LINKING VISUAL PREFERENCES TO PLANNING SUSTAINABLY

Using stormwater management in a rural community as a case study

by

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ABSTRACT

While many communities have readily adopted "sustainability" as one of the community objectives in their planning documents, the actual application of sustainable practices has proven to be challenging for planners and communities. Some of the primary reasons for these challenges may include:

- the disconnect between communities visual preferences and sustainable landscapes;
- the limitations of current public consultation processes to solicit representational and meaningful input from the community due to the "shopping list" approach to developing official community plans encouraged by the Local Government Act;
- the failure of conventional public consultation processes to reach certain segments of the community because of cultural differences or reluctance to publicly "speak one's mind"; and
- the difficulties in the prioritization of the information from the public consultation processes into holistic planning policies.

In the mean time, current research from various disciplines has established evidence to suggest incongruence between visual preferences and ecologically sustainable landscapes: preference for specific landscape typologies does not seem to be affected by the ecological performance of the landscape. The gap in ecological knowledge about sustainability may have contributed to this situation. The bridging of this gap between knowledge and preference was explored through the application of visual preferences for stormwater management in a rural context.

The coastal community of Royston on Vancouver Island was used as a case study for a visual preference survey pilot project. The survey results were synthesized to identify a community aesthetic for Royston and to transform into criteria for selecting sustainable stormwater management best management practices that are appropriate to a rural community to reflect:

- the community's preferred aesthetic based on the results from the visual preference survey to promote better acceptance of sustainable working landscapes;
- the goals and objectives, and the policies adopted in the Royston Local Area Plan;
- the economic realities of a small community; and
- flexibility to address new development needs and the necessity to "retrofit" stormwater management practices into existing developments.
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CHAPTER 1

SCOPE & BACKGROUND

1.1 INTRODUCTION

This thesis explores the interface between sustainable design and public visual preferences to determine whether the visual preferences of the public match appropriate rural stormwater management techniques. The idea is to incorporate visual preference into the stormwater management planning process to allow for the expression of "community aesthetics" in the public realm. The hypothesis is that there is a conflict between visual preference (community aesthetics) and sustainable stormwater design. If this is the case, then the non-acceptance of the visual aesthetics of certain types of stormwater management designs may become a barrier to the adoption of more sustainable stormwater management practices. A "community aesthetic" contributes to the building of community identity that is fundamental to creating a sense of community. A brief literature review readily indicates that a sense of community is vital to social sustainability and the long-term stewardship of the environment.

The pilot process includes the creation and testing of a visual preference survey to establish the visual preferences of the subject community. While results from the case study community of Royston coincide with many of the research findings of the literature review, this process needs to be repeated over time and at multiple locations for further data collection and comparison in order to improve its scientific research value.

1.2 THESIS SCOPE

The scope of this thesis includes the following principle components:
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- Demonstrate connections among sustainable design and public's visual preferences
- Conduct literature review and present three local (British Columbia) stormwater management projects as precedents
- Design and conduct a pilot visual preference survey using Royston as a case study.
- Describe some of the appropriate best management practices (BMPs) suitable for Royston, a representative small coastal rural community in British Columbia
- Discuss the findings of the survey and comment on the relationship between the public's aesthetics preference of the landscape and sustainable stormwater management practices in the public realm
- Suggest "next steps" to further the research

Another aim is to establish a template for future research linking visual preference and sustainable design. The hope is that the research process of linking visual preference to sustainable design can be applied to other issues beyond stormwater management and in other community contexts, ranging from urban environments to specific cultural sub groups.

1.3 THESIS STRUCTURE

The structure of the thesis is outlined in the accompanying flowchart (See Figure 1.3.1) and described briefly below to provide navigation for the readers:

Chapter 1 outlines the purpose and scope of the thesis, introduces the biophysical background and planning context for the Royston case study, and describes the theories underpinning the thesis. The literature review focuses on the linkages between visual preferences and sustainability, as well as discusses the application of sustainable practices in stormwater management in a rural community setting.
Chapter 2 presents the methodologies and a participatory visual preference survey pilot project to solicit public visual preferences. In addition, it describes the pilot project in Royston and summarizes the visual preference survey results.
Chapter 3 reviews the watershed based approach to stormwater management and planning, describes three local stormwater management precedents from British Columbia and the reasons why they are chosen, as well as discusses the applicability of the lessons form these precedents to stormwater management in rural communities.

Chapter 4 discusses proven stormwater best management practices and makes specific recommendations for Royston. These recommendations are based on the results from the visual preference survey, goals and policies of the Royston Local Area Plan directives, and economic realities of implementing stormwater management in a small rural community.

Chapter 5 concludes by promoting visual preferences as one of the planning tools to move communities towards more sustainable practices by bridging the gaps between ecological knowledge and community aesthetic preferences. It also discusses the role of planners in affecting changes as well as the role of visual preferences in planning processes. Finally, this chapter suggests improvements to the pilot visual preference survey in anticipation for further research following this participatory innovation pilot project.

1.4 BACKGROUND

Traditionally, “experts” planned community with minimal public input. This model is no longer the norm. Concurrent with the advancement in technology, such as virtual modeling/scenario generating software such as Sim-City, through realistic simulation of design options using programs such as World Construction Set or Photoshop, or by generating realistic outcomes based on lifestyle choices using programs such as Quest developed by the Sustainable Development Research Institute at the University of British Columbia, the traditional state-directed approach to planning is being challenged from various fronts by academics and practitioners across disciplines. On the process for public participation front, some planners are advocating the enhancement of community-based approaches. These community-building processes can facilitate meaningful dialogue between the state and civil society. Community-based approaches are participatory and
include multiple publics (race, age, gender, education, social strata etc.) in decision-making in order to build public support and encourage participation (Sandercock 1998, Gurstein 1993). In addition, planners and design professionals are addressing an ever-increasing number of sustainability issues (Lyle 1995 and Hough 1984) and to design developments that protect ecological values and enhance the landscape (McHarg 1969, Lynch 1981, Marsh 1999, Condon 1998). One of the important conclusions is that academics and practitioners alike are recognizing that a shift of paradigm towards a more holistic approach is necessary. Dorcey and McDaniels (1999) recommend in their study on citizen involvement in environmental governance, that much greater attention needs to be given to the integration of stakeholder evaluation in the development of community involvement techniques and processes. This thesis attempts to contribute to these fields of research by devising a methodology to determine visually preferred and technologically appropriate sustainable alternatives for stormwater management for small rural communities.

In recent years, the management of stormwater has been recognized as a crucial component of aquatic habitat protection. It has been incorporated into one of the seven principles for livable and sustainable communities promoted by the UBC James Taylor Chair in Landscape and Livable Environment. Principle Five advocates that: "Natural drainage systems where stormwater is always held on the surface and permitted to seep naturally into the ground" (Condon and Teed 1998). The corresponding benefit is improvement of water quality when compare to the status quo "culvert and pipe" solution where stormwater is returned to the hydrological cycle without treatment (See Chapter 4). Recognizing the enormity of building and retrofitting sustainable communities, this thesis chooses to concentrate on finding ecologically sound rural stormwater management practices that meet the visual preferences of the community.

It is wholly possible to propose a sustainable stormwater management plan based purely on scientific, quantitative research methodology, such as the "sieve analysis" pioneered in landscape architecture by the late Ian McHarg (McHarg 1969), by basing the design on the size of the recharge area, the geology, the topography and the existing development patterns and future growth projections of Royston. While this approach may result in a functionally improved watershed, such a purely ecologically based plan would still not be
sufficiently holistic. It would not have taken into consideration the socio-cultural aspects of sustainability such as economic realities, existing community character and visual preferences. The incorporation of visual preferences into design relates the science of ecological functions with the more phenomenological aspects of human preferences for specific landscape types.

While rural communities face many of the same environmental, social and economic challenges as larger urban centers, they offer the design, planning and engineering professionals a largely unpainted canvas on which to experiment with respect to planning methodologies, sustainable design concepts, alternative stormwater treatment possibilities and public perceptions testing. Royston, a small coastal community on the east coast of Vancouver Island is chosen as the pilot study site for several reasons:

i. There is already an established relationship with the community from the yearlong planning studio (2000-2001) conducted by the UBC School of Community and Regional Planning. As part of the studio, the student planning team led by Harry Harker\(^1\) designed and carried out public participation processes, facilitated visioning sessions and outreach programs for children and youths and produced the Royston Local Area Plan (RLAP). The Comox Valley Regional Board has formally adopted the RLAP in September 2001.

ii. The residents, local politicians and the Regional District of Comox Strathcona (RDCS) are very open towards participation in planning processes and academic research

iii. The community is receptive to sustainable alternatives in managing the future of the community

iv. A Liquid Waste Management Planning process has been initiated following the RLAP because the community is experiencing septic failures, and the health of Bayne Sound is of vital economic and ecological considerations for Royston and other neighbouring communities

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\(^1\) Harry Harker is an adjunct professor in the UBC School of Community and Regional Planning as well as the Manager of Planning Services, Regional District of Comox Strathcona. Royston is one of the communities under the jurisdiction of the Regional District.
v. An exploration of stormwater management practices will complement the Liquid Waste Management Plan (LWMP) currently underway

1.5 CONTEXT

1.5.1 PLANNING IN SMALL TOWNS

Arguably, one of the roles of planners is to bring together the synergistic elements from other related disciplines (architects, landscape architects, and engineers to name a few). If planners can solicit tape into this synergy to achieve a more sustainable stormwater management solution that also meets the open space needs and visual preferences of the community, then the resulting plan will be even more desirable especially given the multiple constraints faced by small rural communities. In addition, such a stormwater management plan may have a higher chance of being accepted and supported by the public. For example, it may be possible for planners working with other professionals and the community to obtain multiple benefits by incorporating a surficial stormwater treatment system in the public realm thereby providing recreational opportunities and protecting the ecological integrity of the open space for the community. Stormwater management systems, properly designed, can become landscape features that provide amenity and aesthetic values to the community. A sustainable alternative for Royston is one that is economically feasible, ecologically sound and socially responsible (culturally appropriate, aesthetically acceptable and contextually authentic design).

When compared with urban centres, smaller rural communities face additional challenges in implementing stormwater strategies (conventional or otherwise) that include:

- small industrial and commercial tax base to support infrastructure costs
- dispersed rather than compact development patterns
- patch work, small scale development rather than single large development
- high infrastructure costs because of dispersed land use pattern
few professionals with specialized knowledge on sustainability, open space design or stormwater management on municipal staff

- lack of economies of scale to pursue highly sophisticated and costly engineered, solutions that requires intensive and expensive long term maintenance besides the high initial costs

- limited budget for long term maintenance that depends on governmental transfer payments

- insufficient resources for public education and promotion of alternative stormwater management tools such as BMPs that leads to lack of understanding of the relationship between stormwater management practices and water quality

1.5.2 ROYSTON

The rural community of Royston on Vancouver Island has been chosen as the pilot project for reasons outlined above. The final stormwater best management practices proposed in this thesis will respect the community's goals and objectives in accordance with their newly adopted Local Area Plan, as well as its sense of aesthetics derived from the results of the visual preference survey study. Royston is located in the Comox Valley on the east coast of Vancouver Island across from Comox Harbour (Figure 1.5.1). Union Bay lies to its south, Courtenay to its north and Cumberland to its west. Its origin as a coastal vacationing spot and crossroad town along the railway that served the nearby communities during the height of the mining days (late 1800s to mid 1900s) in Vancouver Island's early history shapes Royston to this day. Until the completion of the new inland highway, Royston continued as one of the rural communities that depended on highway traffic along the old Island Highway for travelers' businesses. Some of the legacies from past commercial and industrial activities include the Royston wharf (Figure 1.5.2), the community hall that was a garage at the intersection of Island Highway and Royston Road, and the relocated schoolhouse. Other existing industries include agriculture and forestry operations.

Some British Columbia rural communities with desirable climate, proximity to regional centres and relatively low housing prices have been experiencing unplanned waves of new residents escaping from the metropolitan areas. Others, such as Royston, have been
designated to become growth nodes for their regions by their official development plans and are preparing their strategies to handle the changes that come with population growth. For example, an additional five hundred people are expected to move to Royston in the next ten years according to population projections based on historic growth rates in the Comox Valley; based on this projection, the population of Royston will grow from the current 2100 to 2600 by the year 2010. Besides the need to provide a wide range of housing choices to accommodate all age groups now and in the future, these communities have to deal with the accompanying manifestation of growth, such as the increasing pressures on rural infrastructures to provide "city-standard services" like safe water supply or treatment of sewer and stormwater.

At the same time, there is increasing public concern regarding quality of life issues such as the health of the environment, public amenities, safety, community identity (urban vs. rural),
sense of community (local control over local issues with local solutions), and the cost to upgrade and maintain infrastructures. We know from local precedents (See Chapter 3) that storm water treatment can be successfully incorporated as public amenity as well as reduce the amount of runoff and cleanse the storm water to improve water quality. Biofiltration ponds and watercourses have been incorporated to improve stormwater quality. In addition, these “landscape features” provide passive recreational opportunities, additional habitat and forage areas for small animals and birds, locale for public art, educational opportunities, and as a symbolic and physical focus of community identity. The three local precedents demonstrate varying options for incorporating other community goals into the stormwater management plans. All three incorporated biofiltration processes to improve water quality. However, the costs and the degree to which other community goals were successfully addressed varied among the three precedents.

1.5.3. ROYSTON LOCAL AREA PLANNING PROCESS

The Local Government Act (Local Government Act, 2002) stipulates that communities must plan to manage change over time. Specifically, Part 26, Subsection 877 - Planning and Land Use Management of the Local Government Act outlines areas that must be addressed by each community. The topics include:

- land use (residential, commercial, industrial, institutional, agricultural, recreational and public utility)
- gravel deposits for future mining and extraction
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- hazardous conditions/environmentally sensitive areas
- infrastructure (major road, sewer and water systems)
- public facilities (schools, park and waste treatment and disposal sites), and affordable housing (rental and special needs).

In addition, a community "may" also address other areas in its official community plan, as permitted under Subsection 878 including:

- social needs and well-beings policies
- regional context
- maintenance/enhancement of farming in designated agricultural use areas
- preservation, protection, restoration and enhancement of the natural environment, its ecosystems and biological diversity.

The Regional District of Comox Strathcona initiated an extensive public consultation process between 1996 to 1998 in order to develop an official community plan for the region. The Rural Comox Valley Official Community Plan was adopted in 1998 that summarized covered goals and objectives for all the above noted areas.

Since, the adoption of the Rural Comox Valley Official Community Plan, some communities within the Comox Strathcona region have chosen to pursue local area plans to formalize policies that more specifically reflect local conditions. To this end, at the invitation by the Regional District, local politician, and community members, fourteen students from the UBC School of Community and Regional Planning spent eight months, as part of a studio course, between September 2000 and April 2001 to complete a series of public consultation processes to engage the citizens for Royston and to draft the first local area plan (LAP) for the community. Two documents were produced as part of the process:

- the Royston Community Inventory (UBC Student Team 2000) and
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- the Royston Local Area Plan (RLAP)²

The public consultation processes that lead to these documents involved the formation of a steering committee that worked closely with the planning team, numerous site visits and ground-truthing of information, and a series of community events including five open houses and a weekend design charrette where two-way information exchange took place in various forms. The student planners also went to the Royston Elementary School and conducted an outreach program to high school students to engage young citizens (who usually have a low participation record in public planning processes). The most important outcome, besides the valuable information and ideas from Royston residents, is the mutual trust and respect that resulted from these sessions. This relationship with the residents was instrumental in achieving the nearly 50% completion rate and the quality of the responses to the visual preference survey administered for this thesis. The Royston Visual Landscape Preference Survey analysis and synthesis described in detail in Chapters 2.

1.5.4. ROYSTON LOCAL AREA PLANNING OUTCOME

Some of the key points from the draft LAP are summarized as follow:

- The citizens are generally content with the quality of life offered by their close knit rural/suburban community and accept Royston's status as a "bedroom community" to near by Comox and Courtenay. However, it is important to the community that the exiting Royston "quality of life" (i.e. rural, quiet, low growth, few heavy industries, a diversity of population etc.) will be preserved as part of the long term vision for Royston.

- No new development will be possible without resolving the urgent liquid waste management problems in the community given the evidence of on-going septic

system failures. The Regional District has initiated a Liquid Waste Management Plan at the time of writing this thesis.

- The community has agreed to promote a radiating development pattern with the village core being the most densely developed area with small scale multiple dwelling and mixed-use commercial facilities. (See Figure 3: Radiating Development Pattern) The density of development will decrease as the distance from the village core increases. The community agreed on a growth boundary that coincides with the proposed service area for sewage treatment and a planning boundary. The intent is to encourage densification of development within the containment boundary to take advantage of service available. Any large development proposal beyond the containment boundary will need to be designed under “Conservation Design”
Development Permit Area requirements where clustering of built structures and road, as well as on site treatment for storm water are key to achieving density bonus/bylaw relaxations.

One of the principles inherent in Section B: 1.0 Environmentally Sensitive Areas of the LAP is to use a watershed based approach to address flood control, water quality improvement, stormwater management, habitat protection, recreation, ground water capture and neighbourhood enhancement. Future development should:

- limit development in environmentally sensitive areas
- integrate development sensitively with natural systems
- ensure conservation principles guide future residential, industrial and commercial development

In addition to the creation of the Conservation Design Residential Area, the Royston LAP addresses the protection and enhancement of riparian areas, the foreshore, vegetation buffers, ecologically sensitive areas; reduction of impervious surfaces; working with land owners and ministries to create bird sanctuary on the coastal wetland; as well as pursuing innovative environmentally friendly forest management practices, agricultural practices, land development options, and natural stormwater treatment systems on private properties.

Royston, along with Union Bay to the east, are the two communities the Trent River pass through before reaching Baynes Sound. As such, the quality of the stormwater reaching Baynes Sound is greatly affected by the treatment received in these communities. As Baynes Sounds is one of the most productive shellfish harvesting areas in British Columbia, the water quality is of significant economic as well as ecological importance to the region.

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3 Section 9.2 Development Permit Area #2: Residential-Conservation Design of the draft Royston Local Area Plan, Schedule "I", Rural Comox Valley Official Community Plan Bylaw, 1998, Bylaw No. 2042.
1.6 LINKAGE BETWEEN SUSTAINABLE DESIGN AND AESTHETIC PREFERENCES

Until recently, sustainability has usually been treated as a technical or ecological problem (Hester, 1995). Finding a relationship between aesthetics and the larger issue of sustainability is one of the keys to determining the relevance of aesthetic preferences as a sustainability indicator. Providing evidence that our community is socially sustainable is proving to be more difficult. A quick search on the Internet shows that there are currently many lists of sustainable indicators under development or in use to measure social sustainability. However, most of these indicators measure the quantitative aspects such as proximity to health care facilities, number of community organizations residents belong to, and so on (Heeney, 1996, Sheppard and Harshaw, 2001). Visual evidence of land stewardship has yet to be included as a sustainability indicator.

We are, at times, led to believe that if we just connect our food, energy, transportation, waste and resource use systems hierarchically, we will have discovered the formula for sustaining communities (Lyle, 1995). More recent research indicates that while a number of surveys indicate that people showed preference for "sustainable solutions" in an abstract way (such as cleaner air vs. pollution), fewer people are prepared to make trade offs or alter their behaviour to affect changes that may actually lead to an improvement of the acknowledged environmental concern if these trade offs are deemed to have negative impact on their lifestyles (EDRA, 2001). The current debate in the Lower Mainland surrounding the transit levy being perceived by some, as an unfair “tax” on drivers, is a local example.

With the emphasis on scientific (measurable) approaches, the more qualitative aspects are often left unmeasured or inadequately measured due to the difficulty in quantifying "livability" because of the variability between individuals' basic needs (survival, food and shelter) and attaining their desired quality of life (life style, wealth, leisure). One of the ways to bridge the gap between the qualitative and the quantitative divide may be to make sustainability more visible in the landscape. (Hough, 1984; Sheppard, 2000) Research in visible stewardship is still relatively sparse. The James Taylor Chair of Sustainability and The Collaborative for
Advanced Landscape Planning (CALP) at UBC are two notable research centres making positive contributions to promoting visible stewardship.

The James Taylor Chair uses design charrettes to explore design solutions to balancing urban growth and ecological integrity paying special attention to watershed based design solutions that take into consideration stormwater management and water quality issues. The James Taylor Chair (Condon, 2000) describes the relationship between design and sustainability as follow:

"... that design can reveal then resolve the contradictions between competing sustainability imperatives. Design may not always be capable of producing the one "correct" solution to a problem; but design is an especially useful method for arriving at good solutions." (See Figure 1.5.1)

The design process can be described as the synthesis of thought (insight, intuition, and reason) into complete and verifiable conceptualization of possibilities. The research activities of the James Taylor Chair have generated many alternative possibilities for land use patterns in communities around the Lower Mainland including Burnaby and Surrey. It has also produced alternative development standards for sustainable communities in the urban landscapes (Condon and Teed, 1998). These alternatives, when implemented, can lead to highly livable communities.
that are also vastly more sustainable. An open space plan incorporating stormwater management system is one of the key elements that contribute to a more sustainable community design.

The Collaborative for Advanced Landscape Planning tries to facilitate large-scale landscape management decisions by incorporating accurate scientific data into realistic three-dimensional simulations. Management options are developed using computer modeling tools and presented to stakeholders and the public to obtain their preferences and to assist the decision making process. By presenting realistic visual three-dimensional images along with technical data, all the parties involved share the same level of visual understanding of the issues and solutions. In this way, they can make their decisions based on both scientific data and visual preferences. The next step in the Collaborative's agenda is the exploration of visual preferences and visible stewardship.

In the planning field, there is a wide range of research projects that attempt to establish indicators for sustainability. Social sustainability indicators, in particular, try to bridge the gap between the scientific ecological models and the economic considerations. However, it is apparent that even when a holistic approach is attempted, aesthetics was not mentioned as an explicit indicator. For example, Sharon Pepperdine (Pepperdine, 2001) did not cite visual quality as a social indicator (See Table 1.5-A) in her study of rural communities in the Woady Yaloak- a largely agricultural river catchment in south central Victoria. According to Pepperdine, these indicators cover the social issues, which underlie "the ways in which people live, work, play, relate to one another, organize to meet their friends, and generally cope as members of society" (Burdge & Vanclay, 1995). They provide a tool to gain a subjective insight into rural community sustainability by measuring the reality in which people live. These subjective social indicators can be used alongside 'objective' measures, such as census data, to give a broader picture of trends in sustainability. Since satisfaction with one's quality of life is personal and varies from individual to individual, then social sustainability must also be 'subjective'. The landscape incorporates a multitude of ecological functions, aesthetic qualities, as well as provides settings for human activities. Consequently, the establishment of common community aesthetics could provide one of the key linkages between the "subjective" and the "objective" quality of life dialectics.
LINKING VISUAL PREFERENCES TO PLANNING SUSTAINABLY:
Using stormwater management in a rural community as a case study

Table 1.5-A: Factors of Rural social Sustainability (Source: Pepperdine)

<table>
<thead>
<tr>
<th>Factor</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Cohesion: coordination; ability to work together</td>
<td></td>
</tr>
<tr>
<td>2. Community mindedness: community life; active participation</td>
<td></td>
</tr>
<tr>
<td>3. Prosperity: population replacement including young adults; positive outlook; property resale</td>
<td></td>
</tr>
<tr>
<td>4. Neighbourliness: friendly and supportive community</td>
<td></td>
</tr>
<tr>
<td>5. Accepting: different points of view; ideas and newcomers; know neighbours</td>
<td></td>
</tr>
<tr>
<td>6. Opportunities to participate in social activities (entertainment, cultural, recreational and sport) and public affairs; presence of motivated and enthusiastic people</td>
<td></td>
</tr>
<tr>
<td>7. Employment opportunities including youth and young adults</td>
<td></td>
</tr>
<tr>
<td>8. Social disintegration: family breakdown; drugs and crime; suicide</td>
<td></td>
</tr>
<tr>
<td>9. Attachment to the area</td>
<td></td>
</tr>
<tr>
<td>10. Open minded: open to 'outside' and women</td>
<td></td>
</tr>
<tr>
<td>11. Economic viability: time for holiday and leisure; retirement; financial security</td>
<td></td>
</tr>
<tr>
<td>12. Community input: community self-reliance, community groups; shop locally</td>
<td></td>
</tr>
<tr>
<td>13. Communication: the 'bush telegraph'</td>
<td></td>
</tr>
<tr>
<td>14. Unity: volunteerism; common values</td>
<td></td>
</tr>
<tr>
<td>15. Population stability</td>
<td></td>
</tr>
</tbody>
</table>

The relationship between public visual preferences and ecological sustainability are currently being studied under distinctively separate fields. Psychologists are looking at the effect of ecological knowledge on visual preference of landscape (Daniels). Forestry researchers are looking at the public's preference of the savanna landscape, biodiversity and forestry management practices (Gobster, 1993). One can intuitively argue that aesthetics and culturally modified social constructs may affect visual preferences for a given landscape. A multitude of established theories including Jay Appleton's "prospect-refuge" (Appleton, 1996) or Stephen Kellert and Edward Wilson's Biophilia Hypothesis (Kellert and Wilson, 1993) are examples of these cultural/social constructs or innate/biological that are supposed to affect our environmental preferences.

For example, according to Gobster, while savannas are highly preferred aesthetically, the attributes that make them successful are largely structural ones (e.g. spacing of trees, ratio of open grassland to clumps of vegetation, etc.); few attributes relate to ecological function. In fact, much of our urban and rural landscape that has the structural character of a savanna is low in biodiversity and managed to inhibit ecological function. This can be seen in the
clean mown lawns that are preferred in our parks (Kaplan, 1984), the "chemlawn" (chemical lawn) yards seen as the aesthetic standard in our suburban areas (Nassauer, 1997), and the popularity of fast growing and non-native tree species for our parks, yards, and street corridors (Nowak and Sydnor, 1992).

Preference research tends to show that landscapes that exhibit high ecological integrity are often thought to be lower in aesthetic quality than more stylized and ecologically simplified landscapes. Schulhof (1989) found that visitors to landscape displays at the North Carolina Botanic Garden considered to have high ecological functions were seen as "unkempt" and "overgrown" by visitors who did not have a special interest or knowledge in ecology or native plants. Similar responses have also been found in studies by Nassauer (1988), who examined farmer's perceptions of agricultural lands planted in native grasses under the Conservation Reserve Program, and by Brunson and Shelby (1992), who found forestry professionals skeptical about public acceptance of "New Forestry" practices that left high amounts of downed woody debris and standing dead "snag trees."

The value of selecting stormwater management practices that are both ecologically sound and visually acceptable becomes apparent when viewed in the light of these findings. The congruity of the visual preference and ecological stormwater management practices will help promote sustainable design and incorporate best management practices into the public realm.

Human feeling about places is a complex phenomenon derived "from locales that are at once ecological, built, social, and symbolic environments" (Hummon, 1992, p. 253). Hummon examined how residents define their community and how they depict other types of communities, and how they construct a sense of identity as a city person, suburbanite, small-town person, or country person (Hummon, 1990). Expanding from this theory, one could argue that the most visible physical manifestation of a community is how it presents itself in the public realm: i.e. its open space. Christopher Alexander observed that people connect with a landscape that shows evidence of long term care (Alexander, 1977). A place that shows signs of being cared for reflects stewardship in the landscape. "Near nature"
LINKING VISUAL PREFERENCES TO PLANNING SUSTAINABLY: Using stormwater management in a rural community as a case study

(i.e. a view of and access to nature) experience affords psychological and physical benefits for people (Kaplan, 1989). Current research also suggests that people like to see "evidence of care for the landscape" and argues for "making sustainability obviously visible" (Sheppard, 2001). Furthermore, our homes and by extension, our neighbourhoods and communities, are places for us to engage in a meaningful relationship with our environment. People's engagement with our environment is fundamental to the generation of a sense of belonging to a particular place (Norberg-Schulz, 1985).

The key purpose of this thesis is the exploration of the relationship between sustainable design and community aesthetic preference. Psychologist, Terry Daniel is currently engaged in a study linking ecological knowledge and visual preference at the University of Arizona. Dr. Daniel's most recent yet to be published research\(^5\) indicated that people's landscape visual preferences are not necessarily affected by knowledge about the ecological conditions associated with the images. Daniels tested subjects in two ways. Some subjects were given a series of coloured photographs of various landscapes representing various stages of ecological health without any explanation on the ecological context. The subjects were asked to rate the photographs for visual preference. Other subjects were given the same set of coloured photographs after an explanation was given to the various ecological practices represented in those photographs. The initial finding was that prior knowledge on ecology did not affect the visual preference choices of the test subjects.

At the same time, planners, as well as other related design and engineering professions are moving towards addressing sustainability: ecology, social issues and the economy in our practices to achieve dynamic sustainable communities. Numerous attempts as defining sustainability indicators have been attempted by various disciplines (Lyle, Pepperdine, Nassauer). Unfortunately, often times, despite the best intentions to pursue sustainability, many management plans failed to gain the political and local support that are vital to the long term implementation of the recommendations.

\(^5\) Per discussion in July 2001 with Dr. Mike Meitner, who collaborates on research with Dr. Daniel.
As noted earlier in Chapter 1, the Local Government stipulates areas that an official community plan must cover in British Columbia. While this methodical approach ensures that all the major areas important to a fully functional community are covered, it does not necessarily facilitate a holistic synergy of the various components. Instead, this "shopping list" approach tends to give the appearance that all the topics discussed have equal weight because each chapter or section is given the same organizational structure.

Since the landscape is where planning policies take physical shape, and landscape character contributes to the development of community aesthetics, it is important for any community planning process to explore and take into consideration the visual preferences of the public. Another compelling reason to consider visual preferences is because the aesthetics of sustainable designs and practices are not necessarily familiar or considered appealing by the public (Parsons, 1995). In the Royston context, by understanding the residents' aesthetic preferences, planners may propose and facilitate the selection of stormwater management practices that are more appropriate to the local context. As well, if there are obvious discrepancies between the visual preferences and sustainable stormwater management practice, then, at least the planners can be aware and decide what course of actions may be required to communicate and educate the public about the benefits of being sustainable.

In addition to theories and precedents from literature reviews and existing projects, a visual preference survey (See Chapter 2) was conducted to understand local aesthetic preferences of Royston. The findings from the Royston Visual Preference Survey will be used to inform the selection of visually acceptable stormwater management options.
CHAPTER 2
ESTABLISHING THE ROYSTON AESTHETICS

2.1 VISUAL PREFERENCE ANALYSIS METHODOLOGIES

2.1.1 Visual Preference Exercise Goals

Given the objective to link visual stewardship with stormwater management, a visual preference survey (See Appendix A) was designed and piloted as part of this thesis with the following goals in mind:

- To establish a visual preference for rural landscape by asking a variety of local residents to photograph and provide written comments on what they like and dislike about the existing open spaces in Royston and the surrounding areas
- To sort and categorize the photographs and comments to discern major patterns or themes
- To determine the aesthetic qualities valued by Royston residents that can guide the choice of stormwater management design
- To select some stormwater solutions, with the Royston "aesthetics" in mind, from existing best management practices (BMPs) to explore suitable application of BMPs in rural context
- To compare the survey finding with theories from the literature review and make recommendations for future research
2.1.2 Research Questions from the thesis that are answerable by the analysis of the results from the visual preference exercise:

1. Whether community visual preferences match with well-established stormwater best management practices?
2. Is there a "community aesthetic" that emerges from the individual responses?
3. Are aesthetically acceptable landscapes actually sustainable?
4. Can stormwater management be selected to reflect aesthetic preferences?

2.2 BACKGROUND RESEARCH

Because there were few precedents for this kind of research in the planning context, literature review yielded little. Consequently, most of the information in this section was based on Internet search and interviews with practitioners. While the proposed survey methodology had not commonly been used in academic research or consulting work because of its open-ended nature, this should not undermine the validity of the proposed research methodology. When enough visual preference studies have been completed using well designed existing scientific research survey methods, then the collective data would have scientific validity. Nonetheless, even if this visual preference survey were a one-off venture, it would still contribute to the understanding of local visual preferences for a specific location. These visual preference findings could contribute positively to the local...
stormwater management plan if integrated into the design and evaluation criteria of the Royston Liquid Waste Management Plan.

The pros and cons for the proposed methodology is summarized in the following table (Table 2.2-A):

<table>
<thead>
<tr>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Open ended methodology allowing for all possible responses</td>
<td>• Open ended methodology that may lead to unpredictable results that are difficult to interpret</td>
</tr>
<tr>
<td>• Responses will be specific to the location and research question</td>
<td>• Difficult to categorize and document the photographs and comments</td>
</tr>
<tr>
<td>• Allows for direct participation by local residents</td>
<td>• Cost of running the exercise (disposal cameras, films, processing fees, distribution and collection costs)</td>
</tr>
<tr>
<td>• Taps local knowledge</td>
<td>• Complex to administrate exercise</td>
</tr>
<tr>
<td>• Builds “ownership” of project by local residents</td>
<td>• No “control” can be established and impossible to predict the outcome, thereby making this methodology “unscientific”</td>
</tr>
<tr>
<td>• Relatively simple methodology for participants to follow</td>
<td></td>
</tr>
<tr>
<td>• No special skills or knowledge required of participants</td>
<td></td>
</tr>
</tbody>
</table>
Table 2.2-B following is a summary of most applicable precedents and local example on similar visual preference survey methodologies to the one proposed in this thesis.

Table 2.2-B: Summary of Survey Methodologies Similar to Thesis Proposal

<table>
<thead>
<tr>
<th>Source</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harv Weidner, Area Planner, City of Vancouver</td>
<td>The City Plan visioning process in Vancouver used a similar process in the Dunbar Local Area(^2). In 1998, a workshop was held with local stakeholders to identify local character. The participants were asked to photograph specific public realm features that they liked and disliked. The resulting photographs were grouped and exhibited in subsequent open houses and citizens were asked to use the &quot;red dot/green dot&quot; method to rank these photographs. The most preferred features were incorporated into the design guidelines and the least preferred features were prohibited. There are no formal documentation of the methodology and findings from the City Plan workshop.</td>
</tr>
<tr>
<td><a href="http://www.gsd.harvard.edu/brc/report/31_visual.html">www.gsd.harvard.edu/brc/report/31_visual.html</a></td>
<td>Alternative Futures for the Region of Camp Pendleton, California The purpose was to determine whether or not personal experience altered visual preferences. Two experiments were conducted: a &quot;geographic study&quot; and a &quot;training study&quot;. In the geographic study, eighteen persons from California and sixteen from New England were interviewed to test if Californians, whose experience, perceptions, and values of the landscape were formed in the study area, had significantly different preferences than...</td>
</tr>
</tbody>
</table>

\(^2\) Source: January 14, 2001 meeting with Harv Weidner, Local Area Planner for Dunbar Area during the City Plan process.
<table>
<thead>
<tr>
<th>Source</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>those from outside the region. In the training study eleven Harvard Graduate School of Design students and twenty-three non-students were interviewed in order to test the difference in preferences of people who have been trained to be perceptive of their visual environments and those who have not. The visual model follows the organizational strategy of the methods used by the USDA Forest Service (1974) and the Bureau of Land Management (1980). There are three phases: 1) preferences; 2) exposure; and 3) value. Preferences were determined by using a set of 26 photographs of the study area which represent the range of land cover types in the region. Participants were asked to arrange the 13cm by 18cm color photographs into five numbered piles ranging from 1 (Most Preferred) to 5 (Least Preferred). There was no required maximum or minimum number of photographs in each pile. The participants were given as much time as they felt necessary for the task. They were permitted to change the location of any photograph until they were satisfied with its location. Average values were then charted by sub-sample and also in the aggregate. The results of the study showed that there were no significant variations in the landscape preferences of the different groups.</td>
</tr>
<tr>
<td><a href="http://www.lgc.org/">www.lgc.org/</a></td>
<td>The Community Image Survey was based on the Visual Preference Survey (VPS) developed by architect Anton Nelessen.</td>
</tr>
<tr>
<td>clic/cis.html</td>
<td></td>
</tr>
</tbody>
</table>
The Visual Preference survey (VPS) commenced with a briefing on the local problems and potentials. The study area was photographed from the public realm. Slides depicting local conditions, other locations and simulations were assembled and administered to the community, interested residents, business owners, community leaders, elected officials and children. Participants rated the slides on a scale from minus 10 (undesirable) to plus 10 (desirable). Response forms were computer processed to obtain a range of statistical results.

The process called DESIGN BY DEMOCRACY, developed by Nelessen and his associates were used to generate patterns of community preferences. Nelessen claimed that as a citizen participation tool, the survey process empowered residents to become a part of the community planning process, and made people aware of the compromises inherent in design and land use decisions because the findings represented a consensus vision of what residents wanted the community to look like. Goals were then generated from the positive images. An example of policy generated by this method might be: “Future policy must preserve open space particularly major view corridors and agriculture.”
2.3 METHODOLOGY

Building on the findings from the precedent review and interviews, the idea was to design a prototypical visual preference survey that could be piloted in Royston. Special care was given to the "ease of use" of the survey. The survey needed to be visually attractive and simple to use in addition to being designed to solicit useful visual information and written comments. A large enough representative sample of Royston residents (approximately 1% of the total population (between 20-25)) was needed to participate in the survey: Their tasks were to take photographs of areas in and around Royston showing their most preferred and least preferred landscape as well as features that represented "Royston" to them. The number of participants was limited in this pilot study because of time and budget constraints. The purpose was to establish a landscape vocabulary that was "uniquely Royston" to be incorporated into the stormwater management options.

The instructions were not directed specifically at stormwater management practices on purpose in order to explore the visual preferences in the landscape (both natural and built forms). The original intention was to use the visual preference findings to guide the design of management options, preferably those using natural processes, to treat stormwater. It was hoped that by incorporating the visual preferences of the residents, along with programming the open spaces with multiples functions and public amenities, the resulting landscape would improve the quality and regulate the quantity of the stormwater, as well as being visually attractive to Royston residents. In the end, the design component was dropped from the thesis to maintain a manageable scope of work.

The survey participants were "randomly" chosen during several LAP open houses. Nonetheless, the participants approached were carefully selected to be reflective of the
demographics of Royston. A diverse group of residents participated in the public open
houses for Royston Local Area Planning process. They included residents of most ages,
economic status and lengths of residency. Despite the special effort made by the student
planning team to reach the youths in the community, none of the youths agreed to
participate in the visual preference survey. Except for this acknowledged gap, the survey
participants were representative Royston residents. Because of the relative complete
sample range, the writer believed that the conclusions from the survey would be meaningful
and applicable despite the small sample size.

2.3.1 The procedure for the visual preference exercise is as follow:

1. Prepare instructions for the visual preference exercise
2. Provide film or disposable cameras to the selected participants along with
   instructions for visual preference exercise write up
3. Provide local contact person to administrate receipt of completed assignments
4. Arrange for processing of film
5. Document and catalogue photographs received to provide a permanent record
6. Group photographs into categories for analysis
7. Document written comments to discern patterns and themes
8. Analysis photographs along with comments to establish visual preference
9. Suggest some appropriate stormwater best practices that correspond to the Royston
   aesthetics using results from analysis
10. Analysis the pilot study and make recommendations for future use

3 The students from SCARP were engaged as consultants by the Regional District of Comox-
Strathcona to prepare the local area plan for Royston. I was part of the student consulting team.
Numerous public open houses and events were included in the planning process. We conducted
regular public consultation events during the entire Local Area Planning process.
2.4 ANTICIPATED FINDINGS

As demonstrated by the background research and confirmation by a conversation with Dr. Stephen Sheppard\textsuperscript{4}, this open-ended methodology used in this visual preference survey is uncommon in academic research. However, it could still be a valid academic research vehicle especially in the context of planning processes with the purpose of soliciting public input. In the Royston pilot survey, the participants were asked to generate the photographs of landscapes they most and least preferred, as well as described what their reasons were instead of being asked to rate their preference for a set of pre-selected photographs of either generic or local examples, was uncommon in academic research. Because of the lack of precedence of similar surveys, it was difficult to predict the outcome and findings of the Royston survey. However, it was hoped that the results for this pilot survey would yield information to analyze the following:

- Definite features considered "precious" to the community that should not be tempered with unnecessarily
- Establish dominant preferred landscape typology that was suitable for stormwater management practices and has high aesthetic and amenity values
- Identify conflicts between visually preferred landscapes and ecologically sustainable landscapes

The exercise would be considered successful if it could assist in harvesting local knowledge and visual preferences that could positively influence planning policies and design of multi-purpose stormwater management options appropriate to Royston. It was hoped that the proposed methodology could be repeated in other communities, or used for other planning exercises for further data gathering and research comparisons. This intuitive and hands-on

\textsuperscript{4} Conversation in July, 2001 with Dr. Stephen Sheppard. Dr. Sheppard is an internationally recognized expert in visual resource management and visualization. He is an Associate Professor in Landscape Architecture and Forest Resources Management at the University of British Columbia.
survey methodology could become a valuable addition to the planner’s tool kit for information gathering and decision support.

2.5 RESEARCH RESPONSES

2.5.1 Visual Preference Survey Process and Responses

Overall, the survey was successfully completed. The completion rate was approximately 41%. Twenty-two packages, each containing survey instruction (See Appendix A) and one roll of film containing 8 exposures were handed out during the Royston Local Area Planning public consultation processes held in February, 2001. Nine (9) surveys were completed and returned. All the returned surveys were completed according to the instructions. A few respondents opted to include additional photographs from their own collection to emphasize a point or add “additional” favorites/dislikes to the submission. One respondent took only six photographs. A tenth one was returned with the roll of unused film with an apology explaining that the 35mm roll of film given was not compatible with the camera equipment the person owned.

The Regional District of Comox Strathcona and City of Vancouver staff acknowledged that a 1-2% participation rate (based on population notified by newspaper advertisement and/or mail-outs) is considered “normal”. The Royston LAP process was deemed to be very successful because the participation rate reached 5% of Royston’s population in some of the meetings. So, by comparison, the 41% completion rate of the visual preference survey is relatively high. This response rate is much higher than the participation rate of public meetings.

The test subjects were chosen to roughly represent the demographics of Royston. As very few young people attended the public meetings, this group was notably underrepresented in the survey sample. The results of the survey are interesting in many aspects. The detailed
annotations that accompanied the photographs provided a deep understanding of the reasons why the specific photographs were taken. In addition, common themes and places were easily discernable.

2.5.2 Overall Impressions

A copy of the survey is included in Appendix A and a sample response of the Visual Preferences Survey is included in Appendix B for reference. The following section presents the overall observations from the survey results. The most obvious observations (See Map 2.6 Summary of Photographed Sites and Figure 2.6.1 Visual Preference Survey at a glance) from the survey results are:

the collective agreement on keys places/views that represent "Royston"
the emergence of common themes and a collective "Royston aesthetic" that prioritizes the "natural landscape" over "built landscape",
the demonstrable preference for "tidy and kept" as a sign of care over the "messy and unkempt" as a sign of neglect.

The responses were grouped into three main categories based on residents' responses:

1. Ecological
   a) Water quality (Creeks and riparian area, ditches, runoff, etc.)
   b) Wildlife (viewing, habitat)
2. Economic (There were no responses that related to economic concerns)
3. Social-cultural
   a) Dynamic landscape (scenic quality-foreshore, water, ocean, the Wreck, Royston Pier, Marine Drive, Gartley Point, Roy Creek "estuary", etc.)
   b) Amenities (Trails/Greenways-old Rail bed, Comox Logging Road, etc.)
LINKING VISUAL PREFERENCES TO PLANNING SUSTAINABLY: Using stormwater management in a rural community as a case study

Special Features (The Pier, the Wrecks, Gartley Point, Roy Creek, Trent River, Seaside Pub, Mini-Mart, heritage features including the old school house, Royston Hall, old railway bed, Grieg Garden, specific housing type/character, etc.)

A separate category "Emotive Responses" (See figure 2.5.1) was included to capture the richness of the responses. The written comments allowed the respondents to include their unique reasons for taking each photograph.

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>POSITIVE</th>
<th>NEGATIVE</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ecological</td>
<td>10</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>Economic</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Social-Cultural</td>
<td>57</td>
<td>2</td>
<td>59</td>
</tr>
<tr>
<td>&quot;Emotive Responses&quot;</td>
<td>40</td>
<td>30</td>
<td>70</td>
</tr>
</tbody>
</table>

Figure 2.5.1: Visual Preference Survey results at a glance
Map 2.5: Summary of Photographed Sites
In addition, it is of note that four out of the nine respondents opted to give personal information including their name and phone number despite that personal data was specifically not requested. Many of the comments were thoughtful and thorough in explaining the reasons the respondents chose to photograph a particular site. One of the reasons for the generous responses may be the rapport and trust built up during the eight months of public process the UBC Student Planning Team and the Regional District invested in the LAP.

For example, the location of the local swimming hole, held so dear and sacred by the residents that no one would mark it on the map during the design charrette for the LAP. This community “secret” was revealed in the visual preference survey comments by a long time Royston residents, Mr. Bill Merrifield: “Trent Falls, best kept secret of Royston. Great swimming for anyone and kids. Cecilia, I will share this secret with you”. It was likely that Mr. Merrifield remembered the author has a young child who loves swimming and that Mr. Merrifield has now accepted the planning team sufficiently to welcome the author and her child to visit the site. Another respondent took photographs of a site and commented that he “went for a walk along the Comox Logging Road” after a conversation with the author to see for himself the “affects of logging” had on the streams. The long collaborative public participation process that produced the Royston LAP most likely played a major role in facilitating this type of enriched information exchange between researcher and residents.
2.5.3 Specific Landscape Features

Not surprisingly, the foreshore features: the pier, the Wrecks, Roy Creek, Trent River and Gartley Point came out clearly as key features. The views and vista in conjunction with the rich wildlife and opportunities for recreational activities are reasons cited as the main reasons for these choices. Some people noted the diversity of species, especially that of waterfowls, and that Roy Creek and Trent River empty into the bay. Next most noted often features are buildings and structures of significance that either have historically meaning, or strong community ties. None of the buildings/structures were cited for their "architectural" merits. For example, the Royston Community Hall has been noted as a landmark despite its non-descript appearance and less than ideal siting 2 feet off the edge the Old Island Highway and Royston Road. On the other hand, the Hall has rich local historic significance. It started out as the Royston Machine Shop (See Figure 2.5-3) and was later converted to the Community Hall (See Figure 2.5-4) largely by the efforts and donated labor from the founding families of Royston and their descendents. Architectural details and landscaping such as building typologies, fencing detail have also been cited as indicators of "evidence of care" or "a lack of care". Unkemptness, messiness and the public display of a lack of maintenance are interpreted as "undesirable" character. A lack of screening of "messy" residential yards and the untidy industrial activities (large trucks in yards, piles of material stored without being screened, etc.,) have been noted as features "disliked" in Royston. Well uses and cared for landscape, including Feeley’s farm at Gartley Point, private gardens and trails etc., are deemed to be desirable "community features" regardless of whether they are on public or privately owned lands. Some has also noted
trails and natural features that are used recreationally, such as the decommissioned old railroad in Laurel Heights subdivision, and the Trent Falls as favorite places, again without concerning themselves with whether these features are on private verses public lands.

By and large, the respondents independently picked similar locations and features to photograph their favorite places and least favorite features. Some picked features that reflected their interests or community involvement (e.g. stream keepers, heritage preservation) or favorite recreational activities (e.g. boating, kayaking or walking). Some correlations were made residents between ecological functions and their aesthetic preferences. Overall, Royston residents showed preferences for natural outdoor features over built environments; “tidy” landscapes with signs of being well cared for over “messy” or “dilapidated” places that indicated neglect.

The relationship between visual preference and sustainability is condensed in Table 2.6-A and summarized in Table 2.5-B following:
Table 2.5 - A Visual Preference Results & Sustainability

<table>
<thead>
<tr>
<th>SUSTAINABILITY</th>
<th>THEMES</th>
<th>SPECIFICS</th>
<th>POSITIVE</th>
<th>NEGATIVE</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Ecological</td>
<td>1.1 Water Quality</td>
<td>Roy Creek riparian area</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ditches</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Run off on Island Highway</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.2 Wildlife</td>
<td>Birds, waterfowls</td>
<td>5</td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>2. Economic</td>
<td>2.1</td>
<td>None directly mentioned</td>
<td>0</td>
<td>0</td>
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<tr>
<td>3. Socio-Cultural</td>
<td>3.1 Dynamic Landscape</td>
<td>Scenic Foreshore: water, ocean, the wreck, pier, Marine Drive, Gartley Point, Roy Creek estuary</td>
<td>28</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>3.2 Trails/ Greenways</td>
<td>Old rail bed, Comox Logging Road</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Railway bed</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>3.3 Feature Specific</td>
<td>The Pier</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>The Wrecks</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gartley Point</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Roy Creek</td>
<td>4</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Trent River</td>
<td>4</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Seaside Pub</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Heritage features (Old School house, old railway bed Grieg Garden)</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mini Mart</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Housing type/for/character</td>
<td>2</td>
<td>5</td>
<td></td>
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<tr>
<td>3.4 &quot;Emotive Responses&quot;</td>
<td></td>
<td>Scenic views (natural)</td>
<td>24</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Human intervention (as evidence of care)</td>
<td>7</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>&quot;Community Identity&quot;</td>
<td>9</td>
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<table>
<thead>
<tr>
<th>POSITIVE</th>
<th>NEGATIVE</th>
<th>TOTAL</th>
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<tr>
<td>97</td>
<td>32</td>
<td>129</td>
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</table>
### Table 2.5-B: Visual Preferences Survey Response Summary

<table>
<thead>
<tr>
<th>ROLL</th>
<th>PHOTO NO.</th>
<th>GENERAL DESCRIPTION</th>
<th>SPECIFIC</th>
<th>CONSIDERED TO BE LANDMARK</th>
<th>LIKE</th>
<th>DISLIKE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>View of the ocean &amp; shore birds</td>
<td>From Marine Drive Picnic Table area</td>
<td>1</td>
<td></td>
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</tr>
<tr>
<td>1</td>
<td>2</td>
<td>Wildlife viewing &amp; habitat</td>
<td>Gartley Point</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>3</td>
<td>Ever changing foreshore</td>
<td>Marine Drive</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>4</td>
<td>Unkempt residence &amp; yard, No screening, larger exposed driveway, many vehicles visible, no vegetation/landscaping on site</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>5</td>
<td>Unkempt residence &amp; yard, Peeling paint, uncharacteristic fence, fully exposed</td>
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<td></td>
<td></td>
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<tr>
<td>1</td>
<td>6</td>
<td>Unkempt residential yard Exposed outdoor storage, lack of evidence of care</td>
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<tr>
<td>1</td>
<td>7</td>
<td>&quot;Heritage&quot; type homes depicting the area Lots of details on the façade, eclectic</td>
<td>1</td>
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<tr>
<td>1</td>
<td>8</td>
<td>Walking trail Quiet, wildlife, soothing, no traffic</td>
<td>1</td>
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<tr>
<td>2</td>
<td>1</td>
<td>The Pier has always been a part of what makes Royston. Parking is bad. Site for numerous summer night parties (noise, people, mess to clean up) Need speed bumps to slow traffic. The Pier</td>
<td>1</td>
<td></td>
<td></td>
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<tr>
<td>2</td>
<td>2</td>
<td>Ship wrecks (a part of Royston) Picnic tables and BBQ are a great tourist bonus The Wrecks</td>
<td>1</td>
<td></td>
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</tr>
<tr>
<td>2</td>
<td>3</td>
<td>Single family house (picture did not turn out) Beautiful house</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>Pathway that almost links to Courtenay</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>2</td>
<td>5</td>
<td>Old railway-Historic Trent River Historic</td>
<td>1</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>2</td>
<td>6</td>
<td>Unkempt ditches-overgrown with blackberries. Clean up so that the ditches will drain better, the community would look tidier. They'd be easier to keep clean</td>
<td>1</td>
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</tr>
<tr>
<td>2</td>
<td>7 Rental corner. Untidy, unkempt, not cared for, tacky</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>8 Blackberries ruining the beautiful ocean view that Royston is blessed with</td>
<td></td>
<td>1</td>
<td></td>
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</tr>
<tr>
<td>3</td>
<td>1 Beach access is a mud pit</td>
<td>Corner of Marine &amp; Hayward</td>
<td>1</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>3</td>
<td>2 Pub is a landmark</td>
<td>Seaside Pub</td>
<td>1</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>3</td>
<td>3 Too many brambles and ditch is full of crap</td>
<td>Ditch outside Seaside on Hayward</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>4 Owners are wonderful</td>
<td>Mini-Mart</td>
<td>1</td>
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<tr>
<td>3</td>
<td>5 Old school is a landmark</td>
<td>Old School</td>
<td>1</td>
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<tr>
<td>3</td>
<td>6 The runoff pools on the highway when it rains, making it dangerous</td>
<td>Hiawatha (sp?) trucking yard</td>
<td>1</td>
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<tr>
<td>3</td>
<td>7 The Wrecks-north of Pier along the coast</td>
<td>The Wrecks</td>
<td>1</td>
<td></td>
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</tr>
<tr>
<td>3</td>
<td>8 The Pier-end of Royston Road</td>
<td>The Pier</td>
<td>1</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>4</td>
<td>1 Dog on beach</td>
<td>Marine Drive - off leash</td>
<td>1</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>4</td>
<td>2b Roy Creek Estuary</td>
<td>Tiny estuary where ducks &quot;saddle and dabble&quot;</td>
<td>1</td>
<td></td>
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<tr>
<td>4</td>
<td>2a Roy Creek Estuary</td>
<td>Where Roy Creek dumps into the ocean</td>
<td>1</td>
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<tr>
<td>4</td>
<td>3 View of wrecks from shore</td>
<td>At the end of Marine Drive, large trees by the beach</td>
<td>1</td>
<td></td>
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</tr>
<tr>
<td>4</td>
<td>4 Sunset from Marine Drive</td>
<td>In front of respondent's house</td>
<td>1</td>
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</tr>
<tr>
<td>4a,b,c</td>
<td>Ducks at water's edge</td>
<td>Marine Dr.-Royston is part of Pacific flyway therefore have lots of birds nesting/over-wintering</td>
<td>1</td>
<td></td>
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<tr>
<td>4</td>
<td>5b Junk in the yard of a house</td>
<td>Royston Road</td>
<td>1</td>
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<tr>
<td>4</td>
<td>7b Old garden &quot;historic&quot;</td>
<td>Greig &amp; Marine Drive</td>
<td>1</td>
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<tr>
<td>4</td>
<td>Sign forest on the highway</td>
<td>North entrance to Royston</td>
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<tr>
<td>4</td>
<td>9b Two new houses displaced heron nests</td>
<td>Had 13-14 heron nests prior to clearing for construction</td>
<td>1</td>
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<tr>
<td>4</td>
<td>10 &quot;Maple Leaf sailing&quot; off Garthley Point</td>
<td>Recreation opportunity</td>
<td>1</td>
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<tr>
<td>4</td>
<td>11 Dog on boulevard (Marine Dr.)</td>
<td>Off leash, by the water</td>
<td>1</td>
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<tr>
<td>5</td>
<td>1 View down Strait of Georgia Mountain on Mainland, Goose Spit over the Courtenay River Estuary to Comox Marina</td>
<td>View from respondent's front yard</td>
<td>1</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>5</td>
<td>2 View of Indian Reservation, eagle chasing ducks</td>
<td>View from respondent's front yard</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>3 Wildlife viewing &amp; habit-ducks, geese, swans, seals, herons, eagles, etc.</td>
<td>View from respondent's front yard</td>
<td>1</td>
<td></td>
<td></td>
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<tr>
<td>5</td>
<td>4 Gated entrance to Comox Logging Rd</td>
<td>Garbage dumped, unauthorized access to nature walk</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>5 Along Comox Logging Road</td>
<td>Clear cut</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>6 Along Comox Logging Road</td>
<td>Clear cut-logs fallen over stream</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>7 Community celebration-</td>
<td>Millard Piercy Watershed Stewardship Group celebrating the publishing of their stewardship plans. The Stewardship group provides ongoing training, funding, volunteering.</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>8 Community celebration-</td>
<td>Millard Piercy Watershed Stewardship Group celebrating the publishing of their stewardship plans. The Stewardship group provides ongoing training, funding, volunteering.</td>
<td>1</td>
<td></td>
<td></td>
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<tr>
<td>6</td>
<td>1 Great swimming for anyone &amp; kids.</td>
<td>Trent Falls-Royston's best kept secret</td>
<td>1</td>
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<tr>
<td>6</td>
<td>2 Great area to walk and talk to the people of Royston</td>
<td>Marine Drive</td>
<td>1</td>
<td></td>
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<tr>
<td>6</td>
<td>3 Dislike this house on Marine Drive</td>
<td>Specific house</td>
<td>1</td>
<td></td>
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</tr>
<tr>
<td>6</td>
<td>4 Hulks of Royston</td>
<td>The Wrecks</td>
<td>1</td>
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</tr>
<tr>
<td>6</td>
<td>5 This will be a great end of the Marine Drive walk. This wharf has history and is part of Royston</td>
<td>The Pier</td>
<td>1</td>
<td></td>
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<tr>
<td>6</td>
<td>6 Royston Park. Kids from here helped pack the rocks for the BBQ</td>
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<td></td>
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</tr>
<tr>
<td>6</td>
<td>7 This building and club has all the history of Royston</td>
<td>Royston Community Hall</td>
<td>1</td>
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</tr>
<tr>
<td></td>
<td>Traffic light &amp; traffic Although the traffic is much better with the new highway-there seems to be a lot still and a fair amount of trucks</td>
<td>Royston Road south of Old Island Highway</td>
<td></td>
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</tr>
<tr>
<td>7</td>
<td>Great place to canoe</td>
<td>Gartley Beach</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Ditto above-at least when there is enough water</td>
<td>Trent River</td>
<td></td>
<td>1</td>
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<td></td>
</tr>
<tr>
<td>7</td>
<td>Nice open space</td>
<td>Feeley's farm</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Marina, anyone?</td>
<td>Seaside Pub</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>The real Royston's community centre-too close to traffic.</td>
<td>Royston Community Hall</td>
<td></td>
<td>1</td>
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<tr>
<td>7</td>
<td>&quot;No comment necessary&quot;-ocean view.</td>
<td>Marine Drive</td>
<td></td>
<td>1</td>
<td></td>
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<tr>
<td>8</td>
<td>View of Comox Bay from water front (Island Highway &amp; Beach)</td>
<td>Spoilt by ship wrecks</td>
<td></td>
<td>1</td>
<td></td>
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</tr>
<tr>
<td>8</td>
<td>Roy Creek Estuary</td>
<td>Looking east toward Gartley Point. Scenic area of sand flats, foreshore and may birds</td>
<td></td>
<td>1</td>
<td></td>
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</tr>
<tr>
<td>8</td>
<td>Contaminated site under remediation</td>
<td>Old Shell gas station on the foreshore at Ronald Ave &amp; Marine Drive It is also within 100' of Roy Creek. Industrial uses should not be permitted in such sensitive areas</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Gartley Point Farm-Feely Farm</td>
<td>Nicely treed, good to see this undeveloped. Note contrast in development pattern between east and west side of the Trent River</td>
<td></td>
<td>1</td>
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<tr>
<td>8</td>
<td>One of the few remaining patches of old growth forest surrounding a single family home</td>
<td>Along the Royston water front</td>
<td></td>
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<tr>
<td>8</td>
<td>Old House at Greig Ave &amp; Marine Dr.</td>
<td>Nice stonewall and rockery gardens</td>
<td></td>
<td>1</td>
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</tr>
<tr>
<td>8</td>
<td>Old farm house on Minto Rd.</td>
<td>Historic: pioneer vantage, typical of its ages, representative of old rural Royston. Shake fence also typical of pioneer style</td>
<td></td>
<td>1</td>
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<td>8</td>
<td>Roy Creek at Marine Drive</td>
<td>The creek has been channelized at this point and house is built to within a few feet to the edge of the creek</td>
<td></td>
<td>1</td>
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<tr>
<td>Rank</td>
<td>Feature</td>
<td>Description</td>
<td>Tally</td>
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<td>------</td>
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<td>-----------------------------------------------------------------------------</td>
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<tr>
<td>8</td>
<td>Roy Creek at Marine Drive</td>
<td>The bridge along with channelization has obviously harmful effects to creek, fish and wild life habitat.</td>
<td>1</td>
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<tr>
<td>9</td>
<td>1 Roy Creek</td>
<td>Running through the respondent's property</td>
<td>1</td>
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<td>9</td>
<td>2 Roy Creek Estuary</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>3 The Wrecks-</td>
<td>Big industries' garbage left for others to deal with</td>
<td>1</td>
<td></td>
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<tr>
<td>9</td>
<td>4 Trail Favorite walk along old railroad bed</td>
<td>Favorite trail along old railroad bed</td>
<td>1</td>
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<tr>
<td>9</td>
<td>5 Open ditch</td>
<td>Beside respondent's house. Takes a great deal of work to keep neat</td>
<td>1</td>
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<tr>
<td>9</td>
<td>6 Royston Road</td>
<td>Outlook towards the bay and foreshore</td>
<td>1</td>
<td></td>
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<tr>
<td>9</td>
<td>7 Mixture of housing styles and lot sizes</td>
<td>Diversity</td>
<td>1</td>
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<tr>
<td>9</td>
<td>8 Riparian Area of Roy Creek</td>
<td>I want to keep the natural wild trees along the streams-Roy Creek, Trent River, etc.</td>
<td>1</td>
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</table>

**TALLY**

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</table>

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**LINKING VISUAL PREFERENCES TO PLANNING SUSTAINABLY:**

*Using stormwater management in a rural community as a case study*
As noted earlier, the results have been classified into categories under the three widely accepted foundations of sustainability: ecological, economic and socio-cultural to tie back into the introduction to the thesis. Interestingly, socio-culturally related comments dominated the survey, closely followed by ecological concerns. Economic issues did not come out directly in the visual preference survey as concerns. One could, perhaps, argue that the ability to show sense of care in the landscape (both publicly and privately owned) may not simply be an indication of one’s attachment to the community, but is directly influenced by one’s health, wealth and the amount of leisure time available (which can also be attribute as an indication of wealth).

Landscape features including views, vistas, scenic quality and recreational opportunities such as trails and water sports were used to describe what a respondent liked about a special space. The respondents took pictures of specific places mainly because they evoked some sort of “emotional responses”. These qualitative comments are rarely captured by other survey methodologies. Some of the repeated themes cited for people’s choices included:

- Historic or community connections to specific buildings (the old school house, the community hall, Seaside pub and the Mini Mart)
- Places with "meanings" that were rich in local history, have community significance to Royston or were vistas that evoked specific emotions/feelings
- The scenic qualities of a specific location
- The type of activities/recreation the respondent partook in at that location
- People disliked places that lacked "evidence of care (painted fences, unkempt yards, messy landscape, etc)
Ecological concerns (water quality, riparian protection etc.) and specific land uses were brought up as expected by the author. Unfortunately, the survey results seemed to indicate areas of disconnect between the visual preferences of how landscapes looked and how that translated in terms of ecological functions and socio-cultural attachment. This observation matched findings of other researchers discussed in the literature review (Nassauer, Schulhof, Daniel, etc.) described in Chapter 1.
 CHAPTER 3  
UNDERSTANDING  
STORMWATER  
MANAGEMENT

3.1 THE WATERSHED

Figure 3.1.1: Watershed (Source: Water All Around Us)

A rudimentary understanding of the hydrological characteristics of stormwater and its impact on the environment is included to emphasize its relationship to open space design and planning policies. A glossary of the "italicized terms" is included at the end of Chapter 5. A watershed (See Figure 3.1.1) is simply the land area that drains to a particular body of water and includes the vegetation, soil, overland flow and sub-surface water. It can range from the Georgia Basin to the community scale watersheds roughly bounded by Roy Creek and Trent River in Royston. The planning boundary used for Royston roughly follows the natural watershed boundary except where political boundaries of Union Bay, Courtenay and Cumberland prevent the natural watershed boundary to be used (See figure 3.1.2).
The watershed is the logical landscape unit in which stormwater management takes place. Unfortunately, this geographical boundary does not always coincide with the political boundary as demonstrated in Figure 3.1.3. When it rains, water that does not evaporate or soak into the soil runs downhill and eventually drains into a stream, lake, or wetland. When development takes place, it changes the characteristics of that particular watershed.
In pre-development condition, the vegetation and soil slows down the overland flow and infiltration rain and the vegetation and soil cleanses the water of its toxins before it reaches the groundwater (See figure 3.1.3 (Schueler, 1987)). The natural vegetation and the ground (soil) act as filters to control pollutants. The removal of vegetation and the addition of impervious surfaces caused by land development will increase frequency of flooding and change stream characteristics. These changes affect the hydrological patterns of the stream as well as negatively affect the water quality and habitat characteristics for aquatic plants and animals.

It is of note that many communities, including some on Vancouver Island, depend on their groundwater for drinking. The quality and quantity of water in any watershed is affected by the activities within it. Our lifestyle choices have major impact on the environment. The sources of pollution may surprise us. Human activities such as fertilizing your lawn, washing your car and allowing the soapy water to drain into the catch basin at the edge of the roadside can harm a stream even if it is not nearby. People, animals, birds, fish and the flora and fauna surrounding us are part of the watershed community. As population increases and more development takes place in a watershed (e.g. sidewalks, streets, parking lots, building, etc.), we increase the impervious surfaces. This in turn affects the quality and quantity of water entering the system. For example, ordinary lawn grass clippings seem harmless enough, but if dumped into the river, the decomposition process may speed up growth of algae, which robs oxygen needed by fish. Even harmless sounding "bio-degradable soap" can be harmful. The reality is that even if a product is biodegradable (and thus takes longer to break down than similar "regular" product), it is not less harmful to fish if it reaches aquatic habitat untreated.
Many people are unaware that the biggest pollution threat to our watershed does not come from industrial point sources. In actual fact, nonpoint source pollution from other sources causes the biggest problem. For instance, a single person allowing car wash water to go down a storm drain might not seem like a big issue. But, multiply that by thousands doing the same thing within the same watershed, and the real picture of the cumulative impacts emerges. In America, over 78% (Stream Team Program, 1995) of all the states reported that water quality problems created by non-point source pollution area worse than those created by point-source pollution.

Figure 3.1.2: Hydrological Cycle for an Urban Area

Most communities concentrate their efforts on the treatment of sanitary sewer. However, the untreated cumulative pollutants in stormwater from the point and non-point sources can have a much more serious overall impact on the environment than the sanitary sewer discharge because of its substantially greater volume. In fact, a Liquid Waste Management Plan that treats and disinfects only sanitary sewage but does not sufficiently treat its stormwater before discharging it back into the streams does little to improve its water quality. It is important to understand the impact of stormwater on the health of streams and aquatic ecology during discussions and planning for water quality. Untreated stormwater carries pollutants into the stream systems. This is particularly problematic in urbanized areas where
impervious surfaces, such as paved roads, parking lots and sidewalks, prevent any opportunities of slow infiltration prior to the stormwater being released into the streams. The infiltration process reduces the peak flow quantity and improves the water quality by means of biofiltration.

Pollutants can be in the form of and grease, trace metals, toxic chemicals or chlorides. They have varying oxygen demand. Unmanaged stormwater has significant negative impact on fish (both directly and in their food chain). A decline in fish population affects the environment as well as the economy. Some of the most common sources of pollutants include:

- Fertilizers and pesticides from gardening
- Industrial and commercial activities
- Accidental chemical spills
- Intentional disposal of hazardous materials in storm drains
- Materials from automobile use

Chronic infusion of these pollutants can cause the same scale of damage to local water quality than major environmental disasters such as the Exxon Valdez oil spill in March of 1989\(^1\). The use of a natural drainage system, including retention ponds, could increase the lag times for run-off entering the steam, thus allowing the stormwater to undergo some cleansing before it reached either the ground water or the streams. These kinds of processes help restore water quality and control flooding. Replanted or naturalized vegetation retains the soils to minimize erosion and provide food and habitat for aquatic life. The protection of floodplains and drainage swales/ditches and other watercourses in developed/developing areas is imperative for regulating stream flow, especially during low precipitation periods in late summer, and for maintaining a high water quality essential to supporting aquatic life.

\(^1\) The EXXON VALDEZ ran aground on Bligh Reef in Prince William Sound, Alaska on March 24, 1989, spilling 10.8 million gallons of oil into the marine environment. It is currently #53 on the all-time list of largest oil spills.
LINKING VISUAL PREFERENCES TO PLANNING SUSTAINABLY:
Using stormwater management in a rural community as a case study

In British Columbia, the Ministry of Water, Land and Air Protection\(^2\) was concerned enough to have published the Land Development Guidelines for the Protection of Aquatic Habitat. The Ministry identified urban stormwater runoff as an essential component of liquid waste to be addressed in any liquid waste management plan (LWMP) with urban settlements including rural areas.

Besides contributing to proper ecological functions of the watershed, stormwater management can be achieved other planning objectives besides water quality. For example, green space that can provide terrestrial and avian habitats, as well as appropriate recreational opportunities can be incorporated into public open space that doubles as stormwater treatment.

The local precedents (See 3.3 Local Stormwater Management Precedents) illustrate how multiple community objectives can be incorporated into stormwater management initiatives and vice versa. The three precedents presented range in scale and varying degree of development densities. What they have in common are:

- innovative approach to problem solving,
- willing partnership amongst different levels of governments, the community and other partners in the project
- adoption of ecological sustainability as a key goal

These projects demonstrate that there are suitable stormwater management practices for communities of all sizes, site conditions, project scale, community goals and different budgetary constraints. The following table (Table 3.1-A) represents the degree to which these projects succeed in achieving the three foundations of sustainability-ecology, economy and socio-cultural improvement.

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\(^2\) The Ministry of Water, Land and Air and Protection was formerly known as the Ministry of Environment, Land and Parks (MELP))
<table>
<thead>
<tr>
<th>PROJECT</th>
<th>ECOLOGICAL</th>
<th>ECONOMIC</th>
<th>SOCIO-CULTURAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hastings Park</td>
<td>★★★☆☆</td>
<td>$$$$$</td>
<td>✔✔✔✔</td>
</tr>
<tr>
<td>Celtic Avenue Subdivision</td>
<td>★★★☆☆</td>
<td>$$</td>
<td>✔✔✔</td>
</tr>
<tr>
<td>Gartley Point</td>
<td>★★★☆☆</td>
<td>$</td>
<td>✔</td>
</tr>
</tbody>
</table>

Table 3.1-A: How well the precedents achieve sustainability
3.2 ROYSTON IN A WATERSHED CONTEXT

What happen on upstream developments have severe impact on downstream locations (See Figure 3.2.1). Royston is a downstream community that is impacted by upland developments in Cumberland as well as Royston. Streams and stormwater from

![Diagram showing the impact of upstream developments on Royston](image)

Figure 3.2.1: Causes and Impacts of reduced water quality in a river system (Source: Dougherty & Hall, Environmental Impact Assessment of Irrigation and Drainage Projects)
Cumberland eventually flow into Comox Bay and Baynes Sound via Royston. Deforestation, mining, agriculture and urban development activities in Cumberland influence the water quality in Royston. Fortunately, Cumberland is in the process of developing alternative sewage and stormwater management plans as well as constructing a wetland to take advantage of biofiltration to improve its water quality. These upstream improvements to water quality will lessen the impact on the streams and groundwater of Royston.

The following three local stormwater management precedents represent the range of options that Royston can consider. Only precedents using biofiltration have been included because of its proven effectiveness. Other criteria for the selection included relatively low capital and maintenance costs, and their success in providing community amenities or opportunity for community participation.

### 3.3 LOCAL STORMWATER MANAGEMENT PRECEDENTS

#### 3.3.1 Hastings Park, Vancouver

![Figure 3.3.1: Parks in Vancouver: Context](image)

Figure 3.3.1: Parks in Vancouver: Context
Hastings Park is located in northeast Vancouver at the boarder to the City of Burnaby. It is bounded by Hastings Street, Renfrew Street, McGill Street and the Trans-Canada Highway. Currently under construction, it is a multi-phased large-scale urban renewal initiative that addresses multiple goals and objectives in the Hastings-Sunrise neighbourhood and beyond. These objectives includes the provision of a multi-functioned urban park that incorporates existing features, including the race track, the Momiji Garden installed by the Japanese Canadian community to commemorate their ancestors, and various heritage buildings on the Pacific National Exhibition site. A series of ponds and re-naturalized green spaces will provide an urban oasis for the community, in addition to stormwater management functions. This project strengthened community relationships, mitigated some negative environmental impacts cause by urbanization, as well as provided urgently needed open spaces and incorporated sound alternatives for managing stormwater using natural biofiltration processes.

Figure 3.3.2: Composite of Park Site Prior to Construction
This project came about when the Province granted the land in trust to the City of Vancouver in 1888 with the stipulation that the site be used as a public park. The grounds were once used as a leisure park much like Stanley Park is today. Historically, Hastings Park was a natural flood plain that emptied into Burrard Inlet. The park became the Pacific National Fair Ground and racetrack in the 1950s. The fair is still in operation today and has become a summer tradition in the Lower Mainland.

Over the years, the character of the park changed substantially from its original natural state to a heavily built environment with very little regard for the ecology of the site.

Specifics

In the mid 1990s, city staff, consultants and the neighbourhood residents came together to develop a restoration plan that resulted in an endorsed plan by City Council in 1997. Once completed, the retrofitted park will cover approximately 64 hectares (162 acres) of land to become the second largest civic park in the City of Vancouver (See Figure 3.3.1: Parks in Vancouver: Context).

This ambitious project aimed to "restore" the site (See Figure 3.3.2) to a more natural state under a long term multi-phased redevelopment plan. The demolition and relocation of some of the historically significant buildings paved way for a major water feature "The Sanctuary" that also functions as a stormwater detention pond. The City had been doing extensive engineering work for several years to separate the existing combined underground sewer system into separate sanitary and stormwater pipes. The stormwater from the adjacent neighbourhoods are being rerouted into a series of ponds. Plants are incorporated into the design to perform Biofiltration processes. The goal is to enhance habitat for wildlife, restore salmon habitat, provide recreational amenity for east Vancouver, and to improve the quality of water prior to releasing it into the Burrard Inlet.

To date, two phases have been completed. Phase I, the "Sanctuary" (See Figure 3.3.3), is comprised of a series of detention ponds and native planting, covering approximately 4 hectares of the site. It was completed in time for the opening of the Pacific National Exhibition in 1999. The Sanctuary has matured into avian and terrestrial habitats that
surpassed even the expectation of its original designers\(^3\). Equally significant is the ability of the ponds to detain, cleanse and polish stormwater prior to gradually releasing it back into Burrard Inlet.

Phase 2 of the master plan— the Italian Garden was completed in 2000. The Italian Garden was conceived as a contemporary interpretation of a classic Italian garden. The was 2.4 hectares garden comprised of fountains, gardens, children's play area and skateboard park.

While, this Italian Garden does not specifically deal with stormwater management. Two features are of note. First, the theme of the garden is the celebration of rain. There are numerous features that highlight rain events (See Figure 3.3.4 "The Italian Garden). These include exposed gutters adjacent to walkways that carry the stormwater to the sanctuary and playful water fountains. The second notable innovation was the public-private partnership in which local Italian community put up part of the construction costs in return for design and thematic input. Besides raising funds for part of the costs of construction, the local Italian community participated in the construction as well as the contribution of public components such as the custom designed gargoyles.

The sense of community pride and ownership was evident in the low incidence of vandalism in either Phase I or II despite original concerns by City staff\(^4\).

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3 6 Per conversation in June, 1999 with Chris Phillips, Principle of Phillips, Farevaag, Smallenberg, a local Landscape Architecture Firm that designed the Master Plan, Phase I, II and III of Hastings Park.
Other phases, such as the 5.5 hectare sized sports fields (See figure 3.7) intended for the amateur will not be discussed here, as they do not have any relation to stormwater management. The stormwater management process using a series of detention ponds used in the to avoid repetition. While the scale and complexity of Hastings Park (See Figure 3.3.5) are unlikely to be encountered in smaller rural communities, some of the community goals and objectives, public-private partnership, technological innovations for stormwater management techniques, as well as the inclusive planning processes could be distilled and transferred to other communities.

Figure 3.3.4: The Italian Garden, circa 2001

Figure 3.3.5: Artist rendering of the entire Hastings Park at Completion
3.3.2 Celtic Avenue

Southlands is a unique rural area in the City of Vancouver within a 15 minutes drive from Downtown (See Figure 3.3.5). These low-lying flatlands form part of the floodplain of the Fraser River. The current land use is predominantly affluent "country residences consisting of large single-family lots with an equestrian theme. There are a few agricultural related businesses such as nurseries and stables. The McCleery Public Golf Course (See Figure 3.3.6) and clubhouse are also located in the area.

The area owes its unique character to its location in the Fraser delta and historical events. According to archaeological evidence, The Coastal Salish Nation first inhibited this area around 400 B.C. because of the abundance of fish and games. The land in this area was originally deemed to be unsuitable for development in the early 1900s because of logging activities and flooding. It was eventually subdivided and developed into large suburban lots and acreages. This land use pattern survives to this date.
In total, Southlands is comprised of approximately 861 hectares, approximately 7.6% of the total land area of the City of Vancouver. Its approximate 7000 households are significantly more affluent than the median Vancouver household\(^5\). The affluence and the high land value in Southlands were the catalysts for the Celtic Avenue project.

The approximately 3.3 acres Celtic Avenue site was located close to the Fraser River: bounded by Balaclava Avenue, Celtic Avenue (See Figure 3.3.7) and Blenheim Street. The owner and developer of the property was the Properties Division of the City of Vancouver. Despite its relative small size, the project was complex because of the need to satisfy multiple objectives within very specific site constraints including

- hydro overhead lines along Celtic Avenue
- Requirement for greenway dedication by the City
- Flood proofing needs that affect the grading requirements of the site
- Replacement of the existing stormwater storage capacity to minimize flooding
- Maximize developable area to maximize profit

In the past, the site was used as a nursery. As a result, there were some significant non-native trees and ornamental shrubs scattered on the site. Another legacy of the site's agrarian past was a roll of mature Lombardy poplar tress along the south property line. This practice of planting a hedge roll to delineate property or to provide windbreak was a common agricultural practice. After the nursery ceased operation, the City expropriated the land in exchange for unpaid taxes. The ecology on the site continued to evolve over time by revegetation with native species and by human intervention. Because of its location in the Fraser delta, the Southlands floodplains were occasionally subjected to flooding. As an

\(^5\) The 1996 average household income in Southlands is approximately $87,132 compared to approximately $48,087 for the City of Vancouver.
interim solution to mitigation the situation, the City had dug a back channel on this site, some time ago, to act as a temporary detention pond. This was an economic and effective mitigation measure that also resulted in the creation of unintended terrestrial and aquatic habitats. Local residents had reported sightings of birds and Speckle Backs, a sea going trout species, spawning by local residents in this drainage channel.

Figure 3.3.8: The original subdivision proposal by the Real Estate Division showing 3 approximately 1-acres sized lots. No site amenities were shown. The stormwater detention areas were to be filled and culverted.

When the City of Vancouver became owner of the site, a subdivision had already been approved for the nine 33’ wide single-family residential lots (See Figures 3.3.9). In 1999, market analysis by the City’s Real Estate Division of the City indicated demand for one-acre lots in this part of the City. The Properties Division applied to the Director of Planning to have the site consolidated into three one-acre lots. From an economics perspective, the extensive mitigation work currently proposed as part of the site consolidation is profitable only because of the extreme minimal original land cost to the developer.
Technically, an application to consolidate existing legal lots does not require public notification or a development permit application under the Vancouver Charter. However, because of the strong anti-development sentiments known to be present in this affluent neighbourhood, the developer opted to consult the neighbouring property owners throughout the design process before it even applied for a development permit. The City's property development officer kept the local residents association apprised of the process at key times so that the neighbours were not "surprised". In addition, an open house was held with staff present from the City's greenway program, representative from the Properties Division (the developer), the Structural Engineer and the project landscape designer. There were over 60 people that attended the open house and the response was overwhelmingly positive. The participants at the open house complimented the team for "listening to their concerns" and "doing something about it". The neighbour's concerns about flood protection, fish species in
the "stream", maintenance of rural character, retention of significant trees, desire for an interim greenway connection, truck traffic and noise during construction were all taken consideration of during the design process. Overall, these concerns were addressed.

Figure 3.3.10: The hatched area with the heavy black outline is the ideal location and size for fish habitat according to the report from the environmental consultant

A win-win solution had to be found for this project. The series of conceptual plans completed by the writer illustrates the transition of an idea from a straight market driven three lot subdivision to the finished development permit application plans that take into considerations community needs, city bylaws, Engineering requirements for stormwater detention, City Greenways Plan, BC Hydro requirements, long term maintenance, expert opinions (biologist and landscape architect) and the Ministry of Water Lands and Park.

6 This design is the property of the local landscape architecture Urban Planning firm Phillips Farevaag Smallenberg. I was employed by the firm as a landscape designer from 1998 to 2000. The account of this project is based on my notes during the period I worked on the project.

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Figures 3.3.8-3.3.11 illustrate the richness that can be layered into the design of the site layout when a truly interdisciplinary approach is adopted. Besides maintaining the existing stormwater storage capacity vital to flood protection, the design also incorporated

- In stream aquatic habitat and vegetative banks for shade and erosion control
- Interim greenway connection along the rear of the site until the property to the south is developed and a waterfront greenway can be realized
- Retention of the a great number of significant existing trees and historically significant landscape features such as the roll of poplar trees adjacent to the proposed interim greenway
- Compromises to minimize costs including working around the existing hydro poles along Celtic Avenue to eliminate any cost to relocate the structures\(^7\), and careful calculation of earthwork to minimize removal of fill material after the preloading period\(^8\).

Originally (See Figure 3.3.8), the Real Estate Division consulted an Engineer and proposed to culvert the channel to maximize the size of the proposed subdivision. No consideration was given to retention of existing vegetation or the mitigation for flooding. The only flood proofing proposed was to berm up the entire site to the required 3.0 m flood proof apron stipulated by the Vancouver Zoning Bylaw which would require the building areas to be filled and elevated to a minimum elevation of 3m above sea level. In this proposal, the resulting stormwater drainage, carrying fertilizers and possibly fecal material generated from the adjacent lawns, combined sewer overflow and equestrian operations would be piped and carried to the catch basins. This polluted stormwater could be discharged directly into the Fraser River when precipitation exceeds the capacity of the sewage treatment plant to process the combined sewage and stormwater generated. In addition, none of the on site vegetation would have been preserved.

\(^7\) The cost to relocate each pole was approximately $40,000 according to BC Hydro estimate.
\(^8\) The site has to be preloaded to ensure soil stability for the laying the foundation slab. Generally, clean fill is trucked on to the site, to a height of approximately 1 m high, prior to commencement of construction and piled where the proposed buildings will be located. The preloading material is trucked off site when the site is ready for construction.
Upon initial consultation with City Greenway staff and City Planner, it was decided that an environmental consultant specializing in aquatic habitat should be consulted regarding the stormwater retention and treatment in addition to addressing the aquatic habitat issues. Unfortunately, the combination of the greenway requirement, the site constraints with respect to the direction of the existing site grading, the size of the pond and associated channels, in addition to the area required for riparian planting and setback recommended by this report would have rendered the development of this site impossible (Refer to all the shaded areas in Figure 3.3.10). Unless a compromised design can resolve all the relevant issues, the City would have been unable to realize financial benefit from it real estate holding, and the community would not have the greenway connection it desired.
In the end, a compromised solution was reached through a collaborative process (See Figure 3.3.11). City staff, consultants, the developer and neighbouring residents all contributed to the final design by working towards the common goals rather than being entrenched in their own positions. For example, the greenway requirements were relaxed to permit narrower widths in part, and a light modification of the alignment, at the eastern end at Balaclava Street, was incorporated to facilitate the retention of significant trees on site and to minimize regarding. The location of the water channel was relocated to along Celtic Avenue instead of being adjacent to the greenway (refer to red hatched area in Figure 3.3.9) to accommodate the retention of the hydro poles on Celtic Avenue and to achieve the longest possible length of water of travel for the stormwater to facilitate biofiltration by the planting material along the channel and to slow down the flow to maximize settling of sediments. The depth of the detention pond is deeper than the ideal recommended dimension to ensure maximum storage capacity. The trade off also resulted in less aerobic (oxygen) activities, thereby lengthening the time required for the biofiltration process. The locations of the future residences on the three properties were fixed to specific locations to minimize the amount of fill necessary for preloading.

The developer agreed to very stringent design guidelines for the size and location of the buildings and to undertake registration of restrictive covenants on title to protect the detention pond, the water channel and the riparian vegetation. The City Engineering Department committed to a regime specified by the landscape architect for the maintenance of the water channel along Celtic Avenue and the detention pond to preserve the long term biofiltration capacity of the system. Instead of sending maintenance crews to mow down the vegetation in "ditches" to keep them looking "tidy", City crew would selectively prune and thin to maintain visibility for vehicles and pedestrian on a "as need basis".

This project was going through the final stages of development permit application at the time of this thesis. Some of the earthwork has begun in order to minimize disturbance to the aquatic habitat during active seasons. The developer will complete the detention pond, greenway and the planting scheme for the slope adjacent to the greenway, detention pond and the watercourse. The lots will be marketed once the site work is completed. The design of the buildings will have to comply with the Southlands Design Guidelines and each property will have a restrictive covenant registered for the protection and maintenance of the
riparian area. The developer will retain ownership of lot 1, where the detention pond is located.

The innovation of this project included the team approach among the interdisciplinary consulting team, the client, City Department and the Environmental Agencies. The City being both the client and regulatory agency was valuable in the facilitation of cooperation among City departments that occasionally had conflicting regulatory requirement or policy objectives. In addition, the early involvement of the area residents and the open communication built good will and consensus. Only time will tell whether the residents’ involvement will continue to flourish in the form of stewardship of the detention pond and water channels upon completion of the project.

3.3.3 Gartley Point

Gartley Point is located at the eastern edge of Royston. It is predominantly a waterfront residential neighbourhood currently without any central liquid waste management system. Most of the properties are on septic systems\(^9\) that discharge directly into Bayne Sound. Most developments in this neighbourhood were constructed during the

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\(^9\) Septic systems have a holding tank, and a leach field with several leaches lines surrounded by crushed stone, which disperses material through a large area of soil. Both the tank and leach pipes are installed underground. The tank has three separate layers of wastewater: a sludge layer, composed of the heaviest sewage components; the middle clear layer of wastewater which flows outward into the leach lines to be broken down by biological processes; and the top layer composed of scum, grease, and other
1970s and early 1980s. As these and other similar on site septic systems scattered along the Vancouver Island coast approach their maximum life spans (between 20-25 years), seepage of insufficiently treated liquid effluent into the ground water and Bayne Sound will increase. The effect on the shellfish industry on the East Coast of Vancouver Island is potentially significant. Bayne Sound is currently the most productive shellfish harvest region on the West Coast (Drake, 2000).

The Comox Chapter of Project Watershed is a community based non-profit watershed stewardship group with a mandate to improve the water quality in the region. Project Watershed, in cooperation with the Ministry of Transportation and Highways (MOTH) constructed a pilot project to enhance stormwater treatment in Gartley Point. The pilot project located within a 6m wide strip of land owned by the Ministry, consisted of a trail connector to the estuary, and adjacent to a bio-engineered water channel planted with aquatic and riparian species to cleanse and detoxify stormwater. Project Watershed raised the funds, installed and agreed to provide on going monitoring of the biofiltration project. MOTH crew maintains the walkway.

Figure 3.3.13: Biofiltration Pilot Project at Gartley Point

floating substances. Part of septic system maintenance involves alternate disposal of items which will settle as sludge or scum in the tank.
The design of the biofiltration channel consists of a series of small cascading pools. This arrangement encourages silt to settle to the bottom at each pool. As well, the cascading motion ensures aeration and prevents stagnation and breeding of mosquitoes. The silt sediments on the bottom of the channels are dredged periodically to ensure that the channels remain at proper depths to function properly as a sediment pond. The plant material selected included sedges, rushes, cattails and other disease resistant perennials that are highly efficient in filtering heavy metals and absorbing other chemicals. This combination of treatments “polishes” the stormwater and the finished product is safe enough to be released back into the estuary. Project Watershed has been conducting periodic water tests for quality control. This ability to augment summer flow is particularly important during drought periods. There is an interpretive sign on the side of the water channel to explain the purpose of the watercourse. This could be a key factor for the apparent acceptance of this visually “unkempt” treatment of a “ditch” in an otherwise well maintained waterfront residential neighbourhood.

This pilot project has been in place since 1999. Periodic testing shows that the water quality after biofiltration is consistently good to excellent\(^\text{10}\). The one area where the staff from Project Watershed was unable to answer readily is the size (i.e. volume) requirement for treating specific volume of runoff stormwater. Further work in this area would be crucial for the design of similar linear biofiltration channels to be integrated into stormwater management scheme. This method of biofiltration has great potential for incorporation into most rural communities because:

- ditch/swale network systems are already in existence
- implementation costs are not prohibitive
- construction is simple. No special skills are required

\(^{10}\) Information per telephone interview with Barbara Joughin, Project Coordinator of Comox Valley Chapter of Project Watershed in July, 2001.
maintenance is relatively simple and cost effective. No special equipment or skills are required.

Why has this form of biofiltration not been more widespread? One of the most obvious observations from the Royston Visual Preference Study (See Chapter 2) is the preference of “tidy” landscape over “messy” appearance. While design can improve visual attractiveness, the promotion of an aesthetic appreciation of a “working landscape” instead of the idealization of a manicured landscape as a sign of land stewardship is equally important. This preference of “tidy” over “messy” was reflected in the current MOTH maintenance regimes of roadside ditches. MOTH staff raised issues regarding the visual obstruction of pedestrians from motorists and vice versa, the maintenance of flow capacity, and budgetary constraints as primary reasons for the current “mow and dredge” regime. Like the aesthetic preference, an acceptance of the ecological benefit of a more “messy looking” working landscape may help change some of these practices and promote the retrofitting of biofiltration in roadside ditches as a practical and cost effective means of improving stormwater quality.

Chapter 4 will summarize of the lessons learned from these local precedents and to suggest specific strategies that are appropriate to the Royston context.

11 Interview with Dan Bowen, Ministry of Highway in the Comox office, July 1999.
CHAPTER 4
SYNTHESIS

4.1 LESSONS LEARNED FROM THE LOCAL PRECEDENTS

While the three precedents varied in size of project and context, there are some common themes that contributed to their successes. The summary of these themes is presented in Table 4.1-A: Summary of Precedents' Key Features, under the following headings for clarity: Biophysical, Institutional and Socio-economic. These categories are borrowed from the organizational structure used for the Fraser Basin Management Program (Dorcey, 1991). As illustrated in Chapter 3, all three precedents successfully used "biofiltration" technologies to improve the pre-development quality, thereby contributing to the ecological well being of the ecosystem. The precedents differed in how well they achieved the other sustainability principles including economic and socio-cultural considerations. For example, while Hastings Park achieved considerable socio-cultural objectives, including intensive public involvement and the provision of recreational opportunities, it was also the most costly project, involving multiple phases.

The biophysical category discusses the natural (i.e. physical and environmental) attributes. The institutional category covers the levels of governments, agencies, developers and citizens' organization that contributed to the success. The socio-economic category speaks to the community support and the fiscal input that was necessary to carry out the projects. The biophysical, institutional and socio-economic considerations are tools for structuring and conceptualizing relevant issues. This analytical framework using the biophysical, institutional and socio-economic categories are not limited to the stormwater management process chosen. Once the issues have been established using this format, the solutions and the individual evaluation indicators/criteria can be developed under these categories to suit specific situations for implementation and evaluation of any plan. However, the development of the evaluation indicators/criteria is not provided, as it is not within the scope of this thesis.
### Table 4.1-A: Summary of Precedents' Key Features

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>HASTINGS PARK</th>
<th>CELTIC AVENUE</th>
<th>GARTLEY POINT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BIOPHYSICAL</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Stormwater processing capacity of the land</td>
<td>Major site restoration required to improve storage and soil capacities to process stormwater</td>
<td>High existing capacity that needed to be maintained/enhanced</td>
<td>The capacity has to be created by constructing new pools, channels and planting appropriate plants</td>
</tr>
<tr>
<td>• Topography</td>
<td>Major regrading required to create ponds and riparian area</td>
<td>Major earthwork required including new channels, detention ponds and flood protection dykes</td>
<td>Cascading water channels created to take advantage of the topography and gravity to facilitate sedimentation and to increase storage capacity</td>
</tr>
<tr>
<td>• Quality of Riparian Vegetation</td>
<td>All new planting of mostly native species. Seems to be functioning well both as habitat and stormwater management</td>
<td>New configuration will cause removal of most existing naturalized vegetation. The strategy is to retain where possible, relocate where practical, and replace where necessary</td>
<td>The small scale and the hands on nature of the project enabled total control for plant selection and placement. All planting material was new and selected for specific stormwater filtration characteristics</td>
</tr>
<tr>
<td><strong>INSTITUTIONAL</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Owner/Developer</td>
<td>The City of Vancouver is both owner &amp; developer. It was prepared to look at alternative stormwater management solutions beyond the status quo engineering standards for the public good. The ability to put public benefits above profit</td>
<td>Same as Hastings Park</td>
<td>An international N.G.O. in North America, Project Watershed initiated a partnership with the owner, Ministry of Highways to install a pilot project. Again, the public good was the primary consideration.</td>
</tr>
</tbody>
</table>
**Linking Visual Preferences to Planning Sustainably:**  
*Using Stormwater Management in a Rural Community as a Case Study*

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>HASTINGS PARK</th>
<th>CELTIC AVENUE</th>
<th>GARTLEY POINT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>and the willingness to &quot;experiment&quot; were key elements.</td>
<td>Same as Hastings Park</td>
<td>The application did not have to go through municipal/Regional District regulatory processes because of the involvement of the Provincial ministry. This partnership avoided red tape all together. However, as courtesy to the local government, Project Watershed worked closely with Regional District staff throughout the process to ensure support from all levels of government and to educate bureaucrats on innovative stormwater management techniques.</td>
</tr>
<tr>
<td>Governmental agencies</td>
<td>When the client and one of the main approving agencies were one and the same, there existed a certain level of comfort. This could facilitate better cooperation and coordination for trying out new ideas and resolving issues. It could also help assure the long term maintenance of the stormwater management systems.</td>
<td>Same as Hastings Park</td>
<td></td>
</tr>
<tr>
<td>Public</td>
<td>The push by the residents to acquire adequate park and recreational facilities was instrumental in sparking the project. Their continuing input and support, as steering committees, funding sources, volunteers, and future stewards of the facilities are keys to the success.</td>
<td>The active Southland Residents' Association was instrumental in ensuring that the developer kept the ecological (aquatic habitat) and social (recreational greenway) agenda alive. The proper long term maintenance of the water channel, pond and associated</td>
<td>While the general public was not directly involved in initiating this project, it was a local stewardship group that organized, proposed and funded the project. The same group also constructed the project and took on the maintenance and the public education role.</td>
</tr>
</tbody>
</table>

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## Linking Visual Preferences to Planning Sustainably:
*Using stormwater management in a rural community as a case study*

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>HASTINGS PARK</th>
<th>CELTIC AVENUE</th>
<th>GARTLEY POINT</th>
</tr>
</thead>
<tbody>
<tr>
<td>riparian areas could depend on the support from the public-politically or via volunteer stewardship groups.</td>
<td>education role.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Socio-economic

| Approach to solution | An interdisciplinary approach was taken to conceptualize the possible solutions. Wide public consultation processes as well as public involvement (design ideas, funding) were involved in all stages. Multiple media (new paper, public mail outs, community groups and community centre postings) and technological processes (City of Vancouver website) were used to generate interest, collect comments and to keep the community abreast throughout planning and the implementation of the project. | Similar interdisciplinary approach was taken to conceptualize and problem solve. The decision by the City to consult the public early on in the process was the one of the keys to gaining public support for the project. The cooperation of the various City departments and levels of government also contributed to the successful resolution of conflicting demands and issues (e.g. utility locations, greenway and watercourse location and size etc.) | A public/semi-private partnership was an innovative approach to promote pilot project especially in communities that may on have either local knowledge or financial resources to initiate these programs. The public education component (interpretive signage and promotion of the pilot project at conferences and stewardship organization networks) is also worth noting as precedents for future projects. |
| Cost | This is a once a lifetime, multi-phased mega-project that will cost over $20,000 (1998 dollars) to complete. | The project cost was estimated at around $450,000. This high up front cost was only feasible because the cost of land to the City was extremely low. | The cost (excluding land purchase) is low (< $10,000) assuming volunteers do most of the construction and maintenance work. |
**LINKING VISUAL PREFERENCES TO PLANNING SUSTAINABLY:**
*Using stormwater management in a rural community as a case study*

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>HASTINGS PARK</th>
<th>CELTIC AVENUE</th>
<th>GARTLEY POINT</th>
</tr>
</thead>
<tbody>
<tr>
<td>extremely low (through tax default). It may not have been a financially viable project if a developer had to pay current land value to purchase the land on top of the mitigation costs.</td>
<td>work.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Alternative resources</strong></td>
<td>The community at large, and specific ethnic communities with special ties in the area were looked upon to fund part of this mega project. New, steering committees, neighbourhood stewardship groups and community groups (schools, community centre etc.) were mobilized to support the project. The most current engineering technologies (storm sewer separations, construction techniques, etc.) were combined with natural processes to store and treat the stormwater.</td>
<td>Other than technical expertise, few alternative resources were involved.</td>
<td>Alternative resources had been used extensively in this pilot project from funding sources, partnership arrangement to the low tech approach are examples that apply well to rural communities.</td>
</tr>
</tbody>
</table>
4.2 STORMWATER MANAGEMENT PRACTICES APPROPRIATE FOR ROYSTON

4.2.1 Local Relevance

The purpose is to match stormwater management practices to the landscape visual preference of Royston residents to promote best management practices that:

- Meet the community goals as set out in the Official Community Plan and the Local Area Plan
- Demonstrate financial feasibility for both construction and long term maintenance
- Improve ecological functions in the watershed and the water quality
- Provide amenity for the community including recreational opportunities and improved visual qualities

The successful incorporation of stormwater management practices that meet these criteria into future stormwater management strategies for Royston will demonstrate their applicability to other coastal rural communities in British Columbia. In this way, the Royston case study will also become a pilot study for implementation of appropriate stormwater management strategies and become an evaluation site in the future.

The precedents described in Chapter 3 utilize some of the most current and effective on-site management practices. This section selectively describes some of these and other technologically appropriate practices that are applicable in a rural context. Best Management Practices for protecting stormwater runoff during construction will not be discussed. Particular emphasis has been paid to select on-and-off site post construction best management practices (BMPs) that are cost effective, simple to install and easy to maintain to respond criteria set out in Section A (i) Context: Planning in Small Towns from Chapter 1. The BMPs described in this chapter have the following in common:

- Incorporation of some form of natural biofiltration processes
LINKING VISUAL PREFERENCES TO PLANNING SUSTAINABLY: Using stormwater management in a rural community as a case study

- Minimal human or technological interventions once in place
- Reflection of the visual preference of the public landscape established by the Royston Visual Preference Survey (See Chapter 2)

Conventional engineered solutions to stormwater treatment generally come with a high capital costs, continued maintenance expenses, and high replacement costs. The advantages and disadvantages of an alternative stormwater management treatment system (kerns, 1999), such wetlands, are summarized below:

DISADVANTAGES
- Land Intensive
- Not appropriate for high "total suspended solids (TSS)"/"biological oxygen demand (BOD)"
- Two summers required for startup
- Performance can be variable

ADVANTAGES
- Long retention time
- Tertiary treatment
- Reliable
- Competitive capital cost
- Low operating and maintenance costs
- High people and wildlife values
4.2.2 Discussion of Best Management Practices

In general, practical alternative stormwater treatment falls under five groups: pods, wetlands, infiltration systems, filtering systems and open channel systems\(^1\). These systems are described in detail in the Land Development Guidelines for the Protection of Aquatic Habitat previously mentioned and will not be repeated here. A brief summary is provided in Table 4.2-A: Acceptable Stormwater Treatment Practices, to facilitate discussion on applications specific to Royston that follows.

The following practices have not been included because they do not contribute to the improvement of water quality and some of them are engineered solutions that require long-term maintenance of mechanical systems:

- **Stand-alone Detention practices** such as temporary detention systems that reduce the peak flows without improving water quality.
- **Oil/Grit Separators** that are best incorporated as part of pretreatment of another practice or in retrofit situations when all others are not possible
- **Hydrodynamic Devices** that are similar in principle to oil/grit separators to accommodate peak flows.
- **Pollution Prevention** while extremely effective is not included because it is not an actual “treatment”.
- **Site Design** such as riparian buffers, rooftop disconnection, and reforestation are practices that can be incorporated into a stormwater management plan. Any regulatory control to minimize/limit impervious cover can reduce the volume of stormwater that requires treatment.

The stormwater treatment systems discussed in Table 4.2-A are proven and recognized stormwater best management practices. They can be adopted for application in Royston taking into consideration its rural context, economic realities and local visual preferences.

\(^1\) [http://www.stormwatercenter.net/Manual_Builder/acceptable_practices.htm](http://www.stormwatercenter.net/Manual_Builder/acceptable_practices.htm) describes a series of "Acceptable Stormwater Treatment Practices"
Instead of accepting conventional engineered solutions that require a large capital expenditure and maintenance costs of building a treatment plant and the associated infrastructures, considerations should be given to these alternatives that combine proven effectiveness and adaptability. These stormwater treatment practices can be used to retrofit existing situations, or incorporated incrementally as development occurs or funds become available. The flexibility of these systems responds well to market needs and specific site conditions. It is the resistance of approving agencies to accept these practices in lieu of conventional systems that hinders more wide spread use of alternative stormwater treatments.
Table 4.2-B: Acceptable Stormwater Treatment Practices

<table>
<thead>
<tr>
<th>GROUP</th>
<th>PHOTOGRAPH/GRAPHICS</th>
<th>DESCRIPTION</th>
<th>EXAMPLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Ponds</td>
<td></td>
<td>A combination of permanent pools, extended detention or shallow marsh</td>
<td>Dry pond, wet pond, combined wet/dry pond</td>
</tr>
<tr>
<td></td>
<td>Dry Pond in Brandt,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Guelph, Ontario</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fishtrap Creek</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Detention Ponds,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Abbotsford, B.C.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Freshwater Marsh,</td>
<td>Shallow marsh areas created to treat urban stormwater and often incorporate</td>
<td>Shallow fresh water wetlands, Salt marsh, pond &amp; wetland system, pocket</td>
</tr>
<tr>
<td>2. Wetlands</td>
<td>location unknown</td>
<td>small permanent pools/extended detention storage</td>
<td>wetland</td>
</tr>
<tr>
<td></td>
<td>Fraser River Estuary-Salt water marsh</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Photo: R. butler CWS)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Freshwater Marsh,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>location unknown</td>
<td></td>
<td></td>
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</tbody>
</table>
### 3. Infiltration Systems

<table>
<thead>
<tr>
<th>PHOTOGRAPH/GRAPHICS</th>
<th>DESCRIPTION</th>
<th>EXAMPLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre and post construction shots of an infiltration trench demonstrating its flexibility to blend into the open space</td>
<td>A system that captures and temporarily stores the stormwater before allowing it to infiltrate into soil.</td>
<td>Infiltration Trench, Infiltration Basin, dry well</td>
</tr>
</tbody>
</table>

**Dry well options to suit sites of varying sizes**

![Dry well diagram](image)

**NOTES**

*UPLAND WATER THREATS ARE INCOMPATIBLE INFILTRATION TRENCHES*
### 4. Filtering Systems

<table>
<thead>
<tr>
<th>PHOTOGRAPH/GRAPHICS</th>
<th>DESCRIPTION</th>
<th>EXAMPLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hastings Park “Sanctuary&quot; that incorporates ponds, marshes and open channels</td>
<td>A system that captures and temporarily stores the stormwater before passing it through a filter bed of sand, organic matter, soil or other medial. The filtered runoff may be collected and returned to the regular stormwater flow or soaked into the ground</td>
<td>Surface sand filter, underground sand filter, perimeter sand filter, organic filter, biofiltration using plant material</td>
</tr>
</tbody>
</table>

### 5. Open Channel Systems

<table>
<thead>
<tr>
<th>PHOTOGRAPH/GRAPHICS</th>
<th>DESCRIPTION</th>
<th>EXAMPLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Landscaped open channel in Ann Arbor, MI</td>
<td>Vegetated open channels that are explicitly designed to capture and treat the stormwater</td>
<td>Dry swale, wet swale, grass channels</td>
</tr>
<tr>
<td>Biofiltration channel at Gartley Point, Royston</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4.3 STORMWATER MANAGEMENT PRACTICES FOR ROYSTON

4.3.1 Royston Context

While a detailed watershed-specific planning analysis and physical infrastructure design are beyond the scope of this thesis, a baseline overview of the biophysical make up of the region is necessary for an understanding of the importance of stormwater management in Royston.

According to information from the Ministry of Water Lands and Parks, Royston is part of a 413 ha. aquifer formation which underlays an extensive area from Royston, north to Courtenay, west to Puntledge and south to the Trent River.

Figure 4.3.1: Aquifer Boundary
Figure 4.3.2 summarizes all the sensitive ecosystems classified by the Sensitive Ecosystems Inventory for East Vancouver Island and Gulf Islands. Not all of the ecosystems are present in Royston. The ecosystems that are applicable include:

- **Coastal Bluff (CB):** e.g. Balmoral Beach, Comox
- **Wetland (WN):** e.g. marsh area along Marine Drive, railway marshes along parts of the rail line
- **Wetland (marsh along Marine Drive, Raven Lands, part of the Raven property**

![Pie chart showing the percentage of ecosystems in East Vancouver Island](image)

Figure 4.3.2: Sensitive Ecosystems Classification as a percentage of ecosystems of all classified land base in East Vancouver Island

- **Riparian (RI):** along all the major river systems and their tributaries such as Trent River and Roy Creek (see Figure 4.3.1).
- **Older second growth forest** is the dominant ecosystem of the undeveloped areas in Royston. The area adjacent to the Trent River is the largest mapped second growth polygon on East Vancouver Island and the Gulf Islands. **Seasonally Flooded Agricultural Field (Gartley Point-Feeley Farm)**
- **Older Second Growth Forest** (undeveloped areas)

A Liquid Waste Management Plan (LWMP) is crucial to any future development opportunities. Royston currently handles all its liquid waste by septic systems. Most of the septic systems are near the end of their serviceable life. Many citizens are facing bills of
between $10,000 and $30,000 to repair or install new septic systems. More troubling is the fact that most of Royston does not have the required 4’ sandy substrate required for the optimal functioning of septic systems. It becomes apparent during the Royston LAP process that it would be useful to provide alternative stormwater management research as background to any future LQMP to be considered by the community, alongside with or as an alternative to the standard costly “pipe and treat” engineered systems for treating stormwater. This desire is captured by the objectives in the Royston Local Area Plan under Section 1.0 Environmentally Sensitive Areas:

- To use a watershed based approach to address flood control, water quality improvement, stormwater management, habitat protection, recreation, groundwater capture and neighbourhood enhancement
- To limit development in environmentally sensitive areas
- To integrate development sensitively with natural systems
- To ensure conservation principles guide future residential, industrial and commercial development

While stormwater management should take place at every opportunity in Royston, several specific locations deserve special consideration because of ecological importance, geographical prominence, community attachment or suitability for bio-filtration enhancement. They include:

- The foreshore area along Marine Drive
Figure 4.3.3: Gartley Point (Feeley Farm) in relation to the Trent River and the regional context of Baynes Sound

- Gartley Point (Estuary on Feeley's Farm)
- Roadside ditches throughout Royston
- On site stormwater management practices

These areas are identified on the map in Figure 4.3.4 Suggested Stormwater Management Strategies for Royston. A brief discussion on the rationales for identifying site specific and general site stormwater management practices follows the map.
SUGGESTED STORMWATER MANAGEMENT STRATEGIES FOR ROYSTON

- Comox Harbour: Slow down stormwater outflow and Roy Creek with additional planting and realignment of the creek as development occurs. Create salt marsh to polish stormwater.
- Feeley Farm: Enhance salt marsh and preserve as estuary.
- Gartley Point: Introduce biofiltration to existing roadside ditches where practical to improve stormwater quality.
- Baynes Sound: Encourage on site stormwater detention and treatment to be incorporated into new subdivisions or development projects.

Figure 4.3.4: Management Strategies for Specific Locations in Royston
4.3.2 Foreshore enhancement at the Waterfront along Marine Drive

Figure 4.3.5: Existing Foreshore Conditions

Marine Drive and the scenic foreshore were identified as the most "favorite" Royston landscapes by the visual preference study (See 4.3.5). The qualities cited included dynamic landscape, ecological value, recreational opportunities, and wildlife viewing. A naturalized shrubby buffer of mostly blackberries and a few volunteer pioneer species trees and shrubs such as cottonwood, alder and native roses dot the shore side along Marine Drive.

Currently, there is an unimpeded view to Comox Harbour, the old pier (See 4.3.6) and the community built picnic area (both identified as "Royston features" in the survey). There are plans to restore the old pier with a public-private partnership in the near future.

On the other hand, the lowest reaches of Roy Creek that abuts Marine Drive south of Royston Road have been channelized and armoured with concrete (See Figure 4.3.7) and thus limits the short-term potential for cost-effective implementation of stormwater management initiatives. The stormwater outlets along Marine Drive carry significant volumes of stormwater from the developed areas in Royston. The stormwater is collected in ditches along the roads of Royston, culverted under the Old Island Highway, redirected along ditches on the west side of Marine Drive, culverted again to cross the Marine Drive and emptied into Comox Bay. Roy Creek meets the ocean adjacent to one of these outlets; consequently, there is a high volume of stormwater...
traveling at high speed at this location. The salt marsh on the beach side of Marine Drive slows down the flow and ease the transition from Roy Creek into Comox Bay.

In addition, because there are no designated parking areas along the foreshore, and the ditches along the west side of Marine Drive prevents roadside parking, many visitors simply use the open portions of the beach, adjacent to the Royston Pier as parking (See Figure 4.3.8). This practice causes concern for potential pollution to the water just before it reenters into the ocean, as well as the negative visual impact it has on the scenic qualities of the foreshore.

Some of the foreshore area along Marine Drive has been naturally revegetated by various species of vegetation including blackberries, cottonwood, alder and willow. Blackberries are dominant. While these bushes are vigorous growing, and they provide forage and habitat for some birds and small animals, and contribute to erosion control, they are not as effective as other plant material such as willow, cattail or red oizier dogwood for biofiltration. Therefore, consideration should be given to the enhancement of the salt marsh along the foreshore by introducing a diversity of salt tolerant trees, shrubs and grasses: such as cottonwood, alder, willows to slow down the water flow with grasses, sedges and rushes. This will benefit the water quality and help mitigate erosion.
The channelized portion of Roy Creek can be rehabilitated, as redevelopment takes place along the creek, by realigned to more natural river morphology or incorporating a series of pools and weirs (United States Department of Transportation, 2002) and to reestablish the riparian vegetation (See Figure 4.3.9). These areas can be further protected through the use of restrictive covenants or right-of-way agreements.

There are also two previously contaminated sites owned by petroleum companies along the foreshore currently under remediation on Marine Drive. Opportunities to incorporate visitors parking and wetland/detention ponds on the redevelopment of these sites to further slow the stormwater flow should be considered. Consideration should also be given to ban vehicular traffic (except local traffic from Marine Dr. residents) on Marine Drive and to convert the road right of way to a recreation and ecological greenway.

4.3.3 Estuary at the mouth of Trent River (Feeley Farm)

The Feeley farm (See Figure 4.3.10) has been a family operated dairy farm on the delta of Trent River for over 100 years. Over time, the physical characteristics of the portion of the farm north of the Trent River evolved from dry farmland to being seasonally inundated. This portion is no longer suitable for farming and has essentially naturalized into an estuary and a wildlife reserve. This estuary is a favorite resting and nesting site for migratory and shore birds. The residents of Gartley Point use the unofficial "estuary" for passive recreation (bird
watching and walking) and the landowner has traditionally permitted the public access onto the farmland. The estuary walk has become so popular that it is slowly in danger of becoming a victim of its own success. For instance, unfortunate incidents involving unleashed dogs frightening livestock and littering on the farm are becoming more frequent. Since the farm owner has expressed an interest in turning over the estuary portion of the farm to public ownership, the Regional District or an appropriate NGO should take this opportunity to formally acquire the land and conserve this ecologically rich estuary for future generations. A dyke and riparian planting to deter bank erosion and intrusion of recreational activities onto the farm need to be considered as compensation to the farm owner for dedicating the ecological reserve.

4.3.4 Adopt On-site Stormwater Management on a Project Level

Besides adopting best management practices, such as the Land Development Guideline by the Ministry of Water, Land and Parks, during construction to minimize siltation and disturbance to vegetation, Royston can institute a policy for on site storm management. The premise can be as simple as to maintain/improve the pre-construction infiltration rate of the development site after development.

A more holistic approach, however, would be to have a watershed wide stormwater management plan in place that monitors the function of the Roy Creek to Trent River watershed. The planning boundary in the Royston Local Area Plan approximates the natural watershed boundary except where municipal boundary conflicts with the geographical boundary. The advantage of this approach would be the availability of a framework to make management decision regarding stormwater management on a watershed scale. For example, rather than installing a costly detention pond or system on a project where the topography or soil is not suitable for stormwater treatment, the stormwater generated on that specific site may simply be allowed to be lightly treated by grass swales and conveyed off site. The developer in this instance may be permitted to make a financial contribute or to carry out an off-site mitigation project, identified by the watershed based stormwater management plan that would have a more positive impact on the overall health of the watershed.
This watershed based management system is not new. Other communities on Vancouver Island have adopted watershed based stormwater management. The Corporation of the District of Central Saanich, in collaboration with the Province, volunteer groups, University of Victoria and the development community have improve water quality in 18 projects around the Colquitz River Watershed in Central Saanich (Lucey, 2002) via stormwater management initiatives as part of development requirements. The projects include small condominium building, residential subdivisions and high-tech industrial park.

On a smaller scale, individual homeowners can also detain stormwater on site during peak flow and improve water quality using some of the same techniques outline in Table 4.2-A Acceptable Stormwater Treatment Practices. In particular, by directing rainwater collected in gutters to infiltration trenches, smaller wet/dry detention ponds, or dry wells are practical ways to provide cheap and effective small scale on site treatment. By directing rainwater toward the grass swales, dry wells and other infiltration systems, oils, fertilizers, herbicides, etc. do not flow directly into the storm system in heavy rains (See Figure 4.3.11). The detention time allows most of the pollutants to be absorbed into the soil. Soil bacteria consume the hydrocarbons in the oil and filter it naturally. The guiding principle here is to disconnect storm drainage from the watershed with vegetation or areas that allow in-soak. These methods help recharge ground water by allowing water to soak into the ground over time rather than running into streams.

Refer to http://www.vitp.ca/Location/default.asp for more information on the site.

3 Refer to http://www.vitp.ca/Location/default.asp for more information on the site.
4.3.5 Biofiltration Planting in Existing Roadside Ditches/Swales

Royston Road is the main east-west road that connects the Old Island Highway through Royston, Cumberland to the recently completed Inland Highway. Royston Road was historically route taken by residents from the booming mining town of Cumberland to their seaside cottages in Royston to “get away from the pollution”. Royston Road remained the only road access to Cumberland until the recent completion of the Island Highway to provide an alternate route.

As most of Royston still has open ditches, it would be prudent to explore the incorporation of biofiltration processes in the ditches to slow the flow and to enhance stormwater quality rather than opting for the conventional culverts and pipe solution as development occurs in Royston.

As well, the adoption of a visually explicit alternative stormwater treatment system, similar to the biofiltration project at Gartley Point discussed in Chapter 3, can become a symbol of the community’s ecologic sensitivity and become an community identification feature that sets Royston apart from other Island communities.

One major objection that has to be overcome is the visual aesthetic of this aspect of the working landscape. For example, in the visual preference survey, even respondents who identified the foreshore along Marine Drive, streams and riparian areas as desirable landscape feature would identify “ditches” as undesirable. Ditches (See Figures 4.3.13 and 4.3.14) are associated with requiring “lots of work to keep neat” (i.e. to maintain manicured lawns extending to the bottom of the channel). The ecological importance of the natural vegetation in the foreshore and riparian areas adjacent to streams is acknowledged and
accepted by most respondents; however, the biofiltration quality of vegetation in swales, which serves the same function as riparian vegetation, is apparently not recognized (See Figure 4.3.15).

This disconnect between ecological knowledge and visual preference for specific landscape features coincides with the research work cited in Chapter 1 (Gobster, Daniels). Ways to overcome this include:

- Exploration of more aesthetically pleasing design of biofiltration planting
- Better communication of the intent and benefits of the working landscape through interpretative signage and education programs
- Public involvement in the planning, planting and maintenance of the biofiltration channels
Figure 4.3.15: Both Respondent 2 and 9 identify the foreshore, the estuary and the creeks as aesthetically desirable and ecologically important landscape

- Turning the biofiltration channels into linear greenways that incorporate public amenities such as benches, cycling paths etc. and to provide connections to recreational and community nodes such as connecting Royston Community Hall to Royston Elementary School, Fallen Alder Hall and the adjacent sports field.
CHAPTER 5 CONCLUSIONS

5.1 USING VISUAL PREFERENCES TO PROMOTE SUSTAINABLE STORMWATER MANAGEMENT PRACTICES

This thesis uses stormwater management as a case study to explore the relationships between visual preferences and sustainability, and the implications of these relationships may have for planning practices. The structure of the innovative, open-ended visual preference survey piloted in this thesis generated richly layered information specific to Royston that have applications far beyond stormwater management. The information can be used to shape planning policies as well as forming part of the evaluation criteria for the selection of planning options.

Stormwater management was used as a case study to test the survey methodology as a valid planning tool to promote sustainability. The visual preference survey results represented the Royston community aesthetic and how the residents saw their community individually and collectively. The collective “community aesthetic” reflected “on the ground” manifestation of the evolution of Royston as a community, the impact of past planning policies, environmental practices, and what public amenities that have been economically possible to provide to date. The Royston community aesthetic demonstrates a preference for landscapes which in some cases can be considered more sustainable, and in other cases, less sustainable. Specifically, it demonstrates some incongruence between sustainability and preference in stormwater management infrastructure.

The extent of citizen participation in the visual preference survey was high (approximately 40% return rate of completed survey). In addition, many of those who participated provided additional or detailed information not requested by the survey, which suggested that the participants might have found the “hands-on approach” of this survey methodology more engaging than conventional public input methods.
Unfortunately, even though planning practices are becoming more participatory and practitioners and the general public is becoming more aware of sustainable stormwater management alternatives, it may take generations before "ecological landscape" becomes an aesthetically preferred landscape. Paradigm shift of this nature can happen over long periods of time. For the time being, visual preferences that reflect community aesthetics can be used to inform planning policies and design in order to increase public acceptance of more sustainable measures in the public realm.

5.1.1 Exploring the Incongruence Between Aesthetic Preferences and Sustainability in Stormwater Management

There may be ways, in the context of stormwater management, to bridge some of the gaps that exist between aesthetic preferences and sustainability. The incongruence of ecological knowledge and aesthetic preferences noted in research (Gobster (1993), Schulhof (1989), Nassauer (1099), Shelby (1992)) and demonstrated by the visual preference study results in Royston perhaps holds one of the keys to public acceptance of alternative stormwater treatment options. People, despite their basic knowledge of ecological functions, tend to associate engineered solutions as "dependable", "clean", "scientific", and therefore better, regardless of the capital and maintenance costs. For example, the town of Kimberley, British Columbia, population 7000, is currently considering a capital investment for a $20 million treatment facility that would produce guaranteed "quality drinking water" (Lucey, 2002)! The $20 million does not cover maintenance costs and the long term costs represent a massive drain on community resources. The importance of water quality is beyond dispute. Nonetheless, the economics as well as the long-term sustainability of these solutions need to be carefully weighed and considered. More detailed information on both ecological knowledge and economic costs and benefits may, over time, convince more communities to adopt more sustainable stormwater management practices.
Other communities are taking a more practical "return to the future" approach and experimenting with more natural ways to maintain/improve water quality. Hopefully, the success of these pilot projects will propel these sustainable alternatives to become common practices and assist society to accept a working landscape as aesthetically beautiful or at least acceptable. Along these lines, the neighbouring village of Cumberland has adopted a holistic tertiary treatment for their sewage and stormwater. Cumberland is in the process of constructing a wetland system for secondary and tertiary treatment (See Figure 5.1.1). The council and citizens carefully considered the ecological and economic advantages and disadvantages of such a system. Based on this analysis, Cumberland voted overwhelmingly for this alternative treatment in 1999. It will be interesting and perhaps instructive to see how the community reacts to the visual appearance of this more sustainable alternative.

This awakening of interest in sustainability has had broader implications in Cumberland. The village has recently approved its first new subdivision based on "Smart Growth".

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1 Smart Growth, as defined in the Smart Growth Definition and Policies by the City of Asheville, North Carolina, is a development pattern that makes efficient use of our limited land, fully utilizes our urban services and infrastructure, promotes a wide variety of transportation and housing options, absorbs and effectively serves a significant portion of the future population growth of Buncombe County and Western North Carolina, protects the architectural and environmental character of the City through compatible, high quality, and environmentally-sensitive development practices, and recognizes the
principles. The goal of Council is to use sustainable development to distinguish Cumberland from other communities on Vancouver Island as a means of attracting new residents and business investments. The outcome of these strategies is yet to be seen. In any case, better upstream water quality from Cumberland can only be beneficial to the aquatic health of Royston and the Baynes Sound. While ideally, all communities should embrace sustainability, it has not been the case to date. Therefore, Royston could take a page from Cumberland's chapter and incorporate sustainable development principles into the community identify to set it apart from the adjoining communities and to lead the way towards building more sustainable communities.

The following highlights learned from the three local precedents described in Chapter 4 that can be applied to Royston:

• Proven natural systems using biofiltration techniques can be relied on to treat stormwater rather than to depend on technologically complex mechanical systems
• Stormwater treatment can happen at any scale from the home backyards, subdivision by subdivision, or as community wide initiatives.
• Stormwater management can be retrofitted or incorporated from the beginning
• Stormwater management can be incorporated into public open spaces that provide community amenities

5.1.2 Practical Approaches to Mitigate the Disconnect between Sustainability and Visual Preferences for Stormwater Management

The author believes that the common disconnect between visual preference and ecologically sustainable stormwater management practices observed by other researchers and supported by the Royston Visual Preference Survey results can be overcome to some degree. Some of the means of achieving a stronger linkage include the following:

City's role as a regional hub of commerce and employment. Inherent to this definition is the need to implement Smart Growth through comprehensive, consistent and effective policies, regulations, capital projects and incentives. (Source: http://www.ci.asheville.nc.us/business/smart.htm)
LINKING VISUAL PREFERENCES TO PLANNING SUSTAINABLY:
Using stormwater management in a rural community as a case study

- Design stormwater management treatments to be more visually acceptable by using landscape design techniques to combine more conventional aesthetics and ecological functions.

- Turn the roadside ditches into biofiltration channels and incorporate a linear pathway that provides public amenities such as benches, cycling paths, etc., and to provide connections to recreational and community nodes, in order to multiple public benefits to the community.

- Promote alternative stormwater management treatment practices as a means of incorporating the community's values in a visible manner in the public landscape,

**Figure 5.1.2: Interpretive signage at the Gartley Point Biofiltration Channel Project explaining the project concept**

and to use stormwater management as a way to enhance the community’s identity aesthetically and to maintain “rural character”. Communicate the intent and benefits of the working landscape through interpretative signage and education programs.
LINKING VISUAL PREFERENCES TO PLANNING SUSTAINABLY:
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(See Figure 5.1.2) to remind the public about the ecological functions of the stormwater system

- Ensure that the important socio-cultural community features not commonly identified in the usual inventory processes are protected and enhanced as part of an overall community improvement/beautification plan linked directly to the stormwater management program
- Find more appropriate economic alternatives that achieve the required technical performance criteria as well as conform to the local community aesthetics
- Use collaborative design processes to incorporate community in the design from the onset and build acceptance and to incorporate local knowledge

5.2 APPLICATION OF VISUAL PREFERENCES IN THE PLANNING CONTEXT

While achieving complete compatibility between visual preferences and stormwater management practices may be impractical, it is possible to use visual preferences to help prioritize a community's stormwater management goals and objectives. In the larger planning context, visual preferences will become one of the criteria among others, which include ecological benefits, financial feasibility, regulatory constraints, and so on.

A visual preference survey, such as the pilot study for Royston, can help prioritize these goals and objectives according to community aesthetics and values. Table 2.6-B “Visual Preferences Results and Sustainability” demonstrated that Royston residents visually prioritized socio-cultural aspects over ecological and economic concerns. This prioritization was not apparent from the Local Area Planning process. The visual preference-based prioritization can be compared with the goals and objectives set out in the Comox Valley OCP and the Royston LAP for concurrence or conflicts in order to assess the degree on congruence (or otherwise). In this way, inconsistencies can be addresses. If solutions to achieve such reconciliation are not readily available, then at least it can be noted in the
process and addressed, or at the very least, made apparent in the decision-making processes.

5.2.1 Planner’s Roles in Promoting Wider Applications of Visual Preference Survey to Encourage Sustainability

On a macro level, the implementation of sustainable practices in communities can be eventually traced back to specific planning documents that guide the development of these communities. Official Community Plans, Local Area Plans, Neighbourhood Community Plans and specific performance standards and design guideline documents provided the means to implement sustainable practices. As such, planners can be, in extreme cases, earnest promoters or unwitting preventers of sustainable developments. The application of sustainable practices in the planning process must be applied across all aspects of the process from inception in order to achieve its full potential.

A conventional community planning process that follows the “shopping list” approach of covering each “required area of inclusion” as stipulated by the Local Government Act, generally produces a systematic but potentially disjointed plan. Planners can use the knowledge from visual preference studies to make comparisons with the community’s vision as set out in its official community plans, local area plans and neighbourhood plans. Visual preferences can help identify specific local issues and may assist in choosing appropriate solutions that meet the aesthetics expectations of a community. Visual preference surveys may help identify:

- Concerns not apparent from conventional planning public input methodologies (public open houses, workshops, visioning sessions, etc.)
- Potential conflict between the Official Community Plan/Local Area Plan and the ‘community’s image of itself gleaned from the visual preference survey results
- Where community education needs be concentrated/expanded

- Planners should understand and promote the benefits of incorporating sustainability into community plans, and integrate the new information arising from visual
preference studies. For example, by incorporating best management practices into local stormwater management appropriate to the rural Royston context, it appears possible to achieve maximum performance in ecological functions and maintain socio-cultural values in a most economically responsible manner.

On a policy level, planners and politicians can further assist in the promotion of sustainable practices by:

1. Planning on a watershed scale to adopt a holistic and flexible approach to ecological issues (In the case of Royston, the Local Area Planning Boundary approximates the natural watershed boundary, taking into consideration of jurisdictional constraints)

2. Involving key stakeholders and the public from the onset in the planning, design, decision making, and maintenance processes to increase community buy-in and ownership

3. Encouraging partnership among governmental agencies, stewardship groups and local residents

5.2.2 Reflecting the Collective Priorities of a Community

In addition, as demonstrated in the pilot survey in Royston, visual preferences can be used as indicators to discern the collective priorities of a community. Traditionally, the prioritization of community goals and objectives had been done by conventional planning methodologies such as written surveys or referenda. These conventional planning methodologies are effective only for a portion of the population. As our society becomes more multi-cultural, both cultural and language barriers may prevent some residents from fully understanding the implications of, and the interconnections between, survey/referendum questions. Consequently, they might make decisions based on an incorrect or incomplete understanding of the issues/questions or based on the misinterpretation that there could be "only" one answer. In more extreme cases, to avoid embarrassing situations, some residents may choose not to participate at all. The result could be plans and policies that do not serve a large segment of the population, which in turn, may lead to widespread frustration or apathy. Relatively simple techniques such as
photographic surveys by planners or by the community themselves can help clarify local values and help prevent policy failure because a holistic approach has not been adopted.

For example, the Royston Local Area Plan devoted an entire chapter (Section 2.0 Land Use and Economy) to economic development because the residents frequently brought up responsible fiscal spending during the Local Area Planning consultation processes. This obsession on economic development was not apparent in the visual preference survey results. Instead, participants identified and confirmed other major concerns, such as the preservation of the existing rural landscape character of Royston. While it could be argued that the lack of comments regarding economic concerns was partly caused by the survey methodology itself since the visual preference survey naturally favoured visual information. However, the wide range of written comments expressed in the survey, ranging from how they use specific locations for different purposes, what they felt about specific properties should be preserved, etc., seemed to indicate that the participant felt "free" to express whatever opinions they choose to share. In this way, it would appeal that "economic concerns" were not noted by choice.

In this case, the survey findings should be considered as validation of one of the economic development objections set out in Section 2.2 Economic Goals and Objectives of the Local Area Plan, which stated:

- To provide opportunities for development of new business and employment initiatives that conform to Royston's rural character

The visual preference findings should not be used as evidence to negate the importance of economic development, but as an affirmation of the value of rural lifestyles and aesthetics over economic concerns, especially given the history of Royston as a "bedroom community" to nearby urban centers of Courtenay, Comox and Campbell River. Royston residents had been accustomed to working and shopping in the neighbouring communities.
5.2.3 Future Applications of Visual Preferences

Besides the incongruence between visual preferences and sustainable stormwater management practices, there is also the need to overcome resistance from approving agencies to accept alternative stormwater treatment practices. While it is understandable that government agencies have to exercise prudence and depend on tried and tested practices, it is also necessary, given the economic realities of most communities, to look for cheaper but equally effective means to process stormwater. Some of the ways to help bridge this acceptance gap include:

- Build more pilot projects to prove the effectiveness of alternative practices
- Monitor pilot projects over time using scientific methods to improve the efficiencies
- Document the and disseminate the results to the widest possible audience through channels such as the local, national and international chapters of professional organizations, and the media
- Use computer visualization technologies (See Figure 5.2.1) to communicate realistic looking design solutions to key stakeholders and the public to solicit input and support (Al_Kodmany, 2000)
- Utilize GIS data to provide information on the location and availability of existing infrastructures to assist in the creation of efficient design options and decision making
- Include alternative stormwater management practices in professional and trade training for engineers, planners, municipal administrators, architects, landscape architects and anyone else involved in the delivery of municipal infrastructure and services
- Provide financial comparisons for capital and operational costs of conventional systems and alternative systems to demonstrate the latter’s viability
Encourage acceptance of these systems by the public so that politicians and public sector agencies can have the “popular” mandate to try out these alternatives.

Figure 5.2.1: the University of Illinois, Chicago, combined traditional architectural hand rendering techniques with computer technologies (GIS data and mapping, PhotoShop, video and the Internet) to achieve a more participatory neighbourhood planning process in the Pilsen Neighbourhood Project, Chicago
5.3 SUGGESTED IMPROVEMENT TO THE VISUAL PREFERENCE SURVEY FOR FUTURE FIELD TESTING

In future surveys, it would be useful to include questions to derive some basic socio-economic information: age range, gender, length of residence in that location, special interest group etc. so as to track what type of respondents this type of survey attracts. Other research (Meitner, Sheppard and Harshaw, 2001) suggests that survey can capture opinions from respondents who normally do not participate in public consultation type processes such as formal presentation, open house and focus groups.

The other area for improvement to assist the administering agency to keep track, should this survey be repeated over time and in multiple locations, is the use of Geographic Information Systems (GIS), such as ArcView or ArcInfo to document and catalogue photographs received. This would provide a permanent record with spatial co-ordinates to allow for future monitoring of view over time, in a interactive format as well as to input the data in a format that would facilitate queries in the future across study sites.

Finally, if an area of disconnect between visual preference and ecological functions becomes obvious over repeated survey results, then, a revised visual preference survey incorporating an educational component may be developed and administered to compare if visual preferences change based on the newly gained ecological knowledge.

5.4 FURTHER RESEARCH NEEDS

It has been shown that people prefer landscapes that show signs of being well cared for (Alexander, 1987). Most equate maintenance of a landscape as a sign of caring, and as providing stewardship of the land (Hummon (1992), Nassauer (1997)). But, as
demonstrated by Gobster (1993), some of these visually preferred landscapes that are also perceived, as examples of good management are actually not very sustainable because of a lack of biodiversity. Such disconnects among visual preferences, ecological knowledge and sustainability affect planning decisions. Consequently, further investigation into the correlation between sustainability and “visible stewardship” (Sheppard, 2001) may yield additional insight into resolving these disconnections.

In addition, the exponential increase in accurate and realistic computer driven three-dimensional visualization technologies and delivery media, such as the Internet and immersion theatres, offer new and powerful ways to research these questions. In addition, the ease of use and increasingly affordability of these programs and facilities are making visualization an attractive alternative to the conventional communication techniques in practice. The incorporation of dynamic three dimensional computer simulation or accurate perspective sketches to compliment existing planning techniques and methods to improve communication will further minimize the need to “interpret” expert knowledge or planning jargon that sometimes frustrates the public and other disciplines.

British Columbia is blessed with many public research facilities and skilled professionals that can potentially put our province in the forefront of these technologies. If the planning profession is to remain relevant, it must embrace these new technologies in seeking a richer dialogue with communities grappling with problems of sustainability and community image, as raised by issues such as stormwater management.
 Biological Oxygen Demand (BOD)  An index of the oxygen-demanding properties of the organic or biodegradable material in water (Brooks et al., 1997). Samples are normally incubated at 20 degrees, after the dissolved oxygen (DO) is measured.

 Contaminant  A substance that is not naturally present in the environment or is present in amounts that can make the environment impure.

 Drainage Basin  (See Watershed)

 Ecosystem  A community of living organisms interacting with each other and their environment (a stream ecosystem, for instance). Damage to any part of an ecosystem may adversely affect the whole. An ecosystem like the Georgia Basin can be thought of as a single complex system or the sum of many interconnected ecosystems-streams, wetlands, and bays.

 Impervious Surfaces  Surfaces such as concrete, asphalt, and roofs that cannot absorb water. Rainfall runs off these surfaces instead of soaking through.

 Metals  Elements such as mercury, lead, nickel, and cadmium that are of environmental concern because they may degrade slowly over time. They sometimes accumulate through the food chain and in high enough concentrations can be toxic to life. Many are necessary nutrients if in very low concentrations. (Also called heavy metals).

 Nonpoint Source Pollution  Pollution that is hard to trace because it comes from many sources-lawn fertilizers, pet wastes, and soapy rinse water-rather than a single point or source. Nonpoint source pollutants are usually released in low concentrations from many activities that collectively harm water quality.

 Nutrients  Essential elements such as nitrogen and phosphorus needed by plants or animals for growth. Excessive amount of nutrients, however, can lead to poor water quality and excessive growth of algae. Some nutrients can be toxic at high concentrations.

 pH  A measure of the acidic or basic character of water. Waters too acidic (low pH) or basic (high pH) will not support animal or plant life. pH can also increase the toxic effects of other pollutants in the water.

 Point Source Pollution  Pollution that can be traced to one source, such as an industrial pipe.
Pollutant  A contaminant in an amount that negatively changes the physical, chemical, or biological properties of the environment. The term includes pathogens (bacteria or viruses), toxic metals, carcinogens, oxygen-demanding materials, and other harmful substances.

Revegetate  To plant vegetation on stream or lake banks that reduces erosion by holding the soil with its roots, provides cover and food for fish, shades the stream to keep temperatures cool, and improves wildlife habitat.

Riparian Corridor  A water body, its lower banks and upper banks, and native vegetation. Also called a stream corridor.

Sanitary Sewer System  A network of pipes that carry sewage to a treatment facility. After treatment, the water is later discharged into rivers/the ocean.

Sediment  Material suspended in or settling to the bottom of a liquid, such as sand and mud that make up much of the shorelines and bottom of streams. Certain contaminants tend to collect and adhere to sediment particles.

Storm Drain  Outdoor drain that collects stormwater and carries it directly to a lake or stream.

Stormwater Detention Site  An area (land, wetland, park, or engineered structure such as a cistern or vault) that temporarily stores or detains stormwater until it can be released slowly to a stream without causing flooding or damage downstream.

Stormwater Runoff  Water from rainfall that flows over land and is routed into the storm drainage system. (Also call urban runoff)

Stream Corridor  (See Riparian Corridor)

Suspended Solid  Particles such as sand, mud, and clay particles that float in and are carried by water. Toxicants may cling to solid particles, magnifying chemical pollution problems.

Toxic  Poisonous carcinogenic, or otherwise harmful to life.
LINKING VISUAL PREFERENCES TO PLANNING SUSTAINABLY:
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**Treatment**  Chemical, biological, or mechanical procedures applied to an industrial or municipal discharge or to other sources of contamination to remove, reduce or neutralize contaminants.

**Total suspended solids (TSS)**  The predicted sediment and phosphorus loadings measure in weight over time e.g. (Predicted TSS (kg/yr))

**Turbidity**  A measure of the amount of material suspended in the water; cloudiness. Increasing the turbidity of water decreases the ability to see through it. High levels of turbidity over extended periods are harmful to aquatic life.

**Urban Runoff**  (See Stormwater Runoff)

**Wastewater**  Where sewage treatment system is in place, water that goes through indoor plumbing drains into the sanitary sewer system. The water is treated and later discharged into lakes, rivers or the sea. For homes with septic systems, wastewater is treated on site in a septic tank.

**Watershed**  Land area that drains to a particular body of water, such as a stream, river, lake or ocean. Also called a drainage basin.

**Wetland Types**
(Source: [http://www.britishcolumbia.com/wildlife/wildlife/information/wetlands.htm](http://www.britishcolumbia.com/wildlife/wildlife/information/wetlands.htm))

There are four major types of wetlands: ponds, marshes, swamps, and peat bogs. Each has its own characteristics.

A **pond** is a well-defined basin, filled with stagnant water and fringed with vegetation. It is fed mainly by rain and snowmelt and loses water through seepage and direct evaporation and during plant transpiration. During the summer, parts of a pond may dry out, exposing mudflats. The shallow depth of a pond allows water lilies and other bottom-rooted plants to reach the surface, while milfoils, pondweeds, and other submergent plants flourish beneath.

A **marsh** is subject to periodic flooding, particularly if located near a river or lake, or in the case of saltwater marshes, near tidal waters. Consequently, its water level can change drastically. Its boundaries are not as well defined as those of a pond, and a marsh may dry out completely by late summer. A marsh is overgrown with coarse grasses, sedges, and rushes.

The water-filled potholes and sloughs of the prairies may resemble ponds or marshes, depending on their characteristics and specific locations.

A **swamp** is essentially a wooded marsh, a waterlogged area supporting trees, tall shrubs, herbs, and mosses. Still or gently flowing water covers much of the surface during wetter seasons.
A peatbog is a poorly drained area covered by mats of moss. The moss slowly decomposes in successive layers to eventually form a material called peat. There are two types of peatbogs: bogs and fens. In bogs, the process of decomposition and peat formation is further advanced than in fens, making the soil and water more acidic. The most common moss found on the surface of a bog is sphagnum moss. Other bog plants are sedges and low-growing shrubs of the heath family and sometimes trees such as spruce.

In fens, sedges are the predominant vegetation and sphagnum moss is not common, although other mosses that require less acidic conditions may grow there. Fens also support reeds, grasses, and low-to-medium height shrubs. Occasionally, too, there may be a sparse scattering of trees -- tamarack or cedar. In northern Canada, a large expanse of bog or fen is called muskeg.

Dry Wells
Add more water-holding capacity with a dry well. The porous well can reduce surface puddling in heavy rains and provide a drainage outlet for downspouts. If you don't want to see rocks, cover them with a double layer of filter fabric and sod. The fabric lets in water but screens out dirt that can clog the system.

Wetland An area of land that has standing water at least part of the year, with wet or mucky soil and plants adapted to wet conditions (cattails, willows, tall grasses, irises, etc.)
LINKING VISUAL PREFERENCES TO PLANNING SUSTAINABLY: Using stormwater management in a rural community as a case study

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APPENDIX I

- Visual Preference Survey
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<th>Picture No</th>
<th>Like/dislike/specific Royston Feature</th>
<th>Why I took the picture?</th>
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<td>E.g.</td>
<td>like</td>
<td>My favorite road to walk because of the greenery and the view to the farms.</td>
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Other features I like about how Royston looks?
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Other features I dislike about how Royston looks?
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Any problems encountered in filling out this form?
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Note: Please use the back of this page for additional comment if necessary.
Map of Rovston for marking location of photographs
APPENDIX II

- Visual Preference Survey Sample Response