Need Your Help

... An opportunity for feedback on options towards a cliff erosion management plan

UBC/Pacific Spirit Park
Cliff Erosion Management Planning

CONSULTATION DISCUSSION DOCUMENT

PLEASE NOTE

1. ***This planning process is being carried out without prejudice to the Musqueam aboriginal interests in this area (see page 14).***
2. ***Consultation Discussion Document Values, Objectives and Principles remain unchanged. Changes have occurred in the remainder of the document. Changes were proposed and supported by the Stakeholder Focus Group or Coordinating Planning Committee post UBC and GVRD Board adoption.***

July 31, 2000

UBC/Pacific Spirit Park - Cliff Erosion Management Planning

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Consultation Feedback Form

UBC/Pacific Spirit Park - Cliff Erosion Management Planning

CONSULTATION DISCUSSION DOCUMENT

PLEASE NOTE - This planning process is being carried out without prejudice to the Musqueam aboriginal interests in this area (see page 14).

This Consultation Discussion Document provides relevant background information and possible options to minimize the causes of erosion of the cliffs of Point Grey along the UBC/Pacific Spirit Regional Park border. A form for your feedback has been included – we look forward to hearing from you!

Introduction

The Point Grey peninsula juts out from the mainland and the Fraser River delta into the waters of the Straits of Georgia. The perimeter is surrounded by steep slopes and cliffs descending down to the foreshore area. These slopes and cliffs occur from Booming Ground Creek at the mouth of the Fraser River and wrap around the peninsula to Acadia Beach on Burrard Inlet (the northeast boundary of Pacific Spirit Regional Park). In places, the boundary between UBC and the park is close to the cliff edges. Due to a variety of reasons, these cliffs are eroding and this erosion impacts the use of the adjacent lands, threatens some UBC facilities and has impacts on the use of the beach.

UBC and GVRD Parks wish to examine the options for action on the erosion of these cliffs and are including public consultation as a vital part of the planning process. This document describes the area in question, outlines a management framework, provides a historical perspective, lists causes of the erosion, notes considerations that need to be included and finally outlines the consultation and decision making process (flow charts of the activities and the decision process are depicted in the appendices).

Consultation Process

A Coordinating Committee representing the Musqueam First Nation, UBC and GVRD Regional Parks has been working with representatives of a variety of community groups to clarify and define the issues and considerations in developing a cliff erosion management plan for the Point Grey cliffs. This pre-consultation process has been underway since mid 1998 and has resulted in a Consultation Discussion Document and an agreed upon public consultation process.

Consultation activities include:

- Provision of information through the Consultation Discussion Document
- An opportunity to review and comment on proposed cliff erosion management actions
- Cliff and beach tours to view causes and effects of cliff erosion
- Public meetings to provide an opportunity for verbal feedback
- A Consultation Input Report summarizing all comments received
- A Consultation Feedback Report advising consultation participants of the decisions made and how public feedback has been used in these decisions

For more information on this project or the consultation process, please contact the Project Secretariat, Lorraine Beckett at 822-4178. She will either be able to answer your question or may ask someone with more information to call you back.

Consultation Discussion Document Availability

Additional printed copies of this document are available through the following locations:

- UBC Campus Planning 2210 West Mall (UBC Campus)
- Museum of Anthropology 6393 North West Marine Drive, Vancouver
- GVRD Park West Area Office 4915 West 16th Avenue, Vancouver
- Musqueam Band Office 6735 Salish Drive, Vancouver
- Westside libraries and Community Centres

The document may also be viewed and/or retrieved electronically on the following Web sites:

- UBC www.lbs.ubc.ca click on *What's New? (see Cliff Erosion Management Plan)*
- GVRD www.gvrd.bc.ca/consult/PointGrey.html

Review and Comment Opportunity

We are interested in receiving your feedback on the possible actions that are being considered for inclusion in the action plan. Written comments submitted up to **September 22, 2000** regarding the proposed actions to address cliff erosion concerns will be included in the Consultation Input Report. These proposed actions are included in the Consultation Discussion Document. A feedback sheet has been included with this document (or can be obtained by calling the Project Secretariat, Lorraine Beckett at 822-4178) to facilitate gathering your comments.

You can submit your written feedback in one of the following ways:

By mail:

UBC/Pacific Spirit Regional Park Cliff Consultation
C/O UBC Campus Planning
2210 West Mall
Vancouver, B.C. V6T 1Z4

By fax:

UBC/Pacific Spirit Regional Park Cliff Consultation
822-6119

By e-mail:

rhpenner@sfu.ca

Cliff and Beach Tours

Cliff and beach tours to view conditions first hand with GVRD and UBC staff. ***If you are interested in taking part on one of these tours, please contact GVRD Parks West Area Office (telephone 224-5739) to register and receive further details.*** There will be 1 tour per day for each of the following days:

1. August 18, 2000 – 9:30 a.m.
2. August 19, 2000 – 9:30 a.m.
3. September 8, 2000 – 9:00 a.m
4. September 9, 2000 – 9:00 a.m.

Tours will start from the front of the Museum of Anthropology. Please have appropriate footwear for a trail and beach walk. Time for each tour will be about 3 hours.

Public Meetings

Four public meetings have been scheduled as the opportunity for those who wish to provide verbal feedback as well as listen to the comments of other members of the public. These meetings are scheduled as follows:

- 7:00 – 9:30 p.m. Thursday, August 17, 2000
- 7:00 – 9:30 p.m. Thursday, August 24, 2000
- 2:30 – 5:00 p.m. Saturday, September 16, 2000
- 7:00 – 9:30 p.m. Tuesday, September 19, 2000

All meetings will take place at:

Lecture Hall
St. John's College
2111 Lower Mall - UBC

Consultation Input Report

The decision making process for the Cliff Erosion Management Plan is outlined in Appendix 1 (Phase 2) of this document. In order to ensure that decision makers are aware of public opinion, all comments received will be organized by topic area and summarized. A draft of this report will be reviewed by representatives of various community groups that have participated in the pre-consultation report and additional comments may be added at this time. The final report will be submitted to decision makers and also be publicly available through the same sources as the Consultation Discussion Document (see earlier section for details).

Consultation Feedback Report

Following the decision process, a final Consultation Feedback Report will be issued noting how the decision makers have utilized the feedback provided. This report will be distributed to all those who have indicated they wish to receive a copy during the consultation process as well as available through the same sources as the Consultation Discussion Document (see earlier section for details).

Consultation Schedule

The projected completion dates* for key consultation activities are as follows (to be announced):

Consultation process advertised and Consultation Discussion Document available	August 3
Cliff and beach tours	August 18 & 19 September 8 & 9
Public meetings	August 17 & 24 September 16 & 19
Preparation of draft Management Plan & Consultation Input Report	September 29
Option Development group meeting to review the draft plan & public input	October 5 & 12
Finalization of Management Plan & Consultation Input Report for submission to UBC BOG, Musqueam Band Council	October 16
Management Plan & Reports submitted to GVRD	October 20
Final Management Plan & Consultation Feedback Report published	December 8

* The actual dates for plan finalization may vary depending on a variety of circumstances that may arise during the course of this consultation..

Background

The Cliffs of Point Grey

During the last ice age, glaciers from the north covered the sedimentary deposits in the area that is now the mouth of the Fraser River. The glaciers were typically hundreds of feet thick and compressed the underlying sand and sedimentary deposits. Following a warming trend 10 to 15 thousand years ago the land took on the form now known as Point Grey. In technical terms, the land in this area is what geologists describe as a perched aquifer topology consisting of layers of glaciofluvial sand interspersed with impermeable layers. This topography extends the length of Wreck Beach.

Over the millennia the uplands became forested and the two main streams of the area developed – Cutthroat Creek and Booming Ground Creek. The forests were populated with a variety of wildlife and the streams were a year-round home for fresh water fish and a spawning ground for salmon. The only erosive forces on the cliffs were those due to creek washout and tidal action at the toe of the cliffs.

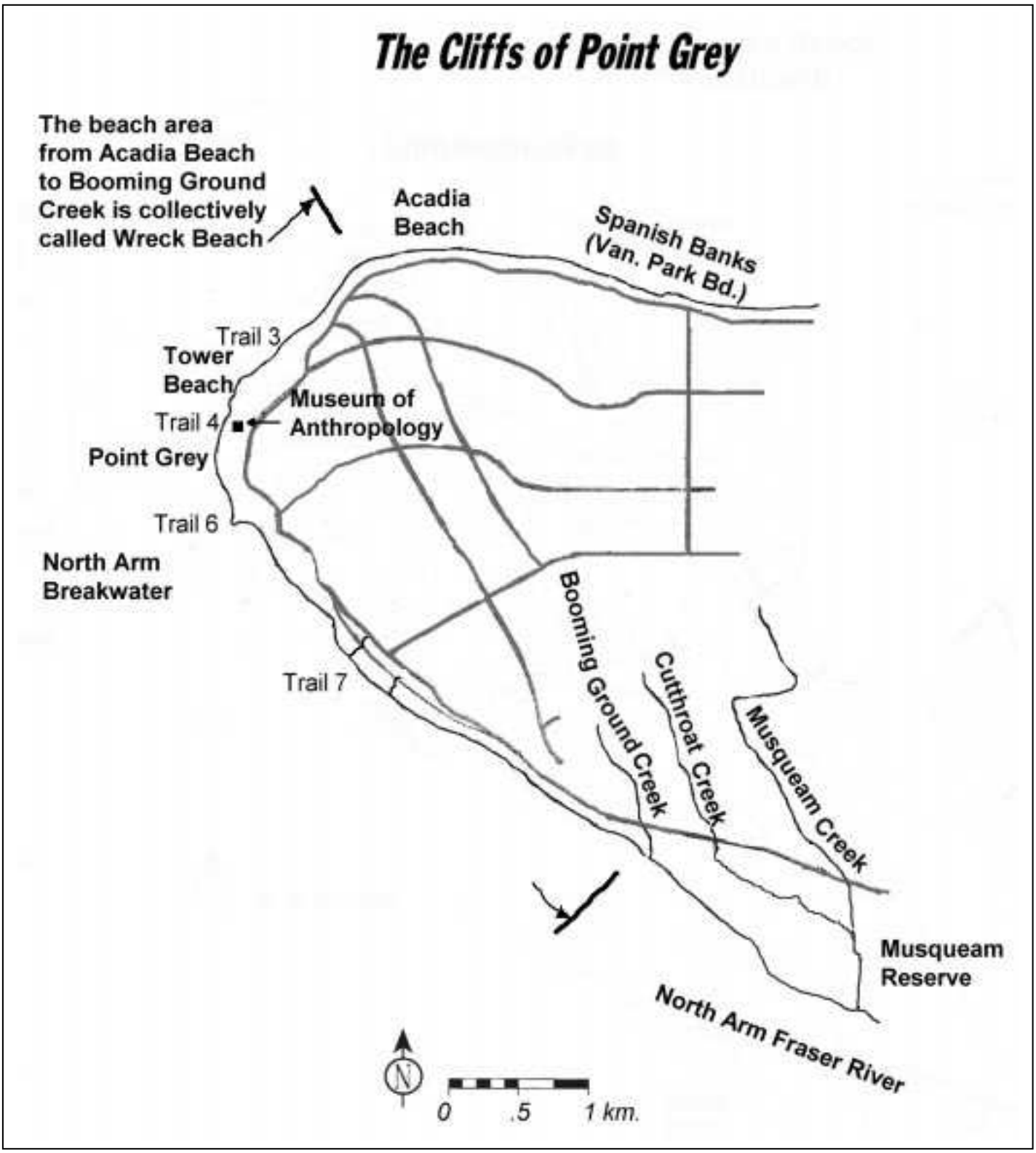
This area is part of the traditional territory of the Musqueam First Nation. The Musqueam have lived in this area for several thousand years and utilized the whole of the Point Grey area. Musqueam sentries used the cliffs as lookout points for the protection of the Musqueam community from intruders. The forests were their hunting grounds and the beach area was utilized to harvest shellfish and access marine resources.

Logging started in these forests towards the end of the last century. Denudation of the land was exacerbated by construction of the new university and by wartime construction of defense works. The cliffs were, from that time on, subjected to erosion from people scaling and sliding down the cliffs. Seepage from the cliff face at the different levels of sand beds has also contributed to erosion by promoting undercutting and shearing off of overhangs – very similar in process to that of the wave action at the base of the cliffs. Another cause of erosion, sappage, is caused by this same water on the cliff face freezing – the expansion of the freezing water causes pieces of the cliff face to be dislodged. Graham's Gully and more recently the cliffs adjacent to the Coach House at Cecil Green House were significantly effected where large portions of the cliff have eroded due to heavy storms causing water to flow over the cliff top.

At one time or another, human efforts have attempted to manage each of the erosive forces in various locations. Storm run-off was partially addressed by construction of the north (spiral) drain adjacent to the museum. The cliff base was protected by construction of a cobble berm and rock drift sills to deflect wave energy. Paths were constructed to manage beach visitors. The cliffs were extensively planted during the 70's to counter seepage erosion. The most severely exposed cliff faces were terraced and seeded with small trees. Each of these efforts to manage erosion have had some effects, some positive and some less so. These actions were reactive, responding to events, rather than planned to minimize the erosion. A successful plan to minimize erosion cannot be seen as a one-time event; minimizing the causes of cliff erosion will require an ongoing process of action and attention.

Planning Area

The areas of Point Grey included in this planning process are the cliffs and slopes from Booming Ground Creek at the mouth of the Fraser at the south-eastern extreme, wrapping around Point Grey and extending to Acadia Beach at the north-eastern extreme. The high ground to the interior of this strip and the immediate foreshore at the base of these slopes and cliffs will also be included. This area can be seen in the map on the following page.


The Cliffs of Point Grey
The beach area from Acadia Beach to Booming Ground Creek is collectively called Wreck Beach
Acadia Beach
Spanish Banks (Van. Park Bd.)
Trail 3
Tower Beach
Museum of Anthropology
Trail 4
Point Grey
Trail 6
North Arm Breakwater
Trail 7
Booming Ground Creek
Cutthroat Creek
Musqueam Creek
Musqueam Reserve
North Arm Fraser River
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Management Framework

The plan that is adopted for managing cliff erosion will unfold over a lengthy time frame. It is likely that some issues will need to be addressed before others. In recognition of the varying time frames and parts of the escarpment, it is important that there be a clear management framework to guide any actions that might be taken and decisions into the future. The final management framework for the cliff area will be comprised of an overall objective, principles (governing policies) and values (important aspects for consideration in decision making) to be agreed to by the Musqueam and UBC and approved by the GVRD Board of Directors. The following is presented as an initial framework for consideration during the consultation and management plan development phases.

Objective

The main objective of this process is to find acceptable and affordable ways to manage the causes of cliff erosion.

The cliff erosion management plan is intended to accomplish the following:

- Protect the cultural and archaeological resources of the area from damage due to cliff erosion (i.e. manage erosion threat and development of the cliffs in a manner that protects the cultural and archaeological resources);
- Preserve the wilderness-like setting of the foreshore;
- Mitigate the threat of damage from cliff erosion to UBC assets and property;
- Reduce embankment spills and fallen trees across the beach and access paths to increase safety for people near the cliff tops and those using the beaches; and
- Mitigate erosion threat to Marine Drive.

Principles

1. All other UBC and GVRD planning activities which may have an impact on Point Grey cliff erosion will be integrated with the cliff erosion management plan.
2. Once the cliff erosion management plan is completed, the UBC Official Community Plan (Electoral Area A) will be reviewed and, where necessary, recommendations forwarded to the GVRD Board to adjust the OCP to minimize the causes of cliff erosion.
3. Any actions taken will be in accordance with UBC's policies and regulations and will ensure preservation of UBC assets and lands to the extent possible given the current state of the cliffs.
4. Any actions taken will be in accordance with GVRD Regional Park policy and regulations, GVRD Parks Department philosophy and management style and, where appropriate, fall within the staffing and funding capability of GVRD Parks Department.
5. Any actions taken will be done in accordance with the government's duties of consultation with aboriginal people. This consultation will include and not be limited to matters dealing with identified and unidentified cultural resources of the area.
6. Any actions to manage cliff erosion will be done considering advisory input from stakeholder groups, members of the public and other relevant agencies. An ongoing advisory committee will be established to facilitate gathering this input.
7. Any action taken will not interfere with the recreational values of Wreck Beach regarding clothing –optional sunbathing and swimming.
8. Any actions taken will maintain the current condition of not being able to view buildings from the beach or vice versa.

9. Any actions taken must take into account the preservation of the beach as a whole in nearly a natural state as possible.

Values

1. The cliffs have important cultural and archaeological value to the Musqueam First Nation that must be respected and preserved.
2. While minimizing cliff erosion will likely call for ecological management, the flora and fauna of the escarpment should be preserved to the greatest extent possible.
3. Any actions taken must integrate with the campus community design.

Recent History

Pre 1858	The area is part of the Musqueam territory.
1858	The colony of B.C. was created in response to the rapid influx of miners and settlers during the Fraser River gold rush
1865 - 1923	The initial principal uses of this area during early days of settlement were military defense and logging.
1928	Land clearing for UBC was started; brick, tile, sand, gravel, stone, cement and other building materials were brought to Wreck Beach by barge and hauled up the cliff embankments.
1930	A dairy farm was established on the lands above Acadia Beach. Around this time, initial recreational use was made of this area.
1935	A major storm water overflow from the north end of campus eroded a new deep gully adjacent to Graham house (Green College) requiring massive in-filling.
1936	The spiral drain at the rear of the Coach House was constructed to handle storm water run-off that could be expected from a storm event with a return period of once every ten years.
1939	Searchlight towers were placed on the beach, gun towers were put on the cliff tops and barracks were erected above Point Grey as part of World War II defences; pathways were constructed to connect these installations.
1953	The North Fraser Harbour Commission installed a breakwater on the North Arm of the Fraser River across from Wreck Beach to protect river moorage and log booms.
1974	A short section of experimental beach berm was constructed to reduce the erosion of Wreck Beach and toe erosion of the cliffs.
1977	Bulldozing and dredging deposition on the foreshore permanently altered the shoreline.
1979	A UBC Cliff Erosion Task Force identified the following priorities for action. *Priority 1* included: removal of damaged trees; barriers to unwanted access, better signing and improved access (particularly Trail 4); planting and fertilizing to stabilize the slopes; and restructuring the storm drain. An advisory group was struck to help with the implementation of these actions. *Priority 2* included: reclaiming washouts as per Graham's Ravine; beach "defenses"; sand replenishment; a North Arm Breakwater; surface water control; and subsurface (i.e. old drainage systems) control. An informational program was also suggested to accompany any actions taken.
1981	A second phase of beach berm and drift sill work was started in accordance with principles established in the 1979 public process.

1987 Extensions to the Public Works Canada's breakwater on the North Arm of the Fraser River were made to further protect log booms and small craft in the Fisherman's Mooring Basin. This has had the unintended consequence of a faster in-fill rate in the Point Grey booming grounds and deposition of river silt on Wreck Beach.

1989 The province transferred part of the University Endowment Lands to the GVRD for designation as Pacific Spirit Regional Park. The Musqueam had previously commenced legal action claiming an existing aboriginal title to the area and objected to the transfer. The transfer was made without prejudice to Musqueam aboriginal rights and title.

1991 A management plan was adopted for Pacific Spirit Regional Park in which the cliff area was rated as an Environmental Protection Zone with access prohibited except by designated trails. The plan upheld the status of Wreck Beach as a clothing-optional area from Acadia Beach (Mile Marker, wood bridge just west of Acadia parking lot) to Booming Ground Creek. No consultation process with the Musqueam had been developed or implemented.

1997 The GVRD Board approved the Official Community Plan (OCP) for Part of Electoral Area "A" (UBC and part of Pacific Spirit Regional Park).

1998 UBC has commissioned a small hydrological study re pipe installation on NW Marine Drive.

The Musqueam, UBC and GVRD have agreed to embark on a planning process (as described in this Discussion Document) as the basis for the development of a long term approach to minimizing cliff erosion.

Causes of Cliff Erosion

Erosion of the cliffs is both a natural and anthropogenic (humanly affected) phenomena. The slopes have been eroding since the last Ice Age left these formations. However, since the area has grown in population, human activities and development have had a greater impact. At the same time, the desirability of this area for human use and enjoyment has also grown.

The erosion in the following pictures has a variety of causes. Primarily these are shoreline erosion from tides and storms, vegetative uprooting and the forces of gravity, hydrological or groundwater forces, stormwater runoff and human activities.

1968 – Low tide showing logs which hit the cliff 4 feet higher at high tide

1968 – Trees and roots on beach as a result of toe erosion

1998 – Cliffs below Museum and Mackenzie House

1976 ***Cliffs below Cecil Green Drive and Museum grounds before and after re-vegetation*** ***1992***

1974 ***Cliffs below Museum before and after re-vegetation*** ***1992***

1998 – View of cliffs at Cecil Green House – note deep gully at right

There are many causes of erosion of the cliffs. These include shoreline erosion, uprooting of trees, stormwater, groundwater, weather and human activities. Each of these causes is briefly described below.

Shoreline Erosion

⇒ The berm and drift sill protection works erected in 1981 were evaluated in 1992 for effectiveness. The consultant's review indicated that most of the work had held up well and had been effective in reducing or eliminating shoreline erosion. Some maintenance work was required, particularly at the northern end. Presently, the berm is almost gone in areas of Tower Beach. Much of the cliff base remains exposed to this day and it was also noted that the areas left unprotected had suffered continual damaging erosion. Much of this erosion is due to littoral drift (wave scour aided by logs pounding the cliff toe) at high tide and during storms.

Uprooting of Trees

⇒ Fast growing but short lived deciduous trees such as alder (40-60 years) can accelerate erosion of the cliffs by uprooting. Older large alder trees with wide crowns often lean outward from the cliff and these trees are susceptible to wind throw. This happens when the upper weight of the tree causes the tree to topple. When this occurs the trees root system pulls away a significant amount of soil creating a cavity and exposing the cliff's sub soils. These sub soils that are then exposed to the rain and other weather elements can become accelerated pockets of cliff erosion. (Note, the relationship between vegetation and erosion needs further study – see proposed actions for vegetation on page 22 of this document).

Hydrological and Stormwater

⇒ A study of the existing stormwater collection and discharge systems has recently concluded that the maximum storm water run-off that can be handled for the development projected in the Official Community Plan approximates to a storm event whose return period is once every ten to twenty years. A study is under way to more precisely determine the system capacity. Once this study is completed, considerations will need to be made regarding the level of protection required for avoiding erosion from storm water flowing over the cliff edge.

Hydrogeological

⇒ The mixed layers of permeable sand and slowly permeable clays concentrate weeping from the cliff face. This cliff face seepage is a source of erosion.

Winter Freeze and Thaw

⇒ Winter conditions that bring heavy freezes lasting for a period of a week or more can accelerate cliff erosion. When the exposed sand surfaces freeze, erosion occurs in two ways. Freezing can expand the surface and force slabs of frozen cliff material to fall. Also, after a heavy freeze is over and thawing occurs, surface materials loosen and fall.

Wind and Rain

⇒ Off shore winds and rain cause an ongoing, low level erosion of exposed cliffs. When conditions are dry, winds erode areas of exposed sand and during wet weather, rain beating on exposed areas of the cliff cause further erosion. The extent of these effects are not well understood.

Human Activities

⇒ Early logging activities, initial construction of UBC, war time construction of towers and tunnels all have been significant early human causes of erosion. In more recent times, the Point Grey cliffs have been and remain an attraction both to residents of the region and tourists. Construction on the UBC campus has been ongoing. Prior to beach trail construction, access to the beach over the cliffs was a significant cause of cliff erosion. Construction of Trails #7, #6, #4, and #3 has helped to protect the cliffs from this activity. Human activities such as cliff climbing, development of scatter trails, tunneling, sculpting, vegetation removal, camping and ineffective vegetation irrigation practices remain a threat to the cliffs.

Planning Considerations

In addition to determining the effectiveness of the various options addressing cliff erosion, there are several other key considerations that must be taken into account in deciding whether the cliff stabilization / management option is desirable. These other planning considerations are noted below.

Musqueam Aboriginal Rights and Title

⇒ The area is part of the traditional territory of the Musqueam First Nation who have lived, hunted and fished here for several thousand years. As with other B.C. First Nations, the Musqueam have never surrendered their aboriginal rights and title to the Crown. They are currently engaged in treaty discussions as part of the B.C. Treaty Process. The area is of spiritual, cultural and archaeological importance. There are important sites of ethnographic significance to the Musqueam along the cliffs and beach.

⇒ Musqueam's aboriginal interests in the area mean that consultation with the Musqueam will be required with respect to any action that might prejudicially impact on their interests. All work must take into account the importance of Musqueam interests prior to undertaking any mitigation procedures. Systematic archaeological investigation in partnership with the Musqueam will be required to ensure that mitigation works will not damage or destroy identified or as yet unidentified archaeological sites or interfere with Musqueam use of and access to this area.

⇒ In 1989, the GVRD received title to the lands from the province. GVRD swore an affidavit in the Supreme Court of B.C. that stated they accepted the transfer without prejudice to the aboriginal rights and title claimed by the Musqueam in its lawsuit.

Official Community Plan

⇒ The Official Community Plan (OCP) for Electoral Area "A" includes specific policies for the "North Campus". These policies include requirements for an area planning process prior to further institutional and non-institutional development and hydrological studies prior to further development that sets the protection of Pacific Spirit Regional Park as a priority objective.

Other Agencies' Land Use Plans

⇒ The North Fraser Port Authority is developing a land use plan which will take into account the environmental, economic and social implications of all land use planning and development decisions which occur in the NFPA's jurisdiction. Since this jurisdiction includes foreshore areas of the cliff erosion management planning area, it will be important to ensure that these two plans are compatible and coordinated.

⇒ Fraser River Estuary Management Program (FREMP) is a partnership of federal, provincial and regional government bodies established to foster coordinated management activities in the Lower Fraser River. FREMP has an estuary management plan which addresses the Fraser River estuary and includes a vision, goals and action plan for improving the environmental, economic and social health of the estuary.

⇒ Burrard Inlet Environmental Action Program (BIEAP) is a partnership of federal, provincial and regional government bodies established to foster coordinated management activities in Burrard Inlet. Their focus includes the foreshore areas within the cliff erosion management Planning Area C.

⇒ Any work that has the potential to affect the intertidal or subtidal areas of the estuary or the inlet must be reviewed by those members of FREMP's Environmental Review Committee (ERC) or by the Burrard Inlet Environmental Review Committee (BERC) who have jurisdictional authority. These committees have been established to provide proponents with a coordinated environmental review process of applications to be handled in a timely manner.

Acadia Beach Boundary Interface Spanish Banks West (City of Vancouver)

⇒ The property immediately to the east of the planning area and adjoining Acadia Beach is within the boundaries of the City of Vancouver. This beach area is called "Spanish Banks West" and is operated by the Vancouver Parks Board. Spanish Banks West is operated as a clothed only swim beach. Vancouver Parks Board has adopted a different style of beach management than that of GVRD Parks for Pacific Spirit Regional Park. Contact with Vancouver Parks Board on planning to minimize cliff erosion is necessary to ensure appropriate treatment along property boundaries.

Vegetation

⇒ A 1985 vegetation survey indicated that the principal vegetation in the cliff areas consisted of big leaf maple, spring wood fern, bitter cherry, willow and trailing blackberry.

⇒ In 1992 a further survey of cliff vegetation was carried out by a former UBC academic who was responsible for the extensive planting programs during the seventies. The survey focused on the area in which planting had taken place and revealed considerable improvement to the cliff face stability, or more precisely, to the ability to withstand erosive forces. Species such as black locust and birch flourished in areas crowding out the short-lived alder.

⇒ In 1994, a park volunteer developed a vegetation survey of the area noting 129 separate plant species. The Pacific Spirit Park Society Vegetation Committee makes suggestions regarding maintenance or changes to vegetation management.

Habitat and Wildlife

⇒ The extensive forest edge and diversity of the Park's flora contributes to fauna species diversity. The upland streams, marshes and Camosun Bog also contribute to the food chain of the Park's wildlife by supporting large, year-round insect populations. The different forest types also provide fruit, seeds and bulbs. Decaying logs, dead trees and a variety of vegetative cover types provide a wide diversity in wildlife habitat. The largest heronry in the Lower Mainland is situated in the park uplands above Wreck Beach.

⇒ The Fraser River estuary (where salt and fresh water meet) and its associated tidal flats are productive feeding areas for many of the birds of the area. The Fraser River is the largest salmon-bearing river on the west coast of North America. The estuary is crucial as a transition zone, allowing juvenile salmon to acclimate to sea water on their way from upstream hatching areas and adult salmon to acclimate to fresh water on their return from the ocean. The marshes provide valuable habitat for salmonids which must be protected from damage.

⇒ The intertidal areas of Point Grey and Spanish Banks are very productive and provide valuable fish and water bird habitat.

Viewscapes

⇒ Demolition of the student residence (Fort Camp) and subsequent construction of the Museum of Anthropology over a quarter of a century ago afforded the University the opportunity to raise the aesthetic level of landscaping. This also improved public access to the Howe Sound viewscape to the north that is comprised of water, trees, beaches and the Tantalus Mountain Range. It has become evident that many visitors enjoy not only the tranquility of the setting but the fine views. Many people believe that it is highly desirable to preserve view corridors that highlight the maritime environment while protecting the natural seclusion afforded park visitors below the cliff tops and protecting cliff integrity. The preservation of current views is a planning consideration for Planning Area B.

Greenway

⇒ Greenways have become an important element integrating natural and urban spaces. The natural spaces including Wreck Beach, Pacific Spirit Regional Park and UEL lands hold the possibility of extending Vancouver greenways to the north and the south of the university and the park. The need for and the form of such a use is a planning consideration.

Museum of Anthropology

⇒ The architectural vision for the Museum of Anthropology grounds was to integrate the interior exhibits and the exterior landscape as a whole experience. First Nations cultural materials displayed within the Great Hall were to relate harmoniously to the surrounding landscaped Haida village and view of the sea. The original concept included a large, shallow reflecting pool. The pool was constructed but its presence was considered a potential danger to the stability of the cliffs and so it has only contained water on a few ceremonial occasions and normally remains unfilled. Currently the Museum is undergoing an assessment of its needs for the next generation. The Museum has requested that a schedule of activities for the second phase of the cliff erosion management planning process be provided to facilitate their own planning activities.

Infrastructure (North Side of Marine Drive)

⇒ Cecil Green House and Coach House are both effected by erosion. A storm in 1994 caused significant erosion directly adjacent to the Coach House and another storm in 1997 furthered the erosion. These buildings have considerable historical value and their location above the cliffs is a cause for concern.

⇒ The University has a number of other assets in this area including Green College, Norman McKenzie House (which serves as the residence for UBC's President) and the Parking and Security Offices. Cliff erosion threatens each of these to some degree.

⇒ The Greater Vancouver Sewerage and Drainage District owns and operates the spiral drain which is designed to handle minor drainage for the 10 year return period storm. This drain is located near to the museum.

⇒ A major trunk sewer was recently constructed on the cliff side of Marine Drive, skirting the UEL and UBC.

⇒ BC Tel has a building near the top of Trail 5.

Provincial Highways

⇒ Marine Drive skirts the cliffs in two locations within the planning area under consideration. Marine Drive adjacent to the west side of the University between gates 4 and 6, is only separated from the cliff edge by a concrete barrier curb and footpath. The cliff in this location is currently not actively being eroded. NW Marine Drive adjacent to the University Endowment Lands between Chancellor Boulevard and Spanish Banks is currently subjected to direct erosion. The closeness of the cliff face at the intersection of Wesbrook Mall and NW Marine to the cliff is a potential threat to the medium to long term use of the road. The erosion situation further down the road where the cliff face abuts Vancouver Parks Board property is relatively more stable. However, the path adjacent to the concrete barrier curb is narrow and in one place almost lost to the cliff slope.

⇒ Marine Drive in this area serves mainly as a collector for the University Endowment lands and as a recreational cycle and sightseeing route, it is not a regional connector or a strategic arterial. The path adjacent to the road on the cliff side is highly valued as a walking and jogging route. Many cyclists also prefer to use the path rather than Marine Drive.

Earthquake Preparation

⇒ Since this area has earthquake potential, any possible erosion control actions must include consideration of the effects of earthquakes. UBC has undertaken earthquake studies of buildings located in the planning area. Also, buildings constructed in the last two decades have included consideration of earthquake potential when determining where these buildings should be situated.

Safety

⇒ As one of the few remaining natural shorelines in the Region, the Pacific Spirit Regional Park shoreline attracts many visitors. Estimated annual visitation for Wreck Beach is 150,000 while annual visitation to Pacific Spirit Park is estimated at 650,000 (1998 projection). Beach use occurs daily, irrespective of the season. While no formal shoreline trail exists, public passage along the shoreline is popular. There are inherent dangers when visiting parks with natural landscapes and vegetation, GVRD is responsible for the park and has a responsibility to provide safe parks. UBC is also concerned with the safety of visitors on its property. Safety measures include area patrols (joint RCMP/GVRD), trimming of undergrowth along paths, repairs to the cliff face and posting of warning notices of the danger related to the cliffs. A reasonable balance has to be reached between excessive safety measures and visual harmony - for example, the cliff-top fence impedes the viewscape.

⇒ At this time, lighting on the grounds is avoided to discourage nighttime activity on the cliff and beach below while allowing viewing from the University Flagpole Plaza of a nighttime sky to the north unpolluted by artificial light. Artificial light also has a negative impact on nocturnal birds that utilize the darkness for hunting activities.

Public Access

⇒ The north campus contains some of the great public spaces at UBC. Pacific Spirit Park's beach area below the cliffs is clearly a unique regional resource. The University and the GVRD endorse both campus users and park visitors having access to park beaches.

⇒ The environmentally and archaeologically sensitive nature of the cliffs require some control of public access. One particular concern is the avoidance of erosion caused by people climbing the cliffs. The demand for natural and scenic filming locations in Greater Vancouver has led to proposals for such a use in the Wreck Beach area.

⇒ It is important to include accessibility to viewscapes for non-ambulatory persons.

Wreck Beach Use

⇒ Wreck Beach is a clothing optional beach from Acadia Beach to Booming Ground Creek. Some areas of the beach have been used in this way since the 1920's.

Fisheries

⇒ Recreational fishing occurs at various times through the year along the shoreline immediately at the base of the cliffs. The smelt fishery is the most practiced fishery in this area but is closed between June 15 and August 15, to coincide with the peak smelt spawning period. Smelt fishers may move rock on the beach to weigh down nets and use driftwood to light fires. Dungeness crabs are also harvested in this area. Anything that adds to silting negatively effects this species. Activities that negatively affect the smelt spawning or crab harvesting must be avoided.

Log Storage

⇒ The log booming grounds in the brackish waters of the North Arm of the Fraser River adjacent to the Musqueam lands provide protection to logs from damage from saltwater organisms. These booms also act as natural barriers to dampen boat wakes and storm surges which in turn protect the shoreline area behind the booms.

Development Proposals

⇒ With the planning area being discussed including large tracts of undeveloped lands and being positioned next to a major urban setting, it is understandable that development proposals for this area will be made. In the past, proposals have included restaurants, barge facilities, roads (including a trucking route) and bridges. It is critical that any future consideration of such proposals takes place in the context of the overall cliff erosion management plan that will be developed as a result of the process described in this document.

Options for Consideration in the Management Plan

The potential actions for consideration to include in a Cliff Erosion Management Plan that are presented in this section were developed through a series of public workshops and meetings held between November 1999 and January 2000. In some parts of this section, there are a number of possible options that indicate choices for moving forward on a potential action while in other cases, only one course of action is presented as no viable options were identified.

This document is inclusive of all ideas put forward. These include some that are relevant for the entire planning area and others that are site specific. You are asked to review these potential actions and provide your comments by September 22, 2000. Following this, decision makers will be supplied with all the input received during the public consultation prior to their decisions on what plan to support.

Potential actions that have a general application for the planning area have been noted using the following headings:

A. Drainage

B. Ground Water (hydrogeology)

C. Vegetation

D. Berm and Drift Sill Maintenance

Other potential actions have been noted for priority sites. These include:

E. Mackenzie House

F. Museum of Anthropology

G. Coach House Area

H. Cecil Green

I. General Cliff Protection in the Museum of Anthropology, Cecil Green Area

J. North West Marine Drive at Wesbrook Crescent

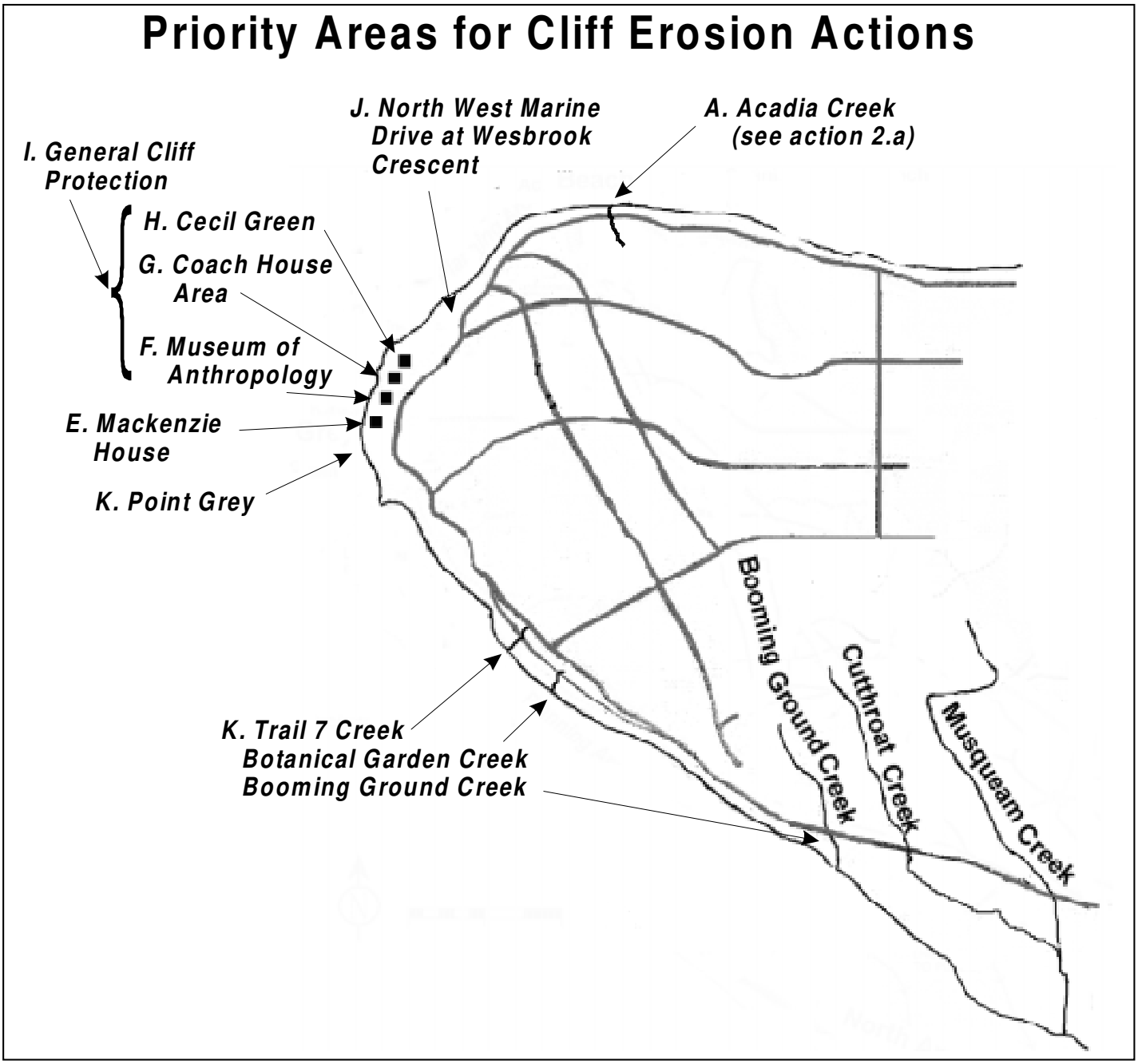
K. Booming Ground Creek, Botanical Garden Creek and Trail 7 Creek

L. Point Grey

Each of these priority sites has been highlighted in a map on the following page.

A final section notes overall planning considerations that need to be taken into account to ensure that this plan can be managed (i.e. sustainable and integrated with other planning initiatives).

M. Overall Management Plan Considerations



A. Drainage

Drainage of storm water is an important issue in managing cliff erosion. While the current pervious surfaces and drainage system is generally capable of addressing normal rain water, water flowing over the top of the cliff from severe storms has been a significant cause of erosion in certain areas. The UBC Campus topography divides the drainage into a north slope and south slope along a roughly east-west line. The amount of impervious surfaces (mainly buildings and roads) add to an increased rate at which such water can accumulate and cause surges in the drainage system. Over the last ten years, UBC has attempted to ensure that the overall ratio of impervious to pervious

surfaces in the North Campus stays about the same. At this time, while the South Campus remains largely undeveloped, planned development may alter this ratio and the pattern of drainage. Through development, many of the creeks in the South Campus have been altered during the last 30 years, causing changes to the previous natural drainage. Creeks in this area that have been affected include Booming Ground Creek, Botanical Garden Creek and Trail 7 Creek.

The drainage system in the North Campus was designed for a ten year return storm. While upgrades to the collection and delivery system have improved the overall performance of the drainage system, the capacity of the spiral drain that routes this water through a vertical pipe behind the cliff face (behind the Coach House and Museum of Anthropology) and out into the ocean is for the ten year return storm.

Possible actions to address general drainage issues include:

1. Conduct drainage study of the South Campus including consideration of:
    a) Retention ponds in South Campus to reduce peak storm discharge
    b) Sustainable development principles using recycled rain water
    c) Possible diversion of storm waters into creeks and bogs
    d) Erosion protection in the creeks where they emerge after flowing under Marine Drive (See Booming Ground Creek and Trail 7 Section later in the document)
    e) Adoption of a policy requiring a comprehensive storm water mitigation plan for any possible further development of the South Campus
2. Continue studying and/or improving the drainage system on the North Campus including:
    a) Diversion of exceptional storm water flows to the bottom of the Marine Drive hill at Spanish Banks via Acadia Creek
    b) Improve the drainage at the rear of the Coach House to increase the system capacity to greater than the ten year return storm using one of the following options:

        OPTION 1 - Install an erosion resistant but natural, aesthetically pleasing creek for drainage through Graham's Gully

        OPTION 2 - Investigate the possibility of reactivating the previous (and now unused) inclined drain behind Cecil Green House; this has a relatively low drainage capacity approximately one foot in diameter

        OPTION 3 - Bore a new additional drain with more drainage capacity (than the currently unused and low capacity drain in Option 2) at back of Cecil Green House
    c) Determine existing facilities that might be used for storm water retention (e.g. parkades and surface car parks, low lying playing fields)
    d) Adopt design criteria for new buildings to include added capacity for storm water retention (e.g. moats, dry ponds, flat roofs, car parks, etc.)

B. Ground Water (Hydrogeology)

Water exists in the ground due to surface seepage to the underground water table. The geological composition of Point Grey consists largely of a top layer of slowly permeable glacial till underlain by a porous but very stable layer of Quadra sand. Through this thick layer are thin layers of clay that are also slowly pervious. It is these layers of clay that block accumulated ground water and cause drainage to the cliff face. One of these clay layers can be seen at the north end of the cliffs at an elevation of about 20 meters. This layer slopes roughly in a southwest direction. The significance of this layer is that accumulated ground water seeps out of the cliff face leading to cliff face erosion. Over the years, various bore holes and wells have been dug on the campus that have led to a general

understanding of the hydrogeology of this area but there is still not a clear understanding of the amounts or paths of ground water.

Possible actions to address ground water include:

1. Conduct a hydrogeological survey with a number of new locations to gather information (e.g. water flow characteristics) on ground water (in addition to information available from existing drill holes) to provide a more complete picture together with previous data – could use drill holes or geophysics (e.g. can test electrical resistance of the ground or use ground penetrating radar)
2. Conduct specific studies at key problem areas including:
   a) Cecil Green Coach House
   b) North West Marine Drive
3. Survey seepage of water at the cliff face and streams emerging from the toe of the cliff
4. Study technical solutions from other areas to see what has been successful
5. Review buildings and services north of Marine Drive constructed prior to the UBC requirement to control storm water seepage next to the foundation to determine if additional controls might be required that are technically feasible, sustainable and financially reasonable

C. Vegetation

Originally, the cliff slopes were largely treed but some logging and other historical uses have altered this vegetation. Now, on many slopes, vegetation remains an important element helping to stabilize cliff slopes. In many places, alders and other fast growing species aid stabilization in their early years. Previous slope stabilization efforts have included re-vegetation initiatives and these have currently stabilized portions of the cliff face although precise records of effectiveness have not been kept.

NOTE 1 – different areas of the cliff have different stabilization needs – vegetation may not be appropriate in all areas

NOTE 2 – On July 28, 2000, the GVRD Board approved recommendations for priority work (the design was evaluated through a stakeholder consultation) and the following actions are currently under way:

⇒ In the area immediately to the west of the Coach House, a berm is being created to help retain excess surface water runoff from up to a 1 in 70 year return period storm from reaching the cliff edge

⇒ Below the Coach House, the top part of the cliff is being filled in using materials with interlocking properties to increase adhesion to the current slope and re-vegetation to help bind the soil

Possible actions to address vegetation issues include:

1. Conduct a more detailed survey of previously re-vegetated areas to determine success levels
2. Research other similar cliff situations to determine what vegetation approaches were most successful
3. Identify the range of plants most suitable for re-vegetation efforts on the cliffs in site specific areas with a preference for indigenous plants
4. Specify areas where the exposed cliffs are relatively stable and/or where natural erosion processes will not threaten safety, UBC buildings or other important infrastructure for allowing natural processes to prevail

5. Establish test area(s) to determine optimal conditions for successful re-vegetation (including different slope conditions and cliff elevations)
6. Ensure that effects on current vegetation are taken into account in any plans that will alter ground water or drainage
7. Initiate a tree management program in sensitive areas to control those large trees that may uproot and cause further slope erosion
    a) Conduct a long term study to determine the impact of various tree species on slope stability
    b) Develop an appropriate tree management program designed to maximize slope stability

D. Berm and Drift Sill Maintenance

Maintaining the integrity of the toe of the cliff is one of the keys to ensuring that the base does not continue to erode. In 1981/82, actions were taken to protect the shoreline north of Point Grey. This action consisted of the construction of rock drift sills (rock "fingers" that extend perpendicular from the shore line) with the addition of rocks and gravel between these to form a berm at the base of the cliff. Survey work in 1991 indicated that the drift sills have been quite stable and the berm material has behaved as expected, migrating slowly down the beach between the sills due to prevailing winds, tidal currents and Fraser River outflow. The engineering specifications for this work called for maintenance on a ten year cycle but to date, no maintenance has taken place. Visual inspection of the beach works indicate that the sills and berms are still providing essential protection but are no longer optimal in providing some of the recreational values on the beach. While beaches generally are formed from natural deposition of materials to replenish the beach, Wreck Beach deposition has been altered due to the construction of jetties for the protection of log booms and marine transportation in the North Arm of the Fraser River. Dredging of marine transportation channels in the North Arm of the Fraser River has also contributed to changes in natural sand deposition.

Possible actions to address berm and drift sills include:

1. Consult Musqueam, Department of Fisheries and Oceans, Ministry of Environment, North Fraser Port Authority, GVRD Regional Parks, Wreck Beach Preservation Society and other park and beach groups to:
    a) Identify areas in addition to those currently protected for which toe protection might be required (additional berm or sill works)
    b) Determine criteria for beach design in areas requiring protection but not currently protected as well as for those areas in which berm and sill works currently exist
2. Design desired beach characteristics (include toe protection, recreation values and fish/aquatic habitat concerns at the initial planning stages)
3. Update the survey to the 1981/82 sills and berm to determine where further erosion has occurred (including cobble lost, current sill elevation, habitat and vegetation and fast ferry effects on beach).
4. Re-design profile of the sills to:
    a) Reduce elevation where possible
    b) Improve access on side slopes
    c) Reduce bypassing of sand and cobble down the beach
    d) Provide fish habitat (tidal pools)
    e) Achieve recreational values

5. Explore feasibility and possible effectiveness of creating a spit and lagoon to protect the cliff toe (e.g. possibly a calm water area near Trail 4 to enhance swimming area)
6. Install stub sills or increase existing sill length to:
   a) Optimize with respect to additional sill lengths and new cobble material
   b) Re-align outer ends to improve efficiency
7. Add beach materials as required:
   a) Coarse gravel between Towers 1 and 2 (2" minus)
   b) Finer gravel south of Tower 2 (minimum size 1 mm sand)
   c) Additional sand/fine materials above the berm crest to enhance the recreational area of the beach

E. Mackenzie House

Mackenzie House, residence of the President of UBC, is located above the cliff top near Trail 4. In the past, lawn and garden maintenance work on the cliff side of this facility contributed to water going over the cliff top edge which contributed to erosion. These irrigation practices have been modified, reducing this cause of erosion.

Possible actions to take at Mackenzie House include:

1. Investigate the need to further reduce any effects caused by the need for watering and, if appropriate, consider the benefits of redeveloping the cliff side garden landscape based on water conservation principles

F. Museum of Anthropology

The Museum of Anthropology (MOA) is located above the cliff top adjacent to Cecil Green House and the Coach House. The spiral drain which is a primary means of ensuring North Campus drain water does not go over the cliff top, is located adjacent to MOA. Geotechnical engineers have given their professional assurances that MOA is not threatened by cliff erosion. They have also determined that the Museum does not contribute directly to cliff erosion. However, with discussions taking place regarding possible expansion of this facility, members of the public have raised concerns that any changes to this structure may have an adverse impact on the cliffs.

Possible actions to take with regards to MOA include:

1. Obtain further professional input regarding any potential cliff related problems (e.g. stability of the soils related to construction activity and possible development) should UBC decide to proceed with development plans at this site.

G. Coach House Area

The Coach House is a heritage structure that was part of the original Cecil Green House. This area is located adjacent to the spiral drain and is one of the low points for drainage from parts of the North Campus. Severe storm events that the drainage system was unable to handle over the last number of years have resulted in storm waters overflowing the top of the cliff and washing out a gully. The erosion is close enough to the Coach House that the facility cannot be used at this time. Improvements to the intake of the spiral drain and storm water collection system have added to the protection of the area. However, the cliffs, the Coach House and spiral drain remain potentially threatened by an overwhelming storm event.

NOTE –Through the process leading up to this consultation, this site was identified as an area that could possibly require priority action. UBC applied to the GVRD Park Committee for approval to

proceed with such action prior to the development of a comprehensive cliff erosion management plan. After working together with a stakeholder committee (Project Design and Implementation Committee) and consultants, a final design for work was submitted by UBC to the GVRD. On July 28, 2000, the GVRD Board approved recommendations to conduct the actions for priority work in this area; the following work is now under way:

⇒ In the area immediately to the west of the Coach House, a berm is being created to help retain excess surface water runoff from up to a 1 in 70 year return period storm from reaching the cliff edge

⇒ Below the Coach House, the top part of the cliff is being filled in using materials with interlocking properties to increase adhesion to the current slope and re-vegetation to help bind the soil

Possible actions to take to protect the Coach House itself include:

1. Take action to protect the Coach House considering one of the following options:

   OPTION 1 - Investigate engineering solutions designed specifically to protect the Coach House in its current location

   OPTION 2 - Move the Coach House further from the cliff edge to protect against further damage to the structure from erosion-based causes

   OPTION 3 - Do nothing to specifically protect the Coach House while whatever actions may be required to protect the spiral drain

H. Cecil Green

Possible actions to protect Cecil Green House include:

1. Investigate the need for protection for Cecil Green and possible engineering or other solutions (e.g. soil anchors, supports, vegetation, etc.)

I. General Cliff Protection in the Cecil Green, MOA area

The cliffs immediately below the Museum of Anthropology and Cecil Green House are very steep and are sites of ongoing erosion. While all of the main buildings are well back of the cliff, long term erosion concerns have been voiced. The areas below the museum and Cecil Green House have been fenced off to prevent unauthorized access. Even with the fences, use of unauthorized trails continues, adding to the erosion. These areas also offer significant viewscapes but the views are impaired in places by cliff top vegetation. In spots, the ground under the roots of the trees at the top of the cliff have been eroded and these trees will eventually fall down, taking materials on the cliff along with them as they fail. While re-vegetation efforts have been carried out on parts of these cliffs in the past, some of this work has been lost while other vegetation has succeeded and is helping minimize erosion. Seepage of ground water in this area comes out of the cliff face at about the 20 meter level and this leads to failure of the slope. In 1982, berm work was carried out at the toe of the cliff providing protection from waves. When installed, engineering specifications called for maintenance approximately every 10 years but this work has not been done.

Possible actions to take for protecting the cliff face behind MOA and Cecil Green include:

1. Sink bore holes or wells to control seepage at cliff face
2. Provide new signage in the area to reinforce the necessity to not use this area for illegal access
3. Initiate a program to repair the fence as soon as there is any sign of damage or trespass
4. Use vegetation barriers to dissuade ongoing trespassing at the cliff top and at lower elevations
5. Remove trees at the top edge that are in danger of falling over

6. Re-vegetate the slopes where possible

Possible action to take to protect the cliff toe below MOA and Cecil Green House include:

7. Improve berms at the toe of cliff (only where needed to protect the cliffs)

Possible action to take to restore the viewscape behind MOA include:

8. Investigate whether installing a permanent viewing spot will be an effective way to prevent people from going past the fence barriers to enjoy the cliff top views (in conjunction with improved signage to designated trails, vegetation barriers and more rigorous fence maintenance activities)
9. Determine appropriate permanent site(s) where vegetation management and site maintenance will provide viewscapes for visitors (including non-ambulatory)

J. North West Marine Drive at Wesbrook Crescent

The cliffs immediately to the north of North West Marine Drive at Wesbrook Crescent have eroded to within 6 meters of the road in this area. A sanitary sewer line (installed 1993-94) runs parallel to the road on the cliff side at this point; a storm sewer line is situated on the opposite side of the road. Both the road and the sewer lines face threats if there is ongoing erosion of the cliffs in this area. The main actual and potential causes of the erosion appear to be seepage of ground water emerging from the face of the cliff, trees on the face of the cliff and insufficient protection to the toe of the cliff from waves. It is also possible that storm water could accumulate in the fill material of the sanitary sewer line, contributing to the ground water seepage on the cliff face however tests done to date indicate that this is not likely a serious threat.

Possible actions to reduce groundwater erosion threats to North West Marine Drive at Wesbrook Crescent include:

1. Conduct hydrogeological survey of this area to determine the actual extent of groundwater and the underground location(s) where this water accumulates
2. Take action to divert ground water currently seeping out of the cliff face using one of the following options:

   OPTION 1 - Drill 1-3 wells to intercept ground water that is currently draining on the cliff face and drain this to a lower level that emerges below the cliff toe

   OPTION 2 - Drill an inclined bore hole from the beach level to the mid cliff clay strata to drain ground water before it reaches the cliff face
3. Capture and divert storm water which accumulates in the bedding material of the sanitary sewer trenches into the storm water system on the far side of road to eliminate potential build up of water in trench (contribution to groundwater and possible overflowing over the cliff edge)

Possible actions to take to protect the cliff face at North West Marine Drive and Wesbrook Crescent include:

4. Initiate a tree management program to protect from uprooting; perhaps use “stumps” as natural mechanical anchors for new cribbing system
5. Where appropriate for slope stability, re-vegetate the slope

Possible actions to take to protect the cliff toe at North West Marine Drive and Wesbrook Crescent include:

6. Carry out berm and/or sill work on the beach to protect the toe of the cliff

Possible actions to take to reduce human causes of erosion at North West Marine Drive and Wesbrook Crescent include:

7. Address issue of shortcut trails with fencing and/or vegetation barriers such as blackberry

Other possible actions to take to address erosion threats to North West Marine Drive and Wesbrook Crescent include:

8. *IF the above measures to protect this area are not feasible or sustainable,* relocate Marine Drive and the sanitary sewer lines from this area

K. Booming Ground Creek, Botanical Garden Creek and Trail 7 Creek

This area near the south end of the planning area has three creeks (Booming Ground Creek, Botanical Garden Creek and Trail 7 Creek) that provide drainage from the South Campus. The water from each creek is channeled into drainage pipes that go under the roads and emerge on the cliff side. The pipes were installed as part of earlier road construction. The areas adjacent to the ends of the drainage pipes and further downstream toward the shoreline have eroded from this water flow. At this time, the ends of the pipes in all locations are several meters in the air due to erosion caused by the water coming out at this height and hitting the ground. The amount of water flowing through the pipe at Booming Ground Creek in particular appears to be higher than other streams in the area – when these others dry up in the summer, a considerable amount of water continues to be present in this channel. In addition to the volume at Booming Ground Creek, reports of skin irritations from people who have waded in the stream indicate that there may be a problem with the water quality. This has raised questions regarding what may have been introduced to drainage water that could cause such problems. The water quality is of particular concern in this area as it is an important rearing grounds for Great Blue Herons and the estuary is a significant habitat area for the migration of salmonids.

Possible actions to take to improve drainage for the South Campus include:

1. Develop an overall drainage plan for the South Campus that places cliff and shoreline protection as a key planning criteria *(See A. Drainage earlier in this section)*
2. Study the amount and velocity of water in each creek at different times of the year to determine the relationship to ecology and erosion.
3. If ecologically sound and helpful to avoid erosion, divert water using one of the following options:

   OPTION 1 - Divert water from both Botanical Garden Creek and Trail 7 Creek through a drainage ditch to Booming Ground Creek

   OPTION 2 - Divert water from Trail 7 Creek and Botanical Garden Creek to an alternative water course for high flow situations

   OPTION 3 - Protect Trail 7 Creek and Botanical Garden Creek from Marine Drive to the Fraser River against excessive scouring or erosion

4. Based on the study results of water flows and the ability to manage the pipe end erosion, undertake one of the following possible actions:

   OPTION 1 - Re-establish (day-light) Booming Ground Creek where it flows under Marine Drive and adjust the profile to the natural grade, ensuring a minimal level of disturbance to the creek banks; undertake remediation work to repair damage and

mitigation to prevent ongoing erosion (e.g. rip rap on sides of creek below pipe end) for the other creeks.

OPTION 2 - Construct an inclined drain in the vicinity of Booming Ground Creek to the beach from where the pipe emerges on the cliff side of Marine Drive; undertake remediation work to repair damage and mitigation to prevent ongoing erosion (e.g. rip rap on sides of creek below pipe end) for the other creeks.

OPTION 3 - Construct an inclined drain or restore a natural watercourse for Booming Ground Creek to the beach from where the pipe emerges on the cliff side of Marine Drive; deactivate the current pipe ends under Marine Drive for Botanical Garden Creek and Trail 7 Creek and divert water from these creeks to a new inclined drain at Booming Ground Creek; carry out any necessary work to repair damage that may lead to further cliff side erosion at the current pipe ends for Botanical Garden Creek and Trail 7 Creek

OPTION 4 - Do nothing and let the pipe end erosion continue

Possible actions to take to ensure water quality is not deleterious in the South Campus creeks include:

5. Construct a public washroom at the estuary (in consultation with the Wreck Beach Liaison Committee)
6. Test the quality of the drainage water at various locations in the catchment area (including where there are specific discharge locations of possible concern)
   a) Conduct tests during different seasons and weather conditions
   b) Make the information on where drainage locations sites are located and where the tests for water quality are done available to interested members of the public
   c) If necessary, take steps to identify and rectify the introduction of any deleterious substances

L. Point Grey

The cliffs in this area are one of the key landmarks from a marine perspective. Toe erosion is the main threat. Elsewhere (between Towers 1 and 2), this toe erosion has been largely controlled through the construction of drift sills and berms (see Berm and Drift Sill Maintenance Section earlier in the document). A trail that was used for beach access in this area (Trail 5) was closed due to the terrain and erosion from human use. Water draining through this area continues to cause some erosion next to the old trail and some people continue to use this trail. While not readily accessible, the cliff top in this area offers a magnificent viewscape.

Possible actions to take at Point Grey include:

1. Extend the current beach works to continue to protect the cliff toe (*See D. Berm and Drift Sill Maintenance in an earlier section)*
2. Review the impacts of the Trail 5 closure to determine:
   a) What benefits have been realized as a result of this closure
   b) Any learnings that may be applicable to other parts of the cliffs
   c) If additional protection or mitigation work may be required along the closed off trail
   d) If other means of preventing continued trail use may be required
3. Protect the cliff top from storm water run-off
4. Repair trail side erosion damage (consider vegetation approaches)

5. Review a "do-nothing" policy for the cliff face combined with ensuring toe protection to consider the possible benefits (e.g. protect the marine landmark aspect) and/or adverse effects of such an approach
6. Adopt policies to ensure this site remains as natural as possible

M. Overall Management Plan Considerations

Overall plan considerations include:

1. Make specific linkages of the cliff erosion management plan to other relevant planning processes (including Musqueam planning processes, Pacific Spirit Regional Park Management Plan, UBC Comprehensive Community Plan, other UBC plans and planning processes, North Fraser Port Authority plans) to ensure that potential negative effects on cliff erosion are avoided and cliff protection efforts are supported. Areas to pursue for such linkages include:
   a) Adoption of the Cliff Erosion Management Plan at a policy level by both UBC and GVRD Regional Parks to ensure support of the principles, considerations and management actions both for internal planning processes and in dealing with other agencies for any actions that will affect the cliffs
   b) Establishment of formal linkages (i.e. formal agreements to include cliff erosion considerations in their planning and management control processes) with other agencies whose activities have affected or in the future might affect the cliffs (e.g. North Fraser Port Authority)
2. Development of a cliff data base integrating the currently available and to be developed information; this could include:
   a) Photo mapping of sensitive sites to provide a way of measuring the effects of actions taken (GIS based)
   b) Ecological inventory including the marine environment
   c) Consideration for remote sensing of conditions for erosion prone areas
3. Establishment of an agreed upon setback line
   a) Identification of areas of the cliff where such a setback line are required
   b) Establishment of the appropriate angle of repose (including consideration of toe protection to retain sloughed materials from the cliffs) plus a safety consideration for each of the identified areas

Consultation Activities to Date

The activities in this process have included the following:

1. *June/98* Initial meetings with UBC and GVRD Ad Hoc committee representatives to develop the steps for Phase 1 of this process
2. *June/98* Development of an initial Draft Discussion Document
3. *July/98* Tour of the beach and cliffs followed by a first meeting with representatives of public stakeholder groups (Consultation Focus Group) to explain process and to get a response to the initial document
4. *Aug/98* Additional meetings with UBC and GVRD Ad Hoc committee representatives; gathering of additional information and revision of the Draft Discussion Document as per the input from Consultation Focus Group
5. *Sept/98* Meeting with the Musqueam; additional meetings with UBC and GVRD Ad Hoc committee representatives to form the Coordinating Committee; second meeting with Consultation Focus Group; further revisions to the Draft Discussion Document and consultation process
6. *Oct/98* Additional meetings with Coordinating Committee and further revisions to the Draft Discussion Document and consultation process
7. *Nov/98* Fourth meeting with the Consultation Focus Group; additional meetings with the Coordinating Committee; circulation of the Draft Discussion Document to relevant agencies for their comments
8. *Jan/99* Agency comments gathered and amalgamated into Draft Discussion Document
9. *Feb/99* Agencies advised how their comments have been used; final review of the Draft Discussion Document by the Coordinating Committee and Consultation Focus Group; document prepared for submission to Musqueam, UBC and the GVRD
10. *May-Nov/99* Meetings of the Coordinating Committee to prepare for the Open Houses and the options development process.
11. *Oct & Nov/99* Two Open Houses to provide information on the issues to interested members of the public
12. *Nov/99* Education and Options Development weekend workshop with interested members of the public.
13. *Dec/99* Second meeting of the Options Development group.
14. *Jan/00* Third meeting of the Options Development group.
15. *Jan/00* Additional meetings of the Coordinating Committee to finalize the Consultation Discussion Document and prepare for the public consultation.
16. *Feb-June/00* Additional consultation process to provide input on design and implementation of priority work on the cliff face behind the Coach House to protect the spiral drain; this also resulted in a short delay on consultation for the overall management plan.

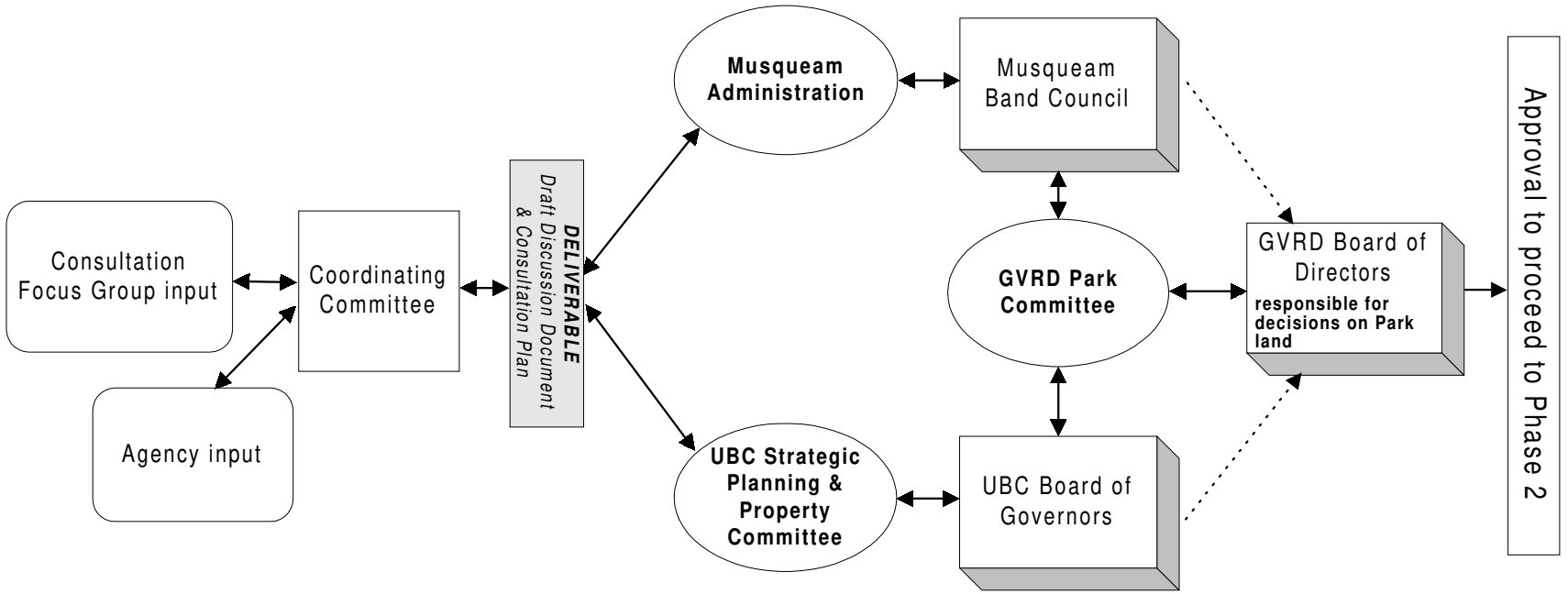
The Coordinating Committee members include representatives from UBC, GVRD Parks and the Musqueam Band. Representation on the Consultation Focus Group has included:

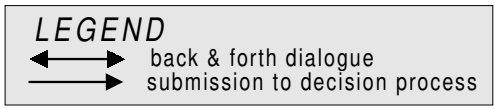
- *Musqueam Band*
- *Pacific Spirit Park Society*
- *Fraser River Coalition*
- *UBC Alma Mater Society*
- *University Endowment Land Ratepayers*
- *Wreck Beach Preservation Society*
- *Vancouver Natural History Society*

Appendix 1 - Overview of Decision Process

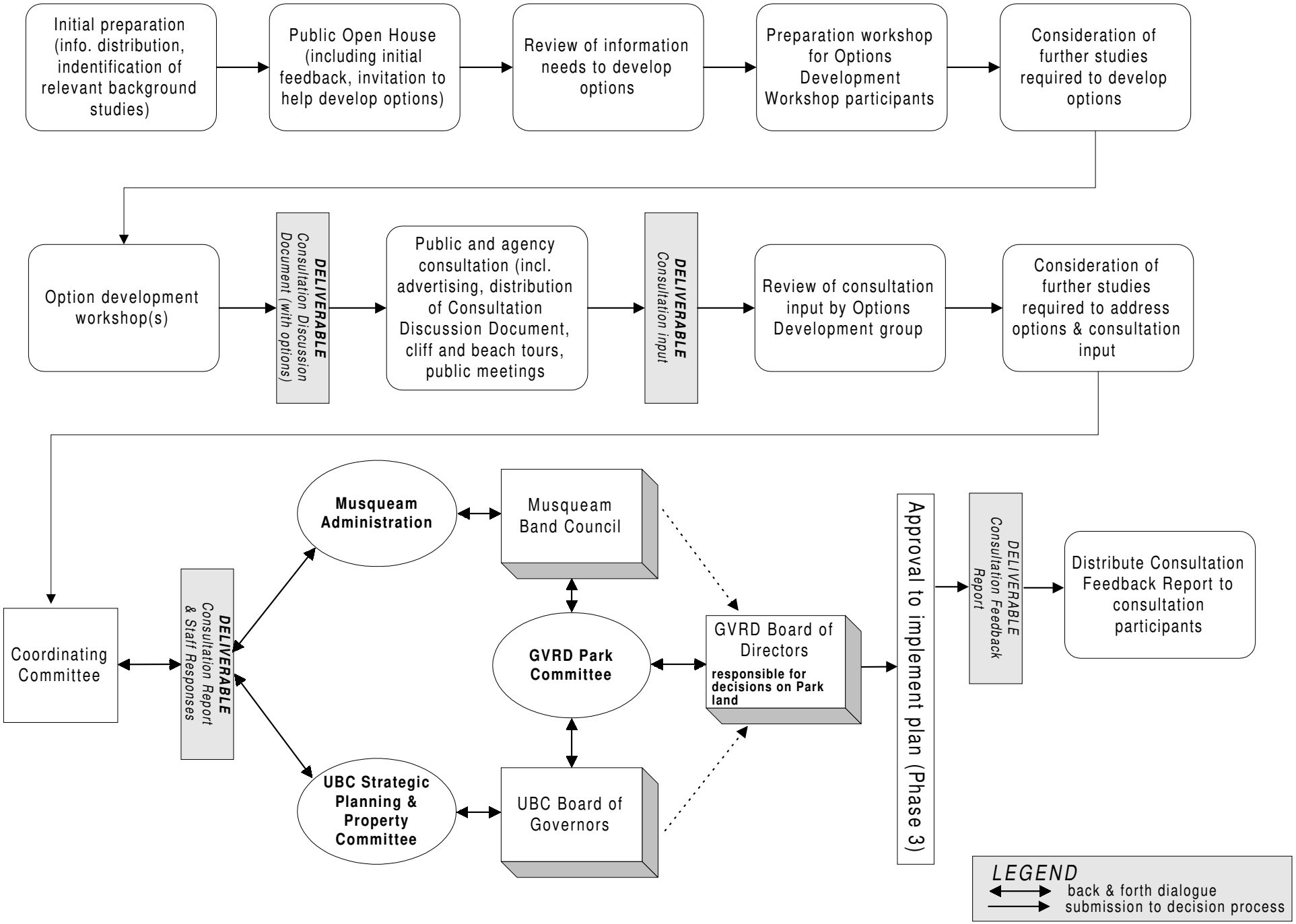
UBC/Pacific Spirit Regional Park
Cliff Erosion Management Planning
Decision Making/Committee Structure

Phase 1 - Consultation Design





UBC/Pacific Spirit Regional Park
Cliff Erosion Management Planning
Decision Making/Committee Structure



UBC/Pacific Spirit Regional Park
Cliff Erosion Management Planning
Decision Making/Committee Structure

Phase 3 - Plan Implementation

TO BE DEVELOPED

Specific actions, schedule and committee structure for implementation will be considered as part of the consultation in Phase 2 and will reflect the decisions of the UBC Board of Governors, GVRD Board of Directors and Musqueam Band Council

UBC/Pacific Spirit Regional Park Cliff Erosion Management Planning Consultation Feedback

*PLEASE NOTE - This planning process is being carried out without prejudice to the Musqueam aboriginal interests in this area (see page 14 of the "*UBC/Pacific Spirit Regional Park Cliff Erosion Management Planning Consultation Discussion Document*").*

Background information regarding the problems, overall management framework and considerations is supplied in the *UBC/Pacific Spirit Regional Park Cliff Erosion Management Planning Consultation Discussion Document* (call 822-4178 if you want to obtain a copy).

Management Plan Objectives

Please indicate your level of support for the following objectives for the *UBC/Pacific Spirit Regional Park Cliff Erosion Management Plan*. If you wish, use the space which has been provided for additional point form comments.

		Strongly Support				Strongly Oppose
1.	Protect the cultural and archaeological resources of the area from damage due to cliff erosion (i.e. manage erosion of the cliffs in a manner that protects the cultural and archaeological resources)	**1**	**2**	**3**	**4**	**5**
2.	Preserve the wilderness-like setting of the foreshore.	**1**	**2**	**3**	**4**	**5**
3.	Mitigate the threat of damage from cliff erosion to UBC assets and property.	**1**	**2**	**3**	**4**	**5**
4.	Reduce embankment spills and fallen trees across the beach and access paths to increase safety for people near the cliff tops and those using the beaches.	**1**	**2**	**3**	**4**	**5**
5.	Mitigate erosion threat to Marine Drive.	**1**	**2**	**3**	**4**	**5**

Additional comments or suggestions re Management Plan Objectives.

Management Plan Principles

Please indicate your level of support for the following principles for the *UBC/Pacific Spirit Regional Park Cliff Erosion Management Plan*. If you wish, use the space which has been provided for additional point form comments.

		Strongly Support				Strongly Oppose
1.	All other UBC and GVRD planning activities which may have an impact on Point Grey cliff erosion will be integrated with the cliff erosion management plan.	**1**	**2**	**3**	**4**	**5**
2.	Once the cliff erosion management plan is completed, the UBC Official Community Plan (Electoral Area A) will be reviewed and, where necessary, recommendations forwarded to the GVRD Board to adjust the OCP to minimize the causes of cliff erosion.	**1**	**2**	**3**	**4**	**5**

Management Plan Principles (continued)

		Strongly Support				Strongly Oppose
3.	Any actions taken will be in accordance with UBC's policies and regulations and will ensure preservation of UBC assets and lands to the extent possible given the current state of the cliffs.	**1**	**2**	**3**	**4**	**5**
4.	Any actions taken will be in accordance with GVRD Regional Park policy and regulations, GVRD Parks Department philosophy and management style and, where appropriate, fall within the staffing and funding capability of GVRD Parks Department.	**1**	**2**	**3**	**4**	**5**
5.	Any actions taken will be done in accordance with the government's duties of consultation with aboriginal people. This consultation will include and not be limited to matters dealing with identified and unidentified cultural resources of the area.	**1**	**2**	**3**	**4**	**5**
6.	Any actions to manage cliff erosion will be done considering advisory input from stakeholder groups, members of the public and other relevant agencies. An ongoing advisory committee will be established to facilitate gathering this input.	**1**	**2**	**3**	**4**	**5**
7.	Any action taken will not interfere with the recreational values of Wreck Beach regarding clothing –optional sunbathing and swimming.	**1**	**2**	**3**	**4**	**5**
8.	Any actions taken will maintain the current condition of not being able to view buildings from the beach or vice versa.	**1**	**2**	**3**	**4**	**5**
9.	Any actions taken must take into account the preservation of the beach as a whole in nearly a natural state as possible.	**1**	**2**	**3**	**4**	**5**

Additional comments or suggestions re Management Plan Principles.

Management Plan Values

Please indicate your level of support for the following values for the *UBC/Pacific Spirit Regional Park Cliff Erosion Management Plan*. If you wish, use the space which has been provided for additional point form comments.

		Strongly Support				Strongly Oppose
1.	The cliffs have important cultural and archaeological value to the Musqueam First Nation that must be respected and preserved.	**1**	**2**	**3**	**4**	**5**
2.	While minimizing cliff erosion will likely call for ecological management, the flora and fauna of the escarpment should be preserved to the greatest extent possible.	**1**	**2**	**3**	**4**	**5**
3.	Any actions taken must integrate with the campus community design.	**1**	**2**	**3**	**4**	**5**

Additional comments or suggestions re Management Plan Values.

Please indicate your level of support for the potential actions for inclusion in a *UBC/Pacific Spirit Regional Park Cliff Erosion Management Plan*. If you wish, use the space which has been provided in each section for additional point form comments.

A. Drainage

	Strongly Support				Strongly Oppose
1. Conduct drainage study of the South Campus including consideration of:					
a) Retention ponds in South Campus to reduce peak storm discharge	**1**	**2**	**3**	**4**	**5**
b) Sustainable development principles using recycled rain water	**1**	**2**	**3**	**4**	**5**
c) Possible diversion of storm waters into creeks and bogs	**1**	**2**	**3**	**4**	**5**
d) Erosion protection in the creeks where they emerge after flowing under Marine Drive	**1**	**2**	**3**	**4**	**5**
e) Adoption of a policy requiring a comprehensive storm water mitigation plan for any possible further development of the South Campus	**1**	**2**	**3**	**4**	**5**
2. Continue studying and/or improving the drainage system on the North Campus including:					
a) Diversion of exceptional storm water flows to the bottom of the Marine Drive hill at Spanish Banks via Acadia Creek	**1**	**2**	**3**	**4**	**5**
b) Improve the drainage at the rear of the Coach House to increase the system capacity to greater than the ten year return storm using **one** of the following options:					
OPTION 1 – Install an erosion resistant but natural, aesthetically pleasing creek for drainage through Graham's Gully	**1**	**2**	**3**	**4**	**5**
OPTION 2 – Investigate the possibility of reactivating the previous (and now unused) inclined drain behind Cecil Green House; this has a relatively low drainage capacity approximately one foot in diameter	**1**	**2**	**3**	**4**	**5**
OPTION 3 – Bore a new additional drain with more drainage capacity (than the currently unused and low capacity drain in Option 2) at back of Cecil Green House	**1**	**2**	**3**	**4**	**5**
c) Determine existing facilities that might be used for storm water retention (e.g. parkades and surface car parks, low lying playing fields)	**1**	**2**	**3**	**4**	**5**
d) Adopt design criteria for new buildings to include added capacity for storm water retention (e.g. moats, dry ponds, flat roofs, car parks, etc.)	**1**	**2**	**3**	**4**	**5**

Additional comments or suggestions re "Drainage"

B. Ground Water - Hydrogeology

	Strongly Support				Strongly Oppose
1. Conduct a hydrogeological survey with a number of new locations to gather information (e.g. water flow characteristics) on ground water (in addition to information available from existing drill holes) to provide a more complete picture together with previous data – e.g. use drill holes or geophysics to test ground electrical resistance or use ground penetrating radar	**1**	**2**	**3**	**4**	**5**

B. Ground Water – Hydrogeology (continued)

	Strongly Support				Strongly Oppose
2. Conduct specific studies at key problem areas including:					
a) Cecil Green Coach House	**1**	**2**	**3**	**4**	**5**
b) North West Marine Drive	**1**	**2**	**3**	**4**	**5**
3. Survey seepage of water at the cliff face and streams emerging from the toe of the cliff	**1**	**2**	**3**	**4**	**5**
4. Study technical solutions from other areas to see what has been successful	**1**	**2**	**3**	**4**	**5**
5. Review buildings and services north of Marine Drive constructed prior to the UBC requirement to control storm water seepage next to the foundation to determine if additional controls might be required that are technically feasible, sustainable and financially reasonable	**1**	**2**	**3**	**4**	**5**

Additional comments or suggestions re "Ground Water"

C. Vegetation

	Strongly Support				Strongly Oppose
1. Conduct a more detailed survey of previously re-vegetated areas to determine success levels	**1**	**2**	**3**	**4**	**5**
2. Research other similar cliff situations to determine what vegetation approaches were most successful	**1**	**2**	**3**	**4**	**5**
3. Identify the range of plants most suitable for re-vegetation efforts on the cliffs in site specific areas with a preference for indigenous plants	**1**	**2**	**3**	**4**	**5**
4. Specify areas where the exposed cliffs are relatively stable and/or where natural erosion processes will not threaten safety, UBC buildings or other important infrastructure for allowing natural processes to prevail	**1**	**2**	**3**	**4**	**5**
5. Establish test area(s) to determine optimal conditions for successful re-vegetation (including different slope conditions and cliff elevations)	**1**	**2**	**3**	**4**	**5**
6. Ensure that effects on current vegetation are taken into account in any plans that will alter ground water or drainage	**1**	**2**	**3**	**4**	**5**
7. Initiate a tree management program in sensitive areas to control those large trees that may uproot and cause slope erosion					
a) Conduct a long term study to determine the impact of various tree species on slope stability	**1**	**2**	**3**	**4**	**5**
b) Develop an appropriate tree management program designed to maximize slope stability	**1**	**2**	**3**	**4**	**5**

Additional comments or suggestions re "Vegetation"

D. Berm and Drift Sill Maintenance

	Strongly Support				**Strongly Oppose**
1. Consult Musqueam, Department of Fisheries and Oceans, Ministry of Environment, North Fraser Port Authority, GVRD Regional Parks, Wreck Beach Preservation Society and other park and beach groups to:					
a) Identify areas in addition to those currently protected for which toe protection might be required (additional berm or sill works)	**1**	**2**	**3**	**4**	**5**
b) Determine criteria for beach design in areas requiring protection but not currently protected as well as for those areas in which berm and sill works currently exist	**1**	**2**	**3**	**4**	**5**
2. Design desired beach characteristics (include toe protection, recreation values and fish/aquatic habitat concerns at the initial planning stages)	**1**	**2**	**3**	**4**	**5**
3. Update the survey to the 1981/82 sills and berm to determine where further erosion has occurred (including cobble lost, current sill elevation, habitat and vegetation and fast ferry effects on beach).	**1**	**2**	**3**	**4**	**5**
4. Re-design profile of the sills to:					
a) Reduce elevation where possible	**1**	**2**	**3**	**4**	**5**
b) Improve access on side slopes	**1**	**2**	**3**	**4**	**5**
c) Reduce bypassing of sand and cobble down the beach	**1**	**2**	**3**	**4**	**5**
d) Provide fish habitat (tidal pools)	**1**	**2**	**3**	**4**	**5**
e) Achieve recreational values	**1**	**2**	**3**	**4**	**5**
5. Explore feasibility and possible effectiveness of creating a spit and lagoon to protect the cliff toe (e.g. possibly a calm water area near Trail 4 to enhance swimming area)	**1**	**2**	**3**	**4**	**5**
6. Install stub sills or increase existing sill length to:					
a) Optimize with respect to additional sill lengths and new cobble material	**1**	**2**	**3**	**4**	**5**
b) Re-align outer ends to improve efficiency	**1**	**2**	**3**	**4**	**5**
7. Add beach materials as required:					
a) Coarse gravel between Towers 1 and 2 (2" minus)	**1**	**2**	**3**	**4**	**5**
b) Finer gravel south of Tower 2 (minimum size 1 mm sand)	**1**	**2**	**3**	**4**	**5**
c) Additional sand/fine materials above the berm crest to enhance the recreational area of the beach	**1**	**2**	**3**	**4**	**5**

Additional comments or suggestions re "Berm and Drift Sill Maintenance"

E. Mackenzie House

	Strongly Support				Strongly Oppose
1. Investigate the need to further reduce any effects caused by the need for watering and, if appropriate, consider the benefits of redeveloping the cliff side garden landscape based on water conservation principles	**1**	**2**	**3**	**4**	**5**

Additional comments or suggestions re "Mackenzie House"

F. Museum of Anthropology

	Strongly Support				Strongly Oppose
1. Obtain further professional input regarding any potential cliff related problems (e.g. stability of the soils related to construction activity and possible development) should UBC decide to proceed with development plans at this site.	**1**	**2**	**3**	**4**	**5**

Additional comments or suggestions re "Museum of Anthropology"

G. Coach House Area

	Strongly Support				Strongly Oppose
1. Take action to protect the Coach House considering **<u>one</u>** of the following options:					
<u>OPTION 1 -</u> Cut back the top edge of the cliff and fill in the top part of the existing gully; vegetate the filled-in gully above the 20 meter level of the cliff; where possible, indigenous plants will be used; keep the Coach House in place; and investigate other possible engineering solutions to protect the Coach House	**1**	**2**	**3**	**4**	**5**
<u>OPTION 2 -</u> Conduct actions as per Option 1 (above) but move the Coach House further from the cliff edge to further protect against possible impacts	**1**	**2**	**3**	**4**	**5**
<u>OPTION 3 -</u> Do nothing to protect the Coach House while taking the actions noted in Option 1 above to protect the spiral drain	**1**	**2**	**3**	**4**	**5**

Additional comments or suggestions re "Coach House Area"

H. Cecil Green

		Strongly Support				Strongly Oppose
1.	Investigate the need for protection for Cecil Green and possible engineering or other solutions (e.g. soil anchors, supports, vegetation, etc.)	**1**	**2**	**3**	**4**	**5**

Additional comments or suggestions re "Cecil Green"

I. General Cliff Protection in the Cecil Green, MOA area

		Strongly Support				Strongly Oppose
1.	Sink bore holes or wells to control seepage at cliff face	**1**	**2**	**3**	**4**	**5**
2.	Provide new signage in the area to reinforce the necessity to not use this area for illegal access	**1**	**2**	**3**	**4**	**5**
3.	Initiate a program to repair the fence as soon as there is any sign of damage or trespass	**1**	**2**	**3**	**4**	**5**
4.	Use vegetation barriers to dissuade ongoing trespassing at the cliff top and at lower elevations	**1**	**2**	**3**	**4**	**5**
5.	Remove trees at the top edge that are in danger of falling over	**1**	**2**	**3**	**4**	**5**
6.	Re-vegetate the slopes where possible	**1**	**2**	**3**	**4**	**5**
7.	Improve berms at the toe of cliff (only where needed to protect the cliffs)	**1**	**2**	**3**	**4**	**5**
8.	Investigate whether installing a permanent viewing spot will be an effective way to prevent people from going past the fence barriers to enjoy the cliff top views (in conjunction with improved signage to designated trails, vegetation barriers and more rigorous fence maintenance activities)	**1**	**2**	**3**	**4**	**5**
9.	Determine appropriate permanent site(s) where vegetation management and site maintenance will provide viewscapes for visitors (including non-ambulatory)	**1**	**2**	**3**	**4**	**5**

Additional comments or suggestions re "General Cliff Protection in the Cecil Green, MOA area"

J. North West Marine Drive at Wesbrook Crescent

		Strongly Support				Strongly Oppose
1.	Conduct hydrogeological survey of this area to determine the actual extent of groundwater and the underground location(s) where this water accumulates	**1**	**2**	**3**	**4**	**5**
2.	Take action to divert ground water currently seeping out of the cliff face using one of the following options:					
	OPTION 1 - Drill 1-3 wells to intercept ground water that is currently draining on the cliff face and drain this to a lower level that emerges below the cliff toe	**1**	**2**	**3**	**4**	**5**
	OPTION 2 - Drill an inclined bore hole from the beach level to the mid cliff clay strata to drain ground water before it reaches the cliff face	**1**	**2**	**3**	**4**	**5**
3.	Capture and divert storm water which accumulates in the bedding material of the sanitary sewer trenches into the storm water system on the far side of road to eliminate potential build up of water in trench (contribution to groundwater and possible overflowing over the cliff edge)	**1**	**2**	**3**	**4**	**5**
4.	Initiate a tree management program to protect from uprooting; perhaps use "stumps" as natural mechanical anchors for new cribbing system	**1**	**2**	**3**	**4**	**5**
5.	Where appropriate for slope stability, re-vegetate the slope	**1**	**2**	**3**	**4**	**5**
6.	Carry out berm and/or sill work on the beach to protect the toe of the cliff	**1**	**2**	**3**	**4**	**5**
7.	Address issue of shortcut trails with fencing and/or vegetation barriers such as blackberry	**1**	**2**	**3**	**4**	**5**
8.	*IF the above measures to protect this area are not feasible or sustainable*, relocate Marine Drive and the sanitary sewer lines from this area	**1**	**2**	**3**	**4**	**5**

Additional comments or suggestions re "North West Marine Drive at Wesbrook Crescent"

K. Booming Ground Creek, Botanical Garden Creek and Trail 7 Creek

		Strongly Support				Strongly Oppose
1.	Develop an overall drainage plan for the South Campus that places cliff and shoreline protection as a key planning criteria (*See A. Drainage earlier in this section*)	**1**	**2**	**3**	**4**	**5**

K. Booming Ground Creek, Botanical Garden Creek and Trail 7 Creek (continued)

	Strongly Support				Strongly Oppose
2. Study the amount and velocity of water in each creek at different times of the year to determine the relationship to ecology and erosion.	**1**	**2**	**3**	**4**	**5**
3. If ecologically sound and helpful to avoid erosion, divert water using **one** of the following options:					
OPTION 1 - Divert water from both Botanical Garden Creek and Trail 7 Creek through a drainage ditch to Booming Ground Creek	**1**	**2**	**3**	**4**	**5**
OPTION 2 - Divert water from Trail 7 Creek and Botanical Garden Creek to an alternative water course for high flow situations	**1**	**2**	**3**	**4**	**5**
OPTION 3 - Protect Trail 7 Creek and Botanical Garden Creek from Marine Drive to the Fraser River against excessive scouring or erosion	**1**	**2**	**3**	**4**	**5**
4. Based on the study results of water flows and the ability to manage the pipe end erosion, undertake **one** of the following possible actions:					
OPTION 1 - Re-establish (day-light) Booming Ground Creek where it flows under Marine Drive and adjust the profile to the natural grade, ensuring a minimal level of disturbance to the creek banks; undertake remediation work to repair damage and mitigation to prevent ongoing erosion (e.g. rip rap on sides of creek below pipe end) for the other creeks.	**1**	**2**	**3**	**4**	**5**
OPTION 2 - Construct an inclined drain for Booming Ground Creek to the beach from where the pipe emerges on the cliff side of Marine Drive; undertake remediation work to repair damage and mitigation to prevent ongoing erosion (e.g. rip rap on sides of creek below pipe end) for the other creeks.	**1**	**2**	**3**	**4**	**5**
OPTION 3 - Construct an inclined drain or restore a natural watercourse for Booming Ground Creek to the beach from where the pipe emerges on the cliff side of Marine Drive; deactivate the current pipe ends under Marine Drive for Botanical Garden Creek and Trail 7 Creek and divert water from these creeks to a new inclined drain at Booming Ground Creek; carry out any necessary work to repair damage that may lead to further cliff side erosion at the current pipe ends for Botanical Garden Creek and Trail 7 Creek	**1**	**2**	**3**	**4**	**5**
OPTION 4 - Do nothing and let the pipe end erosion continue	**1**	**2**	**3**	**4**	**5**
5. Construct a public washroom at the estuary to ensure water quality is not compromised (in consultation with the Wreck Beach Liaison Committee)	**1**	**2**	**3**	**4**	**5**
6. Test the quality of the drainage water at various locations in the catchment area (including where there are specific discharge locations of possible concern)					
a) Conduct tests during different seasons and weather conditions	**1**	**2**	**3**	**4**	**5**
b) Make the information on where drainage locations sites are located and where the tests for water quality are done available to interested members of the public	**1**	**2**	**3**	**4**	**5**
c) If necessary, take steps to identify and rectify the introduction of any deleterious substances	**1**	**2**	**3**	**4**	**5**

Additional comments or suggestions re "Booming Ground Creek, Botanical Garden Creek and Trail 7 Creek"

L. Point Grey

		Strongly Support				Strongly Oppose
1.	Extend the current beach works to continue to protect the cliff toe	**1**	**2**	**3**	**4**	**5**
2.	Review the impacts of the Trail 5 closure to determine:					
	a) What benefits have been realized as a result of this closure	**1**	**2**	**3**	**4**	**5**
	b) Any learnings that may be applicable to other parts of the cliffs	**1**	**2**	**3**	**4**	**5**
	c) If additional protection or mitigation work may be required along the closed off trail	**1**	**2**	**3**	**4**	**5**
	d) If other means of preventing continued trail use may be required	**1**	**2**	**3**	**4**	**5**
3.	Protect the cliff top from storm water run-off	**1**	**2**	**3**	**4**	**5**
4.	Repair trail side erosion damage (consider vegetation approaches)	**1**	**2**	**3**	**4**	**5**
5.	Review a "do-nothing" policy for the cliff face combined with ensuring toe protection to consider the possible benefits (e.g. protect the marine landmark aspect) and/or adverse effects of such an approach	**1**	**2**	**3**	**4**	**5**
6.	Adopt policies to ensure this site remains as natural as possible	**1**	**2**	**3**	**4**	**5**

Additional comments or suggestions re "Point Grey"

M. Overall Management Plan Considerations

		Strongly Support				Strongly Oppose
1.	Make specific linkages of the cliff erosion management plan to other relevant planning processes (including Musqueam planning processes, Pacific Spirit Regional Park Management Plan, UBC Comprehensive Community Plan, other UBC plans and planning processes, North Fraser Port Authority plans) to ensure that potential negative effects on cliff erosion are avoided and cliff protection efforts are supported. Areas to pursue for such linkages include:					
	a) Adoption of the Cliff Erosion Management Plan at a policy level by both UBC and GVRD Regional Parks to ensure support of the principles, considerations and management actions both for internal planning processes and in dealing with other agencies for any actions that will affect the cliffs	**1**	**2**	**3**	**4**	**5**
	b) Establishment of formal linkages (i.e. formal agreements to include cliff erosion considerations in their planning and management control processes) with other agencies whose activities have affected or in the future might affect the cliffs (e.g. North Fraser Port Authority)	**1**	**2**	**3**	**4**	**5**

M. Overall Management Plan Considerations (continued)

	Strongly Support				Strongly Oppose
2. Development of a cliff data base integrating the currently available and to be developed information; this could include:					
a) Photo mapping of sensitive sites to provide a way of measuring the effects of actions taken (GIS based)	**1**	**2**	**3**	**4**	**5**
b) Ecological inventory including the marine environment	**1**	**2**	**3**	**4**	**5**
c) Consideration for remote sensing of conditions for erosion prone areas	**1**	**2**	**3**	**4**	**5**
3. Establishment of an agreed upon setback line					
a) Identification of areas of the cliff where such a setback line are required	**1**	**2**	**3**	**4**	**5**
b) Establishment of the appropriate angle of repose (including consideration of toe protection to retain sloughed materials from the cliffs) plus a safety consideration for each of the identified areas	**1**	**2**	**3**	**4**	**5**

Additional comments or suggestions re "Overall Management Plan Considerations"

If you wish to receive a copy of the Consultation Feedback Report, please note your contact information below:

Name:	
Address:	
Postal Code:	
e-mail:	

You can submit this form:

By mail:

UBC/Pacific Spirit Regional Park Cliff Consultation
C/O UBC Campus Planning
2210 West Mall
Vancouver, B.C. V6T 1Z4

By fax:

UBC/Pacific Spirit Regional Park Cliff Consultation
822-6969

In addition other written comments can be sent by e-mail to:

rhpenner@sfu.ca

THANK YOU!