Bumps on the Road to Net Zero Water!
KENTUCKY STORMWATER ASSOCIATION CONFERENCE

The Berea College Deep Green Student Residence

Berea College, Berea Kentucky

GOD HAS MADE OF ONE BLOOD ALL PEOPLES OF THE EARTH
BEREA COLLEGE

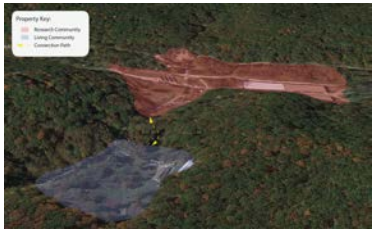
Hastings+Chivetta
ARCHITECTURE • PLANNING • ENGINEERING

hellmuth + bicknese
architects

TYSON LIVING LEARNING CENTER (LBC CERTIFIED)
Cost: 1.5 Million **Sf:** 3,000 Learning Center/ 1,100

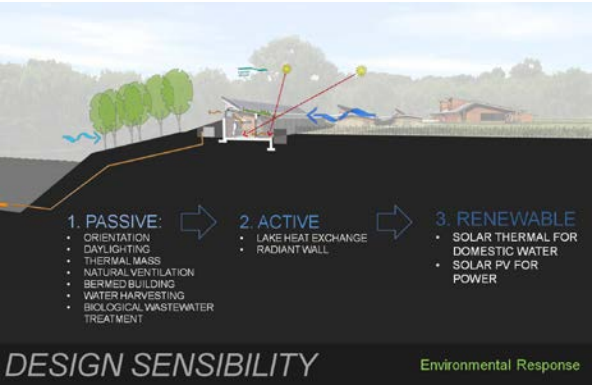
BEREA COLLEGE: DEEP GREEN STUDENT RESIDENCE
(LBC PETAL CERTIFIED – MATERIALS)
Cost: 13 Million **Sf:** 11,500

THE COLLEGE SCHOOL: JAN PHILLIPS LEARNING CENTER (LBC REGISTERED)
Budget: 1.6 Million **Sf:** 3,300 Learning Center / 1,500 Pavilion



KNOX COLLEGE: GREEN OAKS FIELD STATION
Cost: TBD **Sf:** TBD

TYSON RESEARCH CENTER: Living Community Challenge
Cost: TBD **Size:** 2,000 acres



CINCINNATI ZOO: AFRICA IV
Cost: 1.5 Million **Sf:** 2,370

BUTLER UNIVERSITY LIVING BUILDING (BULB)
Cost: TBD **Sf:** TBD

Conceptual Design Phase

Importance of Conceptual Design Phase to explore options, set budgets & goals and establish concensus!

2 Full Day Charrettes with Administration, Staff, Students and Design Team.

Explore Unique Aspects of Berea College

- **Student Labor Program**
- **Student Crafts**
- **History of Student Construction**
- **8,000 acre Berea College Forest**
- **Art Department**

LEED Platinum – Living Building Challenge Stretch Goal

EUI = 29kBTU/sf/yr!

Integrate Pedagogical Opportunities into the Design, Construction Process and Daily Living "Learning by Living"

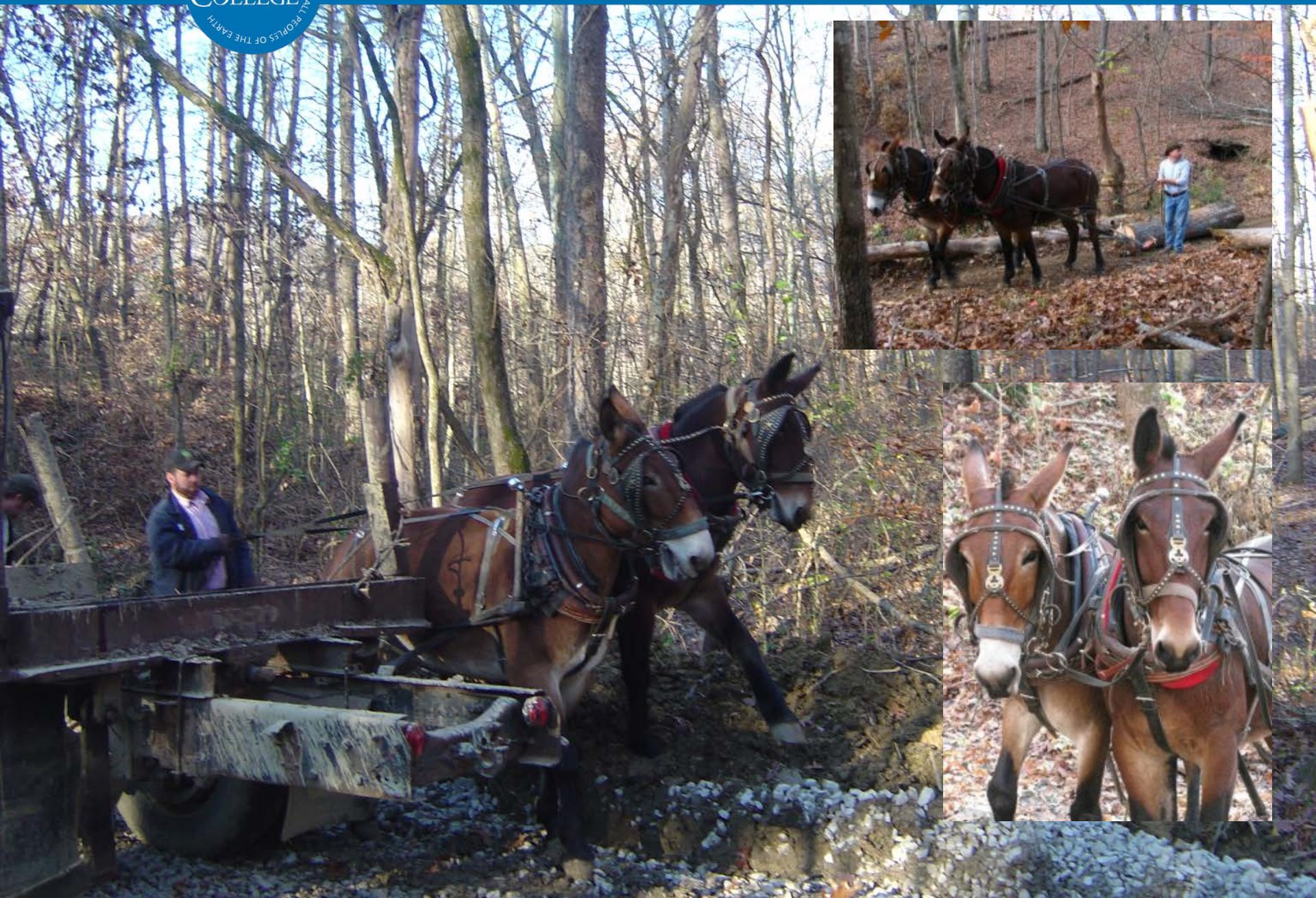
Deep Green's energy performance has been operating as designed, or better. Last year's EUI was around 30 btu/sf/yr!

- **Residents control their energy use and environmental impacts by their actions**
- **Nearly every building feature, inside and out, is designed to teach**
- **Collaborative, creative learning opportunities were integral to making this project a reality**
- **The Building Dashboard provides real-time feedback on energy, water and overall perform**

THE BEREA COLLEGE FOREST

Place-Based Relationships

SKIDDING LOGS WITH A MULE TEAM




DEEP GRE
furniture
Born To Party
Forced To Work

DORMITORY ROOMS

FURNITURE

Student Labor Program

SUNDIAL

SUNDIAL

Art 186

SUNDIAL

Art 186

SUNDIAL

Natural Patterns and Processes

THE METAPHOR OF THE FLOWER

ROOTED IN PLACE AND YET:

Harvests all energy + water

Is adapted to climate and site

Operates pollution free

Is comprised of integrated systems

Is beautiful

LIVING BUILDING CHALLENGE

© 2009 ILBI

STRETCH GOAL: Living Building Challenge Petal Recognition

Petal Summary:

Site
Water
Energy
Health
Materials
Equity
Beauty

The Living Building Challenge provides a directive for Innovation, Integrative Design, Education & Inspiration and a connection to nature through the built environment.

Summary Matrix:

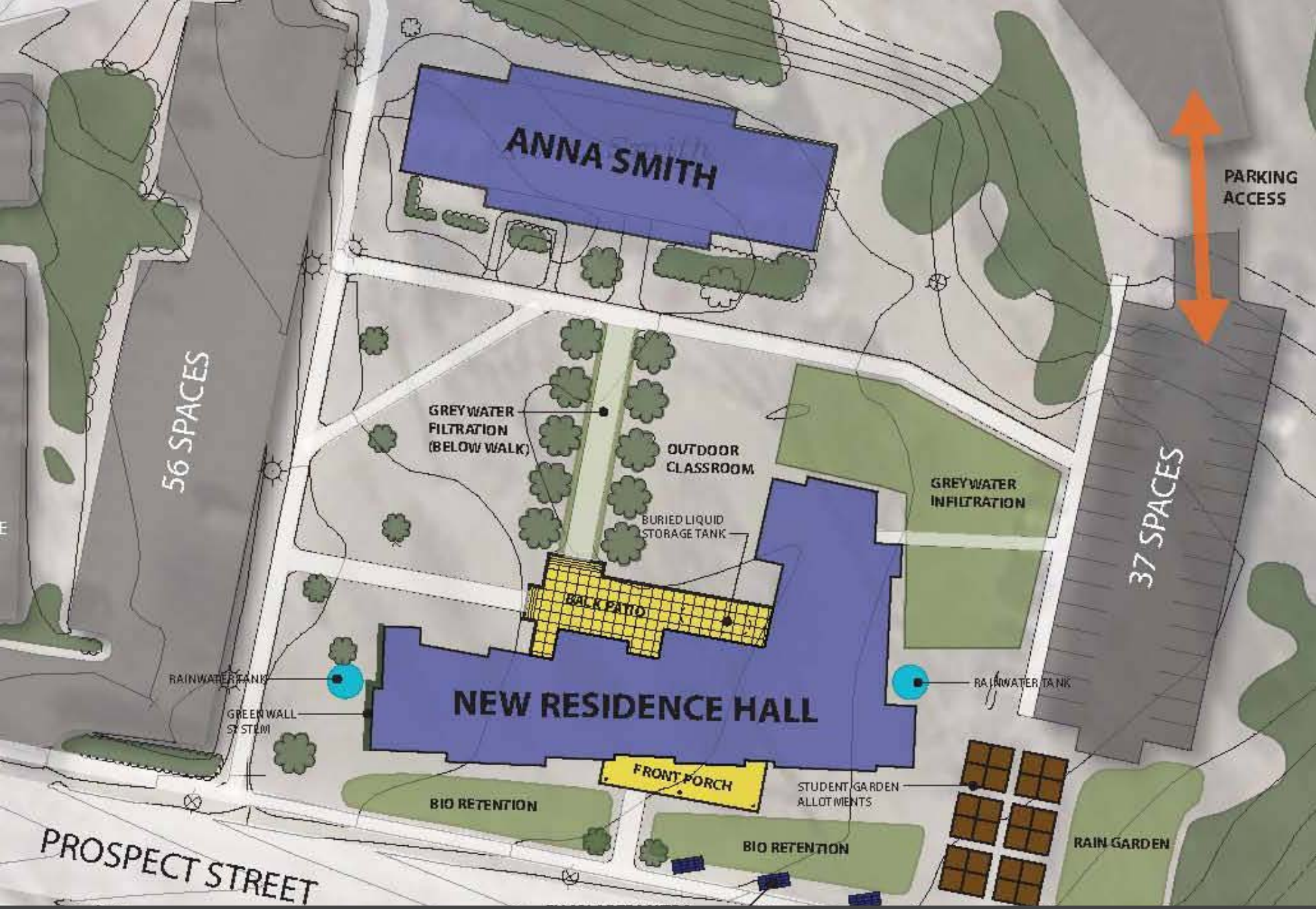
The 20 Imperatives of the Living Building Challenge:
Follow down the column associated with each Typology to see which Imperatives apply.

Imperative omitted from Typology

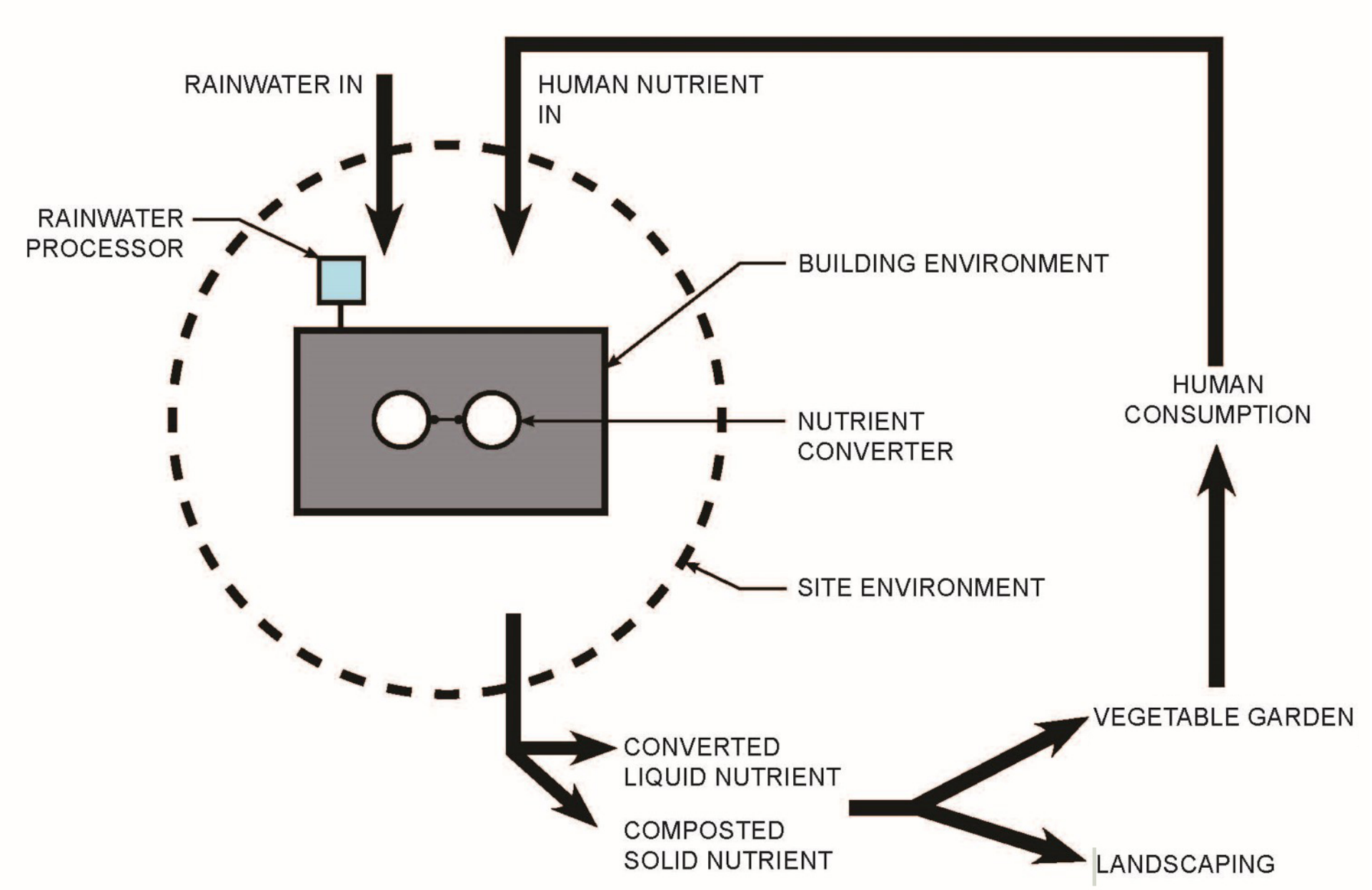
Scale Solutions beyond project footprint are permissible

	NEIGHBORHOOD	BUILDING	LANDSCAPE + INFRASTRUCTURE	RENOVATION	
SITE					LIMITS TO GROWTH
	Scale Jumping				URBAN AGRICULTURE
	Scale Jumping				HABITAT EXCHANGE
					CAR FREE LIVING
WATER	*Scale Jumping*				NET ZERO WATER
	Scale Jumping				ECOLOGICAL WATER FLOW
ENERGY	*Scale Jumping*				NET ZERO ENERGY
HEALTH					CIVILIZED ENVIRONMENT
					HEALTHY AIR
					BIOPHILIA
MATERIALS					RED LIST
	Scale Jumping				EMBODIED CARBON FOOTPRINT
					RESPONSIBLE INDUSTRY
					APPROPRIATE SOURCING
					CONSERVATION + REUSE
EQUITY					HUMAN SCALE + HUMANE PLACES
					DEMOCRACY + SOCIAL JUSTICE
					RIGHTS TO NATURE
BEAUTY					BEAUTY + SPIRIT
					INSPIRATION + EDUCATION

6 PETALS – 20 IMPERATIVES



NET ZERO WATER: From Concept to Reality…


RAINWATER IN
HUMAN NUTRIENT IN
RAINWATER PROCESSOR
BUILDING ENVIRONMENT
NUTRIENT CONVERTER
HUMAN CONSUMPTION
SITE ENVIRONMENT
CONVERTED LIQUID NUTRIENT
COMPOSTED SOLID NUTRIENT
VEGETABLE GARDEN
LANDSCAPING

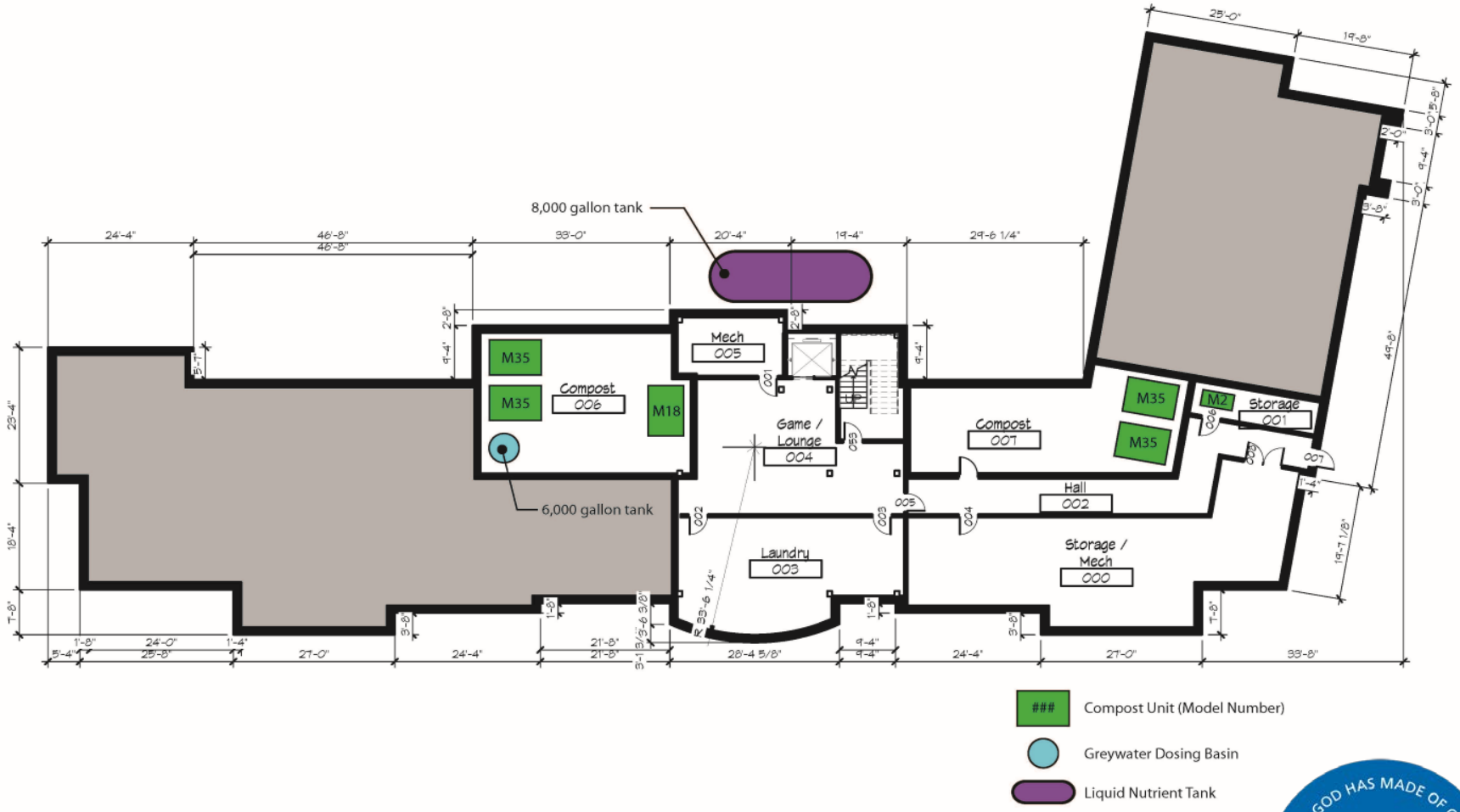
PREMISE:

1. What if human "waste" was actually human "nutrient"?*
2. What if potable water was taken out of the equation all together?
3. Why mix water with waste and make it “septic”?
4. What if this could be duplicated as a modular system at any scale?
5. Is this a "pipe" dream or reality
6. What if stormwater was a valuable resource?
7. What are the regulatory issues?

* A *Compost* Toilet uses virtually no water nor energy and creates a solid compost and liquid nutrient suitable for garden, landscape and agricultural use. This approach takes a “passive” living system approach in converting volatile nutrients into stable organic fertilizer. There is no “discharge” and it eliminates the very concept of waste!

ELIMINATION OF THE CONCEPT OF WASTE

NZW – OPTION 1: Compost Toilet and Graywater Irrigation System



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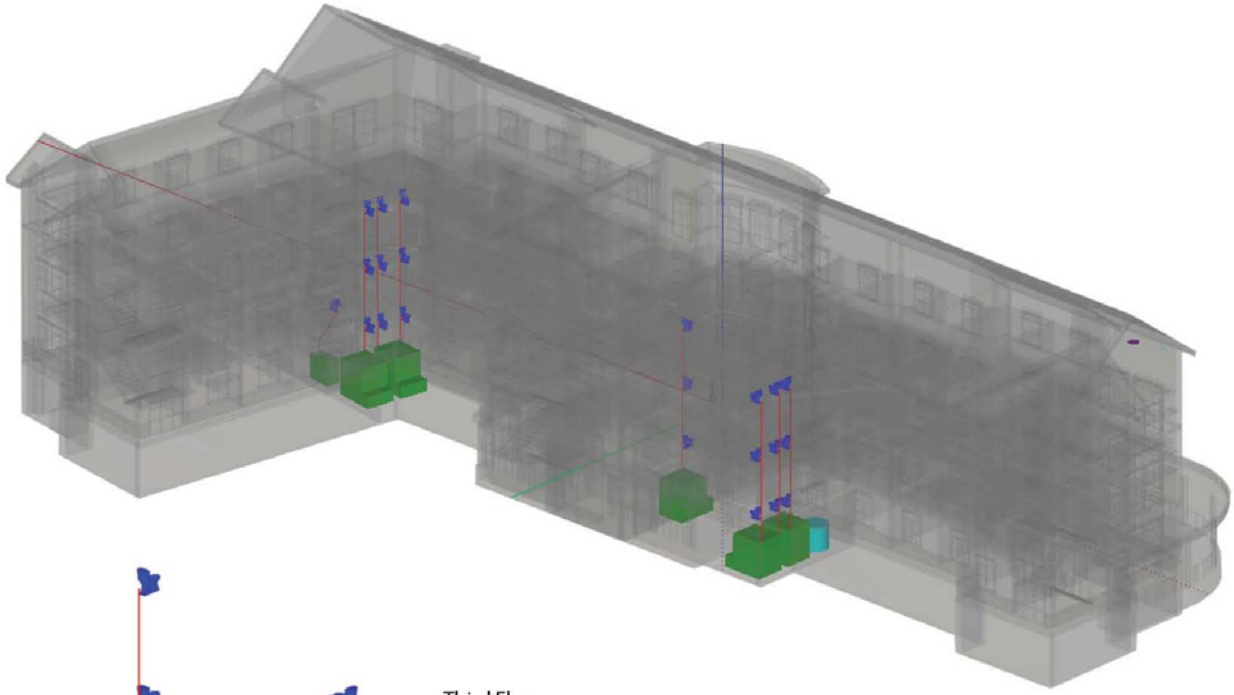

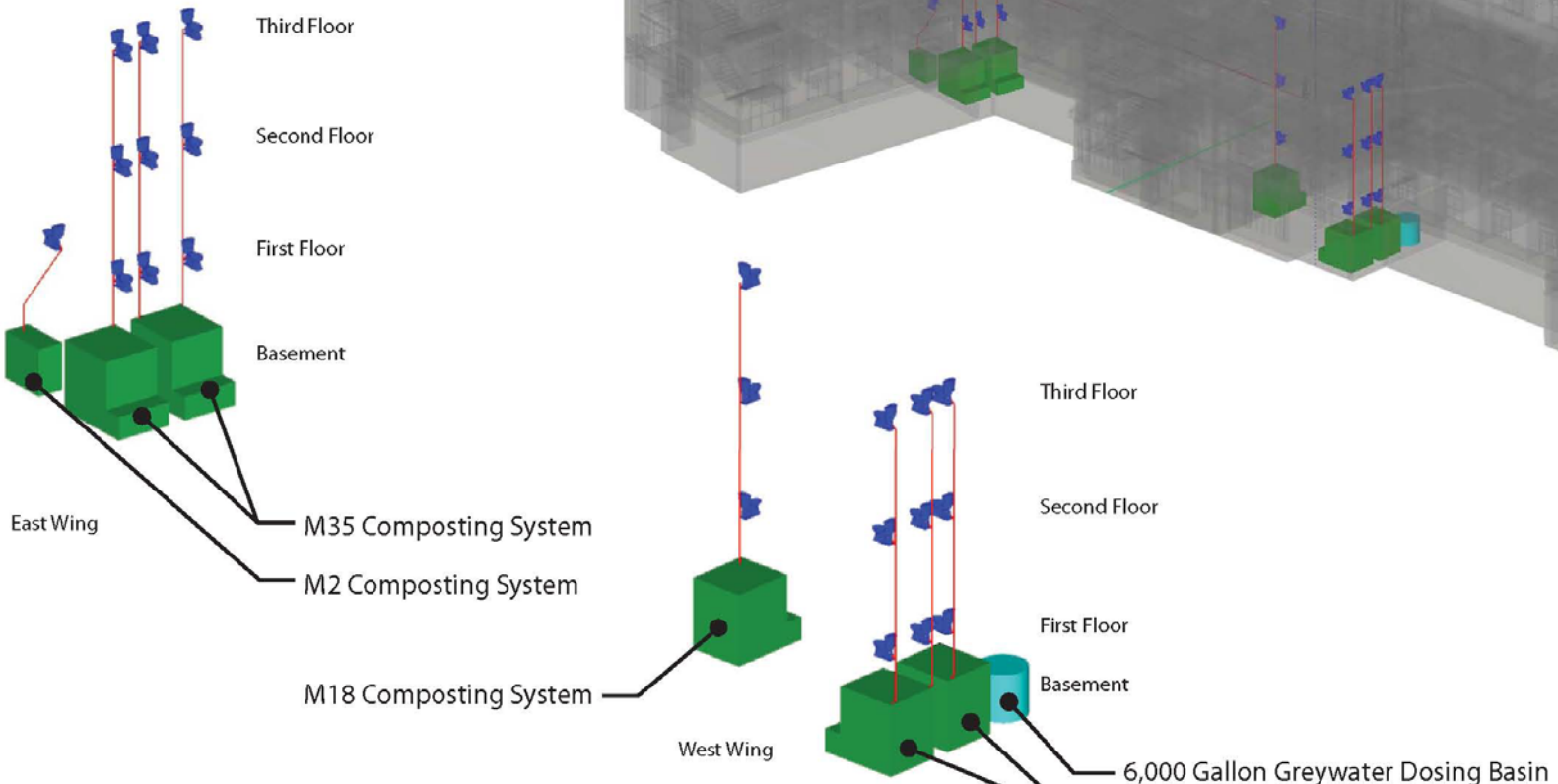

Berea College New Student Residence
Compost Toilet System Diagram - Axonometric

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BEREA COLLEGE

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Strategy:

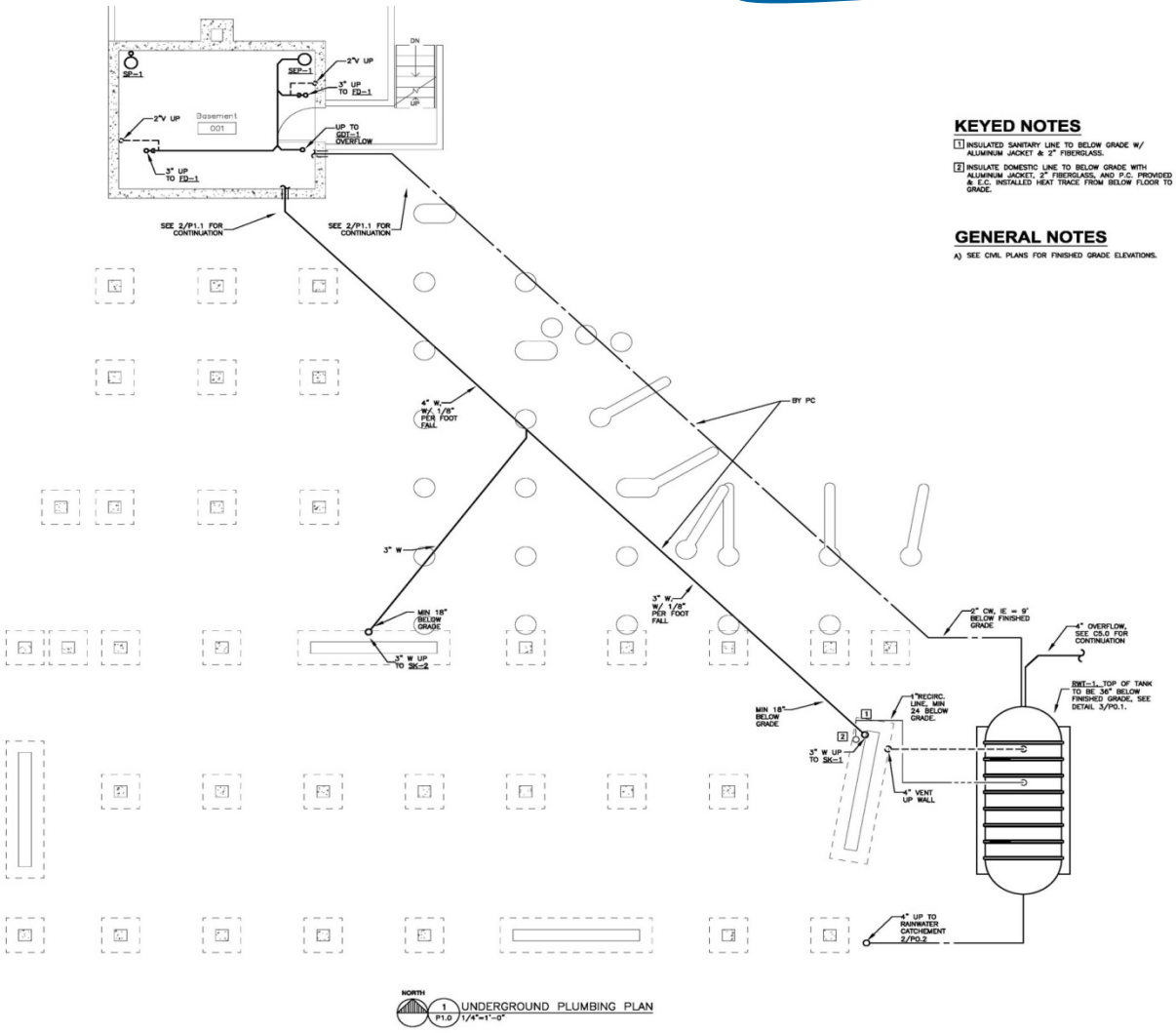
1. Minimize Potable Water Offsite Demand

2. Maintain Predevelopment Hydrologic Cycle

3. Aquifer Supply Recharge Onsite
   - Treated Grey Water
   - Treated Black Water

NZW – OPTION 2: Ecological Treatment System

Rain Water Collection System



KEYED NOTES

1. INSULATED SANITARY LINE TO BELOW GRADE W/ ALUMINUM JACKET & 2" FIBERGLASS.
2. INSULATE DOMESTIC LINE TO BELOW GRADE WITH ALUMINUM JACKET, 2" FIBERGLASS, AND P.C. PROVIDED & E.C. INSTALLED HEAT TRACE FROM BELOW FLOOR TO GRADE.

GENERAL NOTES

A) SEE CIVIL PLANS FOR FINISHED GRADE ELEVATIONS.

NORTH

1 P1.0 UNDERGROUND PLUMBING PLAN

1/4"=1'-0"

Rain Water Collection System

- Rainwater collection and treatment system (potable drinking water source
- Water collected on metal roof and stored in in-ground tank
- Water is then pumped through a secondary filtration system

CODE ISSUES

COMMONWEALTH OF KENTUCKY

<u>STATE PLUMBING BOARD</u>

Advised by plumbing committee made up of plumbing contractors…!

Met with them 3 times and got repeated "Nos" on Compost Toilets!

<u>Department of Environmental Protection (made progress)</u>

Related to use of Compost Toilet byproducts:

- **Solid Fertilizer (compost) compared to toxic sludge**
- **Liquid Fertilizer (diverted, stabilized urine) – regulated concerning run-off**
- **Further regulated by the EPA**

<u>County Public Health Department</u>

No on rainwater or graywater use for toilet flushing…

Results:

1. **Porous Pavers**
2. **Raingardens**

ANALYSIS

REGULATORY AUTHORITIES (AHJ)

Local, County, State, Federal – yikes!!!

State Regulatory Agencies often set the precedent for water.

Health Departments can be very challenging

Plumbing Contractor “lobby” is quite pervasive! Immune to advocacy!

DNRs/DEPs often friendly to the concepts but federal regulations are not consistent and are misguided!

EPA rulings need to be completely revised.


AVERMAX

Learning by Living:

The Berea College Deep Green Student Residence Experience