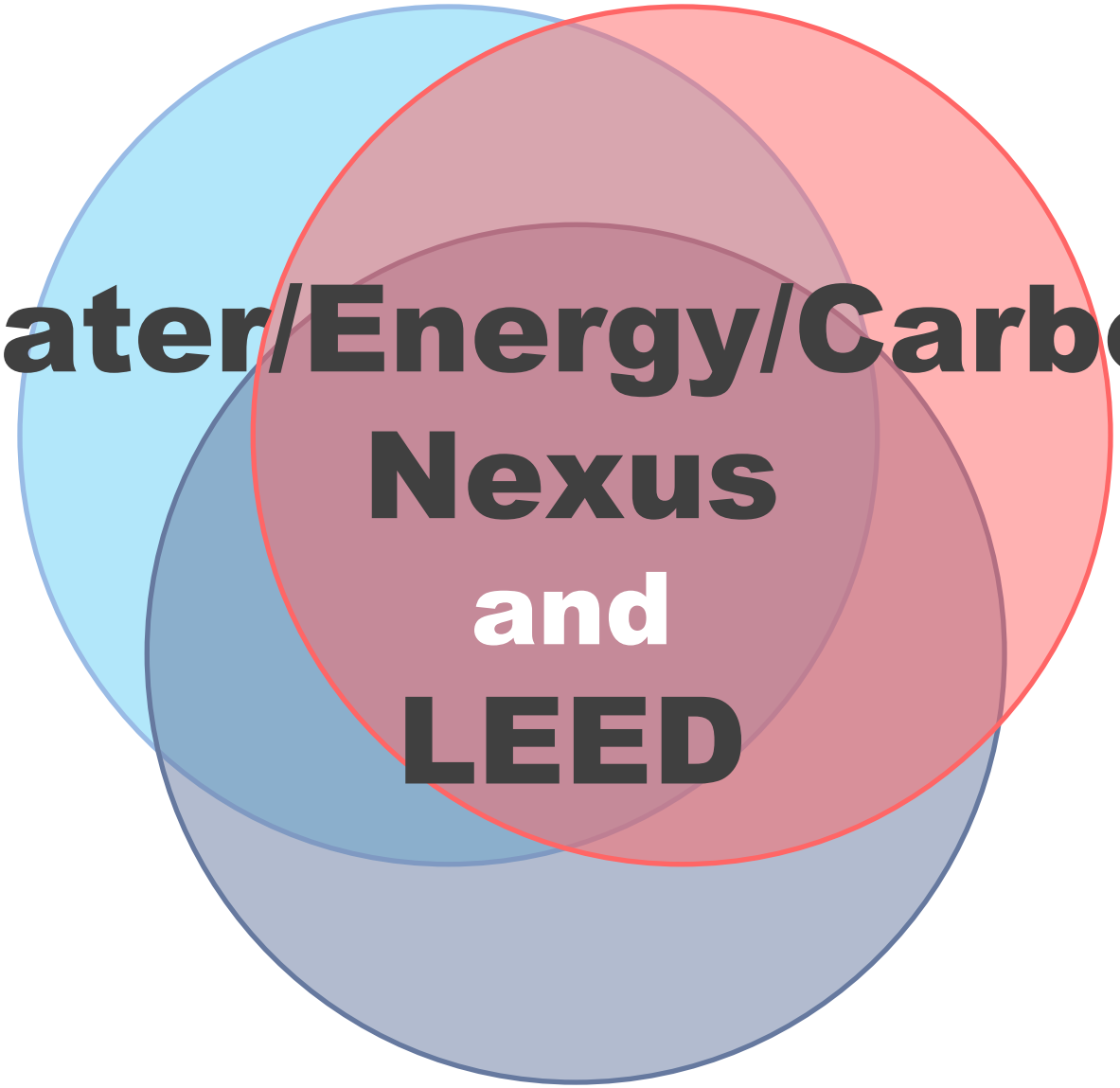
AIA CES no. - Water/Energy/Carbon Nexus and LEED / - AA112012A / 201

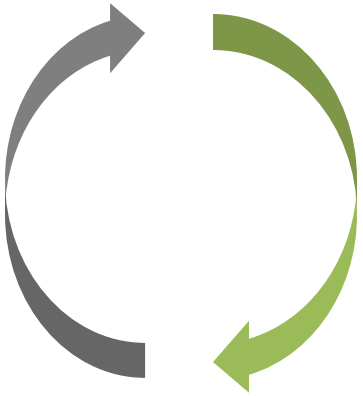


USGBC Course Approval No. 0090005699

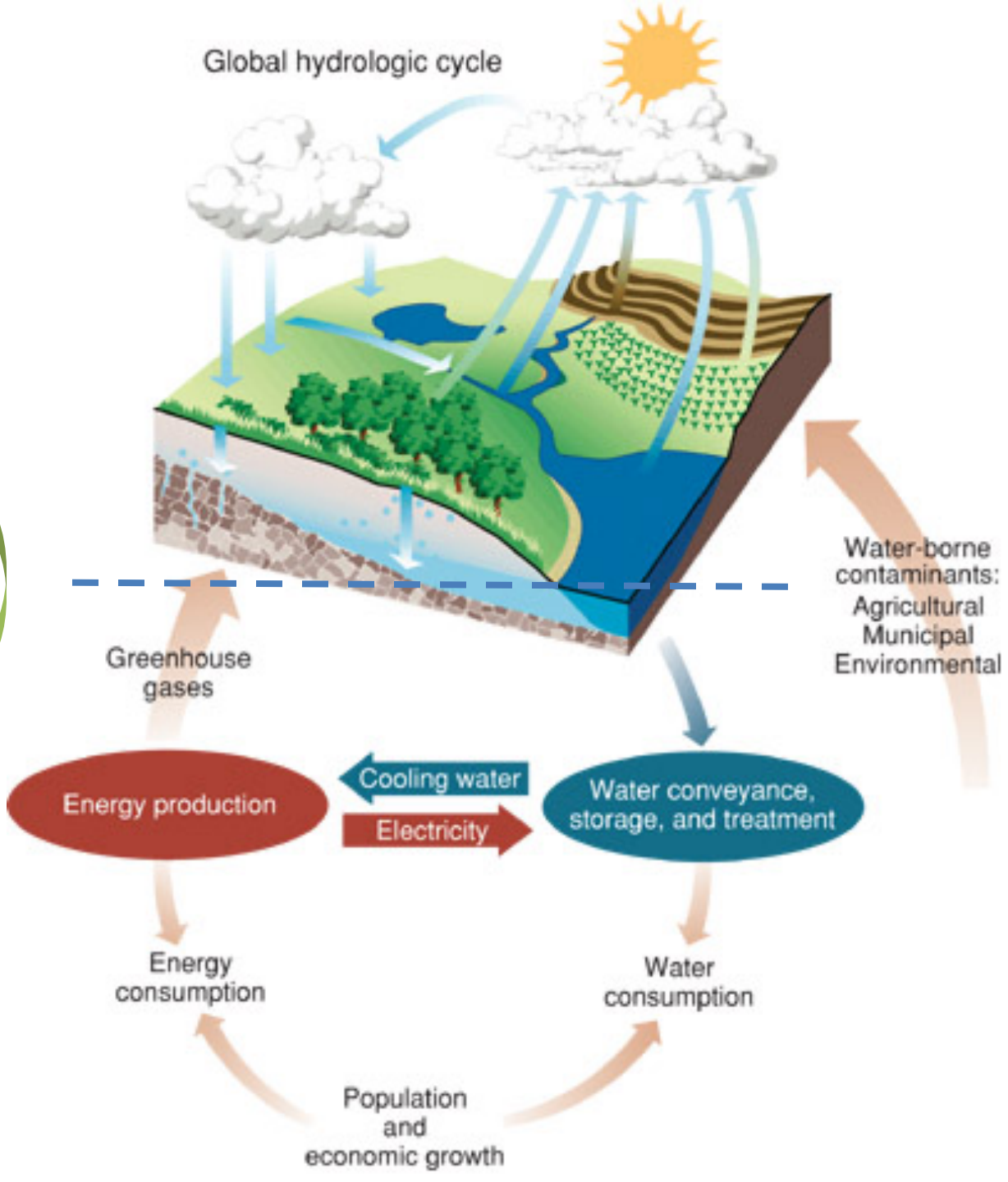
W/E/C Nexus

Prof. Steve Padget, RA, LEED AP.

Natural System

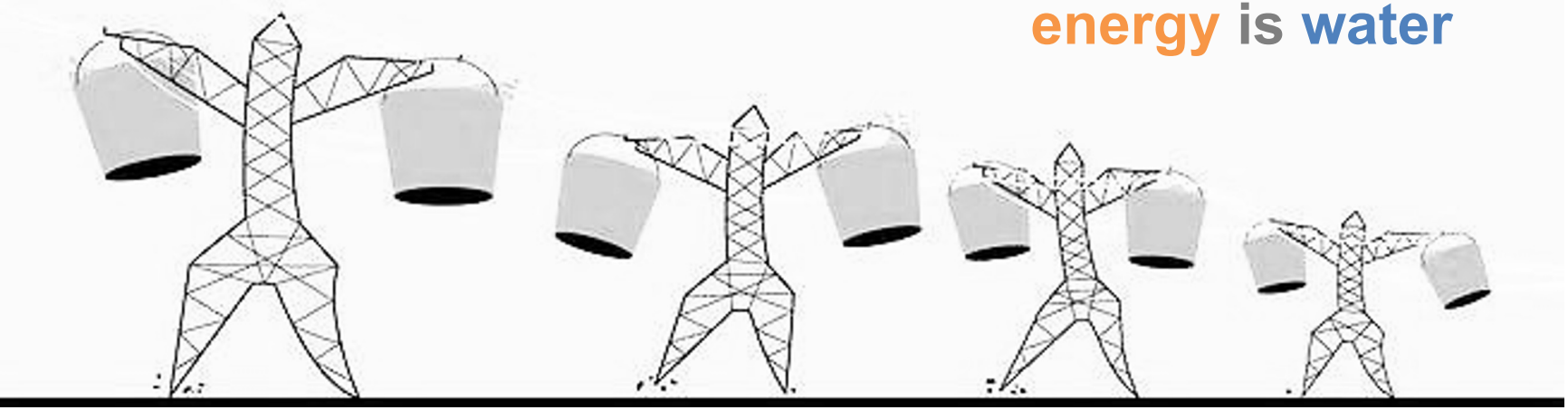


Artificial System



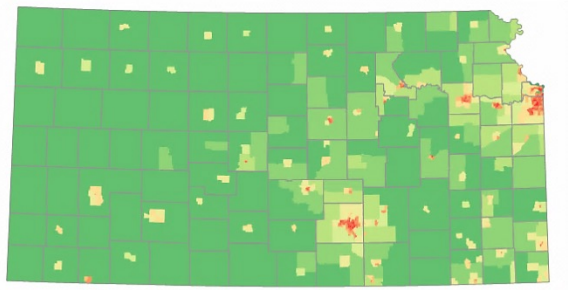
Energy / Water

In the U.S.
the greatest single use of
water is **energy**
the greatest single use of
energy is **water**



Prof. Steve Padget, RA, LEED AP.

10 Tons CO2



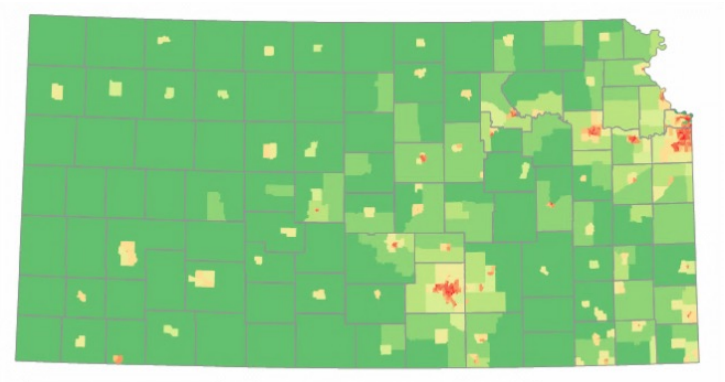
According to the U.S. DOE's Energy Information Administration, The 2008 electrical production in the State of Kansas was
46,630,000 MWh

Given the region's fuel mix, this electrical production results in
1,961 lb.'s of CO2 / MWhr.

So, the CO2 emissions in Kansas from electrical generation In 2008 was nearly
41,000,000 Metric Tons

This is the equivalent of
4,100,000 Goodyear Blimps
Or enough to cover the entire State in a layer of CO2 12" deep.

Prof. Steve Padget, RA, LEED AP.

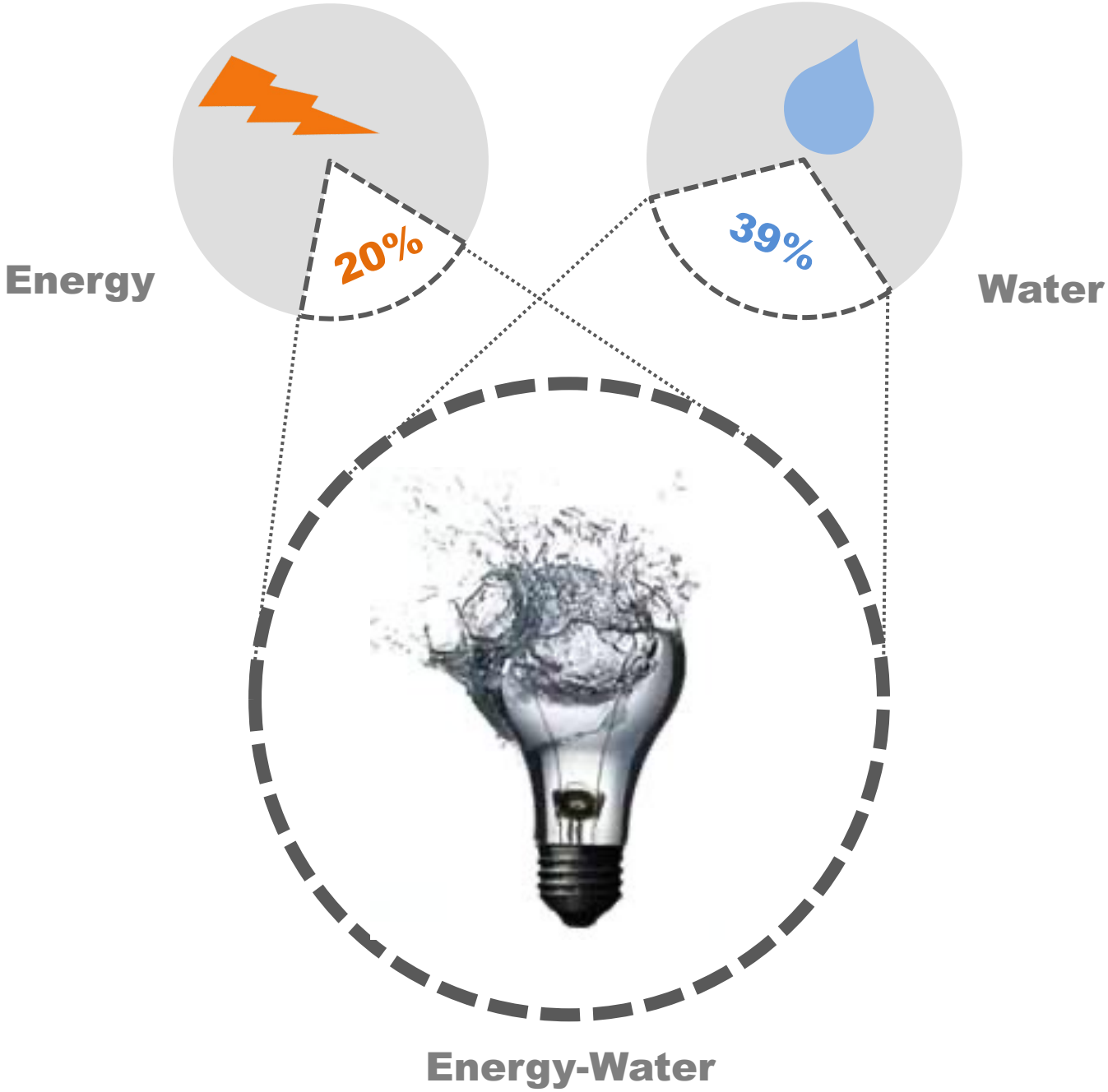


Returning to the State of Kansas in 2008,
There were **46,630,000 MWh** of electrical generation.

According to U.S.G.S. figures,
Kansas thermo-electric generation plants used
821,000 million gallons of water in the year 2000.

Assuming the 2000 and 2008 statistics are roughly comparable,
in Kansas, it takes 17,600 gallons of water to generate 1 MWh.
or **17.6 gallons to generate 1 KWh**.

Prof. Steve Padget, RA, LEED AP.



W/E/C Nexus

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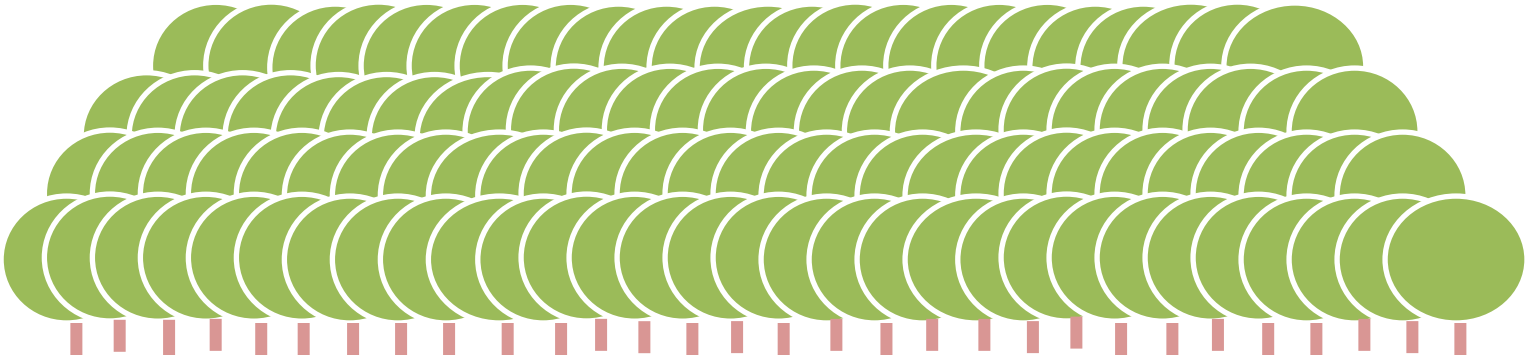
= 1 MG

1 MG = 2.7 MWh

2.7 MWh = 2.7 Tons CO2

2.7 Tons CO2 = 108 Trees



W/E/C Nexus

Prof. Steve Padget, RA, LEED AP.

1. Energy – Water

Energy Demands Water, Water Demands Energy

2. Energy = Carbon

Electrical Generation is from Fossil Fuels

3. Water = Carbon

Water Systems Reliant on Massive Electrical Generation

4. Resources Overtaxed

Demand/Supply Unsustainable

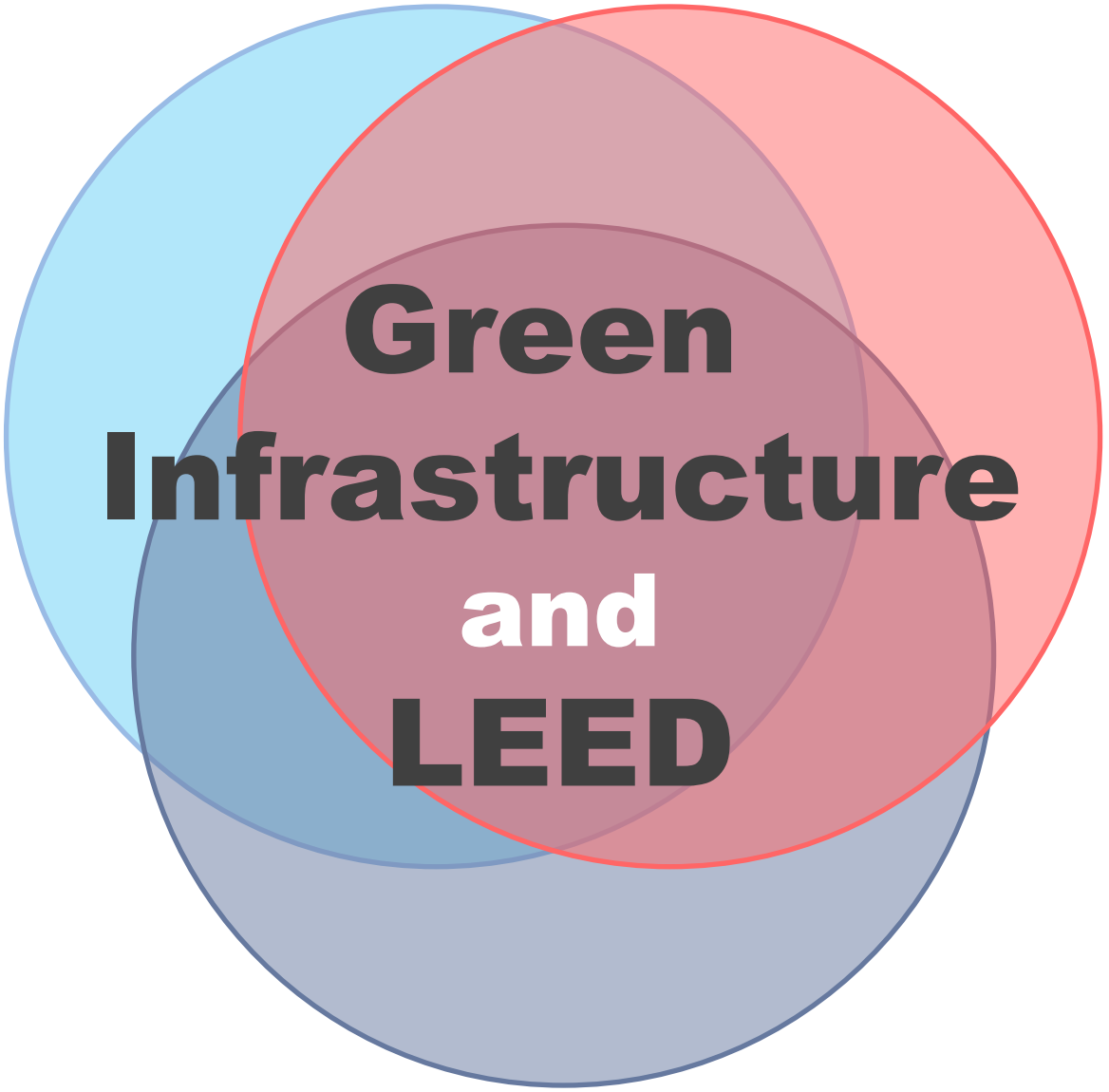
5. Combined Sewer Systems/ Impervious Landscape/ Heat Island Effect/ Pollution

6. Natural System Harmed

Water Sheds, Air & Water Quality, Eco-Systems (all scales)

Prof. Steve Padget, RA, LEED AP.

AIA CES no.-Green Infrastructure and LEED / - AA112012B / 2011



USGBC Course Approval Number 0090005707

Prof. Steve Padget, RA, LEED AP.

1 Human Waste is a Resource

It should be captured and processed effectively and put to use nourishing land and crops.

2 Stormwater is a Resource

Harvest stormwater as a water supply and infiltrate or retain it to support aquifers, waterways and vegetation.

3 Reuse and Reclamation

Water can be used multiple times by cascading it from higher to lower-quality needs (gray water for irrigation) and by reclamation treatment for return to supply.

4 Green Infrastructure

In addition to “Gray Infrastructure” techniques (pipes, treatment plants, etc.) include the natural capacities of soil and vegetation to absorb and treat water.

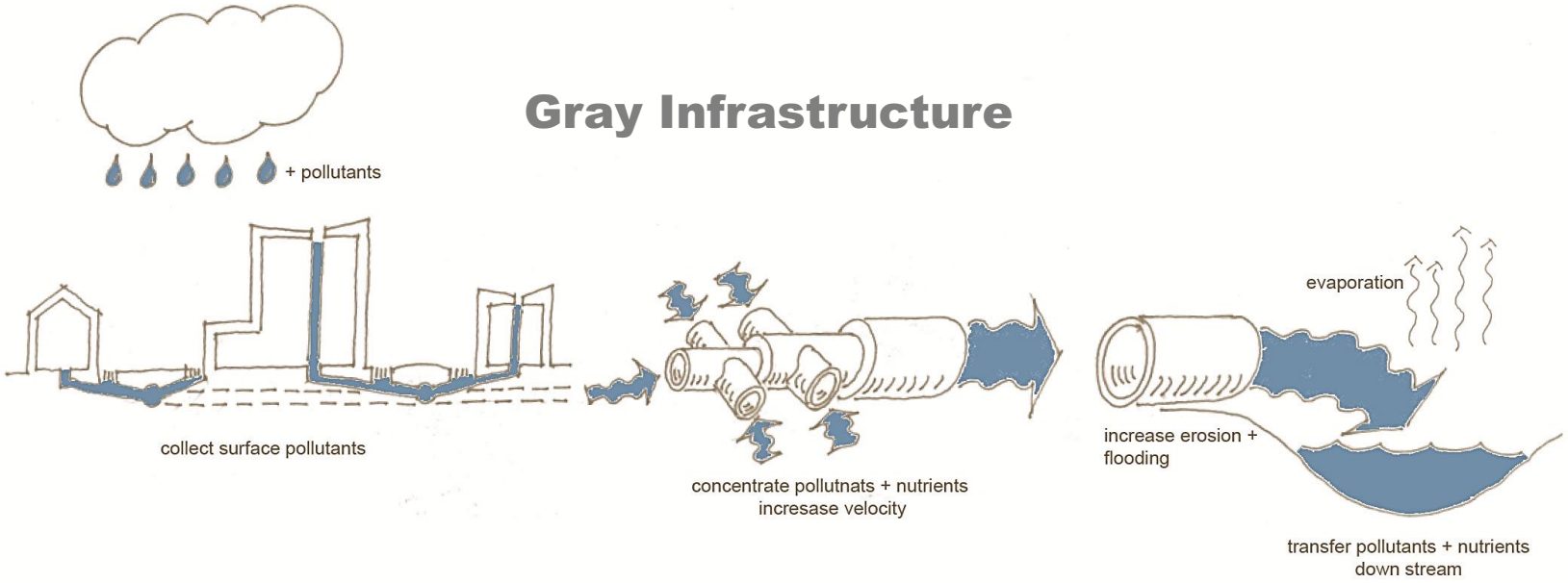
5 Restore Watershed (Biomimicry)

Allow the landscape to act as a sponge (for water and CO2) and to slowly filter out impurities before rainwater reaches major bodies of water.

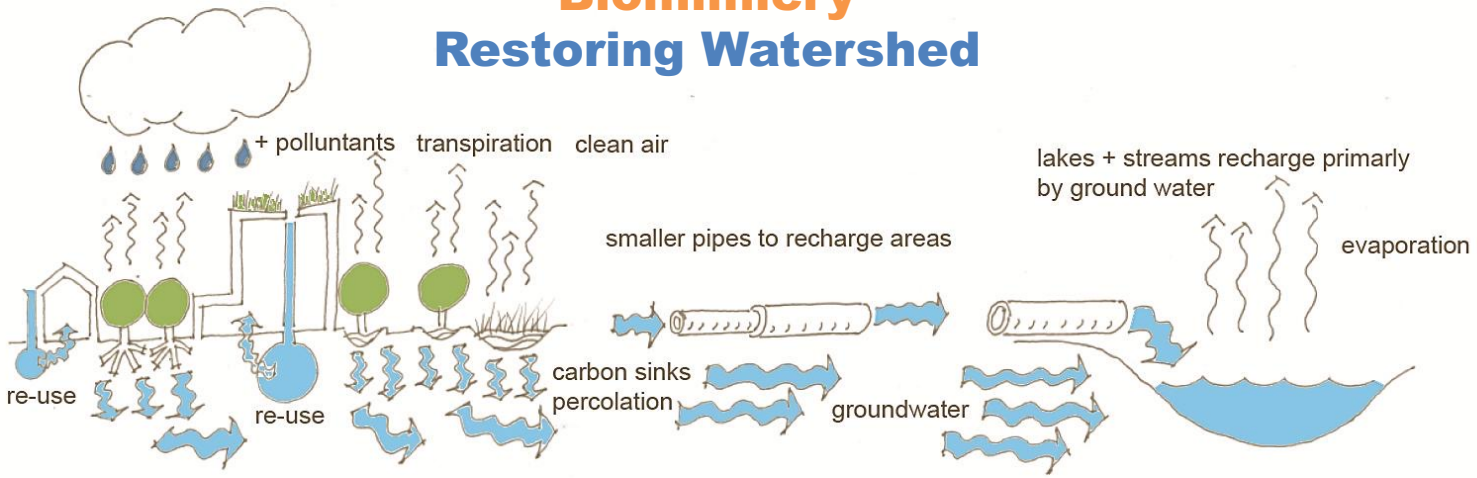
Green Infrastructure

Prof. Steve Padget, RA, LEED AP.

Gray Infrastructure



Green Infrastructure
Biomimicry
Restoring Watershed



filter pollutants, captures nutrients, revitalizes soil + landscape

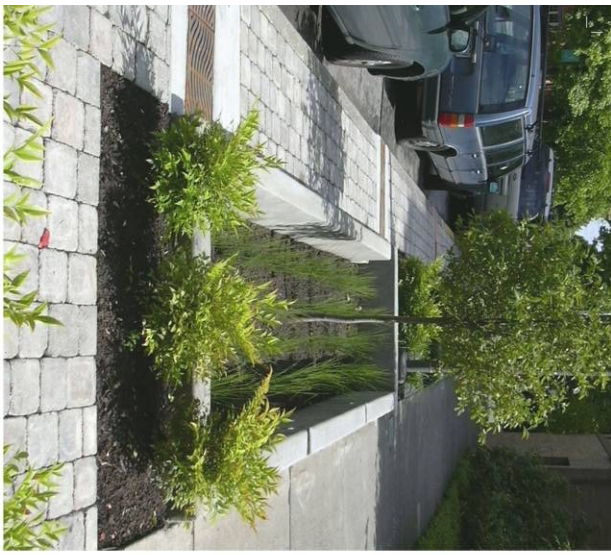
Green Infrastructure

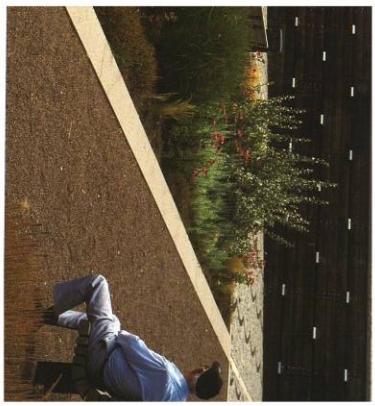
Prof. Steve Padget, RA, LEED AP.

Recessed Planter

Bio-Swale

Recessed Planter





Bump Out

Permeable Paving

Constructed Wetland

Green Infrastructure

Prof. Steve Padget, RA, LEED AP.

The Crossroads

425± total acres

350 million gallons of runoff/ year

75 million gallons of runoff during a 100 year storm

Gray Infrastructure

Prof. Steve Padget, RA, LEED AP.

The Crossroads

Infiltration Planters and Bump-outs (90%)

Pocket Parks

Green Roofs (80%)

Pervious Pavement (65%)

Bioswales (25%)

Green Infrastructure

Prof. Steve Padget, RA, LEED AP.

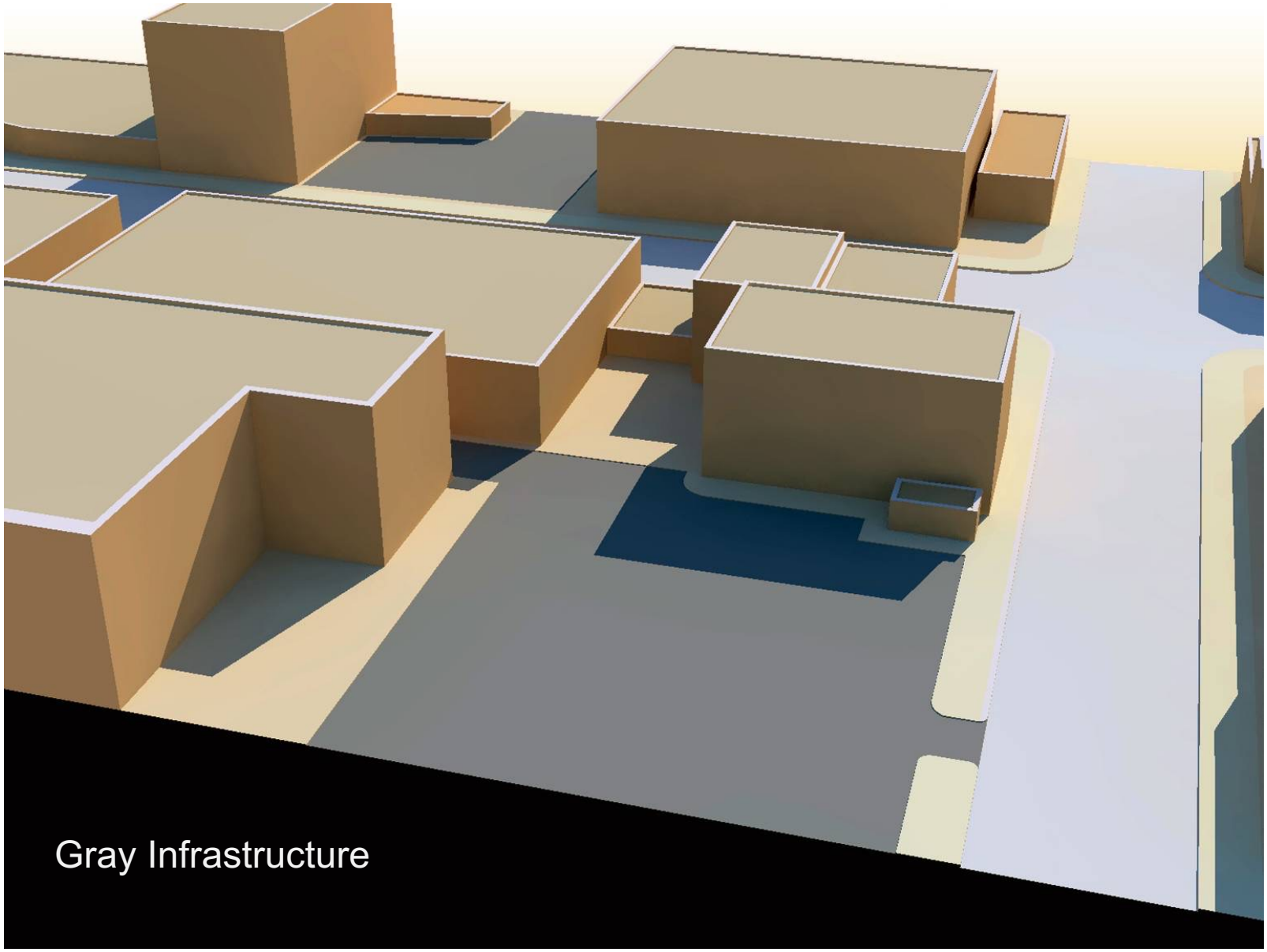
The Crossroads

210 million gallon/year reduction (60% of current run off) within the entire 425± acres of the Crossroads

Green Infrastructure

Prof. Steve Padget, RA, LEED AP.

BMPs in URBAN AREAS



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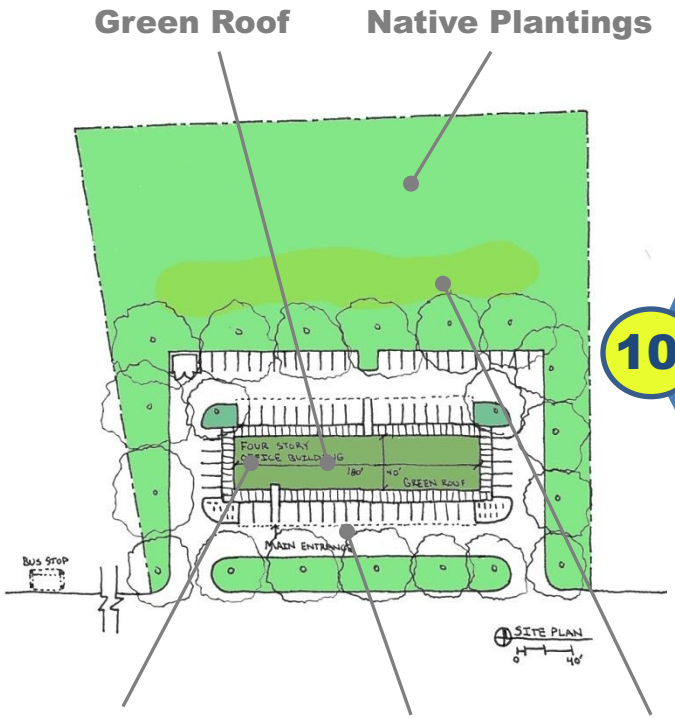
BMPs in URBAN AREAS

Prof. Steve Padget, RA, LEED AP.

Design Strategies:

Narrow Building Footprint
and
Green Infrastructure



10

LEED 2009 for New Construction and Major Renovation

Project Checklist

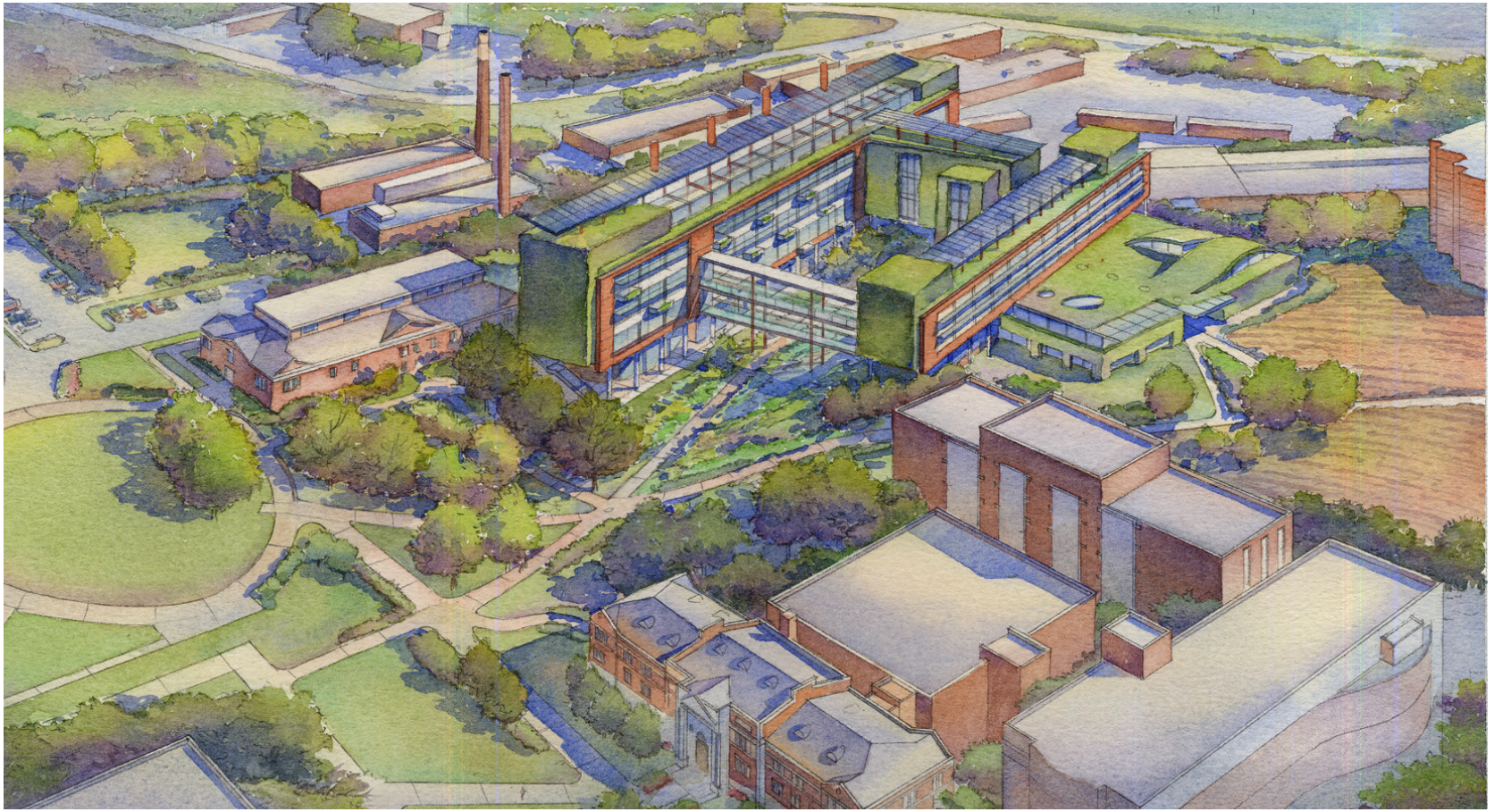
Y	N	?			
			Sustainable Sites	**Possible Points:**	**26**
Y			Prereq 1	Construction Activity Pollution Prevention	
			Credit 1	Site Selection	1
			Credit 2	Development Density and Community Connectivity	5
			Credit 3	Brownfield Redevelopment	1
			Credit 4.1	Alternative Transportation—Public Transportation Access	6
			Credit 4.2	Alternative Transportation—Bicycle Storage and Changing Rooms	1
			Credit 4.3	Alternative Transportation—Low-Emitting and Fuel-Efficient Vehicles	3
			Credit 4.4	Alternative Transportation—Parking Capacity	2
			Credit 5.1	Site Development—Protect or Restore Habitat	1
			Credit 5.2	Site Development—Maximize Open Space	1
			Credit 6.1	Stormwater Design—Quantity Control	1
			Credit 6.2	Stormwater Design—Quality Control	1
			Credit 7.1	Heat Island Effect—Non-roof	1
			Credit 7.2	Heat Island Effect—Roof	1
			Credit 8	Light Pollution Reduction	1
			Water Efficiency	**Possible Points:**	**10**
Y			Prereq 1	Water Use Reduction—20% Reduction	
			Credit 1	Water Efficient Landscaping	2 to 4
			Credit 2	Innovative Wastewater Technologies	2
			Credit 3	Water Use Reduction	2 to 4
			Energy and Atmosphere	**Possible Points:**	**35**
Y			Prereq 1	Fundamental Commissioning of Building Energy Systems	
Y			Prereq 2	Minimum Energy Performance	
Y			Prereq 3	Fundamental Refrigerant Management	
			Credit 1	Optimize Energy Performance	1 to 19
			Credit 2	On-Site Renewable Energy	1 to 7
			Credit 3	Enhanced Commissioning	2
			Credit 4	Enhanced Refrigerant Management	2
			Credit 5	Measurement and Verification	3
			Credit 6	Green Power	2
			Materials and Resources	**Possible Points:**	**14**
Y			Prereq 1	Storage and Collection of Recyclables	
			Credit 1.1	Building Reuse—Maintain Existing Walls, Floors, and Roof	1 to 3
			Credit 1.2	Building Reuse—Maintain 50% of Interior Non-Structural Elements	1
			Credit 2	Construction Waste Management	1 to 2
			Credit 3	Materials Reuse	1 to 2
			Indoor Environmental Quality	**Possible Points:**	**15**
			Credit 8.1	Daylight and Views—Daylight	1
			Credit 8.2	Daylight and Views—Views	1

Design Solutions

Prof. Steve Padget, RA, LEED AP.

Odum School of Ecology, BNIM

http://ugaecolivinglab.wordpress.com/



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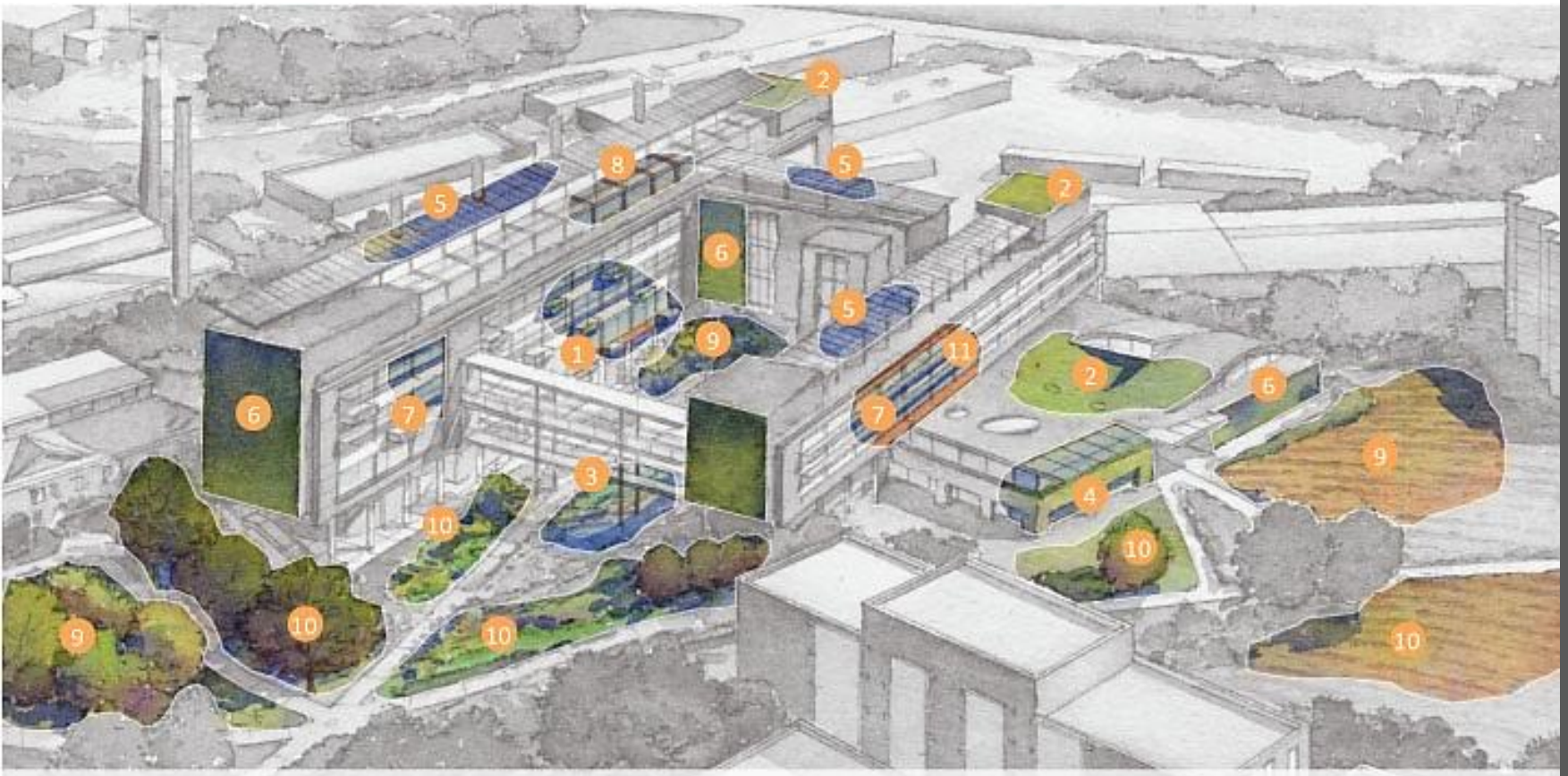

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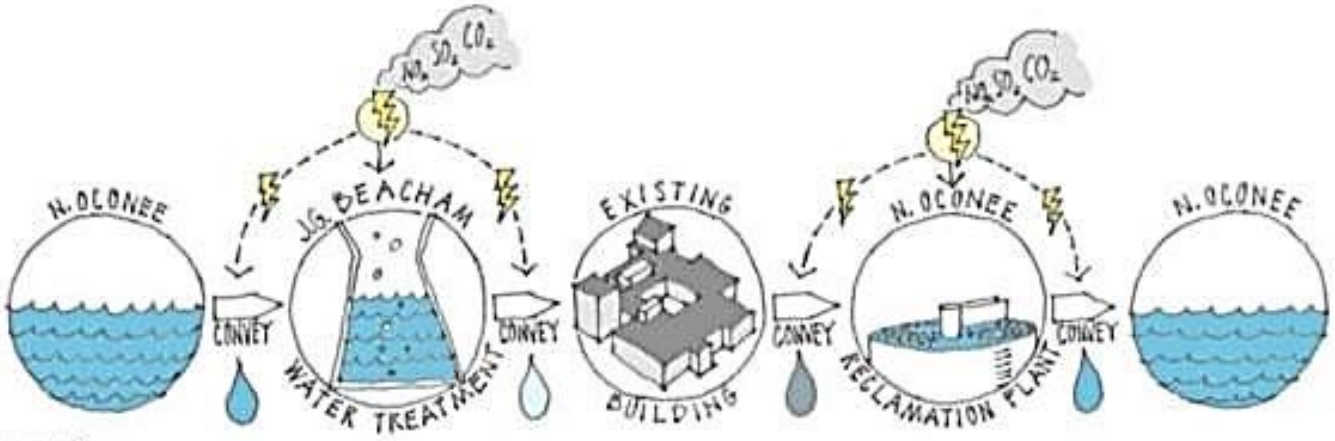
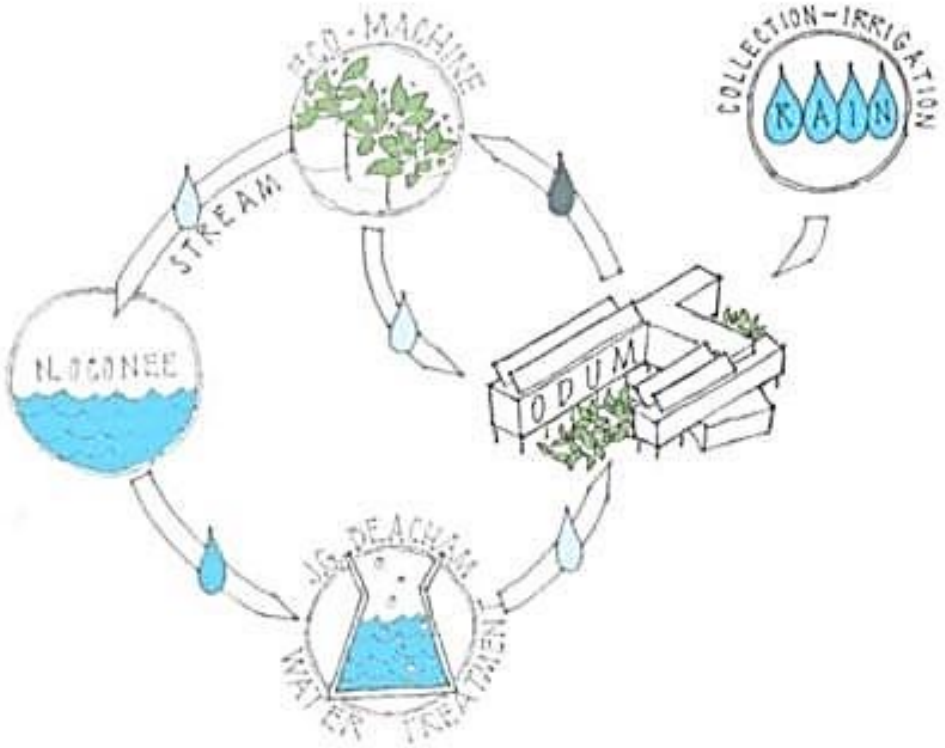


Existing water cycle

New water cycle

75%
REDUCTION



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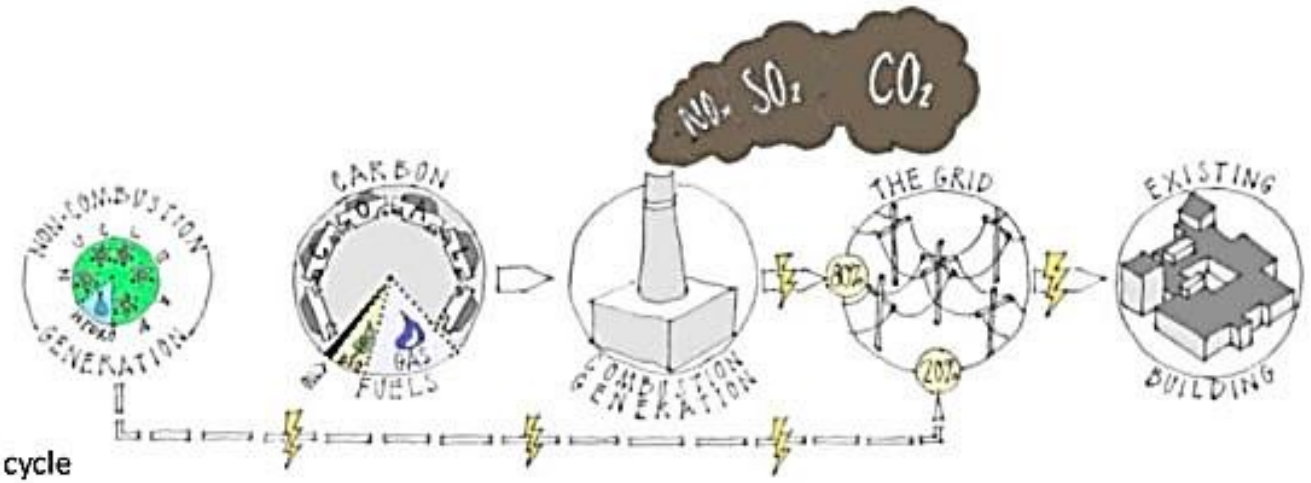
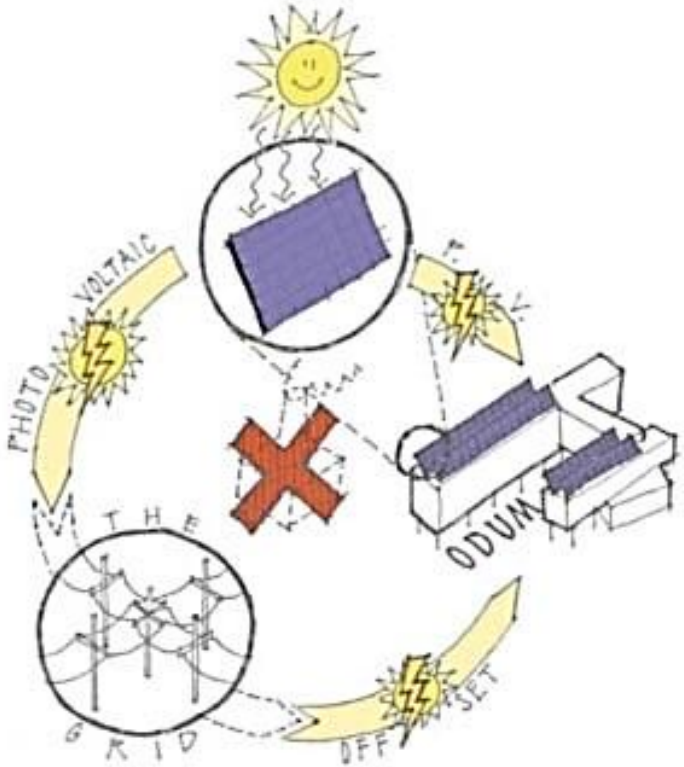


Existing energy cycle

New energy cycle

80%
LESS ENERGY



Design Solutions

Prof. Steve Padget, RA, LEED AP.

Odum School of Ecology, BNIM

1. Mechanical, Storage, Overflow
2. Laboratories
3. Circulation, Garden Commons
4. Courtyard (Stream, Trees, Living Laboratories)
5. Offices, Administration, Café
6. Auditorium, Exhibit Space, Entry, Eco-Machine
7. Green Roof
8. Mechanical Room
9. Green Wall, Green Roof
10. Green House
11. Living Wall
12. Balconies
13. Photovoltaics
14. Access between levels and green roof
15. Double skin facade

Prof. Steve Padget, RA, LEED AP.

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Design Solutions

Prof. Steve Padget, RA, LEED AP.

Omega Center for Sustainable Living, BNIM

Design Solutions

Prof. Steve Padget, RA, LEED AP.

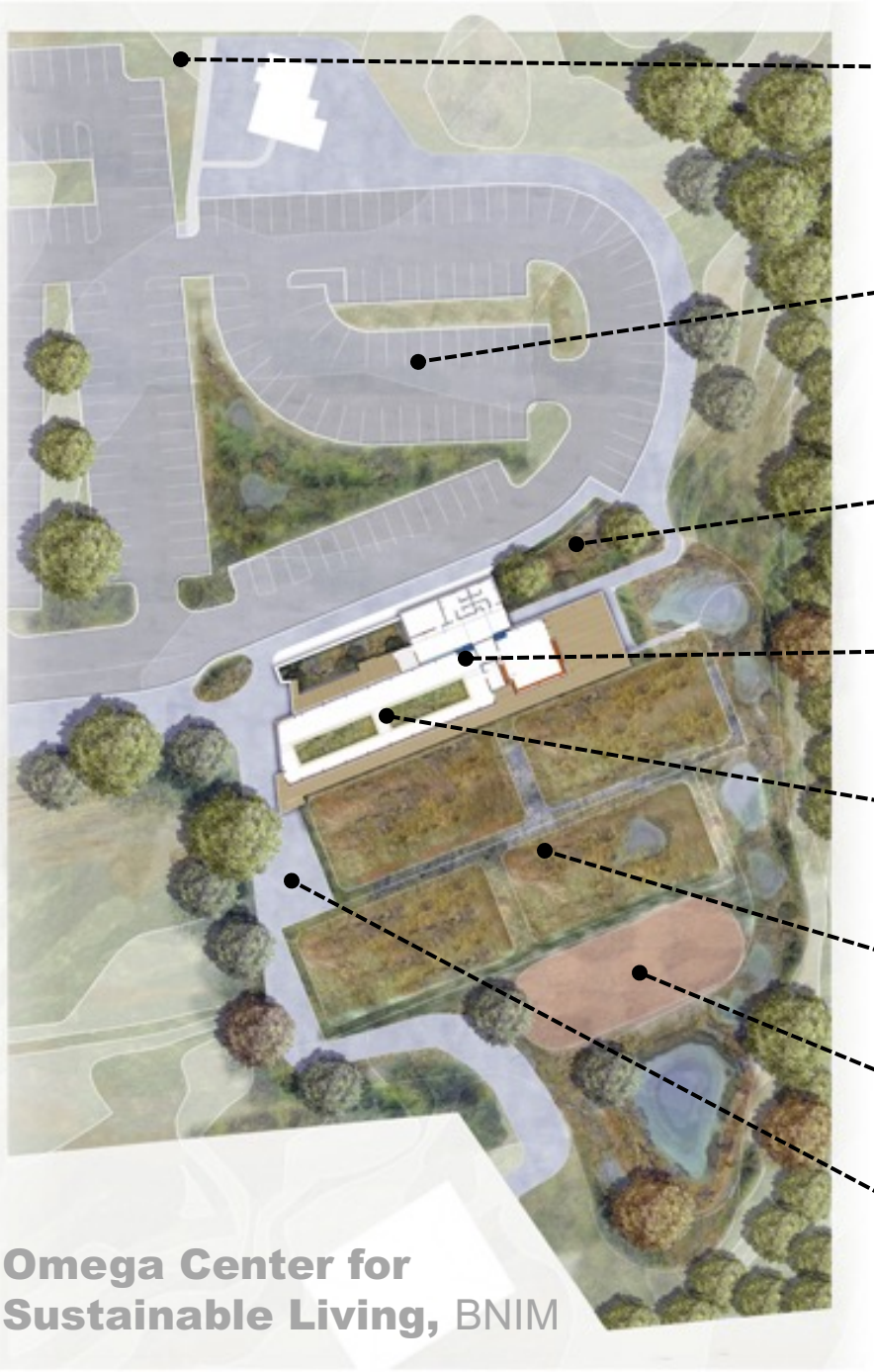
Omega Center for Sustainable Living, BNIM

Sun Air Water Materials Ecosystem

Creating an interior environment, comfortable for people and at the same time fertile for the plants, was critical. The result is a careful balance of passive and mechanical comfort systems. Solar tracking skylights help to provide the optimal amount of light. A high percentage of reclaimed and recycled materials were used throughout.

Design Solutions

Prof. Steve Padget, RA, LEED AP.



Septic Tanks (EM 1)

Permeable
Paving &
Subsurface Dispersal

Water Gardens &
Rainwater Cistern

Rainwater Collection
& Green Roof

Aerated
Lagoons (EM 4)

Constructed Wetlands (EM 3)

Sand Filter (EM 5)

Anaerobic Tanks (EM 2)

Omega Center for Sustainable Living, BNIM

Design Solutions

Prof. Steve Padget, RA, LEED AP.

Building Sq. Ft.

6,250

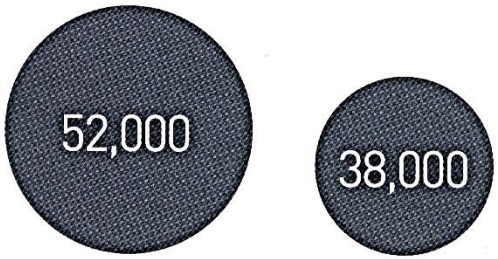
Site Acreage

4.5

Sustainability Metrics

THE PROJECT IS CERTIFIED AS LEED PLATINUM AND HAS EARNED 'LIVING' STATUS IN LIVING BUILDING CHALLENGE 1.3

Water Reclamation Capacity



Maximum Design Flow

Measured Maximum Flow

gallons per day (GPD)
Estimated annual flow 5 million gallons

Rainwater Use for Toilet Flushing

40

gallons. Average Daily Demand

1,800

gallon cistern stores enough water for 45 days

Embodied CO_2

-1,387

metric tons (+/- 25%) (Estimated using buildcarbonneutral.com). The percentage of the shortgrass planting area being replaced with the wetlands plant area greatly offsets the embodied CO_2 of the construction project, which results in a negative number. Embodied carbon is the carbon released when a product is manufactured, shipped to a project site and installed.

The Construction Carbon Calculator estimates embodied carbon. This calculator looks at an entire project and takes into account the site disturbance, landscape and ecosystem installation or restoration, building size and base materials of construction.

http://buildcarbonneutral.org/

Generation Capacity (Electricity)

2,830

sq. ft of photovoltaic panels, 211 panels in 3 arrays

134.2

Kw/day (48.53 Kw/hour max output)

Electricity Demand

132.77

Kw/day (average)

Electricity Usage

-1.43

Kw/day (average) – the building is designed to generate more electricity than it uses

Prof. Steve Padget, RA, LEED AP.