Metro Vancouver Liquid Waste Management Plan Reference Panel

TO: Metro Vancouver Waste Management Committee

CC: Johnny Carline, Chief Administrative Officer, Metro Vancouver

FROM: **LWMP Reference Panel:**

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Ken Hall	Kim Stephens, Chair
Mark Hodgson	Christianne Wilhelmson, Co-Chair

DATE: June 30, 2009

SUBJECT: **Final Report on Draft Liquid Waste Management Plan (March 2009)**

Thank you for the opportunity to assist the Waste Management Committee with its deliberations regarding the management of liquid discharges and rainwater in Metro Vancouver. We are pleased to submit the accompanying **Final Report** for your review and response on July 15.

We again emphasize that the Final Plan must articulate more clearly and consistently the goal of moving beyond regulatory compliance to transitioning Metro Vancouver to an approach where management of liquid discharges and rainwater resources is planned and implemented within a broader, sustainability framework. This framework is one that is designed to achieve the Sustainable Region vision - through resource planning, recovery and management that ultimately integrates liquid and solid waste recovery, land use planning, and the built form/infrastructure.

We also look forward to meeting again with the Waste Management Committee on September 9. At that time we will provide our comments on the **Final Liquid Waste (Resource) Management Plan** which Metro Vancouver staff will be preparing over the summer months.

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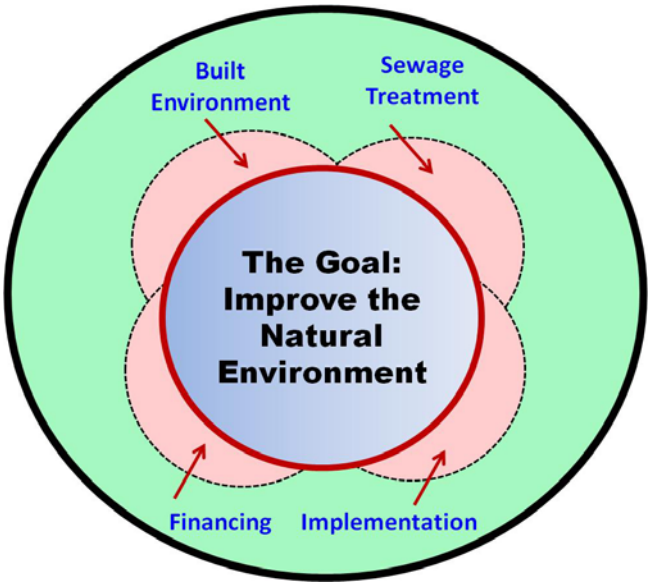
Final Report

On

A Liquid Resource Management Plan for Metro Vancouver



Prepared for:
Metro Vancouver Waste Management Committee

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July 2009

Preface –
A Guide for the Busy Reader

The Reference Panel has a stake in ensuring that Liquid Resource Management outcomes are achieved over time:

- *We live here;*
- *We share a vision and we are motivated by the common good; and*
- *We are passionate about the legacy and the quality of life that we leave for our children and our grand-children.*

As we have progressively absorbed and synthesized information over the past 14 months, our understanding has grown and we have identified opportunities to create linkages among the different areas of action – natural environment, built environment, sewage treatment, financing and implementation – thereby helping to create a stronger plan.

*This Final Report comprises three components. The heart of the report is the three-page Table 1 which we have titled **A Recommended Policy Framework for Liquid Resource Management in Metro Vancouver**. It consolidates our 19 recommendations in a reader-friendly format, and is complete with on-the-ground examples that can help the region implement the Plan.*

The supporting report text serves two objectives. First, it establishes context for Table 1. Secondly, it elaborates on seven key recommendations so that Metro Vancouver and municipal decision makers will have a clear picture of why the examples are important and/or relevant.

The third component is an appendix which highlights the areas of expertise for the members of the Reference Panel.

June 30, 2009

Reference Panel Final Report on
A Liquid Resource Management Plan for Metro Vancouver

1. Scope of Report

Appointed by the Metro Vancouver Regional Board in April 2008 to provide independent review and recommendations on the Liquid Waste Management Plan update, the **Liquid Waste Management Reference Panel** is a community advisory group that brings expert knowledge and relevant experience in liquid waste/resource and rainwater management.

Independent Advice and Comment

The Reference Panel provides a blend of technical, legal, scientific, academic, business, industry and community perspectives and values. We are independent and non-partisan.

On May 13, 2009 we presented a Progress Report to the Waste Management Committee; and we laid out a storyline for communicating our findings.

On June 10, 2009, we presented an **Interim Report**. This was our synthesis of what we believe really matters. The report elaborated on the storyline elements by presenting 19 recommendations under five theme areas.

This **Final Report** reflects insights gained from our interaction with the committee on June 10. It incorporates examples and explanatory information to support our recommendations.

Our hope is that this set of 19 over-arching recommendations will help strengthen and improve the Plan; will help the Waste Management Committee make informed decisions and provide leadership; and will serve as an effective policy framework that helps the region implement the Plan.

Our hope is that these conversations will help the Committee take THE PLAN *from planning to action*:

- ❑ May 13 – present Progress Report
  "understand integration"
- ❑ June 10 – present Interim Report
  "explore our recommendations"
- ❑ July 15 – present Final Report
  "focus on implementation"

2. Summary of Findings

Our overall assessment is that the content in the Draft Plan is strong, but more integration of the vision in the actions is still needed so that the goals will in fact be achieved. The Reference Panel has provided Metro Vancouver with specific and detailed feedback for enhancing the eight **Strategies** and thirty-five **Actions**. On the basis of our comprehensive review, we have concluded that:

- ❑ The Draft Plan is moving the region in the right direction to achieve the *Sustainable Region Vision*. **However there is a need for stronger commitments in some areas in order to see the Plan realize its vision.**
- ❑ The Draft Plan can be characterized as a **transition plan** that, over time, will shift the region from the current practice of managing waste to one that values all its resources.

Get It Right

The strategies and actions in the Plan will have an impact on Metro Vancouver's sustainability for generations to come. Hence, it is important to link those actions to a picture of a desired outcome that will inspire people to strive for constant improvement - *this is what we want our region to look like, and this is how we will get there* – such that:

> ***We will have succeeded when we have healthy urban streams, a healthy Fraser River and a healthy Georgia Strait in which salmon and whales thrive and our children and grand-children can recreate safely***.

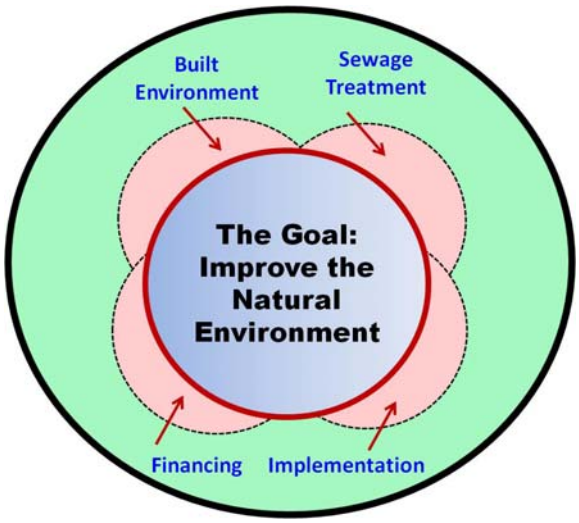
This desired outcome can be achieved by managing sewage and rainwater as resources, not waste. The Liquid Waste Management Plan is a powerful regulatory tool because it enables Metro Vancouver municipalities to integrate community design with desired outcomes at a regional scale and individual actions at a site scale.

The current LWMP was approved in 2002. Today, there is an even greater focus on making sustainability principles real and addressing the impacts of climate change. **Therefore, this updated Plan is an opportunity for Metro Vancouver to "get it right", by promoting public and municipal leadership to take advantage of this opportunity.**

Date of Submission: 30-June-2009

Purposefully Linked Actions; Firm, Forward-Looking Language

To help the region conceptualize what a vision for balance and integration would look like, the Reference Panel has created the graphic below. This shows four elements (or theme areas) which must be integrated if we are to ensure a great Plan. Though the Plan refers to the themes set out in the diagram below, the Plan must clearly and explicitly identify the linkages among the different areas of action.



We see a successful, visionary Plan designed for the future as being one that maximizes the intersection of the four elements – meaning all of these important themes are considered within each Plan action. **We also see visionary communication and education with the public as being key to successful implementation.**

The Plan must avoid using old terminology such as "stormwater management" and "receiving environment"; and "insincere-sounding" objectives or actions (e.g. "will consider doing…"). Instead, strengthen the Plan by emphasizing achievable, enforceable actions, and by incorporating references to the new language, such as: rainwater management, advanced treatment and best available technology, nutrient recovery, heat recovery, and 'purple pipes' (for water reuse).

Metro Vancouver Sustainability Framework

Since 2002, Metro Vancouver has formally put the concept of sustainability at the centre of its operating and planning philosophy and committed itself to be a leader in the attempt to make the region one which is explicitly committed to a sustainable future. This comprehensive endeavour became known as the *Sustainable Region Initiative*, or more familiarly as the 'SRI'.

In 2008, the **Metro Vancouver Sustainability Framework** document brought together all the strands of the SRI as a means of communicating where Metro Vancouver intends to go.

A Liquid Waste (Resource) Management Plan provides the means to translate the visionary Metro Vancouver Sustainability Framework into tangible **actions** on the ground.

3. A Recommended Policy Framework

The 19 recommendations developed previously by the Reference Panel are now re-organized as Table 1. The table is comprehensive, can serve as a policy framework, and provides a picture of:

- The provincial context;
- What regional alignment encompasses;
- Necessary local actions for each theme area;
- The rationale for implementing each action; and
- Examples or precedents that demonstrate the on-the-ground relevance of the actions.

A key message is that Living Water Smart and the Green Communities Project provide an over-arching provincial policy framework for the Plan. The Province's expectation is that there will be alignment of actions at three scales – provincial, regional and local – so that sewage and rainwater are managed as resources, not waste.

4. Our Recommendations Explained

Table 1 is built around five themes that capture how the region can continue to transition from the current path and achieve the SRI vision:

- **Natural Environment** – *move from protect to improve*
- **Built Environment –** *move beyond pilot projects*
- **Sewage Treatment –** *move from waste to resource*
- **Financing –** *move to a total system approach*
- **Implementation –** *move from commitment to action*

Our hope is that the three-page Table 1 will be adopted by the Metro Vancouver Board as an over-arching policy framework; and furthermore, that Table 1 will be embedded in the front-end of the Plan.

Design with Nature

Embracing a 'design with nature' way-of-thinking and acting will help the region achieve the vision for managing liquid discharges and rainwater as resources. The 'design with nature' paradigm captures the essence of climate change adaptation, which is essentially about collaboration at the community scale. If Metro Vancouver municipalities can show how to get the water part right, then other parts of the regional Sustainability Framework are more likely to follow.

Building on Table 1

While Table 1 is designed to be stand-alone, there is value in elaborating on key aspects of the recommended policy framework, in particular:

- **Natural Environment:** Long-term cumulative impacts of multiple contaminants in liquid discharges (Recommendation #3).
- **Built Environment:** Approaches and legal authority for managing flow in private sewer laterals (Recommendation #4).
- **Built Environment:** Affordable and effective ISMPs that result in a greening of the urban landscape and improve watershed health (Recommendation #5).
- **Sewage Treatment:** Implementation of Integrated Resource Recovery at the site, neighbourhood and community scales (Recommendation #11).
- **Sewage Treatment:** Effective source control and enforcement in the industrial-commercial-institutional sector (Recommendation #12).
- **Implementation:** A "stewarding committee" that has an over-arching role to ensure action occurs and the Plan stays true to the vision over time (Recommendation #17).
- **Implementation:** Alignment of local actions with provincial and regional goals via an educationally-based *regional team approach,* one that develops a common understanding and results in consistent expectations region-wide (Recommendation #19).

Each of the seven recommendations listed above is the subject of a stand-alone page.

The associated examples and/or precedents introduced in Table 1 are described in more detail in pages 7 through 14 (i.e. following Table 1).

Our objective in providing this supplementary information is to ensure that the reader has a clear picture as to why these examples are important and/or relevant to Metro Vancouver and municipal decision-makers.

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Table 1 - A Recommended Policy Framework for Liquid Resource Management in Metro Vancouver

Provincial Goals:	The Province's **Living Water Smart** and **Green Communities Project** provide a policy framework for aligning efforts at three scales – provincial, regional and local – to do business differently and prepare communities for change. Infrastructure grant programs are providing an incentive for implementing **The New Business As Usual -** i.e. "today's expectations are tomorrow's standards".	**Regional Alignment:**	The desired outcome is to manage sewage and rainwater as resources, not waste. The **Liquid Waste Management Plan** is a powerful regulatory tool because it enables Metro Vancouver members to integrate *community design* with desired outcomes at the provincial and regional scales and individual actions at a site scale.

	Recommended Action (Guiding Principle)	WHY - The Rationale for each Action (Guiding Principle)	Examples that Inform Policy
	A Healthy Natural Environment – *Move from Protect to Improve*	*The protection and improvement of the natural environment is the ultimate goal of the Liquid Resource Management Plan.*	*Refer to page 7 for supplementary information about Recommendation #3*
1	Call the Plan **A Liquid Resource Management Plan for Metro Vancouver**	To start the paradigm-shift now so that liquid discharges and rainwater are managed as resources, and thereby better protect the natural environment.	Substituting *resource* for *waste* in the report/plan title is analogous to using *Metro Vancouver* in lieu of *Greater Vancouver Regional District.*
2	Adopt the goal of moving from protect to improve the Natural Environment over time.	The health of our waterways and the value of our streams and our oceans to our community are of primary importance not only to our quality of life, but also to our social and economic health. By aiming to improve our environment we are aiming to undo damage already done.	This recommendation is a synthesis of Sustainability Principle #1 in the **Metro Vancouver Sustainability Framework**; and is intended to draw attention to the desired outcome in doing business differently.
3	Undertake more extensive monitoring of the long-term cumulative impacts of multiple contaminants in effluents (both from point and non-point sources).	Current senior government regulations deal with one contaminant at a time and even though levels may be below some set threshold, the presence of multiple contaminants and their interaction can have impacts on organisms in the long term that are not being considered. The current *Cautions, Warnings, Triggers* (CWT) process focuses mainly on individual contaminants.	Metro Vancouver has started to look at the cumulative impacts of multiple contaminants – for example, by funding **Benthic Process, Organic Carbon Cycling and Contaminants in the Strait of Georgia**, a 2008 research report published by the Institute of Ocean Science; this study found that persistent contaminants could be distributed widely.
	Built Environment - *Move Beyond Pilot Projects*	*Decisions we make on the built environment have a direct impact on the health of the natural environment. The following recommendations speak to the need to become more consciously aware of this interconnection in our planning, regulation and decision-making.*	*Refer to page 8 for supplementary information about Recommendation #4* *Refer to page 9 for supplementary information about Recommendation #5* *Refer to page 14 for supplementary information about Recommendation #6 and #7*
4	Resolve the persistent and costly sanitary *Inflow & Infiltration* issue by acting on policy and legal tools that enable municipalities to implement timely and appropriate measures on private property.	Private service connections are the last unmanaged part of the sewer collection system. Groundwater and rainwater entering holes or gaps on private laterals contributes 40% of all wastewater collected, transported and treated. Not only is I&I a significant source of regional system overflows, it means we are repairing/replacing our pipes and pumps sooner, building treatment plants and pipe systems larger than necessary, using more treatment chemicals than necessary, and leaking raw sewage into the ground every day	A report commissioned by Metro Vancouver and titled **Private Sewer Lateral Programs: A Study of Approaches and Legal Authority for Metro Vancouver Municipalities (December 2008)** outlines a spectrum of actions and approaches (carrots/sticks), with corresponding legal authority and real life examples discussed in a Metro Vancouver context.
5	Re-focus ***Integrated RAINwater/Stormwater Management Plans*** on watershed targets and outcomes so that there are clear linkages with the land use planning and development approval process.	ISMPs are needed to develop affordable and effective land use strategies that both green the urban landscape and improve watershed health; however, they must be effectively developed and there must be financial and legal tools in place to ensure their implementation in the land development process. Currently, plans that do not integrate land use and drainage planning are therefore resulting in unaffordable infrastructure budget items that become liabilities, without providing offsetting stream health benefits.	The City of Surrey's Fergus Creek Integrated Plan is the provincial pilot for **Beyond the Guidebook: Rainwater Management & Green Infrastructure in BC**. This plan included a *Neighbourhood Concept Plan* as a feedback loop for testing the acceptability of watershed strategies; and was the genesis for a *stream health methodology* that correlates green infrastructure effectiveness with land use decisions.
6	Mandate a renamed and 'new SILG' (*Stormwater Interagency Liaison Group*) to spearhead a ***regional team approach*** to develop policy, legal and technical tools that will enable 'integrated solutions' for rainwater management, green infrastructure and integrated resource recovery.	SILG is a regulatory requirement under the current LWMP. In the early 2000s, SILG was the driving force behind the development of approaches and tools that have made BC a leader in the field of rainwater management and green infrastructure, and it could do the same for the components of this plan. The ingredients for success were: corporate support, a clear vision, champions, funding, staff resources and projects. Under Recommendation #17, a 'new SILG' would be a critically important technical sub-group.	Initiated by SILG, the **Water Balance Model is** a decision support tool that demonstrates what can be accomplished by an outcome-oriented group that has resources. The model has received international recognition, a **2009 Premier's Award for Innovation & Excellence;** and this has led to an inter-provincial partnership.
7	Implement a consistent region-wide approach to neighbourhood (re)development and building design that integrates rainwater management, green infrastructure and integrated resource recovery.	These linkages must be made as early in the planning and development process as possible, so that feasibility is maximized. Municipalities will have to provide developers and property owners with guidance as to how watershed-specific targets established through **Integrated RAINwater/Stormwater Management Plans** and Integrated Resource Recovery (IRR) targets identified in IRR audits and business casing can be met at the development scale. A desired outcome is to strengthen the relationship with the Metro Vancouver Sustainability Framework and the Regional Growth Strategy.	Metro Vancouver and other regions are learning from each other and moving in the same direction – for example, **Getting Ahead of the Wave: The 2009 Comox Valley Learning Lunch Seminar Series** is the provincial pilot for integrating and implementing regional sustainability, growth and infrastructure plans through a *regional team approach;* this reinforces the approach to integration embraced by Metro Vancouver.

Table 1 - A Recommended Policy Framework for Liquid Resource Management in Metro Vancouver

	Recommended Action (Guiding Principle)	WHY - The Rationale for the Action (Guiding Principle)	Examples that Inform Policy
	Sewage Treatment – *Move from Waste to Resource*	*Historically, we have managed sewage treatment by focusing on what comes out of the pipe. This plan needs to focus on better protection of the marine environment and addressing climate change – by using Integrated Resource Recovery (IRR) approaches and technologies to get there. The plan must describe new approaches to sewage management and make stronger linkages to land-use planning at the community and regional levels when planning for sewage treatment facilities.*	*Refer to page 11 for supplementary information about Recommendation #11* *Refer to page 12 for supplementary information about Recommendation #12*
8	Adopt the following four objectives as the guiding framework so that the Plan ensures a flexible and adaptable approach to regional sewage treatment that strives for continuous improvement over time: a. Manage liquid discharges as a resource b. Minimize discharges c. Minimize financial risk d. Maximize the quality of the discharges	If these objectives are met, all else will fall into place because the best treatment will be provided for the region today and in the future. Just meeting the regulatory requirements is not enough. Achieving the vision requires a commitment beyond regulations. The four objectives can serve as a screening tool to assess the acceptability and effectiveness of proposed actions.	
9	Commit to constructing advanced treatment plants in the North Shore and Vancouver Sewerage Areas no later than 2020.	Ensuring the health of Burrard Inlet, the Fraser River and the Georgia Strait is important to our quality of life, and to our social and economic health. Further delay will only result in a failure to achieve the plan's vision. Metro Vancouver members accept the need for timely implementation and are looking to senior governments to demonstrate their shared responsibility and commitment by providing fair and equitable cost-sharing.	
10	Conduct business case assessments for *Integrated Resource Recovery* (IRR) before proceeding with the engineering for replacement treatment plants in the North Shore and Vancouver Sewerage Areas, and still meet the 2020 commitment.	If the region is to truly achieve the Sustainable Region vision, then the IRR philosophy must be at the heart of the system/facility planning process, not an add-on. By placing the assessment of IRR opportunities as the first step of planning new treatment options – including energy, nutrient and other resources – along with more extensive source control planning and implementation, the result will be more effective protection of the environment through advanced sewage treatment (possibly beyond secondary). An additional benefit will be with the identification of significant resources that could lower longer terms costs of managing the system.	Look to Sweden for regional-scale examples that demonstrate what can be accomplished by a paradigm-shift. Other examples can be found in California and Australia.
11	Strive to achieve Integrated Resource Recovery progress incrementally by committing to business casing (using life cycle accounting approach) through community-scale opportunities such as the ***UBC Living Laboratory: Integrated Water and Energy Project***.	IRR offers the region many opportunities but not all can be acted upon at once. By looking for opportunities as they arise, the region can more effectively achieve its overall vision.	Three Metro Vancouver examples demonstrate a progression in scale: ▪ Lulu Island Treatment Plant - nutrient recovery (fertilizer) technology developed at UBC has been implemented in Alberta and Oregon ▪ Olympic Village at Southeast False Creek has shown how to implement IRR at the neighbourhood scale. ▪ By disconnecting UBC from the Iona plant, the UBC 'closed loop' vision will demonstrate how to implement IRR at the community scale (55,000 people)
12	Ensure effective source control in the industrial-commercial-institutional sector, and ultimately in the residential sector too, by providing additional financial incentives, enforcement resources and automated monitoring technologies.	The region can begin to protect the environment by preventing the introduction of endocrine disruptors as well as persistent bioaccumulating contaminants; and reduce sewer system costs by intercepting fats, oils and greases. The total cost of allowing substances to become part of the sewage system – treatment, pipe maintenance and replacement, impacts of toxins in the environment – is far greater than investing in effective source control implementation (i.e. save the region more in the long term).	For Fats-Oils-Grease (FOG) source control, the cost of software-based enforcement tools (i.e. $5 per cleaning) would be paid directly by the generator of the resource to the cleaning company. Enforcement by municipalities could be funded through a fee (at time of business licence) per grease trap/interceptor installation.
	Financing – *Move to a Total System Approach*	*The Draft Plan identifies the many investments that need to be made in our region (including treatment plants, new pipes, etc.) in general terms, and provides some very high level cost estimates, options for timing and suggestions for municipal, provincial, federal cost sharing. However,* ***the Draft Plan does not provide a road map for how these significant capital investments will be funded or delivered.***	
13	Move from a facility-specific approach to a total system way-of-thinking about financing, constructing, operating and maintaining regional conveyance and treatment infrastructure.	In accordance with the approach endorsed by the Sustainable Region Initiative, the Plan needs to explicitly endorse investment decisions on long-term thinking plus broader economic issues; and adhere to "green value" approaches that embed full-cost and life-cycle accounting (i.e. including the need to put a price on the environment and the services it provides).	Decisions on the corridor and timing for the Canada Line project were based on a multi-criteria analysis that used a social discount rate and 50-yr time horizon. The analysis captured environmental impacts, time travel savings, bus reductions, project costs and project revenues.

Table 1 - A Recommended Policy Framework for Liquid Resource Management in Metro Vancouver

	Recommended Action (Guiding Principle)	WHY - The Rationale for the Action (Guiding Principle)	Examples that Inform Policy
	Financing – *Move to a Total System Approach*		
14	Increase the amortization period for treatment plant financing from 15 years to 30 years to achieve inter-generation equitability.	Financing over a longer period will reduce the annual cost borne by current taxpayers and better reflect the long life of these investments and their long-term environmental benefits. A 30-year amortization period would enable implementation of the Lions Gate and Iona plants in parallel.	All major projects undertaken by the Province have 30-yr financing; most large projects across Canada are financed with long-term debt.
15	Direct that rate-setting will adopt and implement the principles of 'polluter pay' and equity to provide municipalities (and homeowners and businesses) with an incentive to reduce their wet-weather flow contributions to the regional conveyance and treatment system.	It is about fairness and equitability; therefore, the region must provide a meaningful incentive/disincentive to the users to take responsibility for fixing their share of the problem.	Cost-recovery for the City of Edmonton's land drainage system was moved from property taxes to a new utility structure. Property owners are charged a fee based on a formula related to land area, permeability and zoning. The charge appears on the utility bill.
16	Develop major capital projects in a manner that demonstrates value for money, including protecting ratepayers / taxpayers from the risks associated with these major projects.	Affordability and risk management.	The Province of BC Capital Asset Management Framework provides a *useful value for money methodology* for assessing project delivery models. This is a requirement for all projects of $50 million or more.
	Implementation – *Move from Commitment to Action*	*No matter how good the Plan is, for its vision and goals to be achieved it needs to be accompanied by strong political leadership and commitment (political, financial, staff and public support).*	*Refer to page 13 for supplementary information about Recommendation #17* *Refer to page 14 for supplementary information about Recommendation #19*
17	Establish a "stewarding committee" to steward the Plan, and ensure ongoing action implementation occurs and stays true to the vision.	There is a need for fresh, objective eyes bolstered by a strong political mandate to keep asking questions, prod Metro Vancouver and members toward the vision, and assist with the *waste-to-resource* paradigm-shift over time. The "stewarding committee" would report directly to the Waste Management Committee, and would be outside the existing agency and committee structure currently used by Metro Vancouver. An over-arching "stewarding committee" would have broad representation (e.g. community, academia, business), supported by specific government representatives. It would provide oversight for technical working groups, including the current Environmental Monitoring Committee and the 'new SILG' (Recommendation #6). The first action of the committee might be to make presentations about the Plan to all member municipalities – on the need for municipal support and action, to make the transition to the SRI Vision.	The Liquid Waste Management Plan Reference Panel has played this type of independent, expert and non-partisan role.
18	Develop and implement a proactive and innovative education and communication plan that builds broad-based public support for liquid resource and rainwater management.	People cannot appreciate what they do not understand; therefore education about our coastal ecosystems is critical to build support for improved sewage/rainwater management. It is necessary to make the linkage between actions and end vision and goals, and to gain political support for achieving and paying for visionary goals – for example, explain the link between private laterals, sewage overflows and healthy fish/clean Fraser River.	The title of the 1999 Liquid Waste Management Plan, **"Caring for our Waterways"**, nicely encapsulated the connection to the environment. The Seattle Aquarium has displays which illustrate the connection between sewage treatment and a healthy marine ecosystem. Websites that provide information effectively can motivate people to protect habitat (e.g. Georgia Strait Alliance and orca whales).
19	Continue to implement and strengthen inter-departmental and inter-governmental continuing education opportunities for Metro Vancouver members that align local actions with provincial and regional goals, and result in consistent expectations for region-wide implementation of Plan elements.	Experience has shown that success in implementation is maximized when you achieve broad understanding and alignment among all relevant stakeholders. A capacity-building program could be defined by this theme: *How we can simultaneously work together as staff within a municipality and as a region AND externally with the stewardship sector, developers and other private sector players, to ensure we implement sustainable approaches to development*.	Metro Vancouver and other regions are learning from each other, and the **2005 REAC Consultation Workshop** was the genesis for: ▪ **Showcasing Green Infrastructure Innovation in Metro Vancouver: The 2006 Series** was the pilot for a program implemented on both sides of the Georgia Basin in 2007, and continued in the Capital Regional District in 2008. ▪ **Vancouver Island Learning Lunch Seminars: The 2008 Series** was the provincial pilot for linking *Living Water Smart* to green infrastructure outcomes, and led to a *regional team approach* for applying legal, policy and technical tools that result in integrated solutions. ▪ **2009 Metro Vancouver Green Infrastructure Forum** hosted by the City of Surrey adapted Vancouver Island lessons learned and introduced the regional team approach so that Metro Vancouver can move beyond pilot projects to a watershed objectives approach.

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Natural Environment:
Cumulative Impacts of Multiple Contaminants (#3)

The Strait of Georgia and the Fraser Estuary-Delta is a complex aquatic and terrestrial associated environment containing a diversity of organisms that must be protected from anthropogenic contaminants and habitat destruction; and over time improved.

If not managed properly, our point (sewage treatment plants, combined sewer overflows, industrial discharges) and non-point discharges (rainwater runoff) contain a variety of contaminants that can affect the health of this natural environment. Dilution due to the large flow of the Fraser and the mixing with the diurnal tides in the estuary are usually effective in diluting discharges below toxicity thresholds. However, the mobility and bioavailability of persistent contaminants creates problems when these materials can magnify in food chains and accumulate in organisms over time.

The Liquid Waste Management Plan approved in 2002 included a commitment by Metro Vancouver to undertake an extensive monitoring programme to characterize discharges and determine their impacts on the aquatic environment. Millions of dollars have been spent on this program and the results provide an exceptional database on discharge quality and impact in the immediate discharge area of the outfall.

The current ***Cautions, Warnings, Triggers Process*** evaluates these monitoring data in relation to regulations and reference stations to determine if more detailed monitoring is required or if mitigation measures are necessary. Also, a cooperative program in association with the ***Institute of Ocean Science*** (IOS) has been conducting research to document contaminant distribution in the Strait of Georgia and develop an understanding of the processes that regulate the mobility and bioavailability of these contaminants.

Research Findings: A recent publication titled "Benthic Processes, Organic Carbon Cycling and Contaminants in the Strait of Georgia, Canada" – in Marine Environmental Research 66: S1-S120 (2008) summarizes the research from this program.

The concern is that the Strait of Georgia ecosystem is not healthy and contaminant discharge may be an important factor in the poor health of many "keystone species". A five year update report published as part of the Georgia Basin Action Plan (2003-2008) states that:

- *"In 2001, it was declared that the southern resident killer whale population had the unwelcome distinction of being the world's most contaminated marine mammals. Levels of contaminants in these local whales exceeded even those of the St. Lawrence River's beluga population." – page 26*
- *"marine foraging river otters near Victoria have elevated levels of polychlorinated biphenyls (PCBs)," – page 24 -25*
- *"increased area of commercial shellfish closure between 1989 to 2004" – figure on page 18.*

These documented impacts on predators at the top of the food chain (killer whales, otters) and shellfish (filter feeders that can concentrate trace contaminants) generate concern that persistent contaminants and their cumulative effects are a threat to the long-term health of this aquatic environment.

Continuing research is necessary to obtain better information on these detrimental impacts and take necessary steps to manage contaminant discharge. The objectives and context for proposed research by IOS in the next phase of the LWMP submitted to Metro Vancouver in their January 2009 presentation to the Environmental Monitoring Committee is moving in the right direction if they can answer questions such as:

- *"How do outfall contaminants get stored and cycle through the benthic food chain and get transferred to the pelagic food chain?"*
- *"What are the critical levels of organic and/or contaminants loadings which will cause broad-scale damage to biota in the Georgia Strait?*

The ultimate question is can we get this information soon enough to make decisions to protect and ultimately improve the ecosystem of the Lower Fraser and Strait of Georgia.

Built Environment:
Managing Private Sewer Laterals (#4)

A private sewer lateral refers to the pipe that conveys sanitary sewage from a private building to the public sewer system. Each municipality defines where the private lateral extends to in its bylaws; though typically in Metro Vancouver the private lateral ends at the property line.

The property owner is responsible for maintaining the private lateral; however, most private laterals tend to be neglected because they are not visible to the homeowner.

Private laterals are the last unmanaged part of the sewer collection system, and groundwater and rainwater entering from private property account for an estimated 40% of all wastewater collected, transported and treated by the Metro Vancouver regional system.

Because this is an issue throughout Canada and the United States, many jurisdictions are investigating and/or implementing programs to reduce the flow entering from private sewer laterals. These programs range greatly in their design, from voluntary incentive-based measures, to agency-led and funded programs, to mandatory compliance measures.

Before we had sewage treatment plants, leaks such as these into our sewer system were viewed as a 'good thing' – we valued the effect of dilution on our pollution. Not so today. We now know that some of the consequences of this "extra" sewage are:

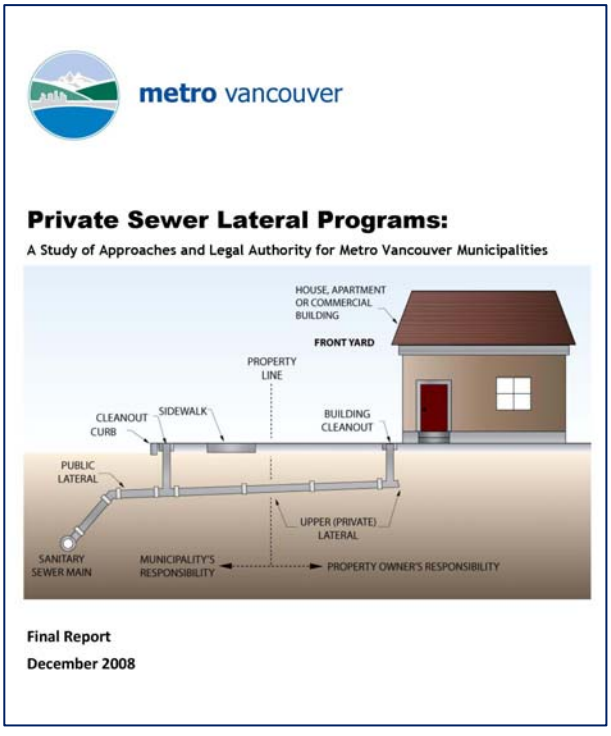
- Treatment plants must be built larger to handle the extra capacity.
- The collection pipes must be built larger to handle the extra capacity.
- Sewage overflows from the system when the pipes cannot contain the extra volume.
- Sewerage backs up into homes when the pipes cannot move the extra volume.
- Raw sewerage leaks out of holes and directly into our grounds.

All pipes and equipment that help to move, measure or treat the liquid discharges (i.e. pumps, meters, tanks, etc.) must handle more volume; therefore, they wear out sooner and must then be repaired or replaced.

A Path Forward for Metro Vancouver: The December 2008 report titled ***Private Sewer Lateral Programs: A Study of Approaches and Legal Authority for Metro Vancouver Municipalities*** provides a synopsis of the range of programs that have been implemented in other jurisdictions, analyzes these options within the context of the Metro Vancouver regulatory environment, and provides recommendations /pathways for moving forward.

The research led to development of a sample bylaw "for the maintenance and repair of private sewer laterals" for Metro Vancouver municipalities. The sample bylaw includes both an enforcement approach over the longer-term, and an incentive approach over the shorter-term.

A key feature of the sample bylaw is a *Sewer Lateral Certificate*. These would be given to property owners for compliance with the standards set forth in the bylaw.



Built Environment:
Affordable and Effective ISMPs (#5)

The Liquid Waste Management Plan approved in 2002 included a commitment by Metro Vancouver municipalities to integrate land use and drainage planning. This was the genesis for **Integrated Stormwater Management Plans** (ISMPs).

When the Reference Panel first reported back to the Waste Management Committee in July 2008, we identified the ISMP process as a sleeper issue because there are 130 watersheds in the region; and continuation of the *old-business-as-usual* would potentially result in an aggregate unfunded liability that could easily equal the $1.4 billion cost of sewage treatment. We used the elephant in the room analogy to make the point that the issue is known, but there seems to be a reluctance to 'tell it like it is'.

Unfortunately, ISMPs completed to date have tended to be engineering-centric, and in general can be described as 'glorified' master drainage plans. ISMPs that do not integrate land use and drainage planning are resulting in unaffordable multi-million dollar infrastructure budget items that become municipal liabilities, without providing offsetting stream health benefits.

As the Reference Panel highlighted in the July 2008 meeting, the City of Surrey's outcome-oriented Fergus Creek ISMP got it right - which is why it is a provincial pilot for innovation and integration.

Provincial Importance of Fergus Creek Pilot: The City of Surrey's Fergus Creek experience has provided the technical foundation for ***Beyond the Guidebook: Rainwater Management & Green Infrastructure in British Columbia***. The accompanying Exhibit A provides the provincial context.

Released in June 2007, the *Beyond the Guidebook* guidance document introduced a guiding philosophy, a pragmatic methodology and a web-based tool for correlating green infrastructure effectiveness with watershed targets for achieving stream health protection.

The science-based analytical methodology that has been validated through the Fergus Creek process now enables the City of Surrey and other Metro Vancouver municipalities to explore the requirements both explicit and implicit in Federal Fisheries Guidelines for stream health and environmental protection.

Moreover, the Fergus Creek outcomes will help local governments determine how they will achieve this over-arching policy objective in ***Living Water Smart: BC's Water Plan***:

> *By 2012, all land and water managers will know what makes a stream healthy, and therefore be able to help land and water users factor in new approaches to securing stream health and the full range of stream benefits* (page 43, Living Water Smart)

This statement of provincial policy is the lynch-pin of Living Water Smart.

Regional Applicability: The Fergus Creek plan has broad regional relevance because its green infrastructure strategies address the land development continuum....ranging from greenfield to redevelopment. No large-scale storage ponds will be built in the Fergus watershed; rather, the City of Surrey is implementing cost-effective 'green solutions' as an alternative to cost-prohibitive engineered 'blue solutions'. To achieve performance targets for rainwater runoff volume management, contiguous large-scale greenways are integrated into the area's land use plan.

BRITISH COLUMBIA
The Best Place on Earth

Ministry of
Community Development

Local Government Infrastructure
and Finance
PO Box 9838 Stn Prov Govt
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Victoria BC V8W 9T1

CIRCULAR

Circular No. 09:03
ARCS File #: 195-20

February 10, 2009

To: All Municipal and Regional District Chief Administrative Officers, Engineers and Planners

Re: *Beyond the Guidebook* - Context for Rainwater Management and Green Infrastructure in British Columbia

Beyond the Guidebook reflects a 'design with nature' approach to climate change adaptation. *Beyond the Guidebook* was released in June 2007 as a guidance document to introduce a methodology for correlating green infrastructure effectiveness in protecting stream health through using a pragmatic approach to achieve performance targets based upon rain water balance.

The ongoing *Beyond the Guidebook* provincial initiative builds on the guidance provided in the original *Stormwater Planning: A Guidebook for British Columbia*. In 2008, Vancouver Island was home of the pilot region for a regional team approach to rainwater management and green infrastructure implementation. Partnerships and the Vancouver Island Learning Lunch Seminar Series enabled capacity building for stakeholders, local municipal staff, developers and consultants.

The Water Balance Model for British Columbia is a web-based decision support tool that provides easy access to the *Beyond the Guidebook* approach and is available at http://bc.waterbalance.ca/. This tool bridges engineering and planning and links the site to the stream and watershed. The Ministry of Community Development is a member of the inter-governmental partnership that develops and maintains the Water Balance Model. The Guidebook and supplementary guidance documents are downloadable from the website.

Over time, sustained application of the water balance methodology can help local governments protect and/or restore stream health.

Beyond the Guidebook supports and/or complements other provincial initiatives, notably: Living Water Smart, the Green Communities Project and A Guide to Green Choices. Collectively, these initiatives establish expectations that, in turn, will influence the form and function of the built environment in general and green infrastructure on the ground in particular.

For more information regarding the *Beyond the Guidebook* initiative and infrastructure grant programs, please contact the Local Government Infrastructure and Finance Division at 250 387-4060.

Glen Brown
Executive Director
Local Government Infrastructure and Finance

Exhibit A

Sewage Treatment:
Integrated Resource Recovery (#11)

Integrated Resource Recovery (IRR) begins when waste is viewed as a potential resource – not something to be disposed of. In an IRR approach, plans for municipal infrastructure are developed in an integrated and holistic manner to maximize the value of 'recovery' from waste resource streams. This approach mimics the closed-loop cycles present in all ecosystems, provides local sources of energy, water and other resources, and reduces demand from external or new sources. As in nature, water, carbon and nutrients are treated as renewable resources and continually recycled: nature has no waste. (Reference: ***Resources from Waste: A Guide to Integrated Resource Recovery***, published by the Province of British Columbia in 2009).

IRR is now part of the Metro Vancouver vision. Three examples illustrate how quickly the vision is becoming reality; and furthermore, the three examples illustrate a progression by scale – from treatment plant to neighbourhood (Southeast False Creek) to community (University of BC).

Nutrient Recovery: Researchers at UBC have developed the technology to capture phosphorus and ammonia from sewage and recycle them into environmentally safe fertilizer – this is at a time when the world is facing a phosphate shortage. Implementation in Metro Vancouver's plants should be a high priority, especially since Alberta and Oregon have embraced the technology. As long as there are people, sewage-based fertilizer will be a renewable and sustainable resource.

Neighbourhood Scale: The Southeast False Creek project, which includes the Olympic Village, will showcase some of BC's most innovative engineering on one unique site. The development has three focal areas: a neighbourhood energy utility (NEU) that will use raw sewage to generate heat; a legacy of engineering innovation and expertise in the village buildings and surrounding area; and, finally, the reclamation of a former industrial area into a pedestrian and bicycle path with a nature island. After the 2010 Winter Games, Southeast False Creek will eventually be home to an estimated 16,000 people.

Community Scale: The UBC President's Office has embraced a bold vision to disconnect the University Endowment Lands from the Iona sewage treatment plant, and implement a closed-loop system serving a community of 55,000. The experience that will be gained and the lessons that will be learned from the ***UBC Living Laboratory: Integrated Water and Energy Project*** can inform the IRR planning for the North Shore and Vancouver Sewerage Areas.

By 2014, the UBC vision is that a 'resource-water' treatment plant would be constructed at Point Grey. This demonstration project would integrate plant operation with research and teaching /learning. The over-arching goal is to develop a distributed resource-water treatment system which is energy and resource smart and can also be implemented within Metro Vancouver, other cities in Canada and the rest of the world.

Nutrient Recovery at Lulu Island: *Fertilizer points the way to a sustainable future*

Southeast False Creek: *Integrated Resource Recovery at a neighbourhood scale*

University of BC: *Moving Integrated Resource Recovery to the community scale*

Sewage Treatment:
Effective Source Control (#12)

Fats, oils and grease (FOG) waste discharges from commercial establishments have significant impacts on the capacity and condition of the sanitary sewer collection system, and therefore have substantial cost implications over time. These are drivers for a mandatory source control program that would encompass:

- **Registration:** All businesses that generate FOG would be required to register their grease traps and/or interceptors as part of the business licence process (for example, at an annual cost of $50 per trap/interceptor).

- **Monitoring & Reporting:** Each business would be connected to a central monitoring system. Each time a trap/interceptor is cleaned, the business owner and/or approved grease hauler would log into the online system to record the Grease, Water and Solid levels.

  The online system is much like that used by parcel delivery services. When the hauler cleans a trap, he would report via the online software at the time of pickup and disposal. In situations where business owners choose to do the cleaning themselves, they would have to provide proof of disposal via online reporting. This would ensure that they are not simply emptying the grease in the garbage or down a storm drain.

- **Fee for Service:** Each time a trap/interceptor is cleaned and reported online, there would be a $5 fee. This would fund the ongoing server and software upgrade costs.

- **Enforcement:** Trap/interceptor registration fees as part of the business licence would cover the cost of enforcement. The central monitoring system would provide enforcement officers with data on who is doing what, and this would enable enforcement officers to target their efforts. The data could also be used to trouble-shoot the sources of grease build-up problems in the sanitary sewer system.

The technology exists. It is a matter of Metro Vancouver municipalities making the decision to mandate FOG source control.

What Other Regions are Doing: The incentive for preventing FOG from entering sanitary sewer systems is the avoided cost of sewer maintenance and/or replacement. Examples of enforcement approaches in the United States include:

- **Washington Suburban Sanitary Commission** – All traps are inspected within 5 years by an enforcement officer. Every Food Service Establishment (FSE) is graded on a set of four criteria, and this grading establishes inspection frequencies, from twice annually for high priority facilities to once every two years for lower priority facilities.

- **Los Angeles, California** – Every trap is registered with the City; and must be cleaned by a licensed hauler at a frequency such that the combined depth of the FOG material and solids does not exceed 25% of the total liquid depth.

- **Fort Worth, Texas** – Every trap must obtain a permit prior to discharging to the municipal sewer; must be cleaned by a licensed hauler at a minimum of once every 90 days; and must be 100% pumped out. Enzymes, solvents and emulsifiers are strictly prohibited. Records must be kept for 5 years

- **Dallas, Texas** - Traps must be completely emptied and cleaned by a hauler licensed by the Texas Commission on Environmental Quality. They must be cleaned as often as necessary but not less than once every 90 days or whenever 25% or more of the interceptor contains floating materials, sediment, oils or grease.

- **St. Petersburg, Florida** – Traps must be pumped out every 30 days when there is garbage disposal on drains, and every 60 days if not.

Most cities have established fines up to $10,000 for non-compliance. Some cities will disconnect the non-compliant business from the water and sewer systems. Other cities will both fine the business and back-charge the cost of sanitary sewer cleaning.

Implementation:

Role of "stewarding committee" (#17)

We have considered the Integrated Resource Recovery (IRR) Committee proposed by Metro Vancouver staff, and building on our intention in proposing a "stewarding committee", we offer the following supplementary recommendations:

1. Choose a name for the over-arching "stewarding committee" that reflects the broader and visionary mandate, recognizing that IRR is a key element.

2. Focus the committee mandate on vision and integration of all the pieces (both within the Plan scope and among all Plans and other policy/actions) that will see the (various) Plans through to effective implementation.

   Note: This mandate is distinct from the sub-committees such as the existing Environmental Monitoring Committee and the 'new SILG' which may be much more technically focussed (Recommendation #6).

3. Draw the committee membership from beyond the regulators – that is, recruit individuals with passion, energy, expert knowledge and wisdom from interested citizenry, non-governmental organizations and academia; and most importantly, who share a commitment to the vision for managing liquid discharges and rainwater as resources.

Integration that leads to Action:

4. Focus the committee members on thinking/solving problems related to seeing the vision through to implementation. The committee members must be able to participate beyond their representative spheres/constraints, to advance the vision.

5. Incorporate an outreach and/or education component to the committee's work – so that a sub-set of the group could go talk to a sub-committee or other groups, if necessary to prompt action/direction.

6. Assign the committee staff resources and a budget large enough to commission research needed from time to time.

The graphic below illustrates how education leads to implementation. The elements can be read in both the horizontal and vertical directions. Learning is a gradual process. Adults take in new information, reflect on it, blend it with their own experience, test it, and eventually apply it in making decisions. This explains why it will require a sustained commitment by Metro Vancouver members to implement the Plan as a package.

Because the majority of projected population growth will be accommodated in existing developed watersheds, redevelopment creates the opportunity for the region to "do it right" the second time around.

Implementation:
Regional Team Approach (#19)

A regional team approach is founded on broad and inclusive partnerships and collaboration that reach for the common goal of sustainability. In short, all the players set their sights on the *common good* and challenge the old barriers of jurisdictional interests. To achieve the *common good*, this ultimately requires bringing together:

- ✓ **Local government** - those who plan and regulate land use;
- ✓ **Developers** - those who build;
- ✓ **The Province** - those who provide the legislative framework;
- ✓ **Universities and colleges** - those who provide research; and
- ✓ **The stewardship sector** – those who advocate conservation of resources.

Metro Vancouver experience has informed the *Convening for Action on Vancouver Island* program, known by the acronym CAVI. Vancouver Island is the pilot region for a multi-year commitment and precedent-setting approach to regional team-building through collaboration.

CAVI has successfully implemented the vision and work plan that were the outcomes of the ***2005 REAC Green Infrastructure Consultation Workshop***, hosted by the City of Surrey. In particular, CAVI adapted the experience gained from ***Showcasing Green Infrastructure Innovation in Metro Vancouver: The 2006 Series*****.** The showcasing approach enables host local governments to tell their stories and share their experiences in a way that no other forum currently provides. In 2007, showcasing series were held on both sides of the Georgia Basin.

Success in Metro Vancouver and on Vancouver Island in 2007 provided the springboard for the ***2008 Vancouver Island Learning Lunch Seminar Series***. Living Water Smart and the Green Communities project provided context that framed the learning outcomes. The Series helped local government representatives conceptualize why a consistent approach to rainwater management and green infrastructure is needed and what it means regionally. This evolved into the 'regional team approach'.

2009 Metro Vancouver Green Infrastructure Forum: The Vancouver Island experience informed the design of the Metro Vancouver Forum in March 2009, which was**:** hosted by the City of Surrey; jointly organized by the Green Infrastructure Partnership and the Inter-Governmental Water Balance Model Partnership; funded in part by Environment Canada; and undertaken as an outreach opportunity for Living Water Smart and the Green Communities Project.

The 'Surrey Forum' was designed to start a dialogue between policy-makers and project implementers. To that end, the Forum program was built around the *HOW question* as it pertains to green infrastructure: HOW will the City of Surrey ensure it gets built right; HOW will a consistent regional approach be achieved in Metro Vancouver?

Exhibit B captures the vision of the partner organizations and their desired outcomes. Their hope is that the 'Surrey Forum' will be the catalyst for additional regional forums that would be organized in collaboration with the 'new SILG' (i.e. Recommendation #6). This outcome would in turn lead to a consistent region-wide approach to integration (i.e. Recommendation #7) modelled on the upcoming *2009 Vancouver Island Series.*

Because the Metro Vancouver region has a decade of experience in implementing green infrastructure, lessons learned about how to influence behaviour can also inform the region's approach to *Integrated Resource Recovery.*

Convening for Action in Metro Vancouver
Getting Green Infrastructure Built

Moving Beyond Pilot Projects to a Broader Watersheds Objectives Approach

THE CHALLENGE: *How do we simultaneously work together as staff within a municipality and as a region AND externally with developers and other private sector players, to ensure we implement sustainable approaches to development?*

"The best laid plans...."

The problem is the gap between design and build
How to ensure that the best laid plans come to fruition?
How to get all the actors singing from the same song sheet?

To get to the big picture, it starts with the smallest pieces. For this reason, the Surrey Forum is advancing a regional team approach that aligns local actions with provincial policy goals as articulated in the **Living Water Smart** and the **Green Communities** initiatives. Making this happen requires partnerships, collaboration, innovation and integration.

We see the Forum as providing an opportunity to generate positive energy in the region. In particular, the Forum will inform the actions identified in the rainwater/stormwater component of Metro Vancouver's updated **Liquid Waste Management Plan**. We believe this is where the opportunity for implementing a regional team approach resides.

We anticipate that the Forum sharing sessions will show that there are solutions if people talk to each other about what they each could do differently. This will help all parties collaborate to more effectively fulfil their piece of the sustainable development puzzle.

Once we know what we want our watersheds and neighbourhoods to look like, the next step is to decide *what the tools are that will get us there*. All of us ....whether we are regulators, developers or designers ....need to understand and care about the goal if we are to create the future that we all want.

Ted van der Gulik, P.Eng.
(BC Ministry of Agriculture & Lands)
Chair, Inter-Governmental Partnership

Vincent Lalonde, P.Eng.
(City of Surrey)
General Manager, Engineering

Raymond Fung, P.Eng.
(District of West Vancouver)
Chair, Green Infrastructure Partnership

WATER Balance MODEL Powered By QUALHYMO

CITY OF SURREY the future lives here.

MMCD BCWWA BRITISH COLUMBIA WEST COAST

Green Infrastructure Partnership

Exhibit B

Appendix
The Reference Panel

Metro Vancouver appoints Reference Panel to provide input to Liquid Waste Management Plan

APRIL 18, 2008: In January 2008, Metro Vancouver drafted discussion documents for updating its Solid Waste and Liquid Waste Management Plans. In April 2008, the Metro Vancouver Board appointed the Metro Vancouver Solid and Liquid Waste Management Reference Panels. According to **Board Chair Lois Jackson**, the Reference Panels will provide input on the discussion documents and on the subsequent Draft Plans.

Reference Panel Concept

The Reference Panels will report directly to the Metro Vancouver Waste Management Committee during the consultation process. "The Reference Panels will provide comments and advice on the strategies for updating each plan," explained **Councillor Marvin Hunt** (City of Surrey), Chair of the Waste Management Committee. "Each panel is comprised of community members who bring a variety of perspectives to solid and liquid waste issues, including technical experts, solid and liquid waste management specialists, business representatives and citizens with an interest in solid and liquid waste topics."

According to **Mayor Pam Goldsmith-Jones** (West Vancouver), Vice-Chair of the Waste Management Committee, the Reference Panel concept is modeled on the Working Group approach which has been successfully implemented in her municipality. The essence of the West Vancouver experience is that the community benefits when there is collaboration and a true partnership between local government staff and community members in a working group. A critical success factor is the creation of a collegial and cooperative atmosphere.

Members of LWMP Reference Panel

The ten members of the Liquid Waste Management Plan (LWMP) Reference Panel are listed as follows:

- Susan Rutherford
- Christianne Wilhelmson
- Elaine Golds
- Ken Hall
- Don Mavinic
- Kim Stephens
- Shaun Carroll
- Garry Cooper
- Mark Hodgson
- Simon Poole

The three categories of representation are: residents or representatives of non-governmental organizations, technical experts, and practitioners.

Representatives of non-governmental organizations:

Susan Rutherford, *Staff Counsel, West Coast Environmental Law (WCEL):* Susan works on WCEL's Livable and Sustainable Communities program where she specializes in local government bylaws and policy tools that support green infrastructure in communities. She is also a member of the Green Infrastructure Partnership Steering Committee. Susan is the author of the *Green Infrastructure Guide*.

Christianne Wilhelmson, *Managing Director Georgia Strait Alliance:* Christianne has worked for the Georgia Strait Alliance for over six years and is currently their Managing Director. She is an Ontario transplant who came to BC in 1995 to pursue a MSc in ecology at UBC and stayed on after graduation. She has worked as a lab technician and freelance science writer. She leads GSA's government and media relations efforts as well as coordinating its Clean Air and Water program, with a particular focus on bring innovative and advance sewage treatment to communities around the Georgia Basin region.

Elaine Golds, *Vice President, Burke Mountain Naturalists:* Elaine has conducted research in the field of cellular immunology and has previously provided input on both the Liquid Waste Management Plan, and the Drinking Water Management Plan. She is a former member of Metro Vancouver's Regional Water Advisory Committee. Elaine is a volunteer with the Noons Creek Fish Hatchery, a member of the Port Moody Ecological Society, Vice-President of the Burke Mountain Naturalists, and President of the Colony Farm Park Association.

Technical Experts:

Ken Hall, *Professor Emeritus, Westwater Research Centre, University of British Columbia (UBC):* In addition to his work at UBC, Ken is also an active member of Metro Vancouver's Environmental Monitoring Committee. Ken has helped to organize and co-ordinate projects on water pollution research and water resources management throughout the Metro Vancouver area.

Don Mavinic, *Professor, Faculty of Applied Science, University of British Columbia:* Don is a researcher and professor of civil engineering at UBC, and an editor on several peer-reviewed journals, including Environmental Technology, the Canadian Journal of Civil Engineering, and the Journal of Environmental Engineering and Science.

Kim Stephens, *Program Coordinator, Water Sustainability Action Plan for British Columbia:* A principal author of Stormwater Planning: A Guidebook for British Columbia, Kim is an engineer-planner who specializes in public policy and its implementation. In his current role, he is the secretariat for a half-dozen partnerships (including the Green Infrastructure Partnership) that are developing tools and providing continuing education for practitioners under the umbrella of the Action Plan.

Practitioners:

Shaun Carroll, *Executive Director, North American Society for Trenchless Technology – BC Chapter:* Shaun is an industry representative for a not-for-profit organization whose mission includes the promotion, education, training, research, and development of trenchless technologies for rehabilitation of linear infrastructure, such as sanitary sewers.

Garry Cooper, *General Manager, Organic Resource Management (BC) Inc*. OMI is Canada's largest provider of vacuum truck services for the collection, treatment and disposal of organic and other non-hazardous liquid waste for commercial, industrial, institutional and residential customers in Ontario, Quebec, and British Columbia. ORMI is moving towards the use of Anaerobic Digesters as a way of recycling liquid waste into biogas renewable energy and fertilizer.

Mark Hodgson, *Chair, Infrastructure Delivery and Finance Committee, British Columbia Water and Waste Association (BCWWA):* In addition to his work with BCWWA, Mark is a partner at Deloitte & Touche LLP, Vancouver, BC. He leads the Infrastructure Advisory and Project Finance group in Western Canada and has many years of experience with developing and executing public-private partnership procurements and transactions.

Simon Poole, *Plant Manager, Saputo Foods:* Simon is the Plant Manager for the fluid milk production plant (Dairyland Fluid Division Ltd) of Saputo Foods Ltd. in Burnaby, one of the permitted industries under Metro Vancouver's Liquid Waste Bylaw.