

University of Hawai'i Sea Grant College Program
Green Stormwater Infrastructure Summit
Advancing Practice and Policy for Green Communities
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Honolulu, HI



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Event summary notes and additional comments and resources – September 2016

“There are real difficulties in addressing stormwater infrastructure needs for resolving growing water quality and quantity challenges. Green stormwater infrastructure (GSI) is a developing field of practice and management of water quality and quantity, and more and more becoming required by regulations and plans. This program brings together leaders and experts from Hawai'i and the continental U.S. to advance practice and policy, and achieve multiple goals around green and livable communities, and water quality and quantity management.”

To begin to address these challenges, over 160 experts from across the state and the nation convened in Honolulu for a day-long summit to discuss how to achieve green and livable communities, with a specific focus on water quality (polluted runoff control) and quantity management (catchment, use/reuse, recharge, flooding, and drought).

The [University of Hawai'i Sea Grant College Program](#) (Hawaii Sea Grant) organized the summit with an award from the [National Sea Grant College Program](#). Additional sponsorship was provided by the Hawai'i Community Foundation, City and County of Honolulu Department of Planning and Permitting, Transit-Oriented Development Division (TOD Honolulu), AECOM, and the Hawai'i Chapter of the American Society of Landscape Architects.

For presentations and other materials, please visit the [GSI Summit Webpage](#).

The following is a summary of Summit notes and additional feedback from speakers and participants that fall into five (5) categories:

- (1) *Common Issues/Current Challenges*
- (2) *Tool, Policy, Investment, and/or Implementation Needs*
- (3) *Critical Moments and Opportunities*
- (4) *Resources and Tools*
- (5) *Takeaways and Testimonials.*

Some items and/or quotes appear in multiple categories. This demonstrates the cross-cutting nature of the topic and categories, as well as the importance and utility of the contribution.

(1) Common Issues/Current Challenges

“Although Hawaii’s landscape and water features are so unique and beautiful, Hawai’i faces similar problems and trends in its water systems as other U.S. great water cities and states.”

– *Howard Neukrug*

Drinking water concerns include:

- Legacy groundwater contamination from the 1950s to the 1970s
- Changes in water availability due to changes in rainfall patterns
- The impact of urban growth on water demand
- Aging infrastructure resulting in increased maintenance costs, water loss and eventual catch-up for facility replacement
- New regulatory and treatment costs, e.g., desalination

Stormwater concerns include:

- Large areas of impervious cover
- Channelized, unattractive streams
- Chronic localized flooding
- Rising groundwater tables prevent infiltration
- Near-shore water quality concerns from untreated runoff
- Inflow and infiltration into the sanitary pipe network
- No designated stormwater utility or direct cost recovery system

Wastewater concerns include:

- Wastewater treatment expansion will cost Hawaii’s nearly \$6 billion and infiltration and inflow remain a large cost and concern to the wastewater systems

Climate change concerns:

- Rising tides and impact on infrastructure and tourism
- Impact of changing weather patterns flooding, drought, crop irrigation
- Changes in extreme weather events may bring new challenge to the resiliency of water systems

Other impacts on the water systems:

- Development, transportation and affordable housing pressures add new burdens onto fragile ecosystems and water and wastewater infrastructure systems
- Some urban streams are not safe, attractive, accessible

Staff and managers responsible for legacy drainage, wastewater, and drinking water systems have insufficient resources to proactively operate and renew these systems to keep pace with the changing needs and conditions presented by major drivers such as:

- climate disruption
- development pressure
- Federal regulation
- economic drivers
- evolving public consciousness and political imperatives around the health of the natural systems and social/racial equity



Other key concerns:

- increased flooding and associated property loss and/or infrastructure damage
- new NPDES permit requirements
- the threat of a stormwater-related consent decree
- nearshore water quality vulnerability (bedrock of tourism and hospitality economy)
- historic social inequities that would be exacerbated by climate-related crises

(2) Tool, Policy, Investment, and/or Implementation Need

“[In] Honolulu you are dealing with a high water table. There is hesitancy on the geotechnical side and concern that with infiltration practices there might be impact to the underground portions of buildings. The [International Association of Mechanical and Plumbing Officials] [“Green Plumbing and Mechanical Code”](#) might be something that we can look into.” – *Randall Wakumoto*

Stormwater Fees

Act 042 (May 06, 2015) – Relating to Stormwater Management (HB 1325 HD1 SD1): Authorizes the counties to establish and charge user fees for stormwater management [HRS Sec. 46-1.5 General powers and limitation of the counties](#). Subject to general law, each county shall have the following powers and shall be subject to the following liabilities and limitations:

- (5) Each county shall have the power to:
- (E) Establish and charge user fees to create and maintain any stormwater management system or infrastructure.

Many speakers noted the importance of this legislation to facilitate water infrastructure development, establish drainage rate structures, and mitigate runoff from impervious surfaces – “a storm water utility will be a first step to getting a more rapid pace of implementation” (*Hye Yeong Kwon*). This is a challenging endeavor, but a critical component to achieving goals. A public education campaign would be necessary (e.g., Charlottesville, VA). Or as another speaker noted, “Someone will need to lose their job over this” (*Howard Neukrug*).

Standards and Permitting

There was consistent appeal for a suite of “design standards” to assist with proposed practices and permitting and review of new and redevelopment. Standards would further assist with education and training, and facilitate interdepartmental review.

Current procedures for permitting demonstration and/or small-scale practices can be daunting (see above): e.g., grading/grubbing, building, etc. Are there means to expedite those activities that are desirable?

Visible Demonstrations and Built Works

There were requests for testing of specific types of materials and practices, including: porous pavements (i.e., asphalt, concrete, pavers, etc.); having visible “green streets” ([“Why Are Cities Using Green Streets for Stormwater Management?”](#)); and, the creation of a [“green infrastructure site tour.”](#)

Green Roofs

Dr. Roger Babcock’s “green roof model” will be available in the future.



Off-site Mitigation Strategies for re-development and infill

Michelle West offered an example for off-site mitigation strategies that still effectively achieved green stormwater infrastructure and polluted runoff management goals and objectives.

Rhode Island Stormwater Design and Installation Standards Manual (Amended March 2015): “The applicant, however, can meet the recharge and water quality requirements either on-site or at an approved off-site location within the same watershed, provided the applicant satisfactorily demonstrates that impervious area reduction, LID strategies, and/or structural BMPs have been implemented on-site to the maximum extent practicable. An approved off-site location must be identified, the specific management measures identified, and an implementation schedule developed in accordance with local review and with DEM/CRMC concurrence, as appropriate. The applicant must also demonstrate that there are no downstream drainage or flooding impacts as a result of not providing onsite management. The intent of this provision is to allow flexibility to meet the goals of improved recharge, water quality, and channel and flood protection to receiving waters while still promoting redevelopment and infill in urban and urban fringe areas” ([Chapter 3, p. 3-6](#)).

“The city/county could develop a green infrastructure plan for an area; the private property owners could offset requirements for their own properties by helping to fund the larger green infrastructure projects within the same watershed...” (*Michelle West*)

(3) Critical Moments and Opportunities

“The rule of holes. When you find yourself in a hole the first thing to do is stop digging the hole deeper. You're trying to retrofit existing development with green infrastructure to deal with runoff issues, protect water quality, etc. This is really expensive and difficult, and generally happens at a comparatively small scale. At the same time you have large scale development proceeding on the 'Ewa Plain and maybe elsewhere that is not requiring/fully utilizing green infrastructure. Other cities are requiring this and you all can too... The quality of life/sustainability part has to be in early as part of the marketing and branding.”

– *Geoffrey Anderson*

Presenters and Summit participants noted several large development areas that must demonstrate, implement, and reflect the strategies and values discussed. These include the Transit-Oriented Development (TOD) zones along Honolulu's rail corridor and areas under the jurisdiction of the Hawai'i Community Development Authority (HCDA), such as Kaka'ako and Kalaeloa – i.e., these areas cannot become “missed opportunities.”

Additionally, several important institutional players were identified: the University of Hawai'i (in particular the Mānoa campus), the military installations, DOE and private schools, the Department of Hawaiian Homelands, etc. Are these critical leaders potential early adopters and testers? “Is there any willingness/mission alignment with any to more systematically adopt [green infrastructure] into their building plans? Who among anticipates a reasonable volume of development activity in their facilities in the near future? The city/[county] and state [transportation agencies] are obviously key entities in this” (*Geoffrey Anderson*).

The Summit produced urges to research, test, and push practices and requirements, and not just be reactionary to NPDES permits and requirements. Furthermore, regarding green infrastructure and meeting regulatory requirements for municipalities, there were claims of certain practices not costing more than traditional water management schemes – “If calculations on pollution reduction were conducted as a part of the design plan, those few extra steps and



design considerations could go toward credit for the community, but somebody (or bodies) have to be willing to take those few steps” (*Hye Yeong Kwon*).

An area identified as ripe for engagement and implementation is the public right-of-way/roadways. There were calls for demonstration projects, as well as references of missed opportunities during repaving, bikeway, or pedestrian improvement projects. As one of the largest contributors of impervious surfaces and polluted runoff, roadways provide municipalities excellent opportunities for “[green streets](#)” projects due primarily to municipal ownership. “[In Seattle] [w]e always talk about the moment of development (or redevelopment, as in the case of road improvements, for example) as the *lowest cost moment* to accomplish green infrastructure improvements and bring in the full suite of co-benefits and additional value...” (*Pam Emerson*).

Lastly, there was ample and passionate discussion of the current and future impacts of climate change on our water security (e.g., Hawai‘i Community Foundation’s [A Blueprint for Action](#) and the [Aloha+ Challenge Sustainability Measures](#)). There is no lack of understanding of the “[d]eep culture of care for the land and water, and deep sense of belonging and pride of place” (*Pam Emerson*), however this is not always manifest in the landscape. Several speakers articulated the challenges and opportunities before us:

“NOW is also a very critical moment in time to move forward aggressively in the technical, financial, messaging, policy and politics to secure the development of a stormwater utility and fee system. A ‘pilot’ of the program should begin” (*Howard Neukrug*).

“Build on the multiple definitions for/images of/needs for a ‘Water-Secure O‘ahu’ gleaned during visioning processes to develop a framework for an integrated Utility that could conceivably deliver that future and be supported by disparate perspectives within the community, despite the known reality of associated fees/added cost” (*Pam Emerson*).

“I would [re]frame this entirely... I'd talk about training local people who are currently under-employed to take the jobs. I'd talk about avoiding flood damage and protecting property. I'd talk about protecting your tourism by ensuring that the natural resources are protected. I would always be talking economic development” (*Geoffrey Anderson*).

“[I] agree a compelling frame is needed... maybe the hook is something else. Open space. Preserved identity of ‘green-ness’. Or, what I saw as both a pressing need and possibly a hook: future water security/community resilience” (*Pam Emerson*).

(4) Resources and Tools

The following is a listing of resources referenced or provided during and after the Summit, categorized by hosting organizations or theme. This listing is by no means exhaustive, nor does listing the resource indicate an endorsement.

Hawai‘i Sea Grant



Help populate the Atlas! The [Hawai‘i Low Impact Development \(LID\) Atlas](#) is a collection of alternative/green stormwater management practices installed across the state. The Atlas is hosted by the [National Nonpoint Education for Municipal Officials \(NEMO\)](#) Network and Hawai‘i Sea Grant. It is an online resource providing geo-referenced examples of green infrastructure and low impact development for stormwater



management. You can browse the Atlas by either selecting a town, land use type, project type, or by simply clicking on pinned sites.

Add your own project to the Atlas by filling out the [Hawai'i LID Atlas Submission Form](#).

- Hawai'i Sea Grant-hosted [Introducing Green Infrastructure for Coastal Resilience](#) (NOAA Green Infrastructure Training hosted October 29, 2015)
- [Green Infrastructure for Stormwater Management](#) pages

Hawai'i Community Foundation

- [A Blueprint for Action: Water Security for an Uncertain Future 2016-2018](#) (2015)

NOAA [National Oceanic and Atmospheric Administration]

- NOAA Office for Coastal Management, *Digital Coast* [Green Infrastructure page](#): tools, resources, and trainings
- [Stormwater Management in Pacific and Caribbean Islands: A Practitioner's Guide to Implementing LID](#) (February 2014)
- [Honokowai Water Quality Management Plan](#) (July 2016)

EPA [U.S. Environmental Protection Agency]

- [Green Infrastructure](#) pages and Greenstream listserv (join-greenstream@lists.epa.gov)
- Polluted Runoff: Nonpoint Source Pollution Forum Resource Center [[npsinfo](#)]
- [Climate Change and Water News](#)
- [City Green: Innovative Green Infrastructure Solutions for Downtowns and Infill Locations](#) (2016)
- [Smart Growth and Water](#)
- [Adapting to Climate Change](#)
- [G3 Partnership](#), "Green Streets, Green Jobs, Green Towns Initiative" and the G3 Digest

Center for Watershed Protection

All of these and other Center resources are found through the Center for Watershed Protection's Online Watershed Library (OWL) and are free: <http://owl.cwp.org/>. Searches for other non-Center resources on OWL does require a membership fee.

- Kwon, H. Y. 2015. "[The Beauty of Stream Restoration and Pet Waste Reduction Programs](#)," *Sustain Magazine*
- [Clean Water Optimization Tool](#)
- [Illicit Discharge Detection and Tracking Guide](#) (2011)
- [A Healthy Harbor Plan - Creating a Cleaner, Greener Future For Our Neighborhoods, Streams & Harbor](#) (2011)
- [Final Recommendations of the Expert Panel to Define Removal Rates for Individual Stream Restoration Projects](#) (2013)
- [Recommendations of the Expert Panel to Define Removal Rates for the Elimination of Discovered Nutrient Discharges from Grey Infrastructure](#) (2014)
- Capiella, K. 2015. [The Challenges of Accounting for Pet Waste](#), *Sustain- A journal of Environmental and Sustainability*, 32: 8-10.
- *Better Site Design: A Handbook for Changing Development Rules in Your Community* (1998), [Part 1](#) and [Part 2](#)
- [Codes and Ordinance Worksheet](#) (1998)
- *Forthcoming: Green Infrastructure Certification*



Georgetown Climate Center

- [Green Infrastructure Toolkit](#)

Trust for Public Land

- [Climate-Smart Cities](#) Program
- [Green Infrastructure](#) Programs

Natural Resources Defense Council

- [Water-Smart Cities](#)

Foundations/Funders

- [David Suzuki Foundation](#)
- [Pisces Foundation](#)
- [Surdna Foundation](#)
- National Science Foundation, e.g., [Environmental Sustainability](#)
- Funders Network, e.g., [Investing in Water Resilience](#)

Climate Change Adaptation

- SPUR's [Agenda for Change](#) (2016)
- Gallucci, M. 2013. "[6 of the World's Most Extensive Climate Adaptation Plans](#)," *InsideClimate News*, June 20.
- City of Seattle, Office of Sustainability and Environment, "[Planning for Climate Impacts](#)"

Urban Renewal Approaches

- Fontenot, A. 2016. "[30 Inspiring Urban Renewal Projects](#)," Social Work Degree Guide (e.g., El Paso, NM voters passed a "\$400M+ quality of life" bond; South Lake Union Developments, Seattle, WA; etc.)

Integrated Water System Approaches + Eco-District Concept

- San Francisco Public Utilities Commission "[Non-potable Water Program](#)"
- SERA. 2014. "[Ecodistricts: Developing sustainable systems at scales that make sense](#)," *SERA Blog*, March 09.
- WERF (Water Environment & Reuse Foundation), "[When to Consider Distributed Systems in an Urban and Suburban Context](#)"
- American Rivers, [Integrated Water Management Resource Center](#)
- [US Water Alliance](#)

Case Studies, Modeling, and Networking

- [Green Infrastructure/High Performance Landscapes Case Studies](#), Landscape Architecture Foundation
- [Highway Runoff Stormwater Management Potential \(HRSMP\) Site Characterization Using NASA Public Domain Imagery](#), Maryland State Highway Administration (2016)
- [Green Infrastructure Leadership Exchange](#)



(5) Takeaways and Testimonials

RE: Roger Babcock's presentation on Green Roof design

Q: How did the various plants tested perform?

A: The one that we used the most was the sweet potato ('uala). The grad students ate the plants. Most of everything else dies over time. In terms of modelling – depending on the plant species you have to use different evapotranspiration rates (ET value). ET is a complicated value; it is not a constant value and depends on season, growth, soil moisture – many factors. For green roofs there is no time for ET, it is all about storage and retention.

Q: What are take homes from the reservoir part of the study?

A: It cannot be any more than half the depth of the module. The reservoir has to be separated from the plants so the plants do not drown. You have to know what your volume retention goal is (e.g., 25%, 50%, 100% of the design storm).

Howard Neukrug

“When it comes to water, Hawai'i is clearly on the verge of something BIG. It has laid the foundation for integrating how water is valued and managed for the benefit of its ecosystems, its communities and its businesses for the 21st century and beyond.”

“While it seems difficult to get majority concurrence on many environmental issues through any legislative body these days, there appears to be considerable political awareness and leadership to support positive change for water-centric issues in Hawai'i at the state, city and county levels.

The recent passage of multiple, significant pieces of state water legislation was punctuated by the passage of law that allows the counties to charge stormwater utility fees to reduce runoff into waterways and the ocean.

This is a critical piece of legislation as it will allow not only new funding sources, but place a market value on Hawaii's rainfall. By moving rainwater into the commodity market, this can become a strong base for balanced and equitable change in managing Hawaii's water.”

“The Summit highlighted for me, and I am sure for all who attended, the level of expertise and passion exhibited by the [local] government[s], the consulting community and the University of Hawai'i. The ability of the program hosts to bring in national experts to this discussion was notable.”

Geoffrey Anderson

“The rule of holes. When you find yourself in a hole the first thing to do is stop digging the hole deeper. You're trying to retrofit existing development with green infrastructure to deal with runoff issues, protect water quality, etc. This is really expensive and difficult, and generally happens at a comparatively small scale. At the same time you have large scale development proceeding on the Ewa Plain and maybe elsewhere that is not requiring/fully utilizing green infrastructure. Other cities are requiring this and you all can too... The quality of life/sustainability part has to be in early as part of the marketing and branding.”

Pam Emerson

“I was struck by a sense that you're really at a key inflection point... with a sort of once-in-a-lifetime chance to step out and prototype a new model that we would all benefit from... [Y]ou're poised to leap-frog mainland communities by envisioning and then pioneering a truly integrative and innovative next-generation approach to the water resources-land use-community resilience nexus.”



“[In Seattle] [w]e always talk about the moment of development (or redevelopment, as in the case of road improvements, for example) as the *lowest cost moment* to accomplish green infrastructure improvements and bring in the full suite of co-benefits and additional value – \$.50/gallon managed vs. \$1.30/gallon managed for a go-it-alone project, in Seattle.”

“Appropriate city-scale precedents are difficult to find. Mainland models of water-related utilities (drinking water, wastewater, stormwater/drainage) center on single-purpose systems, operated largely in parallel with one another and independently of related systems such as transportation. These large, centralized, stand-alone built and organizational systems are now *also* struggling to keep pace with: the ‘new normal’ presented by climate change (150 years of climate data are no longer predictive of future conditions); the scale of solutions are not commensurate with the scale of water pollution challenges caused by 150 years of unmitigated or under-mitigated land development; changing regulations; development pressure and associated affordability challenges, long-standing environmental injustice, etc.”

“[O]ne of my main take-aways from the time spent with you all is the amazing opportunity you have to think differently about the suite of problems (and solutions) you might frame up and fund if you do pursue a new Utility. Our small-but-mighty green infrastructure team here is working within and trying to evolve a fairly heavy/clunky Stormwater Utility, set up in the late 80’s in a very different context with respect to major transformational drivers like climate change, real estate development/land value, and public consciousness. My gut is: don’t do what we did! Do it better!”

---- [Green Stormwater Infrastructure Summit](#) ----

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