

A photograph of a highway embankment that has failed, showing a large section of the road surface that has collapsed into a deep ditch. The road is covered in snow, and there are trees and a guardrail visible in the background.

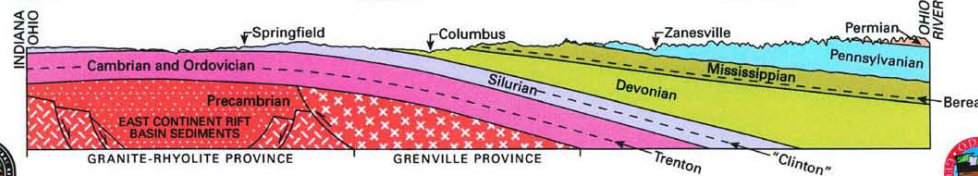
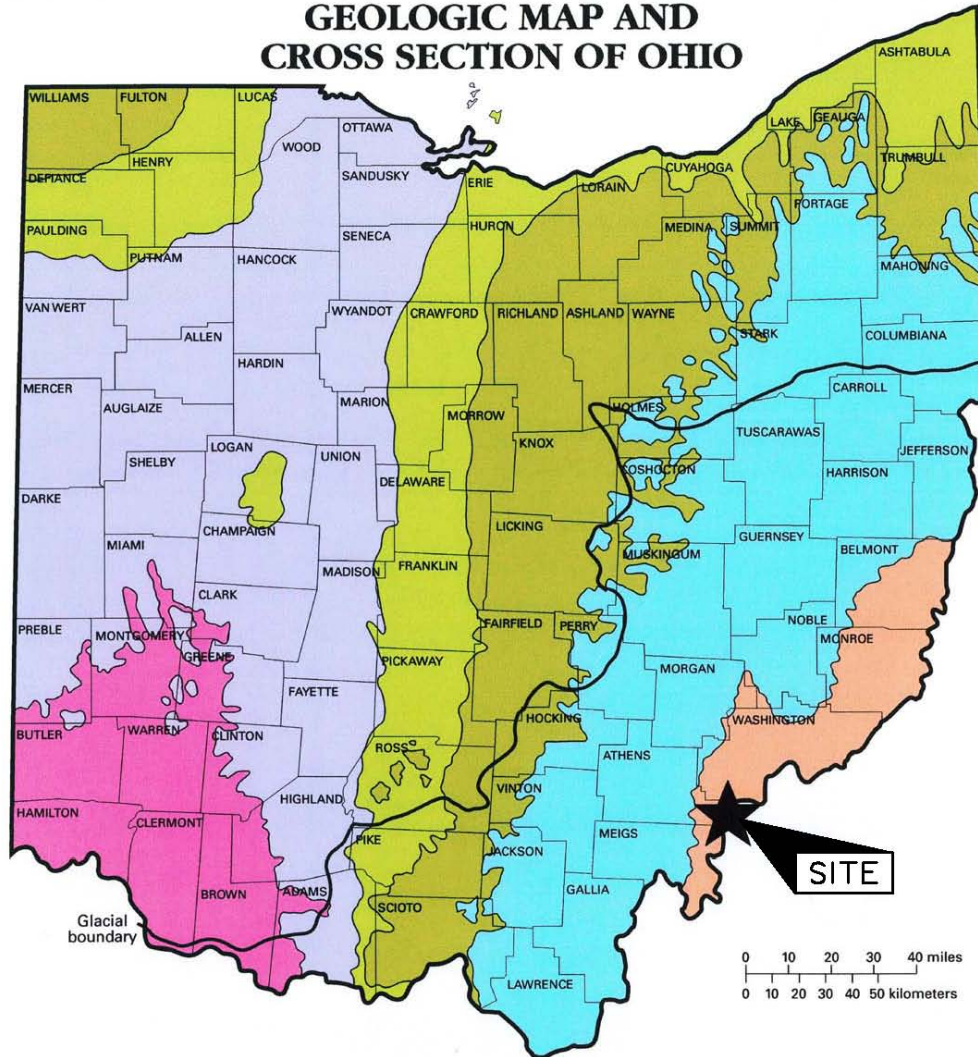
“Emergency Geotechnical Investigations of Failed Highway Embankments Resulting From Ohio River Lock Damage”

Richard L. Williams, Ph.D., P.E.

Richard S. Weigand, P.E.

Steven A. Hurt, P.E.

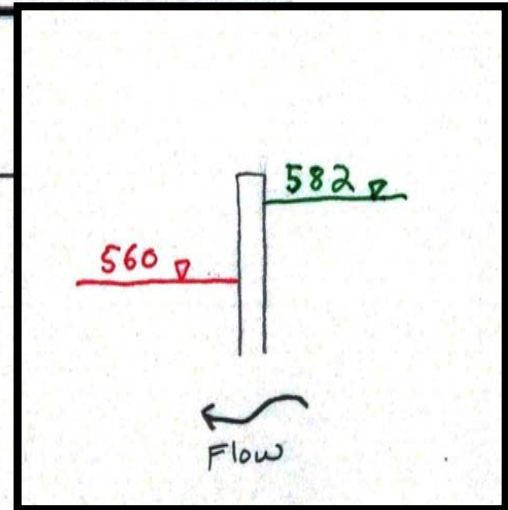
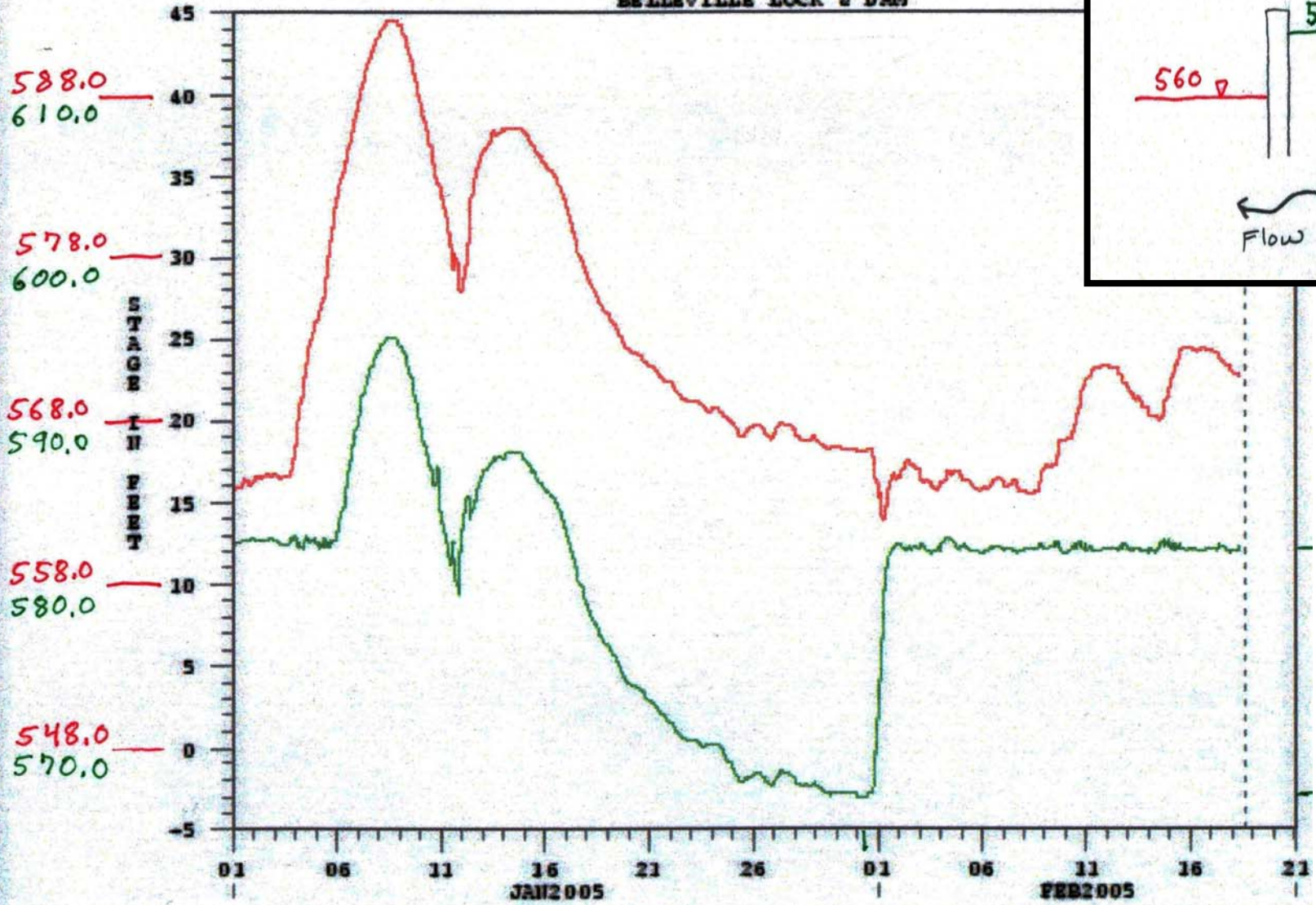
GEOLOGIC MAP AND CROSS SECTION OF OHIO





18FEB05 14:00:55

BELLEVILLE LOCK & DAM



588.0
610.0

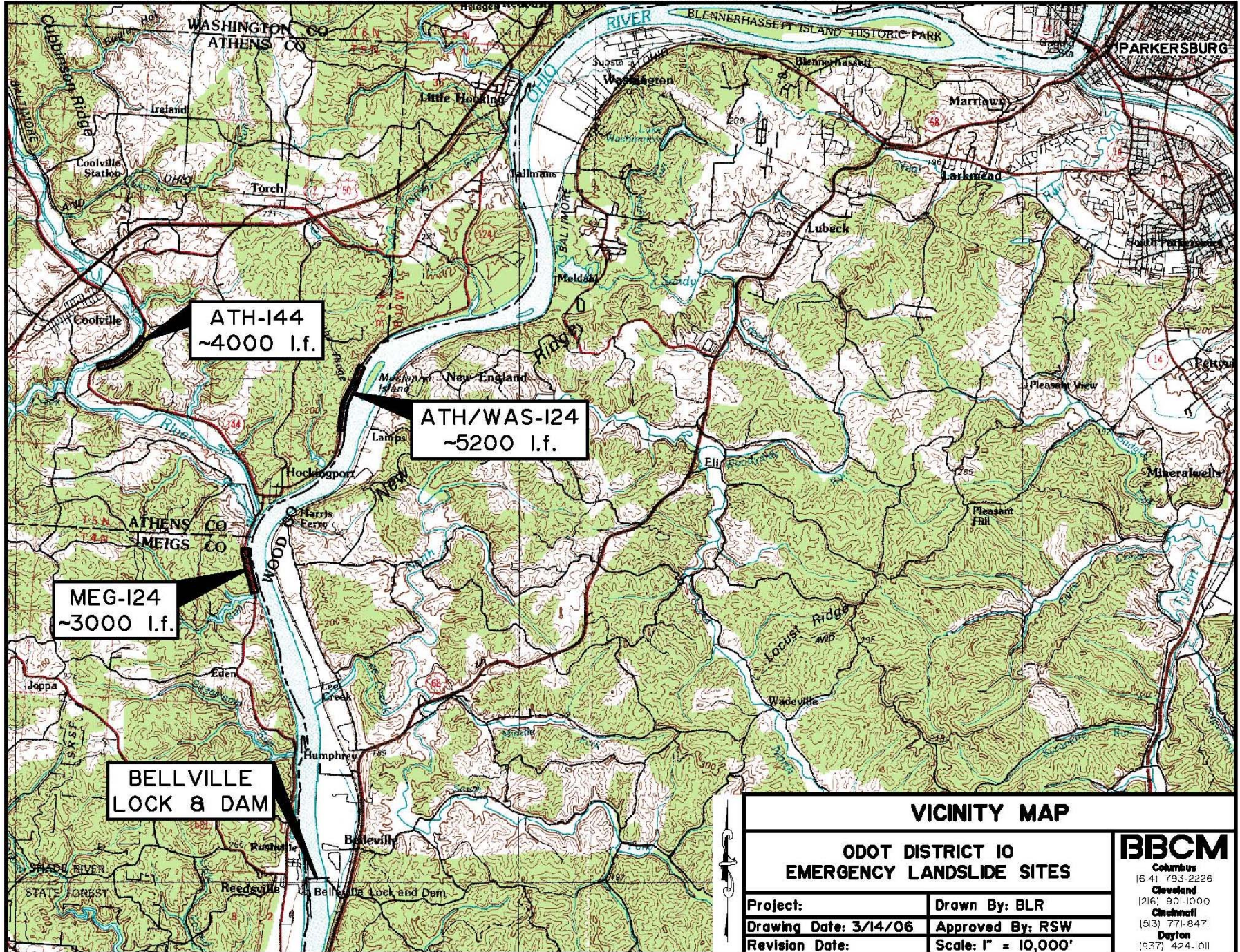
578.0
600.0

568.0
590.0

558.0
580.0

548.0
570.0

— STAGE_LOWER OBS (Lower Gage)
— STAGE_UPPER OBS (Upper Gage)



ATH-I44
~4000 l.f.

ATH/WAS-I24
~5200 l.f.

MEG-I24
~3000 l.f.

**BELLVILLE
LOCK & DAM**

VICINITY MAP		BBC&M Columbus (614) 793-2226 Cleveland (216) 901-1000 Cincinnati (513) 771-8471 Dayton (937) 424-1011
ODOT DISTRICT 10 EMERGENCY LANDSLIDE SITES		
Project:	Drawn By: BLR	
Drawing Date: 3/14/06	Approved By: RSW	
Revision Date:	Scale: 1" = 10,000'	

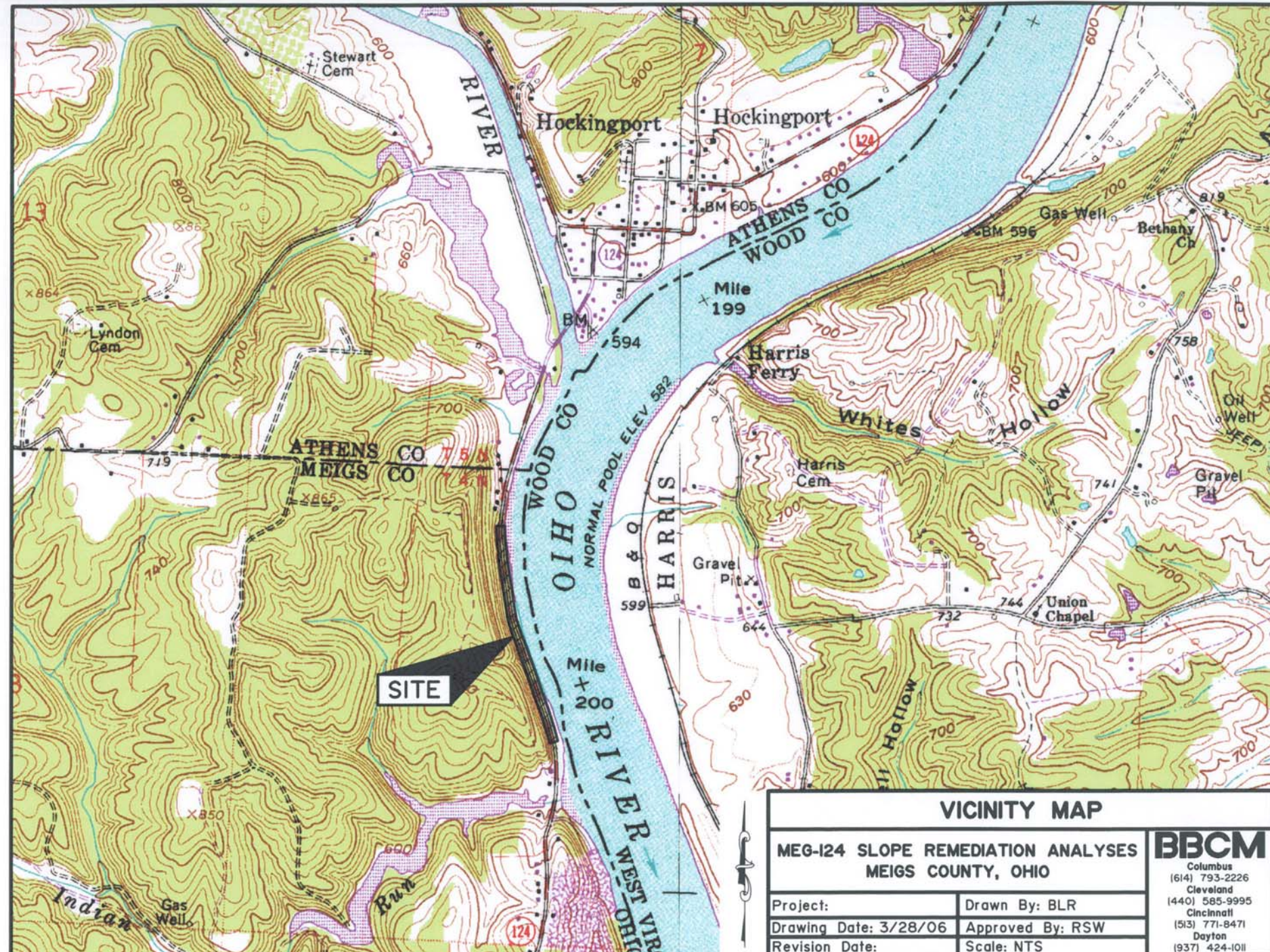


BBCM File Name: H:\RESOURCES\TRANSPORTATION\Purdue Geotech Seminar 2006\Slide6.dwg Tab: B.5x11P Plot Date: Mar 17, 2006 @ 2:52pm Bx: BR.ush

EXISTING USGS LANDSLIDE MAPPING	
ODOT DISTRICT 10 EMERGENCY LANDSLIDE INVESTIGATIONS	
Project:	Drawn By: BLR
Drawing Date: 3/17/06	Approved By: RSW
Revision Date:	Scale: 1" = 3000'

BBCM
 Columbus (614) 793-2226
 Cleveland (216) 901-1000
 Cincinnati (513) 771-6471
 Dayton (937) 424-1011





SITE

VICINITY MAP	
MEG-124 SLOPE REMEDIATION ANALYSES MEIGS COUNTY, OHIO	
BBCM	
Columbus (614) 793-2226	
Cleveland (440) 585-9995	
Cincinnati (513) 771-8471	
Dayton (937) 424-1011	
Project:	Drawn By: BLR
Drawing Date: 3/28/06	Approved By: RSW
Revision Date:	Scale: NTS

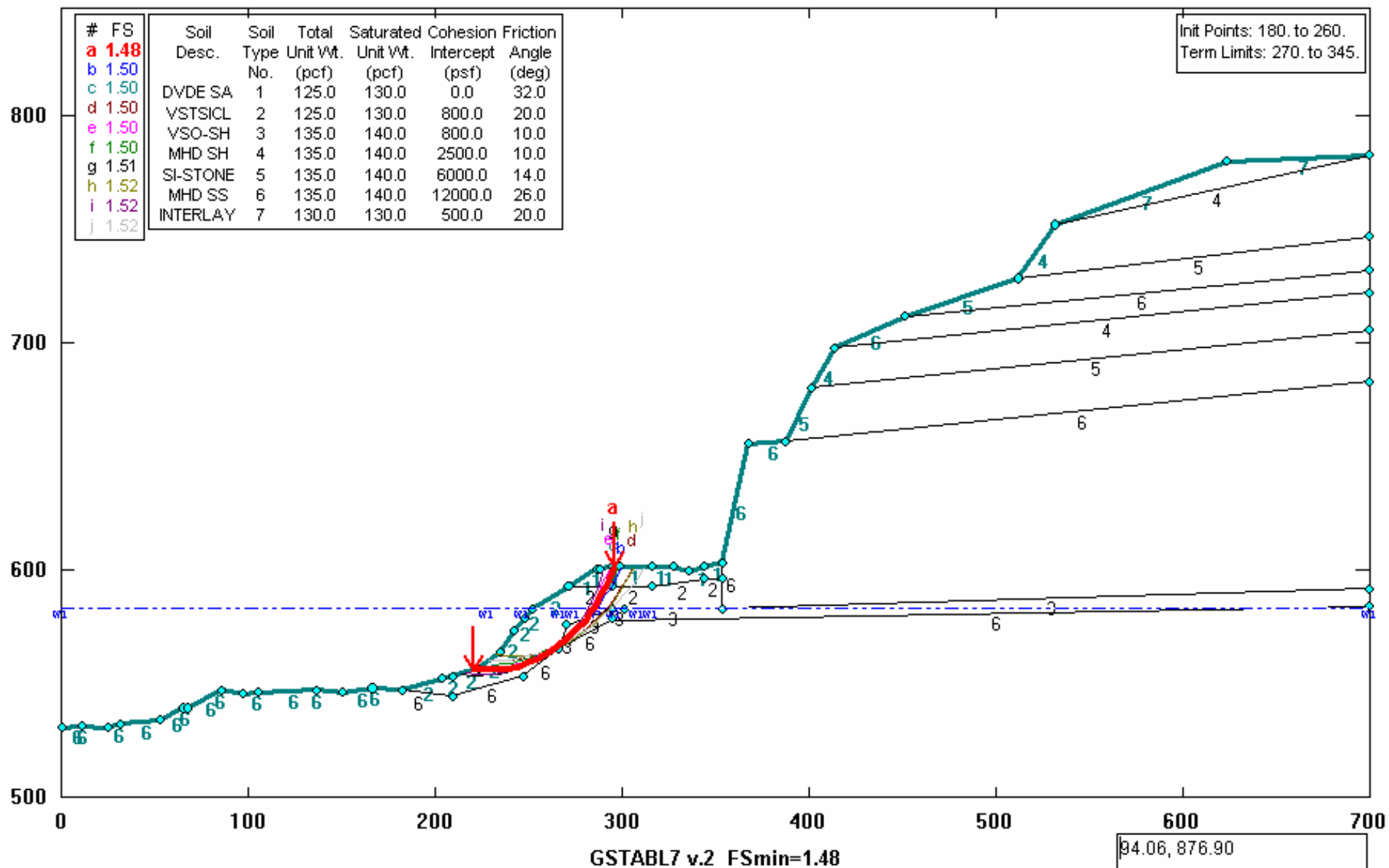






MEG-124 EXISTING STA-32+50 NORMAL POOL

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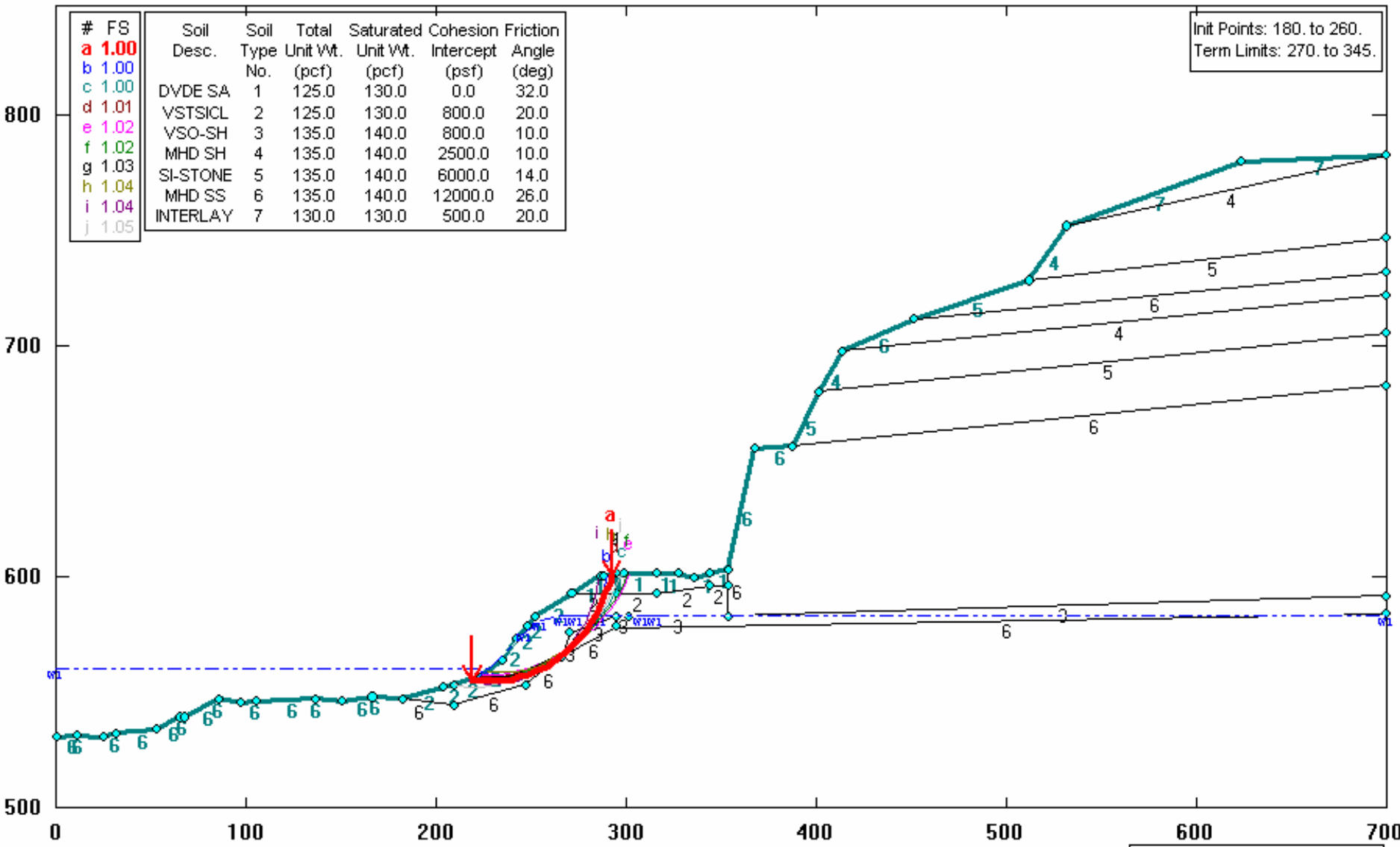
GSTABL7 v.2 FSmin=1.48
 Safety Factors Are Calculated By The Simplified Janbu Method

MEG-124 EXISTING-STA 32+50 RAPID DRAWDOWN

C:\AIZ\10250~1\FINAL\STA-32~1\SEC5-OSD.PL2 Run By: Username 3/14/2006 11:51AM

#	FS	Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)
a	1.00						
b	1.00						
c	1.00						
d	1.01	DVDE SA	1	125.0	130.0	0.0	32.0
e	1.02	VSTSICL	2	125.0	130.0	800.0	20.0
f	1.02	VSO-SH	3	135.0	140.0	800.0	10.0
g	1.03	MHD SH	4	135.0	140.0	2500.0	10.0
h	1.04	SI-STONE	5	135.0	140.0	6000.0	14.0
i	1.04	MHD SS	6	135.0	140.0	12000.0	26.0
j	1.05	INTERLAY	7	130.0	130.0	500.0	20.0

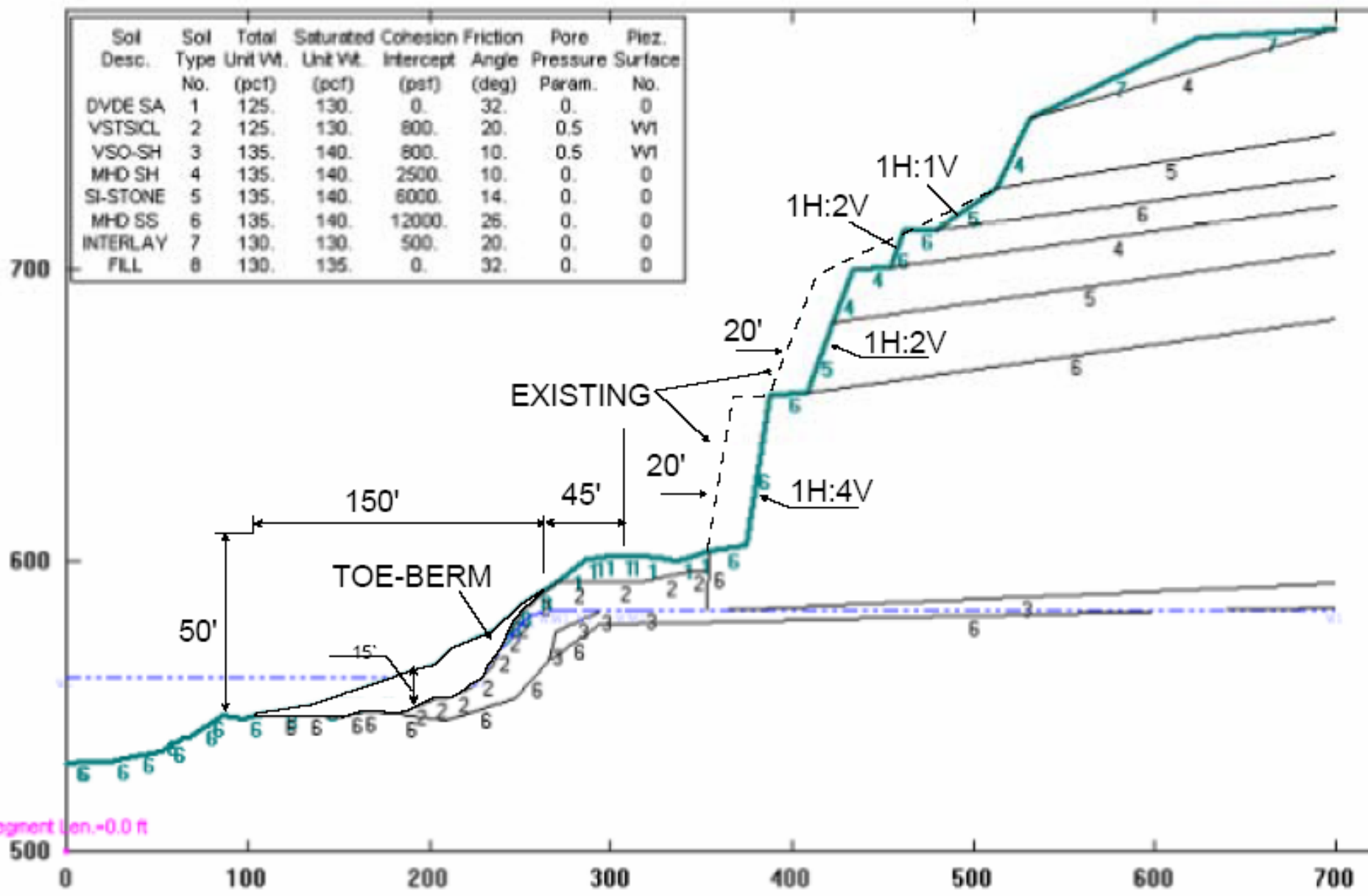
Init Points: 180. to 260.
Term Limits: 270. to 345.



GSTABL7 v.2 FSmin=1.00
Safety Factors Are Calculated By The Simplified Janbu Method for the case of phi=0

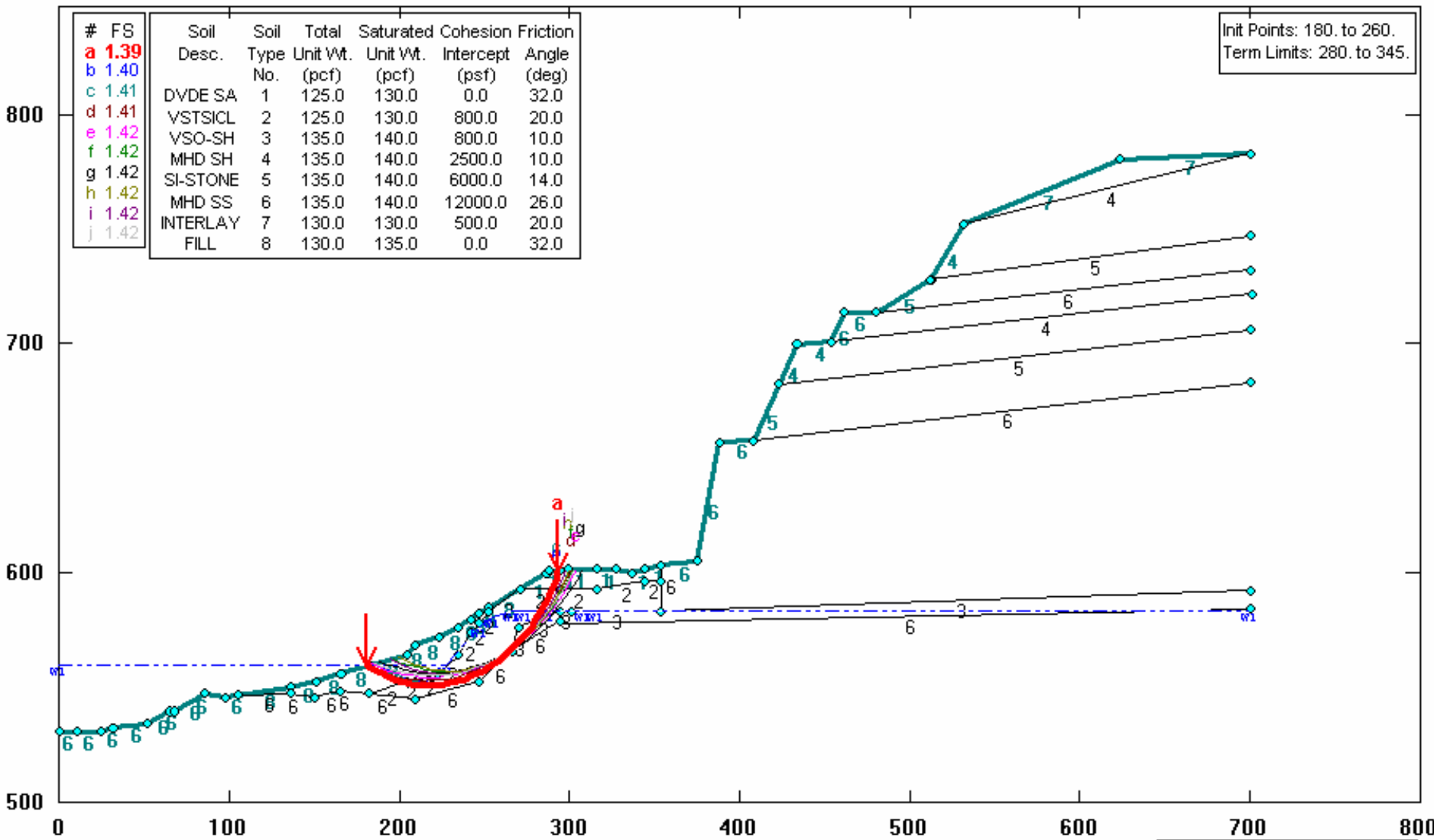
212.19, 876.90

PROPOSED CUT AND FILL-STA 32+50: RAPID DRAWDOWN



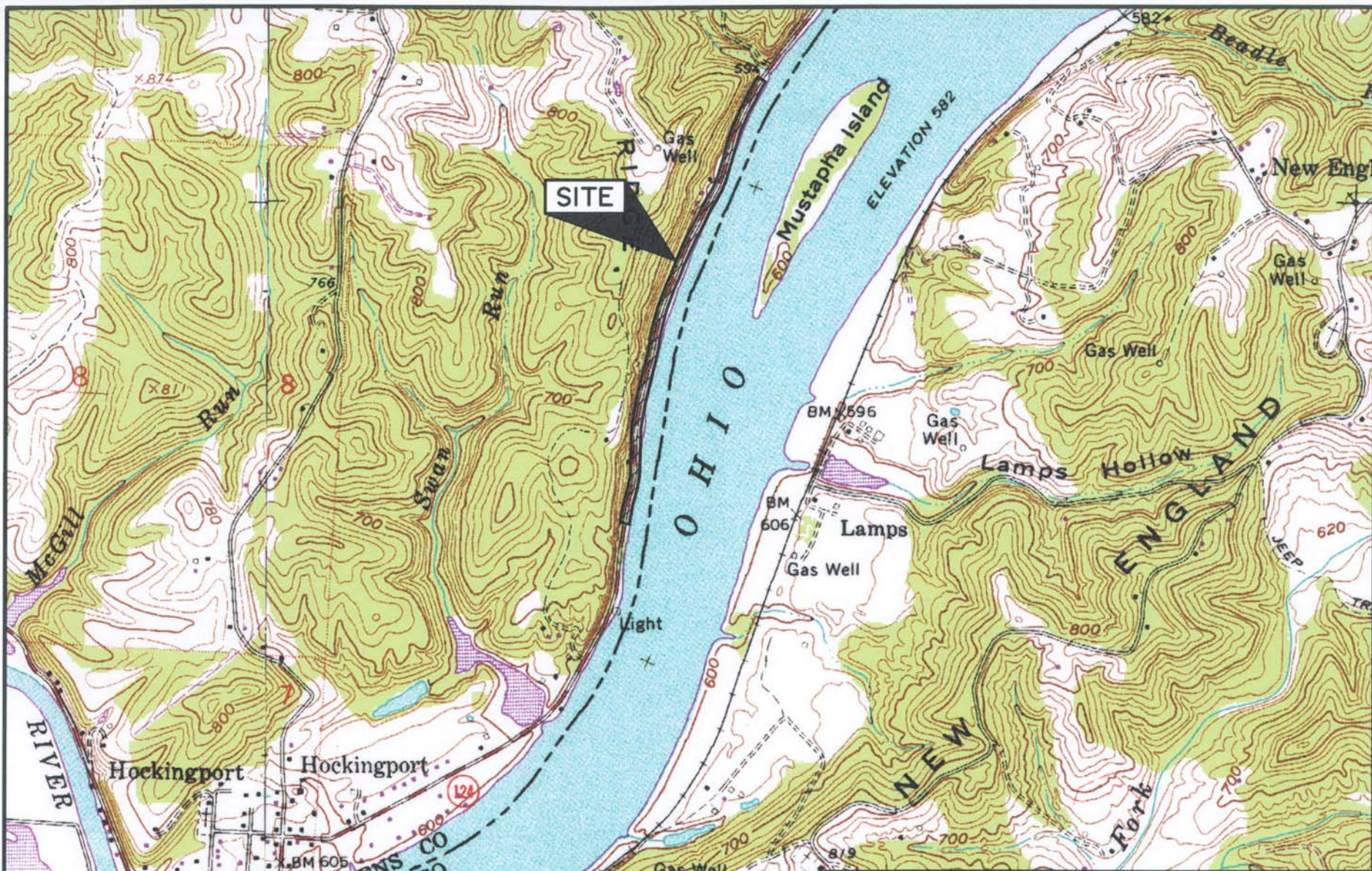
MEG-124 PROPOSED CUT AND FILL -STA 32+50: RAPID DRAWDOWN

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GSTABL7 v.2 FSmin=1.39
 Safety Factors Are Calculated By The Simplified Janbu Method for the case of phi=0

79.38, 876.44



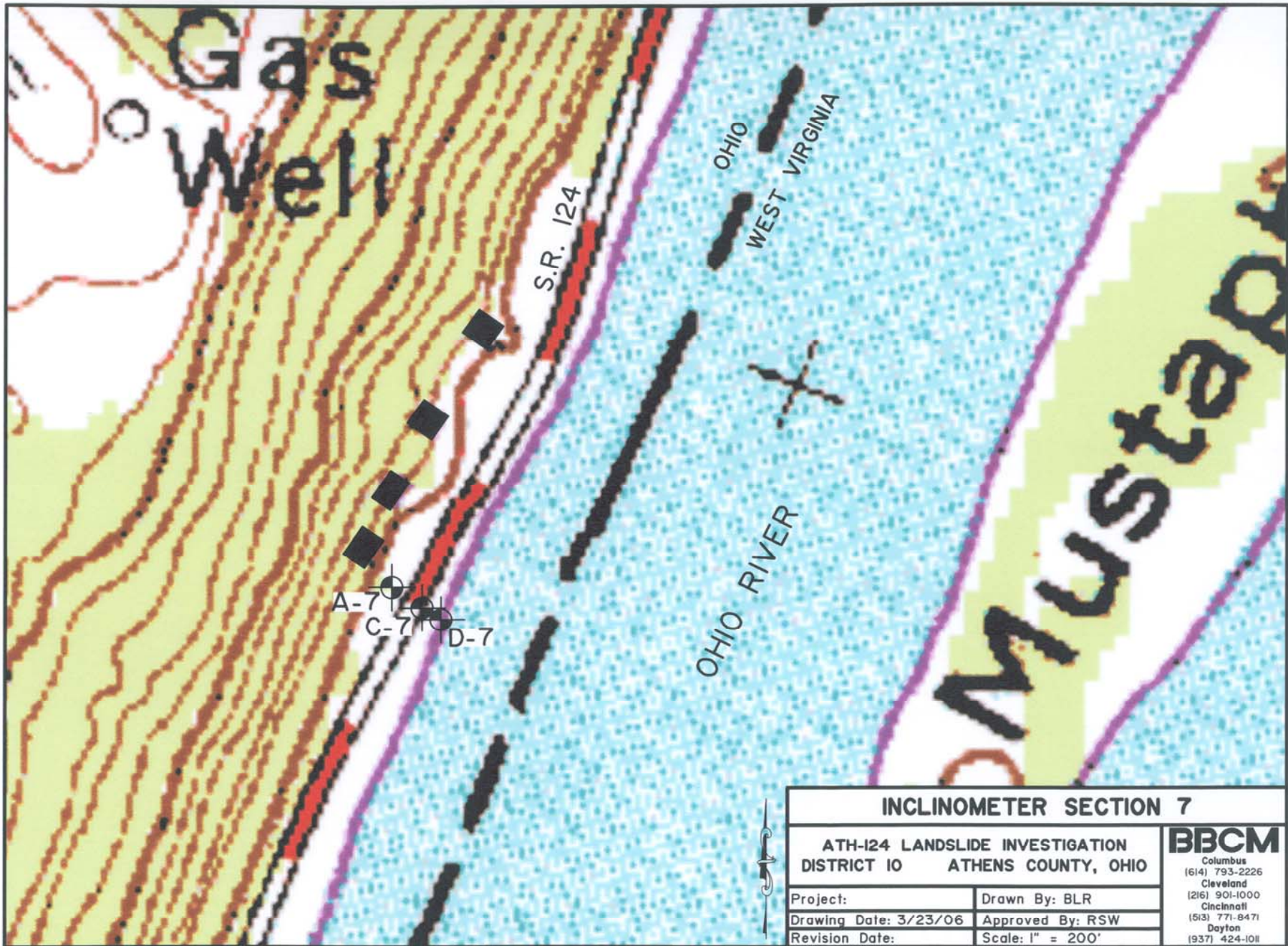
SITE

VICINITY MAP		 BBCM Columbus (614) 793-2226 Cleveland (440) 585-9995 Cincinnati (513) 771-8471 Dayton (937) 424-1011
ATH-124 SLOPE FAILURE INVESTIGATION ATHENS COUNTY, OHIO		
Project:	Drawn By: BLR	
Drawing Date: 3/28/06	Approved By: RSW	
Revision Date:	Scale: NTS	









INCLINOMETER SECTION 7

ATH-I24 LANDSLIDE INVESTIGATION
DISTRICT 10 ATHENS COUNTY, OHIO

BBCM

Columbus
(614) 793-2226
Cleveland
(216) 901-1000
Cincinnati
(513) 771-8471
Dayton
(937) 424-1011

Project:

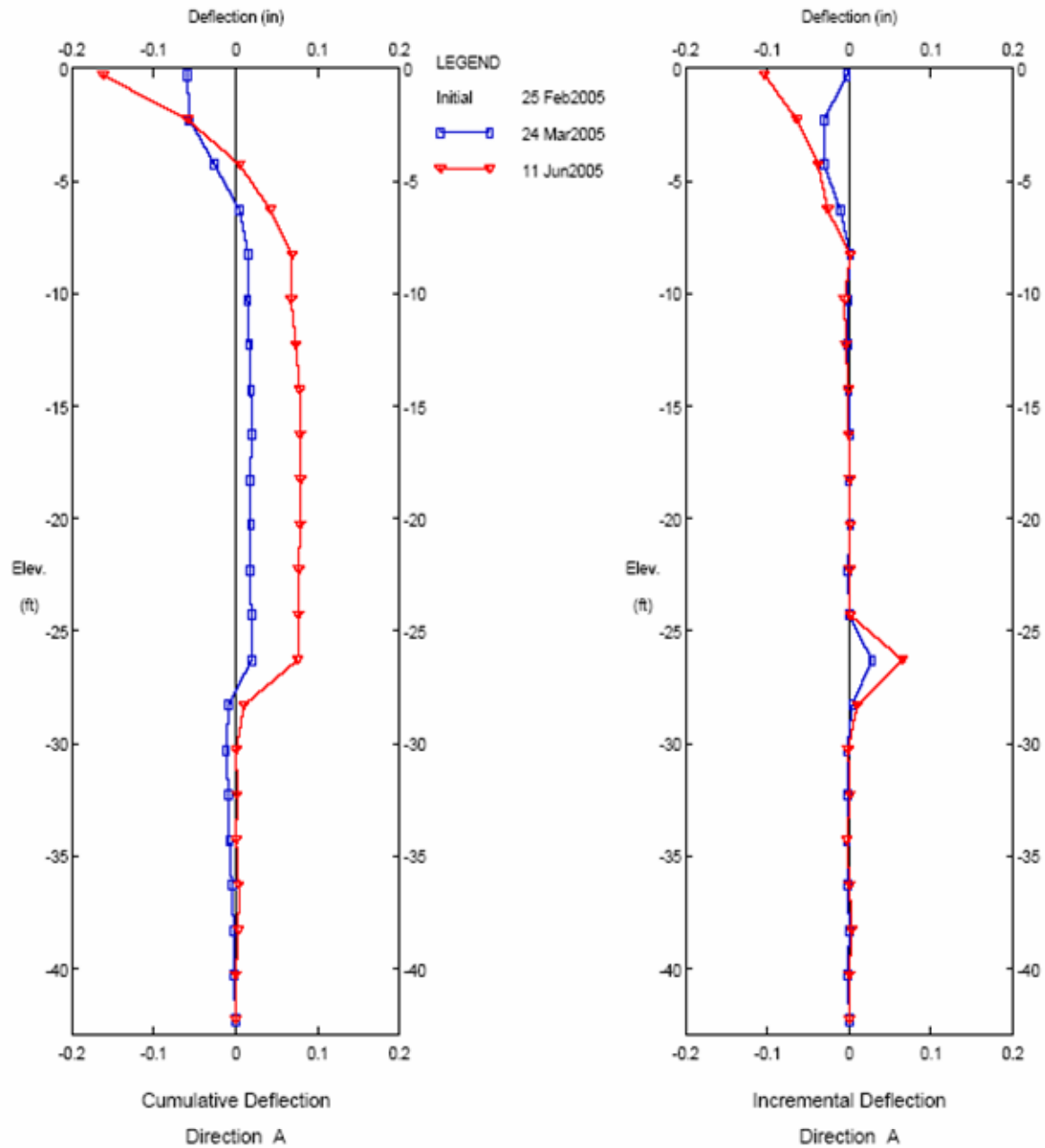
Drawn By: BLR

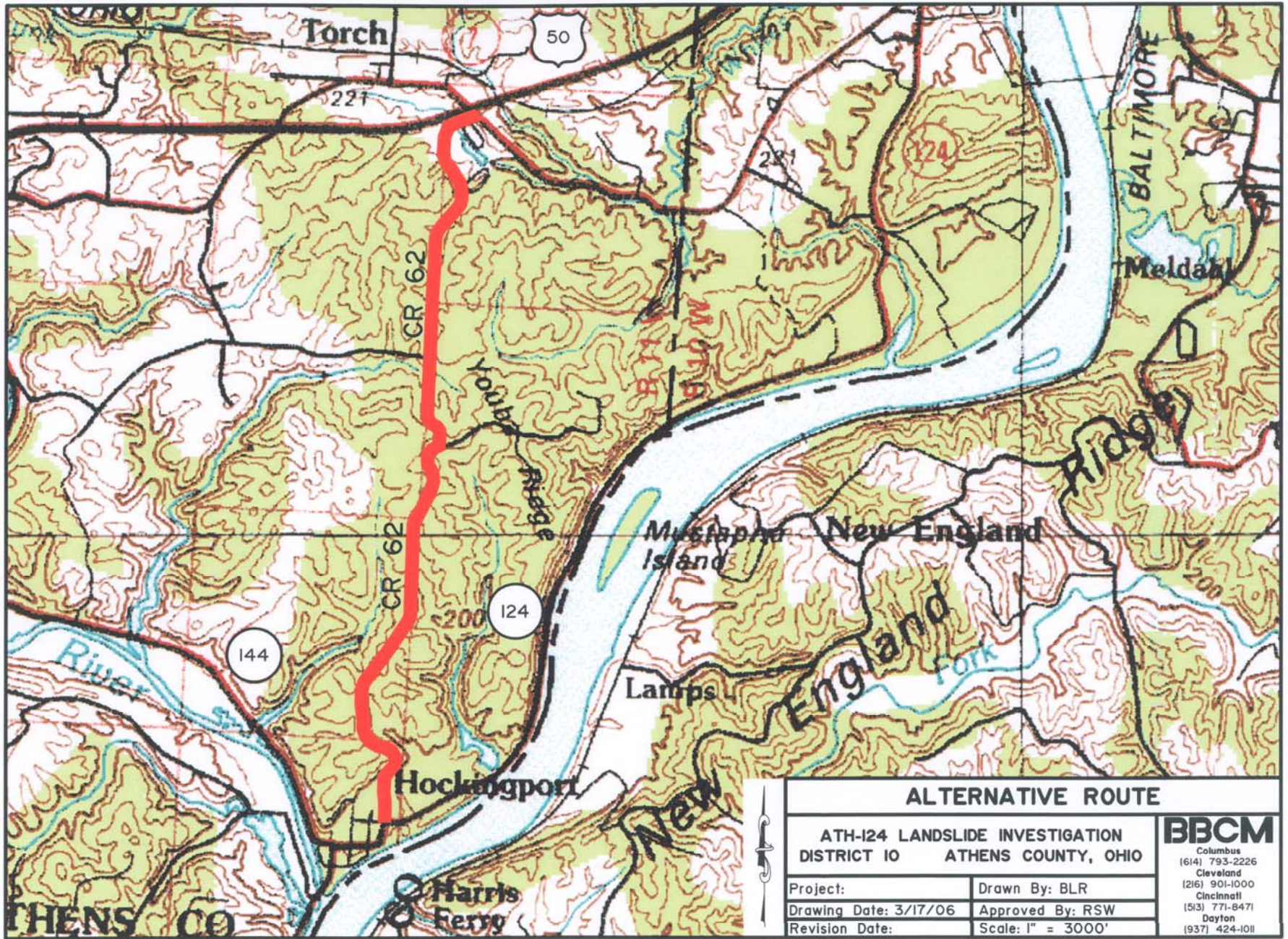
Drawing Date: 3/23/06

Approved By: RSW

Revision Date:

Scale: 1" = 200'





ALTERNATIVE ROUTE

**ATH-I24 LANDSLIDE INVESTIGATION
DISTRICT 10 ATHENS COUNTY, OHIO**

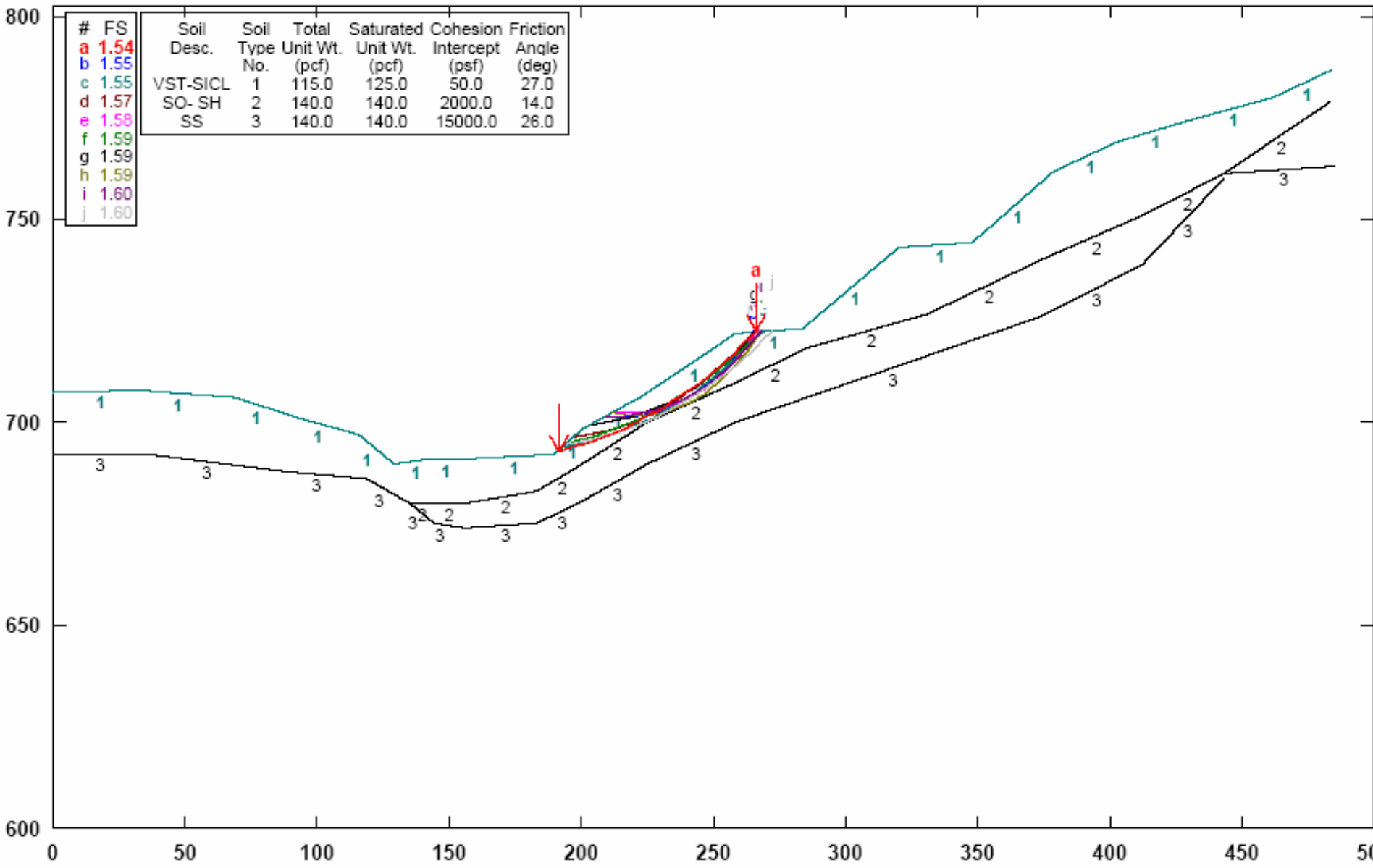
BBCM
Columbus
(614) 793-2226
Cleveland
(216) 901-1000
Cincinnati
(513) 771-8471
Dayton
(937) 424-1011

Project:	Drawn By: BLR
Drawing Date: 3/17/06	Approved By: RSW
Revision Date:	Scale: 1" = 3000'

ATHENS CO

ATH 124 RELOCATION (CR 62 UPGRADE) STA 262+00 (Existing Slope)

C:\AIZ\STABIL~2\ATH-CR~1\262_00~1\262-SN-P.PL2 Run By: Username 3/23/2006 11:24AM

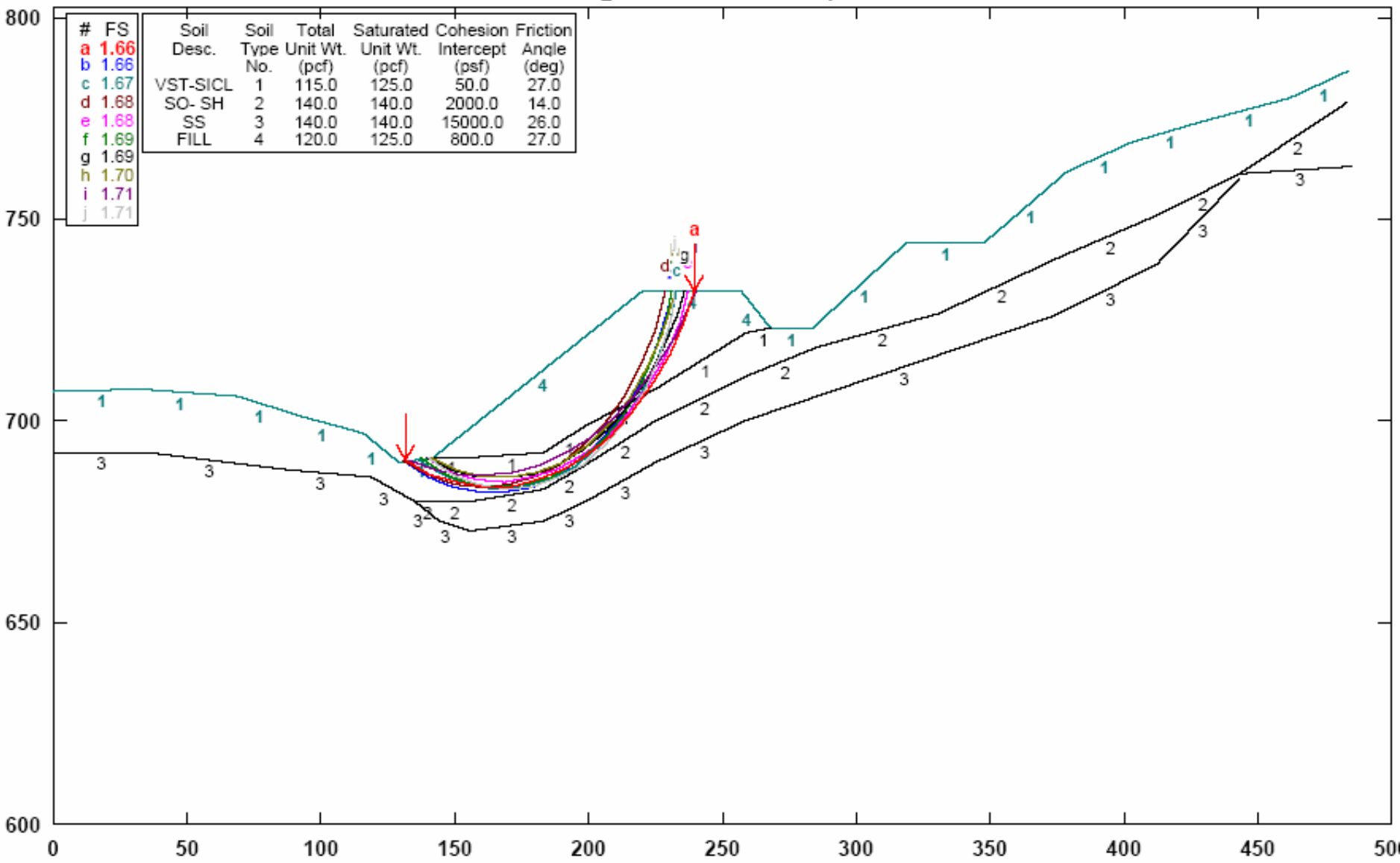


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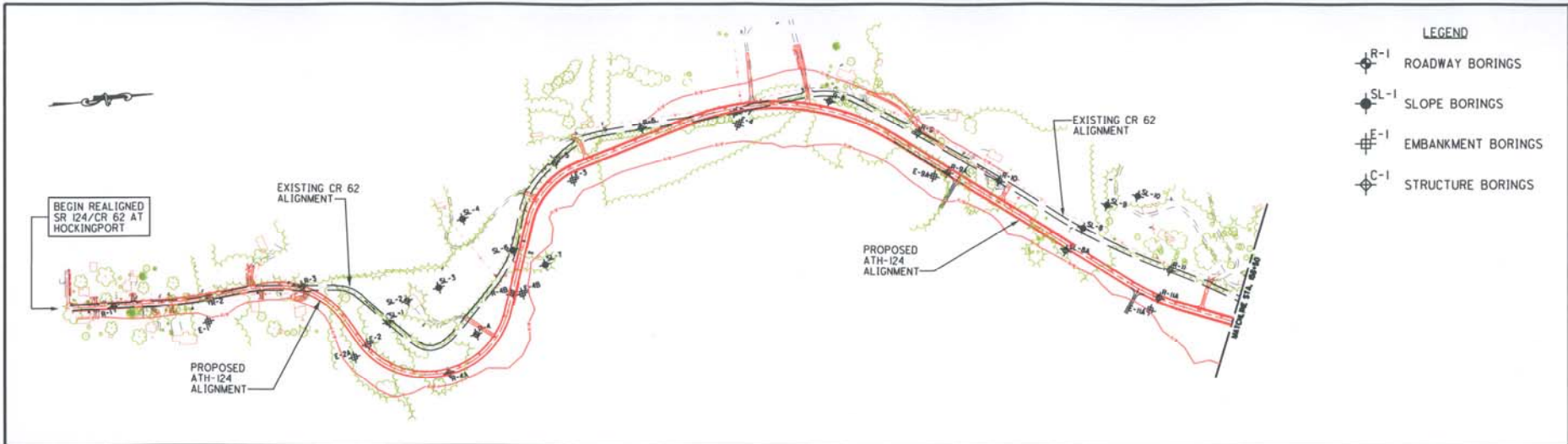
Safety Factors Are Calculated By The Simplified Janbu Method

ATH 124 RELOCATION (CR 62 UPGRADE) STA 262+00 (LONG TERM)

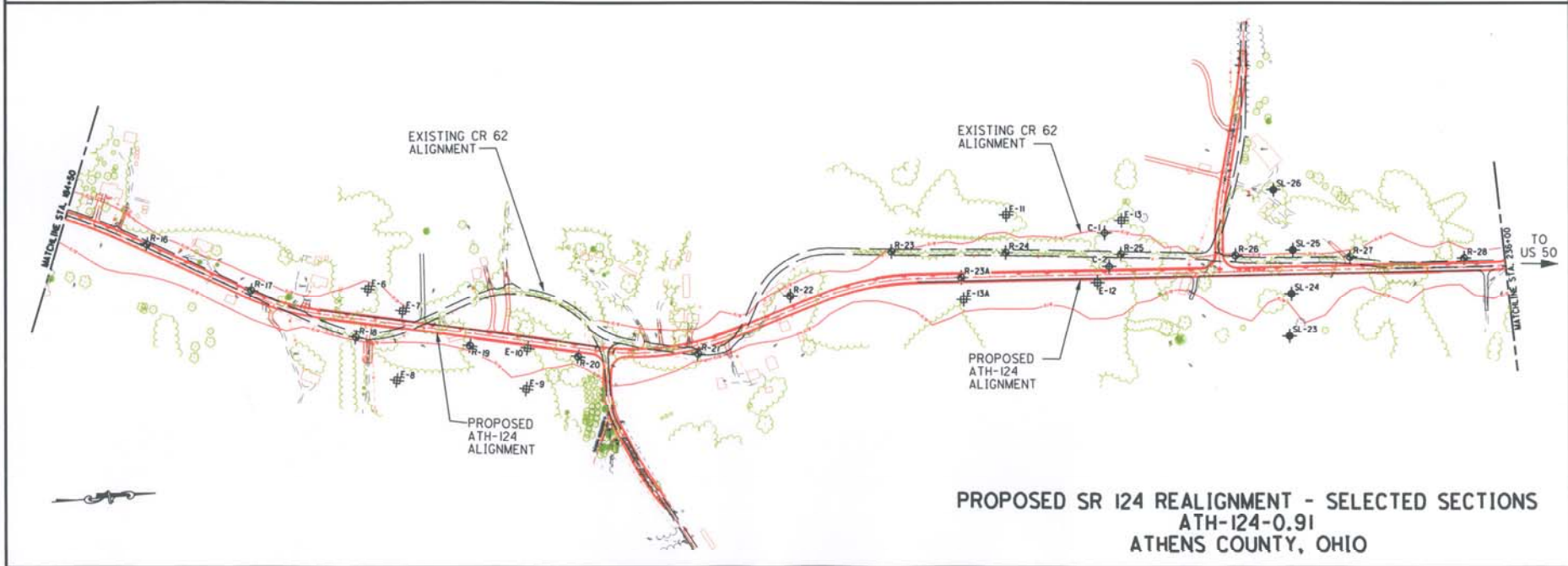
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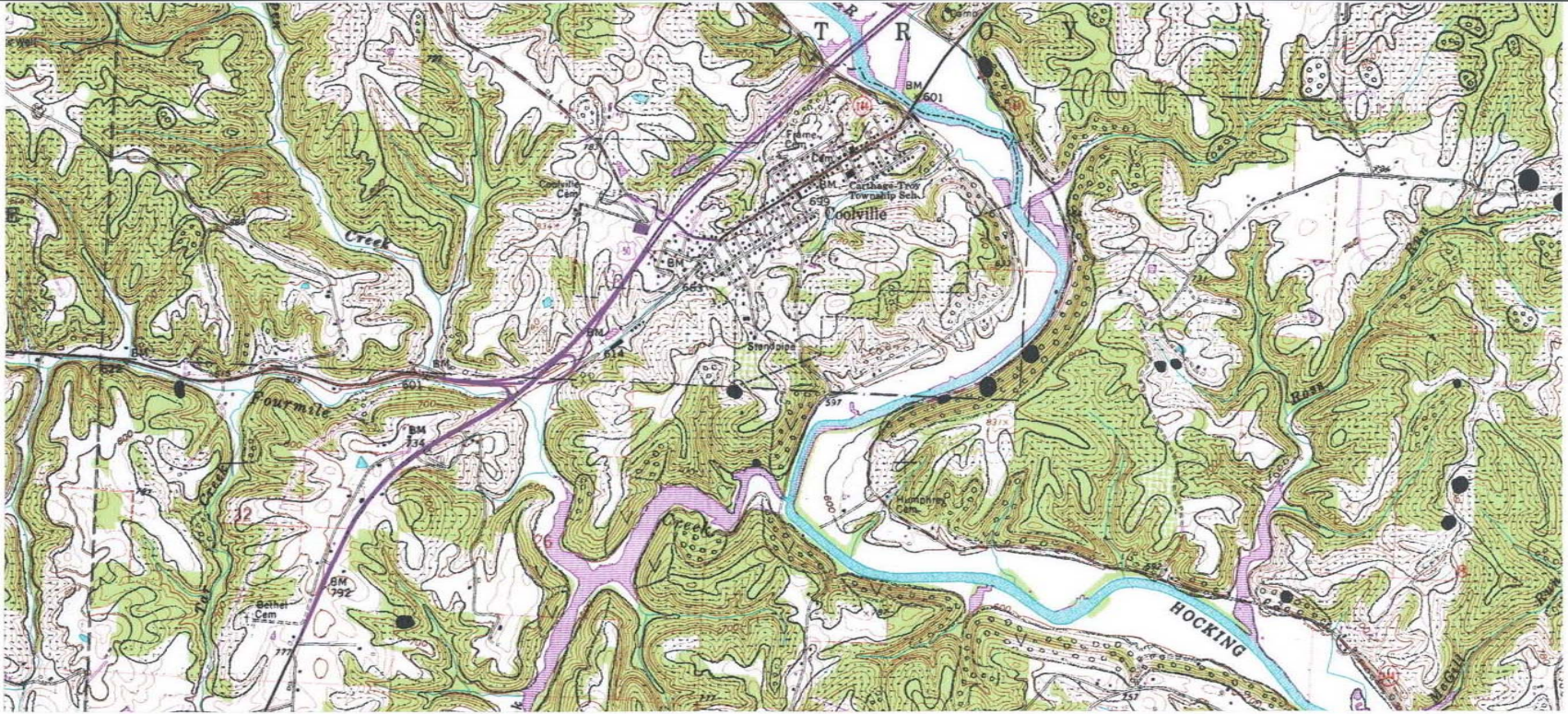
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 Safety Factors Are Calculated By The Simplified Janbu Method



- LEGEND**
- R-1 ROADWAY BORINGS
 - SL-1 SLOPE BORINGS
 - E-1 EMBANKMENT BORINGS
 - C-1 STRUCTURE BORINGS



**PROPOSED SR 124 REALIGNMENT - SELECTED SECTIONS
ATH-I24-0.91
ATHENS COUNTY, OHIO**



SYMBOLGY AS SHOWN ON U.S. GEOLOGICAL SURVEY OPEN FILE MAP #78-1056 [B-2]



ACTIVE OR RECENTLY ACTIVE (1978) LANDSLIDE

Complex landslide composed of earthflow, debris slide, earth and rock slump. Identified from historical records, and from scars, debris and other field evidence. Ground extremely unstable, sliding accelerated by excavation, loading and changes in drainage conditions. May include areas with several active slides too small to be shown separately. Questioned where doubtful.



OLD LANDSLIDE

Area of extensive hummocky ground caused by earthflow and earth and rock slump. Lacks clear evidence of active sliding. Relatively stable in natural, undisturbed state, generally not affected by small structures properly sited in areas away from the edge of the toe; can be reactivated by extensive, rapid excavation, loading, and changes in groundwater and surface water conditions. Area of old landslide probably includes recent ones not identified from field evidence or otherwise documented. Upslope boundary of landslide generally defined by modified scarp, but downslope (toe) may be gradational and not well defined. Questioned where doubtful.



COMBINATION LANDSLIDE

Area of recent and old slides in which individual slides are not identified.



COLLUVIAL SLOPES WITH LANDSLIDES

Landslides too small or obscure to map individually.



AREAS SUSCEPTIBLE TO ROCKFALL

Steep, locally vertical, natural and man-made slopes and cliffs, 15 ft. (4.5m) or more high; formed dominantly of sandstone, limestone, sandy shale, mudstone and claystone. Interbedded mudstone, claystone and shale weather rapidly leaving sandstone and limestone rock faces unsupported.



SOIL AND ROCK SUSCEPTIBLE TO LANDSLIDING

Soil and rock similar to that involved in landslides elsewhere in map area; primarily areas underlain by claystone, mudstone and shale associated with other rock types. Rock weathers rapidly on exposure forming clayey soil highly susceptible to sliding. Includes coves (U-shaped shallow valleys) containing thick layers of clayey soil that are very susceptible to sliding where excavation breaks continuity of slope and where overloaded by artificial fill.

EXISTING LANDSLIDE INFORMATION

**ATH-144-SLOPE FAILURE
ATHENS COUNTY, OHIO**



Columbus
(614) 793-2226
Cleveland
(216) 901-1000
Cincinnati
(513) 771-8471
Dayton
(937) 424-1011

Project: 01-10250-20
Drawing Date: 2/22/05
Revision Date:

Drawn By: BLR
Approved By: RSW
Scale: 1" = 2000'









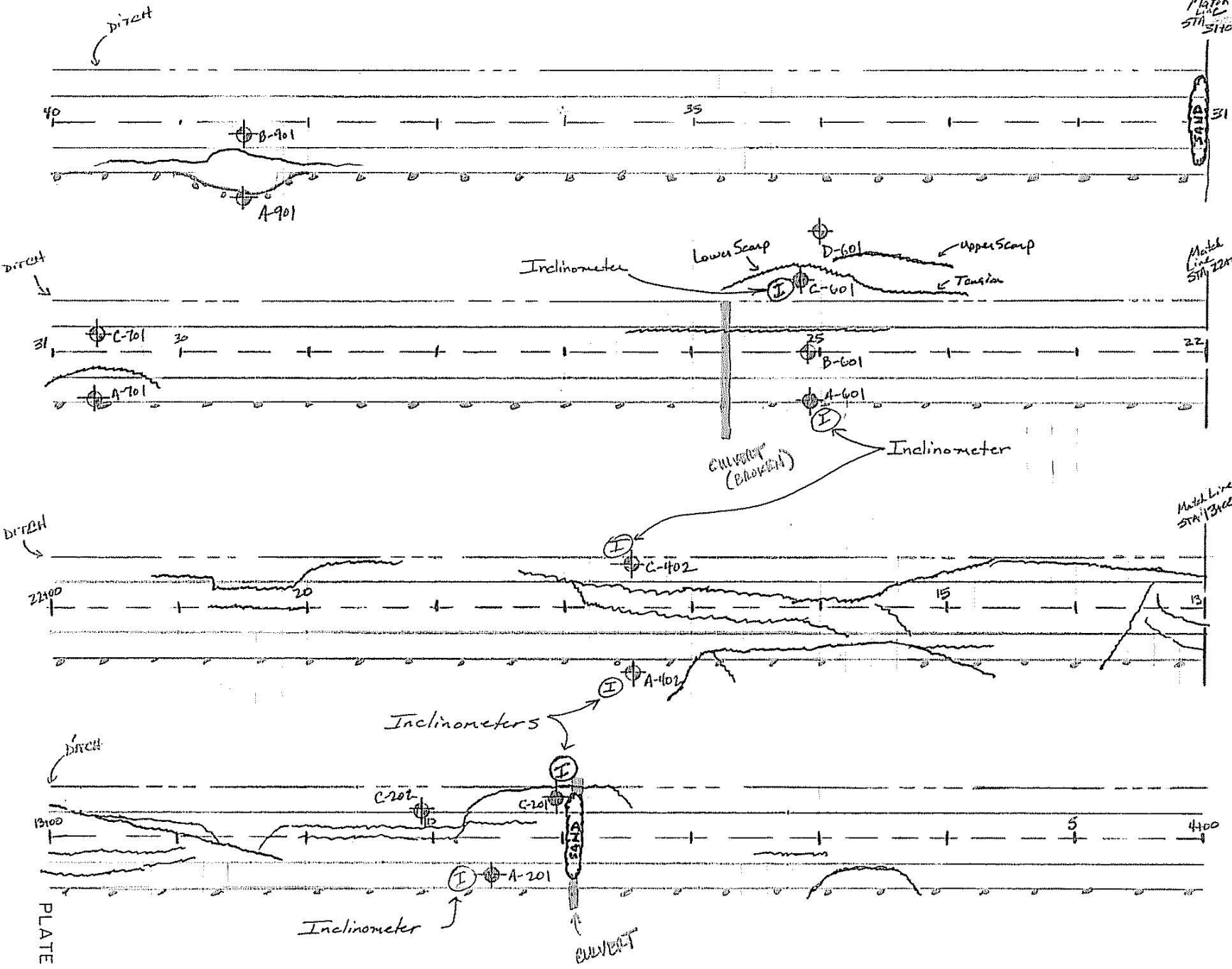


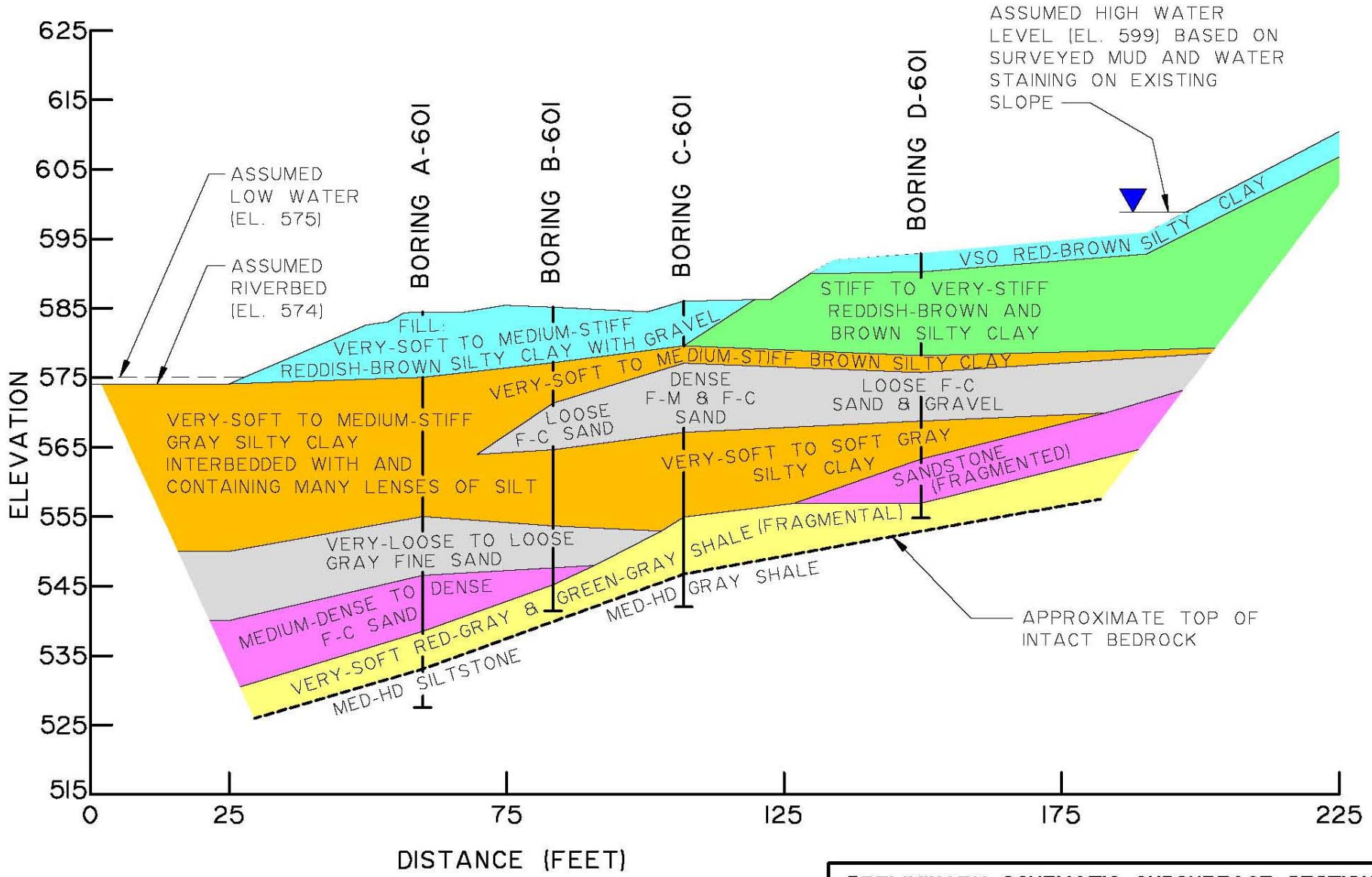


Match Line STA 3100

Match Line STA 2200

Match Line STA 1300





ASSUMED HIGH WATER LEVEL (EL. 599) BASED ON SURVEYED MUD AND WATER STAINING ON EXISTING SLOPE

ASSUMED LOW WATER (EL. 575)

ASSUMED RIVERBED (EL. 574)

BORING A-60I

BORING B-60I

BORING C-60I

BORING D-60I

VSO RED-BROWN SILTY CLAY
STIFF TO VERY-STIFF REDDISH-BROWN AND BROWN SILTY CLAY

FILL: VERY-SOFT TO MEDIUM-STIFF REDDISH-BROWN SILTY CLAY WITH GRAVEL

MEDIUM-STIFF BROWN SILTY CLAY
LOOSE F-C SAND & GRAVEL

VERY-SOFT TO MEDIUM-STIFF GRAY SILTY CLAY INTERBEDDED WITH AND CONTAINING MANY LENSES OF SILT

VERY-SOFT TO MEDIUM-STIFF BROWN SILTY CLAY
DENSE F-M & F-C SAND
LOOSE F-C SAND

VERY-SOFT TO SOFT GRAY SILTY CLAY

SANDSTONE (FRAGMENTED)

VERY-LOOSE TO LOOSE GRAY FINE SAND

SHALE (FRAGMENTAL)

MEDIUM-DENSE TO DENSE F-C SAND

MED-HD GRAY SHALE

VERY-SOFT RED-GRAY & GREEN-GRAY SILTY CLAY
MED-HD SILTSTONE

APPROXIMATE TOP OF INTACT BEDROCK

PRELIMINARY SCHEMATIC SUBSURFACE SECTION

**ATH-144 SLOPE FAILURE
ATHENS COUNTY, OHIO**



Columbus
(614) 793-2226
Cleveland
(216) 901-1000
Cincinnati
(513) 771-8471
Dayton
(937) 424-1011

Project: OII-10250-20I

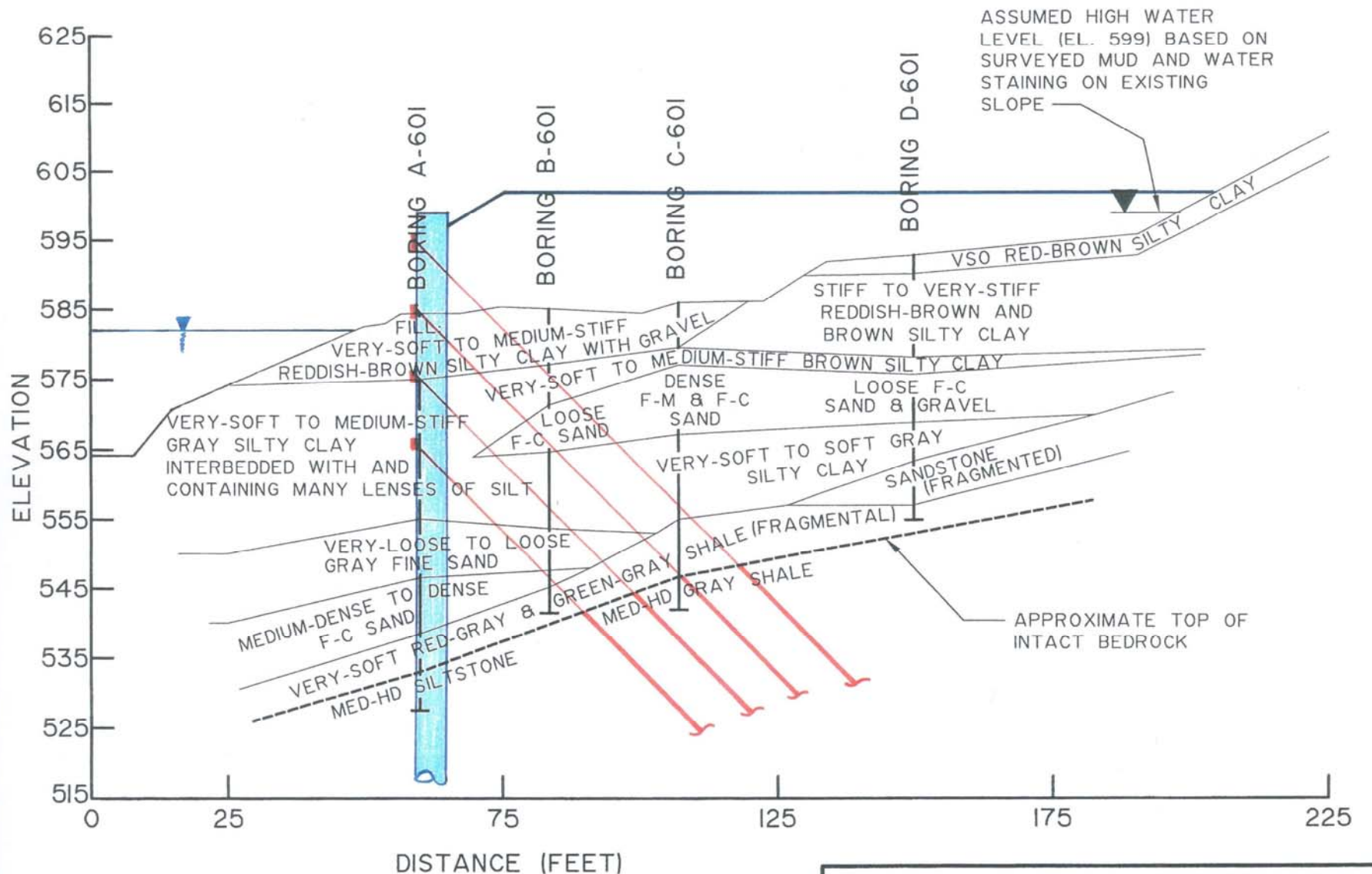
Drawn By: NWB

Drawing Date: 3/24/05

Approved By: RSW

Revision Date:

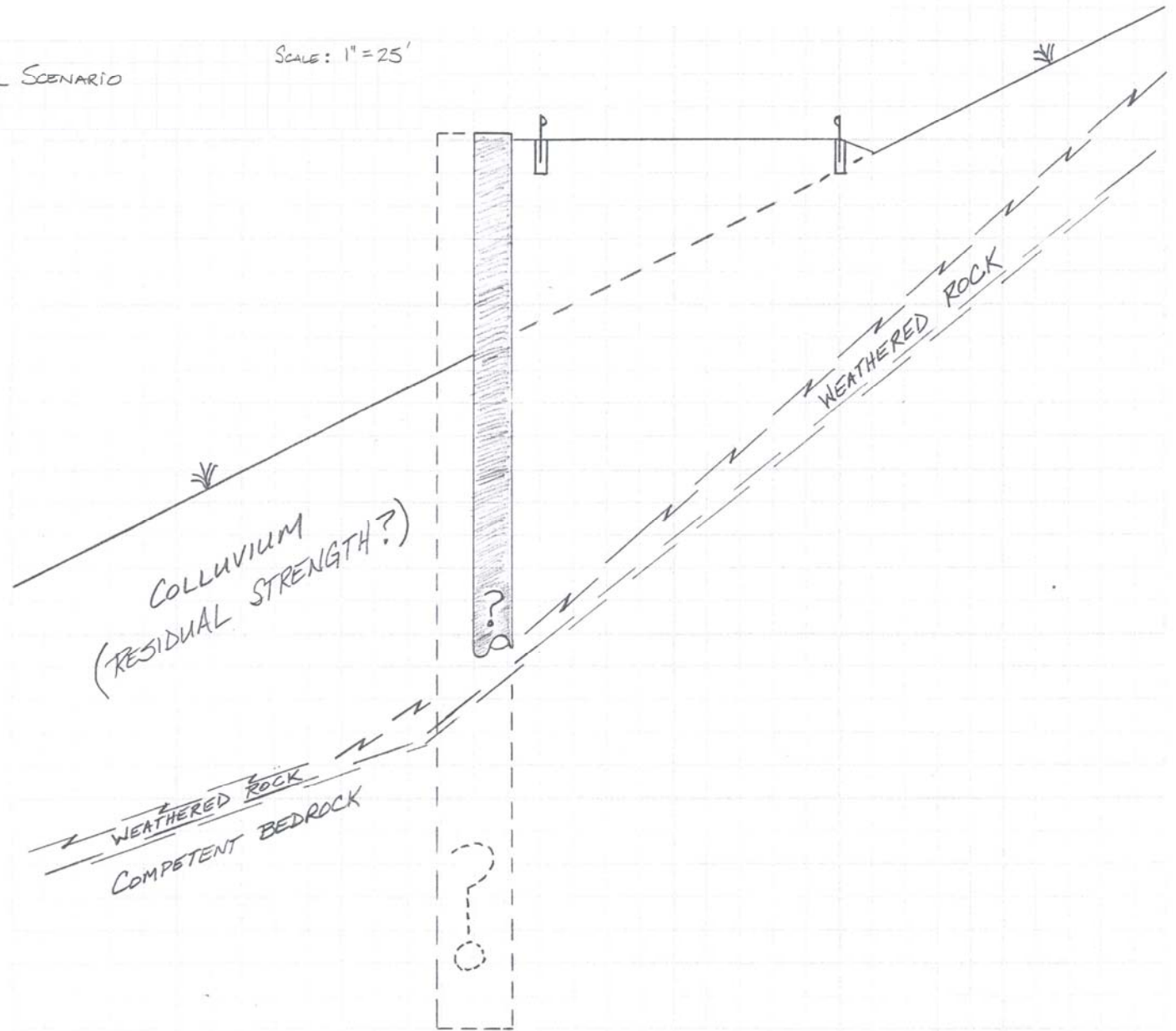
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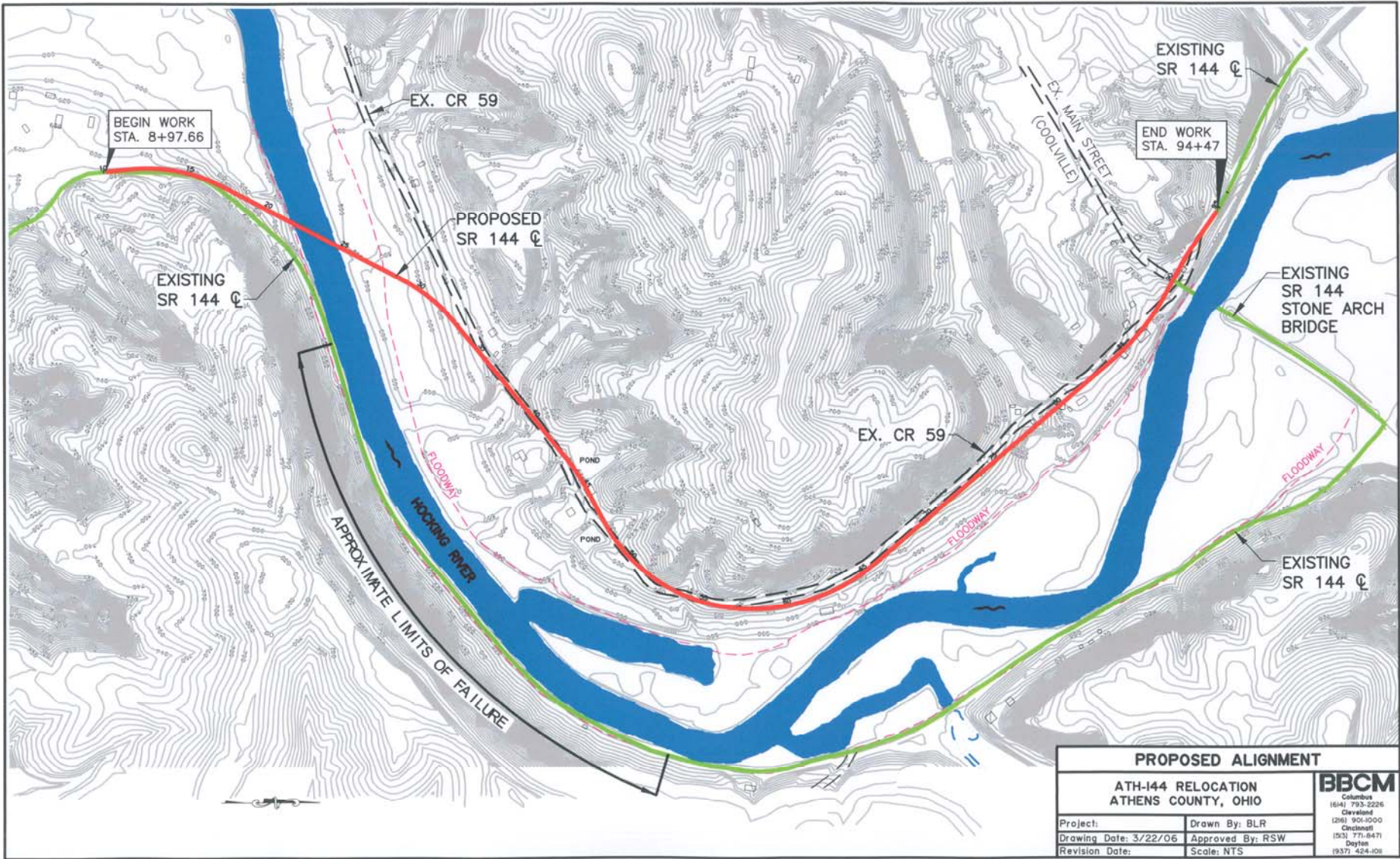


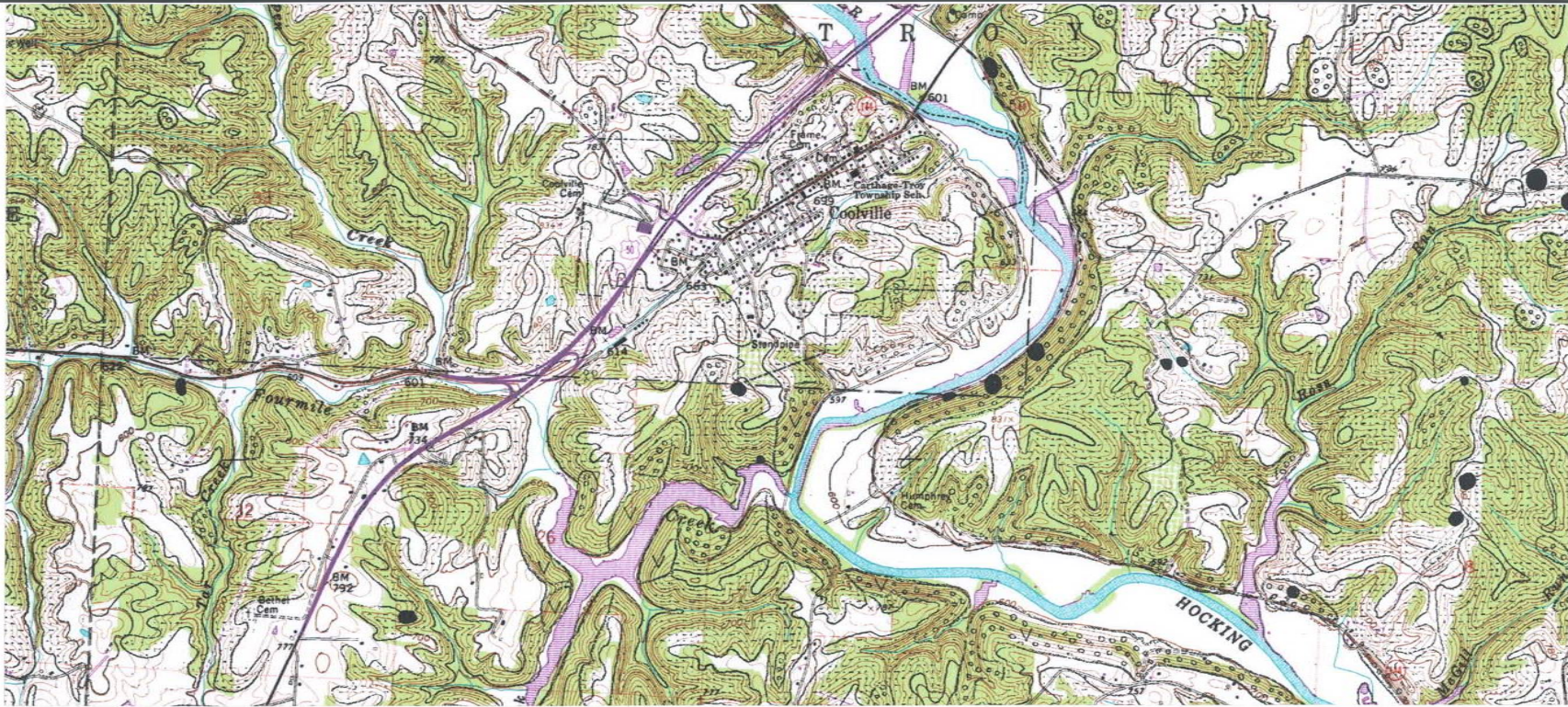
CONCEPTUAL SCHEMATIC SUBSURFACE SECTION	
ATH-144 SLOPE FAILURE ATHENS COUNTY, OHIO	
BBCM	
Columbus (614) 793-2226 Cleveland (216) 901-1000 Cincinnati (513) 771-8471 Dayton (937) 424-1011	
Project: OII-10250-201	Drawn By:
Drawing Date:	Approved By:
Revision Date:	Scale:

"WORST CASE" CONCEPTUAL SCENARIO

Scale: 1" = 25'







SYMBOLY AS SHOWN ON U.S. GEOLOGICAL SURVEY OPEN FILE MAP #78-1056 (B-2)



ACTIVE OR RECENTLY ACTIVE (1978) LANDSLIDE
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COLLUVIAL SLOPES WITH LANDSLIDES
 Landslides too small or obscure to map individually.



AREAS SUSCEPTIBLE TO ROCKFALL
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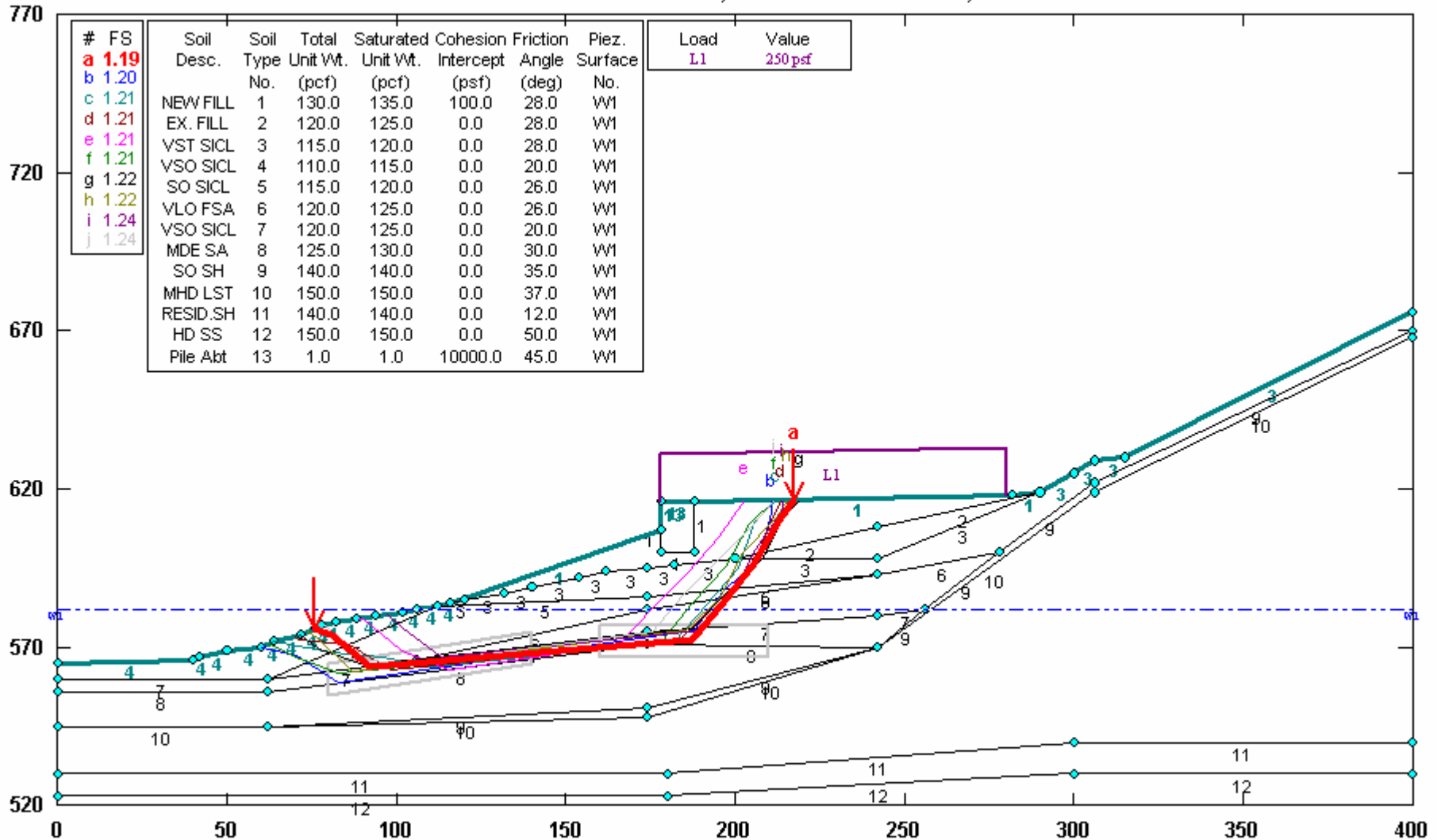
SOIL AND ROCK SUSCEPTIBLE TO LANDSLIDING
 Soil and rock similar to that involved in landslides elsewhere in map area; primarily areas underlain by claystone, mudstone and shale associated with other rock types. Rock weathers rapidly on exposure forming clayey soil highly susceptible to sliding. Includes coves (U-shaped shallow valleys) containing thick layers of clayey soil that are very susceptible to sliding where excavation breaks continuity of slope and where overloaded by artificial fill.

EXISTING LANDSLIDE INFORMATION	
ATH-144-SLOPE FAILURE ATHENS COUNTY, OHIO	
BCBM Columbus (614) 793-2226 Cleveland (216) 901-1000 Cincinnati (513) 771-8471 Dayton (937) 424-1011	
Project: Oil-10250-201	Drawn By: BLR
Drawing Date: 2/22/05	Approved By: RSW
Revision Date:	Scale: 1" = 2000'



ATH-144-Realignment, Rear Abutment X-section STA 21, Long-term

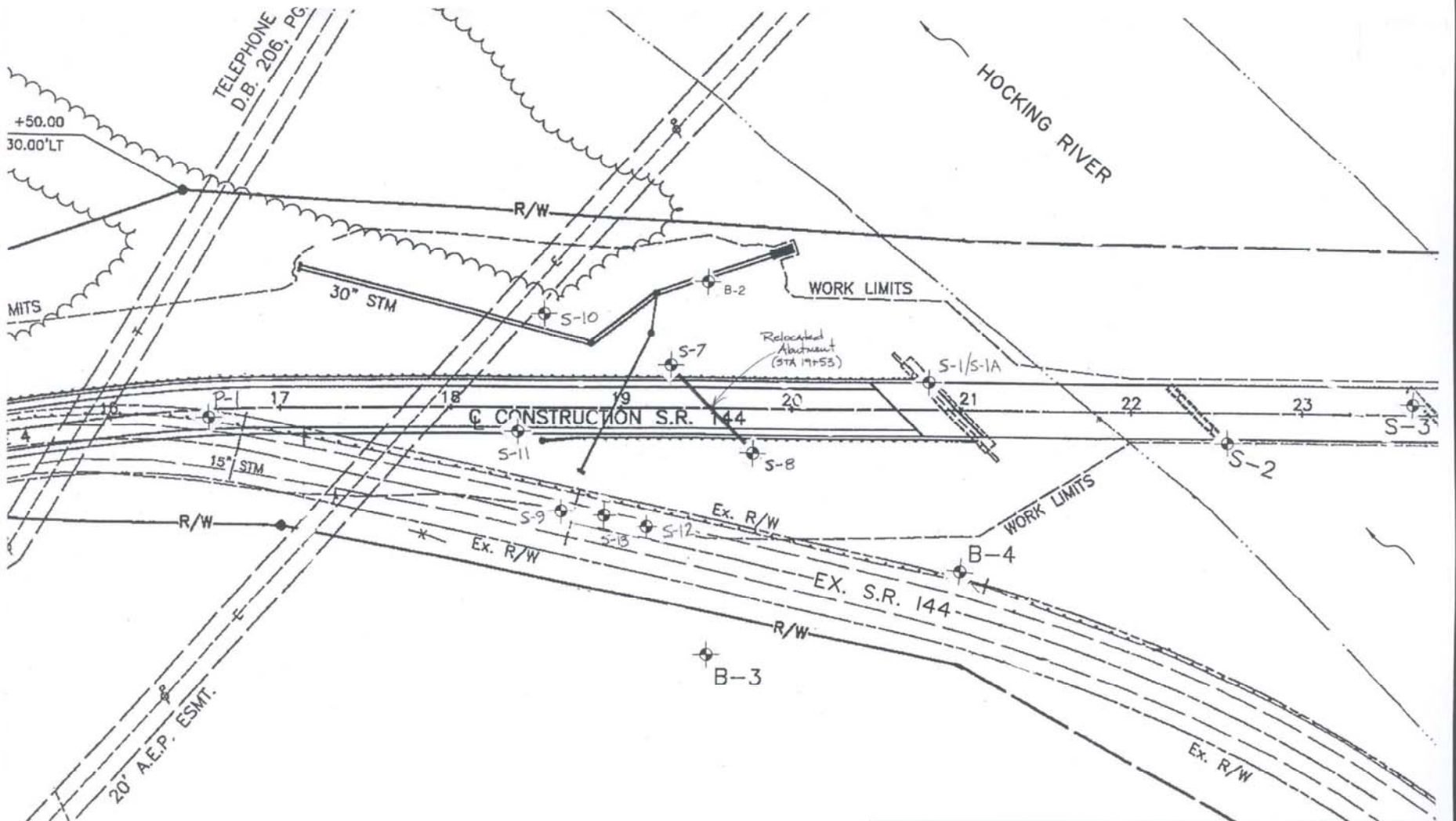
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GSTABL7 v.2 FSmin=1.19

Safety Factors Are Calculated By The Simplified Janbu Method





ADDITIONAL EXPLORATIONS

**REVISED REAR ABUTMENT
ATH-144 RELOCATION
ATHENS COUNTY, OHIO**

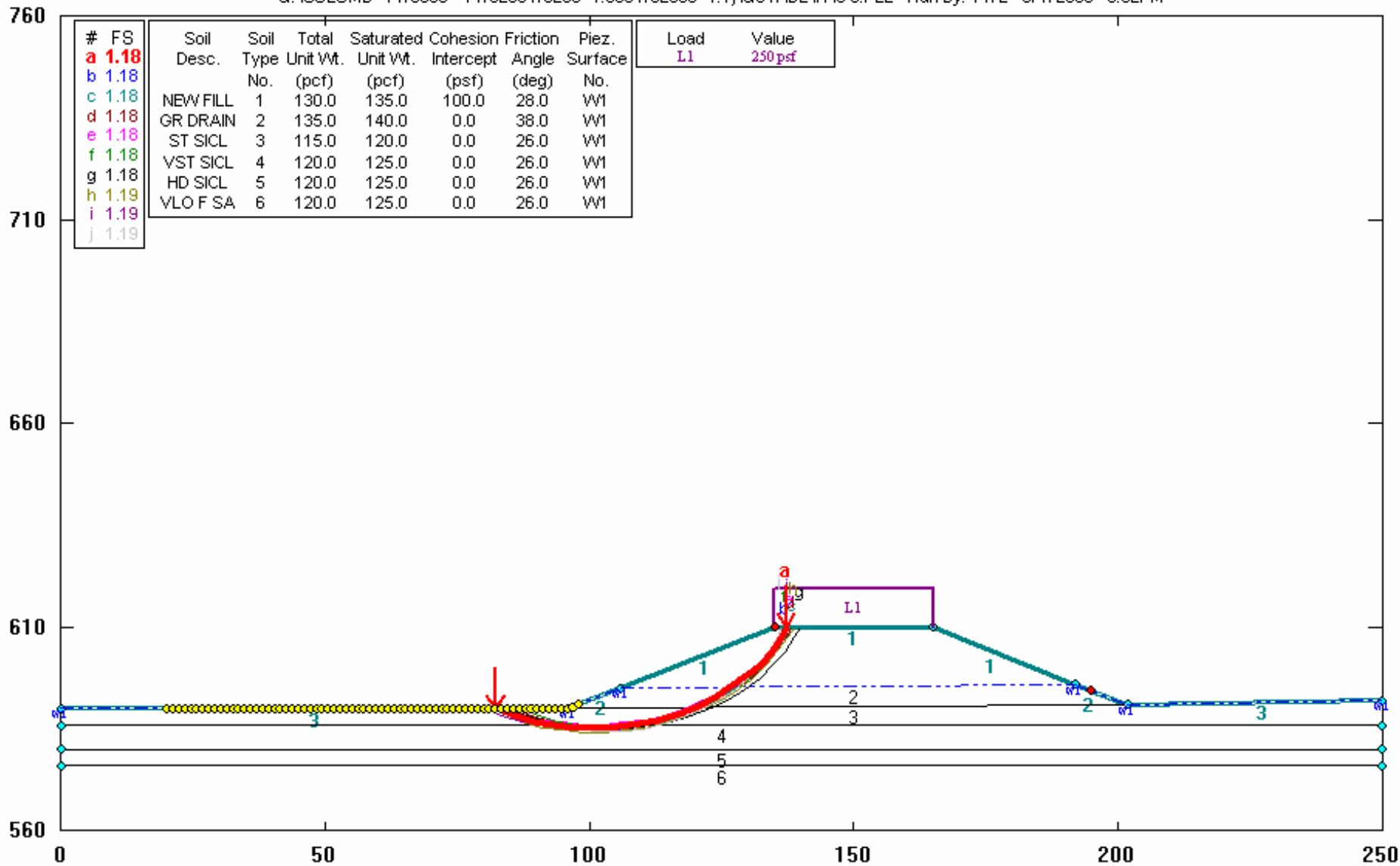
BBCM
 Columbus
 (614) 793-2226
 Cleveland
 (216) 901-1000
 Cincinnati
 (513) 771-8471
 Dayton
 (937) 424-1011

Project:
 Drawing Date: 3/21/06
 Revision Date:

Drawn By: BLR
 Approved By: RSW

ATH-144-Realignment, Forward embankment, STA 28+35, w/drain layer, Rapid drawdown

G:\COLUMB~1\10000~1\10250\10250~1.300\102503~1.1\NGSTABL\F A3-3.PL2 Run By: YWL 9/1/2005 9:32PM



GSTABL7 v.2 FSmin=1.18

Safety Factors Are Calculated By The Modified Bishop Method





Richard L. Williams, Ph.D., P.E.
Richard S. Weigand, P.E.
Steven A. Hurt, P.E.

COLUMBUS
(800) 433-1840

CLEVELAND
(888) 813-9597

CINCINNATI
(888) 718-2056

DAYTON
(937) 424-1011