DECEMBER 2019

SITELINES

Landscape Architecture in British Columbia

Water

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Sitelines is published six times per year; February, April, June, August, October, and November by the British Columbia Society of Landscape Architects and is mailed to all BCSLA members, registered landscape architects, associates and affiliates. The editorial deadline is the 8th and advertising is the 16th day of the intervening months. Advertising rate information is available on request. Inquiries regarding editorial, advertising, or other issues should be addressed to the Sitelines Editor, c/o the BCSLA at the above address. To view the full-colour version of Sitelines, please visit www.sitelines.org.

SITELINES GROUP

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The purpose of Sitelines is to provide an open forum for the exchange of ideas and information pertaining to the profession of landscape architecture. Individual opinions expressed are those of the writers and not necessarily of those of the BCSLA.

BCSLA Sitelines Transition

Jacqueline Lowe, President

It was my pleasure to be the Guest Editor for the December 2019 Sitelines. We hope that you enjoy the articles provided by a terrific team of contributors. A special thanks to Erik S. Mustonen, Connor Redman, Donna Rodman, Daniel Roehr for sharing their thoughts. Robert Evans is the featured CSLA Fellow who has provided a terrific article about how he found and flourished in the profession of landscape architecture. Another thanks and to the loyal and generous advertisers who have supported Sitelines and BCSLA programs. Last, but not least, we appreciate Odette Hidalgo, Sitelines Graphic Artist. She has always gone the extra mile to make Sitelines a fantastic publication. We will continue to work with Odette on other projects.

The CSLA College of Fellows is one of the highest honours the Society bestows. Don Vaughan, LMBCSLA, FCSLA, FASLA, served as the CSLA Fellows Editor for the past three years. Don invited CSLA Fellows to share stories of how they found landscape architecture as a career and how they exemplify the profession. We truly appreciate the enthusiasm that Don brought to the Fellows features!

The BCSLA Imagine Sitelines volunteers are working on updates to the magazine. The new format will be in full-colour and will be published by Naylor Publications twice a year. The 2020 edition has been scheduled for mail out on April 30, 2020 and October 21, 2020.

Through the years several volunteers have served as Sitelines Editors. We are grateful to: Andrew Wilson, Cameron Murray, Laura Jean Kelly, Jane Green, Brett Hitchins, Jessica Tan, Michelle Cloghesy, Donna Chomichuk, Kathy McKee-Flaherty and Mary Chan Yip.

Thank you to Miriam Plishka,Chair; Teena Aujla, Belinda Chan, Lauren Cherzekoff, Thomas Llewellin, Sophie MacNeill, Jergus Oprsal, Jack Tupper, Don Vaughan and Celia Winters. They are the Imagine Sitelines Group who will lead the way with our new magazine in 2020. SL

In this Issue:

Image courtesy of Tyera Lentz.

Visualizing Stormwater Management

Sketch: Daniel Roehr

By Daniel Roehr, MBCSLA, Associate Professor, UBC School of Architecture and Landscape Architecture

The research on stormwater management also called Low Impact Development (LID) in North America has shown for many years that a combination of green roofs, retention areas, swales and raingardens can reduce the stormwater peak flow rates into the already overused existing stormwater drainage systems of cities. They are now standard tools to manage rain and stormwater. Peer reviewed research and a variety of modelling tools at the different stages of the design process are available for designers and engineers to use to design them. In Canada the liability of the LID tool's performance lies within the scope of a hydrological engineer. Landscape architects should never stamp or approve LID without consulting with engineers. However, in the preliminary design phase of a project it is the landscape architect's responsibility to communicate the LID tools' task, cost and different design options to the client, architect and planner to assist in creating a successful stormwater management concept at the initial design stages of a project, not as an afterthought at the end. Until now the different representational tools to communicate stormwater management capabilities to a client were with built projects, LID tool images (green roof, raingarden) and product samples and drawings and diagrams. Plan view drawings of the LID treatment train describes their location and connection to each other, while a section describes how the water is stored on a green roof or drained into the soil at grade through a swale or rain garden. Often the client involved and approving the design is overwhelmed with the information and cannot visualize a: that the different tools are assembled and function as a holistic system called stormwater treatment train and b: that water is not static but continuously flowing through these systems by gravity, downhill so to speak. This often creates confusion for clients to understand and visualize how LID functions and how the different tools are connected to each other, and how the water is flowing and draining through them. This can often lead to the decision not to employ LID in a project. It's a representational problem that can now be easily solved with digital tablet technology animating the water flow in its different stages (rain drops, stormwater sheet flow and drainage) through the LID treatment train. With current tablets (i.e. iPad) one can use traditional hand drawing techniques with a digital stylus to draw an axonometric projection black line diagram of the building and adjacent space at grade integrating the different tools (greenroof and its layers, raingarden and its layers etc.) and using a blue or any other distinct colour to visualize the rains journey. This journey starts with the rain hitting the greenroof plants, flowing through its media and being stored in it until field capacity of the media is reached, followed by overflow water running down a down spout into a partially pervious swale to drain into the soil while the rest of the water flows into a retention area etc. This drawing process can be immediately animated by pushing the camera/record button during drawing. To animate the different LID tools storage times one can, fill the different tools drawn with the blue colour before it continues further. If one is not comfortable to do the whole drawing with the record button one can draw the LID tool in axonometric projection first, save it and then animate only the waterflow. This is a very effective way to visualize step by step a complex stormwater management system. Hand drawing today is still a very effective and fast tool. With a digital tablet, diagrams can be animated to explain, much more rigorously, complex processes which have always existed in landscape architecture. This representational tool is much faster than modelling which needs a computer and much more time to compute the base drawing, hence more expensive, especially in the preliminary design process. Also, in a meeting the tablet can act as tracing paper and can immediately be projected on a large screen for everyone to interact with. Hand drawing is as important as it has always been in design education and practice, except the tracing paper has been replaced by a powerful computer tablet and the pen by a digital stylus, but the hand drawing movement skills and cognitive interaction between brain and hand are the same, only the touch of the stylus on glass instead of a rough paper surface may need some time to get used to. However, there is good news as some recent tablets have a surface paper like roughness or rough plastic film which can be applied to recreate the paper surface feeling. SL

SEE BLOG

http://blogs.ubc.ca/greenskinslab/ and LID animations by greenskinslab:

https://youtu.be/OqlsL1USjRo

https://youtu.be/7PKz6QdPDxI

Catch and Release

Connor Redman, M.L.Arch, BCSLA Intern

By [illegible], PhD, Associate Professor
UBC School of Architecture and Landscape Architecture

I am a fly fisherman. I am also a local landscape designer beginning what I hope to become a long career in landscape architecture here in the Pacific Northwest. Now I, like many other fishermen, tend to find parallels between fishing and life in general. Maybe that's why I like the activity so much. It simplifies otherwise complicated situations and allows me to take the time to think. Fishermen are also famous for telling stories. Fishermen use storytelling to share experiences, get a laugh, and occasionally even speak a bit of truth. But most of the time, the stories shared are to provide something to think about while spending endless hours waiting for a fish. So if you've never heard the one about a fisherman, landscape designer, and sea-level rise, here it is.

Since the 1980's the technique of catch and release fishing has drastically risen in popularity for recreational fisherman like myself. Unlike the saying, "there are plenty of fish", population numbers would say otherwise. The idea behind catch and release fishing is in order to maintain healthy fish populations, some fish need to be returned to continue to grow and spawn. My grandparents often question my sanity when I tell them of a recent catch, asking me "how could you let a fish that nice go?!". I usually tell them, "we aren't allowed to keep fish anymore", but the truth is I often can. I release them not because I don't like to eat fish, I do, but the reality is that I don't require fish to survive while the local wildlife does. And for the non-fishermen that find the act cruel, you're not entirely ►

All photos Tyera Lentz

wrong. Although the majority of fish that are released successfully carry on to live their life and spawn with a new scar, some are unfortunately fatally injured. But the fact is, fishing has significant cultural and recreational value for many people as well as an important industry in the local economy. Banning fishing is an unlikely solution and keeping every fish is worse. Therefore, practicing catch and release fishing is the only way for the increasing number of recreational fisherman to continue to do so, while at the same time enabling a wild fish population to thrive for generations to come.

So what does this have to do with landscape architecture and sea-level rise? Surprisingly, quite a bit. Let me explain in only a way that a fisherman could do, or attempt to do as fishermen are better known for, how this all relates. Sea level rise is happening. And it tends to be doing so at an ever-increasing rate. A recently published paper by Kulp and Strauss in the Nature Communications journal suggests, as with most previously published papers before it, that we have once again underestimated the rate of sea-level rise. I am not going to get into the intricacies of local sea-level rise variations, predictions, and causes as I am certainly not qualified to do so. I will, however, take the stance that sea-level rise is and will continue to be, one of the most significant forces to impact coastal communities for the foreseeable future, and for the unforeseeable future after that. If you look at the Projection of Global Sea Level Rise produced by the BC Ministry of Environment you will notice that in the year 2100 we will need to plan for a meter of sea-level rise, and then another meter by 2200, and then another meter, and another, and the chart ends and the projections continue to rise. So what should we do about this?

As landscape architects, planners, engineers, and all other members of coastal communities, we have an enormous decision to make. I do not doubt that we can engineer a solution as engineers are incredible at solving problems. Similarly planners could provide a solution, as could landscape architects. But what would these solutions look like? What would a collaborative solution look like? And most importantly, I think we should be asking what would an ideal solution look like? Is it a four-meter wall of concrete and steel? or is it a public waterfront? Agricultural land? Golf course? There are many professionals that can and should, be engaged in providing input into the future design of coastal waterfronts… but what about fishermen? what would a fisherman do?

Take a look at the Climate Risk Screening Tool provided online by Climate Central. What you will see is large areas of land that will be at risk for annual flooding by the year 2050, land that will require significant dike protection, elevation raising, and continual infrastructural improvements. Interestingly, you will also see a map that almost perfectly matches the limits of historic flood plains. The same red that highlights the risk of flooding also highlights land that was once marshland, riparian forests, and expanses of estuarial habitat; the same estuary habitat that is so essential to marine species that they are referred to by many as the nurseries of the ocean. This land that once held some of the most biodiverse conditions on our planet, was mistaken for waste marshland and infilled for human use. Now, less than two centuries after being filled, they have once again become land at the highest risk of flooding. So at a time when our planet is losing huge proportions of biodiversity, fish species included, perhaps then there is something to be learned from a fisherman. Perhaps the best thing we can do to this land that we have captured… is to release it.

Like the predicament a fisherman faces after landing a trophy trout, this is easier said than done. If we catch a large fish no one wants to give it back. We want to keep it, hang it on the wall, and protect it as our own. But after the rush of the catch and perhaps a photo or two, reality sets in and releasing is what we

ought to do. By releasing the land from residential development, it can be reused for other purposes that reduce the risk for landowners. Sure the land has been damaged in the process of development but there is life remaining that will recover and regenerate over time. And although we enjoy the waterfront, we don't need to live on it to survive. Other species do. This expanse of land will require the expertise of landscape architects, planners, engineers, biologists, and so many more to restore and re-imagine. In doing so, there is the potential to provide opportunities that do not increase the associated risks of flooding to human life and infrastructure but instead serve to increase the value for non-human species and indirectly, humans as well. So although we can't just move all coastal communities, there is plenty of land outside of flood-prone habitat that can be developed or further densified while existing at-risk developed land, or land set for development, can be strategically re-zoned. If we want to be able to enjoy our coastline for our lifetime and generations to come, perhaps we need to learn a lesson from fishermen and consider practicing catch and release. SL

LID Demystified

Daniel Roehr, MBCSLA, Associate Professor UBC School of Architecture and Landscape Architecture

The International Erosion Control Association (IECA) Conference, Vancouver, APRIL 2019

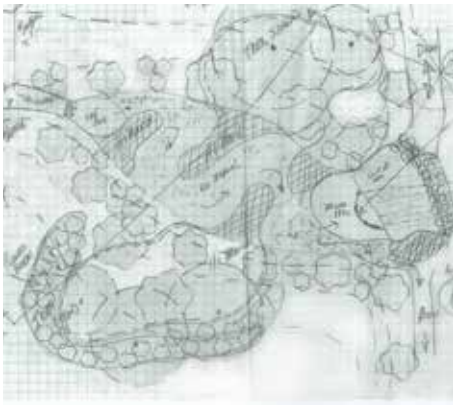
On April 8th, 2019 the International Erosion Control Association (IECA) Conference took place in Vancouver with the title 'Protecting Soil and Water Resources'. This event focused on water quality and Low Impact Development (LID) and was an eye-opener for everyone present. Established speakers in the field such as Dr. Hanspeter Schreier UBC and Jay Michels EOR, US and myself where advocating for LID. The city was host and the venue took place very appropriately in the community center in the Olympic village, with view towards False Creek and the North Shore mountains. The audience were mostly civil and hydrological engineers, planners and city staff. About 100 participants took part. What was evident right away was the enthusiastic atmosphere for the topic, by the speakers and audience. It was clear everyone in the room, was on board with the stormwater issues addressed. LID however, is not a new field, but what was apparent and new was the enthusiastic engagement by Vancouver city staff to lead the implementation of LID. Recently, for example, monitoring stations were created alongside swales on Quebec Street measuring stormwater and water quality performance.

After the presentations we took part in organized tours through the Olympic Village explaining the stormwater management visions, that designers and city staff addressed when the Olympic Village was built, and also whether 10 years after implementation of the LID strategies such as living roofs, stormwater recycling were accepted or not. For example, apartment renters and owners noted that many roofs were not accessible because of the 'extensive' living roofs covering most roofs, allowing for no socializing. City staff had to inform the owners and renters, after renting or buying, that many roofs are not useable. Another issue for the inhabitants was the yellow/brown colour in the toilet water, due to the leaching of organic acids in living roof substrates during stormwater collection of grey water used for toilet flushing. In this case the city addressed the issue with additional water filters and the owners and renters had to be informed about the brown colour. Retrofitting stormwater collection cisterns with filters for the water to appear clear, defeats the purpose as those filters are expensive to buy and maintain. If the renter and owner is informed beforehand that the development has LID measures in place their acceptance might be easier than surprising them after the fact. Even though the water is yellow/brown in colour it's clean, it's a perceptional issue which needs to be addressed through explanation about LID.

Those observations made by the city are very important for future projects in BC and should now be addressed in all future development at the planning permission stage and when selling and renting apartments.

Therefore, LID planning permission guidelines should now be ammended on how LID is planned and addressed to future building owners and renters in the city with those examples mentioned above in mind. It is better to be proactive and inform the client beforehand then reactive in planning to avoid unnecessary environmentally destructive costly retrofits and explanations later. SL

Image right: Donna Rodman, MacDonald Slough



WHERE THE WATER IS, the plants will follow.

Donna Rodman, MBCSLA, CSLA, Dipl. Nursing, B.A., CTech, M.L.A.

"Fear and doubt are the feelings you have to face to experience the incredible"

Adam Kreek, Management Consultant, Olympian, Expert in High Performance

A vast range of environmental conditions lies between the extremes found in the Earth's landscapes and there is no imagery more powerful than those telling pictures from the International Space Station. As a species dependent on fresh air and fresh water, we are rapidly passing a condition where fear and doubt will be replaced with determination and certainty, forcing us to adapt to extreme environmental conditions. We can live only within a certain range of environmental conditions. The landscapes we perceive today reflect the long geologic history of region as well as recent events such as floods, fires, and human-caused environmental disturbances such as deforestation, dams, pollution, introduction of exotic species. Ecosystem boundaries are permeable and aquatic plants will be impacted by sea level changes, inundated for longer periods of time, or suffer in drought conditions. After examining over nine authored books, ten on line articles, and spoken with several experts in climate change biology and geography, there are very few facts that help to predict future trends in the adaptation of plants. The end goal posts keep shifting influenced by evolution; physiological and behavioural adaptations; dispersal mechanisms; competition between species; ecological succession; climate change; gravity, and direct/indirect impact of humans. However, landscape architects can be at the forefront of discussions, and the conserving, the restoring, the planning and the designing of aquatic ecosystems.

Aquatic plants are our natural biofiltration system (lungs, liver and kidneys) with membranes and structures that work as barriers, storage for carbon, channels for conveyance and exchanges of gases. The problem with aquatic plants is their vulnerability if their environment is dramatically changed through a catastrophic event or rapid climate change. They fail due to dramatic temperature changes that hamper gas exchanges or the restriction of uptake of 'good' nutrient material and clean water. Aquatic plants do not have the time to adapt to immediate changes in their growing environments and they can't move quickly out of the way. They become prone to not regulating their plant physiological functions and systemic immunities, and resort to sending off defense signals in their ecological community, reducing seed production, or flowering. Plant 'signaling' is picked up by insects, microbes, and pests in a biochemical exchange, and the plant can't develop quick resistance to pathogens, parasites, nor initiate new symbiosis relationships with insects, pests, microbes. There are two responses: acclimation (the temporary adjustment within a generation) and adaptation (permanent modification over generations) to survive and evolve further.

Adaptability Depends on Timing: A quick response leads to restricted damage of host tissue by the plant attempting to render the pathogen incompatible. A delayed response may favor an invader to grow progressively within the host tissue pushing defense responses and rendering it semi-compatible, disrupting cellular and metabolic functions and even the DNA of plant reproductive processes. A lack of time for an appropriate response and signalling (change in temperature, inundation or sudden chemical immersion) allows an aggressive pathogen or harmful molecular chemical to completely indispose the plant to total failure against invasion and the die off of the plant and/or the entire plant colony.

Adaptability Depends on Opportunity to Migrate: Modeling in wetland restoration and adaptive management can determine plant migration as their habitats change and water supplies fluctuate. Integrated groundwater and surface water modeling of watersheds is important in wetland restoration and management process and ultimately can be used to design a wetland more resilient to climate change. Landscape architects and their scientific colleagues, can shift from applying two-dimensional event-based models, which cannot accurately simulate the complex behavior of the system, to multi-dimensional models. "Historical' modeling will be needed in species recovery to determine what plants were there, what plants can be there today, and what plants can we bring back through climax planting.

Plant Geography Modelling is Useful:

Plant Geography is the science of area applied to plants. Its first task is to establish the distribution of plant taxa in geographically defined areas, and its second is to interpret the origins and present status of these areas. However, the real work of plant inventory happens at the ground level and there are 4 stages to develop a model:

1 stage: The collection, identification and recording of plants in the field. This is performed rigorously.

2 stage: Mapping of plant distributions.

3 stage: Classification of the plant distributions mapped into recognizable patterns or groupings – ecological, historical, migrational, geographical or biogeographical.

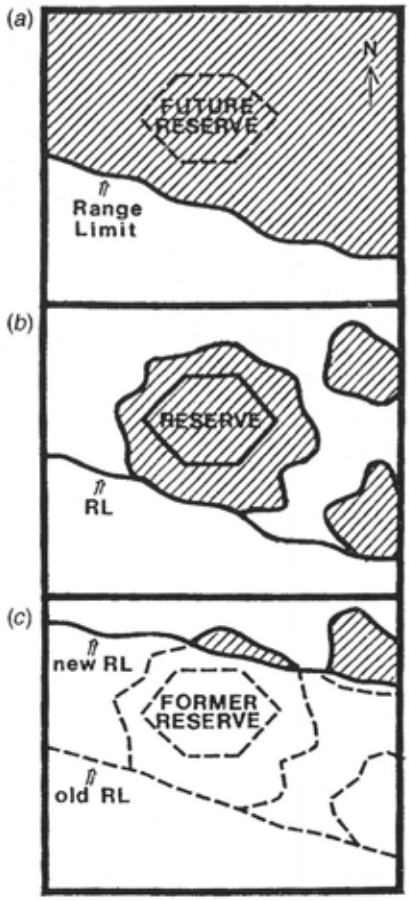
4 stage: Generation and testing of theories to explain the types of distribution that have been discovered and described in the first three stages, this also involves interpreting the origins and present status of the plant taxa.

Opportunity to Migrate Depends on Human Impacts and Environmental Conditions:

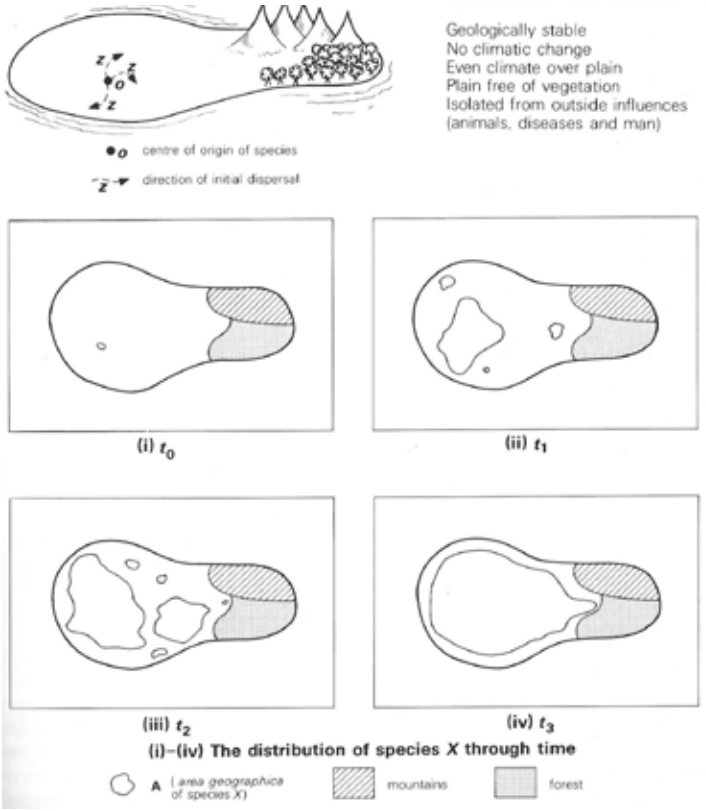
We must consider the influence of unnaturalized fragmentation created by human cultivation and the development of land. Plants and animals have learned and evolved to live in patchy environments, so long as there is also a means to migrate to another area, to develop a new patch.

Biogeography can be used to determine whether existing protective networks for biodiversity will provide for the needs of species who are water dependent, whose distributions are changing.

Existing models of climate change indicate that the protected natural areas of the world will be inadequate to cope with altitudinal or latitudinal shifts in species. In theory, protected natural areas can become ineffective for conserving the species which they were originally established to protect. Image far right illustrates how a protected natural area may be affected by climate change and human development in their habitats. ►



The hatching indicates (a) range limit of species before human habitation or climate change, (b) fragmented species distribution after human habitation but before climate change, and (c) species distribution after human habitation and climate change. This is a paradox when humans impact policies created to conserve land areas for biological diversity. Spellerberg and Sawyer (1999)



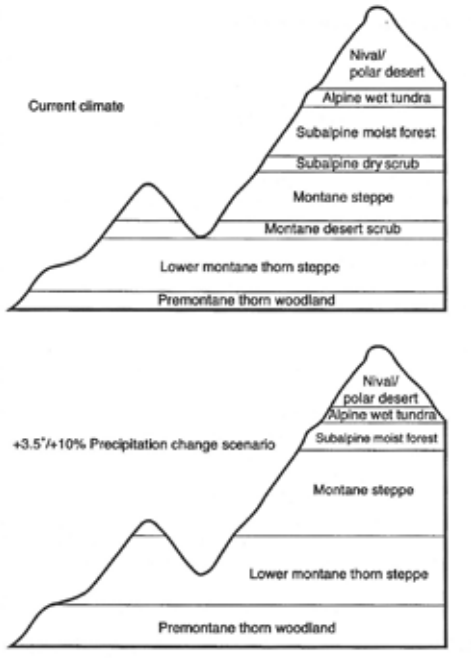
Sample of basic mapping:

Imagine an isolated island, free of climate change issues, unpeopled, stable geology, climate, a plain ecology.

Species x is a true, native species that starts at o = centre of origin, z = direction of initial dispersal, and then time takes place as the original species spreads.

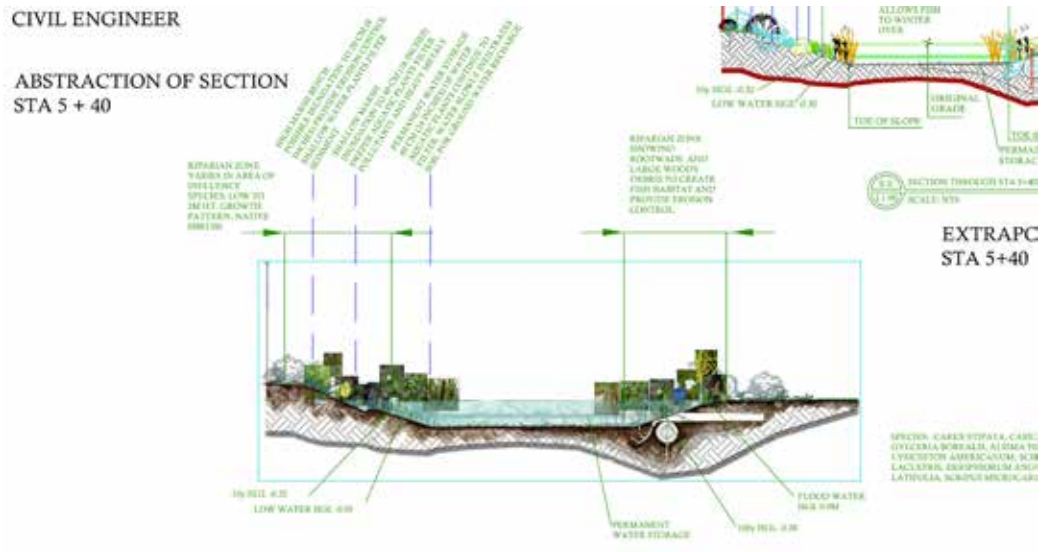
Source: Stott (1981)

The image below illustrates the shift in altitudinal locations of plants as well as the sizeable change in areas of influence depending on snow pack, water supply, and precipitation as plants migrate upward toward cooler temperatures. We may see the development of upper elevation zones dominated by grasses which typically are located in drier, arid vegetation zones. These upper elevation zones will infringe on the alpine ecosystems. The postglacial fossil records show us that plants show individualistic species adaptation and it is often unpredictable where they will re-establish their growing niche. As we witness the decline in the snow pack and possibly the increase in storage of ground water in pockets of glacial rock fields and at the toes of moraines, overtime small wetland pockets will appear at higher elevations to support wetland plant migration. However, the demise of the lower elevation wetlands will result in muddied and silted wetlands, or completely flooded habitats, displacing both native flora and fauna.

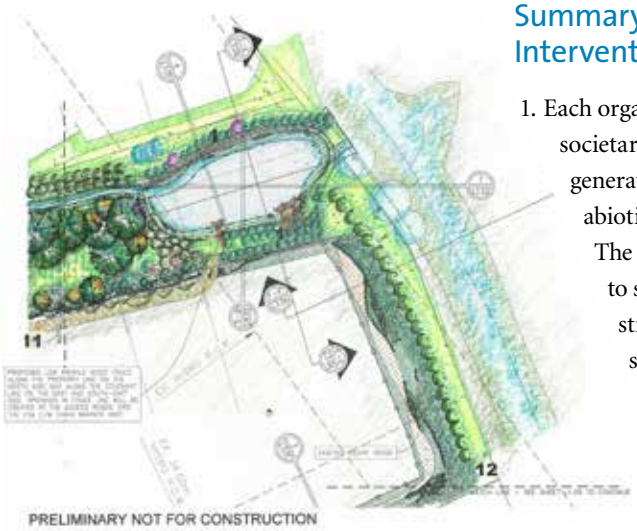


Spellerberg and Sawyer (1999)

Where the Water is the Plants will Follow: Modeling will require integrating surface and groundwater characteristics using land use, topography, hydrological and ecological data. An aquatic plant is normally found in nature growing in association with free-standing water. It may be free-floating upon the water, completely submerged, or partially submerged. It must have a definite association with water at 'normal'. Many aquatics respond to the high quantities of nutrients in polluted water through greatly increased growth. They provide an alternative to more expensive, conventional means of water purification. Toxic industrial pollutants, e.g., heavy metals, may also be extracted from water by plants. The images below are examples of one of the author's commercial/industrial project sites in Richmond, B.C. where: 1. identification of the invasive species in the MacDonald Slough was required; 2. an analysis with a hydrologist of the flood values for 5, 10 and 50 year flooding took place; 3. followed by the prescription of plant selections for aquatic species in a climax planting plan, on high and low marsh benches; 4. a fish riffle was positioned into the slough to prevent fish from travelling too far into the slough and there be stranded as the slough dried up; and 5. a micro-pool was required at the lower elevation of the slough to insure at least 1 metre of water depth was retained allowing fish to rest before dumping into ditches. The ditches were filled by pumping stations that mitigated flooding and indirectly maintained wildlife habitat in the developed area surrounding the slough.



AutoCAD and Rendered Images: Donna Rodman, BCSLA, CSLA, MacDonald Slough, Richmond, B.C.



Summary of Possibilities and Interventions:

1. Each organism is in a genealogical and societary hierarchy and can adapt over generations to evolving biotic and abiotic environmental circumstances. The future is possibly in gene-tailoring to select new plant colonies for a stressed environmental circumstance in order to restore that habitat and to stabilize it.

2. Aquatic plant species will not have time to adapt and evolve to match the rapid progression of climate change forces. Loss of populations will likely be sudden rather than gradual, precipitated by climatic extremes. This suddenness will lead to impoverishment of local and regional floras before the re-establishment of new species can occur

3. Protected areas are essential but protected areas alone are not enough. They will only succeed in attaining their conservation goals and results if management of the surrounding land and infrastructure is compatible with those objectives.

4. Modeling and Monitoring are critical. Developing modelling techniques in landscape architecture to provide data to other professionals as well as predict migration directions of aquatic plants in following the water; would be beneficial. If we could manage our approach to planning and design by scientifically accessing fragility of an ecosystem, its potential for recovery in aquatic environments, fresh water and marine, before there is impact of development, we would further ahead.

5. Plant Species Prescriptions must be rigorously founded on scientific principles toward enhancing biodiversity, conservation, and symbiotic relationships especially in the molecular combinations created by the work of aquatic plants. A precautionary approach principle, allowing for climax species to be mixed with other less robust planting selections may increase biodiversity and enhance chemical exchanges. The bio symbiosis between aquatic plants and aquatic micro-organisms, the beneficial or harmful pathogens and insects present in the habitat must be addressed in planting plans. Creating climax planting plans may be the new norm so that the new plants can establish quickly as mature installations, allowing the smaller, younger plants growing under their canopies as juvenile plants (sprouts, rooted) to mutate or develop new survival responses.

6. Plant species prescriptions may require information included that analyzes biochemical functions. We not only will be specifying quantities and size of plants, but listing the molecular work of the plant, a biodiversity factor for effectiveness in improving a local habitat or specific habitat zone, and a human health variable with respect to the quality of water projected as a result if that particular plant is installed.

7. Pervasive human disturbance has uncoupled ecological processes yet life systems are quite intelligent to incorporate the temporary adjustment within a generation and permanent modification over generations. Under hostile conditions living systems struggle and compete. The evolution of changes in plant physiology and thereby the process of photosynthesis may open a new frontier of research in the stabilization of plants while they adapt. We must identify those new frontiers earlier than later, and start implementing changes in our planning and designs now.

8. Multidisciplinary, multi-cultural approach to prescribing plant materials for ecosystems are required, reasonable and realistic expectations for any project addressing water and the water's planting edge.

9. To evaluate, plan and design for aquatic plant species, Canada needs to develop policies for a protective network of agencies and professional groups to be guardians and stewards in biodiversity conservation. Creating new protected area networks, that are locally initiated, to conserve a region's biological diversity, monitor the effects of climate change on species distributions and feeds data into accessible data/information gathering repositories are keys. In addition, soil mapping and dispersal patterns can be overlapped into visual displays of quantitative information to predict possible directions of migration in order to curb intensive development in aquatic habitat zones and ecologically sensitive areas such as Riparian Management Areas, wetlands (constructed or natural), estuaries, and pools behind dykes.

Conclusion

The major ecological consequences that we may expect by 2025 for wetlands systems will be manifest as 'distress syndrome', indicated by reduced biodiversity, altered primary and secondary productivity, reduced nutrient cycling, increased prevalence of diseases, increased dominance of invaders and a predominance of shorter-lived opportunistic species. As landscape architects we can approach ecosystem sustainability through the prevention or reduction of additional stress that can reduce the ability of wetlands to respond to swings in climate change. By prescribing plants through a climax planting plan, maintaining hydrology, designing marsh benches for various levels of inundation, controlling introduction of exotic vegetation, and protecting wetland biological diversity and integrity, we can develop and begin a program of ecological gradient conservation focused on climatic and hydrological data so that species can disperse if their habitat is stressed or destroyed. We may have to manage a reduced carrying capacity based upon stresses and modify what we can restore by how much water we think will be available. The competition between man and wetland ecosystems will become elevated and is already political. We can't just look at reserving small parcels, we must assume that all of the provincial area must have a conservation strategy. SL

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LIVING CREATIVELY WITH
Water in Singapore

Erik S. Mustonen, MBCSLA

The Republic of Singapore https://en.wikipedia.org/wiki/Singapore is a multi-ethnic Chinese, Malay and Indian (mainly Tamil), island city-state on the equator, south of the Malay Peninsula. It has a population of 5.61 million (June 2017) https://www.singstat.gov.sg/ on 700 square kilometers (270 square miles.)

Located on the equator, it is exposed to monsoons. The annual average rainfall is 2,166 mm with a monthly peak of 250 mm from November through January, and 150 to 200 mm per month for the rest of the year. There is no month without abundant rainfall, and intense downpours are common.

Traditionally, such countries have turned to engineering solutions to cope with the huge amounts of rainfall. This also had been the case in Singapore, but beginning in the late 1980s, the Singapore government began exploring ways to naturalise waterways to incorporate more greenery into the city. In the decades that followed, this converged with growing interest in nature conservation. There is also a concern for the fact that Singapore needs to collect its rainfall, keep it clean and direct it to reservoirs that provide most of the city-state's potable water. Almost 40% of its fresh water is now imported from Malaysia across a causeway under contracts that expire in 2061.

In Singapore's "guided democracy," centralised planning has political and social support. This made it possible in 2001, for various departments to be amalgamated to create the Public Utilities Board (PUB), a national water authority overseeing water, drainage and sewage. Also, the Urban Redevelopment Authority developed the Parks and Waterbodies Plan in 2002, as part of a review of the statutory land-use master plan for Singapore. In a further development, reservoirs were opened for water sports and other recreational activities in 2004. The success of these initiatives led PUB to create the "ABC (Attractive, Beautiful, Clean) Waters Programme" in 2006.[1]

Elements of the ABC vision included:

- Active: Creating new recreational and community spaces while bringing people closer to water.
- Beautiful: Transforming concrete waterways into vibrant and picturesque waterscapes that are well integrated with the urban environment.
- Clean: Improving water quality through holistic management of our water resources and public education by fostering better people-water relationships.

Implementation of the ABC Waters Programme required a master plan to coordinate the multiple agencies involved. The master plan divided Singapore into three catchments: Western (mainly industrial), Central (commercial) and Eastern (residential.) It identified about 100 projects to be developed in phases, by 2030 for water-related infrastructure including waterways, reservoirs, and restored wetlands.

At the same time, the Housing Development Board (HDB), which is responsible for 80% of the residential units in Singapore, began requiring ABC Waters low impact design approaches on its projects – primarily housing

Facing page: Vegetated swale

Top Left: Development along Punggol Waterway, Singapore's first man-made waterway connecting two reservoirs

The land of the "crazy, rich Asians" has not only implemented a comprehensive, multidisciplinary approach to stormwater management, they have embraced a vision for living creatively with water.

Top right: Swale – hard surfaced

Bottom: Soakaway as a lawn with seating

All images: Erik Mustonen, MBCSLA

estates and new towns. Private developers were also incentivised to also comply through the PUB's ABC Waters Certification Scheme and the Building and Construction Authority's Green Mark Scheme.

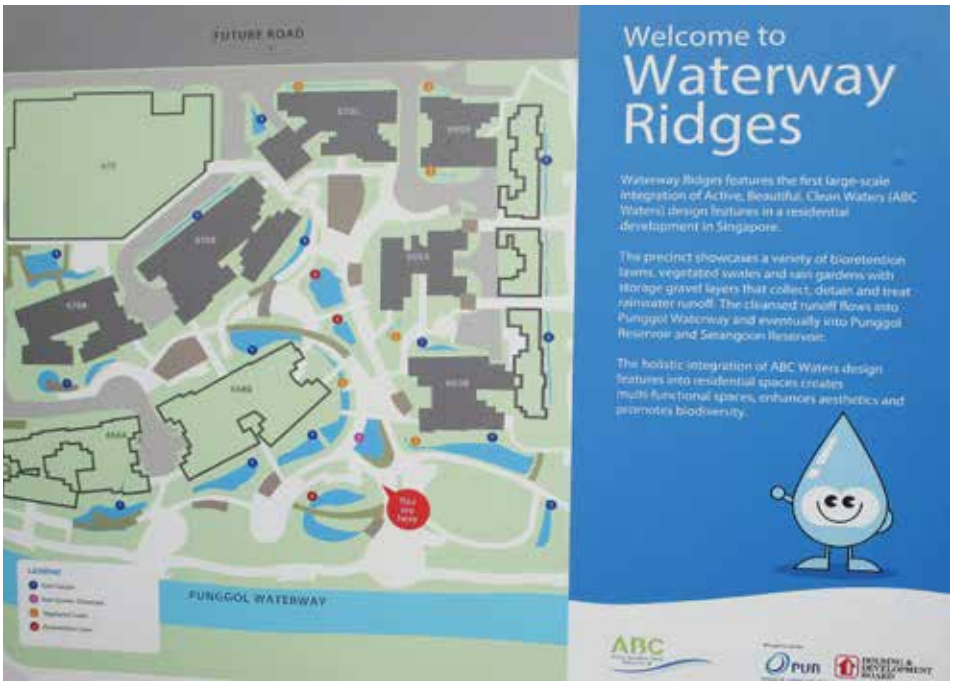
To assist with the technical implementation of ABC Waters, PUB published the *ABC Waters Design Guidelines* handbook[2] in 2009 (currently in 4th Edition, 2018.)

In 2011, PUB also collaborated with the Institution [Ed. note: not "Institute"] of Engineers Singapore, the Singapore Institute of Landscape Architects, Singapore Institute of Architects, HDB, Land Transport Authority and National Parks, to produce the ABC Waters Professional Programme to accredit design and planning professionals.

The Housing and Development Board created the *HDB Landscape Guide*[3] for residential projects. In Chapter 7 – Water Sensitive Urban Design, it states the vision as, "HDB actively initiates the adoption of Water Sensitive Urban Design (WSUD) approaches that are suitable for residential developments. This is to enhance the quality of living environments in HDB estates."

It promotes the adoption of ABC Waters techniques including:

- Landscape soakaway
- Water retention basin
- Swale and vegetated swale
- Bioretention swale and
- Bioretention basin. ►



Waterway Ridges plan promoting the Active, Beautiful, Clean Waters (ABC Waters) concept (ABCSign_ErikMustonen)

As explained in the sign, "the precinct showcases a variety of bioretention lawns, vegetated swales and rain gardens with storage gravel layers that collect, detain and treat rainwater runoff. The cleansed runoff flows into Punggol Waterway and eventually into the Punggol Reservoir and Serangoon Reservoir. The holistic integration of ABC Waters design features into residential spaces creates multi-functional spaces, enhances aesthetics and promotes biodiversity."

The Guide advises that to select appropriate techniques for the site conditions and treatment targets:

- **Know the source of runoff/inflow and the estimated amount of water:**
  - Identify the catchment area.
  - Compute the peak runoff by the Rational Method.
  - Check the accuracy of the calculation to avoid flooding and to confirm the design approach.
  - As a rule of thumb, allow 4 to 7% as a preliminary estimate of space for WUSD.
- **Design according to the pollutant level:**
  - Target to treat runoff from impermeable areas where pollutant level is higher (in HDB estates this is generally from driveways and paved areas.)
  - Runoff from landscaped areas is generally low, so less treatment is needed.
- **Balance the space required for WSUD elements and usable community space.**
- **Plan the flow path to meet the required invert level:**
  - Subsoil discharge level is restricted by the outlet drain level.
  - Preferably, have inflows from surface runoff instead of from intercepted drains.
- **Keep the WSUD features close to the source of the inflow:**
  - Minimise conveying runoff for longer distances as it results in greater level changes to achieve required fall.
  - Keep treatment areas close to the water source to reduce flow level.
- **Work with ABC Waters Professionals and a team of interdisciplinary professionals including:**
  - Landscape architects, architects, hydraulic engineers, civil engineers, soil engineers and horticulturalists.
- **Visually integrate exposed engineering elements with landscape architectural treatment.**

PUB has also introduced programs to involve local communities, schools and residents to inform people about Singapore's water assets and engage them in stewardship efforts.

Waterway Ridges

Waterway Ridges is one of the HDB estates prominently utilizing ABC Waters design principles and techniques. Envisioned as the "Venice of Singapore," it features waterfront living along the Punggol Waterway, the first artificial waterway in Singapore connecting two reservoirs.

As explained in the sign, "the precinct showcases a variety of bioretention lawns, vegetated swales and rain gardens with storage gravel layers that collect, detain and treat rainwater runoff. The cleansed runoff flows into Punggol Waterway and eventually into the Punggol Reservoir and Serangoon Reservoir. The holistic integration of ABC Waters design features into residential spaces creates multi-functional spaces, enhances aesthetics and promotes biodiversity." SL

FOOTNOTES:

1. Evaluation of Singapore's ABC Waters Programme, Conference Paper at the 4th International Perspective on Water Resources and the Environment, Singapore, November 2011.

2. Public Utilities Board, PUB Active, Beautiful. Clean Waters, Design Guidelines, 4th Edition, Singapore ,11 July 2018

https://www.pub.gov.sg/Documents/ABC_Waters_Design_Guidelines.pdf

3. Development and Procurement Group, Housing and Development Board, Singapore, 2013

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CSLA Fellow

PROFILE OF

Robert Evans

FCSLA, MBCSLA, MCIP, RPP

T Bay Eh?

Growing up in Thunder Bay, Ontario, the local career choices where limited at best. Joining the family business was not an option as my dad said to me one day, "get out of Thunder Bay as fast as possible. There is no future here". Alright then. I was never really good at fishing or hunting, so fending for myself off the land wasn't an option either. My high school "lack of" guidance counsellor had told me that I had limited choices due to my average marks. When I let him know that I liked Biology and Art, he just scratched his head. What about Architecture I asked? Your math marks aren't good enough for that or engineering. My prospects looked bleak. Fortunately for me, the cold winter months and my innate competitive nature gave me time to think and develop a plan. I would not be victim to old school limitations! So on the road I was to the lands beyond…also known as Southern Ontario to find a way to earn a living.

I discovered that Fanshawe College in London had a design school that offered a first year that exposed each student to Interior Design, Fashion Design, Urban Design, and Landscape Design. Fall of 1978 I was off to London. To me the exposure to such a wide variety of design challenges and design personalities was a wonderful way to explore who I really was as a young designer-in-waiting. Intellectually I was surrounded by like-minded people that actually thought like I did and had very similar interests and priorities in their lives. I felt I had found my calling.

Urban Design is the winner... sort of.

After the general design first year, I selected Urban Design as my major for the next two years. I loved the combination of arranging built form in a way that responded to every unique situation. This was also a co-op program, and this gave me the opportunity to travel to seek a related job. Calgary was booming back then, and was the best option for getting a job, so off I went without a job or knowing anyone west of Thunder Bay.

I fell in love with the west. This was the second epiphany for me after discovering that yes I am a designer. The west just felt so right for me. It was a homecoming of sorts that blended the beautiful landscapes with an amazing entrepreneurial attitude**.** The stunning Rockies looming so evident on clear days were just calling to be explored.

Back in London as I was winding down my studies, I met one of the instructors for the Landscape Design studio. Ron Koudys was a University of Guelph Landscape Architecture Grad. We had a long discussion about the University and the profession of Landscape Architecture. It sounded wonderful!

Cow Dung.

Arriving at the University of Guelph Landscape Architecture Program in the fall of 1981 I was greeted with a wide variety of farm animals being escorted down Winegard Walk through the centre of campus. This is different, I thought.

My time at Guelph has a special place in my heart. Here I met the best people that turned into lifelong friends and my future wife. The faculty inspired and led me into a greater depth of understanding of our role as Landscape Architects, and our collective responsibility to society. Christopher Alexanders Pattern Language was our class bible, and we absorbed its mantra and lived out its principles in our projects. At Guelph I received the ASLA award for undergraduate achievement and felt both humbled and full of gratitude for all the wonderful people that believed in me and my creative abilities.

Oh Toronto.

My first job after graduating brought me to Walter Kehm, Patrick Li, and Bruce Cudmore at EDA in downtown Toronto. All three of these men greatly influenced my career, and spoke into me (sometimes under duress) key elements of professionalism.

For the next eight years or so I bounced around several firms in Toronto always looking for the next challenge and learning opportunity. Having married my University sweetheart, and nested in our old rowhouse in the Beaches, everyone thought that Bob had finally settled down. Then I was working on the Masterplan for the University of British Columbia in 1991 with duToit, Allsopp, Hillier. I accompanied Roger duToit to Vancouver for a presentation of the 1991 Masterplan to the Board of Governors in Late January. The City was in full spring swing and I decided on the spot that I had to get out west. ►

La Paz Bolivia with Canadian Executive Service Organization. Images Robert Evans.

Go West Young Man (and pregnant wife).

On Boxing Day 1992 we said good bye to good jobs and great friends and headed out west with our reluctant dog peering over the back dash, longing not to be stuck in the car for the 4,000 km journey across the country to Kelowna. The interior of the Province had been a conscious choice, as we had been attracted by the beautiful natural landscape and the feeling that this place just had to "take off" with all its attributes. And it did.

27 years later I can with full integrity say that I am one content man. Firstly, our family grew to include three children, all grown now, and we are on our fourth dog. Secondly, I was able to realize a dream and start my own consulting practice with my civil engineer friend Barry Gowing, Site360 Consulting, in late 1999. At our peak we employed close to 25 people in our little Kelowna practice that completed projects throughout the province. Many young Landscape Architects had been welcomed into our firm, and today they have their own great stories to tell of their individual successes. We managed to garner our fair share of awards over the years, but I can honestly say for me it's been about the people.

Site360 was long ago purchased by a large Multi-national that is now WSP Canada. I am happily still here, and through the new Company get opportunities around the globe. But I still prefer to stay close to home as much as possible.

Feeny Wood and Contentment.

Now much of my attention has turned to a few very special interests. I have been a lifelong volunteer. This is a core value of mine to give back to the community that I have been privileged to live in, and beyond. I continue to advocate for the most marginalized people in our community as Board Chair for the local street mission that feeds and houses thousands each year. I also led an intensive two week urban design exercise in the center of La Paz, Bolivia this past winter, working and training local architects on key place making principles.

We recently purchased our own small acreage in Kelowna where, led by my poet wife, we are developing a place of solace, refuge and reflection that protects and honours the land. The first step was the completion of the Bothy, a prayer pavilion in the forest that will be offered to provide a short reprieve from the loud clamor of daily life.

We can all use less clamor. SL

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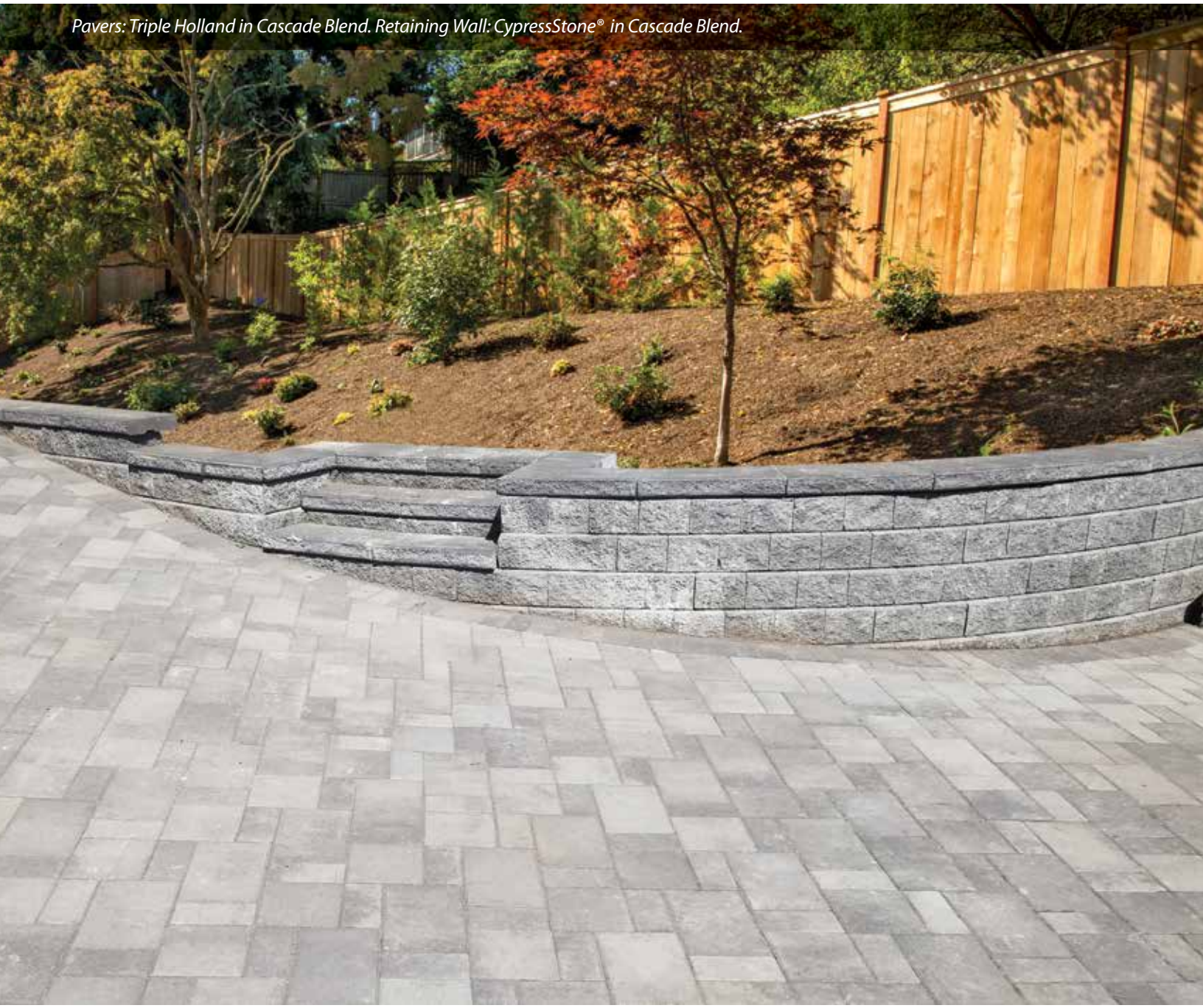

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