Equilibrium[™] Communities HEALTHY COMMUNITIES FOR A HEALTHY ENVIRONMENT



Canada

Natural Resources **Ressources naturelles** Canada





- Up to \$550,000 to selected sustainable neighbourhood development projects
- Funds for:
- research, analysis, design and consultation to improve performance;
- monitor and showcase performance to share lessons learned







- Jointly funded and managed by CMHC and NRCan CanmetENERGY
- Proposals selected by independent selection committee in 2009
- Until end of 2012







Integration Across Six Themes

- 1. Energy
- 2. Land Use and Housing
- 3. Transportation
- 4. Water, Waste Water and Storm Water
- 5. Natural Environment
- 6. Financial Viability







Ampersand, Ottawa

















Ty-Histanis, near Tofino, BC



A collaborative initiative between Natural Resources Canada's CanmetENERGY and Canada Mortgage and Housing Corporation

OMMUNITIES









Regent Park Revitalization, Phase 1:



















Water use – one year monitoring in 3 building types

	Variance in m ³ water use per ft ² compared to conventional TCH building		
246-252 Sackville <u>high-rise</u>	-40%		
One Oak <u>mid-ris</u> e	-14%		
30 Regent <u>townhouse</u>	-60%		





Station Pointe Greens







Equilibrium" Communities HEALTHY DOMAGNET



Lessons learned

- systems adopted in each project are context-specific
- IDPs helped integrate LID practices
- improving performance requires extra analysis, consultation and creativity
- municipal support is key
- long-term sustainable, affordable vision was set early and guided the projects



EQuilibrium[™] Communities InSight

and Low-Impact Development

The EQuilibrium Communities Initiative is a sustainable community demonstration initiative jointly funded by Canada Mortgage and Housing Corporation (CMHC) and Natural Resources Canada (NRCan). It provided financial assistance to developers of selected projects for research and technical activities to improve, monitor and showcase their performance in the areas of energy and water consumption, protection of the natural environment, land use planning, transportation and financial viability. With multiple buildings and mixed land uses, the projects are designed to maximize integration across these sustainability themes, targeting measurable improvements over current practices.

This Insight describes the green infrastructure features the teams chose to build in the projects, the feasibility analysis of options they considered and overall lessons learned. At the community scale, green infrastructure refers to stormwater management. solutions that mimic natural hydrologic processes, also known as Low-Impact Development (LID). It also refers to landscape best practices, which, in combination with LID, aim to improve stormwater management, protect natural hydrology and habitat, as well as maximize diverse, low-maintenance plantings that make communities attractive and pedestrian-friendly.

Much of the feasibility and technical analysis as well as consultation and design work described below was funded through the EQuilibrium Communities Initiative

To evaluate the feasibility of these innovative practices, the project teams conducted separate analysis taking into account the following criteria:

regulatory approvals,

initial and long-term costs,

Green Infrastructure

- marketability and practicality for occupants, maintenance requirements, environmental and other benefits.
- project site conditions and climatic factors, and

Introduction

The conventional approach to stormwater management has focused on large-scale engineered systems, such as storm sewers and detention ponds. However, this approach alone has negative impacts at the watershed level, such as: downstream flooding, stream bank erosion, degradation of aquatic habitats and adverse effects on water quality due to contaminants in the stormwater, such as metals and de-icing salt, as well as increased water temperatures. It also places stress and costs on municipal sewer and treatment infrastructure.



Extensive tree canopy coverage in Ampersand Figure I Green park

¹ For more information on the EQuilibrium Communities projecu, go to http://emb.ca/en/ingo/na/equicoin/equicoin_003.cfm. You can also contact Natural Resources Canada's CanmetENERGY Housing, Buildings and Communities research team at Equilibrium, Communities@NRCan-RNCan.gc.ca or visit the community energy section of the NRCan website.

> uilibrium ommunities

Canada





- Interactive maps
- **EQC** Insights





LID conferences

- CVC, Oct 2012
- ALIDP, Nov 2012





WATER SENSITIVE URBAN DESIGN PERFORMANCE MONITORING

Crafting Water-Sensitive Communities in Cold Climate

March 26-27th, 2013

Chris Denich., M.Sc., P.Eng Aquafor Beech Ltd



Presentation Overview

- Project Goals and Objectives
- Overview of Six (6) sites
 - Trent Street Victoria, BC;
 - Trumpeter, Edmonton, AB;
 - King Street, Kitchener, ON;
 - Lakeview, Mississauga, ON;
 - Habitation Jean-Mance, Montreal QC,
 - Winston Heights-Mountview, Calgary, AB
- Interim Monitoring Results
- Future Monitoring Plans



Presentation Overview



Project Goals and Objectives

Project Goal

 This study is to result in the research, monitoring and documentation of six (6) Canadian water sensitive urban design (also known as Low Impact Development or LID) pilot projects in residential/mixed use developments.



Project Goals and Objectives

Project Objective

- To examine:
 - 1. The technical performance of bioretention and bioswale along streets in regards to:
 - Water quality;
 - Water quantity; and
 - Vegetation health;

- 2. Capital and Operation and Maintenance costs as well as cost trade-offs compared to conventional SWM
- 3. Regulatory and approvals considerations examined, compared and summarized.

Monitoring Program

Performance Monitoring

- Water Quality 4 season (spring, summer, sinter and fall)
 - Total Kjeldahl Nitrogen (TKN);
 - Total Phosphorous (P);
 - Heavy metals (Full metal scan with emphasis on Copper, Lead, Zinc, Cadmium);
 - Total Suspended Solids (TSS);
 - Oil and Grease (hydrocarbons;
 - Chlorides; and
 - pH
- Water Quantity (flow)
- Vegetation Health



Trent Street, Victoria BC







Trent Street, Victoria BC



- Retrofit in 2009
- DA = 0.16 ha;
- Area = 180-196sqm
- Conventional storm sys
- Outlets to Bowker Creek
- Primarily ICI land-use
- Improved parking issue



Trent Street, Victoria BC



Trent Street, Victoria BC

• Preliminary Results





Preliminary Results Monitoring Results						
Parameter	Units	Detection Limits	Standard/Guideline (Type)	mg/L		
Total Suspended Soilds						
Total Suspended Solids	mg/L	10	25 (CCME)	3		
	Nutrie	ents				
Total Kjeldahl Nitrogen	mg/L	0.10	N/V	0.3		
Total Phosphorus	mg/L	0.02	0.03 (PWQO)	0.03		
Inorganics						
Chloride	mg/L	0.1	250 (Aehtic limit CWQG), 230 aquatic limit (chronic), 860mg/l aquatic limit (chronic)	149		
Total Hardness (as CaCO3)	mg/L	10	N/V	29.3		
	Met	als	_			
Calcium (Ca)	mg/L	0.05	N/V	72.3		
Magnesium (Mg)	mg/L	0.05	N/V	27.2		
Sodium (Na)	mg/L	0.05	N/V	80.7		
Aluminium (Al)	mg/L	0.004	0.075 (PWQO) (2)	0.115		
Antimony (Sb)	mg/L	0.006	0.02 (PWQO)	0.00097		
Arsenic (As)	mg/L	0.003	0.1 (PWQO)	0.0011		
Barium (Ba)	mg/L	0.002	N/V	0.0216		
Beryllium (Be)	mg/L	0.001	0.011 (PWQO) (4)	<0.05		
Boron (B)	mg/L	0.010	0.2 (PWQO) (5)	0.115		
Cadmium (Cd)	mg/L	0.0001	0.0002 (PWQO) (3)	0.00002		
Chromium (Cr)	mg/L	0.003	0.0089 (PWQO)	0.003		
Cobalt (Co)	mg/L	0.0005	0.0009 (PWQO)	0.00038		
Copper (Cu)	mg/L	0.002	0.005 (PWQO) (3,7)	0.0097		
Iron (Fe)	mg/L	0.010	0.3 (PWQO)	0.01		
Lead (Pb)	mg/L	0.001	0.005 (PWQO) (3,6)	0.00022		
Manganese (Mn)	mg/L	0.002	N/V	27.2		
Dissolved Mercury (Hg)	mg/L	0.0001	0.002 (PWQO)	5E-06		
Molybdenum (Mo)	mg/L	0.002	0.04 (PWQO)	0.0023		
Nickel (Ni)	mg/L	0.003	0.025 (PWQO)	0.0037		
Selenium (Se)	mg/L	0.004	0.1 (PWQO)	0.0011		
Titanium (Ti)	mg/L	0.002	N/V	0.014		
Uranium (U)	mg/L	0.002	0.005 (PWQO) (5)	0.00112		
Vanadium (V)	mg/L	0.002	0.006 (PWQO)	0.0021		
Zinc (Zn)	mg/L	0.005	0.03 (PWQO) (3)	0.017		
				0		
Oil and Gease	mg/L	1	N/V	<1		
pН	Ph Units		6.5 to 8.5	7.94		





- Multi-phased residential development
- Constructed Fall '09
- Accepts road runoff
- Designed to retain & store the 1:5 year event



 Water quality and flow monitoring is underway and will continue through 2013







- Constructed in 2009 – City Centre
- Integrates onstreet parking, stormwater and aesthetics
- Numerous cells distributed along King St.
- Has unique gate system – prevent chloride introduction









- Water quality monitoring not possible;
- Flow monitoring is ongoing
 - Ultrasonic device and weir installed Nov, 2012

Monitoring the off-line condition (gates closed)

- 197 events recorded
- On-line condition May 2013
 - Results to be normalized (mm)





Strom Sewer Flow Rate (I/sec)









Stationnements écologiques aux Habitations Jeanne-Mance mut

Voici le lout premier stationnement écologique à Montréal. Ce projet sera réalisé aux Habitations Jeanne-Mance et vise à lutter contre les llots de chaleur urbains, et gérer les eaux de pluie.

Objectifs environnementaux :

Réduction de la température aux HJM en été.

- Améloraton de la qualité de l'air au centre-vile.
- Lute aux changements climatiques.
- Amélioration de la qualité de l'eau souternaine et du fieuve Saint-Laurent. Récupération des eaux de pluie détournées du système d'égout municipal.
 Verdissement et augmentation de la biodiversité au centre-ville.

Durée des travaux : 18 mois Coût : 1 200 000 \$ CLIQUEZ ICI pour plus de détaits.

Réfection écologique et verdissement des stationnements Plantation de plus de 100 arbres et 300 arbustes, choisis pour keurs caractéristiques écologiques spécifiques

> Pas de gouttières

Aménagements de la devanture des maisons environnantes

Les eaux de pluie sont captées par un bassin de biorétention

APRÈS



- Flow monitoring completed
 - Pressure transducer and weir installed July, 2012 Feb 2013
 - 204 events Maximum event 38.9mm

















BIO-SWALE DETAIL



LT.S.

UNDERDRAIN DETAIL DETAIL S3B BIO-SWALE TYPICAL CROSS-SECTION

- Monitoring both pre and post construction by CVC;
- Precipitation, flow and water quality;









Lakeview Water Level @ LV - 1 & LV - 4: All Events (2012)









Photo; Courtesy of the City of Calgary

Photo; Courtesy of the City of Calgary



- Constructed in 2011
- City of Calgary initiative part of the City's Broader SWM Strategy
- The majority of Winston heights flows to Nose Creek untreated
- Community Engagement Winston Heights Community Association
- Maintained by the City of Calgary



Photo; Courtesy of the City of Calgary

- Monitoring is ongoing by the City of Calgary:
 - > 2 year program (May- Sept)
 - Flow out of the systems;
 - Water quality (automated)
 - Goal 10 samples/yr
 - TSS, TP, Ammonia–N, TKN, NO2/NO3, pH, Anions & cations, Conductivity and total metals
 - 1/year pesticides, E.coli, total coliforms and dissolved metals



Monitoring Program

- Coordinated Site Inspections;
 - Infiltration testing (Guelph P);
 - Physical inspection of media profile (soil coring)
 - Media samples;
 - Grain size analysis (% weight sands (2 to 0.05mm ø)
 - % weight fines (<0.050mm ø)
 - % weight organics
 - pH
 - Cation Exchange capacity (CEC)
 - Target Date May 2013 (weather dependent)





Interim Results: Media

	Kitchener	Mont	real	Victoria	Edmonton	Mississauga	Calgary
Infiltration Rate* (mm/hr)	82–116 (Avg. 99mm/hr)	127–128 (Avg. 127.5mm/hr)	80–139 (Avg. 104mm/hr)	49–134 (Avg. 91.5mm/hr)	16−25* (Avg. 21.7mm/hr)	ТВС	ТВС
% Sand (2-0.05mm)	69	88	90	79	23	91	TBC
% Fines (<0.050mm)	31	1.8	10	21	77	9	ТВС
Soil Classification	Sandy Loam	Sandy Loam	Sand	Loamy Sand	Clay	Sand	TBC
Compost (Organic Matter by Loss On Ignition – LOI)	10.3	22.0	0.9	17.3	7.06	4.02	TBC
% Material smaller than (75 micron)	35.4	1.8	10	1.22	5.53	20.2	ТВС
CEC (meq/100g)	31.2	34.1	5.52	14.6	29.6	14.6	ТВС
рН	7.22	6.78	7.42	5.26	6.60	7.21	ТВС

Interim Results: Media

Upper Media Profile Chemical Characteristics Summary for HJM, Montreal, QC

Parameter	Result	
Chloride	<2 µg/g	
Sodium	113 μg/g	
Heavy Metals		
Arsenic	1 µg/g	
Cadmium	<0.5 µg/g	
Copper	11 µg/g	
Lead	6 µg/g	
Zinc	33 µg/g	
Oil and Grease		
Animal/Vegetable	800 µg/g	
Mineral	580 µg/g	



Monitoring Summary

Site	Water Quality	Water Quantity (Flow)	Infiltration Testing	Media Composition (Lab analysis)	Vegetation Assessment
King St (Kitchener, ON)	N/A	Feasibility to be determined. Road closure is required and being negotiated.	Completed	Completed	Preliminary Assmnt. Completed
Trent St (Victoria, BC)	Underway	Underway - Flow monitors installed Feb 2013	Completed	Completed	Preliminary Assmnt. Completed
Habitation Jeanne-Mance (Montreal, QC),	N/A No systems outflows	Completed July 2012 - Feb 2013	Completed	Completed (Soil chemical analysis also performed)	Preliminary Assmnt. Completed
Trumpeter (Edmonton, AB)	Underway	Underway - Flow monitors installed Feb 2013	Completed	Completed	Preliminary Assmnt. Completed
Lakeview Neighborhood (Mississauga, ON)	Pre-Construction – Complete Post Construction – Underway by CVC	Pre-Construction – Complete Post Construction – TBC	TBC	Completed	твс
Winston Heights (Calgary, AB).	Underway by City of Calgary	Underway by City of Calgary	TBC - Spring2013	TBC - Spring2013	TBC - Spring2013

Project Deliverables

Deliverables

- Monitoring Results;
- Capital vs. long-tern cost comparisons;
- Regulatory approvals considerations;
- Six case studies; and
- Research report and highlights document.



Questions/ Discussion

Chris Denich, M.Sc., P.Eng Aquafor Beech Ltd denich.c@aquaforbeech.com

