

Green Infrastructure and Urban Water Budget

Youcan Feng, Ph.D. Candidate

Advisor: Dr. Steven Burian

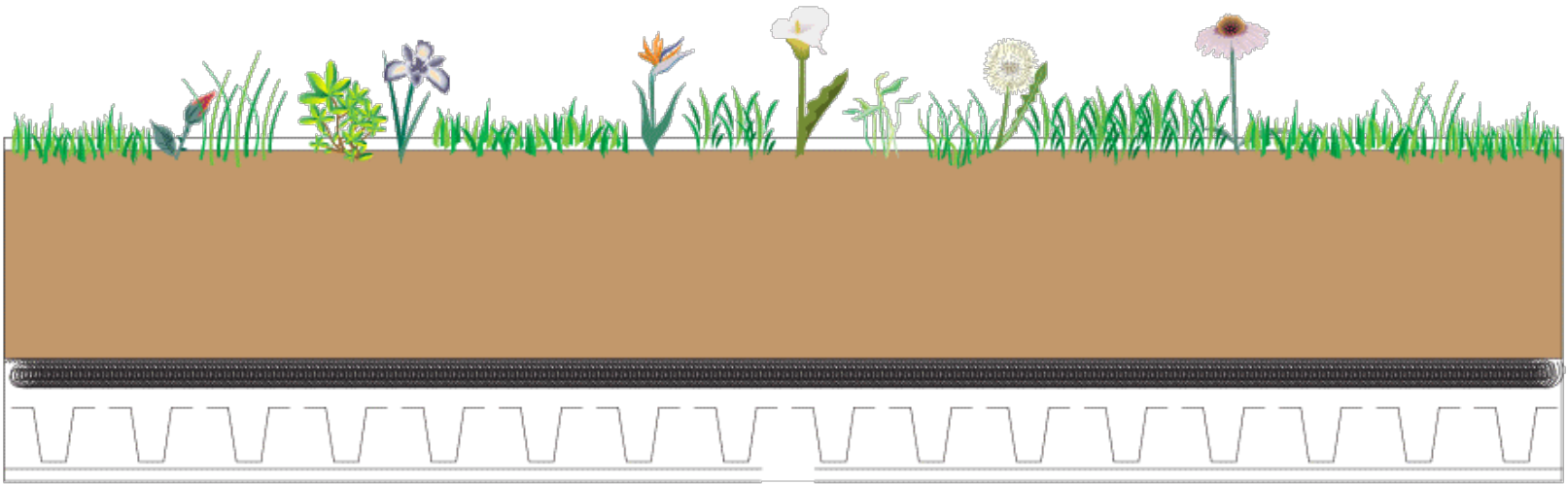
Department of Civil and Environmental Engineering

University of Utah

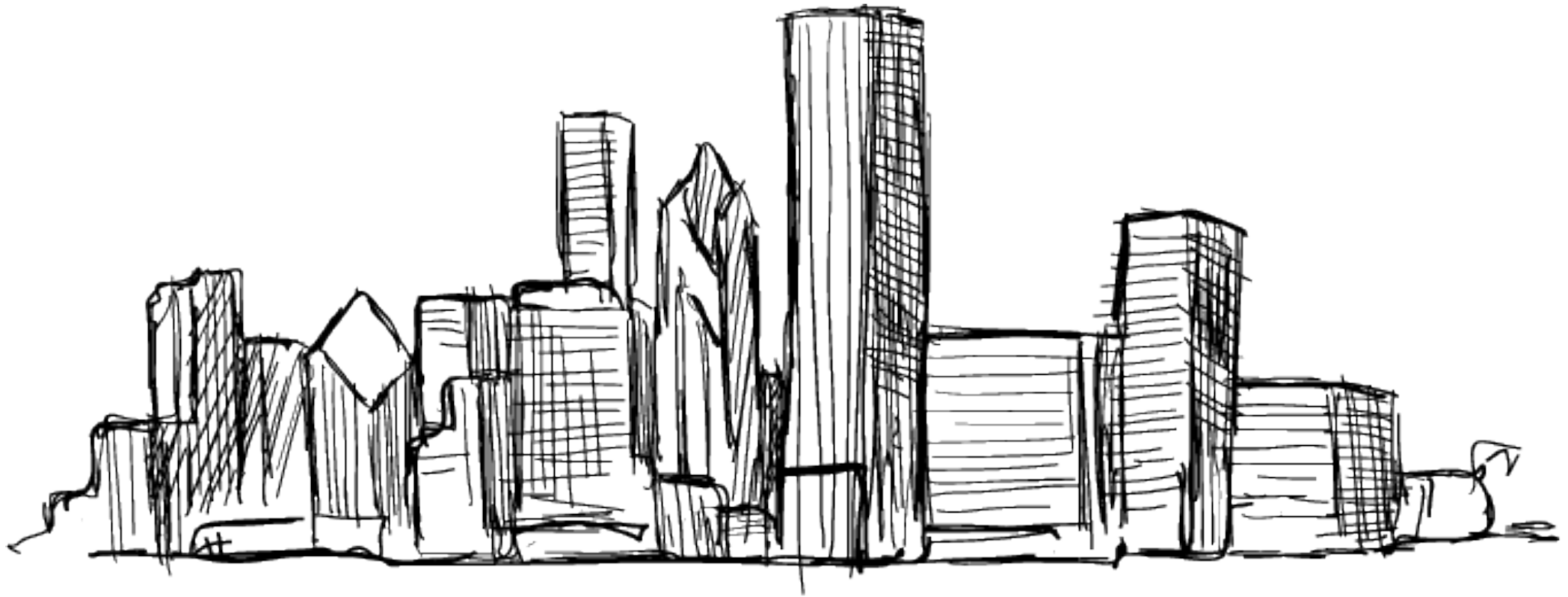
youcan.feng@gmail.com

Green Infrastructure

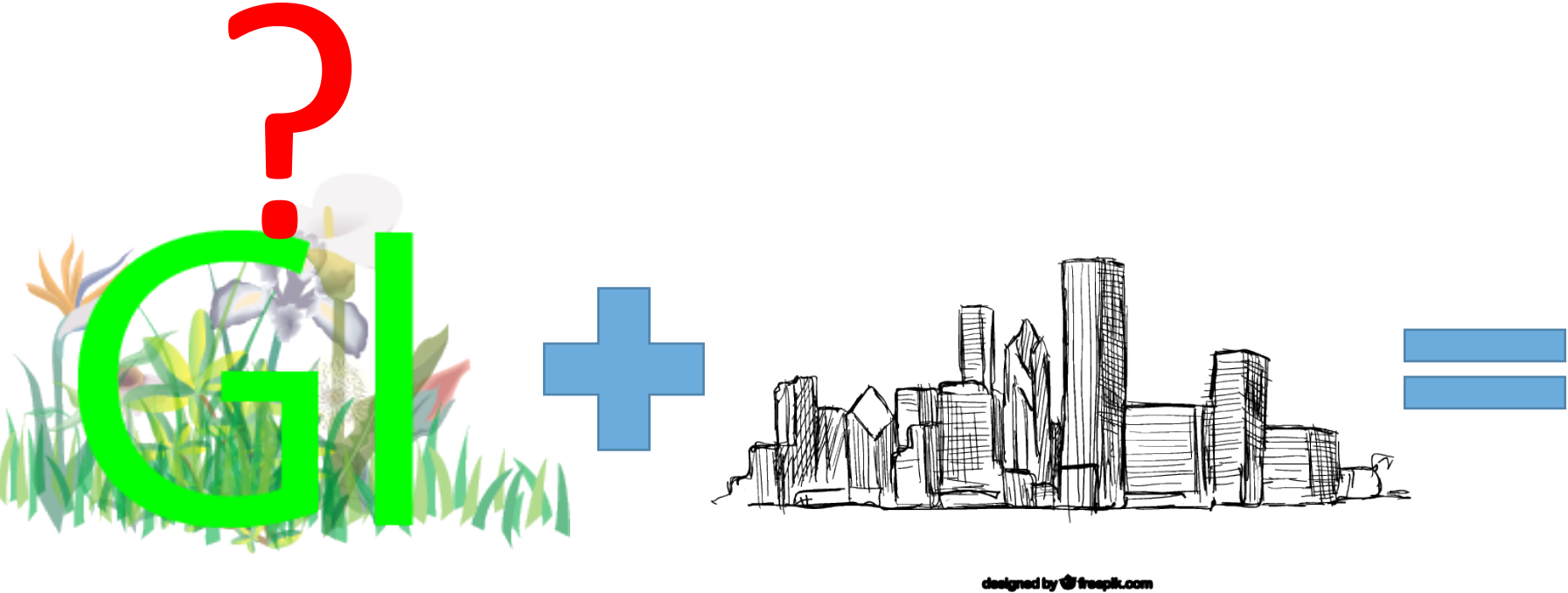




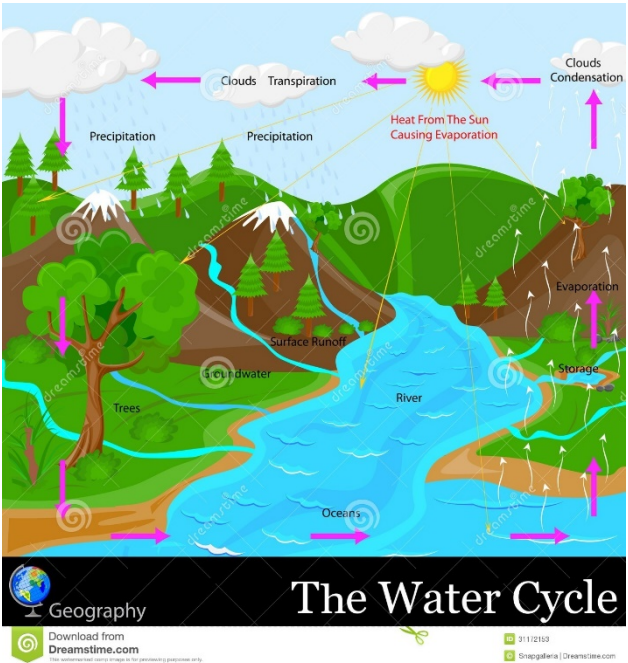
Urbanization



Motivation

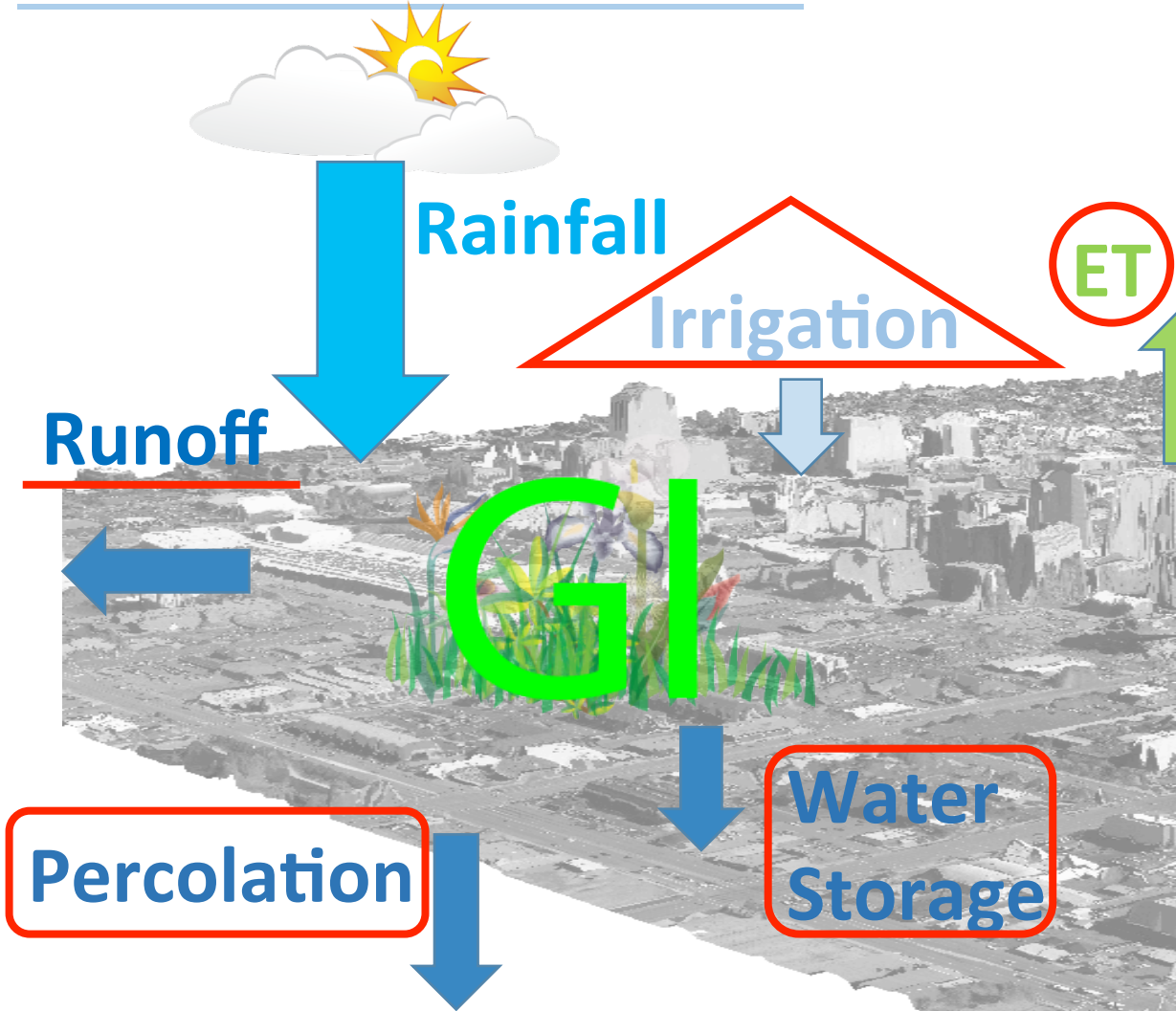


designed by freepik.com

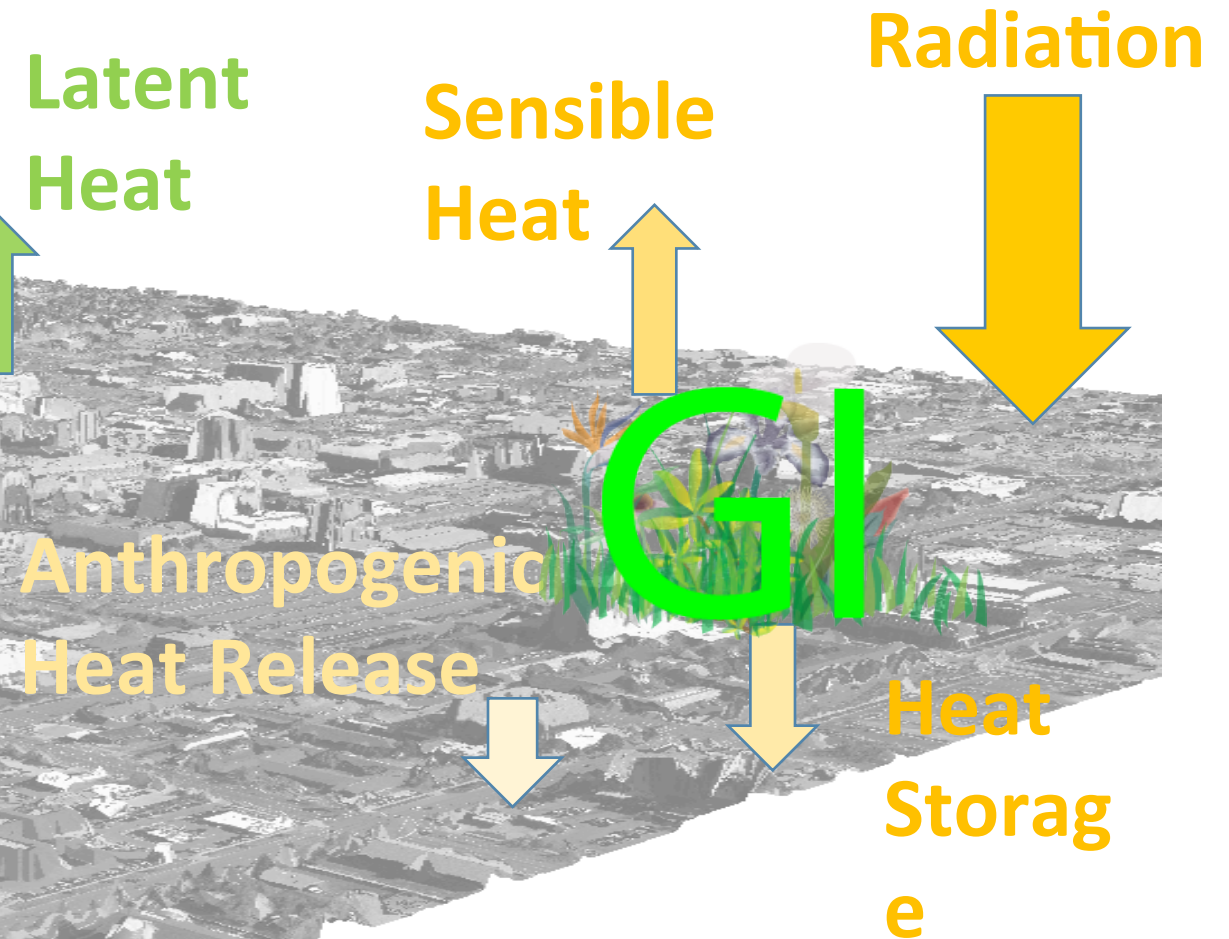


Goal: Study GI Impacts on Urban Water Budget

Urban Water Balance



Urban Energy Balance



EvapoTranspiration

Transpiration



Evaporation





© 2015 Google

33 m

Google earth



Roadmap

Potential Evapotranspiration (PET) Model



Stormwater Model

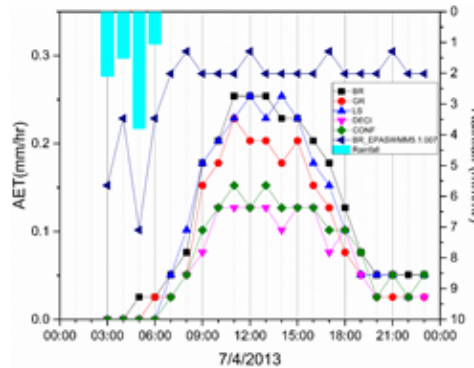


Actual Evapotranspiration (AET) and Water Budget Estimation

$$PET = \frac{0.408\Delta(R_n - G) + \gamma \frac{C_n}{T + 273} (e_s - e_a)}{\Delta + \gamma(1 + C_d)}$$



$$K_s = \frac{\ln\left[\left(1 - \frac{D_r}{TAW}\right)100 + 1\right]}{\ln(101)}$$



$$AET = K_s \times PET$$

Penman-Monteith equation-based Python program generating hourly PET time series



Modified SWMM C++ program generating water stress coefficients



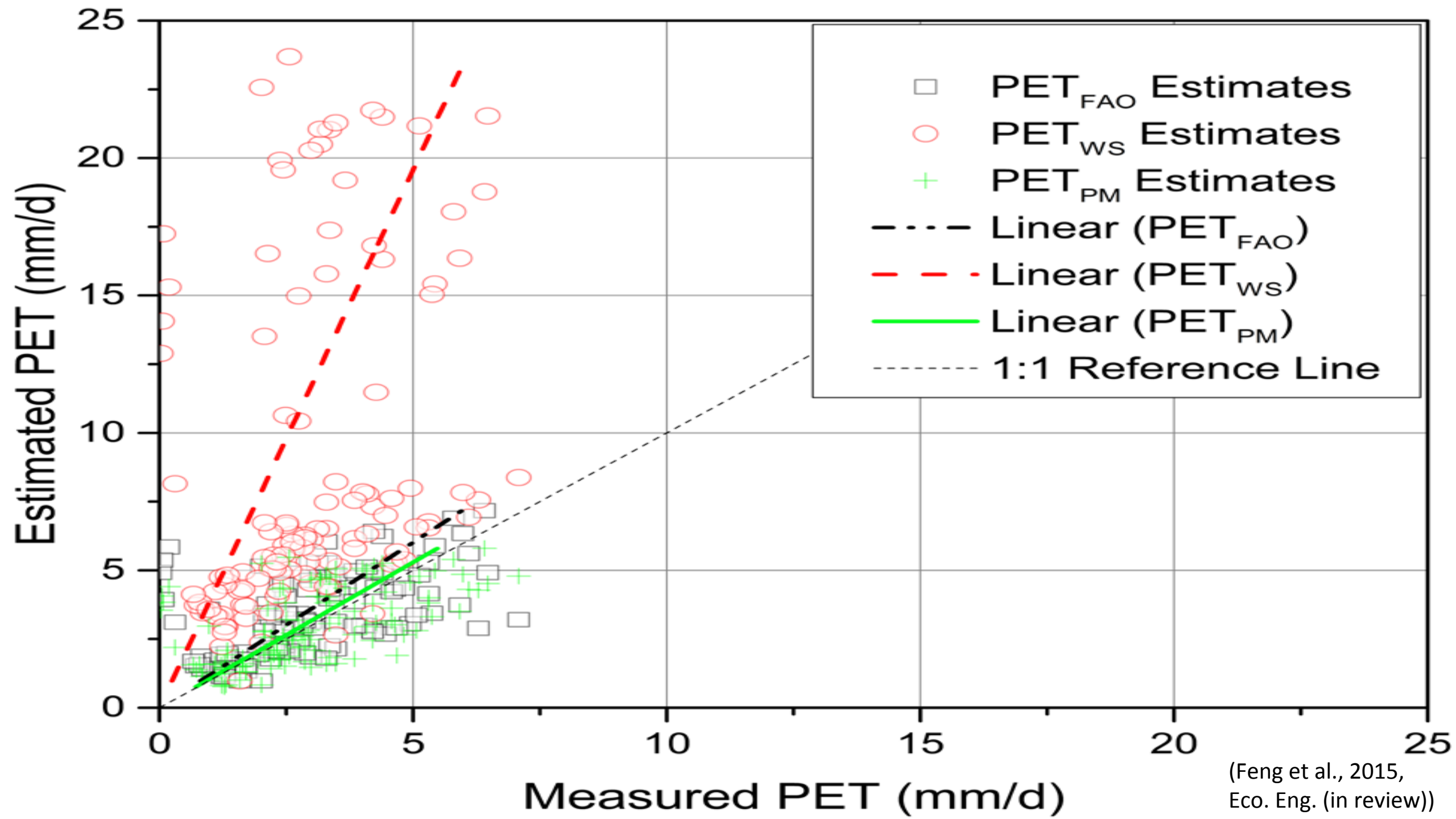
The improved AET and other components of the water budget being updated

(Feng et al., 2015, J. Hydro Eng. (in review))

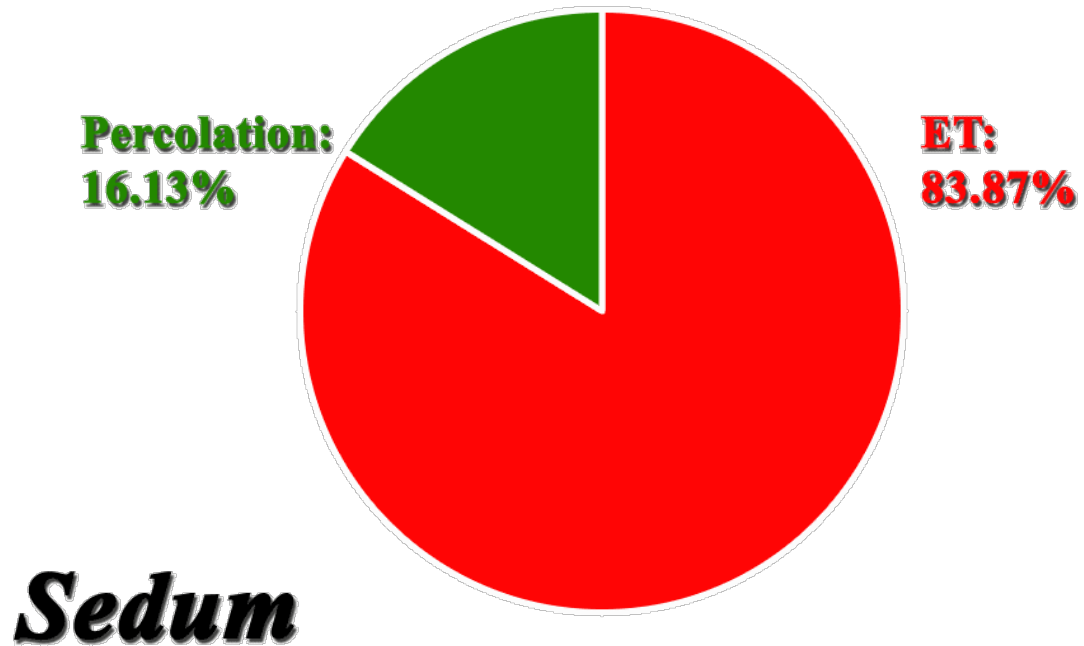
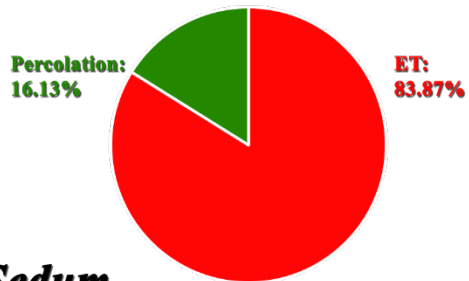
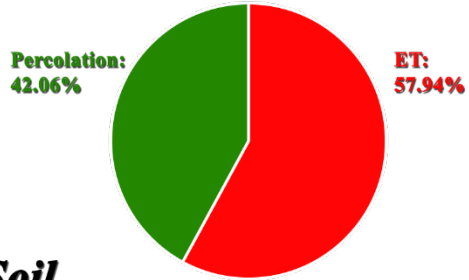
Case Study



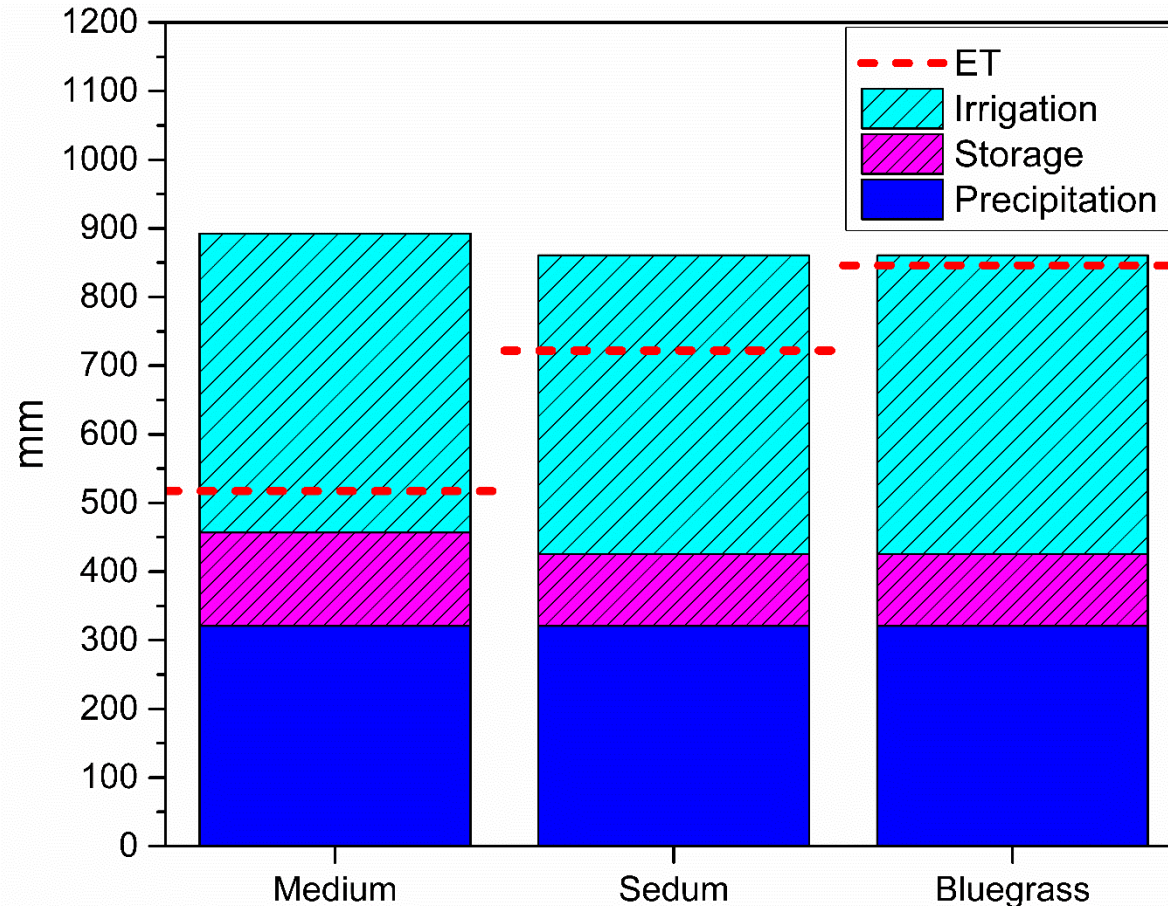
(Feng et al., 2015,
Eco. Eng. (in review))



How is the Stormwater Management Capacity?



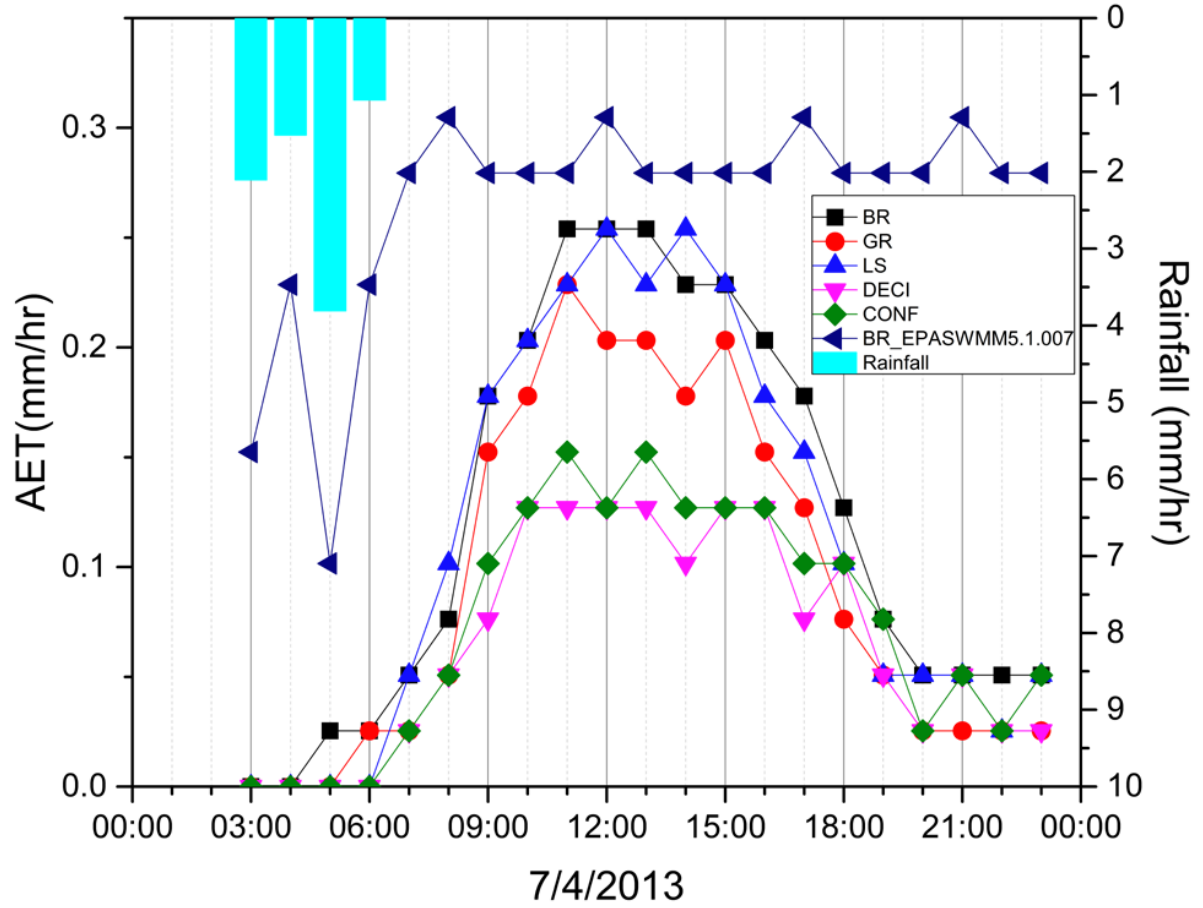
Key Result: Green Roofs Require Large Amounts of Irrigation in This Climate



03/03/2014 – 12/06/2014

(Feng et al., 2015,
Eco. Eng. (in review))

Key Result: The Modified SWMM Model Can Simulate A More Realistic Evapotranspiration Process



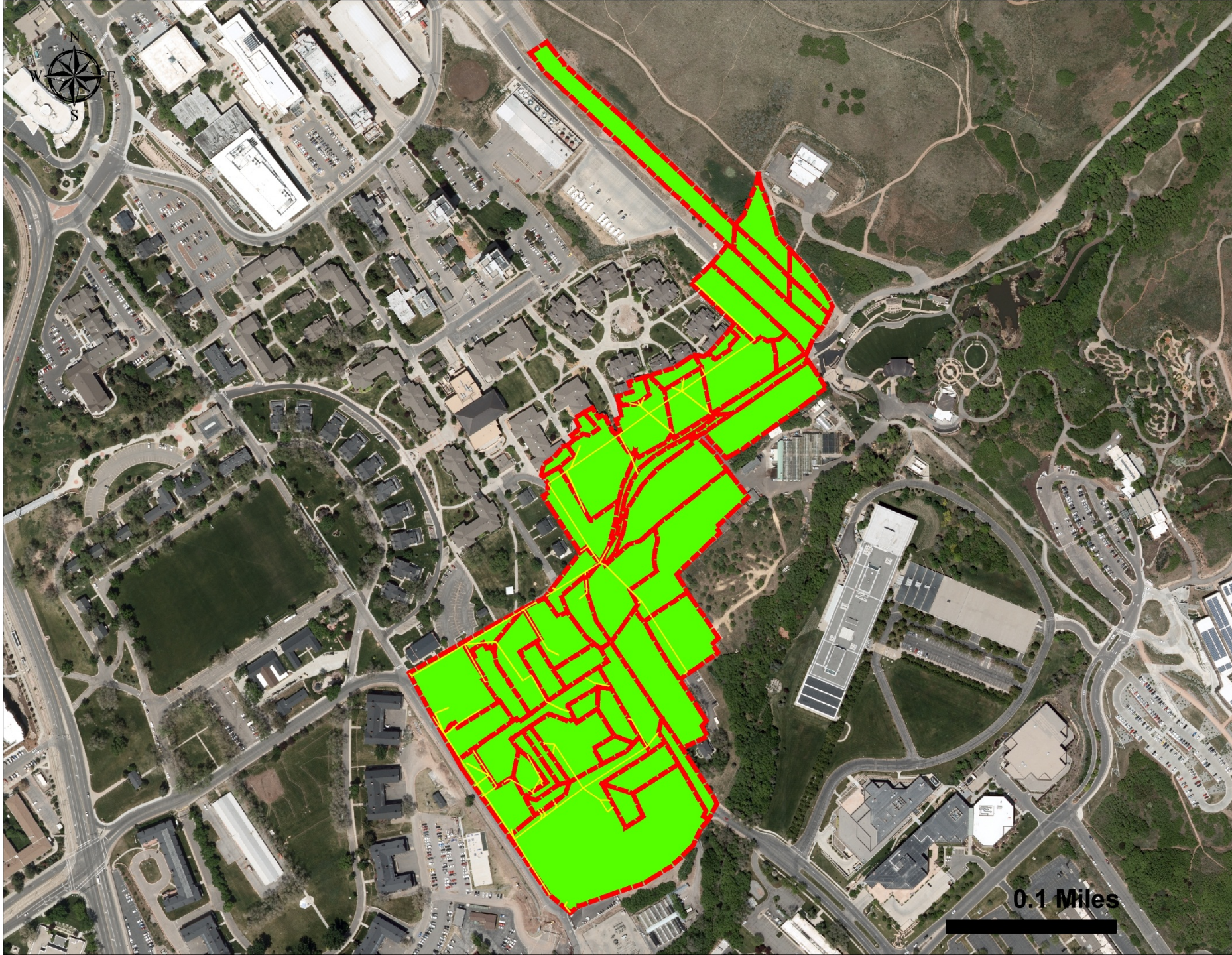
BR: Bioretention
GR: Green Roof
LS: Landscape
DECI: Deciduous Trees
CONF: Conifer Trees
BR_EPASWMM5.1.007:
Bioretention simulated
by EPA SWMM

Fig. 5. Sub-daily ET patterns on 7/4/2013
(Feng et al., 2015, J. Hydro Eng. (in review))

Baseline

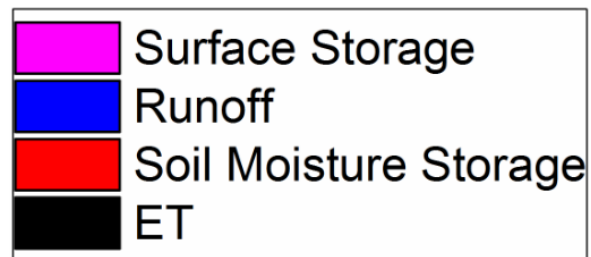
Green
Infrastructure

**Natural
Hydrology**



0.1 Miles

(Feng et al., 2015,
(in prep))



mm/yr

0 100 200 300 400 500

Baseline



Green Infrastructure



Natural Hydrology



Urban Agriculture



Photo courtesy to Sara Mitchell

Web of Work

 **DEPARTMENT OF BIOLOGY**
THE UNIVERSITY OF UTAH

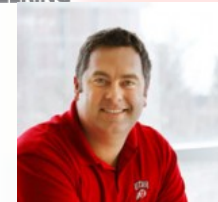


Prof. David Bowling



THE UNIVERSITY OF UTAH
DEPARTMENT OF MECHANICAL ENGINEERING



Prof. Eric Pardyjak



Prof. Rob Stoll


COLLEGE OF ENGINEERING | THE UNIVERSITY OF UTAH
DEPARTMENT OF CIVIL & ENVIRONMENTAL ENGINEERING



Prof. Christine Pomeroy



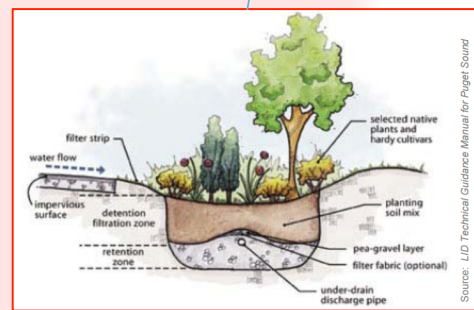
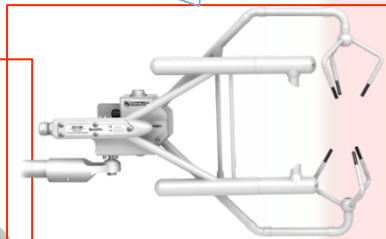
Prof. Jacqueline Grant
 SOUTHERN UTAH UNIVERSITY
LEARNING LIVES FOREVER



Dr. Kimberly DiGiovanni
 **VILLANOVA UNIVERSITY**



Prof. Diane Pataki



designed by freepik.com



Prof. Lee Skabelund
 **KANSAS STATE UNIVERSITY**



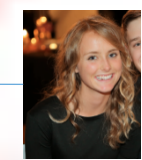
Sue Pope
Landscape Maintenance



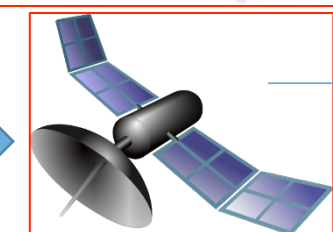
Youcan Feng



Prof. Steven Burian



Sara Mitchell
iUTAH URA



Dr. Indu Jeyachandran
 **SJSU SAN JOSÉ STATE UNIVERSITY**

Thanks for your attention! Questions?

Contact: youcan.feng@gmail.com
<http://urbanwater.utah.edu/>



Sustainable Campus
Initiative Fund



THE UNIVERSITY OF UTAH
J. Willard Marriott Library



**NATURAL
HISTORY
MUSEUM
OF UTAH**



THE UNIVERSITY OF UTAH

**GLOBAL CHANGE
& SUSTAINABILITY
CENTER**



Department of
Civil & Environmental Engineering

THE UNIVERSITY OF UTAH

