GREEN INFRASTRUCTURE SUPPLEMENT FOR SUBDIVISIONS:

A DISCUSSION PAPER PREPARED FOR THE GREEN INFRASTRUCTURE CONSULTATION MAY 11, 2004 VANCOUVER

Green Infrastructure Partnership:
Master Municipal Construction Document Association
Ministry of Community, Aboriginal & Women's Services
Water Sustainability Committee, B.C. Water & Waste Association
West Coast Environmental Law Association

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A. INTRODUCTION

Over the next year, the Green Infrastructure Partnership is creating and disseminating a Green Infrastructure Supplement to the Master Municipal Construction Document Association (MMCD) Design Guidelines to make green infrastructure practices more accessible to communities across B.C. The Partnership members have invited experts who are working on incorporating green infrastructure into municipal standards to a one day consultation to understand the diversity of issues and difficulties inherent in applying a green infrastructure approach to land development, and to alert the MMCD Technical Team to the best practices available. The purpose of this Discussion Paper is to explain the objectives of the consultation, and to raise some of the issues that may be explored at the consultation on May 11.

B. WHAT IS GREEN INFRASTRUCTURE?

Using a narrow interpretation, green infrastructure refers to the ecological processes, both natural and engineered, that are the foundation for a healthy natural and built environment in communities. Municipalities are returning to using the green infrastructure as an integral part of how development occurs because it is often less costly than hard infrastructure, and also offers aesthetic, environmental, health and recreational benefits.

The green infrastructure includes:

- ditches, rivers, creeks, streams and natural wetlands that contain and carry rainwater runoff, improve water quality, and provide habitat;
- parks and greenways that link habitat and provide recreation opportunities;
- working lands such as agricultural or forested areas that are a key part of the economy;
- aquifers and watersheds that provide drinking water;
- engineered wetlands (rainwater detention ponds) that retain rainwater, improve the quality of rainwater runoff, and promote infiltration;
- landscaping-based rainwater management solutions that capture rain where it falls;
- infiltration-based rainwater drainage systems incorporated into streets, parking areas, buildings and yards; and
- trees, rooftop gardens and community gardens that clean air, cool urbanized areas in the summer, and provide a local food source.

Using the green infrastructure to manage common processes, such as rainwater runoff, keeps water on the land longer, thus recharging aquifers while protecting stream hydrology and morphology. Street trees, greenways and rooftop gardens, the "urban forest," help mediate summer heating in developed areas, restore pre-development levels of evapotranspiration, and sequester pollution while providing habitat for many species. Green infrastructure in neighbourhoods, such as green streets, constructed wetlands, protected stream corridors and new greenways, are seen as amenities and increase property values. Finally, maintaining working lands is important both for the economy and for their contribution to the green infrastructure of a region.

Green infrastructure can also be defined in a broader sense as it relates to overall community planning, livability goals, and taking a smart growth approach to land development. "Smart growth" means the land use strategies and types of developments that create more compact complete communities, and also use tax dollars more efficiently. It means neighbourhoods that have a mix of stores and services within walking distance of a variety of housing options, connected by sidewalks and bike paths, and accessible by public transportation. Smart growth means revitalizing existing commercial centres and also supporting a viable rural working land base.

The principles of smart growth include:

1. Promoting urban revitalization and rural preservation by containing urban areas, channeling development into existing neighbourhoods and adopting integrated planning and management approaches;
2. Incorporating green infrastructure into communities;
3. Creating compact complete communities by mixing land uses and using land more efficiently;
4. Increasing transportation choices through land use decisions;
5. Creating inclusive neighbourhoods by ensuring that a diversity of housing types are accessible to a wide range of people of different age groups, family types and incomes;
6. Maximizing the enduring benefits of developments by using resources wisely on sites and in buildings that are tailored to specific neighbourhood conditions;
7. Supporting municipal goals through cost recovery by ensuring that development cost charges and property taxes reflect the true cost of different types of growth;
8. Promoting smart growth throughout the development process by reforming administrative processes and addressing liability issues.

In short, smart growth is good planning with an explicit injection of affordability, sense of place, and renewal of the green infrastructure into community development. Over the long term most smart growth strategies cost less than traditional approaches to municipal development.

Municipal infrastructure design focused on using the green infrastructure more fully and incorporating smart growth principles points towards servicing practices that use land and resources more efficiently. These include:

- Drainage standards based on infiltration, environmental protection, and community amenity;
- Utility alignments for more compact roads where bicycle and pedestrian infrastructure needs are given equal weight to the needs of automobiles;
- Road standards tailored to specific uses, lower speed limits, and community amenity goals such as achieving 40 percent tree canopy at maturity;
- Traffic calming built into road designs;
- A connected (grid) road network;
- Pavement structure allowing for permeable paving in certain circumstances;
- Unique road and servicing standards for projects near working lands;
- Significant street trees and boulevard plantings;
- Low maximum driveway standards;
- District heating systems;
- District water recycling systems;
- Water & sewer infrastructure requirements for subdivisions of high performance (green) buildings (in some cases allowing for smaller pipe sizing); and
- Dark sky outdoor lighting standards and energy efficiency requirements.

For more information on the range of smart growth and green infrastructure practices please see the Smart Bylaws Guide at www.wcel.org/issues/urban/sbg.

C. GREEN INFRASTRUCTURE PARTNERSHIP

The Partnership is a consortium of four organizations, the members of which share a vision for developing and implementing a Model Subdivision Bylaw and Green Infrastructure Supplement that will present a 'best practice' summary for land development regulation. The four partners are:

- Water Sustainability Committee of the BC Water & Waste Association
- Municipal Master Construction Document Association
- West Coast Environmental Law Research Foundation
- BC Ministry of Community, Aboriginal and Women's Services

The Model Subdivision Bylaw and Green Infrastructure Supplement will consist of:

- A Front End – typical bylaw definitions and legal / planning content.
- Technical Content – consisting of references to MMCD Design Guidelines and Construction Standards, including a Green Infrastructure Supplementary Specification.
- Decision Support Tools – consisting of the MMCD's CrossCheck contract management software, the Water Balance Model for BC, and an instrument to be developed by the WCEL to explain to municipal councils when and how to consider using the Green Infrastructure Supplement.

The Green Infrastructure Supplement will complement the MMCD Draft Design Guidelines as an alternative to conventional municipal infrastructure practices. The Draft Design Guidelines are available at http://www.mmcd.net/admin/Draft-DesignGuidelines.pdf. The MMCD is responsible for developing the Green Infrastructure Supplement.

D. GREEN INFRASTRUCTURE CONSULTATION

The work of Phase I of the Green Infrastructure Partnership is for the Partnership to consult with experts to discuss what "green infrastructure" means in the context of engineering Design Guidelines. Consultation participants include representatives with expertise in the jurisdictions and with the projects that have embraced some aspect of green infrastructure. It also includes practitioners who are at the forefront of developing green infrastructure practices. In addition to the participants, Green Infrastructure Partners have invited practitioners who are interested in green infrastructure and who may be involved in developing the Supplement to observe the discussion of the participants. See Appendix A for a list of participants, and Appendix B for the agenda.

The primary purpose of the workshop is to understand the diversity of issues and difficulties inherent in applying a green infrastructure approach to land development, and to provide this information to the MMCD Technical Team. Other purposes include:

- Alert the Partnership to the best practices underway in B.C. and to the technical documents available to the MMCD Team;
- Understand the breadth of what "green infrastructure" currently means or could encompass;
- Debate some of the conflicting issues about the application of a Green Infrastructure Supplement.

The outcomes are twofold: (1) a better understanding of the range of issues involved in translating green infrastructure into on-the-ground standards; and (2) a summary report of the Consultation that will act as a framework for the Phase II technical analysis by MMCD in developing the Green Infrastructure Supplement.

E. EXPECTATION OF PARTICIPANTS

Participants are asked to contribute in three ways:

- Relevant Documents and Materials – please bring to the Consultation a list of resources (and copies of the resources if you have extras) that you believe reflect the best development practices for green infrastructure. These include municipal plans, technical reports, and other studies. The comprehensive set of resources from the Consultation will alert the MMCD Technical Team to the standards and projects already in place.

- Five Minute Statement on Best Development Practices – please attend the Consultation prepared to make a brief statement (five minutes maximum) on what you believe are the key green infrastructure best practices used today in your area of expertise, and what are the key issues yet to be resolved.

- Discussion – please be prepared to discuss the topics with which you are familiar in the MMCD Draft Design Guidelines (see below).

F. SCOPE OF DISCUSSION

The scope of the discussion on May 11 will be limited to those infrastructure standards over which municipalities have regulatory control. As the Green Infrastructure Supplement will follow the MMCD Draft Design Guidelines closely, the discussion will focus on the topics dealt with in the Draft Design Guidelines and those topics that should be included in a Green Infrastructure Supplement. See Appendix C for the Table of Contents of the MMCD Draft Design Guidelines for Municipal Infrastructure, and see http://www.mmcd.net/admin/Draft-DesignGuidelines.pdf to review the MMCD Draft Design Guidelines for Municipal Infrastructure.

Appendix D outlines a number of green infrastructure issues that the Draft Design Guidelines raise. For ease of reference, the sections and order of issues in Appendix D reflect the structure of the Draft Design Guidelines. This scoping of issues is intended only to spur discussion and should not limit your analysis of the Draft Design Guidelines and what should be included in the Green Infrastructure Supplement.

APPENDIX A – LIST OF PARTICIPANTS

Name & Position	Expertise	Contact Information
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APPENDIX B – AGENDA FOR GREEN INFRASTRUCTURE CONSULTATION, MAY 11, 2004

Location:	Room 1430, 515 West Hastings Street (Harbour Centre)
8:30-9:00 a.m.	Arrival & Welcome
9:00-9:15 a.m.	Introductions (Green Infrastructure Partnership) Overview (Deborah Curran)
9:15-10:30 a.m.	Five Minute Statement from Each Participant
10:30-10:45 a.m.	Break
10:45-12:30 p.m.	Discussion
12:30-1:30 p.m.	Lunch
1:30-3:30 p.m.	General Discussion (Participants & Observers) Introduction to Request for Proposals for Green Infrastructure Supplement (Neil Nyberg)

APPENDIX C - TABLE OF CONTENTS FROM MMCD DRAFT DESIGN GUIDELINES FOR MUNICIPAL INFRASTRUCTURE

SECTION 1.0 – GENERAL DESIGN CONSIDERATIONS

SECTION 2.0 – WATER DISTRIBUTION

SECTION 7.0 - TRAFFIC SIGNALS

APPENDIX D - POTENTIAL ISSUES FOR DISCUSSION[1]

1. General Design Considerations

Incorporating the green infrastructure into municipal infrastructure design requires a systems-based and integrated approach to planning, zoning and infrastructure design. Municipal departments and even engineers with responsibility for different aspects of the municipal infrastructure have traditionally worked in isolation. Taking a systems approach to creating new neighbourhoods or retrofitting old ones is more complex than addressing infrastructure questions as discrete tasks.

Design issues include:

1.1 Sustainability and Asset Management (1.1) – are these principles in the MMCD Draft Design Guidelines detailed enough to assist users to screen design considerations? What would be a more effective way to spell out these principles and demonstrate in each section how they are considered? What is an appropriate statement about best management practices that could be included here? How can line-by-line Design Guidelines be transformed into a holistic prescription for continuing ecological functioning using integrated and multiple objectives?

1.2 Design Criteria – What are the overall criteria through which decisions about green infrastructure should be made?

1.3 Utility Rights-of-Way (1.3) – How can the Green Infrastructure Supplement resolve the conflicts between green infrastructure goals (trees and integrated rainwater management) and other spatial demands on the rights-of-way (utilities, conventional drainage, sanitary, fire access, etc.)?

2. Water Distribution

Smart growth and taking the green infrastructure into account require a demand management approach to the provision of water to ensure long-term ecological functioning in light of new growth.

Design issues include:

2.1 Metering (2.2) – What further details are required here to provide guidance to municipalities?

2.2 Per Capita Demand & Minimum Pipe Diameter (2.3 & 2.9) – When high performance (green building) design is used for new neighbourhoods and buildings, how can the Design Guidelines take the lower demand for water and sewer

[1] The numbers in brackets reflect where this topic can be found in the MMCD Draft Design Guidelines.

infrastructure into account, recognizing that water infrastructure sizing is governed by fireflow protection requirements at the neighbourhood and subdivision scales?

3. Sanitary Sewers

Design issues include:

3.1 Per Capita Flows & Minimum Pipe Diameter (3.2 & 3.10) - When high performance (green building) design is used for new neighbourhoods and buildings, how can the Design Guidelines take into account the lower demand for water and sewer infrastructure, recognizing that sewer infrastructure sizing is governed by peaking factors?

4. Rainwater Drainage

A significant cost of the infrastructure for new development is to ensure that water drains away from buildings and roads. Covering over natural vegetation with hard surfaces means less water naturally infiltrates into the ground, creating more surface runoff that needs to be removed and delivered through conveyance systems comprising underground pipes and ditches to receiving watercourses. Rainwater runoff from developed areas flows to the receiving waters much faster and in greater volume than under natural conditions. This causes channel erosion, flooding, loss of aquatic habitat, and water quality degradation. As more development occurs, more municipal infrastructure must be built to deal with the increase in rainwater runoff.

Because of the liability, cost and problems associated with conventional detention and conveyance approaches to rainwater management, over the past decade municipalities and the provincial government have been developing an integrated rainwater management approach. The key to reducing risks to property damage, water quality and to aquatic habitat is to minimize the volume of runoff that is conveyed to streams. The concept is to preserve the water balance of a naturally vegetated watershed by controlling rainwater at its source – that is, where it falls onto the ground. This new approach of source control seeks to capture rainfall (on lots or within road rights-of-way) and return it to its natural hydrologic pathways by ensuring that it infiltrates into the soil or is returned to the atmosphere as evapotranspiration from landscaping. This reduces the volume of water and speed at which rainwater flows into watercourses.

Design issues include:

4.1 Overall Approach - The design, planning, installation and monitoring of drainage and other utilities and roads require a multi-disciplinary vision. No longer the realm of strict engineering or hydrology, aspects of aquatic and terrestrial ecology, geomorphology, groundwater management and other perspectives are becoming recognized as part of understanding the effects of land use decision making. How can this interdisciplinary perspective be incorporated into the Design Guidelines?

4.2 Natural Systems Approach – How can a 'natural systems approach' to rainwater management be integrated into the Design Guidelines to achieve low impact development objectives?

4.3 Three Scales – How can the Design Guidelines be structured to reflect the integration of practical strategies for rainwater management at three scales: site, subdivision (i.e. road rights-of-way) and neighbourhood (i.e. public green spaces).

4.4 Total versus Effective Imperviousness[2] – Should the Green Infrastructure Supplement address the difference between total and effective imperviousness, and suggest solutions to lowering total imperviousness? Or should the focus be on how to achieve performance targets for rainfall capture and runoff control?

4.5 Water Balance Model – How can the Design Guidelines most effectively reference and/or incorporate the web-based Water Balance Model tool that has been developed by an Inter-Governmental Partnership that has representation from all levels of government?[3]

4.6 Minor System Design (Flow Velocities 4.12.3) – Storm sewers should not discharge directly into a watercourse. What design guidelines are needed in this area?

4.7 Minor System Design (Service Connections 4.12.14) – Can roof drains discharge to rain barrels or cisterns for later reuse? To where do splash pads drain?

4.8 Major System Design (Watercourses 4.13.6) – To what extent are watercourses rainwater conduits or should the focus of rainwater management be on infiltrating water into the soil and detaining it?

4.9 Runoff Controls (4.14) – What is the link between ecological and hydrological impacts and how best can the Design Guidelines address this connection? Should the Design Guidelines set out vegetation retention requirements to reduce the amount of site control methods needed?

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[2] Total imperviousness is the amount of a watershed or site covered in hard surfaces. This includes driveways, parking lots and buildings. Effective imperviousness refers to the impact of those hard surfaces. For example, the effective imperviousness of a site can be less than the total imperviousness if water is directed from hard surfaces back into the ground. This can be accomplished, for example, by disconnecting rain leaders from the rainwater system and directing them into front yards and onto gravel splash pads, or constructing an infiltration trench for parking lot runoff.

[3] The Water Balance Model is a web-based interactive tool that replicates how impervious surfaces, absorbent landscaping, infiltration facilities, green roofs and rainwater harvesting affect water behaviour under different development circumstances. It assists local governments to monitor water balance volumes at the site level to determine how best to control flows at the source to minimize runoff volumes. The Model provides an interactive means for local governments to integrate land-use planning with rainwater management and evaluate the potential for developing communities that function hydrologically like naturally forested or vegetated systems. www.waterbalance.ca. Other useful tools include the Greater Vancouver Regional District Preliminary Design Guidelines.

4.10 Soil Layer Thickness – Should the Design Guidelines provide guidance for maintaining a minimum soil layer depth in all landscaped and lawn areas on development sites?

5. Roads

The layout and design of streets shapes the culture of a neighbourhood, with road rights-of-way typically accounting for about 30% of a typical residential area. Streets affect mobility choices, safety in public places, and the quality of human interaction. They form the largest segment of public space in a community. The issue is how to design streets to increase the mobility of people and goods, the accessibility of transportation, and the quality of streetscapes. The best street standards create a pleasant streetscape where walking and cycling infrastructure is built in, and cars travel at safe speeds. Public amenities, such as sidewalks, transit shelters, and bike parking support the desired users. Parking is limited but other transportation modes are efficient and comfortable. It also means managing the demand for roads by prioritizing investment in infrastructure for non-automobile transportation.

Smart street design includes:

- A street and block pattern of an interconnected grid or web network that provides many routes for travel in the neighbourhood and disperses the impact of automobile traffic. Block lengths are between 90 and 240 metres (300 and 800 feet), with an average of 150 metres (500 feet). With rectangular-shaped parcels, a rear lane can provide rear garage access and eliminate curb cuts and driveways on the street;
- An hierarchy of streets within the interconnected network grid with right-of-way width, pavement width, number of lanes, sidewalks, landscaping, and design speed clearly described;
- Streetscape features such as sidewalks, street trees and other landscaping, lighting and crosswalks shown with clear graphics. Sidewalks should be at least 1.5 metres (5 feet) wide in residential areas and between 2.4 and 5 metres (8 to 16 feet) in mixed-use and commercial areas. Parkway strips of at least 2.4 metres (8 feet) buffer pedestrians from traffic and allow tree planting. Crosswalks should be provided mid-block if the blocks are longer than 215 metres (700 feet).

Design issues include:

5.1 Low Impact Development – What are the low impact development techniques that should be set out and integrated between the rainwater section above and this section, including permeability and width? Should roadways be designed to be 'self-mitigating' rather than simply collecting and concentrating runoff? What is the appropriate performance standard for storm drainage (i.e. 1 mm per hour infiltration)?

5.2 Landscaping – Should this section include tree canopy and landscaping coverage criteria to achieve multiple objectives such as rainwater management, heat attenuation, an habitat goals?

5.3 Road Cross Section Elements (Table 5.1) – revisit right-of-way width, curb types and parking. Are the roads too wide and do the curbs prevent a source control approach to rainwater management?

5.4 Intersections (5.5) – do the Design Guidelines limit block length to 150 metres and provide for sidewalk bulges and other tailored road treatments in appropriate areas?

5.5 Cul-de-sacs (5.7) – Are cul-de-sac's prohibited except for developments adjacent to working lands?

5.6 Sidewalks and Bikeways (5.8 & 5.9) – Is more detail needed to make these effective standards?

5.7 Driveways (5.10) – What are the driveway maximums for different types of development? Are different paving materials that promote water infiltration allowed?

5.8 Hillside Standards (5.14) – From recent experience, how can these standards be improved?

6. Roadway Lighting

The glare from streetlights makes stargazing difficult in urban areas and is a waste of light. The glare from some outdoor lights can also hamper visibility. Several jurisdictions, including Saanich and Tempe, Arizona, have adopted street lighting standards aimed at shielding the sky from light pollution, and directing the light downwards to where it will be most effectively used.

Design issues include:

6.1 Light Loss – What designs most effectively project light downwards to where it is needed and prevent loss to the sky?

6.2 Energy Efficiency – do the Design Guidelines suggest the most energy efficient lighting mechanisms?

7. Traffic Signals

Design issues include:

7.1 Signal Coordination (7.16) – What standard design considerations promote transit, bike and pedestrian priority of circulation?

8. Additional Sections

What other sections are required to reflect a comprehensive approach to sustainability and the green infrastructure? Suggestions include:

8.1 Landscaping Standards – These would include "Naturescape" and native plant land care principles.

8.2 Trail and Open Space Management – This reflects the principle that natural capital and ecosystems are as much a form of community infrastructure as are roads and light standards.

8.3 Cost Benefits (socio-environmental and financial) – should the design guidelines point to parameters for evaluating infrastructure decisions? Should they list resources that could assist municipalities with this decision-making?

8.4 Risk Management – does concerns about risk management for design that has a focus on sustainability go beyond traditional "life and property" concerns and include long-term ecosystem functioning? If so, how can this be incorporated into the Design Guidelines, particularly in the adaptive management approach?

8.5 Indicators and Monitoring – What types of monitoring should be built into infrastructure programs and design details that allow for an adaptive management approach?

8.6 Expedited Approvals – If a designer or project uses the Green Infrastructure Supplement should that project receive expedited environmental approvals?

8.7 Process – Does using the Green Infrastructure Supplement require a different type of project approvals process at the municipal and project level to most effectively implement the standards contained in the Supplement?