

# **Bridging the Greenway Gap in Boundary Bay: The Mud Bay Connection**

by  
ANDRÉ KOLBÉR  
B.A., Simon Fraser University, 1994

A THESIS SUBMITTED IN PARTIAL FULFILMENT OF  
THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF LANDSCAPE ARCHITECTURE  
in  
THE FACULTY OF GRADUATE STUDIES

Department of Agricultural Sciences  
Landscape Architecture Programme

*We accept this thesis as conforming to the required standard*

THE UNIVERSITY OF BRITISH COLUMBIA

April 2002

© André Kolbér, 2002

In presenting this thesis in partial fulfilment of the requirements for an advanced degree at the University of British Columbia, I agree that the Library shall make it freely available for reference and study. I further agree that permission for extensive copying of this thesis for scholarly purposes may be granted by the head of my department or by his or her representatives. It is understood that copying or publication of this thesis for financial gain shall not be allowed without my written permission.

Department of Landscape Architecture

The University of British Columbia  
Vancouver, Canada

Date April 26/02



## **Abstract**

The Mud Bay, British Columbia study site is located on eastern shores of Mud Bay, south of the Serpentine River, west of the King George & 99 highways, and north of the Nicomekl River in the Vancouver suburb of Surrey. The site consists of approximately 400 hectares of land. The site is bordered by a growing community on Panama Ridge to the north and Crescent Beach to the south who are exploring the study area. The site is also a rich biologically productive area that lies on the Pacific Flyway route for migratory birds.

With the increasing population and the rich ecological significance of the site, it seems natural to explore the possibilities for a greenway on the site. This is further proven when looking at a map. One notices that Mud Bay sits as a greenway gap in Boundary Bay. To the east is the Boundary Bay Park Network, and to the south is Crescent Beach. If Mud Bay were to become a greenway, then one could potentially follow the Boundary Bay shore and walk from Blaine to Point Roberts USA and would form part of a border to border trail. Currently, when one reaches Mud Bay, one must leave the shore and travel far inland to regain the waterside trail. A Mud Bay greenway would fill in the gap for a greenway corridor along Boundary Bay.

A Mud Bay greenway would also fill in the gap that the Serpentine Fen Nature Reserve has with Mud Bay. Currently, the Serpentine Fen Nature Reserve is separated from the Bay. With the creation of a Mud Bay greenway that is designed for the sensitive habitat, Serpentine Fen would be better connected with the bay and it would help maintain the site as important feeding and resting ground along the Pacific Flyway.

These are the issues and factors that were considered in the project. The project developed a greenway that is sensitive to wildlife while allowing for recreation to take place within it. The greenway design is structured so that it can be implemented over a period of time to form the final design.

# Table of Contents

<b>Abstract .....</b>	<b>ii</b>
<b>Table of Contents .....</b>	<b>iii</b>
<b>List of Tables .....</b>	<b>vi</b>
<b>List of Figures .....</b>	<b>vii</b>
<b>Acknowledgements.....</b>	<b>xi</b>
<b>Chapter 1 - Introduction.....</b>	<b>1</b>
1.1 Overview & Summary .....	1
1.2 Purpose of the Study.....	2
1.3 Surrey-Mud Bay Study Area .....	3
<b>Chapter 2 Background Information .....</b>	<b>5</b>
2.1 Reasons for a Greenway.....	5
2.2 Reasons Against A Greenway .....	8
<b>Chapter 3 Methodology .....</b>	<b>9</b>
3.1 Design Philosophy .....	9
3.2 Design Methodology .....	10
3.3 Planning Cycles .....	11
3.4 Application of Methodological Steps .....	12
3.5 Study Terms .....	12
<b>Chapter 4 Vision, Goals &amp; Objectives.....</b>	<b>21</b>
<b>Chapter 5 Inventory &amp; Site Analysis:.....</b>	<b>23</b>
5.1 Initial Site Contact .....	24
5.2 Stakeholder Comments & Knowledge .....	26
Government & Agencies .....	26
Land Owners.....	31
Stewardship Groups.....	32
5.3 Built Physical Inventory.....	34
General Access.....	34
Boundary Markers.....	36
Utilities.....	38
Existing Structures or buildings .....	38
Recreational Facilities .....	38
5.4 Natural Biophysical Inventory.....	40
Topography & Landform:.....	40
Mud Bay & Tidal River's Shore Morphology .....	42
Natural Hazards .....	43
Climate .....	43
Hydrology & Drainage: .....	44
Soil & Vegetation.....	45
Wildlife.....	45
Biologically Natural Assets Map .....	47

Habitat Zones .....	48
<b>5.5 Cultural Political Inventory .....</b>	<b>54</b>
Land Ownership .....	54
Jurisdictions .....	55
Zoning, Overlay distances .....	55
Easements, rights-of-way .....	55
Land Use (on and adjacent to the site) .....	57
Regional Significance .....	58
User Profiles .....	58
<b>5.6 Cultural Aesthetic Inventory .....</b>	<b>59</b>
Landscape Views .....	60
Landscape Character Units .....	61
Design Vocabulary Inventory .....	68
<b>5.7 Significant Historical Activity .....</b>	<b>74</b>
Pre-European Settlement (Before 1800's) .....	75
Early Settlement (1800s-1900s) .....	78
The Transportation Era 1900-70s .....	92
The Efficiency Era 1970 -2000: .....	100
<b>5.8 SITE ANALYSIS .....</b>	<b>105</b>
Site Analysis Results .....	105
<b>Chapter 6 Program Cycle .....</b>	<b>109</b>
<b>6.1 Development of Program Objectives .....</b>	<b>109</b>
<b>6.2 Preliminary Program Alternatives .....</b>	<b>111</b>
1. The Agriculture Alternative: .....	113
2. The Wildlife Alternative .....	117
3. Status Quo Alternative: .....	122
<b>6.3 Program Evaluation - Alternatives .....</b>	<b>126</b>
Evaluation of Greenway Program Alternatives .....	126
Methodology .....	126
Assumptions .....	126
Matrix Results .....	127
<b>Chapter 7 Design Cycle Stage .....</b>	<b>135</b>
<b>7.1 The Staging Area .....</b>	<b>136</b>
The Staging Area Location .....	136
Evaluation .....	137
Station Area Programming .....	138
Nature Interpretive Center Design Elements .....	138
<b>7.2 Wildlife Option .....</b>	<b>157</b>
Design Rationale .....	160
Design Assumptions .....	160
Design Implementation Stages .....	160
<b>Chapter 8 Summary &amp; Recommendations .....</b>	<b>211</b>
<b>8.1 Wildlife Alternative Positive and Negative Points: .....</b>	<b>211</b>
<b>8.2 Study Recommendations .....</b>	<b>213</b>
<b>Chapter 9 Bibliography .....</b>	<b>215</b>
<b>9.1 Personal Communication .....</b>	<b>215</b>
<b>9.2 Wildlife: Birds .....</b>	<b>216</b>

<b>9.3 Ecology .....</b>	<b>217</b>
<b>9.4 History .....</b>	<b>218</b>
<b>9.5 Maps .....</b>	<b>219</b>
<b>9.6 Trails, Experiences, &amp; Facilities.....</b>	<b>220</b>
<b>9.7 General.....</b>	<b>222</b>

## **List of Tables**

<i>Table 1 Farmland Habitat Zone .....</i>	<i>49</i>
<i>Table 2 River Habitat Zone .....</i>	<i>50</i>
<i>Table 3 Mud Bay Habitat Zone .....</i>	<i>51</i>
<i>Table 4 Property Ownership .....</i>	<i>54</i>
<i>Table 5 Alternative Program Rationale .....</i>	<i>112</i>
<i>Table 6 Program Matrix Summary .....</i>	<i>129</i>
<i>Table 7 In-Depth Matrix .....</i>	<i>130</i>

## List of Figures

Figure 1 Mud Bay Context .....	1
Figure 2 Study Area within the Georgia Basin .....	2
Figure 3 Location of the study area in the city of Surrey and the Lower Mainland .....	3
Figure 4 Immediate (solid line) & surrounding (dotted line) study areas .....	3
Figure 5 City of Surrey's proposed greenways .....	4
Figure 6 Design Philosophy .....	9
Figure 7 Design Cycles .....	10
Figure 8 Four Planning Steps .....	11
Figure 9 Greenway Hub, Links, and Sites .....	12
Figure 10 Vision, Goals, & Objectives .....	21
Figure 11 Inventory planning step .....	23
Figure 12 Inventory flowchart .....	23
Figure 13: Mud Bay study area .....	24
Figure 14 Mud Bay "No Entry" Signs .....	24
Figure 15 Serpentine Railway Bridge view to site .....	25
Figure 16 Crescent Beach Marina .....	25
Figure 17 Elgin Heritage Park .....	25
Figure 18 Mud Bay Stakeholder comment flowchart .....	26
Figure 19 Area Road Network .....	34
Figure 20 City of Surrey Existing Greenway Routes .....	37
Figure 21 Natural Biophysical Inventory .....	40
Figure 22 Topography & Landform Flowchart .....	40
Figure 23 Habitat Zones .....	41
Figure 24 Surrey Lowlands .....	41
Figure 25 Mud Bay Water Depths .....	43
Figure 26 Pacific Flyway Map .....	45
Figure 27 Typical Mud Bay Wildlife Signs .....	46
Figure 28 GVRD Biological Assets Map .....	47
Figure 29 Property Ownership .....	54
Figure 30 Various Right of Ways .....	56
Figure 31 Address Density Map .....	57
Figure 32 Typical Mud Bay Agricultural Field .....	57
Figure 33 Parks & BCALC Map .....	58
Figure 34 Cultural Aesthetic Inventory Flowchart .....	59
Figure 35 Landscape Views .....	60
Figure 36 Landscape Character Units .....	61
Figure 37 Revealing the 6 Landscape Character Units .....	61
Figure 38 Farm Belt Landscape Character .....	62
Figure 39 Farm Belt Character Unit .....	62
Figure 40 Residential Landscape Character .....	63
Figure 41 Residential Character Unit .....	63
Figure 42 Mud Bay Character Unit .....	64
Figure 43 Mud Bay Character Unit .....	64
Figure 44 Railway Character Unit .....	65
Figure 45 Railway Character Unit .....	65
Figure 46 Nicomekl River Dyke Character Unit .....	66
Figure 47 Nicomekl River Character Unit .....	66
Figure 48 Serpentine River Dyke Character Unit .....	67
Figure 49 Serpentine River Character River Unit .....	67
Figure 50 Design Vocabulary Inventory Rationale .....	68
Figure 51 Water Sculpted Landforms .....	69
Figure 52 Pilings .....	69
Figure 53 Mud Bay Mud .....	69
Figure 54 Earth & Gravel Berm .....	69
Figure 55 Steel .....	70

Figure 56 Grasslands .....	70
Figure 57 Bird symbols .....	70
Figure 58 Windmills .....	70
Figure 59 Veranda .....	70
Figure 60 Bams .....	71
Figure 61 Bridges .....	71
Figure 62 Harvesting Fields .....	71
Figure 63 Post & Beam Construction .....	71
Figure 64 Tin .....	71
Figure 65 Alee .....	72
Figure 66 Street trees .....	72
Figure 67 Formal Order .....	72
Figure 68 Grass & Garbage .....	72
Figure 69 Steel & Concrete .....	72
Figure 70 Steel & Wood .....	73
Figure 71 Mud Bay History Flowchart .....	74
Figure 72 Mud Bay Pre European Settlement .....	75
Figure 73 First Nation Territory Context .....	76
Figure 74 Mud Bay at the Early Settlement Period .....	78
Figure 75 Early Spanish Navigation Chart of Mud Bay Area .....	79
Figure 76 Early Homestead Map .....	80
Figure 77 Nicomekl Bridge .....	81
Figure 78 Boat on Nicomekl .....	82
Figure 79 Daniel Johnson .....	83
Figure 80 John Loney .....	84
Figure 81 William McBride .....	84
Figure 82 Ben & Amelia Stevenson .....	84
Figure 83 Mr. & Mrs Stewart .....	85
Figure 84: John Weaver .....	85
Figure 85 The Weaver House: Then (1890's) and Now (2000) .....	85
Figure 86 Dyking the Rivers .....	86
Figure 87 Early Serpentine Dam .....	87
Figure 88 Farming at the Loney Farm .....	87
Figure 89 Logs on Water's Edge .....	88
Figure 90 Picnic at Blackie Spit .....	89
Figure 91 Boundary Bay .....	90
Figure 92 Transportation routes added to Mud Bay during the Transportation Era .....	92
Figure 93 Railway Lines .....	92
Figure 94 Crescent Beach Hotel .....	93
Figure 95 John Loney farm at Mud Bay .....	95
Figure 96 Crab Boat on Nicomekl .....	96
Figure 97 Past Development Proposals .....	98
Figure 98 Mud Bay at the Efficiency Era .....	100
Figure 99 Proposed BNSF Railway Move .....	101
Figure 100 Flooding in Mud Bay District .....	102
Figure 101 Dairy Farming in Mud Bay .....	102
Figure 102 Rowing in the Nicomekl & Mud Bay .....	103
Figure 103 Waterside & Inland Walkway Options .....	107
Figure 104 Program Cycle Objectives .....	109
Figure 105 Program Alternative Summary .....	109
Figure 106 Initial Programming Alternative Options .....	111
Figure 107 Proposed Agriculture Alternative Phase 3 .....	113
Figure 108 Wildlife Alternatives .....	117
Figure 109 Proposed Status Quo Alternatives .....	122
Figure 110 Program Evaluation .....	126
Figure 111 Alternative Program Evaluation Flowchart .....	128
Figure 112 Design Cycle Stage .....	135
Figure 113 Existing and Proposed Staging Areas .....	136

Figure 114 Nature Center Flow Chart.....	138
Figure 115 Wallace Concept Plan .....	141
Figure 116 Master Plan with Vegetation .....	142
Figure 117 Cross Section A-A1 .....	143
Figure 118 Cross Section A1-A2 .....	144
Figure 119 Cross Section A2-A3 .....	145
Figure 120 Cross Section A3-A4 .....	146
Figure 121 Wallace Nature Discovery Building & Exhibits.....	147
Figure 122 Camping Cross Section.....	148
Figure 123 Guest Rooms.....	149
Figure 124 Fishing Shack and Public Wharf.....	150
Figure 125 Suggested Trees and Shrubs .....	151
Figure 126 Outdoor Space Arrangements.....	152
Figure 127 Nature Discovery Centre's Spaces .....	153
Figure 128 Nature Discovery Games: Marsh Bingo.....	154
Figure 129 Nature Discovery Games: Brackish Water Clues .....	155
Figure 130 Nature Discovery Games: Find the Brackish Water Patch .....	156
Figure 131 Wildlife Option.....	157
Figure 132 Mud Bay Greenway Map Stage 1 .....	163
Figure 133 Proposed Zoning Changes .....	164
Figure 134 Proposed Watershed map Boundary Banners .....	165
Figure 135 Nicomekl Road Trail Entrance.....	166
Figure 136 Nicomekl Road Special Entrance Gate.....	167
Figure 137 Rio Place Staging Area.....	168
Figure 138 Proposed Signage-GVRD.....	169
Figure 139 Rio Place Staging Area Improvements - Stairs.....	170
Figure 140 Rio Place Details .....	171
Figure 141 Wallace Nature Interpretive Centre.....	172
Figure 142 Points of Interest.....	173
Figure 143 Points of Interest 2.....	174
Figure 144 Proposed Nicomekl Bridge Location.....	175
Figure 145 Proposed Bridge Styles .....	176
Figure 146 Proposed 32nd Avenue Right of Way Picnic Area.....	177
Figure 147 Proposed 32nd Ave Right of Way Picnic Area 2.....	178
Figure 148 Proposed Viewing Towers .....	179
Figure 149 Mud Bay Inland Dyke Walkway .....	180
Figure 150 Proposed Serpentine Viewing Tower.....	181
Figure 151 Proposed Serpentine Bridge.....	182
Figure 152 Serpentine Trail Widths .....	183
Figure 153 Nicomekl Railway Crossing Improvements.....	184
Figure 154 Proposed Serpentine Pedestrian Railway Crossing .....	185
Figure 155 Proposed Railway Sign Improvements.....	186
Figure 156 Serpentine Greenway Park Facilities.....	187
Figure 157 136th Street Right of Way Trail.....	188
Figure 158 Proposed Hwy 99 Visual Barriers .....	189
Figure 159 Proposed Hwy 99 Right of Way.....	190
Figure 160 Proposed Beckett Road Pocket Park.....	191
Figure 161 Proposed Stage 2.....	192
Figure 162 Proposed Nicomekl Railway Bridge Improvements .....	193
Figure 163 Proposed Serpentine Railway Bridge Improvements 2.....	194
Figure 164 Proposed Rail Right of Way.....	195
Figure 165 Acquire BNSF Lands for Greenway.....	196
Figure 166 Acquire BCALC Lands for Wetlands and Conservation.....	197
Figure 167 Old Streams Uncovered .....	198
Figure 168 Building Dykes on BCALC Lands .....	199
Figure 169 Proposed Wetlands .....	200
Figure 170 Proposed 44th Ave Dykes .....	201
Figure 171 Proposed Weaver Historical Bed & Breakfast .....	202



Figure 172 Proposed 16th Street Marsh.....	203
Figure 173 Mud Bay Greenway Stage 3.....	204
Figure 174 Proposed Hwy 99 Pedestrian Crossing .....	205
Figure 175 Serpentine Fen Site Improvements .....	206
Figure 176 Land Acquisitions.....	207
Figure 177 Proposed 140th Street Dyke.....	208
Figure 178 Viewing Tower .....	209
Figure 179 Proposed Site Elements .....	210
Figure 180 Design Evaluation.....	211

## **Acknowledgements**

Many thanks to my advisors, Stephen Sheppard, Will Marsh, and Don Luymes of the UBC Landscape Architect Program at the University of British Columbia and Peter Kreuk of Durante Kreuk Landscape Architects for their insights in making this project possible. I am also very grateful to all those stakeholders who gave up their time in helping develop this project with their insights and knowledge. A special thanks should go to Jean Lamontagne, and Brad Fischer at the City of Surrey who resources were necessary in getting this project started. Finally, many thanks to my wife, Trish, and my two daughters, Kathryn and Jaclyn whose patience and support allowed me to pursue this project. I could not have completed this project without all of you.

## Chapter 1 - Introduction

### 1.1 Overview & Summary

This study documents the planning process for a greenway framework and the creation of design prototypes for the Surrey Mud Bay area (Figure 1 Mud Bay Context).

The study area is centered on the eastern shores of Mud Bay, south of the Serpentine River, west of the King George & 99 highways, and north of the Nicomekl River. The site consists of approximately 400 hectares of land.

The project was carried out by a graduate landscape architect student under the guidance of the graduate advisors for a graduate landscape design studio in the UBC School of Landscape Architecture. The Studio provides an opportunity for the student to learn from active participation in a real community project. The student undertook the following tasks:

- Existing data acquisition and review
- Site reconnaissance and new data collection
- Analysis of current planning objectives and policies
- Analysis of opportunities and constraints
- Preliminary design of greenway prototypes
- Visualization of options including development of design standards and concepts
- Limited community consultation and feedback
- Final presentation of the greenway prototypes for key areas to UBC Landscape Architecture review

The studio products include

- A systematic process of optimizing multiple resources and community values using GIS
- Documentation and incorporation of stakeholder issues into a discussion of greenways, community values, and subsequent design prototypes

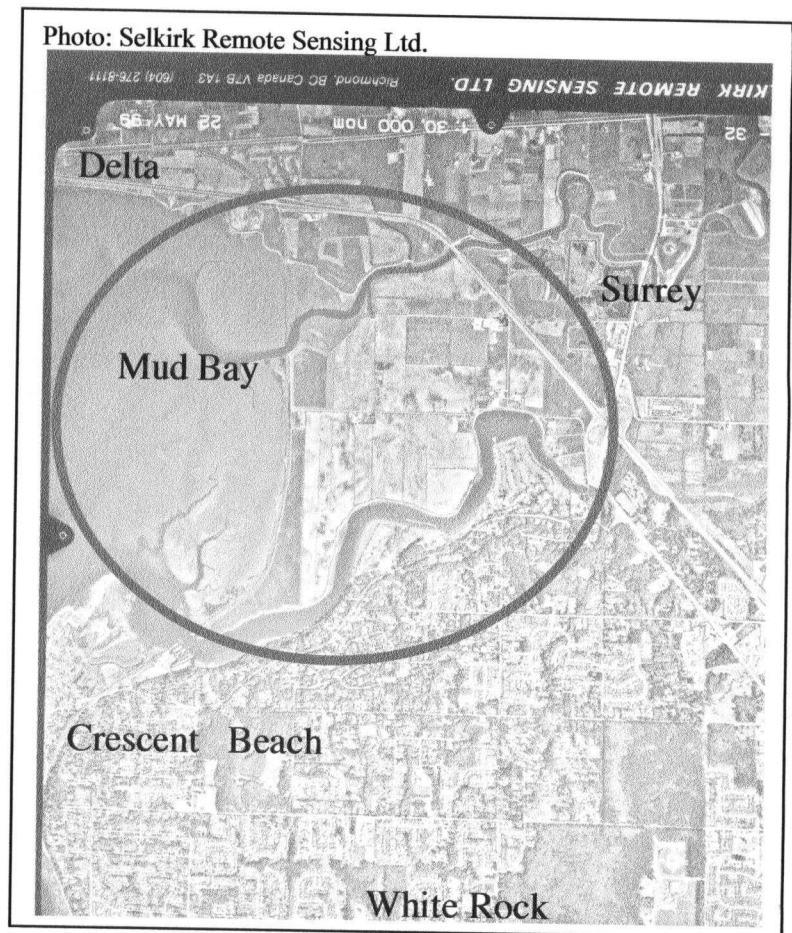


Figure 1 Mud Bay Context

- The initial development of three greenway concepts favoring (1) Agriculture (2) Wildlife and (3) a 'Do Nothing' or 'Status Quo' approach
- One design, Wildlife, out of the three options, was chosen as the basis for further development of design prototypes for the greenway. (The design option was chosen based on having the most favorable result in the evaluation process according to the goals and objectives set out in this thesis)
- Specific recommendations on greenway designs of representative areas and critical zones.

## 1.2 Purpose of the Study

With the increasing number of people now living outside the study area's boundary in Panorama Ridge and Crescent Beach, there is increasing demand put on the area's shoreline for recreational needs. Currently, the area is not designed for public recreation. However, there are an increasing number of people who are going or "sneaking" into the area and using it as an informal park. These people are mostly cycling, dog walking, jogging, walking, and bird watching.

Mud Bay within the larger Boundary Bay is one of the most biologically productive zones in British Columbia and Western Canada. The study area is well known as a critical resting area for vast numbers of migrating birds.<sup>1</sup> In the last few decades, the study area as well as the surrounding Boundary Bay area has lost significant plots of highly productive salt marsh due to large dyking programs. In addition, pollution problems in Mud Bay have eliminated a once successful oyster industry.

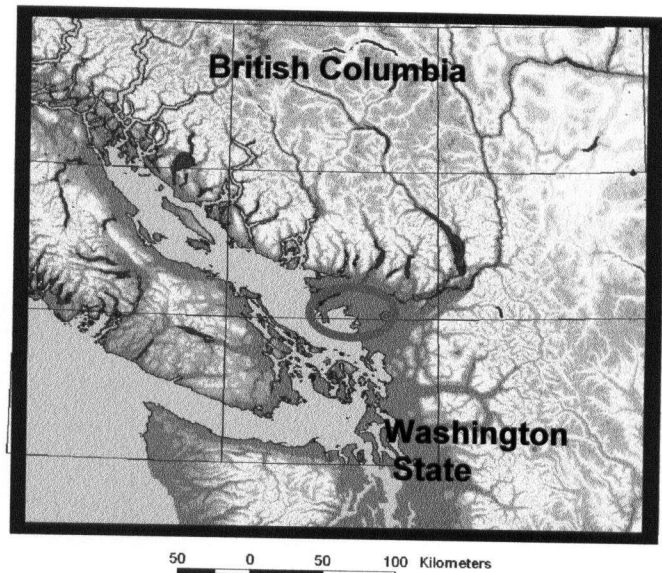


Figure 2 Study Area within the Georgia Basin

Therefore, this study will develop a greenway that incorporates recreation and wildlife into its design. However, if the site were to be developed as a recreational greenway, then there is a problem. It is somewhat isolated from its surrounding areas by the two rivers (Nicomekl and Serpentine Rivers) and the Highway 99. Consequently, to be successful it would have to develop transportation connections with the surrounding area.

Thus the purpose of this study is to prepare a greenway framework which makes key connections across Mud Bay and develop design prototypes in the Surrey Mud Bay area.

<sup>1</sup> Barnard, Tony. – Wildlife Biologist Land Management. British Columbia Ministry of Environment, Lands and Parks, BC Environment Lower Mainland Region. January 14<sup>th</sup>, 2002. (604) 582-5223.

### 1.3 Surrey-Mud Bay Study Area

- The study area is located in the Georgia Basin of British Columbia (Figure 2). It is located in the City of Surrey, a community south of Vancouver, B.C. (Figure 3).
- The site is located within the Nicomekl & Serpentine watershed.
- For the purposes of this study, two levels of study were concentrated in the following areas:

- **Surrounding Study Area:** A general study area (in the dotted oval in **Figure 4**) comprised of the southern half of Surrey and the Boundary Bay area in Delta was chosen in order to investigate the site factors that have a direct influence on the site study area.
- **Immediate Study Area:** The immediate project study area (as outlined with a solid line in **Figure 4**), consists of approximately of 400 hectares of land. It has the Nicomekl River on the south, Serpentine River on the north, 99 Highway to the east, and Mud Bay on the west.

Lands within the project study area are owned by the City of Surrey, the Crown, and, by private citizens.

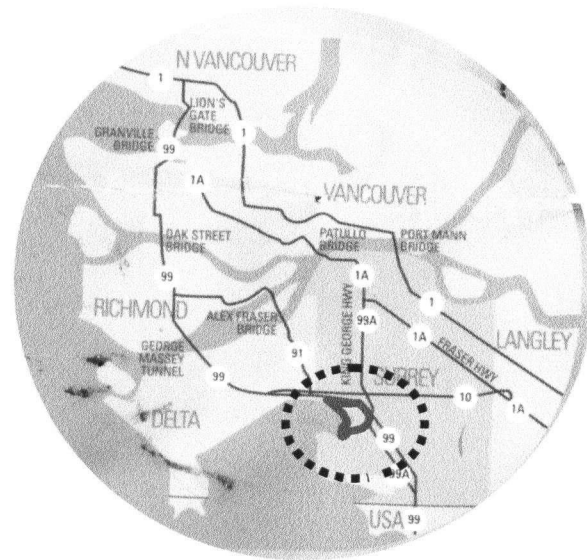


Figure 3 Location of the study area in the city of Surrey and the Lower Mainland.

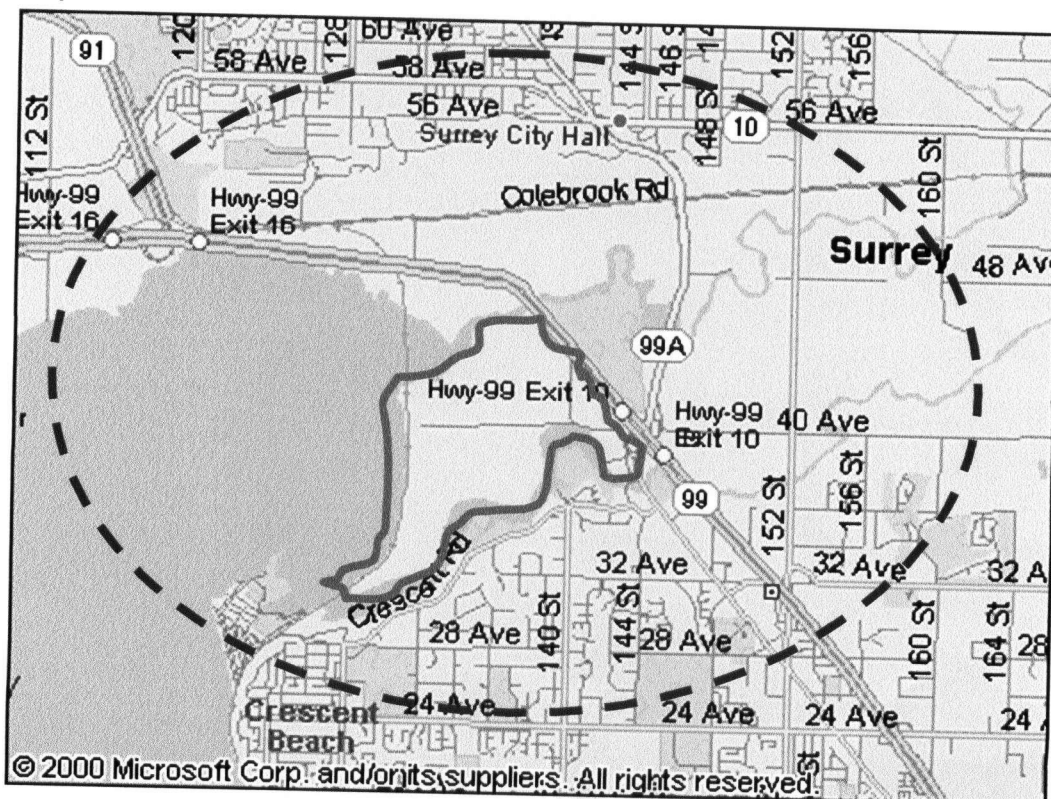
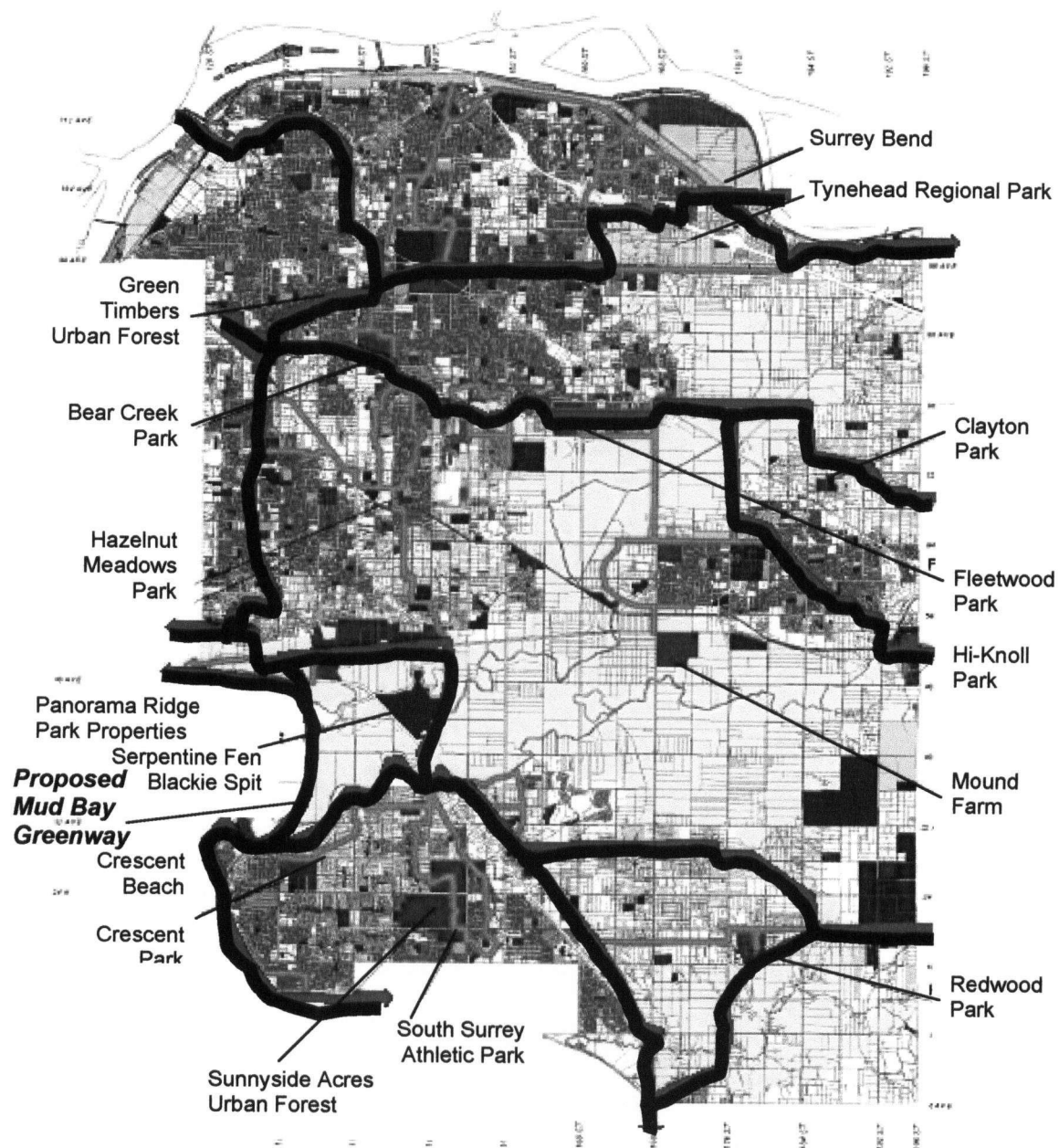


Figure 4 Immediate (solid line) & surrounding (dotted line) study areas





## Regional greenways (draft)



**Surrey Parks  
Recreation  
and Culture**

Figure 5 City of Surrey's Proposed Greenways

## Chapter 2 Background Information

### 2.1 Reasons for a Greenway

#### A Need for a Public Linear Park in Surrey

A 2001 report entitled Future Directions for the Provision of Parks, Recreation, Arts, Heritage, and Cultural Facilities and Services outlined Surrey's need for more trails for walking and cycling. A public survey was conducted in which it was found that of "those respondents who saw a need for additional outdoor facilities, 57% favored more trails for walking and cycling – making trails the most requested outdoor facility".<sup>2</sup>

The concept of a potential linear open space system that connects major parks and open spaces was incorporated into Surrey's 1985 Official Community Plan (OCP). The OCP's "objective is to utilize ravines, creeks, utility rights of way, and areas that can not be easily developed to link parks and open spaces".<sup>3</sup> In addition, Surrey's Engineering Department's 1993 Bicycle Blueprint, further "emphasizes the demand for an improved city-wide trail and pathway network".

#### The Desire for a Public Mud Bay Link

The site, Mud Bay, was chosen because of the need to link Crescent Beach and Surrey's new Mud Bay Park at 131A Street. (The park is yet to be named. For the purposes of this paper it will be referred to as the Serpentine Park). Four parties identify this link.

- The City of Surrey recognizes Mud Bay's link from Crescent Beach to their new park, as an asset for the entire city.<sup>4</sup> This is validated by having the Mud Bay Greenway marked on Surrey's Regional greenway draft (Figure 5)
- The Greater Vancouver Regional District in The Greater Vancouver Regional Greenway Vision is looking "for a feasible route around Mud Bay, to link Boundary Bay Regional Park and Blackie Spit Park" in Crescent Beach.<sup>5</sup>
- Coast Millennium Trails Group located in Washington State have stated that their preferred trail system linking Blaine with Point Roberts is to have a trail that follows the coastline as much as possible. They have mentioned that the trail exists except in two locations: one is the Ocean Park; the other is the Mud Bay section in Surrey. They envision the Mud Bay trail as a positive addition to their Coast Millennium Trail network.<sup>6</sup>
- City of Delta's Engineering Department would consider the Mud Bay Greenway as an asset to their Boundary Bay Regional Park.
- The general public has already gravitated to the edge of Mud Bay. The public can be seen walking the dike on the Surrey side on any given day. Several rather daring types are even crossing the BNSF Serpentine and Nicomekl railway bridges or are crossing the 99 Highway into the Mud Bay study area. The public, through use is informally stating that there is a need to develop the area for recreation.

---

<sup>2</sup> City of Surrey. Future 84

<sup>3</sup> City of Surrey. Future 84

<sup>4</sup> Personal Communication City of Surrey Engineering Department & Parks, Recreation and Culture Department (January 2002).

<sup>5</sup> GVRD. Greenway.

<sup>6</sup> Ellen Barton. Coast Millennium Trail Group. Personal Communication (January 14<sup>th</sup>, 2002).

- With the increasing number of people that are now living outside the study area's boundary in Panorama Ridge, and Crescent Beach, there becomes the increasing demand put on the area's shoreline for recreational needs. Currently the study area is not designed for public recreation. However, there are an increasing number of people who are going into the area and using it for recreational purposes ranging from horseback riding, cycling, motorbike riding, dog walking, jogging, walking, and bird watching. One needs to set limits and boundaries so that all people can enjoy the greenway together.

### **The Desire for a Wildlife Greenway**

Naturalists and environmental biologists have stated that they desire an ecological greenway where there is limited public access to certain sensitive habitat areas and where the certain parts of the land can be restored to a pre-dike state of salt and fresh water marshes. They state that the main reason for their opposition to an open public access greenway or link from Crescent Beach to Serpentine Park without some restricted access is the impact that it will have on the wildlife in the area. Mud Bay within the larger Boundary Bay is one of the most biologically productive zones in British Columbia and Western Canada. The study area is well known as a critical resting area for vast numbers of migrating birds.<sup>7</sup>

Tony Barnard, a Wildlife Biologist in Land Management with the British Columbia Ministry of Environment, Lands and Parks, BC Environment Lower Mainland Region stated that a design for the area should be sensitive to the needs of the wildlife. This includes improving the area for migrating birds by having limited public access and restoring sections of the land to its pre-settlement state.

### **Other Beneficial Reasons For A Greenway**

Greenways provide many practical benefits for the surrounding communities and for the natural ecosystems that they belong to. Some of the benefits are

- **Maintaining Greenspace within the Urban Fabric:** To encourage compact communities and allow greater urban densities while maintaining the quality of natural systems.
- **Improving Urban Habitat:** Greenways are part of the urban habitat; they provide wildlife corridors and connections between remote habitat areas.
- **Helping to Build Complete Communities:** Greenways maintain the visual and physical connection to natural open space within urban areas.<sup>8</sup>
- **Encouraging a Diversity of Species to Coexist:** By including a wide range of habitat types, greenways can encourage a diversity of species to coexist. This diversity of habitats and species provides balance among all species and elements of an ecosystem and it is crucial to the food web.<sup>9</sup>
- **Re-establishing Park Links:** Greenways seek to re-establish the links between parks and larger natural areas to create a network of green space.
- **Creating Meaningful Connections:** Greenways can help in providing a meaningful connection to nature for the people within the community. Greenways allow people to more directly enjoy the benefits of access to natural areas including enjoyment of

<sup>7</sup> Barnard.

<sup>8</sup> GVRD. Greenway. 1.

<sup>9</sup> Province of British Columbia. 10.



passive activities such as bird watching, nature interpretation and aesthetic appreciation<sup>10</sup>.

- **Increasing Property Values:** Property values near greenways increase.<sup>11</sup> More valuable properties mean increased tax revenue, which can be used to offset open space acquisition costs.
- **Improving Air Quality:** According to a study conducted by David Nowak, in 1991, "Trails and greenways improve air quality by protecting the plants that naturally create oxygen and filter out air pollutants such as ozone, sulfur dioxide, carbon monoxide and airborne particles of heavy metals... natural tree-related air filtration provided Chicago, Illinois with \$1 million in annual air pollution removal".<sup>12</sup>
- **Promoting Eco-Tourism:** By protecting critical habitat, trails and greenways also support communities through eco-tourism. Some towns thrive on eco-tourism, such as Damascus, Virginia. Once an industrial-based town, Damascus now caters to users of the Appalachian Trail, Virginia Creeper Trail, the Jefferson and Cherokee National Forest, and many other natural recreational areas.
  - The Slickrock Mountain Bike Trail in Utah generates \$1.3 million in annual receipts for the city of Moab.<sup>13</sup>
  - In a 1992 study, the National Park Service estimated the average economic activity associated with three multi-purpose trails in Florida, California and Iowa was \$1.5 million annually.<sup>14</sup>
  - River recreation such as rafting and kayaking contribute \$50 million annually to Colorado's economy.<sup>15</sup>

In 1991, 108.7 million people in the U.S. spent \$59 million on wildlife-related recreation in the U.S., according to the U.S. Fish and Wildlife Service.<sup>16</sup>

- **Providing an Alternate Transportation Use:** Trails and greenways link neighborhoods with shopping and entertainment districts and provide pleasant transportation alternatives for commuting to work and school. Municipalities include trails and greenways into city plans not only for recreational purposes, but also to encourage the use of alternative modes of transportation.

A 1991 Harris Poll found that 46% of those surveyed said that they would bike to work if designated trails were built.<sup>17</sup>

Seattle, Washington's Burke-Gilman Trail is a popular route for commuting. A 1990 trail survey found that 37% of the cyclists and 7% of the pedestrians used the trail for commuting.<sup>18</sup>

A 1997 trail use study of the Iron Horse Regional Trail in California found that approximately one-third of those surveyed use the trail for transportation purposes,

---

<sup>10</sup> GVRD. Greenway. 5.

<sup>11</sup> Province of British Columbia. 18.

<sup>12</sup> David J Nowak, "Air Pollution Removal by Chicago's Urban Forest," Chicago's Urban Forest Ecosystem: Results of the Chicago Urban Forest Climate Project, (U.S. Forest Service, 1994).

<sup>13</sup> Steve Lerner and William Poole, The Economic Benefits of Parks and Open Space, The Trust for Public Land, (1999, 26.)

<sup>14</sup> National Park Service. The Impacts of Rail-Trails, A Study of Users and Nearby Property Owners from Three Trails, (Rivers, Trails and Conservation Assistance Program, 1992).

<sup>15</sup> National Park Service. Economic Impacts of Protecting Rivers, Trails, and Greenway Corridors, (Rivers, Trails and Conservation Assistance Program, 4th ed., 1995) 2-8.

<sup>16</sup> National Park Service. Economic Impacts 2-6.

<sup>17</sup> Martin Gутtenplan and Robert Patten, "Off-Road but On Track," TR News, (May-June 1995) 178.

<sup>18</sup> Martin Gутtenplan and Robert Patten.

including commuting to work or school, or using the trail as an alternative route to access shopping areas and restaurants.<sup>19</sup>

## **2.2 Reasons Against A Greenway**

### **The desire for things to remain the same**

Some area residents do not want a greenway in the area. They would prefer if their current quiet rural lifestyle would remain. They enjoy living in an area without much automobile traffic, where most people in the area know one another, and where strangers are spotted fairly quickly. They are concerned that if the area's popularity, through a greenway, would increase public visitors then, their quiet rural lifestyle would be destroyed. Presently, the residents protect their grounds by discouraging public access into the Mud Bay Area by posting intimidating signs with messages such as 'no trespassing', 'tow away zone', 'no parking', 'no stopping', and 'private property' in many locations.

### **Increased public traffic from the greenway would be disruptive to farming production**

Farmers working in the area have stated that if a greenway were to go through, they think that it would have a negative affect on their day-to-day farming operations. They speculate that the impact of increased public traffic would hinder their daily farming operations. This negative impact includes: animals becoming sick from eating the litter that people have thrown in the farm fields; loss of productive time from farmers not being able to drive their farm tractors into the fields due to greenway visitors' parked cars not leaving adequate room for farm equipment to maneuver into the fields; increased damage to field crops from farmers not being able to spray their fields on a timely basis due to greenway visitors complaining of spray drift; damage to livestock and a possible decline in livestock production due to greenway visitors' dogs frightening the livestock; damage done to farm equipment from malicious greenway visitors; Finally, damage to field crops from people trespassing onto the fields.

### **The increased public traffic would be disruptive to sensitive wildlife**

If the greenway design is not sensitive to wildlife habitat, then the greenway should not be built. For example, if visitors were allowed to access all areas of the greenway then the increased visitor traffic flow would be disruptive to sensitive wildlife habitat. If the greenway does not have restricted access areas for sensitive wildlife habitat, then the current farm fields, with its present restricted public access policy is seen as a better alternative. Thus, the current farm fields should remain and no greenway should be built.

---

<sup>19</sup> Iron Horse Regional Trail, Trail Use Study, (East Bay Regional Park District, 1997). 11-12.

## Chapter 3 Methodology

### 3.1 Design Philosophy

The planning and design of the Mud Bay Greenway is based on two planning principles.

The first planning principle is the importance of the site. One needs to incorporate its natural features, recreation potential, and landscape character within the cultural patterns and developmental suitability in the planning process as follows:

**Environment:** Mud Bay's uniqueness and intertidal zone should be preserved as well as enhanced. It should be emphasized that the site is a biologically productive salt-water marsh and that preservation of such environments is important in an increasingly urbanized region.

- **Recreation:** The recreation in the area should be organized in such a manner as to be balanced with the area's environmental activities and processes. It should be noted that people will venture into the site therefore the plan should acknowledge this and design for it.

- **Landscape character:** The design should allow the public to be able to continue to experience the area's general landscape character. The areas with distinct landscape characteristics should be protected to promote the site's identity.

- **Connectivity:** The design should have strong physical and visual linkages with the surrounding area.
- **Room for change and growth:** One needs to produce a site development plan which may be implemented and modified over time. The greenway planning should be implemented gradually and in sections to accommodate land acquisitions of important identified properties. Also, the greenway plan should allow for modification over time to reflect the changes in the region's recreation needs.

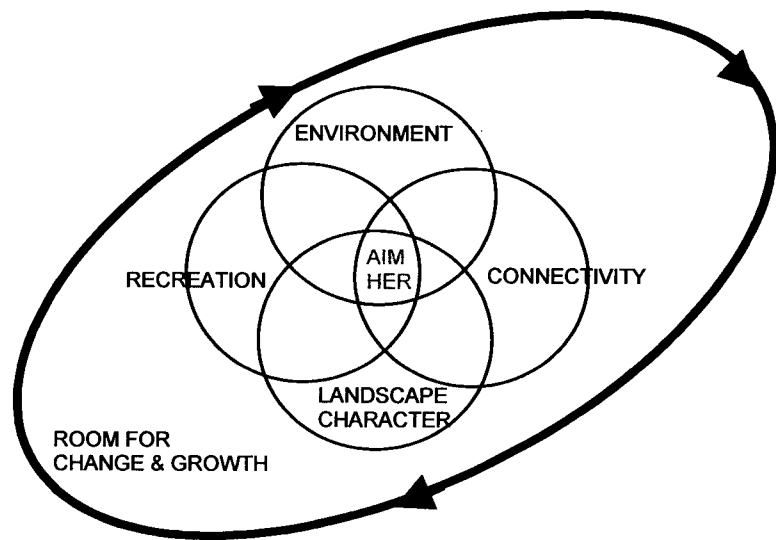


Figure 6 Design Philosophy

The second planning principal is the need to combine all of these planning and design principals into the greenway design. The design will strive to find an equilibrium within these design and planning principals. This philosophy is conceptualized in Figure 6.

### 3.2 Design Methodology

To apply the 'design analysis' approach, where the formulation of alternate plans or design schemes are done at the beginning of the thesis. The positivist approach is structured after the methodology of Karl Popper, who suggests beginning with a specific, testable hypothesis to a particular problem.<sup>20</sup> According to William Marsh in 'The Analysis Dilemma', the hypothesis' 'objective should be to refute rather than to confirm, and statements that do not sustain testing should be discarded'.<sup>21</sup> Marsh further adds that necessary background facts and information needed to formulate the alternatives be specified by the designer. Thus, the design analysis approach calls for the background information, as it is needed in the course of building the alternatives. After the alternatives are prepared, the next step is to review them critically. Alternatives that do not hold up to testing are discarded. Those alternatives that pass the initial tests will be submitted to more rigorous testing. Marsh finally emphasizes, that if all the alternatives fail they all will be discarded.

This methodology is accomplished in three circular planning cycles: Vision, Program, and Design (Figure 7)<sup>22</sup>. Each planning cycle will go through four basic planning steps: Inventory, Objectives, Alternatives, and Evaluation. Within each cycle, the details will go from general to specific. As the cycle spirals closer to achieving its goal the level of detail increases.

Each cycle may have more detail added to it as new information is found in each subsequent planning cycle.

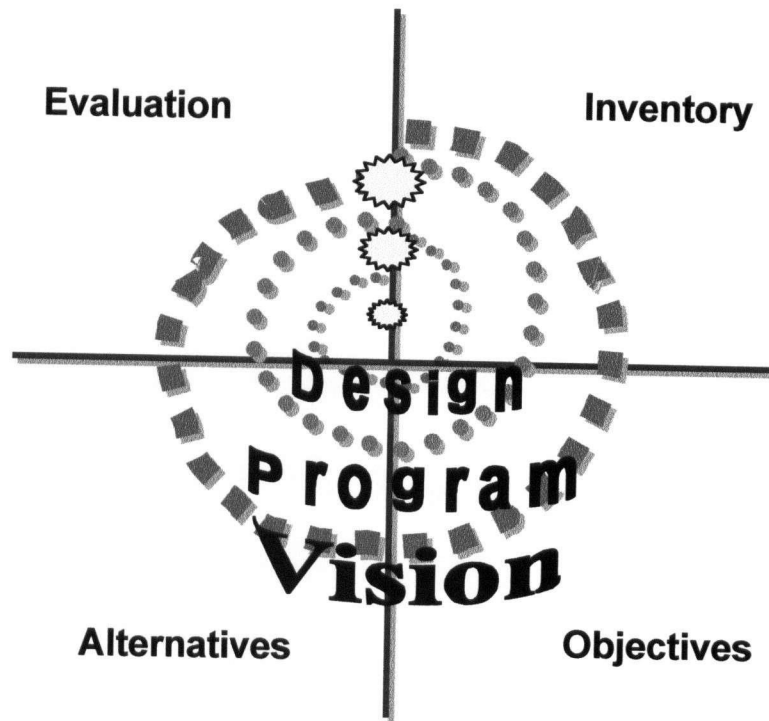


Figure 7 Design Cycles

Finally, as each cycle is run through the four basic planning steps, the basic premise is to refute each alternative rather than to confirm, and alternatives that do not sustain testing will be discarded. Thus the remaining alternative will continue onto the next planning cycles until finally the goal is achieved. However, if all the alternatives fail then they will be all discarded.

<sup>20</sup> Karl R. Popper Conjectures and Refutations: The Growth of a Scientific Knowledge. (New York: Harper & Row, 1965).

<sup>21</sup> William Marsh. "The Analysis Dilemma," Landscape Architecture. (Sept. 14, 2001). 124.

<sup>22</sup> Province of British Columbia. 22.

### 3.3 Planning Cycles

#### Cycle One: Vision

The objective of this cycle is to create a specific goal and objective from the vision statement. At the beginning of the project, a vision is developed and refined into a more specific goal. To achieve this process, the vision is based on a cursory run through the four planning steps: Inventory, Objectives, Alternatives, and Evaluation. The background information is collected, as it is needed in the course of the cycle.

#### Cycle Two: Program

The objective of this cycle is to take the specific greenway goal and to develop it into a more refined program. The refined program sets out how the greenway goal will be accomplished. The program will be completed using the four planning steps, this time concentrating on the preliminary program. Initially, three programs will be developed: two programs from either end of the public spectrum and one 'do nothing' or 'status quo approach'. One program, out of the three alternatives, will be chosen to develop a program in greater detail. The program will be chosen by achieving the most favorable result in the evaluation process according to the goals and objectives set out in the vision cycle.

#### Cycle Three: Design

The objective of this cycle is to take the specific site program and to develop it into a design prototype for the greenway. The site program identifies individual projects to be undertaken. These individual projects will be transformed into a design prototype. The design prototypes will give two-dimensional form to hardscape and planting elements. It will suggest structural types, materials, textures etc. This cycle will be completed using the four planning steps, this time concentrating on the preliminary design prototypes.

### Four Planning Steps

**Inventory:** This step (Figure 8) identifies issues & conditions. It is based on a combination of initial site contact information, stakeholder knowledge, and site inventory. The results are combined into a site analysis that identifies the constraints and opportunities based on inventory.

- **Initial site visit:** A record of the initial impressions of the project study area in an experiential site survey.
- **Stakeholder Knowledge:** A record of

stakeholder views, their thoughts, and their insights regarding the project study area. A stakeholder, for this paper, is defined as someone or some agency who has a vested interest in the site.

- **Site Inventory:** Inventory consists of biophysical (natural and constructed components) and cultural (aesthetic, political, and historical) inventory. Inventory is gathered from onsite observations, personal interviews, and historical data found in various printed materials.

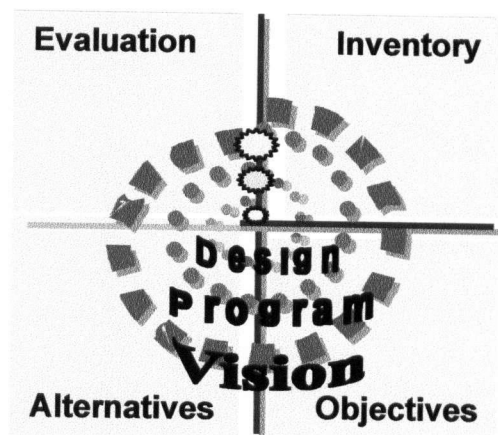


Figure 8 Four Planning Steps

- **Site Analysis:** Identify the constraints and opportunities that exist because of the biophysical inventory, cultural inventory, and stakeholder knowledge.

**Objectives:** Creates written meaningful and attainable objectives based on the greenway's goals. It states what the greenway wants to accomplish. It is refined at each cycle in the planning process.

**Alternatives:** Alternatives are created based on inventory, objectives and the individual planning cycle. Each alternative is developed to the point where it can be objectively evaluated in the next step against the other alternatives. The next planning step is to review them critically in the Evaluation phase.

**Evaluation:** The purpose of this step is to make a decision based on an evaluation of the alternatives in the previous planning step. Choices will be made on which actions and priorities to take. Decision matrixes, discussion with peers, and pin up evaluations with colleagues should be used to review the alternatives. Alternatives that do not hold up to testing are discarded. Those alternatives that pass the initial tests should be submitted to more rigorous testing as the phases continue.

### 3.4 Application of Methodological Steps

This methodology was followed in order to systematically study the greenway from January to April 2002. Each section within the thesis describes how the methodology was followed and applied.

### 3.5 Study Terms

The definitions of terms is meant to show how each is used in the context of this thesis.

#### Greenway

The definition of a greenway for this study is a linear open space that provides connectivity, protects ecological functions, and creates recreational opportunities.<sup>23</sup>

- **Linear Open Space:** Linear Open Space is defined as corridors or open space that has a linear form (Smith and Hellmund, 1993). These corridors can follow the natural land or water features.

- **Linear Form:** Linear forms are systems of open spaces that can protect habitat and ecologically sensitive areas, provide recreation opportunities, and buffer

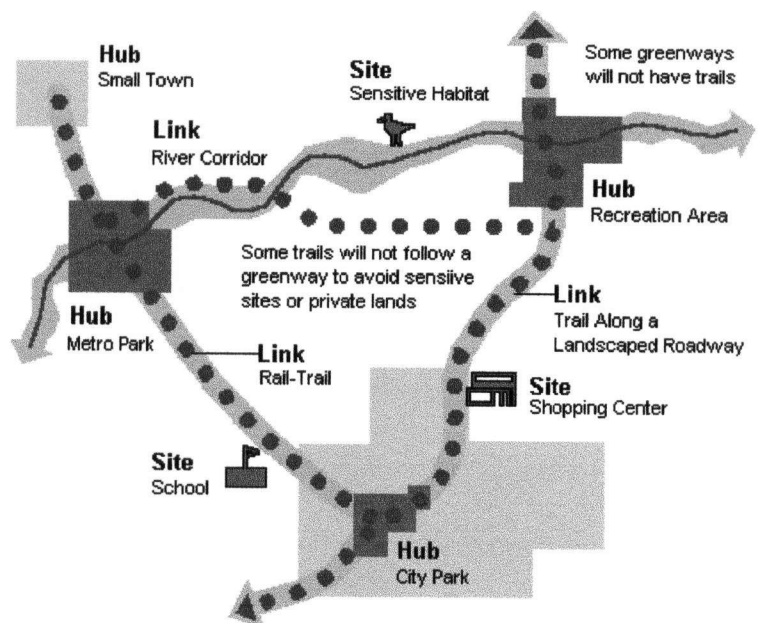


Figure 9 Greenway Hub, Links, and Sites

<sup>23</sup> GVRD. The Burrard Peninsula/Richmond Sector Recreational Greenway Plan. (June 2000).

adjacent uses. The composition of the linear open space is relative to the role it plays and the uses derived from that role.

- **Linear Form Composition:** The greenway linear form will be distilled into three basic parts: links, hubs, and sites (Figure 9)<sup>24</sup>.
  - **Links:** Links are the heart of the greenway system. They are the linear connections for people and wildlife that connect green spaces and parks or linking other greenways. The section of the proposed greenway trail that follows the Burlington Northern Santa Fe Railway line would be considered a link.

- ▲ **Key Elements**

- △ **Staging Area & Access Points:** Local user facilities with limited parking (Secondary Staging Area), litter containers, benches, and information kiosks.
- △ **Water Crossings:** Bridges and water connections such as a boat crossing which would reduce barriers and improve access to other greenway sections especially across the Serpentine and Nicomekl Rivers.
- △ **Hubs:** Hubs are the anchors of the system. They provide a base of destination for people and wildlife. i.e. Crescent Beach and Mud Bay Regional Park are the Hubs.

- △ **Key Elements**

- △ **Major Parks and Open Spaces:** Green zone sites anchoring the greenway including municipal parks, regional parks, and provincial parks. They provide destination recreation opportunities and park facilities (parking, washrooms etc.)
- △ **Staging Area & Access Points:** Local user facilities with major parking (Primary Staging Area), litter containers, washrooms, drinking water, telephone, picnic areas, trails and information kiosks.
- △ **Water Crossings:** Bridges and water connections such as a boat crossing that would reduce barriers and improve access to other greenway sections especially across the Serpentine and Nicomekl Rivers.
- ▲ **Sites:** Sites are smaller features than hubs that serve as points of interest, origins, or destinations. A proposed picnic area in the greenway would be a considered a site.

- ▲ **Key Elements**

- △ **Smaller Parks and Open Spaces:** These include local parks, local areas of interest.
- △ **Staging Area & Access Points:** May or may not have user facilities. Depends on the individual site.
- **Open Space:** The open space can include both public and private land holdings in its plans. The open space will include trails in some areas and no public access in other areas.

---

<sup>24</sup> Ohio State Greenways. Greenway Defined. <http://www.ohiogreenways.org/greenways.htm>. (Feb 20, 2002).



- **Public And Private Land Holdings:** Public land holdings are held by the Crown. Regional, and Municipal governments such as British Columbia Assets and Lands Corporation, Greater Vancouver Regional District (GVRD), City of Surrey etc. Private individuals hold private land holdings. In the long term, these lands may be incorporated into the Greenway through acquisition.

**Land Acquisition Alternatives:** The Stewardship on Community Greenways: Linking Communities to Country, and People to Nature lists several opportunities to incorporate land into a greenway<sup>25</sup> Private Stewardship: Private land holdings where the owner agrees to allow a portion of their property without an easement for a greenway.

- ▲ Land Purchases: Land acquired for public uses such as parks, open spaces, and owned by the government. Acquired through direct purchase.
- ▲ Gifts & Donations: Land acquired by the government from private landowners usually at a tax benefit to the private landowner.
- ▲ Land Exchange: Land exchanged by a private individual for a greenway with the government for another equally valuable land parcel.
- ▲ Conservation Covenants: Land that is registered against a land title and held by governments. This allows a portion of public land holdings to be used for a greenway when the remaining use is used for something else such as a school.
- ▲ Leases and Contracts Agreements: Agreements with private landowners to provide access to their land for the greenway.
- ▲ Rights of Way: GVRD (water, sewer, & drainage), BC Hydro, and BC Gas rights of way can include general public access on these rights of ways despite the fact that they are on private land.<sup>26</sup>
- ▲ Right of First Refusal: A private landowner enters into a contract with the government that when the property is put up for sale the government has the first option to purchase the land.

- **Public Access:** Areas will have restricted access during times that are environmentally sensitive to the wildlife habitat.

- ▲ **Environmentally Sensitive Times:** Critical periods of time when the wildlife needs not to be disturbed such as mating or nesting season.

- **Natural Land or Water Feature Corridors:** The Mud Bay Greenway corridors will follow the natural land (parks, and farmland, dykes) and the

<sup>25</sup> Province of British Columbia. Community Greenways: Linking Communities to Country, and People to Nature. (Ministry of Environment, Lands, and Parks. 1995) 43.

<sup>26</sup> GVRD. Greater Vancouver Regional Greenway Vision: An Environmental and Recreational Greenway Network and Assessment of the Potential Contribution of Existing and Future GVRD Rights-Of-Way. (July 1999) 9.



water features (Mud Bay, Boundary Bay, Nicomekl River, Serpentine River and creeks in the area).

- **Connectivity:** The open space which links parks, nature reserves, and historical sites with each other and with populated areas.
  - **Connects Parks:** The greenway would link local and regional parks
    - **Local Parks:** This study explores a connective route with public access around Mud Bay to link Boundary Bay Regional Park and Crescent Beach.
    - **Regional Parks:** The Mud Bay link is part of a larger link of a future 'Border to Border' greenway trail. This trail would begin in White Rock by the USA border and end at Point Roberts, USA. The trail would follow the shoreline. Many parts of this border-to-border trail already exist; however, there are a few missing links. The Mud Bay Greenway is one of those missing links.
    - ▲ **Regional Significant Greenway:** When the 'Border to Border' greenway is in use, it will become a 'regionally significant greenway' as designated by the GVRD.<sup>27</sup> This greenway will provide connectivity between major parks and recreation sites and to other regionally significant greenways. It will have sufficient assets and values to attract regional use. The entire Greater Vancouver Regional District could potentially use this greenway for recreational purposes. It would become a significant regional destination. The GVRD's selection criteria for a regionally significant greenway<sup>28</sup>
      1. Connects major parks and recreation sites (provincial, regional and or local)
      2. Connects with other regional greenways (creates a loop)
      3. Has sufficient assets and values to attract regional use.
      4. Has adequate staging capacity to provide access and accommodate use.
      5. Provides inter-municipal connectivity.
      6. Protects or enhances ecological functions (wildlife movement, habitat protection, unique species)
      7. Provides access to public recreational waterway (stream, lake, river, ocean, or foreshore)
      8. Provides an existing or potential water crossing
      9. Has significant heritage, interpretive, or educational value.
      10. Provides a green link through urban areas.
  - **Links Historical Sites:** The proposed greenway would help link some selected historical features with one another through an interpretive trail system.
    - The area is fairly rich in local and provincial history that dates back prior to British Columbia becoming a Canadian province or before Vancouver became city and it was still known as Hastings Mill.

<sup>27</sup> GVRD Parks. The North Shore Sector Recreational Greenway Plan: Part of the Regional Recreational Greenway Plan. (August 2000) 9.

<sup>28</sup> GVRD Parks. 46.

- **Links Populated Areas:** The Mud Bay Greenway would potentially provide an easier link for the people in the immediate areas of Crescent Beach, South Surrey, and White Rock with Delta, and North Surrey.
- **Links Nature Reserves:** The greenway would physically link and provide stronger links for nature reserves.
  - **Links Physical Locations:** The greenway will link the Serpentine Fen with Mud Bay Wildlife Management Area.
  - **Links Separated Locations: Bird Wildlife Areas / Nature Reserves:** The greenway will help ensure stronger links with Boundary Bay Wildlife Reserve and other bird reserves located in BC and Washington State. By protecting the greenway from development and destruction, it will help keep the area as an important bird flyway area for the future.
- **Protects Ecological Functions:** The greenway would protect the area's important environmental corridors and safeguard significant habitat and facilitate the movement of wildlife within the Mud Bay area.<sup>29</sup>
  - **Protects the Areas Important Environmental Corridors:** When implemented, a management body (Regional, Municipal, Provincial, and Stewardship Groups) would help put policies in place to protect and preserve the greenway from future pressures of development or other non ecologically beneficial uses. These policies could include changing the current zoning that the greenway would occupy from Agricultural Reserve to Park Zoning or quasi Park Zoning that is on privately, held land.
    - **Safeguards Significant Habitat:** To protect Mud Bay's biological productive zone by limiting public access during certain times of year. One way is by limiting public trail access during certain environmentally sensitive times such as the mating season of certain birds as determined by the Ministry of Environment.
      - ▲ Mud Bay within the larger Boundary Bay is one of the most biologically productive zones in British Columbia and Western Canada. The study area is a well known as a critical resting area for vast numbers of migrating birds.<sup>30</sup> In the last few decades, the study area as well as the surrounding Boundary Bay area has lost significant areas of highly productive salt marsh due to large dyking programs. In addition, pollution problems in Mud Bay have eliminated a once successful oyster industry. This area needs to be protected so that this it can remain a biologically productive zone for future generations to witness and enjoy.
  - **Facilitates the Movement of Wildlife:** The greenway would provide the needed links between fragmented habitats.<sup>31</sup> Partially due to expansive development, "islands" of habitat dot the landscape, isolating wildlife and plant species and reducing habitat necessary for their survival. The Mud Bay Greenway would potentially provide important links between these island populations and habitat and increase the land available to many species.

<sup>29</sup> Bonnie Blue. Regional Planner, GVRD. Personal Communication. (February 22, 2002).

<sup>30</sup> Tony Barnard. Wildlife Biologist Land Management. British Columbia Ministry of Environment, Lands and Parks, BC Environment Lower Mainland Region. (January 14<sup>th</sup>, 2002)

<sup>31</sup> Jonathan M Labaree. How Greenways Work, A Handbook on Ecology (1992).

- Mud Bay Greenway would connect the Serpentine Fen with Mud Bay, It would also help connect and promote the movement of wildlife between Crescent Beach and Boundary Bay Wild Life Management Area.
- **Offers Recreational Opportunities:** The recreational greenway will provide public access to trail and Blueway opportunities and activities. The recreational greenways may also offer routes for alternative modes of transportation. The recreational opportunity must be designed to carefully find balance between recreation and conservation.
  - **Public Access To Trail & Blue way Opportunities and Activities:** The greenway will provide opportunities to the general public for passive and active recreation and tourism. Some of these recreational activities such as walking, jogging, and cycling were directly identified by the City of Surrey. The other recreational activities were identified by some of the area's stakeholders and personal site activity observation. The list is not all-inclusive.
  - **Trails:** There are three types of trails<sup>32</sup>
    - ▲ **Natural Pathways:** Restricted to walkers, modest in width and development, with natural surfacing. It will try to minimize its impact on sensitive important habitats, including sensitive foreshore area, stream banks, etc.
    - ▲ **Developed Pathways:** wider and more developed than natural pathways, and usually providing multiple uses. May use existing corridors such as dykes, trails, utility and road rights of way, and power lines. It is surfaced with resilient materials such as gravel.
    - ▲ **Urban Pathways:** Higher developed, often paved, and maybe wider than other pathways. Often requires some form of separation of multiple users (e.g. cyclists and pedestrians). It will include city boulevards, sidewalks, and promenades. Often requires landscaping and safety features such as traffic calming structures and pedestrian-activated street crossing.
  - **Blueway:** Blueways define aquatic recreation corridors used by boaters and paddlers of watercraft for recreational purposes. It is proposed that the Serpentine River allow non-motorized watercraft. Whereas, the Nicomekl River will have motorized and non-motorized craft to the dam, and non-motorized there after. Swimming will be discouraged in the two rivers and the ocean section of Mud Bay.
  - **General Public:** The trail opportunities and activities will be open to everyone (general public) within the open times of greenway.
  - **Passive Recreation:** Bird watching, wildlife viewing, aesthetic appreciation, picnicking, nature and historical interpretation.
  - **Active Recreation:** Walking, jogging, fishing, cycling, canoeing, and sea kayaking.<sup>33</sup>
  - **Tourism:** linking Point Roberts to Crescent Beach provides initial tourism from residents from Delta, Washington State, and other residents from Vancouver, who would want make the scenic trip.

<sup>32</sup> GVRD Parks. 8.

<sup>33</sup> City of Surrey. Future Directions for the Provision of Parks, Recreation, Arts, Heritage, and Cultural Facilities and Services. (August 23, 2001) 84

- **Routes for Alternative Modes of Transportation:** Recreational greenways can also provide pleasant transportation alternatives for commuting to work and school. The greenway would be initially designed with a porous surface that would provide opportunities for bicycle transportation.
  - The greenway as an alternative transportation corridor would help provide routes within Surrey, between Surrey and Delta, and international traffic from Point Roberts to Blaine Washington. Surrey's Engineering Department, Delta's Engineering Department, and the Coast Millennium Trail network have all shown how the Mud Bay Greenway's trail network could potentially provide alternative modes of transportation.
- **Balance Between Recreation & Conservation:** The greenway's recreational use should be designed, managed, and maintained to ensure that ecological viability is not destroyed.<sup>34</sup> The greenway should be planned to allow adequate space (physical space or time) from critical habitat areas.

**Framework:** A framework is defined by how the greenway elements (linkages, environment, and recreation) can be implemented and modified over time to form a greenway while adapting to the area's landscape character.

- **Implementation Over Time:** Implementation of the greenway plan could and possibly should be done over many years even decades.
  - **Greenway Land Acquisition:** The greenway planning should be implemented gradually and in sections to accommodate land acquisitions.
- **Modification Over Time:** The greenway plan should allow for modification to reflect the evolving needs in the region's population & environment.
  - **Changing Recreational Needs:** Changing lifestyles, modifications in family size, increased recreation time, changes in user groups will cause a shift in recreational user needs.
  - **Changing Environmental Needs:** Changes in bird and other wildlife habitat may cause a change in land use needs. Thus, the greenway should be developed in phases over time so that each construction phase can respond to changing recreational and environmental needs.
  - **Ongoing investigations:** To contribute to the ongoing investigation and discussion from which a framework of policies and guidelines can be derived for the future of the Mud Bay Greenway.
  - **Public to Experience the Area's Landscape Character:** To identify and protect areas with distinct landscape characteristics to promote the area's identity.
- **Distinct Landscape Characteristics:** Qualities that define the study area's sense of place such as significant views. To identify the areas distinct landscape characteristics to promote community identity. To adapt those qualities into the greenway design prototypes.
  - **Views:** To maintain key views, natural and cultural landmarks. The area has a rich visual character with open views to the ocean and farming community. From the dykes on a clear day, there are unobstructed views towards the Mt

---

<sup>34</sup> GVRD. Greenway 48.

Baker, Vancouver Island's Mount Washington and Vancouver's North Shore Mountains.

### Design Prototypes

Design Prototypes will incorporate the goal's themes: linkages, environment, recreation, into a prototype designs to produce conceptual plans and images showing how a particular area green space could be accommodated.

- **Prototype Designs:** One design, out of three options, will be chosen to develop a design prototype for a greenway in more detail. The design will be chosen based on having the most favorable result in the evaluation process according to the goals and objectives set out in thesis paper. .
- **The Design Will Have**
  - Design Description
  - Design Rationale
  - Proposed & Existing Key Features
  - Proposed and Existing Staging Areas
  - Actions Required to implement design
- **Conceptual Plans: & Images:** To create and illustrate a vision of practical and esthetic changes for the Mud Bay community which attempts to incorporate facets of the goal and objectives. The study will develop illustrative concepts and images for greenway proposals. It is not the intent of this study to develop a definitive greenway plan for the area.
- **Implied Design Prototype Greenway User.** It is implied that all greenway options will incorporate methods for universal access. It is also implied that the greenway prototype designs will incorporate various user experiential qualities.
  - **Experiential qualities** are the experience that the user has when they are in that landscape. It that experience beneficial and appreciated by the user. Rachel Kaplan, Stephen Kaplan, and Robert Ryan in their book With People in Mind: Design and Management of Everyday Nature explain that the experiential qualities is the design and management of natural areas in ways that are beneficial for people and appreciated by them.<sup>35</sup> Kaplan and Kaplan and others like them have found through their research that considering one's experiential qualities can have positive usage results with those designed with user experiential qualities in mind. Usage results are usually higher, with all things being equal, with landscape that take user experience into account than those who do not.<sup>36</sup>
  - Each greenway option will have its experiential qualities ranked using Kaplan and Kaplan's chapter of 'Trails and Locomotion' as a basis for the evaluation in the decision matrix. This evaluation is not intended to be comprehensive. Its purpose it to make the reader aware that in designing the greenway, experiential as well as the aforementioned functional aspects must be taken into consideration.
    - **Luring the User into the Trail System:** Methods used to entice the user to go further down the path. To achieve this, the sightlines of the bay, and the

---

<sup>35</sup> Rachel Kaplan, Stephen Kaplan and Robert L. Ryan. With People in Mind: Design and Management of Everyday Nature. Island Press. (Washington DC, 1998). 1.

<sup>36</sup> R. Kaplan, S. Kaplan and Ryan. 91.

mountains will be seen through out the walk. These familiar sights or depth cues will suggest to the user that they can go further down the trail.<sup>37</sup>

- **Curving Trails:** Many studies have shown that people are more attracted to a path that curves than to one that is straight; a sense of mystery is particularly important in the design of trails.<sup>38</sup>
- **Sense of Mystery:** As one proceeds to walk the trail, there are strong hints about what will be seen along the trail.<sup>39</sup>
- **Trail Widths:** Trail widths affect the intimacy of the experience. Narrow trails help one experience the natural setting. Wide trails putting one physically distant from nature increases the psychological distance as well.<sup>40</sup>
- **Trail Surfaces:** Trails with relatively soft surfaces are generally preferred, although asphalt or concrete may be more suitable for certain activities.<sup>41</sup>
- **Way finding:** Trail design needs to facilitate way finding. This can be accomplished by incorporating design elements such as visible access points, landmarks, varying trail widths, and types trail surfaces, which at the same time can make the experience more interesting.<sup>42</sup>
- **Interconnected Trail System:** An interconnected system of trails, as opposed to a simple loop trail can have great charm and attraction.<sup>43</sup>
- **Points of Interest:** Trails that provide access to interesting view points, places to sit, and important features are particularly valued. Well-placed benches offer places for one to notice the landscape. Historical features, such as old farm equipment or remnants of building from the past, often provide an interesting stopping point.<sup>44</sup>
- **Views:** Combinations of open and wooded areas are preferred. Trails that go through open areas with few trees or distinct features are less preferred.<sup>45</sup>
- **User's Fear and Preferences:** The user's fears and preferences should be minimized. A trail that has blocked or obstructed views in the trail creates fear and concern to the user.<sup>46</sup>
- **Sustainable Design:** It is assumed that the prototype designs will use the sustainable design principles found in landscape architecture. This includes design reaching the optimal point between the overlapping targets of environmental, social, and economic interests.

---

<sup>37</sup> R. Kaplan, S. Kaplan and Ryan. 46.

<sup>38</sup> R. Kaplan, S. Kaplan and Ryan. 91.

<sup>39</sup> R. Kaplan, S. Kaplan and Ryan. 91.

<sup>40</sup> R. Kaplan, S. Kaplan and Ryan. 95.

<sup>41</sup> R. Kaplan, S. Kaplan and Ryan. 94.

<sup>42</sup> R. Kaplan, S. Kaplan and Ryan. 95.

<sup>43</sup> R. Kaplan, S. Kaplan and Ryan. 95.

<sup>44</sup> R. Kaplan, S. Kaplan and Ryan. 97.

<sup>45</sup> R. Kaplan, S. Kaplan and Ryan. 89.

<sup>46</sup> R. Kaplan, S. Kaplan and Ryan. 33.

## Chapter 4 Vision, Goals & Objectives

The purpose of the vision cycle is to create a specific planning goal and objective from the vision statement (Figure 10).

The initial vision statement was to create a Mud Bay Greenway. After completing the research in an earlier section titled "Study Terms Defined", a specific study goal and objectives emerged. These become the general criteria that the programs and designs are measured against later.

**Goal:** The principal goal of this study is to prepare a greenway framework and design prototypes in the Surrey Mud Bay Area.

### Objectives:

**Physical Open Space:** To identify significant land parcels within the study area that will form the open space that will be incorporated into the greenway structure.

**Connectivity:** To link parks, greenways, nature reserves, and historical sites with each other and with populated areas through the Mud Bay area.

- Parks
  - Connects the major parks of Blackie Spit to Surrey's new Serpentine River Park
- Greenways
  - Places a missing piece of the border-to-border greenway trail puzzle.
  - Links Crescent Beach to the GVRD South Surrey Connector Greenway
- Nature Reserves
  - Physically link Serpentine Fen with Mud Bay
  - Provides stronger links with the Boundary Bay Wildlife Reserve and other bird reserves by protecting a larger green footprint (area) for wildlife against future development pressures.
- Historical Sites
  - Links several historical features with one another through a trail system.
- Populated Areas
  - Provides a green link for people in the immediate areas of Crescent Beach, South Surrey, and White Rock along with Delta and North Surrey.
  - Provides transportation alternatives for commuting to work and school.

**Environment:** To protect and safeguard the area's significantly important environmental habitat corridors and facilitate the movement of wildlife within the Mud Bay area.

- To protect and safeguard the area
  - To put policies in place to protect the greenway from future development pressures.

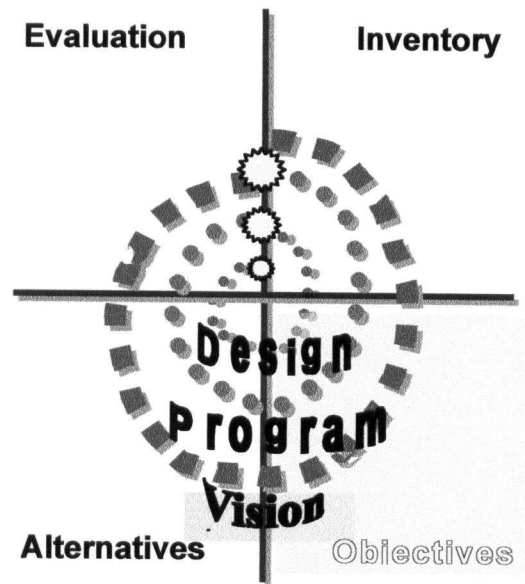


Figure 10 Vision, Goals, & Objectives

- To safeguard significant habitat by limiting public access during certain environmentally sensitive times.
- To facilitate the movement of wildlife
  - To provide links between fragmented habitats such as providing a better connection between Serpentine Fen and Boundary Bay Wild Life Management Area.

**Recreation:** To provide public access to trail recreation opportunities & activities balanced with ecological conservation.

- To provide public access and trail recreation opportunities
  - The greenway provides the general public and tourists with passive and active trail and Blueway recreation opportunities.
- To balance recreational activities with ecological conservation
  - The greenway's recreational use is designed to ensure that ecological viability is not destroyed.

**Implementation:** To produce a greenway plan that can be reasonably implemented and modified over time.

- To implement gradually to allow for land acquisitions
- To modify over time to reflect the changes in the region's population and environmental needs.

**Landscape Character:** To identify the area's distinct landscape characteristics to promote community identity.

- To define the qualities that give the area a sense of place and to use those qualities in the greenway design prototypes.

**User Experience:** To produce greenway prototype designs that incorporate experiential qualities for the user.

- The designs will demonstrate some of Rachel Kaplan, Stephen Kaplan, and Robert Ryan's experiential theories from their book With People in Mind: Design and Management of Everyday Nature. The designs will incorporate various user experiential quality theories from Kaplan and Kaplan's chapter on 'Trails and Locomotion' from their book.<sup>47</sup>

---

<sup>47</sup> R. Kaplan, S. Kaplan and Ryan.



## Chapter 5 Inventory & Site Analysis:

The Inventory step (Figure 11) identifies issues and conditions of the site. First, one gathers information from the initial site contact, stakeholder interviews, physical site inventory, and cultural site inventory. These results are combined into a site analysis that identifies the constraints and opportunities for a greenway location design based on the inventory findings.

This section is broken down into four main sections: initial site visit, stakeholder knowledge, site inventory, and site analysis (Figure 12).

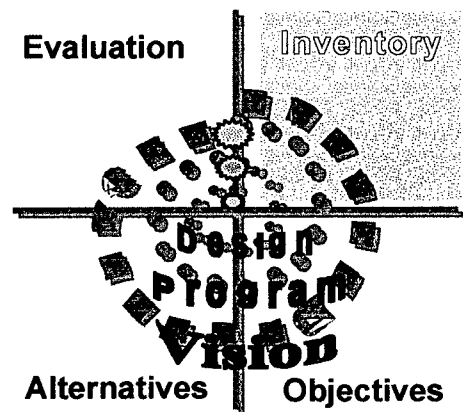


Figure 11 Inventory planning step

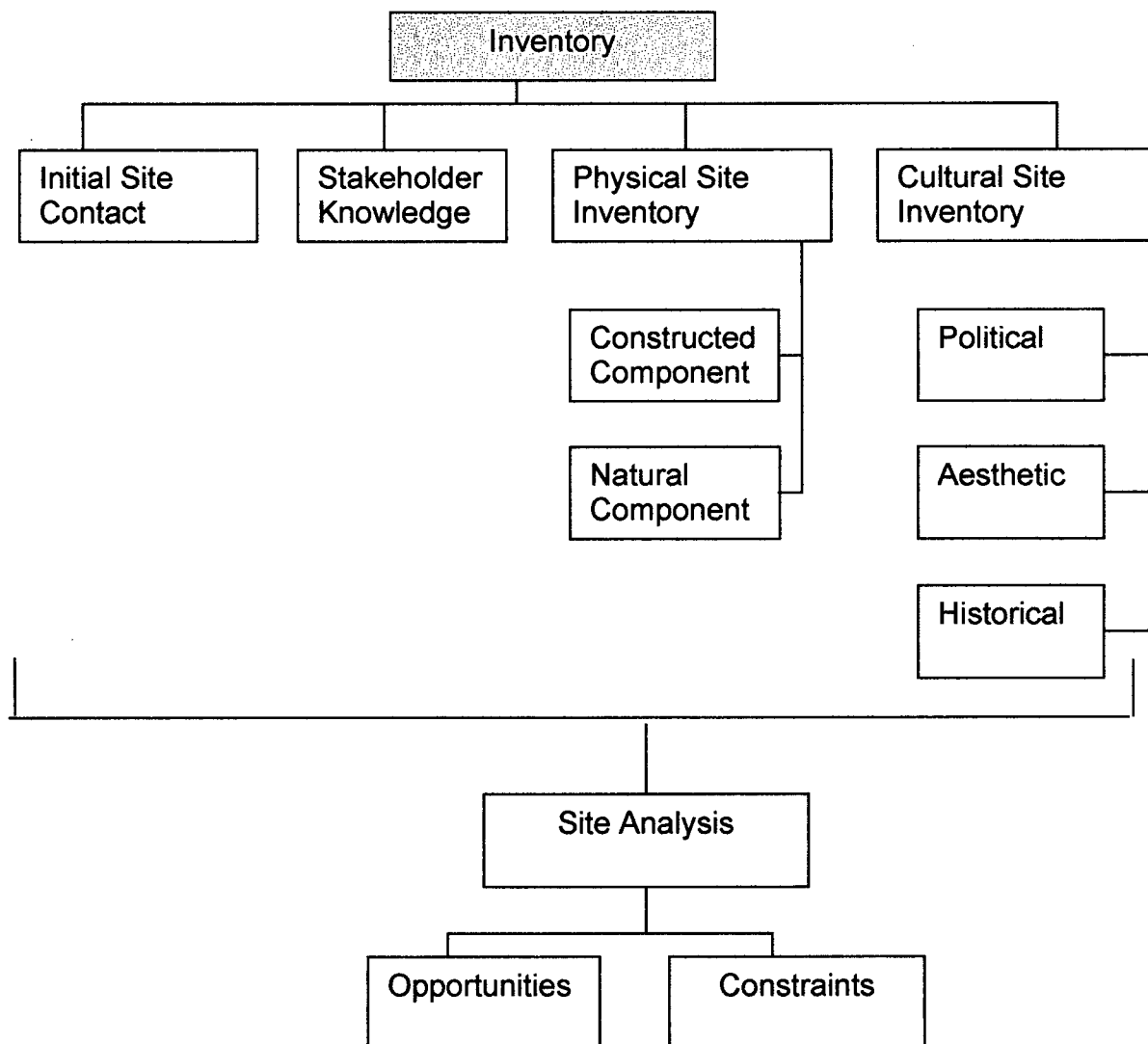


Figure 12 Inventory flowchart

## 5.1 Initial Site Contact

The purpose of this section is to record first impressions and notes.

Initial impressions on first and second site visits are recorded. Impressions for the Mud Bay Study area, and offsite areas that connect to the study area include Serpentine Park, Blackie Spit, and Elgin Heritage Park (Figure 13). The visits took place in early to mid January 2002.

### Mud Bay Study Site First Impressions

- Rich wetlands with a variety of plant species.
- Views of Mt Baker, Twawwassen, Crescent Beach.
- 40<sup>th</sup> Avenue acts as a long site line focusing on the railway berm.
- No trespassing signs on 40<sup>th</sup> Ave, and a nasty farm dog gives an unfriendly welcome to potential visitors (Figure 14).
- One section of 40<sup>th</sup> Ave has two "private property" signs on either end of the road, where the road takes a bend and becomes narrower... it gives the impression that 40<sup>th</sup> Ave has ended and this is now someone's private driveway.
- No road shoulder, no place to pull over to stop and take pictures.
- Heavy farm equipment (eight wheeled John Deere tractors) haul manure from orange barns to a lot in the middle of the site. The manure pile is larger than two typically large Vancouver homes put together.
- No access at end of road to dyke.
- Several roads appearing to give access with the standard GVRD metal gate. Are these public roads? They do not look like farm roads; the road base gravel is too new.
- The site has many ditches.
- Windmill, Spanish looking house with several Spanish houses on river.

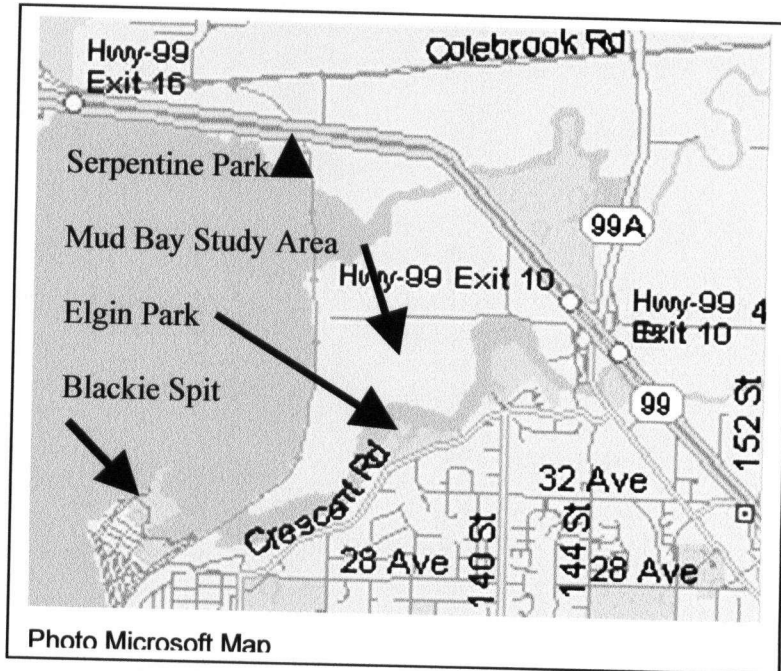


Figure 13: Mud Bay study area

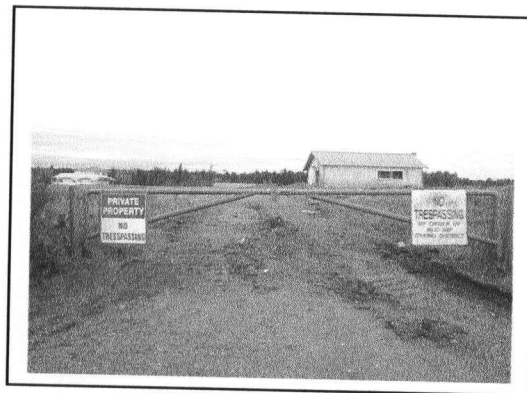


Figure 14 Mud Bay "No Entry" Signs

## Off Site Impressions

### • **Serpentine Park**

- Directional views to site.
- Desire line from Serpentine Railway Bridge to site (Figure 15). A person walking told me about how he saw two people jumping from the Serpentine River railway bridge into the water when a passenger train was about to come across the bridge.
- No formal parking. People park on the side of the road.
- People walking dogs, strolling, jogging, bird watching, cycling, motorbike riding, people with small children etc. on the edges of the site.
- Views across expansive tidal mudflats to the Cascade Mountains
- Families crossing the 99 Highway from the Serpentine Fen to Mud Bay.
- Needs pedestrian railway crossing from east to west side of tracks

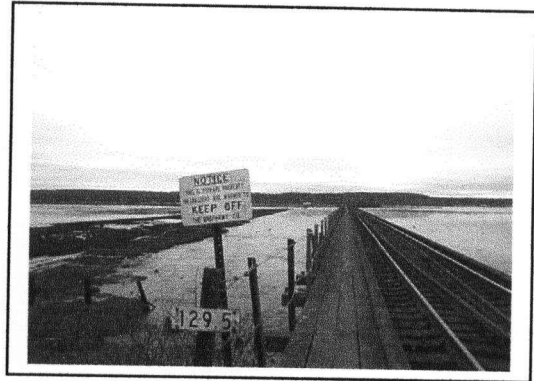


Figure 15 Serpentine Railway Bridge view to site.

### • **Blackie Spit & Crescent Beach Marina**

- Desire line from Nicomekl Railway Bridge to site.
- Formal parking areas at Blackie Spit and pay parking at Crescent Beach Marina (Figure 16).
- Need improved path from Blackie Spit under railway bridge.
- People walking dogs in a restricted area.
- Many people jogging or walking.



Figure 16 Crescent Beach Marina

### • **Elgin Heritage Park**

- Good views to site.
- Many boating activities.
- Large staging area.
- Public washrooms & drinking water.
- Historic Stewart Farm (Figure 17) & Hooser Weaving Center good off site connection to site.
- Part of park has a wetland.

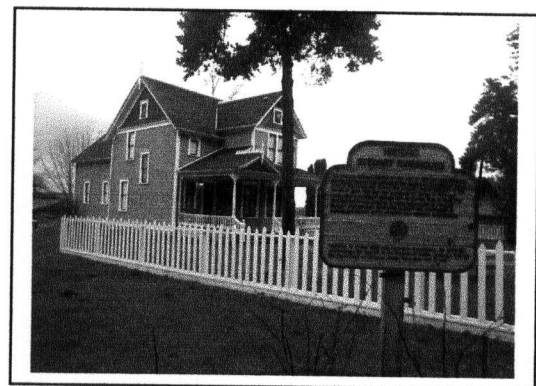
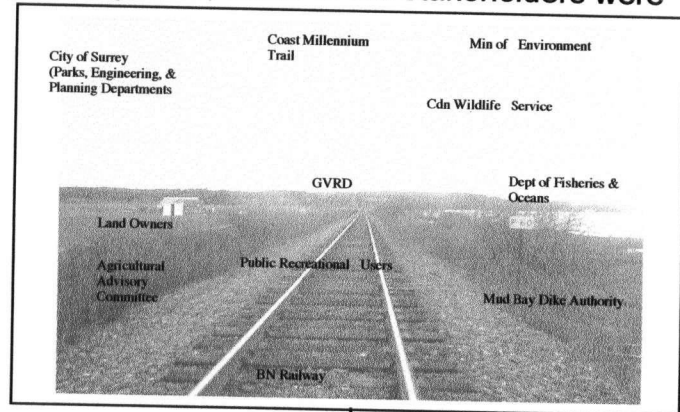


Figure 17 Elgin Heritage Park

## 5.2 Stakeholder Comments & Knowledge

The stakeholder comments & knowledge section is an attempt to record stakeholder views and to note their thoughts and insights regarding the project study area. Stakeholder comments on a site can offer quick insights and a starting point for more research into certain aspects of a site.<sup>48</sup>

From January to March 2002, the author held several personal and phone interviews with some of the stakeholders of the site. Their general comments, views, and insights relating to Mud Bay were recorded (Figure 18). Also, some of the stakeholders were asked what they thought would be a good example of a Mud Bay greenway. Their greenway precedents are recorded in a separate list. Stakeholders are defined as individuals who have a direct or indirect interest in the site. The following is a list of stakeholders contacted (this is not an all inclusive list):



### Government & Agencies

#### BC Ministry of Fisheries and Oceans

Naito, Brian - Biologist

Design considerations:

1. Plant native trees and shrubs.
2. Keep trails far away from high water mark and sensitive eel grass beds west of the BNSF rail tracks.
3. Plant sections with Cotton Wood trees because it is good for certain birds such as Herons.
4. Follow design guidelines in 'Access near Aquatic Areas: a guide to sensitive planning, design and management'

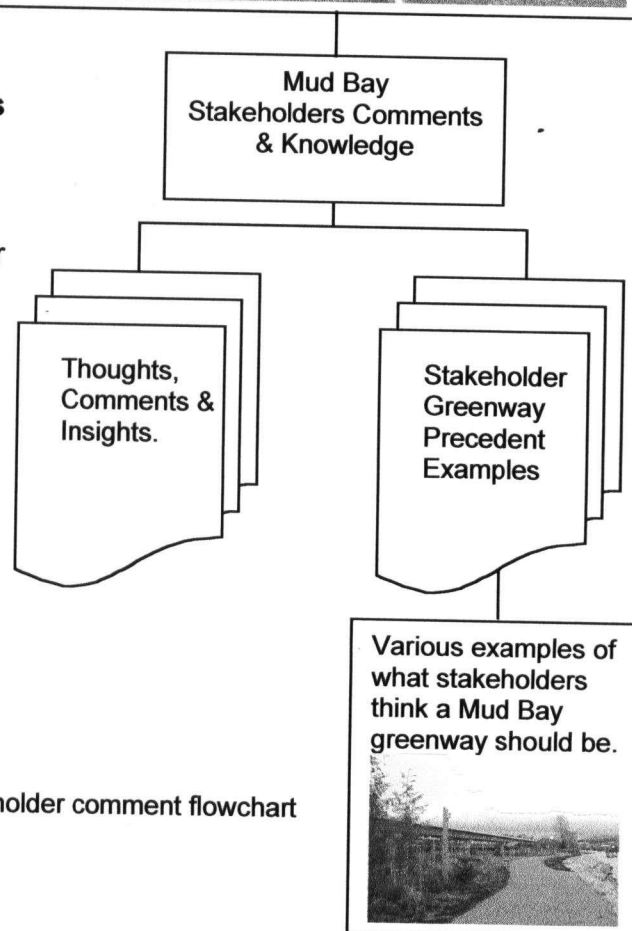


Figure 18 Mud Bay Stakeholder comment flowchart

<sup>48</sup> William Marsh. Personal Communication. January 2002.

## **BC Ministry of Environment, Lands and Parks**

Barnard, Tony – Wildlife Biologist Land Management.

Design considerations:

1. Note that Mud Bay is in the Wildlife Management Reserve and designs concerning this area must be sensitive to it.
2. Try to limit where trail users would go when designing for a trail. i.e. design a boardwalk. Try to keep the users as far away from the shore as possible as bringing people into the area may affect the eating habits of the shore birds.
3. Create buffers for people limiting where they can go. i.e. thorny vegetation buffer or 2x4" gauge wire fence or gates will help guide trail users.
4. Note the negative impact of bringing in more people into the area and how it negatively affects the bird habitat (Colony Farm Pitt Rivers – negative impact of people and dogs).
5. If designing for surrounding Mud Bay farmlands, then prefer for them to be "traditional soil based farming". This includes haying (good for Canada Geese) or grain crops. This does not include blueberries, cranberries, or greenhouse production.
6. Reminder for design to reflect sensitive wildlife area and a "Wildlife Management Area is not a park but a place where wildlife comes first and people second".
7. 8. Use native shrubs as much as possible i.e. Pacific Crab Apple that helps feed the birds
8. 9. use evergreen shrubs when having a trail near a wintering sensitive area to help keep the people out of sight from the birds.
9. 10. Have signs that explicitly state "Do's and Don'ts, signs that state where the park boundary is, signs that explain the sensitive bird habitat.
10. If designing a trail there must be enforcement of the greenways policy. i.e. no dogs allowed during certain times, and all dogs on leashes at all times due to the high bird sensitivity in the area.
11. If designing along the rail line then have it on the landside of the railway line with observation towers that overlook the tracks.

## **B.C. Ministry of Highways**

Callander, Glen - Highways Planning Department

Design Considerations:

1. Highway 99 right of way is approximately 15 meters from the centerline. The highway fence line is an approximate guess of the right of way.
2. Design should note long term plans for the highway widening from two to three lanes in either direction.
3. When exploring a design for cyclists beside the highway consult the BC Ministry Cycling Guide for design guidelines.
4. Cyclists along the highway should be screened from automobiles by a fence (e) Cyclists head lights should not interfere with automotive sight lines so as to startle the oncoming traffic.
5. Highway overpass should be enclosed to avoid someone throwing things onto the highway.
6. There is no extensive planting in the middle of the highway because of maintenance issues. Who will pay for the additional costs involved in maintaining shrubs?

McQuen, Catherine - Cycling Coordinator.

**Design Considerations:**

1. Overpasses usually cost \$1 million dollars. Recreational overpasses are rare. Overpasses usually installed for schools and high traffic areas. Overpasses must be designed for wheelchairs; thus require a much room. .
2. Cow tunnels in that area are done at grade due to flooding, however, even at grade there exists the possibility of flooding.
3. Cycling paths should fit into the landscape, be located below the highway shoulder level, and be designed not to have a 'jump out startle factor'.
4. Cycling paths should be at least 3 meters wide. They should not be paved; instead they should have compacted gravel or limestone for the trail surface.

**Canadian Wildlife Service**

Robertson, Andrew - Canadian Wildlife Service.

**Design Considerations:**

1. Avoid designing trails along the shore, "when something is constructed on top of something then it is lost forever"
2. Timing of construction is important; avoid construction during nesting periods
3. Speaking in general terms, avoid intertidal areas, design for floodplain cottonwoods.  
(d) A good precedent is the Reifel Bird Sanctuary. This is a good design precedent for trails with people and birds.

Smith, Dave

**Design Considerations:**

1. Plant fall 'cover-crops' for birds: Barley, Fall Rye, or Winter Wheat.
2. Naturescape is a good reference book
3. Natural barriers: native roses are good barriers because they are spiny, thorny and they do not grow very tall. Avoid Himalayan Blackberries due to their extreme invasiveness on farmer's fields.
4. Suggests not having to cut highway meridians. Suggests planting in center median good for raptors (birds such as red tail hawks found along the highway that "eat road kill" (Planting Scheme = Highway/Grass/Forbes/Evergreen Shrub/Deciduous Tree/Evergreen Shrub/Forbes/Grass/Highway)
5. Suggests licensing fee or seasons pass to help pay for greenway. Have a locked gate with an electronic pass.
6. Ditches: have a 2:1 slope, and minimum 2 meters wide.
7. Walkway measurements beside farmers field 16 meters wide = (2 m space /fence barbed wire or wire fence / 2 m shrub zone / 4 m ditch with 2:1 slope / 2 meter grass / 6 m wide crushed gravel path for multiple uses (cyclist/horse/pedestrian).
8. Path not to be straight. Suggests curve in path thus making path foot print 20-30 meters wide.

## **City of Delta**

Walters, Rick - City of Delta Engineering Dept.

### **Design Considerations:**

1. Design for users and potential conflicts.
2. Have adequate parking. In Delta people are parking on the road and the farmers cannot get their machinery in and out of their properties.
3. Keep people off the farmer's fields. People in Delta are flying kites on farm property and this aggravates the farmer because a farm field is not a park. Whose insurance will cover the kite flyer if they trip and injure themselves?
4. Design for people walking dogs. Make sure that there are measures (dog poop scoops) for people so that the poop has at least a potential of being cleaned up. Have adequate barriers to keep the dogs out of the farmer's fields and chasing the farm animals.
5. Have adequate staging facilities such as public telephones. In Delta, farmers tell stories of how people want to use the farmer's telephones and bathrooms.
6. Have adequate garbage cans on the trail. In Delta, the farmers complain about people littering on the farmlands and thus posing a threat to farm animals who may consume it.
7. Other notes: (a) Ensure that Surrey has policing of the trails for non allowed uses (i.e. if dogs not allowed) (b) Good precedent (Glenn Valley Regional Park 276<sup>th</sup> Street Matsqui farming dyke (c) If designing around farms, then make the farmers part of the process i.e. have them open and close gates etc.

## **City of Surrey**

Dickinson, Mike - City of Surrey Planning Department.

### **Design Considerations:**

1. Surrey's A-1 zone restricts structures (definition includes greenhouses) to 10% of the site or property. This provision in the A-1 zone would prevent substantial site coverage by greenhouses in this area. However, there is no similar restriction regarding non-traditional soil based farming like blueberry or cranberry farms. Also note with A-1, Section B. Permitted Uses, Section 6, that the zone allows for Conservation and nature study, Fish, game and wildlife enhancement
2. Given the environmentally sensitive nature of this area, one consideration would be for some, all or parts of the properties to be re-designated from Agriculture to Conservation (CNS designation in Surrey's OCP.) According to the OCP (pg. 138), this designation is: "intended for major parks, open spaces and environmentally sensitive areas in their natural state, including appropriate indoor and outdoor recreation activities and facilities." The CNS designation allows for rezoning to the CD (Comprehensive Development) zone. The intent of this is to prevent rezoning to A-2 that would permit intensive agricultural activity (such as mushroom farms.). To date, the CNS designation has only been used for City Parks such as Green Timbers and Sunnyside Acres Urban Forest. It could be used on other areas including privately owned properties. By itself, CNS does not limit the zone uses permitted on properties that are located within this designation.
3. Ultimately, if consideration is given to limiting or altering farming activities for environmental preservation purposes, it's best to involve the major stakeholders in any discussion (the local farm community, City, Provincial, Federal agencies and others.)

Fisher, Brad - Transportation Engineering Technologist – Bicycle Coordinator. City of Surrey Engineering Department.

Design Considerations:

1. Be aware of the public-private issues about bringing more people into the farmlands in the study area.
1. Note that many of the dikes are privately owned.
2. Tie in the greenway with the GVRD's Regional Significant Greenways
3. Allow the design to incorporate cycling into the trail. This would help strengthen the Coast Millennium Trail system.
4. Good source for a similar greenway  
(1) Kettle Valley Railway in Kelowna

Lamontagne, Jean - Manager, Planning, Research and Design. City of Surrey: Parks, Recreation & Culture Department.

- The new park located at 127 A Street in Surrey will be a linear park that will tie into the GVRD Greenway system for Surrey & Delta.

Design considerations:

1. Design for a linear park. The park system in Surrey that is in the most demand is linear trails.
2. Surrey would like to keep the active farmlands productive. Surrey farms produce approximately 80% of the lettuce and 6 out of 10 of the glasses of Safeway milk consumed in Vancouver's Lower Mainland.
3. Consider the staging areas for visitors. The farmers, who make up Surrey's Agriculture Advisory Committee, are sensitive to the public-private land issues. They do not want people interfering with their agricultural production.

Mitchell, David - DMG Landscape Architects.

Consultant for the City of Surrey

- Received some design insight into Surrey's new Serpentine River Park. DMG's current design influence is west of the railway tracks. Mitchell provided some good plant inventory for the north side of Boundary Bay.

Design Considerations:

1. Wildlife is an important issue for the site. Several stakeholders have mentioned their strong concerns to Mitchell.
2. When initially designing the site for recreation, remember to include loop trails and interconnecting trails off the site.
3. Have a contingency plan, such as a bridge in place if BNSF railway does not move its rail tracks.
4. Photoshop renditions are a good tool for explaining design prototypes.

### **Surrey Museum and Archives**

When researching the Mud Bay Area, note the importance of the Serpentine and Nicomekl Rivers as a transportation network that took place prior to the railway and the automobile. A good reference book that covers transportation is 'Rivers, Roads, & Railways.



### **City of White Rock**

Stevenson, Carrie - White Rock Museum & Archives

Design for the historical significance in the area such as the logging that happened on the high parts or the oyster farms that were once in the area.

### **Coast Millennium Trail**

Barton, Ellen - Coast Millennium Trail.

Design Considerations:

1. Design trails for the bicycle.
2. Tie in greenway connections with the Coast Millennium Trail (a border-to-border trail (Blaine to Pt. Roberts)).

### **Fraser River Estuary Management Plan (FREMP)**

Hasselman, Daviet – Project Coordinator

Design Considerations:

1. Contact as many government agencies as possible that may be related to your site and find out information as it relates to your site.
2. FREMP's boundary is approximately where the dam is located on the Nicomekl and Serpentine Rivers.

### **Greater Vancouver Regional District (GVRD)**

Blue, Bonnie - Long Range Planner, Regional Parks, Greater Vancouver Regional District

Design Considerations:

A design opportunity exists to run the greenway over South Surrey Inceptor Pipe. There may be an opportunity for the GVRD to negotiate a 'public right of way' over the 'sewer maintenance right of way'.

Farquhar, Brian. - GVRD Parks

Information on Anacis South Surrey Greenway – Regional Greenway

Design Considerations: Tie into the larger greenway network.

Grass, Jude - Administrative Support. Greater Vancouver Regional District. Burnaby.

Design Considerations:

If dogs are to be on leash, you must either design for them, or you must have monitoring done by the appropriate authorities. The current designs for dogs are such things as signs at staging areas, garbage cans for dog litter, etc.

### **Land Owners**

VanKeulen, John - Donia Farms. Mud Bay - South Surrey, B.C.

Design Considerations:

1. Design for greenway with the notion that there is very little disturbance on farmland.
2. Consider greenway on waterside of tracks.
3. Avoid staging areas on farm roads because there is difficulty-moving equipment in and out of fields.
4. Try to accommodate for vandals IE there must be monitoring of the greenway or it must be closed during certain hours.
5. Have plenty of trash cans for people to get rid of their garbage.

## **British Columbia Lands Assets and Land Corporation**

Berardinucci, Julia - Land Officer

BCLALC owns the property north of the Serpentine River and some in the project area. BCALC leases out the properties to various farmers usually on a long-term lease. Bay West Property Management handles the actual lease.

## **BNSF Railway**

Railway Bridge #69 Bridge Operator

- Bridge operator is at the Nicomekl Bridge between 6:30 and 10:30 pm 7 days a week.
- Roughly 8-12 trains a day: passenger and freight.
- Bridge swings open for boats by either having the boat operator call in by phone directly to the operator or by a boat blowing their horn 3 times.
- People trespass along the rail line and ignore the operator's warnings of trespassing.

Cowles, Mike – BNR Seattle Office

Design considerations:

1. BNSF does not want to have a mixture of people near rail lines for safety and liability reasons. Therefore, does not want design on the railway line.
2. Off right of way is not preferred either for a trail.
3. If designing for a crossing, then either cross at grade or design a pedestrian underpass (width 8 ft and 4ft clearance at top needed).

## **Stewardship Groups**

### **Ducks Unlimited**

Buffet, Dan - Administrative Coordinator

Design considerations:

1. Keep people on the dike trails and not in the farmland, nor on the foreshore. (b)  
Keep horses on the trails and not on the foreshore.

Major dike design issues:

1. Grass edges to see if holes in dykes
2. types of grass help feed native for birds.
3. Top of dykes used as natural pathways.

Native Shrub material along should be designed for

4. 'Pastern species' and not waterfowl.
5. Avoid Blackberry or other seed spreading shrubs that invade the farmers' fields.
6. Bird species in the area are generally the same as those found in Boundary Bay with the exception of Northern pintail and Farmland Wigen.

## **Western Canada Wilderness Committee Surrey / White Rock Chapter**

Riley, David & Margaret

Design Consideration:

1. Have restricted dog areas for leash and off leash areas
2. Have certain no access areas to people
3. Have certain viewing areas

4. Enforce no hunting
5. Restrict access during certain times of the year.
6. Ensure that design promotes conservation.

Walker, Liz.

Design Considerations:

1. Ensure that there is a line of visibility along the trails. This is good for school groups.
2. There should be no tripping hazards.
3. Ensure plenty of garbage cans.
4. Fixed 'Birding Scope' at certain areas would be great.
5. Have signs and enforcement for dogs for restricted areas and dogs on leash.

**Stakeholder Precedents:** Precedents were ideas suggested by the stakeholders as to what they thought a Mud Bay Greenway would/should look like.

**Campbell Valley Regional Park – Surrey B.C.**

- Suggested by Tony Barnard Wildlife Biologist Land Management
- An example of how to design a trail with boardwalks that helps limit the users where they can go on the trail.

**Colony Farm - Pitt Rivers B.C.**

- Suggested by Tony Barnard Wildlife Biologist Land Management
- An example of a park that has a negative impact on wildlife when people and dogs are brought into a sensitive area.

**Glenn Valley Regional Park - 276<sup>th</sup> Street Langley BC**

- Suggested by Rick Walters Delta Engineering Department
- A good example of a linear GVRD park.

**Kettle Valley Railway – Kelowna B.C.**

- Suggested by Brad Fisher – City of Surrey Engineering Department

**Maplewood Flats –North Vancouver B.C.**

- Suggested by Tony Barnard Wildlife Biologist Land Management
- An example for user impact and security for the area.

**Matsqui Farming Dyke – Matsqui B.C.**

- Suggested by Rick Walters Delta – Delta Engineering Department
- An example of a linear GVRD park.

**Reifel Bird Sanctuary – Delta B.C.**

- Suggested by Andrew Robertson – Canadian Wildlife Service
- This is a design that has precedents for trails with people and birds.

**Sapperton Station Greenway – New Westminster, B.C.**

- Suggested by Jude Grass GVRD
- A good example of designing pedestrians with Rail Lines along a waterfront.

**Stanley Park Sea Wall –Vancouver, BC.**

- Suggested by Bonnie Blue - GVRD
- A good example of a seawall that is an asset to the city. The equivalent would be the Boundary Bay walk from White Rock to Twawwassen.

**White Rock Beach Front Park – White Rock, B.C.**

- Suggested by John Van Keulen
- An example of a waterfront park that is parallel to a rail line and the water.

### 5.3 Built Physical Inventory

The built physical inventory is a description and overview of built and planned features that relate to the Mud Bay Greenway. This includes general access, utilities, existing structures or buildings, non permanent equipment and structures, and recreation facilities.

Built Physical Inventory was gathered from onsite notes, observations, personal interviews, and historical data found in various printed materials. With a few exceptions, the majority of the inventory is taken from secondary sources.

#### General Access

##### Public Transit

- Regional public transit access is currently not available directly to the site. Transit is available to the Serpentine Fen Bird Sanctuary and Nature Trails Park and will allow the user to walk directly into the site (with the proposed connections). Transit can be taken to the Serpentine Fen Bird Sanctuary and Nature Reserve from White Rock, Surrey, Delta, Langley and the Metropolitan Vancouver, Burnaby, New Westminster areas with the appropriate bus transfers.

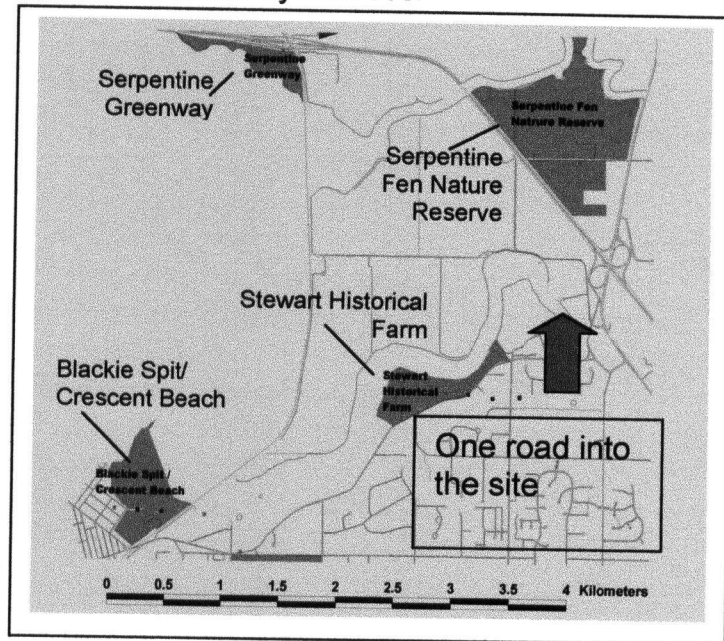


Figure 19 Area Road Network

##### Vehicle

- The study area is located approximately 25 minutes driving time from Vancouver, Burnaby, New Westminster, and Richmond.
- There is only one road, Nicomekl, which leads to the study site (Figure 19)

##### Bicycle

- Local routes: Several proposed bike routes can access the site. The proposed regional and local bicycle routes as suggested in the by the City of Surrey's Pathway & Bikeway Map would link the site to other recreational areas in Surrey and Delta.
- International Routes: This route would also have international potential due to the expressed interest in the United States for a Coast Millennium Trail bike route from Blaine, Washington to Point Roberts, Washington<sup>49</sup>.

##### Pedestrian

- Pedestrian access to the site from the 131A Street, Railway Road, 40<sup>th</sup> Ave, Nicomekl Rd, Rio Pl, the Nicomekl Dyke, or the Serpentine River Dykes, or by walking over the BNSF rail bridge over the Nicomekl.

<sup>49</sup> Whatcom Council of Governments. Coast Millennium Trail: A border-to-border coastline trail. (Bellingham, 2001).

- Some pedestrians are accessing the site by crossing the two railway bridges, walking over the 99 highway then walking on the 99-highway bridge.

#### **Access Roads**

- One main access route into the site for automobiles: from King George highway, take Elgin Road to Nicomekl Road until you reach 40<sup>th</sup> Avenue (Figure 19).
  - Left turn from King George is tricky with many on coming southbound cars.
  - Cars can not come directly from Crescent Road due to the Nicomekl Dam on Elgin Road is one way (south bound). Pedestrians can travel from Crescent Road to the site except must use caution with on coming traffic exiting from the freeway.
- Existing Roads
  - Elgin Road (2 lane road)
  - Nicomekl Road (2 lane road)
  - Rio Place (one lane road with cul-de-sac for turn around)
  - 40<sup>th</sup> Ave (one lane road, used for local traffic and heavy farm equipment that occupies 1 \_ traffic lanes.)
  - 140<sup>th</sup> Street (two lane road)
  - 99 Highway & King George Highway (Boarder the north east and east sides of the site but do not directly access the site).

#### **Dykes**

- The dykes run along the riverbanks and are on average 3 meters high. However, there are several river bends where the dykes reach 5 meters high. The dyke tops are of a road base material and are used for service vehicles. The dykes are either privately or publicly owned. The dyke river's edge is rather steep and difficult for boats to stop and shore-up.
  - Existing Dykes
    - Nicomekl River
    - Serpentine River

#### **Railway Tracks**

- Burlington Northern Santa Fe Railway line is located on the Mud Bay dyke. The train travels from Vancouver to Washington State and down the coast with no stops in Surrey or White Rock.
- 8-12 trains a day consisting of passenger and freight trains cross the Mud Bay tracks.<sup>50</sup>
- It is proposed that the current railway line be relocated to 176<sup>th</sup> street where the trains can travel at higher speeds, as it will not pass through any major residential areas. The long-term plan for passenger rail service in the corridor, as described in the Amtrak Cascades Plan for Washington State 1998-2018 Update (April 2000) has stated the desire to relocate the rail line from White Rock Crescent Beach to a much more desirable location.<sup>51</sup>

<sup>50</sup> BNSF Railway Bridge #69 Bridge-Operator. Personal Communication (February 6<sup>th</sup> 2002).

<sup>51</sup> GVRD. Planning and Environment Committee Minutes. Burnaby. (Wednesday September 5<sup>th</sup> 2001). <http://www.gvrd.bc.ca/board/agendas/01comagendas/penv/0905penv.pdf>. (March 1, 2001).

## **Bridges**

- Currently there are three bridges that cross the two rivers on the site.
- Existing Bridges:
  - Highway 99
    - One bridge spanning over the Serpentine River for south bound highway traffic. Used only for vehicles traveling at least 60 kilometers per hour.
  - BNSF Rail Bridge
    - Wooden trestle bridge spanning the Nicomekl and Serpentine River. The Nicomekl River Bridge is a swing bridge that swings open to allow tall ships to pass. The boat operator can either call or toot their horn three times to alert the bridge operator to open the bridge. Bridge operator is present between 6:30 in the morning to 10:30 at night.
    - Maintenance walkway on eastern side of bridge not suitable to be used when the wider Amtrak Rail cars travel the bridge.
  - Nicomekl Sea Dam
    - Concrete dam with asphalt road on top. One-way road used for cars traveling south bound. Dam opens when the Ocean's tide is going out and closes when the tide comes in. Prevents seawater from leaching up the Nicomekl River.

## **Trails**

The only notable trail into the site is used in the summer time, when the Serpentine River water level is low and some people walk along the riverbank and under the highway bridge to access the other side.

## **Docks**

There are several private docks on the Nicomekl River (The Serpentine River has no docks). The docks are usually gated and locked from public access from the dykes.

## **Rivers**

There is motorboat access up to the Nicomekl River dam on Elgin Road. Tall boats must either toot their horn or call the BNSF Bridge Operator to swing the bridge and allow the tall boat passage into Mud Bay.

## **Greenways**

- Serpentine Greenway
  - To the north of the site boundary is Surrey's Serpentine Greenway (Figure 20) This Serpentine Greenway will eventually link up with the GVRD Regional Greenway: 'Anacis South Surrey Greenway'
- Boundary Bay Greenway Walk
  - On either end of the study site is the Boundary Bay & Crescent Beach walks. The study site would link up with these walks.

## **Boundary Markers**

- Fencing: There are white board fences and barbed wire fences that mark the sites boundaries.
- Signs: Many signs are used to discourage people from entering into the site. These signs include: No trespassing, Private Drive, No Parking, Tow away Zone, No Entry, etc.
- Miscellaneous Boundary Markers: Ditches along the road and telephone poles also mark out properties along the road where no fences exist.

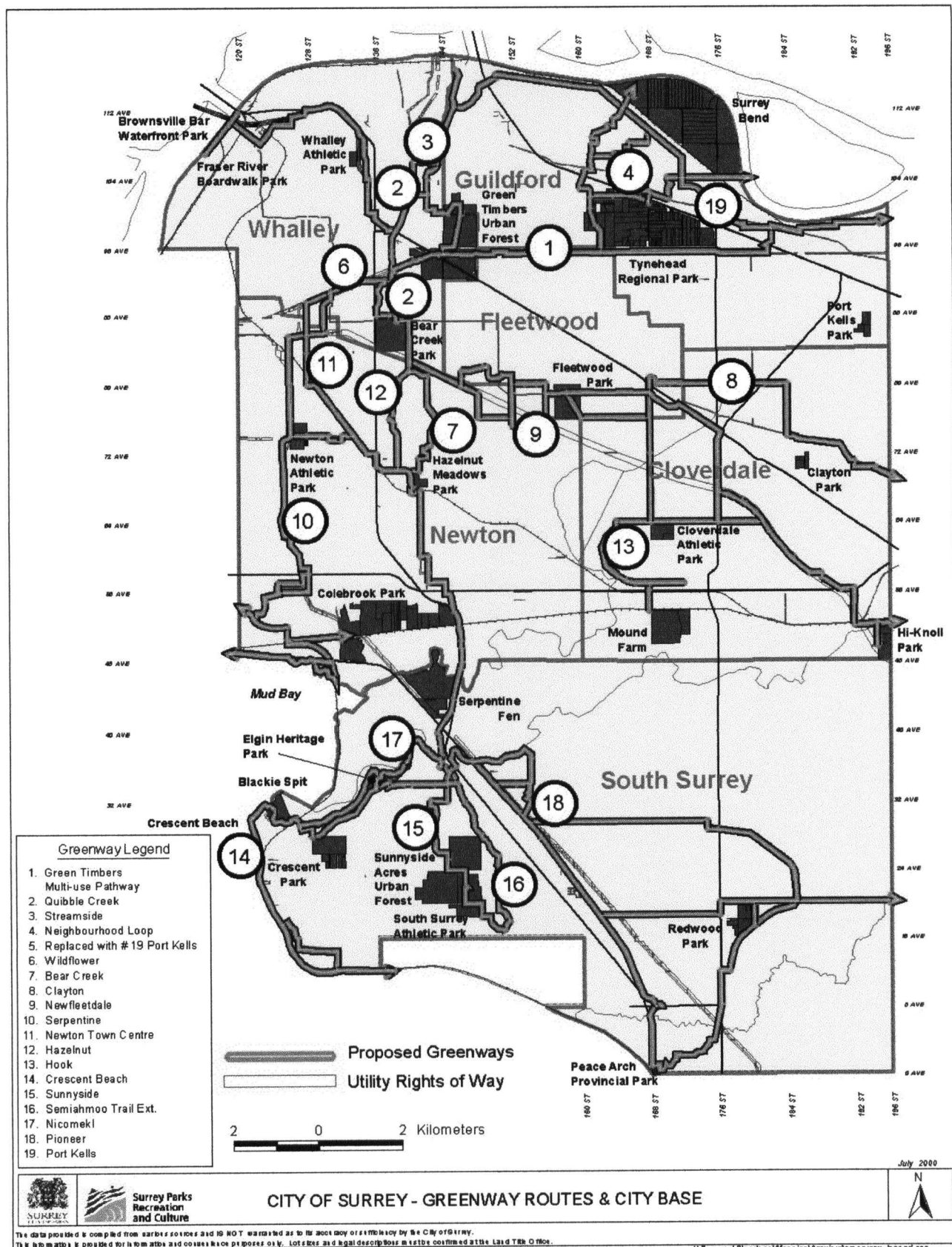


Figure 20 City of Surrey Existing Greenway Routes

## **Utilities**

- Power & Phone lines: Wooden pole power lines dot the site's landscape. They are located on the edge of the road.
- Sewer: The site has the GVRD's South Surrey Interceptor sewer line that crosses the site in two places.

## **Existing Structures or buildings**

- Farm Buildings
  - Barns
  - Pump houses
- Houses
- Heritage House: John Weaver House on 40<sup>th</sup> Ave.
- Non-Permanent Equipment & Structures
  - Irrigation Pipes
  - Tractors
  - Pickup Trucks
  - Farm Trucks
  - Farm Wagons

## **Recreational Facilities**

- Parks
  - On Site: None
  - Off Site: Blackie Spit, Elgin Heritage Park, Serpentine Park, Serpentine and Fen Bird Sanctuary
- Washrooms
  - On Site: No public washrooms on site.
  - Off Site: Crescent Beach, Esso Gas Station (Elgin Road) Elgin Heritage Park Crescent Beach, Nico Wynd Golf Club, or Crescent Beach Marina.
- Bed & Breakfasts or Campsites
  - On Site: No campsites nor bed & breakfasts on site.
  - Off Site: Peace Arch RV Park (14601 40<sup>th</sup> Ave)
- Campsites
  - KOA 40<sup>th</sup> Avenue & King George highway, Surrey
  - KOA is mainly suited for RVers (recreational vehicles) and not for smaller day use campers.
  - Hazelmere RV Park & Campground 18843 8<sup>th</sup> Ave Surrey:
  - Location is out of the area
- Fresh Water
  - On Site: No public fresh water on site.
  - Off Site: Crescent Beach, Esso Gas Station (Elgin Road) Elgin Heritage Park Crescent Beach, Nico Wynd Golf Club, or Crescent Beach Marina.
- Staging Areas
  - On Site: No formal staging areas on site. Informal staging area on Rio Place Cul-de-sac for 3-5 cars.
  - Off Site: King George Highway & Nicomekl River (Park & Ride), Blackie Spit, Crescent Beach Marina (pay parking), 131 A Street informal parking along road, Serpentine Fen Nature Reserve, 44<sup>th</sup> Ave.
- Picnic Areas
  - On Site: None



- Off Site: Crescent Beach, Future Serpentine Fen Park, and Serpentine Fen Nature Reserve.
- Bird & Wildlife Watching Facilities
  - On Site: None
  - Off Site: Serpentine Fen
- Historical Interpretation
  - On Site: None
  - Off Site: Historical plaque in front of the Esso Gas Station on Elgin Road.
- Seating Areas
  - On Site: None
  - Off Site: Blackie Spit & Elgin Heritage Park
- Walking, Jogging & Cycling Trails
  - On Site: None (Informally top of dykes used by trespassing pedestrians)
  - Off Site:
    - Walking: Crescent Beach, Serpentine Fen Nature Reserve & Nicomekl River.
    - Cycling: South Surrey bike trails.
    - Horse Riding Trails
      - On Site: Roadways used only.
      - Off Site: Informal horse trails: North of Colebrook Road and along Boundary Bay Dyke
- Fishing, Canoeing, and Sea Kayaking Sites
  - On Site: None open to the public
  - Off Site: King George & Nicomekl River, Crescent Beach Marina, and Blackie Spit.
- Public Phone
  - Onsite: None
  - Offsite: Crescent Beach, Esso Gas Station (Elgin Road) Elgin Heritage Park, Crescent Beach, Nico Wynd Golf Club, or Crescent Beach Marina.
- Public Trash Bins
  - Onsite: None
  - Offsite: King George & Nicomekl River, Crescent Beach, and Elgin Heritage Park.

## 5.4 Natural Biophysical Inventory

Inventory was gathered from onsite observations, personal interviews, and historical data found in various print material. With a few exceptions, the majority of the inventory is taken from secondary sources. Inventory is broken into 6 general categories: Topography & Landform, Natural Hazards, Climate, Hydrology & Drainage, Soil & Vegetation and Wildlife & Farm Animals (Figure 21). These six general categories were broken down into three general zones: Mud Bay, Farm, and River Zone.

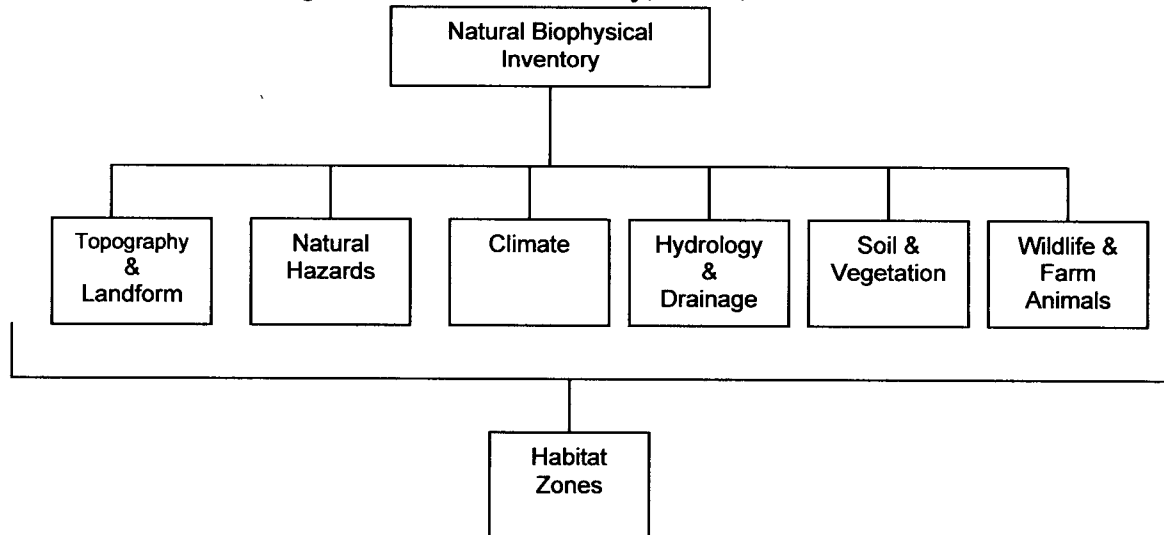


Figure 21 Natural Biophysical Inventory

### Topography & Landform:

- The area can be broken down into three smaller sub-units (Figure 22 and Figure 23): Farmlands, Mud Bay, and Tidal Rivers. The Mud Bay and Tidal River's shore morphology is displayed in one category.
- Context: Mud Bay lies in the northern part of Boundary Bay, which was formerly the inactive south side of the Fraser Delta.<sup>52</sup> The land adjacent to Mud Bay lies between two north and south escarpments. On this land, two rivers cross: the Serpentine and Nicomekl Rivers that drain into Mud Bay (Figure 24).

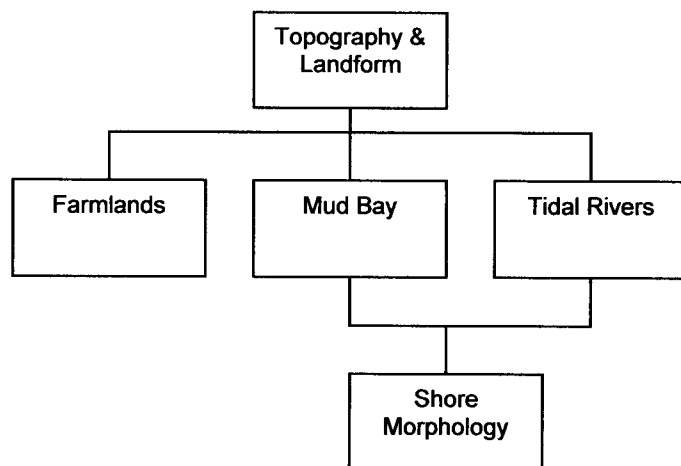


Figure 22 Topography & Landform Flowchart

<sup>52</sup> The Institute of Environmental Studies at Douglas College. A Proposal for the Establishment and Development of the Mud Bay Serpentine River Environmental Reserve. (March 1972) 20.

- Farmlands
  - Grasslands with various farm buildings.
  - The Mud Bay agricultural land is fairly flat with little slope. Dykes on the two rivers and the bay border the farmland. The land on the Mud Bay side is slightly higher (less than 1 meter) than the water line. However, during extremely high tide, if it were not for the dykes the land would be underwater.

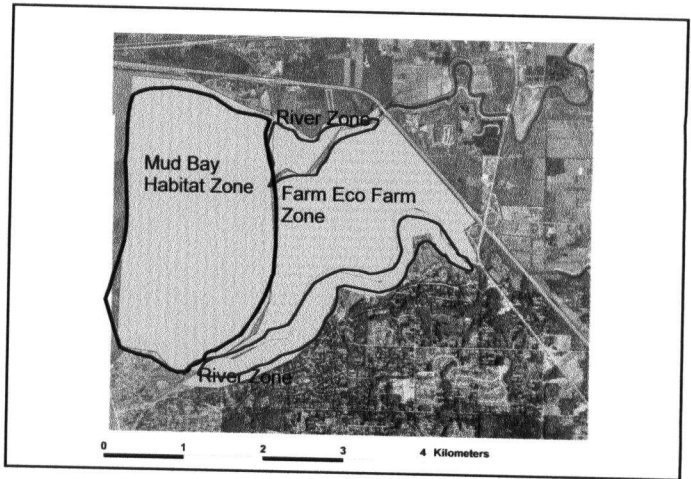


Figure 23 Habitat Zones

- Tidal Rivers
  - Serpentine & Nicomekl Rivers
  - Both rivers are tidal rivers up to the tidal dam located on the King George Highway. The rivers are separated from the land through dykes. The Serpentine River, Nicomekl River, & Mud Bay dykes are approximately 3 meters higher than the surrounding farmland and serve to protect the farmland from the surrounding river and bay waters.

- Mud Bay
  - Mud Bay is a large, shallow tidal bay and bordered by a dyke along its entire length. The dyke is open to public access, except for the eastern-most segment between the Serpentine and the Nicomekl estuaries. At low tide, the sand and mud flats extend up to 2 km (1.2 miles) south of the dike opening large feeding and roosting areas for waterfowl, gulls, and shorebirds. The remaining salt marsh forms a fringe between the high-water mark and the dyke

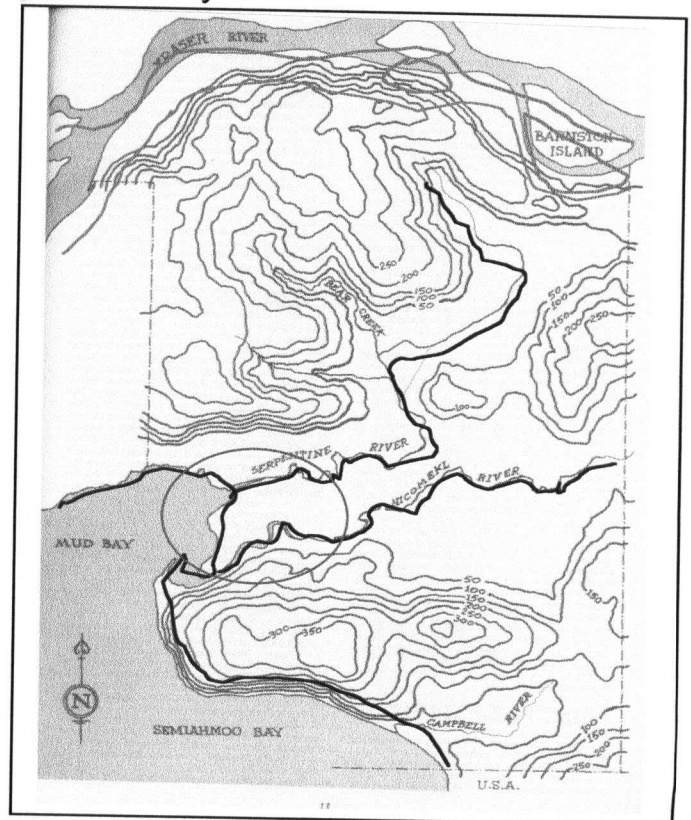


Figure 24 Surrey Lowlands

- The bay is mainly made up of a muddy, silty, sandy sediment. It can be broken again down into smaller sub units
  - Lower Tidal Flats
  - Intermediate Tidal Flats
  - High Tidal Flats
  - Salt Marsh
    - ▲ The 150-hectare salt marsh is located between the Serpentine and Nicomekl River. It is perhaps the most ecologically important single component in the whole Mud Bay area.<sup>53</sup>
    - ▲ The salt marsh is an active cliff about 60 cm high. It is above the mean high tide but flooded during the high spring tides and winter storms.
    - ▲ Ecological Importance
      - △ Contributes nutrient material to adjacent waters
      - △ Produces proteins, phosphates, nitrates, sugars, organic matter and calories
      - △ Helps support the food chain for clams, oysters, crabs, mish shell fish, and other types of fish.
      - △ Provides habitat for waterfowl, nesting, feeding, breeding and shelter.
  - Eel Beds
    - Important nursery and feeding area for salmonids
    - Eelgrass beds are extensive and are an important spawning site for Pacific Herring
    - "Open Bay with its huge expanse of intertidal mud flats and sandbars supports good eelgrass meadows that are so critical to winter Brant as well as the spring herring spawn and its associated feeding birds".<sup>54</sup>

### **Mud Bay & Tidal River's Shore Morphology**

- Bay Size: 3 km from Serpentine Fen Park to Blackie Spit and 2 km deep.
- Water Depth: Shallow tidal flats 3-4 fathoms in the Mud Bay tidal flats (Figure 25).
- Water Temperature
  - Mud Bay's seawater is somewhat warmer than the surrounding water "due to the warming effect of a flooding tide over the heated sand flats on a Sunny day".<sup>55</sup>
- Tides:
  - Tide Datum: 0.00, 2.8m below geodetic zero.<sup>56</sup>
  - Mean Sea Level: 2.8 m above zero.
  - High Water Level, Mean Tides: 4.0 m above zero tide.
  - Higher H.W. Level, Large Tides: 4.45 m above zero tide.
  - Estimated Extreme Tide Level: 5.12m above zero tide.

<sup>53</sup> The Institute of Environmental Studies 24.

<sup>54</sup> Vancouver Natural Historical Society. The Birder's Guide to Vancouver and the Lower Mainland. (Vancouver: Whitecap Books, 2001). 87.

<sup>55</sup> The Institute of Environmental Studies 22

<sup>56</sup> City of Surrey. Crescent Beach Waterfront Walkway Feasibility Study. (June 1990). 4.

- **Material:**
  - River and tidal flows encourage an accumulation of mud sediment. The bay is mainly made up of a muddy, silty, sandy sediment. The mud is carried from the lowlands down the Nicomekl and Serpentine Rivers and into Mud Bay. The sand mainly originated from the erosion of the cliffs along Ocean Park and carried in by other sediment into the area by tides and currents.

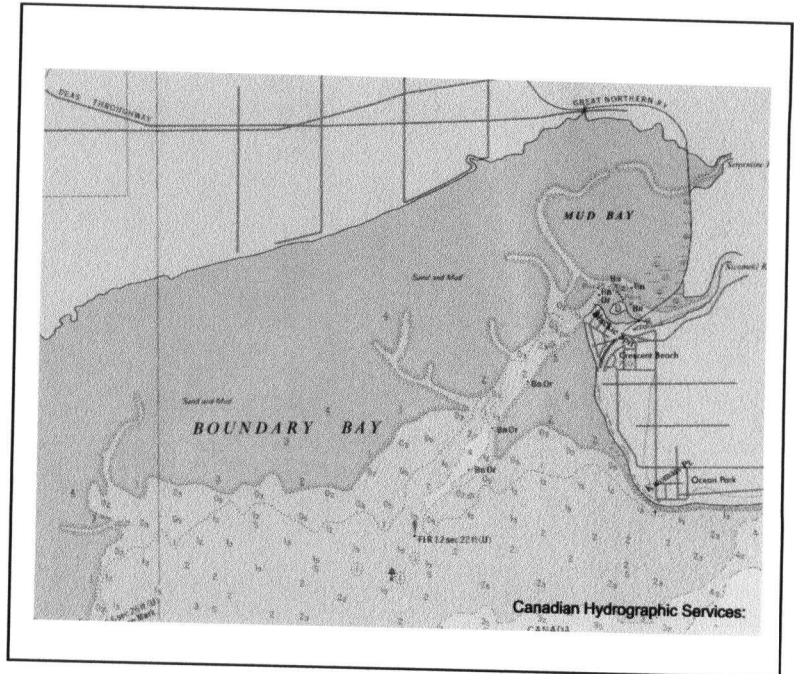


Figure 25 Mud Bay Water Depths

### Natural Hazards

- Quicksand: There are quicksand conditions on Mud Bay's northern shores caused by "upwellings and artesian water".<sup>57</sup>
- River Undertows: The Nicomekl River has extreme undertows by the mouth of the river near Blackie Spit.

### Climate

The climate is a cool summer Mediterranean climate that is similar to some of the nearby Gulf Islands. The ocean moderates the climate resulting in somewhat mild winters and cool dry summers. Extreme temperatures rarely occur nor do severe winter storms

- Wind: Winds veer from southeast to southwest. The higher topographic ground of Robert Banks, Crescent Beach, and Panama Ridge helps shelter Mud Bay from direct winds.
  - Western and South Western winds: blocked by Roberts Bank
  - Northern Winds: blocked by Panama Ridge
  - South & South Eastern Winds: blocked by and escarpment that runs along Crescent Beach
  - Eastern winds that originate up the Fraser Valley are not that well blocked towards Mud Bay. Mud Bay becomes very exposed to the eastern wind. The high ground (Panama Ridge and Crescent Beach act as a funnel for this wind directing it from the east towards the bay.
  - Temperatures:

<sup>57</sup> The Institute of Environmental Studies 21.

- Water: Mud Bay's seawater is somewhat warmer than the surrounding water "due to the warming effect of a flooding tide over the heated sand flats on a Sunny day".<sup>58</sup>
- Rain & Snow Fall
  - The annual precipitation is approximately 92.18 cm compared to 153 cm in Vancouver.<sup>59</sup>
  - The annual snowfall is approximately 45 mm.
- Odors
  - For the most part the area has no odors due to the flushing from the sea air going towards the inland or from the inland air heading towards the sea. However, every few months, when the agricultural barns are being cleaned the area is known to have a distinctly farm-like manure odor.
- Noise
  - Some traffic noise is heard on the northeastern section of the site due to the 99 Highway that borders the site.
- Sunshine:
  - Mud Bay is situated in the "Sunshine Belt" of British Columbia. The area has more sunshine than Vancouver.
- Growing Season
  - Early to mid March 250-265 days per year
  - Min Frost Free Period: 150 days per year

### **Hydrology & Drainage:**

The Nicomekl Serpentine Watershed is bordered by Whalley and Guildford to the North, Clayton and the Langley-Aldergrove border to the east, and Langley Upland and South Surrey to the South.

### **Natural Springs**

There are "upwellings and artesian water" on Mud Bay's northern shores".<sup>60</sup>

### **Water Tables**

The farmlands have a high water table. There is seasonal ponding of water on the surface. The water table is generally within 1-meter below the surface.

### **Public Drinking Water**

- Esso Gas station & Elgin Heritage Park
- Possible source - Serpentine Fen Park
- Crescent Beach Marina, & Nico Wynd Golf Course - Semi Private

### **Ditches**

- Natural farmland field drainage is generally poor (water table 1m-below surface). Farm fields drained with 1-3 meter wide ditches have generally good drainage. The ditch water gravitates its flow into the Serpentine and Nicomekl Rivers.
- Note the ditches are classified as salmon bearing streams.

### **Dykes**

The Dykes are 3 meters above sea level. They run along the Mud Bay (BNSF rail line), the two rivers (Nicomekl and Serpentine Rivers), and the two highways act as a dyke (99 Highway and King George Highway).<sup>61</sup>

<sup>58</sup> The Institute of Environmental Studies. 22

<sup>59</sup> The Institute of Environmental Studies. 20.

<sup>60</sup> The Institute of Environmental Studies. 21.

## Soil & Vegetation

### Agricultural Soils

The Agricultural soil is well drained humus layer. Soil is black, peaty and organic nature with an overlay of deep alluvial silt. Locally, it is referred to as Ladner Clay: Recent Alluvium showing little profile development. Soil less than 15 cm gray brown to black clay, granular and dense. Soil greater than 15cm to 127cm Grey Clay massive frequency mottled with iron stains. Soil greater than 127 cm Blue Sandy clay.<sup>62</sup>

### Bay Soils

Mud Bay, where the Nicomekl and Serpentine Rivers empty into, has a "foreshore characterized by silty surface conditions, and quicksand in areas where underground streams percolate to the surface".<sup>63</sup>

### Vegetation

- Farmlands are used to grow agricultural crops that are soil
- based such as winter rye, corn etc. that are harvested to help feed the dairy herds on the land.

### Wildlife

#### • Waterfowl

##### ○ Pacific Flyway

- Vital link in the Pacific Flyway (Figure 26): Part of the Fraser River Estuary supporting the largest wintering shorebird and waterfowl populations in Canada.

△ Up to 100,000 waterfowl winter in the Boundary Bay each year and over one million birds use the Boundary Bay area annually during migration.<sup>64</sup>

△ For example: the Alaska Canadian Arctic birds

undertake long flights to and from their breeding areas. These birds need feeding and resting areas. Mud Bay provides this for them.

- Significant Feeding Grounds

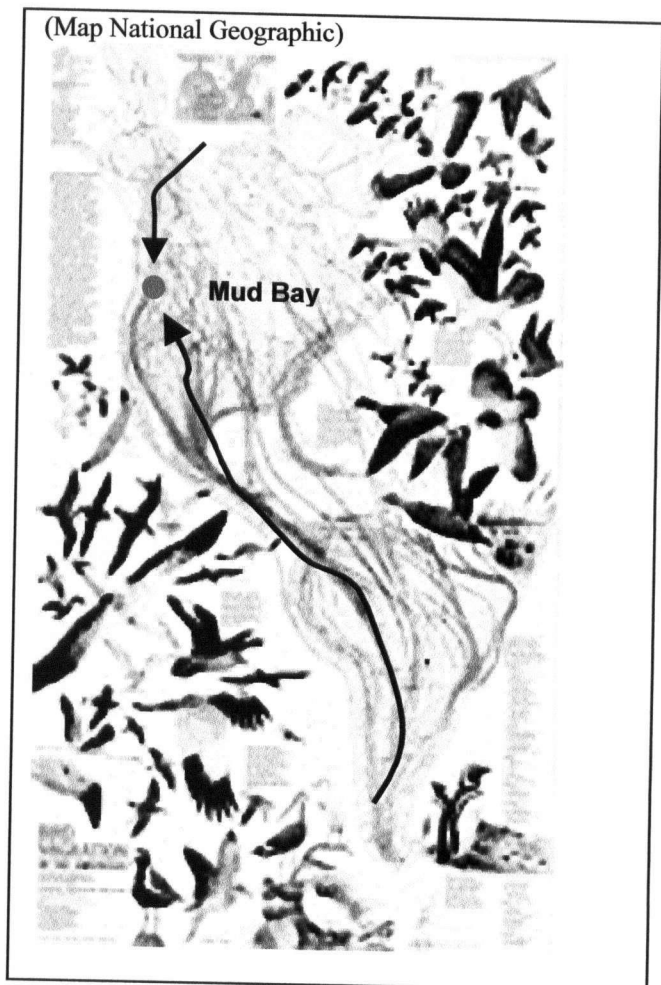


Figure 26 Pacific Flyway Map

<sup>61</sup> John A. Brown. The Historical Geography of South Surrey, British Columbia. A Thesis presented to the Faculty of Western Washington State College. (July 1971). 106.

<sup>62</sup> Surveyor and Chief, Hydrographic Service. Soil Map of the Lower Fraser Valley, Western Sheet. (Experimental Farms Branch, Ottawa, 1938).

<sup>63</sup> Lower Mainland Regional Planning Board. Our Southwestern Shores. (New Westminster: LMRPB September 1968).

<sup>64</sup> Lower Mainland Regional Planning Board. 17



Marsh areas along the shore provide for protection and some nesting, the marine vegetation at the foreshore edge offers an important feeding area, and numerous shore birds feed on the tidal flats. Mud Bay is particularly significant for its sheltered location and as a feeding area (Figure 27).

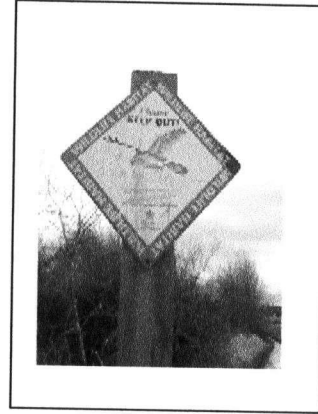


Figure 27 Typical Mud Bay Wildlife Signs

- **Significant Sized Marsh**  
The Mud Bay part of Boundary Bay and the Fraser River Delta foreshores are important because "there are no other big marshes except at Tofino on Vancouver Island" for the Pacific Flyway.<sup>65</sup> Qualicum and Parksville do not support large ducks and other geese species.
- **Bird Viewing**
  - Mud Bay within Boundary Bay hosts 27% of all Lower Mainland foreshore area birds and 40% of all waterfowl birds can be viewed in the area.<sup>66</sup>
  - "Boundary Bay and the many birding sites within this region offer some of the best shore birding in western Canada. At least 47 species of shorebirds, over 30 of them occurring regularly, have been seen in and around Boundary Bay over the years. It also contains much of Canada's vest wintering raptor habitat (all five North American falcons have been found here), large standing gull roosts and huge numbers of wintering waterfowl and other water birds. Its numerous hedgerows, woodlots, sloughs and fallow fields shelter and feed many migrant, wintering and resident passerine species. At least 75 percent of the species on the Vancouver Area Checklist, many of them vagrants, have been seen in the Boundary Bay area."<sup>67</sup>
  - "Birding along the shoreline and the bay is dependent on tidal conditions".<sup>68</sup> The best tides for shorebirds in northern Boundary Bay are 4 m (13ft). Arrive at least 1 to 2 hours before the expected optimum viewing time.<sup>69</sup>
    - **Waterfowl:** "On a sandy or muddy shoreline, most waterfowl are best seen during moderately high tides of 3.7m (12 ft) and higher, although Green-winged Teal and sometimes other dabbling ducks often congregate to feed on tidal flats".<sup>70</sup>
    - **Shorebirds:** "Shorebirds are generally best seen during tides of about 3m (10ft) to 3.8m (12.5ft). During lower tides there is so much exposed mud and sand that shorebirds range over an enormous area. High tides push them near shore, where they can be seen more easily. On the other hand,

<sup>65</sup> The Institute of Environmental Studies. 30.

<sup>66</sup> The Institute of Environmental Studies. 28.

<sup>67</sup> Vancouver Natural Historical Society. 92.

<sup>68</sup> Vancouver Natural Historical Society. 87.

<sup>69</sup> Vancouver Natural Historical Society 71

<sup>70</sup> Vancouver Natural Historical Society. 71.



maximum tides of 4.6m (15ft) or more force shorebirds to other areas that may be inaccessible to birders".<sup>71</sup>

- **Marine Wildlife**

- Shell Fish: Mud Bay and the greater Boundary Bay are known for clams and crabs. "Before the pollution from the Nicomekl-Serpentine Rivers destroyed it, the Bay produced over 50% of the Province's oyster production".<sup>72</sup> Ground fish, sea snails and herring.
- Harbor Seals: There is a large population of harbor seals living in the bay.
- Salmonids: The bay is an important nursery and feeding area for salmonids
- Pacific Herring: Eelgrass beds are extensive and are an important spawning site for Pacific Herring

- **Farm Animals**

- Livestock: Cows, calves, horses, llamas
- Domestic Animals: Farm residents have cats and dogs.

### **Biologically Natural Assets Map**

GVRD map showing important natural assets in the area (Figure 28).<sup>73</sup>

#### **Serpentine River Mouth**

- **Who: Special Habitat:** Includes wildlife licks and sea haul-out areas.
- **Me: Tide flats and Estuaries.** Important areas for marine invertebrates, waterfowl and loafing, marine vegetation, intertidal communities and fishes.
- **Vr: Representative Vegetation:** includes representative zonal forests, sub alpine and alpine areas, representative floodplain forests, and forest parkland

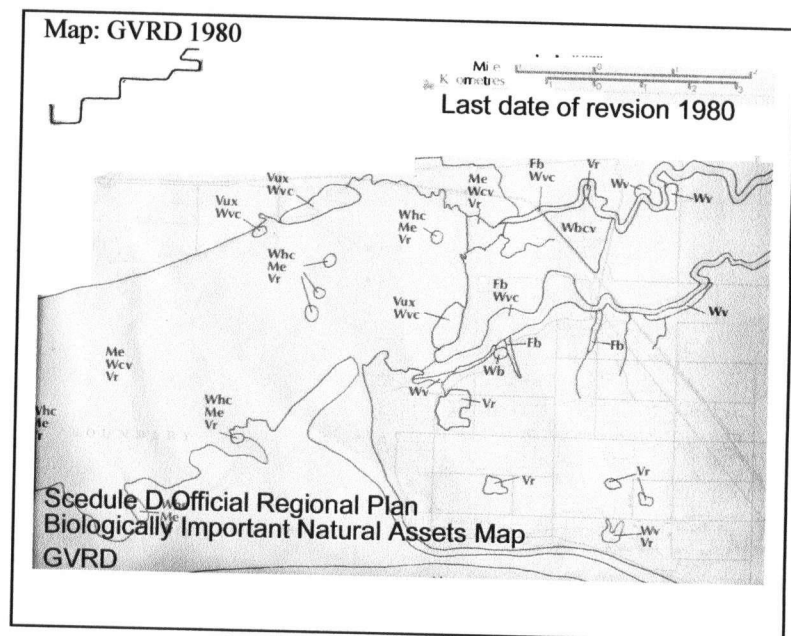


Figure 28 GVRD Biological Assets Map

#### **Serpentine River**

- **Me: Tide Flats and Estuaries.** Important areas for marine invertebrates, waterfowl, feeding and loafing, marine vegetation, intertidal communities and fishes.
- **Wvc: Wildlife Diversity:** Habitats featuring a wide range of wildlife opportunities because of special cover and ecotone effects examples include ravine and shoreline environments and areas with diversity of song birds.
- **Vr: Representative Vegetation:** Includes representative zonal forests, sub alpine and alpine areas, representative floodplain forests, and forest parklands.

<sup>71</sup> Vancouver Natural Historical Society. 71.

<sup>72</sup> Lower Mainland Regional Planning Board. 17.

<sup>73</sup> Greater Vancouver Regional District. Schedule D. Official Regional Plan. Bylaw No 377. Biologically Important Natural Assets Map. Scale 1:50,000 (October 8<sup>th</sup>, 1980).

#### Nicomekl River

- Wvc: Wildlife Diversity: Habitats featuring a wide range of wildlife opportunities because of special cover and ecotone effects examples include ravine and shoreline environments and areas with diversity of song birds.
- Fb: Fish Bearing Habitat: Known streams, rivers, lakes and creeks are important to anadromous and resident fish (water bodies not identified on the map also may be fish bearing habitat). All unlabelled minor tributaries such as creeks are designated Eel Beds.
- Vux: Unique Vegetation: Identifies the occurrence of rare flowers, old growth forests, unique plant communities or unique species.
- Wvc: Wildlife Diversity: Habitats featuring a wide range of wildlife opportunities because of special cover and ecotone effects examples include ravine and shoreline environments and areas with diversity of song birds.

#### **Habitat Zones**

The purpose of this section is to break up the site in to smaller habitat zones and to list the potential wildlife sightings for the zone in one source.

The site was divided into three general habitat zones. (1) Farmland Habitat Zone (Table 1) (2) Nicomekl & Serpentine River Habitat Zone (Table 2) and (Table 3) Mud Bay Habitat Zone (Table 3). Each zone lists the birds and wildlife that potentially could be found in the zone during the listed time periods. The habitat zone list is a summary compiled from several books and pamphlets for the area.

## Habitat Zone

## Farmland:

Grass Lands with various farm buildings. The Mud Bay agricultural land is fairly flat with little slope. It is bordered by dykes on both rivers and the bay. The Mud Bay land is slightly higher than the water line. However, during extremely high tide, if it were not for the dykes the land would be underwater.

## Birds

Common	Name	J	F	M	A	M	J	J	A	S	O	N	D	Wildlife:
Brewer's	Blackbirds	1	1	1	1	1	1	1	1	1	1	1	1	Field Voles
Red-winged	Blackbirds	1	1	1	1	1	1	1	1	1	1	1	1	Fox
Black Capped	Chickadees	1	1	1	1	1	1	1	1	1	1	1	1	Mouse
Brown-headed	Cowbirds			1	1	1	1	1	1					Earthworms
Northwestern	Crows	1	1	1	1	1	1	1	1	1	1	1	1	Salmon
Bald	Eagles	1	1	1									1	Muskrats
Peregrine	Falcon	1	1	1	1	1	1	1	1	1	1	1	1	Plants:
House	Finches	1	1	1	1	1	1	1	1	1	1	1	1	Corn
Purple	Finches	1	1	1	1	1	1	1	1	1	1	1	1	Misc Agricultural Crops
Canada	Geese	1	1	1	1	1	1	1	1	1	1	1	1	Juncus spp rushes
Red-tailed	Hawk	1	1	1	1							1	1	Reed Cannery Grass
Rough legged	Hawk	1	1	1	1							1	1	Sorrel smart weed
Cooper's	Hawk	1	1	1	1	1			1	1	1	1	1	Black Berries
Rufous	Hummingbirds													Himalayan Blackberry
Short-eared	Owl	1	1	1	1	1	1	1	1	1	1	1	1	Mountain Ash Berries
Barn	Owl	1	1	1	1	1	1	1	1	1	1	1	1	Crabapples
Great Horned	Owl	1	1	1	1	1	1	1	1	1	1	1	1	Hawthorns
Ring-necked	Pheasants	1	1	1	1	1	1	1	1	1	1	1	1	
Golden-crowned	Sparrows	1	1	1	1	1				1	1	1	1	
House	Sparrows	1	1	1	1	1	1	1	1	1	1	1	1	
Savannah	Sparrows				1	1	1	1	1	1				
Song	Sparrows	1	1	1	1	1	1	1	1	1	1	1	1	
White Crowned	Sparrows	1	1	1	1	1	1	1	1	1	1	1	1	
	Warblers	1	1	1	1	1	1	1	1	1	1	1	1	
	Woodpeckers	1	1	1	1	1	1	1	1	1	1	1	1	
Downy	Woodpeckers	1	1	1	1	1	1	1	1	1	1	1	1	
	Woodpeckers	1	1	1	1	1	1	1	1	1	1	1	1	
Bewick's	Wrens	1	1	1	1	1	1	1	1	1	1	1	1	

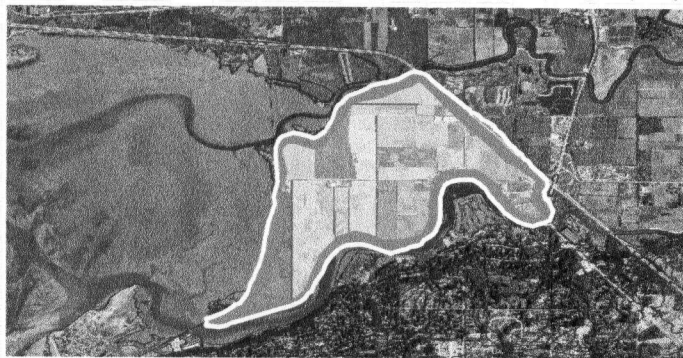


Table 1 Farmland Habitat Zone

Habitat Zone

Nicomekl & Serpentine River:

Both rivers are tidal rivers up to the tidal dam located on the King George Highway. The rivers are slightly polluted from upland sources.

Birds		Wildlife:											
Common	Name	J	F	M	A	M	J	J	A	S	O	N	D
Snow	Bunting											1	1
	Bushtits	1	1	1	1	1	1	1	1	1	1	1	1
Double-crested	Cormorants	1	1	1	1	1	1	1	1	1	1	1	1
	Ducks	1	1	1	1	1	1	1	1	1	1	1	1
	Finches	1	1	1	1	1	1	1	1	1	1	1	1
American	Goldfinches	1	1	1	1	1					1	1	1
Horned	Grebes	1	1	1	1	1					1	1	1
Red-necked	Grebes	1	1	1	1	1					1	1	1
Western	Grebes	1	1	1	1	1			1	1	1	1	1
Bonaparte's	Gulls				1	1			1	1	1	1	1
California	Gulls				1	1	1	1	1	1	1		
Franklin's	Gulls								1	1	1		
Glaucous-winged	Gulls	1	1	1	1	1	1	1	1	1	1	1	1
Mew	Gulls	1	1	1	1	1				1	1	1	1
Ring-billed	Gulls				1	1	1	1	1	1			
Thayer's	Gulls	1	1	1	1						1	1	1
Great Blue	Hérons	1	1	1	1	1	1	1	1	1	1	1	1
Green	Hérons	1	1	1	1	1	1	1	1	1	1	1	1
Lapland	Longspur									1	1		
Bullocks	Orioles					1	1	1	1				
	Robins	1	1	1	1	1	1	1	1	1	1	1	1
Lest	Sandpipers												
Semipalmated	Sandpipers												
Western	Sandpipers												
Northern	Shrike	1	1	1	1						1	1	1
Pine	Siskins	1	1	1	1	1	1	1	1	1	1	1	1
White Crowned	Sparrows	1	1	1	1	1	1	1	1	1	1	1	1
European	Starlings	1	1	1	1	1	1	1	1	1	1	1	1
Barn	Swallows				1	1	1	1	1				
Tree Swallows	Swallows				1	1	1	1	1				
Violet-green	Swallows				1	1	1	1	1				
Caspian	Terns					1	1	1	1				
Yellow	Warblers					1	1	1	1	1			
American	Wigeon	1	1	1	1						1	1	1
Eurasian	Wigeon	1	1	1	1						1	1	1
Common	Yellowthroats			1	1	1	1	1	1	1	1		



Table 2 River Habitat Zone

# Habitat Zone

## Mud Bay:

The bay is mainly made up of a muddy, silty, sand sediment. It can be broken again down into smaller sub units: (1) Lower Tidal Flats (2) Intermediate Tidal Flats (3) High Tidal Flats (4) Salt Marsh and (5) Eel Beds

### Salt Marsh:

The 150 hectare (300 acre) salt marsh is located between the Serpentine and Nicomekl River . It is perhaps the most ecologically important single component in the whole Mud Bay area. The salt marsh is an active cliff about 60cm high. It is above the mean high tide but flooded during the high spring tides and winter storms. Ecological Importance Nutrient material contribution to adjacent waters produce proteins, phosphates, nitrates, sugars, organic matter and calories. Helps support the food chain for clams, oysters, crabs, mish shell fish, and other types of fish. Provides habitat for waterfowl, nesting, feeding, breeding and shelter.

### Eel Beds:

Important nursery and feeding area for salmonids. Eelgrass beds are extensive and are an important spawning site for Pacific Herring

## Birds

## Wildlife:

Common	Name	J	F	M	A	M	J	J	A	S	O	N	D	
Red-winged	BlackBirds	1	1	1	1	1	1	1	1	1	1	1	1	Bull Heads
	Brant					1	1	1	1					Clam
	Buffleheads	1	1	1	1	1	1	1	1	1	1	1	1	Coast Oyster
Snow	Bunting											1	1	Coho Salmon
	Bushtits	1	1	1	1	1	1	1	1	1	1	1	1	Crab
	Canvasbacks	1	1	1	1	1	1	1	1	1	1	1	1	Cut-throat Trout
Black-capped	Chickadees	1	1	1	1	1	1	1	1	1	1	1	1	Herring
Double-crested	Cormorants	1	1	1	1	1	1	1	1	1	1	1	1	Native Olympic Oyster
Pelagic	Cormorants	1	1	1	1	1	1	1	1	1	1	1	1	Pacific Herring
Northwestern	Crows	1	1	1	1	1	1	1	1	1	1	1	1	Salmon
Eastern	Curlews	Rare												Seals
Long-billed	Curlews	Rare												Spring Salmon
														Steal Head



Table 3 Mud Bay Habitat Zone

Habitat Zone	Mud Bay: <i>Continued</i>												
Common	Name	J	F	M	A	M	J	J	A	S	O	N	D
Long-Billed	Dowitchers				1	1		1	1	1	1		
Diving	Ducks	1	1	1	1	1					1	1	1
Long-tailed	Ducks	1	1	1	1	1	1	1	1	1	1	1	1
Long-tailed	Ducks	1	1	1	1	1	1	1	1	1	1	1	1
Bald	Eagles	1	1	1								1	1
Cattle	Egrets										1	1	1
Peregrine	Falcon	1	1	1	1	1	1	1	1	1	1	1	1
House	Finches	1	1	1	1	1	1	1	1	1	1	1	1
Purple	Finches	1	1	1	1	1	1	1	1	1	1	1	1
	Gadwall	1	1	1	1	1	1	1	1	1	1	1	1
Resident Canada	Geese	1	1	1	1	1	1	1	1	1	1	1	1
Black-tailed	Godwits						1	1	1				
Marbled	Godwits						1	1	1				
Barrow's	Goldeneyes	1	1	1	1	1					1	1	1
Common	Goldeneyes	1	1	1	1	1					1	1	1
American	Goldfinches	1	1	1	1	1					1	1	1
Horned	Grebes	1	1	1	1	1					1	1	1
Red-necked	Grebes	1	1	1	1					1	1	1	1
Western	Grebes	1	1	1	1	1			1	1	1	1	1
Bonaparte's	Gulls				1	1			1	1	1	1	
California	Gulls				1	1	1	1	1	1	1		
Franklin's	Gulls								1	1	1		
Glaucous-winged	Gulls	1	1	1	1	1	1	1	1	1	1	1	1
Loafing	Gulls	1	1	1	1	1	1	1	1	1	1	1	1
Mew	Gulls	1	1	1	1	1				1	1	1	1
Ring-billed	Gulls				1	1	1	1	1	1			
Thayer's	Gulls	1	1	1	1						1	1	1
Northern	Harrier	1	1	1	1						1	1	1
Cooper's	Hawk	1	1	1	1	1			1	1	1	1	1
Red-tailed	Hawk	1	1	1	1							1	1
Sharp-shinned	Hawk	1	1	1	1	1	1	1	1	1	1	1	1
Great Blue	Herons	1	1	1	1	1	1	1	1	1	1	1	1
	Killdeer	1	1	1	1	1	1	1	1	1	1	1	1
Lapland	Longspur										1	1	
Common	Loons	1	1	1	1	1					1	1	1
Pacific	Loons				1	1						1	1
Red-throated	Loons	1	1	1	1	1						1	1
Yellow-billed	Loons	1	1	1	1	1					1	1	1
Green-winged Teal	Mallards	1	1	1	1	1	1	1	1	1	1	1	1
Northern Pintails	Mallards	1	1	1	1	1	1	1	1	1	1	1	1
	Mallards	1	1	1	1	1	1	1	1	1	1	1	1
Common	Mergansers	1	1	1	1	1	1	1	1	1	1	1	1
Red-breasted	Mergansers	1	1	1	1	1	1	1	1	1	1	1	1
	Merlin	1	1	1	1	1	1	1	1	1	1	1	1
	Oldsquaw	1	1	1	1						1	1	1

Habitat Zone	Mud Bay: <i>Continued</i>												
Common	Name	J	F	M	A	M	J	J	A	S	O	N	D
Bullocks	Orioles					1	1	1	1				
	Osprey	1	1	1	1	1	1	1	1	1	1	1	1
Barn	Owl	1	1	1	1	1	1	1	1	1	1	1	1
Great Horned	Owl	1	1	1	1	1	1	1	1	1	1	1	1
Northern	Pintails	1	1	1	1					1	1	1	1
Black-Bellied	Plovers	1	1	1	1	1					1	1	1
Semipalmated	Plovers				1	1		1	1				
Snowy	Plovers				1	1	1	1	1				
	Robins	1	1	1	1	1	1	1	1	1	1	1	1
	Sandering	1	1	1	1	1					1	1	1
Least	Sandpipers									1	1		
Semipalmated	Sandpipers				1	1							
Solitary	Sandpipers												
Western	Sandpipers												
Greater	Scaup	1	1	1	1						1	1	1
Lesser	Scaup	1	1	1	1						1	1	1
Black	Scoters	1	1	1	1						1	1	1
Surf	Scoters	1	1	1	1						1	1	1
White-winged	Scoters	1	1	1	1						1	1	1
	Scoters	1	1	1	1						1	1	1
Northern	Shrike	1	1	1	1						1	1	1
Pine	Siskins	1	1	1	1	1	1	1	1	1	1	1	1
Golden-crowned	Sparrows	1	1	1	1	1				1	1	1	1
House	Sparrows	1	1	1	1	1	1	1	1	1	1	1	1
Savannah	Sparrows				1	1	1	1	1	1			
Song	Sparrows	1	1	1	1	1	1	1	1	1	1	1	1
White Crowned	Sparrows	1	1	1	1	1	1	1	1	1	1	1	1
European	Starlings	1	1	1	1	1	1	1	1	1	1	1	1
Little	stints	Rare											
Red-necked	stints	Rare											
Barn	Swallows				1	1	1	1	1				
Tree Swallows	Swallows				1	1	1	1	1				
Viotel-green	Swallows				1	1	1	1	1				
Caspian	Terns					1	1	1	1	1			
Common	Terns					1	1	1	1				
Spotted	Towhees	1	1	1	1	1	1	1	1	1	1	1	1
Orange-crowned	Warblers				1	1	1	1	1	1			
Wilson's	Warblers				1	1	1	1	1	1			
Yellow	Warblers					1	1	1	1	1			
Yellow-rumped	Warblers				1	1	1	1	1	1	1		
American	Wigeon	1	1	1	1					1	1	1	1
Eurasian	Wigeon	1	1	1	1					1	1	1	1
	Willetts	Rare											
	Wrimbrells					1	1	1	1				
Greater	Yellowlegs	1	1	1	1	1	1	1	1	1	1	1	1
Lesser	Yellowlegs	1	1	1	1	1	1	1	1	1	1	1	1
Common	Yellowthroats			1	1	1	1	1	1	1	1		

## 5.5 Cultural Political Inventory

The cultural political inventory is a description and overview of the cultural political inventory features that potentially relate to the Mud Bay Greenway. This includes land ownership, political jurisdictions, land zoning, easements & right of ways, land uses, recreational uses, regional significance, and potential greenway user profiles.

Cultural Political Inventory was gathered from interviews, and data found at the City of Surrey, the GVRD, or Provincial sources.

### Land Ownership

- The project study area consists of approximately 4 square kilometers of land. The major owners are listed in Table 4 Property Ownership. The land is mainly privately and publicly owned. (Figure 29).

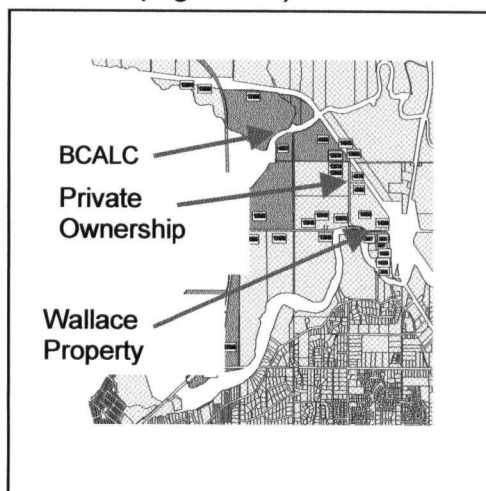


Figure 29 Property Ownership

- BNSF Railway – train track and dyke
- British Columbia Lands Assets and Land Corporation – various properties on site
- Private Land Owners – various properties
- City of Surrey – road right of ways
- Provincial government - inter tidal lands

Table 4 Property Ownership

Address	Street / Ave		Owners
3785	Nicomekl	Rd	Harold Thompson
3927	Rio	Place	Lena Zeeman
3975	40	Ave	Wallace
3977	40	Ave	Wallace
4183	BNSF	Railway	<b>BNSF</b>
4306	140	Street	Kitzel
4370	140	Street	Van Keulen
4440	136	Street	<b>BCALC</b>
4453	136	Street	<b>BCALC</b>
12991	48	Ave	City of Surrey
13030	48	Ave	City of Surrey
13044	32	Ave	<b>BCALC</b>
13168	48	Ave	<b>BCALC</b>
13180	40	Ave	<b>BCALC</b>
13286	40	Ave	Marcan Farms
13476	40	Ave	Marcan Farms
13503	40	Ave	<b>BCALC</b>
13845	40	Ave	Kitzel
13846	40	Ave	Peter Clark
13941	40	Ave	Kitzel
13975	40	Ave	Kitzel
13978	44	Ave	Donia Farms
13979	44	Ave	<b>BCALC</b>
13992	44	Ave	Donia Farms
13996	44	Ave	<b>BCALC</b>
14015	44	Ave	<b>BCALC</b>
14050	40	Ave	James Wallace
14159	40	Ave	Kitzel
14185	Nicomekl	Rd	Hamburg William
14230	Nicomekl	Rd	Hilon Eirmar
14269	40	Ave	Kitzel



- UBC – Wallace property upon bequest.<sup>74</sup>

#### **Jurisdictions**

- General: City of Surrey
- Sewer line: GVRD
- Streams, rivers, and Mud Bay: Ministry of Environment. Department of Fisheries.
- Dykes: Managed by dyking districts<sup>75</sup>
- 99 Highway: BC Ministry of Highways
- Railway: BNSF Railway
- Oceans: Generally to high tide water line.<sup>76</sup>

#### **Zoning, Overlay distances**

- **ALR:** The study area is within the ALR (Agricultural land reserve).
- **General Agriculture Zone:** The area is currently zoned as 'A1' by the City of Surrey for Agriculture and Horticulture. "This zone is intended to accommodate agricultural uses on lots of a minimum size of 2 hectares (5 acres) and to protect agricultural land from the intrusion of uses not compatible with farm operations".<sup>77</sup>
- **Wildlife Management Area:** The bayside tidal and sub tidal lands are recognized as a WMA under the jurisdiction of BC Environment, Ministry of Environment, Lands and Parks.
  - The WMA recognizes significant values for wildlife and habitat and has some opportunities for public recreation and education.
  - According to the crown, the WMA area is comprised of the tidal and sub-tidal lands of Boundary and Mud Bays, from the point where the west side of the bay crosses the 49th Parallel to the point where the east side of the bay crosses the 49th Parallel, together with sections of Crown land on the landward side of the dikes around the Bays and south of Highway 99 and other lands as may be designated by the Lieutenant Governor in Council.<sup>78</sup> Pursuant to subsection 4(4) of the BC Wildlife Act, a person may be authorized under the Act to use land or
  - resources in a wildlife management area for –purposes that are compatible with wildlife management.

#### **Easements, rights-of-way**

- City of Surrey Road Easements (Figure 30)
- Currently the road right of way is not activated by the City of Surrey.
- No public access.
- Road Right of Ways.
  - 136<sup>th</sup> Street
  - 32<sup>nd</sup> Ave

<sup>74</sup> Doug Paterson. UBC Professor. Personal Communication. (March 2002).

<sup>75</sup> City of Surrey. Future 86

<sup>76</sup> Brian Naito. BC Ministry of Fisheries and Oceans. Personal Communication. (January 14<sup>th</sup>, 2001).

<sup>77</sup> City of Surrey Planning Department.

<sup>78</sup> Bill M 202 – 1993 An Act to Establish the Boundary Bay Wildlife Management Areas Schedule 1[Section 1 (2)] Boundary Bay Wildlife Management Area

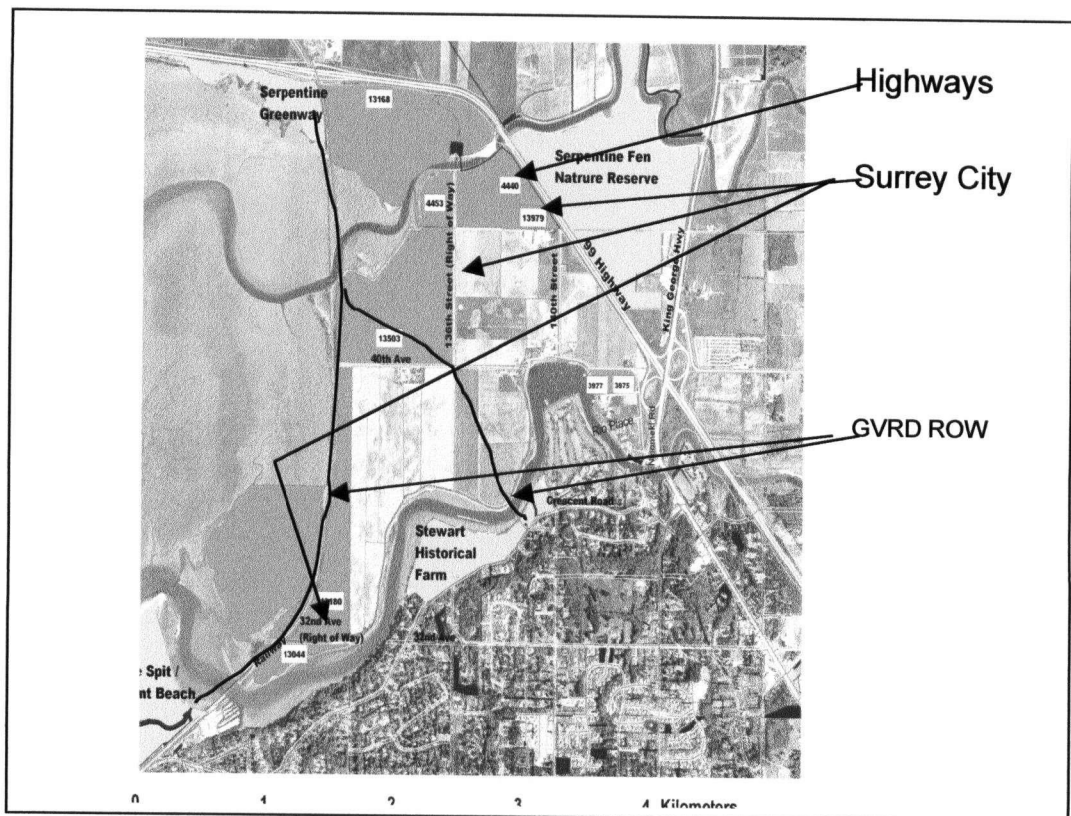


Figure 30 Various Right of Ways

- GVRD South Surrey Interceptor (sewer line)
  - GVRD has maintenance rights.
  - No public access. Public access rights have not been negotiated.
  - Lines
    - Line 1 runs parallel to the dyke
    - Line 2 follows line 1 then cuts across private land to cross Nicomekl River East Of Elgin Heritage Park.
- City Maintenance Path
  - 140<sup>th</sup> Street along 99 Highway to Serpentine River.
  - City of Surrey can access maintenance path to Serpentine River.
  - No public access.
- Highway Maintenance Right of Way.
 

BC Ministry of Highways right of way for Highway 99 is approximately 15 meters from the centerline. The highway fence line is an approximate guess of the right of way.<sup>79</sup>

<sup>79</sup> Glen Callander. Planning Department B.C. Ministry of Highways. Personal Communication (February 8<sup>th</sup>, 2002).

**Land Use** (on and adjacent to the site)

- **Residents:**

The project study area is surrounded by single-family residential users (Figure 31) to the north in Panorama Ridge, to the South Crescent Beach, and to the east South Surrey

- **Agriculture**

- Within the study area there is heavy dairy farming (Figure 32). The two major farms in the area are the Donia Farm and the Kitzel Farm. According to Jean Lamontagne from the City of Surrey, milk produced by these two farms accounts for an estimated 4 out of 10 glasses of milk consumed by Safeway, a grocery chain in the area.

- A GVRD study conducted in 1996, states that Surrey's farmers contribute 31% or \$ 95.4 million dollars of the total yearly farm sales within the GVRD.<sup>80</sup>

- **Recreational Uses**

- The area is bordered by the Serpentine Greenway, Serpentine Nature Reserve, Blackie Spit, Crescent Beach, and The Stewart Historical Farm (Figure 33). This parks and greenways are a popular recreation area for Surrey, Delta, and White Rock residents, but also for people from the entire Lower Mainland. Presently, the side roads 131 A Street where parking is allowed are full of people visiting the area. Bird watching, walking, dog walking, jogging, cycling, horseback riding, picnicking, are just some of the activities observed.

(Dark areas represent heavily housed areas)

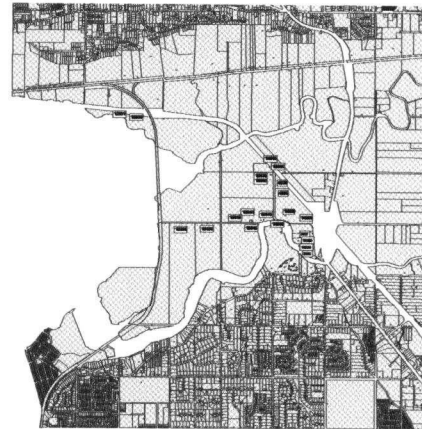


Figure 31 Address Density Map

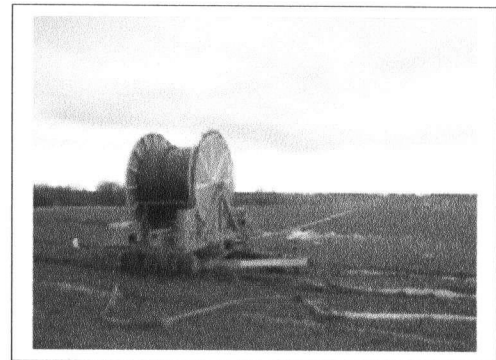


Figure 32 Typical Mud Bay Agricultural Field

<sup>80</sup> GVRD. Managing Outdoor Recreation in Greater Vancouver's Farming Areas: Final Report. (April 1996). 4.

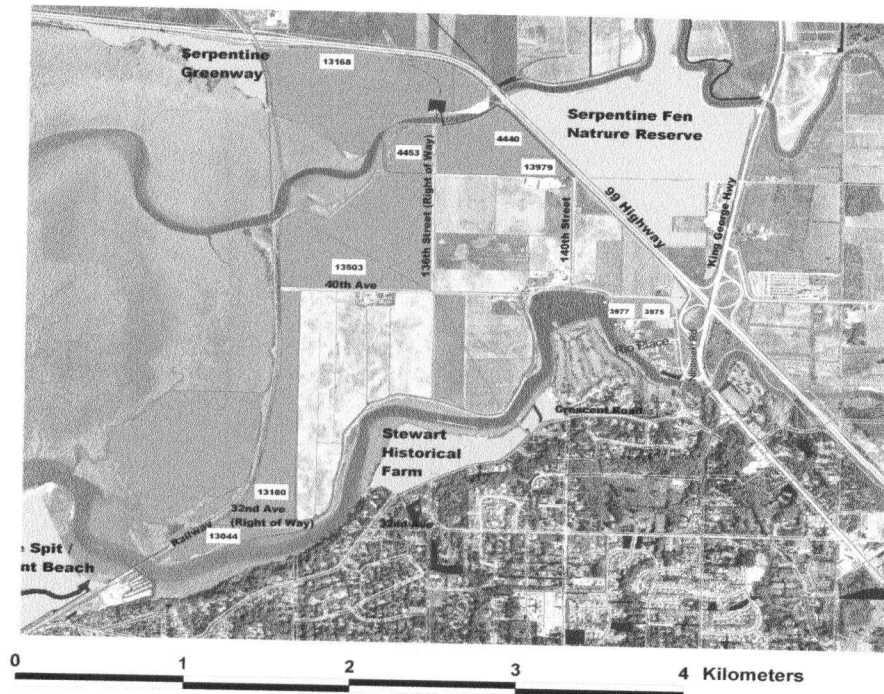


Figure 33 Parks & BCALC Map

### Regional Significance

- The project study area is located adjacent to the Boundary bay salt-water tidal flats in the northeast quadrant. It is also located in the Greater Vancouver Regional District, in what is popularly known as the sunshine belt of the Lower Mainland.
- The development of the site for park purposes will alleviate a growing regional demand for beach related recreation facilities. Additionally, the project study area and adjoining waters of Mud Bay are significant migrating bird habitats.
- Increasing urbanization in the Vancouver Lower mainland will contribute to the importance of the sanctuary quality of the park.

### User Profiles

- No specific user studies have been conducted specifically for the Mud Bay Area. Surrey has conducted studies that found that 74% of those studied had made use of Surrey's waterfront and beaches in the past year. It also found that 64% of those surveyed visited the waterfront beaches at least 2 times per year.<sup>81</sup>

<sup>81</sup> City of Surrey. Future. 32

## 5.6 Cultural Aesthetic Inventory

The object of the cultural aesthetic inventory section is to record the existing landscape views, landscape character units, and a design vocabulary inventory (Figure 34).

Several site visit windshield tests, and brief site visits were made recording the observations and photographs taken from the site. The information was grouped and presented in the cultural aesthetic inventory section. The general limitation of this section is that the site is not accessible in all areas; therefore, the full cultural aesthetic inventory is not recorded.

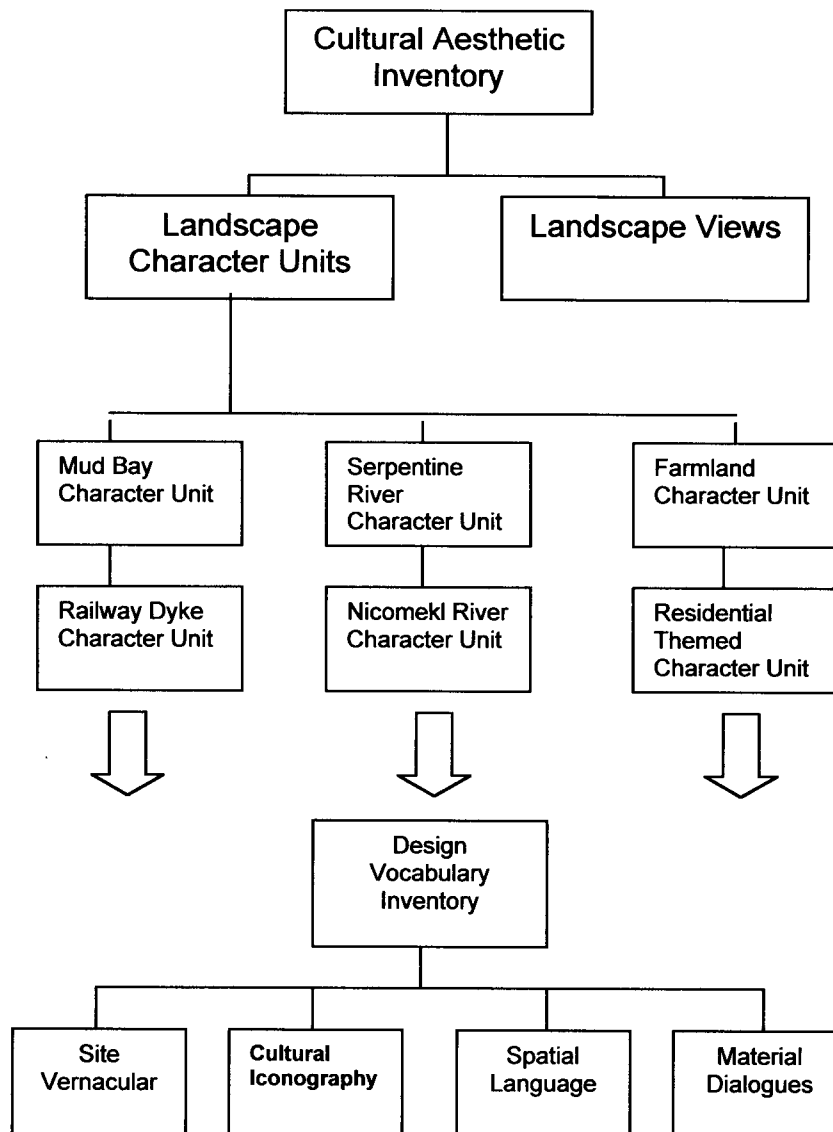
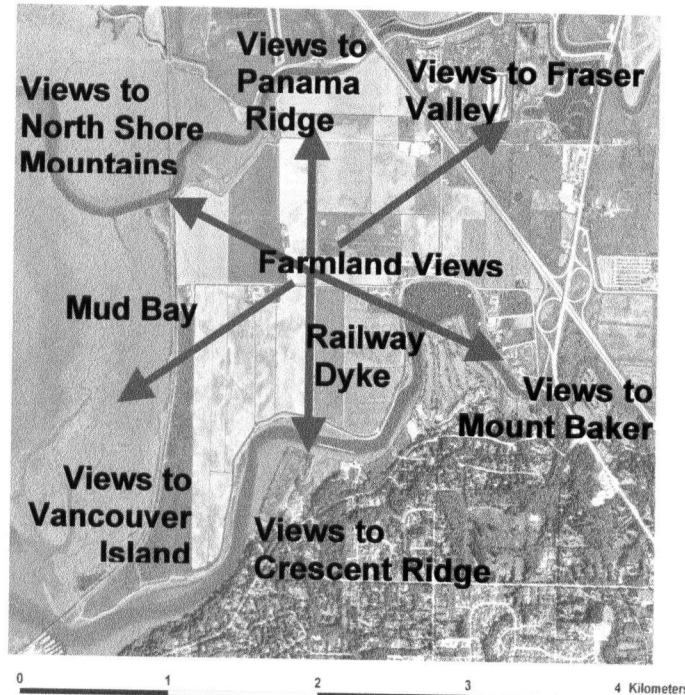


Figure 34 Cultural Aesthetic Inventory Flowchart

## Landscape Views

- General Views

- The project study area is a flat site with minor topographic changes such as dykes and depressions. Orientation is easy to determine when one is in the center of the project area due to the views to the surrounding landscapes (Figure 35).



- Mud Bay View

- Looking out to the Bay from the dyke. The predominant image is water or tidal flats.
  - To the north, views of the mountains and clouds as a backdrop. On a clear day, views to distant landmarks such as Vancouver and the Burnaby Skyline.
  - To the south, the San Juan Islands and Vancouver Island.
  - To the southwest, Point Roberts.
  - To the east, views of Mount Baker and the farm fields.

Figure 35 Landscape Views

## Field Views

In the study area, the dominant images are grassy fields and farm buildings.

Looking outside the study area there are the South Surrey and Panama Ridge escarpments that are on the north and south sides.

Looking towards Mud Bay from the field one does not get the sense that there is a bay; instead there are views to the small rises in topography such as the dykes.

### Experiential

An earlier study records the experiential views as: "The very flatness of the land leads the viewer to the same appreciation of the sky in all its moods and seasons which was felt by the painters of the Dutch school. Unlike Holland, we have here back drops of mountains or bulky islands in every direction".<sup>82</sup>

<sup>82</sup> The Institute of Environmental Sciences 10.



## Landscape Character Units

The existing character of spaces and places was assessed within the Surrey Mud Bay Study area for the purpose of identifying areas unique to the community's sense of place. General discussions with residents and tourists, examining biophysical data, aerial photography, current and historic land use data, and a windshield survey was conducted in January to February 2002. The Surrey Mud Bay area was divided into six character units: Farmland, Residential, Mud Bay, Railway Dyke, Nicomekl River, and Serpentine River Character Units (Figure 36). Each character "unit" possesses a unique set of characteristics. Figure 37 conceptualizes some of these unique characteristics. Using this data, a picture of the existing "essence of Mud Bay" was developed.

- Criteria used to delineate and evaluate the six character units
  1. Slope
  2. Water Features (type of feature, river, bay, ditch or pond)
  3. Vegetation
  4. Spatial Organization
  5. Movement (type of transportation: vehicle, pedestrian, bicycle etc)
  6. Internal views (views that can be only seen within the site)
  7. External Views (views that can be seen outside the site)
  8. Average Lot Size
  9. Land Use
  10. Built Form
  11. Cultural and Heritage (Valued icons/landmarks)

The following is a brief description of the six identified landscape character units.

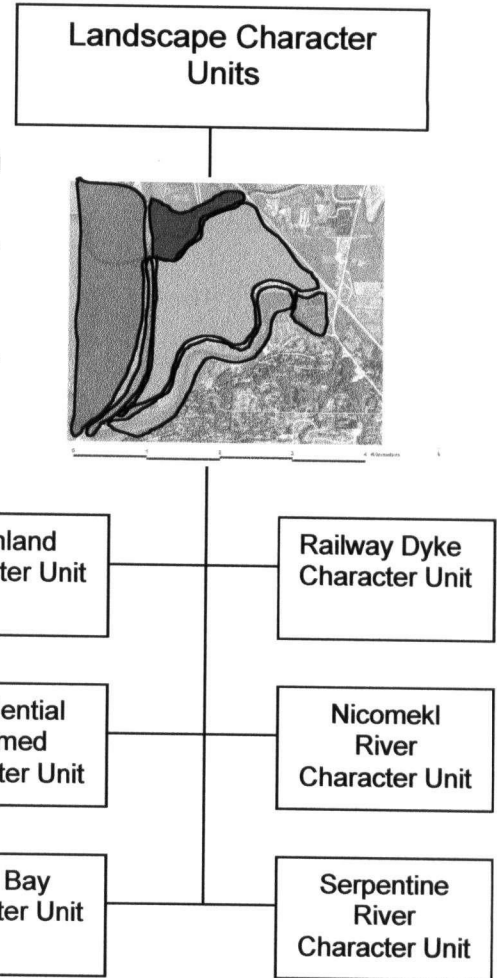


Figure 36 Landscape Character Units

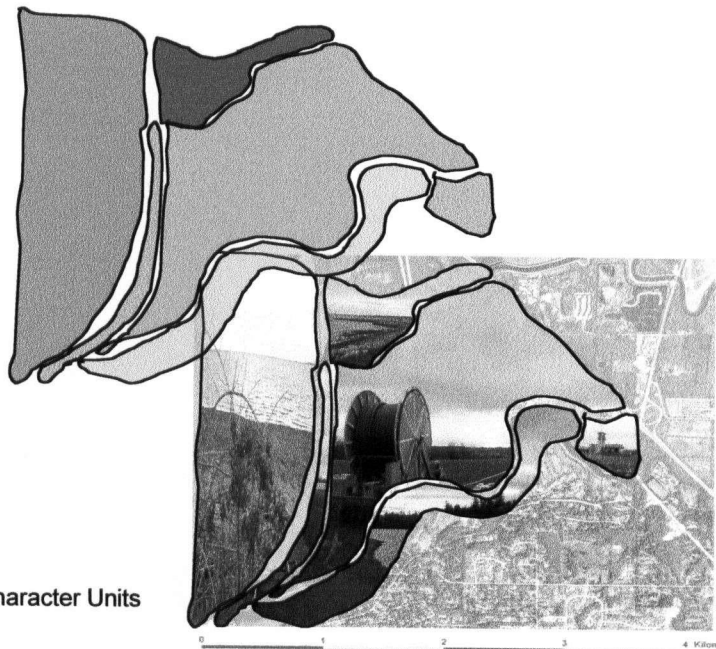


Figure 37 Revealing the 6 Landscape Character Units

## The Farm Belt

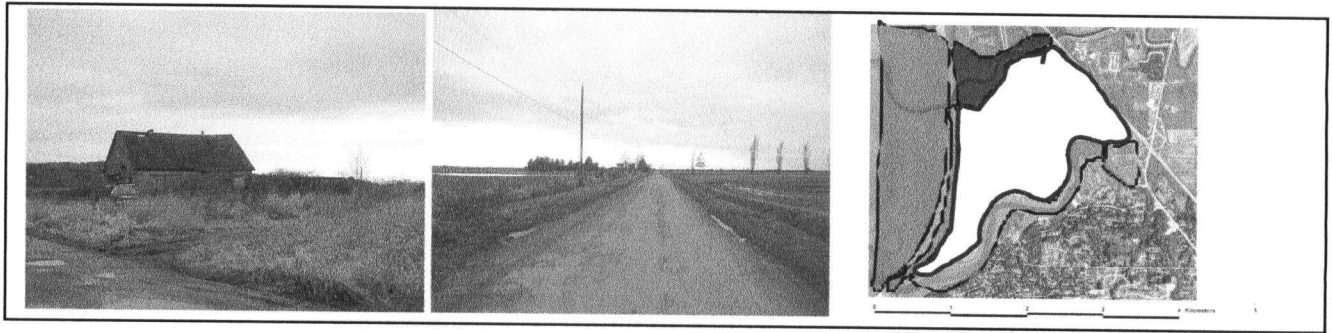


Figure 38 Farm Belt Landscape Character

Slope: Flat to minimal slope

Water Features: Ditches that run along the road or in the farm fields.

Vegetation: Agricultural crops, soil based, usually for feeding livestock.

Spatial Organization:

- Open fields
- Minimum visual buffering of properties from roadways and from surrounding properties

Movement: Grid roads with little or no shoulder, use by agricultural vehicles or local traffic only

Internal Views: Views to open agricultural fields and farm buildings.

External Views:

- Views to Mt Baker, Crescent Road escarpment, Panama Ridge North Shore Mountains.
- Views to Donia Farm prominent from 99 Highway

Lot Size: 5-100+ acreages that spread out from the roadway towards Mud Bay

Land Use: Agriculture

Built Form: Vernacular farm buildings and houses

Cultural and Heritage:

- John Weaver heritage house on 40<sup>th</sup> Ave Surrey
- Orange painted Donia Farm Buildings with white picket fences on 140<sup>th</sup> Street

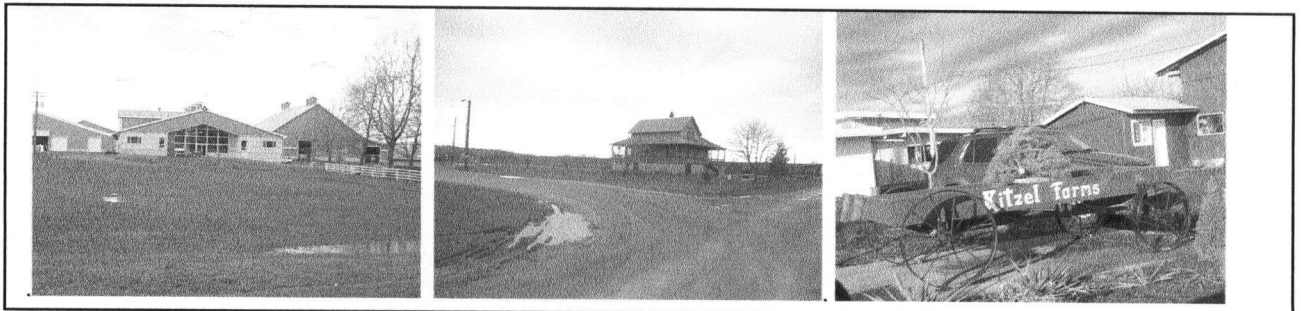


Figure 39 Farm Belt Character Unit



## Residential Themed Character

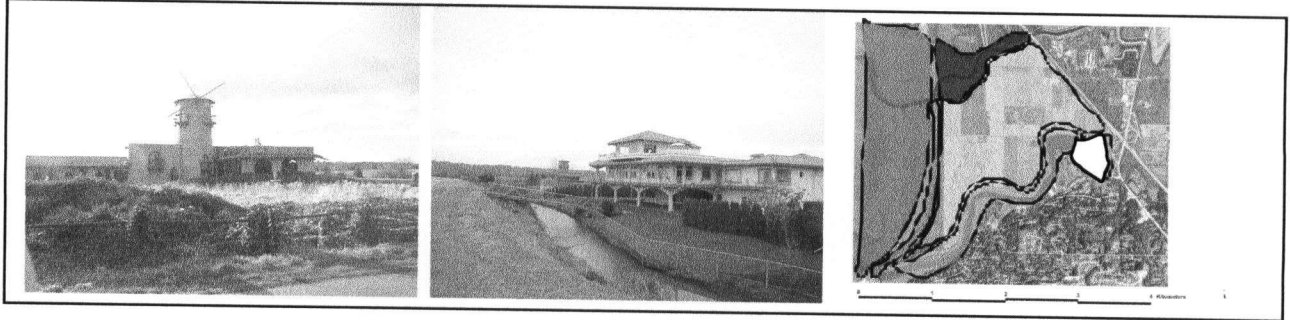


Figure 40 Residential Landscape Character

**Slope:** Flat to minimal slope

**Water Features:** Ditches that run along the road.

**Vegetation:** Open Fields with ornamental landscaping.

**Spatial Organization:**

- Enclosed yards with fences and vegetation.
- Medium visual buffering of properties from roadways and other properties

**Movement:**

- Local traffic, cul-de-sacs (with shoulder), single lane road
- Grid roads with little or no shoulder, use by agricultural vehicles or local traffic only

**Internal Views:** Views to tennis courts, open agricultural fields and farm buildings.

**External Views:**

- Views to Mt Baker, Crescent Road escarpment, Panama Ridge, North Shore Mountains.
- Views to Spanish windmill and prominent from 99 Highway, King George, and Elgin.

**Lot Size:** 5+ acreages that spread out from the roadway towards Mud Bay

**Land Use:** Corrals, large residences, recreation (tennis courts)

**Built Form:**

- Spanish style buildings and houses
- Formal fences and gates around property perimeter

**Cultural and Heritage:**

- James Wallace House (Windmill) on 40<sup>th</sup> Ave. Highly visible views from major roads
- Two other Mediterranean style houses on Rio Place

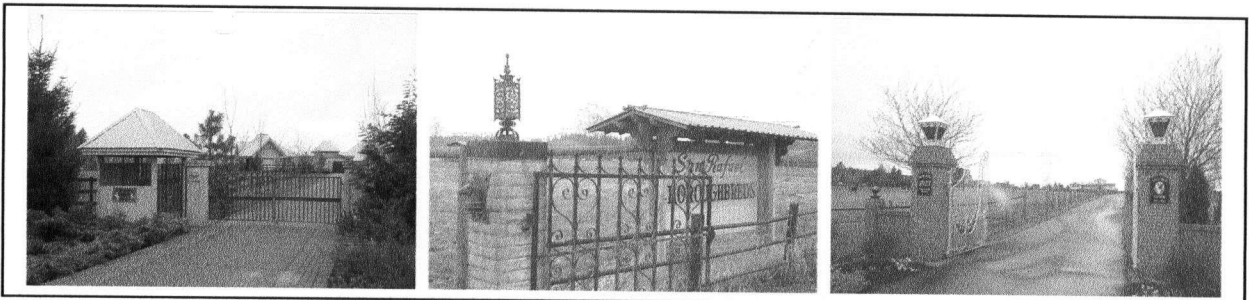


Figure 41 Residential Character Unit

## Mud Bay Shores

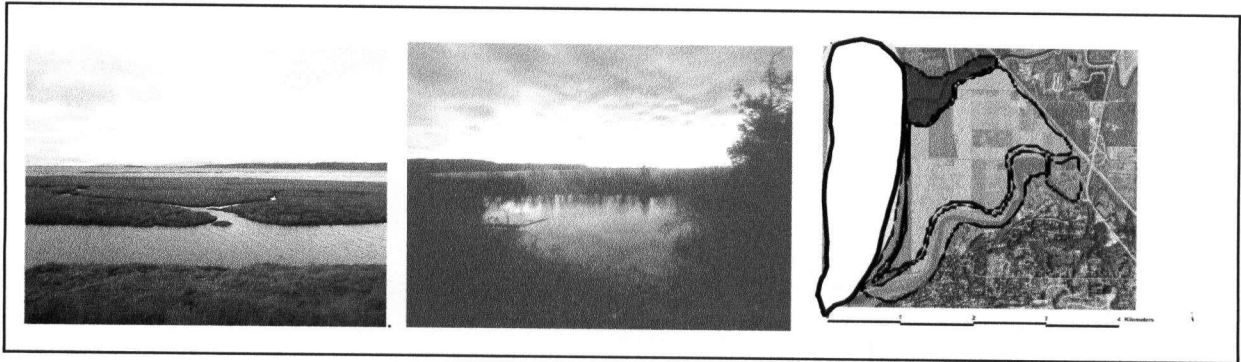


Figure 42 Mud Bay Character Unit

Slope: Little slope.

Water Features: Mud Bay tidal flats & Boundary Bay

Vegetation: At low tide the sand and mud flats extend up to 2 km (1.2m) south of the dike. Opening large feeding and roosting areas for waterfowl, gulls and shorebirds. The remnant salt marsh forms a fringe between the high-water mark and the dyke

Spatial Organization: Open muddy tidal flats

Movement: Shore Birds.

Internal Views: Views to the mud flats.

External Views:

- Looking out towards the Boundary Bay from the dyke. The predominant image is water or tide flats. To the north views of the mountains and clouds as a backdrop. To the south Blackie Spit, San Juan Islands and Vancouver Island. To the southwest Point Roberts.
- Looking towards the Railway dyke (east) views of Mount Baker and railway dyke.

Lot Size: N/A

Land Use: Natural bay used by birds. Bay plays an important role for the Pacific Flyway.

Built Form:

- Railway dyke
- No built form in bay.

Cultural and Heritage: Open, naturalistic bay.

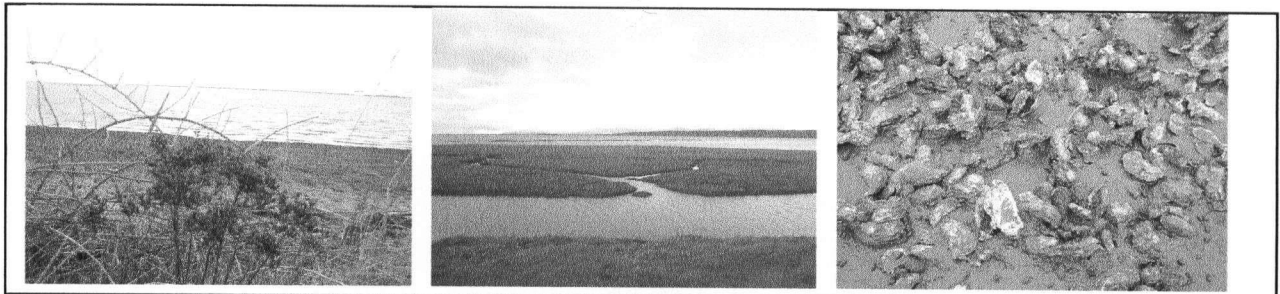


Figure 43 Mud Bay Character Unit

## Mud Bay Railway Dyke



Figure 44 Railway Character Unit

**Slope:** Top of dyke flat. Sides of dyke 2:1 slope on each side.

**Water Features:**

- Ditches that run along the dyke
- Mud Bay on western side of dyke

**Vegetation:** Wild shrubs and grasses.

**Spatial Organization:**

- Waterside: Open muddy tidal flats
- Lands end: Open fields. No visual buffering of dyke from open fields

**Movement:**

- Train traffic on railway line.
- Trespassing pedestrians walking on tracks.

**Internal Views:** Views to along north and south railway line.

**External Views:**

- Looking out to the Bay from the dyke. The predominant image is water or tide flats. To the north views of the mountains and clouds as a backdrop. On a clear day views to distant landmarks such as Vancouver and the Burnaby Skyline. To the south Blackie Spit, San Juan Islands and Vancouver Island. To the southwest Point Roberts.
- Looking towards the farm belt (east) views Mount Baker and the open farm fields.

**Lot Size:** Long narrow rail corridor

**Land Use:** Rail corridor

**Built Form:** Railway line and rock dyke. Railway swing bridge (Nicomekl) and wooden trestle bridge (Serpentine)

**Cultural and Heritage:**

- Nicomekl Swing Bridge
- Serpentine trestle Bridge



Figure 45 Railway Character Unit

## Nicomekl River Dyke



Figure 46 Nicomekl River Dyke Character Unit

### Slope:

Top of dyke flat; sides of dyke approximately 2:1 slope.

Water Features: Nicomekl River.

Vegetation: Small wild shrubs and grass along dyke.

Spatial Organization: Dykes and bordered by fences:

### Movement:

- Sail Boats, motorboats, and canoes, sea kayaks along river.
- Pedestrians along dyke.
- Occasional maintenance vehicle on top of dyke.

### Internal Views:

Views to river channel and boat docks.

### External Views:

- Views to Crescent Road escarpment, Panama Ridge, North Shore Mountains.
- Views to Spanish style houses, Farm fields, Elgin Heritage Park, Crescent Marina, and Nicomekl Railway Bridge.

Lot Size: Top of Dyke 6-8 meters. Entire dyke 20-30 meters wide

Land Use: Dyke

Built Form: Boat Houses, boat docks, and fences. & Gravel dyke.

### Cultural and Heritage:

- Crescent Beach Swim House (moved from Crescent Beach to the safe waters of the Nicomekl River for the winter.
- Crescent Beach Marina.
- Nicomekl Railway Bridge
- Nicomekl Tidal Dam

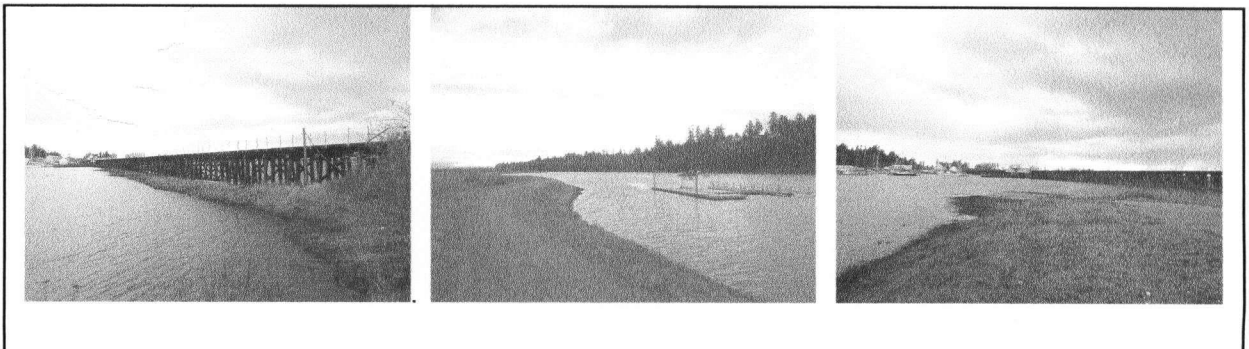


Figure 47 Nicomekl River Character Unit

## Serpentine River Dyke

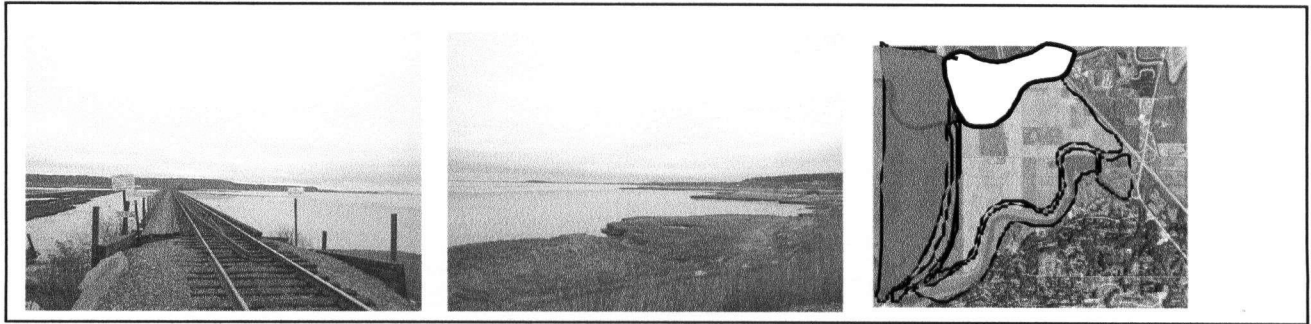


Figure 48 Serpentine River Dyke Character Unit

**Slope:** Top of dyke flat; sides of dyke approximately 2:1 slope.

**Water Features:** Serpentine River.

**Vegetation:** Small wild shrubs and grass along dyke.

**Spatial Organization:** Dyke (Note no fence border)

**Movement:**

- Occasional canoes, sea kayaks along river.
- Pedestrians along dyke across river.
- Occasional maintenance vehicle on top of dyke.

**Internal Views:** Views to river channel

**External Views:**

- Views to Crescent Road escarpment, Panama Ridge, Mount Baker, San Juan Islands, Point Roberts.
- Views to Serpentine Railway Bridge, pumping station, 99 Highway, farm fields and wood lot.

**Lot Size:** Dyke width 25 meters and 3-4 meters high.

**Land Use:** Dyke

**Built Form:** Serpentine wooden Railway Bridge. & Gravel dyke.

**Cultural and Heritage:**

- Serpentine Wooden Railway Bridge.
- Old wooden river pilings reminisce of old river dam.

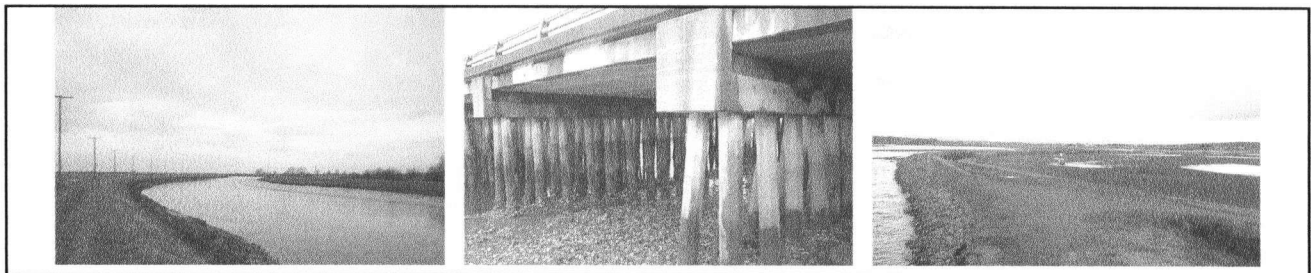


Figure 49 Serpentine River Character River Unit



## Design Vocabulary Inventory

The objective of this section is to record the site's design vocabulary. Later in the design cycle this inventory could be used to suggest structural types, materials, and textures.

The design vocabulary was created by examining the site vernacular and cultural iconography, along with material dialogues in reference to the landscape character unit section (Figure 50). (See landscape character units for a discussion on the character units.)

## Design Language

- A design vocabulary is used to create a narrative that speaks of a particular place's ideals, conventions, myths, that make it distinctive from another place.<sup>83</sup> It incorporates both local and universal elements. Together they form tell the story of the people and the land.

- The use of these elements helps express the region and people's identity instead of using them as naïve and romantic reproductions.<sup>84</sup> In this manner, attention is drawn to distinctive

regional qualities by using them in nontraditional ways. This is the function of critical regionalism with the essential features being that the unified elements express the past and the future and create a strong sense of place.

•

The following section is broken down into site vernacular, cultural iconography, spatial language, and material dialogues.

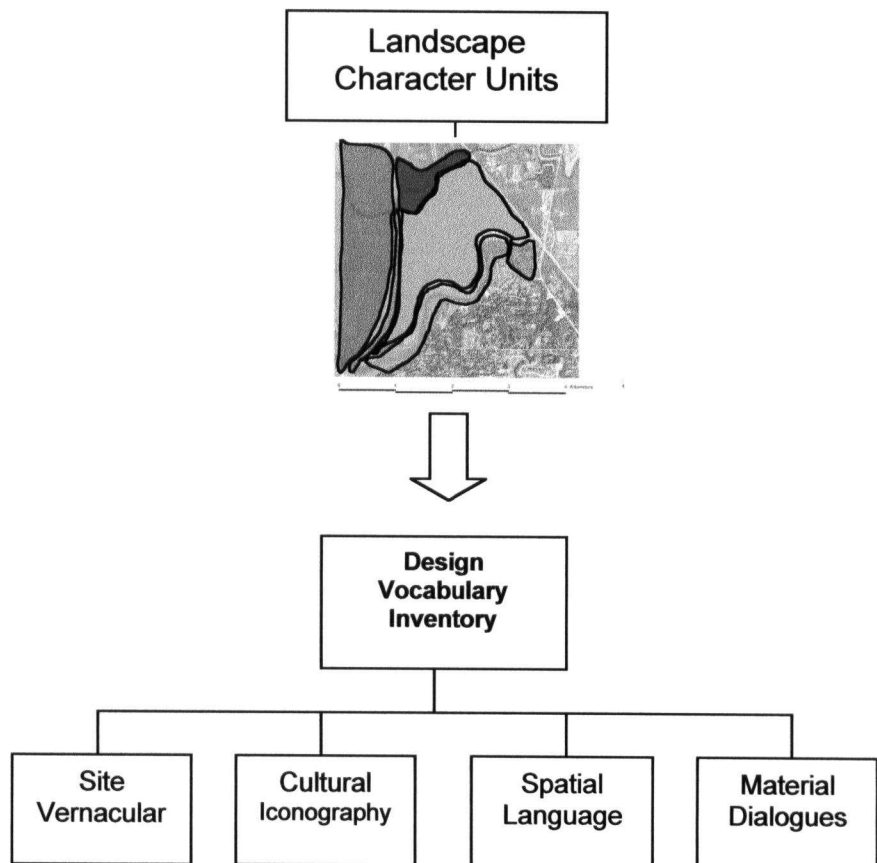


Figure 50 Design Vocabulary Inventory Rationale

<sup>83</sup> J. Bowring and S.R. Swanfield. 'The Happy Colony' design ideals and conventions in a postcolonial culture. Landscape Architecture between Utopia and Convention: European Conference of Landscape Architecture Schools Annual Meeting. Berlin 23-24 (September 1999).

<sup>84</sup> K. Frampton. "Towards a Critical Regionalism: Six Policies for an Architecture of Resistance," The anti-aesthetic essays on postmodern culture. ed. H. Foster (Port Townsend, Washington: Bay Press, 1983).

## Site Vernacular

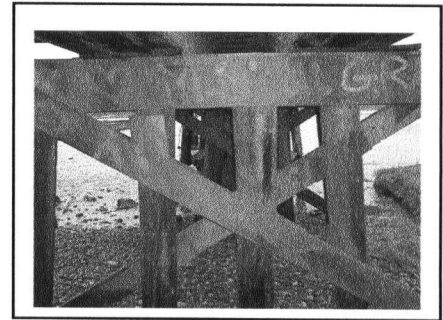
- Site vernacular are the area's characteristic elements. They can be either identified by the designer or by local residents through observation or experience.
- Water Sculpted Landforms: (Figure 51)- The dramatic form where water meets land and where the ocean and the river meet. It determined where the birds and the settlers located. (Mud Bay, Nicomekl, & Serpentine River Character Units)

Figure 51 Water Sculpted Landforms



- Pilings: Remnants of early settlers efforts, the dam, the docks, the bridges - Figure 52. (Mud Bay, Railway, Nicomekl & Serpentine River Character Units)

Figure 52 Pilings



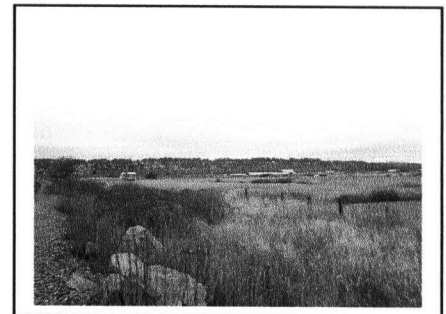
- Mud: Indicative of the forces or elements that move the mud, the physical elements such as the river and tide, or the legends such as the 'underground rivers' - Figure 53. (Farm Belt, Mud Bay, Nicomekl, & Serpentine River Character Units)

Figure 53 Mud Bay Mud



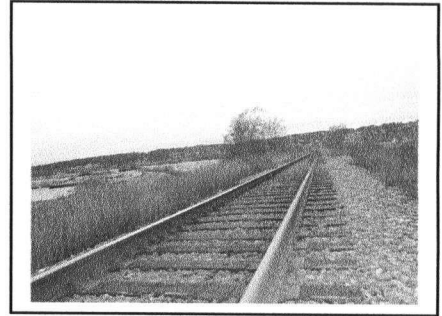
- Earth & Gravel Berms / Dykes: Indicative of the way early settlers battled and conquered the land against forces such as floods and high tides - Figure 54. (Farm Belt, Residential Themed, Mud Bay, Railway, Nicomekl, & Serpentine River Character Units)

Figure 54 Earth & Gravel Berm



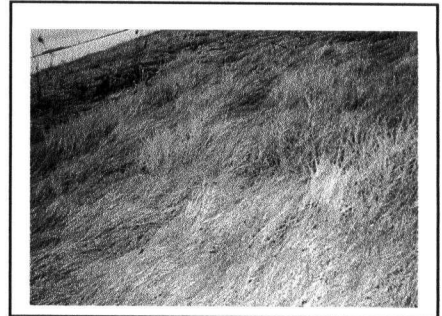
- Steel: Indicative of industrial movement as the railway goes through the site. It provides movement for people.- Figure 55. (Railway, Character Unit)

Figure 55 Steel



- Grasslands - Figure 56: Indicative of the flat fields that are in the area. Yet showing how fragile it is within the urban environment. (Farm Belt Character Unit)

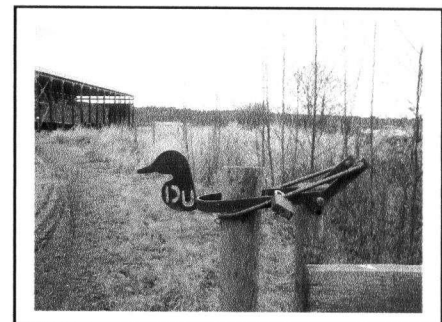
Figure 56 Grasslands



### Cultural Iconography

- Cultural iconography is the area's residents unique expressions evident in art, construction, and ritual.
- Birds - **Error! Reference source not found.:** Symbolize the annual ritual of returning to the area. The area has many birds that help give the area its identity. The birds use the area as a stop over on the Pacific Flyway. (Farm Belt, Residential Themed, Mud Bay, Railway, Nicomekl, & Serpentine River Character Units)

Figure 57 Bird symbols



- Windmills – Figure 58 WindmillsThe large windmill located on the Wallace property symbolizes that there is a relationship with the lowlands, water and the people who live there. They all must be in balance to coexist together. (Residential Themed Character Unit)

Figure 58 Windmills



- Veranda - Figure 59: Symbols of when the time was simpler and people would visit one another or one would simply enjoy the day. (Farm Belt Character Unit)

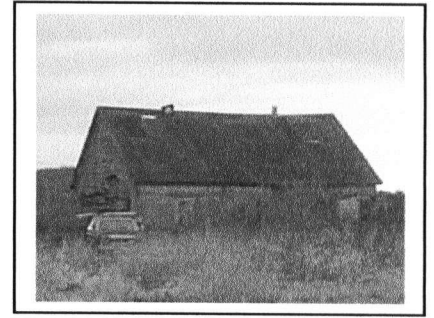
Figure 59 Veranda





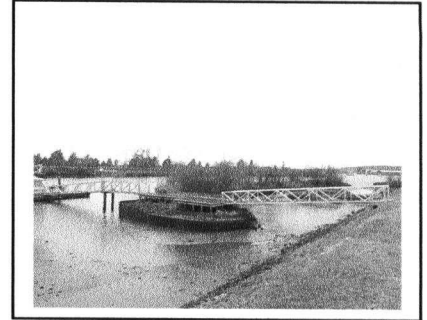
- Tall Roofed Barns - Figure 60: Symbolizes the need to store the food grown for the winter for the farm animals or for the farm family. (Farm Belt Character Unit)

Figure 60 Barns



- Bridges - Figure 61: Symbolizes the linking or joining of land. The bridges are needed for people to get from one side to the other. (Residential Themed, Railway, Nicomekl, & Serpentine River Character Units)

Figure 61 Bridges



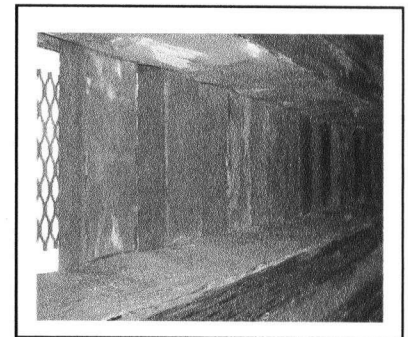
- Harvesting - Figure 62: Symbolizes the harvest from the land. The stewardship involved in caring for the land in order to harvest it.

Figure 62 Harvesting Fields



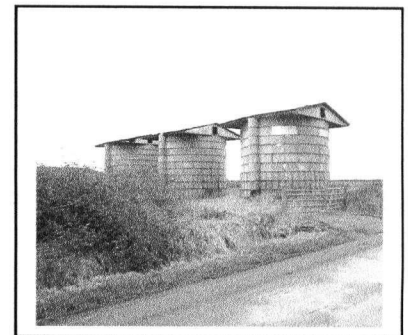
- Post & Beam Construction - Figure 63: Symbolizes the construction of barns and the community that participated in the barn raising. (Farm Belt, Railway, Nicomekl & Serpentine River Character Units)

Figure 63 Post & Beam Construction



- Tin - Figure 64: Indicative of farming as it goes through the site, it provides shelter for people and animals throughout the site. (Farm Belt Character Unit)

Figure 64 Tin



## Spatial Language

- Spatial language is a historic and contemporary spatial organizing tool used to transform elements from materials to form and space.
- Allee - Figure 65: Trees planted in parallel rows in large landscapes provide direction to destinations. Axes form providing a hierarchy of circulation as well as destination points. (Residential Themed Character Unit)

Figure 65 Allee



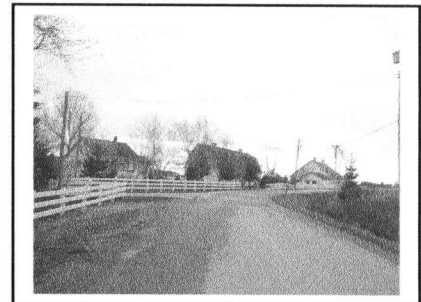
- Street Trees - Figure 66: Street or boulevards lined with trees and area boundaries provide a transition zone from fast to slow, loud to quiet, or from one type of land use to another.)

Figure 66 Street trees



- Orchard - Figure 67: Transforms natural randomness into meaningful formal order. The grid arrangement of elements provides sacred spaces and spatial comfort. The farmers traditionally valued in giving their farm order. (Farm Belt & Residential Themed Character Units)

Figure 67 Formal Order

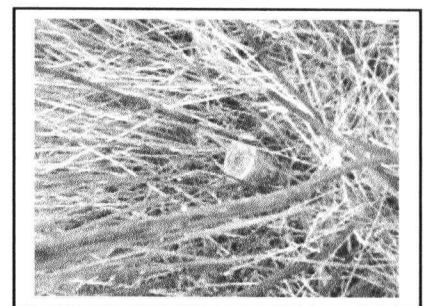


## Material Dialogues

Materials that are in contrast are used to highlight interpretive information. The contrast emphasizes each elements expression and when combined a stronger meaning occurs.

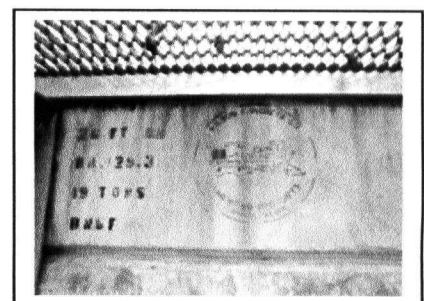
- Grass & Garbage - Figure 68: Represents a fragile environment within a growing urban population.

Figure 68 Grass & Garbage



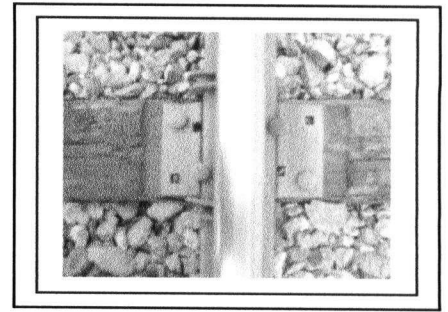
- Steel and Concrete - Figure 69: Represent how man has tried to control nature's waterways through dams.

Figure 69 Steel & Concrete



- Steel and Wood - Figure 70: Represents the harvesting of natural resources and the combination of them allowing man to attain higher goals such as speedy rail transportation.

Figure 70 Steel & Wood



## 5.7 Significant Historical Activity

The intention of this section is to bring together some of the local Mud Bay history in one document. For a more in depth history of the area see the actual source from where the passage originated.

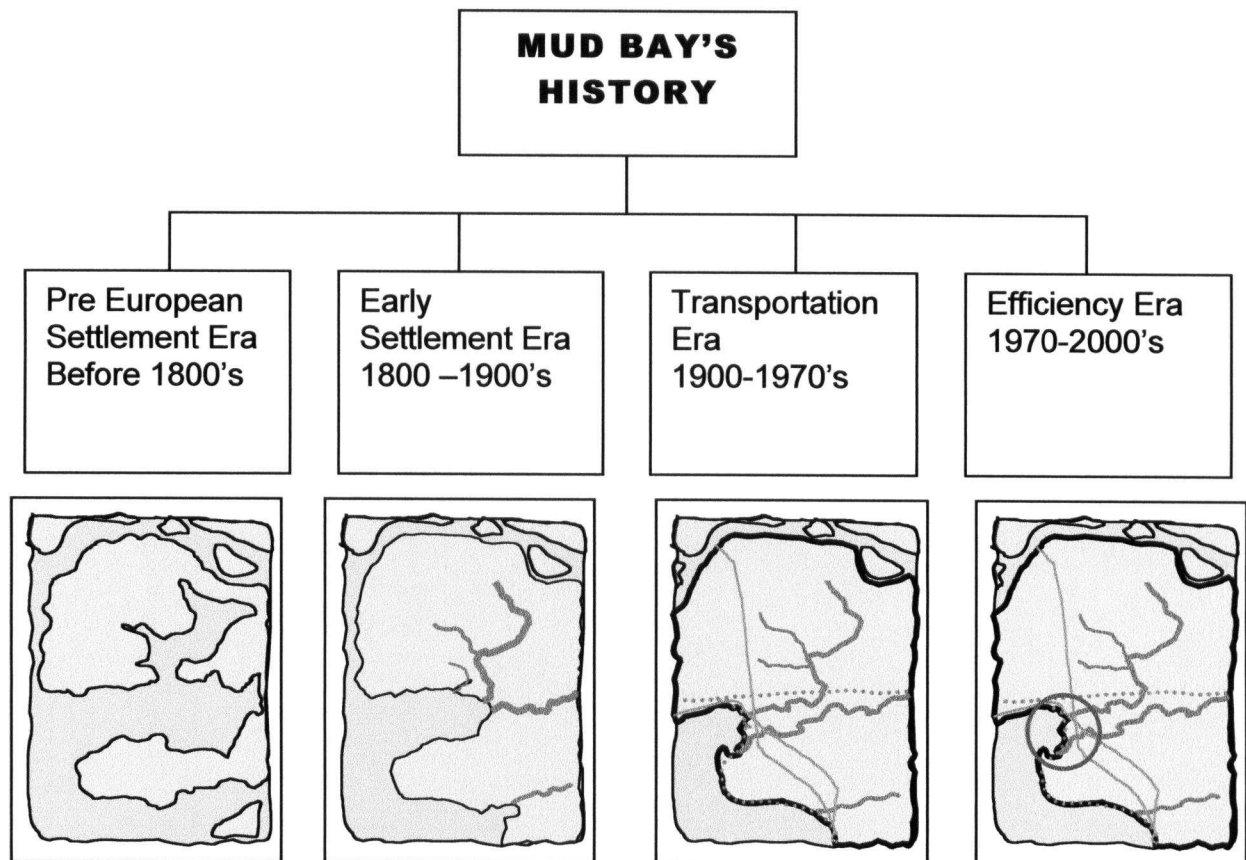
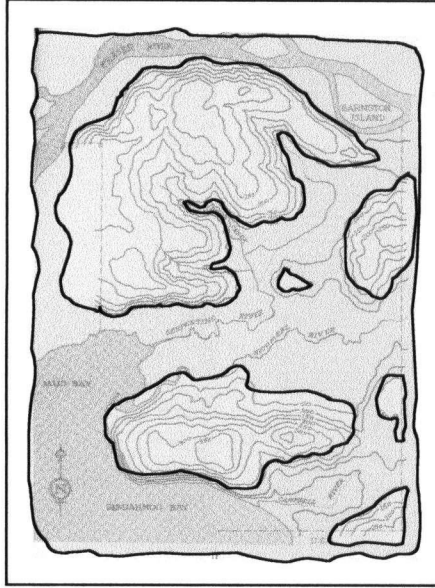


Figure 71 Mud Bay History Flowchart

The Mud Bay history information in this section is a compilation of notes taken from several sources (see bibliography – History). With the exception of the 'Mud Bay's History Maps' (Figure 71), the pictures and photos from this section are contributed by these various authors. The maps are derived from natural history accounts of the time periods. The purpose of showing the maps is to demonstrate the changing landform.

The Mud Bay's historical notes were broken down into four significant time periods that relate to the changing landscape. These time periods demonstrate how the land was changed from a natural draining landform to a highly engineered one. The four time periods are Pre-European Settlement, Era (Before 1800's), Early Settlement Era (1800-1900's), Transportation Era (1900-1970's), and Efficiency Era (1970-2000's).

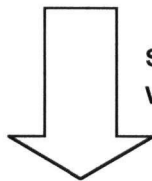
## Pre-European Settlement (Before 1800's)



In this period, the land is shaped and the inhabitants coexist with the land. The First Nations are in harmony with the land. Their actions do not have much impact on the land.

### The Formation

The area is completely covered with water at the end of the ice age. Then, as the transformation begins, Mud Bay, which lies in the northern part of Boundary Bay, was formerly the active south side of the Fraser Delta.<sup>85</sup> The river and tidal flows encouraged the accumulation of mud sediment in the Bay. The Nicomekl and Serpentine Rivers brought sediment from the uplands. The ocean tides transported the sand erosion of the Ocean Park wave-cut cliffs and it carried in the suspended sediment load brought into the area



by tides and currents. These processes helped form the bay's soil into a muddy silty sand. During high winter tides and spring runoff, the entire lowlands would become flooded. According to some of the first settlers, the study area was a blueberry and hardhack marsh

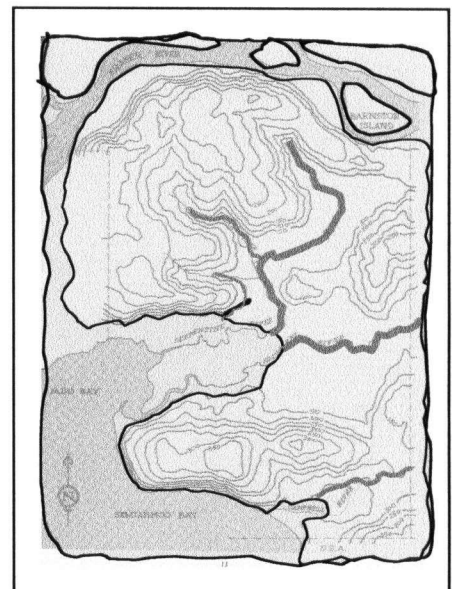
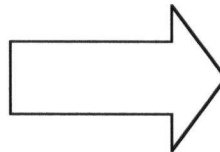
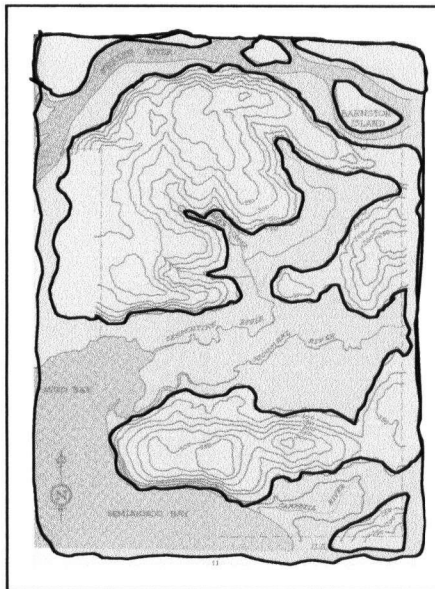


Figure 72 Mud Bay Pre European Settlement

("Brush as high as a man, stems like a pencil or a little bigger. It grew as thick as hair on a dog's back – impossible to walk through. The wood was hard as blazes".<sup>86</sup>

<sup>85</sup> The Institute of Environmental 20.

<sup>86</sup> G. Fern Treleaven. The Surrey Story. (Surrey: Surrey Museum & Historical Society, 1978). 12



## • The First Nations

The Snohomish First Nations and later the Semiahmoo Nation used to set up temporary summer camps at Crescent Beach near the mouth of the Nicomekl River.<sup>87</sup> The area had first been Snohomish territory until a smallpox epidemic wiped out the group and the Semiahmoo Nation took over their territory. Each summer, the people would hunt and fish in the area.<sup>88</sup> A barrier was located at the mouth of the Nicomekl River (Nau-ko-mehlk Creek) for fishing, and the tidal mud flats were good for clam digging. Drying and smoking salmon, oysters, and clams were common sights during the summer months. Wild berries, including cranberries, found in the flood plains of the Serpentine and Nicomekl River made Crescent Beach an attractive summer site.<sup>89</sup>

- Transportation:
  - They used the Serpentine and Nicomekl Rivers as transportation corridors. The First Nations used the rivers to travel on their way to the Fraser River.
- Legends:
  - First Nation's people would tell stories on the areas

natural features. One such story tells how the Mud Bay natural water springs that percolate up in the bay is connected to Cultus Lake. Betty Keller in Norman Lerman's Legends of the River People writes that how the First Nations people thought that Cultus Lake was "bottomless" and flowed into Mud Bay.<sup>90</sup> Keller writes that near Cultus Lake several small creeks would disappear into an underground passage on the site of the present lake. Kootlak's dike partially blocked this passage. The story

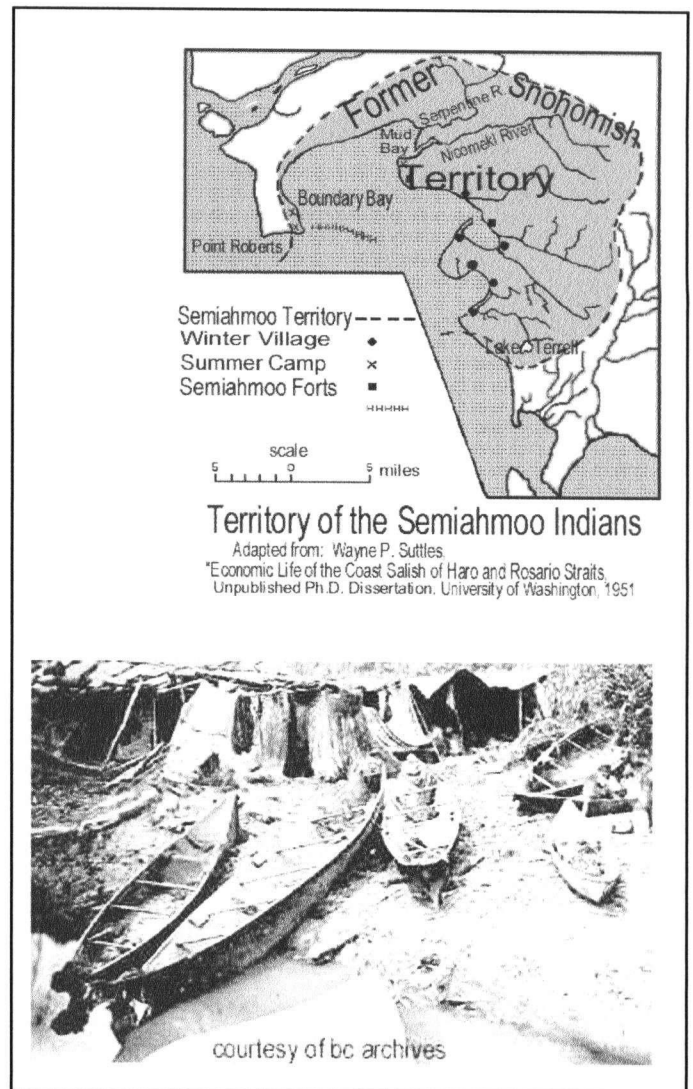


Figure 73 First Nation Territory  
Context

<sup>87</sup> John A. Brown. 30.

<sup>88</sup> Richard C.W. Percy. Salvage Archaeology at Crescent Beach BC. (Burnaby Simon Fraser University, Department of Archaeology 1973).

<sup>89</sup> Jack Brown. Surrey's History Web Site: Surrey's History is adapted from: John A. Brown's *The Historical Geography of South Surrey, British Columbia*. Unpublished M.A. Thesis, Western Washington University, Bellingham, Washington. 1971. <http://members.shaw.ca/j.a.brown/Surrey.html>

<sup>90</sup> Betty Keller. Norman Lerman's Legends of the River People. The British Columbia Folklore Society Web Site. <http://www.folklore.bc.ca/Cultuslake.htm>

explains how a young man who was swimming there was swept from the sight of his friends by an underground current. Sometime after the incident, some young men were out spearing seals and found his body drifting in Mud Bay. The young men identified the body by its decorations. They concluded that the young man was transported down the underground river from Cultus Lake into Mud Bay.

### Early Settlement (1800s-1900s)

During the late 1700s, the Spanish and British explore the land. At this point, the Spanish think that there is a water route from Burrard Inlet to Boundary Bay. However, what they see is just the high winter water levels covering the land (Figure 74).

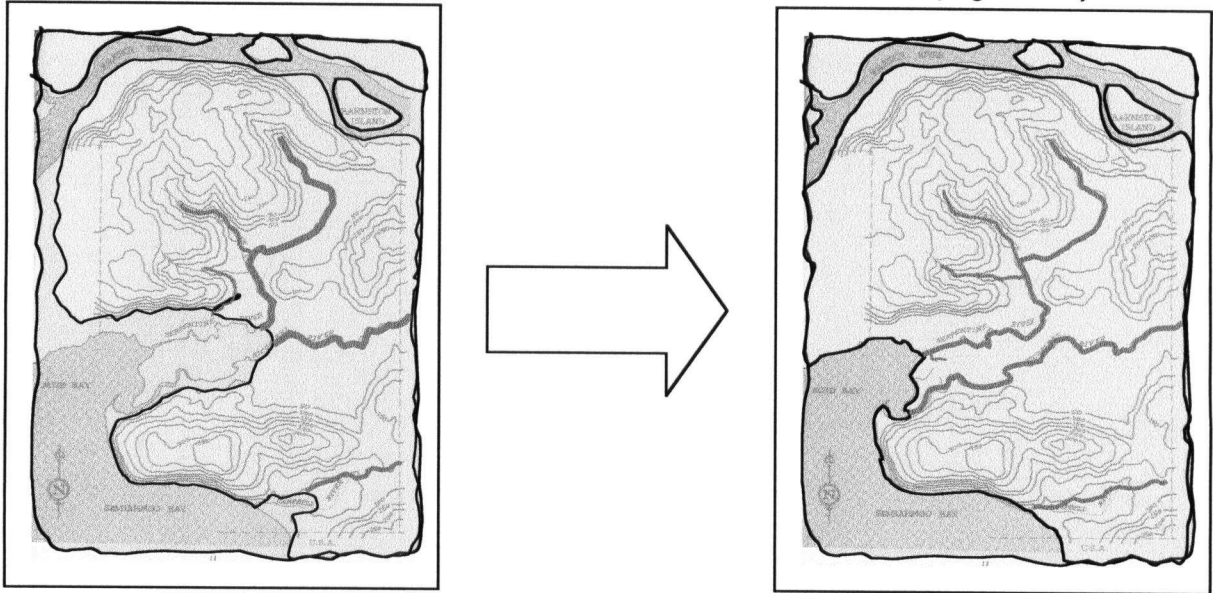


Figure 74 Mud Bay at the Early Settlement Period

In the mid to late 1800's the land is settled. At first, settlers prefer to homestead near the rivers, as boats are the main method for travel. The settlers begin to stop the high winter water from covering their land by erecting dykes. At first the dykes are made by hand, later when there is more advanced machinery, they are dredged by mechanical means. While the early settlers are beginning to farm the low lands, loggers are cutting down the virgin forest on the highlands south of the Nicomekl.

Also during this period, the Mud Bay homesteaders, consisting mainly of farmers, are the largest population group when Surrey becomes a municipality in 1879. By the end of this period, ditches, dykes, roads, and bridges are beginning to be built on the landscape.



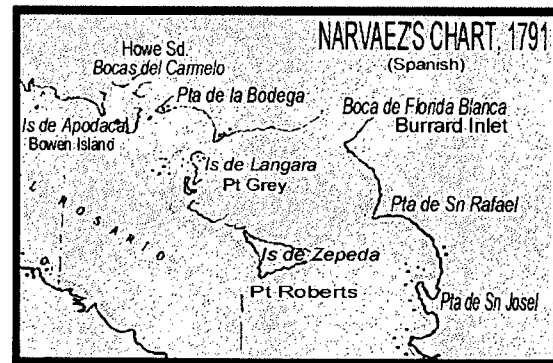
## The Spanish Explore

The Semiahmoo First Nations inhabited the area when 18<sup>th</sup> century Spanish explorers sailed into the Georgia Straight.

- Legends

- When the Spanish explorers first explored Boundary Bay (Figure 75) they thought that they could travel from Boundary Bay to Burrard Inlet. The entire area was covered with water. Cecil Jane in her translated from "A Spanish Voyage to Vancouver And the North-West Coast of America."<sup>91</sup> notes that in 1791 the *San Carlos* and the *Santa Saturnina* set to explore or survey the Strait of Juan de Fuca. Jane states that the Spanish explorers began to map part of Boundary and Mud Bay but they stopped when they encountered shallow water. Their chart shows Crescent Beach in Surrey named as Pt. De San Rafael.
- Jack Brown, in his thesis further adds that the Spanish chart shows no soundings due to the shallow nature of the Bays, but the coast shown is the line of the high water mark. Brown concludes that this suggests that Spanish thought that the area was a marsh, where the boats oars could touch the marsh's bottom<sup>92</sup>.

"We anchored, and with the first dawn we found that we were in mid-channel, in the entry between Point San Rafael and the east point of the peninsula of Cepeda. At daybreak the boat went to take soundings in the direction of the channel of Floridablanca, with instructions to return as soon as it found shallow water. At five in the morning we set sail, following the boat, under light canvas, but we had gone no more than half a mile with a fresh south-south-east breeze when we ere in three fathoms. We changed our course, approaching nearer to the coast, and found the water still shallower; we reached the coast of the peninsula and the depth increased to four fathoms, on which account we headed towards the channel. But in a short while we found three fathoms, and the boat which we had sent out coming alongside, also contributed to confirm the impression that it was impossible to enter the channel of Floridablanca between the east point of the peninsula of Cepeda and point San Rafael. On the other side, we saw no opening at the end of the creek, and only found that it ended in low land, marshy and full of trees. The boat, which reached a point where there was hardly a fathom of water, confirmed us in this view. Since one of the two mouths of the channel of the Floridablanca as depicted in the map made in the previous year had been found to be barred, the impression that we had already formed on the earlier expedition was strengthened. We hoped, however, from the entrance which was in view that the channel ran many leagues inland, and so were anxious



Map Source: Jane, Cecil

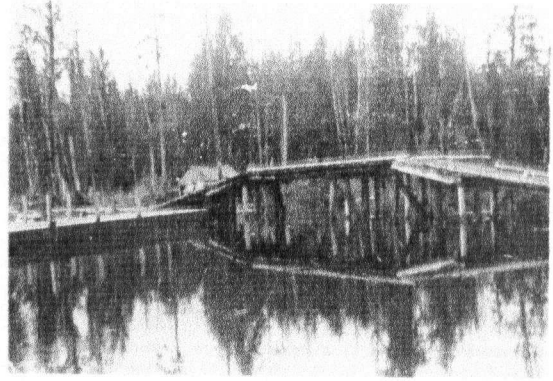
Figure 75 Early Spanish Navigation Chart of Mud Bay Area

<sup>91</sup> Cecil Jane. Translated from the Spanish. *A Spanish Voyage to Vancouver And the Northwest Coast of America*. (London: The Argonaut Press, 1930).

<sup>92</sup> Jack Brown.



- Prior to 1875, wagon road building was done by first cutting two wide and deep ditches 21 feet apart and placing the sod on the inside edge of the ditches to form two walls. Then material excavated from the ditches was placed between the sod walls. Thus a roadway and a dyke were formed. According to Fern Treleaven in *Rivers, Roads, and Railways*, "all roads, survey lines and trails built prior to 1875 interfered little with the natural drainage".<sup>96</sup>



An old bridge over the Nicomekl River.

Photo Surrey Archives  
Figure 77 Nicomekl Bridge

- Generally, prior to 1875 no ditches or creeks were crossed with culverts and small bridges. After 1875, roads had a great impact with the natural drainage. Road ditches were drained into different sloughs, culverts. Treleaven further states that at the crossing of all sloughs, culverts and termination of ditches, the salt water is entirely excluded from the inside ditch, thus dyking the land in the rear of the roadway. In 1875, the government road specifications stated that forest should be cleared between 30-33 feet wide. Grading ranging from 15 to 18 feet between ditches. Bridges all must be 12 feet wide (Figure 77). Finally corduroy laid over boggy patches had to be between 15 to 18 feet wide. Treleaven concludes that this resulted in minor changes in the direction of drainage flow as a result of ditching.
- By the late 1800's roads were improved and several bridges spanned the Nicomekl River.
    - **Draw Bridge:** One of those bridges was a drawbridge located near Elgin. "There was a keeper in charge of the drawbridge over the river. When a boat whistled in the distance the span on the drawbridge would be raised by two or three men walking round for twenty or thirty minutes pushing an iron bar which was attached to two cables. As the boat was passing under, the men began the reverse procedure to lower the drawbridge".<sup>97</sup> The tidal dam replaced it in 1911.
    - **Pontoon Bridge:** There is also mention of a pontoon bridge that crossed the river. In the 1860's, rafts were being used to cross the rivers. "Many early Bridges were split logs laid on trestles. When lumbering began and logs were floated down the three small rivers in Surrey, the flimsy bridges were often pushed down".<sup>98</sup>
  - **Water Transportation**
    - ▲ Water was used to transport people, goods and logs. In the 1870s, there was active logging on the escarpments of the Elgin Area. The logs would

<sup>96</sup> Treleaven 32.

<sup>97</sup> Treleaven 21.

<sup>98</sup> Treleaven 30.

- be cut down and dragged by oxen to the river's edge. Then they would be bundled and towed to sawmills in New Westminster.
- The farmers also used water transportation to transport their goods to Victoria or to New Westminster (Figure 78). Freight boats or tugs averaging 50 to 150 tones would travel up to the big bend carrying supplies to the farmers.

- ▲ Water transportation on the Nicomekl also played an important role in the movement of miners to the coast. During the 1858 Fraser River Gold Rush, boats would go up the Nicomekl River and stop further up river where the passengers would go overland to Fort Langley and make their way up the Fraser Canyon to the gold fields. Miners would travel by boat and stop at Elgin (where the



Photo: Surrey Archives

Figure 78 Boat on Nicomekl

- Semiahmoo trail (now King George Hwy) and the Nicomekl River meet.) and then onto Fort Langley. During the 1858 gold rush, Surrey attracted many new settlers who chose to land along the Nicomekl River in order to utilize the water "highway" as there were few land trails or roads. Due to the water traffic at Semiahmoo Bay, Mud Bay and up the Nicomekl River," a customs office was established in Elgin in 1880".<sup>99</sup> People now entering Canada from the United States would now clear Canadian Customs at Elgin. Besides a customs house, Elgin Port had a stagecoach stop and a hotel. It was also Surrey's first post office. "The first post office in Surrey, called Mud Bay and situated at the mouth the Nicomekl River, opened in 1881 and W. Woodward was the first Postmaster".<sup>100</sup>
- ▲ When the water transportation declined in 1891 due to the building of better roads the Elgin stagecoach, hotel and custom's house soon terminated.<sup>101</sup>
- ▲ Fern Treleaven writes that around 1879 Captain James Hatt had began to sail a "two-masted slop" up and down the Nicomekl River.<sup>102</sup> He would carry produce to market and bring back supplies for the settlers. It is generally agreed amongst historians that Captain Hatt was the first to go up the Nicomekl to Hall's Prairie Road. Later, he used a steamboat called "Staffa 1" to travel the Nicomekl River.

<sup>99</sup> Surrey Museum and Archives. Nicomekl one of Surrey's earliest 'highways' November 14, 1998.

<sup>100</sup> Treleaven 141.

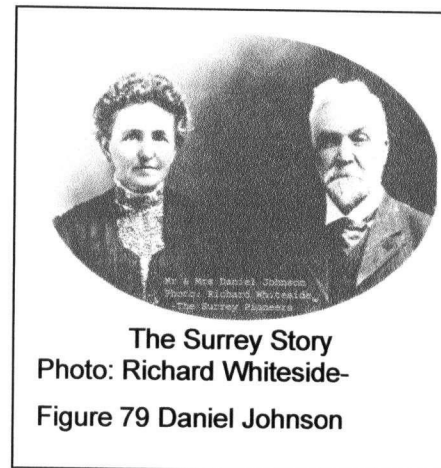
<sup>101</sup> Treleaven 141.

<sup>102</sup> Treleaven 19.

- ▲ Treleaven notes that there was a lot of water traffic on the Serpentine and Nicomekl Rivers. There were steam-powered sternwheelers, such as the Granier, Stella, Bell, Matsqui, Prot Elgin, Staffa I and Staffa II boats. They averaged approximately 100 tons displacement and drew about 12 feet of water. The boats would wait out in deep water in Mud Bay for high tide. When the tide would go in they would go with it up river. Once at their destination, they would quickly unload the supplies and load the farmer's produce before the tide went out. When the tide went out they too would go back to the bay thus avoiding getting stuck in the shallow river waters. Treleaven further notes many times a dozen steamboats with full cargo would line up at the Nicomekl River mouth waiting for high tide. It was said that the air over the bay would be black with smoke from their funnels. Treleaven concludes that the height of river traffic was from about 1883 to 1891.<sup>103</sup>

- **Homesteaders**

- ▲ In 1860 Governor Douglas gives British subjects the right to pre-empt land at 1\$ an acre not exceeding 160 acres<sup>104</sup>.
- ▲ In 1861 Samuel Handy and Hugh McDougall both pre-empt land along the Nicomekl River in Surrey
- ▲ McDougall names the stopping point where the Semiahmoo Trail crosses the Nicomekl River, Elgin, after the place in Scotland where he was from.<sup>105</sup>
- ▲ In 1879 Surrey incorporates.
- ▲ Settlers preferred to homestead near the areas that were easily accessible by water. In South Surrey, early farmers favored the Campbell, Nicomekl, and Serpentine Rivers.
  - ▲ W.M. Chantrell
    - △ 1874 Chantrell settles on the Nicomekl on the upland side of the river and farms the lower side. "His house was built long before the road; utilizing squared timbers and handmade square iron nails. He logged the south side of the river and farmed the north side for hay and grain. Like his neighbor, John Stewart, he sent most of the agricultural products to Victoria on the SS. Grainer...In 1886, he took over the Customs Sub-Collector duties at the port of Elgin...his Customs duties ceased in 1906".<sup>106</sup>



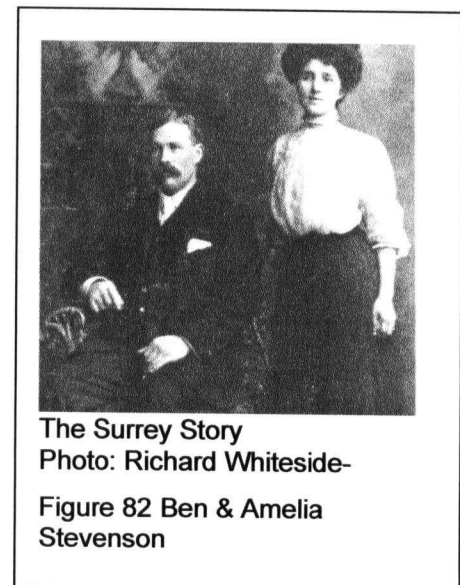
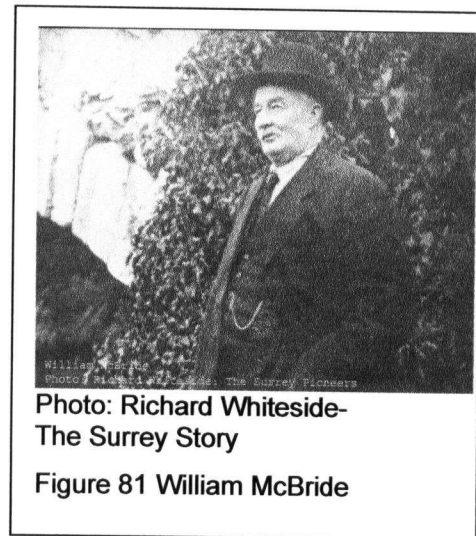
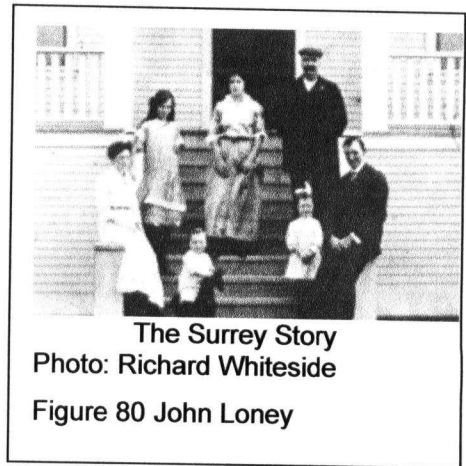
<sup>103</sup> Treleaven 21.

<sup>104</sup> Tom Zytaruk, *Millennium Milestones: A history of Surrey, White Rock and North Delta*. (Surrey: Thunderbird Press. 2000). 17.

<sup>105</sup> Brian Guzzi & Associates. *Crescent Road Corridor* The Corporation of the District of Surrey. 2

<sup>106</sup> Guzzi. 1.

- ▲ Dan Johnson (Figure 79)
  - △ In 1880 Dan Johnson homesteaded on one hundred and sixty acres of land on the Serpentine River in the Mud bay area of Surrey.
- ▲ John Loney (Figure 80)
  - △ In 1888, John Loney settled in Mud Bay. Loney, who lived in Elgin, kept the drawbridge working on the Nicomekl River where the Semiahmoo Trail crossed it.<sup>107</sup>
- ▲ William McBride (Figure 81)
  - △ In 1885, "William McBride was a well known farmer in Surrey for many years. The McBride farm at Mud Bay was dyked by hand to keep out the water of the Serpentine River. In later years, the dyke again was raised by Harry Benson's dredge".<sup>108</sup>
- ▲ Ben Stevenson (Figure 82)
  - △ In 1899, Ben Stevenson purchased 240-acre farm known as the Eldorado do Farm on the Wade Road at Mud Bay. "The Eldorado Farm was on the banks of the Serpentine River, which enabled Mr. Stevenson to ship his grain and farm product directly to Victoria by boat. When stocking his farm he purchased sheep in Fairhaven (now Bellingham) and drove them over the Old Semiahmoo Trail to Mud Bay... It was through his efforts that the first water was piped to Mud Bay. He donated the land for the first school at Ocean Park. He had the first mail contract carrying the mail by horse and wagon from New Westminster to the Elgin Hotel at Elgin".<sup>109</sup>



<sup>107</sup> Treleven 44.

<sup>108</sup> Richard V. Whiteside. The Surrey Pioneers. (Vancouver: Evergreen Press, 1974). 121

<sup>109</sup> Whiteside. 168



▲ John Stewart (Figure 83)

- △ In 1880 Stewart homesteads in Mud Bay in the former Samuel Handy place. "John was a pioneer in the dyking of the low-lying land of Mud Bay. His first venture was to dyke the south bank of the Nicomekl River piecemeal and by hand, field by field. Later, other farmers joined him, and together they dyked the north side of the river. First by hand, and later with a floating dredge, which raised the hand dykes from the Johnston Line. They worked east to the mouth of the river, then around the shoreline of the bay and up the Serpentine River, to the site of the original dam. Harry Benson, a pioneer farmer in Delta, owned the floating dredge. It can truly be said that John Stewart was a Mud Bay pioneer. He was very active in municipal affairs, serving on the Municipal Council in the years 1884-7 and 1892-3".<sup>110</sup>



Photo: Richard Whiteside-  
The Surrey Story

Figure 83 Mr. & Mrs Stewart

▲ J Wade

- △ In 1884, J. Wade purchases land in Mud Bay.

▲ John Weaver: (Figure 84)

- △ In 1887, “John Weaver lived at the foot of Woodward’s Hill in the Mud Bay area, where the family attended the first church and school in Mud Bay”.<sup>111</sup> (Figure 85)

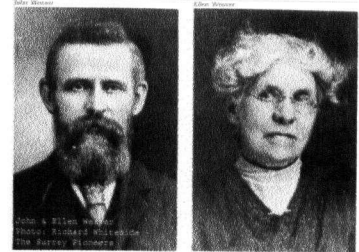


Photo: Richard Whiteside-

Figure 84: John Weaver



1890's The Wear Family Home  
Photo: Richard Wear  
The Surrey



Photo: City of Surrey

[illegible]

Photo: Richard Whiteside The Surrey Pioneers & City of Surrey

**Figure 85 The Weaver House: Then (1890's) and Now (2000)**

<sup>110</sup> Whiteside. 171<sup>111</sup> Whiteside, 183

- ▲ David Kitzel:
  - △ In 1895, David Kitzel came to farm in Campbell River Road. "David is engaged in farming, but his main produce was sauerkraut which he made in large quantities. He packed it in barrels, and hauled it to New Westminster by team and wagon over the Old Yale Road".<sup>112</sup>
- ▲ At the time, the homesteaders land parcels were approximately 1 square mile and between each property's boundary people would travel. In the study what today is known as 32<sup>nd</sup>, 40<sup>th</sup>, and 48<sup>th</sup> Avenues and 132<sup>nd</sup>, 140th street was the original parcel sizes. Then, the land was usually subdivided into halves or quarter sections.
- ▲ By the late 1800's approximately 11 settlers lay claim to the project area. These early settlers included Hal Morgan, Chris Brown, M. McBride, J. Wade Ben Stewson, Loney Bre, D. Johnson, J. Stewart, M. Chantrell, J. Anderson, John Weaver<sup>113</sup>. Many of these early Surrey settlers were responsible for building up the dykes in the area.
- ▲ In 1879, statistics reports that almost everyone who lived in Surrey had worked there.
- **Dykes, Dams & Drainage Ditches**
  - The settlers who farmed the area, first built the dykes (Figure 86) to stop the salt water from contaminating the farming soil. Settlers such as John Stewart, Harry Chantrell, William McBride and William Woodward in the Mud Bay area first instigated these dykes.
  - Many of these dykes were dug by hand by Chinese work gangs. Hand labor was used to build up the 1 meter (3 ft dykes). The work gangs also installed much of the drainage required before the flatlands were really productive. They used a long-nosed, narrow "ditching shovel" to dig channels in the peat, then laid down triangular under-drains formed by three cedar planks.<sup>114</sup>
  - In 1898, the north bank of the Nicomekl and South bank of the Serpentine River were mechanically dyked. Dykes were raised by mechanical methods such as dredges. Farmers such as William McBride and neighboring farmers hired people like Harry Benson who operated a dredge to raise their dykes.<sup>115</sup> "McBride was a well known farmer in Surrey for many years. The McBride farm at Mud Bay was dyked by hand to keep out the water of the Serpentine River. In later years the dyke was

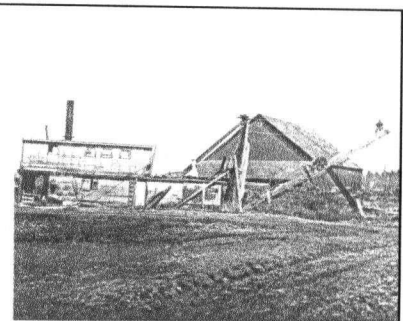
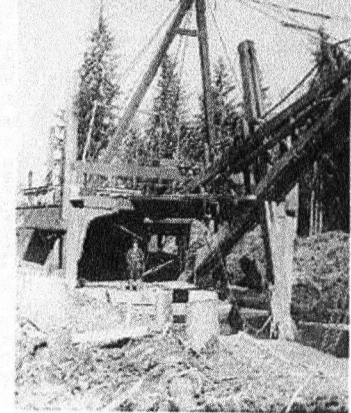


Photo Courtesy: Jack Brown  
Diking Jurisdictions

Dredge used to build  
dikes in Surrey in 1901.



Photos Jack Brown

Figure 86 Dyking the Rivers

<sup>112</sup> Whiteside. 102

<sup>113</sup> Whiteside. 95

<sup>114</sup> Frank McKinnon in "Clearing the Land," Looking Back at Surrey. vol. 1. 15

<sup>115</sup> Whiteside. 120



raised by Harry Benson's dredge, which was hired by McBride and his neighbors."<sup>116</sup>

- In 1890, there was a wooden dam built (Figure 87) at the mouth of the Serpentine River by the Surrey Drainage & Dyking Commission to keep the seawater out of the farmlands. The dam is an earth fill dam with floodgates at the Serpentine River's mouth. Shortly after being built, a storm washed the newly constructed dam and flood gates out to sea<sup>117</sup>

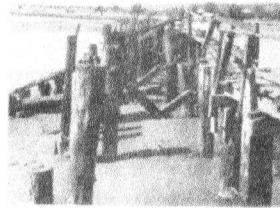
- **Farming:**

- **Potential Early**

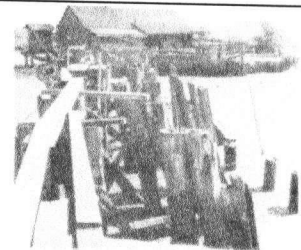
**Crops:** Many of the first settlers in the area were enticed into the area by the lure of

potentially bountiful agricultural harvests (Figure 88). One such advertisement on the back of a 1889 New Westminster Map stated:

"Extolling the opportunities of the area... In the Serpentine, Clover Valley, Surrey Center, Alderbottom and Kensington Prairie settlements the soil is also of first-class quality and is well adapted for growing wheat, barley, oats, peas, and various kinds of roots, fruits and vegetables. These settlements constitute the eastern and central portion of the District; the settlements of Mud Bay, Elgin, and North Bluff are on the west. Here the soil is principally of an alluvial character and produces enormous crops, chiefly oats, barley, roots, &c, as much as one hundred and thirty-six bushels of oats per acre having been threshed that grew in Mud Bay settlement. The Serpentine and Nicomekl rivers flow through the District from east to west, emptying into Mud Bay and



A- LOOKING NORTH  
FROM SOUTH BANK



B- LOOKING SOUTH  
FROM RIVER



C- LOOKING UPSTREAM  
FROM SOUTH BANK



D- LOOKING NORTH  
FROM SOUTH BANK

Photo Fern Treleven

Figure 87 Early Serpentine Dam

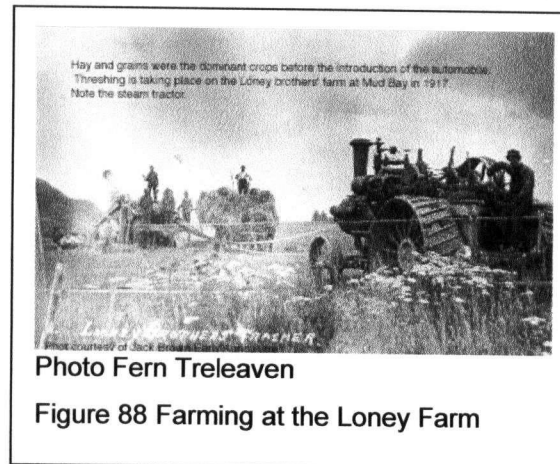


Photo Fern Treleven

Figure 88 Farming at the Loney Farm

<sup>116</sup> Whiteside. 120

<sup>117</sup> John Brown,. 49.

providing unexcelled facilities for the shipment of produce. The land was subject to overflow from extra high tides, but is now almost all dyked still the settlers felt that if a general dyke were constructed, from the high land at Blackie's Spit, across to connect with dykes constructed on the north side of Mud Bay, it would be the means of reclaiming some eighteen or twenty thousand acres that at present is overflowed at every tide, and provide improved facilities for drainage for the whole valley as well. A scheme to carry out this idea is now under consideration and in the future will be an accomplished fact".<sup>118</sup>

- Farming in the area began in the late 1800's. Some farmers lived on the high ground on the south side of the Nicomekl River and farmed the lowlands on the north side of the river. One such farmer, Harry Chantrell (whose farm now forms part of Surrey Historical Park) settled on the higher ground of the Nicomekl in 1874 and farmed the lowlands on the south side of the river for hay and grain. Farmers at this time sent their harvest to Victoria, New Westminster, and Hastings Mill. Fern Treleven in "Rivers, Roads and Railways: 100 years of Transportation in Surrey" comments that "water transportation was vitally important to the early farmers who had heavy and bulky crops of hay and oats and potatoes to move to market in New Westminster and Victoria and even to the new little community at Hastings Mill".<sup>119</sup>

- **Logging**

- Logging occurred during the 1870s-1890's in the area. Kathleen Hardy in Hardscrabble Farming recalls a story told by some Cloverdale old timers how in the early settler days the best tract of Douglas fir found anywhere in Surrey was south of the Nicomekl River. The large trees were soon cut down by loggers where they would drag the logs to the Nicomekl River's edge by oxen and then float them to Mud Bay. Booms were formed at Mud Bay and these were towed to the mouth of the Fraser River, then upriver to the mills at New Westminster.<sup>120</sup>
- The loggers, such as the Gilly Brothers, skidded the logs into the Nicomekl by a flume on Elgin Creek. The logs were stored at the wide section of the river (located east of the tidal dam) and then shipped by water onto sawmills in New Westminster (Figure 89).
  - On the rivers, logging booms competed with boats moving farm produce. Treleven recalls that for some years water traffic increased on the Serpentine and Nicomekl Rivers with their tributary creeks and logging ditches dug by the lumbering companies. Water transportation was vitally important to the early farmers who had heavy and bulky crops of hay and



Photo Fern Treleven

Figure 89 Logs on Water's Edge

<sup>118</sup> Albert Hill. "Maps as Advertising," Looking Back at Surrey. vol. 1.

<sup>119</sup> Treleven. 19.

<sup>120</sup> Kathleen Hardy, "Hardscrabble Farming," Looking Back at Surrey. vol. 1. 22.

oats and potatoes to move to market. At the time, more and more logs were brought down skid roads and logging ditches to float to market via the rivers. Both competed for the river traffic.<sup>121</sup>

- **Log Jams & Bridges:** At the time of logging in Surrey there would be the occasional logjam that would take out existing bridges. Fern Treleaven in Rivers, Roads and Railways stated that "In the Council minutes of November 12, 1881, a contract for clearing a logjam out of the Serpentine was awarded to a farmer for \$130.00. Of course such logjams swept out existing bridges. It was in 1884, as nearly as we can determine, that a drawbridge was built across the Nicomekl. It was 304 feet long and cost \$835.00".<sup>122</sup>

- **Fishing**

In the preliminary research, there is no record of commercial fishing in the Mud Bay area by the early settlers. (Later on fishing does play a role in the area). However, at this stage, the only fishing records found during this time period are of the early settlers fishing at some outings.

- **Recreation**

- Many people used the Nicomekl River as a route to go to picnics on Blackie Spit (Figure 90). Fern Treleaven in Rivers, Roads and Railways recalls how "Neighbors visited one another's homes via a row boat on the river. School picnic groups walked or jolted in wagons to the nearest river wharf and then scrambled joyfully, laden with baskets of food, into row boats to go down river to Blackie's Spit or some other spot along the sea shore for a day of games, water sports and eating. They always returned to the boats when a rising tide made rowing up the river an easy task".<sup>123</sup>
- People came across Mud Bay to Blackie Spit from Delta. There are early accounts of how a barge with railings around it and a tug would bring a school load of picnickers to Blackie Spit.<sup>124</sup>
- A community hall was built beside the Nicomekl River that was nicknamed "Misery Hall, because, unless high tide coincided with the hour of the party or dance, you had to climb from your rowboat up and over a wet and muddy dyke to reach the hall".<sup>125</sup>



Photo Fern Treleaven

Figure 90 Picnic at Blackie Spit

<sup>121</sup> Treleaven. 19.

<sup>122</sup> Treleaven. 19.

<sup>123</sup> Treleaven. 21

<sup>124</sup> John Brown. 129.

<sup>125</sup> Treleaven. 21.

- **Land Use Plans**

- In 1859, Col. Richard Clement Moody of the Royal Engineers proposes a canal from Boundary Bay to the Fraser River. (Figure 91 Boundary Bay)

- In 1859, J.W. Trutch surveys land into 160-acre allotments by the block and range system. Each block was to be three miles square and divided into 36 sections of 160-acres each. Each section would thus be one-half mile square. It was decided that the survey lines run to the cardinal points of the compass, unless natural features or the limits of previously-located land claims were used as boundaries.

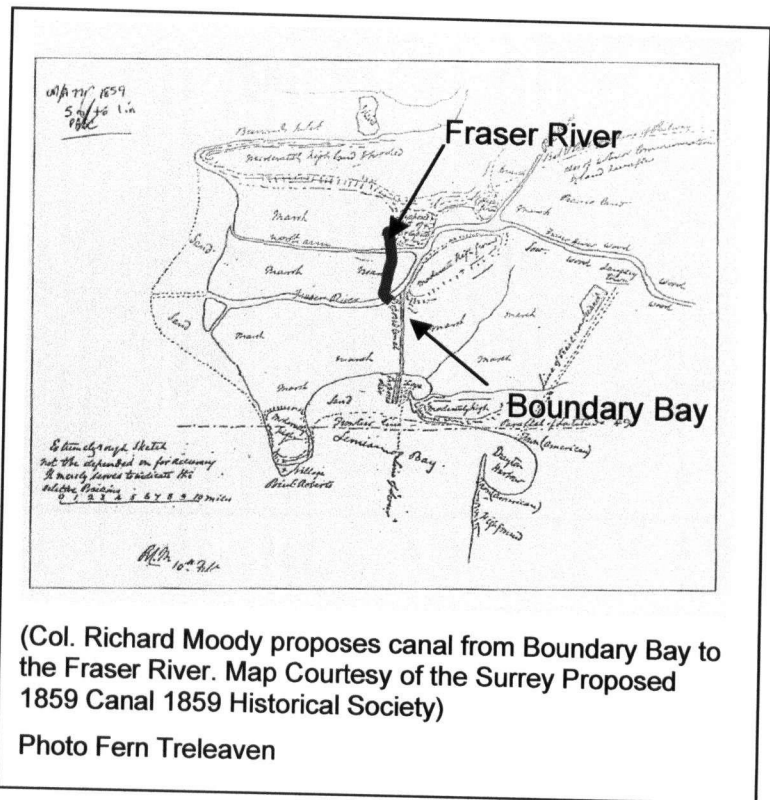


Figure 91 Boundary Bay

- In January 4<sup>th</sup>, 1860 Governor Douglas issues a Proclamation, giving any British Subject the right to enter on and pre-empt any quantity of land not exceeding 169 acres by planting a post at one corner of the property.<sup>126</sup>
- 1879 – November Surrey becomes a municipality; first major consideration facing Surrey's first Municipal Council was the building of roads.
- 1883 – A half acre is set-aside in Mud Bay on the Semiahmoo Trail for a school by the Dinsmore family. Archena McDoughall was the first teacher. There were 29 pupils and the schoolroom measured 18 x 26 feet.<sup>127</sup>

- **Legends**

- **Train Robberies and Gold**

"In 1865, two men robbed a pack train that was carrying gold to pay workers for the Collin's overland Telegraph Office based in New Westminster. The two men were captured somewhere between the Nicomekl River and the Elgin School. The gold, which was stored in a metal box, was buried by the two men".<sup>128</sup>

- **First Nation Burial Boxes**

When the early settlers first came into the area, some of them noticed First Nation Burial Boxes in the trees south of the Nicomekl River. Stan McKinnon cites a story told to him by Claude Harvie about how Harvie's father found some of those burial boxes in 1886. McKinnon recalls that Harvie's father, "Robert Harvie, came to Surrey

<sup>126</sup> Treleven. 12.

<sup>127</sup> Guzzi.

<sup>128</sup> David Dasilva. "Trail Saw its Days of Glory," Peace Arch News. (September 9<sup>th</sup>, 1992).

in 1886, to a logging camp located at Elgin. The presence of old grave boxes in the trees would be reasonable, even in 1886. Research by Mrs. Mabel F. Nichols shows that the Semiahmoo Indian band had build a chapel by 1861. A burial ground would be established by the O.M.I. missionaries around the same time. Undoubtedly burials of some of the old-time members of the Semiahmoo would continue to be tree burials, perhaps for another 6 or 7 years or even longer. In any case, a well-made burial box, tightly lashed into the braches of a tree, could easily last for 25 to 30 years."<sup>129</sup>

- **Hotel Elgin Stories**

- "Melanie Xenbury was nineteen years old in 1890 when she came from England to visit her sister Martha at Stevenson, and decided to stay in Canada. She agreed to work as a seamstress for the E.T. Wade Family in Surrey. Arrangements were made for pretty, young Melanie to travel by stagecoach (which ran twice weekly from Brown's Banding beside the Fraser River to Blaine, just across the U.S.A border), on a certain date. When the lumbering coach, with Melanie and six male passengers aboard, arrived at the designated stop, Mr. Wade wasn't there. The gallant coachman wasn't about to abandon his attractive passenger beside a wilderness trail where bear and cougar lurking in the encroaching forest. No indeed. He made his six male passengers get out and wait while he turned to the coach down the side road and drove until he met Mr. Wade! That was the tale Melanie told her children years later. No one ever heard an opinion from the six men who waited, tired, cold and hungry, for the wandering coach to return and take them on to the hotel and Elgin where they could rest and get a meal while fresh horses were put to the coach for them to continue their journey".<sup>130</sup>

---

<sup>129</sup> Stan McKinnon, "Grave Boxes in the Trees" Looking Back at Surrey, vol 1. 35.

<sup>130</sup> Treleaven. 145.



## The Transportation Era 1900-70s

During this period, transportation issues dominate the landscape. Bridges, railways, and highways are built to aid efficient land movement (Figure 92). Concrete dams are installed on the rivers signifying the end to water transportation dominance. Their actions have a significant impact on the land.

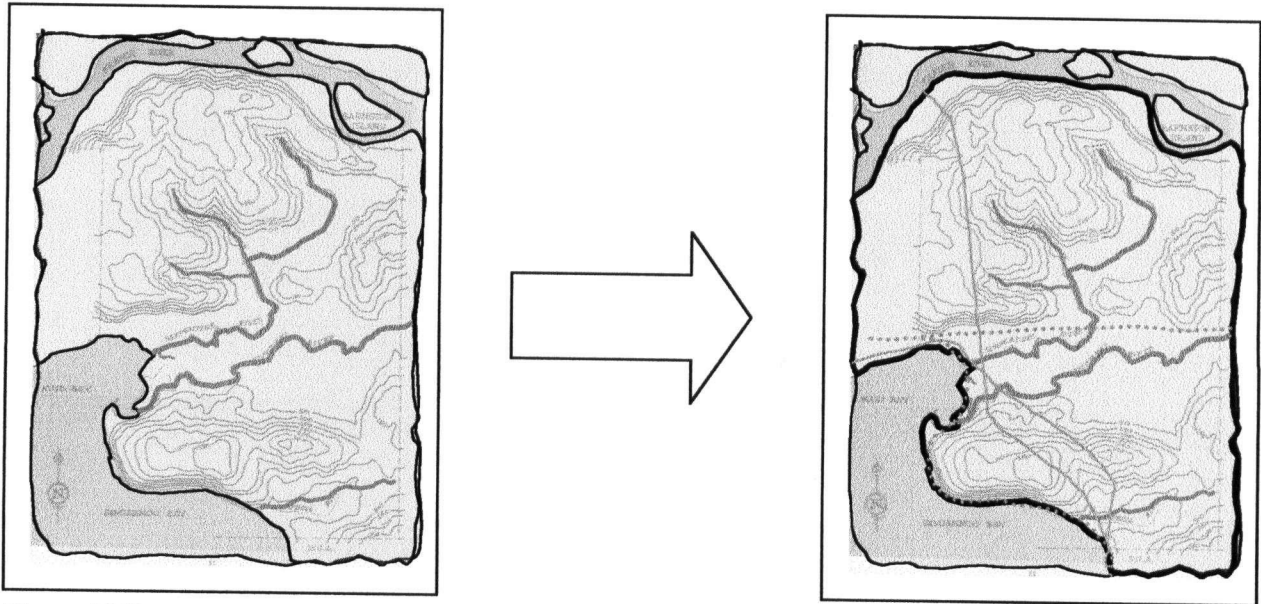


Figure 92 Transportation routes added to Mud Bay during the Transportation Era

With improved transportation comes a wave of new settlers into the surrounding areas. Along with the increasing population, are new ideas regarding what to do with the land. Plans for the time show ideas of natural lakes by the Serpentine River, or industrial ports by the bay. However, the farmlands are spared development threefold. The land is placed into the Agricultural Land Reserve (ALR). The municipality of Surrey no longer allows houses to be built on farmland, and the Mud Bay rate payers want the area set aside as a park. Surrey farms are known as Vancouver's "kitchen garden" because of all the produce they supply.

### Land Transportation Railways

The Great Northern Railway built the rail line in 1909 (Figure 93). The original rail line that ran through Hazelmere had problems with its steep grades. Trains could not make it up the steep hill during bad weather conditions. It was noted, "one year there was a plague of tent caterpillars and

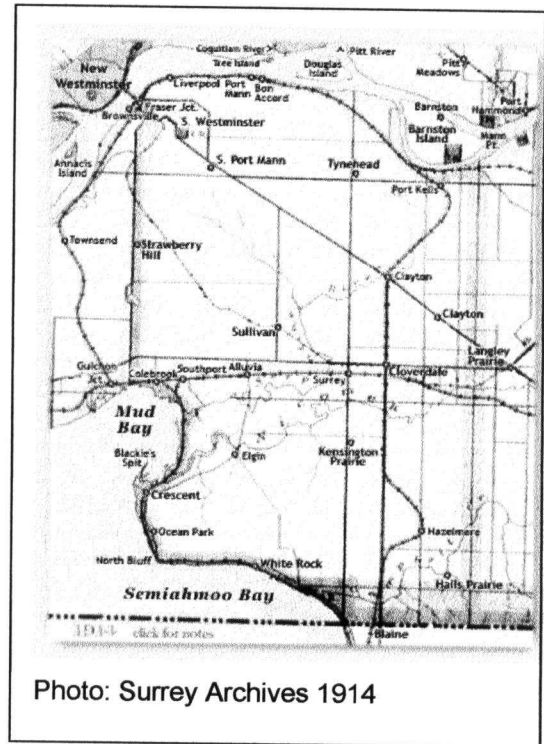


Photo: Surrey Archives 1914

Figure 93 Railway Lines

trains couldn't make it at all until a gang of Chinese workmen was hired to sweep the wriggling masses off the tracks".<sup>131</sup>

- Treleven claims that the Great Northern Railway solved that problem by beginning work on a new line from Blaine in 1905. This line would run along the White Rock, Ocean Park's seashore to the Crescent Beach Hotel (Figure 94). In order to build the rail line along the Mud Bay Shore, Great Northern Railway assumed responsibility for the Mud Bay seawall portion of the dyke.<sup>132</sup> The line was finished in 1909.
- Late 1960's "A contract to sell coal, mined in the East Kootenay district of the province was arranged between the governments of British Columbia and Japan. A railway to carry the coal to the coast for shipment to Japan was proposed to run through Surrey, and a large port to be built at Roberts Bank in Delta".<sup>133</sup>
- After the rail line opened a 'Camper's Special Train' known as the Dinky, consisting of a locomotive and two or three passenger cars. According to O.M Sanford "it was operated during the summer months, going into Vancouver at 7:17 a.m. and leaving town at 5:15 p.m. It picked up passengers at White Rock, Ocean Park, and Crescent and gave office workers and businessmen a chance to spend the evenings with their families".<sup>134</sup>

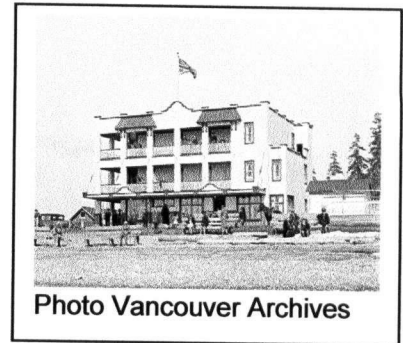


Figure 94 Crescent Beach Hotel

### Highways

- In 1940 King George Hwy is built. "The King George VI Highway between the City of Vancouver and the Peace Portal entrance to the United States was formally opened in 1940 and was named for the British monarch at that time. It enters Surrey at the south end of the Pattullo Bridge, climbs Peterson Hill and then goes straight south on 136<sup>th</sup> Street until it curves to descend Woodward's Hill. As it cuts across the valley between the Nicomekl and Serpentine Rivers it also covers a portion of the original old Semiahmoo Trail near Elgin".<sup>135</sup>
- 1964 Deas Island Highway (Hwy 99) is built
- The building of the Deas Tunnel beneath the Fraser River in the late 1950's changed the pattern of urban development in the South Surrey Area. Commuting by car to work in Vancouver and Richmond made year round living in the area feasible. Prior to this, the only access was by ferry to Stevenson or through New Westminster by automobile via the King George Highway.

### Water Transportation

1940 last boat up the Nicomekl

### Residents

The King George and #99 Highways allow more people to live in the Vancouver suburbs. Population begins to rise outside the study area in Panama Ridge, South Surrey, Crescent Beach, and White Rock.

<sup>131</sup> Treleven. 61.

<sup>132</sup> John Brown. 105.

<sup>133</sup> Treleven. 129.

<sup>134</sup> O.M. Sanford "The Ocean Park Story," Looking Back at Surrey, vol. 1. (approx 1912) 24

<sup>135</sup> Treleven. 52

## Dykes, Dams & Drainage Ditches

- In 1907, Great Northern Railway assumes responsibility for the seawall portion of the dyke.<sup>136</sup> In 1909, The Great Northern Railway line and the Mud Bay dyke are completed.
- In 1911, the newly formed Dyking Commission had concrete dams constructed on the Serpentine and Nicomekl Rivers by Semiahmoo Road for reclamation purposes. It was thought that the Semiahmoo Road will "act as a dyke between the control dams on the Serpentine and Nicomekl Rivers".<sup>137</sup> Shortly afterwards, freight boats and log booms ceased moving on the rivers.<sup>138</sup>
- In the 1920's, "It was a common sight to find Chinese work parties clearing land for settlers in the 1920's. Chinese work gangs also installed much of the drainage required before the flatlands were really productive. They used a long-nosed, narrow "ditching shovel" to dig channels in the peat, then laid down triangular under drains formed by three cedar planks. Using their eyes as the leveling instrument, they developed an uncanny knack for installing drains running hundreds of feet across level land, drains which provided just enough fall to flow properly. Set deeper than the depth of cultivation, some of those cedar underdrains continued working for a great many years. The original Serpentine Canal was dug by hand, by Chinese labor gangs. The canal originally was a ditch seven feet wide".<sup>139</sup>
- In 1935, there was a heavy flood. Heavy snowfall for 5 days caused water to flow through the Fraser Valley as if it were one single stream.
- Kathleen Hardy in "Hardscrabble Farming" observed in "1935 it snowed three feet then froze solid. Then it rained for what seemed like days and the Nicomekl River flooded over, because there were no dykes. Our home had about four feet of water in it and the whole family had to move to a dry house in Cloverdale. On the trip there I remember seeing the gruesome sight of drowned and bloated cattle and pigs floating around, as the water covered the valley. Most of the cattle had been moved to the Surrey Center hill, and those that could not be moved had been moved up to the Surrey Center hill, and those that could not be moved had been set free. I can still recall the vivid sight of some cows standing in the middle of a haystack, eating off it, surrounded by water. The only way to get around was by boat".<sup>140</sup>
- 1939 Federal Government assists in upgrading 46 miles of dykes in Surrey
- 1940's Flooding below Nicomekl and Serpentine control dams and the Mud Bay Dyking Commission was established.
- 1951 – December -Floods occur in Mud Bay. According to Fern Treleaven in The Surrey Story, in December 1951 "the highest tides in months combined with gale-force winds, sent water roaring through a 60-foot break in the dyke along the Serpentine River, in the Mud Bay Dyking District. Five feet of water covered about 1,200 acres of farmland from the south bank of the Serpentine to the north dyke on the Nicomekl. Repairs were estimated at twenty thousand dollars and the productivity of the land was down for the next few years from the effects of the salt water".<sup>141</sup>

---

<sup>136</sup> John Brown. 105.

<sup>137</sup> John Brown. 106.

<sup>138</sup> Treleaven. 69.

<sup>139</sup> Frank McKinnon. 15.

<sup>140</sup> Hardy . 18.

<sup>141</sup> Treleaven. 69.



- 1968 - January - Flooding occurs once again in Surrey. Only low ocean tides prevents it from becoming a disaster. With heavy rain, water rise to the top of the dykes. In February many farmers in the drainage and dyking district vote that they are willing to accept a tax up to the maximum of \$7 per acre for 25 years, in order to get action on the Serpentine-Nicomekl Drainage Plan. This is contingent on the Municipality taking over the dyking district and setting up a drainage commission to look after all of Surrey. An agreement is reached. Local areas are to pay 10% of the cost, with the provincial and federal governments dividing the remaining 90% between them evenly.<sup>142</sup>

### Farming

- Making Hay by Fern Treleaven

"Dad cut the hay every summer with an old mower pulled by a team of horses. After it was raked, the men used pitchforks to pile up the hay into haystacks. After a few more days of curing, the hay was pitched onto the wagons, carefully building the load, and the team drew the loaded wagon up to the barn. There a large, two-tined hayfork was pushed into the hay, and then the movable points of the tines were clamped and locked into place. The horses, hitched to a heavy rope

running over a pulley out the other end of the barn, pulled the hayfork and its portion of the load up to the track that ran just under the center of the roof in the haymow. A carriage ran on this track and the hay was pulled into the barn. Someone working in the mow leveling the hay gave a yell and my Dad tripped the hay by means of a light rope attached to the lock on the hayfork tines. The hay was stored in the barn for use in the winter months. We could put ten loads of hay a day in the barn".<sup>143</sup>

- 1920's Surrey farms begin to specialize. There were poultry, dairy, livestock, vegetable, berry and fur farmers
- 1950's Farmers find it necessary to improve their methods in order to cut costs. Surrey is beginning to be called "Vancouver's kitchen garden as well as its bedroom".<sup>144</sup>
- 1960's Farming occupies 27,000 acres of Surrey Land
- 1969 All milk from dairy farms in Surrey now goes by tank truck and not by milk cans.

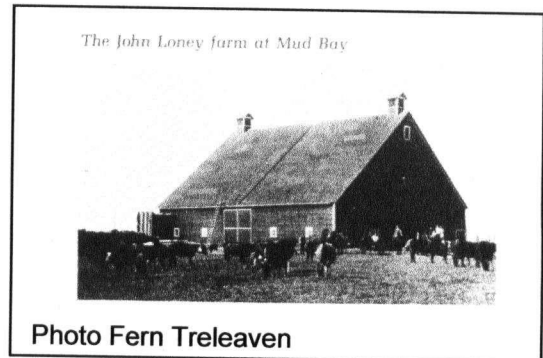


Figure 95 John Loney farm at Mud Bay

<sup>142</sup> Treleaven. 127.

<sup>143</sup> Hardy. 19-20.

<sup>144</sup> Treleaven. 114.

## Logging

### "Names for Wooded Areas"

- "The pioneers used a variety of names to describe different types of wooded areas. According to Frank McKinnon in "Names for Wooded Areas", specific words with specific meanings were used to describe wooded areas.<sup>145</sup>
- "Forest" was not a word used often by the early settlers. When they did refer to the forest, they meant heavily treed portions of wilderness areas.
- "Woods" referred to local areas of large trees, being applied both to first growth stands and later to second growth of good size. It also was used for any stand, which was being logged. You "worked in the woods" if you were in logging; you might sell a few telephone poles out of the woods at the back of your farm; you could go for a walk in the woods, if so inclined.
- "Bush" was a general word used to describe the various mixtures of second growth trees of fair size, smaller tree species, bushes and shrubs.
- "Brush" meant the growth of willow, wild crabapple, bushes and shrubs, which was a feature of the flatlands, and also was applied to the new growth along the edges of the woods.
- "Scrub" was a derogatory word. It could be used interchangeably with "brush", but had the added meaning of referring to scraggly trees and shrubs of no value."

## Fishing

- In the 1910's crab and oyster fisheries were located in the Crescent Beach area. These included the Olympia Oyster Co on Blackie Spit (1911) and William Hadden who made crabbing boats (1919). (Figure 96)
- The first oysters to be harvested were the native Olympic variety. Then, the Atlantic oyster seed was planted until the 1930's. Afterwards, the crates of seed were bought from Japan. The oysters were harvested, shucked and packaged on the Olympia Oyster Co's premises at Crescent Beach.
  - Fishing, clamming, and crabbing were also commercially viable at Crescent Beach. One person, Hadden made crab-fishing boats on the upstream side of the Nicomekl dam. The boats would be filled with a sail, drop board and other fishing equipment on the downstream side of the dam.<sup>146</sup> Another family, as recalled by Mrs. Helen Murphy, remembers "herself, her husband and their children digging for clams commercially in 1947-48."<sup>147</sup>
  - In 1958, Crescent Beach Oyster Co. sold to BC Packers and buildings moved to BC Packers' facilities at Oliver slough.
  - In 1962, it was determined that the Serpentine and Nicomekl Rivers were contaminated with domestic and municipal sewage as well as agricultural runoff. It was decided to close the Oyster Beds. Boundary



Figure 96 Crab Boat on Nicomekl

<sup>145</sup> Frank McKinnon. "Names for Wooded Areas," Looking Back at Surrey, vol 1. (approx 1912) 15-16.

<sup>146</sup> Guzzi.

<sup>147</sup> Treleaven. 161.

Bay is classified as "prohibited when it was found that the median total coliform MPN's at sample areas exceeded 700/100ml."<sup>148</sup>

### **Recreation**

- **Swimming in the Nicomekl River**
  - Several settlers in the Surrey Area recall swimming in the Nicomekl Rivers before the river became polluted. Kathleen Hardy recalls in *Hardscrabble Farming* how "In the summer in their limited spare time the Hardy brothers swam in the Nicomekl River. At that time it had beautiful water. Salt water came up the river at high tides, then both river water and salt water flushed out on low tides. The Nicomekl had fish in it, and oysters spread up the stream from the oyster beds in Mud Bay. We had a lot of fun, in the clean water, on old inner tubes from car tires, Hard remembers. We actually got some initiative in us and sold worms to fishermen for five cents a can."<sup>149</sup>
- **Crescent Beach becomes a Vancouver Summer Resort Destination**
  - After the arrival of the BNR railway, a passenger train known as the 'Campers' Special Train' would arrive from Vancouver to Crescent Beach bringing in tourists who would summer in Crescent Beach. O. M. Sanford in *The Ocean Park Story* recalls in 1912 that "a Campers' Special, known locally as the Dinky, consisting of a locomotive and two or three passenger cars was operated during the summer, going into Vancouver at 7:17 a.m. and leaving town at 5:15 p.m. It picked up passengers at White Rock, Ocean Park, and Crescent and gave office workers and businessmen a chance to spend the evenings with their families".<sup>150</sup>
- **Fishing Shacks along the Serpentine and Nicomekl River**
  - People from Vancouver and New Westminster would travel to Surrey on the B.C. Electric Railway to Surrey, and then walk to their favorite fishing spots on the river where they would stay at a nearby fishing shack. John Tompson in *A More Rugged Surrey* recalls how his uncle Edgar Bloomfield, a Vancouver lawyer, who was an "ardent fly fisherman and used the shack on his fishing trips. He would come out from the city on the B.C. Electric tram to Sullivan Station, walk almost a mile to the shack, and then walk to favored fishing spots on the Serpentine or Nicomekl rivers".<sup>151</sup>

### **Legends**

- **9 O'clock Stanley Park Gun**
  - There is an old story circulating that before the noise pollution in the area people could hear the 9 o'clock Stanley Park Gun in the Crescent Beach Mud Bay area. O.M. Sanford in "The Ocean Park Story" recalls that "before the advent of so much modern-day noise it was possible on clear evenings at approximately one minute and forty seconds after nine P.M. to hear the sound of the Stanley Park nine o'clock gun, 23 miles away".<sup>152</sup>

---

<sup>148</sup> B.H Kay. "Shell Fish Growing," Water Sanitary Survey of Boundary Bay, Mud Bay, and Crescent Beach, BC Pollution Abatement Branch Environmental Protection Service Pacific Region. November Report #EPS5-PR-76-11. 1976.

<sup>149</sup> Hardy. 22.

<sup>150</sup> O.M. Sanford. 24.

<sup>151</sup> John Tompson. "A More Rugged Surrey," Looking Back at Surrey, vol. 1. 8

<sup>152</sup> Sanford, O.M. "The Ocean Park Story" Looking Back at Surrey, vol. 1. 24.

## Room for Wild Animals

- 1970's Some people think that "Surrey is becoming too urbanized over a large part of the municipality to have much space for animals and birds to live in a natural wild state any more with record number of building permits being issued by the city."<sup>153</sup>

## Fresh Water Lake Plan

- 1960's plan calls for a "fresh water lake for boating and swimming to augment ARDA Farmland Drainage".<sup>154</sup>

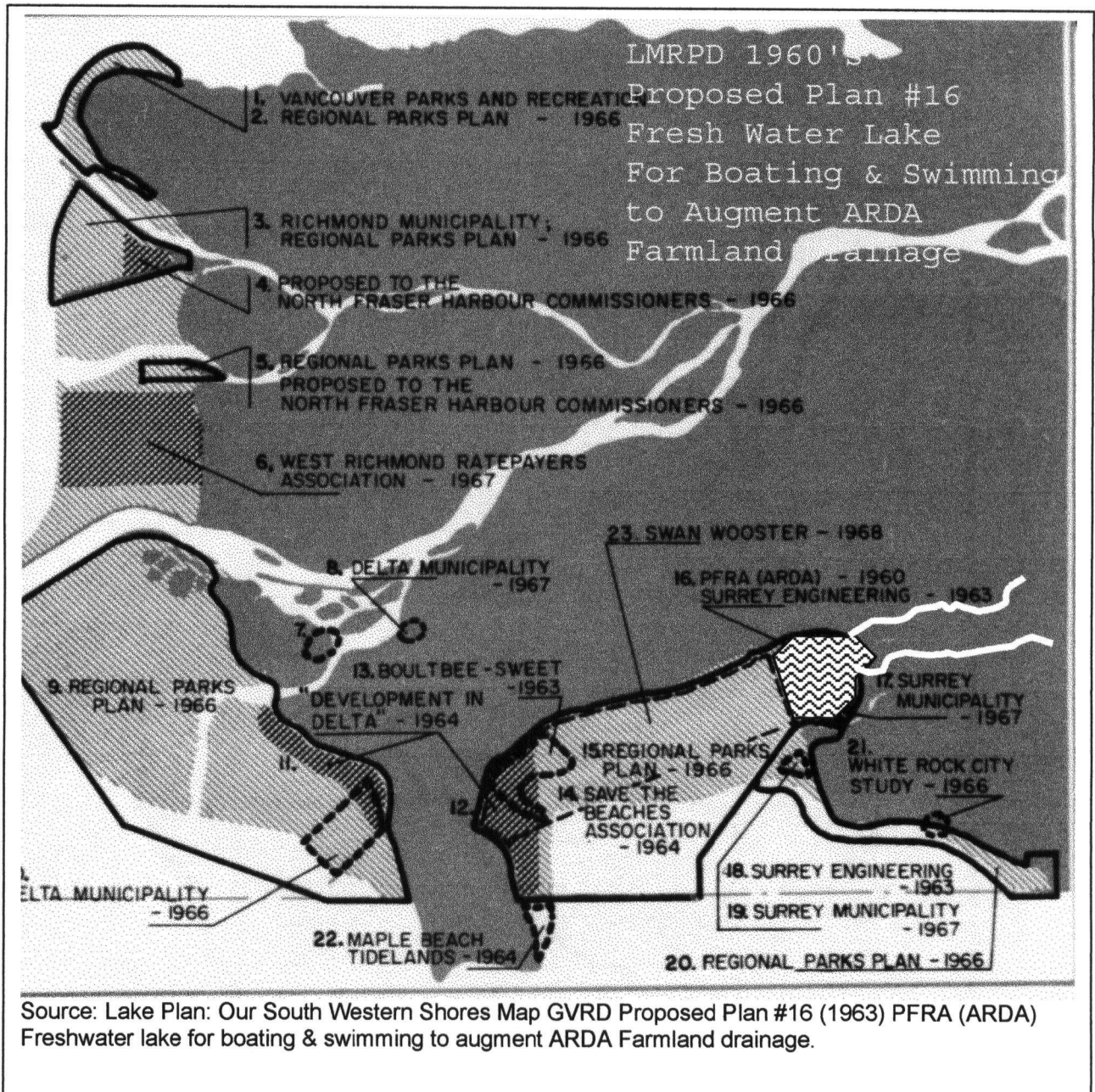


Figure 97 Past Development Proposals.

<sup>153</sup> Treleven. 129.

<sup>154</sup> Lower Mainland Regional Planning Board. 9.

## Land Use Plans

- 1950's Request for Park Land
  - In the 1950's, according to Fern Treleaven in The Surrey Story "ratepayers in the Mud Bay area were opposing development of the ocean front for industrial development of the ocean front for industrial purposes, and requested that the area be set aside for public enjoyment for all time".<sup>155</sup>
- 1955 Agricultural Land
  - In 1955 Surrey Council began the discussion on a zoning bylaw that would prevent the establishment of new residential areas within the dyking districts, where the land is best suited to farming. Other parts of Surrey call for the one-acre minimum for residential over a large part of the Municipality.<sup>156</sup>
- 1960's Mud Bay Rate Payers want land set aside for public enjoyment
  - "Ratepayers in the Mud Bay area were opposing development of the ocean front for industrial purposes, and requested that the area be set aside for public enjoyment for all time".<sup>157</sup> (Figure 97)
- 1967 Surrey became a member of the Greater Vancouver Regional District
- 1957 Surrey changes road names into road numbers. Fern Treleaven states that "the change was necessary for the sake of progress and that much of Surrey's colorful local history disappeared with the old road names."<sup>158</sup>
  - Mud Bay Road - 40<sup>th</sup> Avenue
  - Bergstrom Road – 136<sup>th</sup> Street
  - Elgin Road & Nicomekl Rd – did not change into a numbered street, still a sign of the past history).
- 1968 Lower Mainland Regional Planning Board recommends "the development of Boundary Bay for recreation-conservation purposes be carried out as a major long term project with joint Regional-Provincial-Federal participation".<sup>159</sup>

---

<sup>155</sup> Treleaven. 119.

<sup>156</sup> Treleaven. 114.

<sup>157</sup> Treleaven. 119.

<sup>158</sup> Treleaven. 117.

<sup>159</sup> Lower Mainland Regional Planning Board. 8.



### The Efficiency Era 1970 -2000:

During this period, the focus is how to most efficiently use the land. (Figure 98). Farms begin to consolidate to the extent that only two major farm operations exist in the Mud Bay Study area. The Kitzel and Donia dairy farms dominate the land use in the area. Surrey becomes the largest agricultural producer in the Lower Mainland. Subsequently, the Donia dairy farm is known to supply the majority of a large grocery chain's milk supply in Vancouver's Lower Mainland.

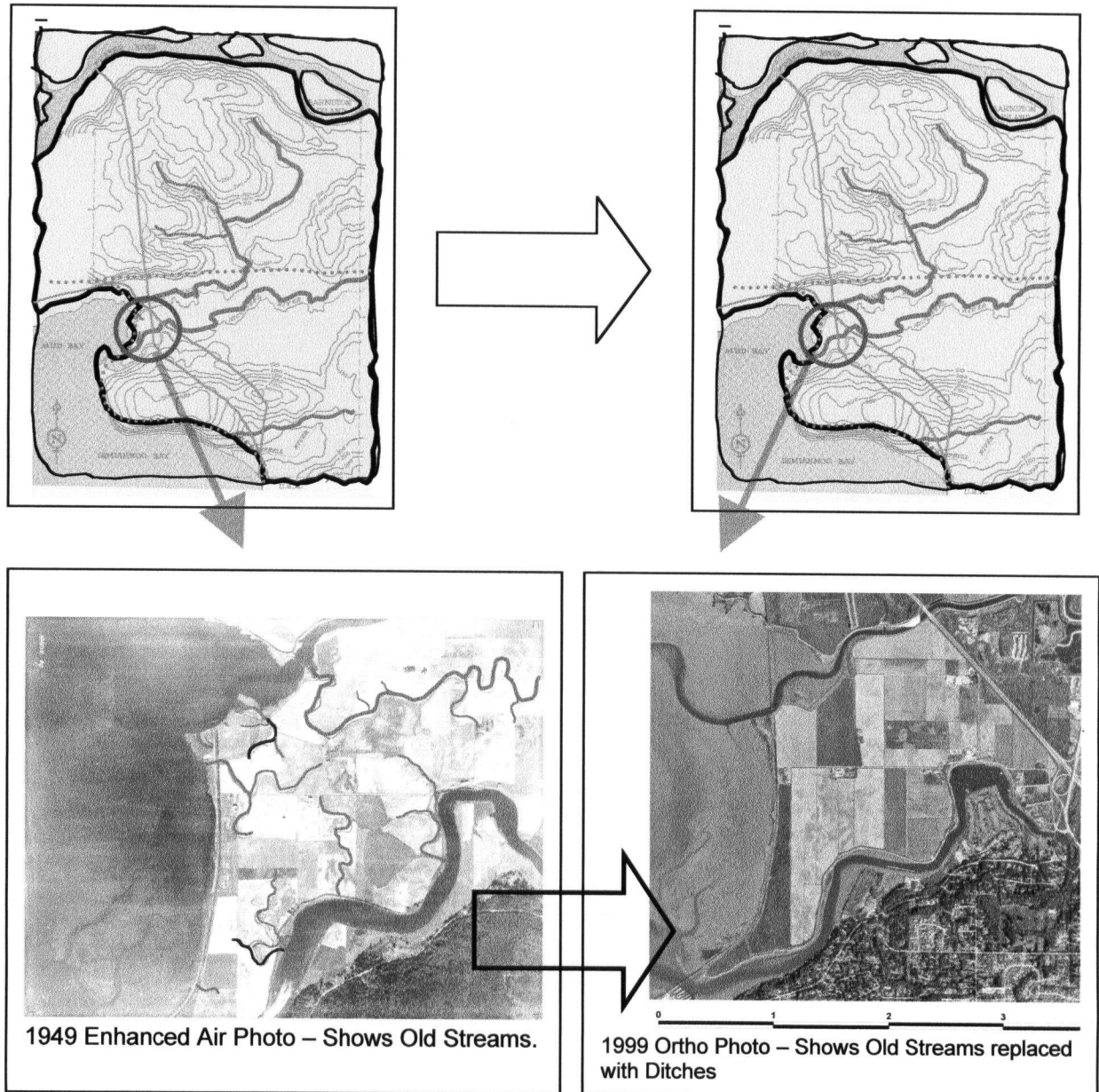


Figure 98 Mud Bay at the Efficiency Era

Along with the concentration of farming, the land is made more efficient for farming. The old streams, such as Snider Creek (large creek upper north west corner of photo) are

completely covered over. The land is extensively graded and ditches are laid out in rectilinear patterns signifying the edge of a farming field.

During this period, there are other groups that would like to see the area not used exclusively for farming. Naturalists and biologists recognize the areas ecological importance and the larger role it plays in the Pacific Flyway. They propose plans for the farmland area to be set back to its former natural state as a wetland. To date they have been successful in setting up the Serpentine Fen Nature Reserve and making Mud Bay a Wildlife Management Area the Pacific Flyway.

The surrounding areas population continues to grow and with it conflict issues begin to develop on how the land should be used. The surrounding areas general population would like have access to the dykes for passive recreation purposes, whereas the farmers want the land to be used exclusively for farming. The farmers try to persuade the general public from entering into the area through no parking and no trespassing signs. However, many people begin to ignore their signs and enter into the area.

### **Land Transportation**

The automobile is the common form of transportation. Public transportation or bus routes are established outside the study area mainly carrying passengers from White Rock & South Surrey to North Surrey. Several bus stops are established outside the area on the King George Highway and Crescent Road. It is proposed that the current railway line be relocated to 176<sup>th</sup> Street where the trains can travel at higher speeds as they won't go through any major residential areas. The long-term plan for passenger rail service in the corridor, as described in the Amtrak Cascades Plan for Washington State 1998-2018 Update (April 2000) has stated the desire to relocate the rail line from White Rock Crescent Beach to a much more desirable location.<sup>160</sup> (Figure 99)

### **Water Transportation**

Water transportation is now completely shifted from utility purposes to recreation purposes. Crescent Beach Marina births many recreation boats.

### **Residents**

- The properties at the eastern section of the site are subdivided into smaller lots. The Wallace Farm is one of those homes built on the smaller lot.
- The area's outside population increases in South Surrey, White Rock, and Panama Ridge.
- Surrey has approximately 50% of the jobs necessary for the people who live there.<sup>161</sup>

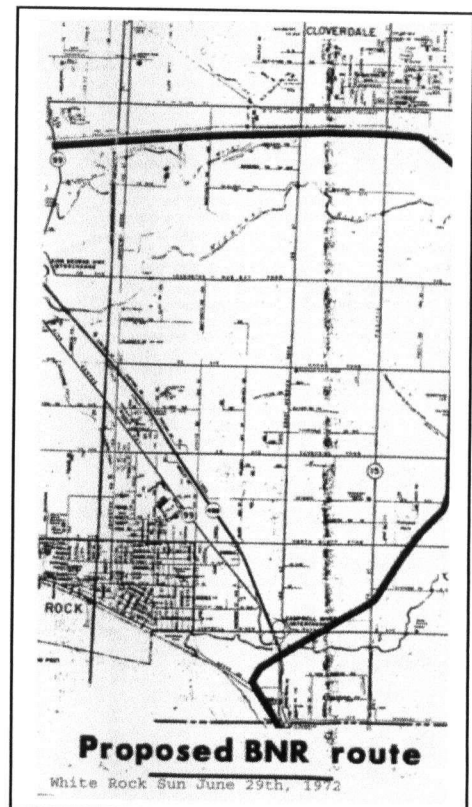


Figure 99 Proposed BNSF Railway Move

<sup>160</sup> GVRD. Planning.

<sup>161</sup> Treleven. 138.

## Dykes, Dams & Drainage Ditches

- Farmers continue to drain their land with improved ditching systems.
- 1972 Flood. According to John Van Keulen, water was waist high, and cattle had to be moved to higher ground. (Figure 100)
- "The farmers are responsible for the drains on their own land. From there, it is a complicated system where a Dyking Association and various levels of government are involved with drainage and sewer systems and dykes and dams on rivers. The constant increase in urban and suburban growth in Surrey brings an inevitable increase in drainage problems for the farmers, for most of the farms are on lower lands".<sup>162</sup>

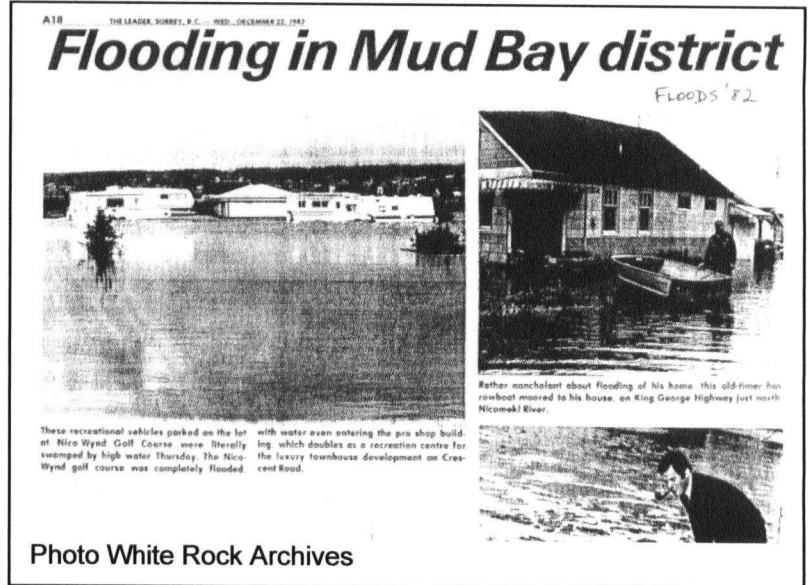


Figure 100 Flooding in Mud Bay District

## Farming

- Land is used more efficiently by concentrating farming practices. Farmers begin to buy other farmer's dairy quotas. As a result, the area becomes dominated by two dairy farms: Donia and Kitzel Farms. The Kitzel family is one of Surrey's farm pioneering families. In Surrey, David Kitzel first farmed the Kitzel Farm in 1895 and now it is being run in Mud Bay by the fourth generation of Kitzels. They are one of five pioneer Surrey families who are still farming the land.<sup>163</sup> Both farms use a small portion of their land for housing the dairy cattle. The rest of the land is efficiently farmed for silage and hay to support their heavily concentrated dairy industry in the area. (Figure 101)
- Mud Bay farmland is put into the Agricultural Land Reserve that preserve good land for farming purposes. Some say it has "caused much controversy. Farmers find themselves unable to dispose of their land as they wish when they are no longer able to farm it. There are questions on the quality of some of the land so frozen and whether it should be open to other uses".<sup>164</sup>
- The government deems the land next to Mud Bay, Nicomekl, and Serpentine Rivers valuable. The government buys these designated farms next to the water and leases them back to the farmers.

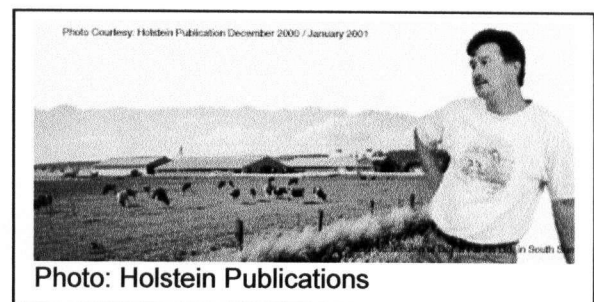


Figure 101 Dairy Farming in Mud Bay

<sup>162</sup> Treleaven. 154.

<sup>163</sup> Treleaven. 153.

<sup>164</sup> Treleaven. 152.



## Logging

Second growth of trees in the area begins to take shape. There is no substantial logging taking place in the immediate area.

## Fishing

There is recreational or sport fishing on the Nicomekl River.

## Land Use Plans

- 1970's Conservation Plans begin.
- In 1973, headed by Dr. Barry Leach the Serpentine Fen was begun. The Institute of Environmental Studies of Douglas College acquired the land from the Provincial Department of Highways. Dr Leach allowed the farm to gradually return to its natural wild state. Dr Leach noted, "Three or four generations of farmers fought against floods and tides, marsh and scrub to create farmland. To allow even a derelict and abandoned patch of 200 acres revert back to something like its original state is to them a retrograde step. But if we related this area to the vast acreage of similar land and water which we have radically changed and ruthlessly exploited, it does not seem much to ask that it remain as a testimony of the landscape and wildlife which was sacrificed to our needs".<sup>165</sup>
- The Agriculture Land Reserve (ALR) was put in place to ensure land being used for agriculture.
- 1990 Surrey commissions a Crescent Beach Waterfront Walkway Feasibility Study from Blackie Spit to White Rock.<sup>166</sup>

## Recreation

- Many local boaters begin to use the Nicomekl River's big bend by Elgin for water-skiing and rowing. (Figure 102)
- Many environmental groups are recording and enjoying the areas natural beauty but are increasingly coming into conflict with the different types of recreational user groups who disturb the natural environment.
- Surrey begins to put up "No Parking" Signs and the various Dyking Commissions begin putting up "No Trespassing Signs" to discourage the number of people coming into the area.
- 1980's Brian Guzzi & Associates, Landscape Architects write about the recreational potential of Crescent Beach Corridor (historical and ecological potential). Guzzi states that the area is in need of various accommodation facilities such as bed and breakfasts, and campsites.<sup>167</sup>

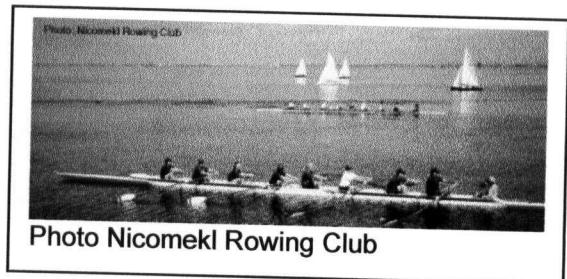


Figure 102 Rowing in the Nicomekl & Mud Bay

## Legends

- George Kitzel one of the decedents from David Kitzel (an 1895 Surrey Farm Pioneer) recalls "in the early days of mixed farming, his parents making the excellent sauerkraut which found a ready market in New Westminster and Vancouver, and the boxes of apples they carefully polished and packed by hand as well".<sup>168</sup>

<sup>165</sup> Treleaven. 166.

<sup>166</sup> City of Surrey. Crescent Beach.

<sup>167</sup> Guzzi. 3

<sup>168</sup> Treleaven. 153

*"It is our wish that this brief look at 'What has been' may interest and help those who are making 'What will be'."*  
*The Surrey Story*<sup>169</sup>

*In Surrey, "change then came so rapidly that it seemed successive Surrey Councils moved in a somewhat harried fashion to catch with the events after they happened. Ribbon development, suburban sprawl, and scattered industrial areas all encroaching on farm land was the result".*

*The Surrey Story.*<sup>170</sup>

---

<sup>169</sup> Treleaven. 131.

<sup>170</sup> Treleaven. 136

## **5.8 SITE ANALYSIS**

The object of the site analysis is to identify the constraints and opportunities for greenway design that exist because of the biophysical inventory, cultural inventory, and stakeholder knowledge.

The site analysis determines (a) if there is enough room on the site for the proposed facilities, and (b) whether the program analysis should be reworked. Arcview GIS 3.2 was used to create the site analysis from the general inventory.

### **Site Analysis Results**

Analysis of existing reports and other research information along with direct site observations regarding structure, programming, usage and existing conditions exposed several key issues:

#### **A. Constraints**

The following list contains potential greenway design constraints that exist because of the cultural and inventory components:

- Eel grass beds and sensitive marine habitat limit building a trail on the waters' edge.
- High tides make a foreshore trail susceptible to flooding.
- High winds make for uncomfortable conditions on the dyke for the user.
- Serpentine (100 meter) and Nicomekl (132 meter) river crossings make connections difficult and costly if their primary purpose is for recreation. Nicomekl River poses another problem: the clearance height that must span the river is 15 meters.
- Railway berm on Mud Bay creates a visual barrier on the inland side of the dyke. The 3-4 meter high dyke blocks the view to the water.
- Traffic noise and highway views are dominant on the northeastern section of the site.
- Highway crossings are difficult to justify in a corridor reserved for recreation when crossings are usually only used in highly populated areas. The current highway width is 62 meters and the proposed distance required is 74 meters.
- Flooding usually occurs in 10 – 20 year cycles at the site due to the rivers overflowing the dykes and or extreme high tides (based on local resident's historical records). Floods range from roof tops to 1-2 meters deep)
- Low water tables (1 meter below surface) make for a wet site for much of the year.
- No public drinking water on site and public drinking water in area is limited.
- Dyke authority does not want shrubs or trees on dykes due to maintenance issues. Dyke Authority states that grass is easier to work with.
- Quicksand conditions in Mud Bay
- River undertows in Nicomekl River make swimming unsafe.
- Many existing recreational opportunities in the area are not compatible with greenway objectives (dog walking & motorbike riding on the mud bay flats) Dogs in Mud Bay pose a threat to bird life and farmers do not like them because they frighten livestock. Motorbike riding poses a threat to the comfort of the wildlife).
- Agricultural zoning in the long run could potentially be used for intense agriculture (greenhouses & blueberry farms) that would not be compatible with wildlife nor the area's visual characteristics.
- High property prices in the lower mainland generally translate to high cost for acquiring land.

- Dairy Farmers (Kitzel and Donia Farms) are opposed to more people in the area
- Privately owned dykes & rail bridges would have to be purchased for the initial trails in stage one.
- Site lines to Serpentine Fen, and Blackie spit with no actual access pose problem because people are beginning to take risks to reach their destination. People cross the 99 Highway and people walk on the railway bridges to reach the destination that they see in the site line.

## **B. Opportunities**

The following is a list of potential greenway opportunities that exist because of the cultural and inventory components:

- Waterways offer opportunities for Surrey's Blueway program
- Relatively flat site offers opportunities for the disabled and elderly. There are no steep grades to climb.
- Location is somewhat diverse offering views to the rivers and to historic sites.
- More sunny days than Vancouver attracts people who want to escape the rain.
- Low water tables ensure water is present virtually all year.
- Farms grow agricultural crops that attract bird and other wildlife.
- Area attracts many birds due to it being a part of the Pacific Flyway Route.
- Mud Bay provides excellent habitat for birds
- Mud bay is a good location to view birds.
- Many existing recreation opportunities in the area that can be incorporated into the greenway (Bird watching, walking, jogging, cycling, horseback riding, picnicking).
- Dairy herd provides viewing opportunities to the public
- Right of ways 136<sup>th</sup> street & 32<sup>nd</sup> Ave good for potential trail access
- GVRD South Surrey Interceptor can be negotiated for public right of way
- Wallace Farm is being bequeathed to UBC and may be incorporated into the site
- City and Highway Right of way pose good opportunity for paths.
- BNSF Railway may relocate their tracks and move out of the area by 2010
- Surrounding area's residents can be potential greenway users.
- Dairy farms potentially could be used to inform people on the importance of agriculture.
- Serpentine Fen and Boundary Bay attract many residents outside the local area to the site.
- Increasing urbanization in the Vancouver Lower mainland will contribute to increasing demand for more significant parks
- Site and surrounding area is rich with Surrey's historical activity
- Many views (Point Roberts, Blackie Spit, River environments, Mud Bay, North Shore Mountains, Mt Baker, Vancouver Island Mountains give visual interest to the site.

## **C. Summary**

The following is a summary list of the above mentioned constraints and opportunities that are a potential concern in the design process.

- Recreational Use Impact
  - Restrictions on dog walking and motor biking.
- Environmental Impact and Protection
  - River sensitivity
  - Natural resource protection

- Habitat and wildlife education and interpretation
- The importance of restricted access to the shoreline for the protection of wildlife.
- The environmental capacity of Mud Bay as marine foreshore habitat
- **Community Needs**
  - Accommodate for increasing local population and tourist base.
  - The connections between Mud Bay and Crescent Beach, and the surrounding greenways.
- **Cultural Awareness and History Education Issues**
  - Interpretation of site's rich and cultural and natural history
- **Accessibility and Privacy Issues**
  - Identify entry points and increase accessibility to public areas, while creating barriers to private and ecologically sensitive areas.
  - The imminent expansion of the already imposing surrounding greenways.
  - The necessity to promote pedestrian connections between the proposed greenway and the existing greenways.
  - Concerns over the influx of users into an existing farming community and a working rail line

### **Walkway Site Analysis**

The objective of this section is to provide further analysis of a potential walkway within the Mud Bay Greenway from items that were discovered in the inventory process. This analysis will examine two route options: 1) a Waterside Walkway and 2) an Inland Walkway. (Figure 103)

#### **1) Waterside Walkway**

A waterside walkway would align itself on the west shore of the BNSF railway dyke. (see proposed waterside walkway route in Figure 103).

#### **A. Constraints**

- The sensitive eelgrass beds that are just off shore would be negatively affected by the construction according to the BC Ministry of Environment, Lands and Parks & BC Department of Fisheries & Oceans.
- There would be a duplication of trails. When the BNSF railway is relocated (see site inventory) the defunct rail line will be incorporated into the greenway network. This would then create a duplication of trails along the waterside. The Greater Vancouver

Regional District and the City of Surrey have stated their interest in acquiring the rail line for a shore side greenway trail. At present, the duplication would not be on the inland side because there is an existing GVRD maintenance gravel road on the site that would be incorporated into the site.

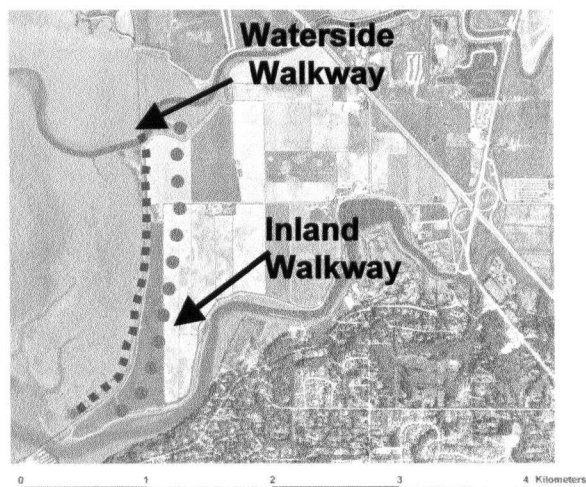


Figure 103 Waterside & Inland Walkway Options

- There is a higher cost for a waterside route as compared to an inland route. Westmar Consultants in a 1990-feasibility study stated that there is considerable cost (\$1250 per lineal meter for rip rap and \$2800 per lineal meter for pilings in 1990 dollars).<sup>171</sup> Versus the lower costs associated with acquiring the greenway rights on the inland side when the properties come up for lease from British Columbia Assets and Lands Corporation (see site inventory property ownership).

#### **B. Opportunities:**

A waterside walkway would have a higher user satisfaction than an inland walkway route. This is due to the waterside route having more visual interest with Mud Bay being visible at all times to the user.

### **2) Inland Walkway:**

An inland walkway would align itself on the inland or eastern side of the BNSF railway dyke. (see proposed inland walkway route in Figure 103.

#### **A. Constraints:**

An inland walkway would have a lower user satisfaction than a waterside walkway route. This is due to the inland route having less visual interest with Mud Bay being not being visible due to the dyke blocking the view. Thus, the user on the inland side would be able to see the 3-meter railway dyke or the farm fields, but would not have views to Mud Bay.

#### **B. Opportunities:**

- The inland route would not disturb the sensitive waterside habitat. The inland route would be on the farmland side of the dyke where there is less sensitive habitat.
- The inland route would waste resources by duplicating trails. The inland walkway would follow an existing GVRD maintenance road. Thus, the trail's basic infrastructure is already in place so not as much effort would be put into making it into a useable trail. In addition, when the BNSF railway is relocated (see site inventory) and when the defunct rail line is incorporated into the greenway network, then the inland trail following the GVRD maintenance road can resume being solely a maintenance road. As a result, few funds are spent on the inland trail as compared to the waterside trail because it would serve no other use.
- There is a lower cost for an inland route versus a waterside route. Westmar Consultants in a 1990-feasibility study stated that there is considerable cost for a waterside route (\$1250 per lineal meter for rip rap and \$2800 per lineal meter for pilings in and in 1990 dollars).<sup>172</sup> versus the lower costs for an inland route. Acquiring the greenway rights on the inland side when the properties come up for lease from British Columbia Assets and Lands Corporation (see site inventory property ownership) will be less costly than the construction costs for a waterside route.

#### **C. Walkway Analysis Summary:**

There are more opportunities for an inland walkway than for a waterside walkway route. The inland route is less expensive, requires fewer resources, and its construction is not as harmful to the sensitive shore habitat.

<sup>171</sup> City of Surrey. Crescent Beach. 15

<sup>172</sup> City of Surrey. Crescent Beach. 15

## Chapter 6 Program Cycle

The object of the program cycle is to take the greenway goal and to develop it into a more refined program for the greenway. The site program will be completed using the four planning steps shown in Figure 104, this time concentrating on the preliminary program. One program, out of three alternatives, will be chosen to expand into a more detailed program. The program will be chosen based on earning the most favorable result during the evaluation process according to the goals and objectives set out in the vision cycle.

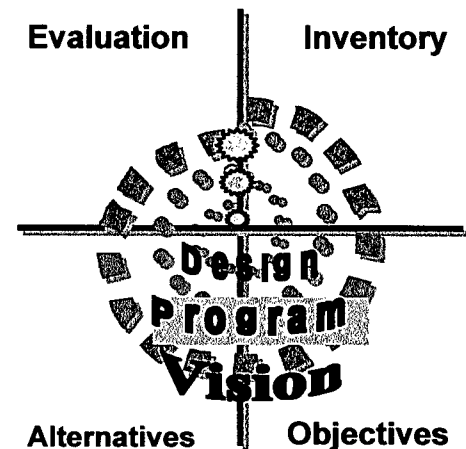


Figure 104 Program Cycle Objectives

### 6.1 Development of Program Objectives

The objective of this section is to develop initial program objectives that can be elaborated upon.

Data was gathered from the inventory and inventory analysis to elaborate preliminary suitable program objectives with alternatives for the site. The individual programs fall within the larger greenway vision goal - to prepare a greenway framework and design prototypes in the Surrey Mud Bay Area.

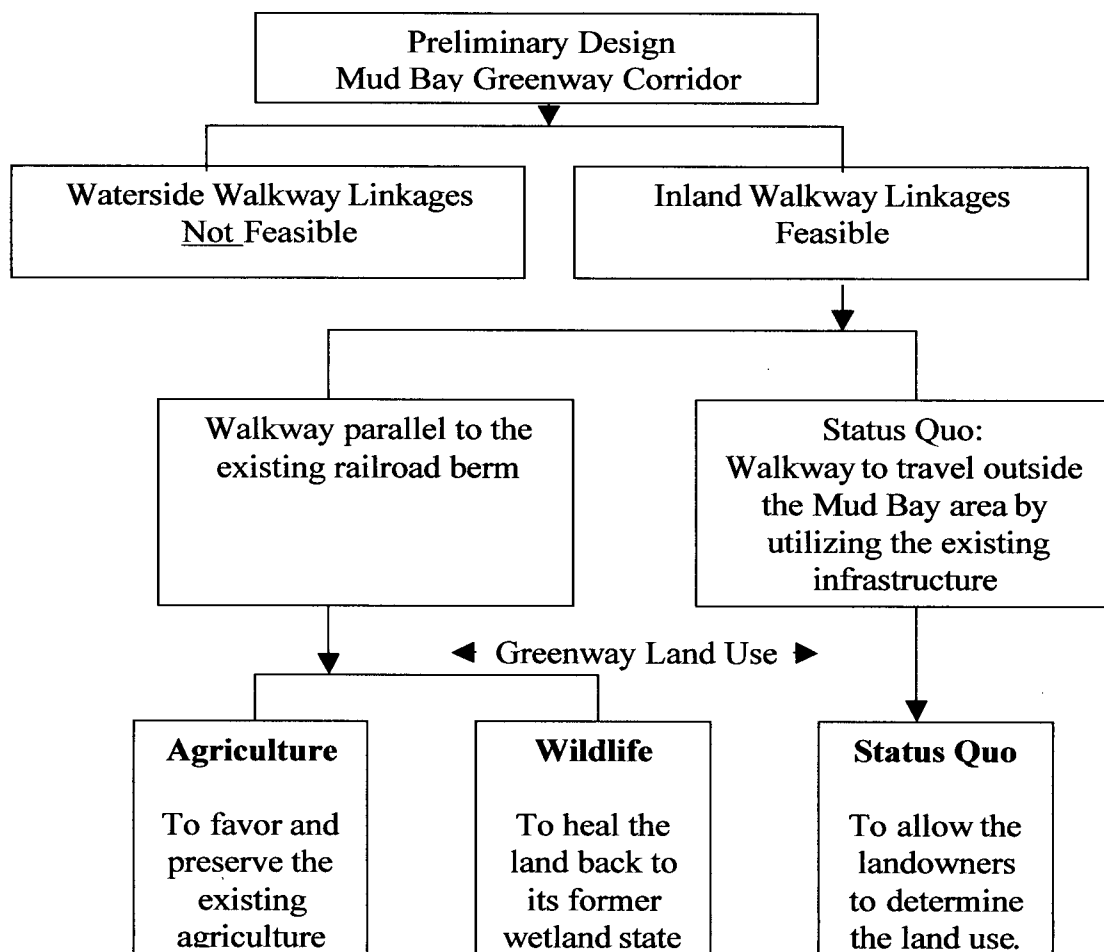


Figure 105 Program Alternative Summary

After a review of inventory analysis for the study area, it has been established that on the Mud Bay shoreline, there is only one feasible walkway alignment that satisfies the Mud Bay greenway vision's objectives: a walkway on the inland side of the railway dyke (see Inventory Analysis and Summary and Figure 105 Program Alternative Summary).

### **Possible Inland Walkway Programs**

There are two possible options that should be explored for the recreational corridor on the inland side :

- (1) Walkway parallel to the existing railroad berm within the study area and
- (2) Walkway to travel outside the Mud Bay area utilizing the existing infrastructure.

**(1) Walkway parallel to the existing railroad berm within the study area.**

- This option aligns the recreational greenway corridor next to the railway berm. It requires two bridges to be built over the Serpentine and Nicomekl rivers. Although this may cost more than the second option, there is an established desire line according to current Mud Bay area visitors who prefer and who are already traveling this route along the bay.
- Within this option, an inland walkway parallel to the existing railway, two alternatives present themselves on how the land in the greenway corridor will be used over time. One will focus on agriculture and the other on the environment. These preliminary objectives, (agriculture and environment) were developed from stakeholders having several strong views on how the land within the greenway should be programmed. Some thought that the greenway land should promote agriculture, while others thought that it should promote the environment.
  - **Agriculture** : This option will favor and preserve the existing agriculture. The agricultural activities will be protected and remain as a traditional activity. It assumes that recreational activities can exist with minimal impact on the agricultural activities in the area. This option is favored by the dairy farmers in the area.
  - **Wildlife & Environment**: The second alternative favors the environment and wildlife. It attempts to restore the land to its former state as a wetland giving prominence to wildlife that is dependent on it. It too will assume that recreational activities can exist with minimal impact on the wetland activities in the area. This option is favored by the surrounding area's naturalist and wildlife groups.

**(2) Walkway to travel outside the Mud Bay area utilizing the existing infrastructure.**

This option is proposed due to some residents and stakeholders suggesting that there should be no greenway within the study site. Instead, they reason there should be a greenway outside the study site connecting Crescent Beach with Serpentine River Park. These residents would like to see the Mud Bay study area's existing character remain the same or they would like to keep the status quo. Since this program objective falls within the Design Methodology (see the Design Methodology section) where if all the program alternatives were found not to be feasible then these alternatives would not be pursued and alternative



programs would be explored. The status quo is viewed as an alternative program that will be developed further.

- **Status Quo:** this option does not require any new bridges to be built. It allows the existing landscape character to remain status quo in the Mud Bay area. To the local residents, the second option does not seem like a threat to their current privacy. Thus, the second option will be called the 'status quo' option. This option is favored by most of the area's residents.

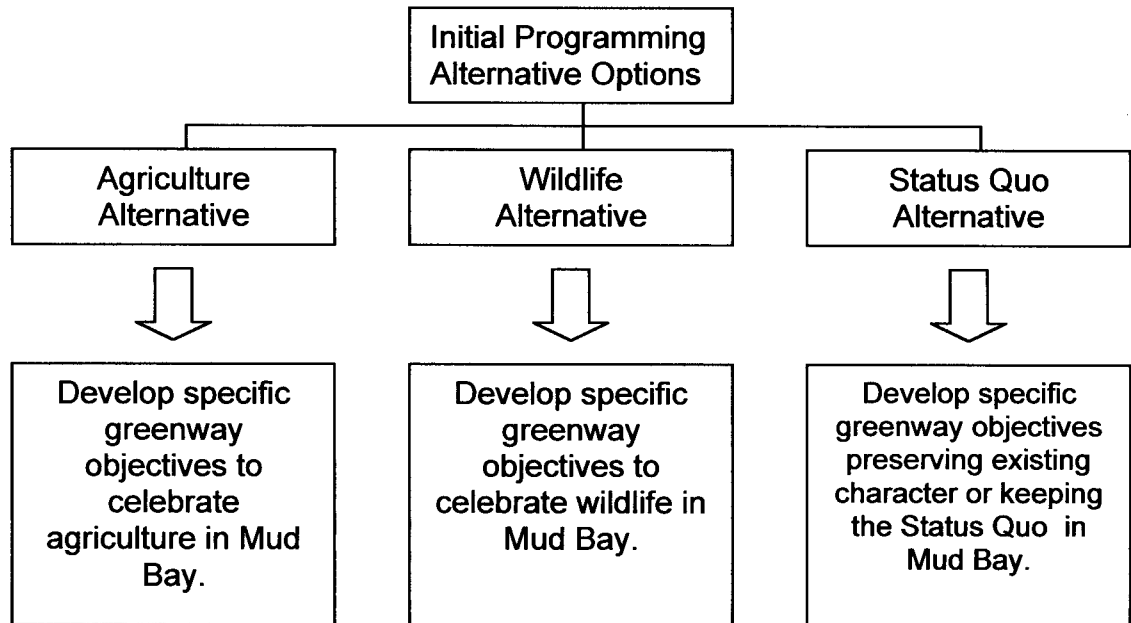


Figure 106 Initial Programming Alternative Options

## 6.2 Preliminary Program Alternatives

From the previous step, Possible Inland Walkway Programs, it is decided that the initial site program will explore three program alternatives focusing on: agriculture, wildlife (environment), and status quo (Figure 106). The reasoning for deciding on these three alternatives is to address some of the stakeholders' concerns previously mentioned.

At this point, it should also be acknowledged that these alternatives are the extreme greenway options. The alternatives will be developed according to the greenway goals and objectives (see sections Study Terms Defined and Vision, Goals and Objectives). The three alternatives will be developed according to the program rationale summarized in Table 5 Alternative Program Rationale

Table 5 Alternative Program Rationale

Rational	Agriculture Alternative	Wildlife Alternative	Status Quo Alternative
Ecological Objectives	Low Priority	<b>High Priority</b>	Low Priority
Greenway Objectives	<b>Moderate Priority</b>	<b>High Priority</b>	Low Priority
Landowner Concerns	<b>Moderate to High Priority</b>	Low Priority	<b>High Priority</b>
Minimizing Development Costs	<b>Moderate Priority</b>	Low Priority	<b>High Priority</b>
Emphasis in Bold			

The following will develop each program alternative (Agriculture, Wildlife, and Status Quo) based on the above rationale listed in Table 5 to the point where it can be objectively evaluated against the other alternatives. After the program alternatives are prepared, the next planning step will be to review them critically.

## 1. The Agriculture Alternative:

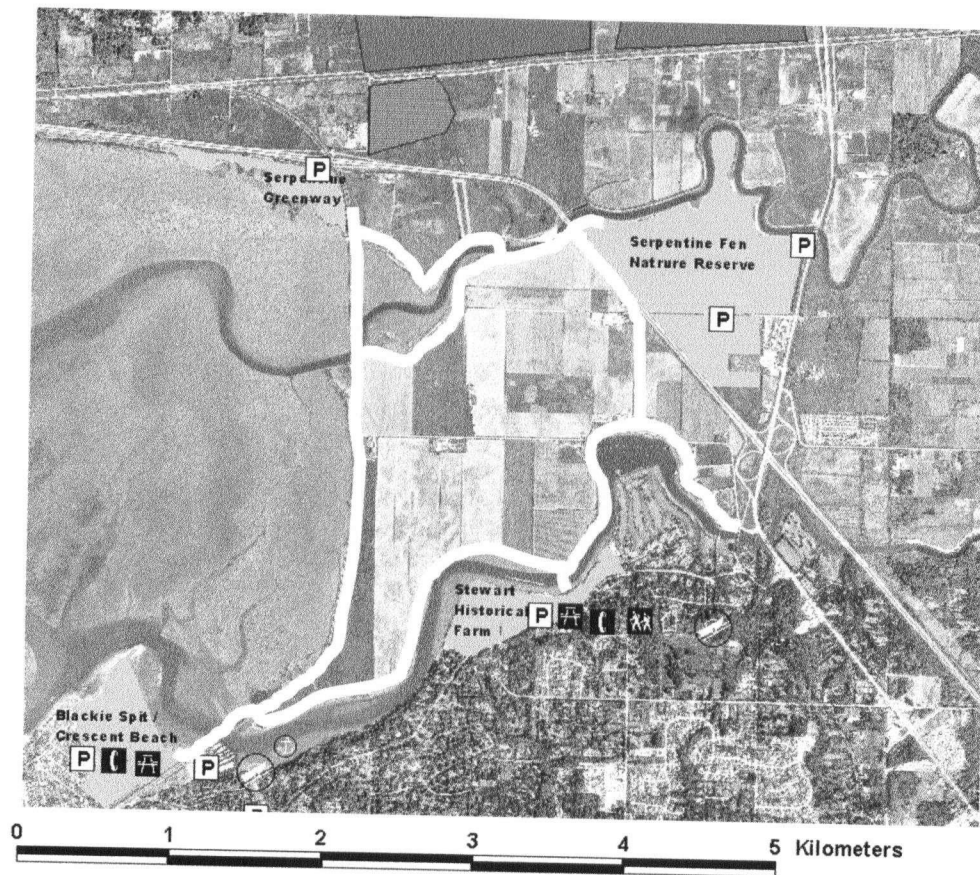


Figure 107 Proposed Agriculture Alternative Phase 3

### Overall Objectives

- To design a greenway at favors and preserves the area's agricultural importance.
- In this greenway design, (Figure 107) Mud bay's agricultural significance will be preserved while allowing public access. Through zoning it will promote traditional soil based agriculture.
- It will emphasize that the site is an agriculturally productive area and that preservation of such areas is important in an increasingly urbanized region.
- It will entertain and educate the public on the area's agricultural importance.
- It will allow limited public access and recreation opportunities along the dykes and on the maintenance roads in the agricultural fields.
- It will incorporate the railway line into its plan.
- It will provide a green link Crescent Beach to Surrey's new Serpentine River Park.
- It will incorporate the area's distinct landscape characteristics to promote community identity.

## **A) The Agriculture Alternative's Greenway Objectives**

### **1. Open Space**

- It will allow limited public access on dykes, GVRD right of ways, and Surrey right of ways.

### **2. Environment**

- It will protect and safeguard the Mud Bay Area by recognizing that its' agricultural operations are within an ecological sensitive area. It will propose changing its zoning from Agriculture A1 zoning to a restricted agricultural zoning that does not allow blueberry farms, cranberry farms, nor greenhouses.
- It will not limit dogs on the dykes or the farm fields. However, it will restrict dogs on the sensitive Mud Bay shore.

### **3. Connectivity**

- It will help connect the local parks, greenways, and historical sites through its trail system.
- It will provide links across the two rivers by incorporating the railway line and by building two bridges.
- It will provide for a link between the Serpentine Fen and the Mud Bay greenway by building a bridge over the Highway 99.
- It will maintain its present role in creating a favorable environment for wildlife between the Serpentine Fen and Mud Bay.
- It will help in providing a green link between populated areas from Crescent Beach to Delta and North Surrey.
- It will provide an emergency route for livestock via the Nicomekl and Serpentine River bridges. The bridges can be used when the area floods extensively to move the cattle across the rivers and out of the flooded lowlands into the higher grounds until the water levels dip.

### **4. Recreation**

- It will not have any pathways in naturalistic settings. All paths will be situated on the existing dyke or roads with the exception of the path along the 99 Highway.
- It will allow for a limited 4-car staging area on Rio Place.
- It will provide minimal site elements such as litter containers, benches, and information signs
- It will provide opportunities for passive recreation such as bird watching, wildlife viewing, picnicking, nature interpretation, and historical interpretation.
- It will provide opportunities for active recreation such as walking, jogging, cycling, and fishing.
- It will allow boats such as canoes, and sea kayaks to dock on the shores of the Nicomekl & Serpentine Rivers. However, it will not provide for space for a formal boat dock nor launch site for boats.
- It will have no speed restrictions imposed for watercraft on the Nicomekl River.
- It will provide a barrier such as a fence between the trail and farm fields to prevent people and dogs from entering fields.
- It will give the option for the residents to become the area's stewards. As stewards they will open and shut certain gates, and inform people about the area. They will be compensated for their role.
- It will not allow access to either people or dogs to be on the sensitive Mud Bay shore habitat

## **B) The Agriculture Alternative's Implementation Objectives**

- It will be possible to implement it over time with the needed land acquisitions.
- It will be easily modified over time to allow for changing recreation or environmental programming needs.

### **1. Landscape Character**

It will incorporate the existing landscape character into its plan. There will be little or no significant change of what exists. The farm buildings, open agricultural fields, the dominant orange farm buildings, the Wallace Windmill, the open 'naturalistic' bay, the panoramic views, the railway bridges, the Nicomekl tidal dam, the Crescent Beach Marina, the various river pilings, and the views to the mountains will all be as seen today.

### **2. Cost**

- It will have a moderate capital cost. Funds will be required to purchase the required greenway, to build the two river bridges, and to build the Highway 99 pedestrian overpass. Land purchase costs are minimal, as the greenway in this alternative only provides for minimal trail widths.
- It will have moderate maintenance costs as the dykes will require yearly grass mowing, and the trail edges will also need trimming as well.

### **3. Response to User Concerns**

- It will allow for limited public access through the trail system in the Mud Bay Area on designated paths. It will not allow access to the general farm fields.
- It will have trails wide enough to allow for emergency vehicle access.
- It will have fenced off areas separating people from hazards such as aggressive farm animals.
- It will provide for an at-grade rail crossing at the Serpentine River Park.
- It will have a moderated experiential ranking based on the theories of Rachel Kaplan, Stephen Kaplan, and Robert Ryan in 'Trails and Locomotion'.<sup>173</sup>
  - It will lure the user into the trail system by having sight lines to various familiar sights such as the existing farm buildings or mountain views.
  - It will have trails, with the exception of the dyke walk, that will not curve. The trails will follow the straight edge of the agricultural fields.
  - It will have little to no 'sense of mystery' in the trail design. There will be no strong hints about what will be seen, as the trails will be situated adjacent to open flat fields. However, the Nicomekl River dyke walk does offer a sense of mystery with its views across the river. The forest canopy is open on one side and closed on the other side which gives visual interest.
  - It will have trail widths that will not vary significantly. The trail will either follow the top of dyke, Highway right of way, or maintenance roads.
  - It will have trail surfaces that are a combination of gravel or asphalt.
  - It will provide methods to facilitate 'way-finding'. Its existing views to the bay, rivers, mountains, Panama Ridge, and Crescent Ridge along with signs will provide methods to allow the user to get its sense of bearings.
  - It will have a trail system that is part of a larger interconnected trail network. It will also provide smaller loop trails within it.
  - It will provide limited seating areas on the dyke.

---

<sup>173</sup> R. Kaplan S. Kaplan and Ryan.

- It will provide limited access to important features such as the heritage house on 40<sup>th</sup> Avenue.
- It will have views to the agricultural fields, the heritage house, Panama Ridge, Crescent Ridge, Point Roberts, the bay, rivers, parks and mountains.
- It will have a mostly open trail system. It will mostly have grass areas that surround the trails. It will not have much tree canopy other than what currently exists.
- It will try to minimize the user's fears. There are virtually no blocked views due to wide-open agricultural fields in the final stage. However, at the greenway's first implementation stage it will have blocked Mud Bay views from the trail on the inland side of the dyke due to the high 3-4 meter railway berm. In the later stages, when the railway line is incorporated into the trail system, the view will not be blocked.

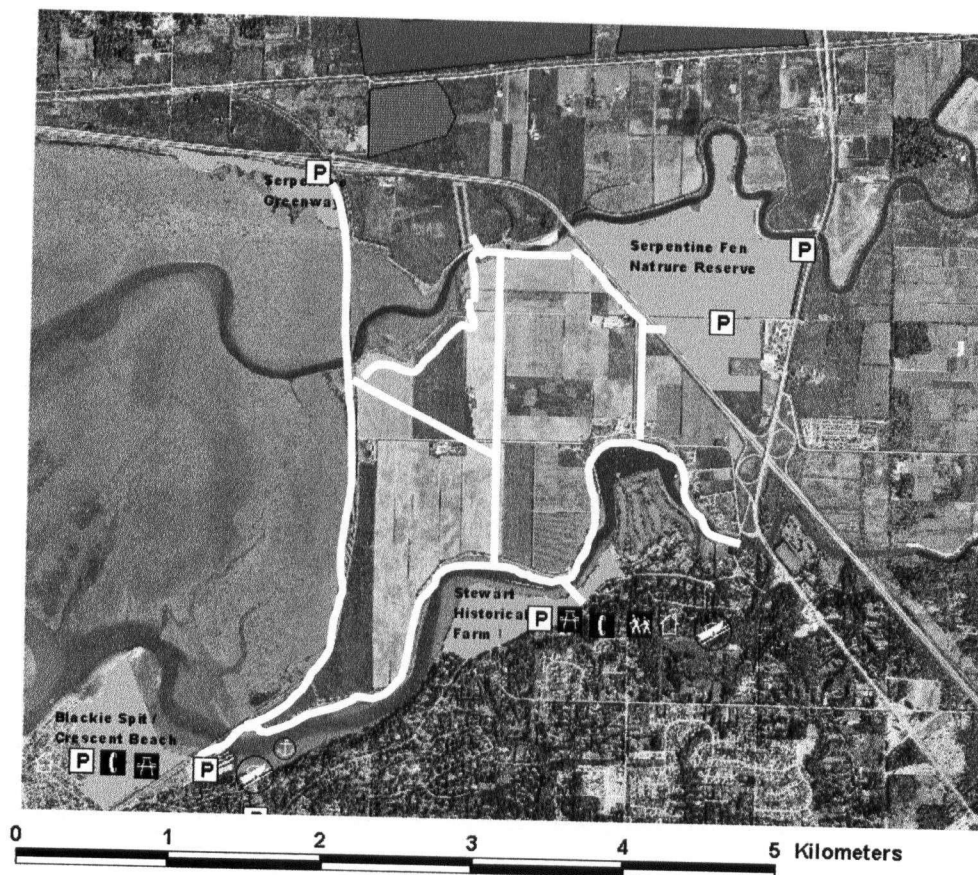


Figure 108 Wildlife Alternatives

## 2. The Wildlife Alternative

### Overall Objectives

- To design a greenway that emphasizes the area's wildlife importance and restores much of the area to its former state over time.
- In this greenway design (Figure 108), Mud Bay's uniqueness and intertidal zone will be preserved and enhanced while allowing public access to the area. It will create a trail system and a new wetland habitat over the existing farm fields.
- It will emphasize that the site on both sides of the railroad is a biologically productive salt-water marsh and that preservation and restoration of such environments is important in an increasingly urbanized region.
- It will entertain and educate the public on the area's ecological importance.
- It will allow limited public access and recreational opportunities along the dykes and within the non-sensitive wetland areas.
- It will incorporate the railway line into its plan.
- It will provide a green link from Crescent Beach to Surrey's new Serpentine River Park.



- It will incorporate many of the area's distinct landscape characteristics to promote community identity.

## **A) The Wildlife Alternative's Greenway Objectives**

### **1. Open Space**

It will allow limited public access on dykes, GVRD, Surrey, and highway right of ways.

### **2. Environment**

- It will protect and safeguard the Mud Bay Area by recognizing that it is situated within an ecologically sensitive area. It will propose to change its zoning from Agriculture A1 zoning to a park zoning where agricultural activities can take place with it until the agricultural land is phased out and it is incorporated into the wetland. The agricultural activities will favor traditional soil based farming. It will not allow blueberry farms, cranberry farms, or greenhouses on the agricultural land.
- It will not allow dogs on the dykes or the farm fields.

### **3. Connectivity**

- It will help connect the local parks, greenways, and historical sites through its trail system.
- It will provide links across the two rivers by incorporating the railway line and by building two bridges.
- It will provide for a link between the Serpentine Fen and the Mud Bay greenway by building a bridge over the Highway 99.
- It will enhance its role in helping facilitate wildlife between the Serpentine Fen and Mud Bay.
- It will help in providing a green link between populated areas from Crescent Beach to Delta and North Surrey.
- It will provide an emergency route for livestock via the Nicomekl and Serpentine River bridges. The bridge's can be used when the area floods extensively to move the cattle across the rivers and out of the flooded lowlands into the higher grounds until the water lowers.

### **4. Recreation**

- It will have some pathways in naturalistic settings. Paths will be first situated on the existing dyke or roads with the exception of the path along the 99 Highway. In the later greenway phases, the paths will be situated in natural settings.
- It will allow for a limited 4-car staging area on Rio Place and a larger staging area at the Wallace Farm.
- It will provide site elements such as litter containers, benches, washrooms, drinking water, telephone access, and picnic areas, and information signs.
- It will provide opportunities for passive recreation such as bird watching, wildlife viewing, picnicking, nature interpretation, and historical interpretation.
- It will provide opportunities for active recreation such as walking, jogging, cycling, and fishing.
- It will allow overnight boating on the Wallace Farm dock on the Nicomekl River.
- It will allow boats such as canoes, and sea kayaks to dock on the shores of the Nicomekl & Serpentine Rivers.
- It will provide space for a formal boat dock and launch site for small boats (canoes and kayaks) near the Wallace Residence.

- It will have speed restrictions imposed for watercraft on the Nicomekl River. Low speeds will help the waterway uses be compatible with the sensitive habitat around it.
- It will in stage one provide a barrier such as a fence between the trail and farm fields. In later stages, the fences will be removed and access to sensitive habitat areas will be limited by means of a wetland barrier or actual gates protecting closed off areas.
- It will give the option for the residents to become the area's stewards. As stewards, they will open and shut certain gates, and inform people about the area. They will be compensated for their role. In later stages, there will be a formal steward at the Wallace Farm.
- It will not allow access to either people or dogs to be on the sensitive Mud Bay shore habitat

#### **B) The Wildlife Alternative's Implementation Objectives**

- It will be able to be implemented over time with the needed land acquisitions.
- It will be able to be slightly difficult to be modified over time to allow for changing recreation or environmental programming needs. after the wetland restoration has begun.

#### **1. Landscape Character**

It will incorporate the existing landscape character into its plan. There will be a significant change of the land use from agricultural fields to a wetland habitat. The wetland view will be composed of water, grass, trees, and shrubs. Some of the farm buildings, the dominant orange farm buildings, the Wallace Windmill, the open 'naturalistic' bay, the railway bridges, the Nicomekl tidal dam, the Crescent Beach Marina, the various river pilings, and the views to the mountains will all be as seen today.

#### **2. Cost**

It will have a high capital cost. Funds will be required to purchase the required land for the greenway and wetland, to build the two river bridges, and to build the Highway 99 pedestrian overpass. Land purchase costs are expensive, as the greenway wetland combination requires much land. However, much of the land is owned by the BC Provincial Government, which should make land acquisition costs reasonable. It will have moderate maintenance costs.

#### **3. Response to User Concerns**

- It will allow for public access through the trail system in the Mud Bay Area on designated paths. The greenway will eventually incorporate most of the existing Mud Bay farm fields.
- It will have most trails wide enough to allow for emergency vehicle access. However, many other trails will not be accessible to emergency vehicles.
- It will have fenced off areas, in the early stages, separating people from hazards such as aggressive farm animals. In the later stages, the only restrictions will be to the sensitive wild life areas.
- It will provide for an at-grade rail crossing at the Serpentine River Park.

- It will attempt to provide a moderate experiential ranking based the theories in Kaplan, Kaplan, and Ryan's section 'Trails and Locomotion' in their book With People in Mind: Design and Management of Everyday Nature.<sup>174</sup>
  - It will lure the user into the trail system by having sight lines to various familiar sights such as the existing farm buildings or Mountain views.
  - It will have trails that will curve. The trail's footprint will be wide enough to allow for curves to take place in it. This will be especially noticeable on the section of path that follows the Mud Bay railway dyke.
  - It will have a 'sense of mystery' incorporated into the trail design. There will be strong hints about what will be seen ahead. In the first stage, the Nicomekl River dyke walk does offer a sense of mystery by views across the river. The forest canopy is mixed open and closed on the other side that gives visual interest. Also in the first stage, the trail will be wider than the agricultural trail to allow for open and closed spaces through various tree, shrub, and grass plantings. In the later stages, there will be a variety of open and closed spaces in the entire trail network through extensive vegetation planting.
  - It will have trail widths that will vary significantly. The trail system will be composed of the dyke trail, Highway right of way, maintenance roads, and various inland trails through the wetland.
  - It will have trail surfaces that are a combination of gravel or asphalt.
  - It will provide methods to facilitate 'way-finding'. Its existing views to the bay, rivers, mountains, Panama Ridge, and Crescent Ridge along with signs will provide methods to allow the user to get its sense of bearings.
  - It will have a trail system that is part of a larger interconnected trail network. It will also provide smaller loop trails within it.
  - It will provide seating areas on the dykes, wetlands, and riverbanks.
  - It will provide access to important features such as the heritage house on 40<sup>th</sup> Avenue.
  - It will have views to the agricultural fields, the heritage house, Panama Ridge, Crescent Ridge, Point Roberts, the bay, rivers, parks, and mountains.
  - It will have an open and enclosed trail system through vegetation. It will have grass, shrubs, and trees with in the trail network. It will not have much tree canopy other than what currently exists.
  - It will try to minimize the user's fears as defined by Kaplan, Kaplan and Ryan (see Introduction and Terms Used). It will try to minimize the blocked views within the trail network in the final stage. However, at the first stage it will have blocked Mud Bay views from the trail on the inland side of the railway dyke due to the high 3-4 meter railway berm. In the later stages, when the railway line is incorporated into the trail system, the view will not be blocked.

---

<sup>174</sup> R. Kaplan S. Kaplan and Ryan.

### 3. Status Quo Alternative:

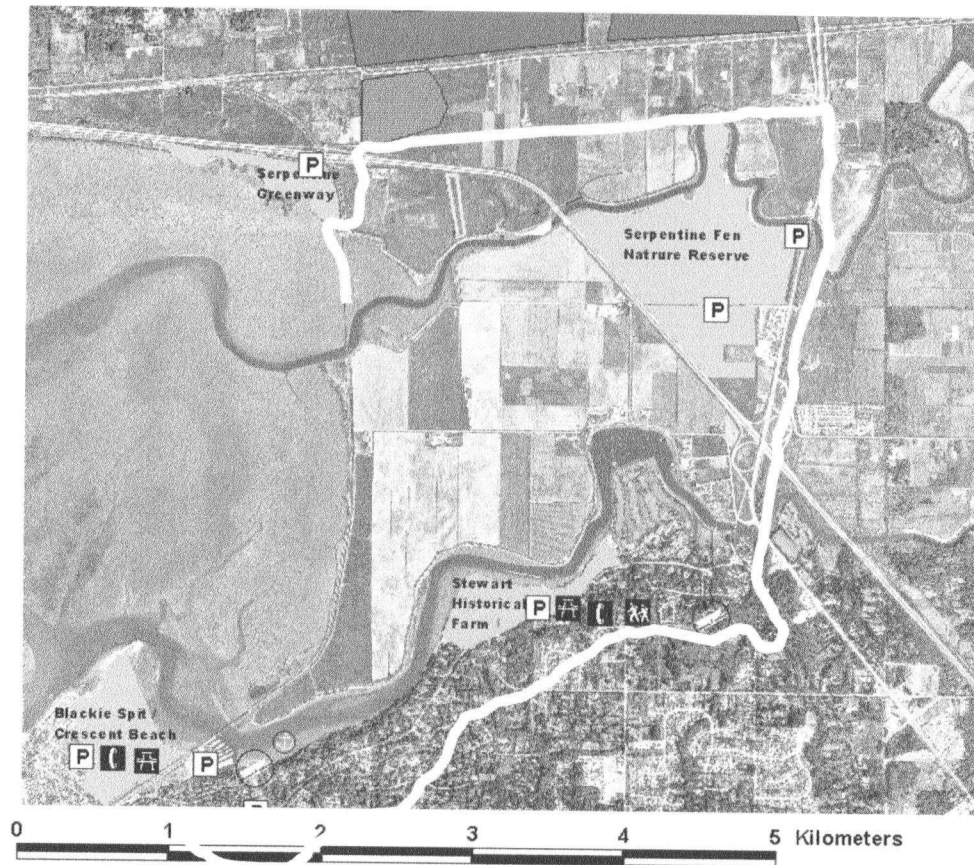


Figure 109 Proposed Status Quo Alternatives

#### Overall Objectives

- To design a greenway that skirts the Mud Bay Area and preserves the area's current landscape character with minimum cost, land use implications, or additional recreational opportunities.
- In this greenway design (Figure 109), Mud Bay's study area will not be used. Instead, a trail will be designed through the area's surrounding rural and urban fabric that utilizes Surrey's existing infrastructure.
- It will emphasize how the site could change over time due to development pressures in an increasingly urbanized region.
- It will attempt to keep the area's status quo. However it will demonstrate that through the existing zoning and natural land changes there will be allowable greenhouse ranges, blueberry farms, traveling hotels on the railway dykes and the Wallace property may be subdivided into smaller lots.
- It will not allow public access or recreation opportunities beyond the trail in the area.
- It will not incorporate the railway line into its plan.
- It will provide a more urban link and not a green link from Crescent Beach to Surrey's new Serpentine River Park.
- It will maintain the area's distinct landscape characteristics in the short run; however, in the long run, the area's landscape will change due to development.

## **A) Status Quo Alternative's Greenway Objectives**

### **1. Open Space**

It will allow no public access to the dykes or the Mud Bay farmlands. The proposed greenway will go outside the area.

### **2. Environment**

- It will not protect or safeguard the Mud Bay Area. It will maintain its existing Agriculture A1 zoning that allows a mixture of agriculture related activities that includes blueberry farms, cranberry farms, and greenhouse ranges.
- It will not limit dogs on the dykes or the farm fields.
- It will maintain its no trespassing policy and thus restrict people's access into the area.

### **3. Connectivity**

- It will help connect the local parks, greenways, and historical sites through its urban roadside trail system.
- It will not provide new links across the two rivers.
- It will not incorporate the railway line.
- It will not provide for a pedestrian link between the Serpentine Fen and the Mud Bay.
- It will maintain its present role of providing a favorable environment for wildlife between the Serpentine Fen and Mud Bay.
- It will help in providing an urban link between populated areas from Crescent Beach to Delta and North Surrey.

### **4. Recreation**

- It will have its pathways mainly on the side of the local roads. All paths will be situated on the road shoulders or sidewalks.
  - It will not have any staging areas other than what exists on the Serpentine Fen, Blackie Spit, and the Stewart Historical Farm.
  - It will provide minimal site elements such as litter containers at the existing staging areas.
  - It will not provide opportunities for passive recreation.
  - It will provide limited opportunities for active recreation such as walking, jogging, and cycling on the side of the roads.
  - It does not address the issue of boats such as canoes, and sea kayaks on the shores of the Nicomekl & Serpentine Rivers.
  - It does not address the speed issues for watercraft on the Nicomekl River.
  - It will limit access to people in the area through the current no trespassing signs, and no parking signs in the Mud Bay area.
  - It does not address the issue of stewardship.
  - It maintains its current policy of not allowing access to either people or dogs on the sensitive Mud Bay shore habitat
- Implementation Objectives**
- It can be implemented over time.
  - It can be easily modified over time to allow for changing recreation or environmental programming needs.
- Landscape Character**

- It will incorporate the existing landscape character into its plan. However, in the long run there could be significant changes to what exists now. The farm buildings, open agricultural fields, the dominant orange farm buildings, the Wallace Windmill, all could be replaced with different land uses such as blueberry or cranberry farms or large greenhouse ranges. This would affect the larger landscape character of the site.

#### **B) Status Quo Alternative's Implementation Objectives**

- It will be able to be implemented within a short period of time if it utilizes the existing road infrastructure.
- It will be able to be easily modified over time to allow for changing recreation or environmental programming needs.

#### **Landscape Character**

It will incorporate the existing landscape character into its plan. There will be no change to of what presently exists. The trail runs outside the study area therefore there will be no change to the landscape character from this alternative.

#### **Cost**

- It will have a low capital cost. Minimal funds will be required set up the trail system as it includes the existing road network.
- It will have low to moderate maintenance costs. It will have its share of regular trail maintenance such as routine asphalt resurfacing etc.

#### **Response to User Concerns**

- It does not allow for public access through the Mud Bay Area
- It will not allow public access to the general farm fields.
- It will have the road system to rely on access for emergency vehicles.
- It will not have barriers between people and vehicle traffic.
- It will use the existing vehicle rail crossings on its route.
- It will attempt to provide a low experiential ranking based the theories in Rachel Kaplan, Kaplan, and Ryan's 'Trails and Locomotion'.<sup>175</sup>
  - It will not lure the user into the trail system. It does not have sight lines to the bay at all times or to the mountains.
  - It will have paths that do not curve. The paths will follow the straight edge of the existing road network.
  - It will have no 'sense of mystery' in the trail design. There will be no strong hints about what will be seen. One is always in a road network with not much sense of mystery.
  - It will have trail widths that do not vary significantly. The path will with be the road curb or the existing sidewalk.
  - It will have trail surfaces that are mainly composed of asphalt.
  - It will provide methods to facilitate 'way-finding' through existing road signs, views to the mountains, Panama Ridge, and Crescent Ridge will provide methods to allow the user to get its sense of bearings.
  - It will have a trail system that is part of a larger interconnected road network.
  - It will provide limited seating areas such as bus stops.
  - It will provide for visual access to important features such as the Serpentine Fen, commercial buildings (Art Knapps), and other various commercial buildings.

---

<sup>175</sup> R. Kaplan S. Kaplan and Ryan.



- It will have distant views from the Highway 99 overpass on the King George Highway to the agricultural fields. It will also have views to Panama Ridge, Crescent Ridge, rivers, and the mountains.
- It will go through a mixture of open and wooded areas. Crescent Ridge area is closed with tree canopy, and the farmland flats are mostly open areas.
- It will try to minimize the user's fears and preferences. There are virtually no blocked views due to wide-open road network.

### 6.3 Program Evaluation - Alternatives

#### Evaluation of Greenway Program Alternatives

In the following evaluation, the three greenway alternatives (Agriculture, Wildlife, and the Status Quo) are run through a decision matrix and the best alternative will be chosen to pursue further in the design cycle.

#### Methodology

- The evaluation criteria are based on the overall greenway vision, its global goals and objectives (see specific section for more detail).
- The greenway's features and impacts are assessed during the implementation stage and after completion.
- It is assumed that cost and safety are also a factor in evaluating the greenway options.
- A summary sheet aggregating all the individual scores is done first:
  - It is based on an in depth program matrix that scores all three options (Agriculture, Wildlife, Status Quo) ranking them first to third on each criterion. A ranking of 3 has the least impact and the most positive features whereas a ranking of 1 has the most impact and most negative features. A ranking of 2 lies between these two extremes.
  - In each of the sections, (Open Space, Environment, Connectivity, Recreation, Implementation, Landscape Character, Cost, User Concerns) the individual criterion rankings are added and the totals expressed as a percentage by dividing the individual score by the optimum score, the resulting percentage, is scored in three categories: #3 (80-100%), #2 (50-80%), and #1 (1-50%). All sections are given equal weight and added to provide a final score as shown in the 'Program Matrix Summary'.
- The purpose of this matrix is not to give definitive scores to the options, but to rank the relative differences between the options.

#### Assumptions

The evaluation is based on the following assumptions:

- There is a desire for the greenway by the public and the city of Surrey, and the GVRD.
- The BNSF railway will move its active railway line within 10 years
- The information supplied by the BC Ministry of Environment, Lands and Parks and the BC Department of Fisheries & Oceans is correct. Their assessment as to the extreme sensitivity of the Mud Bay shores adjacent to the BNSF Railway dyke where absolutely no construction, except in extreme circumstances, should take place in this sensitive habitat will be taken as correct and accurate.
- The Status Quo Greenway option uses the existing road network.

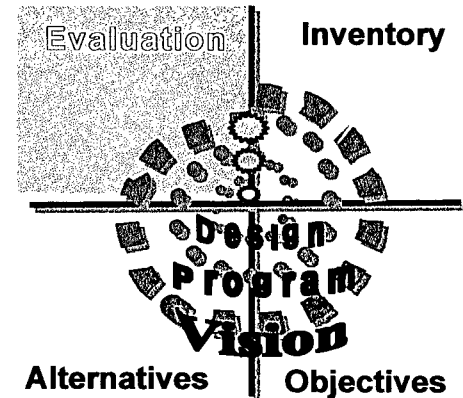


Figure 110 Program Evaluation

## **Matrix Results**

Based on the evaluation criteria, the Wildlife (83%) performed the best (Table 7 & Table 6). It ranked better than the Agriculture (79%) and Status Quo (58%) Alternatives. Therefore the Wildlife Option will be explored in the next design cycle (Figure 111).

### **Evaluation results are summarized as follows:**

#### **Open Space Acquisition**

Status quo alternative ranks high due to having no land to acquire, whereas the agricultural alternative requires less land than the Wildlife Option, therefore it does slightly better. The Wildlife Option does the poorest because it requires the most land purchases of 80-95% of the land in the area.

#### **Environment**

By creating the wetlands, Wildlife scores high. Agriculture, under a protected agricultural zoning, does well here too. The Status Quo option does poorly in this option because over time the land use can change that allows for non-favorable land uses such as greenhouses, and blueberry farms.

#### **Connectivity**

Agriculture and Wildlife do well with linking various parks and greenways. Once again, Status Quo option does not do a successful job in linking these spaces.

#### **Recreation**

The Wildlife option excels in the recreation grouping due to having more opportunities for access for the user, balanced with ecology. Agriculture ranks slightly lower, due the restrictions imposed on it from the agricultural land use that remains. Status Quo provides no recreational opportunities besides cycling and thus it scores low.

#### **Implementation**

Agriculture and the Status Quo rank high in this category as they are better suited to be modified over time. Whereas the Wildlife option ranks slightly less because once the wetlands are created it is more difficult to change.

#### **Landscape Character**

Agriculture has the highest score because the visual surroundings would not change with the area designated as a park. Wildlife ranks lower due to the fact that the character of the land is changed somewhat when a wetland is created. There is a loss of landscape character (when the dykes are opened there is a change from open fields, to a wet land). The Status Quo option receives a low score with the land use changes (blueberry, cranberry, and greenhouse ranges) that can happen in time that would significantly change the landscape character.

#### **Cost**

Status Quo option is the least expensive to implement by using the existing road network. Agriculture did modestly well in this category due to not requiring many land acquisitions. The Wildlife option requires the most land acquisition and site improvements so it does poorly here. For both the Wildlife and Agriculture options, the construction cost of bridges over the Nicomekl and Serpentine Rivers and Highway 99 is an expensive element.

### Response to User Concerns

Wildlife ranks slightly higher than Agriculture in this category due to having the higher user experiential ranking based on Kaplan, Kaplan, and Ryan's theories.<sup>176</sup> The Status Quo option does not do well in this ranking with the route being mainly on the road system versus the more natural setting in Mud Bay.

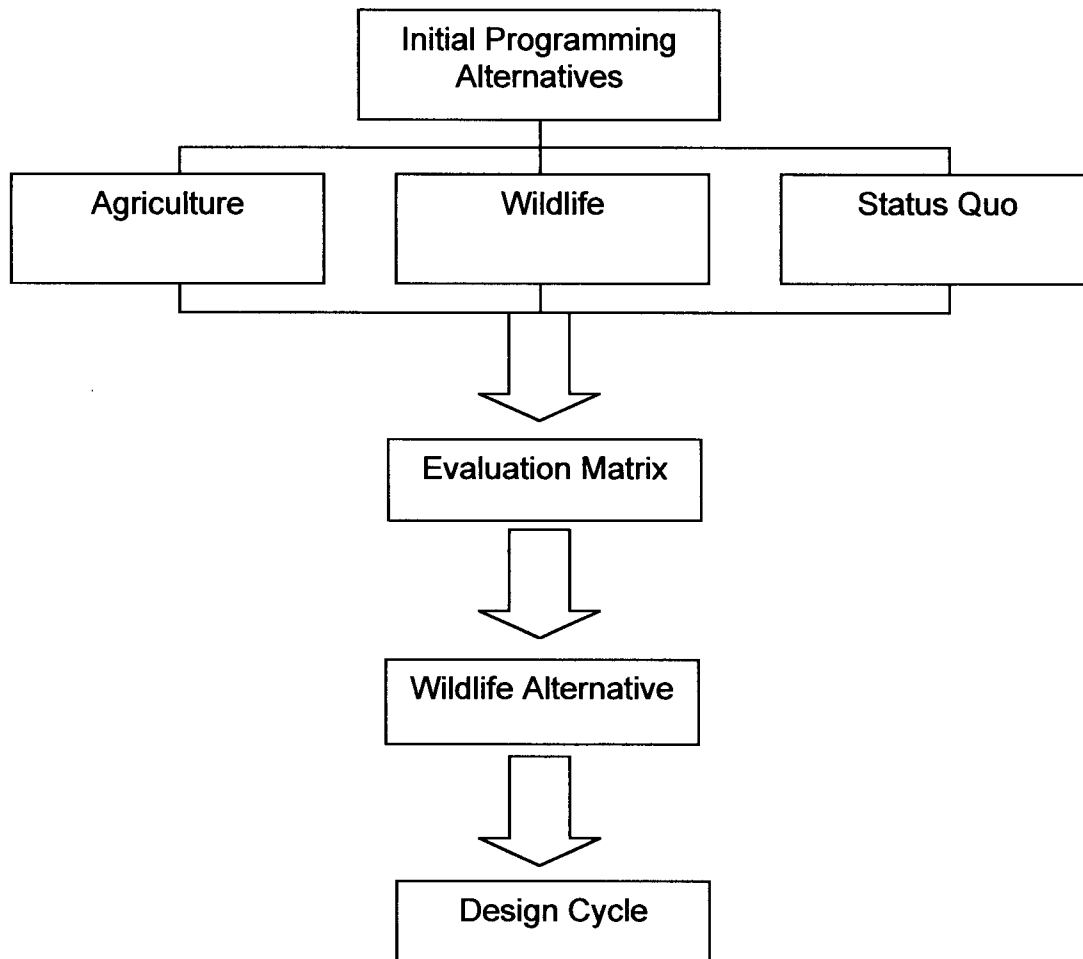


Figure 111 Alternative Program Evaluation Flowchart

<sup>176</sup> R. Kaplan S. Kaplan and Ryan.

## Program Matrix Summary

	Agriculture	Wildlife	Status Quo	Perfect Score
<b>Design Objectives</b>				
<b>Open Space</b>				
Acquire Public/Private Land	12	8	23	24
Total Scores (from In-depth Matrix):	12	8	23	24
Percent (section score divided by perfect score):	50%	33%	96%	100%
Score (3 (80-100%) 2 (50-80%) 1 (1-50%))	2	1	3	3
<b>Environment</b>				
Safeguard through zoning	1	1	3	3
Safeguard Significant Habitat	17	24	8	24
Total Scores (from In-depth Matrix):	18	25	11	27
Percent (section score divided by perfect score):	67%	93%	41%	100%
Score (3 (80-100%) 2 (50-80%) 1 (1-50%))	2	3	1	3
<b>Connectivity</b>				
Parks	9	9	3	9
Greenways	6	6	3	6
Nature Reserves	8	9	3	9
Historical Sites	8	8	3	9
Populated Areas	12	12	6	12
Total Scores (from In-depth Matrix):	43	44	18	45
Percent (section score divided by perfect score):	96%	98%	40%	100%
Score (3 (80-100%) 2 (50-80%) 1 (1-50%))	3	3	1	3
<b>Recreation:</b>				
Public Access:	28	45	19	45
Recreation Opportunities	44	66	24	66
Balance with Ecology	15	18	6	18
Total Scores (from In-depth Matrix):	87	129	49	129
Percent (section score divided by perfect score):	67%	100%	38%	100%
Score (3 (80-100%) 2 (50-80%) 1 (1-50%))	2	3	1	3
<b>Implementation</b>				
Implementation over time	3	3	3	3
Modification Over Time	21	13	21	21
Total Scores (from In-depth Matrix):	24	16	24	24
Percent (section score divided by perfect score):	100%	67%	100%	100%
Score (3 (80-100%) 2 (50-80%) 1 (1-50%))	3	2	3	3
<b>Landscape Character</b>				
Protect Landscape Character	39	32	13	39
Total Scores (from In-depth Matrix):	39	32	13	39
Percent (section score divided by perfect score):	100%	82%	33%	100%
Ranking (3 (80-100%) 2 (50-80%) 1 (1-50%))	3	3	1	3
<b>Cost</b>				
Capital Cost	2	1	3	3
Ongoing Maintenance	2	3	2	3
Total Scores (from In-depth Matrix):	4	4	5	6
Percent (section score divided by perfect score):	67%	67%	83%	100%
Score (3 (80-100%) 2 (50-80%) 1 (1-50%))	2	2	3	3
<b>User Concerns:</b>				
Mud Bay Area Access	3	3	1	3
Safety:	8	6	8	9
Experiential Ranking	79	92	41	102
Total Scores (from In-depth Matrix):	90	101	50	114
Percent (section score divided by perfect score):	79%	89%	44%	100%
Score (3 (80-100%) 2 (50-80%) 1 (1-50%))	2	3	1	3
<b>Scoring:</b>				
In-depth Aggregate Total	317	359	193	408
In-depth before adjusted total average	78%	88%	47%	100%
Adjusted Total from Above	19	20	14	24
Adjusted Average	79%	83%	58%	100%

Table 6 Program Matrix Summary

Table 7 In-Depth Matrix

Table: In-Depth Matrix		Agriculture Option	Wildlife Option	Status Quo Option	Perfect Score
<b>Design Objectives</b>					
<b>Open Space</b>					
Land Holding Acquisitions					
Public					
Crown - BCALC		2	1	3	3
Highways Right of Way		1	1	3	3
Regional - GVRD		3	1	3	3
Municipal - City of Surrey		1	1	2	3
University of BC - Wallace Property		3	1	3	3
Private Land Holdings					
Dykes		1	1	3	3
Farm Land		3	1	3	3
BNSF Railway		1	1	3	3
		15	8	23	24
<b>Environment</b>					
Protect and Safeguard the Mud Bay Area					
Change Zoning from Agriculture A1 to Park Zoning		1	1	3	3
		1	1	3	3
Safeguard Significant Mud Bay Habitat					
Limit Trail Access		2	3	1	3
Sensitive Migrating Times		1	3	1	3
Mating Season		1	3	1	3
Dog Access					
Shore		3	3	1	3
Dyke		3	3	1	3
Farmland		3	3	1	3
Facilitate the Movement of Wildlife					
Link Fragmented Movement of Wildlife					
Bridges		2	3	1	3
Under 99 Highway		2	3	1	3
		17	24	8	24
Total Environment		18	25	11	27
<b>Connectivity</b>					
<b>Parks</b>					
Blackie Spit to Surrey's Boundary Bay Park					
Railway Bridges		3	3	1	3
Nicomekl Bridge		3	3	1	3
Serpentine Bridge		3	3	1	3
		9	9	3	9
<b>Greenways</b>					
Border to Border Greenway Link		3	3	1	3

Crescent Beach to South Surrey Connector				
Greenway	3	3	2	3
	6	6	3	6
<b>Nature Reserves</b>				
Link Serpentine Fen to Boundary Bay Wildlife Mgt Area	3	3	1	3
Create Stronger Links to other Wildlife Management Areas	2	3	1	3
Create protected greenway from development	3	3	1	3
	8	9	3	9
<b>Historical Sites</b>				
Link historical features via trail system				
Stewart Farm Historical Park	3	3	1	3
John Weaver Historical House	3	2	1	3
Historic Nicomekl River Transportation Route	2	3	1	3
	8	8	3	9
<b>Populated Areas</b>				
Green link from Crescent Beach to Delta & North Surrey	3	3	1	3
Provide Transportation Alternatives within Site	3	3	3	3
Designated Bike Route				
Special Bike Trails with no Automobiles	3	3	1	3
Easy Bike Access to Major Schools	3	3	1	3
	12	12	6	12
Total Connectivity	43	44	18	45
<b>Recreation:</b>				
<b>Public Access:</b>				
<b>Dykes:</b>				
<b>Trail Design</b>				
Natural Pathways in Sensitive Areas for Walkers	1	3	1	3
<b>Developed Pathways</b>				
Dykes	3	3	1	3
Trails	3	3	1	3
Utility & Road Rights of Way	3	3	1	3
<b>Urban Pathways</b>				
Separation from traffic	2	3	1	3
<b>Staging Areas:</b>				
<b>Parking</b>				
Limited < 4 Cars	3	3	1	3
Adequate > 4 Cars	1	3	1	3
Litter Containers	2	3	1	3
Benches	2	3	1	3
Information Kiosks	1	3	1	3
Washrooms	1	3	2	3
Drinking Water	1	3	2	3
Telephone	1	3	3	3
Picnic Area	2	3	1	3
Trail Head	2	3	1	3
	28	45	19	45
<b>Recreation Opportunities</b>				
<b>Passive</b>				



Bird Watching	2	3	1	3
Wildlife Viewing	1	3	1	3
Aesthetic Appreciation	3	3	1	3
Picnicking	2	3	1	3
Nature Interpretation	2	3	1	3
Historical Interpretation	3	3	1	3
Active				
Walking	3	3	1	3
Jogging	3	3	1	3
Fishing	2	3	1	3
Cycling	3	3	2	3
Horse Riding	3	3	1	3
Canoeing & Sea Kayaking	1	3	1	3
Tourism				
Overnight Boating	1	3	1	3
Sea Kayakers, Backpacker & Cyclist's Campsite	1	3	1	3
Nature Interpretation Center	1	3	1	3
Conference Center	1	3	1	3
Blue Way				
Water Connections				
Boat Dock	1	3	1	3
Boat Launch	1	3	1	3
Water Route	2	3	2	3
Public Access to Shore				
Serpentine River	3	3	1	3
Nicomekl River	3	3	1	3
Watercraft				
Speed				
<10 knots	2	3	1	3
	44	66	24	66
Balance with Ecological Conservation				
Physical boundaries between sensitive habitat and recreation	2	3	1	3
Stewardship Programs	3	3	1	3
Education	3	3	1	3
Monitoring				
Dog Bylaw Enforcement Officer	3	3	1	3
In Restricted Area violation	2	3	1	3
Off Leash violation	2	3	1	3
	15	18	6	18
Total Rec	87	129	49	129
Implementation				
Implementation over time				
Land Acquisition Stages:	3	3	3	3
	3	3	3	3
Modification Over Time				
Changing Environmental Needs				
Allow for new programming	3	2	3	3
Changing land use needs	3	1	3	3
Ease of Flexibility	3	1	3	3
Changing Recreational Needs				
Allow for new programming	3	3	3	3
Changing land use needs	3	2	3	3

Ease of Flexibility	3	1	3	3
Allow for Ongoing Investigations	3	3	3	3
	21	13	21	21
Total Imp	24	16	24	24
<b>Landscape Character</b>				
Protect Landscape Character				
Farm Buildings	3	2	1	3
Open Agricultural Fields	3	1	1	3
Orange Donia Farm Buildings	3	2	1	3
James Wallace House (Windmill)	3	3	1	3
Open naturalistic bay (Mud Bay)	3	3	1	3
Panoramic View to Mud Bay from center of site	3	2	1	3
Railway Bridge				
Nicomekl River	3	3	1	3
Serpentine River	3	3	1	3
Nicomekl Tidal Dam	3	3	1	3
Crescent Beach Marina	3	3	1	3
Wooden River Pilings	3	2	1	3
Views to Mountains	3	3	1	3
Dyke view to fields	3	2	1	3
	39	32	13	39
<b>Cost</b>				
Capital Cost	2	1	3	3
Ongoing Maintenance	2	3	2	3
≈	4	4	5	6
<b>User Concerns:</b>				
Mud Bay Area Access	3	3	1	3
Total	3	3	1	3
<b>Safety:</b>				
Emergency Vehicle Access	3	2	3	3
General Safety	3	2	2	3
Limits Access to railroad	2	2	3	3
	8	6	8	9
<b>Experiential Ranking</b>				
Luring the user into the trail system				
Sight lines				
Farm Buildings	3	2	1	3
Open Agricultural Fields	3	2	1	3
Orange Donia Farm Buildings	3	3	1	3
James Wallace House (Windmill)	3	3	1	3
Open naturalistic bay (Mud Bay)	3	3	1	3
Panoramic View to Mud Bay from fields	3	2	1	3
Railway Bridge				
Nicomekl River	3	3	1	3
Serpentine River	3	3	1	3
Nicomekl Tidal Dam	3	3	1	3
Crescent Beach Marina	3	3	1	3
Wooden River Pilings	3	2	1	3
Views to Mountains	3	3	1	3

Dyke View from 40th Avenue	3	2	1	3
<b>Trails:</b>				
Layout				
Curved trails vs. Straight	1	3	1	3
Various trail widths	1	3	1	3
Surface Materials				
Various surfaces	2	3	1	3
Soft vs. hard surfaces	2	3	1	3
Open & enclosed spaces				
Combination of Open & Wooded Areas	1	3	1	3
Sense of Mystery				
Strong hints of what will be seen ahead	2	3	1	3
Way Finding:				
Trails facilitate way finding	3	2	1	3
Visible access points	3	3	1	3
Landmarks	2	2	2	3
Varying trail widths	2	3	1	3
Types of trail surfaces	2	3	1	3
Interconnected Trail System				
Interconnected to larger greenway	3	3	1	3
Trails have smaller loops	3	3	1	3
<b>Points of Interest</b>				
Access to interesting view points				
Mt Views	3	3	3	3
Bay Views	3	3	1	3
Access to important features				
Farm Buildings	3	3	1	3
Heritage House (40th Ave)	3	3	1	3
Wallace Wind Mill	3	3	1	3
Places to sit	2	3	1	3
<b>User's Fear &amp; Preferences:</b>				
Blocked & Obstructed Views				
Stage 1 Mud Bay Dyke	1	1	3	3
Stage 3 Final Trail System	3	2	3	3
	87	92	41	102
Total User Experience	98	101	50	114
<b>Scoring:</b>				
3 - Least Impact, positive feature	80%	88%	47%	
1 - Most impact, negative feature:				

Wildlife  
Option

Agriculture  
Option

Status  
Quo  
Option

Ideal  
Score



## Chapter 7 Design Cycle Stage

The objective of the design cycle is to take the specific site program and to develop it into a design prototype for the greenway.

**Methodology:** The site program identifies individual projects to be undertaken. These individual projects will be transformed into a design prototype.

The vision's themes - linkages, environment, and recreation will be incorporated into the prototype designs to produce conceptual plans and images showing how a particular area's green space could be accommodated.

The study will develop illustrative concepts and images for greenway proposals. It will give two-dimensional form to hardscape and planting elements. It will suggest structural types, materials, textures etc. The conceptual designs will be evaluated with a windshield test by going back to the site and seeing if that is the appropriate action for that location.

This cycle will be completed using the four planning steps, this time concentrating on the preliminary design prototypes. It is not the intent of this study to develop a definitive greenway plan for the area.

### Products

- **Wildlife Greenway Design Master Plan:** The master plan will have a design description, specific objectives, design rationale, proposed key features, and the stages required to implement the design.
- **The Staging Area & Nature Discovery Center:** Will have a master plan at a scale of 1:500 for the staging area. This will have more detail such as the camping areas, parking, a boating dock, etc. It will also show various cross-sections that correspond to the plan.

**Tools used:** Arc View GIS 3.2, PowerCadd, Photoshop, Photoshop Elements, and tracing paper. At this stage, it takes the rough layout forms and elements from GIS into a more refined stage using CADD and photo enhancement programs.

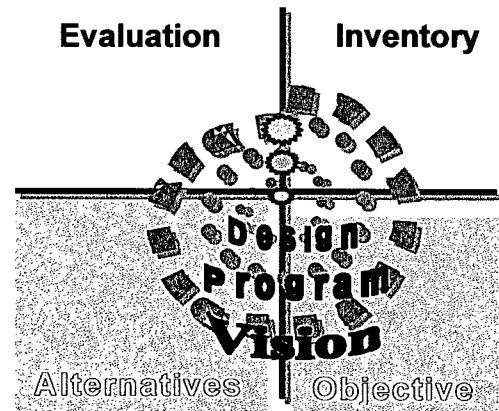


Figure 112 Design Cycle Stage

## 7.1 The Staging Area

### The Staging Area Location

Objective: To provide a staging area for the greenway.

**Alternatives:** Several alternative sites are briefly examined for an adequate Mud Bay staging area.

Existing Staging Areas (Figure 113)

- **Serpentine Greenway Park:** A good staging area for the northwest section of the Mud Bay Greenway. For this staging area to be effective, a safe crossing over the Serpentine River to the Greenway must be in place.
- **Serpentine Fen Nature Reserve:** An adequate staging area for the northwest east section of the Mud Bay Greenway. For this staging area to be effective, a safe crossing over the 99 Highway to the Mud Bay Greenway must be constructed.
- **Stewart Historical Farm:** A good staging area with drinking water, public washrooms, and historical displays for the south central section of the Mud Bay Greenway. For this staging area to be effective, a safe crossing over the Nicomekl River to the greenway must be in constructed.
- **Blackie Spit:** A good staging area for the southwest section of the Mud Bay Greenway. For this staging area to be effective, the BNSF Rail Bridge should be converted to a pedestrian bridge.

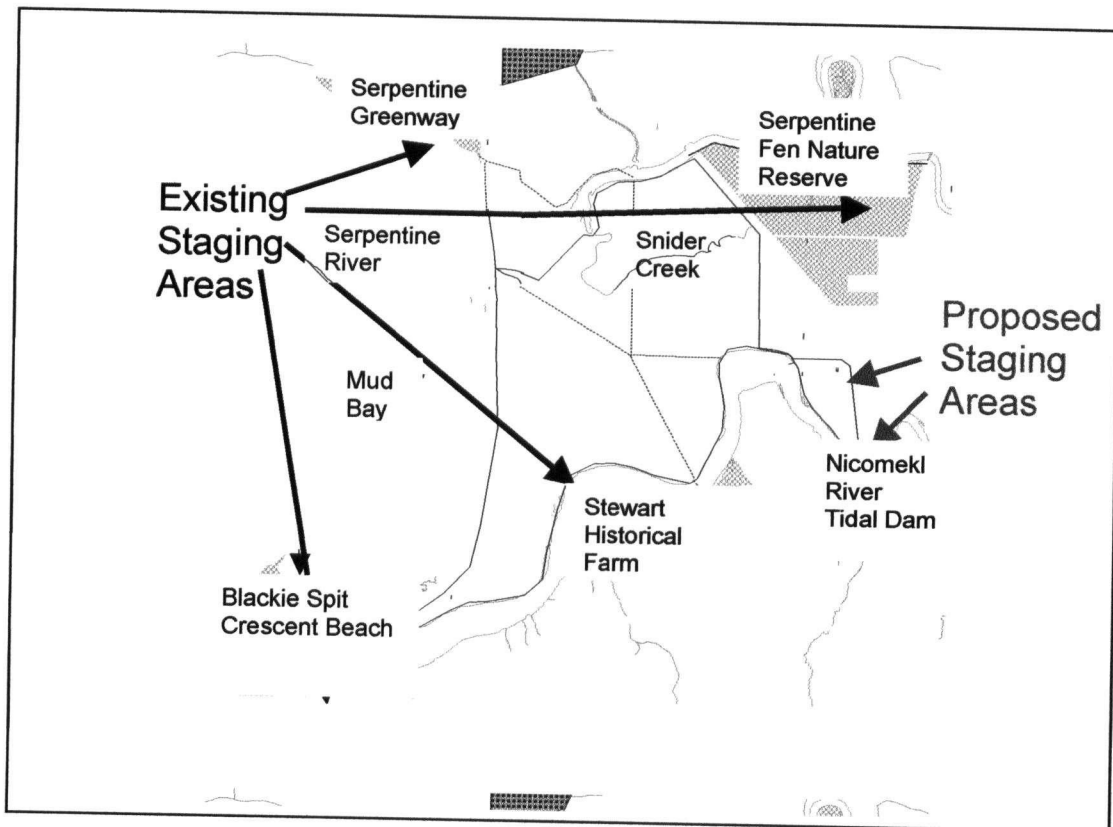


Figure 113 Existing and Proposed Staging Areas

### **Proposed Staging Areas**

- **Rio Place:** An adequate basic roadside staging area for approximately 4 cars. More cars could be staged if the ditches were covered and more parking was created as a result.
- **Wallace Farm:** An adequate staging area for 20 or more cars. The Wallace Farm will have drinking water, washrooms, trash receptacles, a boat launch site, and a picnic area.
- **40<sup>th</sup> Ave Parking:** In stages one to part of stage two the Mud Bay Area is still an active working farm area and any staging areas west of 40<sup>th</sup> Ave 136<sup>th</sup> Street could potentially disrupt the farming activity in the area as it did in Delta. The Delta farmers could not move their equipment in and out of their farm fields due to people parking on the narrow roads.

### **Evaluation**

Under the assumption that the Wallace Farm is being bequest to UBC, this site will be developed into a staging area.

### Station Area Programming

After the location of the staging area is decided upon, the next step is to develop the staging areas individual programming for the site. Three alternatives were developed (Figure 114) and a nature interpretive center was decided upon.

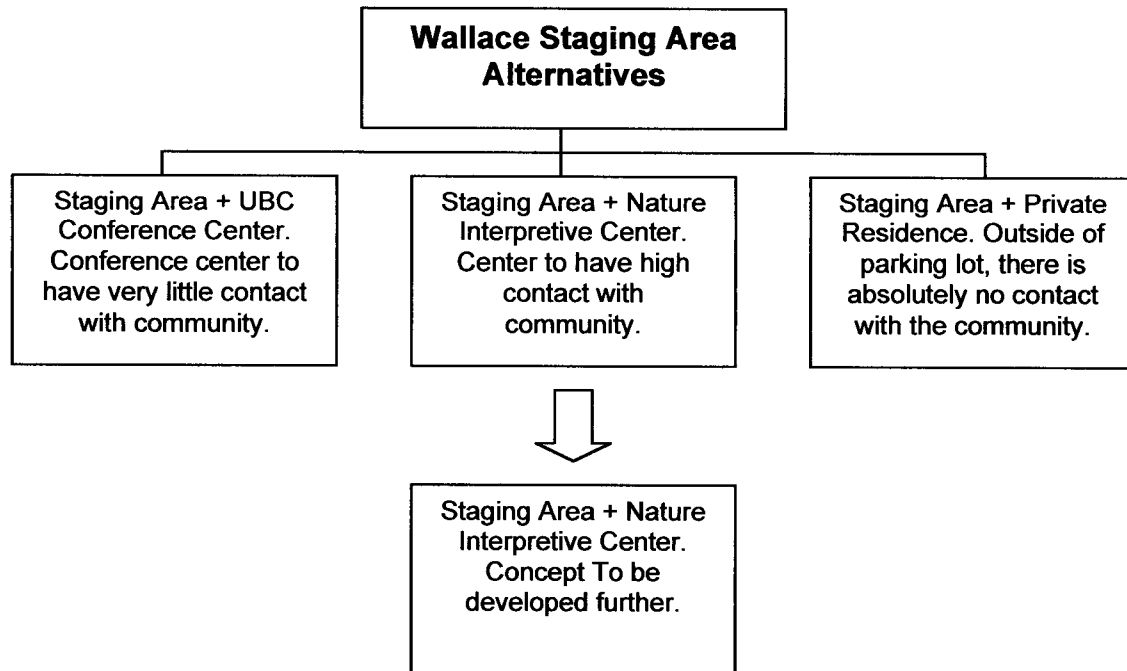


Figure 114 Nature Center Flow Chart

A rough concept plan was developed for the three alternatives. The plans, along with a preliminary program presented and discussed with peers. After presenting the alternatives, it was thought that the best programming for the Wallace Property, that would match the greenway vision statement goals and objectives, would be to develop a nature interpretive center.

**Design Rationale:** To use the Wallace Farm with programming that is better suited to the site. A place to overnight is thought to come into demand when the border-to-border trail is opened up and more tourists are using the trail

### Nature Interpretive Center Design Elements

For diagrams of most of the design elements see figures 115-130

**Nature Discovery Center:** The nature interpretive center will be a nature discovery center. The purpose of the exhibit will be to allow the visitor to discover the Mud Bay landscape and the area's local natural and cultural history. The center will be divided into four exhibits.

- The Pre European Settlement Era – Prior to the 1800's
- The Early Settlement Era – 1800s – 1900's
- The Transportation Era – 1900-1970's
- The Efficiency Era - 1970s –2000



The time periods relate to the land's history and how it has changed over time. It is told by exhibits and narratives of some of the people who witnessed some of those changes. The educational displays would be jointly done by Ducks Unlimited, Natural Historical Society, Friends of Boundary Bay and other natural history groups.

**Primary Parking:** The primary parking for the site will be located off Nicomekl Road. The parking will also serve as parking for the guesthouses and campsites which will be walk in-walk out. No cars will be allowed in the campsite.

**Secondary Parking:** The overflow parking lot will be paved with grass pavers. There are two reasons for this. Firstly, this is to symbolize to those entering the Wallace Nature Center that they are entering into a different type of space than that found in the immediate area. The grass symbolizes that the guests are entering into a sensitive and "ecologically aware" zone. Secondly, the grass parking lot can be easily converted to an outdoor room where events can take place such as weddings or outdoor festivals. The grass paved engineered structure that holds the grass in place makes the grass surface ideal for cars and an adequate surface for parking.

**Guest House Clusters:** The Wallace Nature Discovery Center will host guesthouse clusters that can be rented individually or to groups who will use a portion of the Wallace building as a small conference center (up to 15 people). Each guesthouse will have two sleeping rooms and one washroom. Each cluster will have a cooking hut that will be used for cooking.

**Backpacker, Cyclist, and Ocean kayaker's Camp Rooms:** Walk-in campsites are needed in the area. The Wallace property is well situated for a campsite for people traveling by bike from Vancouver to the USA. The area is also well suited for a paddle in paddle out campsite for sea kayakers and canoeists traveling on the Nicomekl River. Finally, it is well situated for backpackers walking the border-to-border trail on Boundary Bay. Thus, the campsite would be for walk-in walk-out purposes. (KOA on 40<sup>th</sup> Ave would be used for Recreation Vehicles)

The campsites would be located in outdoor camp rooms. The camp rooms would be bordered with native shrubs and trees. The individual campsites would have soft tent pad areas, a picnic table, and some seating. It would be supported with a washroom and shower area as well as a covered area with running water for cooking.

**Theater under the Windmill:** A summer outdoor amphitheatre will be located in front of the Wallace Nature Discovery Center. Summer plays and concerts would take place here. The area will take advantage of the sunken front room to create natural seating.

**Public Wharf:** Boats could moor at the existing boat dock on the Wallace farm.

**Fishing Shack Rest Stop:** The existing boat shed on the Nicomekl River would be converted to a place to rest. The shack is reminiscent of the shacks that used to dot the Nicomekl & Serpentine Rivers.

**Day Use Facilities:** The Wallace day use facility will have washrooms, drinking water, a picnic site, and a public telephone.

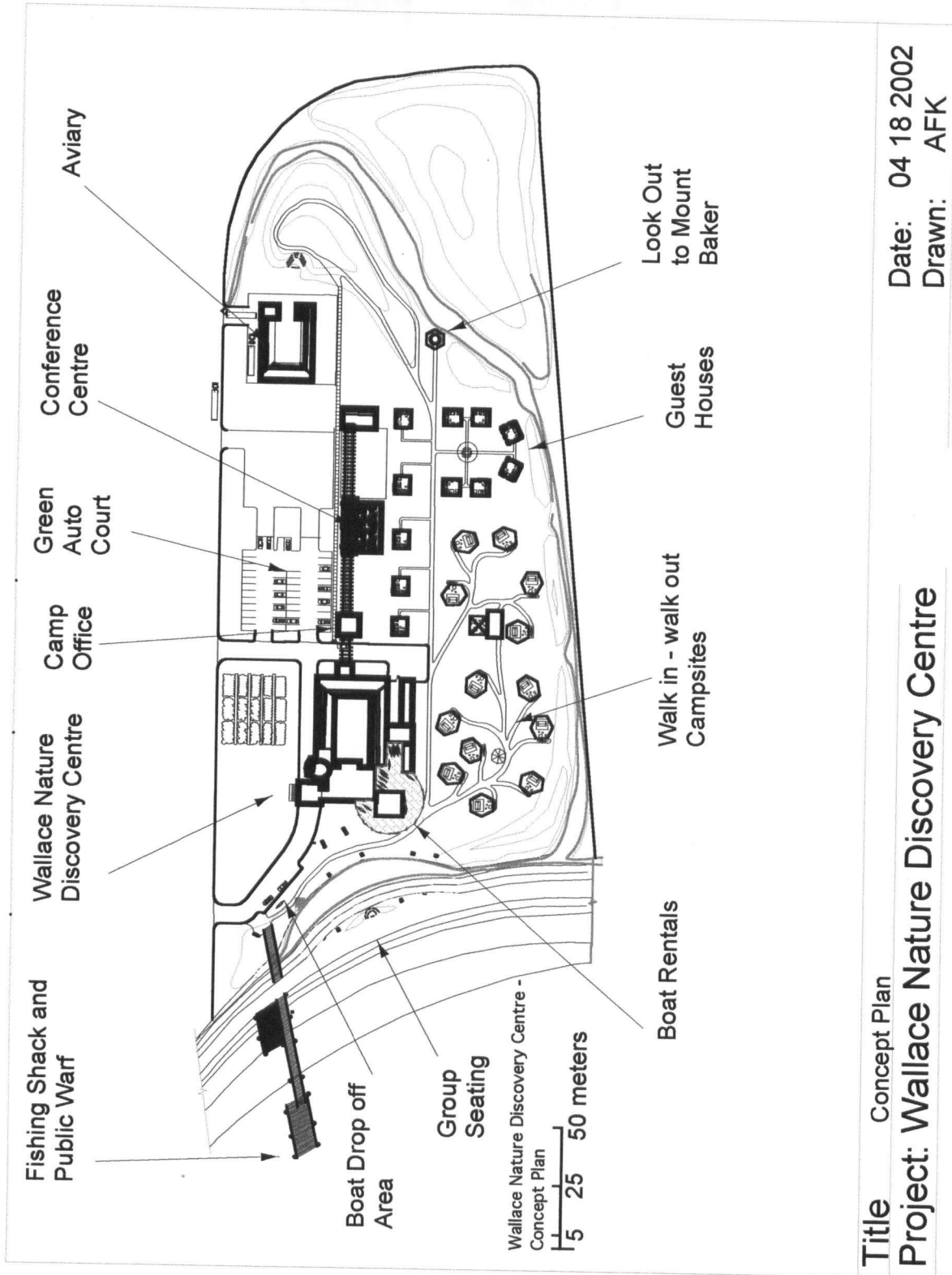


Figure 115 Wallace Concept Plan

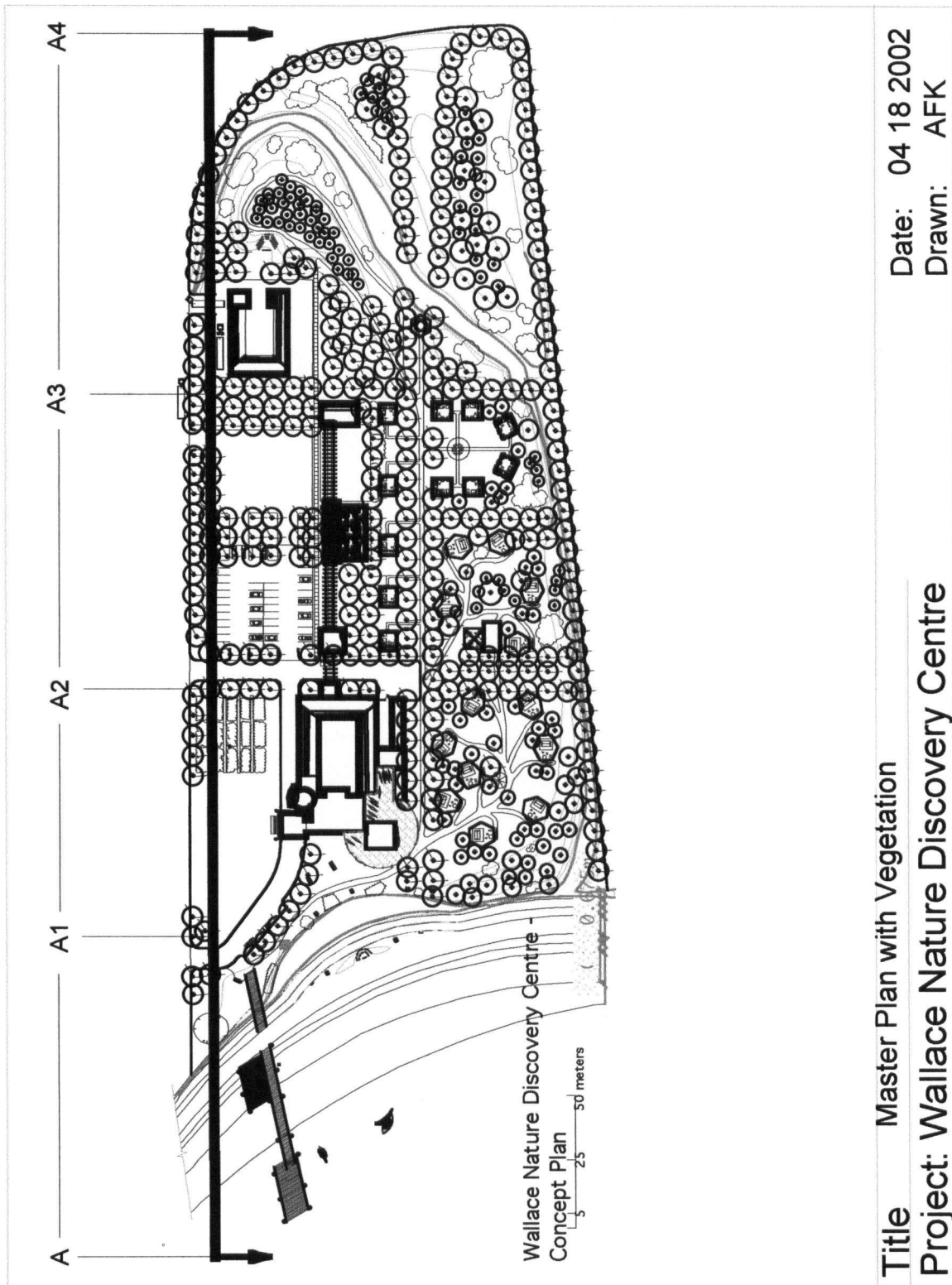


Figure 116 Master Plan with Vegetation

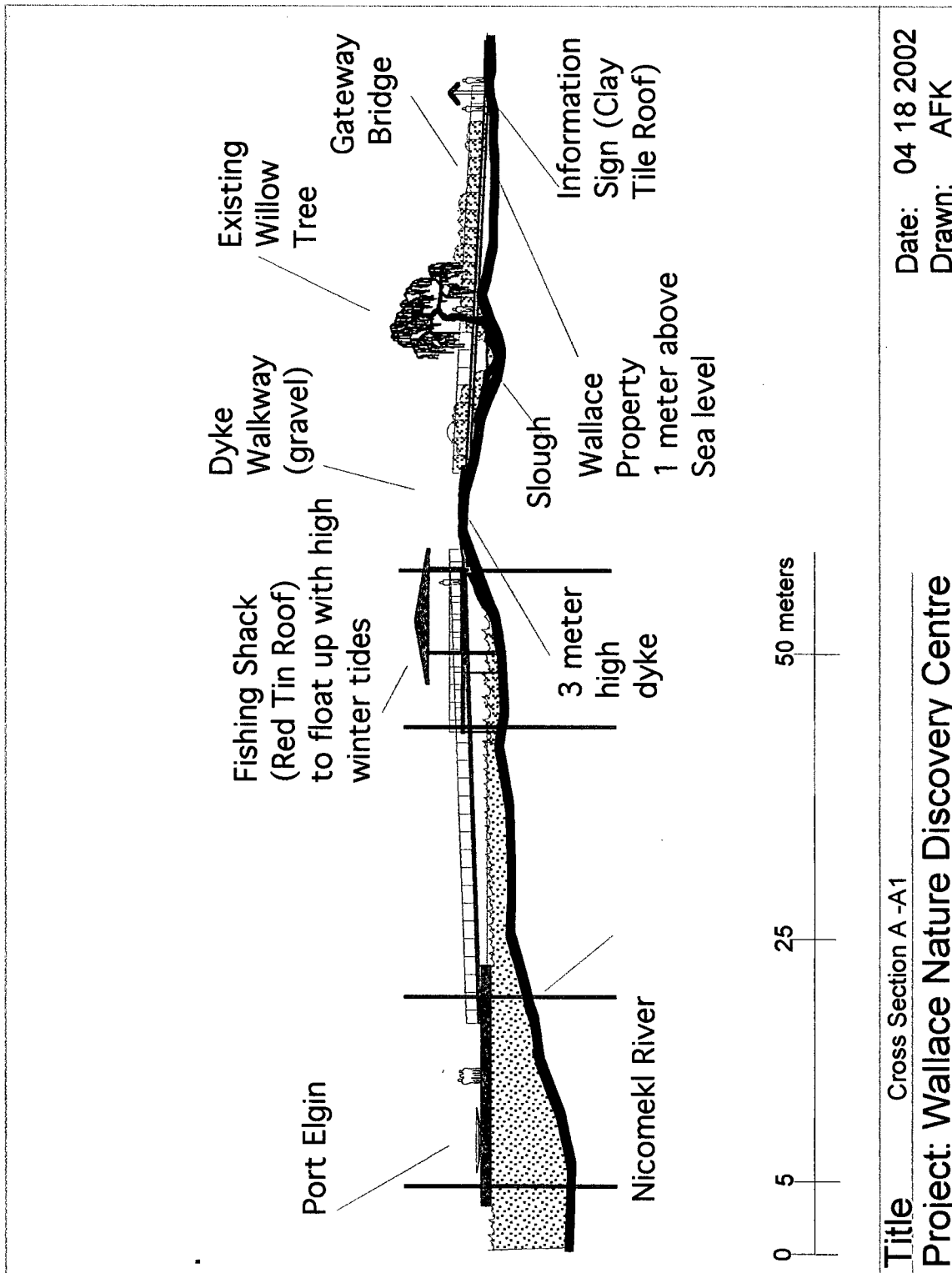


Figure 117 Cross Section A-A1

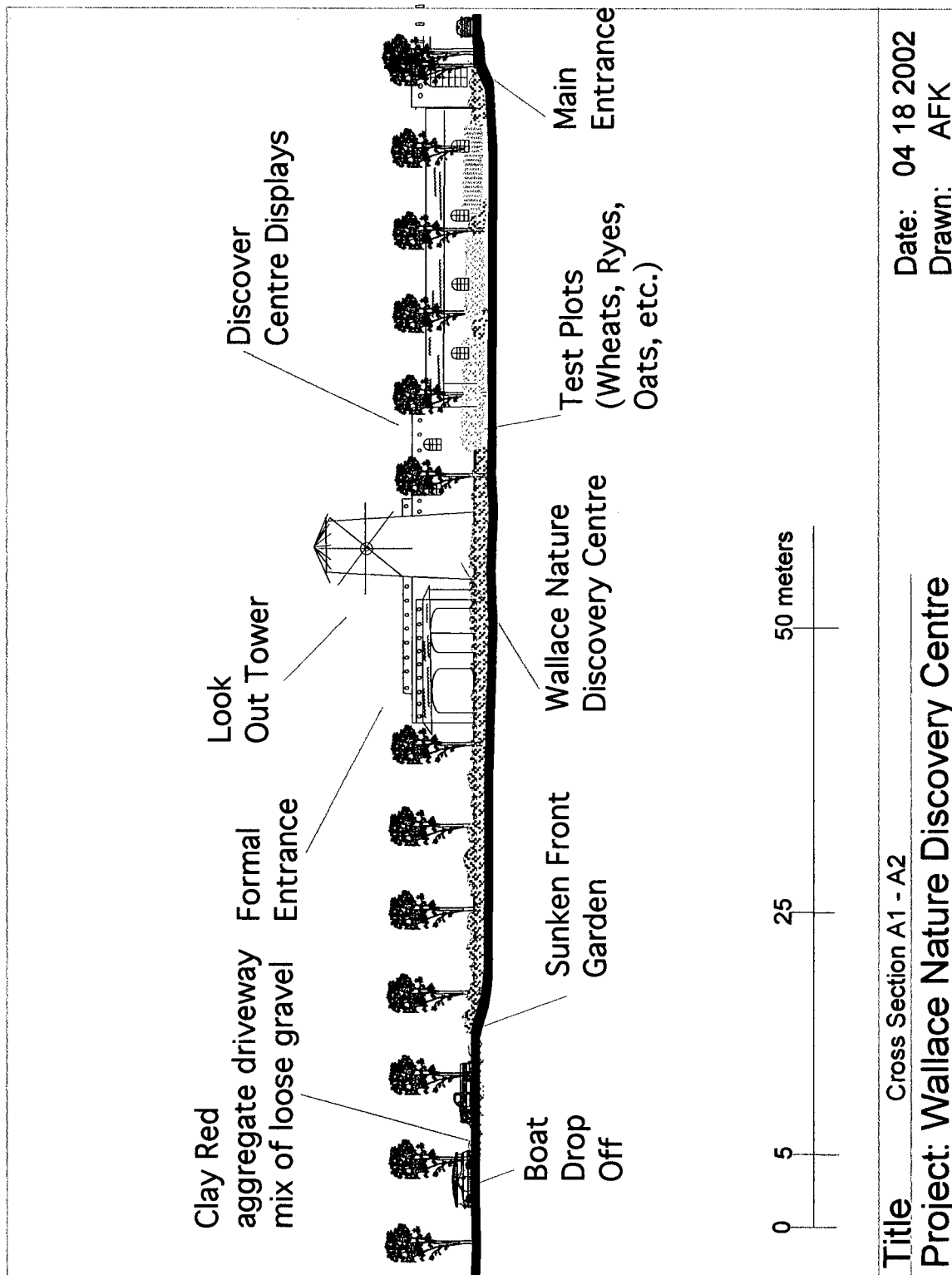


Figure 118 Cross Section A1-A2

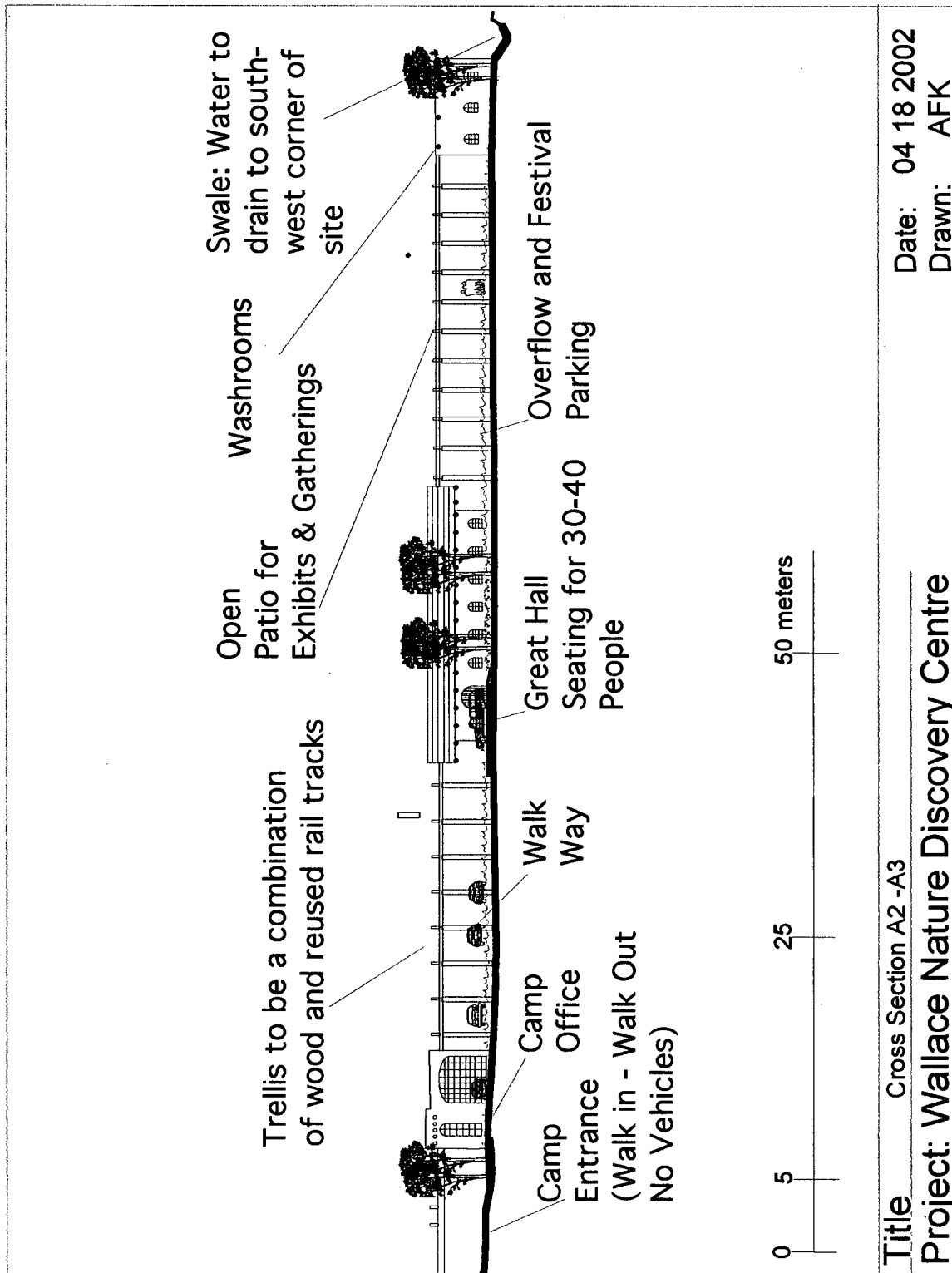


Figure 119 Cross Section A2-A3

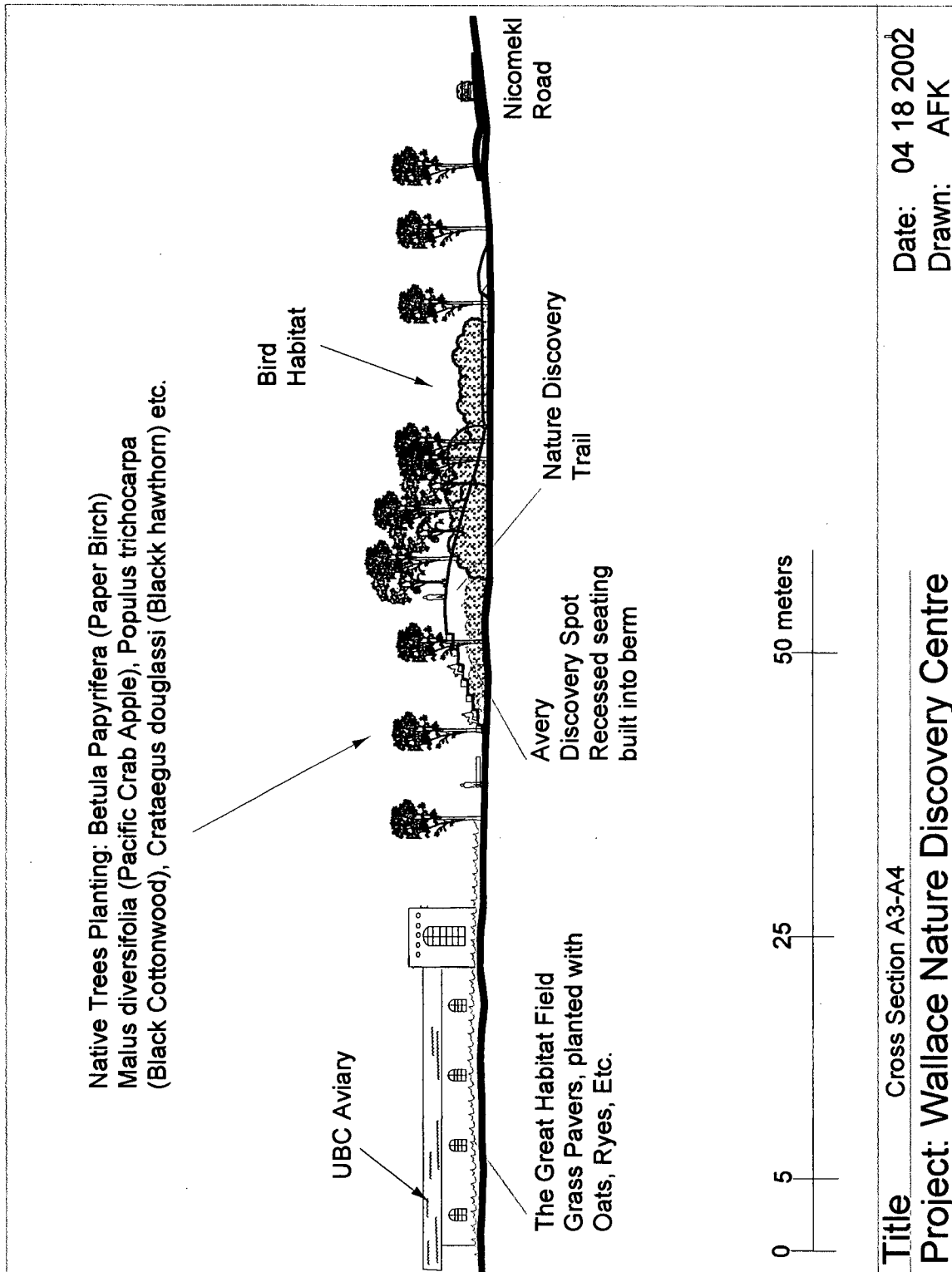


Figure 120 Cross Section A3-A4



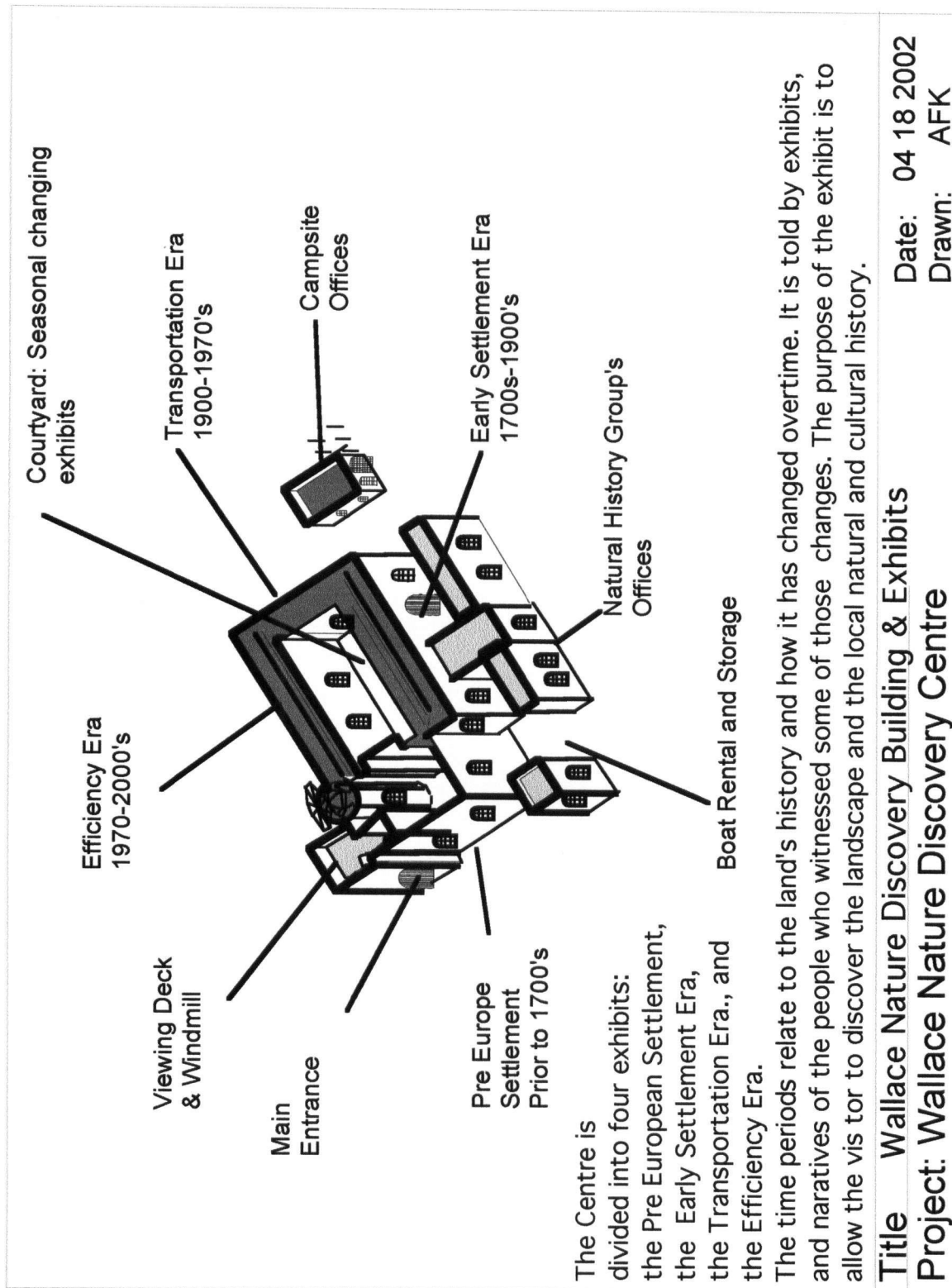


Figure 121 Wallace Nature Discovery Building & Exhibits

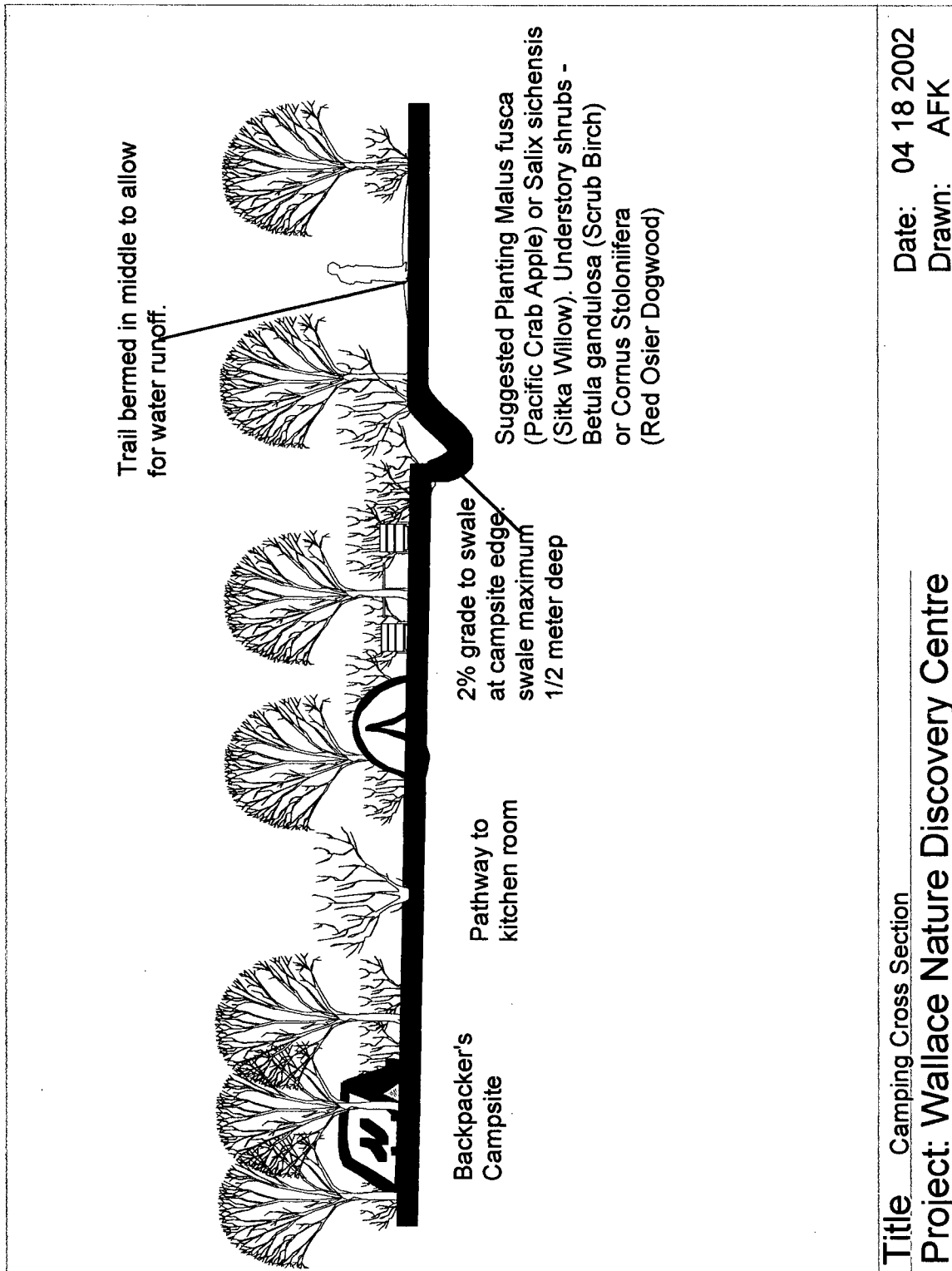


Figure 122 Camping Cross Section

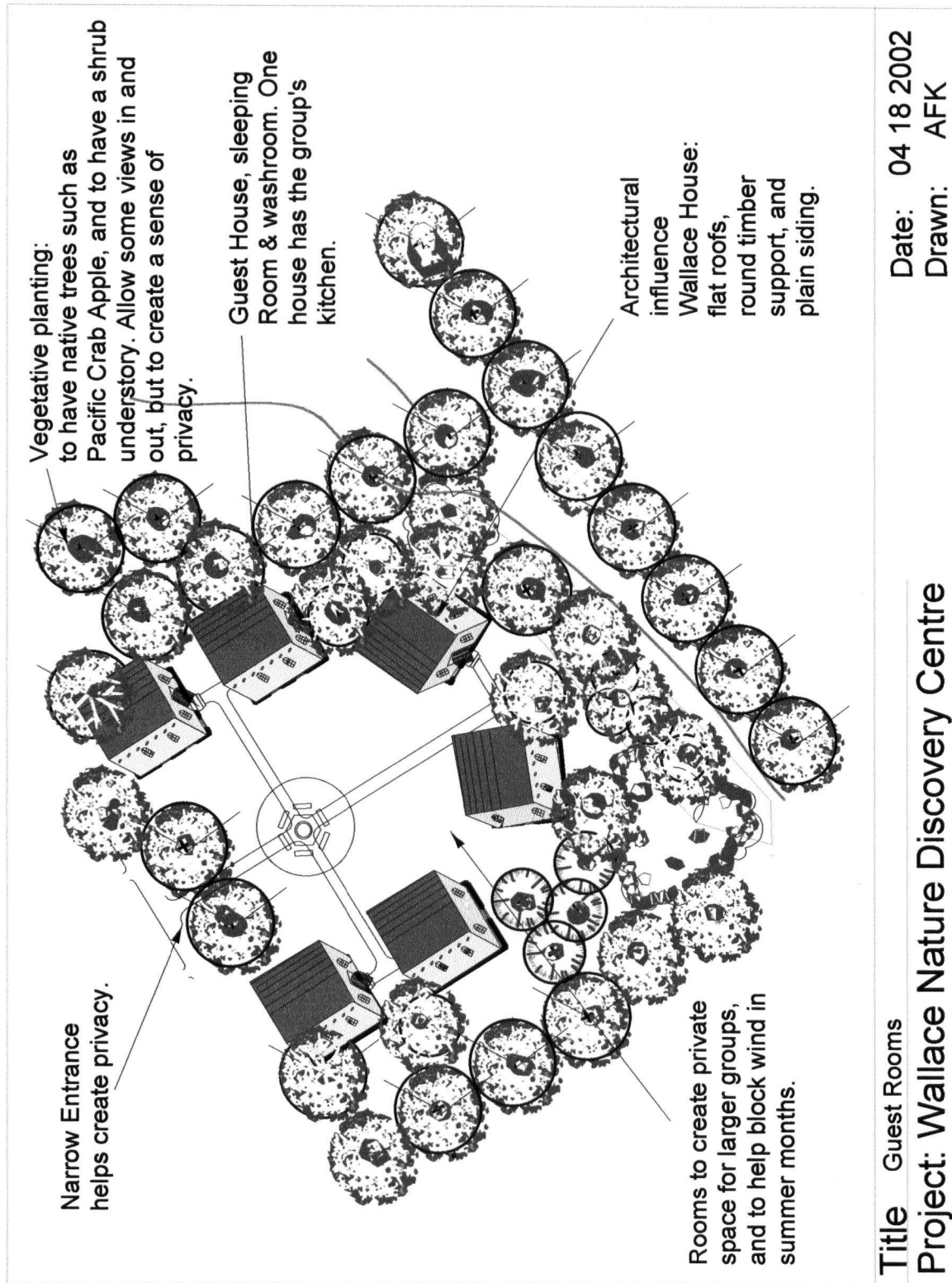


Figure 123 Guest Rooms

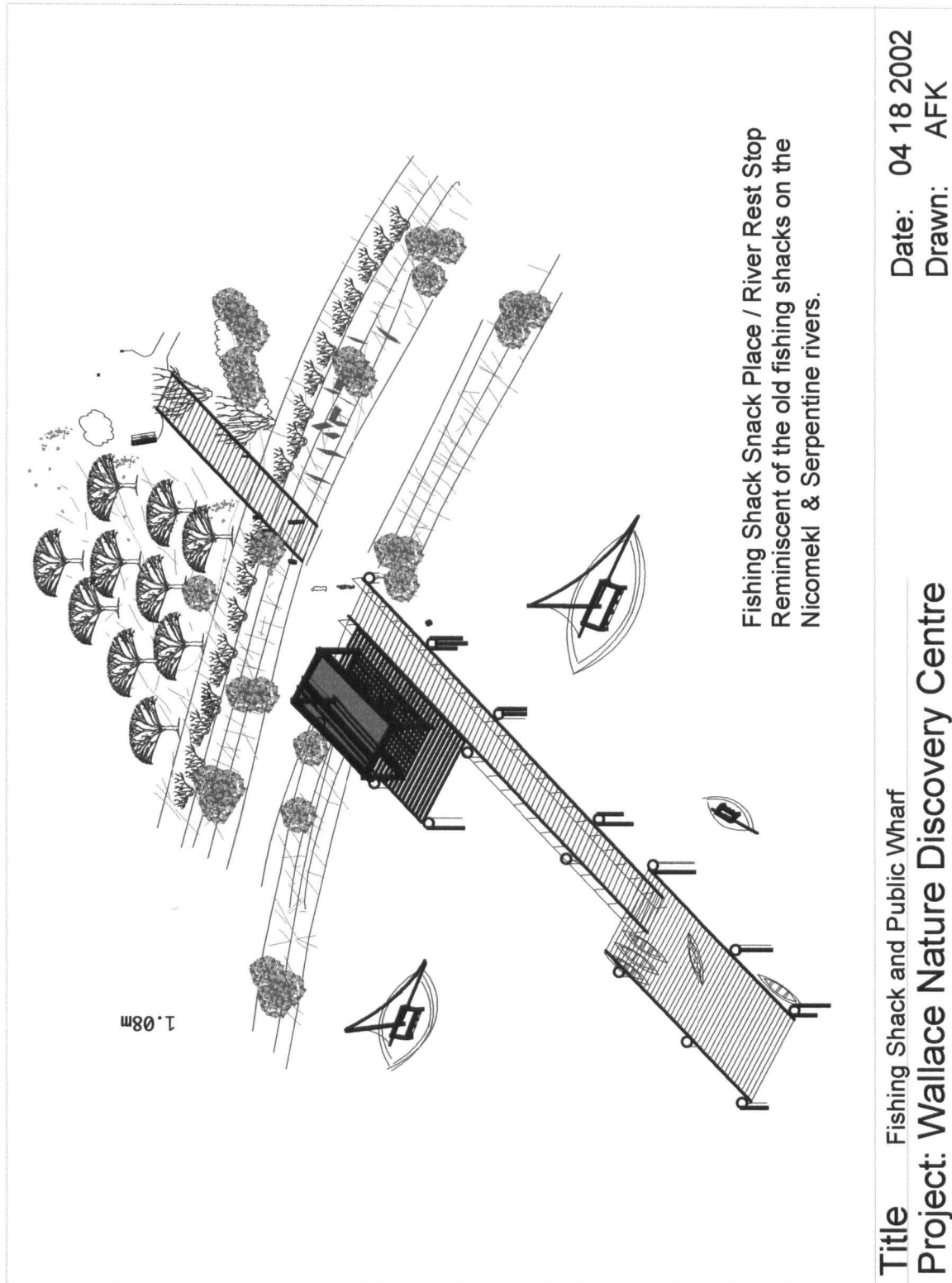


Figure 124 Fishing Shack and Public Wharf

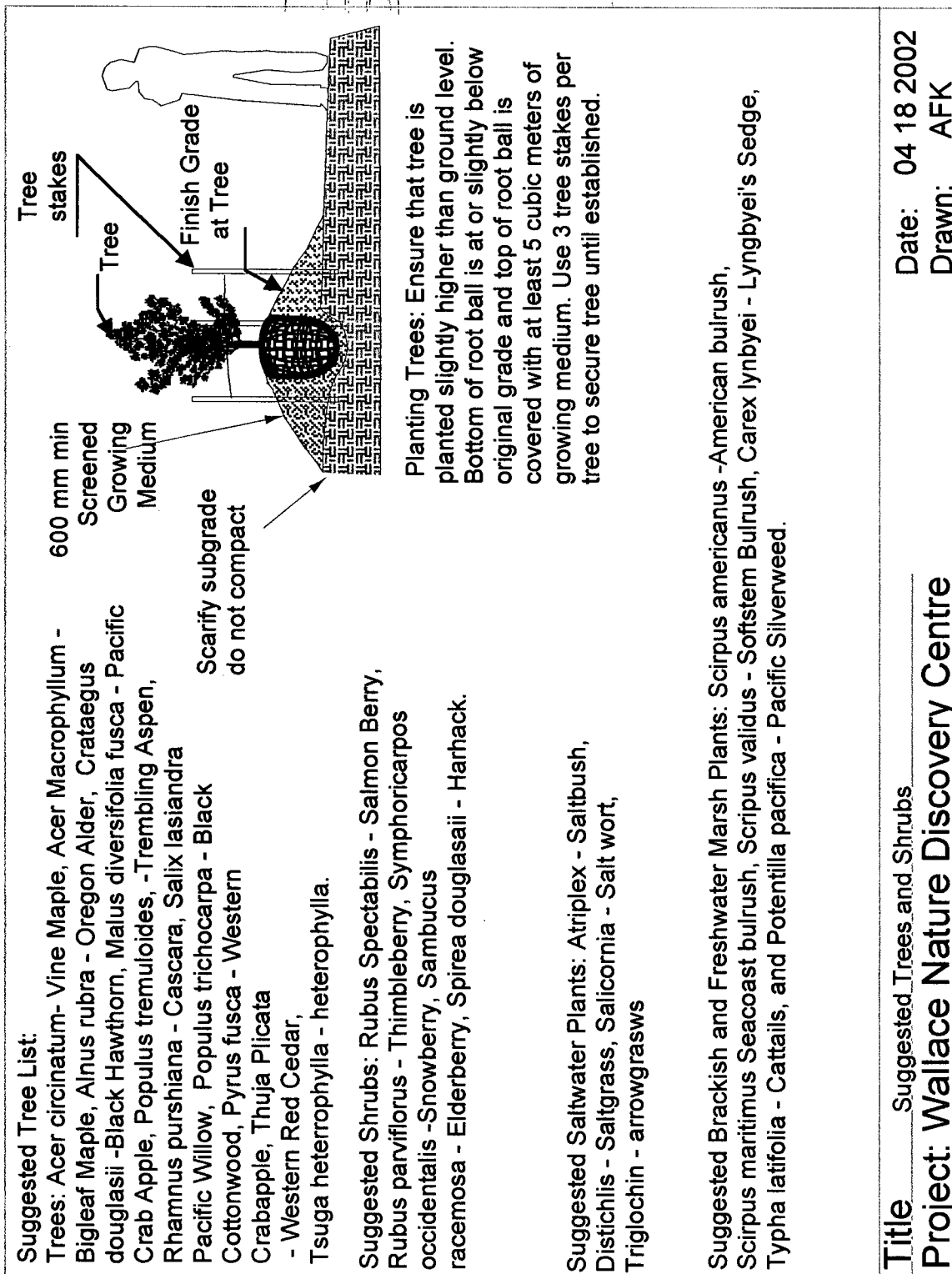


Figure 125 Suggested Trees and Shrubs

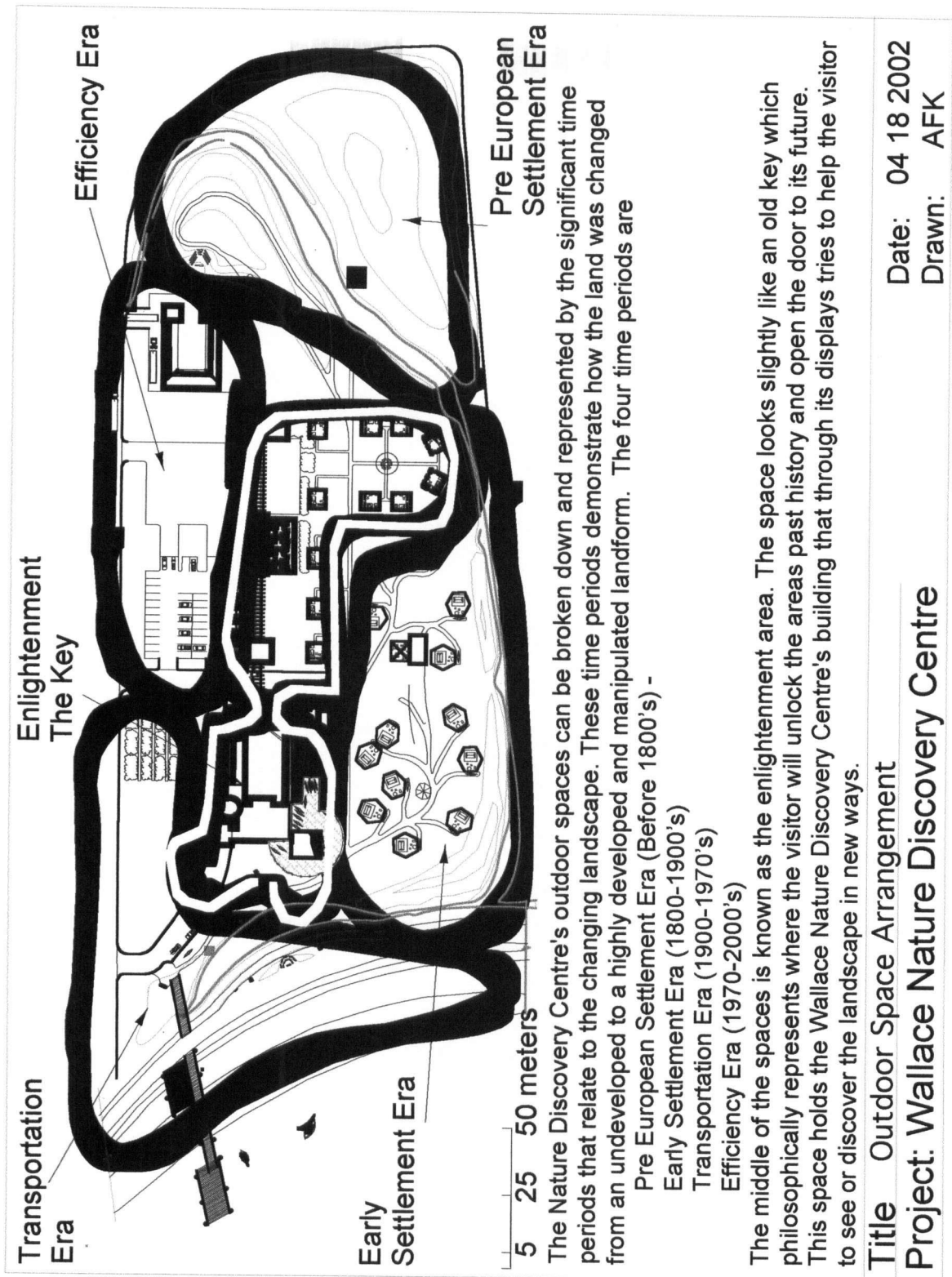


Figure 126 Outdoor Space Arrangements

<p><b>The Nature Discovery Centre's Spaces</b></p> <p><b>Pre European Settlement Era (Before 1800's) -</b>  This era, the Surrey lowlands are separated by water. Some theories state that the water was from the Georgia Straight, others say that the water was a arm of the Fraser River. The two earth mounds represent the high lands and the water represents the water covering the Surrey lowlands during this time period.</p> <p><b>Early Settlement Era (1800-1900's)</b>  This time period, the water is draining from the land. There are tributaries everywhere throughout the Surrey lowlands. In Mud Bay, the former tributaries' paths can be still viewed from old air photos of the area. The campsite trails represent the the tributaries that covered the Mud Bay area. One of those tributaries was Snider Creek.</p> <p><b>Transportation Era (1900-1970's)</b>  This era, transportation is dominant. The land is manipulated to the extent that the natural drainage patterns have changed. There are dykes, bridges and roads. Transportation issues, such as road building change the way the land traditionally operated. The natural drainage changed.</p> <p><b>Efficiency Era (1970-2000's)</b>  The land is manipulated and the most efficiency is reaped from the land. The parking lot with the grass pavers represents how the land is now manipulated and every possible square meter is trying to be used.</p>	
<p><b>Title</b></p> <p><b>Project: Wallace Nature Discovery Centre</b></p>	<p><b>Date:</b> 04 18 2002  <b>Drawn:</b> AFK</p>

Figure 127 Nature Discovery Centre's Spaces

The purpose of the game is to fill the chart up in the shortest time. The first column is a random estuary word that is put on all the charts. Then each person takes their own chart and fills the squares with estuary vocabulary.  
Adapted from Sidewalk to Seashore - BC Naturalists.

	Plants	Animals	Human Activities	Birds
M				
A	Algae	Amphipod	Angling	
R				
S				
H				

Plexiglass

Charts will be left by staging area picnic tables or or by the boat house.

Supply wax crayons to write on boards

Title Nature Discovery Games: Marsh Bingo.

Project: Wallace Nature Discovery Centre

Date: 04 18 2002

Drawn: AFK

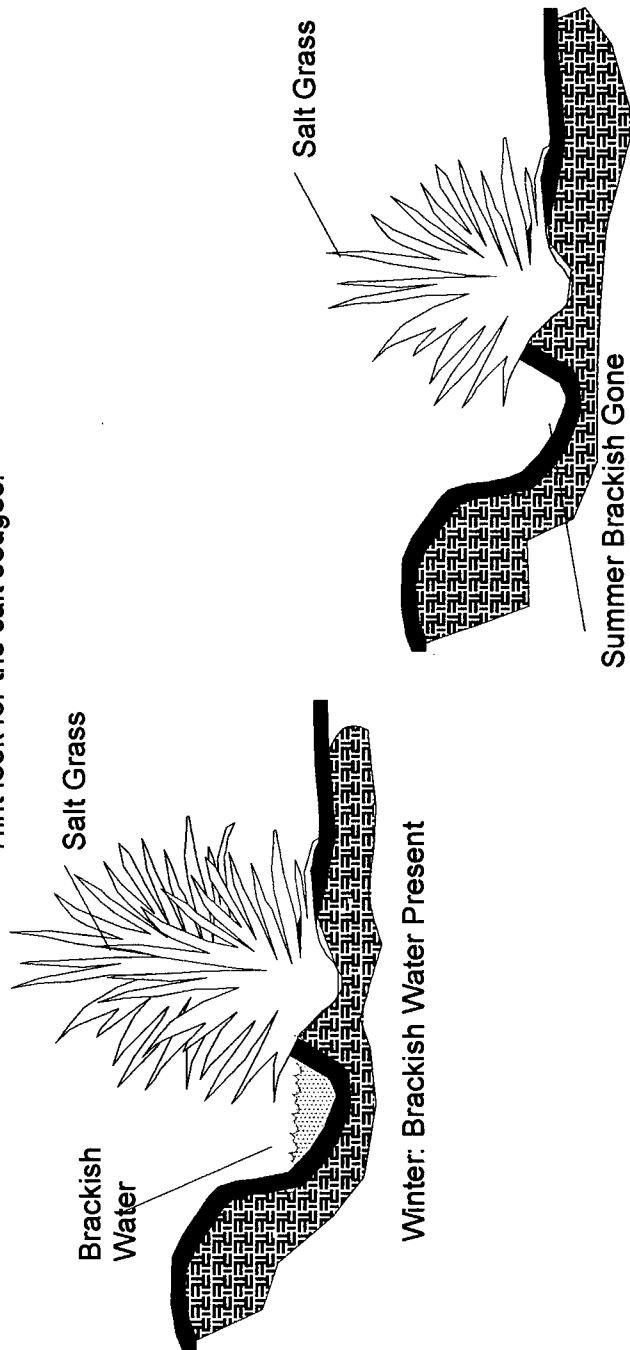
Figure 128 Nature Discovery Games: Marsh Bingo



**Find the Brackish Water:**

After the high tides have passed, there is some stagnant water left aside. This water evaporates during the summer. In the middle of summer the water may be all gone. Find the areas, that could have had the brackish water.

Hint look for the salt sedges:



Title Nature Discovery Games: Brackish Water Clues

Project: Wallace Nature Discovery Centre

Date: 04 18 2002

Drawn: AFK

Figure 129 Nature Discovery Games: Brackish Water Clues

**Brackish & Fresh Water Plants:**

- American Bulrush - *Scirpus americanus*
- Lyngbyei's Sedge - *Carex Lyngbyei*
- Soft Stem Bulrush - *Scirpus validus*
- Sea Coast Bulrush - *Scirpus maritimus*
- Three Square Bulrush - *Scirpus americanus*
- Pacific Silverweed - *Potentilla pacifica*
- Cat-tails - *Typha latifolia*

**Sedges & Grasses:**

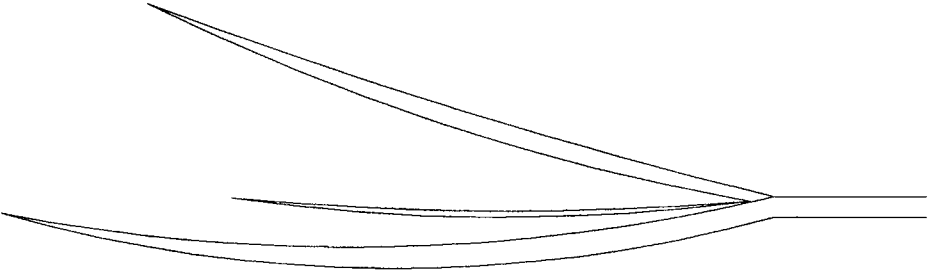
**Purpose:** To discover the difference between grasses & sedge.

In the grass demonstration area have people tell the difference between grass and sedge.

**Sedges & Grasses Look Alike.**

Sedges have stems with sharp edges and soft joints nodes

Grasses have round hollow stems with hard joints.



**Title** Nature Discovery Games: Find the Brackish Water Patch

**Project:** Wallace Nature Discovery Centre

**Date:** 04 18 2002

**Drawn:** AFK

Figure 130 Nature Discovery Games: Find the Brackish Water Patch

## 7.2 Wildlife Option

- This greenway design favors the area's wildlife importance and restores the area to its former ecological functions over time. In this design, Mud Bay's uniqueness and inter-tidal zones are preserved and enhanced by the creation of wetlands over the existing farm fields. It allows public access in the non-habitat sensitive areas.
- This design emphasizes a biologically productive salt-water marsh and that preservation of such environments is important in an increasingly urbanized region.
- This design attempts to entertain and educate the public on the area's ecological importance.
- It allows for limited public access and recreational opportunities along the dykes and within the non-sensitive wetland areas.
- It incorporates the railway line into its plan.
- It provides a green link from Crescent Beach to Surrey's new Serpentine River Park.
- It incorporates many of the area's distinct landscape characteristics to promote community identity.

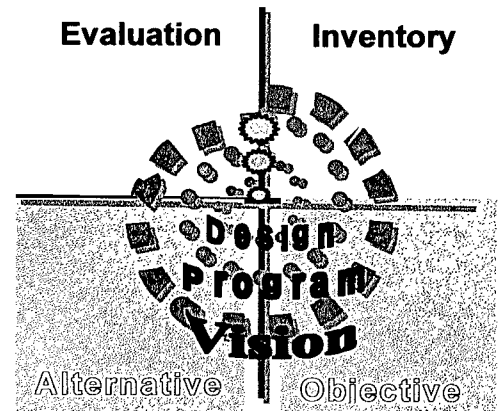


Figure 131 Wildlife Option

### A) Detailed Greenway Design Description Objectives

#### 1. Open Space

It allows for limited public access on dykes, GVRD, Surrey, and highway right of ways.

#### 2. Environment

- It protects and safeguards the Mud Bay area by recognizing that it is situated within an ecological sensitive area. It will propose to change its zoning from Agriculture A1 zoning to a restricted A1 and A2 Zoning where agricultural activities can take place within it until the agricultural land is phased out and is incorporated into the wetland. The agricultural activities will favor traditional soil based farming. It will not allow blueberry farms, cranberry farms, or greenhouses on the agricultural land.
- It does not allow dogs on the dykes or the farm fields.

#### 3. Connectivity

- It assists connecting the local parks, greenways, and historical sites through its trail system.
- It provides links across the two rivers by incorporating the railway line and by building two bridges.
- It provides for a link between the Serpentine Fen and the Mud Bay greenway by building a bridge over the Highway 99.
- It becomes a more hospitable location for wildlife between the Serpentine Fen and Mud Bay.
- It helps in providing a green link between the populated areas from Crescent Beach to Delta and North Surrey.
- It provides an emergency route for livestock via the Nicomekl and Serpentine River bridges. The bridges can be used when the area floods extensively to

move the cattle across the rivers and out of the flooded lowlands into the higher grounds until the water lowers.

#### **4. Recreation**

- It has some pathways in naturalistic settings. Paths will first be situated on the existing dyke or roads with the exception of the path along the 99 Highway. In the later greenway phases, the paths will be situated in natural settings.
- It allows for a limited 4-car staging area on Rio Place and a larger staging area in the Wallace Farm.
- It provides site elements such as litter containers, benches, washrooms, drinking water, telephone access, picnic areas, and information signs.
- It provides opportunities for passive recreation such as bird watching, wildlife viewing, picnicking, nature interpretation, and historical interpretation.
- It provides opportunities for active recreation such as walking, jogging, cycling, fishing, and horseback riding.
- It allows boats to dock overnight at the Wallace Farm wharf on the Nicomekl River.
- It allows boats such as canoes, and sea kayaks to dock on the shores of the Nicomekl & Serpentine Rivers.
- It provides space for a formal boat dock and launch site for small boats (canoes and kayaks) near the Wallace Residence.
- It imposes speed restrictions for watercraft on the Nicomekl River. Low speeds will help the waterway uses be compatible with the sensitive habitat around it.
- It provides a barrier such as a fence between the trail and farm fields in stage one. In later stages, the fences will be removed and access to sensitive habitat areas will be limited by means of a wetland barrier or actual gates to the closed off areas.
- It gives the option for the residents to become the area's stewards. As stewards, they will open and shut certain gates, and inform people about the area. They will be compensated for their role. In later stages, there will be a formal steward at the Wallace Farm.
- It does not allow access to either people or dogs on the sensitive Mud Bay shore habitat.

#### **B) Implementation Objectives**

- It may be implemented over time with the needed land acquisitions.
- It may be easily modified over time to allow for changing recreational or environmental programming needs.

##### **1. Landscape Character**

- It incorporates the existing landscape character into its plan. There will be a significant change of the land use from agricultural fields to a wetland habitat. The wetland view will be composed of water, grass, trees, and shrubs. Some of the farm buildings, the dominant orange farm buildings, the Wallace Windmill, the open 'naturalistic' bay, the railway bridges, the Nicomekl tidal dam, the Crescent Beach Marina, the various river pilings, and the views to the mountains will all be as seen today.

##### **2. Cost**

- It will have a high capital cost during implementation. Funds will be required to purchase the required land for the greenway and wetland, to build the two river bridges, and to build the Highway 99 pedestrian overpass. Land purchase costs

are extensive, as the greenway wetland combination requires much land. However, much of the land is owned by the BC Provincial Government, which should make land acquisition costs reasonable. It will have moderate maintenance costs.

### **3. Response to User Concerns**

- It allows for public access through the Mud Bay trail system on designated paths. The greenway will eventually incorporate most of the existing Mud Bay farm fields.
- Most trails will be wide enough to allow for emergency vehicle access. However, many trails will not be accessible to emergency vehicles.
- It has fenced off areas, in the early stages, separating people from hazards such as aggressive farm animals. In the later stages, the only restrictions will be to the sensitive wildlife areas.
- In stage one, it provides for an at-grade rail crossing at the Serpentine River Park.
- It has a moderated experiential ranking based the theories in Kaplan, Kaplan, and Ryan's 'Trails and Locomotion'.<sup>177</sup>
  - It lures the user into the trail system by having sight lines to various familiar sights such as the existing farm buildings or mountain views (stage one).
  - It has trails that will curve. The trail's footprint will be wide enough to allow for curves to take place. This will be especially noticeable on the section of path that follows the Mud Bay Railway dyke (stage three).
  - It has a 'sense of mystery' incorporated into the trail design. There will be strong hints about what will be seen ahead. In the first stage, the Nicomekl River dyke walk's forest canopy is partially open and closed on the other side, which gives visual interest. Also, in the first stage, the trail will be wider than the agricultural trail to allow some views through various tree, shrub, and grass plantings. In the later stages, there will be a variety of open and closed spaces in the entire trail network through extensive vegetation planting.
  - It has trail widths that will vary significantly. The trail system will be composed of the dyke trail, highway right of way, maintenance roads, and various inland trails through the wetland.
  - It has trail surfaces that are a combination of gravel and asphalt.
  - It provides methods to facilitate 'way-finding'. Its existing views to the bay, rivers, mountains, Panama Ridge, and Crescent Ridge along with signs will provide methods to allow the user to get his bearings.
  - It has a trail system that is part of a larger interconnected trail network. It will also provide smaller loop trails within it.
  - It provides seating areas on the dykes, wetlands, and riverbanks.
  - It provides access to important features such as the heritage house on 40<sup>th</sup> Avenue.
  - It has views to the agricultural fields, the heritage house, Panama Ridge, Crescent Ridge, Point Roberts, the bay, rivers, parks and mountains.
  - It has an open and enclosed trail system through vegetation. It will have grass, shrubs, and trees with in the trail network. It will not have much tree canopy other than what currently exists.
  - It tries to minimize the user's fears by minimizing the blocked views within the trail network in the final stage. However, at the first stage it will have blocked

---

<sup>177</sup> R. Kaplan S. Kaplan and Ryan.

views from the trail on the inland side of the railway dyke due to the high 3-4 meter railway berm. In the later stages, when the railway line is incorporated into the trail system, the view will not be blocked.

### **Design Rationale**

This design tries to restore the land to its former wetland state while putting importance on the sensitive habitat.

The recreational trail system was designed using the area's desire lines and preferred paths. The preferred paths are the actual river dykes. The desire line is the BNSF railway line. The actual land was chosen with this in mind trying to minimize the agricultural disruption that the trail may have. The discovery of the GVRD sewer line, the South Surrey connector pipe, the road right of ways, and the BCALC owned land influenced the implementation stages and trail routes. The bridge locations were chosen to help make a smaller loop system for the trails. If a user did not want to walk the entire site he would have the option of using the railway bridges to make smaller circuits.

### **Design Assumptions**

- The land listed in the inventory stage of this report is still owned by BCALC.
- The information supplied by the stakeholders is correct.
- The City, Province, GVRD, and other various government departments are interested in a Mud Bay Greenway.
- There is user demand for a greenway in Mud Bay.
- The private landowners are willing, for the appropriate compensation, to have a greenway be situated on the edge of their property.
- The BNSF railway will move its active railway line within 10 years and the Crescent Beach-White Rock section of the rail line will be open and used by the public, thus establishing a border-to-border trail.
- UBC will take possession of the Wallace House.
- The information supplied by the BC Ministry of Environment, Lands and Parks and the BC Department of Fisheries & Oceans is correct as to the extreme sensitivity of the Mud Bay shores next to the BNSF Railway dyke and how no construction should take place in its sensitive habitat.
- That the design only suggests potential links and conservation areas. For a more complete design one would consult with a professional.
- The GVRD needs to have maintenance access to their pipes.
- It is understood that the suggested land-use changes is purely hypothetical and not intended to cause hardship to any individual, but to merely demonstrate the current zoning policies and what could be.

### **Design Implementation Stages**

There are three design implementation stages required in the Wildlife Option.

#### **Stage 1: ( 0 - 10 years )**

1. Set initial route & staging area. Loop trail. Use roads & dykes and municipal, GVRD, & Highway 99 right of ways to create loop trail. Dykes to be purchased at fair market value from landowners for greenway trail).

2. Create a special entrance along Nicomekl Road signifying the importance of the site. Change zoning to a restricted A1 & A2 zoning. This is to be compatible to the Greenway objectives. The park zoning will allow certain types of agricultural activities to take place within it.
3. Set up parking signs at the Rio Place staging area.
4. Incorporate the Wallace Farm as a "Nature Discovery Center" & campsite. Establish a campsite for cyclists, sea kayakers on the Wallace property. Also, establish an overnight boat dock on the property river's edge. The Wallace day use facility will have washrooms, drinking water, a picnic site, and a public telephone. (See Staging Area).
5. Establish rest sites, along the dyke.
6. Establish a pedestrian bridge over the Nicomekl River. Beginning at the GVRD Right of way. (Negotiate with landowner 13846 40<sup>th</sup> Ave to acquire land for bridge).
7. Set basic picnic area south of 32<sup>nd</sup> Ave Right of Way. Acquire 13044 32<sup>nd</sup> Ave from BCALC for picnic area.
8. Set up a viewing tower along the inland side of the railway dyke and north of the Nicomekl River.
9. Establish a trail along the GVRD right of way with adequate buffering from farm fields.
10. Set up the second viewing tower on the inland side of the railway dyke and south of the Serpentine River.
11. Establish a bridge over the Serpentine River on BCALC lands. This will link the Mud Bay Greenway with the Serpentine River Park.
12. Establish a dyke trail on the BCAL land on the Serpentine River.
13. Establish pedestrian rail crossings at the Serpentine River Park and at Blackie Spit.
14. Put up safety signs on the train bridge warning people of the danger involved on walking on an active train track.
15. Install washrooms, drinking water, a picnic site, and a public phone at the Serpentine River Park.
16. Acquire 136<sup>th</sup> Street right of way and establish as an elevated trail
17. Put up visual barriers on Hwy 99 where the Serpentine River dykes (East and west) meet Highway 99. Erect a visual barrier along with an effective fence barrier to prevent people from crossing over the highway.
18. Use either Hwy 99 Right of Way or part of BCALC land for trail along 99 Highway.

## **Stage 2 ( 10 – 20 years)**

1. Incorporate the Nicomekl and Serpentine Railway bridges into the Greenway trail network. Modify the Serpentine rail bridge with steel hand railings and roped off sides. Modify the wooden Nicomekl swing rail bridge with steel hand railings with roped off sides.
2. Incorporate the railway dyke into the greenway trail system. Connect the railway dyke trail to the lower river dykes by smoothing out the grade change. Connect the viewing towers to the upper trail. Create lower viewing platform on the upper railway dyke.
3. Acquire 4183 140<sup>th</sup> St and rail right of way from BNSF Railway for wetlands and conservation.

4. Acquire BCALC Lands for wetlands and conservation. (13476 – 40<sup>th</sup> Ave, 13503 – 40<sup>th</sup> Ave, 13979 – 40<sup>th</sup> Ave, 13996 – 40<sup>th</sup> Ave, 14015 – 40<sup>th</sup> Ave, 13168 – 48<sup>th</sup> Ave, 4440 - 136<sup>th</sup> Street 4453-136<sup>th</sup>).
5. Build dykes along 40<sup>th</sup> Ave to 136<sup>th</sup> Street right of way. Resurface old streams on lot # 13503 40<sup>th</sup> Ave and lot # 4453 40<sup>th</sup> Ave. Connect resurfaced streams to Serpentine River. Establish an elevated trail on the GVRD South Surrey Interceptor Pipe right of way on lot # 13503 40<sup>th</sup> Ave.
6. Build dykes along lot # 4440 136<sup>th</sup> Street property boundary (44<sup>th</sup> Ave right of way and 99 Hwy). Connect resurfaced streams to Serpentine River.
7. Renovate the John Weaver heritage house as a walk in walk out B&B in the middle of the wetlands. At the time of the renovations, through fill, elevate the house's foundation by at least 2 meters. (To help protect the house from future floods.)
8. Break open 2<sup>nd</sup> dyke section south of the Serpentine River and between the GVRD pipes and the 136<sup>th</sup> street right of way. Construct a saltwater marsh and build trail bridges where necessary.

### **Stage 3 ( 20+ years )**

1. Build Pedestrian Bridge over the #99 Highway. Build bridge on south side of the Serpentine dyke.
2. Improve staging areas at Serpentine Fen Nature Reserve. Include a picnic site, drinking water, a public pay phone, and washrooms.
3. Acquire at fair market value the remaining lots for conservation and wetlands. (13978 – 140<sup>th</sup> Street, 13992 140<sup>th</sup> Street, 13975 140<sup>th</sup> Street, 13941 40<sup>th</sup> Ave, 13845 40<sup>th</sup> Ave, 13846 – 40<sup>th</sup> Ave, 13476 40<sup>th</sup> Ave, and 13286 40<sup>th</sup> Ave).
4. Build a dyke along 140<sup>th</sup> Street. Create a woodlot with resurfaced streams on lot # 4370-140<sup>th</sup> St, 4306-140<sup>th</sup> Street, 14159 – 140<sup>th</sup> Ave, and 14269 40<sup>th</sup> Ave.
5. Break open Dykes along 40<sup>th</sup> Ave and 136<sup>th</sup> Street right of way to allow water to move between the dykes. Build bridges for the trails.
6. Resurface the old streams and connect to the Nicomekl and Serpentine Rivers.
7. Incorporate the some of the former farm structures for the raptors and other various birds..

See Figure 132 to Figure 179 for design implementations details.



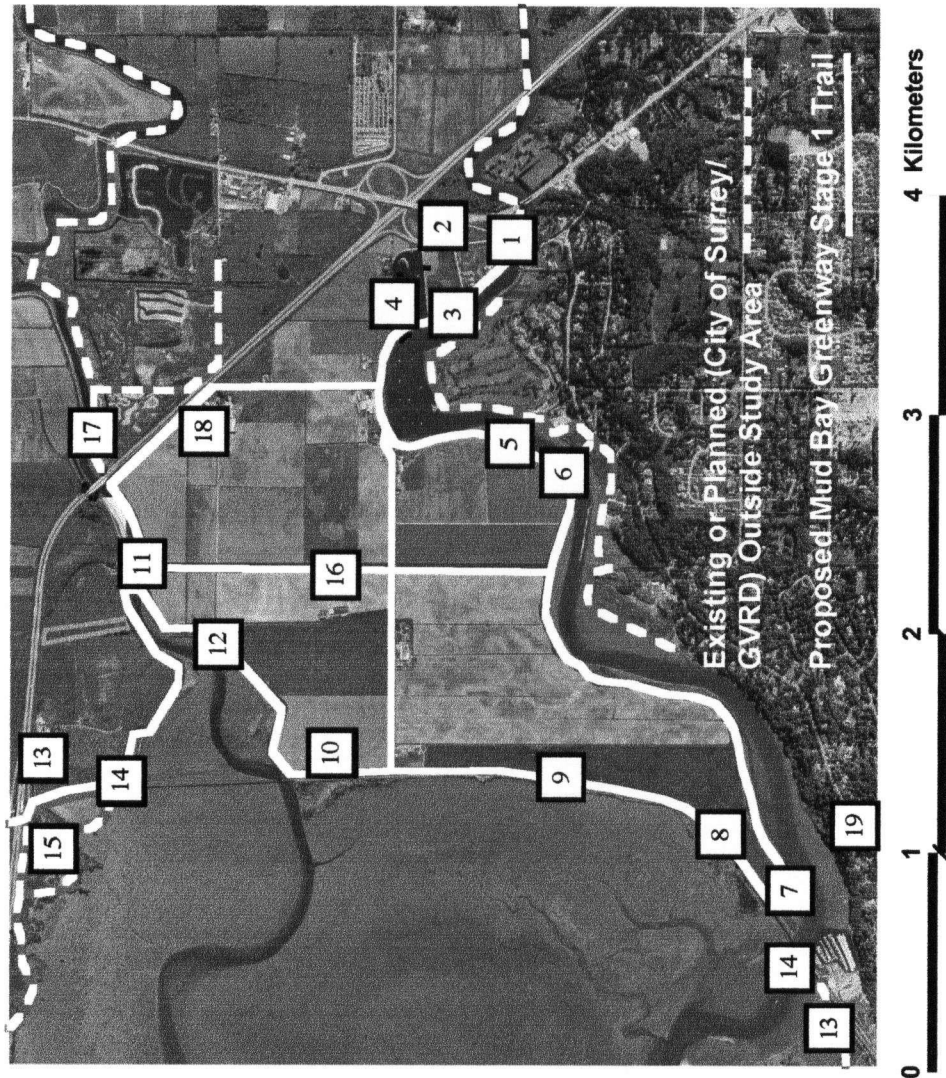
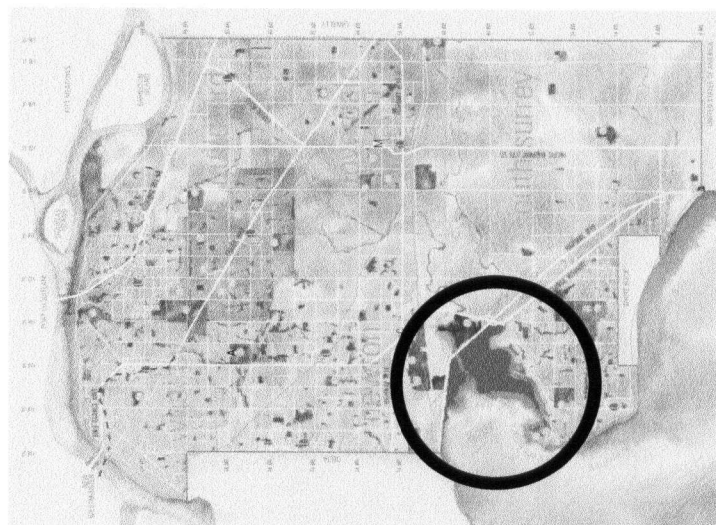


Figure 132 Mud Bay Greenway Map Stage 1

Reference Number 1  
 Title Mud Bay Greenway Stage 1  
 Project: Mud Bay Greenway Wildlife Alternative - Stage 1  
 Date: 04 15 2002  
 Drawn: AFK

Figure 133 Proposed Zoning Changes



**Property Zoning Change**

Zone A1 to Restricted A1 and A2 zoning. This will allow most agricultural activities to take place in the park. But it will not allow greenhouses, or non traditional soil based crops (i.e. blueberry or cranberry farms) Design Rational: The agricultural zoning would have restrictive covenants imposed on it so the land use will be compatible with the area's sensitive ecological needs

**Existing Zoning**

To be removed from A1 and A2 zoning.

**Horticulture**

Blueberry Farms  
Cranberry Farms

**Proposed Zoning**

Planning Tool used: Either amend Zoning or put on a restrictive covenant that does not allow these activities:

Horticulture  
Blueberry Farms  
Cranberry Farms

**Reference Number**

Title Proposed Zoning Changes

Project: Mud Bay Wildlife Alternative - Stage 1

Scale n/a  
Date: 04 15 2002  
Drawn: AFK

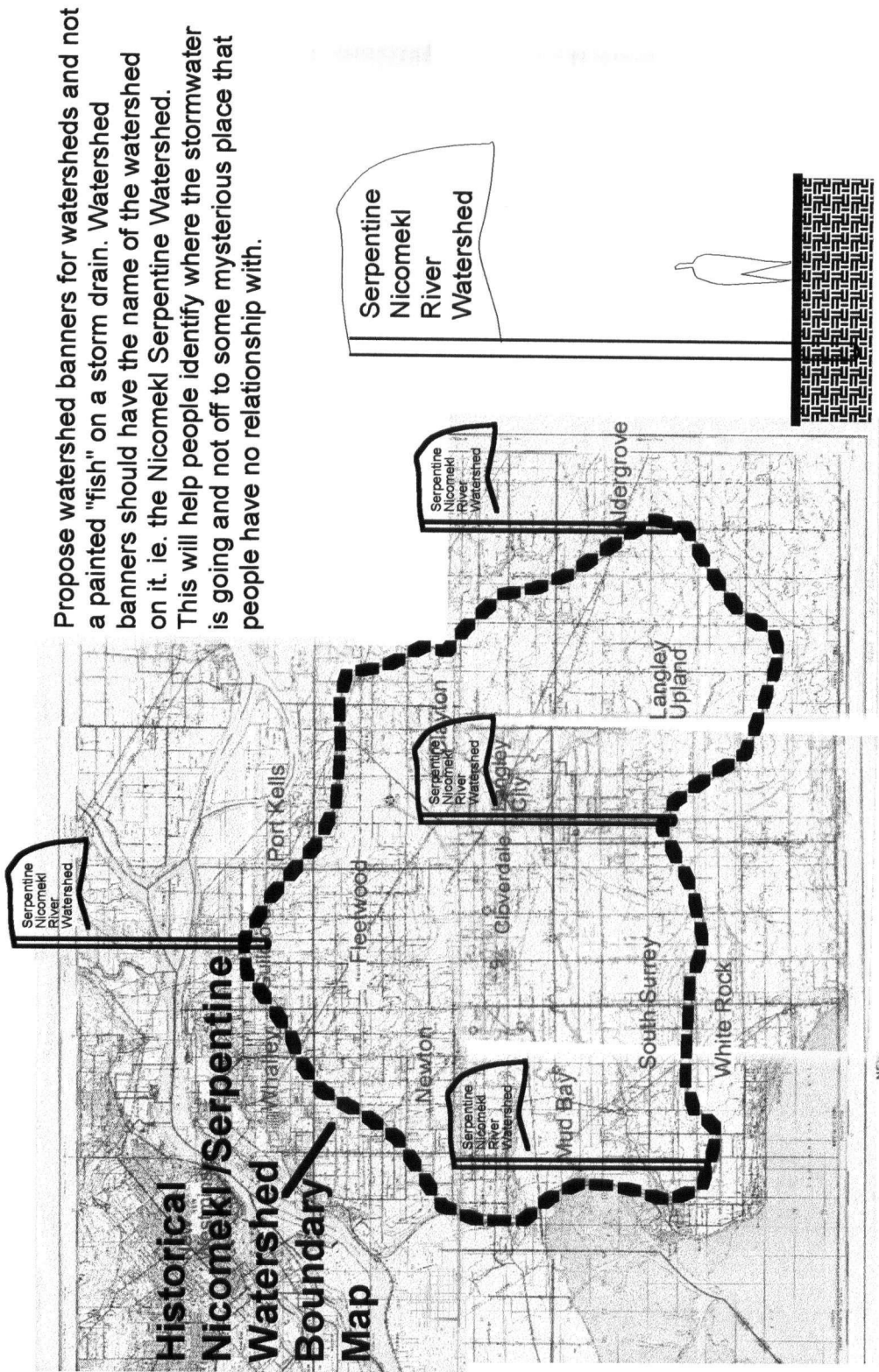


Figure 134 Proposed Watershed map Boundary Banners

Propose watershed banners for watersheds and not a painted "fish" on a storm drain. Watershed banners should have the name of the watershed on it. ie. the Nicomekl Serpentine Watershed. This will help people identify where the stormwater is going and not off to some mysterious place that people have no relationship with.

Reference Number 1

Title Proposed Watershed map Boundary Banners

Project: Mud Bay Greenway Wildlife Alternative - Stage 1

Date: 04 15 2002

Drawn: AFK

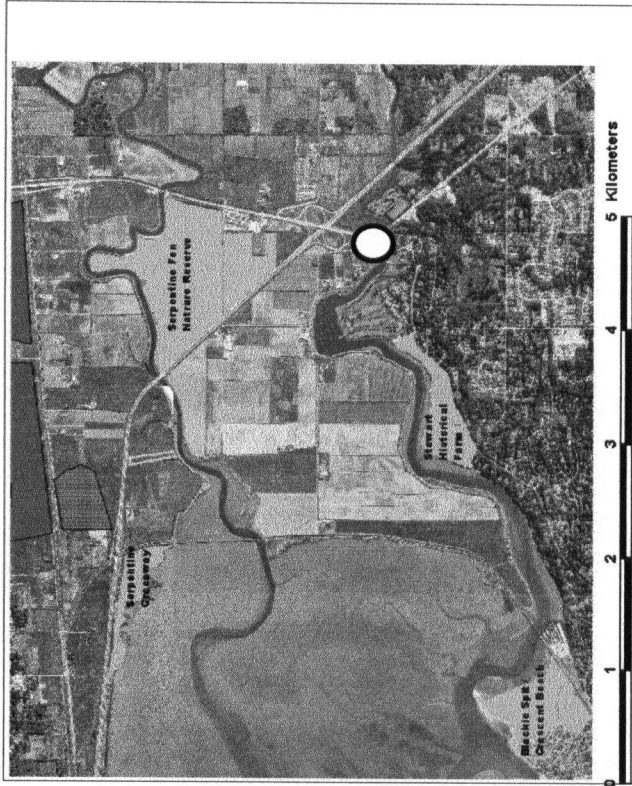
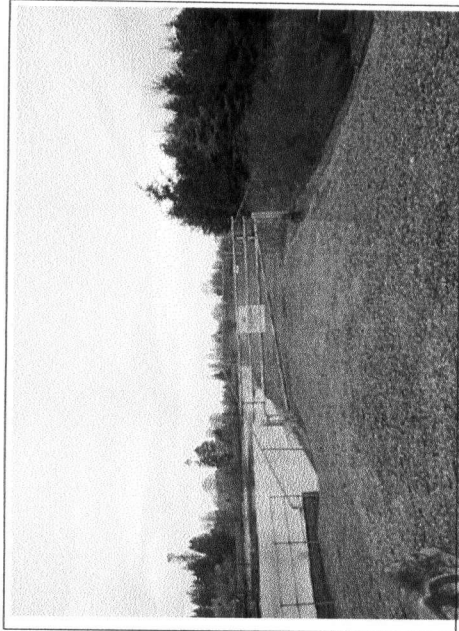
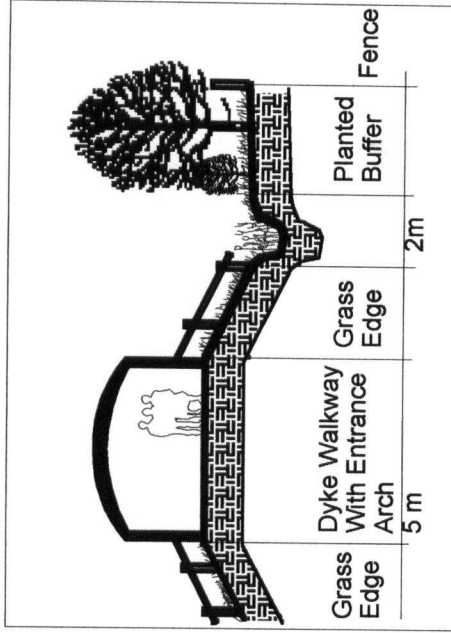


Figure 135 Nicomekl Road Trail Entrance

Image showing the Nicomekl dam trail entrance to the greenway. The Nicomekl Dam is the eastern entrance into the greenway. There is currently a fence across the dyke that should be removed and replaced with an entrance arch signifying that the visitor is entering into a special place.



Existing Nicomekl Rd Dyke Entrance



Proposed Nicomekl Rd Entrance 1:200

Reference Number 1

Title Nicomekl Road Trail Entrance

8361 Date: 04 15 2002

Project: Mud Bay Greenway Wildlife Alternative - Stage 1 Drawn: AFK

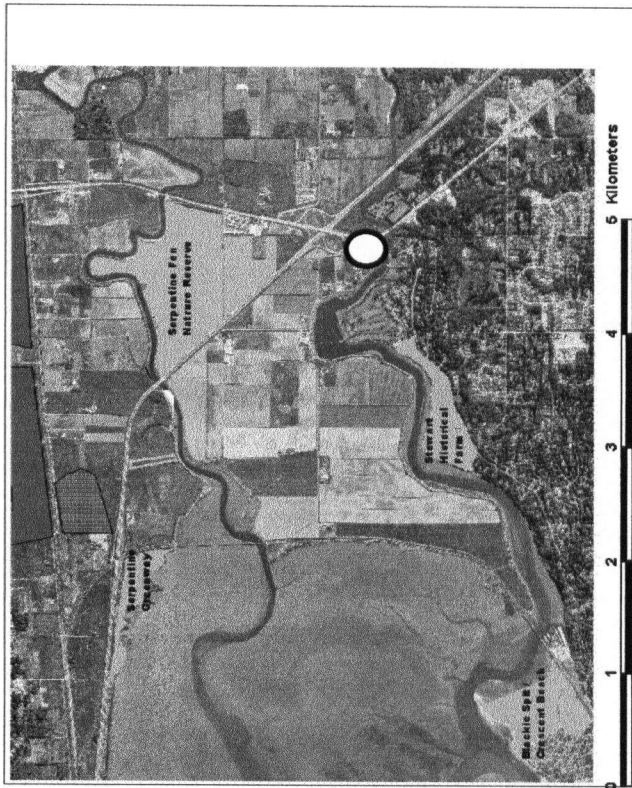
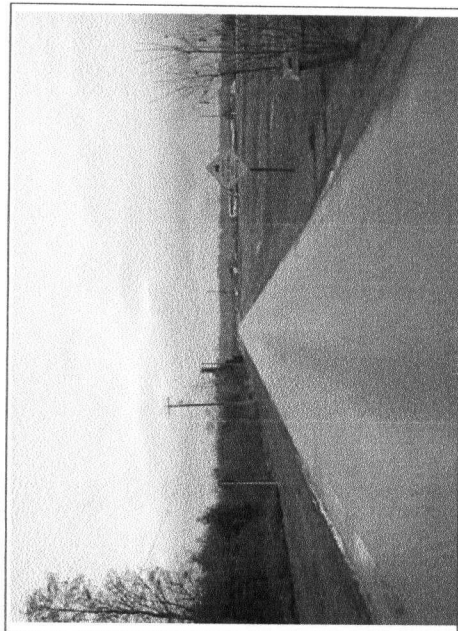
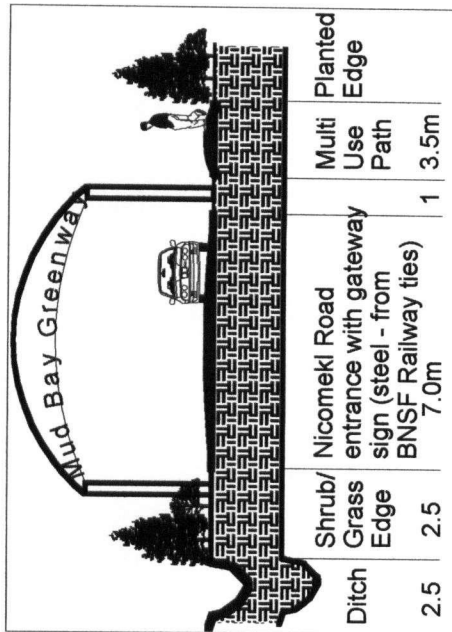


Figure 136 Nicomekl Road Special Entrance Gate

Image showing the only road entrance into the site with a gateway. The Nicomekl Road Gateway signals to the user that they are crossing the threshold into a greenway.



Existing



Proposed

Reference Number 8362 1:200  
 Title Nicomekl Road Special Entrance Gate  
 Project: Mud Bay Greenway Wildlife Alternative - Stage 1  
 Date: 04 15 2002  
 Drawn: AFK



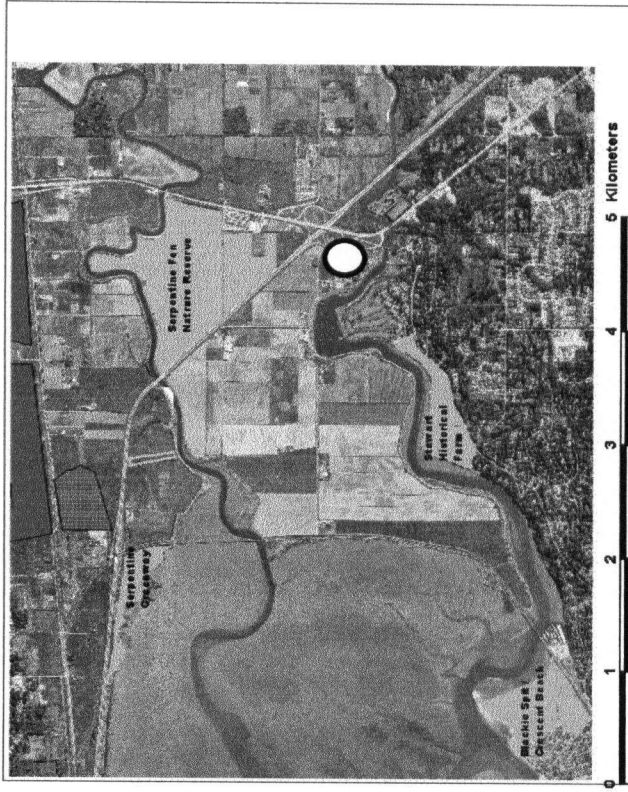


Figure 137 Rio Place Staging Area

The site would mainly utilize the existing staging areas at Blackie Spit, Stewart Historical Farm, Serpentine Fen Nature Reserve, and Surrey's new Serpentine River. Until the Wallace Farm is converted into a Staging Area, Rio Place would become a basic staging area with roadside parking for up to 6 cars. Design Rational: The Mud Bay farmers do not want any roadside parking nor increased traffic on 40th Avenue that would disrupt their farming operations. In Stage 1 post restricted parking signs – 'No overnight parking' and indicate park opening and closing hours at the Rio Place Staging Area.

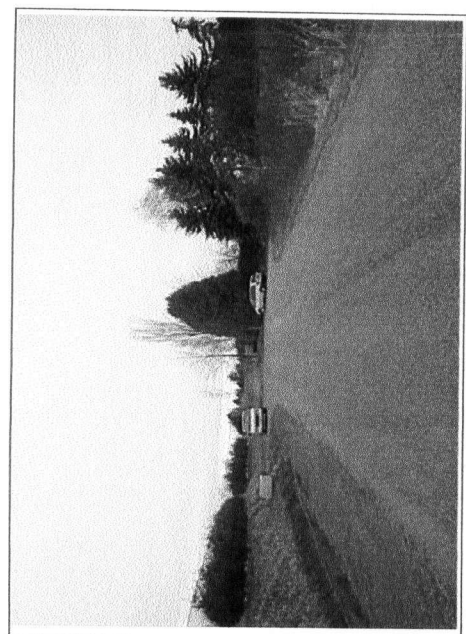
Reference Number 3

Title Rio Place Staging Area

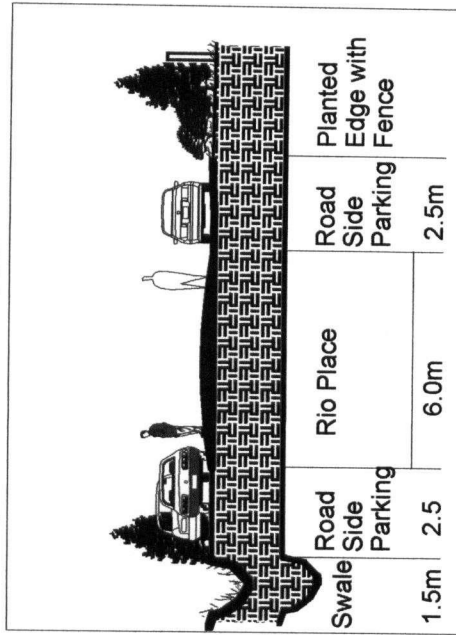
Project: Mud Bay Greenway Wildlife Alternative - Stage 1

8404 Date: 04 15 2002

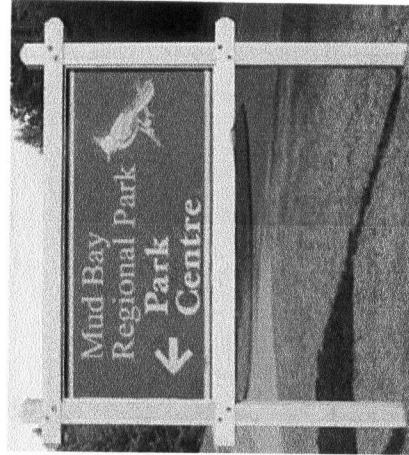
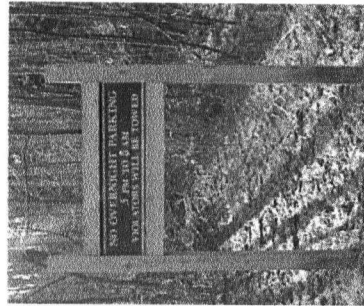
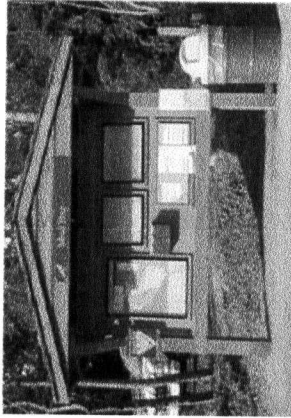
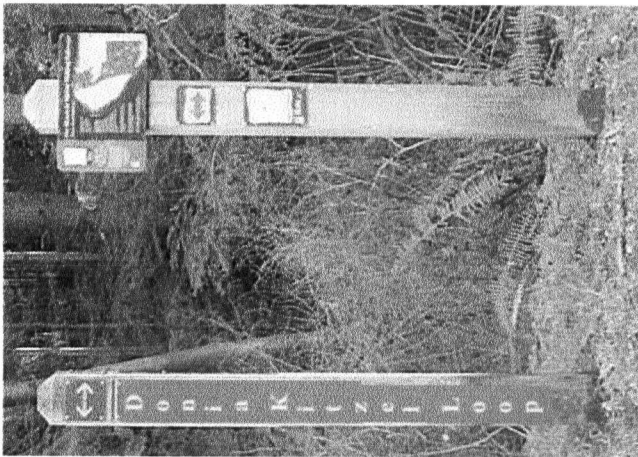
Drawn: AFK



Existing Rio Place Road



Proposed Rio Place Staging Area 1:200



The following images show possible signage that would be found within the Greenway if the GVRD were to become a major party involved in the project.

Figure 138 Proposed Signage-GVRD

Reference Number 3

Title Proposed Signage - GVRD

Project: Mud Bay Wildlife Alternative - Stage 1

Date: 04 15 2002

Drawn: AFK

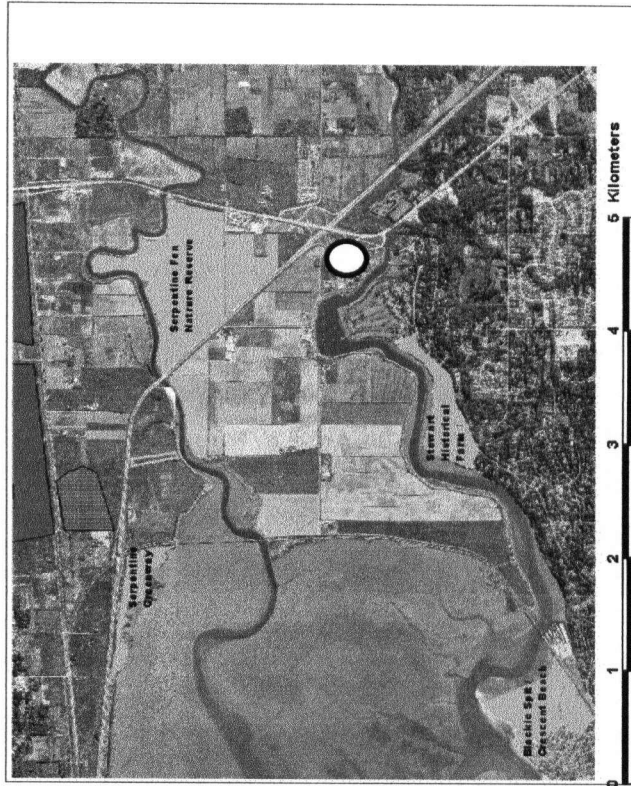
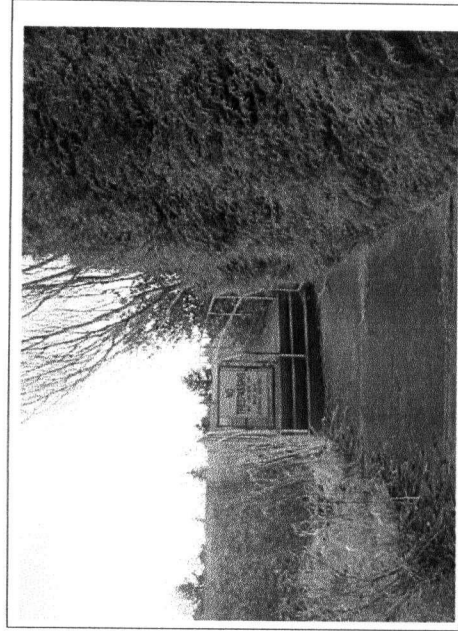
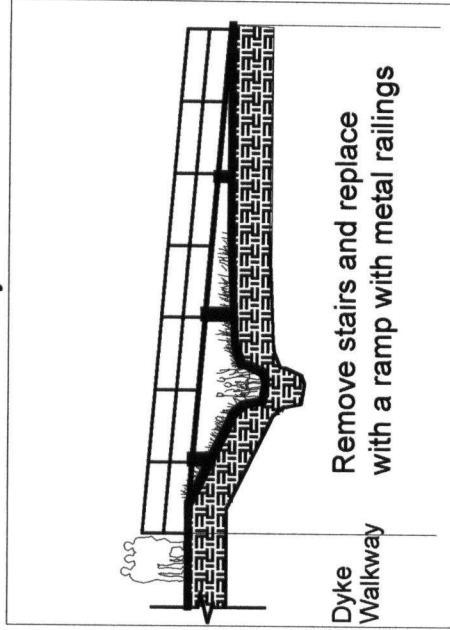


Figure 139 Rio Place Staging Area Improvements - Stairs

In stage one, remove the stairs from the entrance to the dyke and replace it with a ramp (8%). Ramp should be made according to universal standards (See A Design Guide to Universal Access to Outdoor Recreation by Plae, Inc.). If a rest stop is needed then add provisions to ramp design. Ramp width should accommodate wheel chairs, baby strollers, bicycles, and pedestrians. Design Rational: To make Rio Place staging area universally accessible.



Existing Rio Place Dyke Stairs



Proposed Stair Improvements

Reference Number 3

Title Rio Place Staging Area improvements - Stairs

Project: Mud Bay Greenway Wildlife Alternative - Stage 1

Date: 04 15 2002

Drawn: AFK



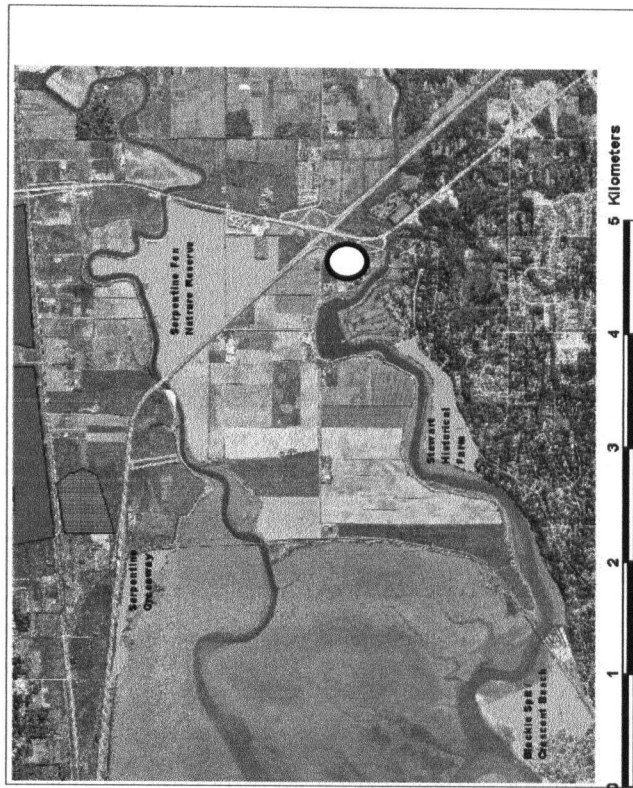


Figure 140 Rio Place Details

#### Historical Piling Detail:

The piling will have historical information on it that describes some of the area's local history. Design Rational: To design a piling cap which serves two purposes. Firstly, to protect the top of the wooden piling from the weather. Secondly, to become a sign post for the areas historical information.

#### Piling Light:

The light will illuminate the trail from dusk to park closing. Design Rational: To have a light that only lights up the trail and not the surrounding area as that may have negative effects on the habitat.

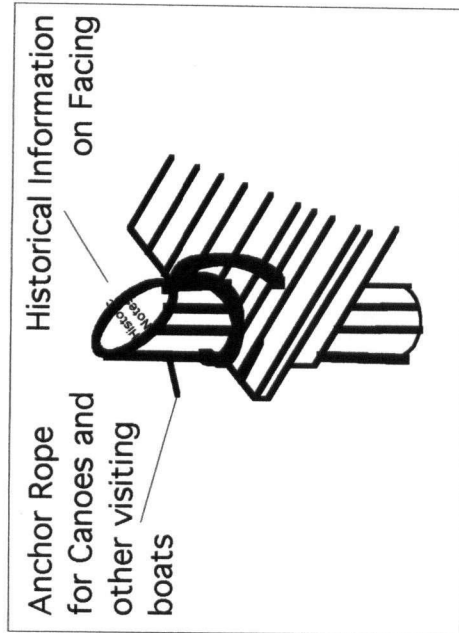
Reference Number 3

Title Rio Place Details

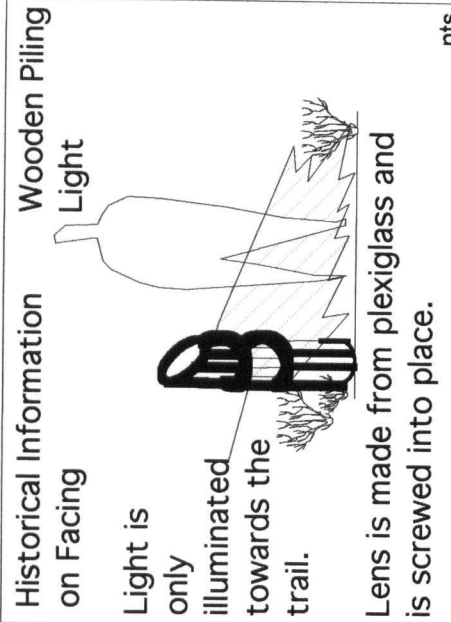
Project: Mud Bay Greenway Wildlife Alternative - Stage 1

Date: 04 15 2002

Drawn: AFK



#### Historical Information on Piling



#### Piling Light Detail

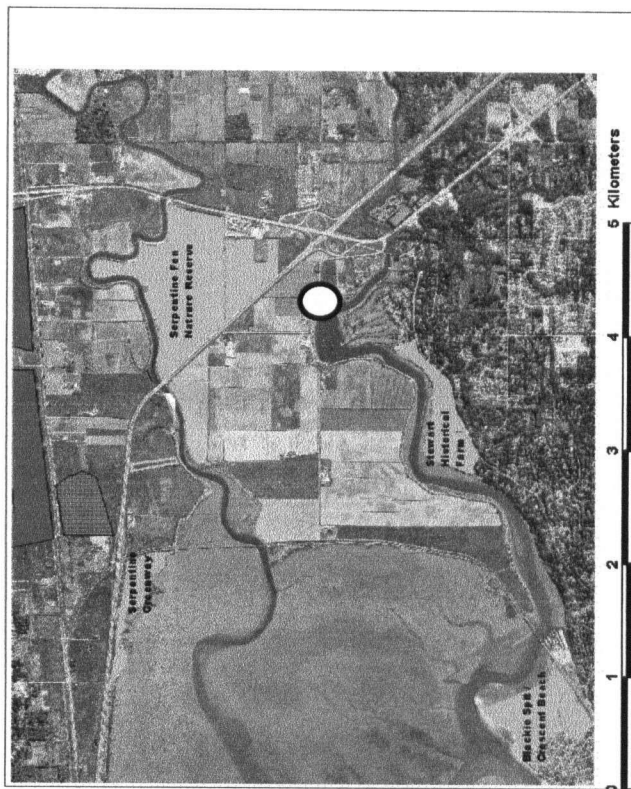


Figure 141 Wallace Nature Interpretive Centre

When UBC acquires the Wallace Farm, it will be established as a nature interpretive center. The Wallace Farm will have educational displays by the area's natural history and wildlife groups. Sea kayakers, and an overnight boat dock on the Nicomekl River's Edge. The Wallace day use facility will have washrooms, drinking water, a picnic site, and a public telephone. Design Rational: To use the Wallace Farm with programming that is better suited to the site. A place to overnight is thought to come into demand when the border-to-border trail is opened up and more tourists are using the trail.

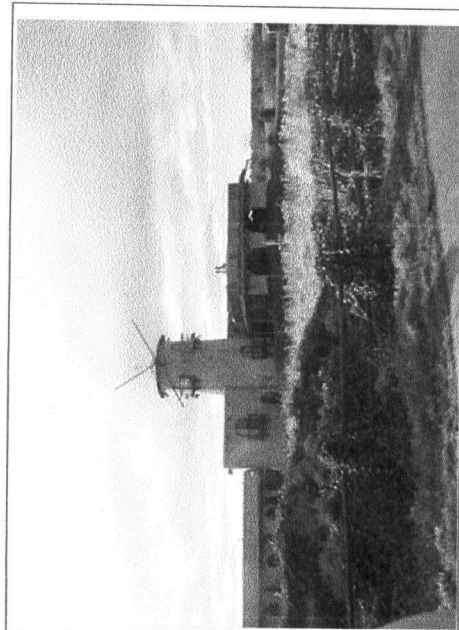
Reference Number 4

Title Wallace Nature Interpretive Centre

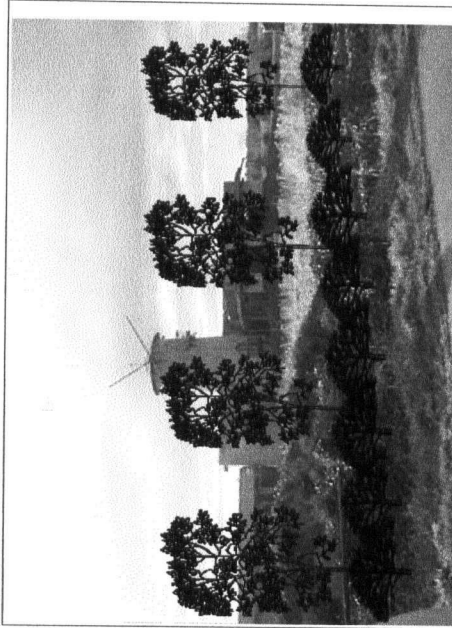
Project: Mud Bay Greenway Wildlife Alternative - Stage 1

6886 Date: 04 15 2002

Drawn: AFK



Existing Wallace Farm



Proposed Nature Interpretive Centre

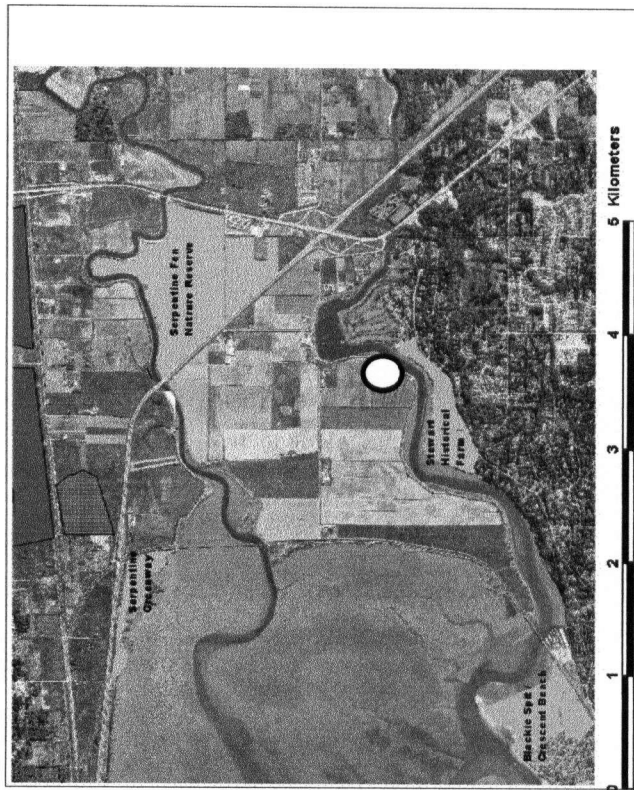


Figure 142 Points of Interest

**Seating Area:**  
Will be covered by the river water in the winter months, however in the summer and early fall they will be higher than the waterline and will provide areas for sitting and picnics. Design Rational to create more seating when the greenway has higher number of visitors.

**Memory Box:**  
A box made from cedar for storing in community memories. Every January 1st, people in the community write down their New Year's reflections and put them into this Memory Box. The Box is then placed in a tree on the south side of the Nocomekl River. The box stays, in the tree until it rots away. At that time, the biodegradable paper is set free into the wind. The paper, will either be used by birds for their nests, or found by a special person who will share that memory.

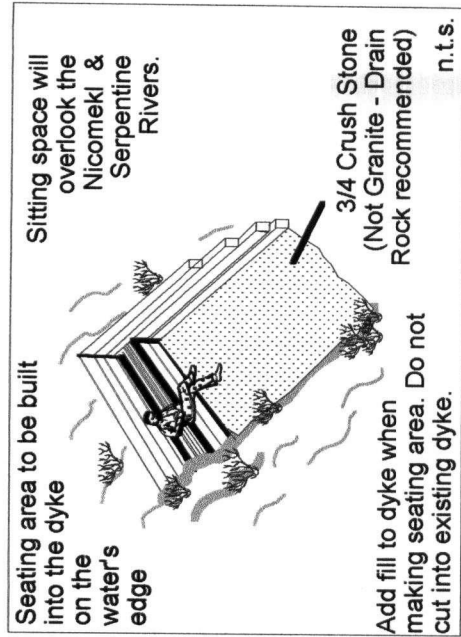
Reference Number 5

Title Points of Interest

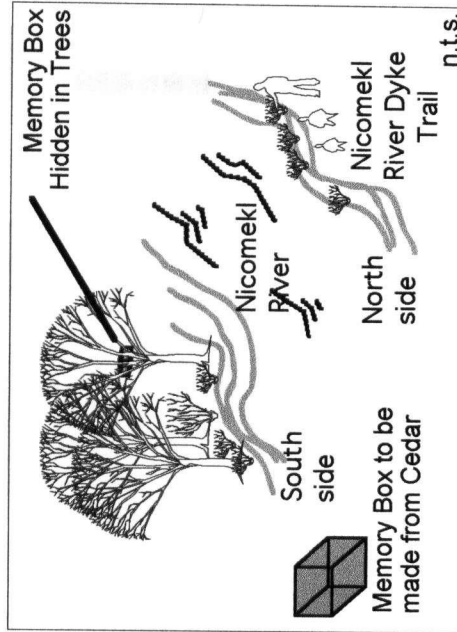
Project: Mud Bay Greenway Wildlife Alternative - Stage 1

Date: 04 15 2002

Drawn: AFK



Proposed Seating Area Detail



Proposed Memory Boxes Along River

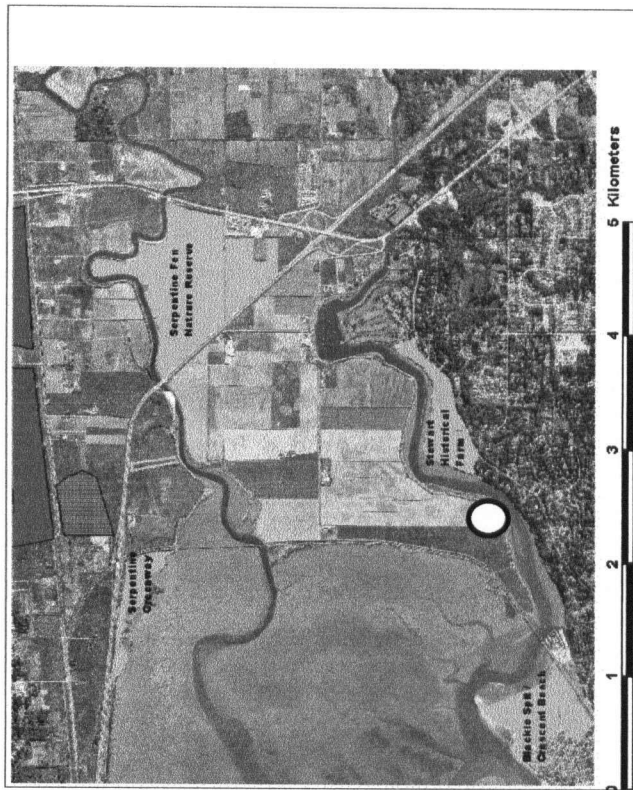


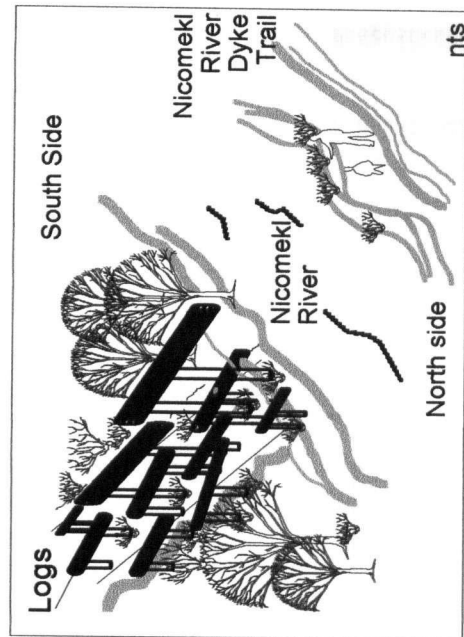
Figure 143 Points of Interest 2

#### Logs on Poles:

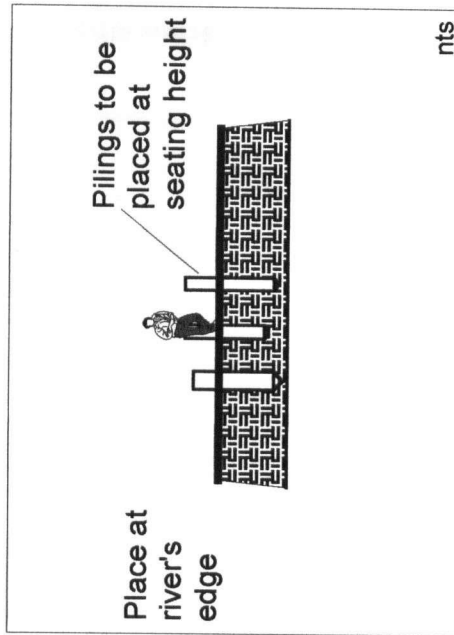
Logs will be balanced on poles near Chantrell Creek. Design Rational: A reminder when the area was logged in the late 1800's and log shoots were common on the South Bank of the Nicomekl River.

#### Piling Seating Areas:

Pilings to be placed in the ground at the river's edge. Various heights to stick out of the ground for leaning or sitting on. Design Rational: to have various rest stops along the dyke walkway.



Proposed Log Shoot Detail



Proposed Piling Seats

Reference Number 5

Title Points of Interest

Project: Mud Bay Greenway Wildlife Alternative - Stage 1

Date: 04 15 2002

Drawn: AFK



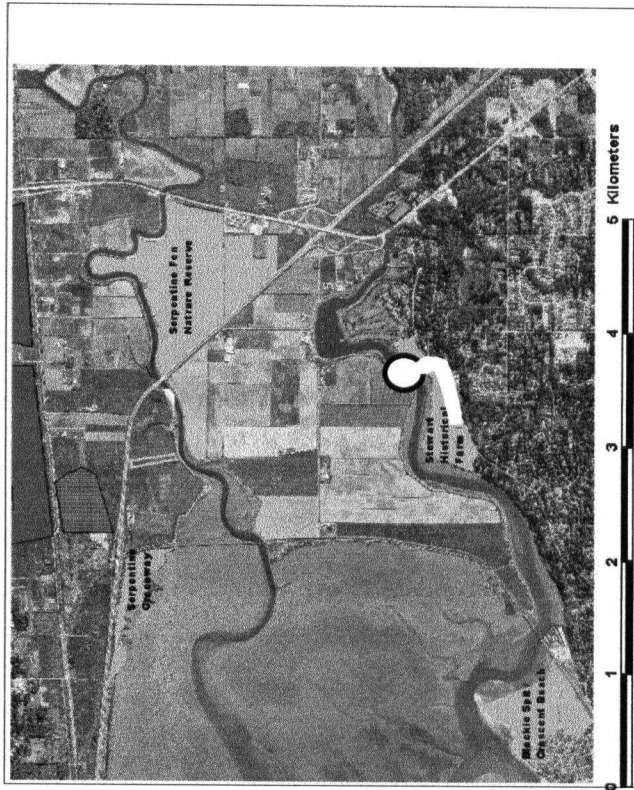
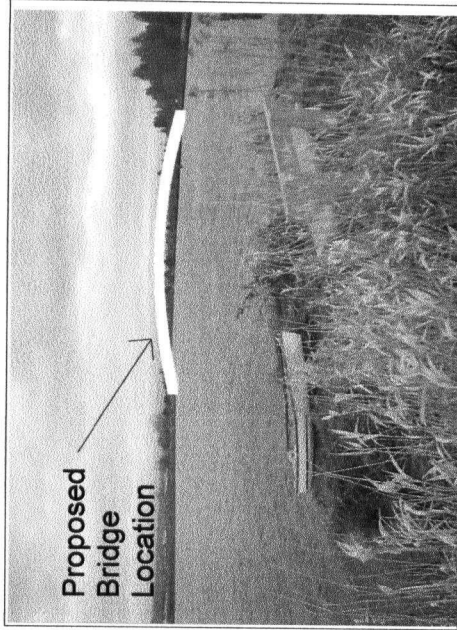


Figure 144 Proposed Nicomekl Bridge Location

The proposed bridge will link the low flood plains to the higher grounds. This bridge will not only be used for recreation but also as part of an emergency preparedness program. When the area floods, as it has demonstrated in the past history, with a 300 or 500 year storm event, the dairy cattle can be rounded up and herded over the bridge into higher ground. Once on higher ground the dairy herd can wait out the high waters at the Stewart Historical Park, or Ocean Park. Design Rational: To have the bridge serve two purposes, one for recreation and the other for assisting the transportation of dairy cattle to higher ground in case of a flood.



Existing Nicomekl River Looking East



Proposed Bridge Location

Reference Number 6

Title Proposed Nicomekl Bridge Location

Project: Mud Bay Greenway Wildlife Alternative - Stage 1

7747 Date: 04 15 2002

Drawn: AFK



Old North Bridge in Concord, Massachusetts  
Photo: Keith Willard - Bridges

The following images show the proposed bridge styles

for the Nicomekl and Serpentine River Crossings. The bridge style depends on the the boat height policy that will pass underneath the bridge. Currently, there are sailboats with tall masts that would have to be considered for height restrictions.

*"When the history of our time is written posterity will know us not by a cathedral or temple, but by a bridge."*

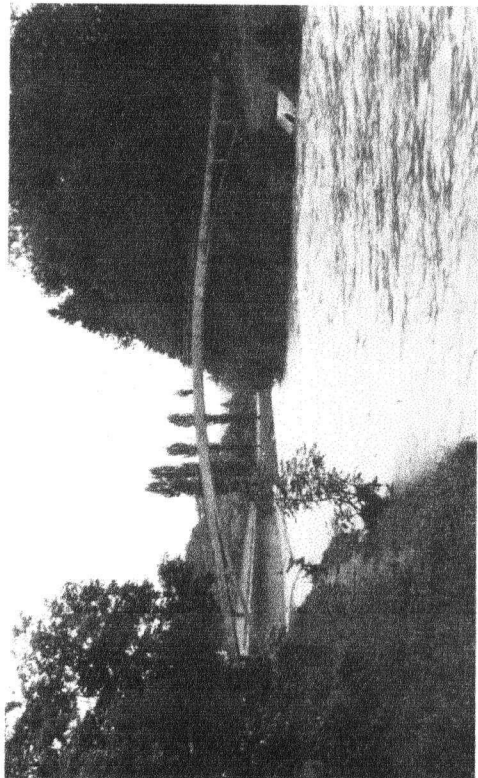
Montgomery Schuyler, 1877, notes on

J. Roebling's Brooklyn Bridge

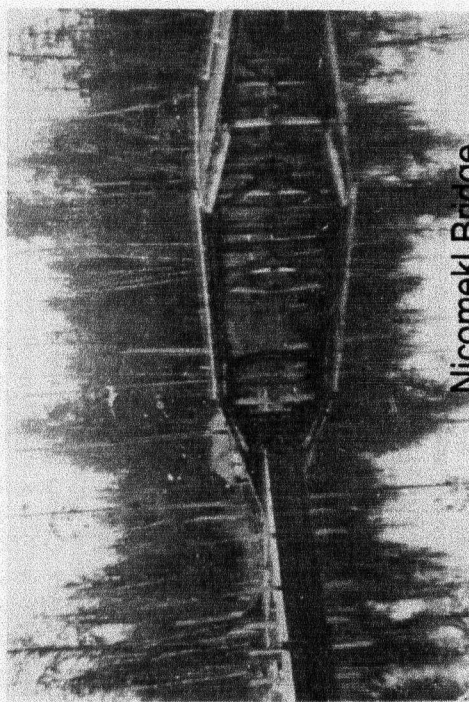
Reference Number 6

Title Proposed Bridge Styles

Project: Mud Bay Wildlife Attlernative - Stage 1



Maillart's Toss River Bridge  
Photo: F Gottemoeller - Bridgescape



Nicomekl Bridge  
Photo: Surrey Archives

Date: 04 15 2002

Drawn: AFK

Figure 145 Proposed Bridge Styles

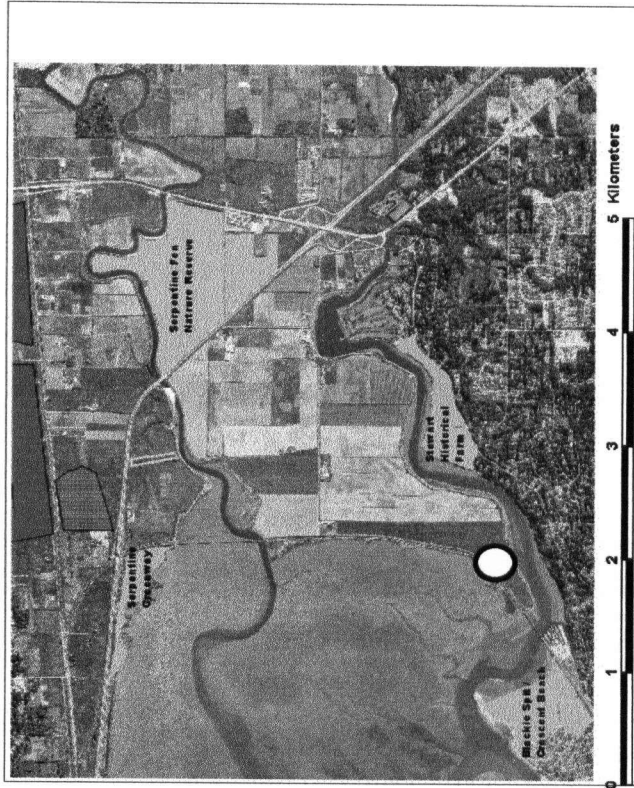


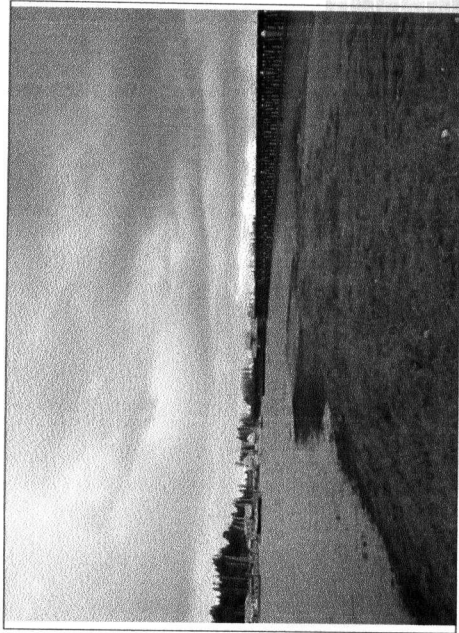
Figure 146 Proposed 32nd Avenue Right of Way Picnic Area

In stage one, acquire BCALC land in area south of right of way for a picnic area. The picnic area would be located on the 32nd Ave right of way on the lower west section of the site. This area is at the mouth of the river yet it is sheltered from harsh winds by the railway dyke and the Crescent Beach escarpment. There is a sandy shoreline with a gentle slope. The views are towards Blackie Spit and the Crescent Beach Marina and up the Nicomekl River. Design rationale: This is a natural spot to rest with the above-mentioned positive attributes. The site would have the same themed site furniture as the Historical Stewart Farm.

Reference Number 7

Title Proposed 32nd Ave Right of Way Picnic Area

Project: Mud Bay Greenway Wildlife Alternative - Stage 1



Existing 32nd Ave RoW



Proposed Picnic Shelters

7966 Date: 04 15 2002  
 Drawn: AFK



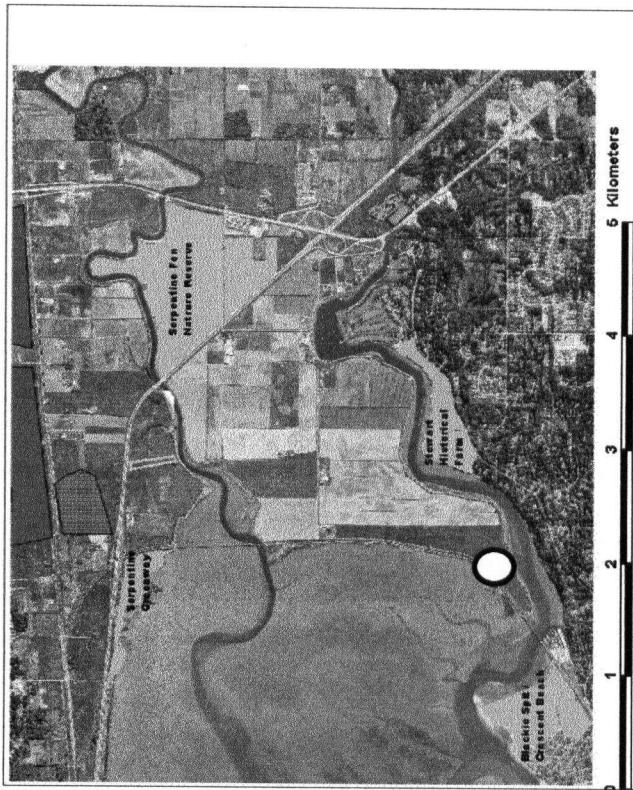


Figure 147 Proposed 32nd Ave Right of Way Picnic Area 2

#### Tide Flow Indicator:

The Paddles slide up and down on the metal track. This also indicates the movement of the tide. If the paddles are moving up the pole, then the tide is coming in. Design Rational: to help boaters know when it is easier to travel on the water. There is less resistance to paddle with the tide than against it.

#### Wind Flow Indicator:

The tube flows in the same direction as the wind.  
Design Rational: Used for boaters to help them locate the direction of the wind.

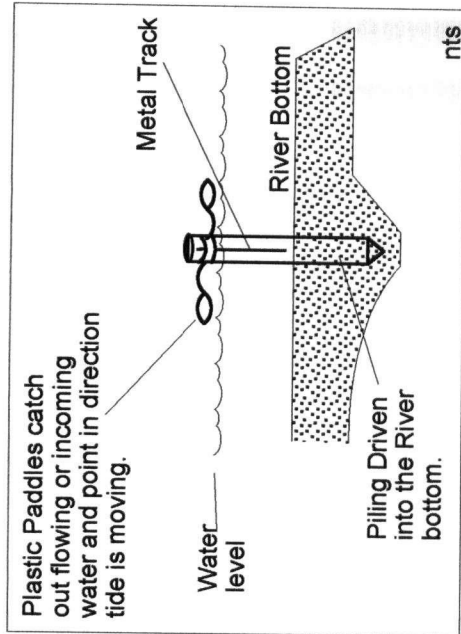
Reference Number 7

Title Proposed 32nd Ave Right of Way Picnic Area

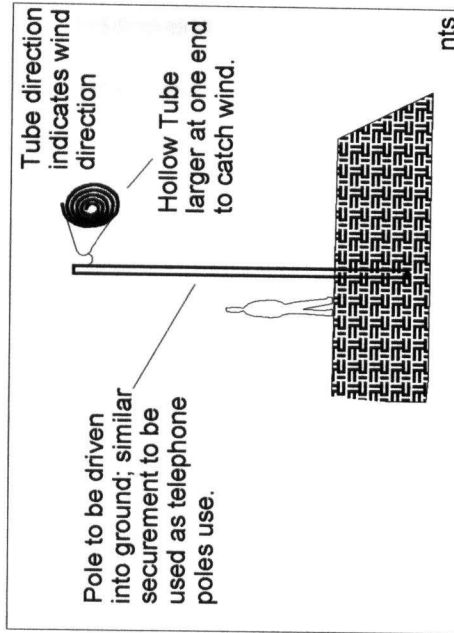
Project: Mud Bay Greenway Wildlife Alternative - Stage

Date: 04 15 2002

Drawn: AFK



#### Tide Flow Indicator



#### Wind Flow Indicator



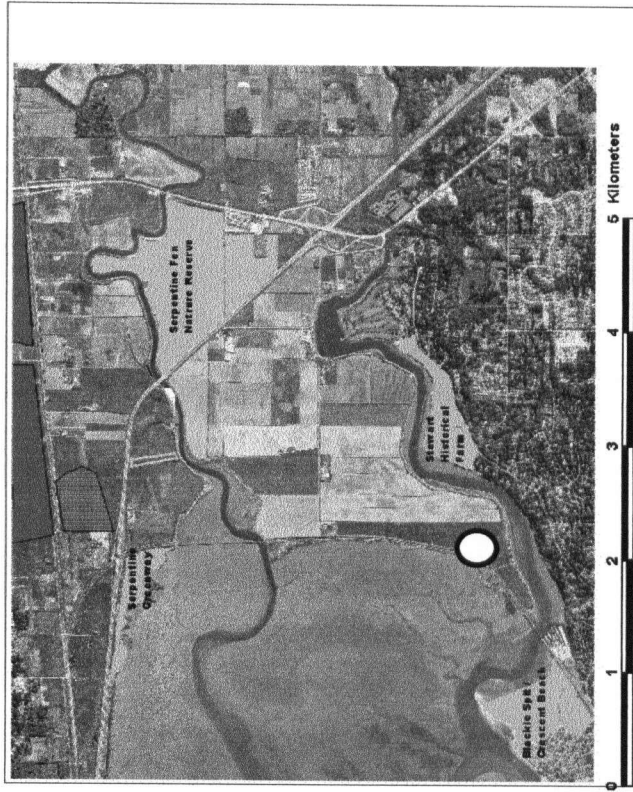
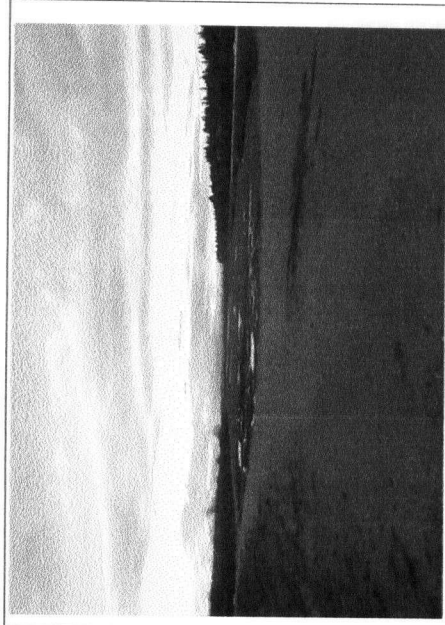


Figure 148 Proposed Viewing Towers

Two Railway Dyke Viewing towers will be built on inland side of the railway at the north and south ends of the site. They will be made of metal, and wood. The towers will be at least five meters tall. They will allow for views towards the bay.

Design Rational: To alleviate the blocked views towards Mud Bay by the 3-meter high railway dyke. The viewing towers will allow the user to see what is on the other side of the berm. The viewing towers will also provide shelters in foul weather. The tower style will be the same as that found at the Serpentine Nature Reserve.



Existing Location for Viewing Tower



Proposed Viewing Tower

Reference Number 8

Title Proposed Viewing Towers

Project: Mud Bay Greenway Wildlife Alternative - Stage 1

7833 Date: 04 15 2002

Drawn: AFK

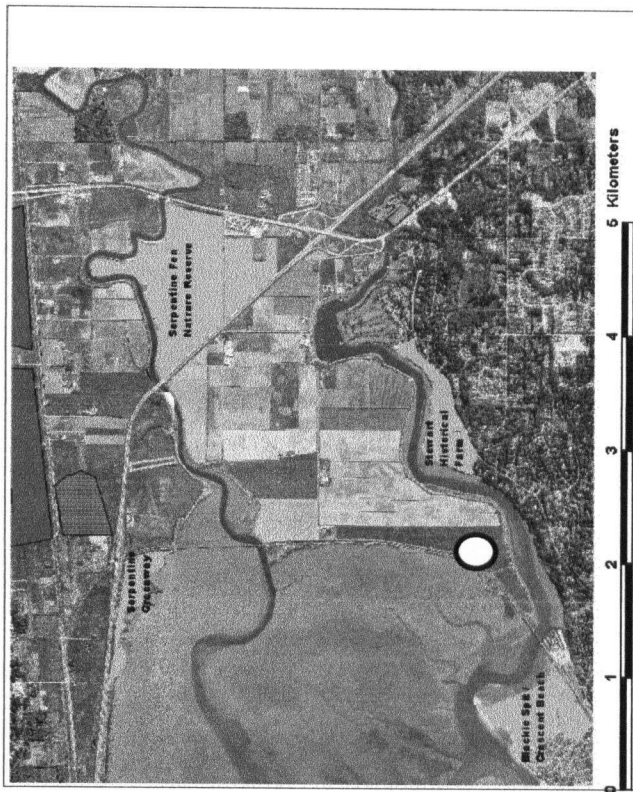


Figure 149 Mud Bay Inland Dyke Walkway

The GVRD Trail has a minimal trail width of 4.5 meters. Its width is determined by utilizing the existing road into the greenway and applying the BC Agricultural Land Commission's Landscape Buffer Specifications. The trail's minimum footprint expands to 12 meters. The trail's footprint will widen if there are some curves put into the trail network by a minimum footprint of 18 meters. Design Rational: The trail is designed with minimal trail widths to allow for the least impact on the agricultural uses on the land. Although this makes for nominally interesting trail walk, it satisfies the farmers request to use as little land as possible for the greenway trail system.

Reference Number 9

Title Mud Bay Inland Dyke Walkway

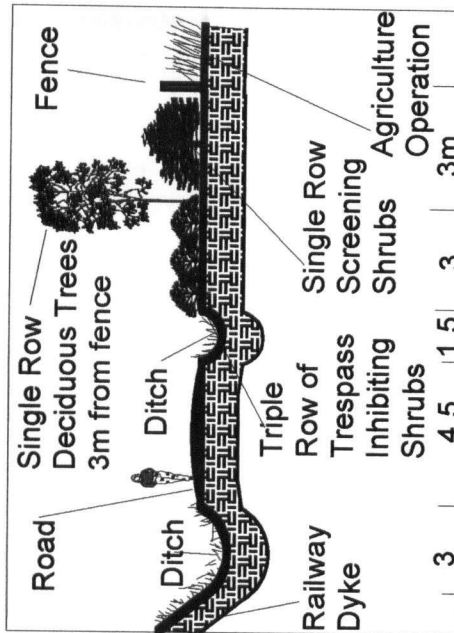
Project: Mud Bay Greenway Wildlife Alternative - Stage 1

7890 Date: 04 15 2002

Drawn: AFK



Existing Dyke Trail



Proposed Dyke Trail widths 1:200

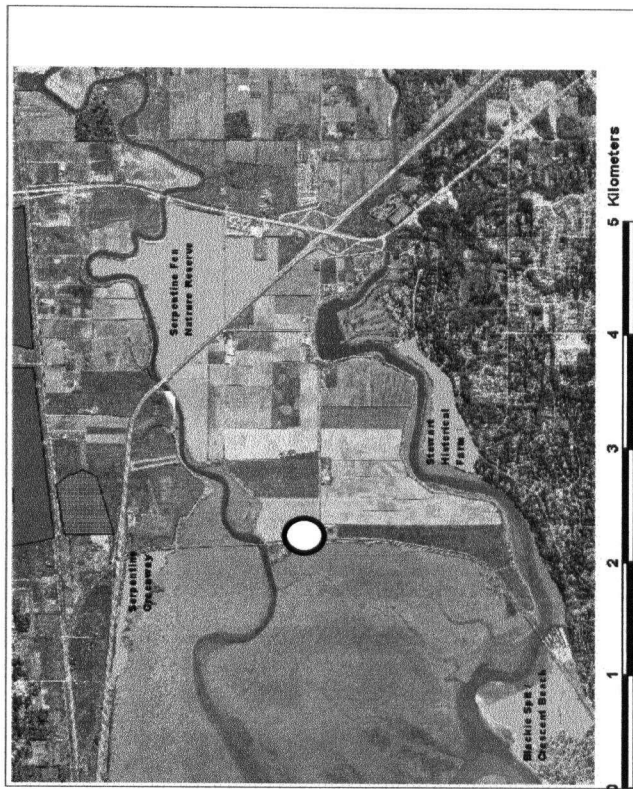
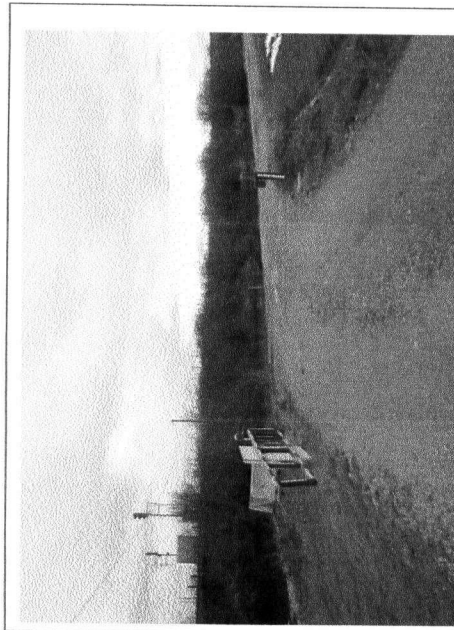


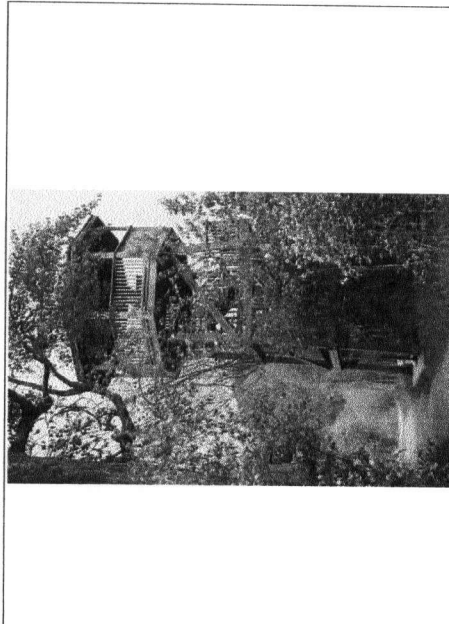
Figure 150 Proposed Serpentine Viewing Tower

Two Railway Dyke Viewing towers will be built on inland side of the railway at the north and south ends of the site. They will be made of metal, and wood. The towers will be at least five meters tall. They will allow for views towards the bay.

Design Rational: To alleviate the blocked views towards Mud Bay by the 3-meter high railway dyke. The viewing towers will allow the user to see what is on the other side of the berm. The viewing towers will also provide shelter in foul weather. The proposed style will be the same as that found at other nature reserves.



Existing Inland Walkway near Serpentine R.



Proposed 2nd Viewing Tower Style

Reference Number 10

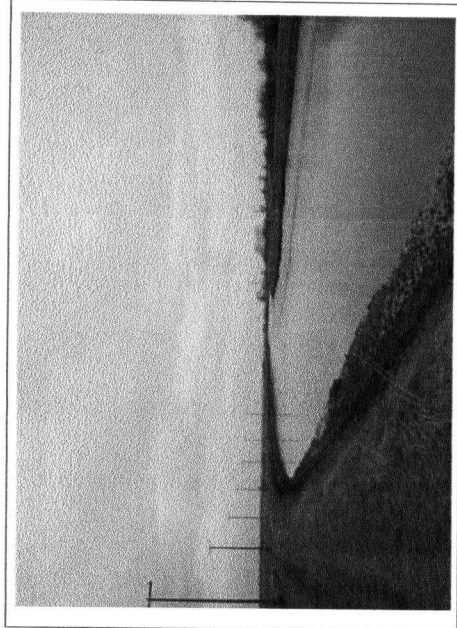
Title Proposed Serpentine Viewing Tower

Project: Mud Bay Greenway Wildlife Alternative - Stage 1 Date: 04 15 2002 Drawn: AFK

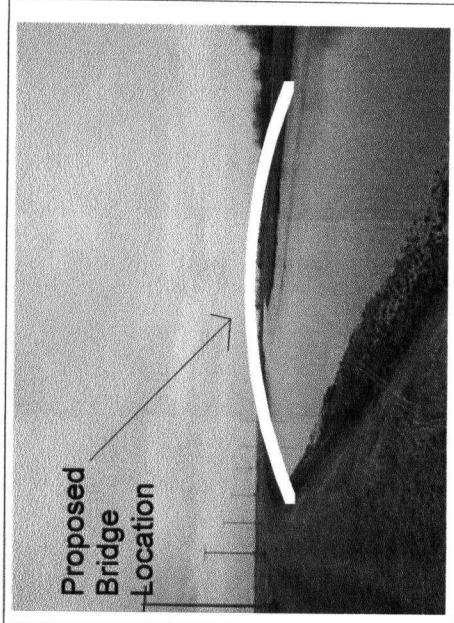


Figure 151 Proposed Serpentine Bridge

The proposed bridge will link the low flood plains to the higher grounds. This bridge will not only be used for recreation but also as part of an emergency preparedness program. When the area floods, as it has demonstrated in the past, the dairy cattle can be rounded up and herded over the bridge into higher ground. Once on higher ground the dairy herd can wait out the high waters at one of Surrey's parks on Panama Ridge. Design Rational: To have the bridge serve two purposes, one for recreation and the other for assisting the transportation of dairy cattle to higher ground in case of a flood.



Existing Serpentine River by 99 Hwy



Proposed Serpentine Bridge Location

Reference Number 11

Title Proposed Serpentine Bridge

Project: Mud Bay Greenway Wildlife Alternative - Stage 1

8354 Date: 04 15 2002

Drawn: AFK



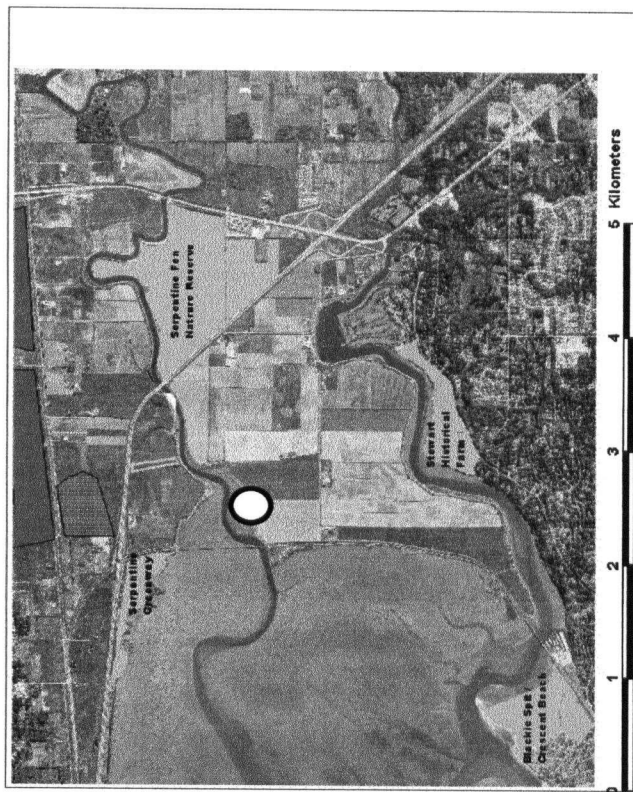
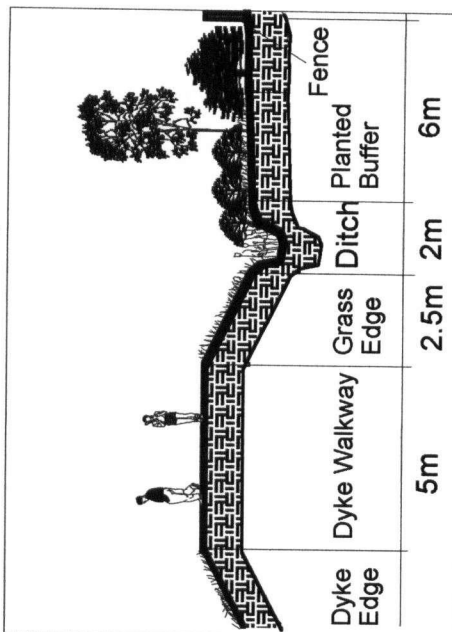


Figure 152 Serpentine Trail Widths

Image showing the Serpentine River Dyke Trail by the BNSF Railway Bridge. Currently there is a maintenance road on the top of the dyke. Proposed trail upgrade would have minimal trail widths with the BC Agricultural Land Commission Landscape Buffer Specifications. Design Rational: To incorporate the existing dyke into the greenway trail system.



### Existing Serpentine River Dyke Trail



Proposed	Serpentine	Trail Widths	1:200
----------	------------	--------------	-------

Reference Number 12

## Title Serpentine Trail Widths

**Title** Serpentine Trail Widths  
**Project:** Mud Bay Greenway Wildlife Alternative - Stage 1  
**Date:** 04 15 2002  
**Drawn:** AFK  
**7897**

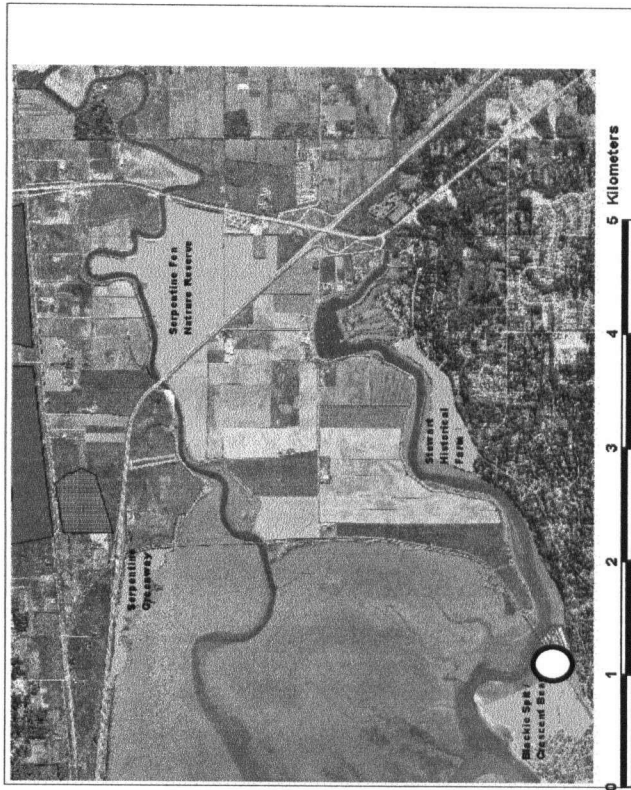
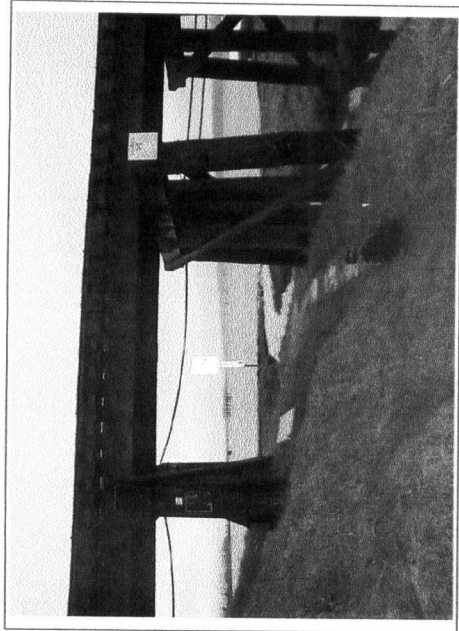
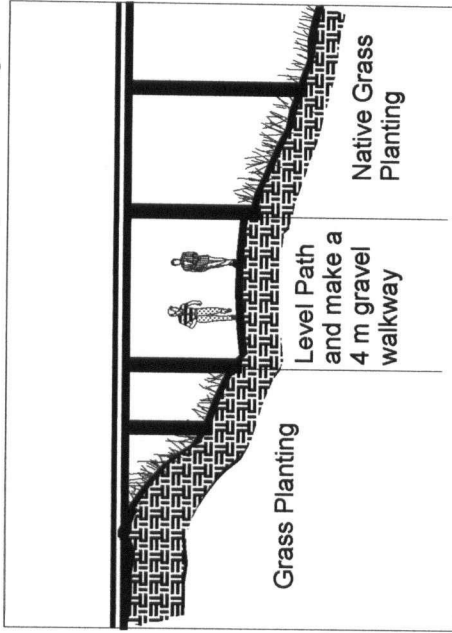


Figure 153 Nicomekl Railway Crossing Improvements

Create a safer trail under the railway bridge at Crescent Beach Marina. The current trail is only a mud path where people with disabilities or with children have a difficult time passing. Level the existing ground and make a 4m gravel walkway.



Existing Nicomekl Railway Crossing



Proposed Improvements

Reference Number 13

7769

1:200

Title Nicomekl Railway Crossing Improvements

Date: 04 15 2002

Project: Mud Bay Greenway Wildlife Alternative - Stage 1

Drawn: AFK





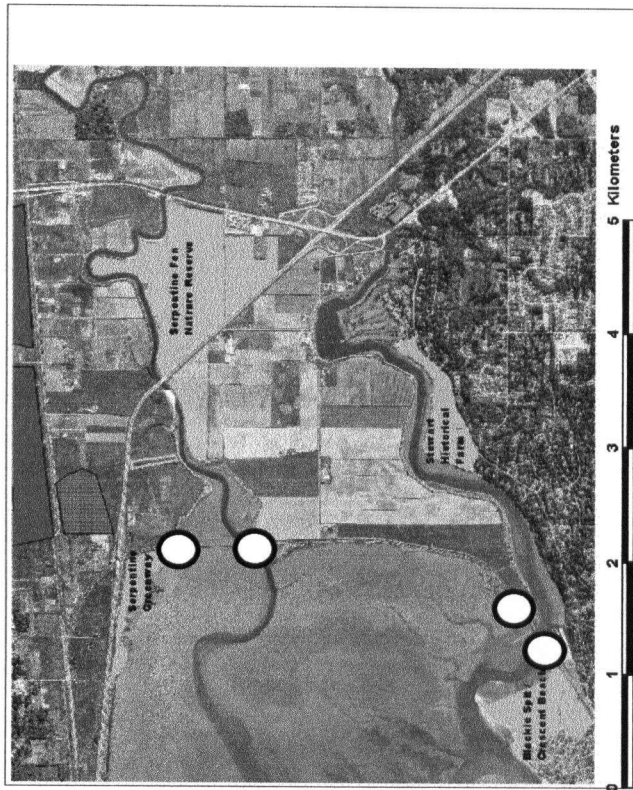
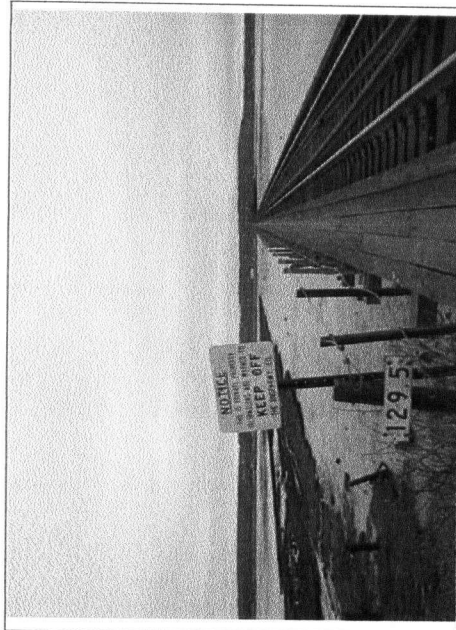
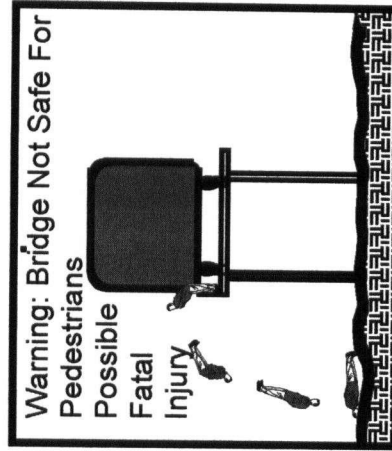


Figure 155 Proposed Railway Sign Improvements

Put up improved safety signs at the entrances to the Nicomekl and Serpentine Railway Bridges. Design Rational: To better inform people about the risks of walking on the railway bridges. Safety signs erected in stage 1 at the entrance to the Nicomekl River Bridge to inform people about the dangers of walking on the active railway bridge. Remove signs when railline is moved.



Existing Railway Bridge Warning Signs



Proposed Sign Improvements

Reference Number 14

Title Proposed Railway Sign Improvements

Project: Mud Bay Greenway Wildlife Alternative - Stage 1

7717 Date: 04 15 2002

Drawn: AFK

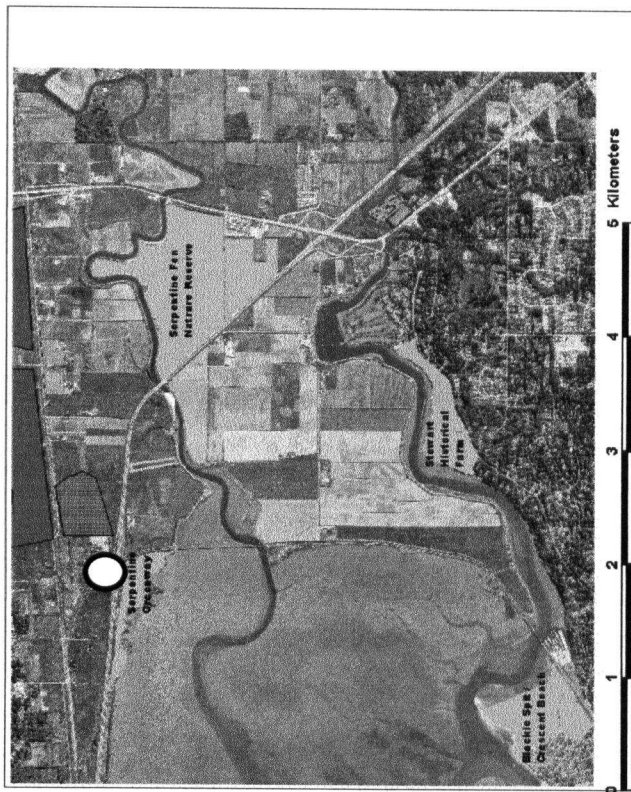
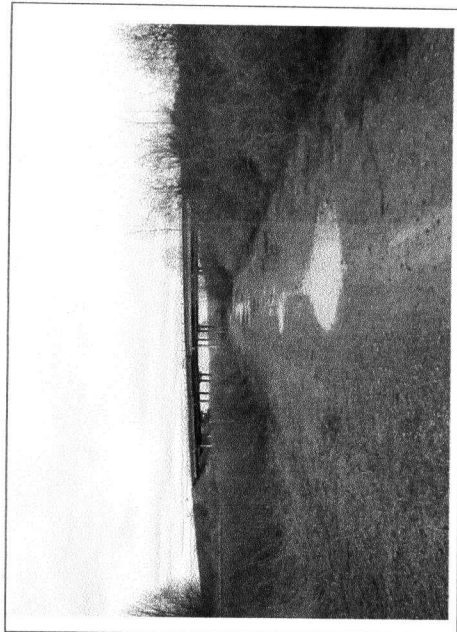
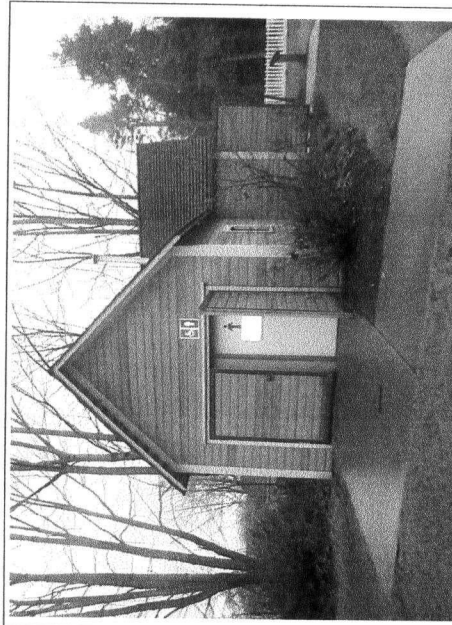


Figure 156 Serpentine Greenway Park Facilities

Propose to have comfort facilities at the Serpentine Greenway Park Staging Area. Washrooms, drinking water, and a public phone are proposed. Design Rational: To have adequate staging facilities when the Serpentine River and Mud Bay Greenways visitor traffic increases. Washroom building style is similar to that found at Stewart Historical Park. Note double doors good to help prevent vandalism.



Existing Serpentine River Park



Proposed Washroom Building Style

Reference Number 15

Title Serpentine Greenway Park Facilities

Project: Mud Bay Greenway Wildlife Alternative - Stage 1

7757 Date: 04 15 2002

Drawn: AFK

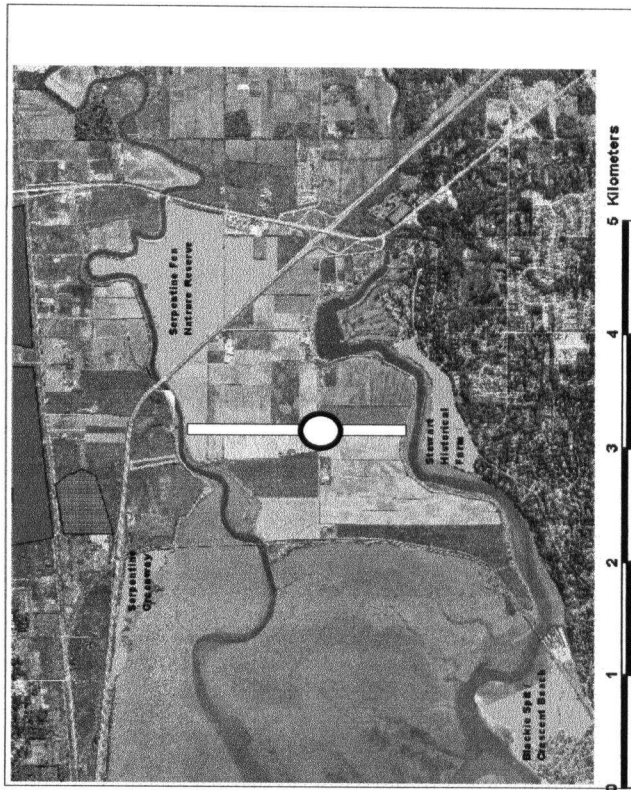
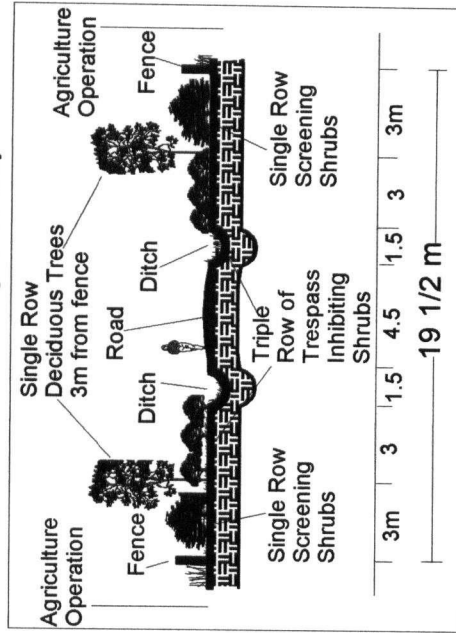


Figure 157 136th Street Right of Way Trail

Incorporate 136th Street right of way into the Greenway trail system. Have trail follow the Landscape Buffer Specifications as set out by the BC Agricultural Land Commission. (The 4.5 meter greenway trail width has a 19.5m trail footprint). Design Rational: To have a direct north south trail from the Serpentine to the Nicomekl Dyke trails. This 136th Street right of way also creates smaller walking routes within the Mud Bay greenway trail network.



Existing 136th Street right of way



Proposed Dyke Trail widths

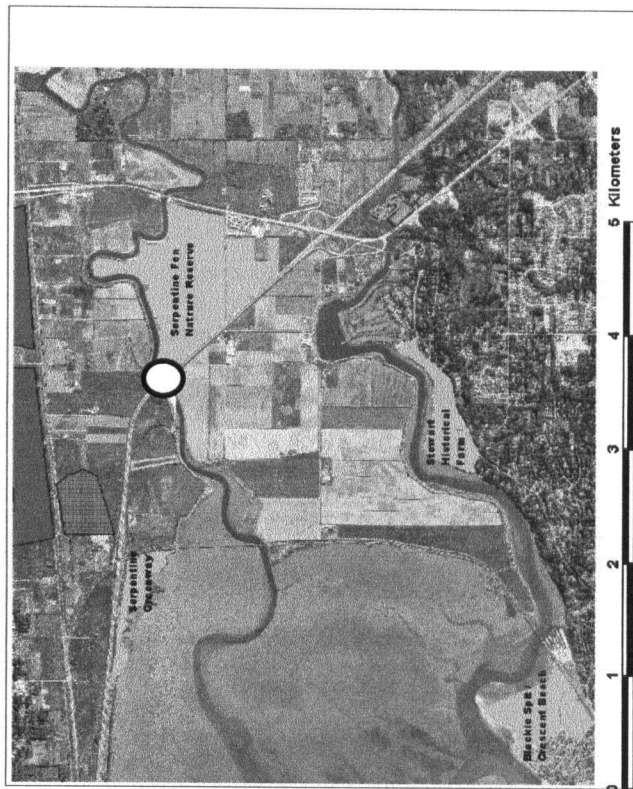
Reference Number 16

Title 136th Street Right of Way Trail

Project: Mud Bay Greenway Wildlife Alternative - Stage 1

8434 Date: 04 15 2002

1 Drawn: AFK



Where the Serpentine River dykes meet the Highway 99, put up a visual barrier with an effective fence barrier to prevent people from crossing over. The proposed uses the same guidelines as the Landscape Buffer Specifications. However, a fence can be used to prevent people from crossing over the Highway 99.

**Design Rational:** To prevent people crossing the highway at an unauthorized crossing. In stage one, the Serpentine River dyke trail becomes the northern half of the loop. The dyke also has views to the Serpentine railway bridge crossing. By erecting a visual barrier, fewer people will be tempted to cross the Hwy into the site.

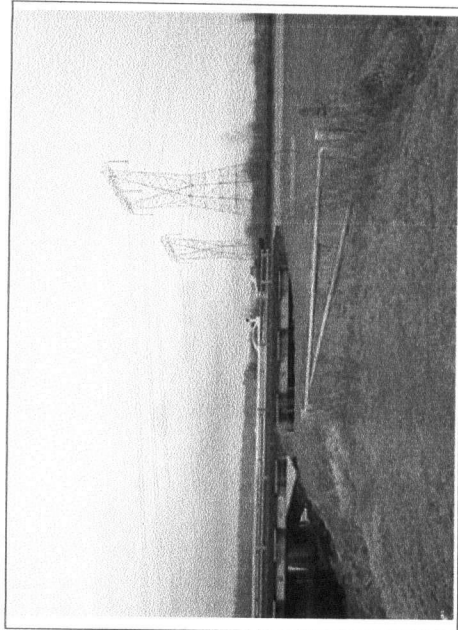
Reference Number 17

## Title Proposed Hwy 99 Visual Barriers

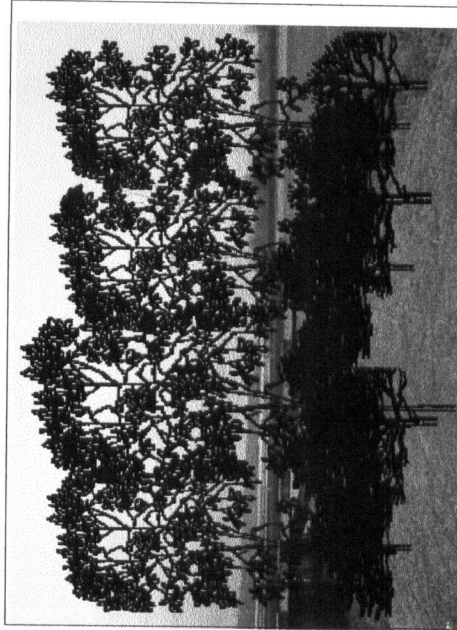
Project: Mud Bay Greenway Wildlife Alternative - Stage 1 Drawn: AFK

8353 Date: 04 15 2002

Drawn: AFK



Existing Serpentine R & Hwy 99 view



## Proposed Hwy 99 Visual Barrier



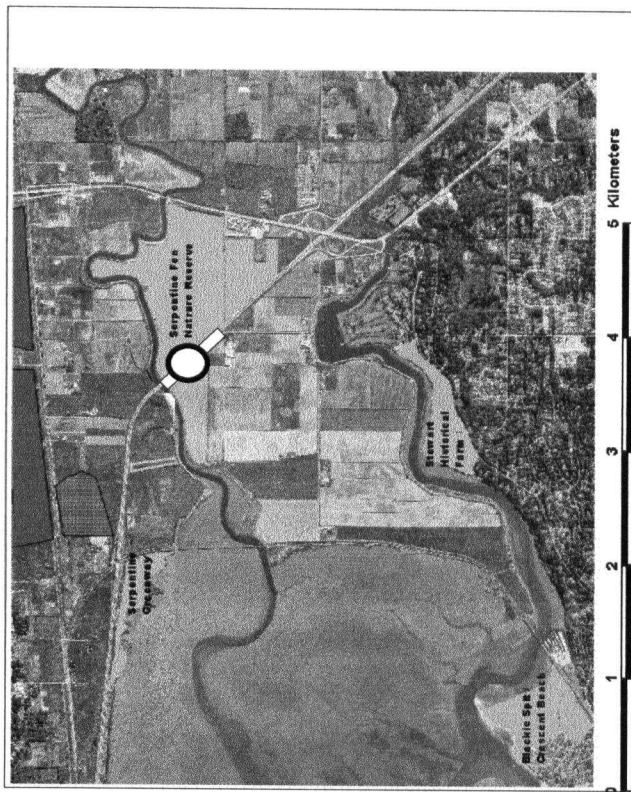
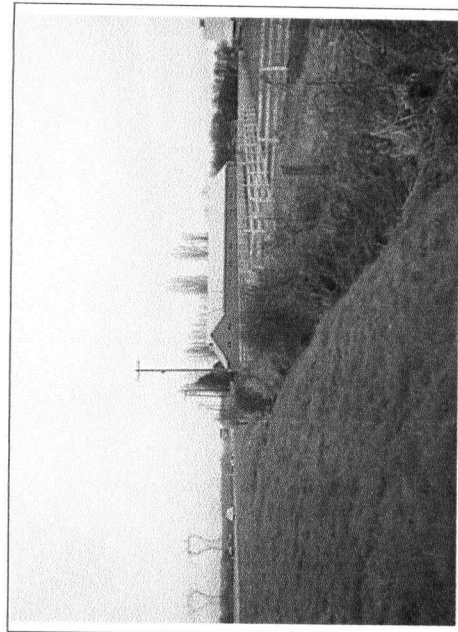
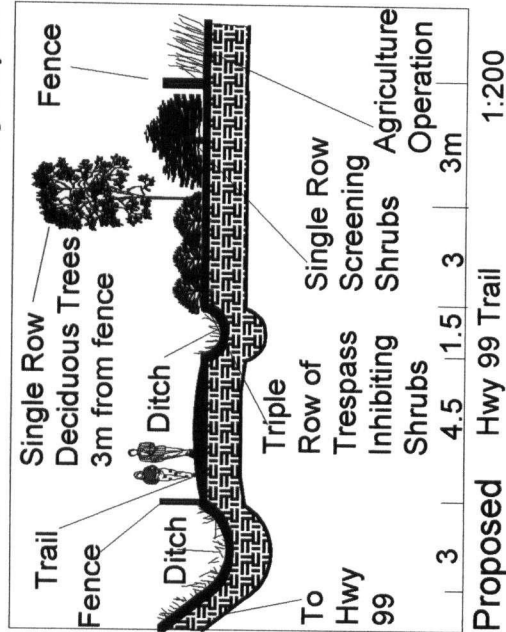


Figure 159 Proposed Hwy 99 Right of Way

Proposed trail along Highway 99. The trail has two options, to either follow the Highway 99 right of way or to follow inside the BCALC land boundary. This picture shows the option inside the BCALC land. If the trail were to be on the highway right of way then the trail would be buffered by more than just a ditch. (See Ministry of Highways for current trail specifications).



Existing Site of Proposed Trail along Hwy 99



Reference Number 18

Title Proposed Hwy 99 Right of Way

Project: Mud Bay Greenway Wildlife Alternative - Stage 1

8359 Date: 04 15 2002

Drawn: AFK

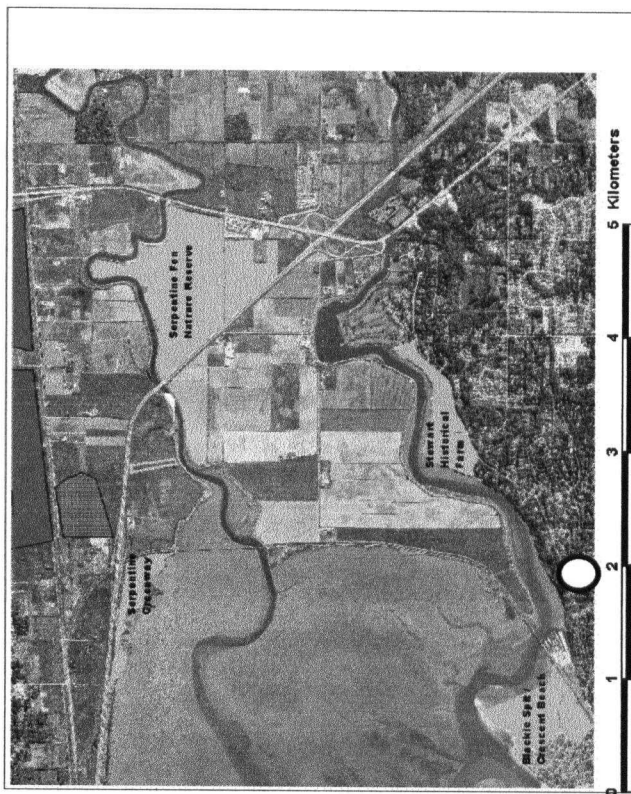
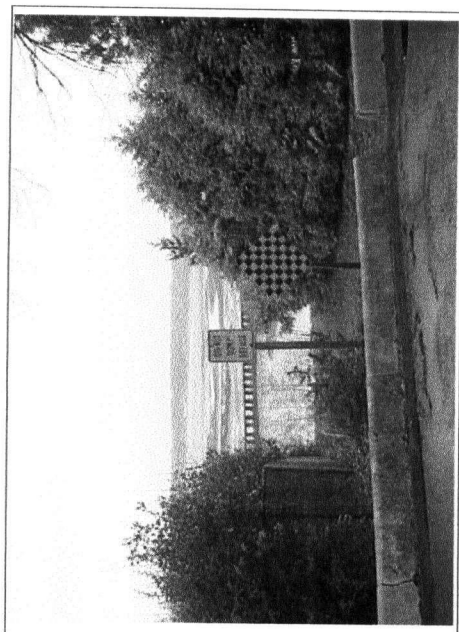
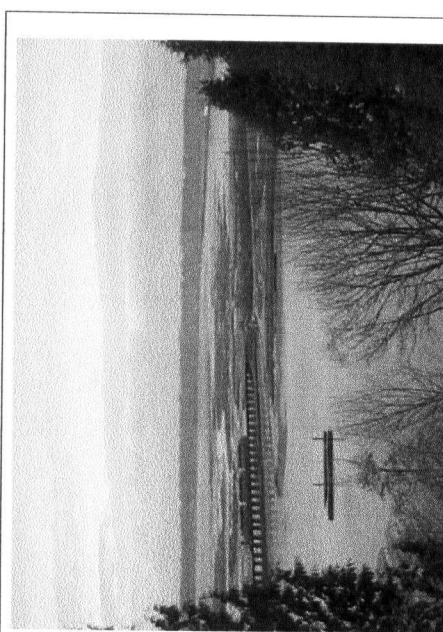


Figure 160 Proposed Beckett Road Pocket Park

Propose Creating a pocket park at 128th Street & Beckett Road with possible future connections to Crescent Beach Marina. Currently, the site offers northern views to the entire Mud Bay site. Design Rational: Site offers vast views of the Mud Bay area and the site should be secured for future public enjoyment.



Existing 128th Street & Beckett Rd View Spot



## Proposed Beckett Pocket Park Viewing Deck

Reference Number 19

**Title** Proposed Beckett Road Pocket Park

Project: Mud Bay Greenway Wildlife Alternative - Stage 1 Drawn: AFK

8367 Date: 04 15 2002

Drawn: AFK

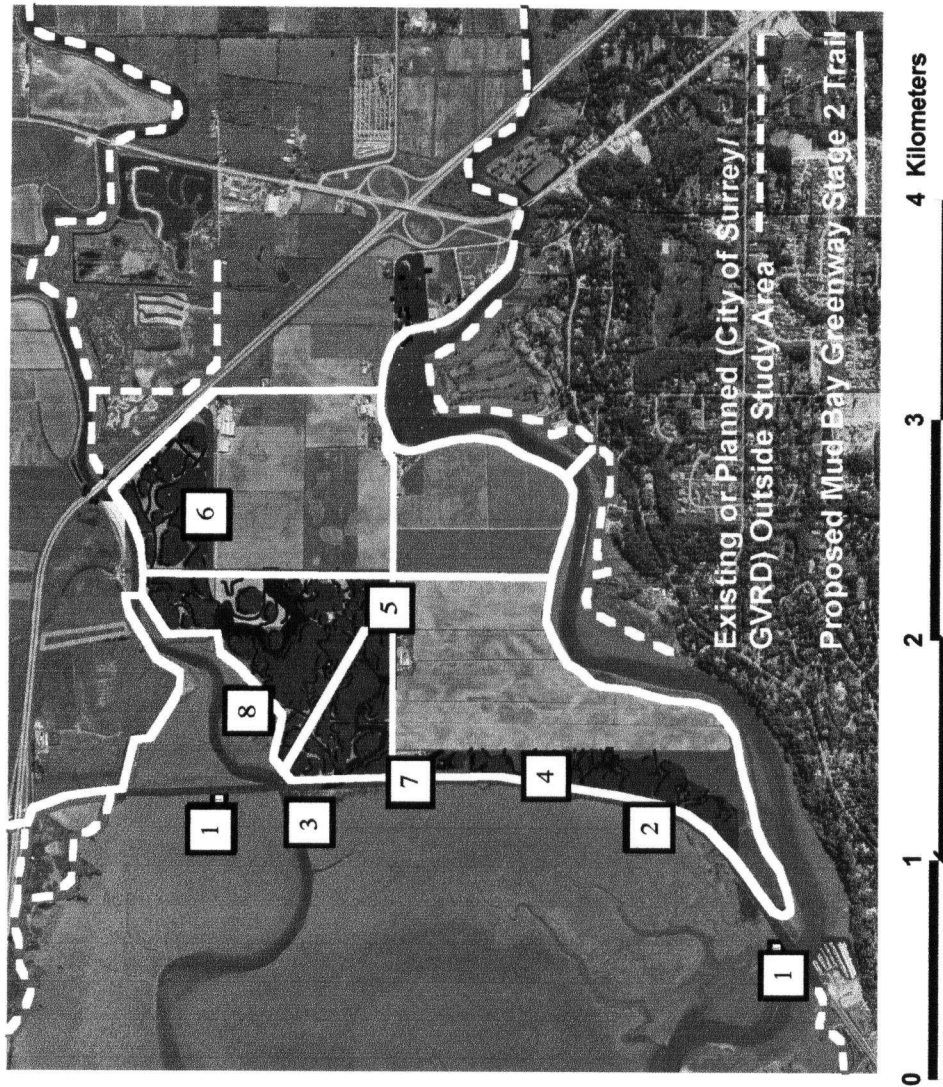


Figure 161 Proposed Stage 2

Reference Number	1	Date:	04 15 2002
Title	Proposed Stage 2	Drawn:	AFK
Project:	Mud Bay Greenway Wildlife Alternative - Stage 2		



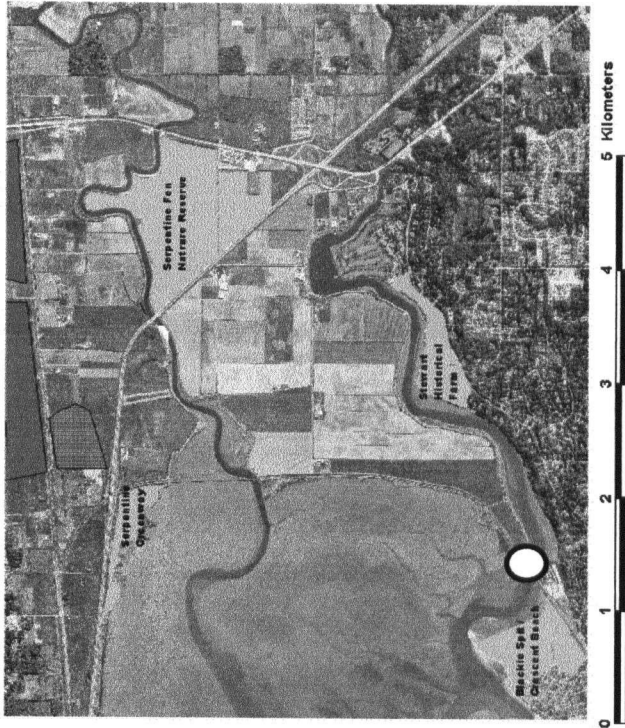


Figure 162 Proposed Nicomekl Railway Bridge Improvements

To incorporate the BNSF Railway bridges into the greenway system when the BNSF Railway relocates its tracks to another location. Design Rational: To incorporate the existing Nicomekl Railway bridge into the greenway framework in stage 3. Modify wooden swing bridge with steel hand railing and roped-off sides. Have a gate at either end to close bridge when not in use. Have bridge operator continue to operate the swing bridge during trail hours.

Reference Number 1

Title Proposed Nicomekl Railway Bridge Improvements

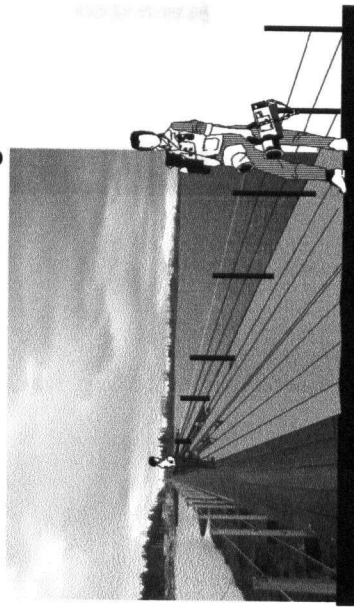
Project: Mud Bay Greenway Wildlife Alternative - Stage 2

7958 Date: 04 15 2002

Drawn: AFK



Nicomekl Rail Bridge



Wooden Deck  
Metal hand railing

Nicomekl Pedestrian Bridge

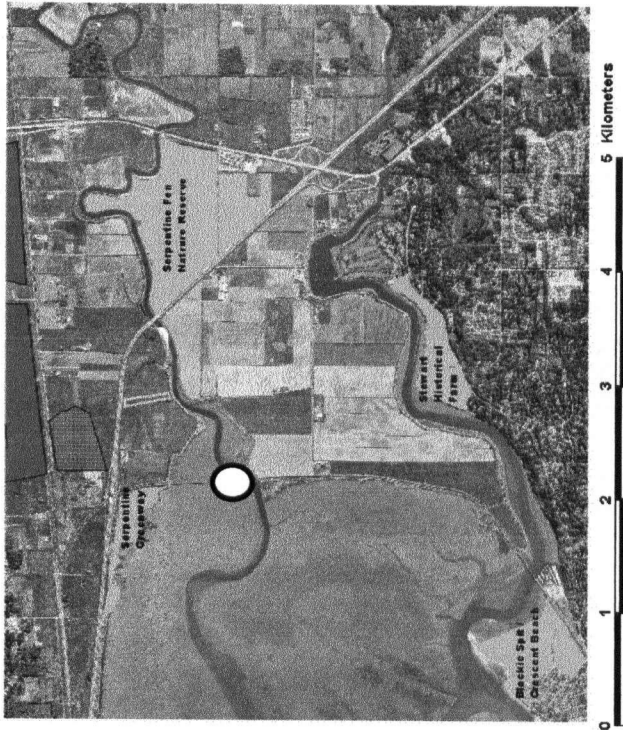
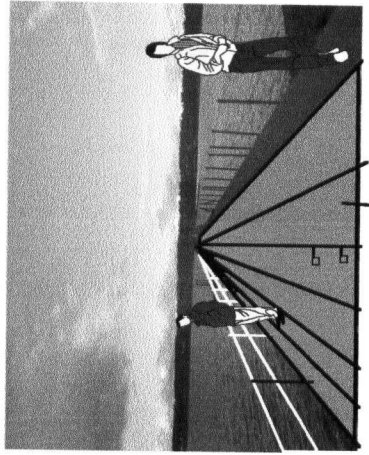


Figure 163 Proposed Serpentine Railway Bridge Improvements 2

To incorporate the BNSF Railway bridges into the greenway system when the BNSF Railway relocates its tracks to another location. Design Rational: To incorporate the existing Serpentine Railway bridge into the greenway framework in stage 3. Modify wooden bridge with steel hand railing and roped-off sides.



Serpentine Bridge



Metal Hand Railings

Wooden Deck

Pedestrian Serpentine Bridge

Reference Number 1

Title Proposed Serpentine Railway Bridge Improvements

7895 Date: 04 15 2002

Project: Mud Bay Greenway Wildlife Alternative - Stage 2 Drawn: AFK

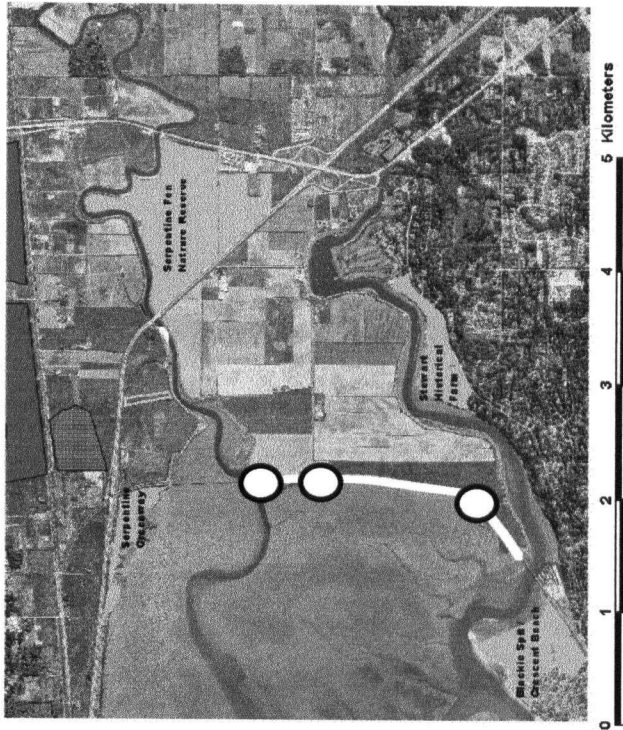
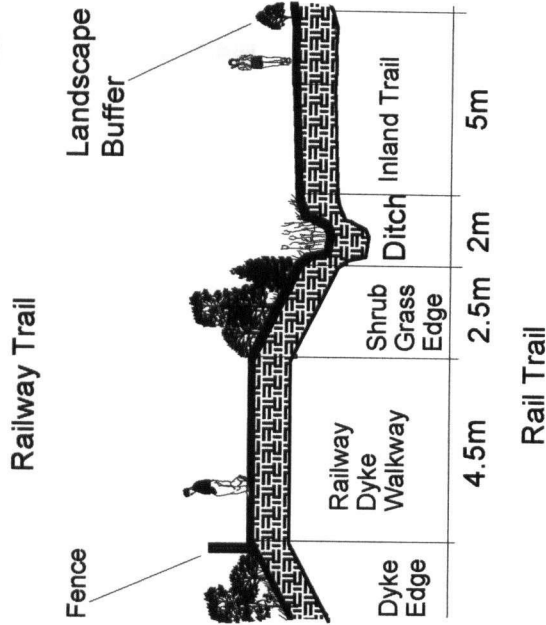


Figure 164 Proposed Rail Right of Way

Incorporate the railway dyke into the greenway trail system. Acquire the BNSF Rail right of way. Connect the railway dyke trail to the lower river dykes by a path with a max 8% grade at the Nicomekl River, Serpentine River, and 40th Ave. Connect the viewing towers at the Serpentine and Nicomekl Rivers to the upper railway dyke trail through a built structure. Create several viewing platforms on the upper railway dyke.



Reference Number 2

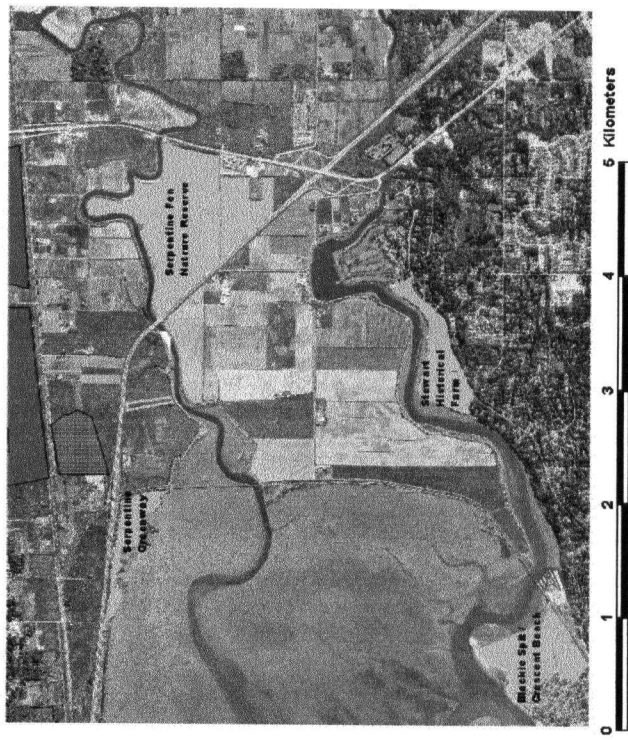
Title Proposed Rail Right of Way Trail

7959 Date: 04 15 2002

Project: Mud Bay Greenway Wildlife Alternative - Stage 2 Drawn: AFK

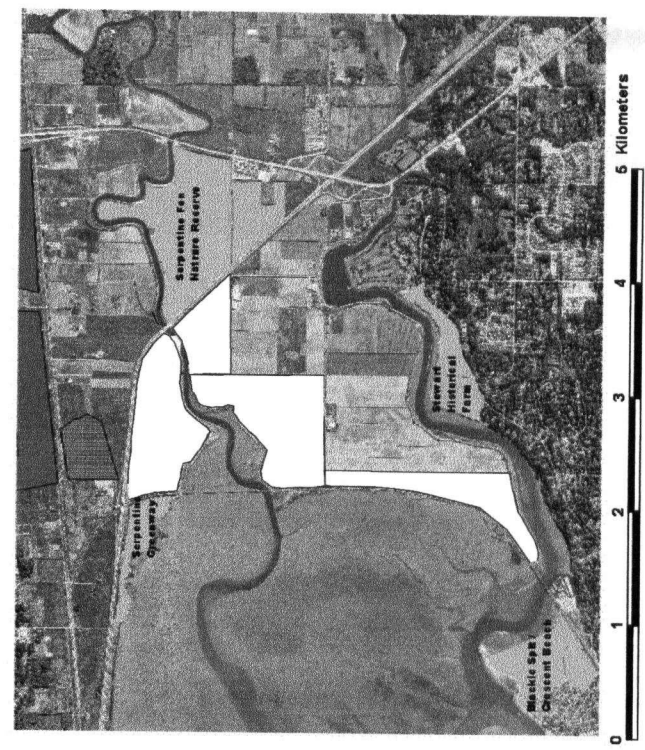






**Existing**

Map of existing Farmlands in Mud Bay.



**Proposed Areas in White**

Acquire BCALC Lands for wetlands and conservation.

- 13476-40th Ave 13503-40th Ave
- 13979-40th Ave 13996 -40th Ave
- 14015-40th Ave 13168-48th Ave
- 4440-136th Street 4453-136th Street

Off Site: Acquire BCALC Lands north of Serpentine River and south of 99 Hwy.

Reference Number 4

Title Acquire BCALC Lands for Wetlands and Conservation

Date: 04 15 2002

Project: Mud Bay Greenway Wildlife Alternative - Stage 2 Drawn: AFK

Figure 166 Acquire BCALC Lands for Wetlands and Conservation

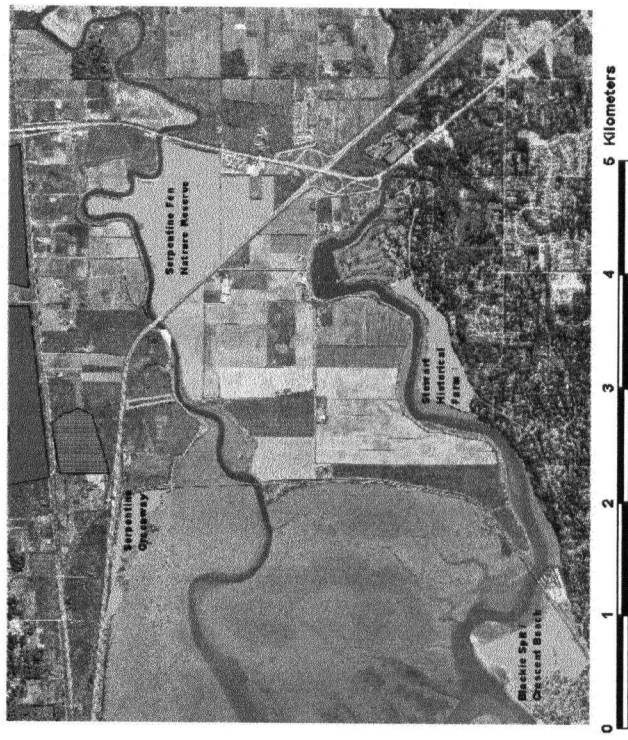
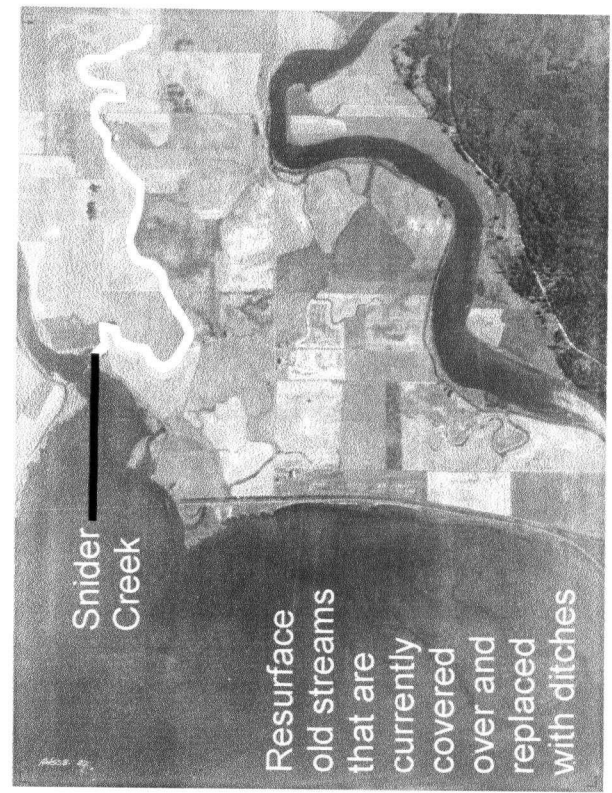


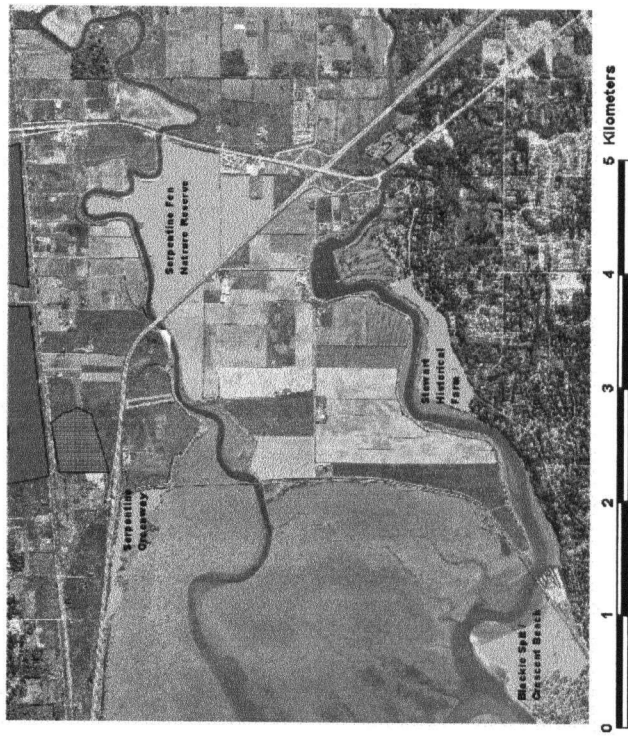
Figure 167 Old Streams Uncovered



1949 Air Photo of Mud Bay

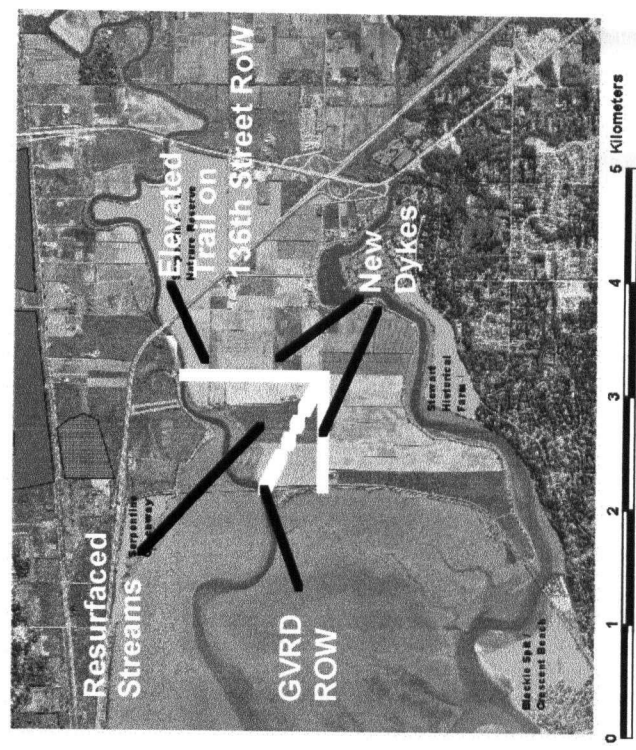
Note in the 1999 photo there are no small streams as in the 1949 Air Photo (such as Snider Creek). Proposed Mud Bay Greenway Design explores restoring the streams with the surface streams reappearing once more.

Reference Number 4  
 Title Old Streams Uncovered  
 Project: Mud Bay Greenway Wildlife Alternative - Stage 2  
 Date: 04 15 2002  
 Drawn: AFK



### Existing

Map of existing Farmlands in Mud Bay.



### Proposed Areas in White

Build dykes along 40th Ave to 136th Street right of way. Resurface old streams on lot #13503 40th Ave and Lot #4453 40th Ave. Connect resurfaced streams to Serpentine River. Establish and elevated trail on the GVRD South Surrey Interceptor Pipe right of way on lot # 13503 40th Ave.

Figure 168 Building Dykes on BCALC Lands

Reference Number 5

Title Building Dykes on BCALC Lands

Project: Mud Bay Greenway Wildlife Alternative - Stage 2

Date: 04 15 2002

Drawn: AFK



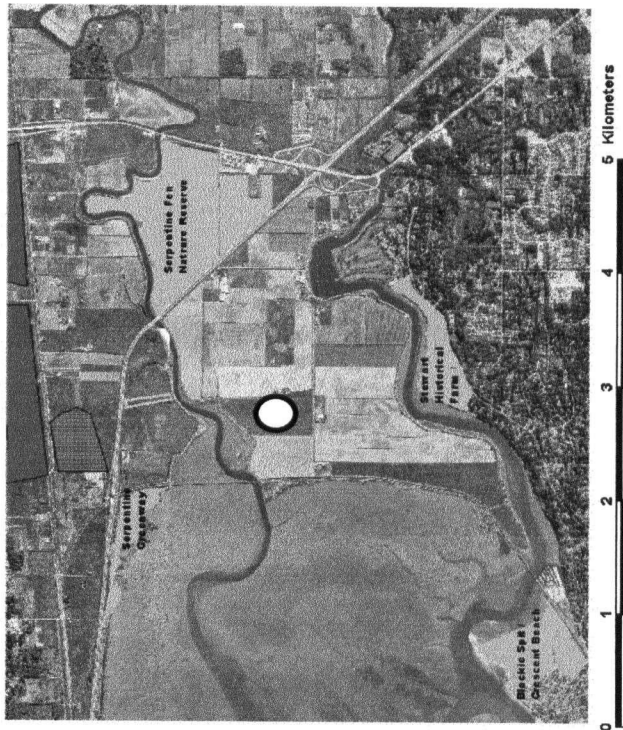
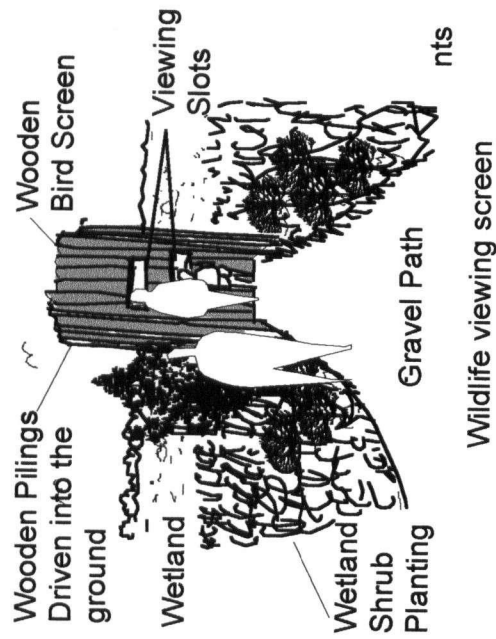


Figure 169 Proposed Wetlands

Image of proposed wetlands.  
Many of the wetlands will not be accessible to the public. They will be exclusively for wildlife habitat. See Access near Aquatic Areas: A guide to Sensitive Planning, Design and Management (The Stewardship Series), and consult with Wildlife Conservationists, and Naturalist groups or other people trained in proper wildlife design at this stage.



Proposed Image of Wetlands

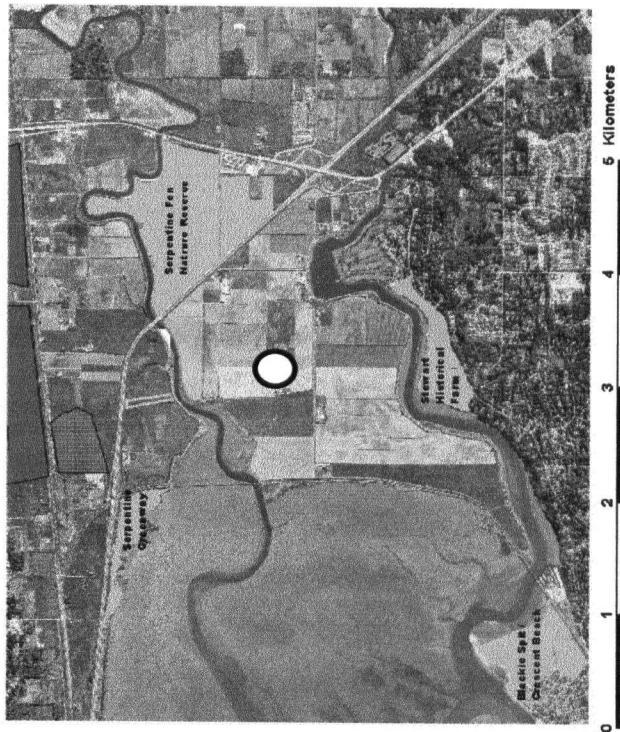


Reference Number 5

Title Proposed Wetlands

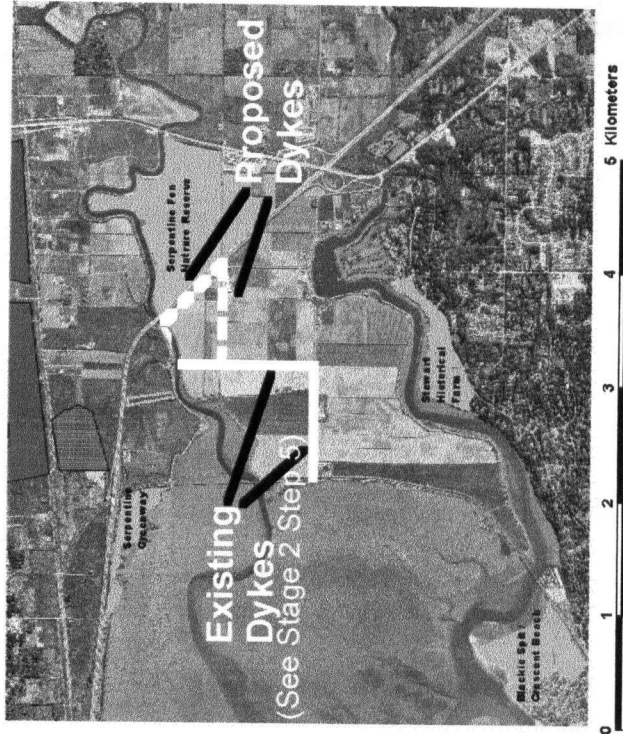
Project: Mud Bay Greenway Wildlife Alternative - Stage 2 Date: 04 15 2002 Drawn: AFK

Figure 170 Proposed 44th Ave Dykes



### Existing

Map of existing Farmlands in Mud Bay.



### Proposed Areas in White

Build dykes along lot # 4440 136th Street property boundary (44th Ave Right of Way and 99 Hwy). Connect resurfaced streams to Serpentine River.

Reference Number 6

Title Proposed 44th Ave Dykes

Project: Mud Bay Greenway Wildlife Alternative - Stage 2 Date: 04 15 2002 Drawn: AFK

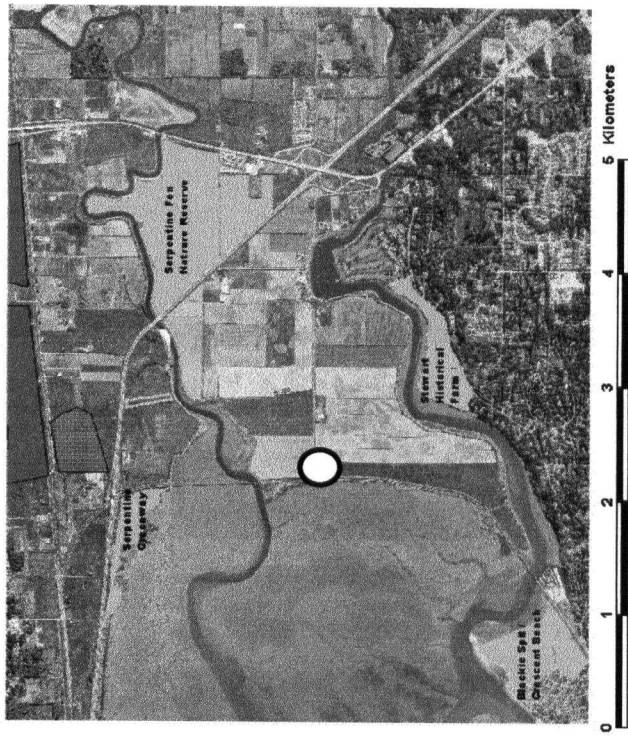
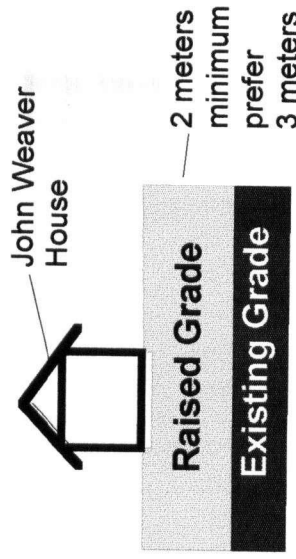


Figure 171 Proposed Weaver Historical Bed & Breakfast

Build dyke around John Weaver heritage house. It becomes a walk-in walk-out Bed & Breakfast in the middle of the wetlands. Prior to building the dyke around Weaver house, purchase several parcels of public and private land holdings for wetlands. Design Rational: To incorporate and preserve the historical Weaver house into the wetland design with practical and marketable uses.



Weaver House



Raise Foundation by 2m

Reference Number 7

Title Proposed Weaver Historical Bed & Breakfast

7885 Date: 04 15 2002

Project: Mud Bay Greenway Wildlife Alternative - Stage 2 Drawn: AFK

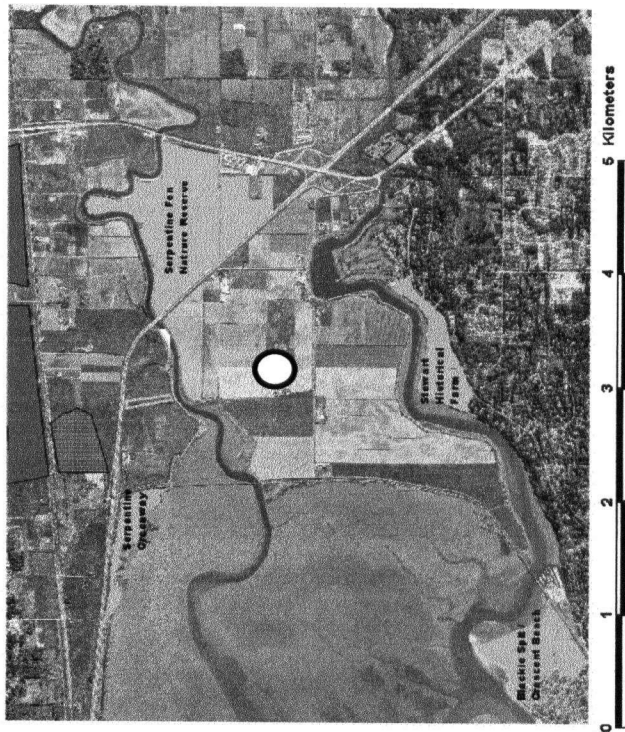
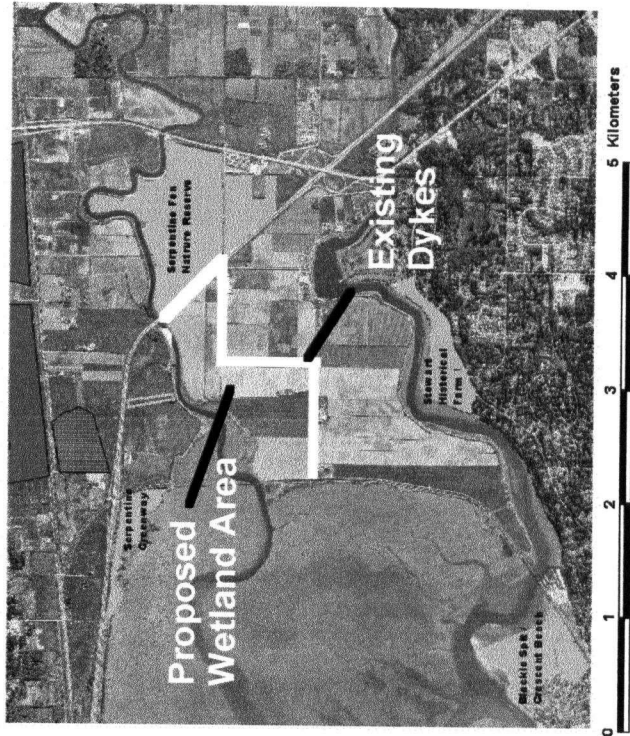


Figure 172 Proposed 16th Street Marsh

### Existing

Map of existing Farmlands in Mud Bay.



### Proposed Areas in White

Break open 2nd dyke sections south of the Serpentine river and between the GVRD pipes and the 136th Street right of way. Construct a saltwater marsh and build trail bridges where necessary.

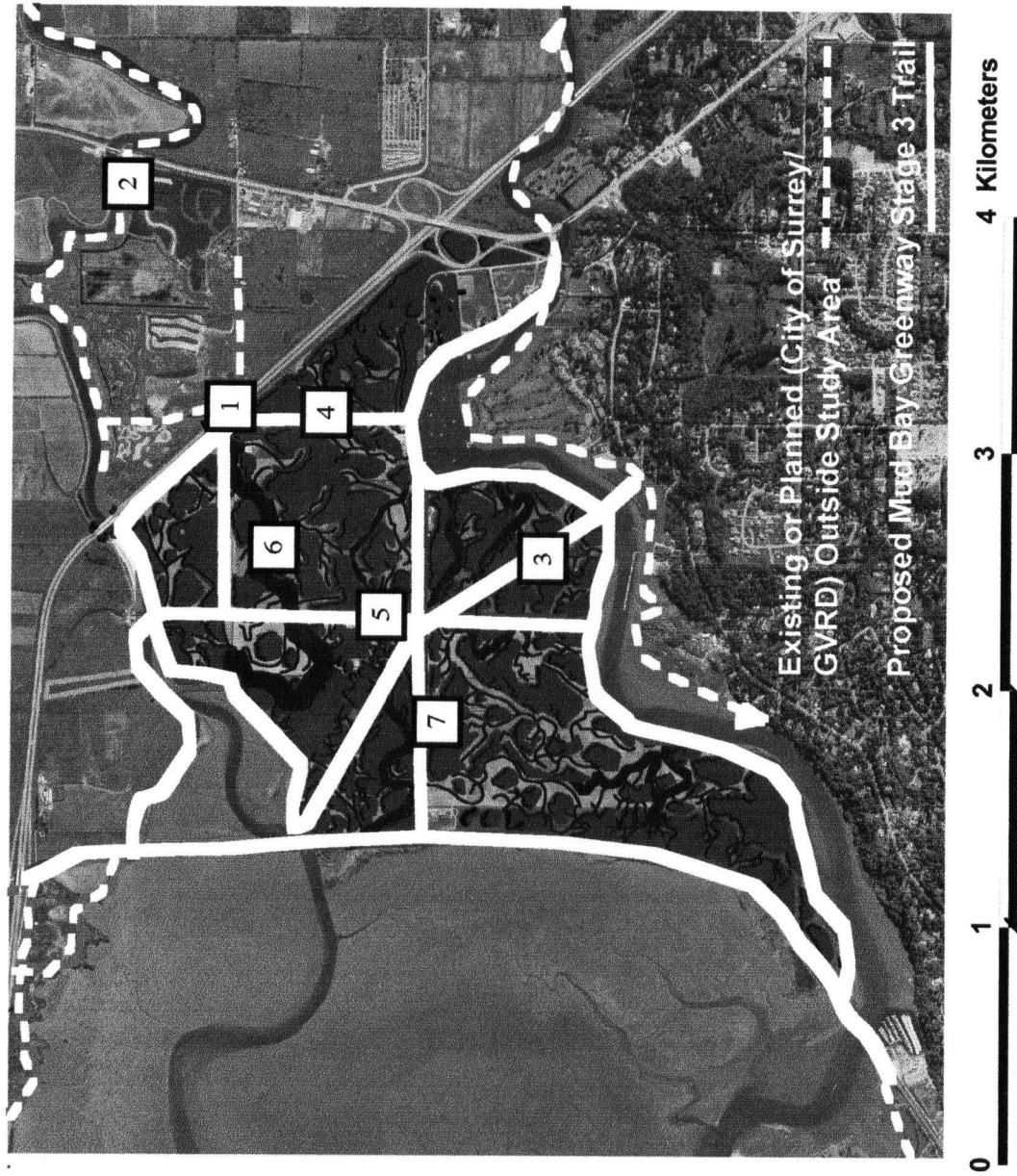
Reference Number 8

Title Proposed 16th Street Marsh

Project: Mud Bay Greenway Wildlife Alternative - Stage 2 Date: 04 15 2002 Drawn: AFK

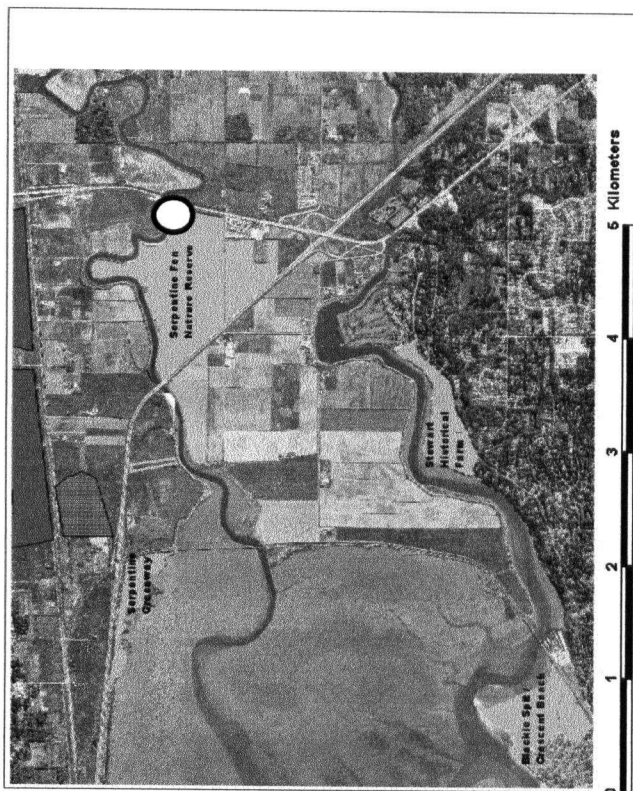


Figure 173 Mud Bay Greenway Stage 3



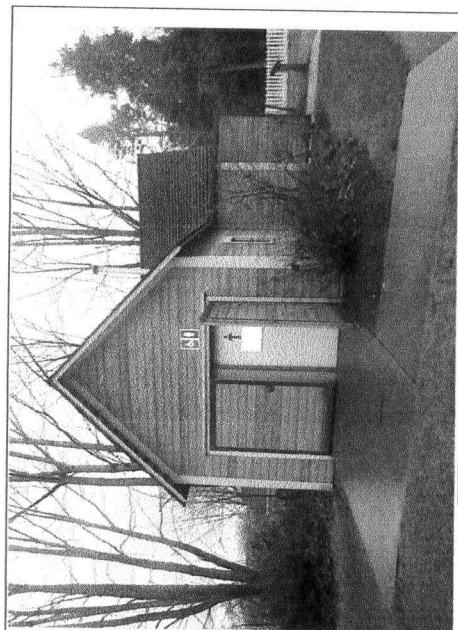
Reference Number 1  
 Title Mud Bay Greenway Stage 3  
 Project: Mud Bay Greenway Wildlife Alternative - Stage 3  
 Date: 04 15 2002  
 Drawn: AFK





**Figure 175 Serpentine Fen Site Improvements**

Improve staging area at the Serpentine Fen Nature Reserve at King George Highway. Design Rational: With the improved access from the Highway 99 pedestrian overpass from the Serpentine Fen to the Mud Bay area, there will be more visitors in the area. Thus, the staging area will have to be improved. Allow for more parking on 44th Ave in Surrey, with improved directional signs at the King George Highway staging area. Include a picnic site, drinking water, a public pay phone, and washrooms.



## Proposed Staging Area Improvements



## Proposed Staging Area Improvements

Reference Number 2

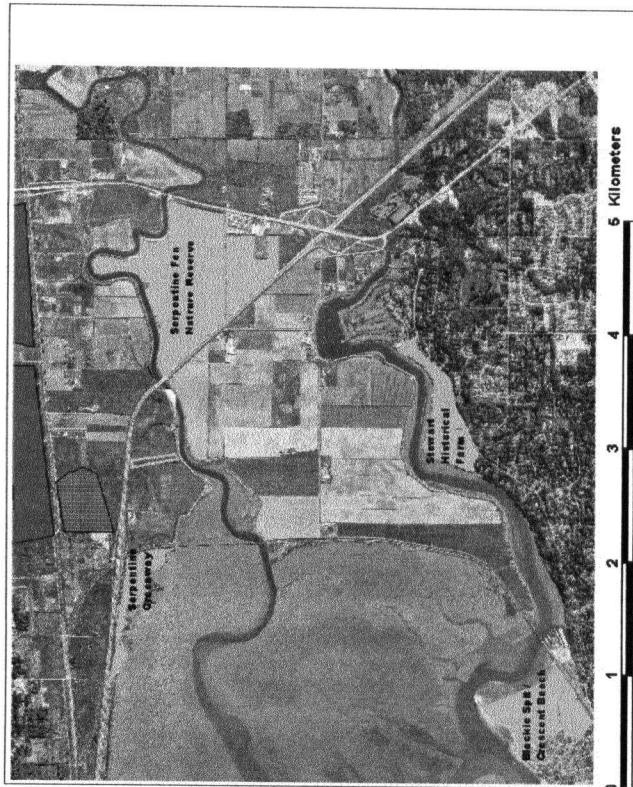
## Title

Project: Mud Bay Greenway Wildlife Alternative - Stage 3

Date: 04 15 2002

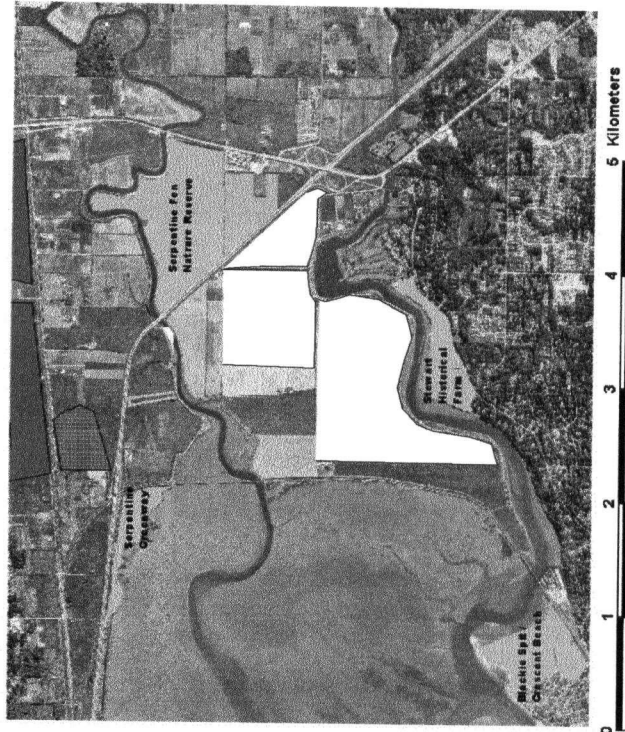
Drawn: AFK





### Existing

Map of existing Farmlands in Mud Bay.



### Proposed Areas in White

Acquire at fair market value the remaining lots for conservation and wetlands.

13978 - 140th Street	13992 140th Street	13975 140th Street
13941 40th Ave	13845 40th Ave	13846 40th Ave
13476 40th Ave	13286 40th Ave	

See Stewardship Series Community Greenways: Linking Communities to Country, and People to Nature (Prov of BC) for a more detailed discussion on property acquisition.

Reference Number 3

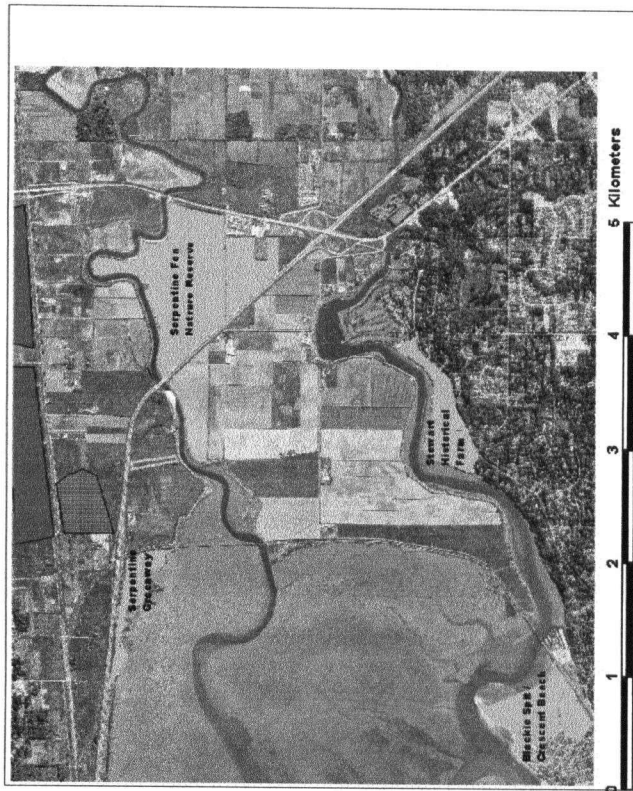
Title Land Acquisitions

Project: Mud Bay Greenway Wildlife Alternative - Stage 3

Date: 04 15 2002

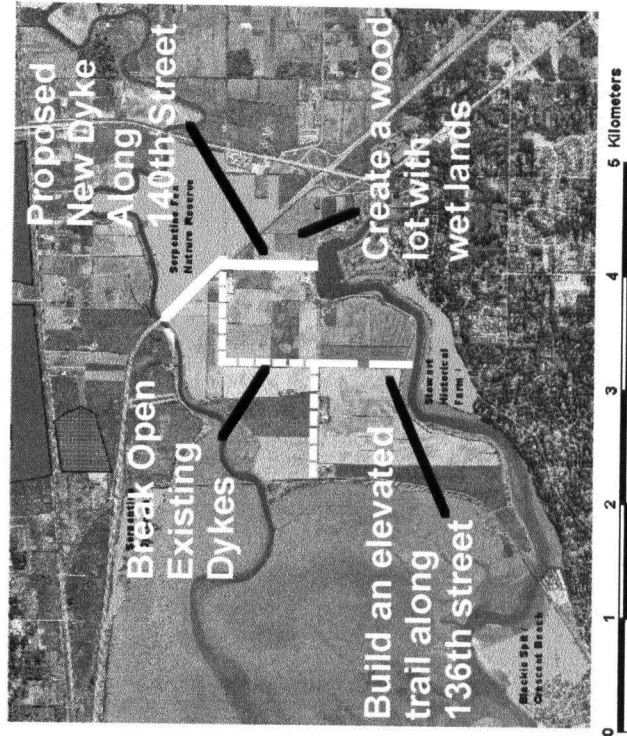
Drawn: AFK

Figure 176 Land Acquisitions



## Existing

Map of existing Farmlands in Mud Bay.



## Proposed Areas in White

- Build a dyke along 140th Street.
- Create a woodlot with resurfaced streams on lot #4370 -140th Street, 4306 -140th Street, 14159 - 140th Street and 14269 40th Ave.
- Break Open Dykes along 40th Ave, and 136th Street right of way to allow water to move between the dykes. Build Bridges for the trails.

Reference Number 4 , 5 , and 6

Title Proposed 140th Street Dyke

Project: Mud Bay Greenway Wildlife Alternative - Stage 3 Date: 04 15 2002 Drawn: AFK

Figure 177 Proposed 140th Street Dyke

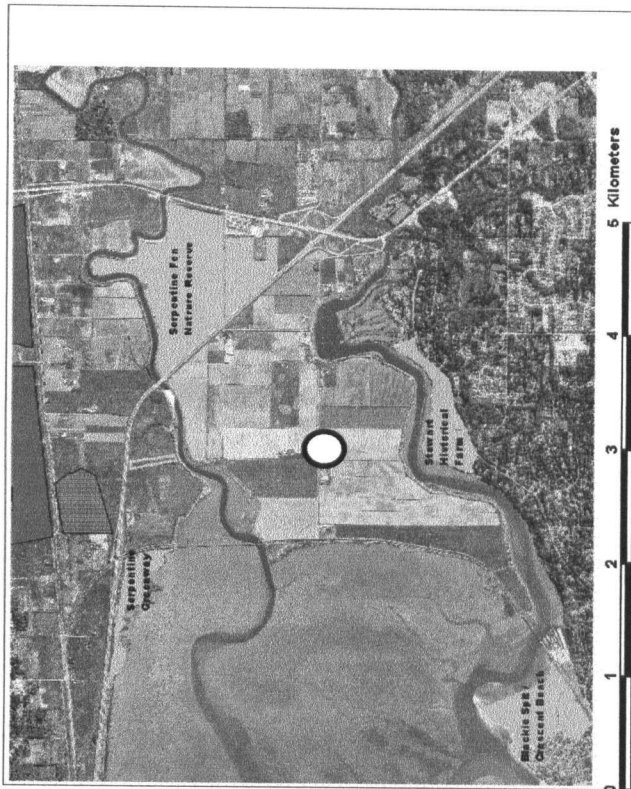
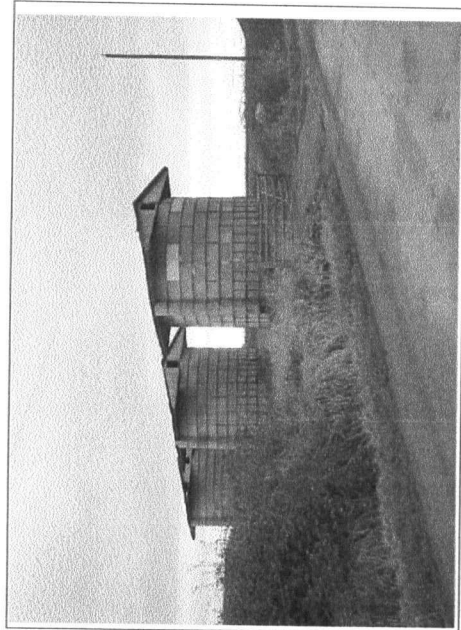
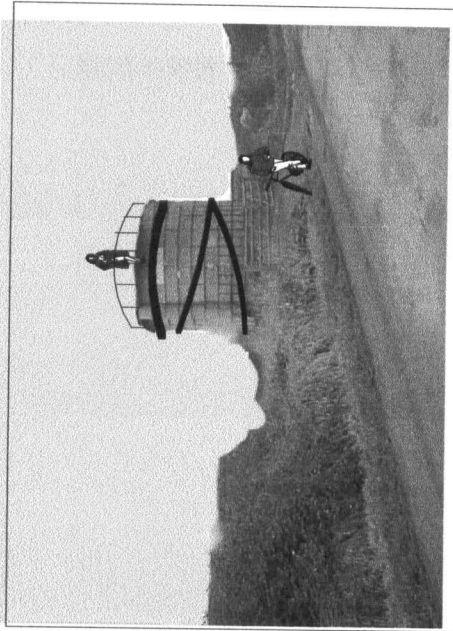


Figure 178 Viewing Tower

Incorporate some of the former farm structures for the raptors and other various Birds.



Existing Grain Towers



Proposed Viewing Towers

Reference Number 7

Title Viewing Tower

Project: Mud Bay Greenway Wildlife Alternative - Stage 3

8442 Date: 04 15 2002

Drawn: AFK

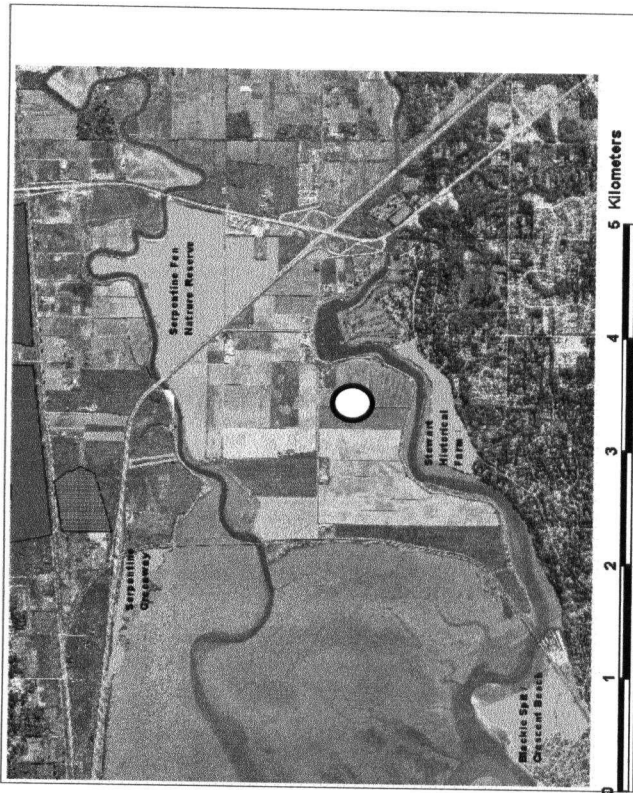
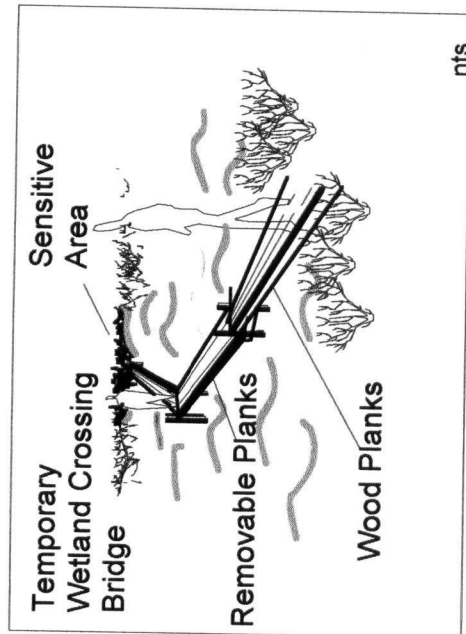


Figure 179 Proposed Site Elements

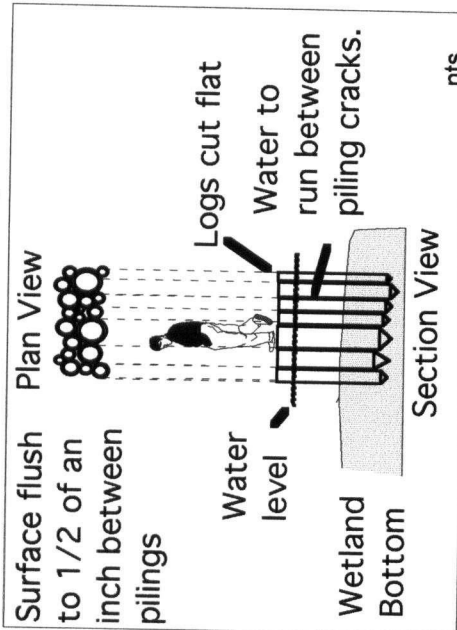
Proposed structures can be made from the building materials found in the old houses and barns on site.

#### Sensitive Trail Crossing Detail

The crossing is designed so that boards can be removed when access is not permitted during environmentally sensitive times. When an area is no longer needs to be protected, remove the boards to stop access.



#### Proposed Seasonal Crossing



#### Proposed Wetland Pile Bridge

Reference Number 7

Title Proposed Site Elements

Project: Mud Bay Greenway Wildlife Alternative - Stage 3 Date: 04 15 2002 Drawn: AFK

## Chapter 8 Summary & Recommendations

### 8.1 Wildlife Alternative Positive and Negative Points:

- The object is to summarize the positive and negative points of the Wildlife Alternative.
  - The wildlife alternative favored the area's wildlife importance and restores the area to its former ecological functions. In this design, Mud Bay's uniqueness and intertidal zones are preserved and enhanced by the creation of wetlands over the existing farm fields. It allows public access in the non-habitat sensitive areas.
- Positive Points**
- Preserves and enhances Mud Bay's environmental uniqueness, intertidal zones, and biological productiveness.
  - Allows for public access.
    - Provides for recreation activities that will have minimum impact on environmental processes and agricultural activities.
    - Allows for green linkages.
    - Restores the land to its prior form and rich ecological significance.
      - "The landscape of the river estuaries the ground between and the seashore of Mud bay are entirely artificial. Human hands have shaped it all, or machines since the first white explorers went up the Nicomekl River in 1824".<sup>178</sup>
      - Helps restore the extensive natural salt marshes from farmland that was created when the dykes were built. "Seventy percent of the original freshwater marshes and 90 percent of the saltwater and brackish marshes have been lost over the last 100 years" in the lower mainland.<sup>179</sup>
  - Recognizes the seasonal cycles, ecological systems; Canada Geese, Tidal Islands, Sandhill Cranes, and Beavers
  - Enhances the area's ecological importance that many biologists & natural history groups have stressed.<sup>180</sup>
  - Helps preserve the Eel grass beds off of Mud Bay by curbing future development.
  - Provides a greater opportunity to view a large variety of wildlife in a natural setting: birds, mammals, invertebrates, etc.
  - Helps the area reach its diverse species potentially increasing the number of species in the marsh..<sup>181</sup>
  - Helps preserves the Pacific Flyway. Millions of Birds pass through the Lower Mainland on their migratory routes between Siberia, Alaska, and northern

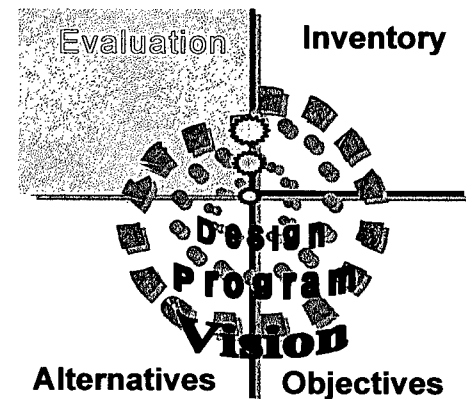


Figure 180 Design Evaluation

<sup>178</sup> The Institute of Environmental Studies. 8.

<sup>179</sup> Vancouver Natural Historical Society. 11.

<sup>180</sup> The Institute of Environmental Studies 33.

<sup>181</sup> Vancouver Natural Historical Society. 93.



Canada, as well as California, Central America, and South America.<sup>182</sup> . "Up to 60 percent of the world population of Barrow's Goldeneyes winters in the Vancouver Area."

- Helps enhance the wintering species such as Raptors. The region is an important area for wintering raptors
- Allows public access to once restricted areas.
- Helps prevent commercial intrusion (large greenhouse complexes), golf courses, large private dwellings that have been built in other areas of Boundary Bay on "rough field terrain that comprised some of the best raptor foraging areas."
- **Negative Points**
  - Major costs, local opposition, threats to landowners and local agricultural lifestyle.
  - Removal of the traditional soil based crops that help feed the wintering waterfowl population. May have some negative effects on the migrating bird population.<sup>183</sup>
  - Changes the area's landscape character from farmland to wetland.
  - Possible reductions in the wintering water fowl population when the farmlands adjacent to foreshore use is changed".<sup>184</sup>
  - Possible negative disturbance to the Mud Bay waterfowl population if the area is not controlled for unauthorized access.
  - Does not recognize the agricultural importance, such as dairy production to the greater surrounding area. The site is an agriculturally productive area and that preservation of such areas is important in an increasingly urbanized region.
  - Does not help sustain the area's long-term economic sustainability through agriculture (instead it attempts to replace it with tourism).
  - Does not create recreation activities outside the study area as the Status Quo alternative proposed
  - The wildlife alternative favored options that was best suited to wildlife. It did not adequately balance its design with a possible compromise that may be best balancing a mix of wetland restoration and continued farming to sustain waterfowl and the local economy.

---

<sup>182</sup> Vancouver Natural Historical Society. 10.

<sup>183</sup> The Institute of Environmental Studies. 33.

<sup>184</sup> The Institute of Environmental Studies. 33.

## 8.2 Study Recommendations

The following lists of suggestions have been developed during the preparation of this study. They are directives that provide a basis for considering implementation of the Mud Bay Greenway options.

It is recommended that:

1. Further studies be done on this site. Major wildlife, social, and economic, engineering feasibility studies should be done.
2. That the water's edge dykes (private and rail) of the approximately 400-hectare study area included in this study becomes the long-range boundaries of the Mud Bay Regional Park. The land should be purchased at fair market value.
3. That the Greater Vancouver Regional District and the City of Surrey proceed to negotiate with the BC Assets and Lands Corporation for the purchase of approximately 150 hectares of land for the Mud Bay Regional Park.
4. That the City of Surrey limits the type agriculture on the land in the study area to traditional soil based farming.
5. That the City of Surrey rezone all land currently owned by the BCALC from Agriculture to Conservation (CNS designation in Surrey's OCP.) "Given the environmentally sensitive nature of this area, one consideration would be for some, all or parts of the properties to be re-designated from Agriculture to Conservation (CNS designation in Surrey's OCP.) According to the OCP (pg. 138), this designation is: "intended for major parks, open spaces and environmentally sensitive areas in their natural state, including appropriate indoor and outdoor recreation activities and facilities." The CNS designation allows for rezoning to the CD (Comprehensive Development) zone. The intent of this is to prevent rezoning to A-2 that would permit intensive agricultural activity (such as mushroom farms.). To date, the CNS designation has only been used for City Parks such as Green Timbers and Sunnyside Acres Urban Forest. It could be used on other areas including privately owned properties. By itself, CNS does not limit the zone uses permitted on properties that are located within this designation."<sup>185</sup>
6. That the City of Surrey considers rezoning the privately held land in Mud Bay to Agriculture Conservation (CNS designation in Surrey's OCP) after consulting with the private landowners.
7. That the GVRD negotiate for public access rights on the sewer's right of way.
8. That the City of Surrey or the GVRD begin negotiations for acquiring the BNSF railway tracks, dyke and bridges.
9. The City of Surrey to consider opening up the right of ways 32<sup>nd</sup> Ave and 135<sup>th</sup> Street to the public.
10. More research be conducted on ownership, actual property lines, and public access to the Nicomekl and Serpentine River dykes.
11. That BCAL give the City of Surrey or the GVRD the first option to acquire their landholdings in the Mud Bay Area
12. That BCAL put a covenant of the land title with in the Mud Bay area to restrict the type of activity or uses held on their property to that of traditional soil based farming.
13. That the City of Surrey, Greater Vancouver Regional District (GVRD) residents, local landowners, local interest groups, Regional (GVRD), Federal, and Provincial

---

<sup>185</sup> Mike Dickinson. City of Surrey Planning Department. Personal Communication March 2002.



government departments be continuously involved in the planning and development of the Mud Bay Park in the larger Border to Border Trail.

14. That further studies be done in the study area and along the Nicomekl River shores for First Nation Heritage sites.
15. That the City of Surrey have future housing construction along Crescent Road conduct a visual impact assessment on its potential visual affect on Mud Bay. The visual assessment should examine the number of trees cut down, housing height, etc and how it affects the Mud Bay character units and views within the Mud Bay area.
16. Further discussion be done between the various levels of government and naturalist groups on the recreation and ecological importance of the Mud Bay area and how to design for its future possibilities.
17. Finally, the greenway plan presented is by no means complete, and should not be seen as the "definitive plan" – just a starting point for future discussion. Let the discussion begin!

## **Chapter 9 Bibliography**

### **9.1 Personal Communication**

Barnard, Tony. Wildlife Biologist Land Management. British Columbia Ministry of Environment, Lands and Parks, BC Environment Lower Mainland Region. Personal Communication January 2002.

Barton, Ellen. Coast Millennium Trail Group. Personal Communication January 14<sup>th</sup>, 2002.

Berardinucci, Julia - Land Officer British Columbia Lands Assets and Land Corporation

Blue, Bonnie. Regional Planner, GVRD. Personal Communication. February 22, 2002.

BNSF Railway Bridge #69 Bridge-Operator. Personal Communication. February 6<sup>th</sup> 2002.

Buffet, Dan. Administrative Coordinator. Ducks Unlimited. Personal Communication. January 2002.

City of Surrey. Engineering Department & Parks, Recreation and Culture Department. Personal Communication. January 2002.

Cowles, Mike – BNR Seattle Office. Personal Communication. January 2002.

Dickinson, Mike. City of Surrey Planning Department. Personal Communication. March 2002.

Callander, Glen. Highways Planning Department .B.C. Ministry of Highways. Personal Communication. January 2002

Farquhar, Brian. GVRD Parks. Personal Communication. January 2002

Fisher, Brad. Transportation Engineering Technologist – Bicycle Coordinator. City of Surrey Engineering Department. Personal Communication. January – March 2002.

Grass, Jude. Administrative Support. Greater Vancouver Regional District. Burnaby. Personal Communication. January 2002.

Hasselmen, Daviet. Project Coordinator Fraser River Estuary Management Plan (FREMP) Personal Communication. January 2002.

Lamontagne, Jean. Manager, Planning, Research and Design. City of Surrey: Parks, Recreation & Culture Department. Personal Communication. January – March 2002.

McQuen, Catherine - Cycling Coordinator. B.C. Ministry of Highways. Personal Communication. January 2002.

- Marsh, William M. Department of Agricultural Sciences, University of British Columbia. Personal Communication. January – April 2002.
- Mitchell, David. DMG Landscape Architects. Personal Communication. February 2002.
- Naito, Brian. BC Ministry of Fisheries and Oceans. Personal Communication. January 14<sup>th</sup>, 2001.
- Paterson, Doug. UBC Professor. Personal Communication. March 2002.
- Riley, David & Margaret. Western Canada Wilderness Committee Surrey / White Rock Chapter Personal Communication. January 2002.
- Robertson, Andrew. Canadian Wildlife Service. Personal Communication. January 2002.
- Smith, Dave. Canadian Wildlife Service. Personal Communication. January 2002.
- Stevenson, Carrie - White Rock Museum & Archives. Personal Communication. January 2002.
- Surrey Museum and Archives. Personal Communication. Surrey, BC January 2002.
- VanKeulen, John. Donia Farms. Mud Bay, South Surrey, B.C. Personal Communication. January & April 2002.
- Walker, Liz. Western Canada Wilderness Committee Surrey / White Rock Chapter. Personal Communication. January 2002.
- Walters, Rick. City of Delta Engineering Department. Personal Communication. January 2002.
- White Rock Museum and Archives. Personal Communication. White Rock BC January 2002.

## **9.2 Wildlife: Birds**

- Aitchison, Catherine J. ed. The Birders Guide to Vancouver and the Lower Mainland. Vancouver: Whitecap Books, 2001.
- Baron, Nancy & John Acorn. Birds of Coastal British Columbia and the Pacific Northwest Coast. Vancouver: Lone Pine Publishing, 1997.
- Bovey, Robin, and Wayne Campbell. Birds of Vancouver and The Lower Mainland. Edmonton: Lone Pine Publishing, 1989.
- British Columbia Wildlife Watch website.: Boundary Bay Regional Park Bird Checklist <http://www3.bc.sympatico.ca/driftwood/bcwwhome.htm>. January 2002.

B.C. Ministry of Environment, Lands and Parks. Bird Checklist: Serpentine Wildlife Area (Pamphlet) . Surrey: BC Wildlife Watch, 1994

B.C. Ministry of Environment, Lands and Parks. General and Wildlife Viewing Information: Serpentine Wildlife Area (Pamphlet) . Surrey: BC Wildlife Watch, 1995.

Butler, R.W. and R.W. Campbell. "The Birds of the Fraser River Delta: populations, ecology and international significance". Occasional Paper No. 65. Canadian Wildlife Service, 1987.

Hancock, David A. and David Stirling. Birds of British Columbia. Surrey: Hancock House Publishers, 1989.

Mark, David M. Where to Find Birds in British Columbia. New Westminster: Kestrel Press, 1984

Poynter, Allen. ed. B.C. Ministry of Environment, Lands and Parks. Bird Checklist: Boundary Bay Regional Park. Surrey: BC Wildlife Watch, 1995.

### **9.3 Ecology**

B.C. Department of Fisheries and Oceans Web Site. [www.pac.dfo-mpo.gc.ca](http://www.pac.dfo-mpo.gc.ca) January. 2002.

B.C. Government: Bill M 202 – 1993 An Act To Establish the Boundary Bay Wildlife Management Area Schedule. [Section 1 (2)] Boundary Bay Wildlife Management Area. Province of British Columbia, 1993.

B.C. Ministry of Environment, Lands and Parks Proposed Boundary Bay Wildlife Management Area Plan. Victoria: Ministry of Environment, Lands and Parks. 1993.

B.C. Ministry of Environment, Lands and Parks. Wildlife Management Areas in British Columbia (Pamphlet). Victoria: Ministry of Environment, Lands and Parks, 2001.

Forbes, Robert D. A Floral Description of the Fraser River Estuary and Boundary and Mud Bays, Vancouver: BC Department of Recreation and Conservation, 1972.

Georgia Basin Website. [www.pyr.ec.gc.ca/GeorgiaBasin](http://www.pyr.ec.gc.ca/GeorgiaBasin) February 14th, 2002.

Guttenplan, Martin and Robert Patten, "Off-Road but On Track," TR News, May-June 1995

The Institute of Environmental Studies at Douglas College. A Proposal for the Establishment and Development of the Mud Bay Serpentine River Environmental Reserve. March, 1972

Kay, B.H. "Shell Fish Growing," Water Sanitary Survey of Boundary Bay, Mud Bay, and Crescent Beach, BC Pollution Abatement Branch Environmental Protection Service Pacific Region. November Report #EPS5-PR-76-11. 1976.

Lyons, C.P. Trees , Shrubs and Flowers to know in British Columbia. Vancouver: J.M. Dent, 1974.

National Park Service. Economic Impacts of Protecting Rivers, Trails, and Greenway Corridors. Rivers, Trails and Conservation Assistance Program, 4th ed., U.S.A. 1995

Nicomekl Enhancement Society Website. <http://www.geocities.com/nicomeklh>. February 20th, 2002.

Nowak, David J. "Air Pollution Removal by Chicago's Urban Forest," Chicago's Urban Forest Ecosystem: Results of the Chicago Urban Forest Climate Project, (U.S. Forest Service, 1994).

Ramsar Convention on Wetlands web site. [http://www.ramsar.org/wwd2002\\_index.htm](http://www.ramsar.org/wwd2002_index.htm) Feb 10, 2002.

#### **9.4 History**

Brown, Jack. Surrey's History Web Site <http://members.shaw.ca/j.a.brown/Surrey.html> January 2002.

British Columbia Folklore Society Web Site. Examples of British Columbia Folklore: Cultus Lake. <http://www.folklore.bc.ca/Cultuslake.htm> January 2002.

Dasilva, David. "Trail Saw its Days of Glory". Peace Arch News. September 9<sup>th</sup>, 1992.

Children of Fort Langley web Site. Fort Langley.. <http://members.tripod.com/~LisaPeppan/FtLangleyChildren.html> January 15th, 2002.

Guzzi, Brian. Crescent Road Corridor: The Corporation of the District of Surrey.

Hardy, Kathleen. "Hardscrabble Farming," Looking Back at Surrey. vol. 1.

Jane, Cecil. Translated from the Spanish. A Spanish Voyage to Vancouver And the Northwest Coast of America. London: The Argonaut Press, 1930.

McKinnon, Frank. "Clearing the Land," Looking Back at Surrey. vol. 1.

McKinnon, Stan "Grave Boxes in the Trees" Looking Back at Surrey, vol 1.

Paterson, Douglas, and Lisa Colby. Heritage Landscapes in British Columbia: A Guide to Their Identification, Documentation, and Preservation. Vancouver: University of British Columbia, 1989

Percy, Richard C.W. Salvage Archaeology at Crescent Beach BC. Burnaby: Simon Fraser University, Department of Archaeology, 1973.

Sanford, O.M. "The Ocean Park Story," Looking Back at Surrey, vol. 1. approx 1912

Surrey Historical Society. Looking Back at Surrey, vol. 1. Surrey: Surrey Historical Society, 1995.

Surrey, City of. (B.C.) City of Surrey Archives: Exhibits Services 2001 (Pamphlet). Surrey: Surrey Parks and Recreation, 2001.

Surrey, City of. (B.C.) Surrey's Stores: Telling the Stories of Surrey's Past, Present, and Future. Surrey: Surrey Parks, Recreation, and Culture Department, Winter/Spring 2002.

Surrey Museum and Archives. Nicomekl one of Surrey's earliest 'highways' November 14, 1998.

Treleaven, G. Fern. Rivers, Roads and Railways: 100 years of Transportation in Surrey. Surrey: Surrey Museum & Historical Society, 1981.

Whiteside, Richard V. The Surrey Pioneers. Vancouver: Evergreen Press Ltd, 1974.

Zytaruk, Tom. Millennium Milestones: A history of Surrey, White Rock and North Delta. Surrey: Thunderbird Press, 2000.

## **9.5 Maps**

Canadian Hydrographic Services. Canada British Columbia East Point to Sand Heads Map. Wise 1. Lat 48deg 54'00".47 N Long 123deg26'37".20 W. Natural Scale 1:80,000. Map # 3450. Mar 7, 1969.

Greater Vancouver Regional District. Boundary Bay Development Study Map. Municipalities of Delta, Surrey, White Rock. Greater Vancouver Regional District. Scale 1:25,000.

Greater Vancouver Regional District. Schedule D. Official Regional Plan. Bylaw No 377. Biologically Important Natural Assets Map. Scale 1:50,000 October 8<sup>th</sup>, 1980.

Hill, Albert. "Maps as Advertising," Looking Back at Surrey. vol.1.

Luttmerding, H. A. Soils of the Langley-Vancouver Map Area. Rab Bulletin 18. Report No 15. British Columbia Soil Survey. Volume 1. Soil Map

Mosaics and Legend, Lower Fraser Valley (Scale 1:25 000). H.A.

Luttmerding, P. Ag. Province of British Columbia. Ministry of Environment. Kelowna 1980.

Surrey, City of. (B.C.) Get out and Grow Facilities (Map). Surrey: Parks Department, 2001.

Surrey, City of. (B.C.) Surrey Pathway & Bikeway Map. (Pamphlet).

Surrey, Corporation of the District of. (B.C.) Surrey Industrial Areas: Planning Division . Map No C60-804. August 1971.

Surveyor and Chief, Hydrographic Service. Ottawa 1938. Experimental Farms Branch. Ottawa. Soil Map of the Lower Fraser Valley. Western Sheet. Scale 1 inch to 1 mile.

### **9.6 Trails, Experiences, & Facilities**

Alexander, Christopher, S. Ishikawa and M. Silverstein. A Pattern Language: Towns, Buildings, Construction. New York: Oxford University Press, . 1977.

BC Agricultural Land Commission. Landscaped Buffer Specifications. 1998.

Christiansen, Monty L. Park Planning Handbook. New York: John Wiley & Sons, 1977.

Douglas, Robert W. Forest Recreation Fourth ed. Illinois: Waveland Press, 1993.

Fogg, George E. Park Planning Guidelines Revised. New York: National Society for Park Resources, 1981

Greater Vancouver Regional District. Canine Conundrum in GVRD Parks: Research, Issues, Possible Solutions Symposium Guide. GVRD Regional Parks Department. May 13th, 2001.

Greater Vancouver Regional District. Canine Conundrum in GVRD Parks: Research Results on Dogs In Individual Parks. May 13<sup>th</sup>, 2000.

Greater Vancouver Regional District. Greater Vancouver Regional Greenway Vision: An Environmental and Recreational Greenway Network and Assessment of the Potential Contribution of Existing and Future GVRD Rights-of -Way. GVRD Policy and Planning Department. July 1999.

Greater Vancouver Regional District. Managing Outdoor Recreation In Greater Vancouver's Farming Areas (Final Report): Recreation Adjacent to Agricultural Lands. GVRD Strategic Planning Department and GVRD Parks Department. April 1996.

Greater Vancouver Regional District. The North Shore Sector Recreational Greenway Plan: Part of the Regional Recreational Greenway Plan. August 2000

Hammitt, William E., and David N. Cole. Wildland Recreation: Ecology and Management. New York: John Wiley & Sons, 1987.



- Harris, Charles W. and Nicholas Dines. Time-Saver Standards for Landscape Architecture. 2<sup>nd</sup> Edition. New York: McGraw-Hill Publishing Company, 1998.
- Jackson, Ann W. and Al Grass. Dogs and Wildlife (Pamphlet). Vancouver: Minerva House Publishing, 1998.
- Kaplan, Rachel, Stephen Kaplan, and Robert L. Ryan. With People in Mind: Design and Management of Everyday Nature. New York: Doubleday, 1998.
- Keller, Betty. Norman Lerman's Legends of the River People. The British Columbia Folklore Society Web Site. <http://www.folklore.bc.ca/Cultuslake.htm>
- Lerner, Steve and William Poole, The Economic Benefits of Parks and Open Space, The Trust for Public Land, (1999, 26.)
- Littlewood, Michael. Landscape Detailing Volume 4 Water. Boston: Architectural Press, 2001.
- Loring, Schwarz. Greenways: A Guide to Planning, Design and Development. McMaster Press, 1994.
- Luymes, Don. "Course Notes: Forestry 292". Wildland and Recreation Site Planning. Vancouver: University of British Columbia, 1998.
- National Park Service. The Impacts of Rail-Trails, A Study of Users and Nearby Property Owners from Three Trails, Rivers, Trails and Conservation Assistance Program, 1992.
- Ohio State Greenways. Greenway Defined. <http://www.ohiogreenways.org/greenways.htm>. Feb 20, 2002.
- Ontario Ministry of Natural Resources. Ontario Provincial Park Landscape Design Principles and Guidelines. Ontario: Parks and Recreational Areas Branch, 1980.
- Paterson, Douglas. The Power of Now: Returning a Sense of the Sacred to the Urban Public Realm. University of British Columbia, Department of Landscape Architecture.
- Project Play and Learning Adaptable Environments Inc. Universal Access to Outdoor Recreation: A Design Guide. Berkley: MIG Communications, 1996
- Rutledge, Albert J. Anatomy of a Park: The Essentials of Recreation Area Planning and Design. New York: McGraw-Hill, 1971.
- Ryan K.L. and J. Winterich. Secrets of Successful Rails-Trails: An Acquisition and Organizing Manual for Converting Rails into Trails. Rails-to-Trails Conservancy; National Park Service, Washington, D.C. 1993.

- Surrey, City of & Urban Systems. Bicycle Blueprint: Creating a Transportation Alternative. File No 6107209.1 Surrey Engineering Department: 1993.
- Surrey, City of. (B.C.) Engineering Department: Surrey Transportation Plan. Surrey: Engineering Department, December 1999.
- Surrey, City of. (B.C.) Future Directions for the Provision of Parks, Recreation, Arts, Heritage, and Cultural Facilities and Services. August 23, 2001
- Surrey, City of. (B.C.) Nature Trails of Surrey (Pamphlet). Surrey Parks, Recreation and Culture Commission. 2002.
- Surrey, City of (B.C.). Surrey Joins the Trans Canada Trail With Serpentine Greenway. Surrey: October 5<sup>th</sup>, 1999.
- Torbic, D.J. The Planning and Design of Bicycle and Pedestrian Crossing: Engineering Report. The Pennsylvania State University, University Park, 1994.
- United States Government: The Interior Bureau of Outdoor Recreation. Outdoor Recreation Space Standards. Washington: US Government Printing Office, 1967.
- United States Rail-Trails Website. Liability Issues of Rail-Trails. [www.railstrails.com](http://www.railstrails.com). February 2002.
- Van der Smissen, Betty, and Oswald H. Goering. A Leader's Guide to Nature Oriented Activities. Third Ed. Iowa, Iowa State University Press, 1977.
- Whatcom Council of Governments. Coast Millennium Trail: A border-to-border coastline trail. (Pamphlet) Bellingham, 2001.
- Whatcom Council of Governments web site. [www.wcog.org/projects/cmt](http://www.wcog.org/projects/cmt). March 2002.

## **9.7 General**

- B.C. Assets and Land Corporation. Surrey Acquires Key Waterfront Parcel Near Mud Bay. Victoria: BCA&LC. April 17, 2001.
- B.C. Ministry of Agriculture, Food, and Fisheries. Landscaped Buffer Investigation. 2000.
- B.C. Ministry of Environment, Lands and Parks. Access Near Aquatic Areas: A guide to Sensitive Planning, Design and Management. Victoria: Fraser River Action Plan Fisheries and Oceans Canada, 1997.
- B.C. Ministry of Environment, Lands and Parks. Community Greenways: Linking Communities to Country, and People to Nature. 1996.

- BCMG Lifestyle Magazines. Visitors Guide 2001/2002 Surrey, British Columbia. Surrey: BC Media Group, 2001.
- Charles Torrence Ltd. Boundary Bay Regional Park: A Development Plan Prepared for the Greater Vancouver Regional District. Vancouver: Charles Torrence Ltd., 1981.
- Driscoll, David ed. A design guide: universal access to outdoor recreation. Berkeley:PLAE, 1993.
- Friends of Boundary Bay. Exploring Estuaries and Wonderous Wetlands: A Teachers Guide to Field Trip Explorations and Classroom Learning. Delta: Friends of Boundary Bay, 1993.
- Friends of Boundary Bay. Discover Boundary Bay: A Teachers Resource Guide. Delta: Friends of Boundary Bay, 1993.
- Gottemoeller, Frederick. Bridgescape: The Art of Designing Bridges. NY: John Wiley & Sons, 1998.
- Government of Canada. An Inventory of International Park Possibilities: Point Roberts, boundary Bay, San Juan & Gulf Islands Archipelago: A Joint Report Prepared for the International Point Roberts Board. Canada: Parks Canada, 1974.
- Greater Vancouver Regional District. Boundary Bay Regional Park - Concept Plan. Vancouver: J.S. Peerpre & Associates. 1986.
- Greater Vancouver Regional District. The Burrard Peninsula / Richmond Sector Recreational Greenway Plan: Part of the Regional Recreational Greenway Plan. GVRD Parks. June 2000.
- Greater Vancouver Regional District. The North Shore Sector Recreational Greenway Plan: Part of the Regional Recreational Greenway Plan. GVRD, August 2000.
- Greater Vancouver Regional District. Planning and Environment Committee Minutes. Burnaby. (Wednesday September 5<sup>th</sup> 2001).  
<http://www.gvrd.bc.ca/board/agendas/01comagendas/penv/0905penv.pdf>. March 1, 2001.
- Hamilton, Stanley and Moura Quayle. Corridors of Green & Gold: Impact of Riparian Suburban Greenways on Property Values. Vancouver: UBC, 1999.
- Hausen, Michael von. Site development Programming, Design & Economics: The Art and Science of Place - Making. Vancouver: Von Hausen, 1997.
- Hough, M. The Regional Imperative. In Out of Place: Restoring identity to the regional landscape. New Haven: Yale University Press, 1990.
- Lynch, Kevin. Managing the Sense of a Region. Cambridge: MIT Press, 1976.

- Lower Mainland Regional Planning Board. Our Southwestern Shores. New Westminster: LMRPB September, 1968.
- Marsh, William M. "The Analysis Dilemma," Landscape Architecture. Sept. 14, 2001.
- Marsh, William M. Landscape Planning Environmental Applications. Third Edition. John Wiley & Sons, Inc. Toronto: 1998.
- National Park Service, Economic Impacts of Protecting Rivers, Trails, and Greenway Corridors, Rivers, Trails and Conservation Assistance, 4th edition, (1995).
- Quayle, Moura. The Rough and the Refined: Expanding Design Vocabulary in the Public Urban Landscape. University of British Columbia, Department of Landscape Architecture.
- Quayle, Moura. Urban Greenways and Public Ways: Realizing Public Ideas in a Fragmented World. Vancouver: Urban Landscape Task Force 1992.
- Smith, D.S. and P.C. Hellmund eds. Ecology of Greenways: Design and Function of Linear Conservation Areas. Minnesota: University of Minnesota. 1993.
- Surrey, City of (B.C.). Crescent Beach Waterfront Walkway Feasibility Study. June 1990.
- Surrey, City of. (B.C.) Finding the Balance: Environmentally Sensitive Areas in Surrey. Surrey: Surrey Planning and Development Department, 1990.
- Surrey, City of. (B.C.) Parks and Recreation Master Plan 1996-2006.
- Surrey, City of. (B.C.) Surrey City Guide. Surrey: Surrey Communications and Public Affairs Division, 1997.
- Surrey, Corporation of the District of. (B.C.) & UMA Engineering Ltd. Crescent Beach Waterfront Walkway Feasibility Study. Surrey: June 1990.
- Thompson, G.F. and F.R. Steiner. Ecological Design and Planning. New York: John Wiley & Sons, Inc. 1997.
- Willard, Keith. Bridges. Minnesota: Creative Education, 2000.