

# *NWACC Rain Garden Revitalization*



Environmental Science ENSC 2001L  
EMPACTS Project Spring 2022  
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Northwest Arkansas Community College  
Bentonville, AR 72712

# Project Introduction

The Environmental Management class of Spring 2022, collaborated with NWACC Faculty and Staff to revitalize an existing Rain Garden.

The primary objective of this project was/is to make the existing Rain Garden at NWACC functional and effective at stormwater management. We spent a cumulative 360 hours on this project



# Our Environmental Management Team

Isaiah Fenner - Content Director

Harrison Brown - Materials Analyst

Trish Redus - Biological Consultant

Hala Robison - Digital Acquisition

Colten Whaley - Hardscape Manager



# Stakeholder Priority List

1st	Beauty
2nd	Stormwater Management
3rd	Habitat/Pollinator Support
4th	Bioremediation/Nutrient & Pollutant Capture
5th	Ease of Maintenance

# Local Rain Garden Tour



# Purpose of Rain Garden

## Water Quality

- Detaining stormwater and removing pollutants is the primary purpose of stormwater management.
- Impervious surfaces do not absorb water and without proper drainage can lead to flooding, erosion, and other infrastructure damage.
- Added bioremediation helps keep communities clean.



## ◦ Hydrology

- Initial perk test
- Function of rain garden and engineering for purpose
- Hardscaping existing



# ◦ Identifying Hardscaping Issues





# Hardscaping Repair Plan

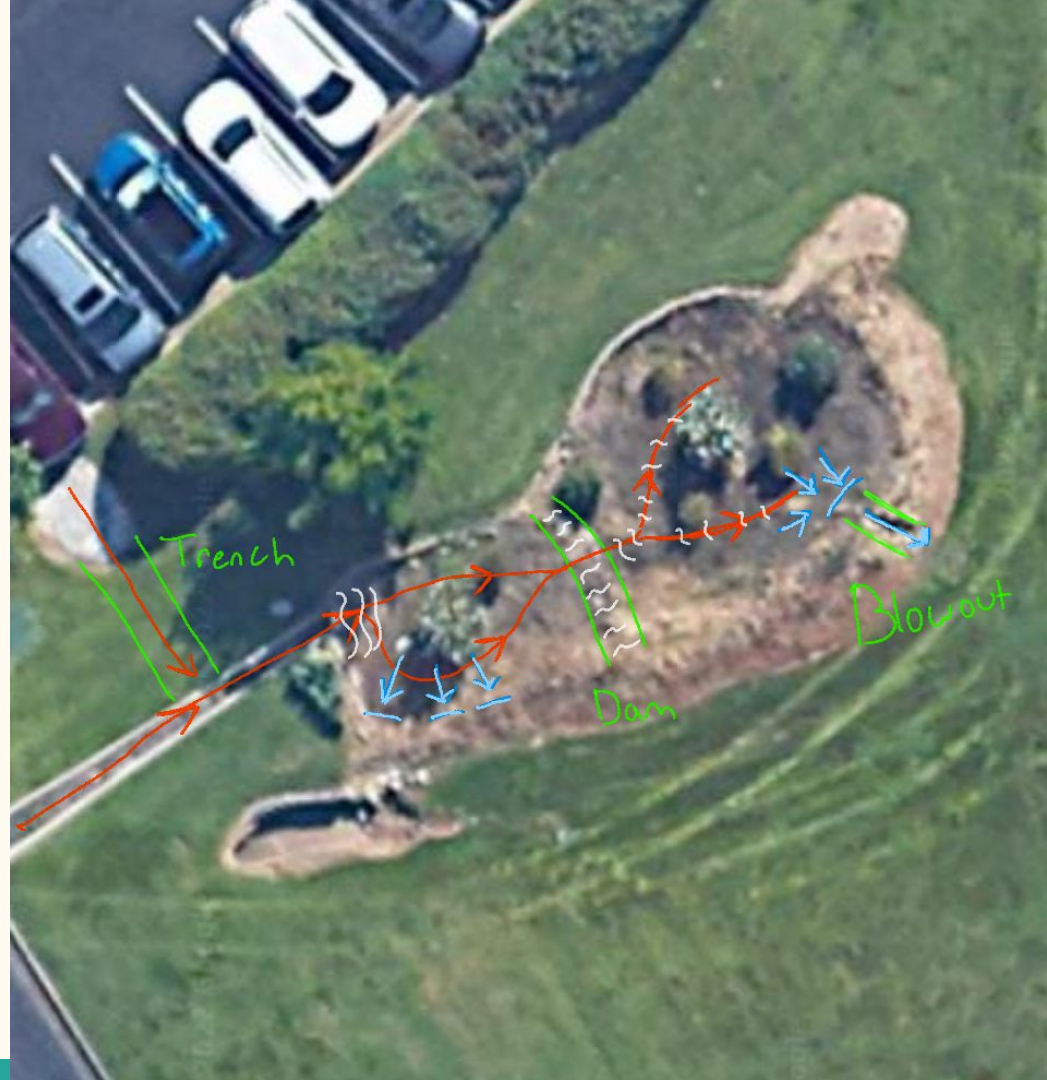
## Key:

Red: Water flow Direction

Light-blue: Water Pressure on Berm

White: Flow Disruption

Green: Planned repair/construction



# Hardscaping Materials Collected

Large river rock

Sand 16 bags, 8 cu ft

Small River Rock

River Rock Pebbles (1-3 inch variety) 36 bags, 14.4 cu feet

Weed barrier

2 cubic yards of compost

Quikrete

4 cubic yards of mulch

Gravel

1 cubic yard of dirt

Retaining Wall Bricks  
x81



# Cleaning / Planning



Hole under inlet

Added a deeper trench  
on the north side of the  
rain garden



# Filling Trench with River Rock



# Repairing Water Inlet?

Poured quikrete under  
pre-existing water inlet



Inlet hole filled

Water  
redirected

Trench dirt  
feathered into  
grass





# Filling the Berm Failure

- Layering different materials to help with erosion control

First layer: gravel / retaining blocks

Second layer: sand

Third layer: dirt

- Packing the materials in between each layer



Pre work

# Filling the Berm Failure



Retainer Stone / Gravel



Sand

# Filling the Berm Failure



Multiple layers of  
dirt individually  
packed



# Filling the Berm Failure

Flagstone placed on top of final layer for weight / it just looks nice

Following monday post-rainstorm



# Dam Revamp

- Dug down 6 inches
- Placed retaining wall stones in core for structural integrity
- Followed similar plan from the berm repair:

First layer: Retainer / Gravel

Second layer: Packed Sand

Third layer: Packed dirt

Fourth layer: River Stone / Flagstone





# Post Mulch Laying



# Soil Amendment Methodology

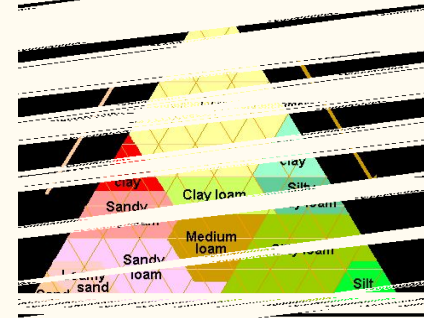
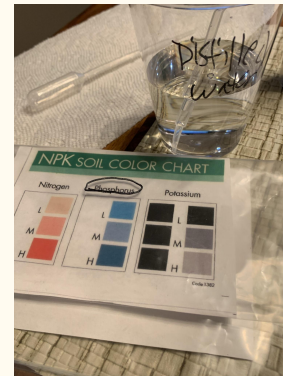
- Floc-Ex Initial Assessment
- Lab Confirmed Assessment
- Perk Testing
- Soil Classification
- Nutrient Analysis
- Initial amendment
- Future amendment recommendations



UofA DIVISION OF AGRICULTURE RESEARCH & EXTENSION University of Arkansas System		Soil Test Report For:	
Marianna Soil Test & Research Laboratory 008 Lee 214 Marianna, AR 72360 (870) 295-2851 <a href="mailto:soiltest@uark.edu">soiltest@uark.edu</a> ~ <a href="https://uasoiltest.uada.edu/">https://uasoiltest.uada.edu/</a>		Trish Redus 913-909-8876 1 College Dr-Burns Hall Bentonville, AR 72712 tredus@nwacc.edu Benton 00588815 (479) 271-1060 Lab ID 44183 Date Processed 4/5/2022 Field ID RainGard	
The University of Arkansas is an equal opportunity/affirmative action institution		Acres: 1	
Field Leveled in last 4 years: No		Irrigation Water Source:	
Lime Applied in last 4 years: No		Nutrient Management Plan:	
Previous Crop: Shrubs (603)			
Soil pH & Nutrient Availability Index		Soil Test Level	
Soil pH: 6.6			
Mehlich III Nutrient		Other Soil Properties	
Phosphorus (P): 98		Electrical Conductivity (EC): 12	
Potassium (K): 63		Estimated CEC (ECEC): %	
Zinc (Zn): 13.7		Organic Matter: %	
		Estimated Soil Texture: Silt Loam - Silty Clay Loam	
		Base Saturation: 76	
		Ca: 70.6 % of ECEC	
		Mg: 3.1 % of ECEC	
		K: 1.3 % of ECEC	
		Na: 0.5 % of ECEC	
		Nitrate (NO3-N): 0.4	
		Sulfate-S (SO4-S): 11	
		Calcium (Ca): 1732	
		Magnesium (Mg): 45	
		Iron (Fe): 145	
		Manganese (Mn): 116	
		Copper (Cu): 2.2	
		Boron (B): 0.4	
		Nitrate (NO3-N): 0.4	

**Methods:** Soil pH and EC in 1:2 soil-water volume mixture; nutrients other than NO3-N extracted with Mehlich-3 determined by ICAP;  
Nitrate extracted with K2SO4 and determined by electrode; ECEC by cation summation; organic matter by weight loss on ignition.

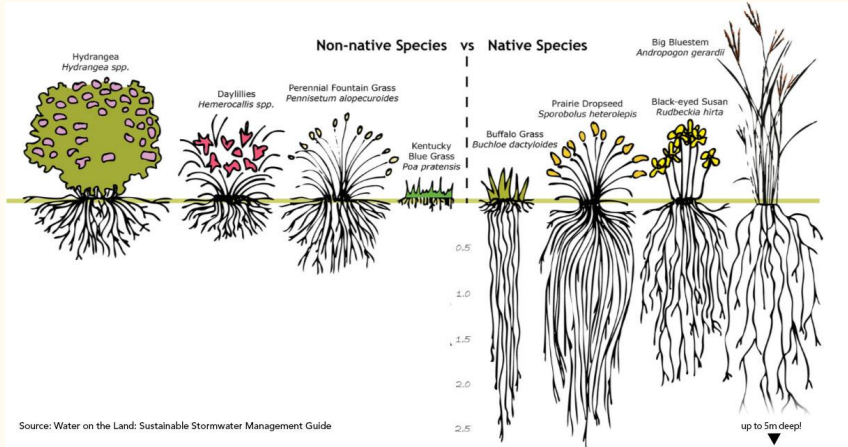
**Comments:** Units of lbs/acre assumes the sample depth represents a plow layer weighing 2 million pounds.





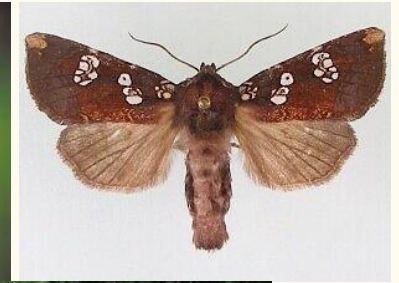
# Stormwater Management & Bioremediation

- Biomass & Natives
- Native Grasses (Big Bluestem & Little Bluestem) & Petroleum Contaminants
- Asteraceae Family & Heavy Metal Bioremediation (Brown-eyed Susans)
- Rhizobial Bacteria Activity



# ◦ Habitat & Pollinator Support

- Variety support multiple pollinators (bees, wasps, birds, butterflies, moths & variety of other insects)
- Benefits of natives vs cultivars for pollinators
- Nativar opportunity for study
- Rattlesnake Master & Rattlesnake Master Borer Moth
- Swamp Milkweed & Monarch
- Opportunity to support Diana Fritillary in Future



# ○ Plant Aesthetics

- Beauty & Public Support
- Role of Pollinator Variety in Garden Appeal (Keystone Species Effect)
- Variety in bloom time, color, shape and height.
- Groupings & layout



# Plants Selected

- Columbine (hummingbird)
- Orange Milkweed (Monarch)
- Whorled Milkweed (Monarch)
- Purple Poppy Mallow
- Pale Cornflower
- Yellow Coneflower
- Purple Coneflower
- Red Cardinal Flower
- Royal Catchfly

## Added Phytoremediation Benefits

- Brown-eyed Susan-5 (NATIVAR)
- Little Blue Stem
- Big Blue Stem

- Fire Pink
- Blue Lobelia
- Prairie Blazing Star
- Rattlesnake Master
- Little Bluestem
- Big Bluestem

- Phase 1
- Columbine-9 plants ●
  - Orange Milkweed-12 ●
  - Whorled Milkweed-12 ●
  - Purple Poppy Mallow-9 ●
  - Pale Cornflower-4 ●
  - Yellow Coneflower-4 ●
  - Purple Coneflower-4 ●
  - Red Cardinal Flower-4 ●
  - Royal Catchfly-9 ●
  - Brown-eyed Susan-5 (NATIVAR) ●
- Phase 2
- Fire Pink-9 plants ●
  - Blue Lobelia-9 plants ●
  - Prairie Blazing Star-9 plants ●
  - Rattlesnake Master-9 plants ●
  - Little Bluestem-12 plants ●
  - Big Blue Stem-12 plants ●



# ○ Future Considerations

- Benefit of Natives for Cost Reduction
- Educational Opportunities
- Research Opportunities



## ◦ Issues Outside of the Project's Scope

- Future water flow will still be an issue, so routine maintenance of the berm will be required until the plants have established their root systems.
- Phase 2 of planting additional natives (grasses for phytoremediation goal).
- Expansion of storm-water management plan to include the drainage basin and the leach field of bermuda grass leading to untreated stormwater drain.
- Correcting issues with watering system to ensure plants get proper water during first establishment year.
- Sourcing of other hard-to-find desired natives for additional planting.
- Soil will need to continue to be monitored for amendment yearly until garden is well established. (Soil samples should be submitted each February to Benton County Extension Lab for analysis)
- Yearly re-assessment and addressing of plant failures and/or disease issues.





## ◦ Future Management Plan

- Replace Rose of Sharon with Swamp Rose Mallow after killing it through hack and squirt technique as well as the diseased plants
- Possible expansion of the garden-system to encompass the drainage ditch beside it.
- Eventually thin and phase out mulch as plants establish and it's no longer needed
- More natives to be planted (Phase II)
- Phase III will consist of thinning plants, turning mulch into soil for nitrogen and also reassessing plant hardiness and replacement. (Additional species can be selected using information on Native Plant Database created)

# Future Management Summary

Phase II Plants have already been ordered for Planting Mid-late May.

Native Plant Database (Excel File) for future plantings or additional rain gardens.

Research Opportunity for Nativars, Pollinator Support, and Species of Concern

Research Opportunity for Phytoremediation Effectiveness of Native Plants

Propagation of the garden's natives for transplant in OLL

Decrease use of mulch to act as nitrogen amendment

Add Educational info Sign to Increase Community Awareness

## ◦ Call to Action

- Rain gardens can also be created in our own backyards
- How to incorporate native plants on our own properties and communities
- Phasing out non-natives with natives in your yard



# Skills We Developed & Learning Outcomes

- Project Management (Determine Scope & Execute on Deliverables)
- Soil & Site Analysis
- Ability to pivot when project experienced supply chain issues.
- Subject Matter Understanding (Raingarden)
- Survey of benefits of natives, nativars and cultivars
- Best hardscaping practices
- Budget Management & Procurement Procedures
- Leverage subject matter expertise and industry connections to improve project outcomes
- Development of Future Improvement and Management Plans

# Acknowledgements

Dr. Galloway

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NWACC Foundation, funds for revitalization

Laurie A. Scott, Science Lab Coordinator - Subject Area Expert and Mentor

Professor C. D. Phillips, EMPACTS Program Facilitate



# Empacts Website Link

What do you think of this as a landing place for your final presentation?

<https://empactsstudentprojects.wordpress.com/environmental-management/>

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