

A scenic photograph of a coastal area. In the foreground, there's a dark, rocky shoreline with some sparse vegetation. A paved road curves along the coast, with a few vehicles visible. To the left of the road is a body of water, and to the right is a smaller inlet or bay. In the background, a range of mountains with patches of snow is visible under a blue sky with some clouds. Bare tree branches are visible in the top left corner.

Goose Spit Coastal Recreation Park: Proposed Enhancements

Project Report

Prepared for the Comox Valley Regional District by:
Outlook Land Design Inc.,
northwest hydraulic consultants and
Rupert Wong Consulting.

Goose Spit Coastal Recreation Park –Proposed Enhancements

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Rupert Wong Consulting

1. Background

Goose Spit Coastal Recreation Park, located on the neck of Goose Spit, is unique and valuable parkland drawing visitors from across the Comox Valley. Key themes addressed in the Park site plan include:

- understanding and working with coastal processes;
- the unique environmental setting;
- recreational demand;
- harmonizing Park infrastructure with the natural setting of Goose Spit.



Goose Spit Park is located on the neck of the Spit. HMCS Quadra and K'omoks First Nations lands are on the middle and tip of the Spit. Comox and Courtenay are in the background.

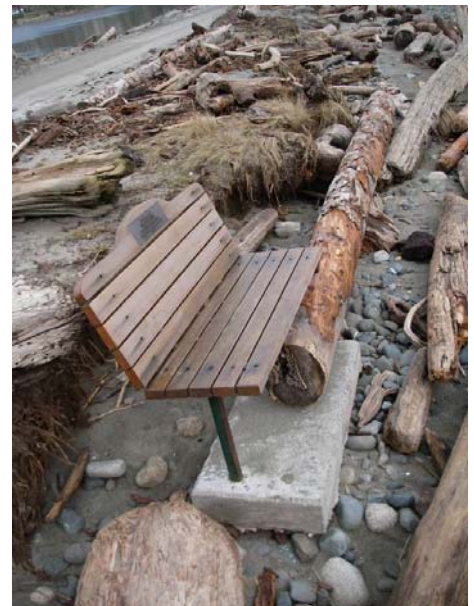
A masterplan for Goose Spit Park was completed in 1996. In 2008 the Regional District contracted Outlook Land Design Inc. to prepare this report which provides guidance on how the Regional District may wish to enhance the Park in the future.

1.1 Coastal Processes

Sixty centuries of wind and waves created Goose Spit. Enhancements must be designed to resist winter storms. Should extreme tides, storm surge and waves coincide, unprotected features may be washed away.

To assist with the preparation of the site plan, a study of the coastal processes was prepared by northwest hydraulic consultants (nhc) (appended). Findings of this report include:

- Goose Spit has remained relatively stable over the last century;
- Hawkins Road is subject to wave overtopping during certain storm conditions;



Erosion on berm.

- Past log placement work has promoted the stability of Park areas and further work of this type is supported;
- The future stability of the Park will be affected by sediment supply and climate change;

1.2 Natural Environment

Goose Spit Park includes several distinct natural environments including dunes, outer shore, and inner shore. Critical habitat zones have been incorporated into the site plan drawing (Drawing L01 appended).

The dune area, located between the outer shore and Hawkins Road, is sparsely vegetated with the dominant species being dune grass, but it also contains rare species such as yellow sand verbena (YSV). The red listed sand-verbena moth depends on YSV for all of its life cycle. This plan allows for the protection of both species and will hopefully result in an increase in their occurrence.



Blue listed yellow sand verbena patches are distributed throughout the Park.

The outer shore is a high energy beach (in winter) yet has abundant inter-tidal organisms such as clams, sculpins, and sand dollars. Some areas of the beach are cobble and some are fine sand. The beach appears to have become rockier over time.



Red listed saltwater marsh along inner shore.

The inside shore (westerly shore) is marshy and protected from the open strait. This shoreline supports red listed plant communities. The typically muddy substrate makes this area less popular for swimming but it is popular for kite boarding and launching kayaks.

Rupert Wong Consulting prepared a biological inventory of the Park area which includes guidance and recommendations for ecosystems protection and restoration (report is appended). It also provides guidance on how to implement the site plan so as to avoid or minimize negative effects on the Park ecology. Findings of this report include:

- Many provincially red and blue listed ecological communities occur within the study area;
- Sand verbena moth occurs in the Park and is considered to be currently imperiled or critically imperiled;



Outer shore and typical summer use.

- Marsh area habitat and deeper water eel grass beds provide critical habitat for herring, salmonids and water birds;
- The study area is a nationally recognized “Important Bird Area” second to the Fraser River estuary for migratory water bird habitat;
- More stewardship initiatives are needed to help ensure the protection and recovery of species and ecosystems within the study area. In particular emphasis should be given to protecting Sand verbena moth, marsh vegetation and migratory birds.

1.3 Recreation

Goose Spit is a popular park due to its excellent swimming conditions, sandy beaches, convenient parking, family atmosphere, superb views, and proximity to Comox and Courtenay. Highest use is during warm weather; however the Park is well used year round. In the winter and shoulder seasons recreation shifts from passive beach lounging and swimming to activities such as walking, running, bird watching, dog exercising and kite boarding. Besides casual visits, Goose Spit hosts events such as school beach days, trash bashes, the polar bear swim and Father’s Day kite flies. Goose Spit is truly a regional destination drawing visitors from across the Comox Valley (see appended open house and public survey results).

Goose Spit is also a place for both festivity and communion with nature. Memorial and celebration gatherings commute a sacred aspect that nourishes people spiritually.

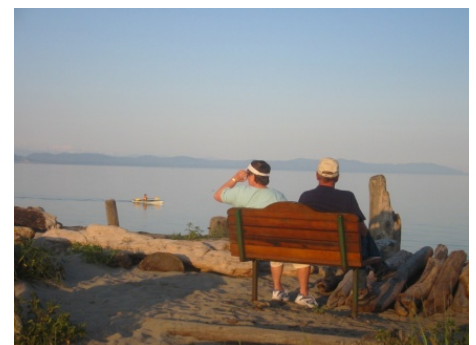
During special events parking demand has been reported to outstrip supply. Therefore improving access by foot and bicycle is a key goal of this site plan. In support of this goal pedestrian improvements on Hawkins Road and a stair along the Sandcliff right of way are proposed.

Many walkers and cyclists access the Spit via Macdonald Wood Park, Young Street and local trails. These routes have been diagramed with suggested improvements detailed (see Drawings L01, L07).

Goose Spit, like most popular parks, creates a push and pull dynamic between the values of recreation, conservation and concerns of local residents. Fortunately, most park goers here are frequent visitors who value the Park’s natural systems and are sensitized to neighborhood concerns. The site plan therefore has a strong



Outer shore setting of Georgia Strait, Denman and Hornby Islands



Goose Spit Park is one of the Comox Valley’s favourite destinations.

emphasis on interpretation and public education. It is expected that with the Regional District taking leadership in conservation and education the majority of park users will respond positively.

1.4 Neighbouring Lands

Besides the CVRD, other tenure holders on Goose Spit include the Ministry of Transportation and Infrastructure, HMCS Quadra, and K'omoks First Nation.

The K'omoks First Nation holds a 4.6 ha reserve on the outermost portion of the Spit. HMCS Quadra operates a cadet training facility during the summer attracting cadets from across Canada. Access to HMCS Quadra is generally off limits to the public. A 24 hour guard maintains security at the entrance to HMCS Quadra.

The Ministry of Transportation is responsible for Hawkins Road. Their contractor maintains the roadway which typically consists of removal of windblown sand from the roadway as well as erosion repairs as required.

Some nearby residents have expressed concerns regarding beach fires at the Park. Management of the Park for public order is made more challenging as the Park can not be gated after Park hours.

1.5 Site Planning Issues

As the above discussion indicates, Goose Spit is a complex environment for both decision making and Park management. Below is a list of issues that formed the background of the site planning process. Some issues are dominated by natural processes and cannot be controlled by people or parks departments.

- Erosion of beach and dunes
- Species at risk
- Parking
- Intensity of use
- Upland neighbour concerns
- Beach fires
- Foot and bicycle access
- Safety of road
- Wheelchair access
- Protection of marsh area
- Natural quality and general aesthetic compatibility
- Above ground power lines



Entry to HMCS Quadra cadet training facility.
Note over head power lines above.

- Dogs on the beach – education and enforcement
- Cost of improvements and implementation process
- Approvals required

1.6 Study Methodology

The following outlines the key steps followed in the production of the site plan and this report:

- Aerial photography and topographical survey
- Coastal processes investigations
- Biological inventory
- Site reconnaissance
- First stakeholders meeting (Attending stakeholders included Town of Comox, HMCS Quadra, Ministry of Transportation and Infrastructure, Ministry of Environment, Fisheries and Oceans Canada).
- Interest group meeting (Area 'B' Planning Commission, Comox Valley Naturalists, Area 'B' Rural Residents Association)
- Park user interviews (summary of results appended)
- Conceptual design development
- Second stakeholders meeting to review conceptual design
- Design refinement
- Public open house of draft final designs
- Site meeting with consultants, volunteers and Ministry of Transportation to discuss beach protection approaches
- Final plan and report preparation



Well attended project open house.

2. Site Plan Description and Rationale

This section describes the various elements of the proposed site plan and provides rationale.

2.1 Drawing Description

The following appended drawings are referred to throughout this section.

- Drawing L01 is the overall site plan. It creates a long term plan documenting the intentions for enhancements, species protection and maintenance;
- Drawing L02 is also the overall site plan plotted with an aerial photo underlay;

- Drawing L03 gives a conceptual section through the spit showing washrooms, parking, beach etc;
- Drawing L04 and L05 provide specific details relating to proposals in the overall site plan;
- Drawing L06 is a conceptual design for upgrading and relocation the existing Sandcliffe Trail;
- Drawing L07 diagrams existing and proposed non-vehicular access routes to Goose Spit.
- Drawing L08 provides typical cross sections for the various routes proposed for accessing the Spit.

2.2 Portals

A total of ten “portals” are distributed along the outer shore in locations most convenient for park users. Portals consist of a marker and information post and a well defined walking route across the dune to the beach. There are six Type 1 Portals which are loose surfaced and may involve stepping up and over beach logs (similar to existing defined routes at the Spit). There are four Type 2 Portals which are hard surfaced and barrier free with a minimum width of 1.5 metres (see Drawing L05, Detail 9). Both portal types include a signage post. Seven of the portals have a bench adjacent to it.

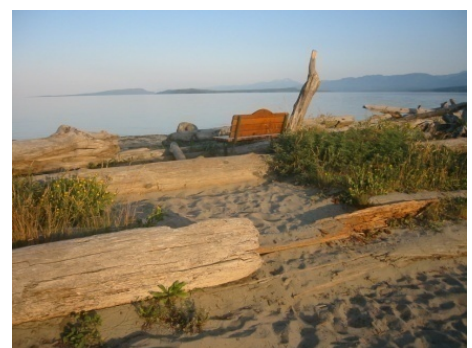
The provision of portals addresses a number of site planning challenges by:

- creating defined locations where people cross the dune area, thus reducing trampling of the sensitive and rare dune vegetation;
- creating safer and easier passage for the elderly, young or those who are carrying supplies;
- providing basic information to park goers in discrete locations, thus reducing the need for dispersed signage along the spit.
- creating an organizing framework to the Park.

Although portals do not fall under the Building Code, for Type 2 Portals, universal access design conventions should be followed as much as practical in this natural environment. Soliciting feedback from the local accessibility group is recommended prior to construction.



Family finding a route across berm.



Example of existing Type 1 Portal.

Clearing of debris and likely some portal repairs will be necessary following periodic intense winter storms. Despite this, there remains a strong rationale for providing portals at Goose Spit Park.

2.3 North Interpretive Area

The North Interpretive Area is proposed in the current location of the steel post cedar entry sign (to be removed). It will serve as the main entry area to Goose Spit Park. Sketches on Drawing L04 and L05 show the suggested arrangement of the area (Details 1 and 7).

The main entry areas typically display an extensive list of Park rules. Alternatively, they could be displayed at the washroom area.

Potential interpretive themes at the main entry and interpretive area include migratory birds, seashore life, offshore islands and coastal processes. The Interpretive Area includes a picnic table and is designed to accommodate casual picnicking as well as small interpretive groups. Ideally, interpretation signs will have a subtle but appreciated presence in the Park. Posting interpretive information on the Regional District's web site would be a useful planning resource for teachers planning to take students on field trips to the Spit.

The gathering area surface is proposed to be tinted and stamped concrete to simulate deck planking. An alternative is heavy timber decking. Of the two, concrete is the preferred system as it can easily be designed for wheel chairs to roll over, is not flammable, subject to rot or splinters and conforms easily to curvilinear shapes. Conventional "city sidewalk" concrete detailing is not acceptable. It is recommended that all concrete must be patterned and integrally tinted to complement the natural setting of the Spit.

Two portals are planned for the North Interpretive Area. The most northerly's width should suit equipment access (for deposit of sand cleared from roadway etc.). The width should be determined following further discussions.

2.4 South Interpretive Area

The South Interpretive Area replaces the toilets in their current location. This location is adjacent to and complements the Verbena Interpretive Area. Like the North Interpretive Area this area will include picnic tables, and will accommodate small groups.



Proposed location for North Interpretive Area.



Proposed location for South Interpretive Area. Toilet area will be relocated.

A suggested interpretive theme for this area is “sparse and marshy shore ecosystems and resident bird life”. Additional information pertaining to interpretive messages is given later in this report.

2.5 Verbena Interpretive Area

Yellow sand verbena (blue listed) and the Sand verbena moth (red listed) are both rare species thus requiring protection planning at Goose Spit. Yellow sand verbena is dispersed among four main locations at Goose Spit Park (see appended biological mapping).

The Verbena Interpretive Area is envisioned to consist of a narrow un-surfaced trail defined by cobbles and driftwood and located to meander between clumps of verbena. See Detail 6, Drawing L05. The trail would be supplemented with low signage that identifies plants species.

The proposed interpretive area contains an abundance of YSV, receives relatively little foot traffic, and is located close to parking areas. Naturally, enhancing this area will require careful consideration to confirm it will be a net benefit to increasing verbena occurrence in the Park. Extending this pathway southward to the turnaround could be considered as a way of decreasing pedestrian vehicle conflicts. However, due to the slope of the land this will require some form of retaining structure.

2.6 Portable Toilets

Portable pumped toilets are proposed because water and sanitary services are not available on site. These types of toilets are easy to clean and can be readily replaced if damaged.

All constructed park infrastructure, and in particular toilets should be designed to have silhouettes that harmonize with the beach environment. Accordingly, the portable toilets are back dropped by a curved wooden enclosure as illustrated in Drawing L03.

2.7 Parking

Systematic observations of parking demand during July and August of 2008 indicated that the total number of parking spaces available at the Park is adequate. Open house participant surveys indicated that during staged events, such as the Father’s Day Kite Fly, parking demand frequently exceeds supply. However, most respondents and interviewees were happy with the amount of available parking and many were concerned about the impacts of expanding it.



Proposed location for Verbena Interpretive area. Picnic table will be removed. Careful planning is required to ensure this is a net ecological benefit.



Existing parking area to be retained. Toilets will be relocated into the centre of this area.

The highest demand beach areas are at the south end of the spit where there is the least parking. As a result, unauthorized parking on Hawkins Road frequently occurs. This is a concern to HMCS Quadra as it can impede traffic flow. Shifting log barriers closer to the pavement and stepping up enforcement are two approaches that should help reduce this problem.

If Goose Spit Park had suitable expansion areas, a slight increase and better distribution of parking would be justified. However, increasing parking would impact red listed shoreline ecosystems. As part of the study analysis, existing parking layouts were tested for alternative layouts. This indicated that the current parallel arrangement creates the highest number of parking stalls within the available parking area.

Expansion of parking at the main entrance was considered. However, there is less demand for parking at that location than to the south. It also poses a safety hazard due to the bend in the roadway and would be visually obtrusive at the entrance to the park.

All parking at Goose Spit Park is gravel and is proposed to remain so. Paving of the northern parking area was considered. This proposal met with strong objection at the public open house (asphalt was considered aesthetically inappropriate in a natural area, contaminated run off was also a concern).

The potential for a bus turn around in the Park was reviewed. However, this would require extensive foreshore fill in red listed marsh vegetation zones and is therefore not appropriate. HMCS Quadra reports they are unable to accommodate a bus turn around on their lands. The existing turn around near the gates at HMCS Quadra works adequately for passenger sized vehicles and will be retained.

Proposals for parking areas on the spit include:

- place permeable pavers in wheelchair zones;
- pothole repair;
- decrease the incidence of unauthorized parallel parking on Hawkins Road by moving logs closer to edge of pavement;
- repair/replace log shoring between the main parking area and the inner shore and around the vegetation buffers that parallel Hawkins Road (see Drawing L05 Detail 8).
- step up patrols and create a fine bylaw.



First parking lot near Park entry. Existing entry sign to left of photo is to be removed.



Unauthorized parking adjacent sandy beaches to south. Log barriers are to be installed to control this problem.



Kayakers unloading.

2.8 Inner Shore

As noted previously, the inner shore supports rare marsh ecosystems. This area receives relatively low use, though it is still a popular launch area for canoes, kayaks, board sailors and kite surfing. Launching activities are potentially impacting marsh vegetation. Three launching areas are defined (see Drawings L01, and Detail 8, Drawing L05). It is expected that with public co-operation this will focus most launching into these areas.

Two picnic tables are proposed between the parking and shoreline. Convenience to parking and unique mountain and estuary views creates their appeal. These are located just south of the existing locations to avoid a patch of yellow sand verbenas.



The inner shore is a popular kiteboarding and sailboarding venue especially during storms.

2.9 Outer Shore

The outer shore is the most popular attraction of Goose Spit Park because of the wide open views to the Georgia Strait and outstanding natural beach. The sandiest beach locations are towards HMCS Quadra and these areas are thus particularly favoured by families.

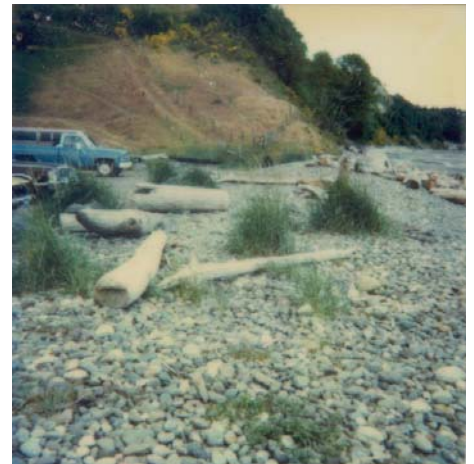
Beach fires have been extensively debated in the community and their continuation is currently under review by the Regional District.

Erosion and reduced sand supply are key concerns. The current program of log structures to control erosion is recommended for continuation. These are described in the appended northwest hydraulics' report. These structures will primarily benefit dune and road stability. It is expected that these structures will perform adequately except in the most extreme events and therefore prevent or delay harsher erosion control methods. Most park users do not object to log structures and see them as a necessary measure. Ideally, these structures should be kept low enough to allow water views from parked vehicles.



Newly installed log structures. The line of widely spaced logs will be further reviewed for their effectiveness and potentially be removed in favour of other techniques and locations.

The northerly portion of the beach is uncomfortable for wading and playing due to the rockiness of the substrate. There may be potential for creating sandier conditions using log structures in this area. A pilot program with monitoring is proposed.



1985 berm photo near the Park entry.

2.10 Berm Area

The berm is a wind deposited sand formation separating Hawkins Road from the outer beach. Its height varies from 0.3m to 0.6m (not

including vegetation), thus it partly secludes the beach area from the roadway.

Prior to the 1980's, the berm was a rough gravel area utilized for parking and fire wood cutting. Since the 1980's, when the Regional District assumed tenure, the berm has evolved to become a unique environment that contributes immensely to park quality and serves as a natural backdrop to the outer shore. This evolution has occurred primarily because of log structure installation and banning driftwood removal. Besides being a natural backdrop, the berm protects Hawkins Road from wave action and windblown debris under non extreme storm conditions. The berm also harbours extensive areas of yellow sand verbena. Broom and other invasive plants need to be controlled periodically.

Road sand from road clearing operations has at times been placed back on the berm. This practice is not effective as it blows back on the road.

Portals, as described earlier, will be constructed across the berm to provide easier access to the beach and protect vegetation from trampling.

The Regional District may want to explore ways to recognize First Nation history in the area in consultation with the K'omoks First Nation. If power poles are removed in the future one possible way of recognizing First Nations would be to put up vertical wooden carvings. Drawing L03 diagrams "symbolic poles" which are inspired by the historical stands of totems at the nearby First Nations village.

3. General Design Information

The following information is provided to assist the Regional District develop and maintain Goose Spit in a cohesive planned manner.

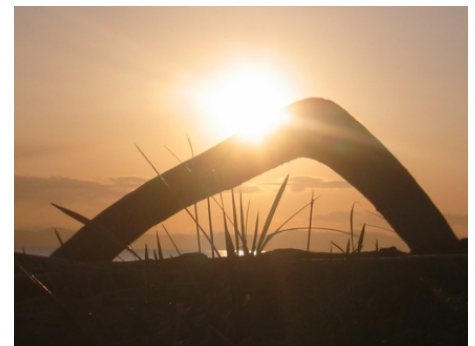
3.1 Design Theme

The design theme for Goose Spit Park can be expressed with a series of words:

- Beach, driftwood, horizon, clouds, dune grass, waves, geese, shorebirds, relaxing, ocean;
- West coast, nature, natural materials, simplicity, strength, organic forms.



2008 berm photo. Note increased vegetation.



Beach art.

The design theme should be consistently applied and items that clearly conflict with these words avoided if possible. Avoid elements of folksiness, pretension, over elaborateness, colonial style, or poor workmanship.

3.2 Furnishings

The main furnishing items are benches, picnic tables, bike racks and litter receptacles.

Proposed benches (see Drawing L01 and Detail 10 Drawing L05) are a customized local manufacturer's design with the goal to install a bench that harmonizes with the natural setting of the spit. Refinishing should be scheduled bi-annually. Existing donated benches do not complement the natural setting of Goose Spit.

Picnic tables should be of concrete (for cooking) and have rounded table tops, seats and bases. Finish should be of high quality and easily cleaned. The existing tables have served their useful life and now detract from the park environment. New tables should be wheel chair accessible and preferably accommodate propane grills or hibachis. Selection of the model is important. The base area below the tables is also important and should be to the same standard as the interpretive areas.

One bike rack is located adjacent the North Interpretive Area. It is anticipated that cyclists will tend to bring their bikes onto the beach once access is made easier via Type 2 Portals. The existing bike rack is suitable but should be re-painted. A second rack should be located adjacent the South Interpretive Area.

Existing litter receptacles are practical and acceptable. Preferably, a more muted earth tone colour will be selected. Barrel lids might also be replaced with earth tones if available. The practice of chaining receptacles to logs or power poles is generally a good solution when done with craftsmanship (note: poles owned by HMCS Quadra) and avoids cluttering the beachfront. Receptacle locations are suggested on Drawing L01.

3.3 Signage

The lack of a coordinated site plan has resulted in visual pollution at the Spit from too many signs. Where a sign is confirmed as necessary, it should be as small as practical and discretely placed to not interrupt



New site furnishings should conform to a design theme. The existing bike rack has an appropriate colour but the crude concrete base detracts from the natural setting.



Signs are necessary but must be well planned to minimize intrusion on the natural setting.

views or detract from the setting. This site plan anticipates that concentrating signage on portal posts will significantly reduce the impact of signs at the Park.

CVRD sign standards are in place and should be referred to during the production of signs. The table below summarizes signage considerations by topic and gives preliminary information on formats, theme and key messages. Not all of the signs are necessarily required. Likewise this is not necessarily a comprehensive list.

TOPIC OR ENVIRONMENTAL SETTING	FORMAT/THEME	Sub-Text /Messages
Entering Goose Spit Park (a very special place)	Entry Sign: - Polished pre-cast concrete main sign - Bordered with beach logs. - Bolt on plates containing text - Stylized Brant Goose	- Goose Spit Park - Comox Valley Regional District - Artistic, inspirational - This is a special place deserving of your respect and interest
Agency Responsible	CVRD logo should be amply displayed	- The CVRD operates and is responsible for Goose Spit Park - Support the CVRD's efforts to expand the Park system
Nature Appreciation and Interpretation	Interpretation Panels - Heavy duty aluminum screen print - Full colour - Include photography - Framed steel	
Red and blue listed Species	"	- Indicate the red listed and blue listed species found at Goose Spit. - Why and how to protect them.
Migratory birds	"	- Species, migratory routes, time of year. - Dog concerns and need for leashing
Marine life	"	- Species that can be found - Shell identification - Please don't remove shells

Sand verbena moth life cycle	“	Describe how the sand verbena moth depends on yellow sand verbena and seasonal life cycle
Geography	“	- Mountain ranges - Gulf islands - Estuary
Coastal processes -	“	- Spit formation - Erosion protection - Tidal cycles
History and archaeology	“	- First nations - Europeans - Military history of the spit
Seasonal information	Near entry. Removable sign panels. Lettering size to suit 30 kmh speed zone	- Brant geese and other migrations - Dog leashing requirements - Other seasonal changes such as herring spawn etc.
Environmental Protection		
Don't trample, leave shells, pick up cigarette butts etc.	At portals – 6x6 aluminum sign	
Regulatory		
Park rules	One panel located at washroom building. Possibly also located at North Interpretive Area (if aesthetics allow)	- Covers most important rules to be followed by public - Panel format gives the opportunity to provide justification for rules - Rules should be presented in a friendly manner and respectful of public's intelligence/maturity
No parking	Existing. Roadside, aluminum	
Towing	Existing. Roadside, aluminum	
30 km/h pedestrian caution	Existing: Road side aluminum, yellow	
Park hours	Road side aluminum sign just after entry sign	
Fire Notes	At relevant portals, 6x6 aluminum sign	- In pits only - Put fires out - Avoid smoldering fires - Do not burn driftwood, treated wood etc.

Dogs		
Pick up	At relevant portals and at dog bag stations, 6x6 aluminum sign	• Pick up after your dog • Dogs to be controlled/leashed • No wildlife harassment

4. Non Motorized Access

Goose Spit is poorly served by non-motorized access routes. This study reviewed ways to improve non-motorized public access to Goose Spit. Existing and proposed future routes were assessed and are indicated in Drawing L07. The various routes are described below.

4.1 Sandcliffe Trail Relocation and Improvement

An historical trail extends from the end of Yates Road and down the hillside to the northern parking area. A portion of this trail crosses private property. Prior to extension of Hawkins Road to the base in the 1970's, this trail likely saw many walkers from far afield. The Regional District wishes to shift the out of bounds portion back within the Sandcliffe Right of Way. This will necessitate stair construction as the land within the Right of Way is too steep for a conventional trail. A conceptual design of the proposed arrangement is given in Drawing L06. Analysis indicates that the proposed SRW near the top of bank should be expanded if feasible.



Location of existing Sandcliffe Right of Way allowing public access from local neighbourhoods.

The Sandcliffe Right of Way continues from Yates Road to Moore Road offering further community access. Brush cutting the edges should occur annually. Minor trail improvement is also recommended. Logs blocking the lower entrance should be shifted.

4.2 Hawkins Road

Most cyclists and pedestrians bound for Goose Spit use Hawkins Road. Pedestrians typically use either shoulder from the intersections of Croteau Road to Yates Road. Vehicles pass frequently, often speeding. The area is poorly lit. Over time traffic is expected to increase. Residents have in the past supported a separated gravel walkway as indicated in the Croteau



Dangerous hill on Hawkins Road. This is the main walking and cycling access to the Park. A separated trail would be a safety benefit.

Beach Local Area Plan. A conceptual section of such a walkway is shown on Drawing L08, Section 1.

Continuing south from the Yates Road intersection, Hawkins descends a steep hill while turning a sharp corner. Without shoulders pedestrians are forced onto the narrow pavement, thus making this portion of Hawkins unsafe and unpleasant for most people. This portion of Hawkins does not meet road safety conventions or the expectations of residents. A parallel separated route is strongly recommended. A conceptual section is provided on Section 2, Drawing L08. A topographic survey is required to confirm feasibility and to which side of the road it is preferred. Construction on either side will have extensive tree impacts.

Below the hill, Hawkins becomes straight and flat. Here, pedestrians utilize a narrow shoulder adjacent to the lagoon area. This part of Hawkins also does not meet a desirable standard - particularly for pedestrian access to a significant regional park. Three possibilities for accommodating pedestrians are shown on Drawing L08, Sections 3A, 3B, and 3C. These include constructing a separate trail inland from the pavement edge, widening the road on the landward side or widening the road on the seaward side. Each option has benefits and detractions. Assessing the preferred option depends on a number of factors beyond the scope of this plan.

4.3 Waterfront Walkway

A waterfront walkway connecting the Town of Comox to Goose Spit Park and to Point Holmes has been a longstanding community goal and is identified in the Town of Comox and the Rural Comox Valley Official Community Plan. At the public open house there was strong interest shown in a waterfront route (see appended public open house results). Although a waterfront walkway is a highly desirable community amenity, there are significant challenges which include:

1. The concerns of waterfront property owners such as unfettered access to the waterfront, maintaining privacy and security;
2. The high cost of purchasing waterfront lands;
3. The many years (potentially generations) required to consolidate the necessary properties;



Hawkins Road just before Park entry. A separated walking route could potentially be constructed potentially reducing pressure from private automobiles.



Croteau Beach shoreline. A waterfront walkway here offers an exciting recreational opportunity. However a walkway would require responsibly addressing significant potential impacts to shoreline ecology and waterfront properties.



A shoreline trail recently constructed in Powell River in an exposed ocean environment.

4. High archaeological values such as fishing weirs;
5. A vibrant shoreline ecosystem that is both rare and sensitive to disturbance;
6. Migrating and resident bird habitat and their sensitivity to dogs;
7. The height of walkway relative to high water;
8. Anticipated sea water level rises.

Challenges 1 to 3 above precludes locating the walkway on private lands except where such lands are in public ownership. This suggests that perhaps the only practical option is to build the walkway along the foreshore. This solution then brings challenges 4 to 8 fully into play. Filling of foreshore lands is a last resort solution that would not normally be supported. It is presented here because there appears to be no other practical option for siting a waterfront trail.

From the above, it is apparent, that if a water front walkway is to be constructed, it will be critical to adopt a responsible design that fully addresses the above challenges. It would require significant funding, community support, a multi-disciplinary design team, extensive negotiation and commitment to habitat protection, improvement and expansion.

The Regional District should contact water front property owners early in any planning process. Such a process should assess the feasibility of all potential routes including an inland route that could potentially start at the Macdonald Wood boardwalk and follow either Docliddle or Midden Roads for part of the route.

4.4 Trails

Trails are typically within parklands such as MacDonald Wood or within unconstructed road rights of ways. The locations of proposed and existing trails are shown on Drawing L07. A typical section is given on Drawing L08, Section 4. Support for trails within the study area is well documented. Existing trails are very well used.

4.5 Low Volume Road Walkways

Where traffic volume is low, pedestrians are generally satisfied with walking on paved roadways without sidewalks. However, once traffic volume increases to a certain level, separated trails or walkways become necessary for reasons of safety and pedestrian

comfort. A roadway serving more than 20 houses will tend to require separated sidewalks to maintain pedestrian comfort.

Within the study area a number of roads serve dual purposes as local vehicular roadways as well as de facto public walkways. Should there be traffic increases resulting from subdivision activity then separated walkways should be provided at the time of subdivision. Separated walkways could be funded by developers as required off site upgrades. A typical section for a separated walkway is indicated in Section 5, Drawing L08.

4.6 “Country Roads”

When populations increase, rural roadways or “country roads” typically become unsafe and unpleasant for walkers, equestrians and cyclists due to increased high speed car traffic. Many of the quiet country roads of the study area are transitioning in this direction. Separated walkways, such as described in the section above, will help to regain the prior multi-functionality of rural roads.

5. Implementation Considerations

The sections below provide cost estimates and suggestions for implementation.

5.1 Construction Cost Summary

The following costs are provided for work within Goose Spit Park. As this plan is conceptual further cost confirmation is recommended. Construction costs have been escalating until recently. Prices are now expected to decrease. A budget in the order of \$350,000 is recommended.

1. Type 1 Portals –
 - o Bench and sign
 - o Excavator and crew
 - o 6@\$3000
 - o **Say \$18,000**
2. Type 2 Portals –
 - o Bench and sign
 - o Concrete
 - o Boulders
 - o Rip rap underlay
 - o Type 1 Log Structure at each

- o 4 @ \$7000
- o **Say \$28,000**
- 3. Beach erosion log structures -
 - o Type 1 Structure at each Type 2 Portal
 - o Sand trapping structures – mid tide
 - o Repair removal of existing
 - o Potential repair work after storms (annual?)
 - o **Say \$25,000**
- 4. Verbena Interpretive Area -
 - o Path demarcation boulders
 - o Botanical signage
 - o Remove picnic tables
 - o **Say \$5000**
- 5. South and North Interpretive Areas –
 - o Stamped concrete
 - o Three picnic tables
 - o Interpretive displays
 - o Dune grass restoration
 - o **Say \$40,000**
- 6. Portable toilet enclosure –
 - o Enclosure structure
 - o Stamped concrete
 - o Permeable pavers
 - o Boulders and shoreline planting
 - o **Say \$30,000**
- 7. Inner shore picnic tables –
 - o Two picnic tables
 - o Stamped concrete base
 - o **Say \$6,000**
- 8. Parking edge reconstruction –
 - o Logs with flat bases
 - o **Say \$10,000**
- 9. Entry sign –
 - o **Say \$6,000**
- 10. Permeable pavers at first parking lot
 - o **Say \$12,000**
- 11. Inner shore launches
 - o Boulders
 - o Signs
 - o **Say \$3000**
- 12. Miscellaneous habitat treatments

- o **Say \$3000**
- 13. Sandcliffe Trail Improvement and Stairway
 - o Sand based trail from beach to stairway
 - o Timber stairway
 - o Hard or loose surface route from stair to Hawkins Road
 - o Minor improvements to trail from Yates to Moore Road
 - o **Say \$65,000**

Subtotal: \$251,000

25% Design and Contingencies: \$62,750

Total Preliminary Estimated Cost: \$313,750 (say \$315,000 GST excluded)

5.2 Suggested Procurement Processes

It is expected that the work proposed in the site plan will be broken into a number of phases.

A suggested procurement process is as follows:

1. Retain the project team (Outlook Land Design, northwest hydraulic consultants, Rupert Wong Consulting) to provide detailed design, tendering and field reviews for each subsequent phase to ensure consistency in design and to ensure the expertise developed is effectively utilized.
2. Define sub-projects that suit particular contractor capacities e.g. civil contractor, landscaper, carpenter, parks maintenance contractor, concrete specialist, sign maker etc. Preparing a general contract that covers all work in this report would likely not be effective. A project management approach where a single manager oversees several simultaneous contracts would likely be most effective.
3. Obtain specialist input as required.
4. Liaise with regulatory agencies such as Fisheries and Oceans, Ministry of Transportation and Infrastructure etc.
5. Prepare construction details and re-assess costs.
6. Prequalify contractors according to category of work.

7. Prepare quotations or tender documents.
8. Award work.
9. Oversee construction.
10. Commissioning.
11. Follow up assessments.

5.3 Specialist Advice

Specialist advice is recommended when:

- o Work has a critical aesthetic design quality that must be achieved;
- o Work is located within red listed habitats;
- o Work is exposed to waves;
- o Work has a structural engineering component;
- o Senior agencies require approval.

As noted above, it is recommended that the project team (Outlook Land Design, northwest hydraulic consultants and Rupert Wong Consulting) be utilized for specialist advice.

5.4 Approvals

Approvals and/or discussions may be required with:

- Fisheries and Oceans regarding work affecting fish habitat;
- HMCS Quadra
- K'omoks First Nation
- Archaeological Branch regarding excavation in documented archaeological zones;
- Regional District Planning Department with respect Environmentally Sensitive Development Permit Areas;
- Ministry of Transportation and Infrastructure with respect to work within Hawkins Road and Sandcliffe Road allowances;
- Ministry of Environment with respect to work around red listed species;

5.5 Future Initiatives

The following initiatives could be beneficial to the management and public enjoyment of Goose Spit and the study area. These suggestions reflect either outcomes to earlier processes or discussions with stakeholders or the public that have occurred during this assignment.

HMCS Quadra

- Discuss potential for gate installation at the Park entrance;
- Negotiate to allow increased recreational access to other locations on Goose Spit, e.g. waterfront trail around entire spit;
- Formally support and encourage early removal of utility poles and undergrounding wires where they pass through Goose Spit Park.

Ministry of Transportation and Infrastructure

- Prepare a plan in conjunction with the Ministry to improve road safety and trail and walkway accessibility in the study area;
- In conjunction with the Ministry register Statutory Rights of Way, licenses or other tenures on unconstructed road dedications to allow both the future construction of trails and underground servicing of sewer, water, power and communications as a precaution should these lands be privately sold;
- Develop a protocol with regard to repairing any future erosion and road damage at the Park in ways that do not compromise public use and appreciation of the Park;
- Develop a protocol with regard to maintenance removal of sands from Hawkins Road and re-deposition at the north end of the outer shore.

Other

- Research available partner funding sources;
- The planning process leading up to this report included one public open house. If further public comment is desired a second open house could be arranged;
- Continue to maintain a systematic record of beach photography in order to document changes on the Spit;
- Work with the installers of beach front rip rap below Willemar Bluffs and HMCS Quadra to remove wave scattered rip rap that is creating hazards and obstacles to public use of beachfronts north and south of the Park;
- Consider expanding Park tenure to include areas best managed by the Regional District (toilet building area, parking, berm etc.);
- Create a security and enforcement plan which could include creation of new bylaws and fining authority;



HMCS Quadra cadet training facility with Goose Spit Park in the background.



Ministry of Transportation contractor repairing erosion along Hawkins Road. Goose Spit Park is located on both sides of Hawkins Road.

- Create a park management statement as a preface to this report to guide day to day park management decisions;
- Plan for the purchase of additional waterfront park land for waterfront walkways or general recreation to regain historical park area/population ratios.

6. Conclusions

The following conclusions are offered based upon the foregoing and appended materials.

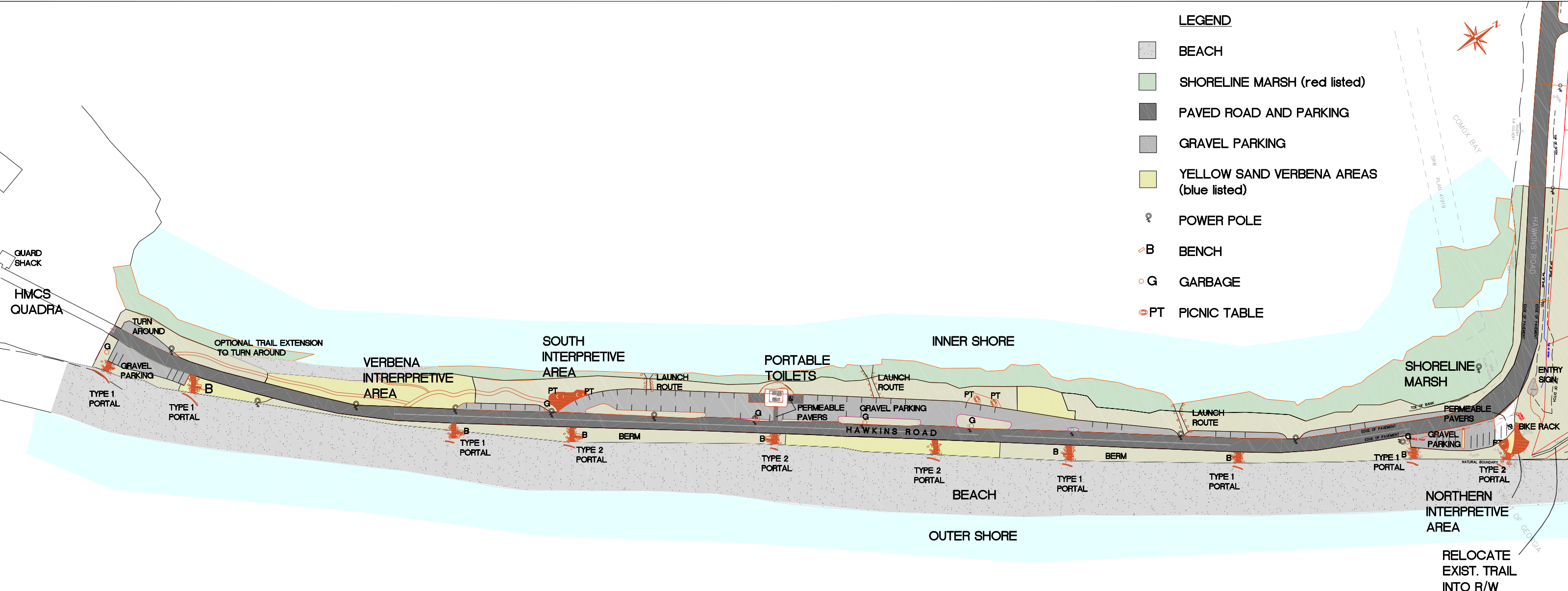
1. Goose Spit Park is a regional destination park drawing large numbers of visitors from across the Comox Valley.
2. Many rare species occur at Goose Spit Park. Protection of these species should be given high status in park management decisions.
3. Recreation and species protection can complement each other at Goose Spit Park. The drawings contained in this report describe enhancements that will improve the park visitor's experience while also helping to protect and promote species at risk.
4. Detailed design and field reviews are required in order to successfully construct the proposed enhancements.
5. Provision of "portals" is an important enhancement for protecting species at risk and for the safety and convenience of visitors.
6. Providing launch routes on the inner shore will likely reduce human impact on the rare marsh species located there.
7. Invasive plant species will require ongoing monitoring and control.
8. Goose Spit Park is vulnerable to erosion. Periodically, large storm events can be expected modify the berm and attack unprotected infrastructure.
9. The current "log structure" erosion protection program is appropriate for the site and was found to be stabilizing the berm and roadway. The program should be continued with ongoing monitoring to determine the most effective placement of logs.
10. Enhancements and infrastructure should be designed to resist wave overtopping events using materials and methods suitable to the Parks natural setting.

11. Hawkins Road where it passes through the Park is at least 1m lower in elevation than is recommended for year round vehicle access.
12. There would be a significant negative impact on species at risk and the public's enjoyment of Goose Spit Park if Hawkins Road were raised.
13. Sand will continue to deposit on Hawkins Road and cannot be materially reduced by altering the berm's profile.
14. Public education should be given a high priority. Interpretive areas and a signage plan provide opportunities for this.
15. The Regional District's web site could host interpretive information and thus create a community planning and research resource.
16. Park infrastructure should follow a design theme in order to harmonize with the Park's natural setting.
17. Re-locating washrooms towards the central part of the Park will increase convenience.
18. Parking supply is generally adequate.
19. There is an opportunity for recognizing First Nations at Goose Spit as part of the planned enhancements.
20. A detailed signage plan will be required in order to ensure key messages are delivered while not detracting from the natural environment.
21. Goose Spit is poorly served by non-motorized access routes.
22. Non-motorized access improvements are suggested in the report drawings. They include an offset walkway paralleling Hawkins Road, stairway and trail improvements within the Sandcliffe Road right of way, protecting the existing public trail on Gayle Road and providing either a waterfront walkway or an inland walkway connecting from MacDonald Wood Park's boardwalk to Goose Spit.
23. Proposed enhancements at Goose Spit Park are estimated to cost approximately \$315,000.
24. A project management approach using specialist consultants and specialist contractors is the preferred way to enhance Goose Spit Park. Tendering of a general contract would not be cost effective or provide sufficient control of the many sub-trades involved.
25. This and previous public processes have identified a wide range of future initiatives that pertain to the ongoing improvement and management of Goose Spit Park.

Appendix A: Conceptual Drawings

LEGEND

- BEACH
- SHORELINE MARSH (red listed)
- PAVED ROAD AND PARKING
- GRAVEL PARKING
- YELLOW SAND VERBENA AREAS (blue listed)
- POWER POLE
- B BENCH
- G GARBAGE
- PT PICNIC TABLE



LEGEND

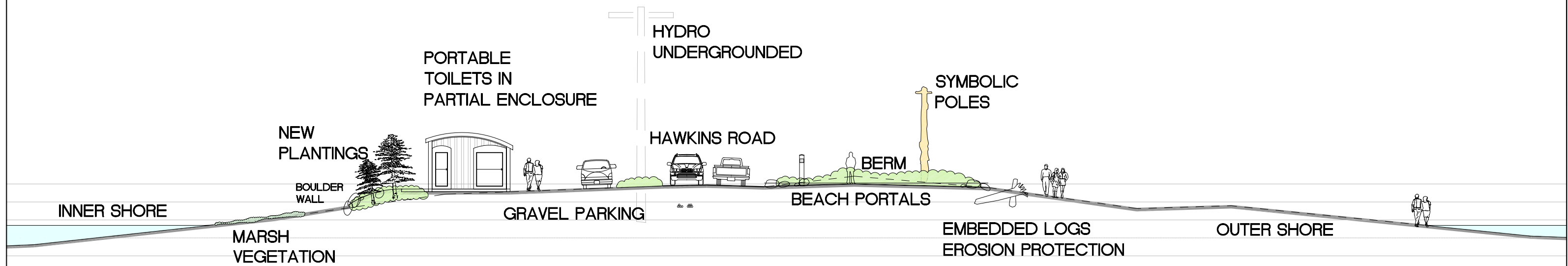
- BEACH
- SHORELINE MARSH (red listed)
- PAVED ROAD AND PARKING
- GRAVEL PARKING
- YELLOW SAND VERBENA AREAS (blue listed)
- POWER POLE
- B BENCH
- G GARBAGE
- PT PICNIC TABLE



Goose Spit Park

SITE PLAN AERIAL OVERLAY

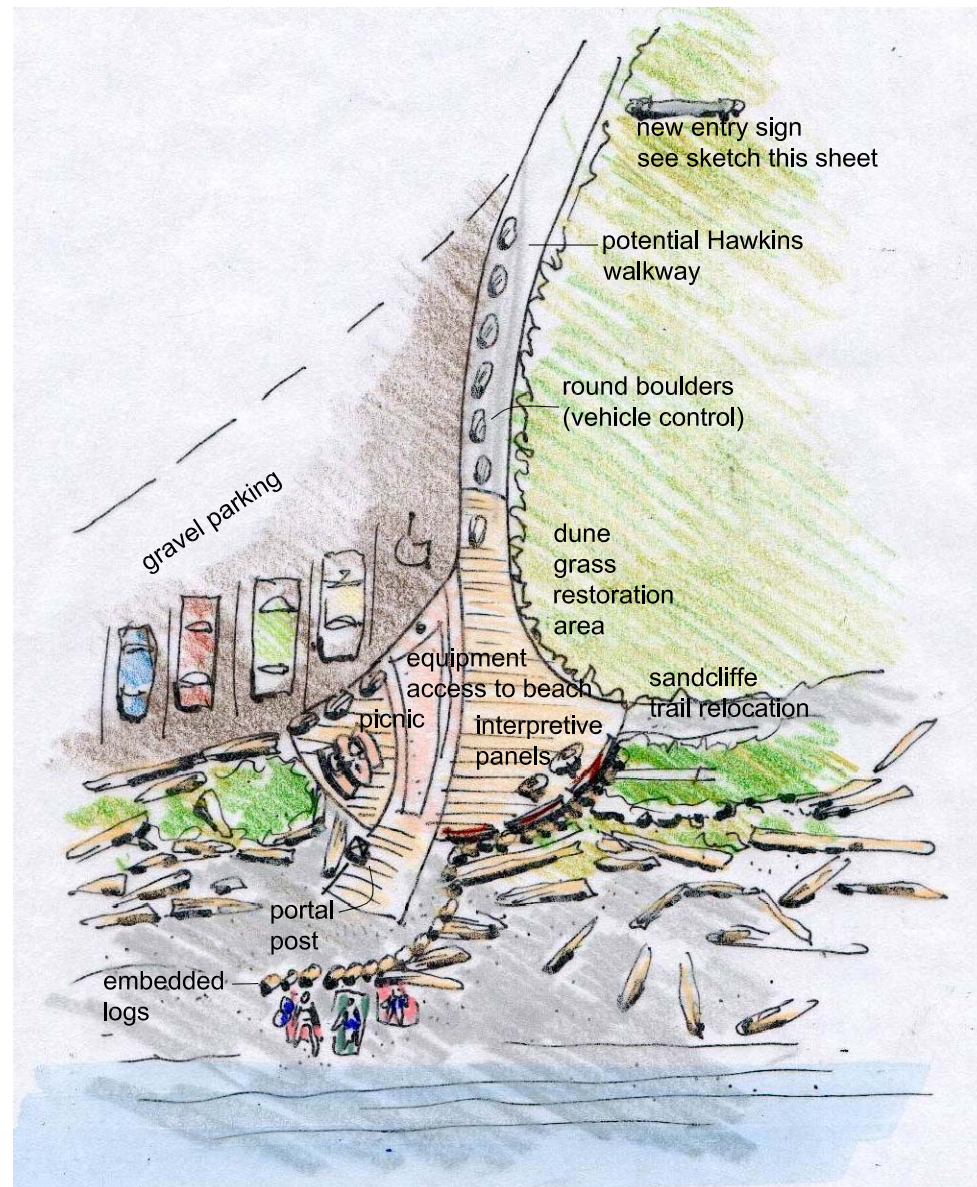
DRAWING L02
DECEMBER 6, 2008



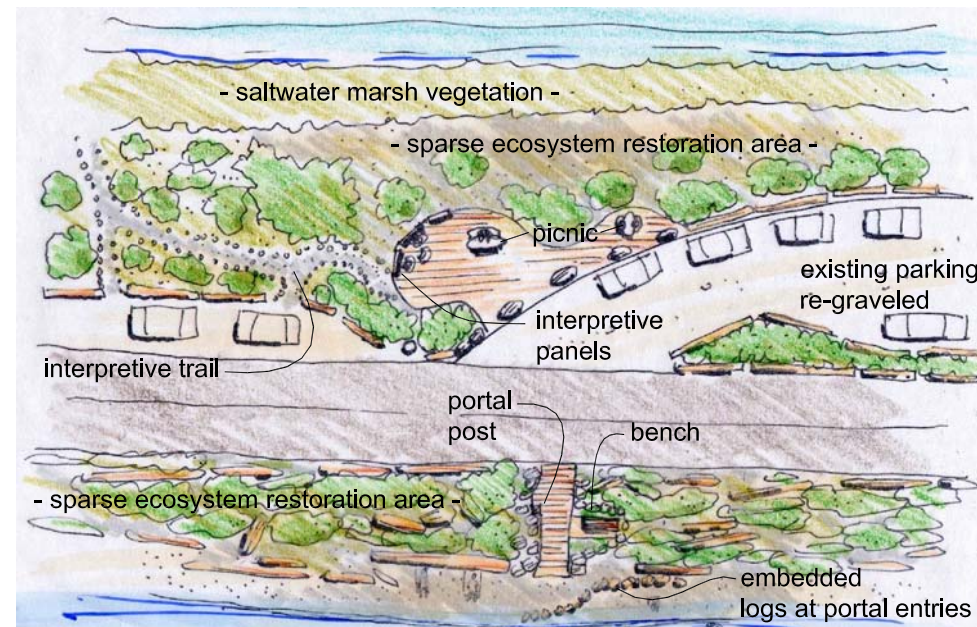
Goose Spit Park

CONCEPTUAL SECTION

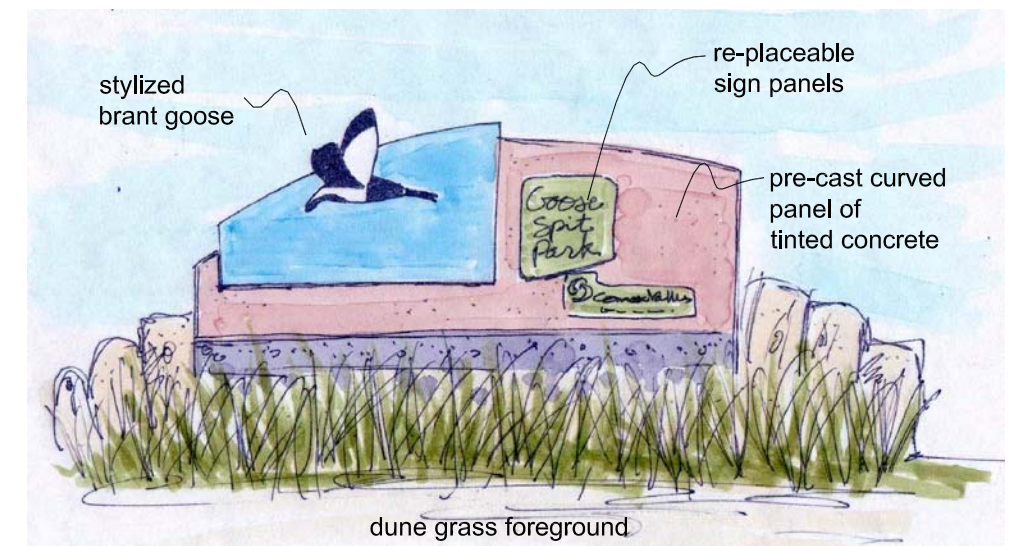
DRAWING L03
 DECEMBER 6, 2008



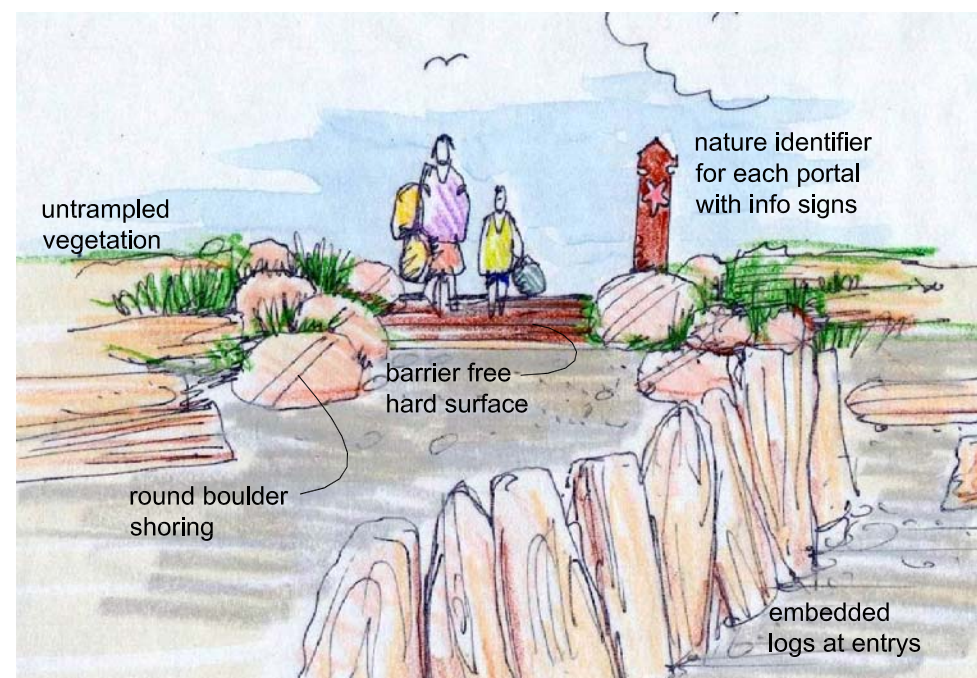
North Interpretive Area at Park Entry



South Interpretive Area



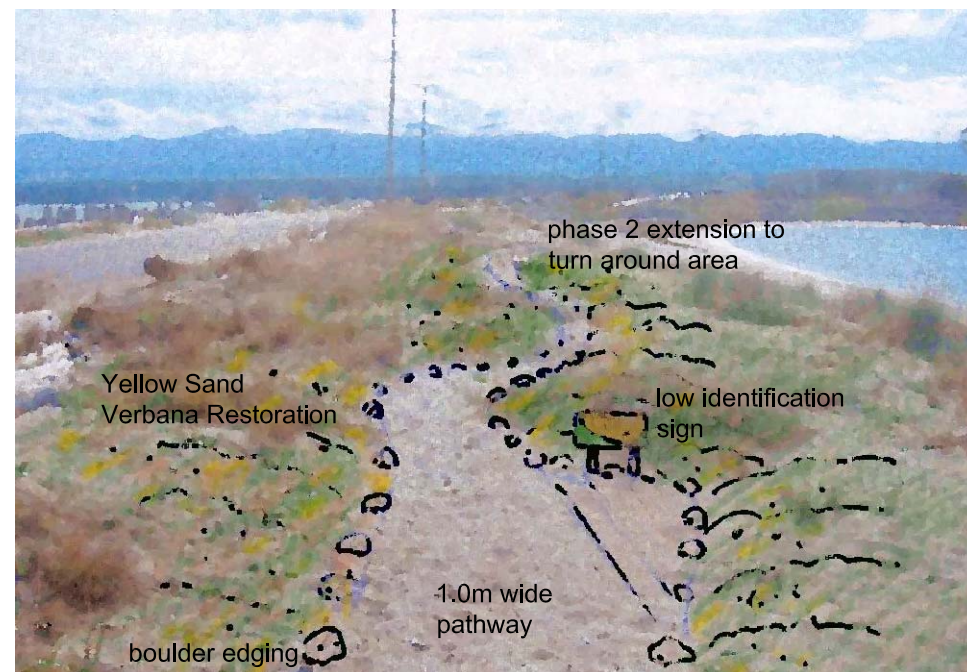
Entry Sign Concept



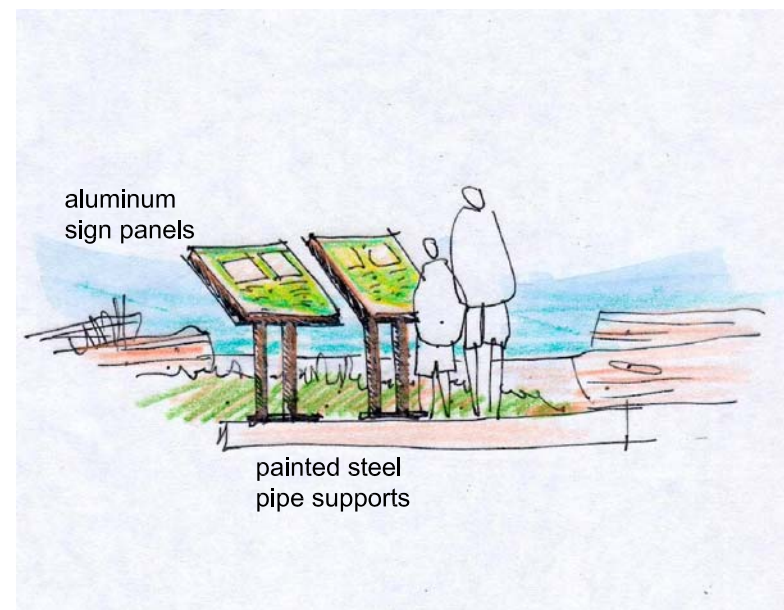
Beach Arrival via Type 2 Portal



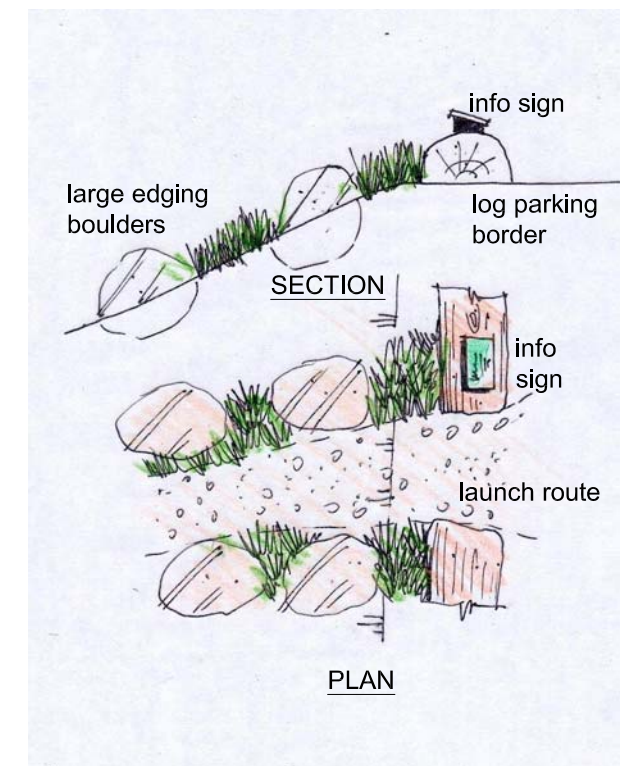
Symbolic Carved Poles replace Power poles



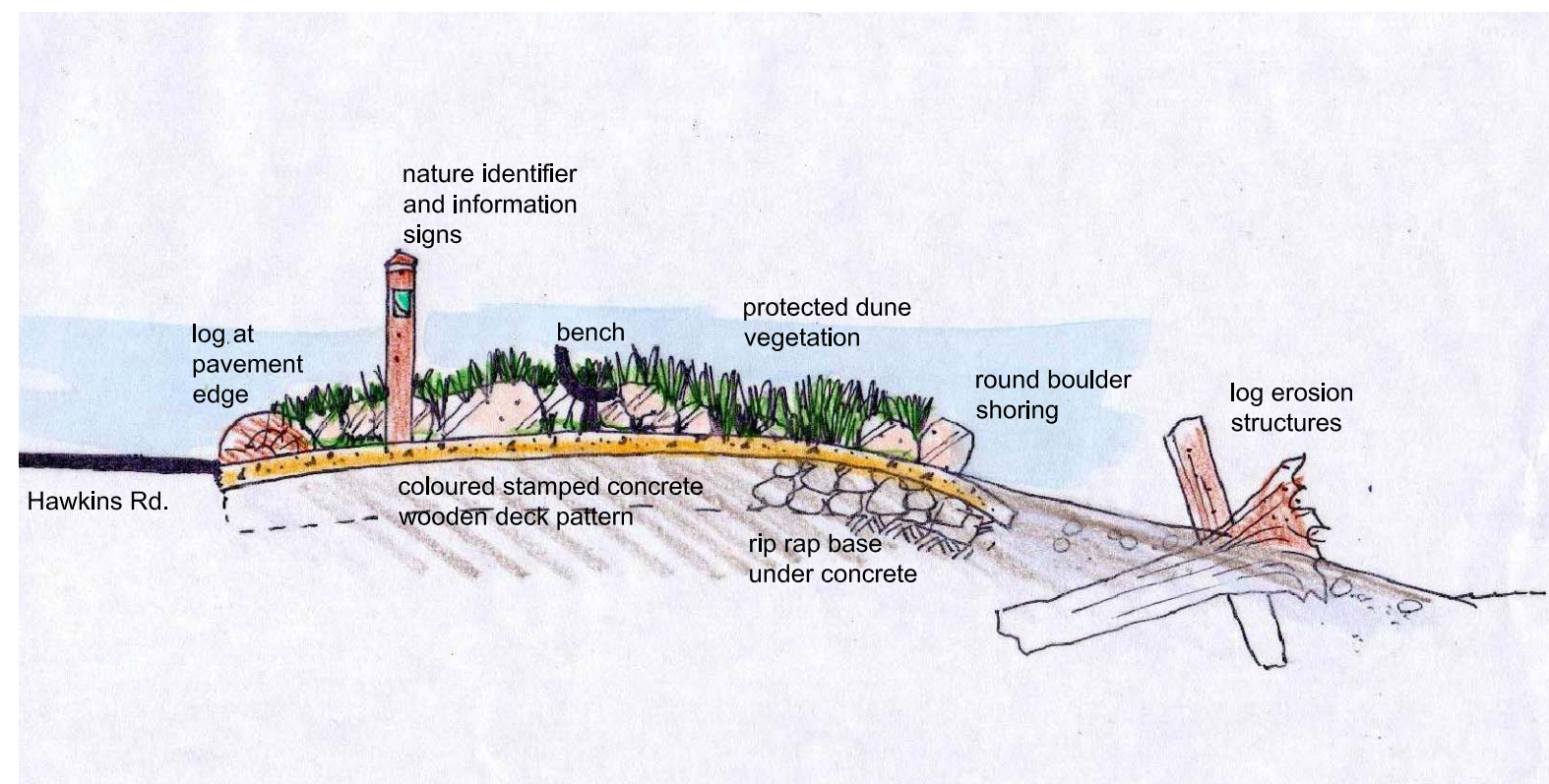
Verbena Interpretive Area



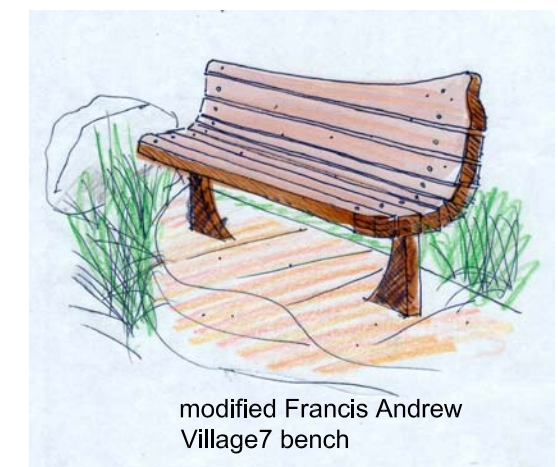
Interpretation Sign Arrangement



Launch Routes - Inner Shore

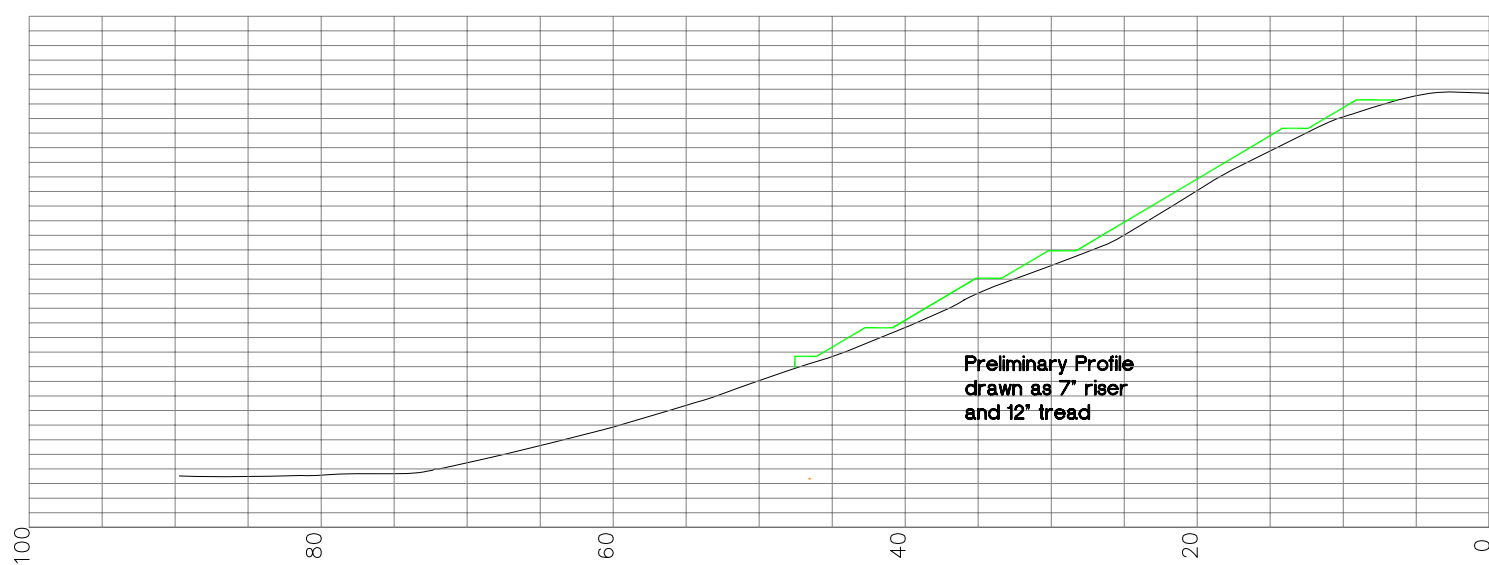
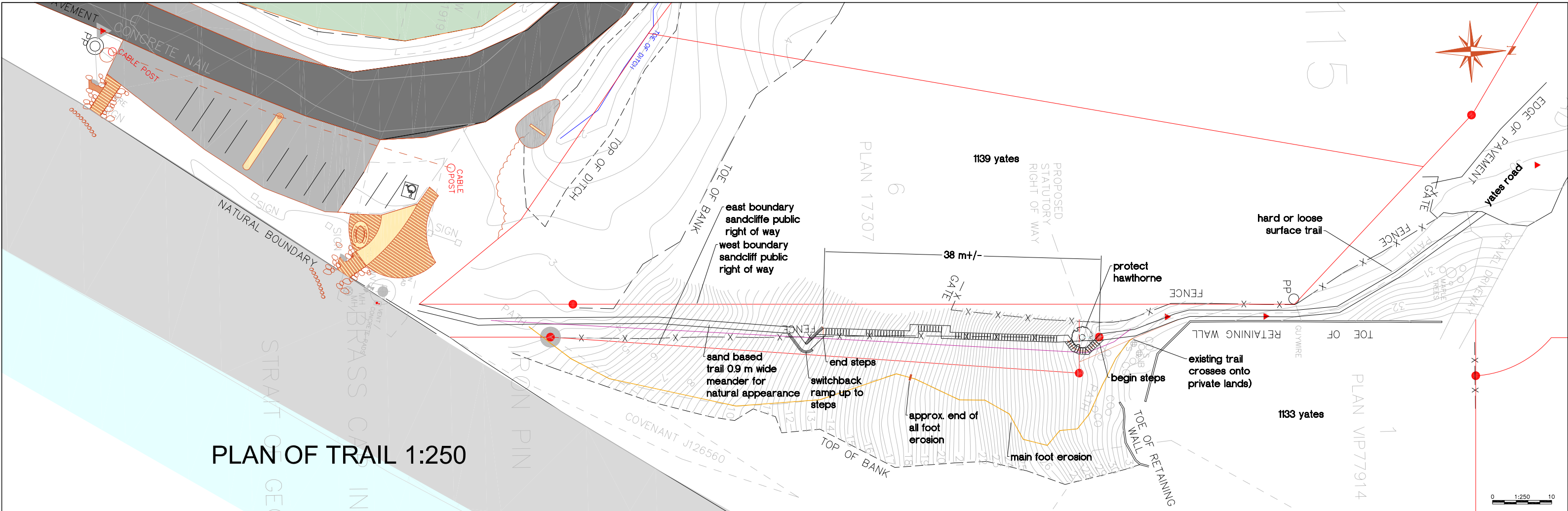


Type 2 Portal Conceptual Cross Section



Bench Design

PLAN OF TRAIL 1:250



PROPOSED PROFILE

VERTICAL AND HORIZONTAL 1:250

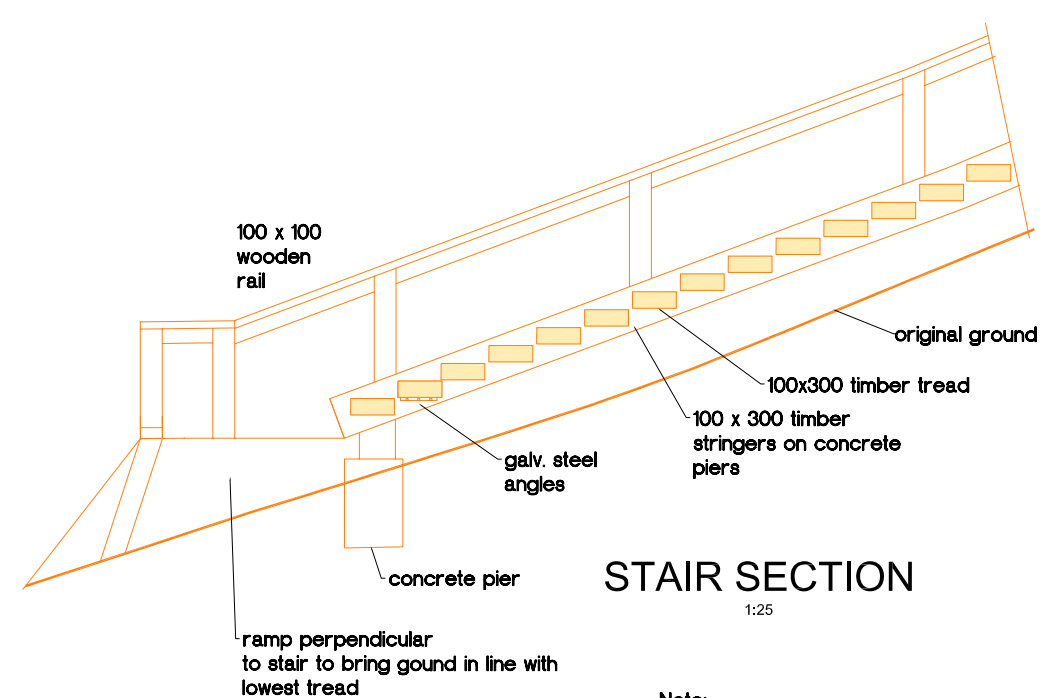
Note:

1. Profile indicates surveyed ground surface along centre of r/w.
2. Final construction is to result in a constant riser/tread relationship.
3. Bottom of stringer to vary 0.3m to 0.6 m above ground.
4. Builder to set landings at intervals to maintain constant riser/tread relationship and distance of stringer above ground.
5. Soil profile may not be adjusted more than 150mm.
6. Assessment of trail in 2008 indicates that sand surface is stable for trail slopes up to 36% (20D).
7. Monitor trail stability after construction and provide switchbacks as required should trail surface experience continued erosion.

Goose Spit Park

SANDCLIFFE TRAIL 1:250

DRAWING L06
DECEMBER 6, 2008



STAIR SECTION

1:25

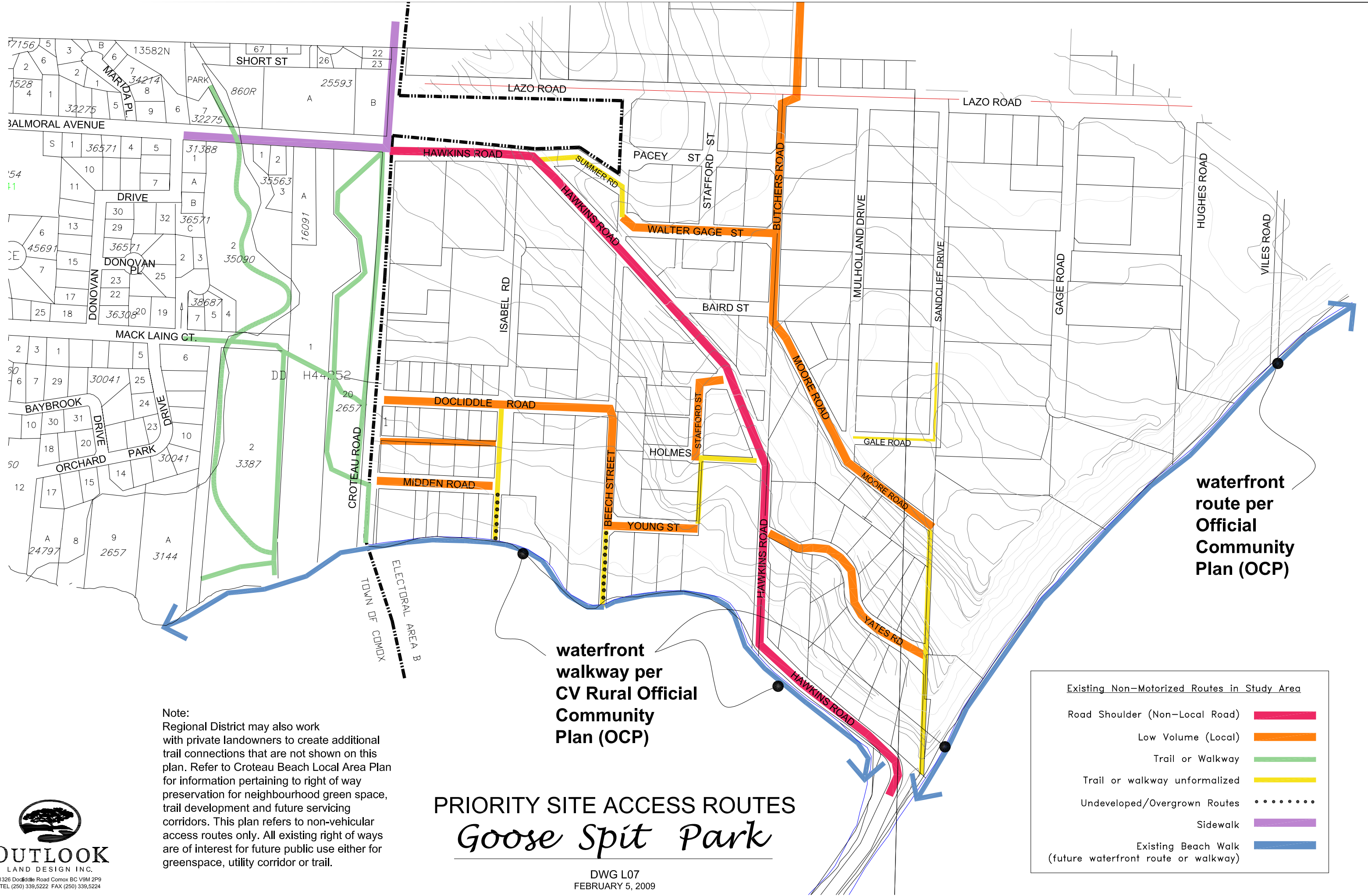
Note:

1. Concept only. Not for construction.
2. Additional detailing required.
3. Timber is treated Douglas Fir.
4. Stair clear width is 900 mm but could be widened to 1.2m.
5. This stair is not required to meet BC Building Code requirements. Where the code cannot be practically met due to terrain conditions, Code conflicts should be confirmed with authorities responsible.



OUTLOOK
LAND DESIGN INC.

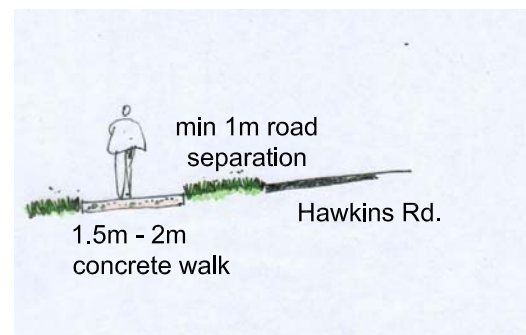
1326 Doodie Road Comox BC V9M 2P9
TEL (250) 339.5222 FAX (250) 339.5224



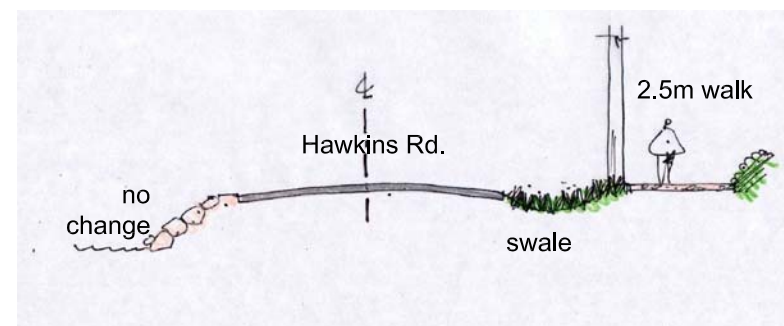
Note:
Regional District may also work with private landowners to create additional trail connections that are not shown on this plan. Refer to Croteau Beach Local Area Plan for information pertaining to right of way preservation for neighbourhood green space, trail development and future servicing corridors. This plan refers to non-vehicular access routes only. All existing right of ways are of interest for future public use either for greenspace, utility corridor or trail.

PRIORITY SITE ACCESS ROUTES
Goose Spit Park

DWG L07
FEBRUARY 5, 2009



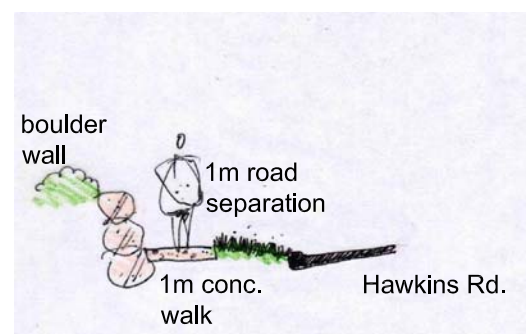
Section 1- Hawkins Rd Stafford Area



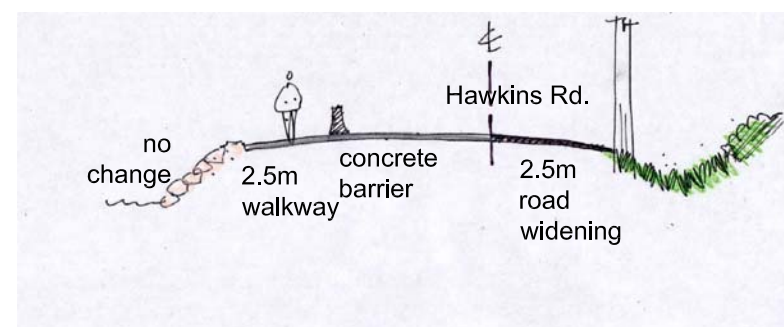
Section 3a Hawkins Road on Flats Option 1



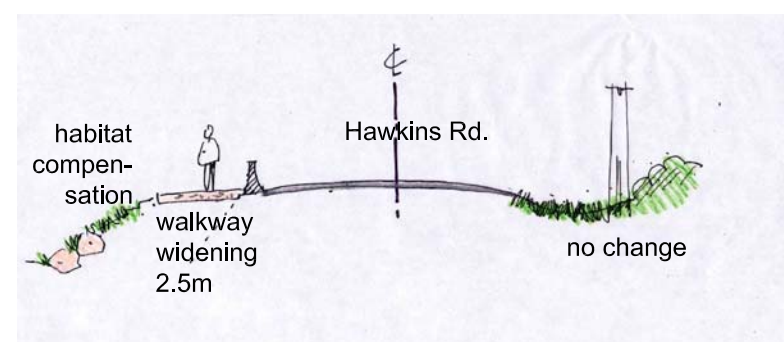
Section 4 Trail Cross Section



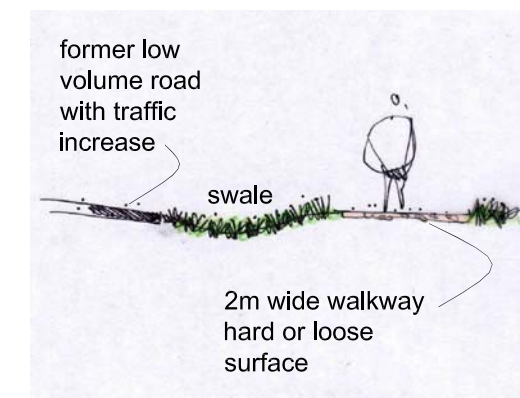
Section 2 Hawkins Road at Hill



Section 3b Hawkins Road on Flats Option 2



Section 3c Hawkins Road on Flats Option 3



Section 5 Higher Traffic Road Retrofit

Appendix B: Summary of Public Open House Responses

GOOSE SPIT SITE PLAN – OPEN HOUSE MATERIALS SURVEY – 149 responses

(Please complete and return tonight, fax , mail or drop your responses off prior to October 31at Comox Valley Regional District Office, 600 Comox Road, Courtenay, BC. V9N 3P6. Fax (250) 334-4358)
Your Name, Address and telephone: (Optional)

1.	How do you feel about proposed measures for protecting rare or endangered flora and fauna? (Portals to minimize trampling, interpretive areas, a yellow sand verbena restoration area.)	No Answer	Positive	Negative	Various Comments Balance protection with use People were not aware of sand verbena before open house		
		12 (8%)	120 (81%)	9 (6%)	8 (5%)		
2.	Do you feel interpretive areas will be a positive addition to the park?	No Answer or conditional	Yes	No	Various Comments Keep small/vandalism concerns		
		16 (11%)	86 (58%)	31 (21%)	16 (11%)		
3.	How do you feel about the strategy of continuing to stabilize the beach using embedded logs?	No Answer or ambiguous	Like	Don't Like	Various Comments Futile endeavor/make more natural Esthetics unpleasing in a straight line. Suggestions of using rocks and random driftwood. Questions if the logs work.		
		28 (19%)	87 (58%)	16 (11%)	18 (12%)		
4.	The plans show the number of parking stalls to remain the same. Is this appropriate? Do you have other suggestions for parking?	No Answer	Remain same	Increase	Yes/No	Decrease	Suggestion: HMCS Quadra to provide some area
		14 (10%)	99 (66%)	12 (8%)	2 (1%) /2 (1%)	4 (2.7%)	16 (11%)
5.	What do you think of paving the first parking area to provide for a more organized entrance area? The rest of the parking would remain gravel.	Pave	Don't Pave		Paving stones not asphalt/Wheelchair access only/budget concerns/ambivalent/No answer		
		47 (31%)	84 (56%)		18 (12%)		
6.	Does shifting the washroom area to the centre of the park make sense to you?	No Answer		Move Washrooms		Don't Move	Put at both ends and maintain
		20 (13%)		78 (52%)		33 (22%)	18 (12%)

7.	Do you support removal of the utility poles and undergrounding of power, telephone and cable?	No Answer	Remove Poles		Leave Poles		Concerns about expense and feasibility	
		8 (5%)	85 (57%)		9 (6%)		47 (31%)	
8.	What is your response to improving the Sandcliffe trail and providing a stairway?	No answer	Improve		Don't improve		Mixed feelings – mainly regarding costs	
		16 (11%)	70 (47%)		43 (29%)		20 (13%)	
9.	What are your preferred access routes for walking or cycling to the park?	No answer	Balmoral	Yates	Sandcliffe			Curtis
		28	2	3	7			1
		Main Road	Don't walk or cycle		Waterfront	Improve waterfront and trails and roadways		Comments questioning what other access is there?
		57	4		11	24		9
10.	If beach fire rings are removed what alternatives do you suggest?	Do not remove	Remove	Provide Propane		No answer or did not understand question		Restrict hours of use
		97 (65%)	19 (13%)	12 (8%)		18 (12%)		3 (2%)
11.	If beach fire rings are retained what improvements , if any, are needed?	No answer		Leave as is or make more rings		Restrict hours of use/Supply dry wood/Maintenance/Supply BQ's/Security		Remove rings
		27 (18%)		50 (33%)		61 (41%)		11 (7%)
12.	Other comments. Please use reverse if needed.	Majority of comments contained the retention of beach fires or alternatives such as propane barbeques. The natural nature of the spit is the main attraction.						

PARK USE SURVEY – 154 responses

(PLEASE ANSWER THE FOLLOWING QUESTIONS IF YOU ARE A REGULAR PARK USER)

(Please complete and return tonight, fax , mail or drop your responses off prior to October 31at Comox Valley Regional District Office, 600 Comox Road, Courtenay, BC. V9N 3P6. Fax (250) 334-4358)

1.	Where do you live? (circle one)	Adjacent to Goose Spit (Area ‘B’)	Electoral Area ‘B’	Comox	Courtenay	Electoral Area ‘A’	Electoral Area ‘C’	Cumberland	Other Place or not identified
	No Answer -3	32 (21%)	19 (12%)	56 (36%)	39 (25%)		4 (3%)		1 (>1%)
2.	What is your most common method of getting to Goose Spit? (circle one)		Car	Bike		Foot		Bus	Did not answer or made multiple choices
	Adjacent (Area ‘B’)		4			24			7
	Area B		12	1		1			5
	Comox		35	5		3			13
	Courtenay		28			1			10
	Area C		4						
	Other		1						
	TOTAL (out of 119 responses)		84 (71%)	6 (5%)		29 (24%)		0	35
	Multiple choice breakdown (35 responses)		30	24		22			
3.	Would you take the bus if service was extended to the park from Courtenay and Comox?		Yes		No		Comment made that bus will not take dogs		
	Adjacent				31		1 non applicable and 1 no answer		
	Area B		1		16		3 either no answer or possible		
	Comox		12		39		3 possible		
	Courtenay		8		29		2		
	Area C		1		3				
	Other				1				
	TOTAL (out of 150 responses)		22 (15%)		119 (79%)		9 (6%)		

4.	How often do you visit the park over a year? (circle one)	More than 20 visits	about ten visits	about 5 visits	once or less per year	Everyday	No Answer
	Adjacent (Area ‘B’)	31	1	2		2	
	Area B	13	3	3			
	Comox	45	10			1	
	Courtenay	28	5	6			
	Area C	4					
	Other		1				
	TOTAL	121 (78%)	20 (13%)	11 (7%)	0	3 (2%)	0
5.	What are your main activities at Goose Spit Park?		Question open ended. Majority of answers were: swimming, walking, beach fires, picnics, dinners at the beach, time with friends and family, kids playing in the sand, dog walking, enjoying the views, bird watching, launching kayak, relaxing. Other comments: star gazing, running, kite surfing, appreciating beauty of sea, photography, reading, fresh air before fire rings were allowed, watching windsurfers, sing-along fires, kite-flying, windy day watching, drumming, painting, sailing, shell collecting, watch the moon rise, ...				
6.	What do you like about Goose Spit Park?		Question open ended. Answers included: natural beauty, swimming, size, family gatherings, fires, walking, views, birds, beautiful sandy beach, walking all the way around HMCS Quadra,				
7.	What things would you like to see changed?		Question open ended Majority of answers were: Leave natural, leave fire rings, do not change Other comments: widen access road and add bike path, more garbage cans, speed bumps on access road, more enforcement of rules with regards to fires, partying after hours and garbage, footpath separate from road, extend pathway from Comox along beach.				
8.	What things would you not like to see changed?		Majority of comments were: keep it natural and keep the fire rings. Other comments: no paving, no permanent buildings, no access bans, only plant native plants, family oriented park, do not restrict dog access, allow a mobile refreshment stand, do not charge for parking,				
9.	Do you have any comments on the toilet facilities?		Majority of comments were to keep them clean and could use more. Other comments: most times very clean, have improved in recent years.				
10.	Would you like to see more or less restrictive dog leashing rules in the park? (Right now leashing is required from Mar. 1 to Apr. 30 during Brant Geese migration period)		Majority of comments were to keep the same rules Other comments: if restrictions are implemented provide a running area for dogs, provide “doggie bags”.				

10.a	Breakdown of answers	Leash year round 37	Remain same 101	Less Restrictive 9	No Answer/provide bags/ban dogs during summer months 7
11.	Do you use the beach fire rings? If not, do you object to having beach fires in the park?	Majority of comments were that the fires be allowed to continue. A number of people mentioned that there should be more restrictions and monitoring for use of proper dried wood. Example given: beach fires at Ambleside Park in West Vancouver allowed.			
11.a		Use fire rings 90	Do not object to fires 48		Object to fires 16
12.	Have you ever not found a parking space at the Park and had to leave without a visit?	Adjacent to Goose Spit – out of 35 replies 1 yes (3%) Area B – out of 19 replies 1 yes (5%) Comox – out of 56 replies 9 yes (16%) Courtenay – out of 39 replies 11 yes (28%) Other – out of 5 replies 0 yes (0%) Overall: 14% have at one time or another not found a parking spot			

Appendix C: Summary of Park User Interviews

Goose Spit Coastal Recreation Park

Public Survey Results Summary August 4, 2008

1. Number of interviews completed: 43 (many were group interviews).
2. Dates, time of day and weather conditions:

Sunday July 13, 4:00 -6:00 pm, sunny warm, light wind, tide in

Monday July 14, 4:00-6:00 pm, warm, high overcast, light wind, high tide

Tuesday July 15, 6:30 – 8:30 am, clear, sunny, 15 degrees +/- tide way out.

Tuesday July 15 2:00-4:00 pm, 25 degrees +/-, low tide

Tuesday July 15, 3:30 -5:30 pm, sunny warm, light wind, tide medium

Wednesday July 16, 7:30 pm to 9:30 pm, full moon, tide in, clear, no wind

Friday July 18, 2:00 -4:00 pm, clear sunny, strong southeast wind, tide out

Saturday July 19, 12:00 to 2:00 pm sunny, light wind south east, tide out

3. Weather Range:

Very good to good beach weather throughout survey period.

4. Maximum number of cars parked:

80 cars on Sunday the 13th of July at 4 pm during very good beach weather. (Note there were still parking spaces available.)

5. Average number of cars parked during survey period: 55

6. Maximum estimated number of people in park: 175 on Sunday July 13th.

7. Average number of people in park during survey period: 99

8. Average number of people per car over all days: 1.8

9. Where respondents live:

Area B:	21.3%,
Comox:	22.2%,
Courtenay:	34.3%,
Areas A, C, D and Cumberland:	16.7%,
Outside Comox Valley:	5.6%

10. How people arrived:

95% by car,
2.7% by bus,
1.9% by bike,
There were no respondents who came on foot.

11. Number of respondents reported having problems with parking: none

12. Percentage of people willing to take the bus if available:

46% yes,
46% no,
7% maybe

13. Frequency of Visits (summer):

Daily: 12.8%
At least weekly: 51.3%
At least monthly: 28.2%
Infrequently: 7.6%

14. Respondents listed the following favourite activities (not in any particular order):

sitting, swimming, walking, wading, sunbathing ,cooking and eating dinner, visiting and socializing, youth group meetings, beach fires, dog walking, cooking on fire, beach and water play, playing with kids, watching kids play, making sand castles, flying kites, throwing football,reading, wiener roasts, bocce, hanging out, sketching, playing with dog, digging in the sand, relaxing, finding crabs, enjoying view, skim boarding, nature appreciation, sitting by fire, celebrating birthdays, sailing, cleaning up.

15. Respondents gave the following information as to what they like about Goose Spit (not in any particular order):

access to beach, cleanliness, fire pits, views, plant material, beach walking, water temperature, scenery, people watching, the beach the way it is, fun for the dog, sandy beach, swimming, being together, beauty, near by, no glass, well taken care of, relaxing, watching boats, peacefulness, driftwood shapes, proximity, two sides, warm water, close parking to beach, easy to get to, doesn't smell (like Kye Bay), close to extra foods, wild feeling, seems isolated, 360 degree views, lots of drift wood for dogs to chase, dog friendly, no traffic, quiet, being able to have a fire, clean air, having water buckets (for fires), very therapeutic, clear water, not too many weeds, no garbage, natural beauty, fresh air, driftwood character.

16. Respondents indicated that the following changes would be appreciated (not in any particular order):

another set of toilets (to north), a bit more parking, remove the after 11 curfew, enforce on leash, change rooms, nothing, sidewalk on road, more fire pits, more sand, hydro lines underground, wheelchair access, more doggy bags, speed control on road, portable concession, more parking, potable water, more picnic tables, volley ball nets, bus stop, boat rentals, somewhere to camp, too rocky, trail access to military base, military base should be park, ecology signs, bike route, more garbage cans, possibly concrete slabs under fire pits (to make fire areas cleaner), flush toilets, outdoor rinse shower, consistent enforcement of parking, more benches, keep cleaner, don't like log fencing (erosion fence), remove curfew, allowed to go around military area, what about some events, celebration of park opening, music events – concert on the beach, kayak lessons, use goose spit as a start or finish for running race, close the beach access to vehicles on some days, invite self contained food vendors, bike lane along road.

17. Respondents indicated the following should not be changed (not in any particular order):

keep road narrow, like it the way it is, keep it natural, free parking, don't remove fire pits, no food kiosks, no commercial, don't armour beach, keep it natural, is a park – not a mall, keep up the maintenance.

18. Comments on toilet facilities (not in any particular order):

are OK, provide more at north end, toilets like at Simms Park – big, clean, more cleaning but nothing fancy, change rooms and toilets plus outdoor showers, nice to have flush toilets, at least there are facilities, pit toilets are ok, good enough, just fine, didn't notice them, works fine, never use them, one more – reduce line ups, usually ok, need a h/c parking stall by toilets, better if permanent, adequate.

19. Dog leashing:

more restrictive 40.7%,
ok as is 59.3%,
less restrictive – 0%,
other comments received – no dogs on beach, special area for dogs only, north area is too rocky for walking, leashing requirement depends on the dog, dog poop not a problem, people not picking up after their dogs, leash during migration, enforcement required.

20. Beach fire rings:

percentage of respondents who use fire rings: 79.5%
percentage of people not objecting to fire rings: 100%
percentage of people objecting to fire rings: 0%
comments: like water buckets and wood, use wood provided if around, like that there is a place where you can have beach fires, wonderful, great for families, bring own wood, buy kindling from gas station, get permits for special event fires, needs to be a place for people to have fires.

21. How respondents feel rare plants on the dunes should be protected (in no particular order):

Limit access, snow fencing, signs, build boardwalks for access, information, designated walkways, boardwalk paralleling beach, opposed to fencing (ugly), education, don't know, natural fence, make the rare plants a point of interest in the design, make people aware of what it is and why it should be protected, interpretive program, don't tell people about them so they leave them alone, signs – don't disturb, clear access that dictates where not to go.

22. Information respondents would appreciate having (in no particular order):

Tides, fire permits scheme, park fauna and flora, dog restrictions, information about ecosystem, historical information, leash requirements, alcohol restrictions, which islands are offshore, bird types, brant geese information, ecological protection, use cans not bottles (to reduce broken glass), ferry schedules, skyline photo, types of shells, general information about the park, map showing where you are in relation to everything, pictures of rare plants, mountain names, tide cycles, why it is called goose spit, see air park's information board, interpreter for children especially, times when dogs need to be on leash, how beaches form, conduct guidelines e.g. geese migration period, sensitive plants, general tourist info, dog leashing rules, not burning treated wood, extreme weather events information.

23. Respondents general comments and questions:

Since the RD has taken over the spit has gotten better, fire smoke complaints not valid, how long a park? People's choice to live there, why do fire pits have to be moved, recycling containers would be good, biodegradable dog bags really good, what to do with dead seal, most popular beach in the valley, take out what you bring in, keep kids out at night, keep them from partying, so close and convenient access, like the posts, create shade, nice easy going beach, most beautiful spot in the valley, not looked after enough, sand cliffs are dangerous, better bike access, rent a kayak or something cheap for families, like that it's not an overly restrictive beach...not too many rules, why close at 11 pm?

24. Average of respondents overall satisfaction rating: 8.9 out of 10

Commentary:

1. The interviewing process did not readily allow for interviews of people who were actively walking or doing other activities. Therefore the results tend to be skewed towards those people who were stationary.
2. Parking availability appears adequate, but there is a demand for more parking towards the guard shack where the beach has the best quality.
3. There is a good level of car pooling occurring.
4. During good weather there is in the order of 700 park users per week or 3000 per month. By projection the yearly number may be in the order of 6,000 to 12,000.
5. Goose Spit is used by people throughout the Comox Valley and from further afield as well when in town visiting. People from Courtenay were the biggest users.
6. Almost all respondents arrived by car. There was little or no concern with parking availability.
7. Almost half of respondents expressed an interest in taking the bus.
8. Only 7.6% of respondents were not frequent users of the park. This suggests that education strategies could be effective.
9. There was a clear demand for toilets at the north end of the beach. By and large people found the toilets themselves to be adequate. However adequate may be a lower standard than the RD wishes to attain.
10. Although 41% of respondents wanted to see more stringent leashing of dogs, many respondents were ok with sharing the beach with dogs and seemed to understand some of the complexities of the management issue. People wished to be tolerant where they could be.
11. About 80% of respondents used beach fire rings and all respondents supported them. Fire rings were a cherished as a unique opportunity by many.
12. People were concerned about protecting natural aspects of the beach, and were concerned about commercialism or the beach becoming more built up.
13. Respondents were interested in knowing more about the beach and area. Interpretive boards and an interpretive program would appear to hold a strong interest.

14. Respondents were overwhelmingly satisfied with Goose Spit giving an average rating of 8.9 out of 10.

Appendix D: Goose Spit Coastal Processes – northwest hydraulic consultants

COMOX VALLEY REGIONAL DISTRICT



GOOSE SPIT COASTAL PROCESSES

DECEMBER 17, 2008

nhc northwest
hydraulic
consultants

GOOSE SPIT COASTAL PROCESSES

Prepared for:

Comox Valley Regional District

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December 17, 2008

3-4979

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1. INTRODUCTION

1.1 SCOPE OF WORK

This appendix describes the coastal processes at Goose Spit and identifies some potential measures that could be implemented for coastal zone management. The information has been prepared as input to the Goose Spit Coastal Recreation Park Site Plan. This information is intended to assist the Regional District make decisions on the most appropriate ways to manage a complex coastal environment by integrating natural processes into a longterm overall site plan.

1.2 WORK CARRIED OUT

The main tasks that were carried out included:

- Compiling background information and data on wave climate and tides;
- Site investigations and field trips including a review of existing erosion protection measures with local citizens and Regional District staff;
- Reviewing historical airphotos and mapping to document historical changes on the spit over the last century;
- Analyzing topographic surveys of beach;
- Attending public meetings;
- Developing conceptual plans for coastal management at the park.

2. PHYSICAL SETTING

2.1 OCEANOGRAPHIC SETTING

Figure 1 shows the study area. Figure 2 shows an overview of the spit, taken at an extreme low tide. Goose Spit is a prominent marine spit feature at the mouth of the Courtenay River estuary and is attached to the southern end of the Willemar Bluffs, a glacio-fluvial deposit that extends from Comox to Cape Lazo. The spit is located near the northern end of Baynes Sound, Strait of Georgia.

2.1.1 TIDES

The tides in this area are mixed, mainly semi-diurnal. Published tide levels at the site are summarized in Table 1.

Table 1 Published Tide Levels at Comox

Tide Condition	Tide Level (m)	
	Chart Datum	Geodetic Datum
Highest Measured Tide	5.9	2.6
Higher High Water (Large Tide)	5.4	2.1
Higher High Water (Mean Tide)	4.7	1.4
Mean Water Level	3.3	0.0
Lower Low Water (Mean Tide)	1.3	-2.0
Lower Low Water (Large Tide)	0.0	-3.3

Note: Tide level values from CHS Chart 3527

Recent studies of extreme ocean levels (tide + surge) using long-term records at Point Atkinson produced the following estimates (Geodetic Datum):

10-year: 2.44 m

50-year: 2.63 m

100-year: 2.74 m

200-year: 2.90 m

These values are strictly still-water levels and do not include any provision for wave runup or other freeboard. Long-term tide records are not available at Goose Spit. The B.C. Ministry of Environment's published ocean flood construction level at the mouth of



Figure 1: Site Location

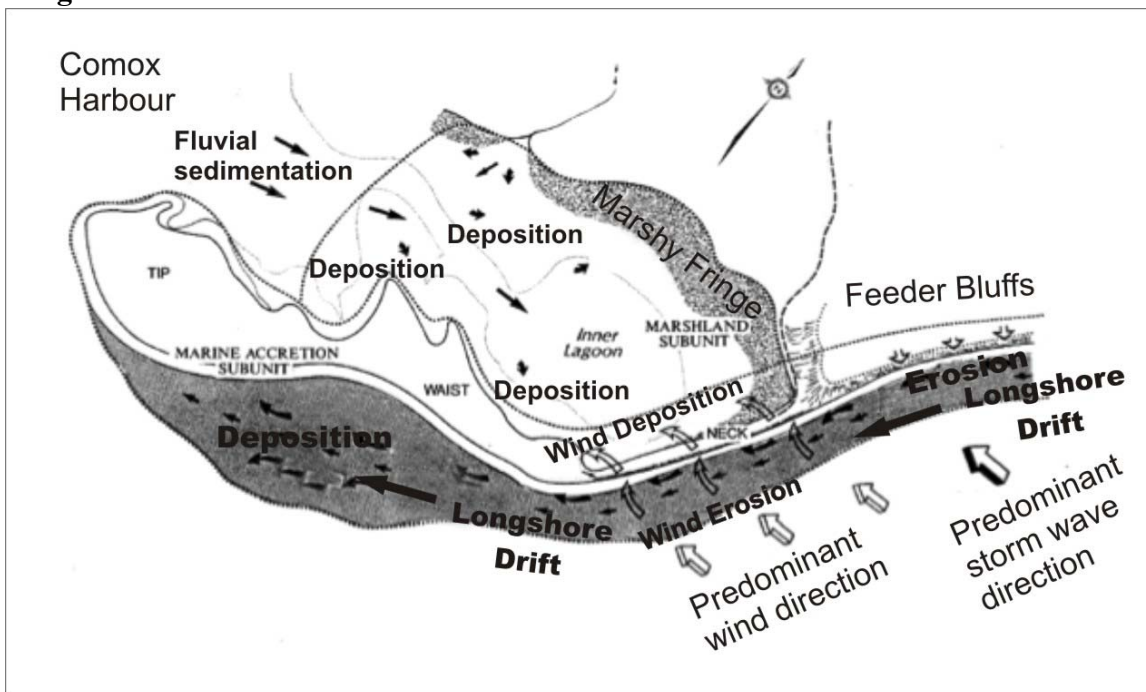


Figure 2: Coastal Processes at Goose Spit

the Courtney River is 3.7 m Geodetic Datum. This level represents an extreme tide with storm surge (200-year return period) and includes a freeboard of 0.6 m to account for wave runup. This level is used to set the foundation levels of buildings and other infrastructure such as roads and bridges.

Recent studies sponsored by the International Panel on Climate Change (IPCC) have projected that sea level will rise in response to global climate change. However, there is considerable uncertainty about the magnitude of this rise. For example, typical median projections in IPCC (2007) were in the range of 0.3 to 0.5 m/century while more recent estimates suggest a rise of 1 m/century or higher. Ongoing research and monitoring should lead to more reliable estimates in the future.

2.1.2 WAVES

The spit is exposed to waves from the east and south east and is partially sheltered by Denman Island and Hornby Island. The fetch length near the north end of the park at the Wilemar Bluffs reached up to 150 km (but more typically 90 km). The southern end of the spit is noticeably less exposed, with the maximum fetch being approximately 50 km. Hindcast deep water offshore waves heights are summarized below in Table 2. Waves breaking along the shore are generally depth-limited and will be generally lower in magnitude.

Table 2: Hindcast Wave Height at Goose Spit Park

Return Period (Yrs)	Wind Speed (km/hr)	Hs (m)	
		South End	North End
2-yr	69	2.0	2.5
5-yr	75	2.2	2.7
10-yr	80	2.3	2.9
25-yr	85	2.5	3.1
50-yr	90	2.7	3.3

The fetch length and hindcast wave heights decreases towards the south-west tip of the spit near the entrance to Comox Harbour. This progressive reduction in wave energy will promote sediment deposition towards the south-west end of the spit

2.2 GEOMORPHOLOGY

The landforms adjacent to Goose Spit Coastal Recreation Park have been shaped during Pleistocene times, particularly since the end of the Fraser Glaciation, approximately 12,000 years ago when glaciers began retreating from Vancouver Island. Deglaciation resulted in rapid changes to the level of the land as well as to the sea during this period. During the initial phase of ice retreat, the land was inundated by the sea up to an elevation of 150 m. Sea level fell rapidly, reaching 15 to 20 m lower than at present by around 10,000 years ago and stabilized to near its present level approximately 6,000 years ago. The prominent shoal (Comox Bar) that lies between the Wilemar Bluffs and Denman Island is probably a remnant of this period of lower sea level. The large isolated rocks exposed offshore on the bar are

remnants of glacial-fluvial sediments that were left behind when the rising sea eroded away more erodible sediments that connected the bluffs to Denman Island.

Goose spit formed in Holocene times (last 10,000 years) as a result of littoral currents transporting sand and gravel sediments in a south-westerly direction. The main source of sediments in the past has been the Willemar Bluffs which are exposed to easterly and south-easterly waves. The process of spit formation was described by Thompson (1976) and Clague (1980):

South east facing sea cliffs about 2 km long and up to 70 m high are being severely eroded by waves. As a result of wave erosion, the cliffs are unable to attain an equilibrium slope and other erosional processes, including mass movement, gullyng by water down the cliff faces and possibly piping contribute to continued instability. Sediment accumulates at the base of the cliff as a backshore apron and is entrained by waves and transported by littoral currents. The apron is prominent in the summer and fall but is generally absent in winter when storm waves cut directly into the cliff-forming Pleistocene sediments. Sediment entrained at the base of the cliff by waves is transported by littoral currents in a south westerly direction. Goose Spit is maintained by this sediment.

The sediment “source” (Willemar Bluffs) and sediment “sink” (Goose Spit) define a closed “littoral cell” and a simple sediment budget can be established to illustrate the relation between erosion and deposition within the cell. The spit has an overall length of 2,200 m, its crest extends up to 5 m above the Lowest Low Tide line and the base width varies from around 200 m at its northern end to 600 m at its southern end (measured at the Low Tide line). The total volume of sand contained in the spit is approximately 1.5 million m³. Assuming the spit formed over a period of about 6,000 years, the average net rate of sand accumulation is approximately 250 m³/year. In order to supply this sediment to the spit, the corresponding rate of retreat of the Willemar Bluffs would be around 6 mm/year or 36 m of total retreat over the last 6,000 years. However, it is likely that the rate of erosion of the bluffs has not remained constant over this time period. It is more likely that the erosion rate was higher in the past, so that most of the spit formed relatively rapidly after sea-level stabilized.

2.3 HISTORICAL CHANGES AT GOOSE SPIT

2.3.1 AVAILABLE INFORMATION

The earliest charts of Goose Spit and Comox Harbour date back to the British Admiralty Chart of 1898. Air photos taken at low tide were obtained from the archives at the University of British Columbia, Department of Geography. Table 2 summarizes the available information.

Table 3: Historic Mapping Information

Date	Source
1898	British Admiralty Chart 3127
1950	BC Government Air Photo
1968	BC Government Air Photo
1991	BC Government Air Photo
2005	Regional District Orthophoto
2008	Low level overflight

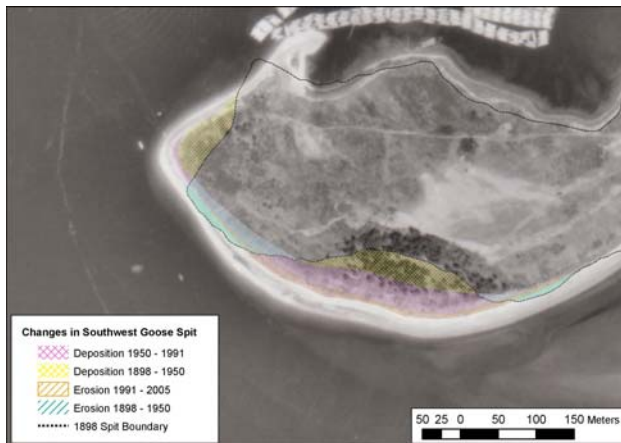
2.3.2 HISTORICAL CHANGES

The 1898 British Admiralty chart was re-published with only minor revisions by the Canadian Hydrographic Service in 1955. The chart describes the Willemar Bluffs as “conspicuous bare white cliffs” while the beach at the north end of Goose Spit was described as “shingle beach 4 feet high, washed up logs 6 feet”. These levels represent the height above High Water, Spring Tides, which would correspond to approximately elevation 3.2 m to 3.4 m (Geodetic). The low elevation tidal flat was described as “flat, drying sand banks”. The naval rifle range and wharf were shown on the chart, indicating considerable development had occurred at the time of the surveys.

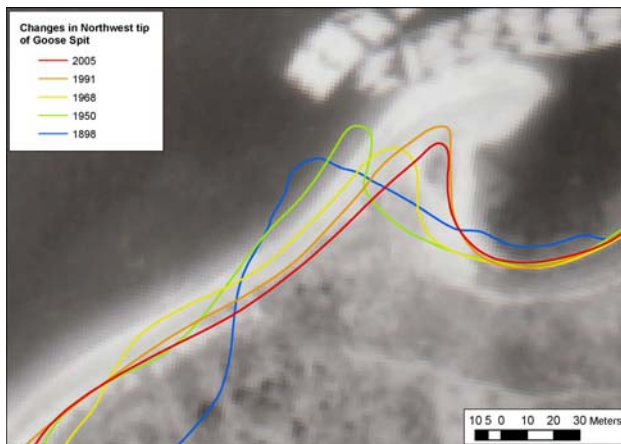
In general, Goose Spit has remained relatively stable throughout the time period of record (1898-2005) with the exception of the western end of the spit.



The southern portion of this area has experienced significant deposition over time, increasing by approximately 2 ha from 1898 to 1991. There is some evidence the vegetation boundary in this area has retreated by roughly 10 m between 1991 and 2005 although this is difficult to determine due to the relatively low resolution of the available 2005 imagery. Deposition has also occurred on the western edge of the spit with the overall shape of this area changing between the 1898 survey and the 1950 aerial photography, remaining relatively constant for the remainder of record.



The small spur on the northwest corner of Goose Spit has been shifting to the east over time.



1991 – 2005:

With the exception of the spur on the northwest corner of the spit there are no definitive changes between the two dates (small differences in outlines are likely due to differences in photo resolution than real change)

The unvegetated portion of the spur does not extend as far out in 2005 (may be differing tides) and more sediment appears to be deposited on the leeward side by 2005 ;

The vegetation boundary on the south edge of the west spit end may have retreated but it is difficult to say for sure with the scan resolution/overexposure in the 2005 image;



2005



1991



1991 – 2005 (2005 scanned ortho copy)

1968 – 1991:

The north side of the spit has remained stable throughout this time period with the exception of the spur on the northwest corner:

The western edge of the spur has shifted eastward;

1991 spur extends farther out than in 1968 but aerial extent of spur was greater in 1968 (although the 1991 photos are taken at a higher tide level).

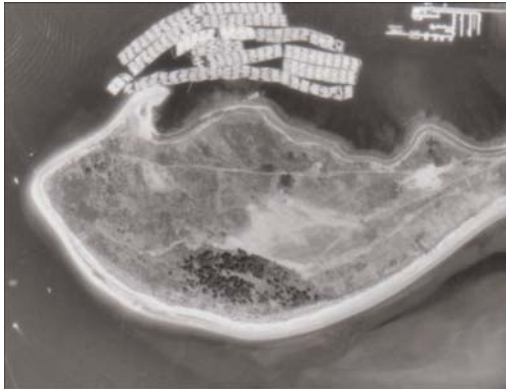
The shape of the western and southern edge of the spit has changed during this time interval:

Some erosion (retreat of vegetation line by ~ 10m) occurred directly west of the spur (continuation of the eastward shift of the spur in this time interval);

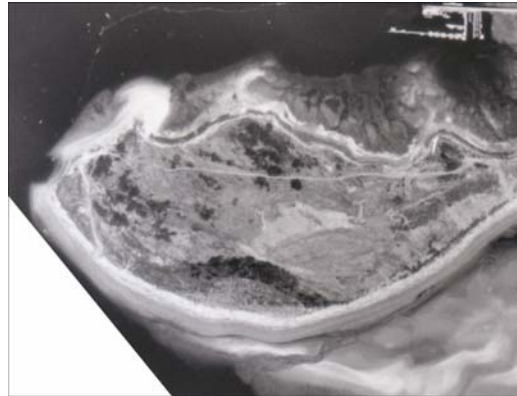
Deposition has occurred on south edge of this area continuing to the west tip of the spit (the vegetation line has extended outward 10 – 20m in this area corresponding to a 0.84 ha increase in spit area).

Vegetation is also more established in the 1991 photo along the middle of the southern edge of Goose Spit (spatial extent of the spit is stable here). The vegetation line has extended

outwards ~10m in this area (differences in outlines of north boundary shown in same picture below are due to differing water levels in the two photo dates).



1991



1968



1968 to 1991 (1991 Photo)

The neck of the spit has remained stable throughout this time period.



1968 – 1991 (1991 photo)

1950 – 1968:

The north side of the spit and the spit neck has remained stable (apparent growth in spit shown by outlines due to differing water levels in photos:

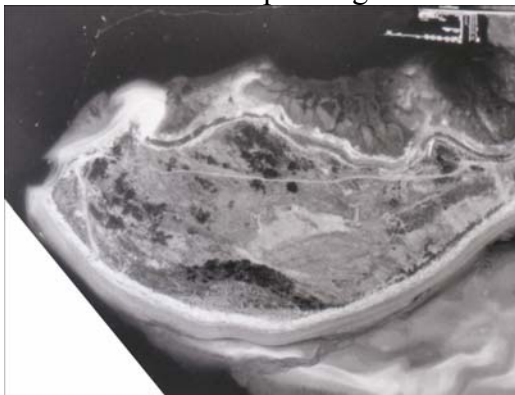
Grass is exposed in 1968 photo and taken as boundary, higher water level in 1950 photo as well as lower resolution – shrub boundary has remained unchanged in this time period);

Spur on northwest corner of spit has shifted eastward ~20m by 1968 photo.

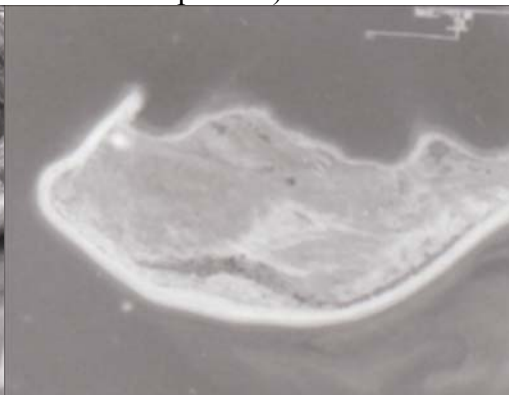
The shape of the western and southern edge of the spit has changed during this time interval:

West tip of spit has eroded ~ 10m (0.04 ha) but compensating deposition (0.04 ha) occurred during same time period directly north of this tip (between spur and tip);

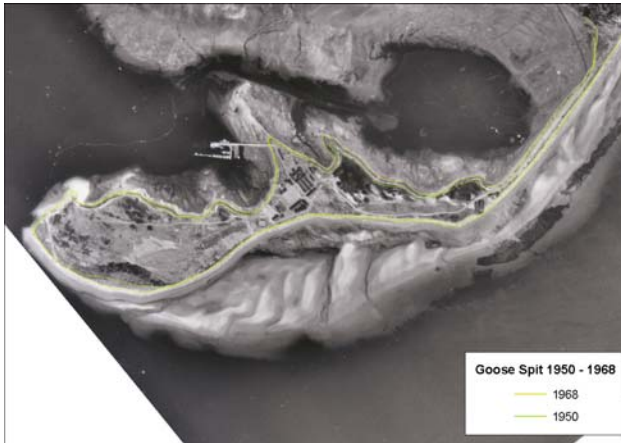
Deposition has occurred on south edge of this area continuing to where the mentioned erosion on the west tip of the spit occurred (the vegetation line has extended outward 12 – 25 m in this area corresponding to a 0.69 ha increase in spit area).



1968



1950



1950 to 1968 (1968 photo)

1898 – 1950:

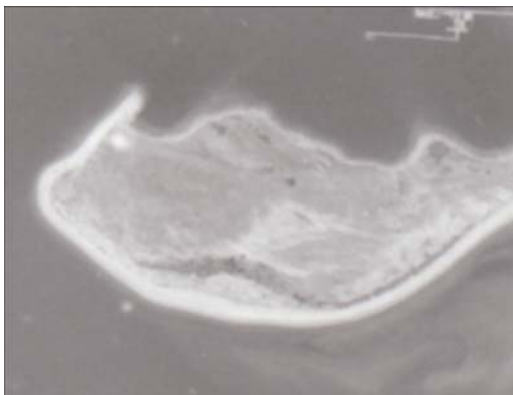
The mapped outline of Goose Spit is smaller on the north side but the marsh/shallows areas marked on the 1898 chart correspond relatively well with the boundaries marked on the 1950 air photos, indicating the boundary difference may be more a difference of interpretation of spit boundaries than actual change. However, definite changes have occurred on the west end of Goose Spit:

Spur on northwest corner has moved eastward between 1898 and 1950;

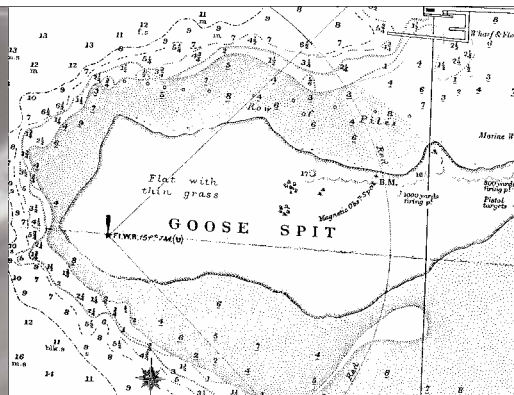
Deposition of 0.35 ha on west tip of spit and north towards spur; immediately below this there has been erosion of 0.36 ha on what was the west tip of the spit in 1898;

Southern edge of the west end of the spit (by convex line of trees in 1950 air photo) has extended outwards by up to 35 m – adding 0.54 ha of land between 1898 and 1950.

Southern edge of the remainder of Goose Spit (that to the east) may have retreated ~ 10 – 15m between 1898 – 1950 although this may be a difference in boundary interpretation between the map and air photos rather than actual change.



1950



1898



1898 to 1950 (1950 photo)

2.4 BEACH CHARACTERISTICS

Figure 3 shows three cross sections of the spit in the park, surveyed for the project in May 2008. These surveys were all made along the relatively narrow south-west trending “neck” of the spit. This portion of the spit has a prominent 100 m wide sandy low-tide

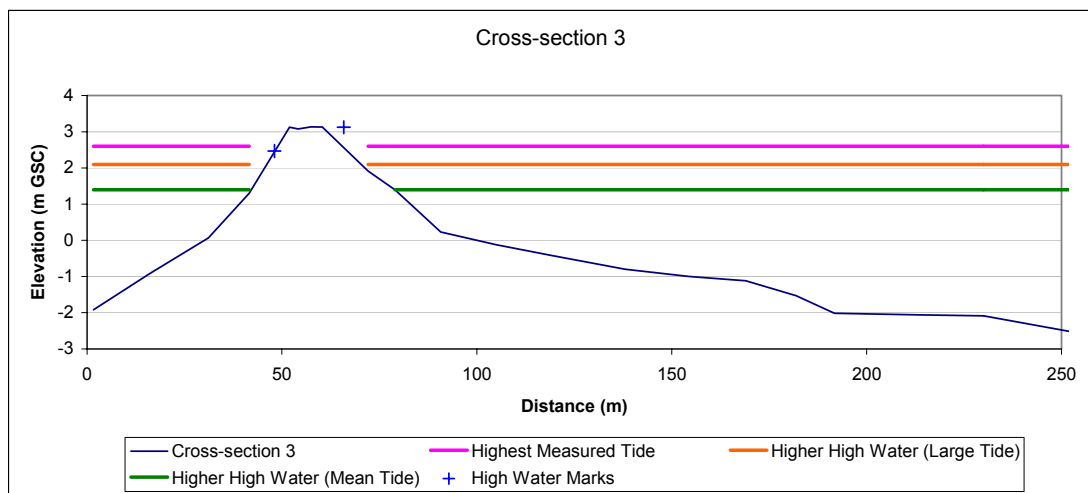
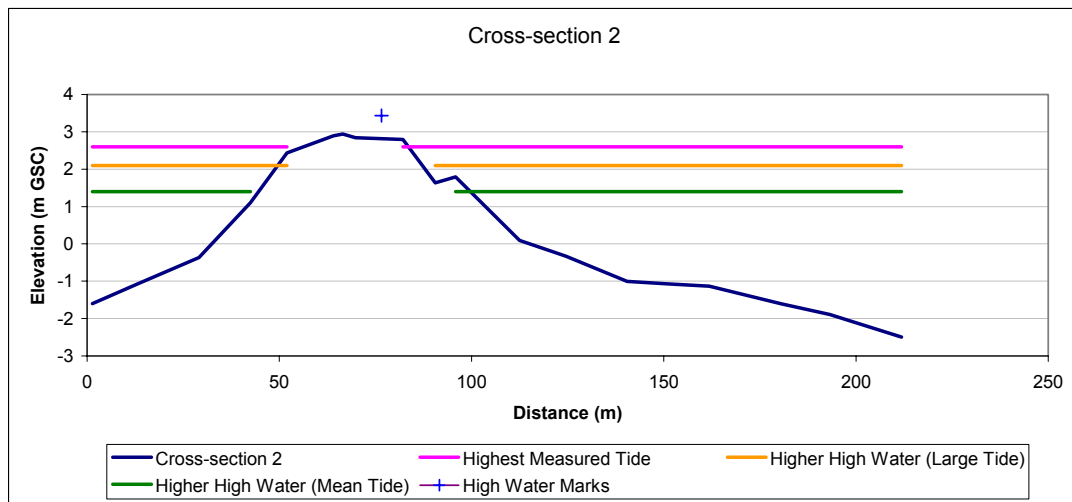
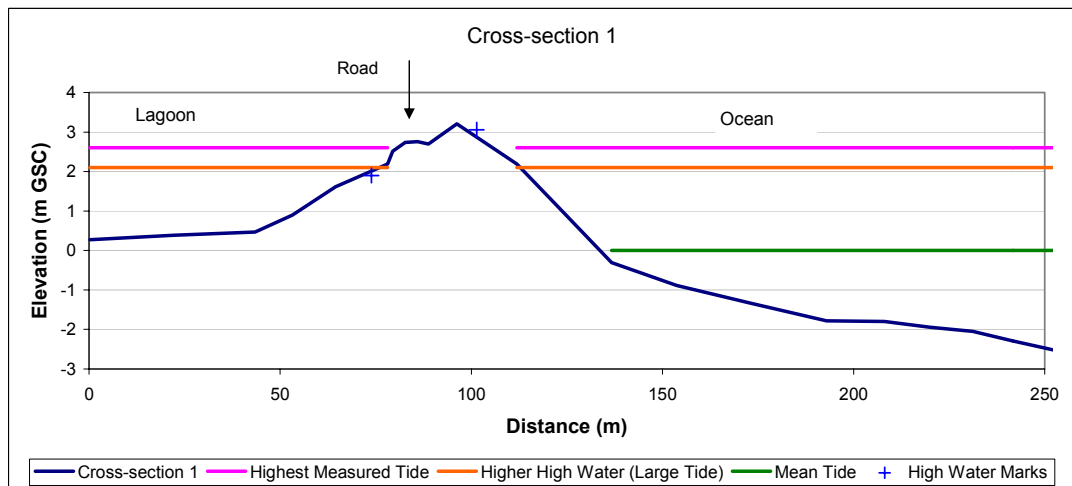


Figure 3: Beach Profiles In Goose Spit Park

platform extending between El. - 3m to 0 m (Geodetic), and a steeper sand and gravel beach (1V:10H slope) that extends from El. 0 m to +3 m (Geodetic). Wind-blown sand accumulates up to El. 3.4 m near the road on the seaward side of the spit and there is a large amount of woody debris deposited near the high tide line. The edge of the road varies between El. 2.7 m and El. 2.8 m over most of its length in the park and is typically 0.3 m to 0.6 m lower than the crest of the wind-blown sand deposits. This portion of the road is 0.9 m below the B.C. Ministry of Environment's coastal flood construction level.

The spit turns west and widens just past the end of the park boundary. This portion of the spit is bordered by a series of large sand waves that are exposed at low tide. This section has formed in the lee of the Comox Bar - a large offshore deposit of glacial-fluvial sediment that extends between Denman Island and the Willemar Bluffs. As discussed previously, the progressive reduction in wave energy along the spit promotes deposition at its south-western tip.

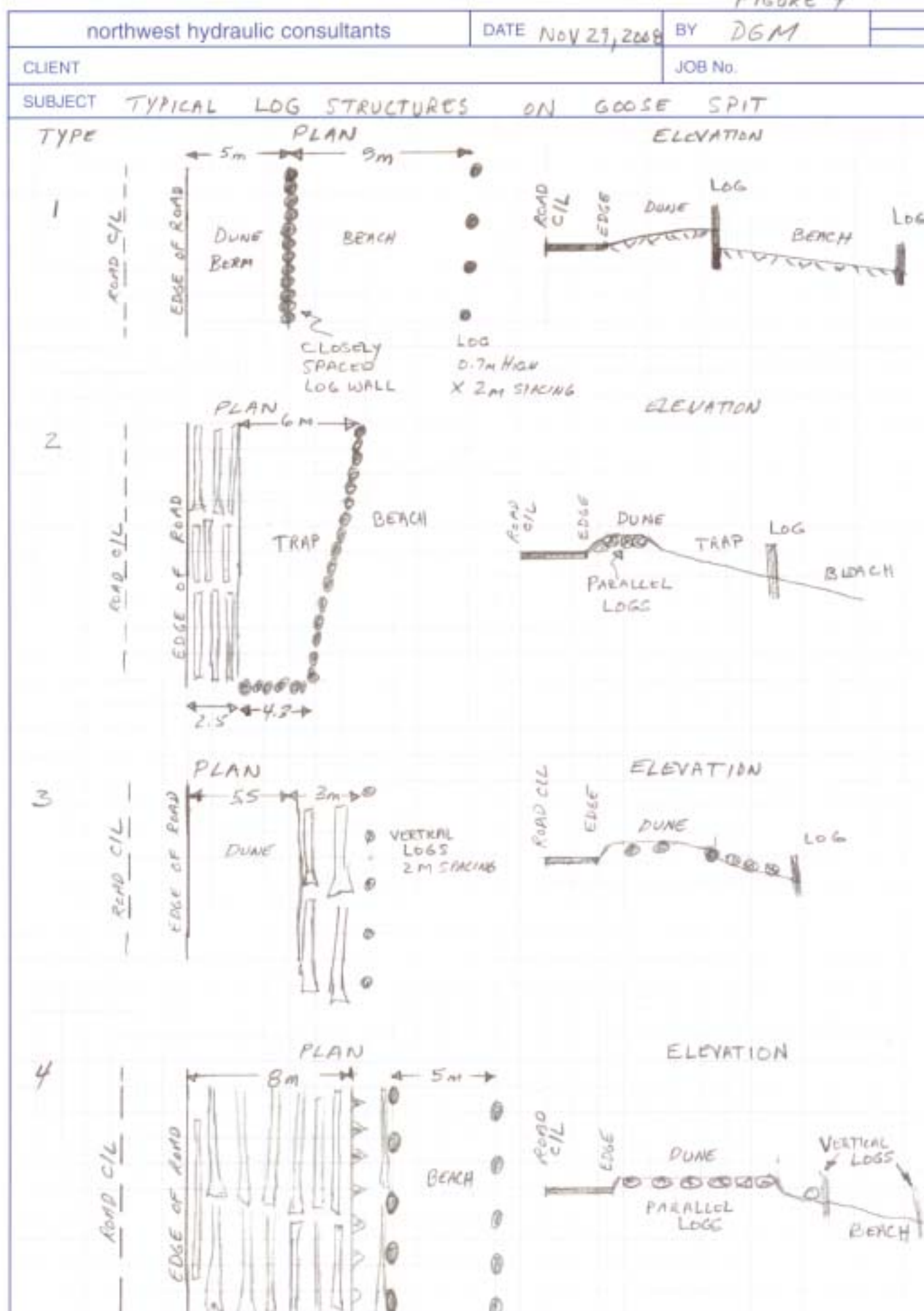
2.5 EROSION PROTECTION AT GOOSE SPIT PARK

2.5.1 LOG STRUCTURES

The District in conjunction with local citizens groups and volunteers has placed various log structures along the beach over the last ten years in an effort to reduce coastal erosion. This work has been carried out annually, at minimal cost using available driftwood and logs found on the beach. The work has been somewhat experimental in nature, although the original concept for the protection received some input from an experienced coastal geomorphologist. We made several field visits to inspect the protection and also discussed the concepts with several of the originators of this work. We also made a detailed review of the available repeat photos of the site conducted by the Regional District since the late 1980's. Based on this information the log structures can be classified into four main types. These types are illustrated in the set of photos appended to the back of this report. The four types are also sketched in Figure 4.

Type 1: Vertical Log Wall

This type of structure is found mainly along the south-west end of the park towards the entrance to the Department of National Defence base and is illustrated in Photo 1. The structure consists of a row of closely spaced logs embedded in the beach to form a continuous wall near the edge of the road. The wall promotes wind-blown sand to deposit directly behind it, which probably reduces sand accumulation on the road. A second row of logs spaced around 2 m apart has been embedded in the beach approximately 9 m further down the slope. It appears these logs do not have much effect on the beach profile (Photo 1), although they may help to retain driftwood on the higher elevation portions of the beach.



Type 2: Vertical Log Trap Structure

A closely spaced row of vertical logs has placed at an angle to the crest of the spit. The narrow end has been blocked off completely with logs, while the wider entrance is more open, although some parallel logs have been placed. The structure traps driftwood and sand moving along the coast, building up the berm in front of the road (Photo 2). It appears that the structure mainly traps log debris during high tides, then sand (possibly wind-blown) deposits later on.

Type 3: Single Row Vertical Logs With Horizontal Logs On Berm

In some locations, a single row of widely spaced (2 to 3 m) logs has been embedded in the beach to form a row running parallel to the shoreline. A number of logs have been placed horizontally behind this row along the upper berm. The vertical logs do not appear to have had much effect on the beach profile, but do seem to stabilize the horizontally-placed logs, preventing them from washing offshore during high tides.

Type 4: Double Row Vertical Logs With Horizontal Logs on Berm

Near the north east end of the park there are sections with two rows of widely spaced vertical logs embedded in the beach, with additional flat-lying logs behind, along the top of the berm (Photo 4). The berm is noticeably wider (up to 8 m) in this area. The vertically placed logs appear to prevent the driftwood and flat-lying logs from washing offshore during high tides. This promotes vegetation to become established on the berm area.

2.5.2 EFFECTIVENESS OF LOG STRUCTURES

Wave transmission through a row of vertically-spaced piles has been analyzed in a number of studies for designing breakwaters. The transmission coefficient K_t has been described in terms of several parameters including:

Pile porosity = $b/(D+b)$ where b is the spacing between the piles and D is their diameter;

Wave steepness ratio (H/L), where H is the wave height and L is the wave length;

Wave height/water depth ratio (H/d);

Wave breaking parameter: d/gT^2 where g is the gravitational constant and T is the wave period.

A simple method by Wiegel (1964) illustrates an idealized case for a single row of piles:

$$\frac{H_t}{H_i} = \sqrt{\frac{b}{D+b}} \text{ where } H_i \text{ is the incident wave and } H_t \text{ is the attenuated wave}$$

For example, if 0.3 m diameter logs were placed with 2 m openings between the logs, then the transmitted wave will be 93 % of the incoming wave, indicating only minor energy dissipation will occur. This equation indicates the gap between the logs has to be kept small (less than 0.5 m) to significantly attenuate the waves. Therefore, only the upper row of closely spaced logs in the Type 1 structure will significantly attenuate the incoming waves.

The lower wall of widely spaced logs in the Type 1 structure will not contribute much in the way of energy dissipation. The relatively open log structures (particularly Type 3 and Type 4) also will not significantly reduce the wave energy reaching the shoreline. However, these structures may trap other floating wood, which then accumulates along the upper berm and then promotes sand deposition and vegetation establishment (Photo 5).

3. STORMS EVENTS AND COASTAL EROSION

3.1 FACTORS GOVERNING EROSION PROCESSES

On the east coast of Vancouver Island, coastal erosion usually occurs when severe storms coincide with periods of unusually high tides. The maximum water level depends on a number of factors including:

- Astronomical high tide;
- Temporal variations in mean ocean level during El Nino and La Nino cycles;
- Storm surge;
- Wave runup.

The meteorological and tide level conditions for two recent intense storms in the Strait of Georgia:

- November 15, 2006;
- November 12, 2007.

Both of these storms were “south-easterlies”. The 2006 storm caused extensive coastal flooding, erosion and landslides along Vancouver Island and the Lower Mainland (Stanley Park for example).

3.2 AVAILABLE INFORMATION

Hourly meteorological data was obtained from the following stations:

- Comox Airport
- Vancouver International Airport
- Halibut Bank Wave Buoy

Hourly predicted and observed tide levels were obtained for Point Atkinson and Campbell River tide gauges. The difference between the observed and predicted tide levels was taken to represent the storm surge.

The basic data are summarized in Table 4 below.

Table 4: Summary of Observed Conditions in 2006 and 2007

Parameter	Unit	Location	November 2006	November 2007
Wind Speed	(Km/hr)	Comox	70	83
Wind Speed	(Km/hr)	YVR	---	61
Wind Speed	(Km/hr)	Halibut Banks	64	64
Wave Height	(m)	Halibut Banks	2.27	2.37
Ocean Level	(m Chart Datum)	Campbell River	4.79	4.56
Ocean Level	(m Chart Datum)	Point Atkinson	5.05	5.04
Storm Surge	(m)	Campbell River	0.70	0.58
Storm Surge	(m)	Point Atkinson	0.78	0.83

3.3 STORM EVENTS

3.3.1 NOVEMBER 15, 2006

A strong frontal low pressure system passed over Vancouver Island between November 14 to November 16, 2006, causing widespread flooding in the region. Very strong winds combined with the heavy rains triggered tree falls, debris flows and slope failures on portions of Vancouver Island and the Lower Mainland. Figure 5 summarizes the met-oceanographic conditions recorded during the event.

Winds

Winds were blowing from the west to northwest on the morning of November 14th, then veered to the south east as the front advanced and increased in magnitude to typically 40 to 50 km/hour throughout the remainder of the day. The storm intensity increased throughout the morning of November 15th, reaching 70 km/hr at Comox at 08:00 hr and 64 km/hr at Halibut Banks at 15:40 hr. At Comox, the winds averaged more than 60 km/hr for seven consecutive hours. The return period of this event was estimated to be just under 5 years at Comox.

Waves

The observed significant wave height (Hs) at Halibut Banks varied between 0.5 and 1.0 m on November 14th and early morning of the 15th, then increased to 2.3 m in the afternoon of the 15th. The time of the peak Hs value coincided with the peak wind speed measured at Halibut Banks, but differed appreciably from the time of the peak winds at Comox.

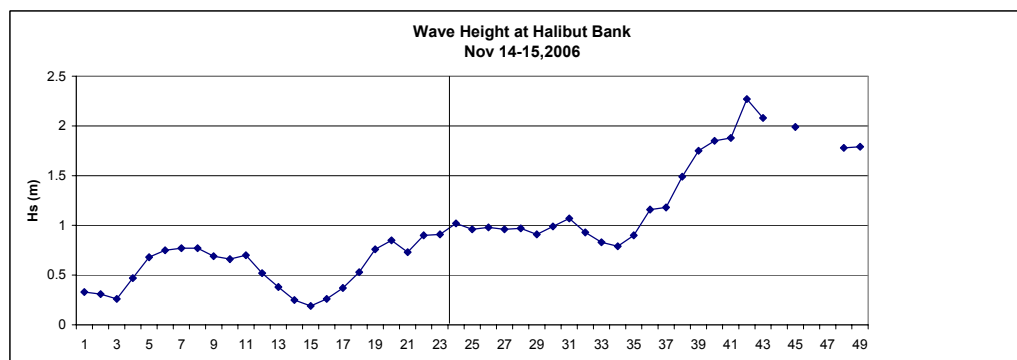
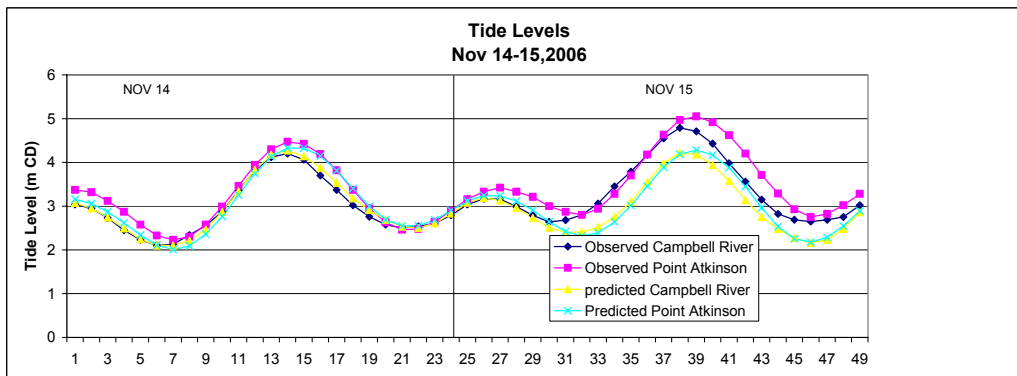
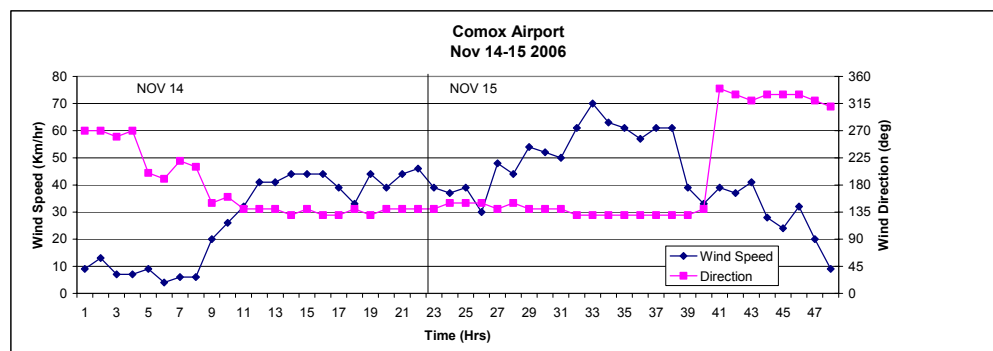
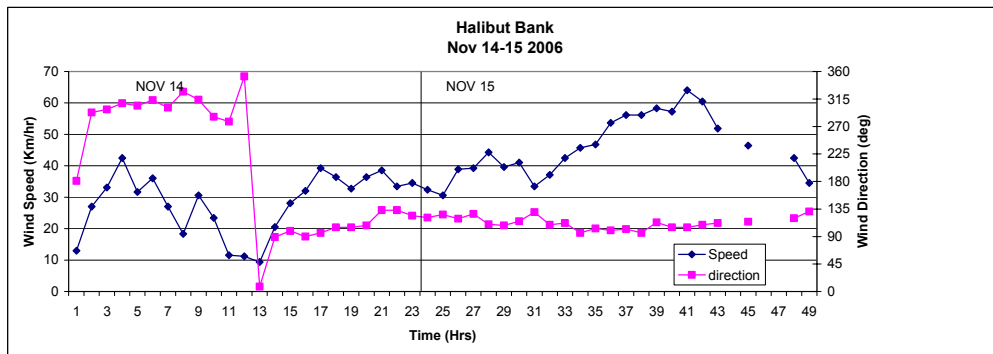


Figure 5: November 2006 Storm Event

measured at Halibut Banks, but differed appreciably from the time of the peak winds at Comox.

Tide Levels

Times of predicted high water at Point Atkinson and Campbell River are quite similar (within one hour). Higher high water at Point Atkinson was about 0.3 m greater than at Campbell River. The predicted high tide on Nov 15th was 4.22 m (Chart Datum) at 13:00 hr at Campbell River and 4.28 m (Chart Datum) at 14:00 hr at Point Atkinson. The observed tide levels at these times were 0.5 m to 0.77 m higher than predicted-this difference represent the magnitude of the storm surge. The observed high tide was 4.79 m at 13:00 hrs at Campbell River and 5.05 m at 14:00 hr at Point Atkinson. These levels were not particularly extreme, having return periods of less than a 2 year magnitude.

The maximum storm surge reached 0.7 m at 09:00 hr at Campbell River and 0.78 m at 13:00 hrs at Point Atkinson. Therefore, the maximum storm surge at Point Atkinson coincided almost exactly with the astronomical high tide. The maximum storm surge at Campbell River occurred several hours before high tide, near mean sea level.

3.3.2 NOVEMBER 12, 2007

Figure 6 summarizes met-ocean data during the period November 11th-12th, 2007.

Winds

The wind was blowing predominantly from the south east on November 11th and 12th at Vancouver International Airport (YVR), with the maximum speed reaching 61 km/hr at 06:00 hr. Measurements at Halibut Banks were intermittent, however the pattern and magnitude was generally very similar. One difference between the sites is that the highest wind speeds were reported to occur between 13:40 and 14:40 hrs at Halibut Banks-at YVR the winds had died down to approximately 40 km/hr by this time.

The winds at Comox veered from predominantly west during the morning of November 11th, to south east throughout the period of the greatest storm intensity, then veered rapidly back to the west after the passage of the low pressure system. The maximum wind speed reached 83 km/hr at 08:00 hr and averaged more than 70 km/hr for five hours. The return period for this event is 20 years (at Comox).

Waves

The output from the wave buoy was not continuous during this storm event. However, the buoy shows the wave heights increased during the evening of November 11th and morning of November 12th. A significant wave height of 2.13 m was reported at 08:40. However, the higher wave conditions (up to 2.37 m) occurred between 14:40 and 18:40 hr. Due to missing records it is likely that the period of highest wave conditions was not recorded.

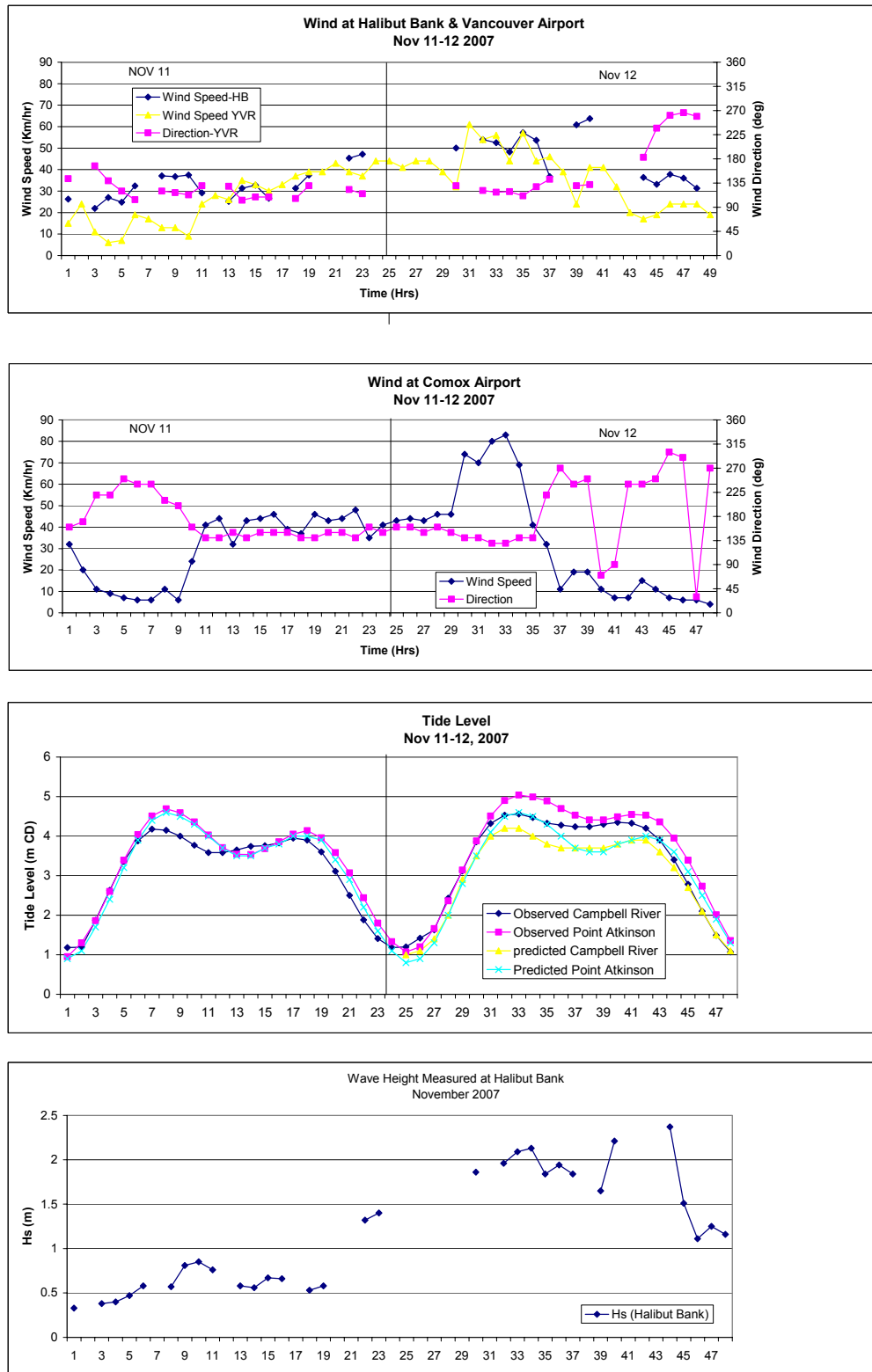


Figure 6: November 2007 Storm Event

Tides

The highest predicted tides reached 4.2 m (Chart Datum) at 08:00 hr at Campbell River and 4.6 m (Chart Datum) at 08:00 hr at Point Atkinson. The highest observed tide level reached 4.56 m at 08:00 hr at Campbell River and 5.04 m at 08:00 at Point Atkinson. The magnitude of the storm surge at these times varied between 0.36 m at Campbell River and 0.44 m at Point Atkinson. The maximum recorded storm surge reached 0.6 m at 14:00 hr at Campbell River and 0.83 m at 12:00 hr at Point Atkinson. It is expected that the highest still water level at Goose Spit was around El. 2.0 m (Geodetic Datum) during the November 2007 storm.

3.4 ASSESSMENT

The November storms of 2006 and 2007 had return periods of between 5-years (2006) and 20-years (2007), based on wind records at Comox Airport. In November 2006 the greatest potential for erosion occurred near the southern end of the Strait of Georgia, since the storm intensity peaked at the time of highest astronomical tide level. Further north near Comox/Campbell River the storm intensity reached its maximum at the time of mean sea level, causing waves to break before reaching the highest point on the shoreline. In November 2007, the greatest potential for erosion occurred along the northern end of the Strait of Georgia, due to the greater wind speed in this region.

The maximum observed wave height in November 2006 at Halibut Banks was 2.27 m. The corresponding deep water wave height at Goose Spit was estimated to range between 2.7 m and 2.2 m.

During the November 2007 storm, the highest wind speed coincided with the time of the highest astronomical tide at Comox. This produced a relatively severe storm condition, with a 20-year wind coinciding with a high ocean water level (but still under a 2-year return period). The storm surge did not reach its maximum value until several hours after higher high water (around the time of the highest waves recorded at Halibut Banks). The still-water level (approximately El. 2.0 m Geodetic Datum) was 0.7 m below the crest of the road during the storm. However, wave runup would have caused breaking waves to overtop the road.

The highest observed wave height (H_s) at Halibut Banks in 2007 was 2.4 m. The hindcast deep water wave height along Goose Spit park was estimated to range between 2.9 m to 2.5 m.

These results indicate that the existing log erosion protection structures were exposed to relatively severe storm conditions in the last few years. The fact that they survived intact is a good indication that the approach is reasonable and effective.

4. COASTAL ZONE MANAGEMENT

4.1 PREVIOUS PLANNING STUDIES

The Regional District has prepared a general framework plan for coastal zone management (Marsh and Mewett, 2002) in the region. That plan identified the geological processes governing the formation of the spit and recommended restricting the use of groins or riprap revetments on the spit. It also recommended adopting set-backs from the cliffs and bluffs in order to avoid the need for further hard protection along the base. The following discussion on future shoreline management generally attempts to be consistent with this approach.

4.2 COASTAL MANAGEMENT ISSUES AT GOOSE SPIT

4.2.1 ROAD OVERTOPPING AND SAND DEPOSITION

The road in the park is presently subject to overtopping by wave runup during severe winter storms and is approximately 0.9 m below the published Coastal Flood Construction Level for this region. The road is also subject to sand deposition both from wind and wave runup. The sandy berm is typically 0.3 to 0.6 m higher than the adjacent road surface, which makes it inevitable that sand will be deposited on the road (Photo 6). At present, the sand that is deposited on the road is generally scraped and pushed back onto the berm. In terms of maintaining the sediment budget of the spit, it would be better to stockpile the sand and put it back onto the beach near the north end of the spit (say near mid-tide level).

Sand fencing is sometimes used to prevent sand from being blown onto the road. The Type 1 shoreline protection described in Section 2.5.1 appears to provide a similar function to some degree. However, given the narrow width of the berm and the large amount of sand on the lower tidal flats, it will be very difficult to significantly reduce this problem with walls or sand fencing alone.

If the road is raised at some time in the future then additional measures will be required to harden it, to prevent attack during wave runup. The use of buried riprap, similar to the approach used recently at the Department of Defence would be appropriate.

4.2.2 SHORELINE PROTECTION

Efforts have been made by the District along with local volunteers to reduce erosion by installing a variety of log structures. The work has been carried out at very minimal cost and appears to be contributing to stabilizing the upper portions of the beach. The use of log structures as erosion control measures has been very successfully applied for river restoration and streambank erosion protection. There is much less experience with coastal applications. However, the use of log structures to protect coastlines has been used with success in Washington State and is consistent with other bio-engineering methods and the “Green-Shores” approach. Therefore, this approach has considerable merit. In order to be sustained it

will involve ongoing maintenance costs and support by the District. A more systematic approach should be developed, which would involve monitoring the effectiveness of the work and then identifying which areas should be protected. It appears the Type-1 vertical wall placements are most effective in protecting the berm against erosion as well as limiting wind-blown sand accumulation. These measures also have a smaller “footprint” than some other log structures that have been built. There needs to be some assessment on how much wood on the beach is desirable from the point of view of beach usability and environmental considerations. In particular, some less successful structures on the lower part of the beach could be removed without significantly affecting the stability of the shoreline.

The existing structures do not have much benefit towards increasing the area of sandy deposits at the mid-tide level of the beach that are most desirable in terms of recreation. However, other log structures could be developed to enhance sand deposition. These could include placing a row of closely spaced logs parallel to the beach (similar to an offshore breakwater) so that a tombolo feature is created in the lee of the logs. A series of log walls could also be constructed perpendicular to the beach to form low spurs. Both structures could be built in conjunction with efforts to dispose sand accumulated from the road.

4.2.3 *LONG-TERM STABILITY OF THE SPIT*

The long-term stability of the spit will be governed by several factors including:

- Sediment supply
- Impacts of other engineering structures or interventions
- Sea level rise
- Impacts of other engineering structures or interventions

It is believed that the sediment supply to the spit is lower now than in the past. The sediment supply will affect both the overall stability of the spit as well as the characteristics of the beach. For example, a reduction in sediment supply will result in the development of a coarser, boulder-shingle beach, rather than a predominantly sandy beach. The portion of the spit in the park appears to be in a reasonably stable state - no longer accreting but not actively degrading at least in the short-term. However, further monitoring is required to confirm the actual trend.

Given the present situation, care should be exercised to avoid interfering further with the sediment supply or constructing measures that adversely affect the stability of the spit. Examples of measures that could affect the stability of the spit include (1) installing a sea-wall to prevent the road from overtopping (3) installing groins. Although there may be benefits to these types of measures in the long-term, the impacts and mitigation requirements would need to be carefully evaluated before they were implemented.

Climate change and sea-level rise are long-term threats to the stability of the spit and will affect its function as a recreational area. There is a relatively broad scientific consensus indicating that climate change is occurring and will be accompanied by rising sea levels. However, projections of future sea-level rise are very uncertain. IPCC (2007) reported a

median estimate of many different scenarios and model predictions of +0.3 m to the year 2100, while more recent research is suggesting higher values of around 1 m by 2100 (Washington Climate Impacts Group, 2008). Furthermore, most studies predict a greater intensity and frequency of storms. A sea level rise of 0.5 m means that the still ocean level would exceed the top of the road in many years. If the high tides coincided with intense SE winds and wave action, this would lead to significant erosion and likely breaching of the road and causeway near the narrow neck of the spit. If sea-level rose by 1 m, then the road would be overtopped by more than 0.3 m for many days each year. The road could not be maintained intact without major hardening efforts to prevent undermining and erosion. If this hardening was not undertaken, the park would no longer be accessible to vehicle traffic.

4.3 RECOMMENDED STABILIZATION MEASURES

4.3.1 SHORT-TERM MEASURES

The following measures (three to five years) could be incorporated into shoreline management plans at relatively low cost.

Shoreline Erosion Protection Using Log Structures

Fund pilot-scale projects for installing and monitoring the effectiveness of log structures using the general techniques and methods developed by the volunteer group and District staff. Focus efforts to refine the Type-1 vertical walls, which appear to be most effective and have the smallest overall footprint. The lower row of widely spaced vertical logs does not appear to contribute to reducing wave energy at the shoreline and probably can be discontinued. Some logs on the beach and on the berm in areas identified by biologists should be removed.

The use of alternative methods incorporating ballasted root wads and anchored log groups should be considered to produce more natural structures. These structures and the closely spaced vertical log walls (Type 1 structures in Section 2.5.1) should be considered for protecting more critical areas such as utility poles, beach access portals and parking lots. The annual cost of this type of work could be in the order of \$25,000 to \$50,000 per year.

Alternative measures such as low log crib walls placed parallel to the beach at the mid-tide level to generate sand accretion should also be attempted. This should be planned in conjunction with any efforts to provide sand nourishment using wind-blown sediments from the road.

Sediment Supply

Wind-blown sediments that currently deposit on the road should be placed back on the foreshore portion of the beach near the up coast (eastern) end of the park. This would contribute to maintaining the overall sediment budget of the spit by offsetting the reduction in supply from up coast sources.

Monitoring

The District's beach profile surveys and systematic photography of the beach should be continued to provide a means for assessing trends and changes in the spit. The three profiles of the beach should be re-surveyed annually and compared. The terrestrial photography should be carried out twice each year (late summer and early spring) in order to provide some information on seasonal patterns.

4.3.2 LONG-TERM MEASURES

Road Raising

If access to the spit needs to be maintained throughout the year then consideration will have to be given to raising the road. The current Flood Construction Level (El. 3.7 m Geodetic) would provide a reasonable elevation that would reduce wave overtopping and sand deposition. This would require hardening the road to protect against wave runup and wave breaking.

Sediment Supply

It may become necessary to carry out periodic beach nourishment, if the beach experiences degradation over time. One approach might be to use dredge spoil from nearby harbours if the sediment quality is suitable. Another approach might be to pump sand from offshore, provided this did not result in any adverse impacts. However, the cost of beach nourishment could be high (in the order of \$0.5 million to \$1 million) given current dredging costs. Therefore, the other more natural, low-cost approaches would be more desirable.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 CONCLUSIONS

1. Goose Spit has remained relatively stable over the last century;
2. The road is subject to overtopping by wave runup during storm events that coincide with high tides;
3. Past log placement work has promoted stability of the berm and back-shore zone;
4. A low-intensity maintenance approach to shoreline stabilization, using log structures and monitoring appears to be cost-effective and appropriate;
5. The future stability of Goose Spit will be affected by factors such as sediment supply (probably lower than in the past) and climate change (rising sea level and greater storm intensity is predicted)
6. The road will need to be raised in the long-term to maintain year-round access. This may not necessarily be critical in terms of the overall plans for the park.

5.2 RECOMMENDATIONS

Continue to follow the general framework guidelines for coastal zone management as prepared by Marsh and Mewett (2002), particularly in terms of adopting low-impact “greenshores” approaches for shoreline protection.

Implement a more systematic monitoring program including annual re-surveys of the three profiles established for this study and repeat photography of the beach.

Increase the level of support to the volunteer group that has undertaken installation of the log structures and implement a more systematic approach to design, install and monitor their operation. Aim to eventually produce structures that can protect the road and parking areas against a relatively severe storm event (say 25-year to 50-year return period).

Pilot-test additional design concepts to increase sand accretion on the mid-tide portion of the beach using low log walls and beach nourishment using wind-blown sand accumulating on the road.

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TABLES

Table 3.1: Composition of Foreshore Sediment Samples

Bulk Composition	Average of All Samples	Range
Per Cent Gravel	42	75 – 21
Per Cent Sand	56	75 – 24
Per Cent Fines	4	7 – 1

Table 3.2: Historical Air Photography

Year	Date	Flight Line	Scale
1951	09/18	BC 1421	1:31,680
1964	06/08	BC 5097	1:31,680
1968	07/24	BC 7078	1:16,000
1975	07/26	BC 7764	1:30,000
1980	08/18	BC 80102	1:20,000
1984	07/15	BC 84024	1:20,000
1996	07/14	BC 96016	1:40,000
2001		orthophoto	N/A

Table 3.3: Erosion Along Shoreline

Location	Time Period	Shoreline Change (m)	Advance/Retreat
Hart Creek mouth	1968-1980	-29.6 $\pm$ 8.0	Retreat
	1980-1984	+12.0 $\pm$ 1.4	Advance
	1984-2005	+11.8 $\pm$ 5.6	Advance
Union Point Area	1968-1980	-26.2 $\pm$ 4.2	Retreat
	1980-1984	+18.2 $\pm$ 1.9	Advance
	1984-2005	+38.0 $\pm$ 7.2	Advance
Southern Shoreline	1968-1980	-20.2 $\pm$ 5.1	Retreat
	1980-1984	+3.2 $\pm$ 1.9	Advance
	1984-2005	-6.4 $\pm$ 2.4	Retreat

Table 3.4: Erosion Rates Along Shoreline

Location	Time Period	Rate of Shoreline Change	Advance/Retreat
Hart Creek Mouth	1968-1980	-2.5 m/y	Retreat
	1980-1984	+3.0 m/y	Advance
	1984-2005	+0.6 m/y	Advance
Union Point	1968-1980	-2.2 m/y	Retreat
	1980-1984	+4.5 m/y	Advance
	1984-2005	+1.4 m/y	Advance
Southern Shoreline	1968-1980	-1.7 m/y	Retreat
	1980-1984	+0.7 m/y	Advance
	1984-2005	-0.3 m/y	Retreat

Table 3.5: Published Tide Levels at Comox

Tide Condition	Tide Level (m)	
	Chart Datum	Geodetic Datum
Highest Measured Tide	5.9	2.6
Higher High Water (Large Tide)	5.4	2.1
Higher High Water (Mean Tide)	4.7	1.4
Mean Water Level	3.3	0.0
Lower Low Water (Mean Tide)	1.3	-2.0
Lower Low Water (Large Tide)	0.0	-3.3

Note: Tide level values from CHS Chart 3527

Table 3.6: Fetch Distance At Five Locations Along Shoreline

Azimuth	Location				
	1	2	3	4	5
90 (East)	3.4	3.2	3.3	3.2	3.3
100	3.4	3.1	3.2	3.1	3.0
110	3.4	3.1	3.0	3.2	3.2
120	3.4	3.3	3.3	3.4	3.3
130	3.8	3.6	3.5	3.7	3.7
140	4.3	4.1	4.2	4.4	4.2
150	5.2	4.9	12.0	11.1	10.4
160	8.9	8.5	8.2	8.0	7.5
170	0.3	5.3	4.7	2.5	1.7

Table 3.7: Frequency of Occurrence of Winds at Comox Airport 1982 to 2007

Hourly Wind Speed (km/hr)	Hourly Records Exceeding Indicated Speed	% of Time Winds Exceed Indicated Value	Average Number of Days/Year	Average Number of Hours/Year
> 10	108,053	46.7	170.6	4,094
> 20	48,502	21.0	76.71	1,841
> 30	21,758	9.4	34.3	823
> 40	7,428	3.2	11.6	278
> 50	2,223	1.0	3.7	88
> 60	381	0.16	0.6	14
> 70	64	0.03	0.1	2.6
> 80	6	0.003	0.01	0.3

Note: Total number of observations in period of record = 231,461

Table3.8: Annual Frequency of Wind Speeds

Return Period (Years)	SE to SW	E to SE	NW to NE	All Directions
2	67.8	69.0	44.2	71.3
5	73.4	75.2	48.7	76.7
10	76.1	79.6	51.5	80.0
25	78.9	85.4	55.1	83.5
50	80.6	89.6	57.6	86.0
100	82.1	94.0	60.1	88.4
200	83.5	98.6	62.7	90.0

Table3.9: Deep Water Wave Hindcasting (SE Storms)

Return Period (Years)	Wind Speed (Km/hr)	Significant Wave Height H_s (m)				
		Site 1	Site 2	Site 3	Site 4	Site 5
2	71.0	1.0	1.0	1.2	1.2	1.1
10	80.0	1.2	1.2	1.2	1.3	1.3
25	83.5	1.3	1.2	1.4	1.4	1.4
50	86.0	1.3	1.2	1.5	1.4	1.4
100	88.5	1.4	1.3	1.6	1.5	1.5

Table 4.1: Gradation of Beach Fill

Per Cent Finer Than	Diameter (mm)
100 %	300
75 %	225
50 %	150
25 %	75
10 %	2

Table 4.2: Gradation of Armour Stone

Per Cent Finer Than	Mass (Kg)	Diameter (mm)
100 %	700	730
75 %	440	630
50 %	230	500
25 %	140	430
10 %	75	350

Table 4.3: Cost Estimate Summary (Phase 1)

Description	Cost
Supply 5,000 t riprap to site	\$120,000
Supply 20,000 t gravel/cobble to site	\$400,000
Site preparation	\$15,000
Site cleanup/rentals/misc	\$12,000
Equipment mobilization	\$7,000
Placing riprap	\$47,000
Placing cobble	\$65,000
Final Design, Surveys & Monitoring	\$50,000
Subtotal 1	\$716,000
GST	\$35,800
Subtotal 2	\$751,800
Contingency (10%)	\$75,180
Total	\$826,980

Photos



Photo 1: Viewing southwest, Type 1 log protection near SW end of park



Photo 2: Viewing north east Type 2 log protection



Photo 3: Type 3 Protection



Photo 4: Type 4 Log Protection



Photo 5: Changes on Berm 1999 to 2008



Photo 6: Sand Deposition on Road

**Appendix E: Ecological Inventory and Review of Site Plan –
Rupert Wong Consulting**

**ECOLOGICAL INVENTORY
AND REVIEW OF ENHANCEMENT CONCEPTS
AT GOOSE SPIT COASTAL RECREATION PARK,
COMOX, BC**



Cover photos: Study Area at 2.1 m tide (R. Wong, 2008); inset Brant in spring (M. Yip, 2007); inset SVM larva (R. Wong, 2008)

Submitted January 7, 2009

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INTRODUCTION

In April 2008, Outlook Land Design Inc. assembled a team of professionals to prepare a site plan for Goose Spit Coastal Recreation Park (the Study Area). R. Wong Consulting was retained to delineate occurrences of sensitive ecosystems and the wildlife they support within the Study Area and outline recommendations to protect these environmentally sensitive areas (ESAs). Accordingly, the following information has been summarized in the sections to follow:

- 1) Biophysical inventory of ESAs including habitat types and rare species represented in the Study Area.
- 2) Habitat classification and delineation.
- 3) Summary of site plan concepts and recommended ecosystem management strategies.
- 4) Anticipated permitting requirements

SITE DESCRIPTION

Goose Spit is located at the southeast entrance of Comox Harbour where it gradually evolved thousands of years ago by way of erosion of Willemar Bluffs, littoral drift and accretion by wind and waves. The Study Area occupies an estimated 15.08 ha comprised of a 9.08 ha marshland planning unit and a 6.00 ha outer foreshore and dune planning unit (Figure 1). The biophysical features of Goose Spit are recognized as a unique and highly productive biological environment that supports rare plant and animal species as well as rare and fragile plant communities. Accordingly, one of CVRD's management priorities is to sustain critical habitat features and function of Goose Spit.

The upper portion of the marshland planning unit is regularly inundated with brackish water and supports a marsh ecosystem that is associated with the estuaries of Courtenay River and Brooklyn Creek (Figure 2). Marsh habitat within the Study Area is recognized globally as the established Important Bird Area (IBA) regularly exceeds Congregatory Species Thresholds for numerous water bird species. Tidal marsh ecosystems similar to the one located in the marshland planning unit are comprised of plant species that exist in distinctive vegetation zones, which were mapped and identified in 1998 by Environment Canada (Polygon S1170). Field verification in 2008 by Rupert Wong Consulting confirms the presence of the provincially red-listed ecological communities described further in this report. Large intact salt marsh communities such

as these are significant due to the increasing rarity on the east coast of Vancouver Island. Tidal marsh communities play a critical role in sustaining food web dynamics.

An estimated 0.20 ha (3 %) of the Outer Foreshore and Dune planning unit is associated with the globally significant Sparsely Vegetated Coastal Sand Spit ecosystem (CDFmm/00) mapped by Environment Canada in 1988 (Polygon S1185B). Dune plant communities were recently designated by the BC Conservation Data Centre as part of the Provincial Rare Natural Ecological Communities Red and Blue List (BC Conservation Data Centre, 2008). This ecosystem experiences relatively harsh environmental conditions including wind, wave and sun exposure and sand movement.

SCOPE AND LIMITATIONS

This report is one component of an interdisciplinary Site Plan for the Study Area. The overall study area includes the 15.08 ha regional park with emphasis placed on the Marshland planning unit and Outer Foreshore and Dune planning unit. This report is based on 1.5 person days of field reconnaissance completed during May/June and review of existing information. The level of effort expended on field assessment was limited by the project budget.

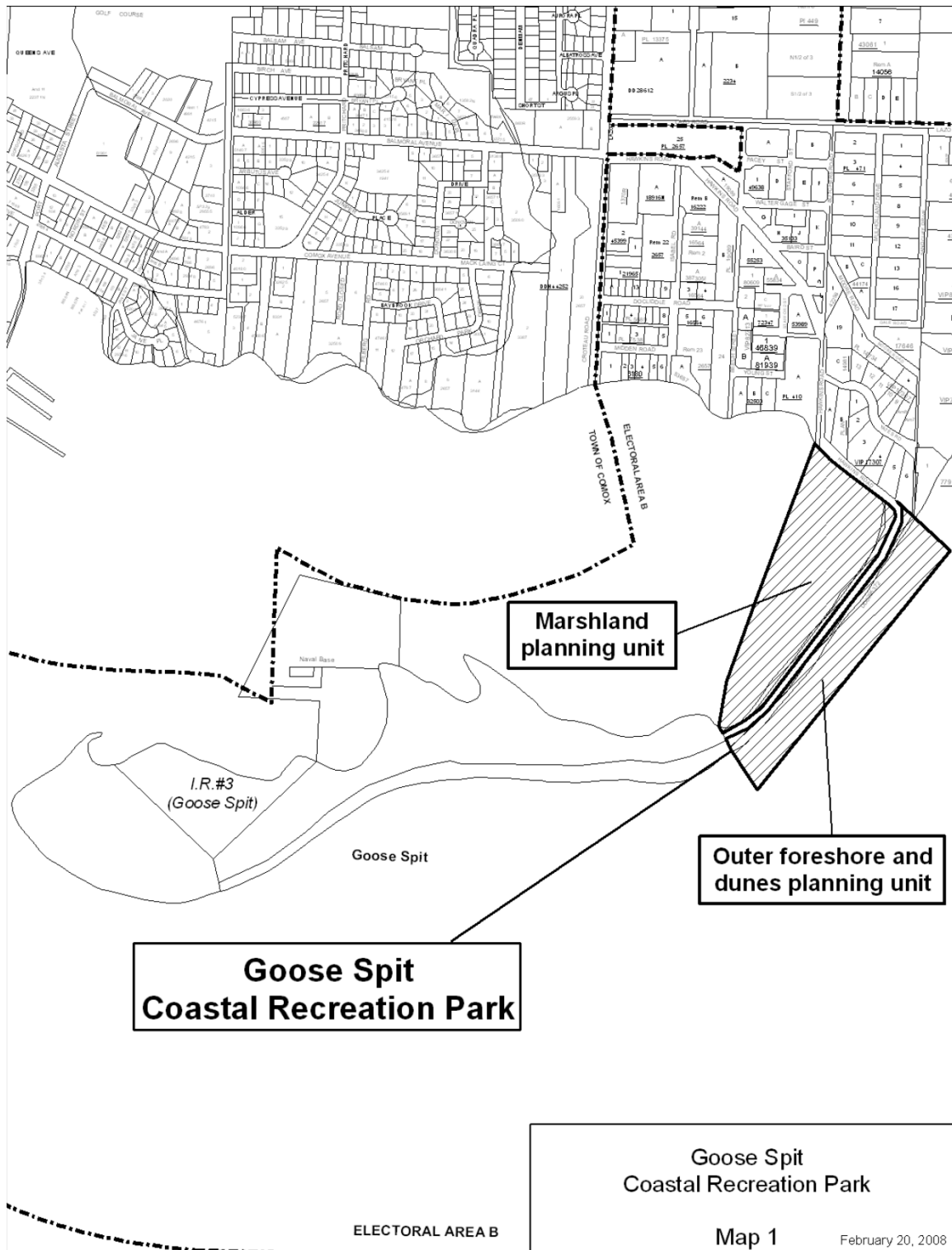


Figure 1. Overview map showing planning units within Goose Spit Coastal Recreational Park (adapted from CVRD, 2008).

METHODS

The environmental site assessment is based on reconnaissance level field sampling conducted during the summer of 2008 by Rupert Wong, RPBio with technical assistance provided by Russell Blake. The study area was traversed along transects in order to locate terrestrial and intertidal vegetation communities and species at risk. Using 1 m x 1 m and 5 m x 5 m quadrats plant assemblages were determined within the Study Area including high salt marsh, coastal sand spit, sand/gravel beach and sand/mud bay. Field assessments were made in accordance with methods described in Vegetation Resources Inventory (MoF, 2004), Describing Ecosystems in the Field (MELP/MOF, 1998), Biodiversity Standards (MELP, 1998), and the Sensitive Ecosystem Inventory (Ward, 1998). Plant lists were intended to provide an overview of community composition and were not comprehensive.

The information review accessed local, provincial, and federal sources and included the Conservation Data Center (CDC), Sensitive Habitat Inventory and Mapping (SHIM), TRIM maps, aerial photographs, Ministry of Environment (MOE) agents, and research publications. Information was also collected from interviews with scientific authorities. The different habitat types within the study area and wildlife presence were recorded. The presence of wildlife was indicated by visual observation as well as evidence of browse, associated vegetation, or by auditory observation such as calls. All wildlife and evidence of wildlife were noted in the field with a primary focus on insects, birds and fish. Presence of adult Sand-verbena moth (*Copablepharon fuscum*) was determined with the assistance of Nick Page on June 14 between 9 – 11 pm using visual observation. Geospatial delineation of ESA's was completed using a Trimble Pro XR. Data was differentially corrected using the Natural Resources Canada *Canadian Spatial Reference System* Global Positioning System Correction Service (GPS-C)¹. The accuracy of delineated ESA's is assumed to be within 2 m.

¹ GPS-C is a national real-time GPS Correction Service of the Canadian Active Control System that facilitates enhanced real-time positioning by providing corrections for the users of GPS observations. See http://www.geod.nrcan.gc.ca/aboutus/gpsc_e.php

RESULTS

Information on vegetation and wildlife occurrence within the Study Area was obtained from the following sources:

- Reconnaissance level field sampling carried out by Rupert Wong Consulting during May/June 2008.
- Review of existing information including Conservation Data Center (CDC), Sensitive Habitat Inventory and Mapping (SHIM), TRIM maps, available reports, aerial photographs and interviews with scientific authorities.

The Study Area is located in the very dry Maritime Coastal Western Hemlock Subzone (CWHxm1). The xm1 variant occurs at lower elevations from sea level to 700 m along the east coast of Vancouver Island. It experiences warm, dry summers and moist, mild winters with relatively little snowfall. Overall, the Study Area is recognized as a highly productive site that supports numerous ecosystems and a broad range of associated wildlife species. The Conservation Data Center (CDC) maintains an active database of species and ecological communities at risk for each Forest District in British Columbia. Detailed records are maintained for species and ecological communities that are of special concern (blue list) or at risk of extirpation and extinction (red list). Species listed under the federal Species at Risk Act (SARA) were observed in the Study Area during field assessment work in May 2008. Rare and endangered plant communities observed within the Study Area are described in this section with the occurrence of SARA-listed species summarized in Table 1.

FISH HABITAT

The upper beach associated with the Marshland planning unit is dominated by provincially red-listed ecological communities CDFmm/Em03 and CDFmm/Em02. Such salt marsh habitat is considered to be of high value to fish production as the vegetative cover provides nursery habitat for juvenile salmonids and other fish species that typically utilize outer estuary beaches during high tide cycles. Fry residence in and around the Study Area typically lasts up to 60 days after the outmigration of smolts during the spring and early summer (Northrup, 2008; FoC, 2000).

The lower midlittoral zone associated with the Coastal Foreshore and Marshland planning units is characterized by foreshore vegetation including eelgrass (*Zostera spp.*) and other algae. Utilization of vegetated foreshore habitat during adult reproduction and juvenile rearing by Pacific herring (*Clupea herengus pallasii*) is known to occur within

and around the Study Area where suitable stands of eelgrass and other algae occur (Figures 2 & 3). In Comox Harbour and Baynes Sound adult herring aggregate in massive schools to spawn during late winter with heaviest concentrations occurring in March and lasting for approximately 4 weeks (Koke, 2008). Female herring produce an estimated 19,000 eggs, which are fertilized externally during extrusion and adhesion in dense masses to eelgrass, other algae and suitable substrate (Hart, 1973). Fertilized eggs incubate for 7 – 10 days before hatching into larvae, which typically remain in shallow near shore water for an additional 2 months. While adult herring spawn repeatedly for several years mortality to eggs and adults during the reproductive cycle is high as the annual concentration of food resource in and around the Study Area attracts an array of predators including water birds, marine mammals and fish.

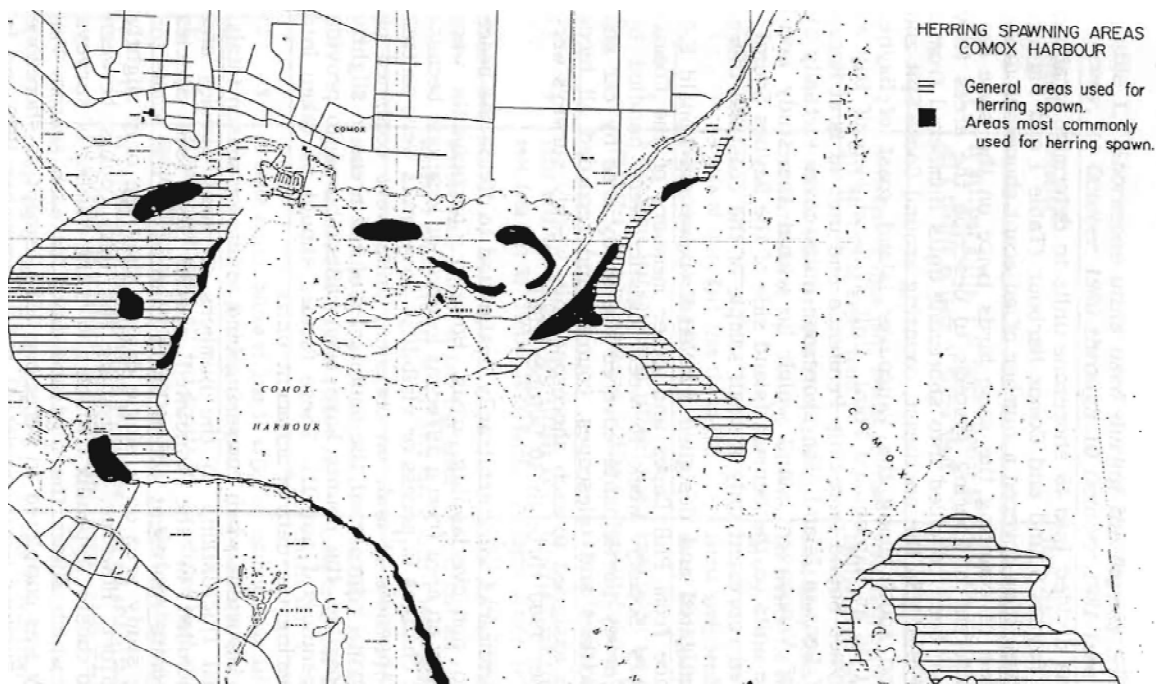


Figure 2. Known herring spawning areas in and around the Study Area (adapted from Dawe et al, 1998).

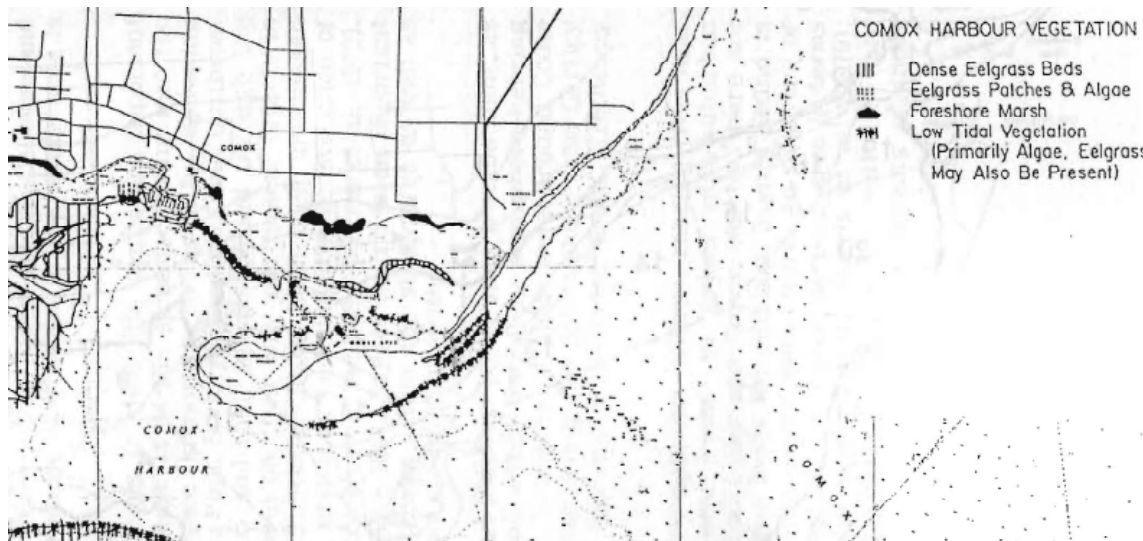


Figure 3. Known distribution of foreshore marine vegetation within and around the Study Area (adapted from Dawe et al, 1998).

AVIAN HABITAT

The Study Area is located within a nationally recognized Important Bird Area² (IBA) covering an estimated 1,760 km² including estuaries and lowland valley bottoms east of the Beaufort Range from Oyster River to Comox Harbour. The Comox Valley IBA



(BC014) represents a critical staging and wintering area for migratory and resident bird species in BC and is ranked second in importance after the Fraser River estuary for migratory water bird habitat within the Strait of Georgia (Dawe et al, 1998; Butler, 2008).

Photo 1. Brant and other water birds grazing on herring spawn (M. Yip, 2007).

Continuing winter bird count data generated from BC104 suggest a declining trend in bird populations observed elsewhere in BC. However, habitat in both the Coastal Foreshore and Marshland planning units continue to support globally significant

² Canada's IBA program is a science-based initiative to identify, conserve and monitor a network of sites that provide essential habitat for Canada's bird populations. For more information on the Comox Valley IBA visit <http://www.bsc-eoc.org/iba/site.jsp?siteID=BC014&seedet=N>

populations of water birds including red listed Western Grebe, blue listed Surf Scoter, Pacific Loon, Harlequin Duck, White-winged Scoter, Brant, and blue listed Great Blue Heron (Martell, 2007). While the number of water birds is significant throughout winter the highest concentration in and around the Study Area occurs in March and April when valuable food resources become available with the onset of peak herring spawning activity (Martell, 2008). Conflicts between water birds and recreational users were observed in the field during this study and continue to be a conservation concern despite an existing seasonal dog leashing law implemented in February 2004 by Comox-Strathcona Regional District. Recommendations to minimize disturbance to water birds during critical periods are described in the Conclusions & Recommendations section. Photos 1 – 3 illustrate typical migrant and resident water birds that utilize sensitive habitat within and around the Study Area.



Photo 2. Typical congregation of winter waterfowl that can be observed utilizing the Study Area (M. Yip, 2007).



Photos 3 & 4 . Great Blue Heron feeding in protected shallow waters (left). Surf scoter feeding on bivalves in shallow waters (right). Photos by M. Yip (2007)

PLANT COMMUNITIES

Overall, the Study Area is characterized by a moderately low level of plant diversity within the Marshland planning unit and the Outer Foreshore and Dunes planning unit. Previous study by Brooks & Morton (1992) provide a comprehensive inventory of plant species observed on Goose Spit in 1990/91. Field verification work by Rupert Wong Consulting in May/June 2008 confirmed no significant change in the assemblage of plant species in the Study Area. Rare and fragile plants and plant communities identified and geospatially delineated during this study are described further in this section and summarized in Table 1 and Figures 4 -8.

Distichlis spicata var *spicata* Herbaceous vegetation (CDFmm/Em03)

The seashore saltgrass community occupies an estimated area of 0.26 ha along the northeast margin of the Marshland planning unit where soils are typically fine textured (Figures 4 & 6). The site is frequently inundated by tidal waters and is



Photo 5. Typical low plant species diversity observed in seashore saltgrass community (May 2008).

recognized as important habitat for aquatic wildlife. *Distichlis spicata* is dominant with subdominant coverage of *Salicornia virginica* and scattered coverage of *Glaux maritima* and *Atriplex patula* (Photo 5). Margins of this community are poorly defined with Em02 as these two communities are occurring in complex with one another (Photo 6).



Photo 6. Southwest view of 5 m x 5 m quadrat located in northeast corner of Marshland planning unit showing typical complex between CDFmm/Em03 and CDFmm/Em02 (May 2008).

Table 1. List of species and ecological communities at risk in Goose Spit Coastal Recreation Park.

BCG	Area (ha)	Scientific	Common	Status		BC List
				Global	Prov	
PLANT COMMUNITIES						
CDFmm/Em02	0.15	<i>Salicornia virginica</i> - <i>Glaux maritima</i>	American glasswort - Sea milkwort	G3/G4	S2	Red
CDFmm/Em03	0.26	<i>Distichlis spicata</i> var <i>spicata</i> Herbaceous vegetation	Seashore saltgrass Herbaceous vegetation	G5	S1S2	Red
CDFmm/Ed03	0.12	<i>Juncus arcticus</i> - <i>Plantago macrocarpa</i>	Arctic rush - Alaska plantain	GNR	S1	Red
CWH/Em04	0.10	<i>Plantago maritima</i> - <i>Puccinellia pumila</i>	Sea plantain - Dwarf alkaligrass	G2	S2	Red
CDFmm/00	0.20	<i>Carex macrocephala</i> Herbaceous vegetation	Large headed sedge Herbaceous vegetation	G1G2	S1S2	Red
PLANT SPECIES						
	0.11	<i>Abronia latifolia</i>	Yellow Sand verbena	G5	S3	Blue
	<.01	<i>Polygonum paronychia</i>	Black knotweed	G5	S3	Blue
		<i>Leymus triticoides</i>	Creeping wildrye	G4G5	S1	Red
ANIMAL SPECIES						
	0.11	<i>Copablepharon fuscum</i>	Sand-verbena moth	G1G2	S1	Red
		<i>Melanitta perspicillata</i>	Surf scoter	G5	S3B,S4N	Blue
		<i>Ardea herodias fanini</i>	Great Blue Heron	G5	S3B	Blue
		<i>Branta bernicla</i>	Brant	G5	S3M	Yellow
		<i>Aechmophorus occidentalis</i>	Western grebe	G5	S1B,S2N	Red

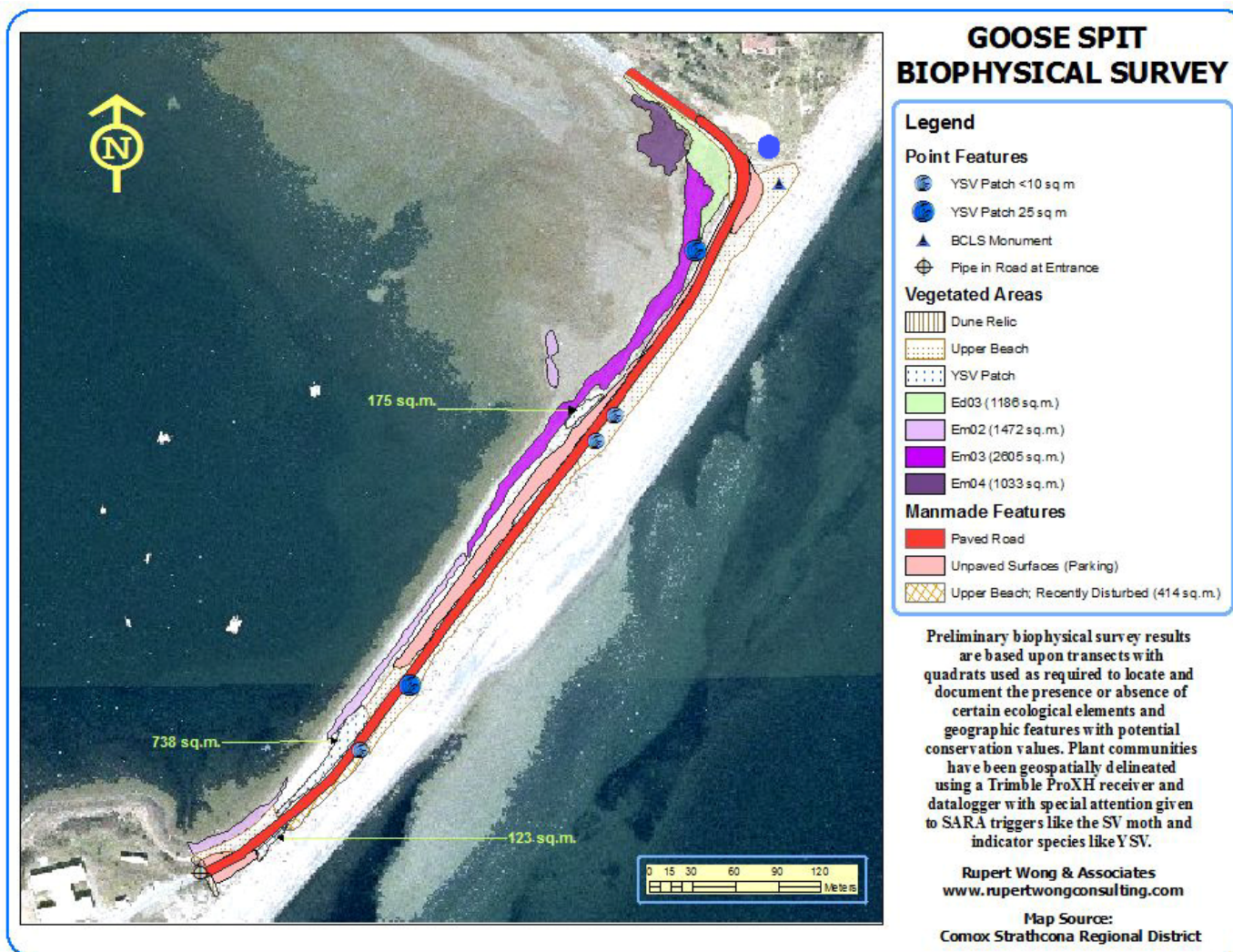


Figure 4. Overview map showing delineated plant communities within the Study Area.



Figure 5. Overview map showing distribution of map indexes used to delineate occurrences of rare plant communities.

Salicornia virginica - *Glaux maritima* (CDFmm/Em02)

The Glasswort - Sea-milkwort community occupies an estimated area of 0.15 ha along the southeast margin of the Marshland planning unit where soils are mainly fine textured with some coarse fragments (Figure 4, 7 & 8). Em03 and Em02 dominate a nearly continuous margin of vegetation along the high intertidal zone of Comox Harbour that extends into the Marshland planning unit. The complex of both plant communities were mapped and identified as Polygon S1170 in 1998 by Environment Canada. The site



is frequently inundated by tidal waters and is recognized as important habitat for aquatic wildlife. *Salicornia virginica* and *Glaux maritima* is abundant in this stand with patches of *Distichlis spicata* and *Ruppia maritima* (Photo 7). Plant cover in this community occurred both continuously and with open segments in the Study Area (Photo 8).

Photo 7. Typical low plant species diversity observed in Glasswort - Sea-milkwort community (May 2008).



Photo 8. Typical Glasswort - Sea-milkwort community located in southwest corner of Marshland planning unit (May 2008).

Juncus arcticus - *Plantago macrocarpa* (CDFmm/Ed03)

An estimated 0.12 ha Arctic rush - Alaska plantain site association occurs in the northeast corner of the Marshland planning unit above Em03 where tidal inundation is infrequent (Figure 4 & 6). *Juncus arcticus* is the stand dominant with *Potentilla egedii*, *Aster subspicatus* and *Plantago macrocarpa* in less abundant occurrence (Photo 9).



Photo 9. South view of Arctic rush - Alaska plantain site association located in southwest corner of Marshland planning unit above Em03 (May 2008).

Plantago maritima - *Puccinellia pumila* (CWH/Em04)

An estimated 0.10 ha Sea plantain - Dwarf alkaligrass site association occurs in the north end of the Marshland planning unit where tidal inundation is regular and substrate is typically gleyed (Figure 4 & 6). Species diversity in this stand is low with scattered cover dominated by *Puccinellia pumila* and *Plantago maritima* (Photo 10).



Photo 10. South view of Sea plantain - Dwarf alkaligrass site association located in north end of Marshland planning unit (May 2008).

Carex macrocephala Herbaceous vegetation (CDFmm/00)

The Sparsely Vegetated Herbaceous Sand Dune site association occurs in different sized patches over an estimated 0.20 ha within the Study Area (Figures 4, 6, 7 & 8). The site is located along the upper beach and is typically fragmented or impaired by human-made features, frequent disturbance, and stabilization of sand by coarse wood accumulations and establishment of invasive plant species. Substrate in this site is dominated by exposed sand, which is regularly transported by way of wind and wave energy. Species diversity in the Sand Dune community is characteristically low and consists of scattered cover of rare and provincially listed *Abronia latifolia*, *Polygonum*

paronychia, *Leymus triticoides*, *Carex macrocephala*, and *Lupinus littoralis* (Photos 11 - 15). Special attention was given to geospatially delineate and map the occurrence of significant patches of Yellow sand verbena (*Abronia latifolia*) within the Sand Dune site association as the strong association with the endangered Sand-verbena moth (*Copablepharon fuscum*) has even broader implications for conservation (Figure 1). Other plants occurring in this site include *Grindelia integrifolia*, *Poa macrantha*, *Elymus mollis*, *Ammophila aranerica*, *Ambrosia chamissonis*, *Cakile edentula* and *Glehnia littoralis* (Photos 16 - 18).



Photo 11. Typical Sand dune site association showing coverage of Yellow sand verbena (May 2008).



Photo 12. Typical Sand dune site association showing coverage of Black knotweed and Yellow sand verbena (May 2008).



Photo 13. Typical Sand dune site association showing sparse coverage of *Carex macrocephala*, *Elymus mollis* and *Poa macrantha* (May 2008).



Photo 14 & 15. Left: Flowering Yellow sand verbena (May 2008); and Right: Large-headed sedge (May 2008).



Photo 16. Left: Beach-carrot (*Glehnia littoralis*); and Right: Silver burweed (*Ambrosia chamissonis*).



Photo 17. Entire-leaved gumweed (*Grindelia integrifolia*).

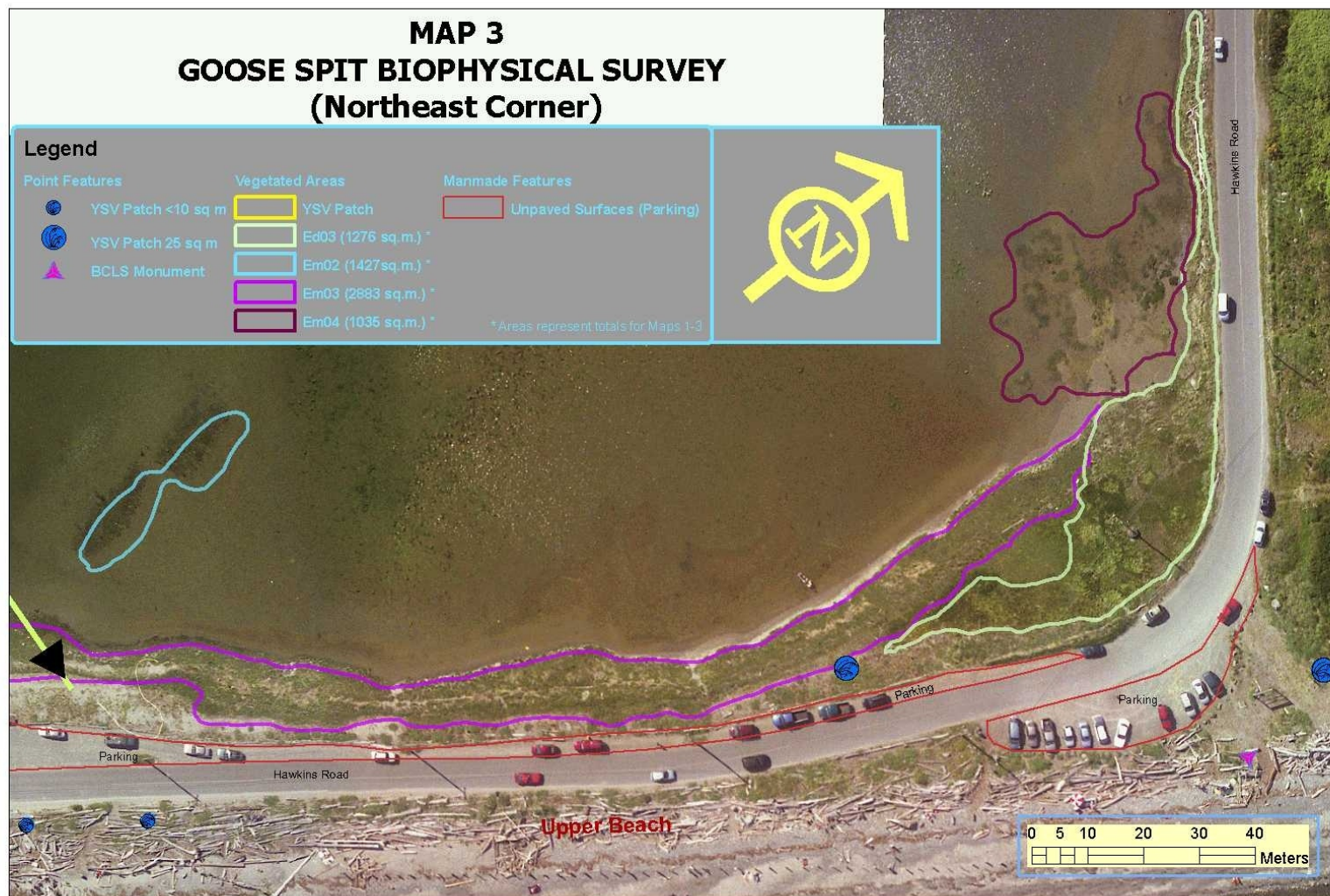


Figure 6. Index map 3 showing geospatial delineation of salt marsh and sand dune ecosystems in the northeast corner of the Study Area.



Figure 7. Index map 2 showing geospatial delineation of salt marsh and sand dune ecosystems within the central portion of the Study Area.



Figure 8. Index map 1 showing geospatial delineation of salt marsh and sand dune ecosystems within the southwest corner of the Study Area.

INSECT HABITAT

The Study Area supports critical habitat to the provincially red listed Sand-verbena moth (*Copablepharon fuscum*), which is monophagous to *A. latifolia* for all life stages (Page, 2003). The occurrence of *C. fuscum* within the Study Area was confirmed during an evening reconnaissance on June 14 when adults were observed nectaring and depositing eggs in flowers of *A. latifolia*. Endangered status designation was given to *C. fuscum* in 1993 as global populations are limited to 9 small sites, of which 2 are represented in the Comox Valley Regional District at Goose Spit and Sandy (Tree) Island. Preliminary studies imply that each location is composed of a series of subpopulations, which is directly correlated with the patchy distribution of yellow sand-verbena in coastal spits and dunes (BC Invertebrate Recovery Team, 2008). Until recently, the general awareness of *C. fuscum* has been limited to select scientists and naturalists as the species is relatively small, silent and both adult and larval activity is nocturnal. As described by Page (2003) adult moths fly once per annum between mid-May and early July during dusk and early evening as they seek the nectar from flowering patches of *A. latifolia*. Mating peaks in mid-June and eggs are deposited singly or in groups within *A. latifolia* flowers or on leaves. Larvae emerge and feed nocturnally on *A. latifolia* foliage during July and August after an estimated 2-week incubation. Larval growth and feeding slows with the onset of declining temperatures in fall, and larvae hibernate in the sand



beneath *A. latifolia* patches. Pupation occurs in late April and May over the course of approximately 10 days.

Photo 18 & 19. Adult Sand-verbena moth (left) and late instar larva (right). Photo of adult taken by N. Page.

DISCUSSION

The sum of rare and endangered ecosystems and affected species observed in Goose Spit Coastal Recreation Park raises significant challenges for maintaining the natural processes that sustain the marsh, coastal and dune ecosystems. This study generally confirms the habitat classification developed by Fisheries and Oceans Canada (2000) for Goose Spit through the Courtenay River Estuary Management Plan (CREMP). The development constraints on Goose Spit as suggested by the CREMP are summarized in Appendix 1.

Erosion counter-measure options summarized below were considered during the course of study completed by nhc (2008). Other improvements to Goose Spit Coastal Recreation Park summarized below are also considered in the main report completed by Outlook Land Design Inc (2008). Based on the results of this study the anticipated environmental constraints associated with erosion counter-measure options and site improvements for recreation are discussed in this section.

- Log structures
- Beach nourishment
- Road raising
- Beach portals
- Interpretive areas & signage
- Portable toilet improvements
- Parking improvements
- Public access development

LOG STRUCTURES

The continued installation and monitoring of Type 1 vertical log walls is proposed to evaluate effectiveness as localized short-term erosion counter-measures for infrastructure including parking, utility poles and portals. Anticipated installation and operation of log structures that have potentially harmful effects are summarized in Table 2.

Table 2. Summary of mitigative measures to be implemented during construction and operation of log structures.

Nº	Potentially Harmful Effects	Technical Rationale & Mitigative Measures
1	Disturbance to sensitive habitat during log salvage	- Seek advice from a qualified environmental professional to ensure that sensitive habitat is not adversely affected during log salvage. - Restrict log salvage where Yellow Sand –verbena patches occur. - Limit log salvage to the northeast end of the outer shore where removal from dense log accumulations over the upper beach are not expected to have negative environmental effects (Photo 20 & 21). - Avoid construction activities during critical avian migration period (March – April)
2	Disturbance to sensitive habitat during installation of log structures	- Seek advice from a qualified environmental professional to ensure that sensitive habitat is not adversely affected during site access or construction. - Follow DFO's BMPs for Constructing Erosion Control Structures in the South Coast Area (2006). - Restrict machine travel and log installations in upper beach where Yellow Sand –verbena patches occur. - Restrict machine travel in intertidal zone where stands of growing algae occur. - As required use plywood sheets beside excavations to accommodate sidecast material and minimize disturbance to adjacent intertidal habitat. - Replace sidecast in a stratigraphic sequence to restore surface layer, which potentially supports the highest concentration of invertebrates. - Salvage a relocate invertebrate and vertebrate species as required. - Avoid construction activities during the critical avian migration and herring spawning period. - Schedule construction in foreshore during the typical work window for the marine foreshore (Jun 1 – Feb 15).
3	Excessive stabilization of sand during operation of log structures	- Disruption to sand supply and transport regime has been shown to have potentially negative effects on the dune ecosystem (Page, 2005). - Balance shoreline protection strategies with maintenance of features and functions for the dune ecosystem. - Take an adaptive approach to erosion counter measures whereby environmental monitoring is undertaken and adjustments to structures can be made as required to minimize harmful effects. - Where impacts to the dune ecosystem are unavoidable develop suitable habitat compensation strategies such as Yellow Sand – verbena propagation and habitat construction.

The installation and operation of log structures is expected to result in the harmful alteration, disruption or destruction of fish habitat (HADD) without mitigative measures in place and will therefore require a Request for Review under the Fish Habitat Protection Provisions of the Fisheries Act. Installation and operation of log structures will also have potentially harmful effects on dune ecosystem function and direct species impacts on the Sand-verbena moth. Page (2005) and Wong (2007) demonstrate that recovery of Yellow Sand –verbena habitat is technically and biologically feasible. Opportunity exists to develop a Sand-verbena Moth Recovery Strategy concurrent with the Site Plan for Goose Spit Coastal Recreation Park.



Photo 20. Northeast end of the outer shore showing dense log and coarse woody debris accumulations over the upper beach where opportunity for log removal and Sand-verbena Moth Recovery exist (May 2008).



Photo 21. Northeast end of the outer shore showing dense log accumulations and proliferation of invasive plant species over the upper beach where opportunity for log removal and Sand-verbena Moth Recovery exist (May 2008).

BEACH NOURISHMENT

The concept of beach nourishment is in keeping with the broader objectives of maintaining the natural processes that sustain the dune ecosystem described by Marsh & Mewett (2002) and BC Ministry of Environment (2002). Modeling coastal sediment transport is identified as a priority by the BC Invertebrates Recovery Team (2008) to help meet objectives of the Recovery Strategy for Sand-verbena moth. Appropriate BMPs to support species at risk should be followed to avoid harmful alterations. While harmful alteration to dune species may result from sand removal along the road and parking areas an overall net benefit to the function of the Dune ecosystem is anticipated.

Timing constraints sensitive to avian and herring spawning periods will apply to beach nourishment projects. Provided that no disturbance to existing sensitive habitats takes place and a suitable Environmental Protection Plan is developed, authorization to undertake work to implement small and large scale beach nourishment projects would likely proceed under the authority of a Letter of Advice issued by FoC. Mitigation measures for small and large scale beach nourishment projects are expected to include sediment control, water quality monitoring and reclamation by way of revegetation with dune natives.

ROAD RAISING

Recent study by nhc (2008) suggests that Hawkins Road is an estimated 0.9 m below the current regional Coastal FCL within the Study Area. As indicated by nhc (2008) the concept of elevating an estimated 620 m segment of Hawkins Road would require considerable armouring to protect the road prism from erosion. Road construction of this scale will result in significant destruction of the Dune ecosystem including direct impacts to Yellow Sand –verbena and Sand-verbena moth (Photo 22). While areas like the northeast end of upper beach are suitable for restoration of Yellow Sand –verbena habitat considerably more area than what is available within the Study Area would be required to suitably compensate for the anticipated harmful alteration. A road raising project of this magnitude would therefore likely not be feasible or acceptable unless compensatory works of a proportionally larger scale can be completed likely both within and beyond the limits of Goose Spit Coastal Recreation Park.



Photo 22. Northeast view of 844 m² patch of Yellow sand-verbena located along southeast side of Hawkins Road across from the main parking area with other patches not shown (May 2008).

Recent shoreline protection work along 200 m of HMCS Quadra property on Goose Spit authorized displacement of an estimated 32 m² of Yellow sand-verbena habitat under certain terms and conditions of a SARA Permit (Wong, 2007). A required minimum 96 m² (3:1 compensation ratio) of new Yellow Sand-verbena and Sand-verbena moth habitat was constructed and successfully re-established with Yellow Sand-verbena propagated from root stock. Similar compensation and restoration strategies used at HMCS Quadra could be adopted for localized shoreline protection work in the Study Area however; approval to undertake such work will require appropriate planning and design by qualified professionals and support from regulatory agencies.

BEACH PORTALS

Part of the strategy to address conflicts between recreational use and sensitive Dune ecosystem is to localize and concentrate disturbance to constructed and maintained beach access sites described as Portals by Outlook Land Design Inc (2008). While existing beach access sites provide some measure of mitigation the 10 proposed portals are distributed along the outer beach to enhance existing access locations and create additional suitable sites (Photo 23). Depending on the location, type and quantity of portals constructed a range of harmful alterations will occur to the Dune ecosystem including direct impacts to Yellow Sand –verbena and Sand-verbena moth. To avoid environmental impacts careful consideration should be given to locating portals between existing Yellow Sand-verbena patches and providing an adequate

buffer to allow for stand growth where habitat criteria is met. Careful consideration should also be given to evaluating the need for impermeable surfaces proposed for type 2 portals as the cumulative effect of such permanent features can impose a significant footprint that will potentially impair natural dune processes and opportunities for



ecosystem recovery. Where impacts to Yellow Sand-verbena and Sand-verbena moth habitat are unavoidable suitable compensation strategies such as Yellow Sand –verbena propagation and habitat construction are expected to be feasible for the scale of the beach portal project.

Photo 23. Typical existing beach access achieved by maneuvering and placing beach logs (May 2008).

Further consideration should be given to establishing exclusion fencing around Yellow sand-verbena patches that are vulnerable to disturbance from uncontrolled access. Plants are fragile and the late instar stages of *C. fuscum* are vulnerable to trampling as they spend considerable time in the sand when not feeding at night. Fencing used at HMCS Quadra cadet training facility has proven to successfully minimize previously observed conflicts between military activity and Yellow sand-verbena habitat. Installation and maintenance of exclusion fencing around significant patches of Yellow Sand-verbena is an encouraged stewardship approach to support species at risk (BC Invertebrates Recovery Team, 2008).

INTERPRETIVE AREAS & SIGNAGE

The concept of interpretive areas and signage is not expected to have a significant impact on existing sensitive habitat provided the footprint of these features is located in existing high traffic areas where natural dune shaping processes and growth of Yellow sand-verbena is already impaired. Construction methods should follow appropriate BMPs to avoid harmful alteration of existing sensitive habitat in proximity with special attention to the south interpretive area. Public education and stewardship is identified as a high priority by the BC Invertebrates Recovery Team (2008) to help meet objectives of the Recovery Strategy for Sand-verbena moth. As awareness amongst the public becomes heightened through educational initiatives like interpretive signage the risk of threat to habitat or to Sand-verbena moth populations is expected to decrease.

The environmental cost and benefit to interpretive trails through sensitive dune habitat however should be given more consideration. While there is some additional educational value to using “ambassadors” the designated endangered status of the Sand-verbena moth warrants an appropriate level of stewardship by way of habitat protection from further risk of disturbance. Protecting existing Sand-verbena moth populations and habitat from further degradation caused by cumulative effects of traffic through stands of significant size is a high priority for the BC Invertebrates Recovery Team (2008). Interpretive sites may be more acceptable within a small Yellow Sand-verbena patch that is insufficient in size to support Sand-verbena moth production.

PORTABLE TOILET IMPROVEMENTS

Relocation of portable toilet facilities within the existing central parking lot footprint is not expected to have significant detrimental effect to sensitive habitat. Encroachment into the salt marsh community if any would likely be minimal and development of an appropriate compensation plan would be developed to ensure no net loss of habitat.

The greatest risk to sensitive habitat for this component of the Site Plan is the potential risk of deleterious substances entering the marsh ecosystem during construction phase and during maintenance cycles. An acceptable emergency response plan should be in place to ensure the means to manage and control spills.

PARKING IMPROVEMENTS

Parking improvements proposed in the Site Plan are limited to decreasing unauthorized parallel parking along Hawkins Road and utilizing existing parking areas without expansion. Other minor improvements proposed include establishment of parking zones within the existing parking area for wheelchair access using permeable pavers. None of the proposed parking improvements are expected to have a significant environmental effect.

PUBLIC ACCESS DEVELOPMENT

Pedestrian and cyclist traffic to Goose Spit Coastal Recreation Park along Hawkins Road is a growing concern for public safety. The Site plan summarizes options for addressing these concerns. Environmental impacts to the salt marsh community can be minimized by adopting a design that locates a walkway on the north side of the Hawkins Road flats (Option 1) or widens the road northward to accommodate a barrier controlled walkway on the south side (Option 2). Avoiding encroachment into the salt

marsh community precludes having to develop a compensation plan and implementing costly mitigative measures for sediment control during construction. The southward widening proposed in Option 3 would result in a harmful alteration to fish habitat and will require a Request for Review under the Fish Habitat Protection Provisions of the Fisheries Act.

PERMITTING REQUIREMENTS

A complete list of permits and approvals that may be required for development of the Site Plan is summarized by Outlook Land Design Inc (2008). In our experience, the review and processing time for applications can vary from a few weeks to a couple of months. In order to receive the required permits prior to the work window permit applications should be submitted in months in advance to allow ample processing time. As well, some agencies may request an onsite inspection prior to issuing the permit.

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

- 5 provincially red listed ecological communities occur within the Study Area.
- 1 of the provincially listed ecological communities also has a G1G2 global ranking meaning on a national scale the ecosystem is considered to be currently imperiled or critically imperiled.
- 1 provincially red listed and 2 provincially blue listed plant species occur within the Study Area.
- 1 provincially red listed and 2 provincially blue listed bird species utilize the Study Area as either a resident or winter migrant.
- 1 provincially red listed insect species that also carries a G1G2 global ranking occurs within the Study Area.
- Vegetated foreshore habitat within the Coastal Foreshore and Marshland planning units support critical habitat for production of herring, salmonids and water birds.

- The Study Area is located within a nationally recognized Important Bird Area, which is ranked second in importance after the Fraser River estuary for migratory water bird habitat.
- Aquatic habitat in and around the Study Area continues to support globally significant populations of water birds with peak occurrences between March and April.
- Stewardship approaches to support species and ecosystems at risk within the Study Area are being implemented and adapted further by CVRD. For example, beginning in 2004 a mandatory dog leashing law in Goose Spit Coastal Recreation Park is implemented annually between March 1 and April 30.
- More stewardship initiatives described below are needed to ensure the protection and recovery of species and ecosystems at risk within the Study Area.

RECOMMENDATIONS

Continue to follow the coastal zone management approach described by Marsh & Mewett (2002) that recognizes and promotes the processes and systems that define the coastal zone. Accordingly, plan and design shoreline features with a minimal geomorphic and ecological footprint.

Continue to engage in stewardship initiatives that follow guidelines or best management practices to support species and ecosystems at risk. Mandatory dog leashing throughout the Study Area during critical water bird migration (March-April) is a good start and should be continued, reinforced and evaluated for effectiveness. Improvements to stewardship initiatives for avians are recommended as follows.

- Stewardship initiatives for avians should be coordinated with the Comox Valley Naturalists Society.
- Implement stronger dog leashing bylaw enforcement for non-compliant individuals and consider rewarding compliant owners and canines.
- Explore the possibility of annual beach closures during critical spring (Mar - Apr) period in areas of intense use by avians. Martell (2008) suggests a beach closure area southeast from the entrance to HMCS Quadra would help address recreation/avian conflicts.

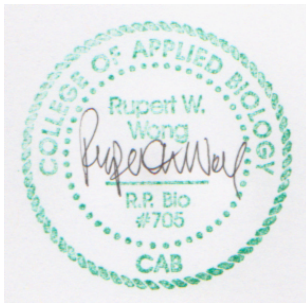
- Assess impacts of recreational activity and development within the Marshland planning unit. In particular, evaluate potential negative effects of activities such as kite boarding during inclement weather when water birds often seek refuge on the inside of Goose Spit.
- Assess impacts of the proposed inner harbor shoreline walkway on water birds that utilize the Marshland Planning unit.

Focus stewardship initiatives on management and restoration of Sand-verbena moth habitat with an emphasis on broader processes that sustain the sand dune ecosystem and species within. Continued public education is a good example of initiatives already being implemented. Other stewardship initiatives for management and restoration of Sand-verbena moth habitat are recommended as follows.

- Cooperative management and restoration efforts should be coordinated through the recovery team for sand dune and sand beach ecosystems being initiated by Parks Canada and the Ministry of Environment.
- Control stabilizing coarse woody debris and vegetation to restore potential dune habitat and minimize disruption of sediment transport. Habitat restoration activities should include selective removal of recumbent coarse and small woody debris in the northeast end of the outer beach as well as systematic removal of invasive plants. This site is underutilized and represents a good opportunity to increase the patch size of Yellow Sand-verbena.
- Human disturbance such as trail, road and parking development on Dune ecosystems should be minimized to prevent habitat destruction. Exclusion fencing should be considered around vulnerable large patches that supports Sand-verbena moth populations.

DISCLAIMER

This report was prepared exclusively for Comox Valley Regional District by Rupert Wong. The quality of information, conclusions and estimates contained herein is consistent with the level of effort expended and is based on: i) information available at the time of preparation; ii) data collected by the author, technical personnel and/or supplied by outside sources; and iii) the assumptions, conditions and qualifications set forth in this report. This report is intended to be used by Comox Valley Regional District only, subject to the terms and conditions of its contract or understanding with Rupert Wong, RPBio. Other use or reliance on this report by any third party is at that party's sole risk.



Signed by Rupert Wong, R.P.Bio. on January 7, 2009.

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Appendix 1. CREMP habitat classification and development definitions for Goose Spit.

