



JUNE 2016

SITELINES

Landscape Architecture in British Columbia

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starts with the first
rain garden”*

In this issue, the Partnership for Water Sustainability in BC presents

WATER BALANCE PATHWAY TO A WATER-RESILIENT FUTURE

Restoring the Water Balance: What Happens on the Land Matters! | Water as a Form-Maker | The Journey to Balance Economy, Ecology and Settlement on Vancouver Island | waterbucket.ca | Water Balance Express: Restore ‘Environmental Flows’ in Urban Streams | Water Licensing Calculator | High Efficiency Irrigation Standard: How It Will Help Achieve a Water Balance | Sustainable Service Delivery: Watersheds Are Infrastructure Assets



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WATER BALANCE PATHWAY

by Kim A. Stephens,
M.Eng., P.Eng.

to a Water-Resilient Future



CATHEDRAL THINKING: A far-reaching vision, a well thought-out blueprint, and a shared commitment to long-term implementation

The Water Balance of watersheds in urban areas is out of balance. A legacy of community and infrastructure design practices has failed to protect the water balance. In an era when BC's climate is changing (wetter, warmer winters and longer, drier summers), the consequences are feast AND famine, flood AND drought.

A watershed is an integrated system. Restoring hydrologic integrity, and thus the Water Balance, is the pathway to a water-resilient future. Achieving this will require a long-term commitment by the community at large, successive elected Councils, and generations of land AND water professionals.

In embarking on this journey, we can learn from our ancestors. The grand creations of antiquity were not designed with a quarterly report or 4-year election term in mind. The builders of great cathedrals in medieval times thought in terms of multiple generations carrying out their work, to complete a dream that would not be realised until long after the originator's death. When one thinks of a cathedral two aspects come to mind: a soaring aspiration; and a grounded structure firmly planted throughout time.

Cathedral thinking aptly describes the philosophy that guides the work of the Partnership for Water Sustainability in BC. We inform, educate, train and mentor with a view to the long-term and creating a lasting legacy. The Partnership's current leadership team may not be around to witness the fruition of our work. However, we will have made a difference – by raising awareness, translating science-based understanding into methodologies and tools, and helping decision-makers set actions in motion.

In this special issue on a Water Balance Pathway to a Water-Resilient Future we explain that the natural pathways by which rainfall reaches streams are nature's "infrastructure assets". They provide Water Balance Services that blend with services provided by engineered assets (infrastructure). We start out at a high level, present tools developed by the Partnership, and conclude with a watershed focus. [SL](#)



Cover Image: Rain garden. All images courtesy of The Partnership for Water Sustainability in BC

In this Issue:

Water Balance Pathway to a Water-Resilient Future	3
Restoring the Water Balance: What Happens on the Land Matters!.....	5
Water as a Form-Maker.....	7
The Journey to Balance Economy, Ecology and Settlement on Vancouver Island.....	9
waterbucket.ca: Website Showcases Water-centric innovation and Leadership.....	10
Water Balance Express: Restore 'Environmental Flows' in Urban Streams.....	13
Water Licensing Calculator: Managing Water as One Resource.....	15
High Efficiency Irrigation Standard: How It Will Help Achieve a Water Balance	16
Sustainable Service Delivery: Watersheds Are Infrastructure Assets.....	17



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WHAT HAPPENS ON THE LAND MATTERS!

the Water Balance:

by Kim A Stephens and Peter Law

The Partnership for Water Sustainability in BC shares responsibility with government for the Water Sustainability Action Plan for BC, released in 2004. The Action Plan created a partnership umbrella for aligning actions at three scales – provincial, regional and local. The approach is “top-down and bottom-up”. The centrepiece is the Water Balance Model family of online tools (www.waterbalance.ca). These were developed as an extension of Stormwater Planning: A Guidebook for BC, released in 2002 (Guidebook). They are unique in the world.

Call to Action

The Action Plan’s success helped to lay the groundwork for two provincial initiatives in 2008 – **Living Water Smart** and **Green Communities**. They constituted a call to action by the Province to live water smart and build greener communities in order to prepare BC residents for a changing climate. They also established expectations vis-à-vis protecting and/or restoring the water balance.

The Partnership for Water Sustainability brings together, and supports the efforts of, local and regional governments across BC. Its overarching goal is to provide tools to help organizations achieve their water sustainability goals, and opportunities for shared learning. Launched in 2012, the *Georgia Basin Inter-Regional Educational Initiative* (IREI) is an outstanding example of this shared learning approach, and is endorsed by 5 Regional Boards representing 75% of the population in BC (Nanaimo, Capital, Cowichan Valley, Comox Valley, Metro Vancouver).

Design with Nature

The “salmon crisis” of the 1990s followed loss of small stream habitat in rapidly

urbanizing areas. The Province of BC’s response included the Fish Protection Act (1997) and the Guidebook (2002). BC was the first jurisdiction in North America to adopt the Water Balance Methodology. The Guidebook:

- applied science-based understanding to integrate Washington State stream health research,

To protect or restore the Water Balance in the urban environment, the process starts with rain gardens. A single rain garden would not make a material difference. But thousands would.

- introduced the Rainfall Spectrum and associated Retain-Detain-Convey Strategy (Figure 1),
- formalized the use of Water Balance Performance Targets,
- established a precedent for Adaptive Management (change direction when science and experience lead to a better way), and
- initiated the shift from engineered-focussed Stormwater Management to interdisciplinary and multiple objective Rainwater Management.

The desired outcome is to foster a “land-water ethic” and protect hydrologic integrity by slowing, spreading and sinking rainwater runoff to sustain low flows in our small Coho and Trout streams. The Water Balance tools apply performance targets, enable scenario comparisons and inform “design with nature” choices that achieve water sustainability goals through green infrastructure (natural and engineered).

Watersheds as Infrastructure Assets

Beyond the Guidebook 2015: Moving Towards “Sustainable Watershed Systems,

through Asset Management” is an IREI deliverable and third in a series that builds on the Guidebook foundation. It has initiated the branding of “watersheds as infrastructure assets” (Figure 2).

In 2002, the Guidebook transformed conventional wisdom with the premise that land development and watershed protection can be compatible. This breakthrough

resulted from application of science-based understanding to mitigate seasonal changes in the Water Balance. A decade and a half later, *Beyond the Guidebook 2015* is similarly transformational with its premise that protecting Water Balance Services saves communities money and restores aquatic habitats!

The Living Water Smart vision is to move beyond traditional infrastructure asset management and also account for nature’s Water Balance services. In 2014, three provincial game-changers came to fruition (Figure 3). The three are mutually reinforcing. They **enable** implementation of actions by local governments to protect and/or restore the natural pathways by which rainfall reaches streams. Over time, this would achieve the goal of redistributing the seasonal water balance to restore hydrologic integrity in urban areas where local government regulates land use.

Asset management requirements for the Province’s capital grants program provide the financial incentive for local governments to integrate ‘watershed systems thinking’ into **Sustainable Service Delivery**. ▶

“Land development and watershed protection can be compatible” – This Guidebook premise provides historical context for judging progress.



Surface runoff
from minutes to hours

Interflow
from days to seasons

Deep Groundwater
from years to decades

Maintain the proportion of rainwater entering the stream via each pathway

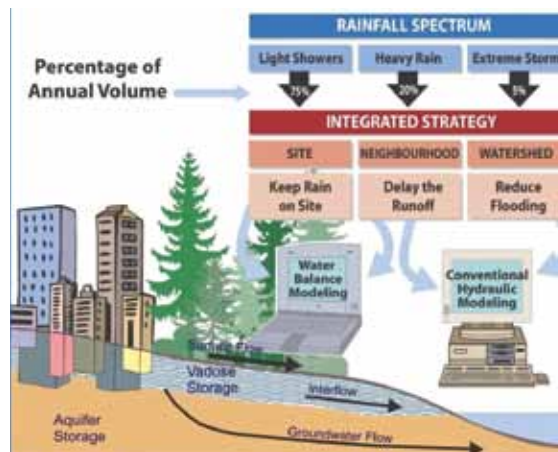


Figure 1: Watershed protection starts with an understanding of how water gets to a stream, and how long it takes...

2002

Policy, Program and Regulatory Framework

Science-Based Understanding of “Changes in Hydrology” & Developmental Impacts

In 2002, the breakthrough was: Science-based understanding bridged the gap between “policy and “practice”

Infrastructure & Site Servicing Practices

2016

Policy, Program and Regulatory Framework

Science-Based Methodologies & Tools to Mitigate Development Impacts

In 2016, the challenge is to: Bridge the disconnect between “understanding” and “implementation”

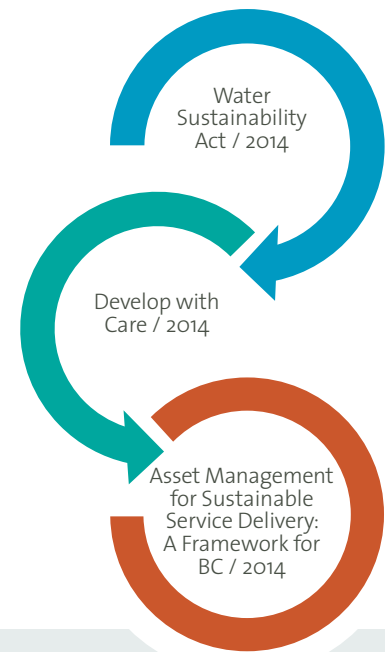
Infrastructure & Site Servicing Practices

Figure 2, left: There are persistent challenges for practitioners to adopt, change or evolve practices. **Figure 3, above right:** Game-changers enable action by local governments.

A desired outcome in protecting hydrologic integrity in urban watersheds is to avoid incurring expensive fixes and/or an unfunded liability.

Dawn of a New Era

Sustainable Service Delivery is the “New Paradigm”. It is the singular aim. Asset Management is the means to achieve the aim. BC is at the dawn of a new era for local governments in terms of how communities service urbanizing and redeveloping areas, and define how infrastructure is planned, financed, implemented and maintained. By 2017, an IREI program goal is that all local governments would *understand* how to achieve **Sustainable Watershed Systems, through Asset Management.** [SL](#)



What The Act connects land and water, and makes the link to desired water balance outcomes.

So What 'Develop with Care' makes the link between environmental function and resilience as communities grow.

Then What The Framework makes the link between local government services, the infrastructure that supports the delivery of those services, and watershed health.

Water as a Form-maker

by Tim Pringle

The Context Statement for the Cowichan Basin Water Management Plan (2007) provides this perspective: “The basin we see today is the product of the hydrological cycle over thousands of years of geologic and climate processes, and several centuries of human activities.” As this and other plans recognize, watersheds are defining landscapes that serve the needs of human settlements and provide natural habitats and their integral ecological systems. In numerous ways, the built environment has to adapt to watershed features and water movements to maintain viable settlements.

This article provides a bridge to the articles that follow. It reflects on the role played by land use and water resource practitioners. They too are form-makers. Their decisions, one property at a time, have consequences that ripple through time. Consequences can be either cumulative benefits or cumulative

impacts. Hence, the mission of the Partnership for Water Sustainability in BC is to develop tools and talent, and focus practitioners on desirable outcomes, so that a vision for settlement, economy and ecology will be realized over time.

Use and Conservation of Land

Nature shapes landscapes, and harbours ecological assets that support human settlements. Our communities and enterprises have an uneasy relationship with this master form-maker. Why this tension when it is in human nature to respond to the run of the land, the palette of flora, and sensations stirred by wind, water, wildlife and other whims of nature?

Evidence? During the past 50 years a number of non-profit trusts have been established to protect natural assets, which economic and settlement growth threatens to waste. Examples are not all in the wilder-

ness, they include wetlands-estuaries in urban areas. For well over 100 years Metro Vancouver has relied on obtaining drinking water from watershed areas that have restricted access by humans. Federal fisheries regulations point to watershed degradation as an on-going reality.

Few of us do view use and conservation of land as equal values. However, this axiom must be true; human settlement cannot exist without a supporting, healthy ecology as is the case for all living systems.

A Perspective on Development Practice

Today urbanism is at the forefront of settlement change in Canada and a host of practitioners are involved in the design of this expansion. Engineers, planners, landscape architects and other designations are shaped by graduate studies, possibly mentoring, and the on-going influences of their professional associations. ▶

CREATE A LEGACY:

Settlement, Economy and Ecology in Balance

- Influence choices by individuals and organizations
- Use the term “sustainability” as a lens for considering approaches that influence choices

Decisions made today ripple through time!

Visualize what we want our regions to look like in 50 years.

Be guided by Cathedral Thinking.



Working in the politically charged context of local government oversight, these practitioners are motivated to design and deliver harmonious results in the landscape, places they and their fellow citizens want to experience.

While Official Community Plans may set goals for designing with nature, recognizing on a watershed scale natural assets that capture rainwater, help with climate change mitigation, or supply other services needed by humans, the reality is that most land development happens parcel by parcel. The process is not linear, so old infrastructure may be connected to new as zoned lands fill in. Designers (including regulators) of new development want to lessen dependence on old systems and possibly increase reliance on natural systems.

The Partnership for Water Sustainability in BC has developed tools such as the Water

Balance Model for designers to address such challenges. The model enables design of drainage systems at multiple scales to maintain or enhance hydrology. This is a basic building block of watershed health. Optimum infrastructure design should equal watershed sustainability.

Settlement, Economy and Ecology in Balance

Current infrastructure design and use practices have evolved in a financial world where price significantly influences decisions. “People know the price of everything but the true cost of nothing. Price is what the person pays. Cost is what society pays, here, now, elsewhere, and into the future.” (P. Hawkin. A. & L. Lovins – Natural Capitalism).

Opportunity cost realities hit hard in the case of infrastructure assets owned and managed by local government. The province of BC and other authorities are turning

to the Asset Management approach to planning for sustainable service delivery. Utilizing services supplied by nature inevitably will become part of the most cost-effective design and planning.

Since the early years of its work, the Partnership for Water Sustainability has espoused the concept of settlement in balance with ecology and economy. It makes sense that as form-makers, designers would want to harmonize with natural systems and the supporting landscape.

Love of Place

Perception makes design and harmony possible. Nature should turn humans on. The built environment only partially gives us a sense of place, nature does the rest. There is a word for our primal perception of the natural environment and the watersheds in which we live; it is topophilia – love of place. [SL](#)

The Journey

to Balance Economy, Ecology and Settlement on Vancouver Island

By John Finnie, Derek Richmond and Eric Bonham

In 2005, the Water Sustainability Action Plan for BC initiated and cross-pollinated “convening for action” programs in three regions: Vancouver Island, Metro Vancouver and the Okanagan. Each had its own vision and road map. A commonality, however, was a desire for a Regional Team Approach founded on partnerships and collaboration.

Insertion of the word team in ‘regional approach’ has had a profound impact on how practitioners view their world. Team implies there is a personal commitment; it also suggests there is a game plan and coachable context. The Regional Team Approach is proving to be a powerful motivator.

CAVI - in the beginning.....

It started with a conversation. In 2005 a group of similar thinking individuals, recognizing a need to balance economy and ecology with the increasing settlement on

Vancouver Island, and the critical importance of water in that equation, gathered in Parksville to have a conversation about water sustainability on Vancouver Island.

Within a year, that initial meeting evolved into a movement, Convening for Action on Vancouver Island – Leadership for Water Sustainability. CAVI. Formally launched in 2006 at the Water in the City Conference in Victoria, CAVI was initially co-funded by the Ministry of Environment, Ministry of Community Development and the Real Estate Foundation of BC as a demonstration program, with support from local governments on Vancouver Island.

Convening for Action on Vancouver Island set a goal that Vancouver Island would be well on its way to water sustainability by 2010. Since that initial meeting in 2005, CAVI has successfully promoted the message of water sustainability by engaging

governments, developers and the community in water-centric thinking, planning and development activities.

Cathedral Thinking?

There is much yet to be done but CAVI’s approach is like Cathedral Thinking – an idea that takes time to evolve and establish, and ends up benefitting future generations. It is not so much what we do but what we cause to happen that matters.

The original CAVI team exceeded their program expectations. Water sustainability became a common thread in discussions and decisions about land development, water use and water conservation. Participants from governments, the development community, academia, consulting organizations, and others, understand the importance of water sustainability and incorporate water sustainability practices into their activities.



MISSION POSSIBLE

The 'regional team approach' brings together....

- **The Province** – those who provide legislative framework
- **Local Government** – those who plan, regulate and... operate, maintain and build
- **Developers** – those who build
- **First Nations** – those who connect to the land
- **Stewardship Sector** – those who advocate for conservation
- **Agricultural Sector** – those who grow food
- **Academia** – those who provide research



Conversations & Education: CAVI Forum within the 2011 State of Vancouver Island Summit.

Water-centric thinking, planning and doing have become more than a vision. They are a reality on Vancouver Island and elsewhere in BC. CAVI was a driver in this accomplishment and demonstrated what can be done through partnerships and collaboration. CAVI continues to organize events that create opportunities to start conversations that lead to action. The signature Learning Lunch seminars created a multi-agency network that builds and educates on successful practices. CAVI works because there is no pressure, no regulation, no “must do’s”. It is about people sharing ideas and successes with people.

Four Cs for Lunch

While information exchange through the Learning Lunch series was the genesis for CAVI's evolution, its credibility has grown through the inter-regional implementation of the 4-C's – collaboration, communication, cooperation and coordination. This

approach culminated in the Georgia Basin Inter-Regional Educational Initiative (IREI), whose focus is on a watershed-based approach to community planning and development. The Capital, Cowichan Valley, Nanaimo and Comox Valley Regional Districts have endorsed the IREI and support IREI activities.

Experience and intuition tell us that collaborating and planning on a watershed basis is the right thing to do. Innovative servicing standards provide more on-site rainwater capture, more infiltration into the ground and facilitate the slow release of run-off response to rainfall events. Many of these innovative standards had not, until recently, been tested over the longer term for their continuing effectiveness, public acceptance, and maintenance costs.

There was reluctance by municipalities for major changes to their servicing standards

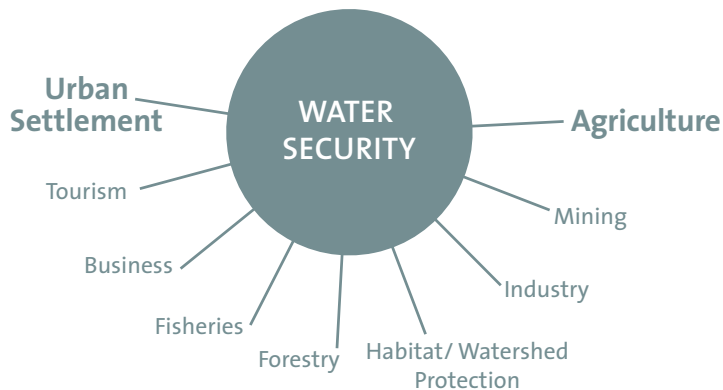
without a proven track record. This institutional inertia to change could only be overcome with a better understanding and demonstrated success of new approaches. CAVI can now demonstrate this through networking and outreach, education and training, capacity building and development of products and tools.

The Asset Management Challenge

Asset management usually commences after something is built. The challenge is to think about what asset management entails BEFORE the asset is built. Cost-avoidance is a driver for this 'new business as usual'. This paradigm-shift starts with land use and watershed-based planning, to determine what services are affordable, both now and over time.

Developers, governments and agencies understand that a collaborative balance of economy, settlement and ecology ►

WATER is the VITAL LINK



Water is truly the connector of all activities on earth, whether it is the economy, ecology or the well-being of human and non-human alike.

provides for the best outcomes. Through ‘developer dialogue’, the approach of planning for development on a watershed basis and getting things right at the front end has emerged as essential for investing in the right infrastructure for pragmatic asset management.

By viewing watersheds through an asset management lens, Sustainable Service Delivery integrates all the principles of Asset Management. It understands the value of both land-use planning and its impacts on service delivery. It also integrates the ‘design with nature’ philosophy, the genesis for balancing economy, ecology and settlement.

So now what?

As we stand at the start of a new chapter in adapting to climate change on the west coast, we are faced with a challenge and an opportunity to get things right at the front end. We can succeed with collaborative planning and building on a proven cooperative model that is working through the solid foundation built by CAVI. Our challenge is to get the right cornerstone firmly set in the right place for the next levels of the initiative. Because affordability ultimately drives local government asset management and infrastructure standards of practice, sustainable service delivery is one of the foundation pieces for building the next phase of a vision for Vancouver Island...

Such as “The VI2065 Vision”

The future of Vancouver Island calls for Cathedral-like thinking to create a vision that is inspirational, pragmatic, and based on a strong foundation. Individuals, communities and local governments must commit to a future that ensures both water security and the sustainability of our watersheds. The VI2065 initiative will create a legacy to support settlement change on Vancouver Island in balance with ecology and economy.

Given this context and the reality of climate change, planners, engineers, politicians and citizens will be collectively challenged to focus on water-resilient outcomes against a backdrop of an unpredictable water cycle. Achieving consensus in this situation emphasizes a commitment to collaboration based upon cooperation and partnerships across institutional and political boundaries.

On Vancouver Island, as elsewhere, water security underpins economic security, for water is truly the connector of all activities – the economy, ecology, urban settlement, agriculture and the wellbeing of humans and other living things. CAVI has collaborated on VI2065 with several agencies including provincial and local governments, Vancouver Island Economic Alliance (VIEA), Royal Roads University (RRU) and Vancouver Island University

(VIU). Engaging the academic sector and youth is considered an important component of the VI2065 vision as future leaders are trained to address the challenges of a rapidly changing world where the economy, ecology and human settlement in balance will become central to maintaining a stable society.

VI2065 envisions a Vancouver Island based on long-term sustainability and water resiliency models that involve innovative partnerships. The results guide us towards effective land and water management practices. Water is an entrance point for the discussion on climate change, for the connection on this complex issue is clearly understood in light of the increase in floods and droughts.

CAVI – moving forward.....

In 2015, the scope of CAVI as a regional initiative of the Partnership for Water Sustainability in BC was redefined. With past successes and some fresh ideas, CAVI is moving forward under a new name – The Partnership on Vancouver Island. The conversations that lead to education and accomplishment continue. [SL](#)



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the partnership
for water sustainability in bc

waterbucket.ca: Website showcases water-centric innovation and leadership

by Mike Tanner

Launched in 2005, the waterbucket.ca website is a 'destination location' for resources on green infrastructure and water sustainability in BC. The Partnership for Water Sustainability is recording and showcasing the history of land and water champions even as they are creating it. Written in a magazine style, waterbucket.ca weaves quotable quotes and images into storylines that engage readers.

The genesis for waterbucket.ca was an action item arising from a consultation workshop hosted by the Province in November 2003, and was the first deliverable flowing from the Water Sustainability Action Plan. waterbucket.ca was co-funded by federal and provincial ministries, regional governments, BC Hydro and BC Gas.

Communities-of-Interest

By providing universal access to information, the Partnership for Water Sustainability in BC believes that we will see improved standards in all aspects of land development and water resource management. waterbucket.ca comprises a family of communities-of-interest that provide a ready-made platform for advancing a "design with nature" approach to community development.

An International Reach

Since 2008, some 300,000 visitors have accessed stories, resources and tools that the website offers. This is remarkable considering that waterbucket.ca was developed for a BC audience of elected officials, government agencies and utility

"waterbucket.ca is providing reasons to have the conversation about 'why change'. The resulting awareness of need will help us obtain the mandate to implement watershed-based land use planning" – Marvin Kamenz, Municipal Planner, Town of Comox

managers. The site has attracted tens of thousands of visitors from across Canada and from cities and countries around the globe: 5000-plus cities in 180 countries. Interestingly, 60% of the audience is in the age range 18 to 34.

A Measure of Influence

A decade ago, the Partnership pioneered a hierarchy of 'green' vocabulary that included this transformational definition: ***Water Sustainability is achieved through Green Infrastructure practices that reflect a full and proper understanding of the relationship between land and water.***

A measure of the global influence of waterbucket.ca is that this definition is now widely accepted as conventional wisdom.

A Race to the Top

Communication is vital. Storytelling leads to understanding about why we need to do business differently; and this is promoting completion and a race to the top. waterbucket.ca is the technical voice that is getting the technical story out in a consistent way. It provides reasons to have conversations about 'why change'.

Check out waterbucket.ca and visit your community-of-interest. [SL](#)



Water Balance Express:

RESTORE 'ENVIRONMENTAL FLOWS' IN URBAN STREAMS

by Jim Dumont and Richard Boase

Funded by government to support stream protection and climate change adaptation strategies, the Water Balance Model family of online tools includes the Water Balance Express for Landowners (waterbalance.ca).



The Express helps landowners quantify how well rain gardens on their properties slow, sink and spread rainwater runoff and do their share to meet pre-set watershed targets for volume, infiltration and flow. The tool is integrated with Google Maps/Earth and the land use zoning of partner local governments.

North Vancouver District undertook the 'proof of concept' for Express development as an element of its Hastings Creek watershed plan. Other local government leaders have followed. Each time the tool is enhanced.

Stream Health

The Express is populated with watershed targets determined by applying the Water Balance Methodology. The flow-duration relationship is the cornerstone of the methodology. By maintaining flow-duration, stream erosion is not increased during wet weather and 'environmental flows' are

sustained during dry weather. When homeowners slow, sink and spread rainwater runoff on their property, urban streams benefit.

Protection of streams and fish is an important public expectation, creating a driving force altering our perceptions, aspirations, and treatment of the urban landscape.

The new Water Sustainability Act will establish regulations pertaining to 'environmental flows' within the next few years. The Express is a key part of the long-term Rainwater Management solution for protecting stream health.

Typical Water Balance on the West Coast	
Precipitation	100%
Losses	20%
Surface evaporation	10%
Plant transpiration	5%
Lost to deep groundwater	5%
Stream flow	80%
Surface runoff	10%
Interflow	55%
Aquifer discharge	15%

Rainwater Management

The purpose of Rainwater Management is to mimic the natural Water Balance and three flow pathways naturally occurring in a watershed. The pathways are surface run-off, seasonal interflow system (shallow horizontal flow), and water stored deep in saturated aquifers which then discharges at some future date. Managing watersheds as an integrated Water Balance system

provides a level of assurance that:

- Excess water would not be directed to the ground and would avoid potentially adverse impacts of excessive groundwater levels and discharges in areas lower in the watershed.
- Summer flows would be maintained with an operating interflow system.
- Downstream properties would not suffer an increased risk of flooding or flood damages.

The Water Balance Methodology establishes watershed targets with verifiable calculations and mitigation systems are optimized for both cost and function.

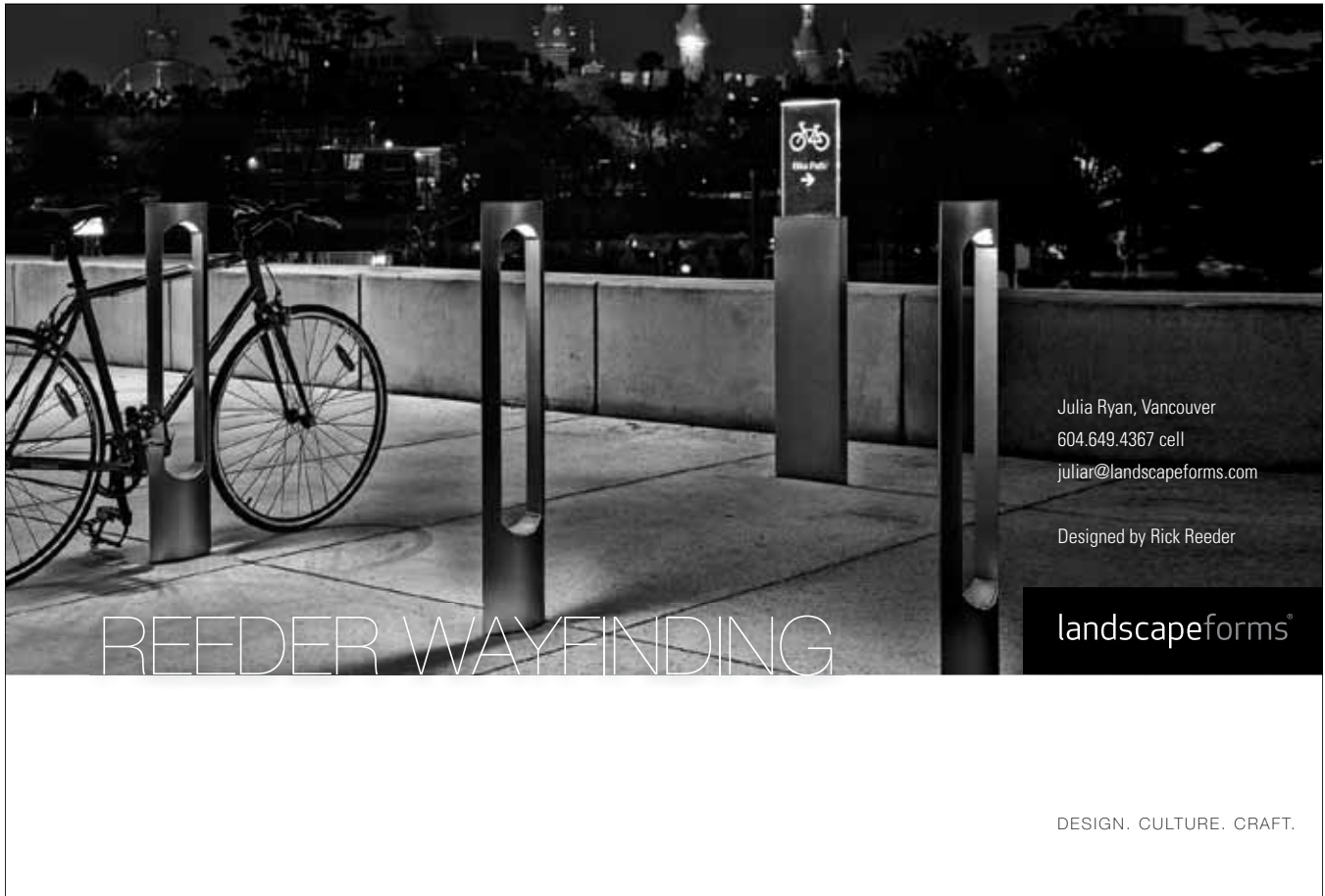
Water Balance Methodology

Water Balance Methodology objectives start with the stream and end with the stream, thereby providing a true measure of success for environmental protection:

- Maintain stream flows,
- Improve water quality,
- Provide flood protection,
- Prevent unforeseen impacts,
- Prevent stream erosion, and
- Replace the lost interflow system.

The Water Balance Methodology is based upon watershed and stream function and operation. Understanding how precipitation makes its way to the stream allows one to assess how a watershed and stream operate while analytically demonstrating impacts of development and the effectiveness of mitigation works. The table summarizes the natural Water Balance of many west coast watersheds. Clearing and stripping of ▶

Far Left: Richard Boase of North Vancouver District is a tireless champion for the Water Balance approach to stream health.

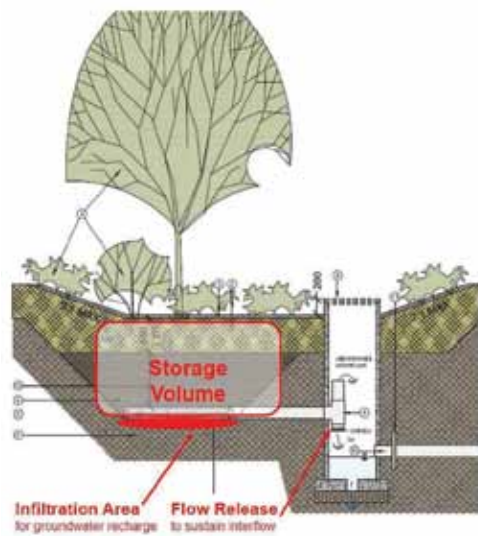


land eliminates interflow, thereby impacting ‘environmental flows’.

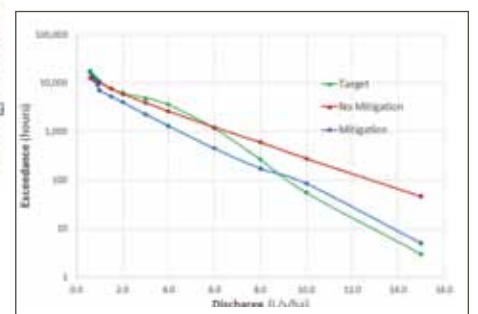
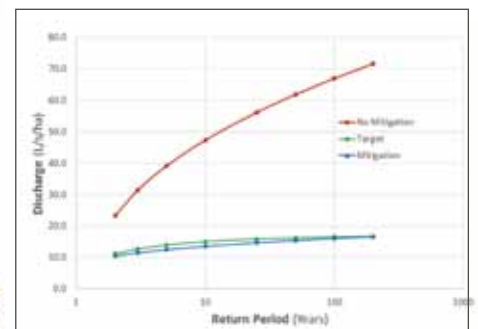
Analysis begins with calibration of continuous simulation models using long term climate records, not just selected storms or typical years. The effects of urban development are then estimated and required mitigation measures are sized. Chart 1 shows the flood frequency for one watershed and stream. The results also yield estimates of stream flow durations (Chart 2) where the system has been optimized. The rain garden detail illustrates application of the three performance targets for design - the origin of the illustrated detail is the Metro Vancouver Source Control Guidelines.

What this Means

The analytical approach underpinning the Water Balance Methodology is verifiable, and allows the mitigation works (such as rain gardens) to be optimized for size and cost while achieving watershed objectives.



The Water Balance Methodology is superior to approaches that rely upon simplistic capture targets unsupported by calculations to demonstrate effectiveness. [sl](#)



Top left: How performance targets for storage, infiltration and flow release are incorporated in a rain garden design. **Top right:** Flood Frequency. **Above:** Streamflow Duration.

CALCULATOR: Managing water as one resource

The Partnership for Water Sustainability in BC is assisting the Province with implementation of the new Water Sustainability Act (WSA), passed in April 2014 and effective as of 2015. WSA is the signature piece in a policy, program and regulatory framework that establishes expectations for adapting to a changing climate. To enable groundwater regulation, the Ministry of Environment turned to the Partnership to develop the online Water Licensing Calculator (<http://www.bcagriculturewatercalculator.ca/>).

Unveiled publicly for the first time at the annual conference of the BC Society of Landscape Architects, this tool went live on February 29, 2016. It builds on the Agricultural Water Demand Model (AWDM) which the Partnership manages on behalf of the Ministry of Agriculture.

Groundwater Regulation

Under WSA, surface and groundwater are managed under the same regulatory regime. All non-domestic users of groundwater must now obtain a licence to extract and use water from wells. This requirement applies

to wells constructed both before and after the WSA came into effect. This means that 20,000 existing non-domestic wells must now apply for a licence. While the new legislation affects everyone, most of the 20,000 wells are in the agriculture sector.

Groundwater has been used for agricultural irrigation for decades. The old Water Act did not require licensing of groundwater use. Hence, agricultural operations had no compelling reason to accurately quantify the total groundwater volumes they used. Furthermore, traditional computation methods for estimating irrigation water demand are either complex or overly-simplified. Given this context, there was a concern that agricultural operations would tend to over-estimate water need when applying for water licences.

Use of Agricultural Water Demand Model

This concern became the driver for development of a reliable tool for calculating water volumes for water licensing purposes. The innovation by the Partnership was in connecting the dots to the AWDM.

Development of this tool had previously established a 500-metre climate grid over the entire province and this generates daily evapotranspiration data. Output from the AWDM is input to the Water Licensing Calculator.

The calculator works for any and all properties in the province and can be used for both landscape and agricultural purposes. The tool allows a user to zoom in on a specific property. It then generates the annual water demand and the peak irrigation flow rate for the property. The output is based on a forage crop with a sprinkler system. If the soil texture is known, then that information will also be taken into account. If not, then a default of sandy loam is provided. The user has the ability to change the crop, irrigation system type and soil type to generate a new number.

A Look Ahead

The calculator will be used by licensees and water managers. It will allow managers to improve the accuracy of licensing, thereby enhancing the management of BC's water resources. **SL**



Left: Center Pivot System.

Below: Spray emitter system on grapes.

High Efficiency

HOW IT WILL HELP ACHIEVE A WATER BALANCE

IRRIGATION STANDARD:

By Ted van der Gulik, P. Eng.

Each year the Partnership for Water Sustainability in BC co-hosts a “call to action” workshop with the Irrigation Industry Association of BC (IIABC). These forums create opportunities to cross-pollinate the experience of those who are Water Balance champions, and thereby advance the Living Water Smart vision. Over the years, IIABC has developed web-based tools that will help achieve a seasonal water balance, most recently the High Efficiency Irrigation Standard (HEIS).

Context for Action

In many regions of the province landscape irrigation consumes about 50% of domestic water use on an annual basis. Ensuring a healthy water balance in our ecosystems must not only address how we manage rainfall, but also how anthropogenic activities are managed to protect stream and ecosystem health. A Living Water Smart target (2008) is that, by 2020, water use in BC will be 33% more efficient.

case) it is because changes to the design are made during the installation process, or just an incorrect run time was programmed into the timer and never monitored or changed. Irrigation systems continue to underperform, often due to poor design and installation, but more often due to the lack of knowledge or follow-through with the irrigation system managers operating the system.

A Systems Approach

IIABC recognized the need to come up with something better. It must be a holistic approach from beginning to end. The designer, installer, maintenance personnel and scheduler must be on the same page. To move towards higher efficiency the IIABC has developed the High Efficiency Irrigation Standard. Achieving better efficiency cannot be accomplished by merely introducing standards into a bid process. There must be follow-up and someone held accountable. The HEIS was built with this outcome in mind.

The HEIS is an online tool that checks each component of the system receives an acceptable rating. To be authorized a passing score must be obtained, printed and provided to the client with the irrigation plan. When the system has been installed, and the irrigation schedule entered into the timer, the HEIS seal can be placed on the controller.

A Look Ahead

The High Efficiency Irrigation Standard has been developed to improve irrigation efficiency in British Columbia. It is new, innovative and an attempt by the industry to improve the efficiency of water use. It will take time to train those specifying a HEIS standard as well as those preparing the information and installing the system. If individuals and communities can do a better job of saving irrigation water, the HEIS will have been a worthwhile investment to help achieve a Water Balance in our ecosystems. [SL](#)



*The HEIS tool can be found at the following URL under the resources tab:
www.irrigationbc.com*

There are many benefits to thriving landscapes. Done properly landscape irrigation can reduce water use by 50% with proper design, installation and maintenance. Most irrigation systems that were installed five or more years ago will not be performing at an optimum rate. While many of these systems were designed with good intentions they ultimately become inefficient. Irrigation assessments that have been done over the past 10 years prove this out time and time again.

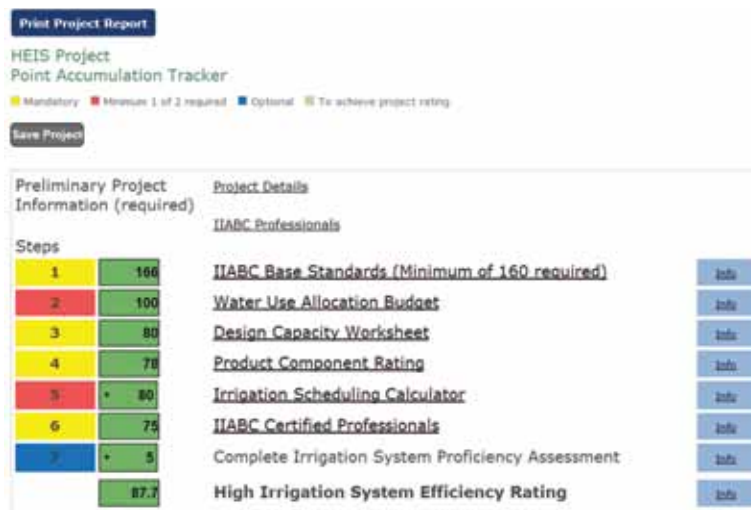
It is not that they were necessarily designed incorrectly (even though this is often the

The HEIS takes into consideration water budgets, system performance and design, product rating, system scheduling and maintenance. The tool utilizes the tools offered by the IIABC such as the landscape scheduling calculator and also identifies the trained professionals that will design and install the irrigations system. The premise of the standard is that if all of the correct steps are taken, from design to installation to operation, the irrigation system will be more efficient and save water.



Far Left: Online landscape scheduling calculator.
Above Right: Automated irrigation system.
Above: Irrigation system operating at excessive pressure.

Below: HEIS seal of approval.
Right: Output from HEIS online tool.



SUSTAINABLE Service Delivery: Watersheds are infrastructure assets

by Glen Brown & Raymond Fung

The Partnership for Water Sustainability is collaborating with the Union of BC Municipalities, Asset Management BC and the Province to profile, raise awareness and advance Asset Management for Sustainable Service Delivery: A Framework for BC. The Partnership is the champion for Step Three as shown on the accompanying Continuum graphic.

BC Framework

Years in the making, the vision for Sustainable Service Delivery became a reality with rollout of the outcome-oriented BC Framework in 2015. Because it is a driver for tackling the unfunded infrastructure liability, the BC Framework has garnered both national and international attention.

The BC Framework is a game-changer because it is strategically aligned with asset management requirements under senior government funding programs, in particular the Gas Tax Program. The BC Framework also points the way to integration of natural

systems thinking and climate change thinking into asset management.

Asset Management & Ecosystem Services

The ultimate vision for fully integrated Sustainable Service Delivery is that communities would protect, preserve, restore and manage natural assets in the same way that they manage their engineered assets.

A watershed, and the ecosystem services that it provides, is a fundamental and integral part of a community's infrastructure. This is not to suggest that all ecosystem services provide a municipal function. But as an example, trees, soil, green spaces and water do contribute a valuable municipal function in maintaining the hydrologic integrity of a healthy watershed system.

The Asset Management Journey

Implementation of asset management along with the associated evolution of local government thinking is a continuous quality

improvement process, not a discrete task. This ongoing process is incremental and scalable, involving: assessing capacity, demand and results; planning what needs to be done; and implementing the plans. We needed a way to illustrate this diagrammatically, and thus communicate, what the journey by a local government to the eventual Sustainable Service Delivery destination would look like.

This led us to the concept of a continuum. The relevance of this way of thinking is that different local governments will always be at different points and different levels of maturity along the asset management continuum. This is why we focus on outcomes and do not prescribe what to do in BC.

The continuum bridges two pieces. One piece is recognition that the asset management process is founded on an incremental approach. The other piece is integration of natural capital, natural assets and watershed systems thinking. [SL](#)

Asset Management Continuum *for* Sustainable Service Delivery

As understanding grows, local governments will progress incrementally along the 'Continuum'



GROUND ZERO: In the beginning, there was no Asset Management Plan and a consequence is the 'unfunded infrastructure liability'

STEP ONE: They will embrace the BC Framework, with an initial focus on core engineered assets (water supply, sewage, roads, etc.) and embark on an Asset Management Strategy / Plan / Program process

STEP TWO: They will think holistically and implement a life-cycle approach to infrastructure decision-making so that Sustainable Service Delivery for engineered assets is standard practice

STEP THREE: For the drainage function, they will integrate natural systems thinking and account for the Water Balance Services provided by watershed systems

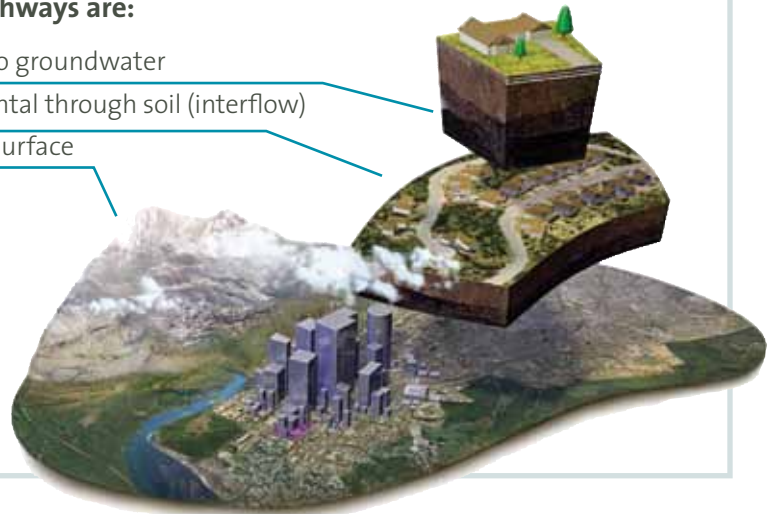
INTRODUCING
THE NEW PARADIGM –

Watersheds as Infrastructure Assets

- A watershed is an integrated system.
- The three pathways by which rainfall reaches streams are 'infrastructure assets'.
- The three pathways provide 'water balance services'.

The three pathways are:

- Deep vertical to groundwater
- Shallow horizontal through soil (interflow)
- Over the land surface



Moving Towards "Sustainable Watershed Systems, through Asset Management"

As an example, the District of West Vancouver has been working through asset management tasks for many years. In 2010, the municipality completed its first Storm Infrastructure Asset Management Plan. This work inventoried the District's municipal infrastructure and calculated the replacement value of the storm drainage system at \$333 million in 2009 dollars. An estimate of the financial resources required to support the renewal of all of the District's storm drainage assets was provided, and Council endorsed an enhanced capital replacement program, as

well as detailed condition assessment efforts to prioritize specific projects.

Meanwhile, the Town of Gibsons has recognized that natural assets (such as creeks, ditches and wetlands) reduce the need for engineered infrastructure for rainwater management. Further, compared to engineered infrastructure, natural assets are potentially more cost-effective to operate and maintain, do not depreciate, and are carbon neutral or even carbon positive. Yet currently, the Canadian Public Sector Accounting Board Standards do not allow for the valuation and recording of natural assets into local government financial statements.

Yet, both the approach of West Vancouver and Gibsons are needed; marrying the asset management process with an acknowledgment of the value of ecosystem services would allow human settlement to be balanced with ecology. To this end, the Municipal Natural Capital Initiative (of which Gibsons is a convening partner) and the Ecological Accounting Protocol (an initiative of the Partnership for Water Sustainability) are two important projects advancing research and practice towards integrating natural capital into an asset management framework, which when refined and normalized would allow local governments to truly move towards Sustainable Service Delivery! [SL](#)



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