SENIOR CAPSTONE/
SENIOR DESIGN EXPERIENCE

2025

Wildcat Bank Restoration

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Environmental and Natural Resources Engineering; Agricultural Engineering; Agricultural Systems Management

PURDUE UNIVERSITY
Agricultural and Biological Engineering

1. Objective

This project focuses on addressing the rapid erosion of the banks along a portion of Wildcat Creek. The erosion has created a significant threat to nearby homes (including that of our sponsor's), putting properties at risk of collapsing into the creek if action is not taken. The project will use stabilization measures to reinforce the creek's banks, preventing further erosion and protecting the homes and community for decades to come.

By stabilizing the eroding banks, we will protect the homes of local residents, prevent further loss of land, and reduce the risk of sediment pollution in the creek. Additionally, this project will improve the environmental health of Wildcat Creek, ensuring a more stable ecosystem and better water quality.

Research and Design Context

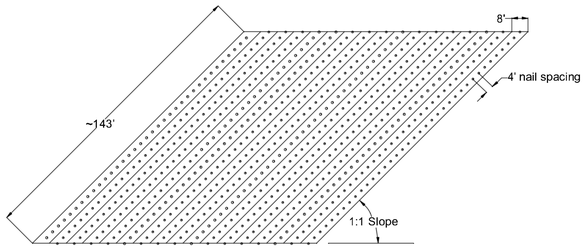
<u>Sheet Erosion:</u> runoff removes a uniform layer of soil across a large area. Vulnerable to mass-wasting.

<u>Splash Erosion:</u> raindrops hit the soil surface, dislodging soil particles.

Constraints	Criteria
- Realistic Implementation - Work with surrounding environment - Withstand 25-year flow - Civil/safety codes	- Determine the cause - Minimal environmental disturbance - Cost - Easy to implement by our sponsor

2. Design and Development

Project Deliverables:
- Determine the cause of the erosion
- Complete a set of drawings, parts list, and assembly manual
- Create a model to represent the site of the erosion



Standards
- ASTM D6818 –Blanket Tensile Strength
- ASTM D6525 – Blanket Thickness
- ASTM D6566 - Blanket Mass/Unit Area
- ASTM D6524 – Blanket Resiliency
- ASTM D4355 – Blanket UV Stability
- ASTM D6092-21 – Stone Sizing
- ASTM D5519 - Particle Size Analysis
- ASTM 66825-02 – Placement

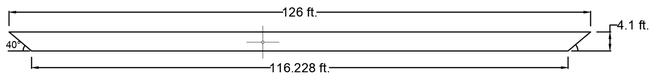
Solution Ideas and Selection

A weighted decision matrix was used to determine the best solutions to protect the slope from erosion and properly secure the toe

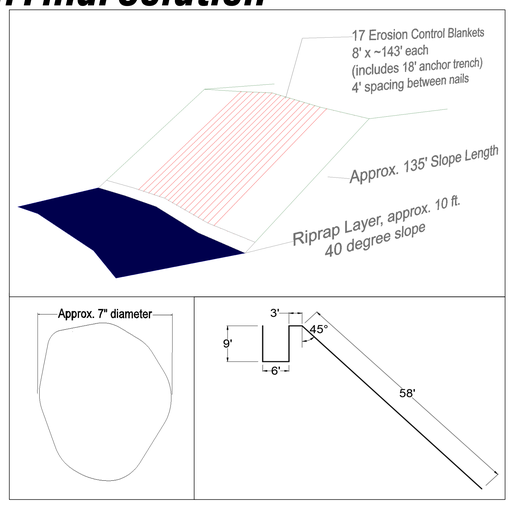
1. Soil nails
2. Soil erosion control blankets of different materials
3. Gabion walls
4. Vegetative cover

3. Tools and Testing

Google Earth Pro: Topography data
IndianaMap: Topography data
StreamStats: 25-year storm data and bank dimensions
Manning's equation: Equation to determine riprap sizing and flow velocity
Excel Solver: Solve Manning's equation with 25-year storm
AutoCAD: Digital modeling



4. Final Solution



- Steep Slope Erosion Control Mat, Eastgate Supply
- 4-ft spacing between Erosion Control Mat nails
- Erosion Control Mat permissible velocity: 5.8 m/s (60 min)
- Erosion Control Mat permissible Sheer Stress: 0.38 kN/m (60 min)
- 10-ft rip rap layer at base of slope
- Approximate 7-in riprap diameter
- 25-year storm stream depth: 13.9 ft
- 25-year storm stream velocity: 5.09 ft/s

5. Cost Analysis

Materials + Costs	Units	Cost (USD $)
Erosion Control Blanket	17	1,304.6/blanket
11 gauge 8" x 1" x 8" metal pins	340	62/500 pins
Hydroseeding	3103.84 ft^2	0.2/ft
Riprap	294.26 tons	175/ton
Installation Contractors	2280 ft^2	100-275/linear ft

6. Project Impact

- Protects our sponsor's home and family: prevents further erosion threatening our sponsor's property.
- Improves public safety: reduces the risk of further slope failure, sediment pollution, and potential flooding.
- Provides a replicable solution: creates a practical erosion control model for future use by others.
- Drives economic activity: Engages local suppliers, manufacturers, and contractors, contributing to the local economy.

The project offers long-term value by preventing costly erosion damage, preserving property, and improving environmental stability. It benefits the sponsor, local community, and future users by providing a practical, sustainable solution that can be replicated.

Thank you to our sponsor, Logan Heusinger, our faculty advisor, Margaret Gitau, Professor Dani Lay, the Indiana Department of Natural Resources, and Eastgate Supply for assistance throughout the duration of our work.