

Still Creek Rehabilitation and Enhancement Study

Prepared for:



CITY OF **VANCOUVER**
COMMUNITY SERVICES
Planning Department
City Plans

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This project was also assisted by an Advisory Committee, which included the City Steering Committee and others. The time and effort of Erin Stoddard (Ministry of Water, Land and Air Protection), Ed von Euw (Greater Vancouver Sewerage and Drainage District), Vince Busto (Fisheries and Oceans Canada), Martin Pardoe (City of Burnaby), Catherine Sinasac (CityPlans), Michelle Harris (City of Vancouver Greenways), and Alf Guthrie (Vancouver/Richmond Health Board) is gratefully acknowledged.

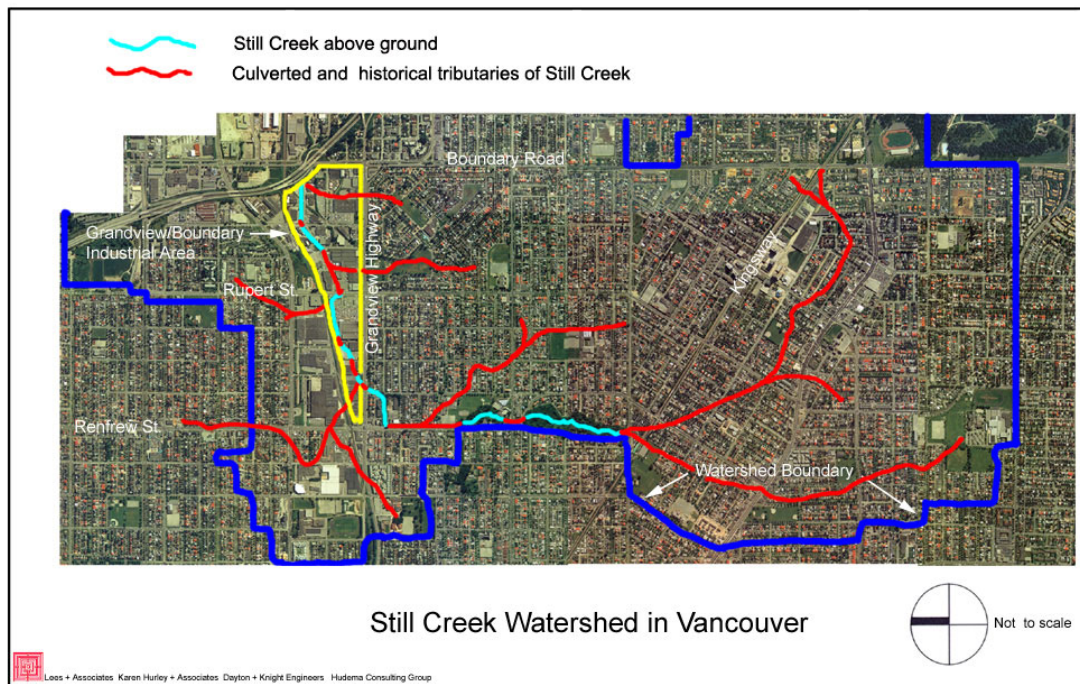
EXECUTIVE SUMMARY

Background

Still Creek is one of only two remaining partially daylighted streams in the urbanized area of Vancouver. It forms an important part of the Brunette River system that flows into the Fraser River. Still Creek, although presently channelized in many sections, and underground in portions, has the potential to be an important green space for the workers and visitors in the Grandview Boundary Industrial Area (GBIA) and to the residents of the Renfrew area. Our team was asked to review practical approaches, in the form of various options, which would be feasible to achieve Council's long-standing objectives for enhancing Still Creek. The primary focus of this study was the GBIA.

Staff from CityPlans coordinated the study, with guidance and support from the Engineering Department and the Vancouver Board of Parks and Recreation. A technical advisory committee further assisted the process of analyzing opportunities, constraints and planning options.

GBIA businesses and landowners, and the residential community had the opportunity to express their opinions on the draft plan at two open houses. There was strong support for the ideas to rehabilitate Still Creek and to bring vibrant green space, with recreational opportunities, to the area. Appendix 4 includes a summary of responses from the open houses.



Still Creek is an urbanized stream that originates in headwaters near Kingsway and Boundary Road. The headwaters of Still Creek actually extend into the Metrotown area of Burnaby, they include most of the area from Boundary Road to Renfrew Street and north to nearly Broadway, at Renfrew.

Challenges

- The majority of the Still Creek watershed (in Vancouver) is covered with roads and buildings - 68% impervious cover in the overall watershed and nearly 100% in the GBIA.
- Approximately 70% of the original Still Creek and all its tributaries have been put into underground storm sewer pipes.
- Storm water velocity and peak volumes hinder the capacity of the creek to provide habitat for fish.
- Within the GBIA, where the creek remains open, the channel has been straightened to fit within a narrow 15m wide right-of-way.
- Due to the lack of streamside vegetation habitat values are limited and water temperatures fluctuate.
- The quality of the water in Still Creek is not good, and occasionally the water quality falls below standards for aquatic life.

Yet, despite the challenges affecting Still Creek, there are many promising opportunities for rehabilitation along the stream. Once implemented, the recreational and ecological benefits will be further enhanced by more effective management of stormwaters in the Grandview Boundary Industrial Area, and across the entire Still Creek watershed.

Grandview Boundary Industrial Area

The Grandview Boundary Industrial Area (GBIA) has been separated into 5 zones for this study, based on each area's natural and built characteristics. The unique opportunities and constraints of each area have been individually addressed. The 5 areas are:

Area #1: Still Creek West

Area #2: Real Canadian Superstore Site

Area #3: Rupert Street to Cornett Road

Area #4: Cornett to Skeena

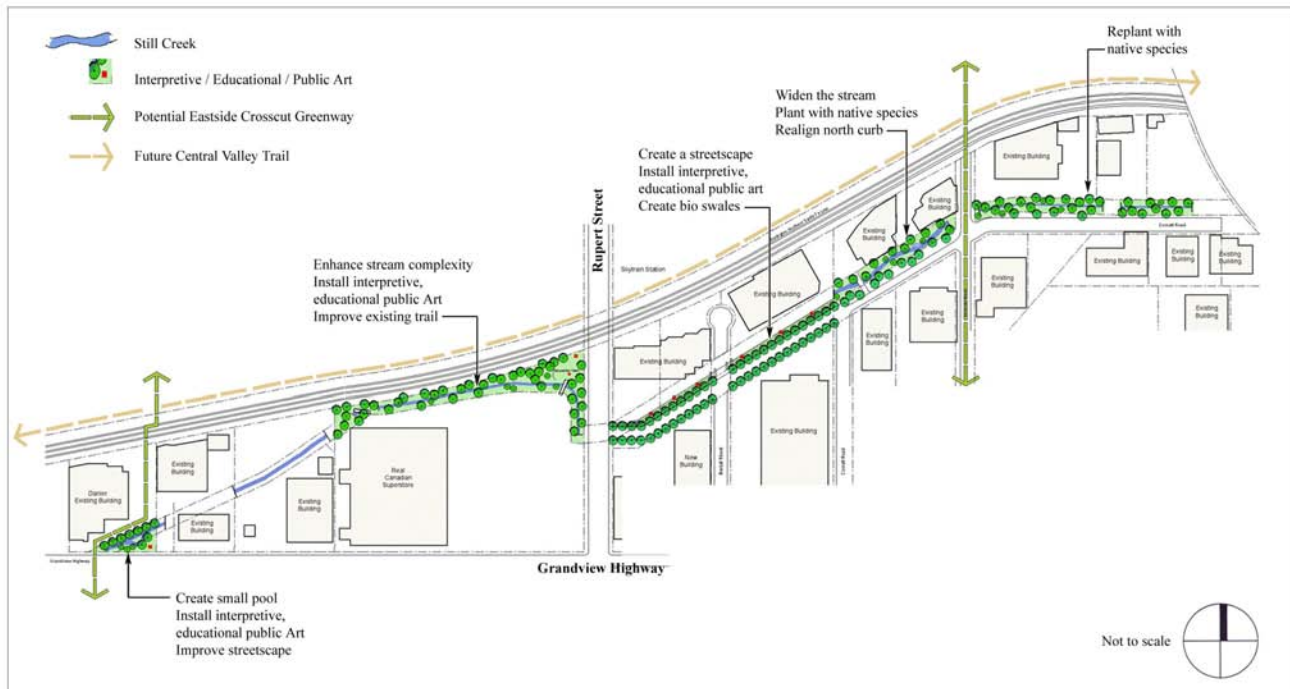
Area #5: Skeena to Boundary



Rehabilitation plans for the first 10 years and for 10 – 50 year period were generated for each of the 5 areas. A practical series of actions are proposed, with the hope that in the long term, further rehabilitation measures would take place.

The Grandview Boundary Industrial Area - Ten Year Action Plan

The following summarizes opportunities and enhancements that could occur to Still Creek over the next 10 years, within the GBIA. These rehabilitation scenarios are based on funding that staff has estimated could be expected during this time period. These actions are based on the approach that community enthusiasm, education and recreation opportunities should be tapped early in the rehabilitation of Still Creek, and that a series of “do-able” projects will sustain interest for further improvements to Still Creek and the GBIA.



Still Creek 10 Year Action Plan

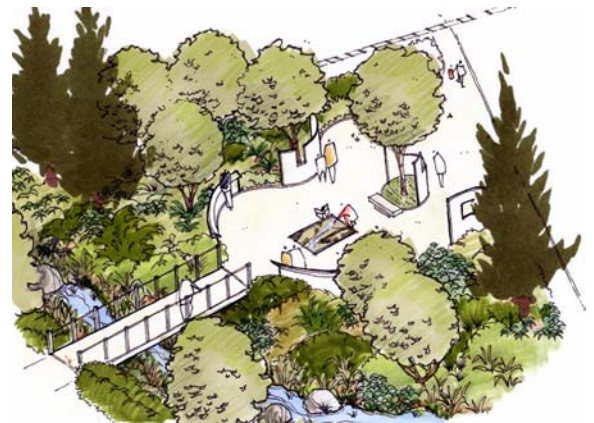
Area #1: Still Creek West

In the short term, the Danier Leather site at the junction of Still Creek and Grandview Highway offers a good opportunity to increase awareness of Still Creek and provide green space for nearby workers. Enhancing the stream channel and riparian vegetation, installing public art and creating a small seating area are proposed. Promoting this site as a high profile pilot project is strongly recommended.



Area #2: Real Canadian Superstore

Within the next 10 years, it is recommended that pathway extensions and improvements, education, public art and stream habitat initiatives be implemented along Still Creek at the Real Canadian Superstore Site. In this zone riparian rehabilitation will be done on the south side of Still Creek. The connection of the pathway with the Rupert Street SkyTrain station and the Central Valley Greenway will enhance the recreation and cycling opportunities in this area.



Area #3: Rupert Street to Cornett Road

We recommend that an innovative streetscape plan be designed and implemented as part of changes to the roads system within the Rupert Street to Cornett Road area. The streetscape improvements would include tree planting, public art and grassed swales. The intention of these initiatives would be to improve stormwater runoff quality from the site, and to reflect the presence of Still Creek in a series of green, artistic additions to the area. In this way, the high profile quality of this site will be used to educate the community and enhance what is now an austere urban environment.



Area #4: Cornett to Skeena

Given the narrowness of the Still Creek corridor in this part of the GBIA, we recommend the elimination of on-street parking on the north side of Cornett and a slight narrowing of the driving lanes. This will provide an additional 6 metres of space for the creek -- where a pedestrian and cycle path could be created, and native trees and shrubs could be planted. As well, the multi-use path should be extended to Skeena, where the East Side Crosscut Greenway and the Central Valley Greenway are tentatively proposed.



Area #5: Skeena to Boundary

The narrow right of way and extent of impervious cover limits the enhancements that can practically be implemented in this area, which is now the Vancouver Film Studios. Over the next 10 years, replanting of the riparian zone on both sides of the creek with native species and creating a path and seating area should be undertaken.



Benefits from the Ten Year Action Plan

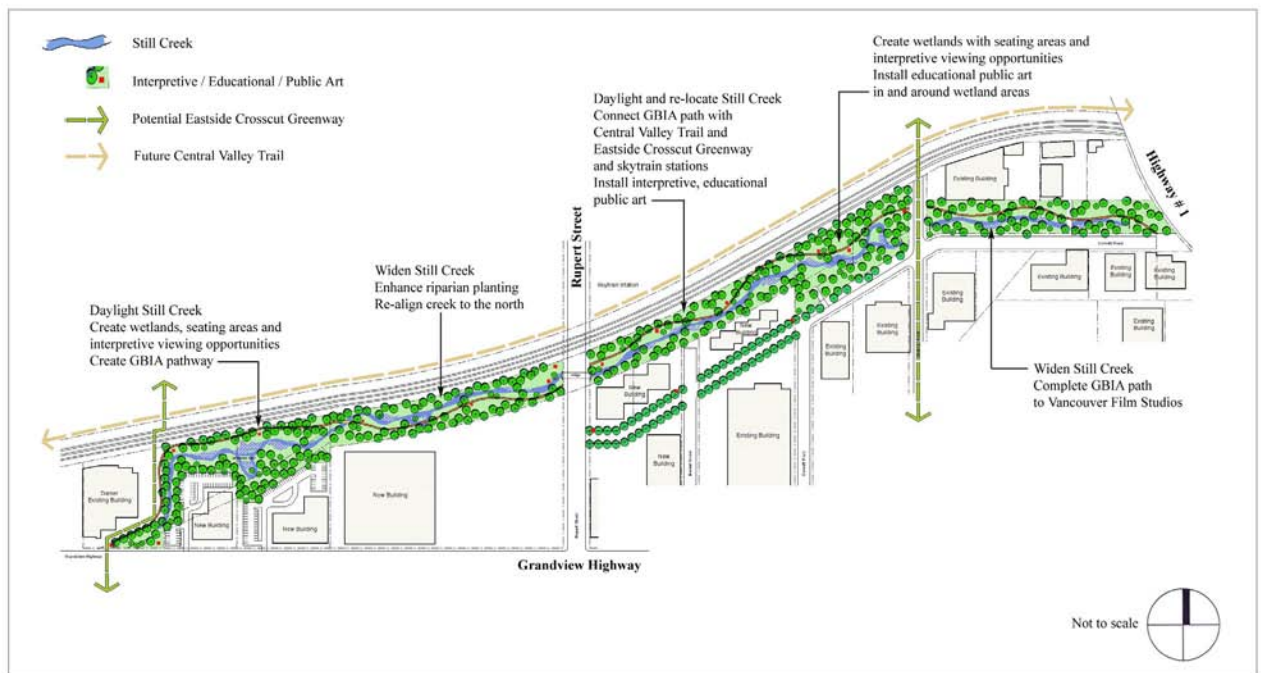
Benefits arising from the actions, over the first 10 years of the rehabilitation of Still Creek, will include:

- Improved stormwater management;
- Enhanced recreation opportunities along and near Still Creek;
- Increased awareness of Still Creek through public art installations, events, educational kiosks, displays and lectures, and,
- Improved liveability through increased green space, attractive streetscapes, community art and a clear sense of place.

The Grandview Boundary Industrial Area - 10 to 50 Year Action Plan

Over the long term, significant changes to the alignment and culverted nature of Still Creek are recommended. These changes will be determined, to a large extent, by the re-development patterns within the GBIA. However, the City of Vancouver, non-governmental organizations and advocacy groups can effectively foster an environment, and funding arrangements, in which major rehabilitation of Still Creek can take place.

As redevelopment occurs on properties adjacent to Still Creek, opportunities exist to make significant changes. The many options provided in the 10-50 year Action Plan combine to form a long term vision for restoring Still Creek, while maximizing stormwater management, recreation and education values within the GBIA.



Still Creek 10 - 50 Year Action Plan

Area #1: Still Creek West

As properties are redeveloped a series of constructed wetlands and daylighting of the stream will provide recreation and green space. The long term action plans for this area include:

- The creation of a constructed wetland or a series of linear wetlands at the gravel parking lot in the northwest corner of 3185 Grandview Highway;
- Daylight 80 metres of Still Creek and realign the stream;
- Creation of a multi-use pathway for walking and cycling that should eventually connect all along Still Creek;
- Replant the riparian zone with native species to create green space and habitat;
- Provide seating areas within green space for resting, observing birds, eating lunch, connecting with nature;
- Install educational signs, kiosks and community arts events;
- Incorporate Best Management Practices, in building and parking lot designs, to reduce stormwater volumes from the site and improve runoff quality (see Appendix 2).



Area #2: Real Canadian Superstore

The 10 – 50 year vision for Still Creek within the Real Canadian Superstore site includes enhanced recreation opportunities, significant improvements to the stream, more viewing points and ongoing public art opportunities. These actions include:

- Provide a continuous southern loop to the Central Valley Greenway that would connect Rupert Street with Renfrew Street;
- Create a variety of nature and recreation experiences, including bird and creek viewing platforms;
- Build venues for public art and outdoor learning that would form part of a community art, education and environment program;
- Widen Still Creek with meanders, reshaped banks, and installation of large woody debris and enhanced riparian zones, and,
- Re-align the eastern leg of Still Creek in this zone by replacing the 90-degree bend with a gentle meander and directing the creek to a more northerly position under Rupert Street.



Area #3: Rupert Street to Cornett Road

Still Creek, from Rupert Street to Cornett Road, should be daylighted over the next 50 years. Bringing the creek back to the surface, along the northern edge of the area, immediately south of the BNSF tracks, will enable opportunities for enhanced recreation and green space as well as significant rehabilitation of Still Creek. Actions that should occur, over the 10 – 50 year period of implementation, are:

- Daylight Still Creek in a new right-of-way abutting the south side of the BNSF rail line;
- Build lookouts and rest places along the creek;
- Create a multi-use pedestrian and cycle walkway along the edge of the riparian zone;
- Link the pedestrian/cycle path with the BNSF crossing to the SkyTrain Station and the Central Valley greenway;
- Implement new development requirements for Best Management Practices to reduce stormwater volumes from the site and improve runoff quality, and,
- If possible, leave the streetscape and public art improvements, built during the first phase of implementation, in situ. If not, relocate the public art to the daylighted section of the creek.



Area #4: Cornett to Skeena

The keystone to the long term action plan for this part of the GBIA is the creation of a constructed wetland or series of wetlands and pedestrian and cycle paths. The City of Vancouver should take a proactive stance with respect to re-development and, if necessary, acquire the property in order to ensure sufficient space is set aside for the wetland. Specific actions should include:

- Create a constructed wetland or series of wetlands on the properties at 3445 Cornett and 2525 Skeena;
- Widen the stream upstream and downstream of the wetland(s), enhance the streambed and install riffle weirs;
- Create diverse riparian zones around the wetlands and the creek;
- Build viewing sites and pathways surrounding the wetland;
- Provide interpretive displays and/or kiosks;
- Involve artists in the wetland design process in order that an artful and ecological approach is taken, and,
- Incorporate Best Management Practices for stormwater in all new development.



Area #5: Skeena to Boundary

As properties adjacent to Still Creek in this zone are re-developed, more space should be made available for a wider streambed with meanders and an expanded riparian zone/ green space. This will also offer an opportunity to integrate the trail within planted zones and create viewing areas focused on Still Creek. Community arts and education

opportunities should be provided along the creek. Collaborative public art efforts should be pursued with the Vancouver Film Studios. Through the course of redevelopment, Best Management Practices (BMPs) should be implemented for buildings and parking lots in this area.



Actions that should be implemented over the 10 – 50 year period include:

- Widening the stream channel, incorporating meanders, enhancing the streambed and increasing stream complexity;
- Expand the width of the riparian zone on both sides of the creek and enhance the planting to include a wide variety of native species in order to create a more diverse and attractive green space;
- Relocate the path within the shade of the riparian planting;
- Constructing green roofs or roof top storage on existing and new buildings in this area to reduce stormwater runoff volumes;
- Installing porous pavement systems in the parking lots, as they are upgraded and maintained;
- Directing runoff to grass swales, and,
- Install community art and /or produce films or videos that celebrate Still Creek and the rehabilitation process. These could be done in partnership with the broader community, especially local children and youth.

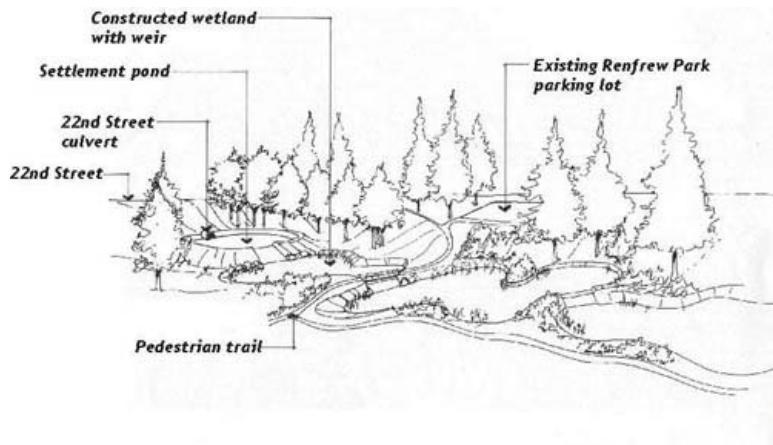
Benefits from the 10 – 50 year Action plan will include:

- Decreased stormwater peak flows and volumes and flood risk;
- Improved runoff water quality;
- Increase of recreation opportunities through the creation of extensive linear green space with pathways for walking and cycling, and rest areas with benches;
- Improved pedestrian and cycle connections to transit and 1 with the Central Valley Trail and East Side Crosscut Greenway systems;
- Enhanced ecosystem health through enhanced riparian habitat and tree planting, and,
- Improvement to liveability through increased green space, introduction of nature back into the city and ongoing art installations and events along the creek.

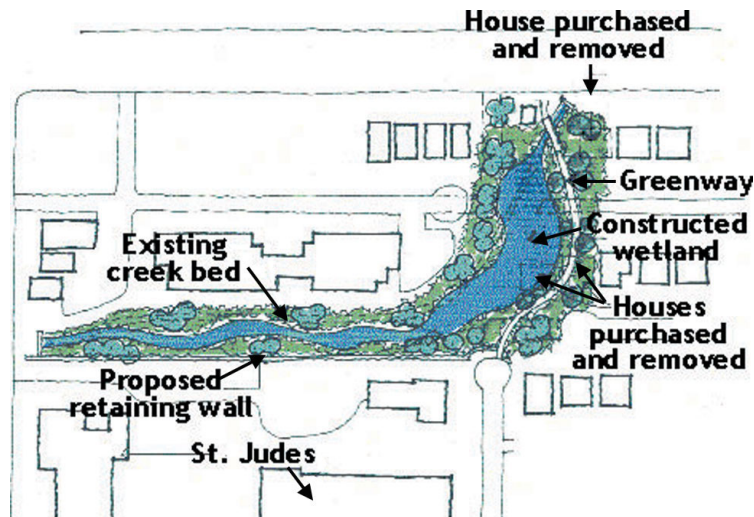
Still Creek - Outside the Industrial Area

The rehabilitation of Still Creek would be significantly enhanced if the areas outside the GBIA, indeed, across the watershed are considered. Renfrew Ravine, Renfrew Ravine Park and the area around St. Jude's School are important, as are the developed residential neighbourhoods. All of these areas contribute runoff waters into Still Creek. If water can be slowed and enter the creek with less pollutants, Still Creek will benefit.

The short and long term rehabilitation measures for the areas outside the GBIA have not been including in the budget estimates as part of this study. It is recommended that components of the following action plans be integrated into the capital work programs for the City of Vancouver and the Vancouver Board of Parks and Recreation.



Proposed Wetland: Renfrew Community Park



Proposed Wetland and Creek Enhancement: St. Jude's Area

Highlights of recommendations for areas outside the GBIA in the next 10 year Action Plan include:

- Establish partnerships for cost-sharing programs;
- Work with Friends of Falaise Park to design and implement daylighting of a Still Creek tributary into a stream and constructed wetland;
- Conduct a study to assess temporarily storing flood waters in Renfrew Ravine to reduce downstream flooding;
- Develop a multi-faceted education and community arts strategy celebrating Still Creek and describing the community's role in enhancing the health of the system;
- Create detailed designs of rehabilitated stream, constructed wetlands and riparian zone/forest with pathway and educational sites at Renfrew Community Park and St. Jude's School;
- Develop an Urban Forest Management Plan for the watershed;
- Develop a bylaw restricting the use of pesticides in Vancouver with a pilot implementation/ program in Still Creek watershed;
- Create pilot programs to test different BMPs in the watershed;
- Investigate appropriate sites for blue-green storage, and,
- During road replacements, replace curbs and gutters with grassed swales or treed boulevards.

Highlights of recommendations for areas outside the GBIA in the 10- 50 Year Action Plan include:

- As paved lanes require replacement, do so with a porous pavement system or pavement with grassed strips in centre, or grassed swale on the sides;
- Continue replacement of curb and gutters with grassed swales or porous material, and,
- Create constructed wetlands, rehabilitated stream, new pathways, enhanced riparian zone and forest and interpretative sites at Renfrew Community Park and St. Judes School.

Best Management Practices - Pilot Projects

Best Management Practices (BMPs) are recommended to reduce stormwater runoff volumes and peak flows and to increase runoff water quality. A number of the BMPs are well documented and many, such as green roofs, have already been applied within Vancouver. The three BMPs that are recommended for a trial project are street cleaning, deep well infiltration and downspout disconnections. A pilot program should be implemented in the GBIA that tests the effectiveness of increased street sweeping frequency. The pilot program would involve an analysis of runoff quality into Still Creek before and after the increased street vacuuming.

Outside the GBIA, a deep well infiltration pilot project is recommended for a neighbourhood in the southern portion of the watershed. Deep well injection involves drilling down to porous geologic formations and directing stormwater runoff through wells into these formations where the water recharges underground aquifers.

A pilot project of downspout disconnections in designated neighbourhoods within the Still Creek watershed would be an inexpensive way to evaluate the technical opportunities and constraints of this technique, as well as gauge community interest and support.

Conclusions

Key findings and recommendations of the study are that:

- Rehabilitating Still Creek, including daylighting portions and constructing wetlands, in the long term is feasible;
- Greenways, habitat enhancements, public education and art are feasible, affordable and should be based on the implementation of the 10 year action plan;
- Stormwater flows can be reduced and runoff water quality can be improved by implementation of Best Management Practices;
- Pilot projects on street sweeping, rain spout disconnects, deep infiltration, and ravine flood storage should be incorporated into the Capital Programs;
- Responsibility for enhanced management and education strategies for Still Creek should be incorporated into a new or existing position/s.
- The 10 – 50 year action plan should be implemented as policy, land use and redevelopment issues within the GBIA come forward.
- Recommendations within this report should be incorporated into the Grandview Boundary Area Plans, the Greenway Plan and the Engineering Department and Park Board capital works plans.

Still Creek is clearly worthy of enhancement and celebrating. Opportunities exist to transform the creek into a healthy environment that the community can take pleasure in and that will enhance the liveability of this part of Vancouver. New pathways and viewing areas associated with the creek will provide important places of solace, interest and recreation for residents, workers and visitors. Once implemented, likely in conjunction with other initiatives such as City Plan and the Greenways Program, the rehabilitation of Still Creek along the Grandview corridor will result in a revitalized urban experience.

Rehabilitating Still Creek is a challenging proposition due to the complexities of land ownership, market forces, existing infrastructure, and landscape conditions. Successfully rehabilitating Still Creek will, therefore, require an ongoing commitment of Council, other agencies and the community. These challenges are presently being addressed through a series of planning and engineering initiatives throughout the Brunette River basin. Still Creek is a crucial component of that watershed and aside from the many direct local benefits of rehabilitation, improvements to the creek will support other downstream and basin-wide initiatives.

This study reveals that it is feasible, over the long term, to realize such a vision and that incremental change, based on available funding and cooperation with land owners, will lead to a rehabilitated Still Creek that will benefit downstream initiatives in the Brunette River basin and provide a legacy for future generations.

CHAPTER 1 INTRODUCTION

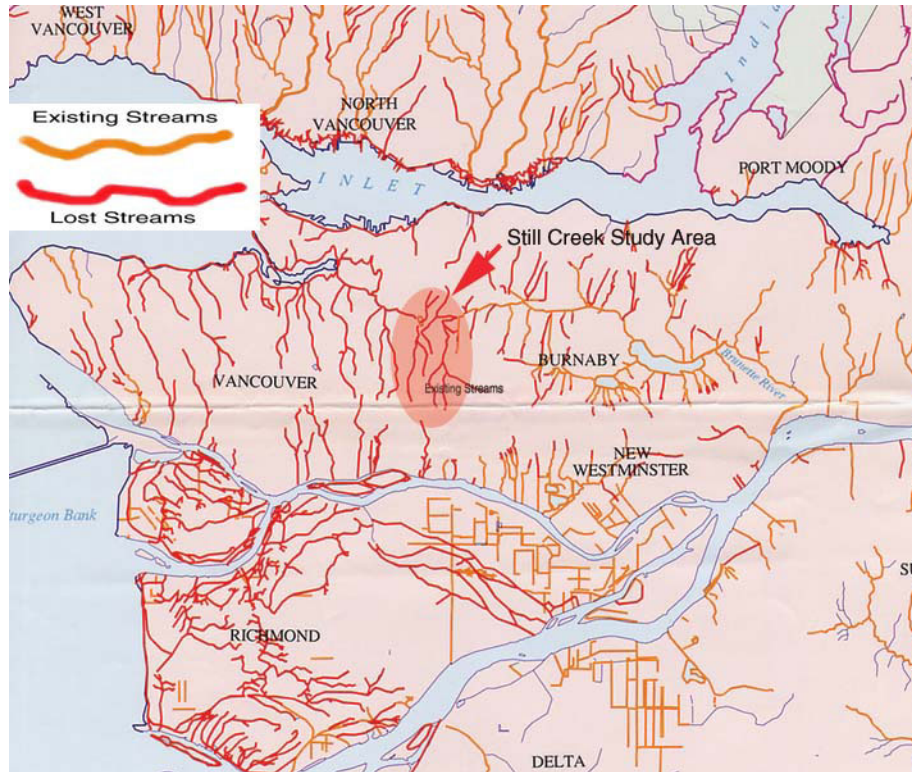
Background

Streams within cities contribute significantly to the liveability, sense of place, and environmental education of residents. They play an important role in the fabric of open space, provide space for recreation and can offer valuable opportunities to connect with nature. Streams also have the potential of providing critical habitat for birds, fish, small mammals, amphibians and other wildlife. In addition, the vegetation adjacent to urban streams can help improve urban air quality by removing pollutants and cooling the air. Finally, urban streams and creeks often play a significant role in stormwater management by conveying runoff from roads, buildings and properties towards larger water bodies, thereby minimizing the chances of flooding and associated property damage.

Typically, however, the ecological and recreational values of urban streams are affected by development. Previously vegetated watersheds are replaced with impervious roads and buildings, drainage patterns are altered, and portions of streams and creeks are channelized or culverted to aid in conveying stormwater runoff. The result can be a dramatically different stream flow pattern that is considerably lower during dry periods than predevelopment conditions and considerably higher during rainy periods. These highly variable water levels result in more extreme stream flow velocities that can lead to excessive scouring of stream channels and the de-stabilization of stream banks.

In addition to these structural changes, urban streams commonly have poor water quality especially during rain events when urban runoff carries pollutants from roads, parking lots, and properties directly into the urban waterway system. Consequently, the health of aquatic life, some of which is highly vulnerable to changes in pH, temperature and other water quality characteristics, can be jeopardized.

Still Creek, in its present condition, demonstrates most of the characteristics of an urban stream system. The vast majority of its watershed is covered with roads and buildings with only a small fraction of forest cover remaining.



Existing and Lost Streams in Vancouver, Fisheries and Oceans Canada, 1998

Approximately 70% of Still Creek’s original channels and tributaries are now found in subsurface pipes. Within the Grandview/ Boundary Industrial Area (GBIA), in the areas where the creek remains open, the channel has been straightened to fit within a narrow right-of-way. This situation provides few opportunities for streamside vegetation to grow and mature. Like most urban streams, Still Creek suffers from extremes of high and low flows that undermine the ecological integrity of the system and threaten to flood adjacent lands during heavy storm events. The water quality of Still Creek has not been thoroughly studied, but tests that have been conducted indicate that the water quality is variable and can, during rainfall events, be harmful to aquatic life.

As with many urbanized streams, one of the main functions of Still Creek is to convey stormwater safely away from developed areas. Flooding concerns for the Grandview Boundary Area of Still Creek have been documented by the GVRD (1998). Flooding in the Still Creek- Brunette River is an issue that is being addressed by staff from GVRD and others, including City of Vancouver. The terms of reference for this study did not include a thorough examination of storm and floodwater potentials. Although we recommend further work be undertaken in the management of stormwater and flooding, this report does not make specific recommendations in this regard.

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Parts of Still Creek have not been culverted and remain open, with some portions providing valuable habitat. In the Renfrew Ravine, for example, Still Creek remains in relatively good condition and warrants specific measures to protect and enhance the stream capacity and habitat that is present.

In order for the work on Still Creek to be most effective, attention should be given to the entire watershed. Managing stormwater volume and flows and addressing runoff water quality on a watershed scale should be a key component of the rehabilitation strategy.

In addition to engineered solutions, the role of education is important. Increasing the understanding of the Still Creek ecosystem among residents, businesses and agencies that live and work in the area is crucial to the long term success of the rehabilitation efforts. It would be beneficial for the community to be aware of the environmental and recreational values that Still Creek has to offer and how residents might contribute to improving the health of the creek.

This study identifies a range of opportunities for enhancing the environmental, recreational, educational and public place qualities within the Still Creek area. These opportunities are evaluated in terms of their feasibility, time frames, and the funding required to implement them.

Terms of Reference / Advisory Committees

The CityPlans Division of the City of Vancouver Planning Department initiated this study. The purpose of the study, as articulated in the terms of reference, was:

"To do a feasibility study for Still Creek from 29th Avenue to Boundary Road, that reviews practical approaches to achieving Council's long standing objectives for enhancing the Creek. The study should review opportunities to integrate Best Management Practices for stormwater management within the drainage basin as a whole, and improvements to stream and riparian ecology, while maximizing the recreational and amenity opportunities from the resource."

The challenge of the study was to provide practical solutions to the complex objectives outlined in the Terms of Reference to:

“...create an amenity for area workers and surrounding residents through such measures as enhancing recreational opportunities and public access to the water, improving connections with planned or existing Greenways and pedestrian routes, and celebrating the historic and cultural meaning of the creek;

Protect and enhance aquatic habitat, terrestrial habitat and biodiversity;

Minimize health and safety impacts due to flooding and poor water quality;

Provide opportunities for learning to help increase the public's understanding of natural systems and support for Still Creek enhancement, and,

Ensure the options are cost-effective, affordable and implementable.”

As these are multi-faceted objectives, an integrated consulting team was brought together that offered expertise in recreation planning, watershed management, stream ecology, urban sustainability, stormwater management, urban design and land economics. The consulting team worked closely with a City of Vancouver Steering Committee including City staff from the Planning, Engineering, and Environmental Protection Departments and the Board of Parks and Recreation.

A broader Advisory Group assisted the consulting and staff teams in identifying issues and opportunities. The Advisory Group met over the course of two workshops, numerous communications and a review of report drafts. This group included representatives from Fisheries and Oceans Canada, the Ministry of Water, Land and Air Protection, Greater Vancouver Sewerage and Drainage District, City of Burnaby and Vancouver/Richmond Health Board. These people shared their knowledge, experience and technical resources with the consulting team and Vancouver City staff.

GBIA businesses and landowners, and the residential community also had the opportunity to express their opinions on the draft plan at two open houses. There was strong support for the ideas to rehabilitate Still Creek and to bring vibrant green space, with recreational opportunities, to the area. Appendix 4 includes a summary of responses from the open houses.

The Report

In this report, we examine the existing planning, policy and bio-physical context and provide rehabilitation recommendations for the Grandview Boundary Industrial Area (GBIA) and strategies for improving those areas of the watershed outside the GBIA. Appendices provide detailed background on Best Management Practices and related policies. The report chapters include:

- Chapter 2 describes the existing characteristics of Still Creek and its surrounding watershed;
- Chapter 3 provides site specific descriptions and options for rehabilitation of Still Creek within the Grandview Boundary Industrial Area;
- Chapter 4 brings forward options for Still Creek and watershed rehabilitation outside of the GBIA including Renfrew Ravine and Renfrew Park;
- Chapter 5 details education and community arts strategies and actions, and,
- Chapter 6 summarizes the findings of the report and recommendations.

References cited follow Chapter 6.

The four appendices include:

1. A glossary
2. Descriptions of Best Management Practices
3. City of Vancouver Policies Related to Still Creek
4. A Summary of the Public Open House.

CHAPTER 2 STILL CREEK CONTEXT

The Watershed

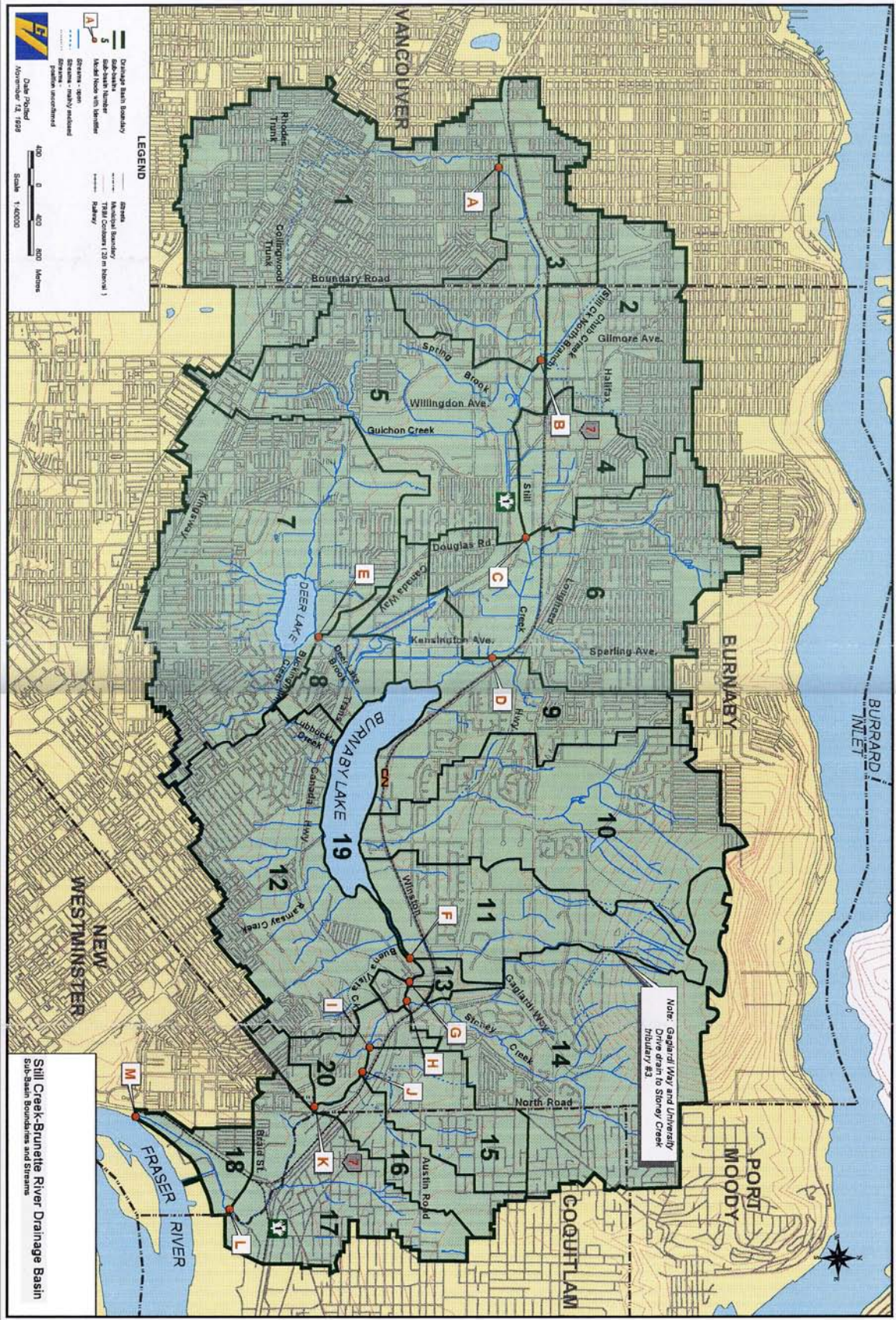
Still Creek is one of only two remaining partially daylighted streams in the urbanized area of Vancouver. It forms an important part of the Brunette River system that flows into the Fraser River. The Brunette River basin is 73.3 square kilometre urban watershed encompassing portions of five cities – Vancouver, Burnaby, Port Moody, Coquitlam and New Westminster. It contains over 200 km of watercourses, (with Still Creek and the Brunette River being the dominant streams) and two lakes – Burnaby Lake and Deer Lake. The main Still Creek – Brunette River channel is approximately 17km in length and drops approximately 32 metres in elevation from Renfrew Street at 14th Avenue to its outlet at the Fraser River.

Still Creek's upper watershed, which is the focus of this study, is approximately 1050 hectares in size. The upper reaches of the watershed originate in Burnaby's Metrotown area. Much of the stream in Vancouver and the Metrotown area has been enclosed in storm sewers or culverts and only 3.25 kilometres remain open. Renfrew Ravine is the most southerly section of Still Creek that is open. Still Creek, both open and culverted portions flow through a mix of residential, commercial and industrial areas.

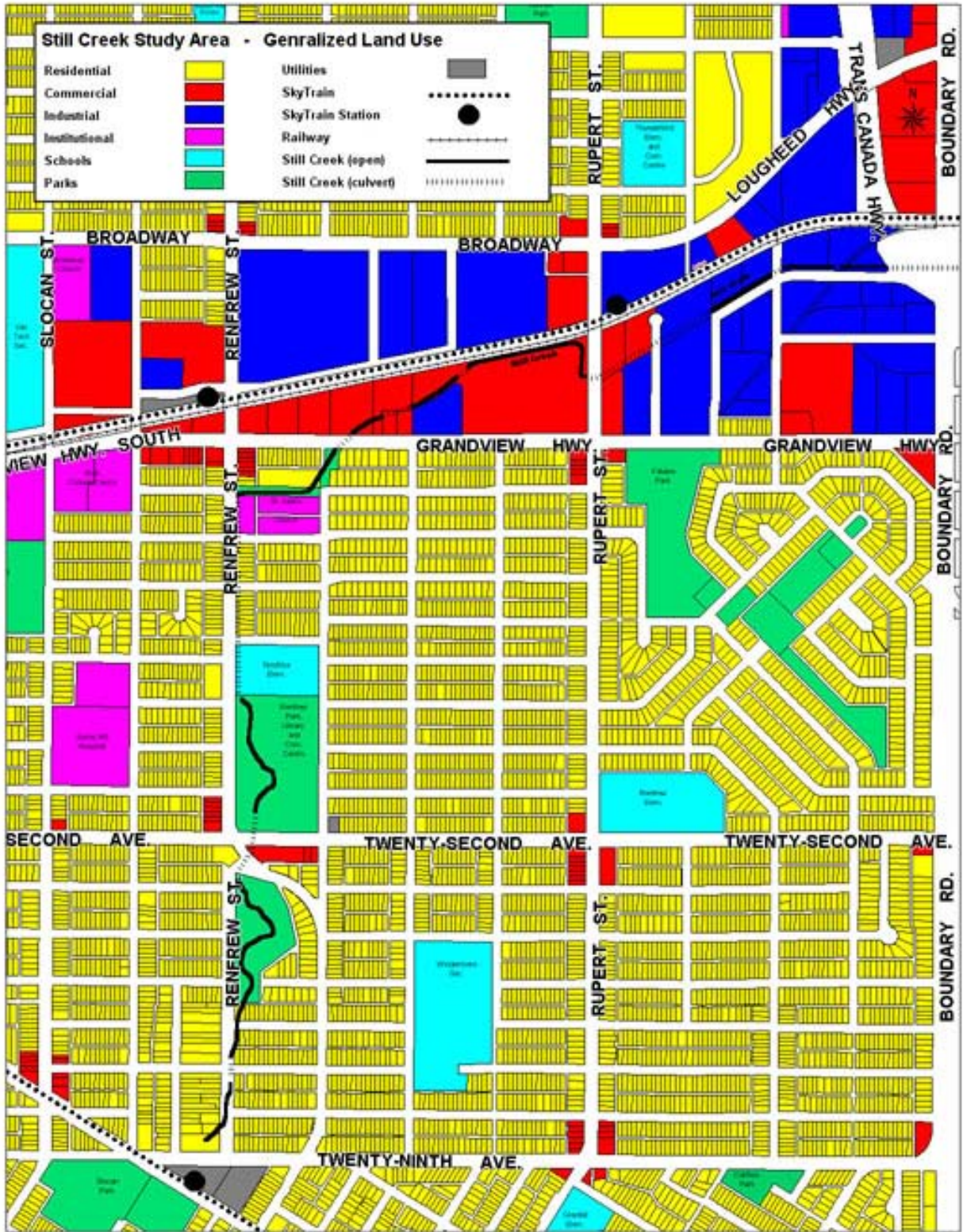
At this time, the upper watershed is not known to support any species of fish due to the creek's water quality, limited habitat and highly variable flows. In addition, the culvert at Boundary Road is considered to be an impassable barrier. However, sightings of cutthroat trout and coho salmon have been made along downstream segments of Still Creek in the City of Burnaby (Smith, 2001). Furthermore, Still Creek flows into the Brunette River, which supports resident cutthroat trout and spawning coho salmon. The Brunette River, in turn, flows into the Fraser River, the province's most important salmon supporting river. Therefore, the importance of Still Creek to the larger Brunette River system should not be discounted even though the creek's current ecological condition is not good.

Land Use

The Still Creek watershed, with the exception of the Grandview Boundary Industrial Area (GBIA), is dominated by residential land use of which single-family homes comprise the largest percentage. Pockets of high-rise and low-rise multi-family housing are located in the Collingwood area near the Joyce Street SkyTrain station and east of Boundary Road, in Burnaby's Metrotown area. The areas of single-family housing include a network of relatively wide streets, boulevards with street trees, and rear yard lanes. The Still Creek watershed also includes another significant commercial area along Kingsway Avenue. Within Vancouver's portion of the watershed, the majority of roads include curbs and gutters, and lanes are typically paved.



Burnette River Basin and Sub Watersheds
 (GVRD Sill Creek – Burnette River Floodplain Mapping, 1998)



The land base of the GBIA is characterized by one and two storey buildings used for commercial retail, warehousing, and small scale manufacturing. Two new SkyTrain stations have recently been built along the north side of the Burlington Northern Santa Fe (BNSF) rail line at Renfrew and Rupert Streets. To the north of the rail line, a new cluster of high technology office buildings has recently been built between Renfrew and Rupert Streets, on the south side of Broadway Avenue. To the east of Broadway at Rupert, a new self-storage warehouse has been built.



Few new buildings have been constructed on the south side of the BNSF rail line in the GBIA, and a number of existing buildings are currently for lease or sale. The most notable businesses in this area are the Real Canadian Superstore at Rupert Street and



Grandview Highway, Costco and the cluster of buildings that comprise the Vancouver Film Studios off of Cornett Road. The relatively high vacancy rate and age of buildings indicate the GBIA is not, at present, among the City's most desirable commercial or industrial districts. The City expects to see significant changes occur in the GBIA in the coming years and decades due to the presence of the SkyTrain stations, the expansion of the Vancouver Film Studio and the replacement of traditional industrial uses near the SkyTrain stations with more high-tech facilities.

Recreational and Amenity Characteristics

Still Creek, Renfrew Ravine and Renfrew Park are part of the Greater Vancouver Regional District's Green Zone. Considering its location in the East Side of Vancouver, Still Creek's watershed provides a unique opportunity for human connection with the natural environment in an otherwise highly urbanized setting. Aside from active park areas within the watershed, there are not many natural, unrefined public open spaces in the Still Creek watershed. Opportunities for residents, workers or visitors to the area to find quiet contemplation in natural areas are limited.

This is especially the case in the Grandview Boundary Industrial Area where the heavily urbanized conditions lack park or open space amenities. Still Creek, within the GBIA, offers an unparalleled opportunity to enhance recreational experiences in the industrial area. As well, the north-south alignment of the creek provides a corridor through which greenway connections could be made.

The Central Valley Trail is proposed for the north side of the Burlington Northern Santa Fe rail line. It will be the major east – west commuter and recreational route linking Vancouver and Burnaby. Connections to the Central Valley Trail, via a new East Side Crosscut Greenway (that will link Burrard Inlet with the Fraser River) will occur very close to proposed improvements to Still Creek in the GBIA. Four different location options for the Eastside Crosscut Greenway are presently under consideration. (This report shows 2 of the 4 options.) As well, the existing SkyTrain station at 29th Avenue would be a node on the East Side Crosscut Greenway, linking that part of the community with the new Rupert and Renfrew SkyTrain stations.

During the early years of development of this part of Vancouver, Still Creek was a place rich with fish and many chances for children and others to experience undisturbed, natural open space. Fishing, building forts and adventuring near the creek were common. Those days are gone and much of the creek is now lost in underground pipes. Sections of Still Creek remain, however, and they are accessible, intriguing places. It is clear, given the existing and new transit stations and proposed greenway routes, that the location of Still Creek forms a natural framework around which different recreation and community activities could occur.

General Stream Characteristics

As a result of urbanization within the watershed during the last 100 years, Still Creek has been buried in pipes and culverts, straightened and channelized, had its banks armoured with concrete, stone walls and gabions, and had most of its riparian vegetation removed. Today Still Creek’s primary purpose is to serve as an urban stormwater conveyance corridor. Typically, existing development has resulted in the channelization and straightening of Still Creek. This has reduced opportunities for natural meanders of the stream channel and has limited areas for riparian vegetation.

The headwaters and southerly portions of Still Creek, beginning at 50th Avenue in Vancouver and Royal Oak Avenue in Burnaby, are entirely underground and drain through the Collingwood and Rhodes stormwater sewer trunk lines. Still Creek daylights at an outfall culvert in the southern end of the Renfrew Ravine near the 29th Avenue SkyTrain Station. The creek then flows above ground through Renfrew Ravine and Renfrew Park.





Through Renfrew Ravine, the creek remains largely in its original state with steeply sloped banks and significant riparian vegetative cover, including large Poplars, Alders and some evergreens.

A few isolated sections of the creek's banks have been modified with stone retaining walls, and some encroachment from adjacent residential areas has taken place along the upper banks of the ravine.

A trail is located at the top of the ravine along the east side. Smaller trails are found within the lower areas of the ravine, some of them very close to the wetted portion of the creek.

Still Creek has been largely channelized where it passes through Renfrew Park. The park is immediately adjacent to the Renfrew Community Centre and Public Library. Its natural banks have been replaced with stone retaining walls. There are a number of large trees in the park, although some tree removal has occurred within the last year. There are a number of paths in the park but few opportunities to sit and enjoy the quiet solitude of the park.

From Renfrew Community Park, Still Creek flows northward in a pipe underneath Renfrew Street, and daylights again at St. Judes School near 14th Avenue. In this open section, the creek's channel has few meanders and little stream complexity. Large sections of the creek's banks have been armoured with concrete and rip rap (large boulders). As the creek flows north to Grandview Highway, it enters into a narrow concrete flume, approximately 2 metres wide at the base.



At Grandview Highway, Still Creek passes through a double culvert and enters the Grandview Boundary Industrial Area at the Danier Leather site. From here it flows above ground in a straight line to the northeast for approximately 60 metres before entering an 80 metre long culvert that passes under a parking lot. The creek then continues in an open channel to the northeast, passing between a vacant property to the north and a manufacturing/ warehouse facility to the south. Still Creek then flows through a 30 metre long culvert, then along the north side of Real Canadian Superstore property to Rupert Street.



The creek follows a circuitous underground route through a parking lot eastward until it daylights at Cornett Road. At this location the creek is open and flows through a narrow, linear channel. In most locations where the creek is open in this section, the banks have been engineered and armoured with gabions (baskets of wire mesh enclosing rocks), riprap or concrete, and little riparian vegetation, except for Blackberry, exists.

In general, the streambed throughout the Grandview/Boundary Industrial Area contains very little stream complexity and a substrate that is primarily organic. No large woody debris is present. One concrete riffle exists in the creek, just upstream of the Superstore.



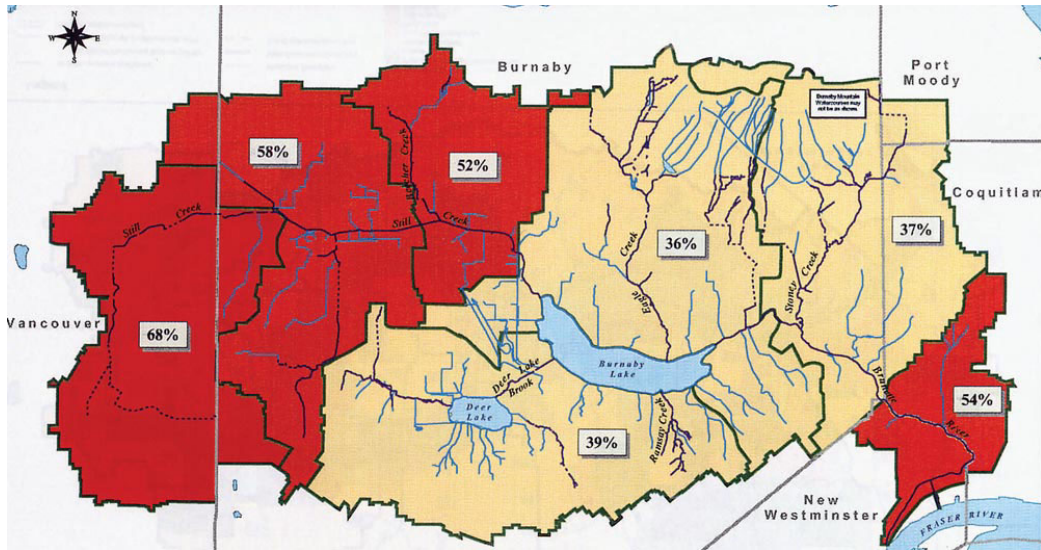
Stream Flow Characteristics

One of the fundamental problems with Still Creek is that precipitation falling in the watershed flows from land to stream too quickly due to the high percentage of impervious cover across the watershed. The watershed, in general, has an impervious cover of 68%, with the more densely developed GBIA having an impervious cover approaching 100%. This condition limits the infiltration of water into the soils and subsurface geological layers. This results in water flowing at a high velocity)and in large volumes, over short periods of time through the stream system. The summer low flows (2 year, 7 day low flow: $0.04\text{m}^3/\text{s}$) are a fraction of the mean annual flow ($0.4\text{m}^3/\text{s}$).

The 2 year, 7 day low flow, refers to the lowest flow in the stream over a seven-day period in two years. The mean annual flow is the total flow measured on a regular basis, over many years, divided by the number of years.

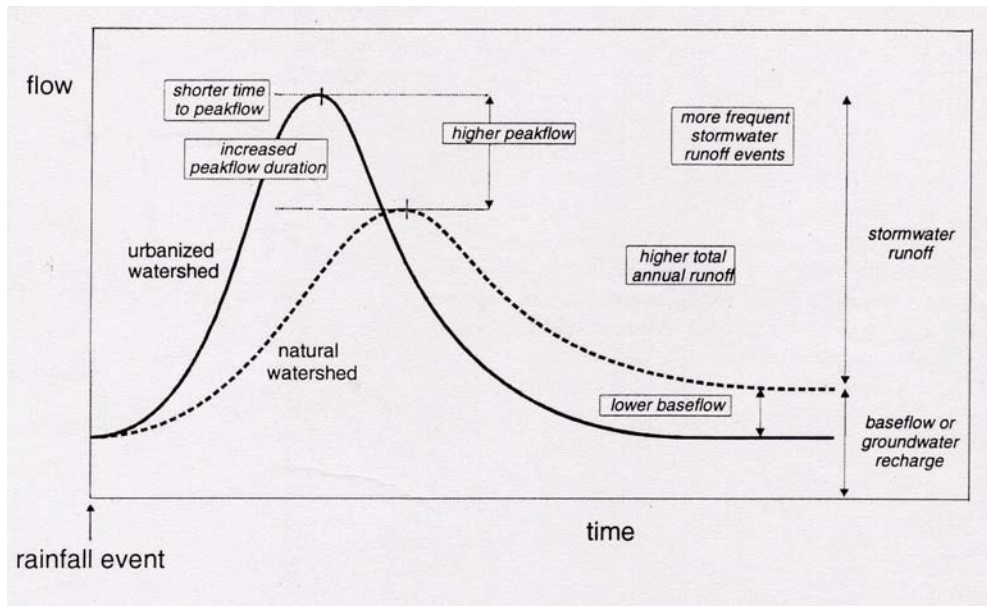
During a heavy rainfall event, the creek's flow can increase to many times the average annual flow. For example, in February 1998, Environment Canada (1998) recorded an increase in stream flow of 6 times the daily base flow within 1.5 hours of the start of a rain event. This quick response in the stream to precipitation and runoff is typical of an urban system with a high percentage of impervious cover and is referred to as a 'flashy' system.





Cover, Brunette Basin Watershed Plan, 2001

Flashy systems create stream morphology problems such as "down cutting, bank erosion and instability, increased sediment load in the stream and infilling" (GVRD, 2001). In response to erosion, and to prevent bank de-stabilization that might reduce stormwater conveyance capacity, creek banks are lined with concrete, riprap or gabions to reduce further erosion.



Typical hydrograph of an urban stream (From GVSDD Stormwater Classification System)

It is not just the large 10, 25 or 100-year storm events that cause problems in protecting the ecology of an urban stream. Recent research in Washington State has demonstrated that the frequent small storms common in coastal BC and the Northwest US are responsible for a great deal of stream erosion. Consequently, in Washington State's King County, new developments are required to include methods to mitigate impacts of small storms on streams (King County, Surface Water Design Manual, 2000).

To ensure that stream rehabilitation and enhancement work is effective, consideration must be given to reducing the impact of both large and small rainfall events on Still Creek. The key to any urban stream enhancement work will be the need to reduce the volume and energy in the stormwater runoff to protect the stream and stream bank from excessive volumes and velocities.

Water Quality

The water quality of Still Creek is a major impediment to enhancing the ecological integrity and biological productivity of the stream. To date, the water quality has been affected by pollutants brought into the creek by stormwater runoff.

The document, *Still Creek - Brunette Basin Issues and Proposed Actions* (1996) refers to a major problem with faecal coliforms in the system; the result of cross connections (incorrect plumbing connections) between storm and sanitary lines in the watershed. These sources of coliform have mostly been eliminated in Still Creek due to the City of Vancouver Engineering Department's efforts to reduce sanitary sewer cross-connections. However, new cross-connections can be created when plumbing work occurs without a permit, as coliform measures continue to indicate. The City's Environmental Protection Branch has a source control program that has resulted in the elimination of industrial or commercial discharges to the storm sewer system.

However, significant problems remain. These include some residual coliforms and dioxin/furan levels that exceed federal guidelines for protection of aquatic life (Environment Canada, 1998). Also, Still Creek's low base flows in the summer result in higher water temperatures and low dissolved oxygen levels, each of which pose significant impediments to enhancing aquatic habitat.

Water quality problems that continue to persist are largely the result of pollutants accumulating on roads, parking lots, lawns, driveways and other surfaces that are conveyed in runoff to the creek. The high percentage of impervious cover limits opportunities for infiltration of runoff. Non-point sources (as compared to discrete, localized sites) of contaminants include bird and pet faeces, various pollutants associated with vehicles, road surface materials loosened by traffic, pesticides, fertilizers (nutrients), and industrial spills. The type of land use also affects the amount of pollutants that reach the stream. Hydrocarbons from residential areas average 9.80 kilograms/km²/cm of precipitation, while commercial areas have 3 times this rate and parking lots can have 25 times the residential rate (Stenstrom, et al, 1984).

Atmospheric emissions also affect water quality, as suspended hydrocarbons and gases from manufacturing, carbon, sulphur, lead and vehicles may fall directly into surface waters or onto impervious surfaces where they are carried to receiving

waters with stormwater runoff. In large urban areas, the deposition rates from the atmosphere can be considerable. This may lead to the 'first flush' phenomenon, during which contaminants that have accumulated on roads and other impervious surfaces during dry periods are conveyed to streams during the first rainfall following the dry period. Once the majority of the pollutants are removed from the streets by the stormwater runoff, the levels of pollutants in the runoff decrease rapidly.

Accumulated sediment is also swept away by stormwater during the first flush after a rainfall. It is generally understood that most pollutants have a close association with sediments (50-99%). Therefore, removal of accumulated sediments from urban surfaces and drainage infrastructure can help to reduce pollutant loads to receiving waters. Pollutants may also be entering the water in Still Creek from contaminated sediments in the streambed as a result of historical activities.

A study by Environment Canada (1998) of the Brunette River Watershed included a data-gathering site on Still Creek. The Still Creek observations in the study include:

- Eight trace metals exceeded guidelines or criteria for aquatic life or recreation.
- Highest loadings for most metals in Still Creek.
- All contaminants increased with flow (runoff correlation).
- E.coli and faecal coliform levels peaked with the increase in flow (reflecting denser urbanization and possible cross connections).
- Nutrients (phosphorus and nitrogen) increased with rainfall peaks.
- Dioxins/furans exceeded CCME guidelines for protection of aquatic life (CCME: Canadian Council of Ministers of the Environment).
- Polycyclic aromatic hydrocarbons (PAHs) measured in suspended solids were two to three orders of magnitude higher than elsewhere in the Fraser system.
- Polychlorinated biphenyls (PCBs) measured in suspended solids were twice the level downstream, and exceeded water quality criteria for protection of aquatic life.
- Concentration of total organochlorine pesticides in the suspended solids was more than 10 times other levels in the Fraser River.
- Still Creek DDT levels exceeded federal guideline for protection of aquatic life.

The study concluded that "urban watersheds like the Brunette River watershed are a significant source of contaminants to the Fraser River". Therefore, any actions to improve the stormwater quality from the watershed will benefit Still Creek and contribute to a healthier Fraser River.

The City's Environmental Protection Branch continues to monitor and regulate all sources of wastewater from industrial and commercial operations.

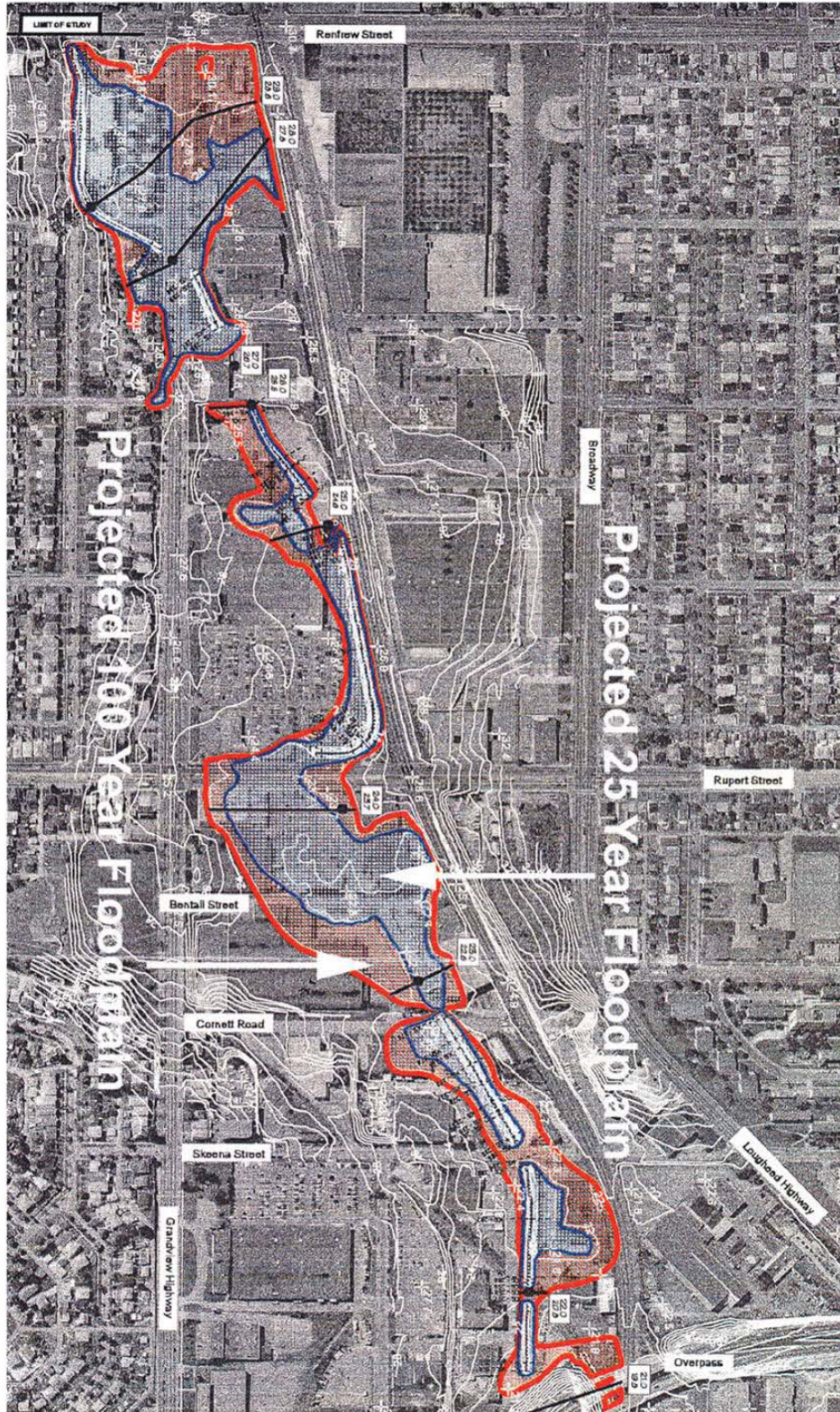
Staff and students of the BCIT Burnaby Lake System project undertook an intensive evaluation of Still Creek in 1998 (BCIT Burnaby Lake System Project). They found the water quality to be very poor, corroborating the findings of the Environment Canada study (Laura Smith, personal communication, 2001).

Still Creek Floodplain

In 1998 the Greater Vancouver Regional District produced a floodplain map for the Still Creek-Brunette River drainage basin that included the Grandview Boundary Industrial Area. The floodplain map illustrates that a significant amount of land in the GBIA could be flooded during a 25 and 200 year rain event. Two areas near Nootka Street and Grandview Highway, and immediately east of Rupert Street are vulnerable to flooding during both a 25 year and 200 year rain event. Elsewhere in the GBIA, the 25 year floodplain remains relatively close to Still Creek's existing channel, whereas the 200 year floodplain includes a significant portion of the Vancouver Film Studios east of Skeena Street. During a Still Creek Advisory Committee meeting, the GVRD representative cautioned that the areas of potential flooding are, or could be, larger than shown due to increasing impervious cover in the watershed and the complications associated with climate change.

In response to the concerns identified within the floodplain mapping project, the GVRD undertook a study to "investigate technical flood reduction alternatives." The June 1999 preliminary report considered a number of alternatives, including land-use management options, temporary storage in Renfrew Ravine, and peak flow diversion. One of the diversion options that was identified and is under consideration would involve directing large stormwater flows (i.e. 10, 25 or 200 year rain events) from the Collingwood and Rhodes Stormwater Trunk lines, near the 29th SkyTrain Station, south to the Fraser River via a large subsurface pipe. The report concludes this option "would generally eliminate the risk of flooding for the 25 year flood, and greatly reduce the risk of flooding for the 200 year flood." It is unclear what the final cost of this option would be but preliminary estimates indicate it could cost at least \$25 million (GVRD).

The potential for flooding within the GBIA, and elsewhere in the lower reaches of Still Creek, remains a major concern to the GVRD, the City of Vancouver and the City of Burnaby.



Floodplain map: Grandview Boundary Industrial Area
 (GVRD Still Creek - Brunette River Floodplain Mapping, 1998)

Riparian Zones / Streamside Vegetation

The 'riparian zone' refers to lands immediately adjacent to the wetted edge of streams, lakes, and wetlands. It is the transition area between the water and the land and has a direct influence on the aquatic environment.

The riparian zone is also important because it provides:

- Filtering of pollutants carried in runoff from surrounding land uses;
- Shade for the stream, thereby moderating water temperature;
- Stream channel stabilization;
- Cover and food for fish and other animals, both aquatic and terrestrial;
- Movement corridors for wildlife;
- Large woody debris (dead trees) for the stream, and,
- Areas of high biodiversity.

Of the portion of Still Creek presently above ground, only 26% has intact riparian vegetation forest with only 4.6% of the riparian forest being greater than 30 metres (GVS&DD, 1999). Within the study area, the only significant intact and relatively healthy riparian zone is within Renfrew Ravine. The ravine contains significant riparian forest cover including Alders, Big Leaf maples and Western red cedars, native shrubs (Ocean spray, Snowberry) as well as invasive exotic species such as Holly, English ivy and Blackberry. Renfrew Park contains clusters of large native trees but these are sporadic with very few shrubs or low trees.



Adjacent to St. Judes Church and school, near 14th Avenue and Renfrew Street, Still Creek includes a narrow riparian zone with a few large Cottonwoods and Alders, as well as a native shrub layer along the southern bank. Additional riparian planting along the south bank has recently occurred, although it is unclear as to whether these plantings will thrive.

Within the Grandview/Boundary Industrial Area, the riparian zone is sparsely vegetated. Weeping willow trees are found adjacent to the creek in two locations - at the Vancouver Film Studio and Danier Leather. At both sites the trees are on the north side of the stream with the trees at the Danier leather

site being in relatively poor health. As Still Creek passes to the north of the Real Canadian Superstore parking lot, there is a narrow riparian zone that includes native species of shrubs and Cottonwood and Alder trees.

To the east of Rupert Street, the creek is open only from Cornett Street to near Boundary Road with no significant native riparian vegetation. In general, the riparian zone within the GBIA is dominated by invasive species that include Himalayan blackberry and Reed canary grass.

Ecological value

The watershed lacks significant numbers of trees in most areas. Forests and trees provide high levels of evapotranspiration and storage in the ground. Evapotranspiration from a forest can amount to about 50% of the annual rainfall -- lawns have less than half that (Holz, Lipman and Schueler, 1998). Forest landscapes can hold water in the ground down to about 150 mm whereas lawns typically hold soil moisture to only about 50mm. For these reasons, trees are vital to reducing stormwater volumes to receiving streams. Of course, trees also can reduce air pollution and contribute to habitat, aesthetic and liveability values.

The current ecological value of Still Creek is relatively poor. The combination of creek channelization, high flows and velocity during storm events, poor water quality, minimal riparian vegetation and overall fragmentation of the system has reduced the presence and diversity of wildlife in and near the creek. The exception to this is the small portion of the creek found in Renfrew Ravine where riparian vegetation is intact, although dominated by non-native species. In this section of the creek the ravine is predominantly free of artificial bank reinforcement.

During the 1950's, fish were observed in Renfrew Ravine and prior to this local boys were known to catch cutthroat trout (McCreeley, 2001) in Still Creek. "Salmon populations were completely eliminated in Still Creek, and disappeared from the Brunette River during the 1960's and 1970's" (GVS&DD, 2001). Over the past two decades, fish passage and habitat improvements by community groups and government agencies have resulted in small numbers of spawning salmon to the Brunette watershed. Spawning salmon are known to return through the Brunette River into Stoney Creek, with additional salmon sightings in Deer Lake Creek, Eagle Creek, and Beecher Creek - all within the City of Burnaby. In addition, BCIT staff and students found Coho salmon smolts in Still Creek on the Burnaby side of Boundary Road, in June 2001.

Based on these observations it is likely that enhancement measures and restorative work within Vancouver's portion of Still Creek will be beneficial to both the upper watershed as well as the Brunette Basin.

The Brunette Basin Watershed Plan (February, 2001) lists a number of rare and endangered bird species that nest or over winter in Burnaby Lake Regional Nature Park including: Cooper's hawk, Western grebe, Great blue heron, American bittern, Green-backed heron, Bald eagle, Double crested cormorant, Turkey vulture, and others. Other notable animals in the Brunette watershed include Painted turtle, Snowshoe hare, Pacific water shrew and Beavers. While this study did not assess the absence or presence of wildlife for the Still Creek watershed, it is likely that a number of the animals found throughout the Brunette basin and observed in Burnaby Lake Regional Nature Park, (particularly bird species) use Renfrew Ravine and other segments of Still Creek.

Due to the absence of significant stands of native trees and shrubs in the Still Creek watershed, it is likely that wildlife use is restricted to those species better suited to urban conditions. This holds true with the types of vegetation found in the watershed, where current conditions favour more adaptable non-native plant species, further altering the ecological capability of the existing landscape and reducing wildlife habitat for native species.

Stormwater Management for Still Creek

Since the early 1900's, the Greater Vancouver Regional District has been responsible for managing Still Creek to convey stormwater from urbanized areas of the watershed to Burnaby Lake and ultimately the Fraser River. As early as 1913, engineering reports identified the Still Creek-Brunette River system as a stormwater management priority requiring stormwater trunk lines and channel straightening. In 1956, the Greater Vancouver Sewerage and Drainage District was formed with a mandate to improve the drainage capacity throughout the Still Creek – Brunette River system.

Similar to most urban watersheds, the recreational and ecological qualities inherent in Still Creek have traditionally not been a primary management consideration, (BBWP, 2001). Due to development in the watershed that has severely reduced infiltration and concentrated and accelerated runoff, Still Creek's channel now conveys substantially more water with more intensity than it did prior to development of the city around it.

Development in and around the creek, its channelization and culverting and ongoing pressures to create more impervious areas in the Still Creek watershed emphasizes the need to prepare an integrated approach to managing stormwater, including a flood management strategy for the Still Creek watershed. As identified in the GVRD's Preliminary Flood Reduction Alternatives report, "much of the defined channel system is insufficient to carry flood flows, and the bigger floods tend to spill onto the historic floodplains"(GVRD, 1999).

Planning Context and Governance

Jurisdiction for Still Creek overlaps several levels of government. Because Still Creek is part of the Brunette River system, which is a salmon bearing system, both the provincial and federal governments are involved in management of the stream and the vegetation adjacent to the Still Creek. The Greater Vancouver Regional District, through the Greater Vancouver Sewerage and Drainage District, is responsible for the conveyance of stormwater in Still Creek as part of its stormwater management mandate. The City of Vancouver is responsible for land use adjacent to the creek, which directly affects the health of the creek. Therefore, during redevelopment, the City has attempted to secure wider setbacks from the creek. The City also responds to accidental spills into Still Creek. Because of its mandate, the City plays an important role in protecting and enhancing the stream.

City of Vancouver Policy and Commitments

The City of Vancouver has made a commitment to protecting and enhancing Still Creek in a number of different planning initiatives and policies, including:

- Brunette Basin Watershed Plan;
- Still Creek / Greenway Enhancement Fund;
- Still Creek CD-1 Guidelines;
- Highway Oriented Retail, I-2 and I-3 Policies;
- I-3 High Technology / Highway Oriented Retail (HOR) GVRD Liquid Waste Management Plan;
- Rupert and Renfrew SkyTrain Station Precinct - Interim Rezoning Policies and Guidelines;
- Rupert SkyTrain Station Precinct Public Enhancements Plan Rupert Precinct Vision;
- City Plan, and,
- City of Vancouver Park Board Policy - Management Plan (1992).

Summaries of these documents are included in Appendix 3.

Provincial Government Legislation

Fish Protection Act - 2000 Streamside Protection Regulations

The purpose of this section of the Fish Protection Act is to protect riparian zones from the impacts of residential, commercial and industrial development. Through the Act and the Regulations, local governments are directed to provide streamside protection through their zoning and planning processes within a 5 year period or in consultation with senior environmental agencies on an agreed to alternative. This regulation is currently under review.

The Regulation recommends streamside protection areas between 5 and 50 metres from the top of bank or top of the ravine based on availability of land and classification of the stream. In discussions with Ministry of Water, Land and Air Protection (MWLAP) staff, it was agreed the streamside protection areas for Still Creek within this study area would likely fall within the category of a non-fish bearing streams within a fish bearing system. This is the least demanding of the requirements.

The levels of streamside protection will be negotiated on a site specific basis in collaboration amongst the City, MWLAP and the Department of Fisheries and Oceans. The negotiations may be conducted through an intergovernmental cooperation agreement between the City of Vancouver and the senior agencies specific to Still Creek. In the agreement, roles, responsibilities, and processes (such as site specific analyses) would be clearly identified and measures of flexibility would be established. The agreement would empower the City of Vancouver to review and approve land use applications that would be supported by the senior agencies without the need for their participation in the review process.

Water Act - Section 9 Approvals and Notifications

The Water Act pursuant to Section 9 and the Regulations requires that the Ministry of Air, Land and Water Protection (MWLAP) review and provide approval for any works in and around a stream. In the Lower Mainland Region, the review and approval of proposed work is managed, in cooperation with Fisheries and Oceans Canada, through a “one window approach” via a lead agency supported by the MWLAP and the Ministry of Sustainable Resource Development. An intergovernmental agreement established under the Streamside Protection Regulation could also incorporate processes and procedures for work in and around streams which could either eliminate or greatly reduce the need for senior agency involvement. The GVRD would also be a participating partner.

Federal Government Legislation

Fisheries Act

The Fisheries Act has a number of sections that are in place to protect fish habitat and water quality. Salmonids do not live within the portion of the stream in the City of Vancouver so direct harm cannot be done within the city boundaries. But water from Still Creek flows into the Burnaby portion of Still Creek, the Brunette system and eventually the Fraser River. The Brunette system now supports chinook, coho and sockeye salmon as well as cutthroat trout. Therefore, the sections related to deleterious substances would apply to Vancouver. These are sections 34(1) definition of deleterious and section 36(3) Deposition of deleterious substance prohibited. Section 35(1), which prohibits alteration of fish habitat, may also apply, as the food/shade aspects of the riparian zone would be considered fish habitat.

This means that although there are no salmonids in Still Creek the water from the stream flows into a salmon bearing stream and if the water quality is found to have a harmful affect on the salmon this could be found to be a Fisheries Act violation.

Conclusion

A complex web of bio-physical, regulatory, policy and planning factors interconnect within the watershed of Still Creek. In the following chapters of this report, we describe and evaluate a series of options that, if implemented, would assist Council, staff and the community in their efforts to rehabilitate Still Creek.

CHAPTER 3 GRANDVIEW BOUNDARY INDUSTRIAL AREA

Introduction

The Grandview/Boundary industrial area (GBIA) extends, for the purposes of this study, from Renfrew at Grandview Highway, east to Boundary and from Grandview north to the Burlington Northern Santa Fe rail lines. Land uses include warehousing, small scale and big box retail and some light manufacturing. The Vancouver Film Studios occupy a significant portion of the eastern part of the site

Still creek crosses into the GBIA area approximately 100 metres east of Renfrew Street. From this point it flows east/northeast to the boundary of Vancouver and Burnaby at the junction of Boundary Road and the Trans Canada Highway.



The Still Creek channel is contained in steep engineered, linear banks, in the sections where it flows at the surface through the GBIA. There are few meanders, (bends and turns) in the creek and the riparian vegetation is sparse. The few native species that are growing in the riparian zone are limited to shrubs and volunteer trees in the section that flows behind the Real Canadian Superstore property. Aside from the path along the south side of the creek, where it flows through the Real Canadian Superstore property, there are no recreation amenities near the creek.

The Grandview Boundary Industrial Area is situated partially in the floodplain of Still Creek and as such the engineering challenges associated with managing the flow of stormwater is an issue that both the GVRD and the City of Vancouver have actively sought to address. Any work, in and around the creek, must be designed with the management of stormwater as key criteria. This chapter addresses a range of strategies for addressing stormwater and for optimising the recreational, water quality and ecological opportunities along the creek.

Still Creek in the Grandview Boundary Industrial Area:



Area 1



Area 2



Area 3



Area 4



Area 5

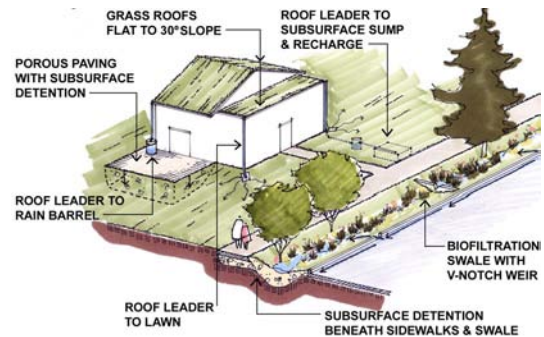
Engineering studies are underway that will address the management of floodwater flowing in Still Creek through the GBIA. Some of the Still Creek rehabilitation measures discussed in this chapter should be part of the range of stormwater management solutions necessary to mitigate flood potentials in the GBIA. One of the strategies for managing stormwater, that has proven effective in many Pacific Northwest communities, is the integration of best management practices (BMP's) with planning, engineering and site designs. The next section of this chapter recommends BMP's best suited for implementation in the Grandview Boundary Industrial Area. It is followed with long term rehabilitation plans for the GBIA.

Best Management Practices

Best Management Practices (BMP's) are those actions, operations and technologies that have been developed over the last 10 – 15 years to better manage stormwater quality, volume and peak flows. Several different BMP's may be effective within the Grandview Boundary Industrial Area in reducing flood potential and improving the water quality of Still Creek. BMP's should be a component of an integrated watershed management plan for the entire catchment area, including the GBIA.

The following best management practices that would be effective in managing stormwater in the Grandview Boundary Industrial Area include:

- Constructed wetlands;
- Grassy swales;
- Green roofs;
- Roof top storage;
- Parking lot detention;
- Increased street cleaning, and,
- Grass pavers /porous paving.



Potential BMP's in a residential area

Constructed wetlands can provide significant improvements to both the water quality and flood concerns related to urban streams. They can reduce downstream peak flows by providing short-term storage during high flow periods. The wetlands are also effective in removing pollutants, as wetland plants and organisms remove nutrients, sediments, heavy metals, and hydrocarbons. Wetlands can also be rich habitat and provide recreational amenities to an area. The diversity of vegetation and wildlife also make wetlands useful for educational purposes. Finally, wetlands have high aesthetic value as they provide a sense of openness, colour and textural contrasts, reflect sky and weather conditions, and where songbirds are present, enhance the experiential quality of a place. Benches and access points provide people with a place of natural solitude, and if built along Still Creek, this would contribute to the liveability of the area. Constructed wetlands are recommended in 3 different areas within the GBIA.



Constructed Wetland

Grassed swale for collection and transport of runoff is an old idea still found in many residential areas. Grassed swales also provide a water quality treatment function and are often constructed for stormwater management in parking lots and adjacent to roads and as a pre-treatment for other BMP's. Grassed swales help to decrease runoff velocities, reduce peak flows - which in turn help to reduce flooding and stream channel erosion. Some of the rainfall may infiltrate into the ground or evaporate which further reduces runoff volumes (GVSDD, 1999). In the GBIA, grassed swales could be used in parking areas as part of retrofits or when new development takes place. The City of Vancouver should incorporate swales in new boulevards in the Grandview Boundary Industrial Area.

Green roofs are roofs that include grasses and/or low growing plant material. A green roof can be purely utilitarian or can be developed as part of a rooftop garden amenity. Green roofs detain rainfall that is subsequently used by the plants or evaporates. In a recent study on the benefits of green roofs, the Canadian Mortgage and Housing Corporation found that green roofs can improve air quality, reduce heat build up in urban areas, provide wildlife habitat and improve stormwater management (CMHC, 2001). Green roofs also have the aesthetic benefit of softening the expansiveness roofs when viewed from higher ground. It is recommended that green roofs be incorporated into the design of new and redeveloped buildings in the GBIA.

Rooftop storage is the temporary holding of rainwater on a roof. It is typically directed to the storm drainage system and can be used on site for irrigation purposes. The Building Code requires a roof be capable of supporting a load of 15 cm (6 inches) of rainwater. Only slight changes to the construction process would be required to accommodate rooftop storage of runoff. This BMP should be encouraged with all new and redeveloped buildings in the GBIA.

Parking lot detention basins should be integrated into all new and redeveloped parking areas in the GBIA. A thick parking lot subgrade, comprised of coarse aggregate, creates a subsurface reservoir while maintaining the structural requirements of the subgrade. These types of reservoirs would receive relatively large volumes of stormwater runoff, in a short period of time, thereby reducing the peak flow of runoff into Still Creek. They should be incorporated where soil and grades in the GBIA permit.

Street cleaning is traditionally done for aesthetics, to remove visible refuse and to keep storm drains clear of sediments so they can flow efficiently. However, it has been found that more intensive street sweeping can significantly reduce pollutants in runoff if modern vacuum systems are used (GVS&DD, 1999). Vancouver presently uses this type of sweeper. Vacuum street sweeping is one of the few management alternatives available to use in existing urban areas to reduce the influx of pollutants that originate across a wide area.

The industrial portion of the GBIA is street cleaned only 2 times per year, while the commercial areas may be cleaned 3-4 times per year (Rolland, 2001). For optimum effectiveness in reducing contaminants in stormwater runoff and improving water quality in Still Creek, streets and parking lots in the GBIA should be cleaned every week or at least 2 times per month. A pilot project should be implemented to sweep streets bi-weekly for one year to assess improvements in the stormwater. This will require a monitoring program for sediments, heavy metals, nutrients and oxygen demand.

Porous pavement allows rainfall to infiltrate into the ground and offers a viable alternative to conventional, impervious pavements. Typically, porous paving includes a porous surface and a porous subsurface layer that temporarily stores, and slowly releases, the stormwater. As a result, porous pavement can provide significant reductions in runoff peak flows volumes and water quality improvements (GVSD, 1999).

Grass pavers are commonly rigid plastic grids or pre-cast concrete lattice structures, with a high percentage of void space, in which soil is placed and grass grown. The rigid grid or lattice supports vehicular traffic while the void spaces provide areas for infiltration. These surfaces provide a hard protective surface that appears as a grassed area. Grass pavers are appropriate for parking lots, storage areas, and access roads and should be incorporated into new and redeveloped areas within the GBIA.

Direct costs and benefits of implementing the various best management practices are unknown at this time until further study and a pilot project are implemented in the GBIA. The effectiveness of BMP's has, however, been demonstrated – as detailed in Appendix 2. It is recommended that a pilot study to test the cost and efficacy of street sweeping be undertaken in the first phase of implementation and that as the rehabilitation and redevelopment initiatives proposed in this report are implemented, that further best management practices be tested.

Still Creek Enhancement Options

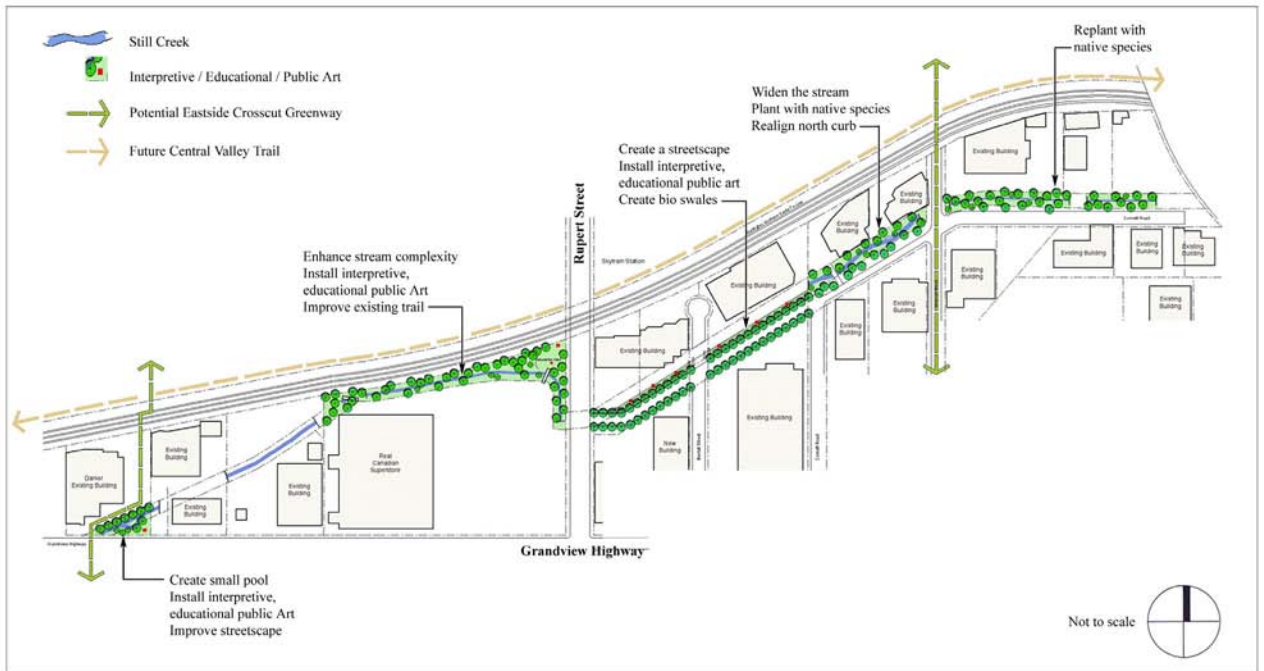
The Grandview Boundary Industrial area has 5 distinct zones, segregated with respect to the property relationships to Still Creek and the existing road and rail patterns in the area. Still Creek, within the GBIA, has been delineated within the following zones, for the purposes of developing rehabilitation scenarios:

- Area #1: Still Creek West
- Area #2: Real Canadian Superstore
- Area #3: Rupert Cornett
- Area #4: Cornett to Skeena
- Area #5: Skeena to Boundary

Given the zoning, disparate land ownership patterns, supply of industrial lands in the city (and near the GBIA) and the cost of daylighting and other enhancement opportunities, the potential rehabilitation efforts for Still Creek have been segregated into two different implementation periods: a 10 year period and the 10 to 50 year period.

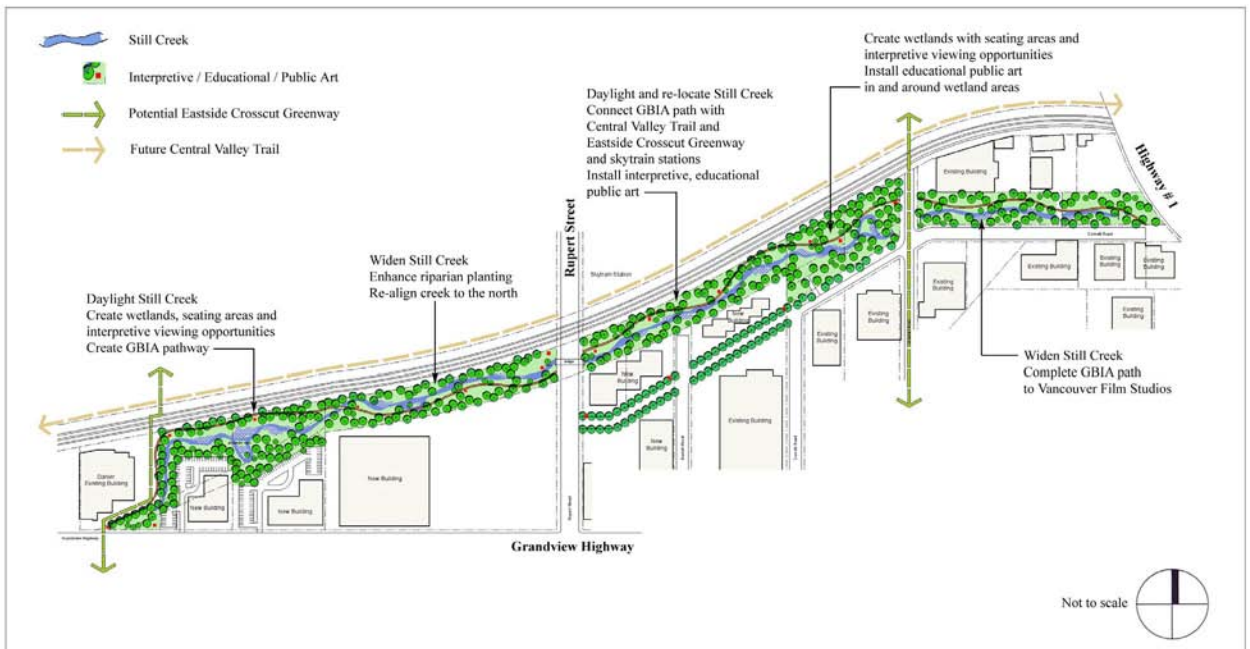
Improvements in the first 10 years can be funded entirely from monies already committed, or that staff have identified as being reasonable to expect for use in this part of the city. The subsequent implementation period will depend on redevelopment of key properties and would most likely occur after 10 years and may take as long as 50 years. The 50 year scenario recognizes the uncertainties of market forces at play in this area, vagaries of industrial capacity and the unknown appetite of future Councils to foster land use changes.

The vision of a fully rehabilitated Still Creek is a worthy goal and one that the consultant team believes is realistic, given sufficient leadership, funding and commitment over the next 10 – 50 years.



Still Creek 10 Year Action Plan

Lees + Associates Karen Hurley + Associates Dayton + Knight Engineers Hudema Consulting Group



Still Creek 10 - 50 Year Action Plan

Lees + Associates Karen Hurley + Associates Dayton + Knight Engineers Hudema Consulting Group

Area #1: Still Creek West

Site Description

Still Creek West is on the western end of the Grandview Boundary Industrial Area. It includes six properties, one of which is currently the Danier Leather store, the other five are used for either commercial and/or light manufacturing. Sites are typically covered by building and parking lots – a condition similar to that throughout the GBIA that leads to a high percentage of impervious surfaces and a minimal amount of vegetation within the riparian zones.

Still Creek flows into this area, via a culvert under Grandview Highway, at 3003 Grandview Highway. From here it flows above ground, in a straight line to the northeast, for approximately 60 metres. This section of the creek is lined on the north by large, mature Weeping willow trees with lawn. The riparian vegetation on the south is primarily Himalayan blackberry. At the eastern end of this section of the GBIA, the creek enters an 80 metre long culvert under a parking lot. The creek then continues in a 120m long open channel towards the northeast. This section has minimal riparian vegetation consisting primarily of Himalayan blackberry. Still Creek then flows under a service road, just south of a gravel parking lot situated northwest of the Real Canadian Superstore. The parking lot is part of that company’s property.



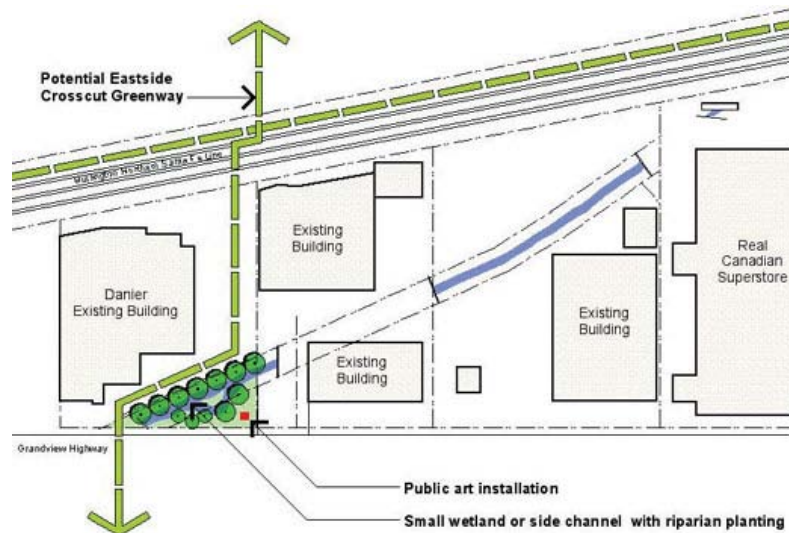
Total Area:	3.4ha
Percentage Impervious Cover:	80%
Riparian Vegetation:	primarily non-native species
Creek Complexity:	negligible
Properties effected:	

- | | |
|------------------------|------------------------|
| 3003 Grandview Highway | 3057 Grandview Highway |
| 3061 Grandview Highway | 3083 Grandview Highway |
| 3127 Grandview Highway | 3185 Grandview Highway |



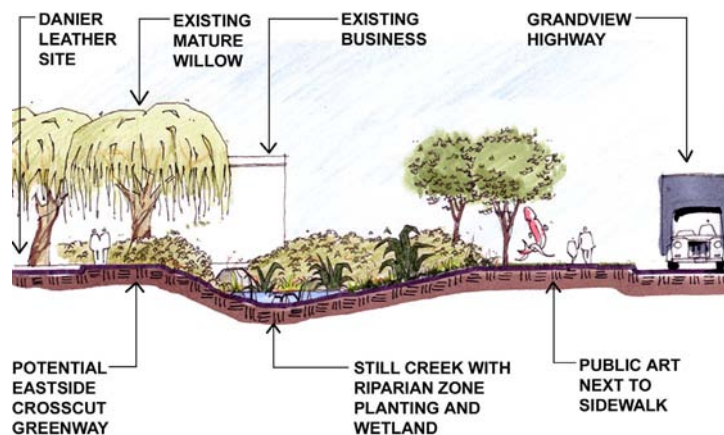
10 Year Action Plan

In the short term, this site offers good opportunities to create a strong Still Creek presence at Grandview Highway. Enhancing the riparian vegetation, widening the stream with a small wetland or pool, installing public art and creating a small seating area are proposed.



This action plan includes:

- Widen Still Creek to accommodate a pool, side channel or small wetland area and enhance the stream bed;
- Establish native plantings in the riparian area, including the planting of significant trees near the Grandview Highway culvert;
- Install public art and facilitate education events to create awareness of Still Creek and rehabilitation work and contribute to a sense of community, and,
- Promote this site as a Still Creek rehabilitation pilot project in order to generate enthusiasm for further work on the creek.



Benefits

Stormwater flow management: A widened channel will provide a small amount of flood/high flow storage. Slowing the water will also reduce velocity downstream.

Water Quality: A wetland or side channel will provide a small amount of treatment of runoff as sediments are collected. Aquatic plants will remove pollutants and excess nutrients from the water. (Appendix 2 provides further detail on wetland treatments).

Recreation: The seating area will provide a passive recreational space and visual amenity for workers, visitors and residents in this part of the city. The new vegetation will provide an interesting green space for people to walk beside, have lunch or observe the stream and plants. The area will provide a pleasant view for travelers on Grandview Highway. When the Still Creek path system is completed, this area will be an attractive resting place and will connect with either one of the four Eastside Crosscut Greenway locations.

Education: This high profile site offers tremendous opportunity to enhance awareness of Still Creek within a natural amenity. An educational kiosk should be used to communicate the importance of Still Creek and its various functions as well as provide updates, on a regular basis, to inform people of the rehabilitation activities. This site will be an important demonstration project or pilot study for other rehabilitation efforts on Still Creek.

Community Art: This is an ideal site for an art installation because of its high visibility. It would also be effective to use the site to involve the community via a community art event that would include riparian vegetation planting and celebration of Still Creek. Partnerships with local businesses should be established to encourage their support and participation in events.

Ecosystem: The native trees, shrubs and plants used as part of the demonstration project will be good bird habitat and provide shade for the stream which keeps the water cool in the summer months.

Constraints

- Relatively small site would limit ecological impact of this action.
- Availability of property may be an issue.

Estimated Costs

- Land acquisition: \$180,000 (6000 square feet @ \$30.00/square foot)
- Capital costs: \$150,000

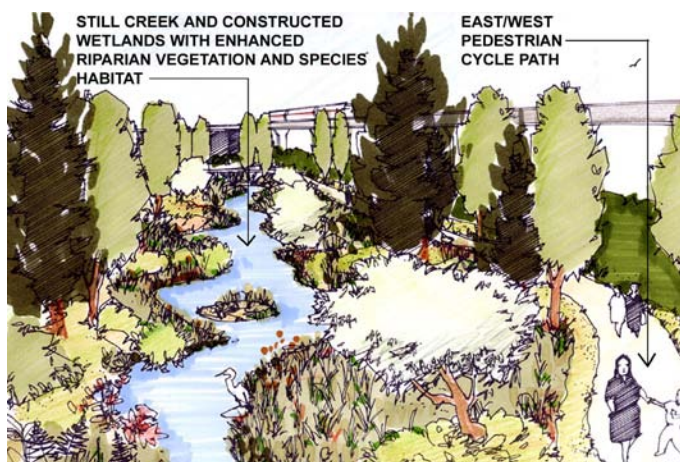
10 – 50 Year Action Plan

Over the 10 – 50 year period creation of a wetland and daylighting of Still Creek is proposed for this site. As these works are undertaken, ongoing public art should be commissioned and a multi use path and seating areas should be built.



The long term action plan should include:

- The creation of a wetland or a series of linear wetlands at the gravel parking lot in the northwest corner of 3185 Grandview Highway;
- Creation of a multi-use pathway with seating areas for walkers and cyclists that should eventually connect all along Still Creek;
- Daylight 80 metres of Still Creek and realign the stream along the western and northern side of 3057 and 3061 Grandview Highway;
- Replant the riparian zone with native species to create green space and habitat;
- Install educational signs and kiosks and host community arts events that will inform citizens about the site, Still Creek and the Brunette system, and,
- Implement Best Management Practices such as roof top gardens and use of porous pavement systems as new buildings and parking lots are built.



Benefits

Stormwater flow management: A significant volume of peak flows could be stored in the wetland to reduce downstream flooding and decrease stream velocity. Also the rooftop gardens and porous pavement systems will reduce runoff volumes and peak flows directed to Still Creek.

Water Quality: The wetland series would be effective in reducing pollutants in the water (which is almost entirely urban runoff). For example, wetlands have removal efficiencies of 90% for hydrocarbons, 67% of nitrogen, 77% of bacteria and 63% of lead (See Appendix 2 for further information). The BMPs used in parking areas will reduce runoff contaminants directed to the stream.

Recreation: The multi-use pathway will connect other portions of the area adjacent to Still Creek and provide a path for workers to have a mid-day walk or residents to enjoy a linear stroll along the stream. The benches among the trees will provide a restful place to sit, have lunch or watch the birds.

Education: wetlands are ecologically diverse and offer a range of educational opportunities. Schools could use this area to teach students about wetland plants and habitat functions. Signage, printed material and videos could be produced and made available to schools, community associations and residents.

Community Art: The path, resting areas and wetland will provide opportunities for community art events and video productions. Installations of art within the wetland and riparian areas would bring interest and whimsy to this part of the industrial area of the city.

Ecosystem: The wetland will provide bird, amphibian, insect and small mammal habitat. Water quality improvements will benefit fish and other aquatic wildlife downstream in the Brunette system.

Constraints

- Requires purchase, lease and/or negotiation with owners of affected property at the time of redevelopment.

Estimated Costs

- Land acquisition: \$500,000
- Capital costs: \$600,000

Area #2: Real Canadian Superstore

Site Description

This area is dominated by the presence of the Real Canadian Superstore. The creek flows through a 30 metre long culvert at the northwest corner of the Real Canadian Superstore property, passes along the north side of the store, makes a 90° southerly turn for a short stretch and then passes through a culvert under Rupert Street. A pedestrian walkway exists along the south bank of Still Creek with a bridge over the creek connecting to Rupert.



Currently this small park space serves mainly as a pedestrian passageway between the Superstore and residential and commercial areas to the north. The new SkyTrain station at the north-east corner of the

Rupert/BNSF intersection will also be a hub for pedestrians entering and leaving the Superstore property.

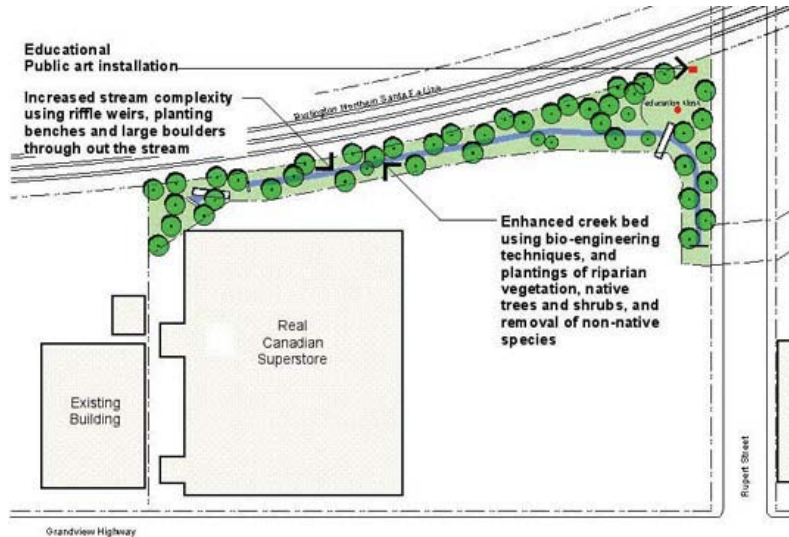
The banks of the creek in this section are typically armoured with a combination of riprap, gabions (wire baskets filled with large stones) and geotechnical plastic webbing. In some locations the gabions are beginning to fail. A mixture of planted and “volunteer” planting is beginning to establish in some areas along the north and south banks. The bed of the creek has a few areas of granular material but in general is covered in finer, silt-like materials.

Total Area:	4.6ha
Percentage Impervious Cover:	almost 100%
Riparian Vegetation:	Black cottonwood, Red alders, some native shrubs, Poplars, Willows and non-native species
Creek Complexity:	negligible
Properties effected:	3185 Grandview Hwy



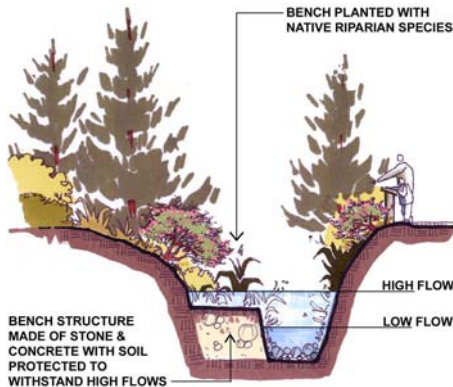
10 Year Action Plan

Within the next 10 years, it is recommended that **multi-use pathways, education, public art and stream habitat initiatives be implemented** along Still Creek at the Real Canadian Superstore Site. The riparian zone rehabilitation will be done on the south side of Still Creek, in this zone.

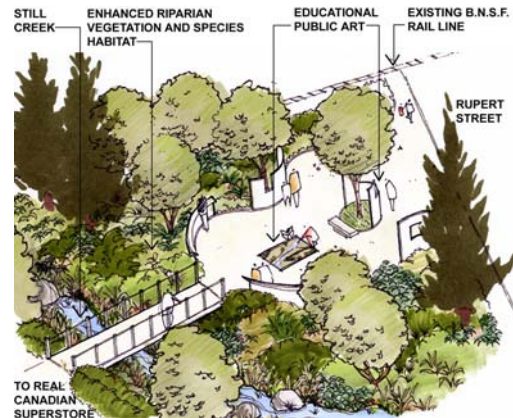


These actions will include:

- Create a pedestrian and cycle link with the Rupert Street SkyTrain Station, the Eastside Crosscut and Central Valley Greenways. This would occur along the existing path alignment,
- Replant the northeast corner of the Superstore site at Rupert and the BNSF rail line, creating an inviting entry to the Still Creek path and providing a venue for public art and educational installations and events;
- Improve riparian habitat and stream complexity through streamside planting and installation of planting benches and riffles, and,
- Replace gabions with planting benches and bio-engineered slopes as a pilot project.



In-stream planting bench



Rupert Street at Still Creek

Benefits

The primary benefits that will result from these actions, in conjunction with the improvements to the area to the west, are an **improved recreation and commuter bicycle and pedestrian connection** to the SkyTrain Station, and **educational opportunities** at a high profile location.

Water Quality: Incremental improvements to water quality will result with improved riparian habitat and planting.

Recreation: Safe, attractive recreation, cycling and pedestrian opportunities will result when the Still Creek route is built. Passage through this area, previously along Grandview Highway, could be taken along the Still Creek route. Rest places would further enhance the recreation potential of this section of Still Creek.

Liveability: New landscape plantings, pathways and signage at the Rupert/BNSF corner will significantly improve the urban experience along the adjacent section of Rupert Street and for workers, residents and visitors passing into and through this area, near Still Creek

Education/Public Art: Provision of educational kiosks at a high traffic location will further instill the awareness of Still Creek, as well as offer an opportunity for greater public involvement in the planning, design and experience of the public space. Public art incorporated into the reconstructed corner of Rupert Street and the BNSF rail line will provide both a provocative and educational experience, as well as enhance Rupert Street .

Ecosystem: Incremental steps towards improving the ecological integrity of the riparian zone, including enhanced habitat for bird and aquatic species. Rehabilitating the riparian zone will benefit wildlife and aquatic species by providing shade, cooler water and increased oxygen.

Constraints

- Limited stormwater flow management benefits
- Innovative bio engineering methods will have to be monitored
- Recreational linkages, in order to be effective, will have to be built simultaneously with improvements in the area to the west, as well as improvements to the Central Valley Trail

Estimated Costs

- Land acquisition – negotiations with RCS property owners will be required
- Capital costs:
 - \$45,000 public art and educational kiosk
 - \$300,000 riparian zone enhancement
 - \$100,000 stream complexity enhancement

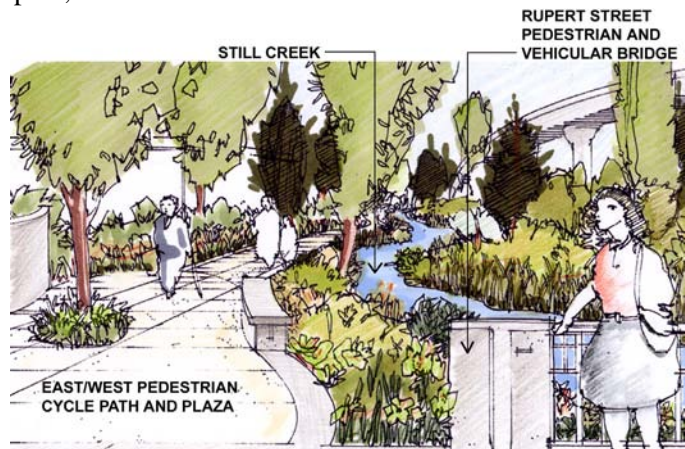
10 – 50 Year Action Plan

The 10 – 50 year vision for Still Creek within the Real Canadian Superstore site includes enhanced **recreation opportunities**, significant **improvements to the stream**, more viewing points and **ongoing public art opportunities**.



These actions include:

- Provide a continuous southern loop to the Central Valley Greenway that would connect Rupert Street with Renfrew Street;
- Create nature and recreation experiences, including bird and creek viewing platforms. These may include steps down to safe, creek side edges, overlooks. Nature in the city/the city in nature should be celebrated in the design of these places;
- Build venues for public art and outdoor learning that would form part of a community art, education and environment program. Schools, design professionals, artists, industry and retailers should be encouraged to participate;
- Widen Still Creek with meanders, reshaped banks, installation of large woody debris and enhanced riparian zones including replacement of non-native species with native plants, and,
- Re-align the eastern leg of Still Creek by replacing the 90 degree bend with a meander and directing the creek to a more northerly position under Rupert Street.



Benefits

The primary benefits arising from these actions would be a significant **improvement to the recreation experience and ecological integrity** of this part of the Grandview Boundary Industrial Area.

Stormwater: Stormwater flow management could be enhanced through the reduction of stormwater velocity by widening of the channel.

Recreation: Provision of nature viewing experiences and strengthening connections to the greenways will enhance the recreational amenities built in the first phase. They will also attract people to this area and potentially keep them here longer

Liveability: Rehabilitation of Still Creek, at the site of a large scale retail building will provide a dynamic nature/city interface, as well as a potential precedent for similar conditions elsewhere in the city. Improving the Still Creek/Rupert Street intersection will further enhance the streetscape experience on Rupert. These actions will continue to enhance the liveability of the GBIA for workers, residents, shoppers and other visitors.

Education/ Public Art: Provision of public art and education opportunities along the north side of the Real Canadian Superstore will provide interest in and focus to a highly visible and well visited portion of the stream. A Still Creek Celebration Day, or Streamkeeper Creek Cleanups or numerous other community events could take place at the revitalized corner of Rupert and the Real Canadian Superstore Site. Educational materials on Still Creek should be made available to local schools to encourage visits to this site.

Ecosystem: A widened channel, large woody debris, riffle weirs and rehabilitated riparian zones will slow the water, oxygenate it and help to sustain cooler water temperatures. This will impact the ecological integrity of Still Creek, both upstream and downstream. Removal of the culvert and the 90 degree turn will return Still Creek to a more natural alignment.

Constraints

- Property acquisition or right of way issues arising at time of redevelopment may curtail improvement options.

Estimated Costs

- Land acquisition: To be determined at time of redevelopment, allow \$500,000
- Capital costs: \$500,000(not including cost to replace culvert or build a bridge)

Area #3: Rupert Street to Cornett Road

Site Description

This area, generally referred to as the “Rupert Block,” includes retail, commercial and warehousing land uses. The road layouts in this part of the GBIA can be confusing for first time visitors to the area. Pedestrian circulation is awkward and unclear. There is no obvious pedestrian or cycling route through the Rupert Block as sidewalks are discontinuous and no provision made for cycle travel.

Still Creek is entirely culverted in this zone. The culvert extends from under the sidewalk on the west side of Rupert, through this zone to Cornett Road. It passes under the road and parking areas within the precinct. As a result, significant changes to Still Creek in this area are unlikely until the area is redeveloped.



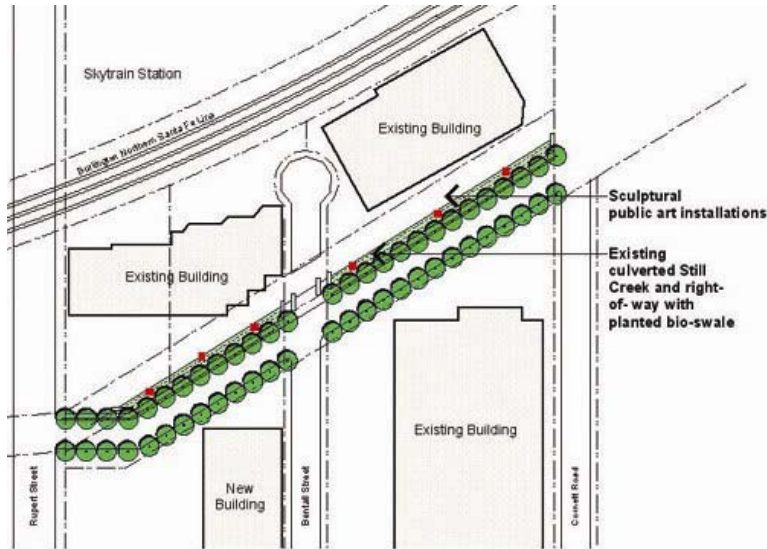
Total Area:	6.4ha		
Percentage Impervious Cover:	100%		
Riparian Vegetation:	n/a		
Creek Complexity:	n/a		
Properties effected:	2750 Rupert	2876 Rupert	3355 Grandview Hwy
	2770 Bentall	2820 Bentall	



Still Creek flows in a culvert beneath this road and parking area

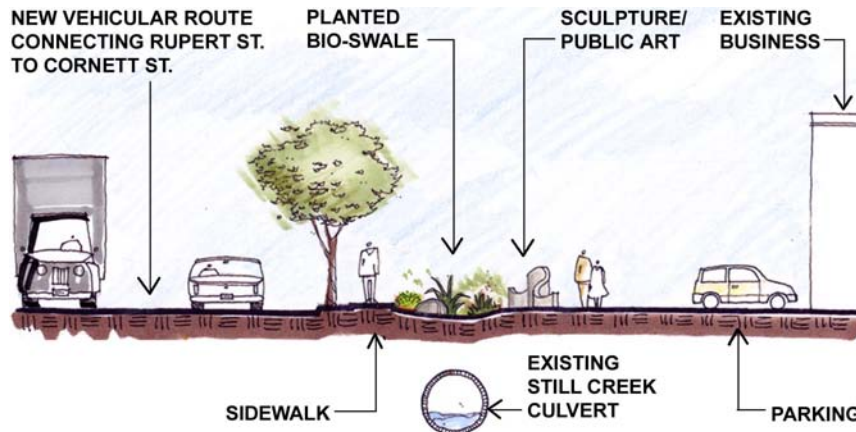
10 Year Action Plan

We recommend that an innovative streetscape plan be designed and implemented as part of the changes to the roads system within the Rupert Block. The streetscape improvements would include tree planting, public art and grassed swales. The intention of these initiatives would be to improve stormwater runoff quality from the site, and to reflect the presence of Still Creek in a series of green, artistic additions to the precinct. In this way, the high profile quality of this site will be used to educate the community and enhance what is now an austere urban experience.



These actions should include:

- Construction of a safe pedestrian and cycle link from Rupert Street to Cornett, that would also tie into the Rupert Street SkyTrain station;
- Creation of a grassed or dry swale, to reflect the historic path of the creek;
- Installation of public art, to be based on the “lost” nature of the stream, through this zone, and,
- Planting of street trees along the pedestrian/cycle way and swale.



Benefits

The primary benefits that will result from these actions are a **safe recreation bicycle and pedestrian connection** to the SkyTrain Station, improvement of stormwater runoff quality and **educational opportunities** at a high profile location.

Stormwater flow management: If grass swales are used extensively within re-designed parking lots and adjacent to side roads then there will be some slowing of runoff velocities to Still Creek as well as some rainfall infiltrating in the ground and evaporating.

Water Quality: water quality from the site will be improved if a large portion of the parking lot and side road runoff is directed to grass swales. Sixty metre long swales have been shown to have significant removal efficiencies for total suspended solids, oil and grease, zinc and lead. See Appendix 2 for more information.

Recreation: A much safer pedestrian and cycle route would be beneficial to workers and visitors to this area.

Liveability: New landscape plantings, public art and the pedestrian/cycle way combined with an improved connection with the Rupert Street Station, will significantly improve the urban experience in this area. As well, the planting of trees up to Rupert Street will enhance Rupert Street, between Grandview and the BNSF rail line crossing.

Public Art/ Education: Provision of public art within this precinct will not only enliven the space, but more importantly, public art will provide a canvas upon which community artists can tell the story of Still Creek, and by association, the narrative of other “lost” streams in Vancouver. This should be considered a primary theme to any public art in the Rupert Block. As well, opportunities to involve the community, schools, businesses and others in the creation, installation and celebration of the art should be encouraged.

Ecosystem: Marginal ecosystem benefits will result from this action plan. However small, the planting of trees is always beneficial.

Constraints

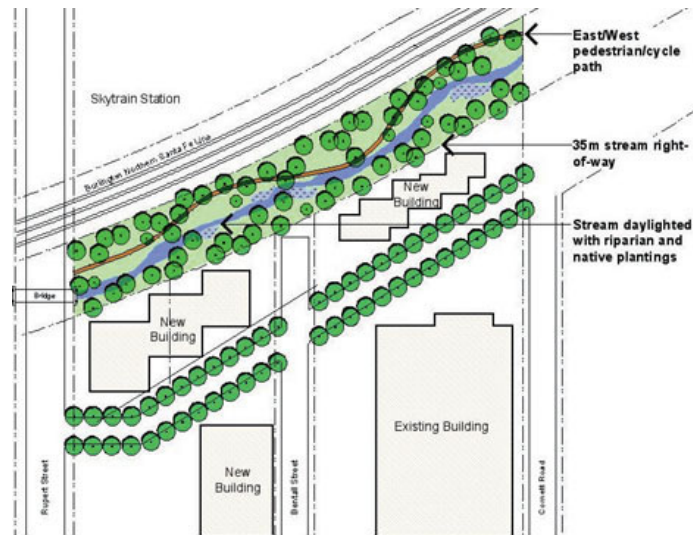
- No stormwater flow management benefits
- All the 10 year actions will be contingent on changes to the road network within this part of the GBIA

Estimated Costs

- Land acquisition: n/a
- Capital costs: \$75,000 for streetscape and public art components

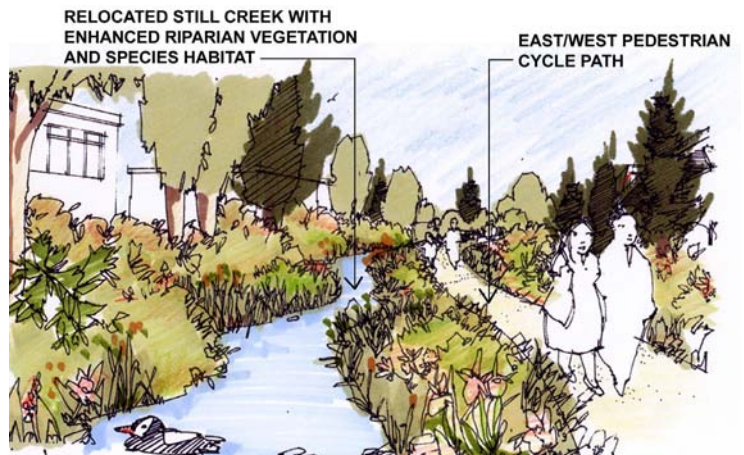
10 – 50 Year Action Plan

Still Creek, through the Rupert Block, should be daylighted over the next 50 years. Bringing the creek back to the surface, along the northern edge of the area, immediately south of the BNSF tracks, will include **new recreation opportunities** much **improved pedestrian and cycle routes, increased flood storage through stream widening, enhancement of the riparian zone, and new buildings and surrounding landscape and parking areas that incorporate Best Management Practices.**



Actions that should occur, over the 10 – 50 year period of implementation are:

- Daylight Still Creek in a new right-of-way abutting the south side of the BNSF rail line.
- Build a multi-use pedestrian and cycle walkway, lookouts and rest places along the creek;
- Link the pedestrian/cycle path with the BNSF crossing to the SkyTrain Station and the Central Valley greenway;
- Implement Best Management Practices, and,
- If possible, leave the streetscape and public art improvements, built during the first phase of implementation, in situ. If not, relocate the public art to the daylighted section of the Creek.



Benefits

The benefits of daylighting Still Creek will be an increase in flood storage area and a major **improvement to the ecological capacity and integrity** of the creek in this part of the GBIA. As well, **recreation opportunities will be significantly enhanced.**

Stormwater: The wider stream channel will be able accommodate larger peak flows which will contribute to reduced flood potential for the immediate area as well as downstream. The wider stream channel will also result in a reduced stream velocity. Best Management Practices such as green roofs, rooftop storage, parking lot detention basins and porous pavement systems will significantly reduce the runoff volume flowing off the site as well as the peak flow levels in Still Creek downstream from the site.

Water Quality: The application Best Management Practices in the redevelopment of the site will result in significantly improved stormwater runoff from the site to Still Creek. Grass swales and porous pavement incorporated into newly developed sites will have significant removal efficiencies for total suspended solids, oil and grease, zinc and lead. See Appendix 2 for more information.

Recreation: The creation of a multi-use path and rest areas, adjacent to the daylighted Still Creek, south of the BNSF rail corridor, will provide nature viewing and contemplation places. The strengthened connections to the greenway system will enhance the pedestrian and cyclist amenities.

Liveability: Daylighting Still Creek, at the time of redevelopment, will form an open space connection through this part of the GBIA. We believe redevelopment based on the ecological improvement of Still Creek will be a significant benefit to the GBIA. As well, daylighting Still Creek will create a linear green space that will further enhance the streetscape experience along that corridor. These actions will continue to enhance the liveability of the GBIA for workers, residents, shoppers and other visitors.

Ecosystem: An open, wider, stream channel and rehabilitated riparian zone will enhance terrestrial and aquatic habitat through improvements to water quality, food sources and refuges. The widened channel, large woody debris, riffle weirs and rehabilitated riparian zones will slow the water, oxygenate it and help sustain cooler water temperatures. All of these benefits will contribute to a healthier Still Creek at this site - and downstream.

Constraints

- Improvements to the Rupert Block will be predicated upon cooperation and negotiation with affected property owner(s)

Estimated Costs

- Land acquisition: To be determined at time of redevelopment, allow \$1 million
- Capital costs: \$700,000 (not including movement of utilities)

Area #4: Cornett to Skeena

Site Description

This area includes primarily warehousing and light manufacturing operations. The building stock is relatively old with two buildings, 3445 Cornett and 2525 Skeena, appearing to be in poor condition.

In this area Still Creek flows through a straight, narrow channel with no stream complexity such as riffles or meandering of the stream channel. Vegetation is limited to non-native plants such as Himalayan blackberry. There is little other notable riparian vegetation. A storm sewer parallels the creek along the south bank of the creek.



Total Area:

3.6ha

Percentage Impervious Cover:

95%

Riparian Vegetation:

mostly Blackberry

Creek Complexity:

negligible

Properties affected:

3434 Cornet	3445 Cornet	3462 Cornet
2525 Skeena	2625 Skeena	2741 Skeena
2743 Skeena		



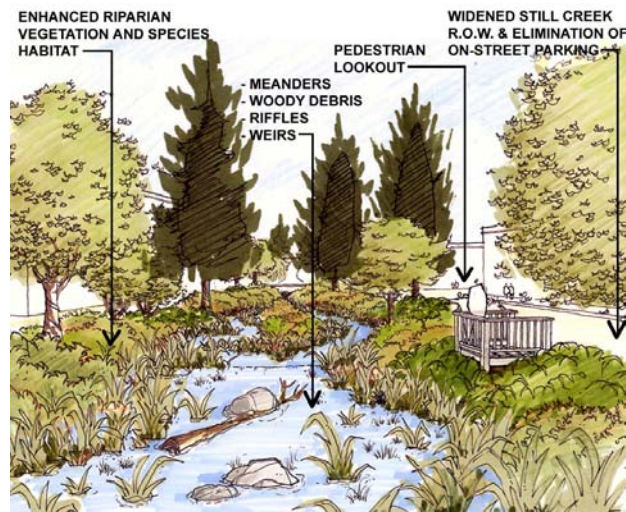
10 Year Action Plan

Given the narrowness of the Still Creek corridor in this part of the GBIA, we recommend the elimination of on-street parking on the north side of Cornett and a slight narrowing of the driving lanes, in order to provide an additional 6 metres of space for the creek.



This plan should include the following actions:

- Create a pedestrian and cycle path along the south side of the riparian zone;
- Widen the stream channel;
- Enhance complexity in the stream by creating meanders, riffle weirs and large woody debris and improving the stream bed;
- Enhance the riparian zone by removing the Himalayan blackberries and replacing with native shrubs and trees;
- Plant shade trees as part of the streetscape improvements, and,
- Link the pedestrian and cycle path with the East side Crosscut Greenway.



Benefits

The benefits of this action plan will be **linking pedestrian and cycle paths** to the east and west and to **the East Side Crosscut Greenway**, widening the stream channel to **provide increased flood peak storage**, and provision of linear green space through the enhanced riparian zone.

Stormwater flow management: The widening of the stream channel will provide additional space for Still Creek during high flows. This will result in reduced flood potential in the immediate area as well as reduce stream velocities and peak flows downstream.

Water Quality: Water quality will improve somewhat due to oxygenation, shading and cooling affects of the improved riparian vegetation and stream complexity works.

Recreation: The creation of a pathway from Cornett to Skeena is an important link in the pedestrian and cycle commuter and recreation opportunity spectrum for the GBIA. Although a short section, it will connect with similar improvements to the east and west as well as provide a secondary loop off the proposed Central Valley Trail and East Side Crosscut greenways.

Constraints

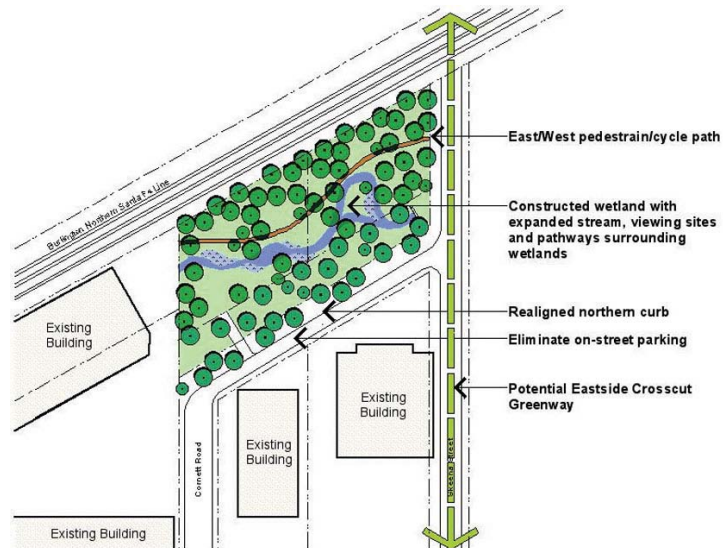
- Existing underground stormwater, sewer and electrical utilities may restrict tree planting
- Some utilities may have to be relocated

Estimated Costs

- Land acquisition: n/a
- Capital costs: \$150,000

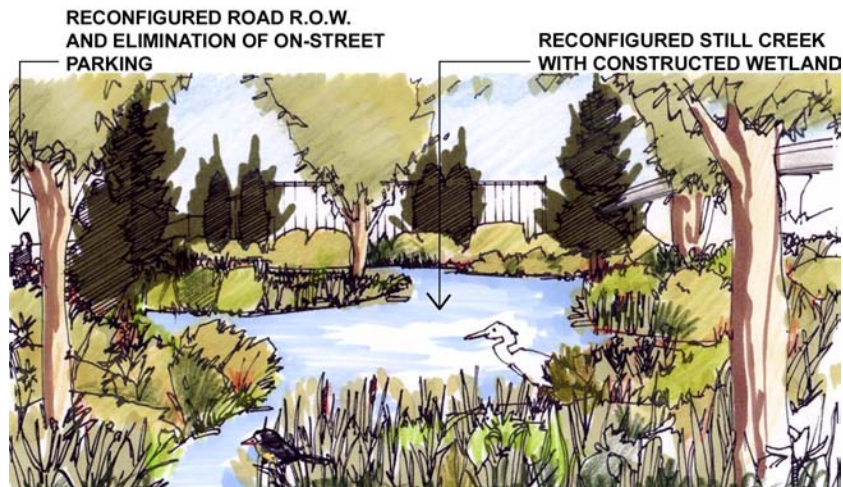
10 – 50 Year Action Plan

The keystone to the long term action plan for this part of the GBIA is the **creation of a constructed wetland or series of wetlands and pedestrian and cycle paths** on the properties north of Still Creek. The City of Vancouver should take a proactive stance with respect to re-development and, if necessary, acquire the property in order to ensure sufficient space is set aside for the wetland.



Specific actions should include:

- Create a constructed wetland, or series of wetlands, at 3445 Cornett and 2525 Skeena;
- Widen the stream upstream and downstream of the wetland(s), enhance the streambed and install riffle weirs;
- Create diverse riparian zones around the wetlands and the creek;
- Build viewing sites and pathways surrounding the wetland;
- Provide interpretive displays and/or kiosks;
- Involve artists in the wetland design process, and,
- Incorporate Best Management Practices for stormwater management.



Benefits

The constructed wetland, or wetland series, and the various amenities that will accompany it at this location, will benefit the stream by providing **stormwater storage and treatment, enhance recreation opportunities, and educational potential,**

Stormwater: Storage of storm runoff peak flows through the constructed wetland(s) will be a major benefit of this initiative. Although this constructed wetland series, will not address all the stormwater management issues, each will contribute to improving stormwater volume and quality. Stream velocity will decrease as the runoff is stored and floodwater capacity will be increased. The application of BMPs will also help reduce runoff peaks and volume and enhance water quality.

Water quality: The quality of water leaving the wetland would be enhanced. Sediment could be collected in the first wetland, which would enhance the water quality and enable maintenance the downstream wetlands.

Recreation: Contemplation and pedestrian strolls should be the primary recreation objectives around this wetland. It is one of the quieter areas within the GBIA and the wetland should exploit that characteristic. As well, the proximity to the proposed East Side Crosscut Greenway should be emphasized. Once built, the wetland would benefit both the east/west movement of pedestrians and cyclists, and would also form an attractive side loop in the greenway system.

Liveability: The creation of a wetland, combined with new riparian zones, viewing and contemplative places, pedestrian and cycle paths and public art will enhance the livability of this area for workers, shoppers and those in transit by bicycle and foot through the GBIA.

Education/Public Art: The blending of public art, engineering and recreation objectives at a manageable scale, in a prominent location such as this site offers, is a unique opportunity. Once the wetland is completed, it will provide school groups a place to observe nature and to understand wetland functions. In order to maximize this benefit, written and video information should be made available to local schools.

Ecosystem: The creation of wetland and riparian zone habitats, with the associated improvements to water quality, will provide improvements to the ecological values and potential within the GBIA and further downstream in the Brunette River system.

Constraints:

Requires one or more of the following:

- Purchase of two properties
- Rezoning of the properties
- Negotiation with property owners

Estimated Costs

- Land acquisition: \$600,000
- Capital costs: \$2,000,000

Area #5: Skeena to Boundary

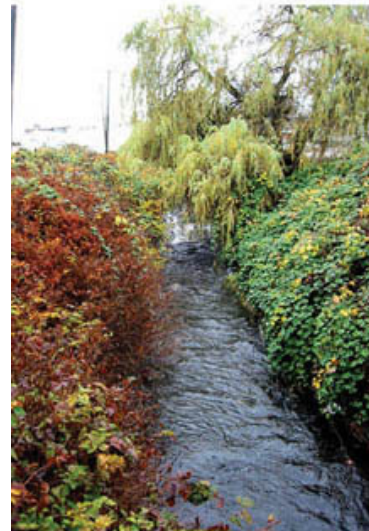
Site Description

The Vancouver Film Studios (VFS) occupy the majority of land in this area with several soundstages, administration offices and warehouse facilities. The VFS has expanded over the last ten years. As part of their most recent expansion, the VFS entered into a lease agreement with the City of Vancouver that involved restricted public access to the 3500 block of Cornett Road for private use. In return, under the terms of the lease agreement, the City receives \$79,500 annually for five years, which is placed in the Still Creek Enhancement Fund. The lease has an option to renew every five years.



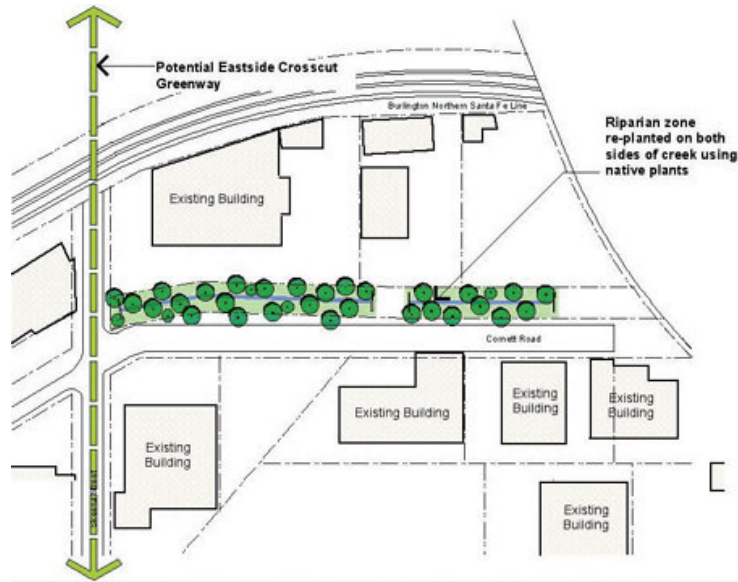
The creek flows through a straight, narrow channel with no riffle weirs, or meandering of the stream channel through this area. Vegetation is limited to several Weeping willow trees along the north bank and Himalayan blackberry on both sides of the creek. A storm sewer parallels the creek along the south bank.

Total Area:	6.1ha
Percentage Impervious Cover:	95%
Riparian Vegetation:	non-native species only
Creek Complexity:	negligible
Properties affected:	3525 Cornet 3596 Cornet 3610 Cornet 3664 Cornet 2626 Skeena 3585 Grandview Hwy 3695 Grandview Hwy 3645 Grandview Hwy



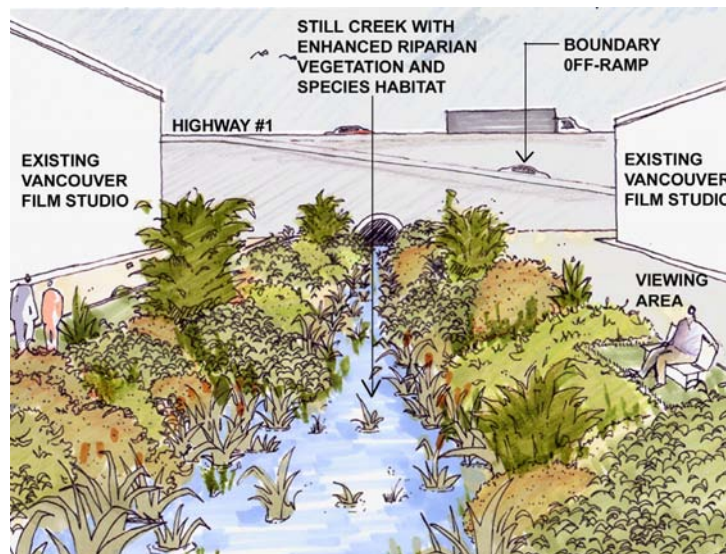
10 Year Action Plan

The narrow right of way and extent of impervious cover limits the enhancements that can practically be implemented in this area. Over the next 10 years, **replanting of the riparian zone** on both sides of the creek with native species should be undertaken.



This will include:

- Removal of Himalayan blackberry;
- Planting a wider riparian zone with native shrub and trees species;
- Installation of benches and seating areas to create comfortable outdoor resting and socialization spaces for workers in the area, and,
- Creation of a path that would lead to the East Side Crosscut and link with the rest of the GBIA pathway system.



Benefits

The primary benefit of these improvements will be the **creation of amenities and green space for workers** in the area and some enhancement of habitat.

Recreation: Quiet places and socialization places will be created within this zone. The new riparian zone will provide attractive green space. This will enhance the experience of workers in the area, and if this part of Still Creek is open to the public in the future, it will also benefit other members of the community.

Ecosystem: The creation of an enhanced riparian zone will contribute to the biodiversity of native plants in the area as well as bird habitat. The shrubs and trees over the creek will help moderate summer water temperatures and provide food sources that will benefit fish downstream in the Brunette River system.

Liveability: Installation of a pathway will facilitate movement of workers from the western end of the GBIA on to the East Side Crosscut and Central Valley greenways and over to the Rupert or Renfrew SkyTrain stations.

Constraints

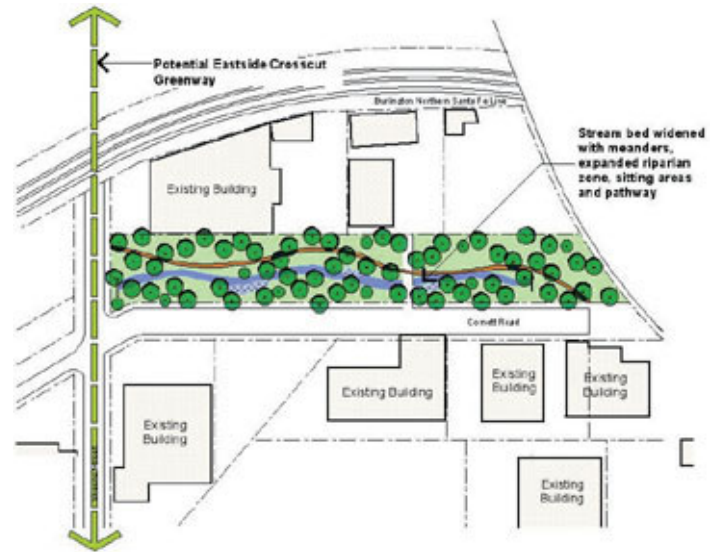
- Underground stormwater sewers may restrict the planting of trees
- No mitigation of stormwater flood potential

Estimated Costs

- Land acquisition: nil
- Capital costs: \$50,000

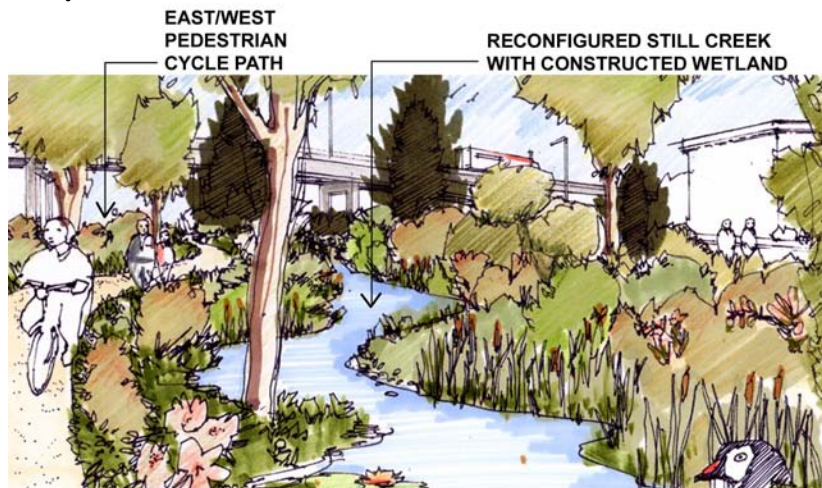
10 – 50 Year Action Plan

As properties adjacent to Still Creek in this zone are re-developed, more space should be made available for a **wider streambed with meanders and an expanded riparian zone/green space**. This will offer an opportunity to integrate the trail within planted zones and create viewing areas that are much more connected to Still Creek than the adjacent roads. Best Management Practices should be implemented for all stormwaters in this area.



Actions that should be implemented over the 10 – 50 year period, include:

- Widening the stream channel, incorporating meanders, enhancing the streambed and increasing stream complexity;
- Expand the width of the riparian zone on both sides of the creek and enhance the planting to include a wide variety of native species;
- Construct green roofs or roof top storage on existing and new buildings in this area to reduce stormwater runoff volumes;
- Installing porous pavement systems in the parking lots, as they are upgraded and maintained.
- Directing runoff to grass swales, and,
- Install community art and /or produce films or videos that celebrate Still Creek and the rehabilitation process. These could be done in partnership with the broader community, especially local children and youth.



Benefits

The major benefit of these improvements will be the **creation of green space amenities** for workers in the area. Stormwater flows will be reduced and runoff quality will be improved due to the use of Best Management Practices. Some improvement to the habitat will also result, over and above those beneficial changes resulting from the first phase of recommended changes.

Stormwater flow management: The green roofs or rooftop storage and porous pavement system in the parking lots will significantly reduce runoff from the site, thereby, reducing the total volume and peak flows of runoff in Still Creek.

Water quality: Significant improvements to the water quality of the runoff will be made by using porous pavement systems or directing the stormwater to grass swales. Both technologies are effective in reducing hydrocarbons, sediments, heavy metals and nutrients to the receiving water.

Recreation: The pathway and benches along the stream will provide a place for workers to enjoy the bird habitat and green space adjacent to the stream.

Liveability: The enhanced green space, paths and benches will provide a much more enjoyable natural condition in an area otherwise dominated by asphalt and built elements.

Community Art/Education: Workers within the film studios will benefit from the community art within the creek area. The community will benefit from any video or films done about the stream, and the rehabilitation process, especially if they are involved in the process.

Ecosystem: The creation of an enhanced riparian zone will contribute to the biodiversity of native plants in the area as well as habitat for birds. The shrubs and trees over the creek will help moderate summer water temperatures and provide a food source to the benefit of fish in the Brunette system.

Constraints

- Implementation of the 10 – 50 year action plan is contingent upon major redevelopments within this part of the city.

Estimated Costs

- Land acquisition: n/a
- Capital costs: \$200,000

SUMMARY
GBIA 10 Year Action Plan

Approach	Action	Estimated Cost
<ul style="list-style-type: none"> • Increase awareness • Fill information gaps • Test ideas • Initiate Rehabilitation Still Creek 	<p>Still Creek West: Creation of a small wetland Public art installation</p>	\$330,000
	<p>Real Canadian Superstore: Education kiosk and public art installation Riparian zone enhancement Stream complexity enhancement</p>	\$445,000
	<p>Rupert Street to Cornett Road Enhanced streetscape Public art and education</p>	\$75,000
	<p>Cornett to Skeena Riparian zone enhancements In-stream enhancements</p>	\$150,000
	<p>Skeena to Boundary Riparian zone planting</p>	\$50,000
	<p>Commission Integrated Watershed Management Plan</p>	\$25,000
	<p>Street Sweeping Pilot Project</p>	\$25,000
	<p>Coordination</p>	\$50,000
	<p>Sub -Total:</p>	\$1,115,000
	<p>Contingency @ 10%</p>	<u>\$115,000</u>
	<p>Allow:</p>	\$1,230,00
<p>Estimated Revenues: Still Creek Enhancement Fund \$79,000/ year Development Cost Levies \$100,000 – \$500,000 (over 10 years)</p> <p>GVRD: For in-stream works (\$200K in 2002)</p> <p>Total over 10 years: \$1.2 – 1.5million</p>	<p>Other Potential Contributors: Steelhead Society</p> <p>Vancouver Board of Parks and Recreation</p> <p>Greenways Program</p> <p>Fisheries and Oceans Canada</p> <p>Georgia Basin Initiative</p>	

SUMMARY		
GBIA 10 – 50 Year Action Plan		
Approach	Action	Order of Magnitude Costs
<ul style="list-style-type: none"> • Rehabilitate Still Creek • Implement BMPs as properties redevelop • Continued programs to build awareness of Still Creek • Sustain enthusiasm for enhancement • Build the vision incrementally 	Still Creek West: Wetland Creation Still Creek Re-alignment	Land Acquisition: \$500,000 Capital costs: \$600,000
	Real Canadian Superstore: Rehabilitate Creek/Riparian zone enhancement Increased stream width	Land Acquisition: \$500,000 Capital costs: \$500,000
	Rupert Street to Cornett Road Widen stream In –stream and riparian zone enhancements	Land Acquisition: \$1,000,000 Capital costs: \$700,000
	Cornett to Skeena Wetland creation	Land Acquisition: \$2,000,000 Capital costs: \$600,000
	Skeena to Boundary Stream widening	Land Acquisition: \$2,000,000 Capital costs: \$600,000
	Estimated Order of Magnitude Capital Costs:	\$9.0 million
Estimated Revenues: Still Creek Enhancement Fund \$79,000/ year Development Cost Levies 500K – 1.0 mil/ 10 yr		
Total over 50 years:		\$6.0 – 7.5 million

Feasibility of Enhancements

Rehabilitating watercourses within a city is an expensive proposition. Due to the complexities of land ownership, market forces, existing infrastructure, and existing landscape conditions, rehabilitating Still Creek to a well functioning, ecological system will be difficult. A long term commitment is required in order to realize the vision of a fully rehabilitated Still Creek ecosystem.

The exact timing of these changes is, of course, impossible to predict. Many factors could affect the scenarios, including funding, competing municipal priorities, community support and the desire of landowners to redevelop their properties. With respect to the first stages of implementation of stream rehabilitation, an important key to the early success of the proposed program will be the construction of meaningful, high profile changes to Still Creek and its environs. Site changes, greater visibility of the creek, public art, tree plantings, greenways and public education will foster and encourage local community enthusiasm for Still Creek. Over time, it is anticipated that momentum will grow, support for rehabilitating Still Creek will increase and funding will be compounded through collaborative projects. Once begun, the first Still Creek rehabilitation and enhancement projects will hopefully inspire the imagination of the community, Council and property owners.

Our team believes that the implementation of the “10 Year Action Plan” enhancements of Still Creek within the Grandview Boundary Industrial Area is eminently feasible. The timing of these actions, and the extent to which they are completed, will be determined largely by budget and the dedication of staff resources to coordinate the program of enhancements. Most of the 10 Year Action Plan enhancements do not require significant land negotiations or purchases. They will, however, require funding, some volunteer involvement and champions for the cause, both within City Hall and the community. Many of the initiatives such as the public art and community education actions will spark excitement within the neighbourhood and across the city. The implementation of this project will be recognized as one of Vancouver’s most proactive environmental initiatives and, if adequately funded and organized, could garner significant community and business support.

The feasibility of actions that are dependent on redevelopment of properties within the Grandview Boundary Industrial Area is much more difficult to evaluate. The likelihood of stream widening and wetland creation within the GBIA will hinge to a great extent on the willingness of property owners to consider alternate land configurations and capital investments. Land use trends and patterns within this area will be impacted by changes in the retail, commercial and industrial markets in the eastern and southern parts of Vancouver, western parts of Burnaby and even the north side of the Second Narrows Bridge, in North Vancouver. The impact of those trends on property owners, businesses and tenants will directly affect the appetite owners will have for redevelopment within the GBIA.

The City of Vancouver can influence the pace at which the redevelopment might occur, when the market is ripe for such decisions. A vision of the area, such as that which has been described in this chapter, combined with a demonstrated willingness to consider redevelopment plans will contribute significantly towards a positive development attitude in this part of the city. Adoption of this report, a commitment to an action plan and dedication of resources and funding to implement the plan, will send a message to property owners that when they are ready, the City of Vancouver will be encouraging. That type of enthusiasm will greatly enhance the feasibility of the longer term rehabilitation strategies outlined in this chapter.

Implementation

We recommend that a program of Still Creek rehabilitation initiatives begin immediately, as outlined in the 10 Year Action Plan.

The effectiveness of in-stream works such as widening, stream bed enhancements, stream complexity enhancement, bio-engineered slope installations and riparian planting rely, to a certain extent, upon the integration of these works with stormwater and flood management plans, which are presently underway. We recommend that stormwater and flood management criteria be integrated into the detailed planning and design of the Still Creek rehabilitation and enhancement projects.

It is further recommended that resources be dedicated to the coordination of planning, design and engineering changes to the creek and to public education and outreach. The presence of this level of effort will serve to move the rehabilitation of the creek forward in a coordinated manner. It will also serve to leverage the impressive community and volunteer enthusiasm that was evident at the public open house, and has been growing ever since.

The City Plan consultations for this part of Vancouver as well as the greenway planning process will form the foundation for more detailed community input and planning. We recommend this report be utilized during those processes.

CHAPTER 4 ENHANCING THE STILL CREEK WATERSHED

Introduction

In the previous chapter, a variety of enhancement and rehabilitation options were identified for Still Creek within the Grandview Boundary Industrial Area (GBIA). However, the GBIA represents a small component of the Still Creek watershed. In order for efforts in the GBIA to be most effective a number of watershed-wide initiatives should be implemented. The focus of this chapter is to identify the key rehabilitation and enhancement opportunities for the broader watershed within the City of Vancouver, outside the GBIA.

Given the limitations of this study, the rehabilitation and enhancement opportunities discussed in this chapter have not been developed to the same degree as those in Chapter 3. There remain numerous unanswered questions regarding their efficacy and financial viability for those areas outside the GBIA. In many cases these questions can only be determined through pilot projects that test the ideas under real watershed conditions. In other cases, further study is required. Some explorations have begun in other parts of the Brunette Basin Watershed (e.g. Stoney Creek Integrated Stormwater Management Plan). The high value of Still Creek within Vancouver warrants the pilot projects and further evaluation.

Outside of the Grandview Boundary Industrial Area (GBIA), Still Creek flows above ground in Renfrew Ravine, Renfrew Community Park and around St. Judes Church and school. Elsewhere it is underground, including the culverts under 22nd Avenue and from the northern end of Renfrew Community Park (19th Avenue) to 14th Avenue along Renfrew Street. What were once the upper reaches of the Still Creek watershed are now conveyed through the Collingwood and Rhodes trunk lines. The southern portion of the watershed begins at 50th Avenue in Vancouver and at Royal Oak Avenue in Burnaby. In Vancouver, the eastern boundary of the Still Creek Watershed is Boundary Road. The western boundary curves along Renfrew Street and along Broadway and Napier Avenue to the north.

The three open sections of Still Creek are each quite distinct from one another and from the contributing watershed. Each presents a specific set of rehabilitation and management challenges. Therefore, areas outside the GBIA discussed in this chapter have been divided into 4 sections. They include:

- The contributing watershed;
- Renfrew Ravine;
- Renfrew Community Park, and,
- St Judes Church and School.

Contributing Watershed

Background

Land use in the watershed outside of the GBIA is predominantly residential land use, with single family homes comprising the largest percentage. Pockets of high rise and low rise multi-family housing are located in the Collingwood area adjacent to the Joyce Street SkyTrain station, and east of Boundary Road, in the City of Burnaby. In the contributing Still Creek watershed, within Vancouver, the majority of residential roads include curbs and gutters and lanes are typically paved.

Some residential areas, within the watershed, contain large trees including boulevard trees. Other neighbourhoods are devoid of large trees with yards dominated by grass. Some residential properties are extensively paved with an impervious cover reaching 80% as the rear-yard is covered with patios, driveways, and parking areas.



Single Family Homes



Multi family homes



Curb and gutter

The link between what happens in Still Creek and in the larger watershed is inseparable. A number of different types of rehabilitation and enhancement opportunities are possible, within the contributing watershed, that will make significant improvements in the quantity, timing and quality of water flowing into Still Creek. These include Best Management Practices, an urban forest management strategy, a pesticide control bylaw and a campaign to curb use of chemical fertilizers.



Best Management Practices

The development and implementation of a comprehensive program of Best Management Practices (BMP's) throughout the watershed should be a key component of efforts to improve water quality and rehabilitate Still Creek. These should be part of an Integrated Stormwater Management Plan (ISMP). The ISMP should provide details on how to maximize stormwater infiltration, minimize runoff, and improve water quality. Pilot projects and further investigations are recommended for deep well infiltration, downspout disconnections, street sweeping and other BMP's.

A deep well infiltration pilot project is recommended for a neighbourhood in the southern portion of the watershed. Deep well injection involves drilling down to porous geologic formations and directing stormwater runoff through wells into these formations where the water recharges the underground aquifers. This removes the stormwater from the storm sewer system and reduces the stormwater flow into the receiving stream. See Appendix 2 for further details on deep well infiltration.

A pilot project of downspout disconnections in designated neighbourhoods within the Still Creek watershed would be an inexpensive way to evaluate the technical opportunities and constraints of this practice, as well as gauge community interest and support. It is recommended that the neighbourhood(s) designated for the trial, share a common storm sewer so that effectiveness of the program regarding volume and peak flow reductions can be monitored and compared with other areas with downspout connections. See Appendix 2 for additional technical details.

The various BMP's may be effective, over the long term, in reducing peak flow and flood conditions. Best Management Practices such as porous pavement systems, grass swales, blue-green storage in parks, grass pavers and others could be used to infiltrate or store runoff and cleanse stormwater of pollutants and excess nutrients. Grass swales could be installed between streets and sidewalks (curbs removed) to collect and treat stormwater. Porous pavement systems could be used to replace the asphalt or concrete in the alleys and roads, as they require upgrading. Blue-green storage areas in parks are simply areas of grassed depressions that are used to temporarily detain runoff to reduce peak flows to the stream. And grass pavers could be used in parking areas to hold runoff on site and improve stormwater quality. For details on the technologies and water quality improvement efficiencies see Appendix 2.

Constructed wetlands could be located in neighbourhood parks as a means to temporarily treat and store stormwater before it is discharged into Still Creek. Small wetlands could be constructed in neighbourhood parks, including Falaise Park, as means to store and treat stormwater. These wetlands also provide interesting places for people to visit and for wildlife to use.

The City's source control program should continue to be supported to ensure that there are no industrial or commercial discharges directed to Still Creek via the stormwater system. This program could be expanded to include working with the various companies active in the watershed to reduce or eliminate pollutants or contaminants in their operations.

Urban Forest Management Plan

Planting trees is one of the simplest and most useful activities that can enhance a watershed. Trees consume a considerable volume of water, thereby reducing

stormwater flowing into the sewers. Trees also help reduce greenhouse gases and moderate the urban heat island effect. Planting trees is also an activity that residents and businesses can undertake on their property for relatively little cost, yet with significant benefit to the watershed. However, planting activities need to be guided by a common purpose. In the absence of purpose, inappropriate species may be planted or trees may be planted in the wrong location.

Developing an Urban Forest Management Plan with a mandate to enhance Still Creek could help direct both the location and species of tree planted. The City of Vancouver could work with other governmental agencies such as Tree Canada or non-profit organizations to manage tree planting in the watershed. Information should be available on the attributes of the preferred types of trees

Bylaw to prohibit use of pesticides

The federal Supreme Court ruled in July 2001 that municipal governments have the right to impose and enforce pesticide bans. Since the improper use of pesticides may result in chemical contaminants entering the groundwater and storm water, the City could adopt a bylaw prohibiting their use. The potential benefit to Still Creek would be an improvement in water quality, and enhancement of wildlife by eliminating these chemicals from the watershed. The bylaw should be accompanied by extensive communication to ensure that people understand the alternatives and the advantages of pesticide free lawns and gardens at both the residential and watershed scale.

Fertilizer Restrictions

The City should develop a program to educate residents on the potential impact of chemical fertilizers on water quality within the Still Creek watershed. Many of these products are highly water soluble and could be transmitted, by stormwater, to Still Creek. An education program, including demonstration gardens, could help residents learn how to use non-chemical fertilizers on their gardens, and enhance understanding of the importance of not using fertilizers during high rainfall periods.

Rehabilitation of Neglected Public Land

The City should undertake a detailed inventory of small, remnant pockets of land throughout the watershed that are currently neglected and could be upgraded to provide ecologically functioning spaces. Small lots could contain new plantings of native trees and shrubs, or organic vegetable gardens with an educational component. For example, the western side of Renfrew Ravine between 23rd and 25th is now a place where garbage is dumped and invasive exotic plant materials have colonized. This high profile site could be transformed into a native plant garden, a bird habitat, and a demonstration site interpreting environmentally sound landscape practices.

Rehabilitation and Enhancement Stages in the Contributing Watershed

Short-term Opportunities: 0 – 10 years

- Establish partnership for cost-sharing programs;
- Develop an Urban Forest Management Plan for the watershed;

- Develop a bylaw restricting the use of pesticides in Vancouver with a pilot implementation/ program in Still Creek watershed;
- Create pilot programs to test different BMPs;
- Investigate appropriate sites for blue-green storage and constructed wetlands in parks; implement if considered appropriate (see Appendix 2);
- Work with Friends of Falaise Park to design and implement daylighting of a Still Creek tributary into a stream and constructed wetland;
- Train City staff in proper installation of porous pavement systems;
- Establish policy that existing swales will not be replaced with curb and gutters and replace existing curb and gutters with grassed swales or treed boulevards;
- Create inventory of small neglected public spaces and create native or organic gardens with educational components;
- Work with community to remove garbage in the ravine;
- Create an educational program to reduce the use of chemical fertilizers in the Still Creek watershed, and,
- Build in source control strategies to further reduce point and non-point sources of pollutants.

Long term Opportunities:

- Extend the downspout disconnection program to all appropriate parts of the watershed if pilot has been successful;
- Monitor deep well infiltration and extend to other sites, if successful;
- Continue to replace conventional surfacing materials with on-site infiltration methods;
- Continue to protect existing swales and replace curb and gutter infrastructure with grassed swales in treed boulevards;
- As paved lanes require replacement, do so with a porous pavement system or pavement with grassed strips in centre, or grassed swale on the sides;
- Continue intensive street sweeping program, and,
- Replacement of curb and gutters with grassed swales or porous material.

Renfrew Ravine

Background

Renfrew Ravine is an undeveloped treed ravine section of the Still Creek watershed. It daylight at a culvert in the southern end of the Renfrew Ravine near the 29th Avenue SkyTrain Station. Through Renfrew Ravine, the creek remains largely in its original state with steeply sloped banks. Exceptions include a few isolated sections of the creek's banks that have been modified with stone retaining walls, and some encroachment from adjacent residential areas that has taken place along the upper banks of the ravine. At the top of the ravine, a trail is in place along the east side. Smaller trails are found within the lower sections of the ravine.



The relatively poor water quality coming from the outfall at 29th reduces the overall ecological health of the ravine. Laurie Smith, of BCIT (2001) conducted a detailed assessment of Still Creek in 1998 and reported that the sediments in Still Creek, within the ravine, are likely contaminated due to long term effects of urban runoff in the stream and may need to be removed.

Renfrew Ravine contains significant riparian forest vegetative including large Alders, Big leaf maples, Douglas fir and Cedars. There are native shrubs (Ocean Spray, Snowberry, and ferns) in the ravine, but many areas are dominated by invasive species such as Holly, English ivy, Daphne and Blackberry). The Renfrew Ravine Committee has conducted invasive species removal work parties although their focus has been on Blackberry removal. Also, the Renfrew Ravine Committee has recently produced a booklet, "Renfrew Ravine; a jewel in the city" (Ross, 2001) which provides excellent background on the Ravine and includes future options for: planting native shrubs and trees, interpretative area, detailed studies, habitat and stream restoration, education activities and sites, birdhouses and community art events.



In general, Renfrew Ravine is the most natural of all the sections of Still Creek. However, near the outfall, stone and concrete walls have been built to reduce stream bank erosion from the high velocity of the water discharging from the culvert. The invasive species are reducing the biodiversity of the area. Furthermore, it seems apparent that a few parts of the ravine's banks are susceptible to failure.

Rehabilitation and Enhancement Opportunities

Temporary Flood Storage

The "Preliminary Flood Reduction Alternatives for the Still Creek - Brunette River System Report" (GVRD, 1999) identified a possible option to reduce potential downstream flooding that would involve temporarily storing flood waters in Renfrew Ravine. The system could potentially employ a weir near 22nd to control the depths of water stored in the ravine. This option was dismissed early in the GVRD review process for a number of reasons, including potential landowner and geotechnical concerns. However, a detailed flood and geotechnical study of this option was not conducted. Considering the GVRD and the City are exploring a range of options for reducing stormwater flows and flood concerns in the watershed, with some costing potentially tens of millions of dollars, there is merit in conducting a more detailed study of this option. With an extensive vegetation management plan for the ravine, including bio-engineered slopes, adequate slope stability might be gained for most of the ravine during temporary flood situations.

Habitat and Stream Rehabilitation

Detailed study on Still Creek and the surrounding area is required to fully assess the nature of rehabilitation that is appropriate for Renfrew Ravine. Research studies have been conducted by students and staff at BCIT, Capilano College and Environment Canada but further work on water quality, peak flows, sediments, ravine stability, flora and fauna is required. Once this information is in place, detailed habitat and stream rehabilitation plans can be undertaken. Ongoing collaboration with the Renfrew Ravine Committee is recommended.

Rehabilitation and Enhancement Stages

Short-term Opportunities:

- Formalize partnerships with the Renfrew Ravine Committee, BCIT, environmental enhancement non-profit groups, residents, GVRD, Vancouver Board of Parks and Recreation and the City of Vancouver;
- Work with potential partners to establish priorities, funding opportunities, and rehabilitation plans;
- Conduct research on the sediments in the streambed to establish if the sediments need to be removed and the streambed re-established;
- Conduct a study to assess temporarily storing flood waters in Renfrew Ravine to reduce downstream flooding;
- Support community efforts to remove invasive species and plant native species;
- Create education displays that interpret Still Creek and Renfrew Ravine, including efforts at rehabilitation;
- Develop a multi-faceted education strategy celebrating Still Creek and describing the community's role in enhancing the health of the system;

- Establish monitoring program to see if the rehabilitation work is reflected in improvements in stream, and,
- Conduct a study of the stability of the ravine's banks and identify techniques to improve slope stability.

Long term Opportunities:

- Monitor effectiveness in rehabilitation and enhancement work, if necessary make changes.

Renfrew Community Park

Background

Renfrew Community Park is almost entirely developed park through which Still Creek flows north. Still Creek has been channelized as it passes through Renfrew Community Park. Its natural banks have been replaced with stone retaining walls, which may help convey stormwater efficiently but creates fast flowing, potentially dangerous conditions during times of heavy rainfall. There are a number of large trees in the park, but no riparian shrubs. Recent removals of mature trees suggest the forest cover is in decline.

The park has footpaths that cross the ravine and transect its length, but limited opportunities to sit. Given the close proximity of the creek and park to the Renfrew Community Centre and Public Library, this location offers one of the best opportunities in the watershed for education and awareness of the creek and involving the community in rehabilitation efforts.



Rehabilitation and Enhancement Opportunities

Stream Bank / Bed Rehabilitation

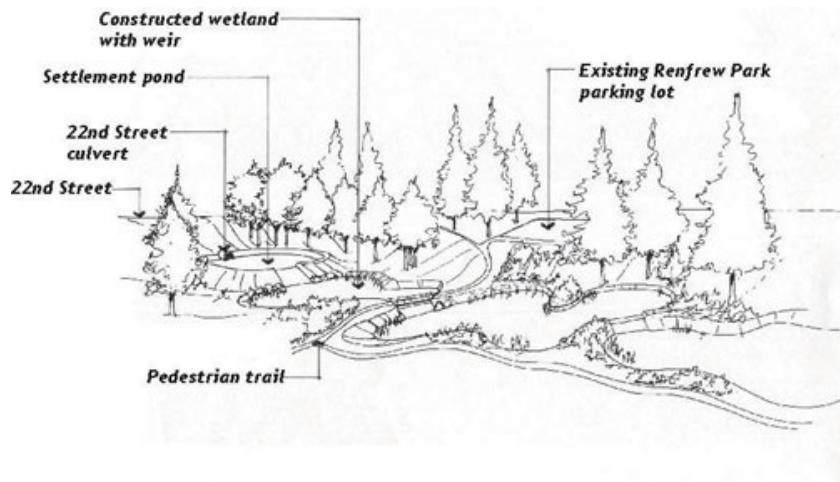
Still Creek through Renfrew Community Park will require significant work to return it to a more natural state. The vertical concrete and rock walls should be replaced with gentle slopes (minimum 3:1). The creek's current alignment results in high velocity flows as it passes through Renfrew Community Park. There is ample room in the park to reconfigure the creek bed to include meanders, pools, riffles, and possibly side channels that would create a much enhanced habitat and a creek with much greater complexity. The streambed itself will also need to be re-established including the surface gravels and the underlying material.

The riparian zone should be planted along the new slopes including native plants, shrubs and trees.

Constructed Wetlands

Constructing a series of wetlands in Renfrew Community Park is one of the most promising rehabilitation opportunities within the watershed. The wetland system could begin with a wetland at the outlet of the 22nd Street culvert, and be followed by subsequent wetlands that step down with the change in topography as the creek flows north through the park to the culvert under Renfrew Street. The first pond could be designed as the initial energy diffuser, and would provide for sediment collection as the stormwater emerges from the 22nd Avenue culvert. This pond would have easy access from the road behind the Library/Community Centre for sediment removal.

Subsequent ponds would provide short-term detention of stormwater, thereby reducing the potential of downstream flooding during relatively small storms. The ponds will also improve water quality, enhance wildlife habitat, improve recreational opportunities associated with strolling and wildlife viewing, and provide numerous educational opportunities. The design should include fish passable transitions to enhance the long-term possibility that fish may return to this portion of Still Creek.



Rehabilitation and Enhancement Stages

Short-term Opportunities:

- Develop an education strategy that celebrates Still Creek and inform park, library and community centre visitors of the creek and future plans;
- Establish partnerships with the City of Vancouver, Vancouver Board of Parks and Recreation, senior levels of government, non-profit environmental groups, the community, and BCIT;
- Establish planning priorities and funding allocations at the Vancouver Board of Parks and Recreation for changes to Renfrew Community Park, and,
- Create detailed designs of stream, wetland and riparian zone/forest with pathway and educational sites in collaboration with the partners and with the involvement of the community.

Long-term Opportunities:

- Construct the wetlands;
- Restoring the streambed and stream channel;
- Construct new pathways;
- Construct interpretive sites along wetlands and creek;
- Continue to enhance the riparian forest;
- Create educational programs, and,
- Assess rehabilitated park to ensure the components are functioning, as they should; make changes if necessary.

St Judes School

Background

The St. Judes section of the Still Creek watershed is an area that contains a church, school, multiple family housing and Still Creek. The area includes an open section of Still Creek from the Renfrew Street culvert in the west to the culvert under Grandview Highway in the east. Close to Renfrew Street, Still Creek flows in a narrow, yet relatively natural, channel for approximately 175 metres. This includes a fragmented and narrow riparian zone of a few large Cottonwoods and Alder trees.

Even in this more natural area, the creek channel is steep and has some sections of armoured banks. Further downstream, the creek becomes highly channelized as it flows through a narrow concrete channel. During heavy rain events, the stormwater flows quickly through this flume.

Kelly Court, a multi-family housing complex is located on the north side of the creek.





St. Judes Catholic School is located to the south, approximately 7 metres above Still Creek. A significant amount of fill has been placed along the southern bank of the creek. This area also includes a 20 metre road allowance. Riparian vegetation was lost during the placement of the fill. A number of small trees and shrubs have been planted.

The St. Judes area has been identified by the GVRD, 1988 as a flood risk area for both the 1:25 year and 1:200 year storm.

Rehabilitation and Enhancement Opportunities

Stream Bank / Bed Rehabilitation

Between Renfrew and Nootka Streets, within the St. Judes area, there are few opportunities to expand the existing channel and riparian zone of Still Creek due to the proximity of Kelly Court to the north and the steep embankment near St. Judes School to the south.

Riparian vegetation along the south bank should be enhanced but this would not improve concerns related to creek flow velocity, water quality, and flooding.

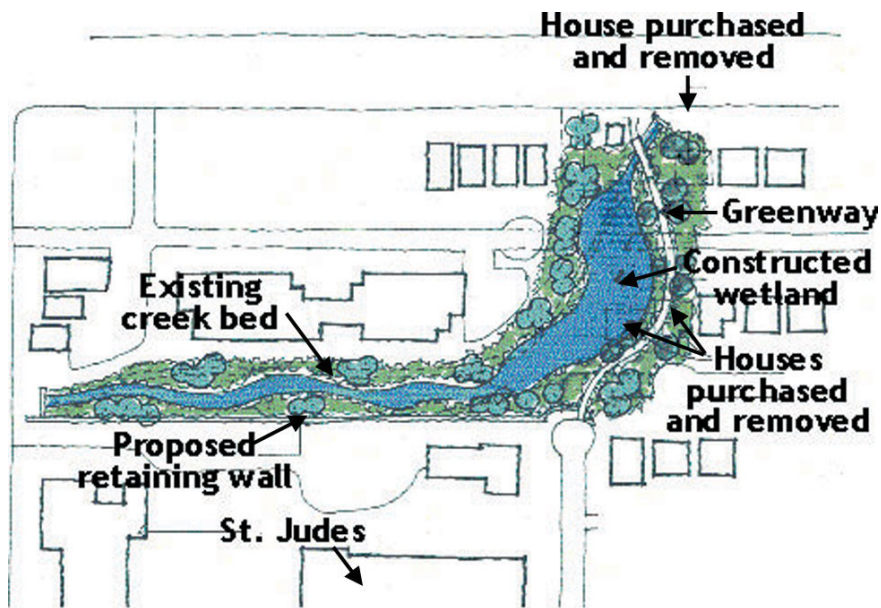
Constructed Wetland

The most promising rehabilitation opportunity in the St. Judes area involves the construction of a series of wetlands on the Nootka Street Right-of-way. The wetland could provide some flood water mitigation, reduce the velocity of peak flows, improve water quality and wildlife habitat.

Creating the wetlands would require the acquisition of three residential properties, as well as reconfiguring the road alignment. Based on current market conditions the acquisition costs would be approximately \$750,000. This would be a significant financial commitment and may be justifiable given potential flooding mitigation and ecological benefits.

The St. Judes wetlands would look like one wetland but would actually be a series of wetlands. The series approach has been found to be more effective in stormwater management because each subsequent pond improves the water quality. The first wetland dampens the energy of the creek's flow during rain events and provide a means of trapping sediments. Subsequent ponds provide additional storage and help remove contaminants. Wetlands are complex places with many ecological processes ongoing simultaneously. They could become an outdoor learning laboratory for St. Judes and other schools in the area. The proximity of the wetland to Grandview Highway would also provide a high exposure and an opportunity to increase awareness of Still creek.

The exterior walls of the pump station, recently constructed adjacent to Still Creek at Grandview Highway, could become a useful education kiosk outlining activities in the immediate area and the larger watershed.



Proposed wetland at St. Jude's and Grandview Highway

Rehabilitation and Enhancement Stages

Short-term Opportunities:

- Develop an education strategy including signs which interpret Still Creek and inform the school and community of the stream and future plans;
- Establish partnerships among various City departments, senior levels of government, non-profit environmental groups, St. Jude's, the community, and BCIT;
- Create detailed designs of stream, wetland and riparian zones with pathways and educational sites in collaboration with the partners and with the involvement of the community;
- Construct interpretive facilities, and,
- Enhance riparian zones near Renfrew Street.

Long-Term Opportunities:

- Acquire properties and construct the wetlands;
- Develop and implement monitoring program to ensure the wetlands are functioning properly; adapt as required;
- Restore the streambed and stream channel by adding riffle weirs;
- Construct pathways and interpretive facilities, and,
- Continue enhancing the riparian zone.

Financial Considerations

Costs for the rehabilitation and enhancement measures discussed in this chapter vary considerably. Community based initiatives typically involve low capital costs and high volunteer commitments. On the one hand, capital intensive initiatives such as constructing wetlands have high costs and require technical expertise. On the other hand, downspout disconnect programs are comparatively inexpensive. Ultimately, many opportunities exist for partnerships in the rehabilitation of Still Creek that could make the rehabilitation options feasible, even in the short term.

Funding Partnerships

Constructed wetlands and improved stream channel and riparian plantings are options for St. Judes and Renfrew Community Park that would likely be viewed favourably by the government agencies and non-profit granting agencies that support stream rehabilitation. It is likely that partnerships could be established to fund rehabilitation of this portion of Still Creek due to the close proximity to schools, community centre, library and a church.

The Steelhead Society, for example, may be able to assist in attaining funding from various granting agencies, businesses and foundations as well as providing in-kind support through their professional staff. The Evergreen Foundation may be interested in partnering a riparian planting project for the northern tip of Renfrew Community Park. The City of Vancouver could also work with other governmental agencies or non-profit agencies such as Tree Canada, to encourage and possibly subsidize tree planting in the watershed.

Summary

There are many actions that could be taken to rehabilitate Still Creek and the surrounding area. Still Creek is a valuable asset to the community that is worthy of time and funding. Partnerships with community groups, special interest groups, schools, residents and senior government agencies will be effective in implementing the various options. Many of the options (stream/habitat rehabilitation, wetlands, deep well infiltration, street vacuuming) will require further study or pilot projects before full implementation can begin. Other options (education, tree planting, pathways, and forest rehabilitation) can begin quickly and continue slowly over time. See Table 4.1 below for a summary of the options described in this chapter.

The wetland series and riparian rehabilitation of Renfrew Community Park will require consideration and long term planning by the Vancouver Park Board.

The community has demonstrated strong support for the options described in this study. (See Appendix 4 for a summary of the comments from the open house). Those in attendance at the open house seemed anxious for the rehabilitation work to be undertaken sooner, rather than later.

Table 4.1 Summary of Rehabilitation and Enhancements Outside the GBIA

	Timing	Water quality	Hydrology	Recreation	Ecology	Education/Art
Stream rehabilitation	S	•	•	•	•	•
Constructed wetland - design	S	•	•	•		
Constructed wetland - build	L	•	•	•	•	•
Education strategy - develop	S					•
Hire .5 FTE education resource person*	S	•	•	•	•	•
Education strategy - implement	S,L	•	•		•	•
Construct pathways	S,L			•		
Riparian forest rehabilitation	S,L	•	•	•	•	•
Downspout disconnection - pilot	S		•			•
Downspout disconnection - all	S/L	•	•			•
Underground percolation - pilot	S		•			•
Underground percolation - all	L	•	•			•
On-site infiltration	S/L	•	•			
Blue-green storage	S/L	•	•	•		
Daylight tributary at Falaise Park	S	•	•	•	•	•
Street vacuuming - pilot	S	•				
Street vacuuming - all	S/L	•				
Pesticide bylaw	S	•			•	•
Tree planting	S/L	•	•	•	•	•
Rehabilitation of public lands	S/L	•		•	•	•
Fertilizer restrictions	S	•			•	
Monitoring	S/L	•	•	•	•	•

S: Short Term

L: Long Term

** .5 Education resource person to work in both the GBIA and non-GBIA.*

CHAPTER 5 EDUCATION AND COMMUNITY ART

Introduction

Education is vital to the success of efforts to rehabilitate Still Creek. Many people who live, work or shop in the Grandview Boundary Industrial Area likely know little about Still Creek, if they are aware that it exists at all. In order for effective rehabilitation of the creek to occur, residents, workers, land owners, and visitors to the area should understand the affect their actions have on the creek's ecology and what they can do to help the restoration process. To be effective, the education component needs to:

- Involve many methods of communication;
- Be intensive - especially in the early stages;
- Be long term - revitalizing Still Creek is a long term commitment, requiring an equally, long term commitment to education;
- Create partnerships among individuals and groups active in the watershed;
- Focus on specific Still Creek initiatives;
- Celebrate successes and acknowledge partners;
- Accommodate cultural diversity;
- Be well supported, and,
- Be monitored on a regular basis to determine the efficacy of the various programs.



Methods of Communication

The education component for the GBIA section should include many types of communication covering a wide range of mediums. The education materials should build on the work of the Environmental Protection Branch and their Stormwater Bulletins.

Printed material should be produced and distributed widely, covering a spectrum of topics including:

- Watershed ecology and hydrology;
- Best Management Practices;
- Alternatives to impervious cover;
- Roof top gardens;
- Rainfall storage and grey water use;
- Alternatives to pesticides and herbicides;
- Native plants, and,
- Landscape installation and maintenance.

Ideally, numerous pamphlets would be made available in a variety of languages and on the City's web site, which would be illustrated with diagrams, watershed information, photographs and contacts.

Signs along the creek at walkways and road crossings naming Still Creek would be an effective way of creating awareness of the Creek's presence. Signs identifying the boundaries of the Creek's watershed, and markings on roads and sidewalks that indicate the location of former channels that are buried are effective techniques to help people create a connection between the land base and the stream.



Interpretive Panel: Watershed Park, Delta, BC

Stone Story Book, West Vancouver, BC

Educational kiosks/storybook signs along the path adjacent to Still Creek are useful in providing information about the creek and the effects of human activity on it. This information could include historical narrative and photos, maps and aerial photographs of the watershed, descriptions of stewardship activities and updates on restoration and enhancement activities.

Videos on Still Creek with a specific message for people in the GBIA are useful ways to pass on information to a group situation and for people who are short of time or are not literate.

Speaker series and talks to companies and community groups in the GBIA could be organized on specific topics or industrial application. Person to person connections, with the ability to ask questions and share experiences, is one of the best ways to affect change.

Special sessions for design professionals involved in the redevelopment process could be organized. Developers, Architects, Engineers, Landscape Architects, Planners and other professionals involved in development within the watershed need to learn more about Still Creek, and the value of strategies such as Best Management Practices.

Develop the forest in Renfrew Community Park as an arboretum complete with identification tags. The associated riparian zone plants and shrubs would also be identified as a way to educate park users of the native plants in the Vancouver bioregion. Maps and accompanying information could be available to guide people through the park.

Guided tours as part of the annual BC Rivers Days celebrations could be created for both Renfrew Community Park and Renfrew Ravine. More frequent tours could be organized that involve students with support from volunteers through local naturalist groups.

Intensive Process

The educational component needs to be intensive. Especially in the early stages, the message should be heard often and in a variety of formats. Similar to a commercial marketing program, the audience needs to be engaged frequently.

Long Term Process

Rehabilitating Still Creek will be a long-term process. The education component needs to be long term as well. Too often education initiatives are one-off exercises with little long-term effect. There needs to be a long-term commitment to education throughout the stream rehabilitation process. An example of effectiveness of a long-term process is the continuation of low water use in Seattle after the 1991 drought, which was accompanied by an intensive and long-term educational program. This can be compared to Victoria, which did not have an effective education process and where water use returned to, and surpassed, pre-drought levels. It can be difficult to fund long term education initiatives, but over the long run, the educational initiatives will support the capital investment in the landscape.

Partnerships

Partnerships between ‘Streamkeepers’, ‘Watershed Councils’ and other groups active in the watershed will enable the enhancement message to reach a broad range of people. Currently, there are three groups known to be active in the watershed, Friends of Renfrew Park, the Renfrew Ravine, and the Friends of Falaise Park. Downstream in Burnaby, British Columbia Institute of Technology’s Fish, Wildlife, and Recreation Program have been very active in environmental enhancement work along Still Creek and elsewhere in the Brunette watershed. Their expertise could be involved in the speaker series or assist with pamphlet development. Partnerships with various educational institutes may be developed to assist with video development, building educational kiosks or graphic design.

The City should support the local Streamkeepers group and BCIT or others to conduct on-going water quality and quantity monitoring as well as benthic invertebrate (water insects) surveys. Benthic invertebrates have been recently recognized as being excellent indicators of watershed health. The changes in water quality, quantity and benthic invertebrates will be excellent indicators of the success of the watershed enhancement efforts.

The non-profit sector is also a source of partners. The Steelhead Society is working with the City of Vancouver to acquire funds from various granting agencies with an environmental focus to conduct a pilot project that will include educational kiosks, signs and a large Wild Salmon Work of Art. Naturalist groups could be enlisted to observe wildlife use in Renfrew Ravine and Renfrew Community Park and create an ongoing database of observed birds and mammals.



Many of the professionals involved in re-development of the GBIA could be involved in creating and implementing BMP educational events. Furthermore, the Still Creek Advisory Committee includes knowledgeable professionals from GVRD, Fisheries and Oceans Canada, and the Ministry of Water, Land and Air Protection. They could join with staff from City of Vancouver in educational events, planning and possibly funding.



Specific to Still Creek

Information used to communicate with people working in the watershed needs to be specific to Still Creek. In this way, the information will be relevant and useful to the local experience. The technical information should be described and illustrated with specific references to locations within the watershed. Also, the information should include local sources for recommended products and professional services.

The education efforts within Renfrew Community Park should focus on the rehabilitation processes at work as they evolve over the years. The education strategy can take advantage of the creek's close proximity to the library, school and community centre. It can also be developed to provide an outreach to schools in the broader area, given the unique resource the creek provides. Specific issues to be addressed near Renfrew Ravine could include celebration of the unique nature of a ravine within the city. As well, information can be provided on how the residents can adopt be environment friendly habits such as not putting garbage and garden waste into the ravine.

In Newfoundland, Arts Smarts is designed to demonstrate that the arts can be used to teach anything in the curriculum, and the students and teachers at Pius X use the Rennie's River as the theme of their art and their learning.

When they study flight, they make sculptures of waterbirds. They write river poems on the school's computers. They make videos, ceramic tiles, fabric hangings and puppet shows. Huge murals of fish and trees and turtles and airplanes cover the school's walls and stairwells. And the river runs through all of it.

"The kids get so motivated," says Margaret Best, the Arts Smarts co-ordinator in the school. "They want to get it right. You see them rushing into the library to research the background of what they're doing. It's an alternative to verbal reporting, but it also builds verbal skills. We had a boy with real reading trouble, but he thrived on this - and he wrote a wonderful artist's statement about his work."

- Silver Donald Cameron, 2001

Celebrate Successes

It is important to celebrate successes to maintain community interest and support over the long term. Successes should be promoted in the media and within government agencies. The partners in the project should be acknowledged in media releases, photo opportunities and with civic awards.

Cultural Diversity

The communication on Still Creek, in all the mediums used, should accommodate the cultural diversity of those who work, shop and do business in the area. The City of Vancouver has a positive track record of translating information into many languages. This should be applied to any communication tools used in the Still Creek projects, including signs and educational kiosks. Research should be conducted on the language needs for the area, and resources dedicated to ensuring that all information is made as accessible as possible.

Well Supported

Education and communication work in Still Creek will be extensive, creative, on-going and long term. For the project to be a success it will need to be well supported with financial resources and a part-time staff person to ensure that the education programs are high quality and those partnerships are actively pursued.

Monitoring

The education programs should be monitored on a regular basis, to take advantage of knowledge of what is working well and to change what isn't. Programs can be adapted during implementation, if necessary, to ensure maximum success. Success stories should be shared with others working in stream and watershed enhancement so that a broad range of stakeholders is able to share in the Still Creek enhancement educational benefit.

Public / Community Arts

The public and community art component of the Still Creek enhancement within the Still Creek watershed should be:

- Diverse;
- Multi-faceted, and,
- Involve the community as much as possible.

Many community artists actively involve residents in the development of their art and are typically experienced in community involvement. Artists can also make education into a community event by engaging people through a parade or play as a non-threatening and fun way to explore ideas.

Community art, at its best, is a method for a community to express a vision of itself, provide commentary on areas requiring change and direct thinking towards a larger vision (Jardine, 1993). For example, Luminaries, a night-time lantern based event in Vancouver, is focused on Trout Lake. Beginning in 1993, Luminaries included an environmental message by installing flags marking the routes of streams that once existed and are now in storm drains. From this awareness, a Lake Committee was established dedicated to finding solutions to improve water quality in the lake.

Public/community art is not limited to sculptures or installations. Community art can be theatre, a parade, an event, a book, a celebration, or a video.

The residents, workers, landowners, shoppers, and business owners offer diverse skills and interests to engage in the evolution of community art. For example, the Vancouver Film Studio, with its large pool of artists and technicians, could be a powerful and energetic part of community arts development. Landowners could be brought into the stream enhancement work through their participation in and support for artistic events and products. And visitors to the GBIA could be encouraged to participate in various types of community arts.

Connections between people and the environment (both natural and built) should be encouraged as part of the public/community art component. Celebrating the seasons is one effective method for making such connections. Seasonal events are also

Communities making their own art...is the active participation of people in the creative process. It results in the public expression of a collective experience... It is a community's active intervention in its own cultural development and future, not a way to increase consumption of other people's culture." (Australian Community Arts Council in Jardine, 1993).

effective because they occur in most cultural traditions and therefore can be used to celebrate the cultural diversity of the workers and visitors to the GBIA.

A community arts event could be used to *start and inspire* a workshop or technical event. This was done very effectively at an Aboriginal Fisheries conference in Kamloops, February 2000. The Senklip Native Theatre Co. was commissioned to produce a play about salmon as part of the conference. The work they developed, which involved local community members to supplement the professional actors, was a powerful combination of humour, drama and education. The audience learned from interpretations of legends how salmon came to live in BC rivers and the importance of salmon to First Nation peoples and culture.

Artists should *be involved in the design* of the rehabilitation projects. Their insight will likely increase the human connections and effectiveness in the design of the environmental features, for example, a constructed wetland. Artist Mel Chin worked with scientist Rufus Chaney to create a sculpture garden using plants that absorb toxins from contaminated soil. Also, sites for sculpture or other installations should be identified, with artist input, early in the detailed enhancement design. Ideally, artists will be part of the detailed enhancement process in general.

"Because of their familiarity with symbolism, metaphor, and public expression, artists can serve as spark plugs to creative thinking in the initial stages" (Jardine, 1993).

Art can be used to *document* the success of the Still Creek rehabilitation process. Video artists can film success stories and ongoing work as it evolves. They may come up with creative ways to monitor ecological health improvements.

Celebrating Still Creek as a precious remnant of nature -in the community- should be encouraged. Once residents recognize that a creek with ecological value, and that provides a meaningful natural area, runs through their neighbourhood, they will be more likely to participate in activities that benefit the creek's ecosystem. They will discover their actions (e.g. not using pesticides or directing roof runoff to the front lawn) can make a difference in the health of the creek.

Furthermore, if residents can participate in an event (or learn what they can do on their own) they may be more likely to become involved and active in the community.

In Seattle, Environmental Artist, Buster Simpson has created porcelain plates that when they absorb pollution the toxins create a colourful glaze. The goal is white plates (Jardine, 1993).

It is also important to *involve children and youth* in the community and public art projects associated with Still Creek. They benefit directly through participation, and over time develop a sense of ownership and pride as they reflect on their participation. Since they typically bring other family members or friends along to the event, the impact of the event expands. There are a number of schools in the watershed that would be good sources for partnership initiatives with children. For example, youth could be brought together with video makers at the Vancouver Film Studio to collaborate on Still Creek projects.

Summary

Education and community art activities will be vital in creating awareness of Still Creek and celebrating its existence in the community. It will be important to involve all members of the corporate and residential community, and all age groups. The education and community arts efforts need to be ongoing to ensure the message is heard throughout the community and over time. Partnerships with existing groups like the Renfrew Ravine Committee and Friends of Falaise Park will be useful in involving the community in a meaningful way. As well, artists should be involved throughout the educational process and implementation of community art activities.

CHAPTER 6 CONCLUSION

Still Creek is one of Vancouver's few remaining streams that has not been altogether lost. Although most of Still Creek has been impacted by urbanization, many opportunities remain to rehabilitate, enhance and celebrate this important urban stream.

This report has concentrated on that portion of Still Creek that runs through the Grandview Boundary Industrial Area. Within a two-phase process, key recommendations for the GBIA are:

Phase One- as funding permits, over the next 10 years:

- Create greenway linkages to existing and proposed pedestrian and cycle routes;
- Increase water quality as well as reduce stormwater flow and volume through stream improvements and implementation of Best Management Practices (BMP's) including street cleaning;
- Enhance the creek through a series of riparian plantings and in-stream works;
- Raise the visibility of the creek through public art and education, and,
- Enhance the streetscapes adjacent to the creek through green urban improvements.



Part of the Still Creek Vision: accessible, delightful, ecologically strong

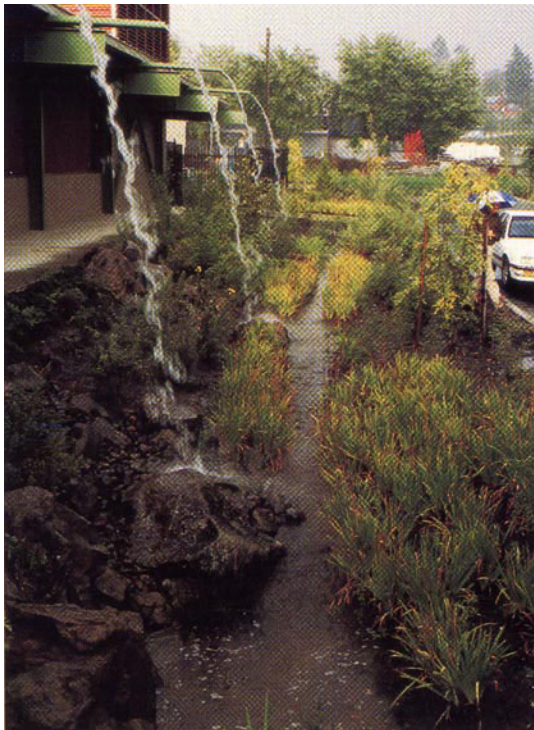
Phase Two- as redevelopment proceeds, in the 10 – 50 year period

- Create a linear green space that includes a multi-use pathway,
- Improve stormwater flow, storage, velocity and water quality by implementing BMP's and creating wetlands;
- Create green space and enhance the ecological integrity of the creek by daylighting sections of the creek as sites are redeveloped, and,
- Sustain the public art and education initiatives begun in the first phase;

Areas outside the GBIA, across the Still Creek watershed, should also be addressed. Primary actions that should be undertaken in the watershed include:

- Test and implement stormwater best management practices;
- Create wetlands in Renfrew Community Park, at St. Jude's School and possibly as part of the daylighting of a Still Creek tributary in Falaise Park;
- Support community rehabilitation work in Renfrew Ravine and Falaise Park, and,
- Assess of Renfrew Ravine for stormwater storage.

In order to proceed with these plans, approximately \$1.2 million is required for the first phase of redevelopment within the GBIA. Pilot studies and further research are required in order to more accurately estimate costs of implementing proposed actions inside the GBIA and outside the GBIA). As well, significant staff, Council and community support will be required in order for these initiatives to be effective and sustainable.



Still Creek is one of Vancouver's least known natural assets. It is time for the short and long term health of the Still Creek ecosystem and surrounding neighbourhoods to become a priority and for its rehabilitation to begin.

*Best Management Practices
address stormwater quality and volumes*

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APPENDIX 1 GLOSSARY

Daylighting: The term used to describe the removal of a culvert and the creation of a natural, open stream course, ideally, includes a riparian zone or area of streamside vegetation.

Earthslide or flow: Slides are slope failures that are initiated by slippage along a well-defined surface and often take place after prolonged or exceptionally heavy rainfall. Flows involve the movement of fine-grained slope materials and range from slow to rapid.

Enhancement: The improvement of environmental conditions for a specific benefit or use.

Environmental Restoration: Are the changes made to improve a disturbed area to a defined target state and goals based on background studies and existing conditions.

Fragmentation: The dividing of habitat into smaller and smaller pieces; with small and non-connected spaces being less hospitable to most wildlife and plant life.

Non-point pollution or Non-point source pollution: Stormwater runoff is referred to as non-point pollution because the pollutants are a result of accumulation over time and enter the system anonymously. This term differentiates stormwater runoff pollution from specific forms of pollution (point sources) such as industrial or sewer treatment plant outfalls.

Nutrients: Nutrients play a major role in the synthesis of living matter. Some elements are needed only in trace amounts. Others, such as carbon, oxygen, hydrogen, sulphur, nitrogen and phosphorus are required in larger quantities. An oversupply of the nutrients nitrogen and phosphorus can lead to overproduction of algae and large plants that may result in eutrophication of a water body.

Rehabilitation: The restoration of ecosystem functions and processes in a degraded system or habitat. (Dunster and Dunster, 1996).

Stream complexity: Features such as rock weirs, pools and riffles, large woody debris, side channels, etc. which provide variation in the stream usually associated with habitat for fish.

Riparian zones and vegetation: Riparian zones are the areas located next to streams, rivers, lakes and wetlands. They are the transition between water and land and have a direct influence on the aquatic environment. Riparian vegetation, when healthy, contains native plants, shrubs and trees. This vegetation is distinct from the surrounding uplands vegetation. Riparian zones are important for filtering pollutants, shade for the stream, provide large woody debris to the stream, stream channel stabilization, water, cover and food for fish and other animals, movement corridors for wildlife are areas of high biodiversity.

APPENDIX 2 BEST MANAGEMENT PRACTICES

Introduction

Best Management Practices (BMP) are site specific methods used to reach the objectives of:

*Protection of life and property (flood and erosion control);
Protection of habitat (erosion and sedimentation), and,
Protection of water quality.*

For the enhancement of Still Creek to be successful from both a recreational and ecological perspective, the high flows that characterize the system during heavy rain events will need to be reduced in both the intensity and volume of flow. The water quality also needs to be improved. These changes cannot take place simply within the Creek's channel, or its immediate banks. These are fundamental watershed management issues whose solutions reside in broad, watershed wide initiatives that affect the way in which rainfall moves through the watershed before it reaches Still Creek.

As land is redeveloped, a comprehensive stormwater management strategy including a program of Best Management Practices (BMP) will need to be implemented to improve the stormwater runoff situation. Such a program has the potential to lower the total runoff volumes, stream flow peaks, and improve water quality, all of which are critical components of a rehabilitation plan for Still Creek. BMPs will play an important role in the implementation of the program as they offer a range of environmentally sound treatments that can be applied to different conditions in the urban watershed.

BMP's have been used effectively in many cities around the world for many years. Many Washington State regional and local governments require BMPs as standard practice in new developments as well as re-developments. Since the early 70's, the Denver Urban Renewal Authority has required developers to detain on-site rainfall that falls on their properties. This has been accomplished mostly through rooftop storage and some on-site ponds at relatively low cost and with little inconvenience to land developers and the public (Poetner, 1974).

Some BMP's involve new technologies such as green roofs. Others are newly appreciated applications of old techniques such as grassed swales and strips between parking areas or driveways. BMP's can collectively make a difference to water quality and volumes in receiving streams.

As noted in Chapter 2, over 68% of the Still Creek watershed is covered with impervious surfaces. In the GBIA, this percentage is closer to 100% of the land base. Consequently, little rainfall infiltrates into the ground throughout the watershed. Instead it flows quickly into storm drains that discharge into Still Creek. This condition exacerbates stormwater characteristics common in the watershed – the high volumes and peak runoff flowing rapidly into the creek, as well as contaminants conveyed in the stormwater. Ideally, a comprehensive program of Best Management Practices (BMP's) would be applied throughout the watershed to

significantly improve the ecological and hydrologic characteristics of Still Creek. There are a number of general BMP techniques and practices that can potentially be applied throughout the watershed, and specifically in areas like the GBIA. These include:

Green Roofs;
Constructed Wetlands;
Rooftop storage;
Grass swales;
Porous paving;
Parking Lot Detention Basins, and,
Street Sweeping.

A general description of each of these techniques including limitations, estimated costs and effectiveness follows.

Please note: all of the information below in italics are quoted directly from Best Management Practices Guide for Stormwater. Prepared by Allan Gibb, Harlan Kelly, Thomas Schuler, Richard Homer, Joseph Simmler and John Knutson (GVS&DD, 1999).

Constructed Wetlands

Constructed wetlands can provide significant improvements to both the water quality and flood concerns related to urban streams. Constructed wetlands can reduce downstream peak flows by providing short-term storage during high flow periods. The wetlands are also effective in removing pollutants, as wetland plants and organisms remove nutrients, sediments, heavy metals, and hydrocarbons. Additionally wetlands have the advantage of creating rich habitats for wildlife and recreation opportunities. The diversity of vegetation and wildlife makes wetlands important for educational purposes. Finally, wetlands have high aesthetic value as they provide a sense of openness, colour and textural contrasts, reflect sky and weather conditions, and where songbirds are present, enhance the experiential quality of a place. Benches and access points provide people with a place of natural solitude, and if built along Still Creek, this would contribute to the liveability of the area.

Within the GBIA various locations have been identified that could accommodate constructed wetlands (see Chapter Three for specifics). One would be located northwest of the Real Canadian Superstore on a vacant portion of the Superstore property. This site is promising due to the absence of buildings and the relative isolation of the site from Grandview Highway. As the site is part of the Superstore property it does not have any street frontage and therefore could not be easily subdivided. In essence it is a land locked site with limited redevelopment potential on its own.

Another potential wetland area is at the intersection of Cornett Road and Skeena Street. The two properties are limited in size and, when considering the impacts of the Provincial Government's Streamside Protection regulations are constrained from a redevelopment perspective due to their close proximity to Still Creek.

Also, an ideal location for a wetland within the GBIA would be immediately east of Rupert Street and to the south of the BNSF rail line. This site is one of the most threatened sites with regard to the 25 and 200 year flood plain as identified by the GVRD. Unfortunately the site is fully developed and Still Creek is completely

underground through this area. Daylighting of the creek and the construction of a wetland to address the flood concerns would require a comprehensive redevelopment of the area and the dedication of upwards of 25% of the redeveloped site for the creek and wetland. This is considered a long-term proposition.



Examples of constructed wetlands

Elsewhere in the watershed, constructed wetlands could be located in neighbourhood parks as means to temporarily treat and store stormwater before it is discharged into Still Creek. One such location is within Renfrew Community Park where a series of wetlands would transform a channelized section of Still Creek with no notable ecological or stormwater qualities into one that improves water quality, slows stormwater flows and enhances the ecological function of the creek and park. Opportunities exist to construct small wetlands in other neighbourhood parks, including Falaise Park, as means to store and treat stormwater. These wetlands also provide interesting places for people to visit and for wildlife to use.

Typically constructed wetlands are created on sites adjacent to existing stream channels to preserve the natural channel. However, in many urban situations space adjacent to a stream is limited, thereby requiring the wetland to be constructed within the stream channel. For Still Creek we have identified two locations where constructed wetlands could be located within the existing creek right-of-way. This means it will be an 'in-line' facility which the Ministry of Water, Land and Air Protection, under the Water Act, has not, generally, supported in the past. However, exemptions are made for the applications of in-line constructed wetlands in urban streams like Still Creek if the wetlands are:

- *Well designed from ecological and hydrological perspectives;*
- *Part of a larger watershed based effort to improve the water quality of the Still Creek - Brunette River system, and,*
- *Reduce downstream flooding (Stoddard, 2001).*

Designing and constructing wetlands is a collaborative process involving an interdisciplinary team that includes a biologist, environmental planner, landscape architect, engineer and geomorphologist.

Costs:

Typical construction cost \$33 to \$66 per m³ (adapted from Brown and Schueler, 1997)

For total capital cost add 35% to construction cost (engineering, contingencies, erosion and sediment control during construction, landscaping, etc) – does not include the cost of land

Maintenance costs 3% to 6% of construction cost per year

Effectiveness

Contaminant removal varies widely – treatment volume appears to be an important variable but the relationship is not clearly evident

The best overall contaminant removal appears to be associated with combination techniques such as the pond/marsh system – poor internal design geometry significantly reduces performance

Median contaminant removal efficiencies for wetlands based on 35 performance monitoring studies as follows:

- *total suspended solids 78%*
- *organic carbon 28%*
- *total phosphorus 51%*
- *soluble phosphorus 39%*
- *total nitrogen 21%*
- *nitrate nitrogen 67%*
- *lead 63%*
- *copper 39%*
- *zinc 54%*
- *cadmium 69%*
- *hydrocarbon 90%*
- *bacteria 77%*

Benefits Vs Costs

Wide range of benefits including flood control, stream bank erosion protection, fish and wildlife habitat protection/enhancement, aesthetic and recreational benefit;

Greater diversity in structure than most other BMPs, with a resulting greater potential for removal of particulate, colloidal and dissolved contaminant;

More potential for filtering through root mats and soils and adsorption of contaminants to soil particles than wet ponds ;

Wider application and more reliable service than infiltration;

Relatively high construction cost – more complex to construct than most other surface BMPs;

Delayed efficiency until plants are well established;

Public concern about nuisances (mosquitoes, odours;)

Relatively large space requirement, and,

Some safety concerns associated with open water pools.

Green Roofs

Green roofs are roofs that include grasses and/or other plant material. A green roof can be purely utilitarian or can be developed as part of a rooftop garden amenity

area. A special waterproof membrane protects the roof structure. On top of this membrane specific layers that ensure adequate drainage and growing medium are installed. Drought tolerant, low growing plants, that require little maintenance, are typically used.

Green roofs detain significant volumes of rainfall that are subsequently used by the plants or evaporates. Green roofs typically are built using one of two different forms depending on the structural capabilities of the roof. Extensive green roofs use a thin layer of soil (>20cm) and drought tolerant plants, and are suitable for existing roofs that have structural limitations. Intensive green roofs (soil depths of approximately <20cm) are heavier, provide more complex rooftop treatments, and are suited to new construction.

In a recent study on the benefits of green roofs, the Canadian Mortgage and Housing Corporation found that green roofs can improve air quality, reduce heat build up in urban areas, provide wildlife habitat and improve stormwater management. (CMHC, 2001). Green roofs also have an aesthetic benefit of softening the expansiveness of commercial and industrial roofs when viewed from higher ground.

Green roofs have become common in many European countries with some German cities requiring all flat and moderately sloped roofs to include green roofs. In Vancouver there are a number of applications of green roofs, including the new Vancouver Public Library. A variety of green roof designs are being built as pilot projects in the Vancouver area to determine the pros and cons of the technology.



A green roof over an institutional complex

Cost:

Highly variable - \$100/m² – 200/m² (CMHC, 2001)

Rooftop Storage

Rooftop storage involves temporarily holding rainwater on a roof and slowly directing it to the storm drainage system or use it on site as grey water. The Building Code requires a roof be capable of supporting a load of 15 cm (6 inches) of rainwater. Only slight changes to the construction process would be required to accommodate rooftop storage of runoff, including slightly higher parapets, more attention to the joints and the more extensive application of the waterproof membranes.

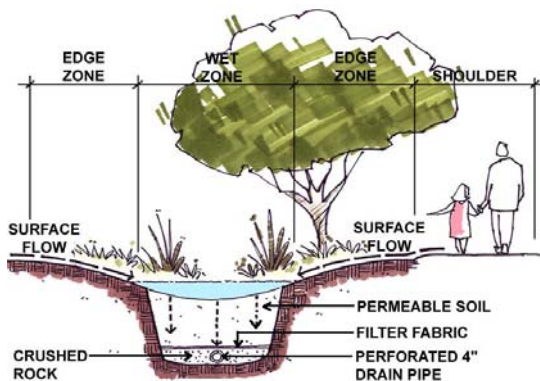
Cost:

Minimal capital cost increase over conventional roof

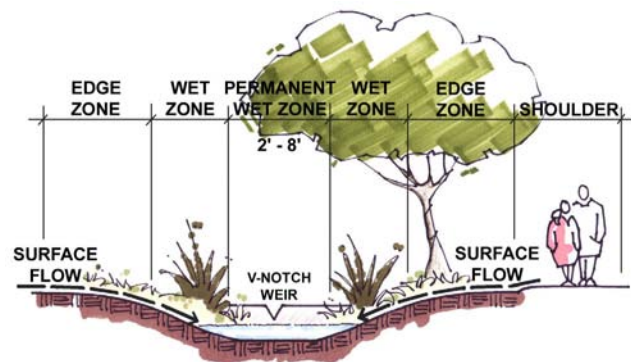
Grassed Swales

Grassed swales for collection and transport of runoff is an old idea still found in many residential areas. Grassed swales are understood to also provide a water quality treatment function and are often constructed for stormwater management in parking lots and adjacent to roads and as a pre-treatment for other BMPs. Grassed swales help to decrease runoff velocities, reduce peak flows which in turn helps to reduce flooding and stream channel erosion. Some of the rainfall may infiltrate into the ground or evaporate which reduces runoff volumes (GVSDD, 1999).

In the GBIA grassed swales could be used in parking areas as part of retrofit or when new development takes place. The City of Vancouver could also consider using swales in the boulevards adjacent to roads as part of a pilot project.



Dry Swale



Wet Swale

Cost

Construction cost depends on swale depth, land slope, soil conditions, etc;

Budget construction cost for grassed channel \$5.40/m² surface area plus \$2.25/m² surface area for stabilization;

Typical construction cost for grassed channel \$24 to \$74 per linear m.;

For total capital cost add 35% to construction cost (engineering, contingencies, erosion and sediment control during construction, landscaping, etc) – does not include the cost of land, and,

Effectiveness

Relatively effective for capturing suspended solids, oils, and particulate metals

Less effective for soluble metals and nutrients;

Contaminant removal is a function of length, and,

Average contaminant removal efficiency of a swale in the Puget Sound area over 6 storms as follows):

	30 m length		60 m length	
	mean	range	mean	range
<i>total suspended solids</i>	60%	0%-93%	83%	69%-97%
<i>turbidity</i>	65%	26%-80%	65%	42%-91%
<i>oil & grease/TPH</i>	49%	33%-65%	75%	64%-92%
<i>total zinc</i>	16%	<0%-86%	63%	38%-84%
<i>total lead</i>	15%	<0%-95%	67%	50%-90%
<i>total phosphorus</i>	45%	19%-74%	29%	<0%-58%
<i>nitrate nitrogen</i>		<i>negative</i>		<i>negative</i>
<i>faecal coliforms</i>		<i>negative</i>		<i>negative</i>

FHWA 1999 proposes the following contaminant removal efficiencies for swales:

- *total suspended solids 70%*
- *total phosphorus 30%*
- *total nitrogen 25%*
- *heavy metals 50% to 90%*
- *oxygen demand 25%*
- *oil and grease 75%*

Benefits Vs Costs

Some attenuation of peak flows for flood control and stream bank erosion protection;

Contaminant removal is less than wet ponds, constructed wetlands, and infiltration but still significant;

Can significantly reduce the sediment and contaminant load on downstream facilities;

Wet swales may provide fish habitat;

Can be aesthetically pleasing if maintained properly – aesthetic concerns include accumulation of trash and debris, insect nuisance in wet swales;

Technically simple;

More appropriate for removing low concentrations of oil and grease (< 10 mg/L) than coalescing plate separators (BMP S1) ;

Relatively inexpensive – more costly where swale channel is deep;

Can last for 10 to 20 years with proper design and maintenance;

Can reduce development costs by combining conveyance and treatment in one system, and,

Lower construction cost than conventional conveyance systems that include curbing, inlets, and pipes.

Porous Surfaces

Porous pavement allows rainfall to infiltrate into the ground and offers a viable alternative to conventional, impervious pavements. Typically, porous paving includes a porous surface and a porous subsurface layer that temporarily stores, and slowly releases, the stormwater. As a result, porous pavement can provide significant reductions in runoff peak flows volumes and water quality improvements (GVSD, 1999).

Types of porous paving include porous asphalt and certain types of interlocking pavers. Porous asphalt is the most common and involves modifying conventional asphalt paving by eliminating fine aggregates in the asphalt mix. This leaves a mix composed of coarse aggregate that forms large pore spaces in the pavement into which stormwater infiltrates. Porous paving applications are most appropriate for areas with low traffic volumes. It is less appropriate for high traffic and loading areas as there are still questions regarding its durability under heavy use. In order to be effective, porous paving requires subsurface native material that also allows for infiltration.

Porous paving techniques and limitations on impervious cover should be encouraged in all new development in the watershed. The City could demonstrate leadership, in this regard, by converting its own facilities to incorporate porous pavement and onsite infiltration. For example, parking lots could include porous paving and subsurface detention systems. As lanes are repaired, these could be reconstructed using porous pavement systems, subsurface detention basins and/or narrow grassed swales along the sides or down the centre.

Costs

Budget \$20 to \$30 per m² pavement for construction;

Additional costs above conventional pavements are the underlying gravel reservoir layer, extra cost for open graded pavement (10% to 15% higher than conventional asphalt), filter fabric, sediment and erosion control, and underdrain system (if used);

For total capital cost add 35% to construction cost (engineering, contingencies, erosion and sediment control during construction, landscaping, etc) – does not include the cost of land, and,

Maintenance - clean at least quarterly with vacuum street sweeper followed by high pressure wash.

Effectiveness

Higher contaminant removals for particulate contaminants than for soluble, and,

Long term contaminant removal efficiencies as follows:

- *sediment 82% to 95%*
- *total phosphorus 65%*
- *total nitrogen 80% to 85%*
- *chemical oxygen demand 82%*
- *zinc 99%*
- *lead 98%*

Benefits Vs Costs

Provides effective runoff quantity and quality control, and groundwater recharge;

Can be cost effective for areas smaller than 4 ha with no off-site contribution – otherwise other BMPs are more cost effective (FHWA, 1996);

Can reduce or eliminate the need for conventional curb and gutter systems and downstream detention;

Greater potential to reduce runoff peak flow rates, runoff volumes, and contaminants than gravel or conventional asphalt shoulders (St. John and Horner, 1997);

High failure rate due to poor construction and maintenance practices, may become sealed after 1-3 years (WEF, 1998) - subject to wheel rut deformation, and,

Requires extensive site evaluation.

Grass Pavers

Grass pavers allow on-site infiltration, thereby reducing stormwater volumes peaks and pollutants entering the receiving stream. They have also been found to be effective in reducing urban heat build up. Grass pavers are commonly rigid plastic grids or pre-cast concrete lattice structures, with a high percentage of void space, in



which soil is placed and grass grown. The rigid grid or lattice supports vehicular traffic while the void spaces provide areas for infiltration. These surfaces provide a hard protective surface that appears as a grassed area. Grass pavers are appropriate for parking lots, storage areas, and access roads.

Costs:

Budget construction cost \$80 to \$115 per m² for system using porous interlocking concrete pavers (WG, 1998) – poured in place slabs and simple lattice units should be less expensive;

For total capital cost add 35% to construction cost (engineering, contingencies, erosion and sediment control during construction, landscaping, etc) – does not include the cost of land;

Turf requires maintenance if used – watering, fertilizing, mowing, and,

Avoid the use of pesticides and fertilizers that have adverse effects on concrete products and groundwater.

Effectiveness:

- *total suspended solids 75% to 99%*
- *total phosphorus 50% to 70%*
- *total nitrogen 45% to 70%*
- *heavy metals 50% to 90%*
- *oxygen demand 70% to 90%*

Benefits Vs Costs

Can provide effective runoff quantity control, groundwater recharge;

Potential for very effective contaminant removal depending on subsoil;

Can reduce or eliminate the need for conventional curb and gutter systems and downstream detention ;

Requires extensive site evaluation, and,

Higher capital cost but lower maintenance requirements and easier to renovate than porous asphalt pavement.

Parking Lot Detention Basins

While detention basins are frequently used to detain stormwater runoff, the GBIA has little room to accommodate these structures. However, one effective technique involves using the area under parking lots as detention basins. By placing a thicker subgrade (50cm – 80cm) under parking lots, comprised exclusively of coarse aggregate, a large subsurface reservoir can be created while the structural requirements of the subgrade are retained. This reservoir can receive relatively large volumes of stormwater runoff in a short period of time thereby reducing the sudden deposit of runoff into Still Creek. Subject to a comprehensive stormwater management for Still Creek that would determine the optimal combination of BMPs throughout the watershed, it is reasonable to expect that all new parking lot construction use this detention technique.

Costs:

Varies depending on the depth of the detention basin under the parking lot.

Blue - Green Storage or Dry Storage

Blue-Green storage refers to the controlled temporary detention of runoff in a grass area. The runoff then flows slowly into the storm drain system, which is effective in reducing the peak flows in the system. Volumes are also reduced as water infiltrates and evaporates. Some of the small parks in the watershed could be used for this purpose.

Costs:

Typical construction cost \$26 to \$53 per m³

For total capital cost add 35% to construction cost (does not include cost of the land).

Effectiveness

Conventional dry detention basins are effective in matching post development peak flows to predevelopment peak flows;

Typical contaminant removal efficiency of extended detention dry basins (blue green storage that detain smaller more frequent storm:

- Suspended solids 50% to 70%
- Total phosphorus and total nitrogen 20% to 40%
- Lead 75% to 90%
- Zinc 30% to 60%
- Hydrocarbons 50% to 70%
- Bacteria 50% to 90%.

Benefits Vs Costs

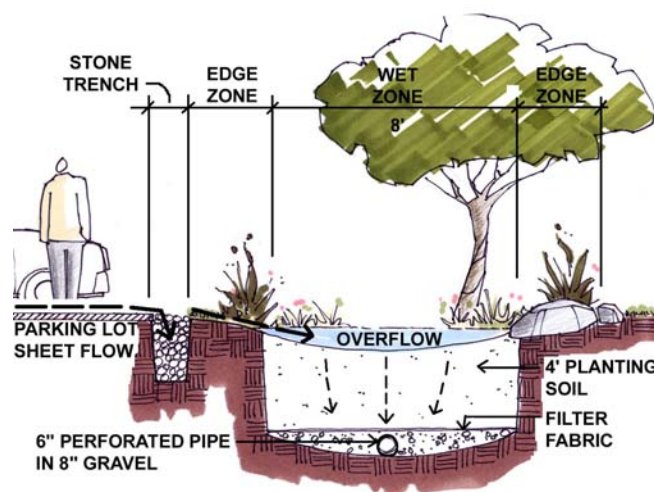
Conventional dry detention – control of peak flows only – may not provide adequate streambank protection, no significant removal of contaminants;

Extended dry detention – can be used to control duration and frequency of bankfull flows and/or remove particulate contaminants (sediments, particulate metals and organics) and floatable material – little or no removal of soluble and colloidal contaminants (soluble metals and organics, nutrients);

Can be configured as a multi-use facility – flood protection, streambank protection, contaminant removal, sports fields, wildlife habitat;

Not as effective in removing contaminants as wet ponds and engineered wetlands;

Not as aesthetically pleasing as wet ponds and engineering wetlands;



Equal to other BMPs such as wet ponds for flood control and streambank erosion protection;

Less desirable than wet ponds and engineered wetlands from a public standpoint (aesthetics, fish and wildlife habitat, recreation property values);

Some safety concerns, particularly with larger basins – side slopes, flow velocities, pool depth, integrity of impounding embankment, and,

Some aesthetic concerns – accumulation of trash and debris, boggy areas, odours.

Street Cleaning

Street cleaning is traditionally done for aesthetics, to remove visible refuse and to keep storm drains clear of sediments so they can flow efficiently. However, it has been found that more intensive street sweeping can significantly reduce pollutants in runoff if modern vacuum systems are used (GVS&DD, 1999). Vancouver presently uses this type of sweeper. Vacuum street sweeping is one of the few management alternatives available to use in existing urban areas to reduce non-point source pollution.

The City of Vancouver uses vacuum assisted street sweeping equipment. This type of street sweeper is effective in collecting contaminants off paved surfaces, thereby reducing the pollutant loads in urban runoff. The present schedule for sweeping residential streets in Vancouver is only 2 times per year. A pilot project should be implemented to sweep streets in certain locations more frequently, perhaps bi-weekly for one year to assess improvements in the stormwater. This will require a monitoring program for sediments, heavy metals, nutrients and oxygen demand. If the improvements are significant then the City could approach the GVRD for funding for a more intensive street sweeping program throughout the watershed.

The industrial portion of the GBIA is street cleaned only 2 times per year, while the commercial areas may be cleaned 3-4 times per year (Rolland, 2001). To be effective in reducing contaminants in stormwater runoff and improving water quality in Still Creek, streets and parking lots in the GBIA should be cleaned every week or at least 2 times per month.

Costs:

Increased frequency of cleaning from 2-4 times a year to a minimum of 24 times requires additional staff and equipment;

Recommend a year long pilot project for a catchment in the GBIA for increased street cleaning accompanied by a monitoring program to assess effectiveness. Potential budget of \$100,000.

Effectiveness

Removes particulate contaminants;

Also reduces dissolved contaminants in runoff by picking up solid contaminants that would otherwise become dissolved during runoff events;

Reduction in contaminant load using traditional street sweeping with mechanical sweeper in Oregon as follows for monthly to twice weekly sweeping frequency:

- *total suspended solids 5% to 30%*
- *heavy metals 5% to 25%*

- *nutrients 0% to 15% and oxygen demand 5% to 20%*

Reduction in contaminant load using high efficiency street sweeping (vacuum or regenerative air) in Oregon as follows for monthly to twice weekly sweeping frequency:

- *total suspended solids 40% to 80%*
- *heavy metals 35% to 70%*
- *nutrients 15% to 40%*
- *oxygen demand 20% to 50%.*

Benefits Vs Costs

Helps to prevent sedimentation and blocking of conveyance systems and fish spawning beds;

Protects/enhances water quality;

potential noise and dust nuisance

Vacuum assisted sweepers, have higher capital costs but lower O&M costs than mechanical sweepers, resulting in lower life cycle cost for vacuum assisted sweepers;

Vacuum assisted sweepers have much greater contaminant removal efficiency than mechanical sweepers;

Sweepers that are effective at removing smaller particles may generate respirable dust and particulates (<10 microns) that are a safety concern, and,

Vacuum sweepers are noisier than mechanical sweepers.

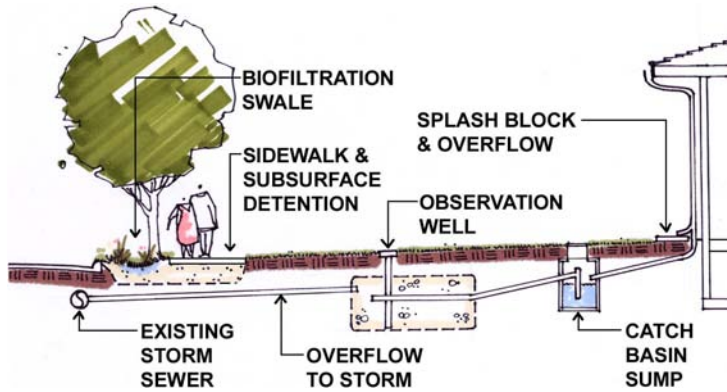
Downspout Disconnection

Keeping residential storm water on-site could be accomplished through a number of different techniques. Disconnecting rainwater downspouts is a relatively effective and inexpensive technique for reducing the total volume and peak flows in urban runoff. The runoff is either diverted to a rain barrel at the base of the downspout, an underground cistern, or to infiltration sites in nearby grassy areas. This technique is most effective in reducing impacts from the numerous small rainfall events throughout the year -- it will not solve major flooding problems.

A downspout disconnection program was attempted in Vancouver in the 1990's to reduce flows to combined sewers. The program was deemed unsuccessful and cancelled due, in part, to limited resident participation despite the program supplying a \$100 subsidy and technical support to the homeowner to participate in the program.

In the summer of 2001, the Municipality of Saanich began to implement a downspout disconnection pilot program in partnership with two environmental organizations. The purpose of the pilot is to reduce the runoff to Mount Douglas Creek by directing rainfall to vegetated areas on residential lots. The program is voluntary and the resident pays only \$25 to participate. The installation is done by a provincially funded, youth E-Team. Friends of Mount Douglas Park are providing marketing of the program with Saanich funding the remaining costs including administration and materials (McKay, 2001).

A pilot project of downspout disconnections in designated neighbourhoods within the Still Creek watershed would be an inexpensive way to evaluate the technical opportunities and constraints of this technique, as well as gauge community interest and support. It is recommended that the neighbourhood(s) designated for the trial, share a common storm sewer so that effectiveness of the program regarding volume and peak flow reductions can be monitored and compared with other areas with downspout connections.



Residential downspout disconnect system



Rainwater harvesting

Effectiveness

Can significantly reduce peak runoff flow rates and runoff volumes and recharge groundwater if extensively used in residential areas;

Assume negligible contaminant removal.

Benefits Vs Costs

Relatively simple to install;

Can reduce the need for downstream conveyance and detention facilities;

Promotes groundwater recharge;

Infiltration trench variant requires large area;

Dry well requires less area but requires relatively permeable soil;

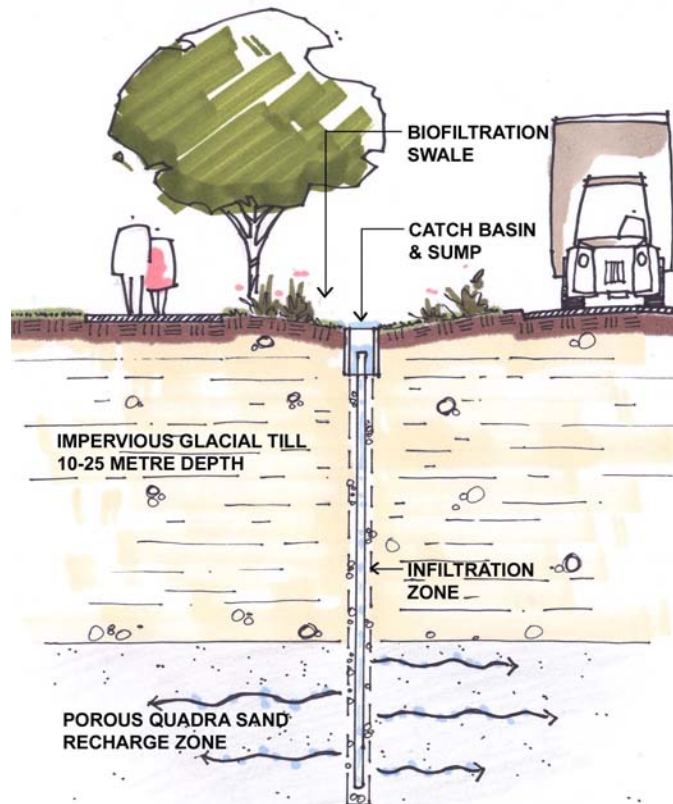
Infiltration trenches, dry wells, and infiltration tanks are buried and the surface can be used for other purposes (turf, garden, etc.), and,

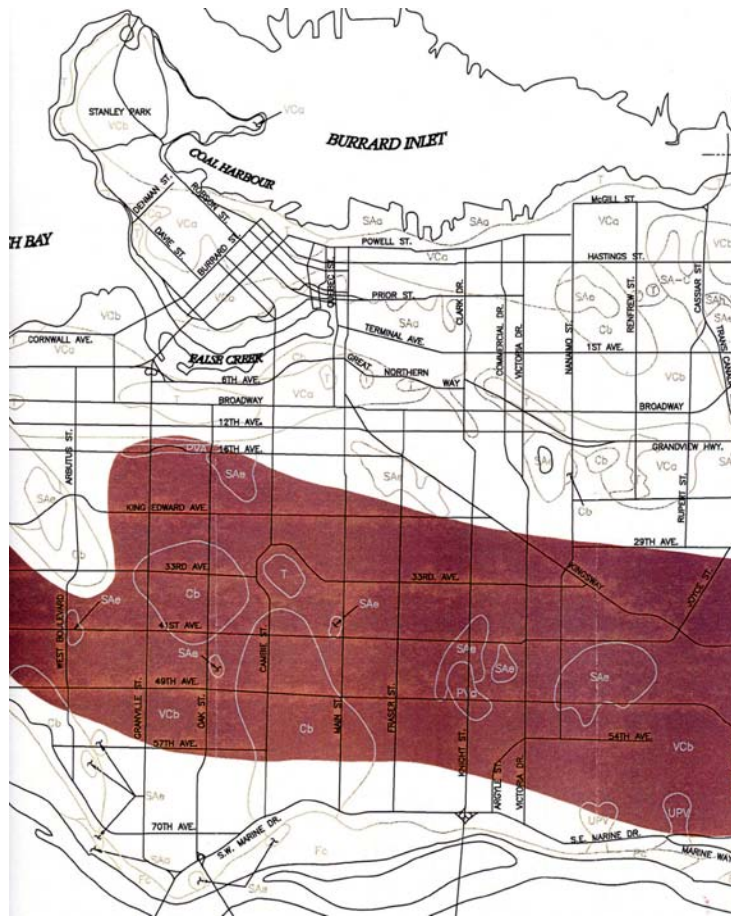
Dispersion trenches and surface dispersion are easy to construct but top area is exposed and cannot be used for other purposes – incorporate drain rock into landscaping features.

Underground Stormwater Percolation

A 1997 report by Klohn-Crippen for the City of Vancouver investigated opportunities for 'Underground Percolation of Stormwater' as a means to reducing the demands on storm sewers. The report focused on two approaches to stormwater interception – roof leader disconnection and catchbasin infiltration. Within each of these approaches, a number of storm water routing options were discussed, including direct surface infiltration, rock pits, dry wells, gravel trenches, percolation catch basins and the concept of deep well injection. Most of the techniques are surface based, or occur within the first few metres of the surface.

Deep well injection involves drilling down to porous geologic formations and directing stormwater runoff through wells into these formations where the water recharges the underground aquifers. This removes the stormwater from the storm sewer system and reduces the stormwater flow into the receiving stream. In the Klohn-Crippen report, the consultants identified an area in South Vancouver that may be suitable for deep well infiltration because of the geology of the area. A large part of this area forms the southern portion of the Still Creek watershed (Figure A1). Care must be taken to ensure that the runoff is of sufficient water quality that the aquifer would not be polluted. It is anticipated that this could be accomplished by intensive street sweeping and use of grassed swales. High traffic streets such as Renfrew and Kingsway Avenues may not be good candidate sites for deep well infiltration because of higher pollutant loads.





Excerpt from the Klohn Crippen Report showing areas of permeable subsurface layers

The Klohn-Crippen report recommends a pilot project be conducted to “determine the feasibility, effectiveness, and maintenance requirements...” prior to full scale implementation. This pilot project is an important part of the investigation into determining the appropriate BMP practices for the watershed.

APPENDIX 3 CITY OF VANCOUVER POLICY DOCUMENTS

The following are excerpts from various City of Vancouver plans, policy statements and guidelines that relate to Still Creek and/or its watershed.

Brunette Basin Watershed Plan

This plan provides the overarching framework for stormwater management within the Still Creek – Brunette River Watershed. It was adopted by Vancouver City Council in 2000 with the recommendation that:

"... the goals, objectives and guiding principles in the draft Brunette Basin Watershed Plan be taken into consideration when carrying out City activities in the Still Creek drainage basin."

The policies and principles of the Brunette Basin Watershed Plan that are relevant to Still Creek include:

- Develop floodplain management strategy and associated bylaws;
- Develop watercourse protection and sediment and erosion control bylaws ;
- Consider property acquisition of riparian, wetland and flood storage areas where local planning process provides opportunity;
- Integrate stormwater management and Best Management Practices guide with land use planning tools - policy statements in Official Community Plans and zoning and subdivision or bylaw;
- Develop sub-watershed stormwater management plan;
- Improve fish passage and enhance/re-vegetate as part of facility repair or upgrades, and,
- Consider daylighting the creek where local planning process provides opportunity.

The Brunette Basin Watershed Plan also includes recommendations for education and stewardship programs, as well as specific improvement programs for a variety of issues.

Still Creek / Greenway Enhancement Fund

Financial commitment to Still Creek has been made with the creation of this fund. The fund was established in July 2000 when Council agreed to the closure of a portion of Cornett Street to allow the Vancouver Film Studio (VFS) to control access to their site. The VFS will lease the road right-of-way for \$79,000 per year. The fund is to be used for:

"..future initiatives toward achieving Council objectives to protect, enhance and daylight Still Creek, including acquisition of properties in fee simple rights-of-way, and protection and enhancement initiatives in the Grandview Boundary area" and a "continuous pedestrian/bicycle pathway."

As part of the agreement the VFS has also agreed to enhance the portion of Still Creek within their property. The lease is for 5 years with options to renew in 5-year intervals.

Still Creek CD-1 Guidelines

The Still Creek CD-1 Guidelines were adopted by City Council in April 1990. The guidelines call for "development to occur in a manner consistent with retaining and enhancing the open watercourse." The guidelines include the following section:

"6.0 Amenity Areas: Still Creek shall be retained and enhanced as an open watercourse, except for pedestrian and vehicular crossings, the location and design of which shall be subject to the approval of the Director of Planning".

Highway Oriented Retail, I-2 and I-3 Policies

This document was adopted in July 1999, and includes policies and guidelines for land use in the Grandview/Boundary Industrial area (GBIA). It includes a number of innovative approaches to re-development and enhancement of Still Creek. These include daylighting the creek, limiting impervious cover and using on-site retention of stormwater among other Best Management Practices.

Section 10.2 Water: Surface and Groundwater Protection includes the following recommendations:

- (a) Permeable surfaces should be maximized to reduce stormwater runoff and recharge groundwater in the following priority order: First, grass then gravel on sand and, third, paving stone on sand.
- (b) Consider providing on-site stormwater storage by incorporating ponds or similar recreational/ amenity features that have dual functions.
- (c) Streams should be daylighted where feasible and supported by Engineering Services to expand recreational opportunities and feed into Still Creek.
- (d) Ditches or swales should be created, where appropriate, to carry, filter and reduce surface runoff as well as minimize underground infrastructure.
- (e) Grey water should be recycled on site, if possible, for irrigation purposes to reduce water use, waste water and runoff."

The importance of connecting people with the natural environment is also reinforced in the policy with a number of references including section 6.3 Linkages to Greenways, Bikeways and Stations:

- (c) Convenient and safe pedestrian and bicycle routes to SkyTrain stations should be integrated into development sites and City Greenways and Bikeway networks.

I-3 High Technology / Highway Oriented Retail (HOR)

This policy was adopted in July 1999. It includes the following statement associated with Still Creek:

"Still Creek is a significant watercourse and has been identified in the GVRD as part of the Green Zone. Over the years many sections of the creek have been buried and consequently the creek has lost its natural and aesthetic attributes. It is the City's intention to fully daylight the creek and provide pedestrian/bicycle access and landscaped public open space amenities along the creek edge. Still Creek should be retained and enhanced as an open watercourse. The ability to secure this amenity will be a key criteria in assessing proposed developments."

GVRD Greenways Plan and Regional Green Zone

These adopted policy documents call for the protection and enhancement of Vancouver's ecologically important areas, including Still Creek.

GVRD Liquid Waste Management Plan

Council has previously approved a number of recommendations concerning the development of the liquid water management plan including support for staff to participate on stormwater management task force groups and to apply a proactive integrated planning approach to municipal stormwater systems like the Still Creek watershed.

City Plan

Consider environmental impacts when making decisions on land use, transportation, and City services: establish spending priorities for City and regional sewer, water and transportation improvements.

Rupert and Renfrew SkyTrain Station Precinct - Interim Rezoning Policies and Guidelines (adopted July 22, 1999)

These guidelines were adopted July 22, 1999. They include a reference to: "Depending on the specific location of the subject site, application should describe how the Central Valley Greenway and Bikeway, Still Creek, traffic and circulation requirements and utilities are to be accommodated."

Rupert SkyTrain Station Precinct Public Enhancements Plan *Rupert Precinct Vision*.

The vision for the Station Precinct is to create a safe, vibrant and accessible neighbourhood place that is connected with other transit modes and the community around it and the Grandview / Boundary Industrial Area. The Plan suggests that the proposed Still Creek Greenway, located south of the station, "offers another opportunity to provide a pedestrian link to the surrounding neighbourhood. Additional commercial activity, set back from Still Creek but in an underutilized portion of the Great Canadian Superstore site, could also further enhance the pedestrian and bicycle orientation of the precinct area around the station."

Regional Context Statement section 2.2(3)

Protecting other elements of the Green Zone through the City Greenways Plan, including,

Still Creek, and Grandview Cut. For example, the City is working towards maintaining Still Creek as an open watercourse and pursues further improvements, including reclamation of the culverted portions, where these are practical (Greenways Plan, 1995 and Still Creek CD-1 Guidelines).

Vancouver Park Board “Management Plan” (approved by the Board May 25, 1992)

“Through participation with City Departments in joint studies, develop planning and urban design recommendations for the City to ensure that: a) the natural features within the City are respected and enhanced; b) lost landscape features (old creeks, ravines, etc.) are commemorated.

Key features to be considered are the Point Grey escarpment, the definition of hills and valleys including Little Mountain, Mount Pleasant, Grandview-Woodlands, and Vancouver Heights, and small waterbodies including Still Creek and Trout Lake.”

The following table is a summary of the guidelines which affect development within the Grandview / Boundary Industrial Area (GBIA). The table also includes comments on guidelines that are notable and changes that could be included in revised guidelines. The proposed changes to the guidelines include many of the Best Management Practices discussed in Chapter Three and Appendix 2.

Summary of GBIA Guidelines and Policies

Existing Guideline	Comments / Possible changes
<p>CD-1 (249) Still Creek By-law No. 6654 (April 24, 1990; amended March 14, 2000) Zoning and Development by-law</p> <p>5.0 Off-street Parking and Loading Off-street parking and loading shall be provided, developed and maintained in accordance with the applicable provisions of the Parking by-law</p> <p>6.0 Amenity Areas: Still Creek shall be retained and enhanced as an open watercourse, except for pedestrian and vehicular crossings, the location and design of which shall be subject to the approval of the Director of Planning.</p>	<p>consider requirement for stormwater management (porous pavement system, under pavement storage or on-site storage pond with grassy swales)</p> <p>continue language which supports Still Creek to be retained and enhanced consider adding specific language for riparian plantings and ecologically sound crossings, opportunities for acquisition or development bonuses for land or amenities adjacent to stream, greenway connections</p>

<p>I-3 High Technology / Highway Oriented Retail (HOR) and I-2 / I-3 Educational, Institutional, Cultural and Recreation Uses (all adopted July 22/ 1999)</p> <p>1.3 Still Creek Reclamation (not in I-2 / I-3 Educational) Still Creek is a significant watercourse and has been identified in the GVRD as part of the Green Zone. Over the years many sections of the creek have been buried and consequently the creek has lost its natural and aesthetic attributes. It is the City's intention to fully daylight the creek and provide pedestrian/bicycle access and landscaped public open space amenities along the creek edge. Still Creek should be retained and enhanced as an open watercourse. The ability to secure this amenity will be a key criteria in assessing proposed developments.</p> <p>Still Creek protection policies should continue to apply to sites currently regulated by the Still Creek. CD-1 and should form part of the CD-1 amendments for individual sites.</p> <p>1.5 Public Support The proposal should demonstrate public support among surrounding residents and businesses, as documented in surveys, and public meetings.</p> <p>1.6 Design Guidelines Developments should improve and enhance the quality of the public realm through careful site planning, high-quality architectural building expression, public and private landscaping, and appropriate vehicular and pedestrian circulation, generally as set out in the design guidelines. The rezoning application should demonstrate that, based on the design guidelines, the proposed rezoning enhances the physical environment.</p> <p>2.1 Yards and Setbacks Front yards as shown in Figure 2, unless otherwise specified (12.1 metres to 3.6 metres.) NOTE: in I-2 and I-3 District Schedule the no front or side yards are required.</p> <p>3.2 Shared Driveways to Reduce Curb Cuts and Impervious Surfaces ...minimize impervious surfaces and increase the landscaped buffer</p> <p>4.Public Realm and Streetscape 4.1 General Provisions (g) Landscape design should provide opportunities to site, view or take part in walking or active recreation. (h) Still Creek should be incorporated into the site design on applicable sites.</p>	<p>continue to support daylighting of Still Creek</p> <p>consider adding requirement for ecological and greenway values adjacent to Still Creek in both I-3 High Technology / Highway Oriented Retail (HOR) and I-2 / I-3 Educational, Institutional, Cultural and Recreation Uses</p> <p>new approaches will require an education component to ensure long term success (public, staff, industry)</p> <p>include reference to ecological values as part of the public realm,</p> <p>include references to improvements to Still Creek.</p> <p>provide opportunity for flexibility in requirements for yards and setbacks to provide additional space for Still Creek.</p> <p>excellent, continue to support expand to include a reference to use of landscape for runoff treatment/storage.</p> <p>include landscaping opportunities for stormwater management and wildlife. include additional language regarding Still Creek enhancement.</p>
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<p>5.9 Exterior Materials and Colour (e) Roofs visible from the SkyTrain should be architecturally treated and/or landscaped</p> <p>6 Rupert and Renfrew Street SkyTrain Station Precinct Area 6.1 Public Realm and Streetscape (a) Dedicated public open space should be provided at Renfrew and Rupert SkyTrain stations, in the form of a landscaped plaza or green mini-park.</p> <p>7 Open Space, City Greenway and Bikeway Public open space should be provided at the Renfrew/Broadway intersection. (c) Neighbourhood Greenways connections should be incorporated where appropriate. (d) Where the Still Creek alignment passes a site, public access to the Still Creek pathway for public enjoyment and use should be provided (refer to Still Creek CD-1 Guidelines). (e) Still Creek should be incorporated and emphasized in the streetscape design where possible.</p> <p><i>Linkages: Development site should provide direct entries and public connections to the Greenway and Bikeway, to SkyTrain stations and to the Still Creek pathway</i></p> <p><i>Open Space: It is City policy to enhance daylight in Still Creek. Some ideas include a more natural treatment that enhances both the water quality and enjoyment of workers in and visitors to the area.</i></p> <p><i>Still Creek may be realigned in some areas to existing or new street corridors, and become a more visible amenity in the public realm.</i></p> <p>8 Outdoor Storage and Display Areas (a) Outdoor storage areas should be limited to the rear yard areas, screened from streets, main entrances and the City greenway.</p> <p>10 Environmental Considerations 10.1 Trees and Vegetation: Retention, Relocation and Replacement (a) Existing trees and vegetation should be retained where possible and incorporated into site planning. (e) A variety of native trees and vegetation should be provided to minimize maintenance, water use and</p>	<p>add requirement for green roofs for storage of rain, amenity for people and bird habitat.</p> <p>explore opportunities to celebrate Still Creek via public art and educational installations at SkyTrain stations</p> <p>reference to connection to Still Creek pedestrian/ bikeway system (if implemented)</p> <p>provide example illustration of potential crossing at Grandview Highway, which celebrates Still Creek. include drawing of connection to Still Creek pathway</p> <p>excellent, continue to support consider amending language to enhance 'ecological values' rather than water quality (or include both). include illustrations of potential expanded streamside vegetation with a trail and naturalised stream bank.</p> <p>provide potential reasons for realignment i.e. to enhance ecological values, to provide additional space for the stream and greenway.</p> <p>add Still Creek</p> <p>very good section if possible, add reference to trees adjacent to Still Creek being native species appropriate to riparian zone. reference importance of continuity of streamside vegetation (riparian zone) along Still Creek to expand green space corridor.</p>
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<p>integrate the planting design into the traditional landscape character as much as possible.</p> <p>(f) Existing planting patterns and connections to adjoining properties should be extended and reinforced where possible.</p> <p>10.2 Water: Surface and Groundwater Protection</p> <p>(a) Permeable surfaces should be maximized to reduce stormwater runoff and recharge groundwater in the following priority order: First, grass, then gravel on sand and, third, paving stone on sand.</p> <p>(b) Consider providing on-site stormwater storage by incorporating ponds or similar recreational/ amenity features that have dual functions.</p> <p>(c) Streams should be daylighted where feasible and supported by Engineering Services to expand recreational opportunities and feed into Still Creek.</p> <p>(d) Ditches or swales should be created, where appropriate, to carry, filter and reduce surface runoff as well as minimize underground infrastructure.</p> <p>(e) Grey water should be recycled on site, if possible, for irrigation purposes to reduce water use, waste water and runoff.</p> <p>Rupert and Renfrew Skytrain Station Precinct - Interim Rezoning Policies and Guidelines (adopted July 22, 1999) Note: Depending on the specific location of the subject site, application should describe how the Central Valley Greenway and Bikeway, Still Creek, traffic and circulation requirements and utilities are to be accommodated.</p> <p>Rupert SkyTrain Station Precinct Public Enhancements Plan <i>Rupert Precinct Vision.</i> In the longer term, potential supportive commercial uses on the north side of the station site along the edge of the proposed plaza could provide convenient services for the transit users and local workers. The Still Creek Greenway, located south of the station, offers another opportunity to provide a pedestrian link to the surrounding neighbourhood. Additional commercial activity, set back from Still Creek but in an under-utilised portion of Great Canadian Superstore site, could also further enhance the pedestrian and bicycle orientation of the precinct area around the station.</p>	<p>include reference to site preparation (soil layers) as important to effectiveness.</p> <p>include reference to porous pavement system with diagram.</p> <p>expand list to include wetlands, connected ponds/wetland trains, values also include aesthetics and wildlife.</p> <p>include ecological and aesthetic values not clear what reference to "feed into Still Creek"</p> <p>consider pilot projects</p> <p>continue to support</p> <p>connection to Still Creek neighbourhood Greenway could be referenced (if implemented).</p> <p>continue to support connection to Still Creek Greenway (if implemented)</p>
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APPENDIX 4 OPEN HOUSE SUMMARY

A public open house was held at the Renfrew Library on November 20, 2001, from 3:30 to 8:00 PM. The following is a summary of comments received, in writing, at the open house.

Enhancement ideas you particularly like?

Better management of bushy areas of the ravine above (south) of 22nd Ave.

Widening of water channels and slowing of water flow, promoting wildlife and green growth

I like the idea of several wetlands along the creek

I like making the creek accessible with pathways

I like educational and artistic (community art) component

Greening of concreted-over areas, wild plant installations and enhancements, removing concreted areas of the stream as much as possible, wider public plantings of trees in the neighbourhoods, protection of the waterways through enforcement laws against dumping and pollution protection of waterways, greater public information and education so that people learn to appreciate wild places and things all are needed to stop the concreting over of the wild places and the creatures that live there

Daylighting any part of a stream sounds good to me

Enhanced width of stream

Enhanced marsh

Enhanced park/seating areas

Street trees

Storm water detention

More fish habitat opportunity

Better water quality

Anything that opens up Still Creek is a wonderful idea. I certainly like your plans for the future

Daylighting and widening the stream

Planting vegetation along the creek

Bike pathways

I like the wetlands construction in Renfrew Park and the scope of the project to include the whole Vancouver portion of Still Creek

I think it will be a great improvement to the industrial / commercial district for residents and employees

The sides of the creek must be accessible to public (at least one side) in such a way that people can walk from the beginning to the end of the creek to watch and enjoy the natural gift of this area.

Designated areas where communities, schools, clubs etc. can plant and maintain. Let people have their hands on the project. More reason to visit the creek more frequently and this all encourages families and youth to consider the creek as their backyard recreation facility Through exposure of our city's natural phenomenon, more people from all the corners of the city or nearby municipalities will come to enjoy. Citizens having information that there is something like this will be so happy to enjoy on days that they want to do something different. Good reason your efforts to take people out to connect them with nature.

Good project

I like the idea of opening the creek and creating green space for recreational enjoyment

I like all of them

I like that the ideas are broken down into short and long term, one block at a time so that it can be funded and community education can grow along with the project

Creek green space for humans, habitat for fish / wildlife, retain / detain storm water, greenway / walkway opportunities and more

I believe that reconstructing the riparian zone is a very important step forward, especially where the stream bank is lined with only unattractive, to both people and animals, blackberry brambles

Diversification of the flora will attract local animals, especially birds and other "desirable" animals

Improvements to better manage the water and reduce flooding risks is always welcome

Enhancement ideas that you have concerns with?

Be vigilant about monitoring commercial and industrial areas for pollution. Maybe they could be encouraged to put in roof top gardens to minimize run-off from large buildings

Need to retain more employment opportunities. I would be sad to have a net loss of job potential. May need to adjust FSR

Suggest coordination with traffic planning for narrower pavement area, more boulevard space

The length of time it may take to realize this plan

Much money has been spent by the City on Parks in other neighbourhoods (ie. Yaletown \$20 million land acquisition - park at PNE grounds). This is an ideal environment for birds, wildlife, people, salmon enhancement

I want Renfrew Ravine to be part of the big picture. Would like a wetland to slow the stream down between 29th Ave. and 27th Ave. and perhaps even bio-filtration there too so that the ravine water quality improves and we can have fish in the ravine again

I have difficulty with tearing down buildings but I can see the necessity. I would like to see this kept to a minimum

If there are any planned walkways along the creek it could possibly create a traffic / pedestrian situation at Nootka and Grandview if the public is wanting to cross the highway at this point

I'm located next to the pump station at Grandview and Nootka where the creek is extremely dangerous as the water level during a heavy rain will rise to within a foot of the top and flow at great speed. Any enhancement idea that would make this worse would be devastating for nearby residents.

General Comments

Looks like a good plan for improvement. I'm glad to see the City is interested in the natural environment as well as commercial and industrial concerns

Overall vision is great

I would like to see a long term plan for Renfrew Ravine area. Stabilize slopes and build a boardwalk down at creek level from 27th ave. to 22nd ave.

We need these wild and green spaces more and more, not less. Stand up to developers and other who cut down trees and concrete yards. Maybe tougher laws and enforce them. Please continue with this enhancement - I really like it

I would like to see particularly native plantings and green connecting corridors for wildlife stressed

Courageous plan

Good presentation, boards and delivery

We were born in the area and have had some wonderful times down at our of swimming holes

Very impressed with the presentation

Would like to see a Renfrew citizen's panel formed to increase communication between the City and the citizens and keep abreast of current happenings

One of my main concerns is the garbage and trash people deposit in the ravine. I am also concerned about stream water quality. A garden/yard composting area might keep people from throwing their yard waste in the ravine

Thanks you for realizing what a wonderful resource Still Creek is. Our neighbours have pictures of cut-throat trout being caught in the creek in the 1930's and 1940's

Would also like daylighting from 18th ave. to 13th ave. included in the long-term vision

I think it is a great initiative for our neighbourhood, good for the ecology, eco-education, property values, quality of life, adding art and culture to the neighbourhood in the art installations

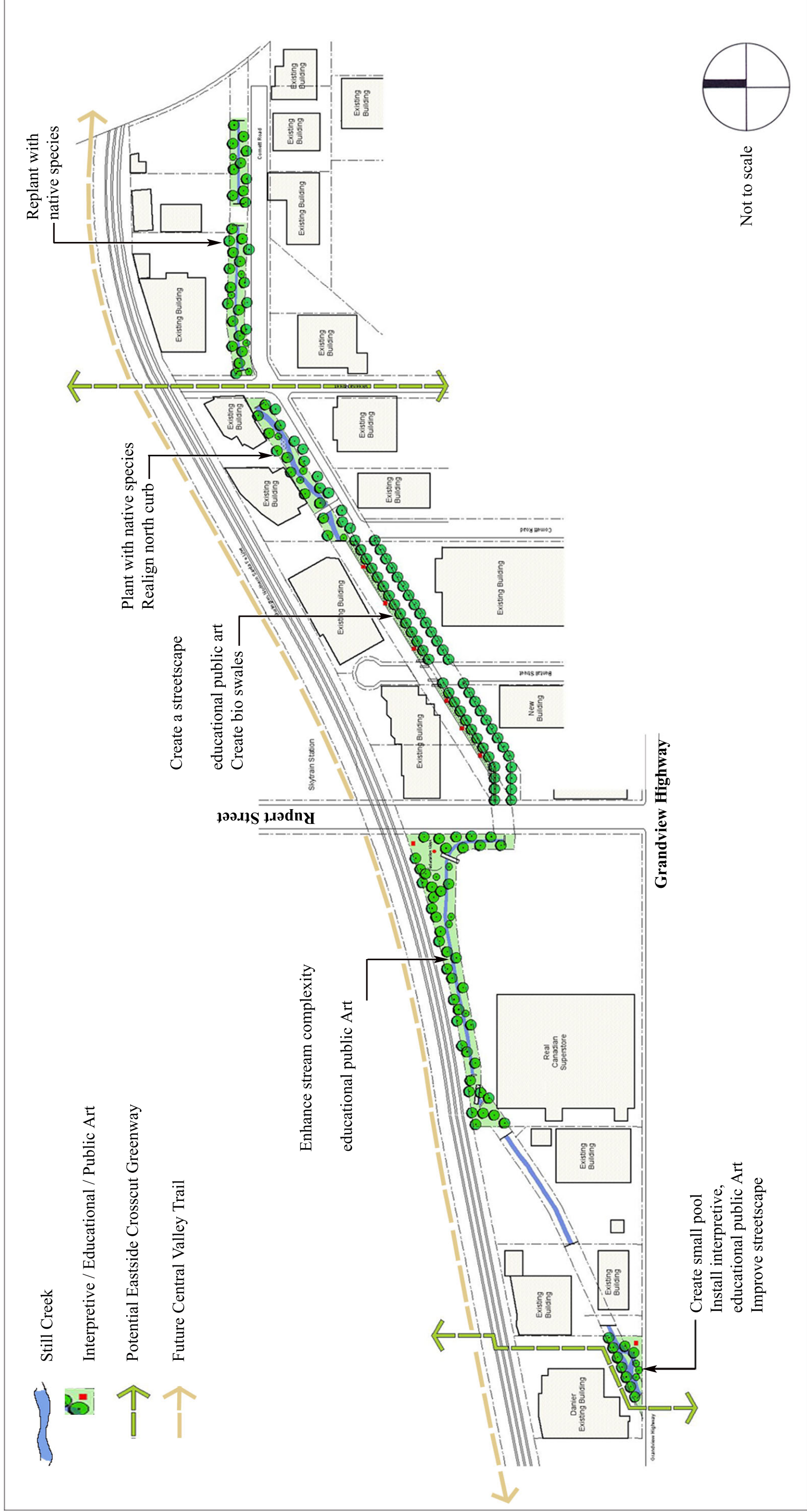
General Comments (cont'd)

I think community involvement is essential and positive

Well done, thank you for taking the initiative on this - there is community support. Local volunteer stewards will help with the funding, building, maintenance, and long term monitoring of the projects

This will increase both residential and commercial land values

Fruition of this plan will benefit the entire community. Hopefully ideas written up in the proposal will result in tangible results in the creek.



Still Creek 10 Year Action Plan

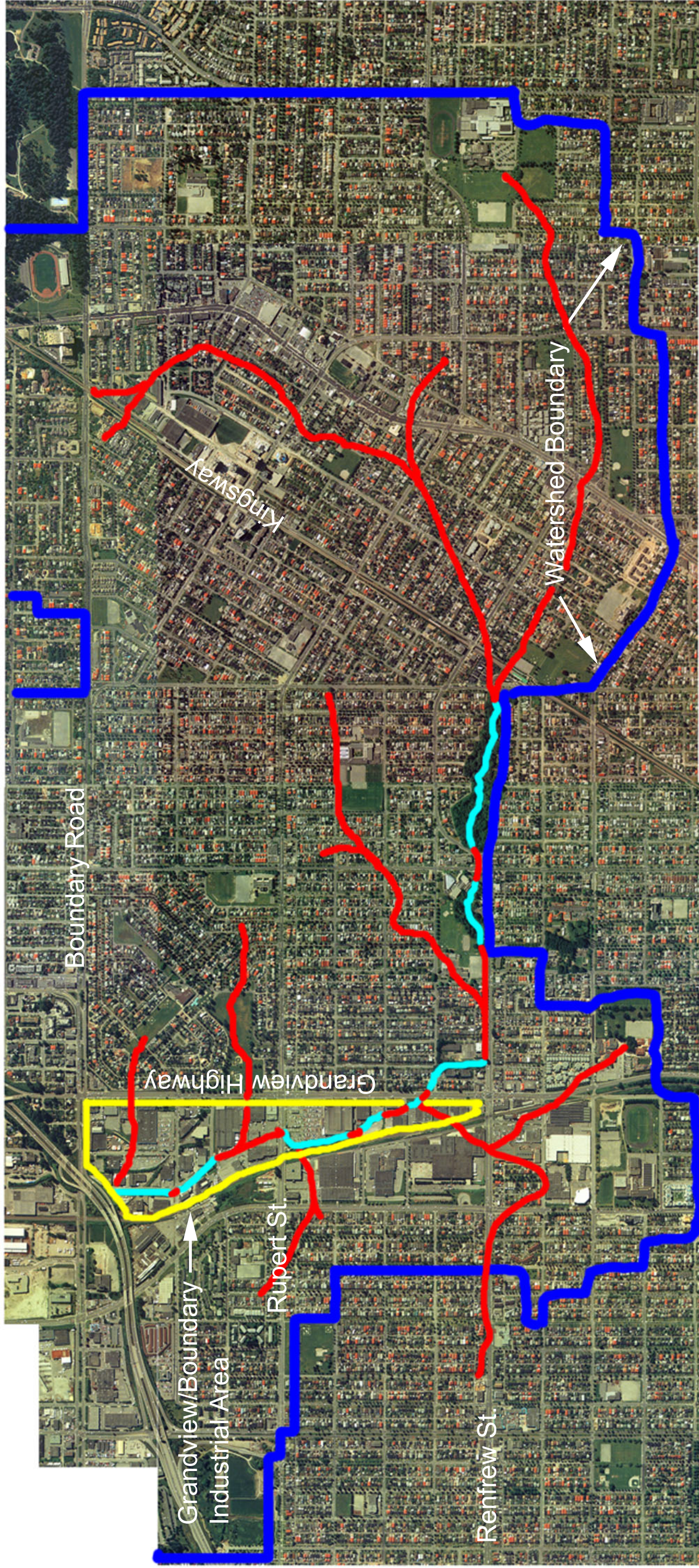




Still Creek 10 - 50 Year Action Plan



-  Still Creek above ground
-  Culverted and historical tributaries of Still Creek



Still Creek Watershed in Vancouver

Not to scale

