

# Two-Stage Ditch Design at Throckmorton Purdue Agricultural Center (TPAC)

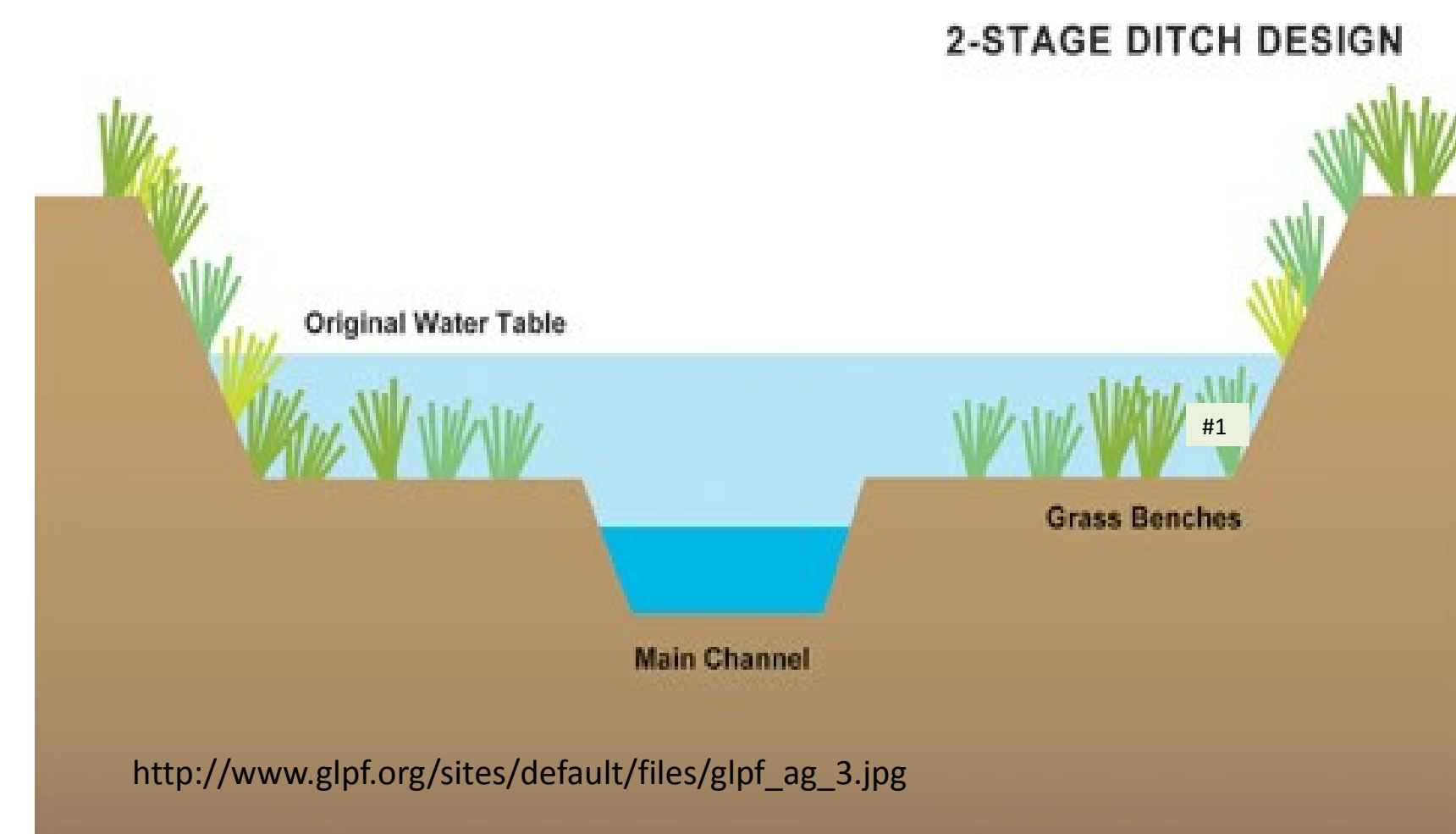
Jacob Niemeier (ANRE), Katie Losekamp (ANRE)

## Problem Statement

The Throckmorton Purdue Agricultural Center wants to convert approximately 700 feet of its existing ditch into a two-stage ditch that will be stable, protect resources, and will allow for monitoring to determine the performance.



Profile-View



Descriptive Cross-section



Delineated Watershed (653 acres)

## Societal Impact

This center devotes most of its time to researching various agricultural and natural resource practices and this two-stage ditch will give the center another practice to monitor and better understand. Also, specific research analyzing the effects of a two-stage ditch versus a traditional agricultural ditch will be conducted. In addition, it will provide a teaching tool for farmers in the area, students at Purdue University, and local employees in the field of natural resource conservation.

## Design Constraints

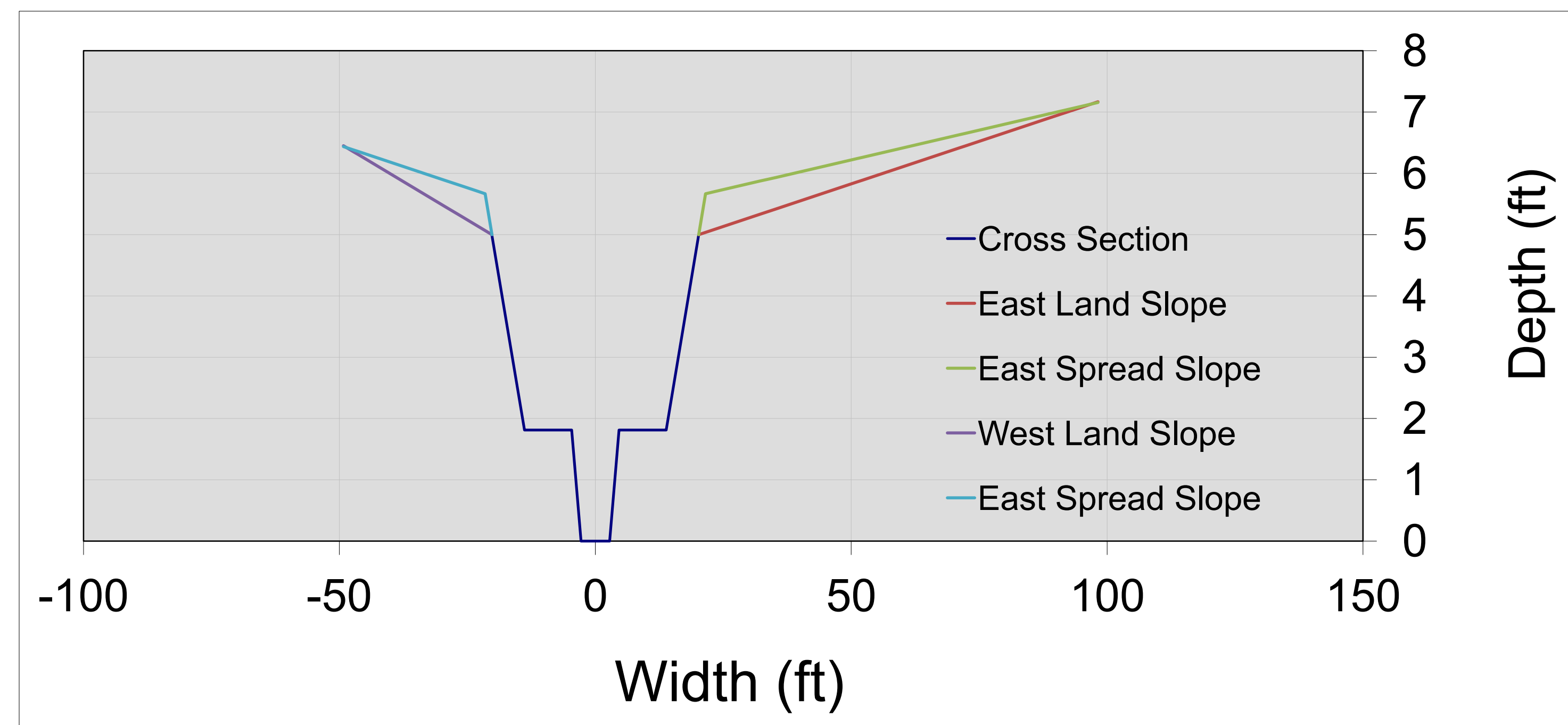
- Max excavation width constrained by agriculture plots
  - West Side: 50 feet
  - East Side: 100 feet
- Stability: 10 yr, 24 hr peak discharge when un-vegetated
  - Silt Loam Permissible Velocity: 2 ft/s
  - Profile Slope: 1<sup>st</sup> 300 ft = 0.26%; Last 400 ft = 0.6%
- Capacity: 10 yr, 24 hr peak discharge when fully vegetated
  - Not to flood out of ditch



Aerial Photo- Constraints

## Spoil Management

- Location 1:** Reapply topsoil to benches
  - Depth of application: 4 inches;
- Location 1.1:** Feather remaining on banks
  - Width to spread soil:
    - East Side: 79.75 ft
    - West Side: 29.75 ft
- Maximum Interior Depth : 8 inches
- Location 2:** Fill in gully at NW end of ditch



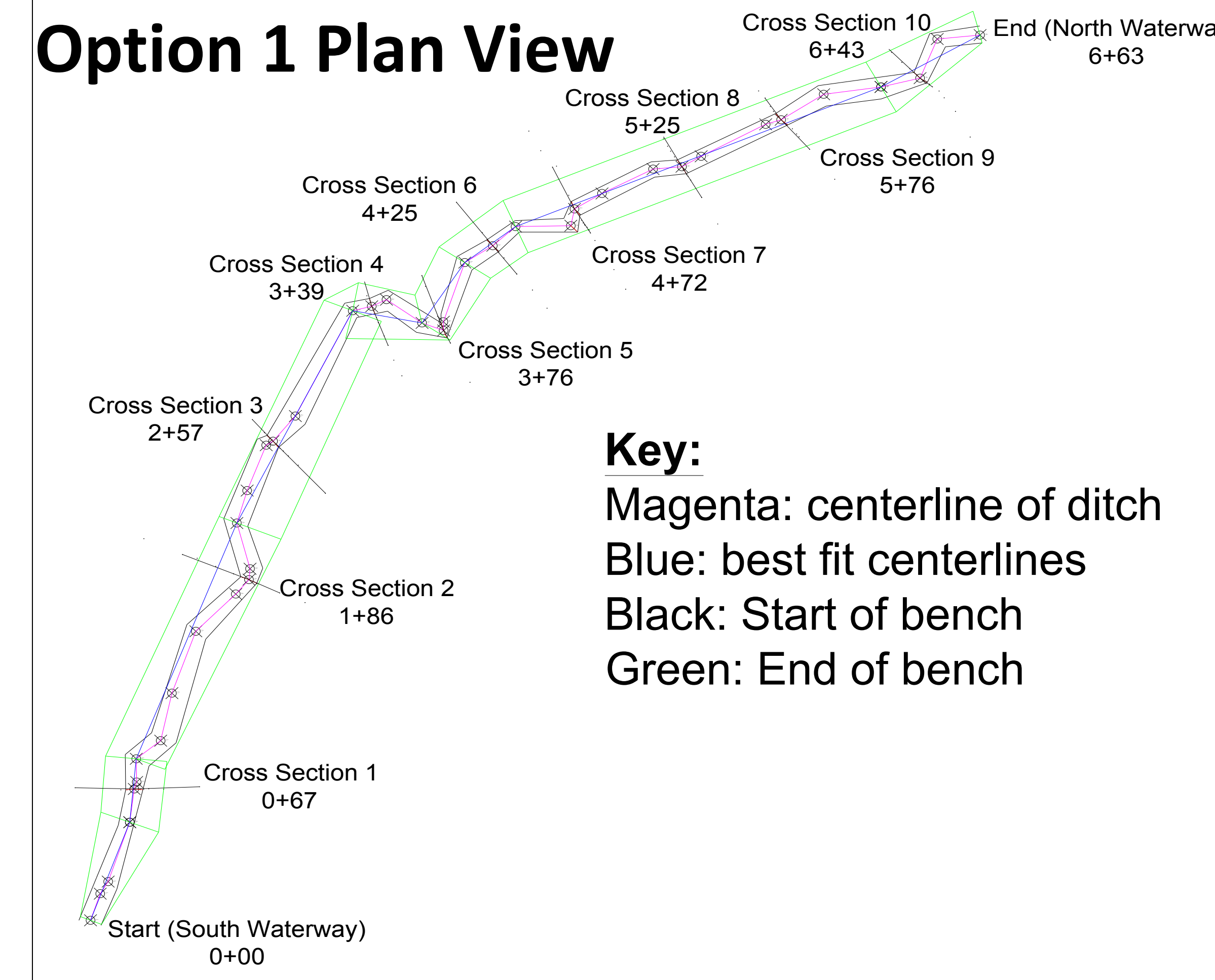
Cross-Section View of Soil Feathering Plan

Bench Applied	160 cu. yd
Feathered	888 cu. yd.
Transported	346 cu. yd.

## Final Design

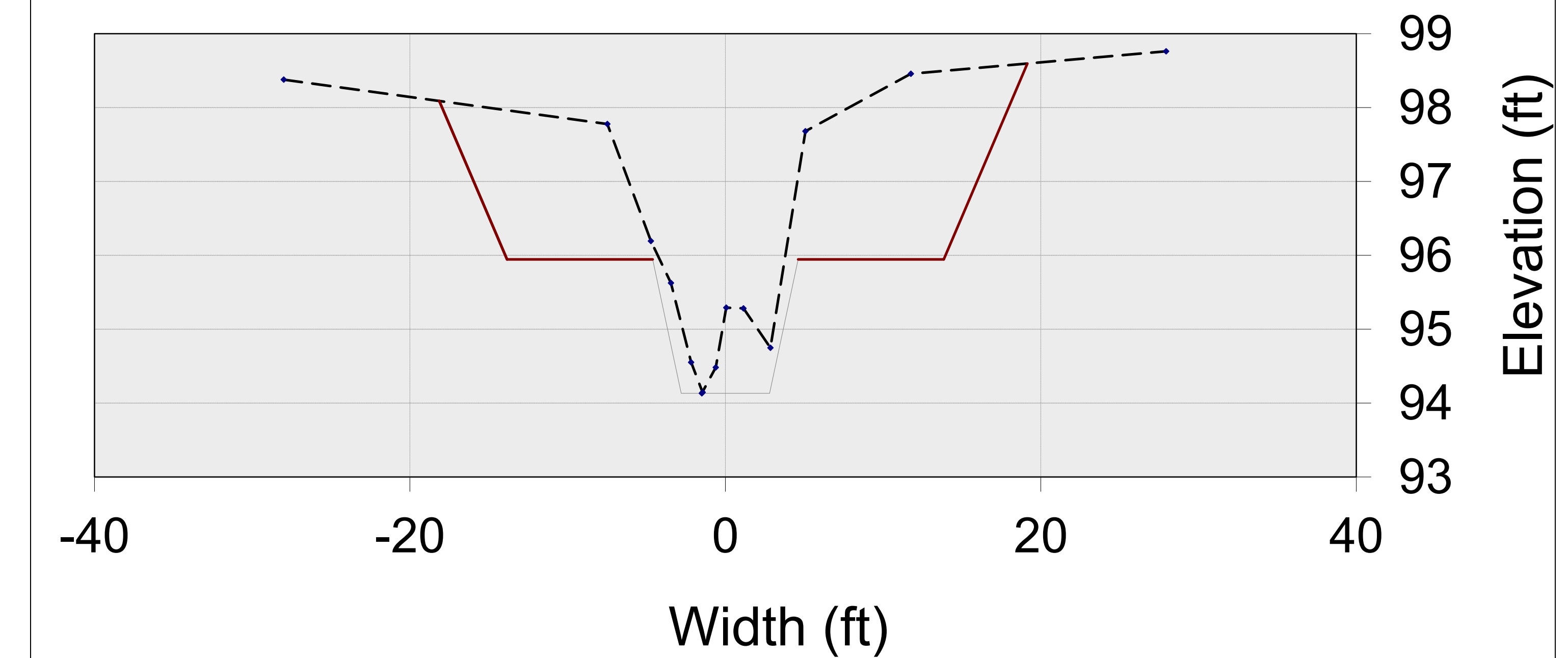
- Bankfull analysis of surveyed data used to determine initial bench height
- Dimensions:
  - Low-flow channel remains untouched
  - Channel Depth/Bench Height: 1.8 ft
  - Ditch Depth: 4.6ft
  - Bench Width: 9.25 ft
- Stability : Flow velocities exceed permissible levels thus erosion control is needed
- Calculated Velocities-
  - 1<sup>st</sup> 300 ft: 5 ft/s
  - Last 400 ft: 7 ft/s
- Capacity : flow depth does not exceed ditch depth

## Alternative Solutions



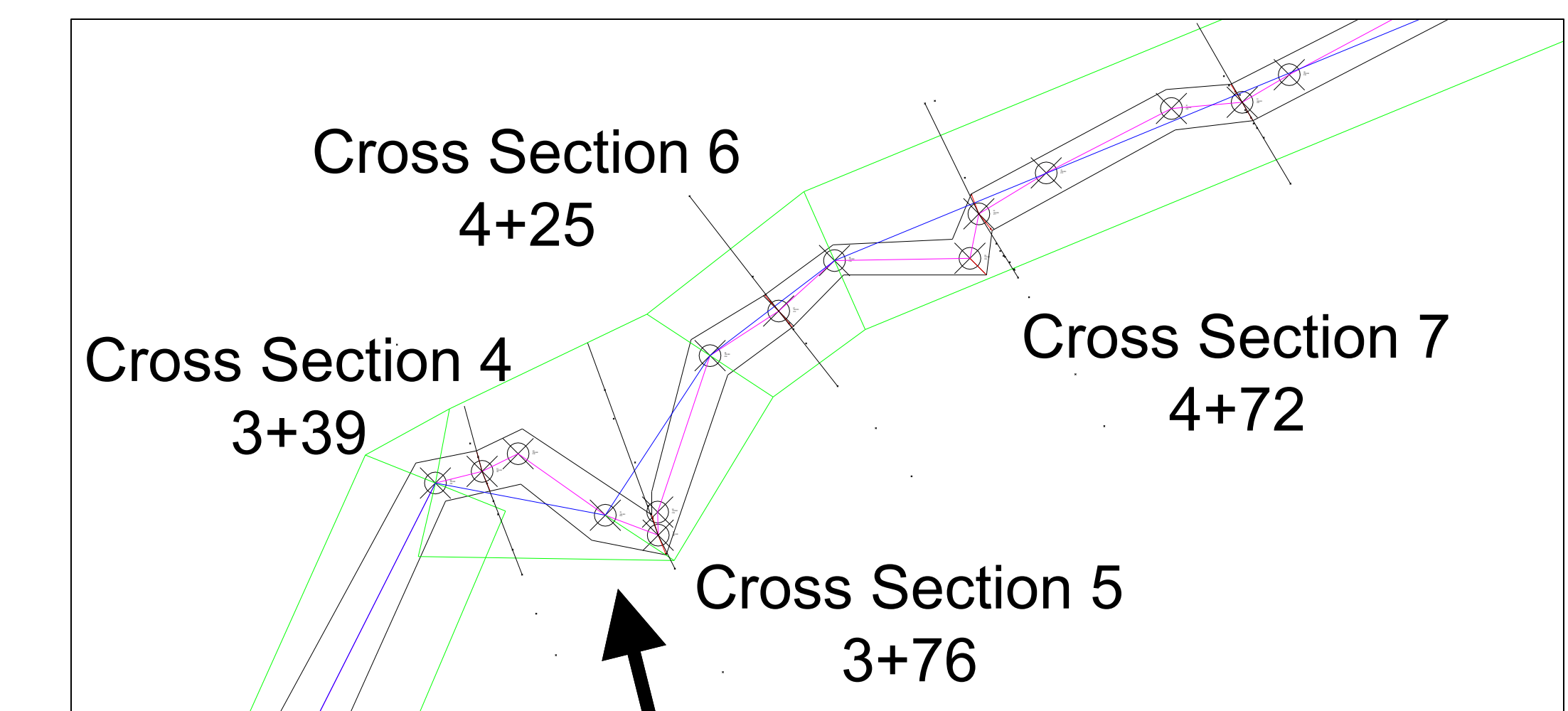
Option 1 Plan View

Cross Section 1 Earthwork Balance: cut 47 sq.ft.  
Bench Elevation: 95.9 ft



Representative Design Cross-Section

## Option 2 Plan View



Widening of bench due to extreme meandering

## Cost Estimate

	Cut (yd <sup>3</sup> )	Excavation Cost	Erosion Control Blanket First 300 feet		Erosion Control Blanket Last 400 feet		Total Cost
			Surface Area (yd <sup>2</sup> )	NAG S-150 (Max Vel. = 6 ft/s)	Surface Area (yd <sup>2</sup> )	NAG SC-150 (Max Vel. = 8 ft/s)	
Option 1:	1331	\$4,392	714	\$1,606	952	\$2,570	\$8,569
Option 2:	1404	\$4,633	742	\$1,670	990	\$2,672	\$8,976



Spoil Spreading Locations