



**the partnership
for water sustainability in bc**

IREI - Inter-Regional Education Initiative



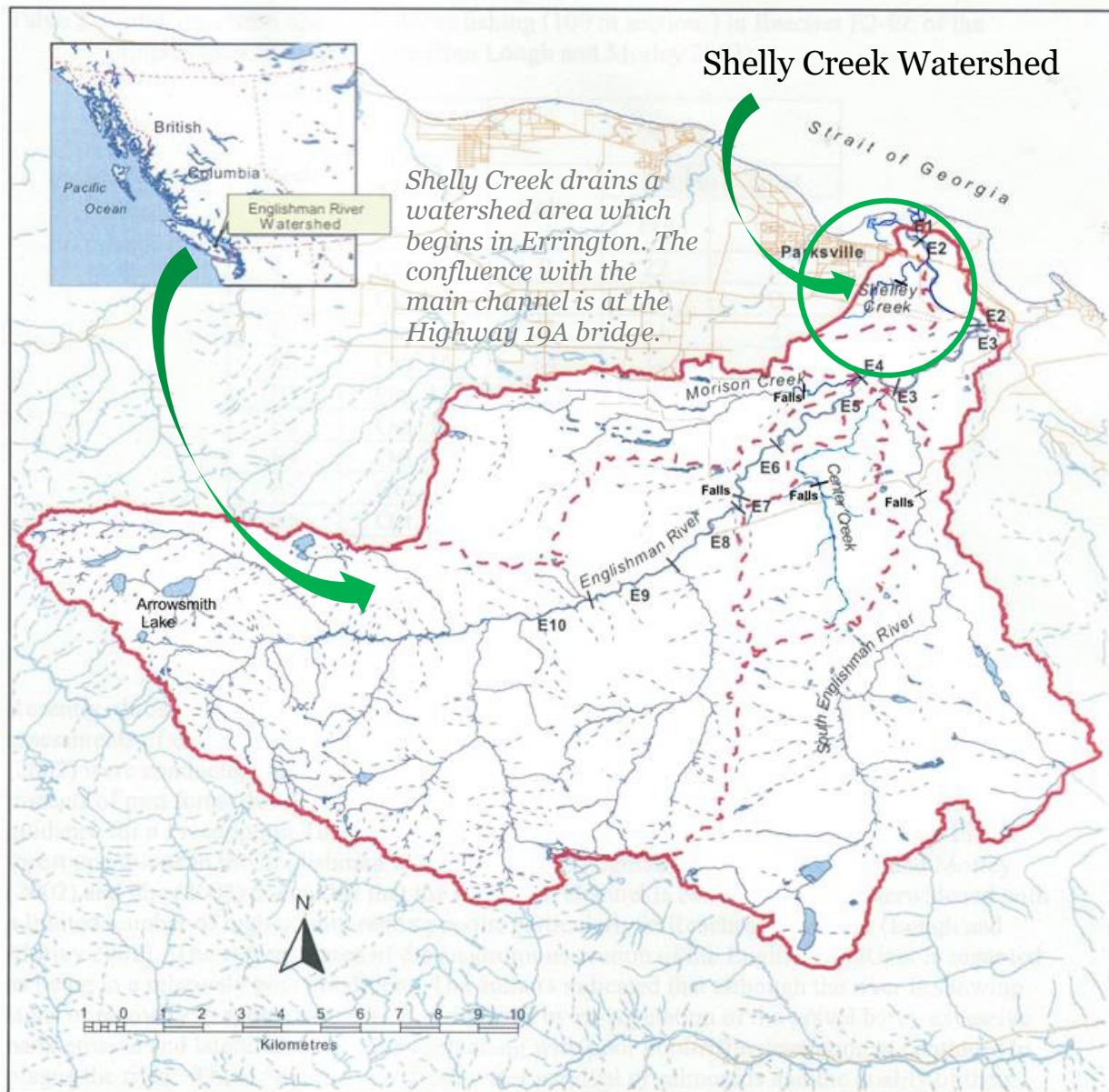
Shelley Creek is Parksville's last fish-bearing stream!

Restore Watershed Hydrology, Prevent Stream Erosion, Ensure Fish Survival



October 2017

*This publication is the 6th in the Partnership's
"Watershed Blueprint Case Profile Series"*



Englishman River Watershed, Vancouver Island

Shelly Creek is Parksville's last fish-bearing stream: What the reader will learn from this Case Profile

Context is everything!

Shelly Creek is a tributary of the Englishman River, a major watershed system on the east coast of Vancouver Island. Shelly Creek is important to salmonids, and this is why it is necessary to understand what is causing the Shelly Creek stream channel to fill with sediment, as well as what can be done to ensure fish survival over time.

In 1999 the Englishman River was first declared to be one of the most endangered rivers in BC. Extinction of the fisheries resource was viewed as a very real possibility. This was the catalyst for action. It resulted in two transformational outcomes: implementation of the Englishman River Watershed Recovery Plan (2001); and creation of the Mid Vancouver Island Habitat Enhancement Society (MVIHES).

Fast forward to the present. Through their involvement in MVIHES, community stewardship volunteers are demonstrating what it means to embrace 'shared responsibility' and take the initiative to lead by example. A paramount goal is to "get it right" in the stream channel. Their challenge is to move from stop-gap remediation of in-stream problems to long-term restoration of a properly functioning watershed.

*MVIHES has established a provincial precedent with the **Shelly Creek Water Balance & Sediment Reduction Plan**; and this will have reverberations as the "Shelly Creek story" becomes well-known.*

The Shelly Creek experience foreshadows that an informed stream stewardship sector may prove to be a difference-maker that instigates and accelerates implementation of the 'whole-system, water balance' approach in the Georgia Basin region and beyond.

As a co-funder, the Partnership is thrilled to have contributed to the Shelly Creek Plan. Our commitment to the Shelly Creek stream stewardship volunteers is to tell their story far and wide. This Watershed Case Profile is the launch of the storytelling process!



Kim A. Stephens, MEng, PEng,
Executive Director
Partnership for Water Sustainability in BC
October 2017

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¹ Plan development was co-funded by five organizations:



About the Watershed Blueprint Case Profile Series:

The Case Profile Series is unique.

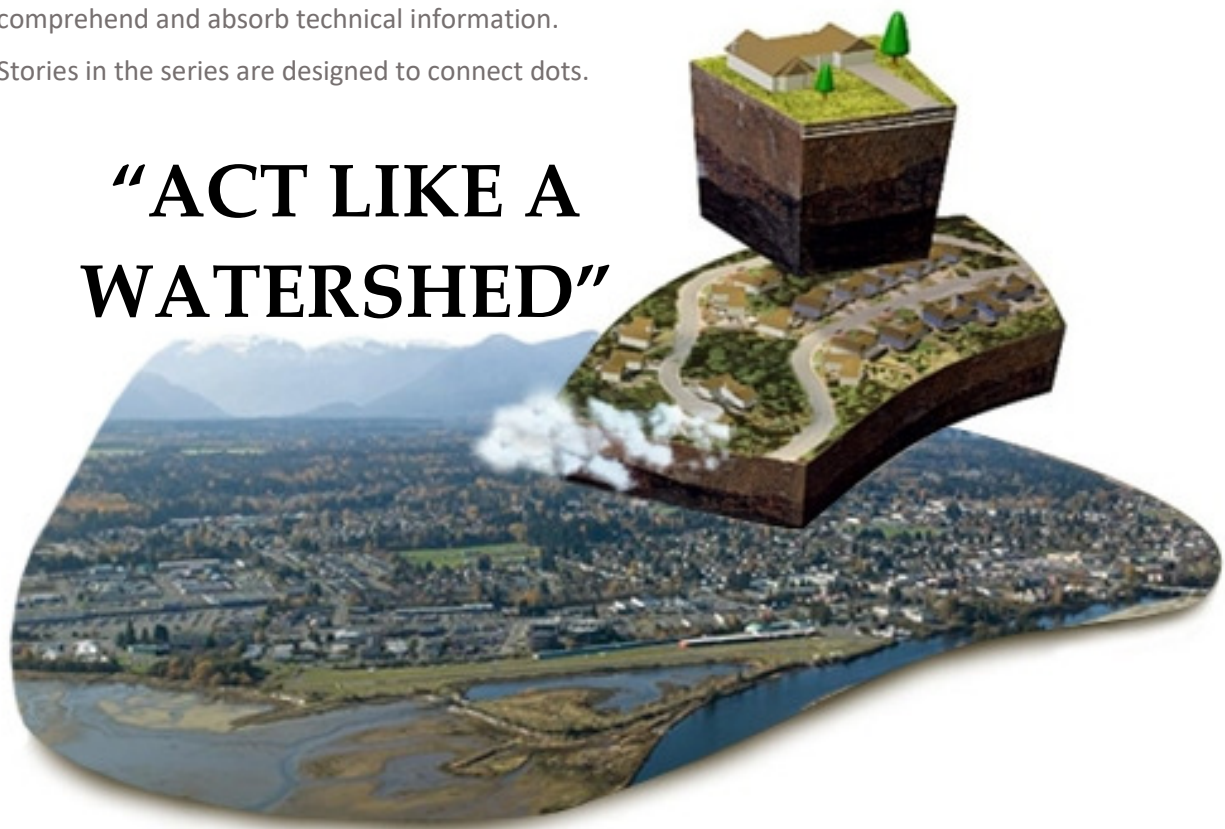
The series showcases and celebrates successes and long-term 'good work' in the local government setting in British Columbia. Our spotlight is on champions in communities which are breaking new ground and establishing replicable precedents.

Storylines touch lightly on technical matters, yet are grounded in a technical foundation.

The objective in 'telling a story' is to engage, inform and educate multiple audiences – whether elected, administrative, technical or stewardship.

Stories in the series are presented in a magazine style to make it easier to read, comprehend and absorb technical information.

Stories in the series are designed to connect dots.



“ACT LIKE A WATERSHED”

A watershed is an integrated system:

The need to protect headwater streams and groundwater resources in BC requires that communities expand their view - from one that looks at a site in isolation - to one that considers HOW all sites, the watershed landscape, streams and foreshores, groundwater aquifers...and PEOPLE....function as a **whole system**.

ACKNOWLEDGMENTS: The Partnership for Water Sustainability in BC gratefully acknowledges the financial support of the governments of Canada and British Columbia (through the Clean Water & Wastewater Fund), as well as the support of our regional district partners in the Georgia Basin Inter-Regional Education Initiative (IREI).

The educational goal of the IREI is to build practitioner capacity within local government to implement a whole-system, water balance approach branded as **Sustainable Watershed Systems, through Asset Management**.

Inter-governmental collaboration and funding enable the Partnership to develop approaches, tools and resources; as well as provide teaching, training and mentoring.



About the Partnership for Water Sustainability

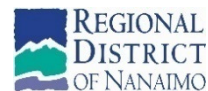
The Partnership for Water Sustainability in BC (i.e. “the Partnership”) is a legal entity, incorporated in 2010 as a not-for-profit society, and delivers services on behalf of government. It originated as an inter-governmental partnership, formed in 2002 to fund and develop the Water Balance Model as a web-based decision support tool.

*When the **Water Sustainability Action Plan for British Columbia** (Action Plan) was released in 2004, the Water Balance Model for BC was the centrepiece initiative. Action Plan experience informed development of **Living Water Smart, British Columbia’s Water Plan**, released in 2008, as well as the parallel **Green Communities Initiative**.*

*The Partnership is the hub for a “convening for action” network in the local government setting, is responsible for delivering the Action Plan program through partnerships and collaboration, and embraces a vision for shared responsibility where all the players align their efforts for the common good. The Action Plan program includes the **Georgia Basin Inter-Regional Education Initiative**.*

*The Partnership plays a bridging role between Province, local government and community; and is the steward for **Stormwater Planning: A Guidebook for British Columbia**, a provincial guidance document released in 2002.*

Regional Districts supporting the IREI



Context for Action

What Happens on the Land Matters!

Community development hardens the land surface.

This short-circuits the water balance, with these impacts:

- *when it rains - too much runoff, too fast;*
- *when there is no rain - too little streamflow.*

As the landscape is built over, there is more runoff volume to manage. This has consequences for stream stability and fish survival.

Cause-and-Effect

Short-circuiting of water balance pathways increases the total number of hours per year that streams are subjected to erosion-causing streamflow rates.

The Solution



Replicate water balance pathways to restore the flow-duration relationship

Coho Salmon Crisis

In the early 1990s, the 'Coho salmon crisis' raised the alarm and galvanized action to tackle the adverse impact of human activities on stream health in urbanizing watersheds. By 1996, for example, the government of BC established regulatory and program support for restoration of salmon freshwater habitats through *Fish Renewal BC* and the *Urban Salmon Habitat Program*.

Across Vancouver Island and the Lower Mainland, salmon enhancement stewardship groups formed. They asked questions about the linkages between small stream salmon demise and land developments. The push from the stewardship sector for science-based approaches led to cross-border collaboration. Washington State research findings informed the 'whole-system, water balance' approach that underpins the hydrology foundation for *Stormwater Planning: A Guidebook for British Columbia*, released in 2002.

Many volunteer groups had their beginnings in small stream salmon enhancement projects. A generation later, most community-based groups still exist. They provide thousands of volunteer hours to restore aquatic habitats. From (salmon egg) incubation boxes to habitat restoration, they partner with fisheries agencies to restore salmonid populations. **Now the scope of their involvement and influence is expanding beyond the creek channel.**



Englishman River Watershed Recovery Plan

The Englishman River is designated a 'Sensitive Stream'. Thus, it requires special management attention under the Fisheries Protection Act.

The recovery plan was the first to be funded by the Pacific Salmon Endowment Fund.

MVIHES played a central role in Plan delivery, and convened a broadly based steering committee.

Human impact on the Shelly Creek watershed

Over the past 80 years, the Shelly Creek watershed has been transformed by human activities.

Land alterations have included clearing and ditching for farming, ditching for road development and land subdivision, logging, linear developments (highway, railway, hydro transmission), and residential and industrial developments.

Englishman River / Shelly Creek

Over the past two decades, the evolving role of stream steward groups in British Columbia is exemplified by Englishman River experience. When the river was declared the most endangered river in BC, in 2001, extinction of Coho salmon was viewed as an imminent possibility.

Call for Action: In the 1990s, the Coho salmon crisis resulted in two transformational outcomes:

- development of the Englishman River Watershed Recovery Plan; and
- creation of the Mid Vancouver Island Habitat Enhancement Society (MVIHES), a not-for-profit society.

Over time, MVIHES has morphed from *Stewards of the Plan* to *Stewards of the Watershed*. Beginning in 2011, the MVIHES action plan has concentrated on Shelly Creek. One of five Englishman River tributaries, it is the last fish-bearing creek flowing through the City of Parksville.



Shelly Creek Watershed in the Nanaimo Region

Mid Vancouver Island Habitat Enhancement Society



Faye Smith

(1937-2017)

Community Leader

Faye Smith, project coordinator, was the 'face' of MVIHES from the time of its inception

"MVIHES experience demonstrates that positive outcomes are a result of strong community support for protection of small streams and their tributaries."

A Voice for the Community

"MVIHES represented the community in the Watershed Recovery Plan implementation process during the period 2001 through 2008," explains Peter Law, MVIHES vice-president. "There were substantial financial investments in stream restoration projects to enhance salmon and steelhead habitat. MVIHES was the community voice, and its eyes and ears."

"As time moved on, priorities changed, and the role of MVIHES was refocussed into 'monitoring streams' to ensure watershed health. This meant getting the community involved by connecting people to their landscape through the *Watershed Health and You* initiative."

Watershed Health and You: The initiative aims to engage the local community in recognizing the importance of the watershed. This is the prelude to involving community members in activities that would help to protect their own watersheds. MVIHES:

- coordinates projects and community discussions about management of the watershed;
- disseminates information regarding the status of aquatic habitat in the watershed; and
- provides opportunities for the community to participate in hands-on care for the watershed, estuary and shorelines.

The MVIHES mission is to **connect people to their landscape through education**. Public events raise the level of awareness.

Watershed Recovery Goal

Restore the whole watershed to a healthy state and thereby benefit all wildlife and residents, including the recovery of Coho and steelhead populations.





Fisheries Importance

A Smolt is a stage of a salmon life cycle that is getting ready to go out to sea.

“The large number of Smolts found indicates that Shelly Creek offers spawning and rearing habitat within its lower reach.”

“It also indicated that it is heavily used as overwintering habitat during high water by migrating fish in the Englishman River.”

Source: 2011 Smolt Trapping Report for DFO



Why Shelly Creek is Important

Approximately 6.5 km long, the Shelly Creek stream channel drains a watershed area of 5 km². **The survival of Coho salmon in the Englishman River depends on a healthy Shelly Creek!**

“Shelly Creek was the subject of a habitat assessment 15 years ago, when challenges to fish and fish habitat were first identified,” recalls Peter Law. “In 2011, MVIHES volunteer streamkeepers installed a downstream smolt trap to quantify the importance of this small stream, to Coho populations in the river.”

“We were pleasantly surprised when we counted thousands of smolts as they migrated downstream to the river/ocean. This project helped us understand the important role Shelly Creek plays in sustaining healthy Coho salmon populations in the Englishman River.”



What the Community Watershed Monitoring Network has revealed

In 2011, the Regional District Nanaimo (RDN) *Drinking Water and Watershed Protection Program* partnered with the Ministry of Environment, MVIHES and nine other stewardship groups to implement the Community Watershed Monitoring Network.

Erosion is the Issue: “The network expands on the provincial data base, collecting enough data to see watershed trends and raise watershed health awareness in local communities,” explains Julie Pisani, RDN Program Coordinator. “Data are collected for turbidity, dissolved oxygen, temperature and conductivity.”

“The Shelly Creek turbidity measurements were two times higher than the value established for acceptable sediment runoff in the Englishman River,” reports Peter Law. “In fact, Shelly Creek’s turbidity numbers were the highest in the region (as reported in 2013). **This was the alarm bell that alerted us to a serious problem** with watershed health. By 2014, efforts to identify sediment sources and their causes, and then develop solutions, were underway.”

Apply the *BC Process* for Moving from Awareness to Action

Questions that Define the Issues

What is causing the stream channel to erode and fill with sediment?

How can community action restore the stream's health?

From Awareness to Action

"We recognize that there is a problem."

"This is what we will do about it."

Informed by the ground work described on the previous pages, MVIHES secured funding from multiple agencies, in particular the Pacific Salmon Foundation, and developed the **Shelly Creek Water Balance & Sediment Reduction Plan**. Two questions (opposite) defined the conceptual framework for the 'whole-system, water balance' approach which underpins the plan.

Inform, Educate, Inspire: The challenge for MVIHES is to facilitate the community's journey from awareness to action, expressed as follows: *Once a community as a whole acknowledges that there is a problem, and also understands why there is a problem, what will the community do about it?*

For the past decade, Vancouver Island has been a demonstration region for "convening for action". Illustrated below, the process is incremental. It requires time and commitment. As applied to Shelly Creek, the process is currently in transition between WHAT and SO WHAT. **This is the hardest gap to bridge.** Below, the table is a road map for the next four sections of this Watershed Case Profile.

Transition from Stop-Gap to Long-Term

A goal is to "get it right" in the stream channel.

The challenge in "getting it right" is to move from stop-gap remediation of problems to long-term restoration of a properly functioning watershed.



Section Theme	Key Message for Section
What	Understand what causes erosion
So What	Develop performance targets
Now What	Engage the community
Then What	Change engineering standard practice

WHAT – Changes to the Water Balance

Washington State and British Columbia are geographically similar. On the coast, Washington State's Puget Sound and BC's Strait of Georgia together comprise the Salish Sea.



Chris May

Division Director
Surface & Stormwater,
Kitsap County Public Works,
Washington State

"It is not sufficient to do only a single or even a few things – it is necessary to do everything!"

"We know we need to work at multiple scales and multiple levels to improve conditions in our small stream watersheds – that's our strategy. Kitsap (a rural county) is at a manageable scale."

Understand What Causes Erosion

The foundation for the Shelly Creek Plan is **science-based understanding** of causes and effects. What is the issue? The form of land development impacts how water is used, how water runs off the land, how water reaches streams, and how streams erode.

In 1996, Richard Horner and Chris May (University of Washington) published their seminal research. Their findings shook conventional stormwater management wisdom in the Pacific Northwest to its very core. They conclusively demonstrated that, **as the watershed landscape is incrementally transformed from forested to rural to urban, the impacts on aquatic habitat and fish survival are initially experienced at a very low threshold (10% impervious cover) and are cumulative.** What happens on the land matters!

In British Columbia, the Stormwater Guidebook (2002) incorporated the research and translated science-based understanding into a road map for **science-based action** to restore watershed health.

A Road Map for Integrated Watershed Management:

The legacy of Horner and May resides in their science-based **ranking of four limiting factors**. In the course of his career in local government, Chris May has put theory into practice (*read sidebar*).

1. **Changes in Hydrology** – Greater volume and rate of surface runoff caused by increased impervious area and road network densification.
2. **Disturbance and/or Loss of Integrity of the Riparian Corridor** – Clearing and removal of natural vegetation in riparian (streamside) areas.
3. **Degradation and/or Loss of Aquatic Habitat within the Stream** – Caused by erosion and sedimentation processes, bank hardening, and removal of large organic debris; aquatic habitat degradation is a direct result of 'changes in hydrology'.
4. **Deterioration of Water Quality** - Increased fine sediment load due to more runoff volume causing channel erosion. Pollutant wash-off from land uses, deliberate and accidental waste discharges.

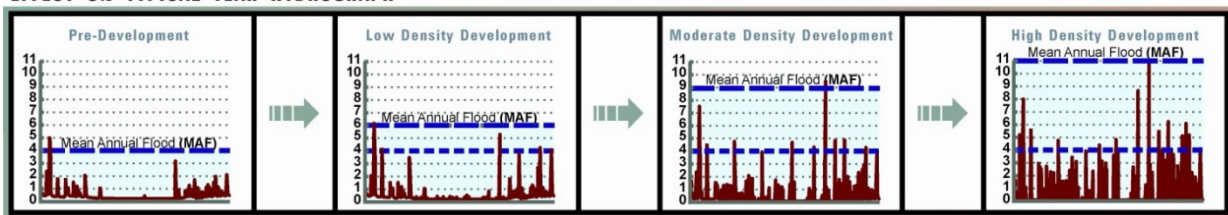
Same Rainfall, Different Runoff Pattern

Watershed protection or restoration starts with an understanding of how water gets to a stream, and how long it takes. The flow of rainwater from cloud to stream is comprised of **three water balance pathways**: surface runoff, interflow (shallow horizontal, typically less than 1 metre from the ground surface), and deep groundwater.

In coastal BC, interflow is the primary pathway in an undeveloped watershed. It typically accounts for $\frac{3}{4}$ of the annual volume that reaches a stream.

The combination of ditching and land development changes the water balance proportions. Simply put, **interflow is transformed into surface runoff**. Expressed another way: same rainfall, different runoff pattern. This is illustrated by the increasing amount of red in the image below.

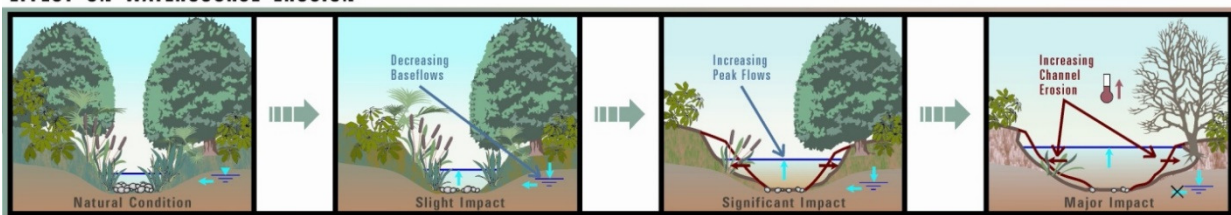
EFFECT ON TYPICAL YEAR HYDROGRAPH



Consequences of Changes to the Water Balance: The cumulative impacts on stream corridor ecology are conceptualized below. A critical parameter is the number of runoff events per year that equal or exceed the magnitude and duration of the natural channel-forming event.

On pages 8 and 9 following, two full-size images reproduced from the Guidebook illustrate the progressive changes in hydrology and resulting impacts on stream health when ditching plus land use changes alter the Water Balance.

EFFECT ON WATERCOURSE EROSION

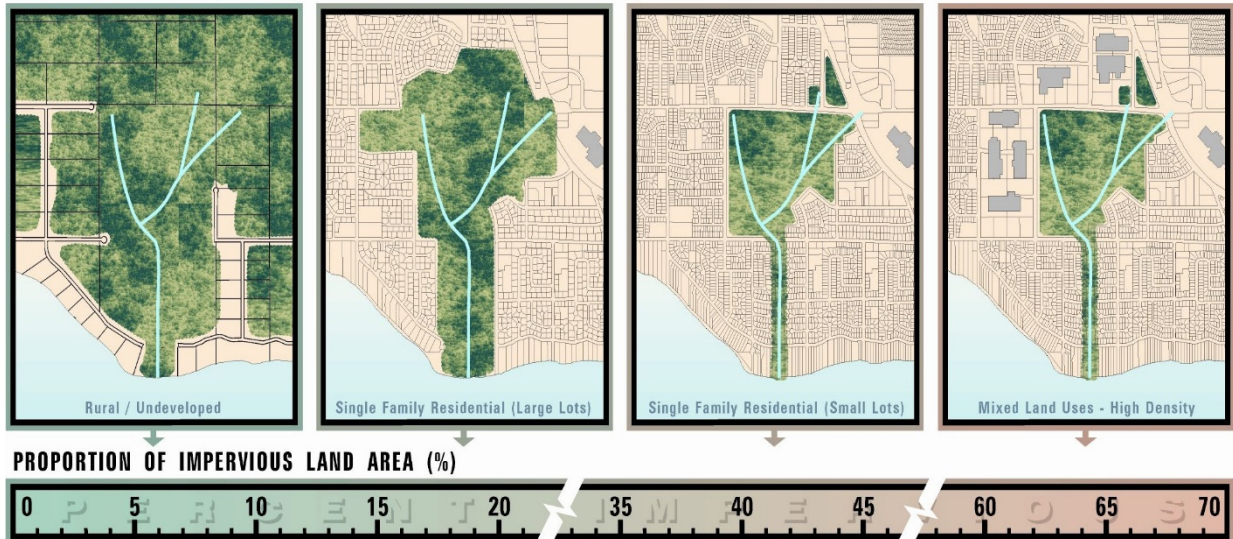


Increasing Volume + Longer Duration = More Stream Erosion + Loss of Stream Habitat

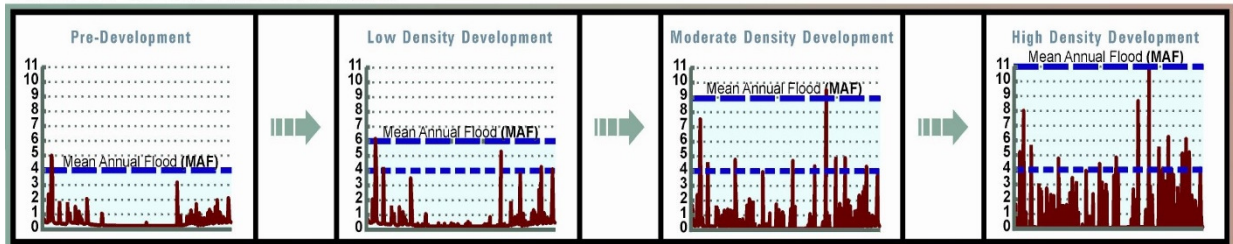
Impact of Ditching and Changes in Hydrology on Watercourse Erosion and Base Flow Relationships

When the Horner & May findings were published two decades ago, Kim Stephens and Bill Derry created communication tools (below and opposite page) to explain the research in a way that would be readily understood. A capacity-building program informed and educated multiple audiences about these universal relationships. The process was effective in creating a shared understanding of cause-and-effect. An outcome was the Guidebook (2002). The images are useful for Shelly Creek purposes.

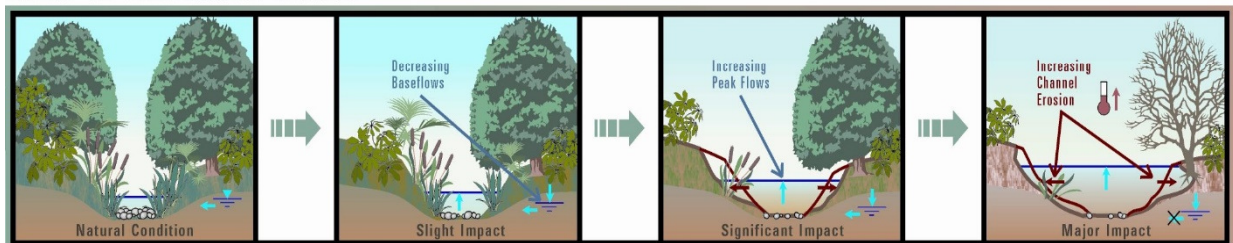
INCREASING URBANIZATION (NO BEST MANAGEMENT PRACTICES)



EFFECT ON TYPICAL YEAR HYDROGRAPH



EFFECT ON WATERCOURSE EROSION



NUMBER OF STORM EVENTS AT OR ABOVE PREDEVELOPMENT MEAN ANNUAL FLOOD



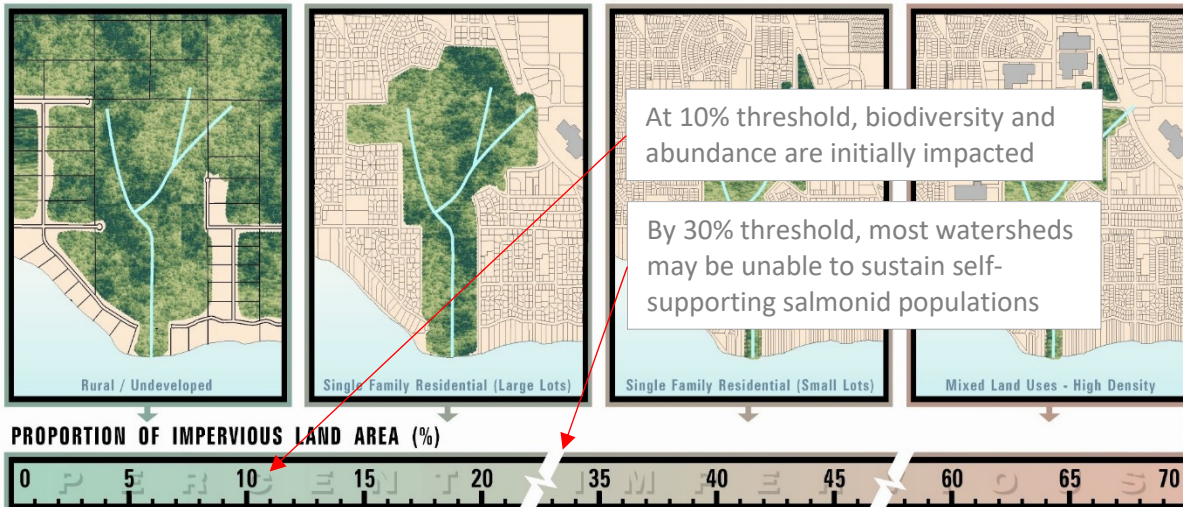
RATIO OF MEAN ANNUAL FLOOD TO WINTER BASE FLOW



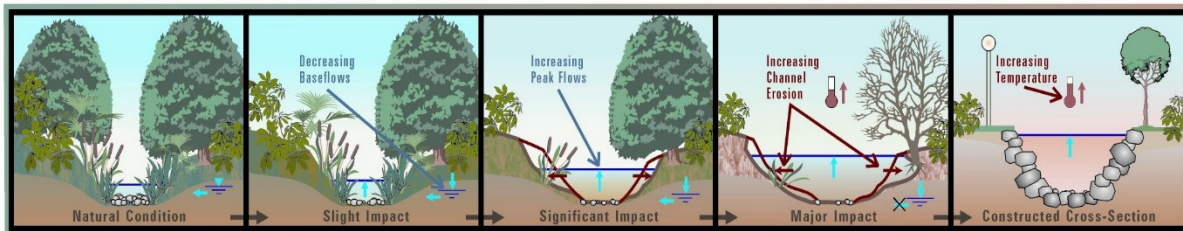
Source: Stormwater Planning: A Guidebook for British Columbia, 2002

Impact of Ditching and Changes in Hydrology on Stream Corridor Ecology

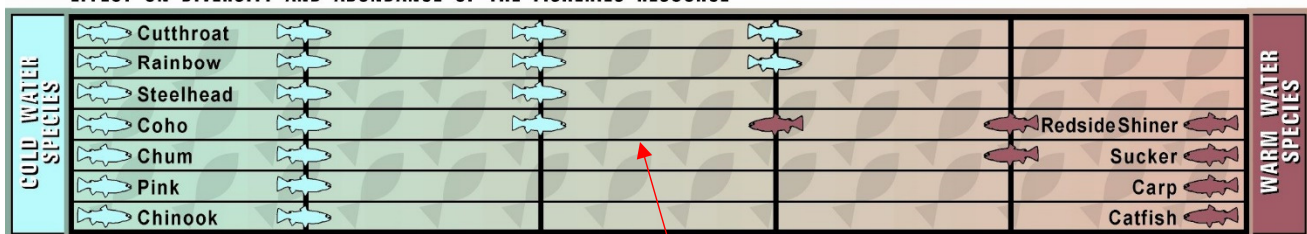
INCREASING URBANIZATION (NO BEST MANAGEMENT PRACTICES)



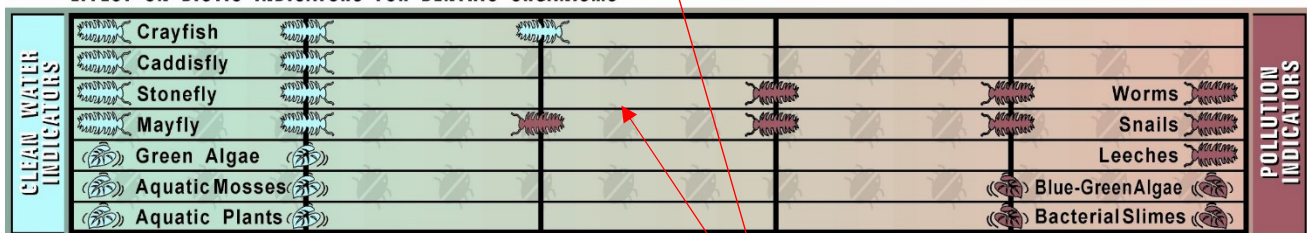
EFFECT ON WATER QUALITY AND AQUATIC HABITAT



EFFECT ON DIVERSITY AND ABUNDANCE OF THE FISHERIES RESOURCE



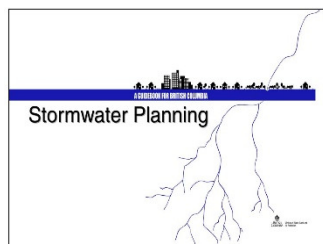
EFFECT ON BIOTIC INDICATORS FOR BENTHIC ORGANISMS



Source: Stormwater Planning: A Guidebook for British Columbia, 2002

NOTE: The "changes to the fisheries resources/benthic indicators" panels were simplified for purposes of informing & educating

SO WHAT – Shelly Creek Water Balance & Sediment Reduction Plan



“Performance targets provide the foundation for implementing common sense solutions that eliminate the source of rainwater-related problems.”

- from the Guidebook, page 6-1

Integrated Strategy for Managing the Rainfall Spectrum

Mimic the proportion of water infiltrated to groundwater under natural watershed conditions, provide interflow connectivity to the stream, and maintain or decrease potential flood risks.

Develop Performance Targets

The previous section described the consequence of changes to the water balance. **So what can be done?**

The east coast of Vancouver Island is a demonstration region for showcasing how to apply the **Water Balance Methodology** at a regional scale and then downscale water balance performance targets to the site scale. The objective is to keep the three flow paths in balance and so prevent erosion-causing flow.

The **Shelly Creek Water Balance & Sediment Reduction Plan** represents the culmination and synthesis of understanding gained through a 20-year building blocks process. The plan shows how to apply an understanding of regional hydrology and the rainfall spectrum to establish verifiable targets for site design.

Evolution of Water Balance Methodology

2002 – How to reduce runoff volume

(“Stormwater Guidebook: A Guidebook for BC”)

2007 – How to mimic flow-duration

(City of Surrey - Fergus Creek Watershed Plan)

2012 – How to sustain deep infiltration

(“Primer on Integrated Rainwater & Groundwater Mgmt”)

2013 – How to integrate performance targets

(Cowichan Valley & North Vancouver - case studies)

2014 – How to downscale targets to a site level

(“Primer on Water Balance Methodology”)

2015 – How to view water balance pathways as infrastructure assets providing services

(“Beyond the Guidebook 2015: Sustainable Watershed Systems, through Asset Management”)

2017 – How to apply water balance targets to prevent erosion and restore stream health

(“Shelly Creek Water Balance & Sediment Reduction Plan”)

Simulate Flow-Duration to validate targets:

The critical parameter is the number of hours per year of erosion-causing streamflow rates.

Erosion-causing rates occur in the range between the mean annual discharge and 2-yr flood.

*Water balance goal is to **prevent** an increase in the number of hours per year of erosion-causing rates.*

Downscale Targets to Design at the Site Level:

The Water Balance Methodology accounts for all three flow paths. Each flow path is associated with one of these three design parameters: **volume**, **area** and **flow rate**.

The objective in setting targets is to **keep the three flow paths in balance** – by not infiltrating too much, while allowing interflow to occur and to discharge the water to the stream within a season.

An easy way for drainage designers and others to visualize the application of performance targets is to consider the cross-section view for a properly designed rain garden (as illustrated below).

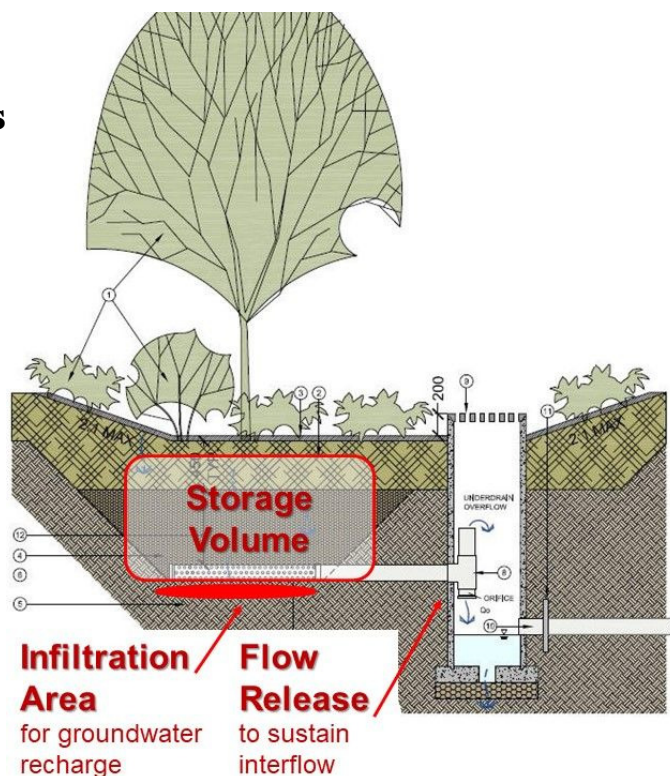
Verifiable Calculations: The Water Balance Methodology has evolved since 2002 such that it is now a **synthesis of watershed hydrology and stream dynamics**. The Water Balance Methodology provides drainage engineers with the capability to quantify impacts on watershed hydrology as well as the benefits of replicating water balance pathways.

What the Guidebook also says about Performance Targets:

“For a performance target to be implemented and effective, it must be quantifiable.

“It must also have a feedback loop so that adjustments and course corrections can be made over time.

“To be understood and accepted, a performance target needs to synthesize complexity into a single number that is simple to understand and achieve, yet is comprehensive in scope.”



Watershed Assessment

“Existing standards of practice have resulted in negative impacts.

“Continuing to use the accepted standard of practice (for) municipal engineering and land development will result in further environmental degradation of the watershed and loss of stream productivity.”

Source:

Shelly Creek Water Balance and Sediment Reduction Plan – Technical Summary, June 2017

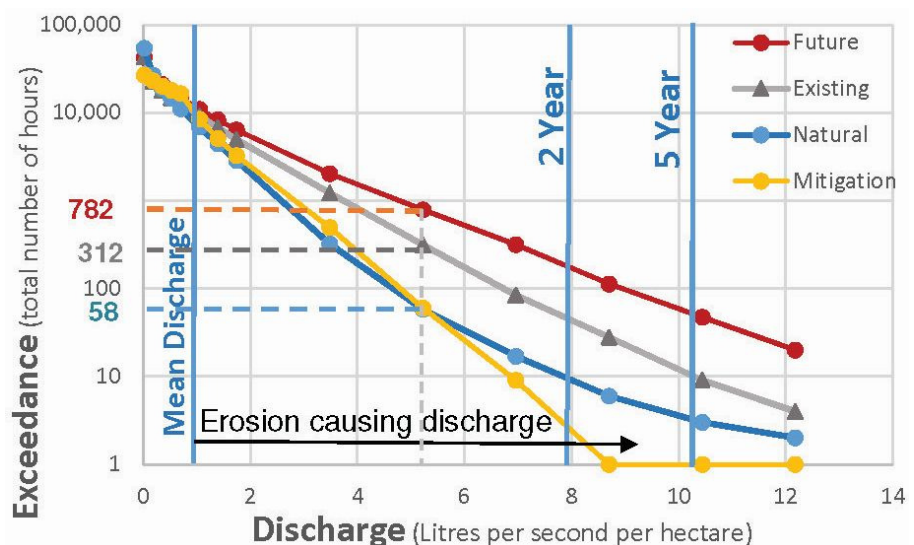
Restore Characteristic Flow-Duration

Interweaving of watershed hydrology and stream dynamics boils complexity down to this measure: **how many hours each year is the discharge larger than a specific erosion-causing flow rate.** Most stream erosion is caused by flow rates that range between the *mean annual flood* and the *2-year flood event*.

The image below presents the total picture for Shelly Creek. This shows the results of flow-duration analyses for a range of scenarios.

Under future conditions, in this application, Shelly Creek would experience a **14-fold** increase in the duration of erosion-causing discharge rates (i.e. from 58 to 782 hours as shown on the y-axis).

The table below lists the target combination necessary to restore the annual **flow-duration** characteristic of a natural watershed.



The **Retention Volume** is required to limit the flood frequency of discharges, to allow time for infiltration to ground and to provide a volume that augments low stream discharges.

The **Base Flow Release Rate** replicates interflow and is equal to the mean annual stream discharge; it allows stored volume to augment low summer flows.

The **Infiltration Area**, is the surface contact area required to achieve desired volumes of infiltration to deep groundwater and mimic pre-development water balance.

The **Detention Volume** for the 100-year event reduces the risk of downstream flooding.

Shelly Creek Targets are per hectare of impervious area	
Retention Volume cubic metres per hectare	150
Base Flow Release Rate Litres per second per hectare	1.0
Infiltration Area square metres per hectare	100
Neighbourhood Detention Volume cubic metres per hectare	100

NOW WHAT – Shared Responsibility

Look to Bowker Creek Blueprint for a precedent

The Bowker Creek story is inspirational. Community values drive the 100-Year Action Plan.

The process has gone well beyond any other drainage plan in BC to engage community, achieve consensus and galvanize local government commitment to long-term action.



Soren Henrich

Community Member,
Steering Committee,
Bowker Creek Watershed
Renewal Initiative

Outreach – A Powerful Tool

“Community celebration events draw people out and bring them together. Our experience is that the community events are the forums for engagement.”

Engage the Community

The previous section presented the Water Balance Targets that would keep the three flow paths in balance and so prevent erosion-causing flow. **Now what can the community do about it?**

Shared and Inter-Generational Responsibility: All of us have an impact on the land, on the water, and on the way things look. Restoring watershed hydrology and aquatic habitat depends on all the players embracing shared responsibility. There are solutions to be found if we **communicate, cooperate, coordinate and collaborate**. Commitment to action must be inter-generational.

A Watershed Blueprint: The *Shelly Creek Water Balance & Sediment Reduction Plan* is a starting point for ‘getting it right’. The Nanaimo region can learn from the Capital Region’s Bowker Creek Blueprint² process. Their story personifies perseverance. The community took a decade to move from awareness to action.

“MVIHES is a small group of community volunteers with limited resources. So the challenge is daunting. Yet someone has to spark a consensus in our community that: ***we must implement ‘state-of-the-art’ Rainwater Management practices ASAP, or we will lose what remains of fish values in Shelly Creek,***” states Peter Law.

“Building support for action will start with community engagement through events such as ‘beer & burger’ nights and local workshops. Much like Bowker Creek, it will require a bottom-up approach to inform, educate and inspire City and Regional District governments to implement 21st century policies for rainwater and development.

“The goal of restoring a healthy watershed with viable fish-bearing flows and habitats would take at least 50 years. Over the coming months, MVIHES will meet with owners of large land holdings about projects that could be implemented in the stream channel. Because stream channel restoration is costly and time consuming, our message will be that effectiveness depends on preventing erosion.

“We had better get busy,” concludes Peter Law.

² <http://waterbucket.ca/viw/category/convening-for-action-in-2010/2010-bowker-creek-forum/>

THEN WHAT – Whole-System, Water Balance Approach



Jim Dumont

Engineering
Applications Authority,
Partnership for Water
Sustainability in BC

“Issue #1 is widespread lack of understanding of the relationship between flow-duration and stream (watershed) health”



The New Paradigm: Watersheds as Infrastructure Assets

A watershed is an integrated system.

Three pathways by which rainfall reaches streams are “infrastructure assets”.

The pathways provide “water balance services”.

Change Engineering Standard Practice

In 2002, *Stormwater Planning: A Guidebook for British Columbia* established a new direction for drainage engineering. As the last 15 years show, it is a multi-year process to develop methodologies, tools and resources to support **the transition to science-based practice**. It **requires patience** to make the Whole-System, Water Balance Approach real to land use and infrastructure practitioners.

Legacy of Standard Practice is an Unfunded Liability:

Drainage engineering practice is based on very simple formulas and methodologies to calculate peak flow rates. Only surface runoff is considered. The other two pathways by which rainfall reaches streams are ignored.

This means that **drainage engineering practice lags behind real-world hydrology, and as a consequence streams are eroding**. Consequences are cascading - failure to protect the natural water balance creates and exacerbates risks; floods and droughts impact more often; unfunded liabilities grow over time. This legacy of ‘avoidable consequences’ has financial implications for taxpayers.

Sustainable Watershed Systems, through Asset Management:

We know what we ought to do to restore watershed hydrology; and the provincial framework is in place to support implementation of the *whole-system, water balance* approach through asset management (refer to page 15 opposite).

But, the gap between UNDERSTANDING and IMPLEMENTATION is substantial - for example, the water balance requirements in the Ministry of Transportation and Infrastructure **Design Guidelines are not being enforced**; and the City of Parkville’s **drainage criteria are not aligned** with provincial Guidebook direction.

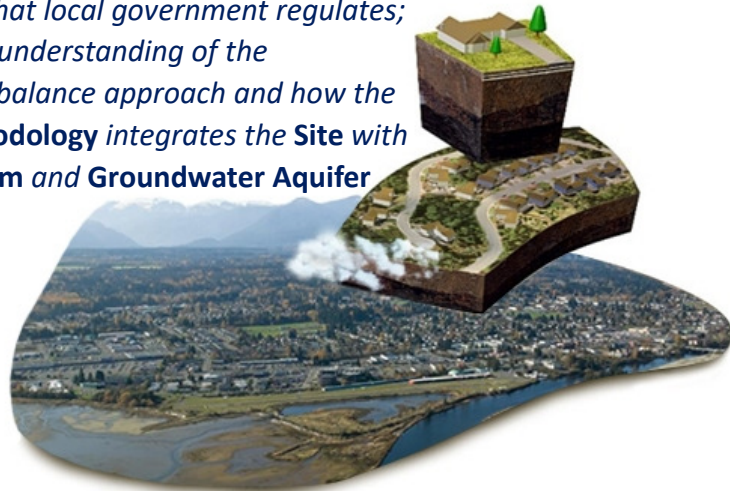
There is a capacity-building challenge: it is one thing to provide practitioners with tools; it is another matter for them to apply them. The process to change standards of practice takes time.

Looking ahead, regulatory objectives linked to *Asset Management for Sustainable Service Delivery: A BC Framework* may ultimately be the driver for transformative changes in drainage engineering practice. **The BC Framework sets a strategic direction.**

In 2017, an educational goal in British Columbia is that those involved in land use and drainage would understand the vision for.....

Sustainable Watershed Systems, through Asset Management³

*Applies to land uses that local government regulates; and is founded on an understanding of the whole-system, water balance approach and how the **Water Balance Methodology** integrates the Site with the Watershed, Stream and Groundwater Aquifer*



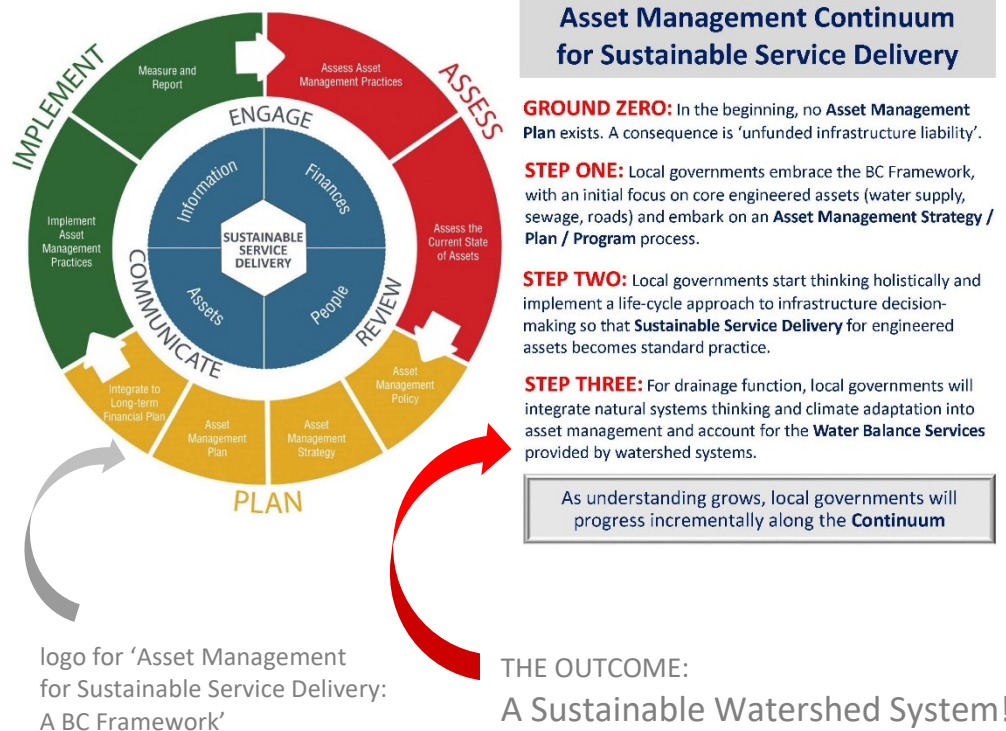
³ <http://waterbucket.ca/rm/category/sustainable-watershed-systems/>

Asset Management Continuum

Asset management for sustainable service delivery occurs alongside associated evolution in community thinking. It is a continuous quality-improvement process, and incremental.

A local government would experience the asset management process for sustainable service delivery as a continuum leading to a water-resilient future.

Sustainable Watershed Systems would be the outcome in Step Three



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