

Proactive Landscape Design Addressing Water Quality in Lake Thunderbird Watershed

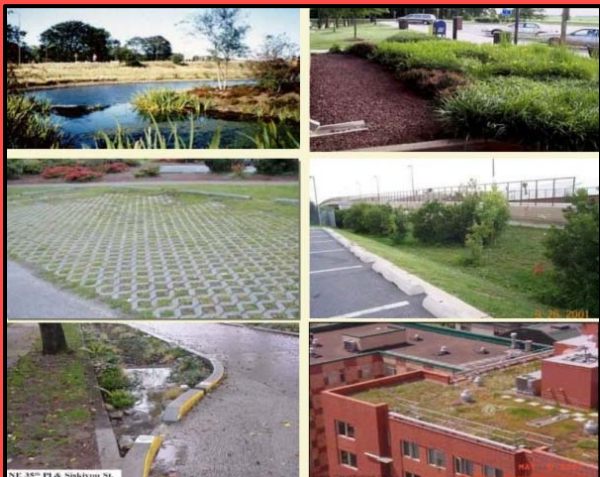
Trail Woods Subdivision Norman, OK



Division of Landscape Architecture
Dr. Reid Coffman, Kent State University
Graduate Assistant: Bryce Frost, OU



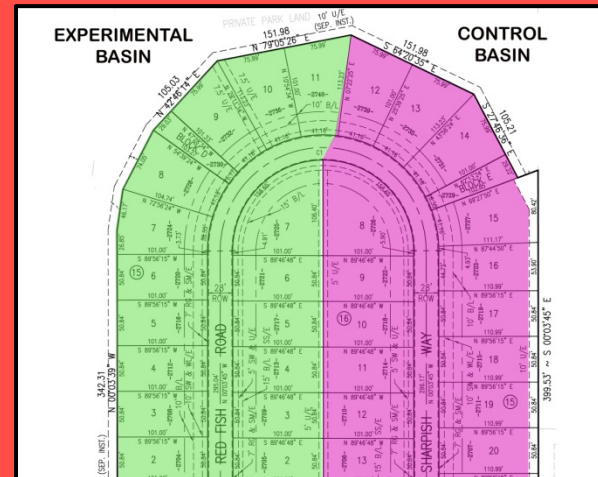
School of Civil Engineering & Environmental Science
Dr. Bob Nairn, OU
Graduate Assistant: Michael Rice, OU



Green Infrastructure



Site Context/Problem



Trailwoods BMPs



Work in the Gardens



Monitoring Plan



Results to Date

Green Infrastructure



Green Infrastructure

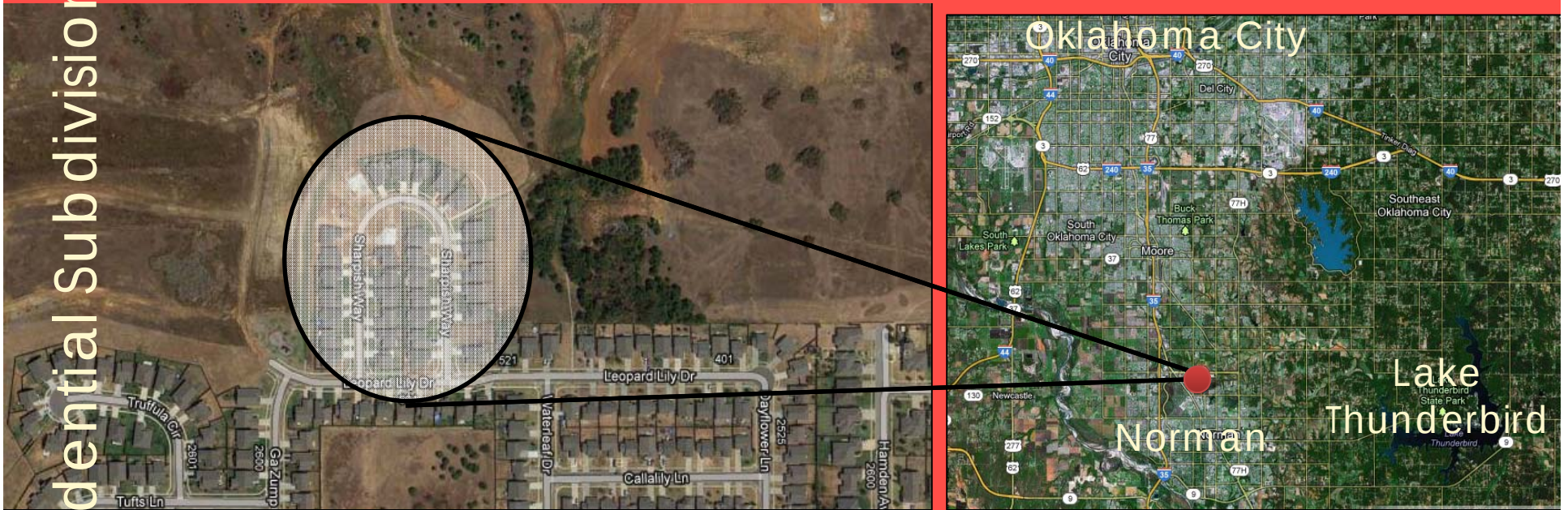
- Address stormwater runoff quantity and quality
- Various techniques
 - *down spout disconnection*
 - *rainwater harvesting*
 - *rain gardens*
 - *planter boxes*
 - *bio-swales*
 - *permeable pavements*
 - *green roofs*
 - *urban tree canopy*
 - *land conservation*



Site Context / The Problem



Site Context / The Problem



Why:

- location within developing headwaters
- construction schedule & subdivision size conducive for research
- environmental mission partnering with Ideal Homes

Project Duration:

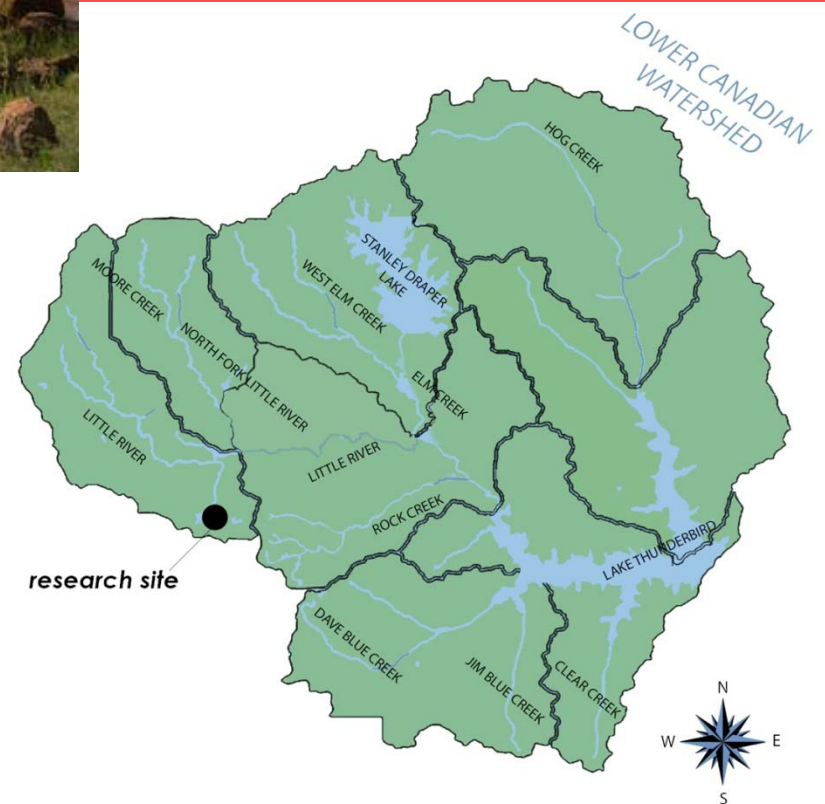
- 30 houses planned, designed, and constructed over 3 years
- monitoring period part of a 2 year contract

Site Context / The Problem



marktrashphotostream.com

- **Lake Thunderbird - Sensitive Water Supply but not supporting designated uses**
 - Turbidity
 - Low dissolved oxygen
 - Color
 - Chlorophyll-a
 - Taste and odor
- Due to urban expansion



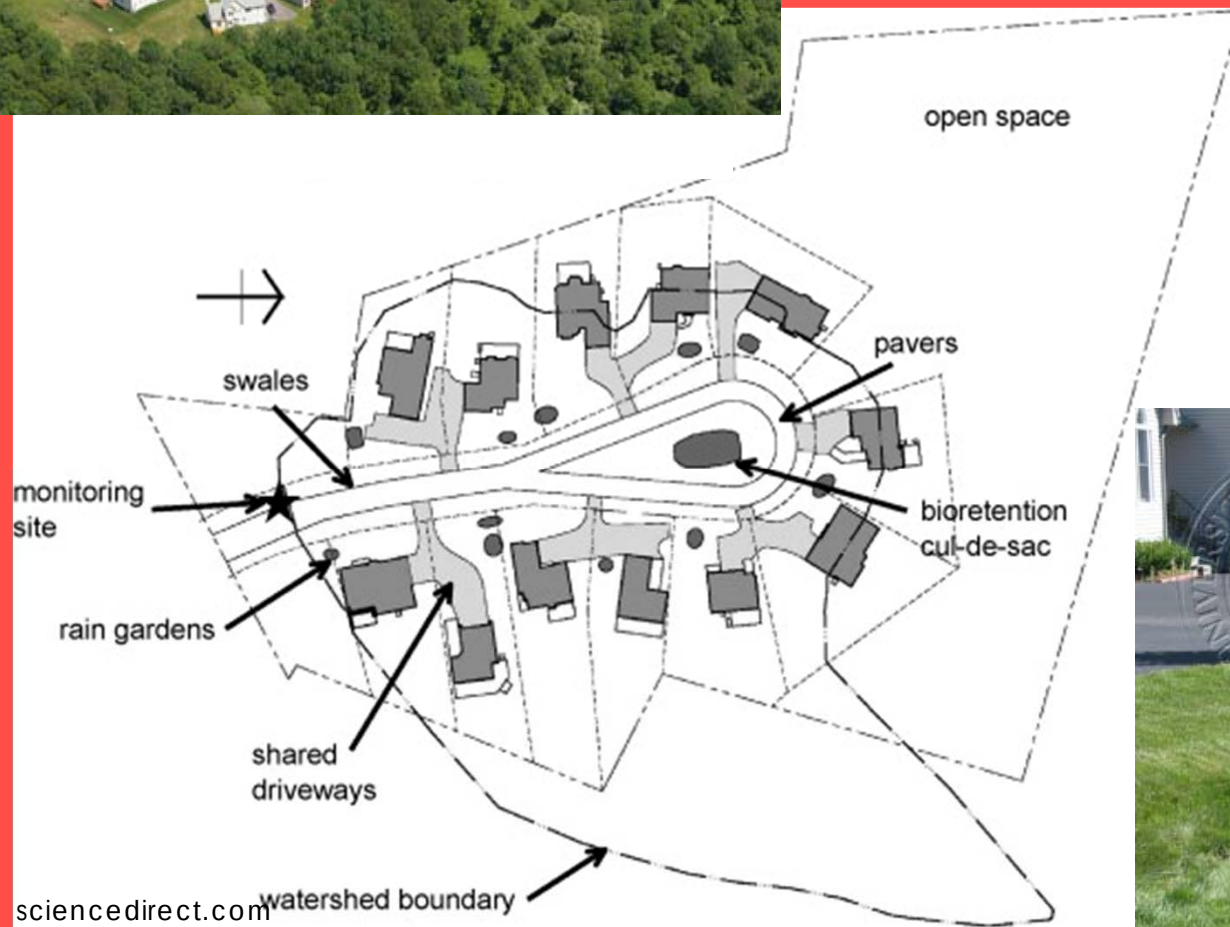
National Precedent

Jordan Cove

Urban Watershed Project

Waterford, CT

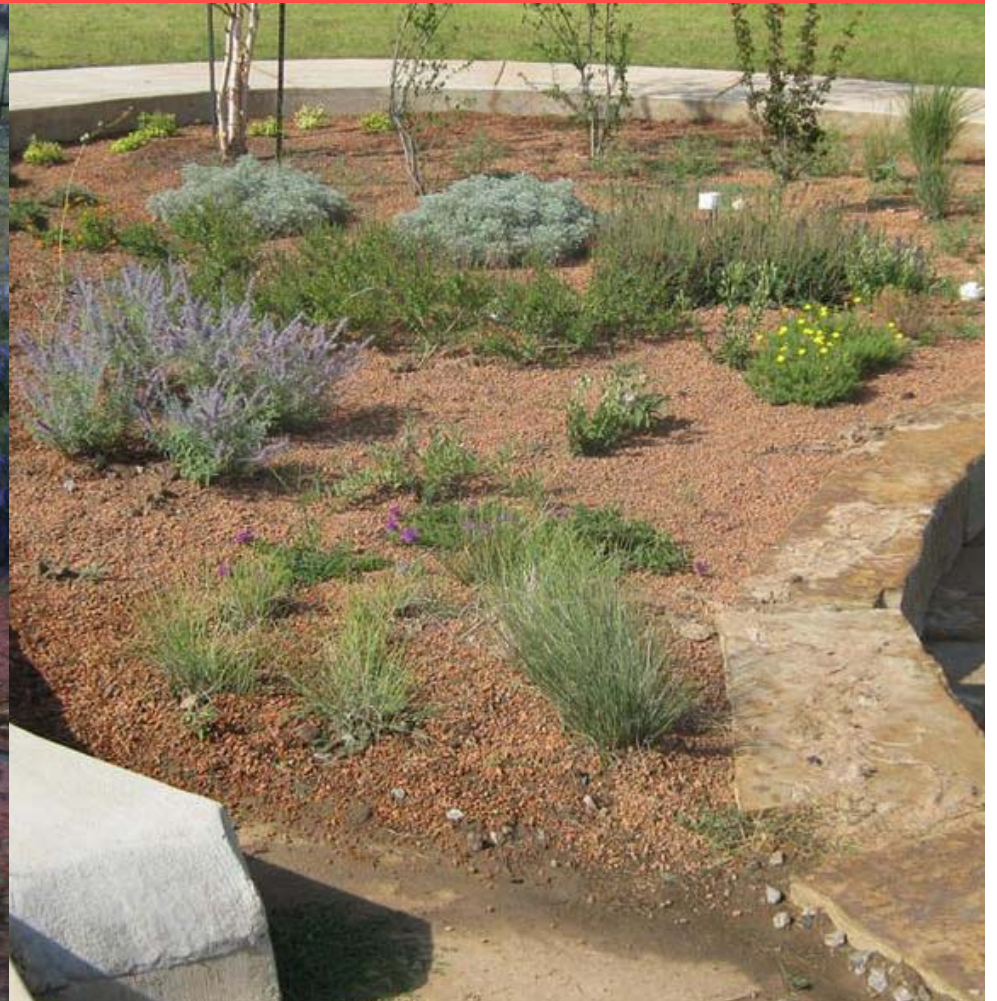
(Bedan and Clausen, 2009)

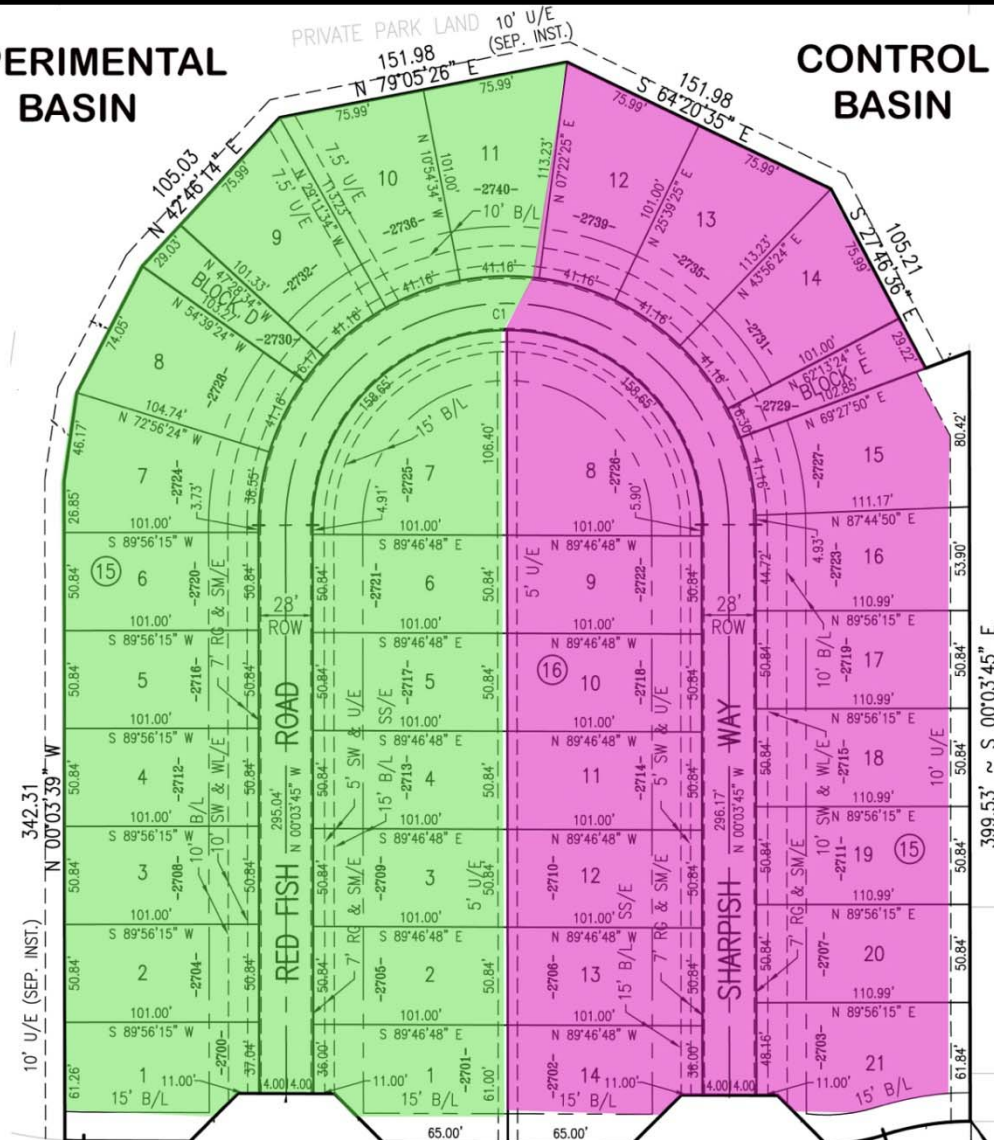


Local Precedent

Carrington Lakes Residential Community

Norman, OK





Experimental Design

The diagram illustrates the experimental design for a biocontainment facility, showing the movement of a biocontainment unit (BCU) through the facility and the locations of various biocontainment units (BCUs) at different stages of the experiment.

The facility is divided into three main sections:

- Capture:** The initial stage where the BCU enters the facility.
- Diversion:** The stage where the BCU is moved from the capture area to the biocontainment area.
- Biocontainment:** The final stage where the BCU is contained within the facility.

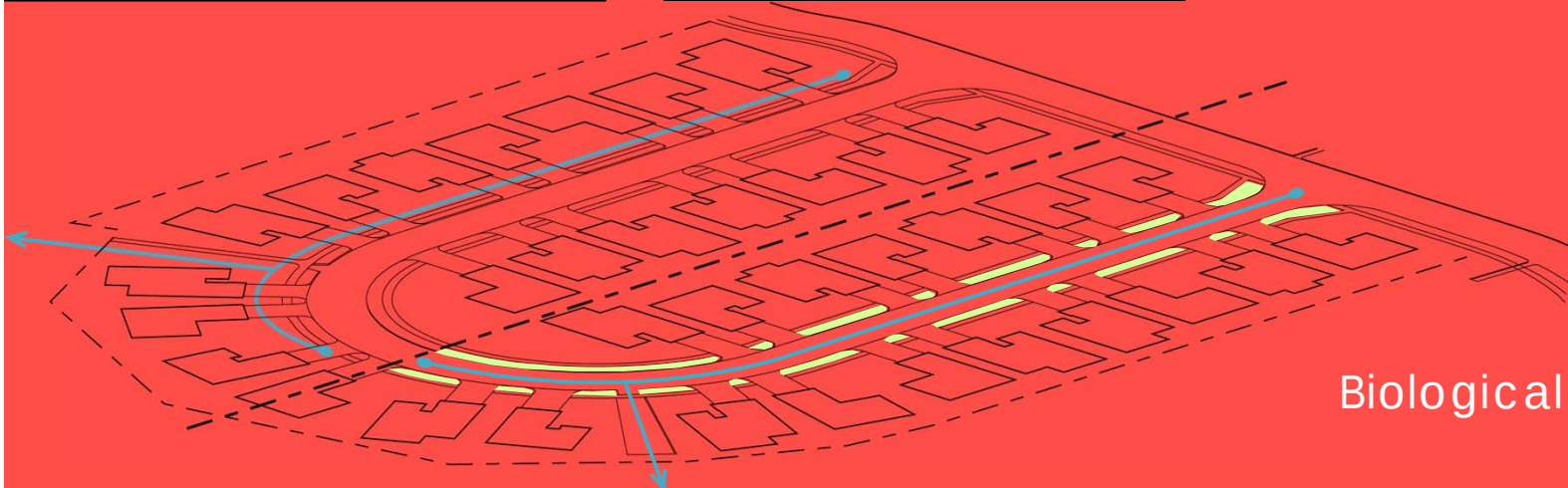
The diagram shows the BCU moving through the facility, with yellow dots indicating the locations of various biocontainment units (BCUs) at different stages of the experiment. Blue squares represent the locations of various biocontainment units (BCUs) at different stages of the experiment.

A close-up photograph of a white downspout pipe attached to a brick wall. The pipe is connected to the wall with a metal bracket, and there is a visible gap between the pipe and the wall, suggesting a potential entry point for water or insects.





BMP systems within the Neighborhood



Biological



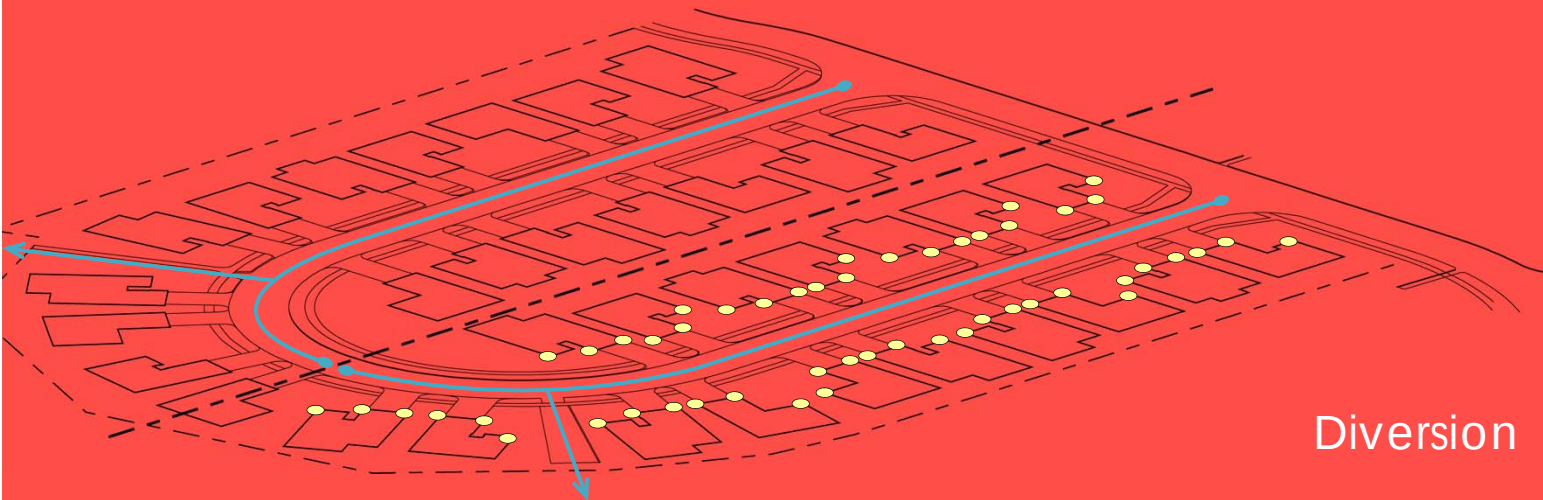
BMP systems within the Neighborhood



Containment



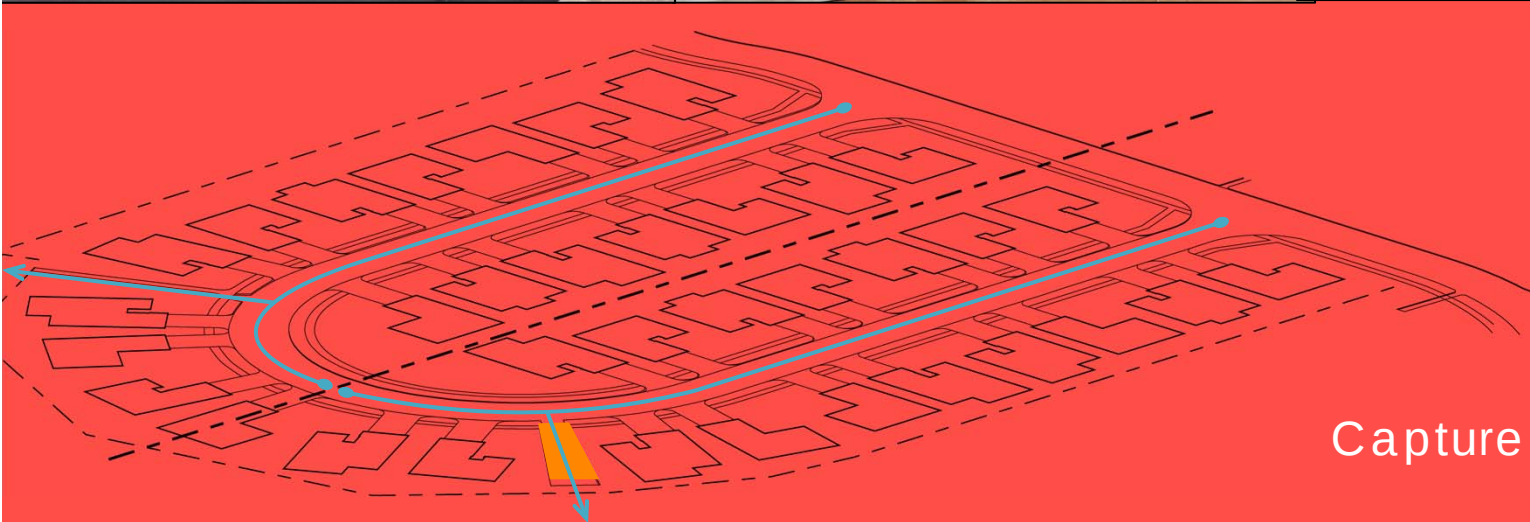
BMP systems within the Neighborhood



Diversion



BMP systems within the Neighborhood



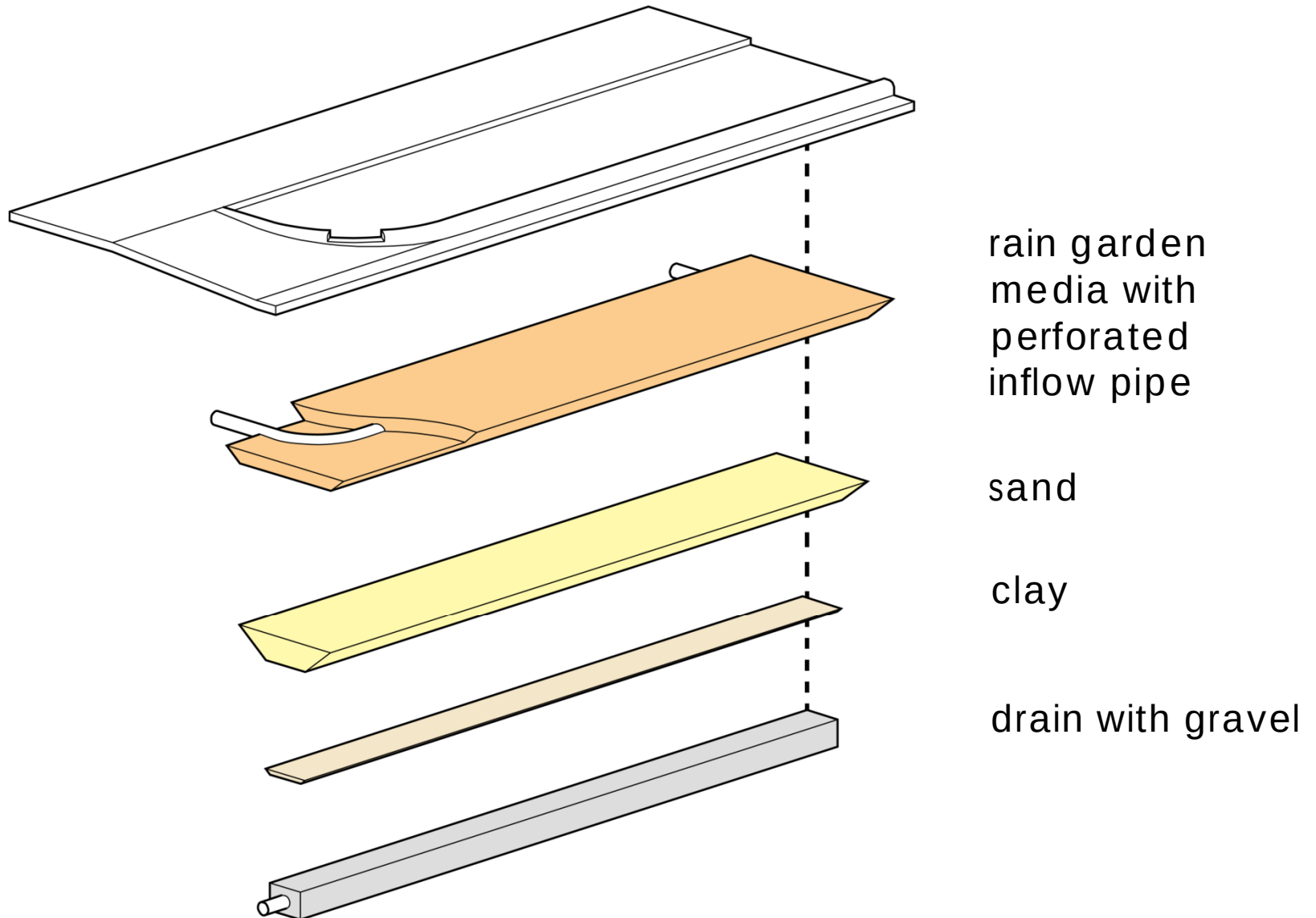
Capture



Work in the Gardens



Rain Garden Components

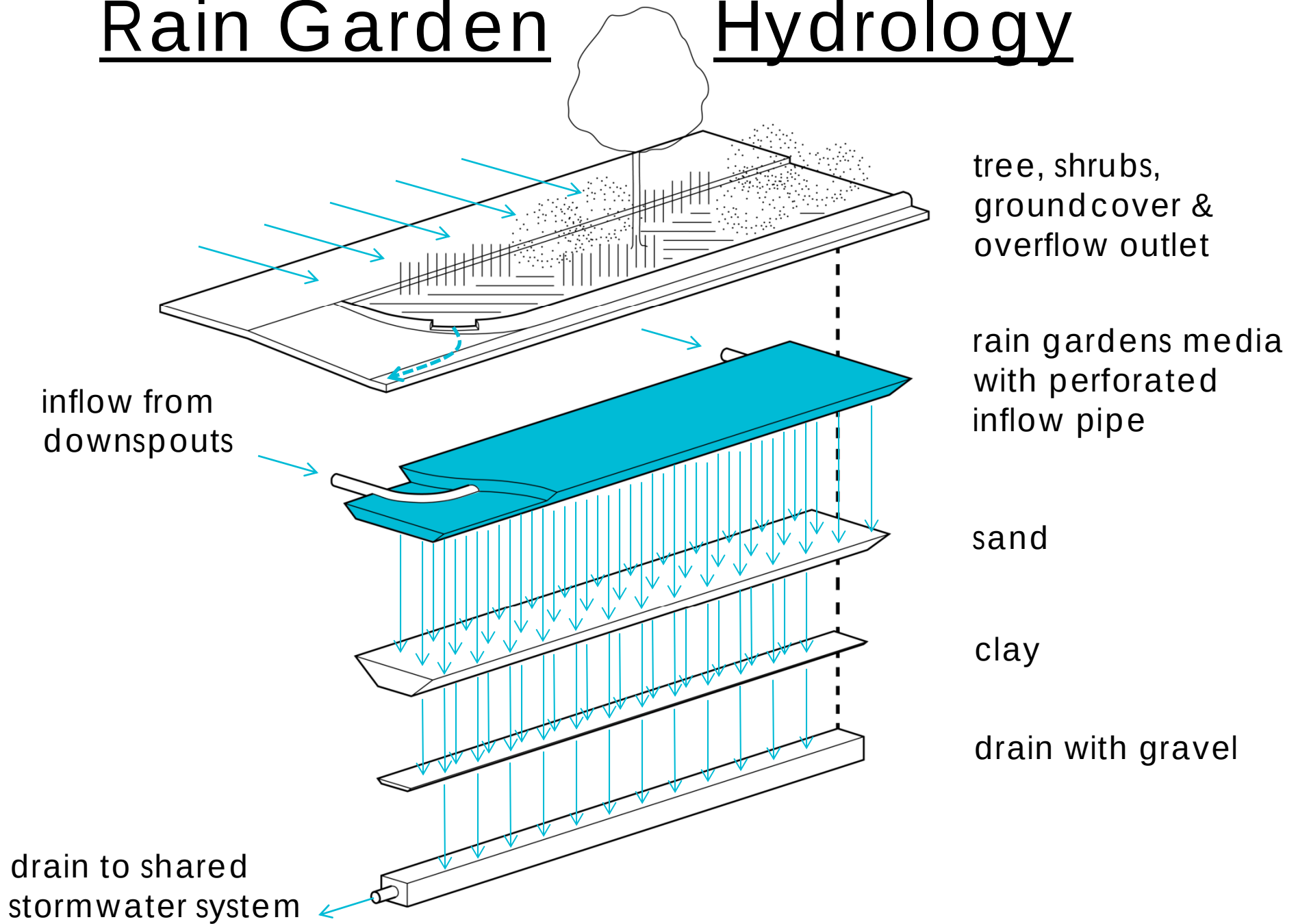


Installing the Gardens



Rain Garden

Hydrology



Maintaining the Gardens



Flume Installation



Monitoring Plan



Monitoring Stations

Trapezoidal Flumes

- two 18" 45° pre-fabricated trapezoidal flumes
- include both bubbler (quantity) and sampler (quality) connections

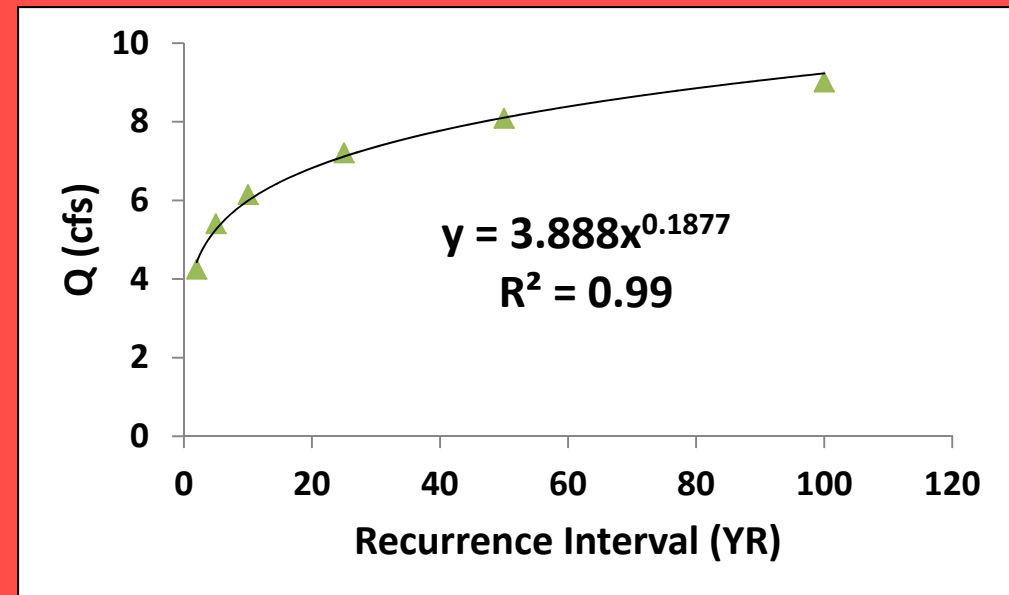
Automatic Samplers

- depth-activated
- composite “first flush” samplers



Water Quantity-Activated Sampling

- rational method to determine flow of storms of different return intervals
- calculated depth in each flume for each storm event
- actuator set at known depth to trigger



Interval	Q (cfs)	Depth (ft)	Depth (in)
15-day	2.14	0.75	9.06
30-day	2.43	0.80	9.63
60-day	2.77	0.85	10.23
120-day	3.16	0.91	10.87
180-day	3.41	0.94	11.27
270-day	3.68	0.97	11.67
1-yr	3.89	1.00	11.96
2-yr	4.25	1.04	12.45

Planned Water Quality Analyses

event-driven analyses

Analyses	
Field	Lab
T	TSS, SSC
DO	BOD
pH	TP, DRP
SC	NO ₃ -N, NH ₄ -N
TDS	Cu, Pb, Zn
ORP	Oil & grease



Installation Challenges



Flow Activation Challenges



Sampling Challenges



Sampling Challenges



Results to Date



Results to Date

- Near completion of all houses
- One remaining garden to install
- Monitoring site setup near completion
- No viable storm event samples been collected
- Homeowners need educated
- Successful plants / replanting



Project Participants

Oklahoma Conservation Commission	<i>Sponsor</i>
Terra Verde Land Development & Ideal Homes	<i>Client</i>
College of Architecture	<i>Designer/Planner</i>
College of Engineering/Center for Restoration of Ecosystems and Watersheds	<i>Researcher</i>
City of Norman	<i>Partner/Regulator</i>
SMC Engineering	<i>Consultant</i>
CH Guernsey Engineering	<i>Consultant</i>
Watershed Restoration Inc.	<i>Consultant</i>

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Thank you