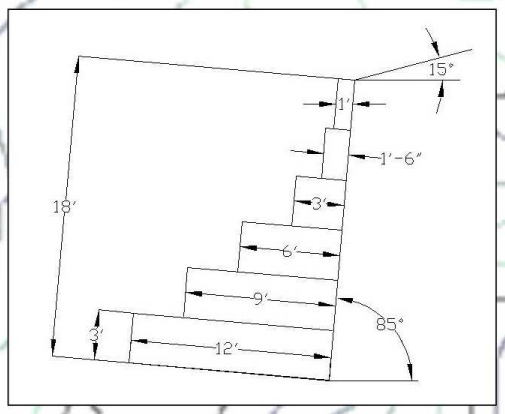
FINAL DESIGN

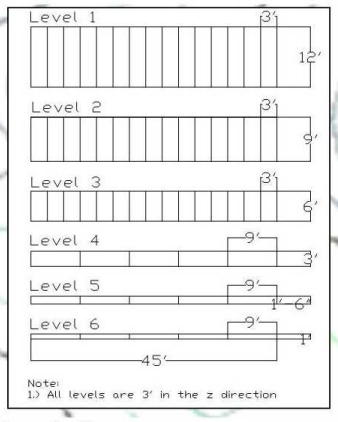
Final Dimensions of Gabion Structure

Variable	Symbol	Units	Value
Slope of Backfill above wall	β	degrees	15
Height of wall	H	feet	20
Angle of Internal friction	Φ	degrees	45
Angle of wall friction	δ	degrees	40.5
Unit weight of soil	γ	pcf	125
Angle of inclination	α	degrees	85
Weight	W	lbs.	466200



- Cost estimates from INDOT indicate $160 per cubic yard which translates into approximately $25,000 for gabion construction
- Local contractors are being contacted for additional cost estimates

Plan View of Gabion Levels



Standard Gabion Compartments Necessary

Level	Quantity	Description	Letter	Volume (yd^3)	Total Vol (yd^3)
1	15	12' X 3' X 3'	C	4	60
2	15	9' X 3' X 3'	B	3	45
3	15	6' X 3' X 3'	A	2	30
4	5	9' X 3' X 3'	B	2	10
5	5	9' X 3' X 1.5'	E	1.5	7.5
6	5	9' X 3' X 1'	H	1	5

FURTHER CONSIDERATIONS

- Proposed design only corrects currently affected area of erosion; modified gabion may be needed to prevent further erosion on hill
- Use of alternate materials (concrete chunks, broken bricks) may reduce stability of gabion structure
- Contact government agencies to research cost-sharing methods
- Research erosion-preventing plants
- Continue to monitor hillside condition

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PURDUE UNIVERSITY
Pond Design ABE: ENRE
CAAKE Engineering: Schotter, Conklin, Harris, Bush, Raderer

April 19, 2007

BANK EROSION DESIGN

CAAKE Engineering

Chad Schotter, Adam Conklin, Amber Harris, Katy Bush, Emily Raderer

April 19, 2007

OBJECTIVE

To design an erosion management system to prevent future bank erosion in the backyard of Professor Bruce Hamaker.

GOALS

- Research documentation and past work done to stop on-site erosion
- Investigate the source of water causing severe erosion
- Design a system to prevent future erosion
- Design a system to maintain the current state of the bank or repair damage

INTRODUCTION

- Located at 153 Pathway Lane near Happy Hollow in West Lafayette, IN
- Severe bank erosion threatening lawn and home
- Ideal solution will have two main components
  1) Decrease or halt erosion
  2) Cost efficiency
- Two different routes for solving bank erosion
  1) Treat the symptoms (soil erosion)
  2) Treat the underlying cause (water sources)

Bank in Summer 2006 when West Lafayette City Engineers looked at property

Bank in January 2007 when our group went to property for field observations

Problem History

- Leaking storm sewer system
- Underground spring several lots away
- City of West Lafayette attempted to fix problem
  1) Constructed concrete "catch basin" at end of underground drainage pipe
  2) Two corrugated plastic pipes inside collection box carry water down steep slope to creek at the bottom of ravine to dissipate energy and decrease erosion

PROPOSED SOLUTION

Bank Erosion Problem

January 2007 photograph highlighting locations of seeping water

Proposed Solution – Gabion Structure

Alabama NRCS example of gabion structure (www.al.nrcs.usda.gov)

METHODS

1.) Determine site History

2.) Monitor Holes & Ditches biweekly

→ Water found in Hole #1 only

3.) Diagnose Water Source(s)

→ Determined by frozen sheets of ice on hillside

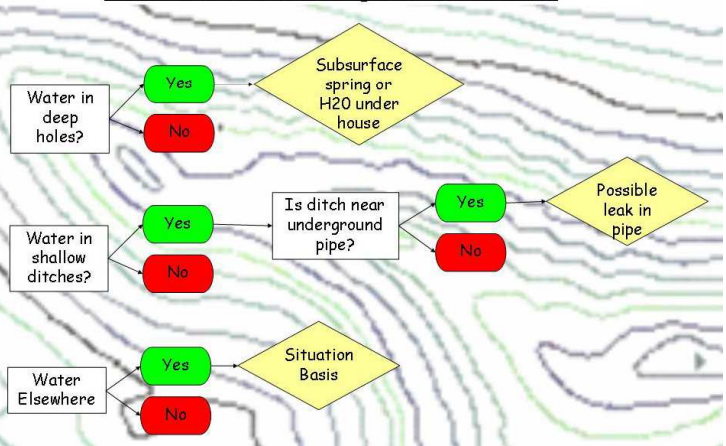
4.) Research Erosion Solutions

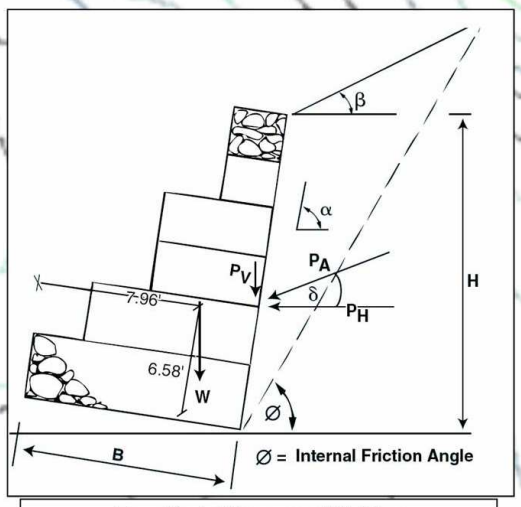
5.) Weigh benefits & disadvantages of gabion

+	-
Long life	Cost
Natural materials	Material intensive
Effective solution	Difficult location

6.) Confirm ideas with property owner before proceeding on design

Subsurface Water Diagnosis Flowchart





Free Body Diagram of Gabion (http://www.terraaqua.com)

Gabion Calculations & Design

Assumptions

1) Isotropic & homogeneous backfill soil
2) Plane backfill surface
3) Rigid wedge body

Gabion Design

- Measure affected area for initial dimensions
- Draw Free Body Diagram
- Calculate frictional and normal forces from the soil
- Use standard sizes gabion compartments to calculate volume & weight
- Analyze initial design for sliding & overturning
- Redesign & adjust dimensions to minimize cost while maximizing stability