

Attachment I-11: MN Diversion Channel Phase 3 Results



Fargo-Moorhead Metro Feasibility Study Phase 3 Geotechnical Design/Analyses of MN Diversion Alternatives

Compiled By: KAH
Date: 7/23/2010

Revised By: KAH
Date: 8/3/2010

Target Factor of Safety 1.400 1.400 1.200 1.200 1.300
variation 0.050 0.050 0.050 0.050 0.050
 1.350 1.350 1.150 1.150 1.250

Minnesota Diversion Channel, Section 1

STA 20+00 0+00 70+00 7,000 1.3

Filename	Channel Configuration									Spoil Pile Surcharge		Other Changes	Stability Analysis: Min FS					Water Exits Slope	Below Ground Surface	Height above Bottom	Top of slope	% Increase	X-Sectional Area	% Increase
	Bottom Width	Bottom Elev.	Bench Width	Bench Height	Bench Slope	Ground Surface	Channel Slope	Depth	Setback	Height	(A) Global Entry/Exit		(B) Wedge	(C) Lower Localized	(D) Upper Localized	(2) Undrained Global								
Original MN Sect-01	360	875				895	7	20											320		10066			
FM_P3_MN_Div_Sect-01_DSGN	225	875	70	7	10	895	7	20	50	11		1.701	1.828	2.604	2.230	1.331	882	13	7	344	7%	9879	-2%	

Minnesota Diversion Channel, Section 2

STA 175+00 70+00 220+00 15,000 2.8

Filename	Channel Configuration									Spoil Pile Surcharge		Other Changes	Stability Analysis: Min FS					Water Exits Slope	Below Ground Surface	Height above Bottom	Top of slope	% Increase	X-Sectional Area	% Increase
	Bottom Width	Bottom Elev.	Bench Width	Bench Height	Bench Slope	Ground Surface	Channel Slope	Depth	Setback	Height	(A) Global Entry/Exit		(B) Wedge	(C) Lower Localized	(D) Upper Localized	(2) Undrained Global								
Original MN Sect-02	360	876				894	7	18											306		8814			
FM_P3_MN_Div_Sect-02_DSGN	225	876	70	7	10	894	7	18	50			1.911	1.899	3.647	3.245	1.368	876	18	0	330	8%	8533	-3%	

Minnesota Diversion Channel, Section 2B

STA 350+00 220+00 420+00 20,000 3.8

Filename	Channel Configuration									Spoil Pile Surcharge		Other Changes	Stability Analysis: Min FS					Water Exits Slope	Below Ground Surface	Height above Bottom	Top of slope	% Increase	X-Sectional Area	% Increase
	Bottom Width	Bottom Elev.	Bench Width	Bench Height	Bench Slope	Ground Surface	Channel Slope	Depth	Setback	Height	(A) Global Entry/Exit		(B) Wedge	(C) Lower Localized	(D) Upper Localized	(2) Undrained Global								
Original MN Sect-02B	360	878				896	7	18											306		8814			
FM_P3_MN_Div_Sect-02B_DSGN	225	878	70	7	10	896	7	18	50			2.041	1.834	2.642	2.680	1.476	878	18	0	330	8%	8533	-3%	

Minnesota Diversion Channel, Section 3

STA 510+00 420+00 570+00 15,000 2.8

Filename	Channel Configuration									Spoil Pile Surcharge		Other Changes	Stability Analysis: Min FS					Water Exits Slope	Below Ground Surface	Height above Bottom	Top of slope	% Increase	X-Sectional Area	% Increase
	Bottom Width	Bottom Elev.	Bench Width	Bench Height	Bench Slope	Ground Surface	Channel Slope	Depth	Setback	Height	(A) Global Entry/Exit		(B) Wedge	(C) Lower Localized	(D) Upper Localized	(2) Undrained Global								
Original MN Sect-03	360	880				906	7	26											362		14158			
FM_P3_MN_Div_Sect-03_DSGN	225	880	70	7	10	906	7	26	50	11		1.657	1.634	2.029	1.703	1.442	881	25	1	386	6%	14253	1%	
FM_P3_MN_Div_Sect-03_kratio_1-5	225	880	70	7	10	906	7	26	50			1.669	1.664	2.029	1.743	1.442								
FM_P3_MN_Div_Sect-03_kratio_1-10	225	880	70	7	10	906	7	26	50			1.671	1.670	2.100	1.751	1.442								

Minnesota Diversion Channel, Section 4A

STA 582+00 570+00 640+00 7,000 1.3 43rd Ave N

Filename	Channel Configuration									Spoil Pile Surcharge		Other Changes	Stability Analysis: Min FS					Water Exits Slope	Below Ground Surface	Height above Bottom	Top of slope	% Increase	X-Sectional Area	% Increase	
	Bottom Width	Bottom Elev.	Bench Width	Bench Height	Bench Slope	Ground Surface	Channel Slope	Depth	Setback	Height	(A) Global Entry/Exit		(B) Wedge	(C) Lower Localized	(D) Upper Localized	(2) Undrained Global									
Original MN Sect-04A	360	881				910	7	29											383		16393				
FM_P3_MN_Div_Sect-04A_Raise4FT_70	400	884	70	7	10	910	10	26	50	13	Left Side	1.474	1.478	1.652	1.502	1.306							19886	21%	
											Right Side	1.475				1.306									
FM_P3_MN_Div_Sect-04A_Raise4FT_70_kratio_1-5	400	884	70	7	10	910	10	26	50	13	Left Side	1.504	1.517	1.652	1.546	1.252									
											Right Side	1.506				1.306									
FM_P3_MN_Div_Sect-04A_Raise4FT_70_kratio_1-10	400	884	70	7	10	910	10	26	50	13	Left Side	1.519	1.532	1.653	1.566	1.252									
											Right Side	1.516				1.306									

Minnesota Diversion Channel, Section 4B

STA 688+00 640+00 730+00 9,000 1.7 15th Ave N

Filename	Channel Configuration									Spoil Pile Surcharge		Other Changes	Stability Analysis: Min FS					Water Exits Slope	Below Ground Surface	Height above Bottom	Top of slope	% Increase	X-Sectional Area	% Increase
	Bottom Width	Bottom Elev.	Bench Width	Bench Height	Bench Slope	Ground Surface	Channel Slope	Depth	Setback	Height	(A) Global Entry/Exit		(B) Wedge	(C) Lower Localized	(D) Upper Localized	(2) Undrained Global								
Original MN Sect-04B	360	881				912	7	31											397		17953			
FM_P3_MN_Div_Sect-04B_35k_Raise4FT_70	400	885	70	7	10	912	10	31			Left Side	1.457	1.456	1.571	1.447	1.357	901	11	16			20956	17%	
											Right Side	1.447	1.419	1.484	1.420	1.395								

Minnesota Diversion Channel, Section 5B

STA 796+00 730+00 850+00 12,000 2.3 12th Ave S

Filename	Channel Configuration									Spoil Pile Surcharge		Other Changes	Stability Analysis: Min FS					Water Exits Slope	Below Ground Surface	Height above Bottom	Top of slope	% Increase	X-Sectional Area	% Increase
	Bottom Width	Bottom Elev.	Bench Width	Bench Height	Bench Slope	Ground Surface	Channel Slope	Depth	Setback	Height	(A) Global Entry/Exit		(B) Wedge	(C) Lower Localized	(D) Upper Localized	(2) Undrained Global								
Original MN Sect-05B	360	884				912	7	28											376		15634			
FM_P3_MN_Div_Sect-05B_Raise4FT_70	400	888	70	7	10	912	7	24			Left Side	1.498	1.483	1.722	1.488	1.436	896	16	8	459	22%	16939	8%	
								0			Right Side	1.568				1.442								
FM_P3_MN_Div_Sect-05B_Raise4FT_70_kratio_1-5	400	888	70	7	10	912	7	24			Left Side	1.488	1.473	1.717	1.490	1.436								
								0			Right Side	1.556				1.442								
FM_P3_MN_Div_Sect-05B_Raise4FT_70_kratio_1-10	400	888	70	7	10	912	7	24			Left Side	1.512	1.497	1.763	1.514	1.436								
								0			Right Side	1.573				1.442								



Fargo-Moorhead Metro Feasibility Study Phase 3 Geotechnical Design/Analyses of MN Diversion Alternatives

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Target Factor of Safety	1.400	1.400	1.200	1.200	1.300
variation	0.050	0.050	0.050	0.050	0.050
	1.350	1.350	1.150	1.150	1.250

Minnesota Diversion Channel, Section 6

STA 930+00 850+00 1055+00 20,500 3.9

Filename	Channel Configuration									Spoil Pile Surcharge		Other Changes	Stability Analysis: Min FS					Water Exits Slope	Below Ground Surface	Height above Bottom	Top of slope	% Increase	X-Sectional Area	% Increase
	Bottom Width	Bottom Elev.	Bench Width	Bench Height	Bench Slope	Ground Surface	Channel Slope	Depth	Setback	Height	(A) Global Entry/Exit		(B) Wedge	(C) Lower Localized	(D) Upper Localized	(2) Undrained Global								
Original MN Sect-06	360	886				914	7	28											376		15634			
FM_P3_MN_Div_Sect-06_Raise4FT_70	400	890	70	7	10	914	7	24	50			1.611	1.592	1.952	1.476	1.393	901	13	11	459	22%	16939	8%	

Minnesota Diversion Channel, Section 7

STA 1100+00 1055+00 1155+00 10,000 1.9

Filename	Channel Configuration									Spoil Pile Surcharge		Other Changes	Stability Analysis: Min FS					Water Exits Slope	Below Ground Surface	Height above Bottom	Top of slope	% Increase	X-Sectional Area	% Increase
	Bottom Width	Bottom Elev.	Bench Width	Bench Height	Bench Slope	Ground Surface	Channel Slope	Depth	Setback	Height	(A) Global Entry/Exit		(B) Wedge	(C) Lower Localized	(D) Upper Localized	(2) Undrained Global								
Original MN Sect-07	360	890				914	7	24											348		12738			
FM_P3_MN_Div_Sect-07_Raise4FT_70	400	894	70	7	10	914	7	20	50			1.839	1.839	2.048	1.819	1.533	899	15	5	431	24%	13379	5%	

Minnesota Diversion Channel, Section 7B

STA 1185+00 1155+00 1235+00 8,000 1.5

Filename	Channel Configuration									Spoil Pile Surcharge		Other Changes	Stability Analysis: Min FS					Water Exits Slope	Below Ground Surface	Height above Bottom	Top of slope	% Increase	X-Sectional Area	% Increase
	Bottom Width	Bottom Elev.	Bench Width	Bench Height	Bench Slope	Ground Surface	Channel Slope	Depth	Setback	Height	(A) Global Entry/Exit		(B) Wedge	(C) Lower Localized	(D) Upper Localized	(2) Undrained Global								
Original MN Sect-07B	360	891				910	7	19											313		9433			
FM_P3_MN_Div_Sect-07B_Raise4FT_70	400	895	70	7	10	910	7	15	50			2.191	2.195	2.127	2.115	1.683	900	10	5	396	27%	9244	-2%	

Minnesota Diversion Channel, Section 8

STA 1270+00 1235+00 1309+80 7,400 1.4

Filename	Channel Configuration									Spoil Pile Surcharge		Other Changes	Stability Analysis: Min FS					Water Exits Slope	Below Ground Surface	Height above Bottom	Top of slope	% Increase	X-Sectional Area	% Increase
	Bottom Width	Bottom Elev.	Bench Width	Bench Height	Bench Slope	Ground Surface	Channel Slope	Depth	Setback	Height	(A) Global Entry/Exit		(B) Wedge	(C) Lower Localized	(D) Upper Localized	(2) Undrained Global								
Original MN Sect-08	360	893				912	7	19											313		9433			
FM_P3_MN_Div_Sect-08_Raise4FT_70	400	897	70	7	10	912	7	15	50			2.080	2.080	1.875	2.189	1.724	902	10	5	396	27%	9244	-2%	

Minnesota Diversion Channel, Section 9A

EXT CH STA 80+00 0+00 105+00 10,500 2.0

Filename	Channel Configuration									Spoil Pile Surcharge		Other Changes	Stability Analysis: Min FS					Water Exits Slope	Below Ground Surface	Height above Bottom	Top of slope	% Increase	X-Sectional Area	% Increase
	Bottom Width	Bottom Elev.	Bench Width	Bench Height	Bench Slope	Ground Surface	Channel Slope	Depth	Setback	Height	(A) Global Entry/Exit		(B) Wedge	(C) Lower Localized	(D) Upper Localized	(2) Undrained Global								
Original MN Sect-09A	50	887				911	7	24											193		5298			
FM_P3_MN_Div_Sect-09A_DSGN	215	897				911	7	14				2.026	2.029	2.156	2.025	1.872	898	13	1	206	6%	4448	-16%	

Minnesota Diversion Channel, Section 9B

EXT CH STA 130+00 105+00 164+84 5,900 1.1

Filename	Channel Configuration									Spoil Pile Surcharge		Other Changes	Stability Analysis: Min FS					Water Exits Slope	Below Ground Surface	Height above Bottom	Top of slope	% Increase	X-Sectional Area	% Increase
	Bottom Width	Bottom Elev.	Bench Width	Bench Height	Bench Slope	Ground Surface	Channel Slope	Depth	Setback	Height	(A) Global Entry/Exit		(B) Wedge	(C) Lower Localized	(D) Upper Localized	(2) Undrained Global								
Original MN Sect-09B	50	890				914	7	24											193		5298			
FM_P3_MN_Div_Sect-09B_DSGN	215	900				914	7	14				1.616	1.620	1.996	1.615	1.600	901	13	1	206	6%	4448	-16%	

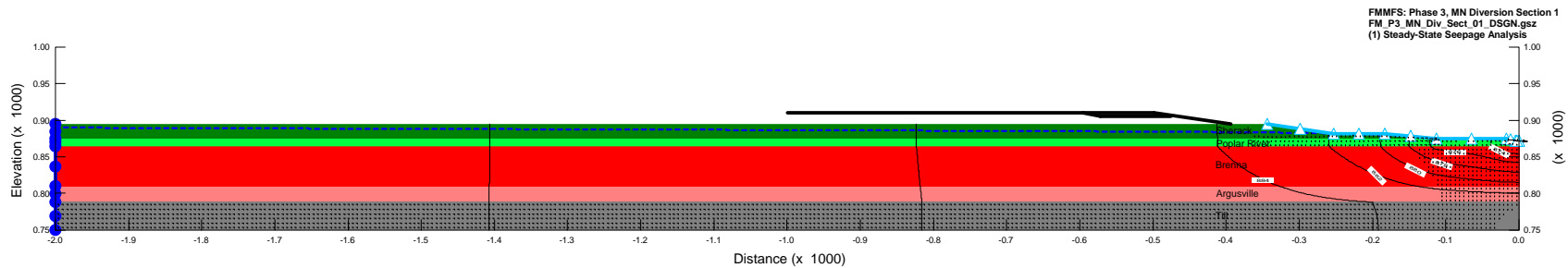
File Name: FM_P3_MN_Div_Sect_01_DSGN.gsz

Fargo-Moorhead Metro Feasibility Study Phase 3 Analysis MN Diversion Channel Stability Section 1

(1) Steady-State Seepage Analysis

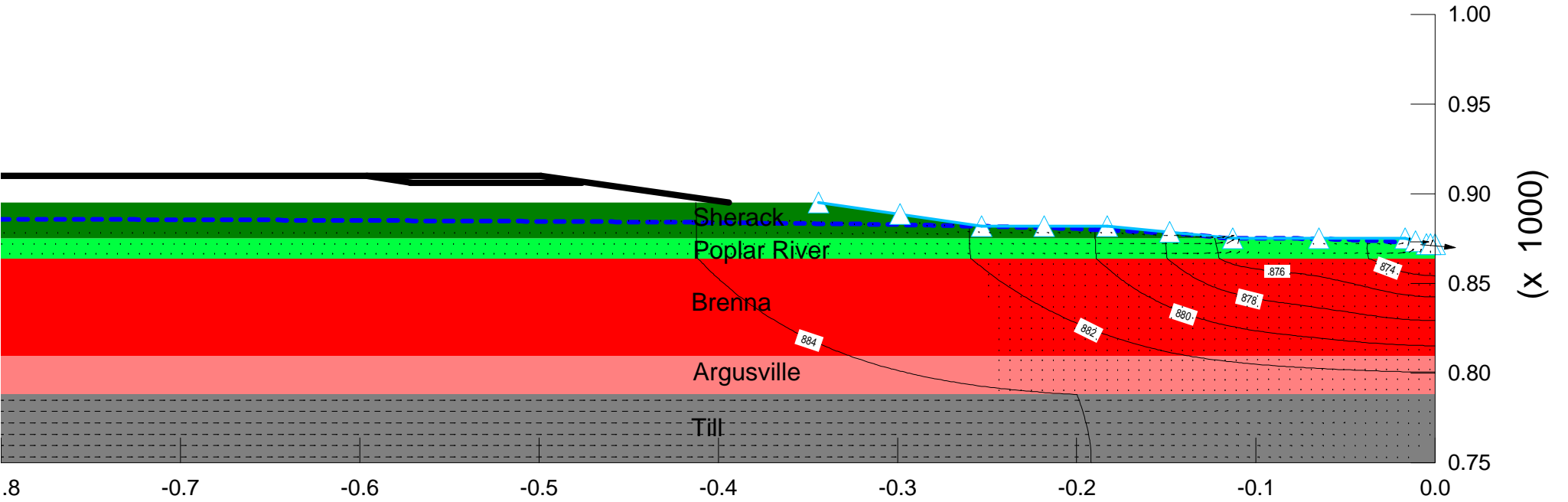
Soil Properties

Name: Sherack Model: Saturated / Unsaturated K-Function: Alluv/Sherack Vol. WC. Function: Alluv/Sherack K-Ratio: 1 K-Direction: 0°
Name: Poplar River Model: Saturated / Unsaturated K-Function: Alluv/Sherack Vol. WC. Function: Alluv/Sherack K-Ratio: 1 K-Direction: 0°
Name: Breina Model: Saturated Only K-Sat: 0.00028 10days Volumetric Water Content: 0.53 100% Mu: 3e-005 psf K-Ratio: 1 K-Direction: 0°
Name: Argusville Model: Saturated Only K-Sat: 0.00028 10days Volumetric Water Content: 0.6 100% Mu: 3e-005 psf K-Ratio: 1 K-Direction: 0°
Name: Fill Model: Saturated Only K-Sat: 0.007 10days Volumetric Water Content: 0.45 100% Mu: 3e-005 psf K-Ratio: 0.25 K-Direction: 0°
Name: Sand Model: Saturated / Unsaturated K-Function: Sand Vol. WC. Function: Sand K-Ratio: 1 K-Direction: 0°



Created By: Heckendorf, Kurt A MVP
Last Edited By: Killian, Elizabeth A MVP
Date: 8/11/2010

FMMFS: Phase 3, MN Diversion Section 1
FM_P3_MN_Div_Sect_01_DSGN.gsz
(1) Steady-State Seepage Analysis



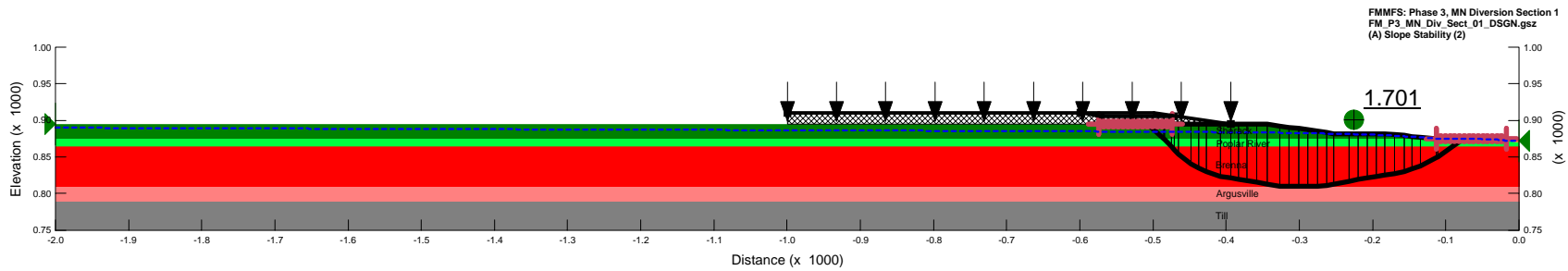
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Fargo-Moorhead Metro Feasibility Study Phase 3 Analysis MN Diversion Channel Stability Section 1

(A) Slope Stability (2)

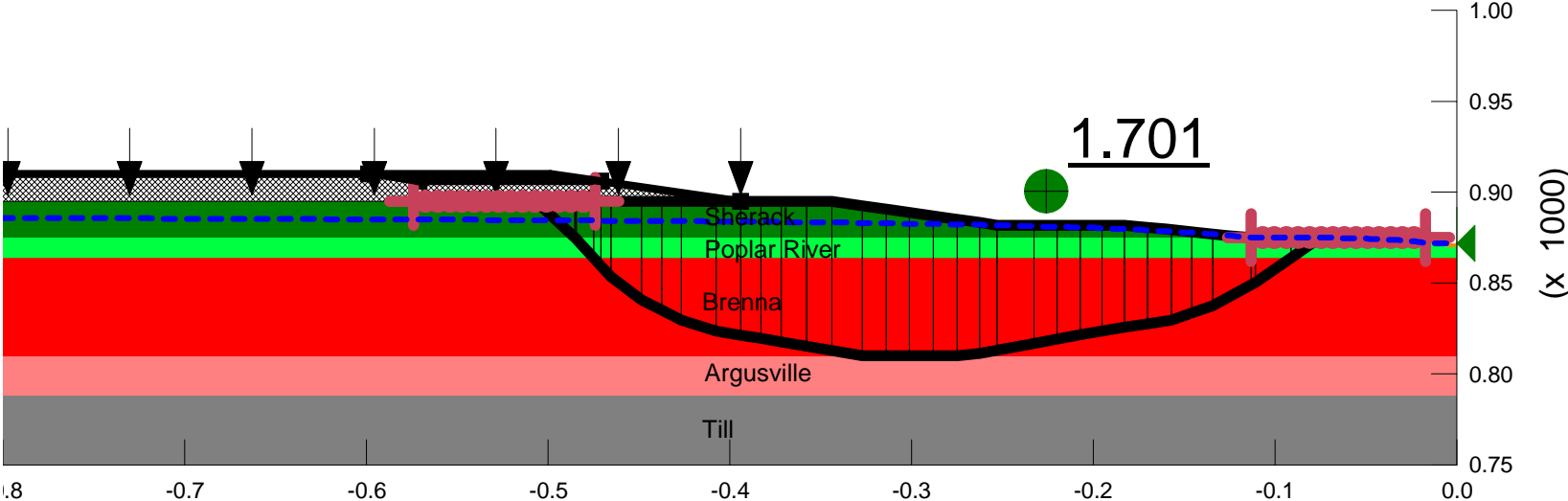
Soil Properties

Name: Sherack Model: Mohr-Coulomb Unit Weight: 118 pcf Cohesion: 0 psf Phi: 28° Phi-B: 0°
Name: Redjar River Model: Mohr-Coulomb Unit Weight: 119 pcf Cohesion: 0 psf Phi: 26° Phi-B: 0°
Name: Berens Model: Shear/Normal Fn. Unit Weight: 104 pcf Strength Function: Berens Phi-B: 0°
Name: Argusville Model: Shear/Normal Fn. Unit Weight: 105 pcf Strength Function: Argusville Phi-B: 0°
Name: Fill Model: Mohr-Coulomb Unit Weight: 122 pcf Cohesion: 0 psf Phi: 31° Phi-B: 0°
Name: Sand Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion: 0 psf Phi: 32° Phi-B: 0°

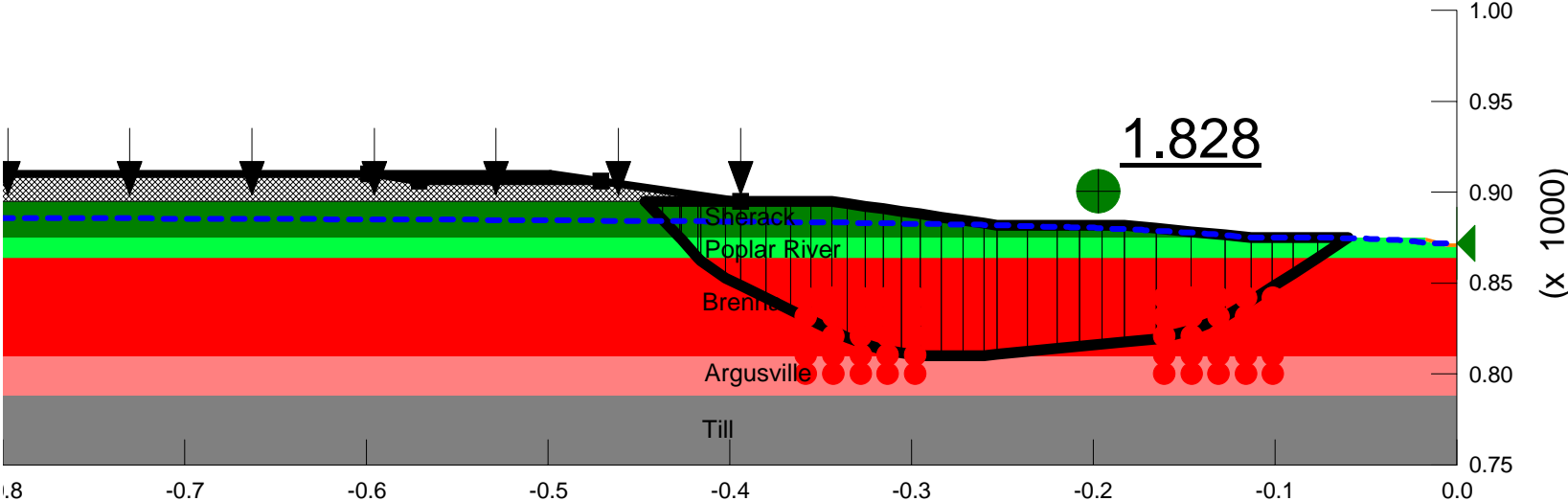


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Date: 8/11/2010

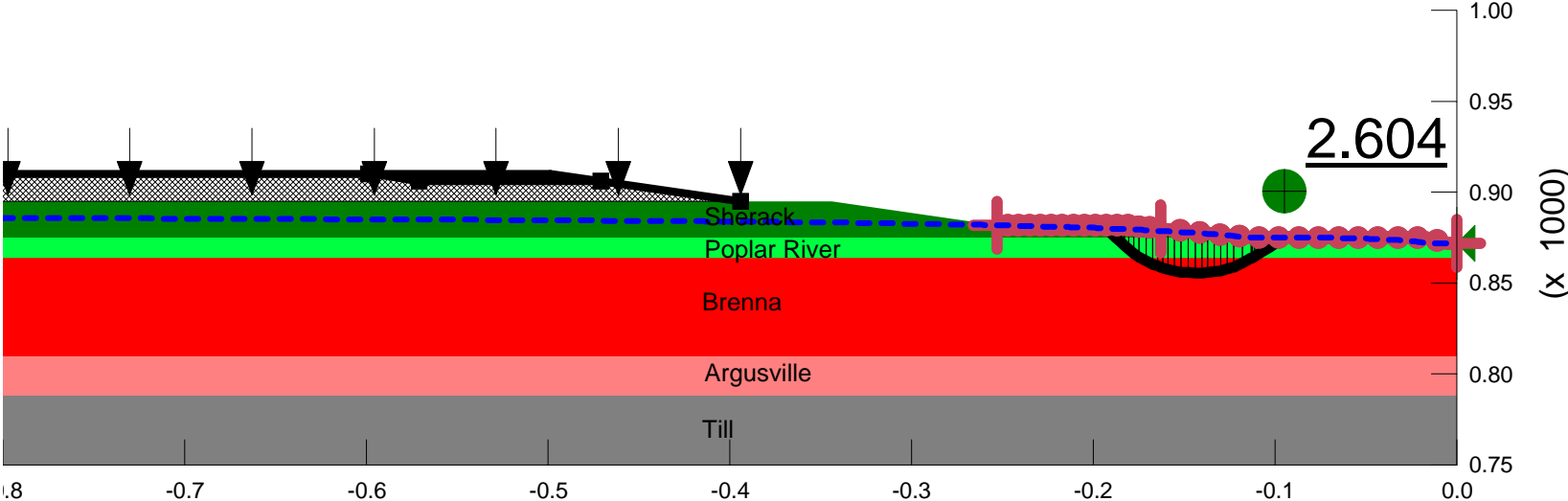
FMMFS: Phase 3, MN Diversion Section 1
FM_P3_MN_Div_Sect_01_DSGN.gsz
(A) Slope Stability (2)



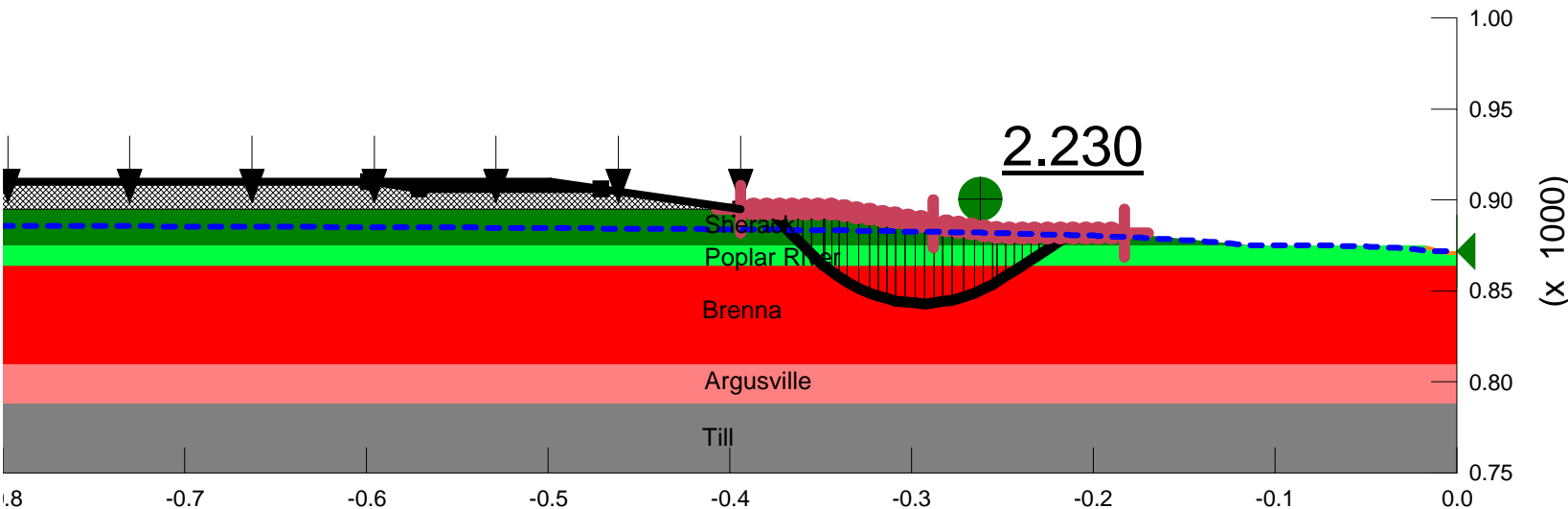
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(B) Wedge Slope Stability



FMMFS: Phase 3, MN Diversion Section 1
FM_P3_MN_Div_Sect_01_DSGN.gsz
(C) Lower Localized Stability



FMMFS: Phase 3, MN Diversion Section 1
FM_P3_MN_Div_Sect_01_DSGN.gsz
(D) Upper Localized Stability



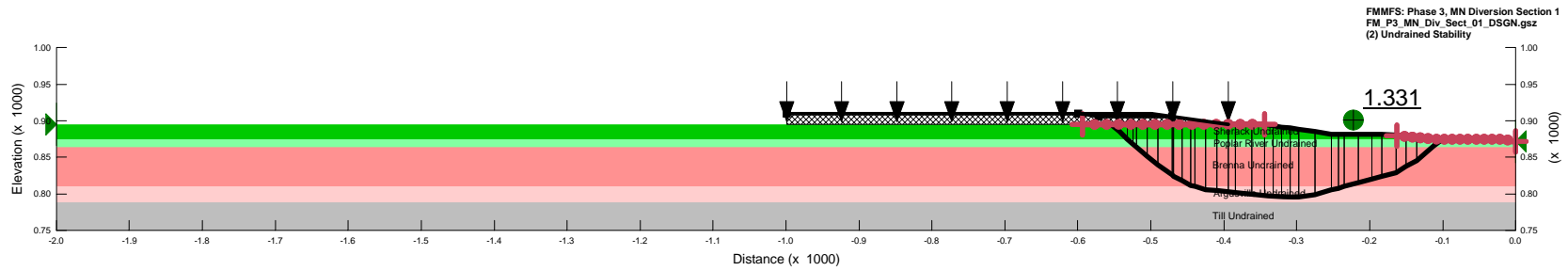
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Fargo-Moorhead Metro Feasibility Study Phase 3 Analysis MN Diversion Channel Stability Section 1

(2) Undrained Stability

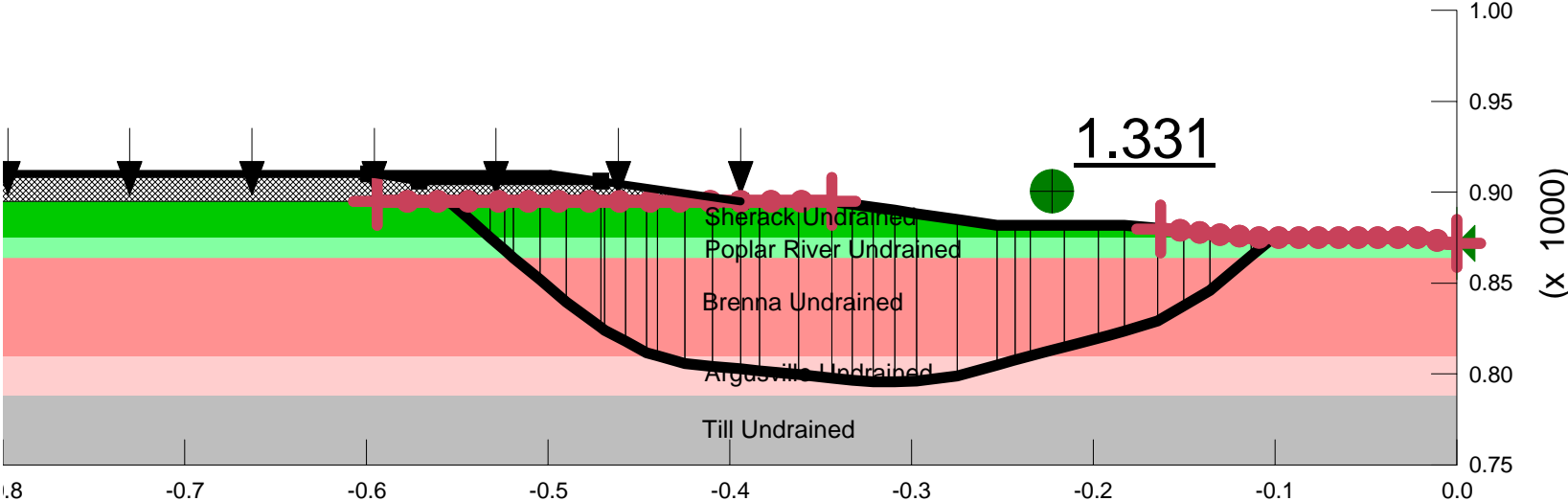
Soil Properties

Name: Sherack Undrained Model: Undrained (Phi=0) Unit Weight: 118 pcf Cohesion: 900 psf
Name: Poplar River Undrained Model: Undrained (Phi=0) Unit Weight: 119 pcf Cohesion: 1030 psf
Name: Brenna Undrained Model: Undrained (Phi=0) Unit Weight: 124 pcf Cohesion: 525 psf
Name: Argovilla Undrained Model: S-4(Slope) Unit Weight: 106 pcf C-Top of Layer: 525 psf C-Rate of Change: 10 psf/ft Limiting C: 1025 psf
Name: Till Undrained Model: Undrained (Phi=0) Unit Weight: 122 pcf Cohesion: 1800 psf
Name: Sand Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion: 0 psf Phi: 32° Phi/B: 0°



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Date: 8/11/2010

FMMFS: Phase 3, MN Diversion Section 1
FM_P3_MN_Div_Sect_01_DSGN.gsz
(2) Undrained Stability



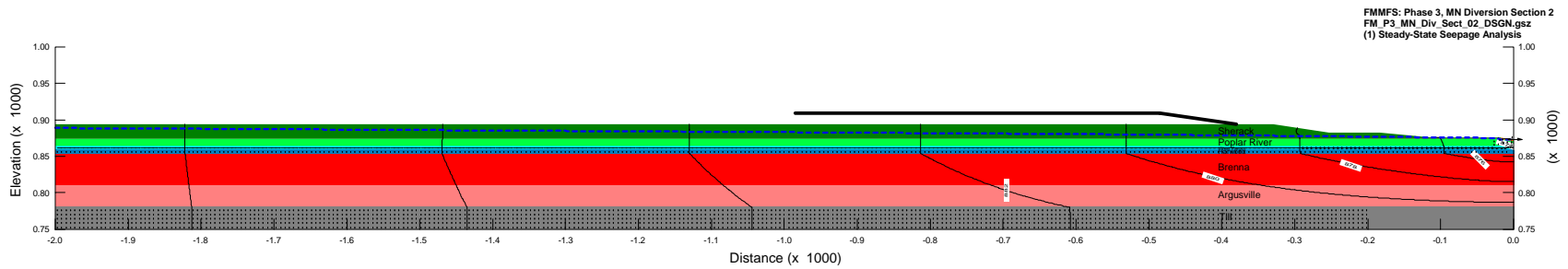
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Fargo-Moorhead Metro Feasibility Study Phase 3 Analysis MN Diversion Channel Stability Section 2

(1) Steady-State Seepage Analysis

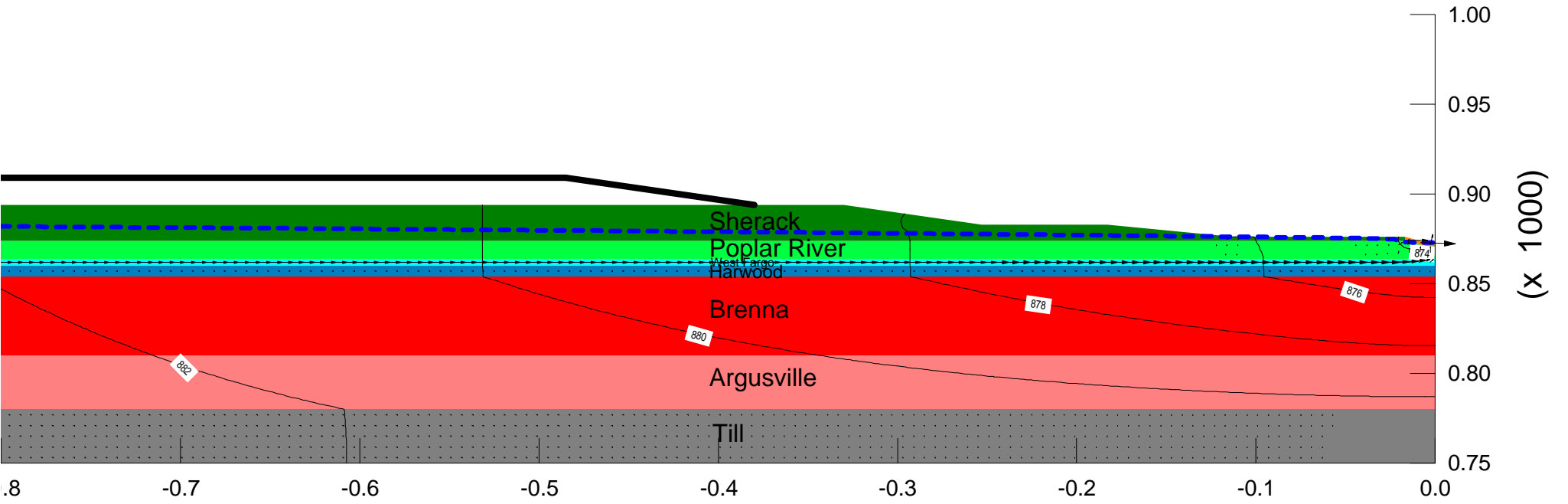
Soil Properties

Name: Sherack	Model: Saturated / Unsaturated	K-Function: Alluv/Sherack	Vol. WC. Function: Alluv/Sherack	K-Ratio: 1	K-Direction: 0°	
Name: Poplar River	Model: Saturated / Unsaturated	K-Function: Alluv/Sherack	Vol. WC. Function: Alluv/Sherack	K-Ratio: 1	K-Direction: 0°	
Name: West Fargo	Model: Saturated / Unsaturated	K-Function: West Fargo	Vol. WC. Function: West Fargo	K-Ratio: 1	K-Direction: 0°	
Name: Harwood	Model: Saturated / Unsaturated	K-Function: Harwood	Vol. WC. Function: Harwood	K-Ratio: 1	K-Direction: 0°	
Name: Brenna	Model: Saturated Only	K-Sat: 0.00028 f/day	Volumetric Water Content: 0.23 81/81	Mv: 3e-005 psf	K-Ratio: 1	K-Direction: 0°
Name: Argusville	Model: Saturated Only	K-Sat: 0.00028 f/day	Volumetric Water Content: 0.6 81/81	Mv: 3e-005 psf	K-Ratio: 1	K-Direction: 0°
Name: Fill	Model: Saturated Only	K-Sat: 0.007 f/day	Volumetric Water Content: 0.45 81/81	Mv: 3e-005 psf	K-Ratio: 0.25	K-Direction: 0°
Name: Sand	Model: Saturated / Unsaturated	K-Function: Sand	Vol. WC. Function: Sand	K-Ratio: 1	K-Direction: 0°	

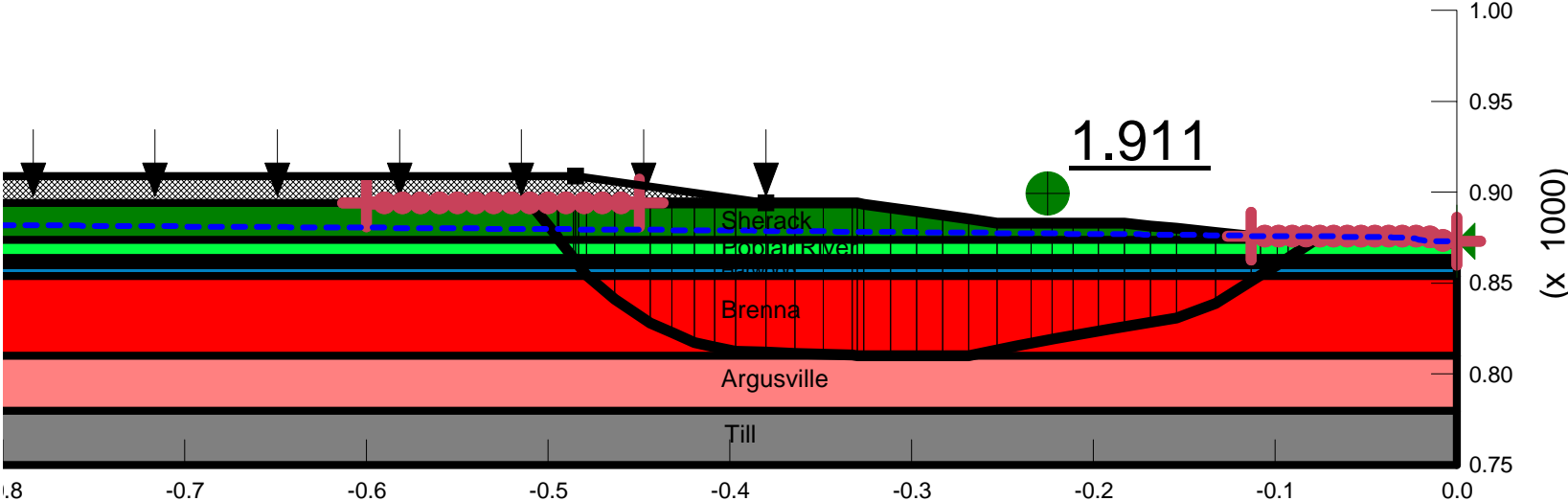


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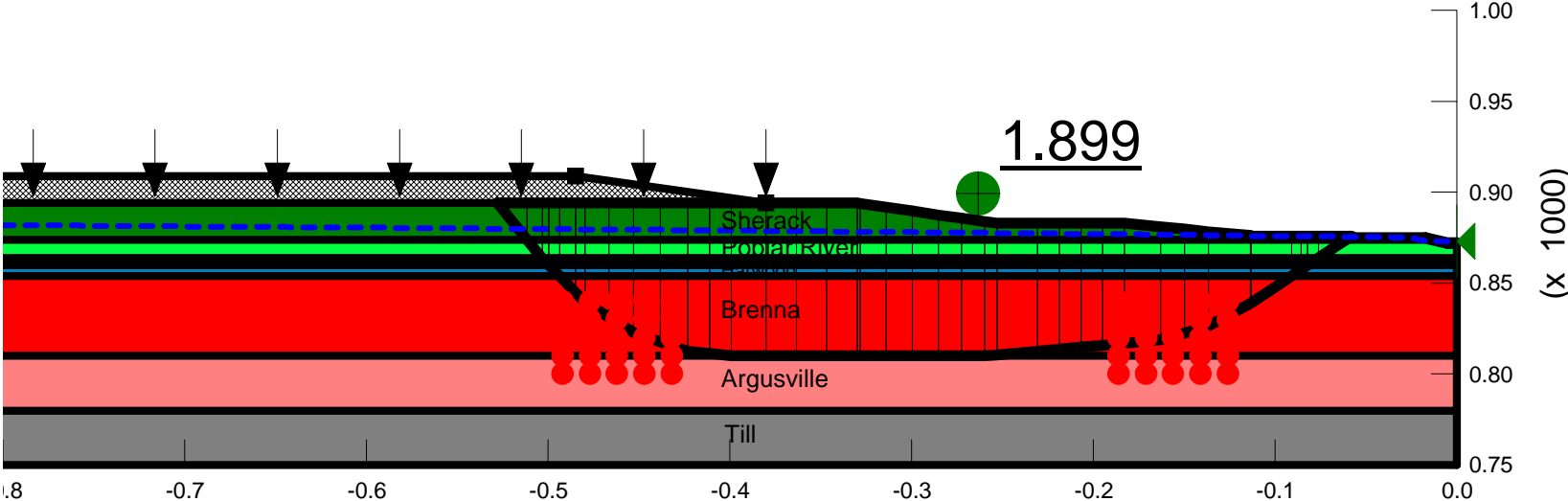
FMMFS: Phase 3, MN Diversion Section 2
FM_P3_MN_Div_Sect_02_DSGN.gsz
(1) Steady-State Seepage Analysis



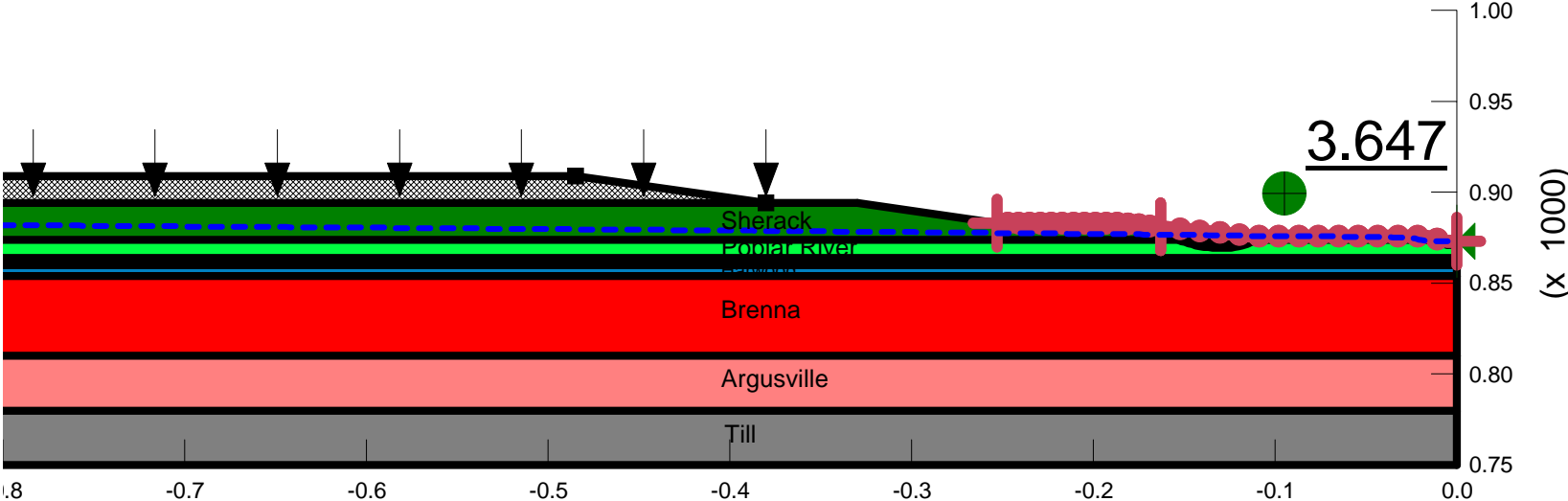
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(A) Slope Stability (2)



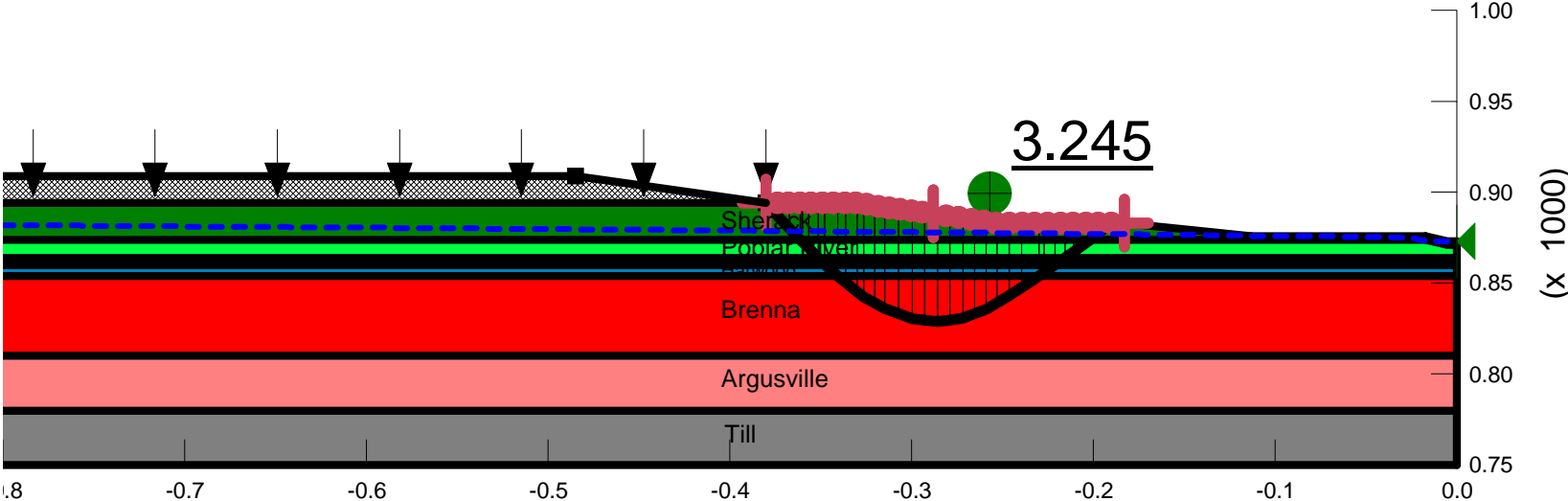
FMMFS: Phase 3, MN Diversion Section 2
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(B) Wedge Slope Stability



FMMFS: Phase 3, MN Diversion Section 2
FM_P3_MN_Div_Sect_02_DSGN.gsz
(C) Lower Localized Stability



FMMFS: Phase 3, MN Diversion Section 2
FM_P3_MN_Div_Sect_02_DSGN.gsz
(D) Upper Localized Stability



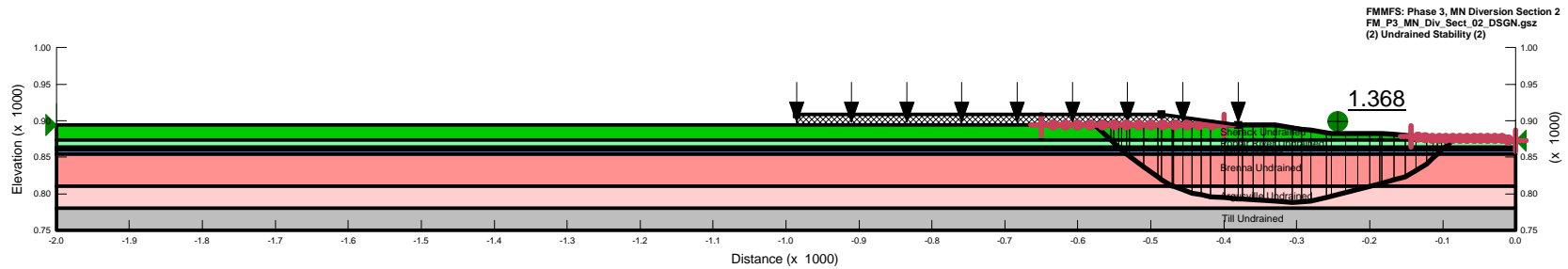
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Fargo-Moorhead Metro Feasibility Study Phase 3 Analysis MN Diversion Channel Stability Section 2

(2) Undrained Stability (2)

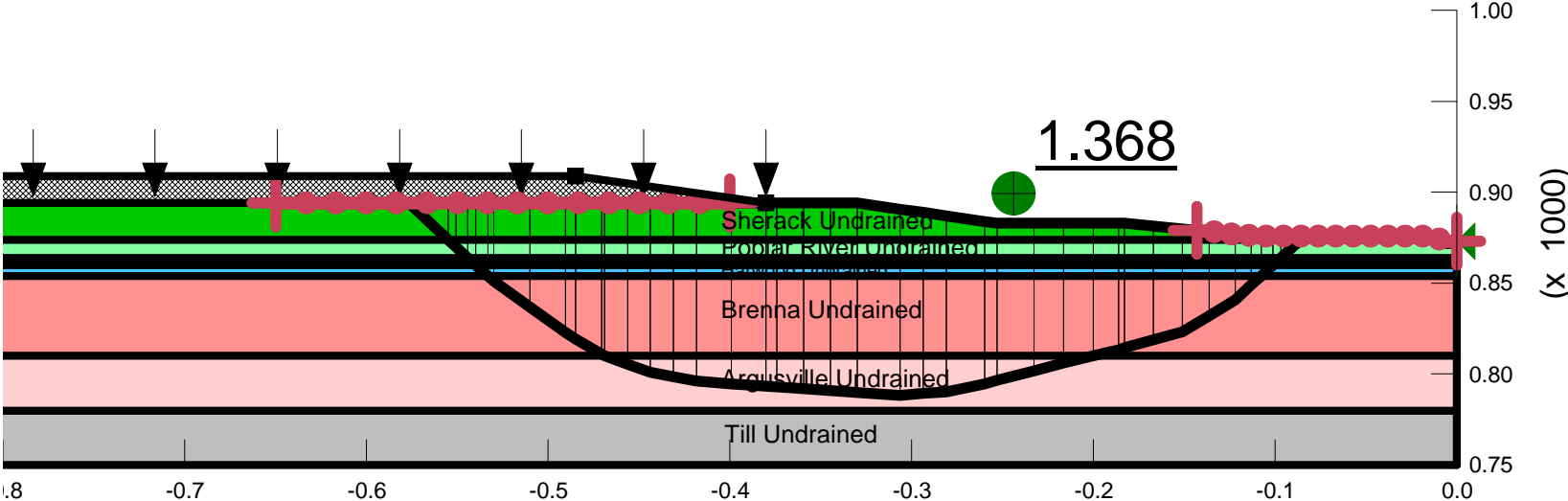
Soil Properties

Name: Sherack Undrained Model: Undrained (Phi=0) Unit Weight: 118 pcf Cohesion: 900 pcf
Name: Poplar River Undrained Model: Undrained (Phi=0) Unit Weight: 119 pcf Cohesion: 1200 pcf
Name: West Fargo Undrained Model: Undrained (Phi=0) Unit Weight: 123 pcf Cohesion: 1900 pcf
Name: Harwood Undrained Model: Undrained (Phi=0) Unit Weight: 119 pcf Cohesion: 1300 pcf
Name: Brenna Undrained Model: Undrained (Phi=0) Unit Weight: 134 pcf Cohesion: 525 pcf
Name: Argoville Undrained Model: S-Heavy Unit Weight: 106 pcf C-Top of Layer: 525 pcf C-Rate of Change: 10 pcf/ft Limiting C: 1025 pcf
Name: Till Undrained Model: Undrained (Phi=0) Unit Weight: 122 pcf Cohesion: 1900 pcf
Name: Sand Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion: 0 pcf Phi: 32° Phi/B: 0°



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Date: 8/11/2010

FMMFS: Phase 3, MN Diversion Section 2
FM_P3_MN_Div_Sect_02_DSGN.gsz
(2) Undrained Stability (2)



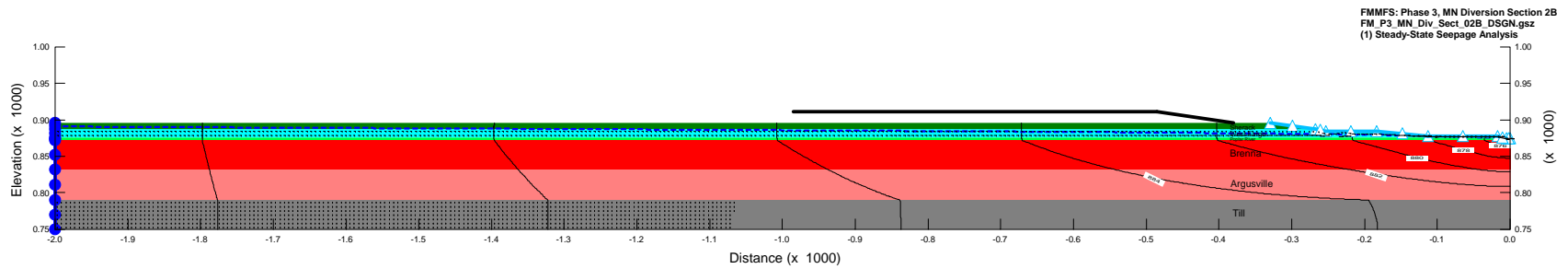
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Fargo-Moorhead Metro Feasibility Study Phase 3 Analysis MN Diversion Channel Stability Section 2B

(1) Steady-State Seepage Analysis

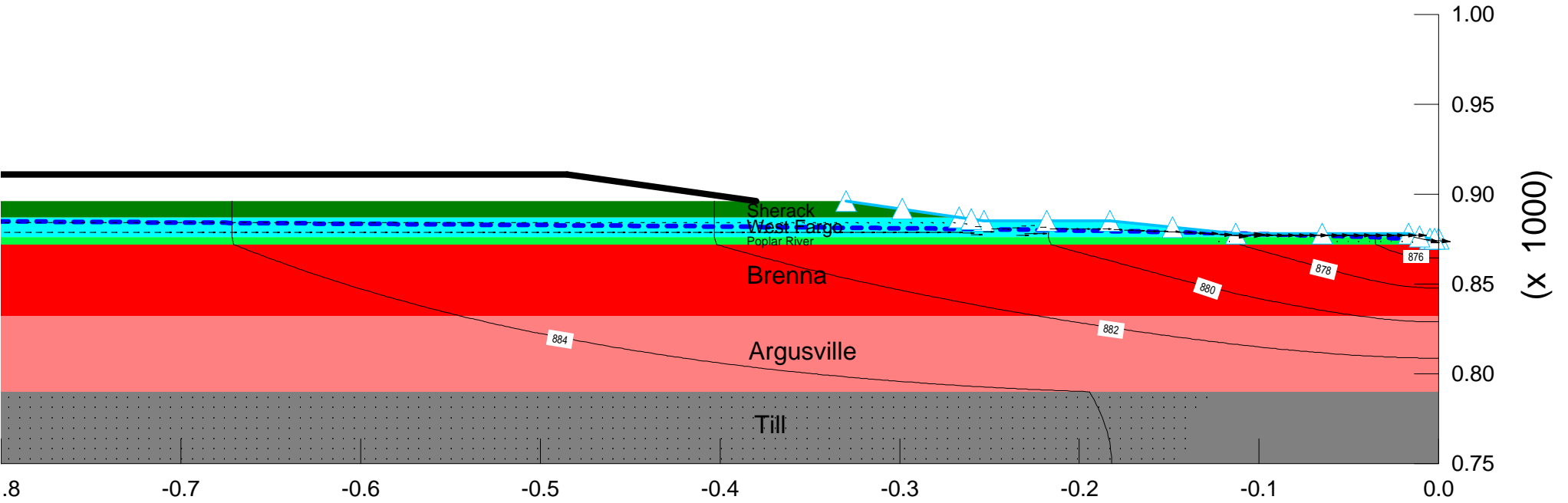
Soil Properties

Name: Sherack Model: Saturated / Unsaturated K-Function: Alluv/Sherack Vol. WC. Function: Alluv/Sherack K-Ratio: 1 K-Direction: 0°
Name: Poplar River Model: Saturated / Unsaturated K-Function: Alluv/Sherack Vol. WC. Function: Alluv/Sherack K-Ratio: 1 K-Direction: 0°
Name: West Fargo Model: Saturated / Unsaturated K-Function: West Fargo Vol. WC. Function: West Fargo K-Ratio: 1 K-Direction: 0°
Name: Brenna Model: Saturated Only K-Sat: 0.00028 10days Volumetric Water Content: 0.33 100% Mu: 3e-005 psf K-Ratio: 1 K-Direction: 0°
Name: Argusville Model: Saturated Only K-Sat: 0.00028 10days Volumetric Water Content: 0.6 100% Mu: 3e-005 psf K-Ratio: 1 K-Direction: 0°
Name: Till Model: Saturated Only K-Sat: 0.007 10days Volumetric Water Content: 0.45 100% Mu: 3e-005 psf K-Ratio: 0.25 K-Direction: 0°
Name: Sand Model: Saturated / Unsaturated K-Function: Sand Vol. WC. Function: Sand K-Ratio: 1 K-Direction: 0°



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Date: 8/11/2010

FMMFS: Phase 3, MN Diversion Section 2B
FM_P3_MN_Div_Sect_02B_DSGN.gsz
(1) Steady-State Seepage Analysis



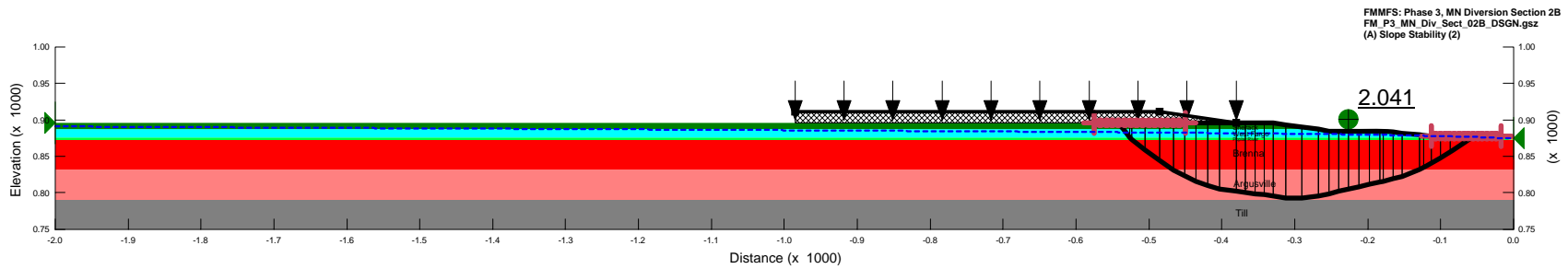
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Fargo-Moorhead Metro Feasibility Study Phase 3 Analysis MN Diversion Channel Stability Section 2B

(A) Slope Stability (2)

Soil Properties

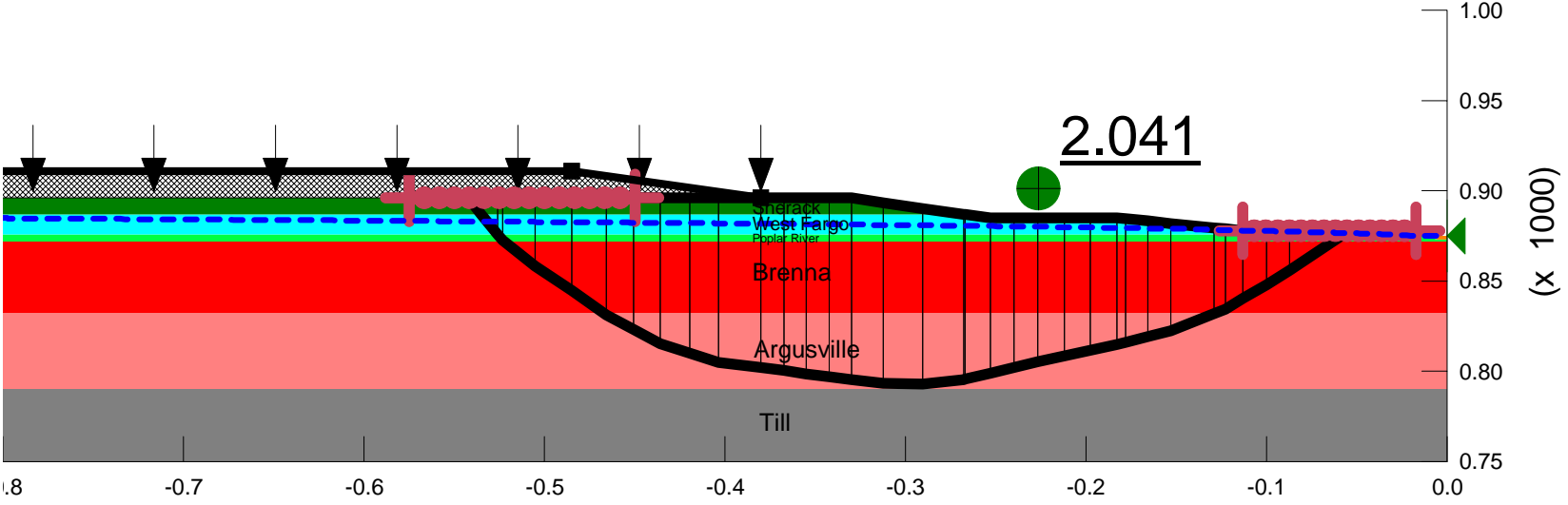
Name: Sherack Model: Mohr-Coulomb Unit Weight: 118 pcf Cohesion: 0 psf Phi: 28° Phi-B: 0°
Name: Poplar River Model: Mohr-Coulomb Unit Weight: 119 pcf Cohesion: 0 psf Phi: 25° Phi-B: 0°
Name: West Fargo Model: Mohr-Coulomb Unit Weight: 123 pcf Cohesion: 0 psf Phi: 34° Phi-B: 0°
Name: Brenna Model: Shear/Normal Fn. Unit Weight: 104 pcf Strength Function: Brenna Phi-B: 0°
Name: Argusville Model: Shear/Normal Fn. Unit Weight: 105 pcf Strength Function: Argusville Phi-B: 0°
Name: Till Model: Mohr-Coulomb Unit Weight: 122 pcf Cohesion: 0 psf Phi: 31° Phi-B: 0°
Name: Sand Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion: 0 psf Phi: 32° Phi-B: 0°



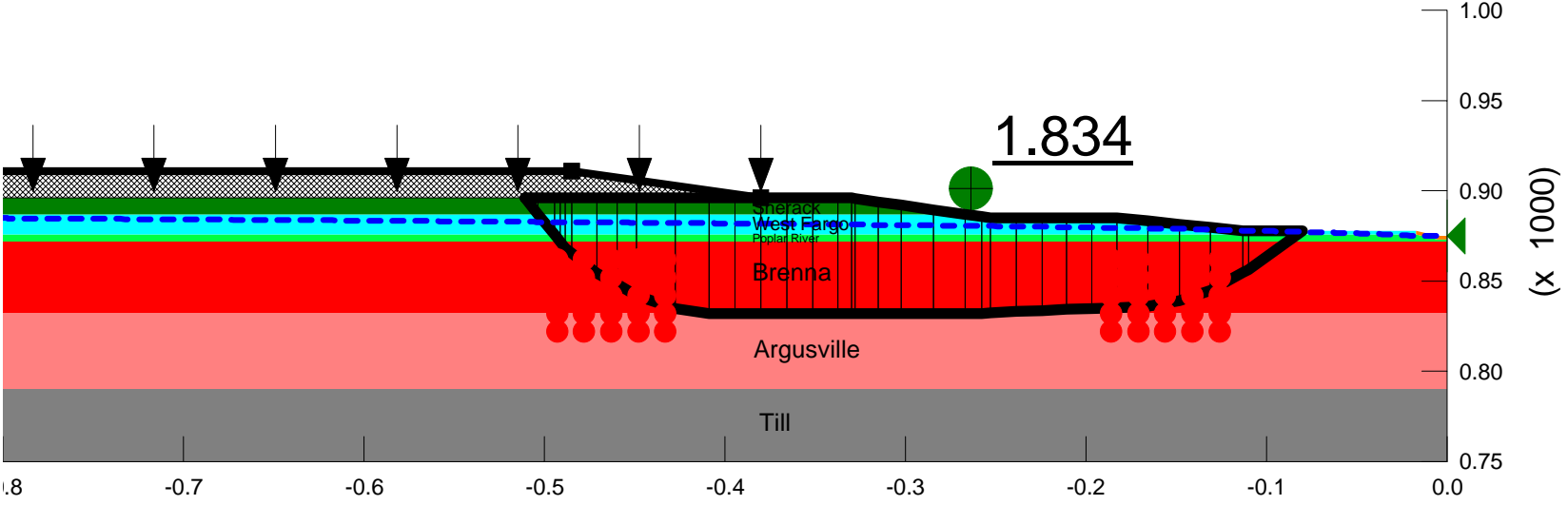
FMMFS: Phase 3, MN Diversion Section 2B
FM_P3_MN_Div_Sect_02B_DSGN.gsz
(A) Slope Stability (2)

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Date: 8/11/2010

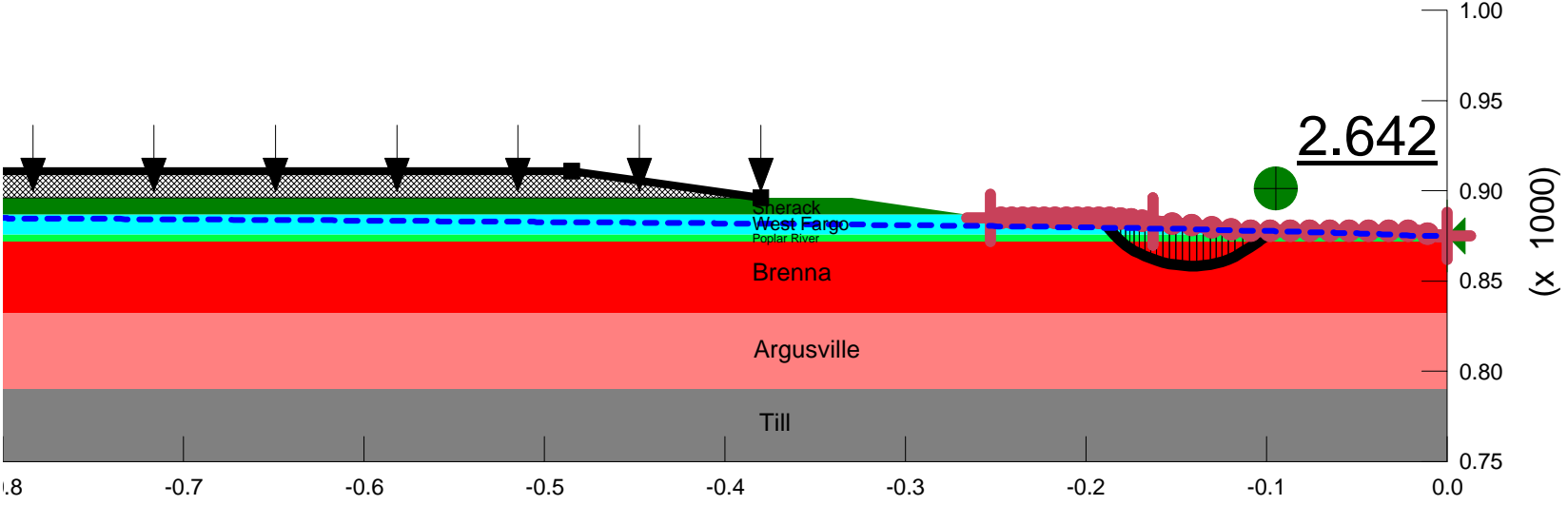
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(A) Slope Stability (2)



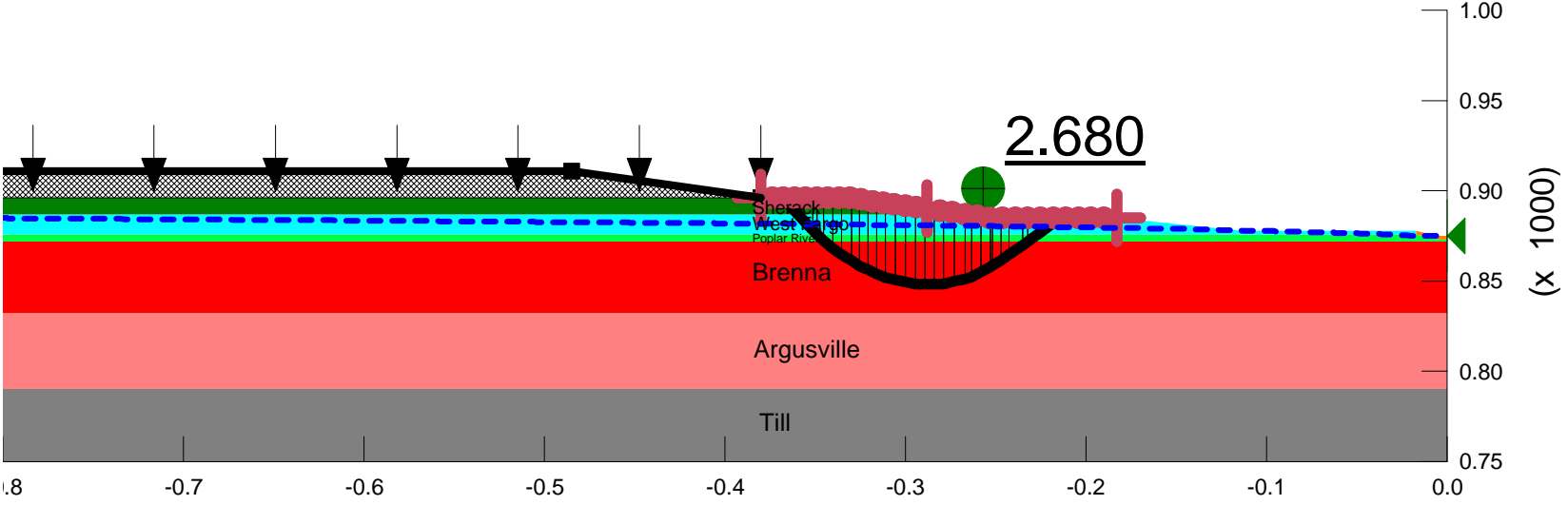
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(B) Wedge Slope Stability



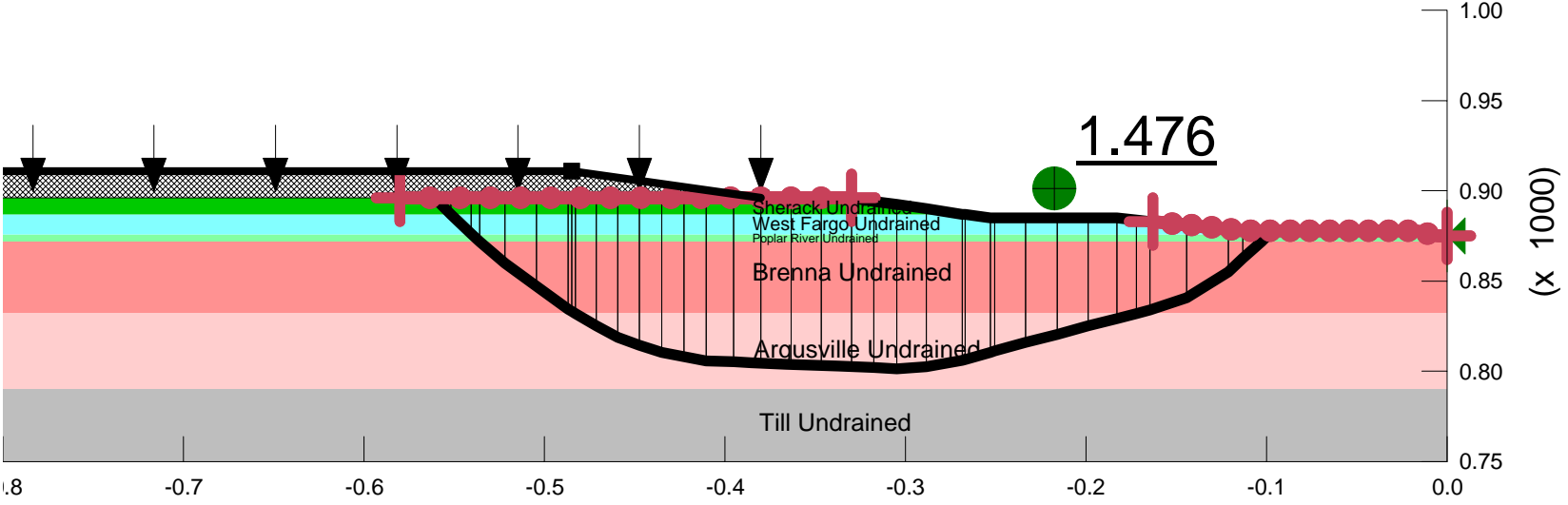
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(C) Lower Localized Stability



FMMFS: Phase 3, MN Diversion Section 2B
FM_P3_MN_Div_Sect_02B_DSGN.gsz
(D) Upper Localized Stability



FMMFS: Phase 3, MN Diversion Section 2B
FM_P3_MN_Div_Sect_02B_DSGN.gsz
(2) Undrained Stability



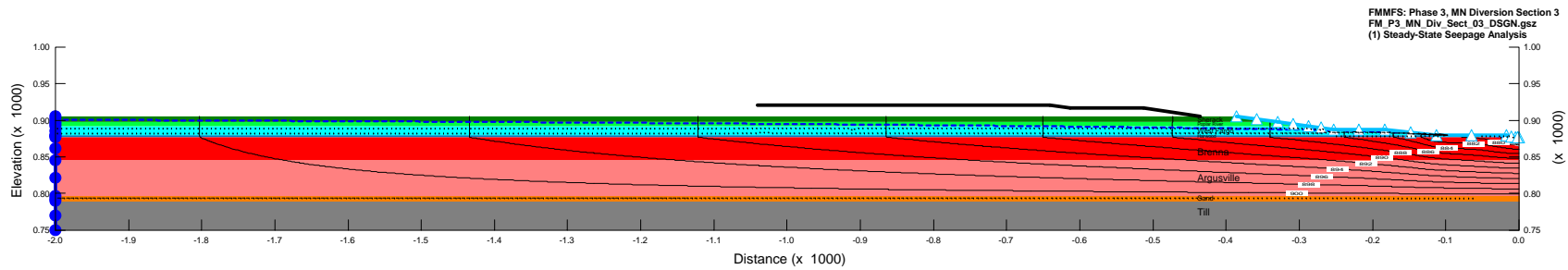
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Fargo-Moorhead Metro Feasibility Study Phase 3 Analysis MN Diversion Channel Stability Section 3

(1) Steady-State Seepage Analysis

Soil Properties

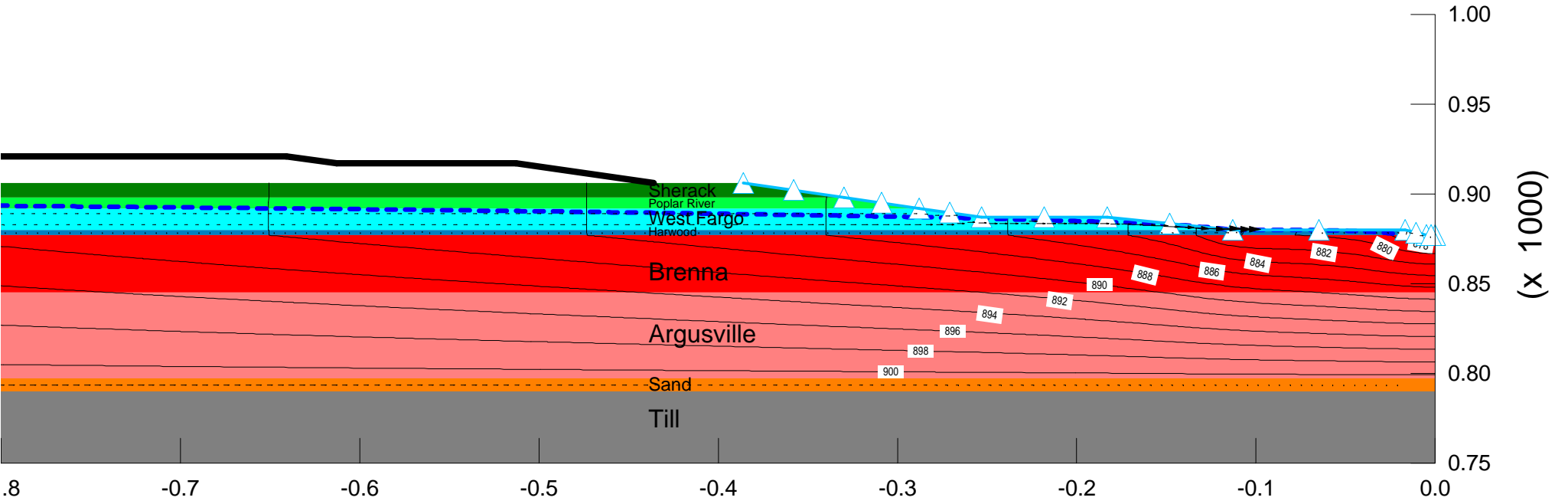
Name: Sherack	Model: Saturated / Unsaturated	K-Function: Alluv/Sherack	Vol. WC. Function: Alluv/Sherack	K-Ratio: 1	K-Direction: 0°	
Name: Poplar River	Model: Saturated / Unsaturated	K-Function: Alluv/Sherack	Vol. WC. Function: Alluv/Sherack	K-Ratio: 1	K-Direction: 0°	
Name: West Fargo	Model: Saturated / Unsaturated	K-Function: West Fargo	Vol. WC. Function: West Fargo	K-Ratio: 1	K-Direction: 0°	
Name: Harwood	Model: Saturated / Unsaturated	K-Function: Harwood	Vol. WC. Function: Harwood	K-Ratio: 1	K-Direction: 0°	
Name: Brenna	Model: Saturated Only	K-Sat: 0.00028 fdays	Volumetric Water Content: 0.23 80%	Mv: 3e-005 psf	K-Ratio: 1	K-Direction: 0°
Name: Argusville	Model: Saturated Only	K-Sat: 0.00028 fdays	Volumetric Water Content: 0.6 80%	Mv: 3e-005 psf	K-Ratio: 1	K-Direction: 0°
Name: Till	Model: Saturated Only	K-Sat: 0.007 fdays	Volumetric Water Content: 0.45 80%	Mv: 3e-005 psf	K-Ratio: 0.25	K-Direction: 0°
Name: Sand	Model: Saturated / Unsaturated	K-Function: Sand	Vol. WC. Function: Sand	K-Ratio: 1	K-Direction: 0°	



FMMFS: Phase 3, MN Diversion Section 3
FM_P3_MN_Div_Sect_03_DSGN.gsz
(1) Steady-State Seepage Analysis

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Date: 8/11/2010

**FMMFS: Phase 3, MN Diversion Section 3
 FM_P3_MN_Div_Sect_03_DSGN.gsz
 (1) Steady-State Seepage Analysis**



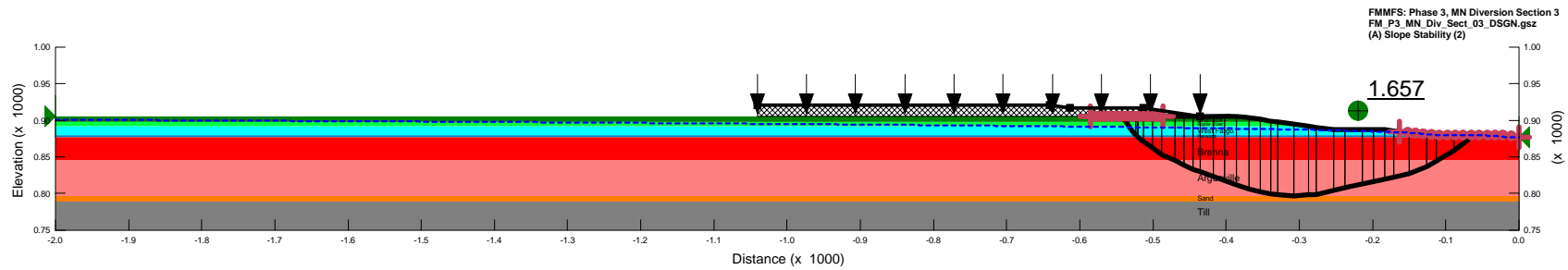
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Fargo-Moorhead Metro Feasibility Study Phase 3 Analysis MN Diversion Channel Stability Section 3

(A) Slope Stability (2)

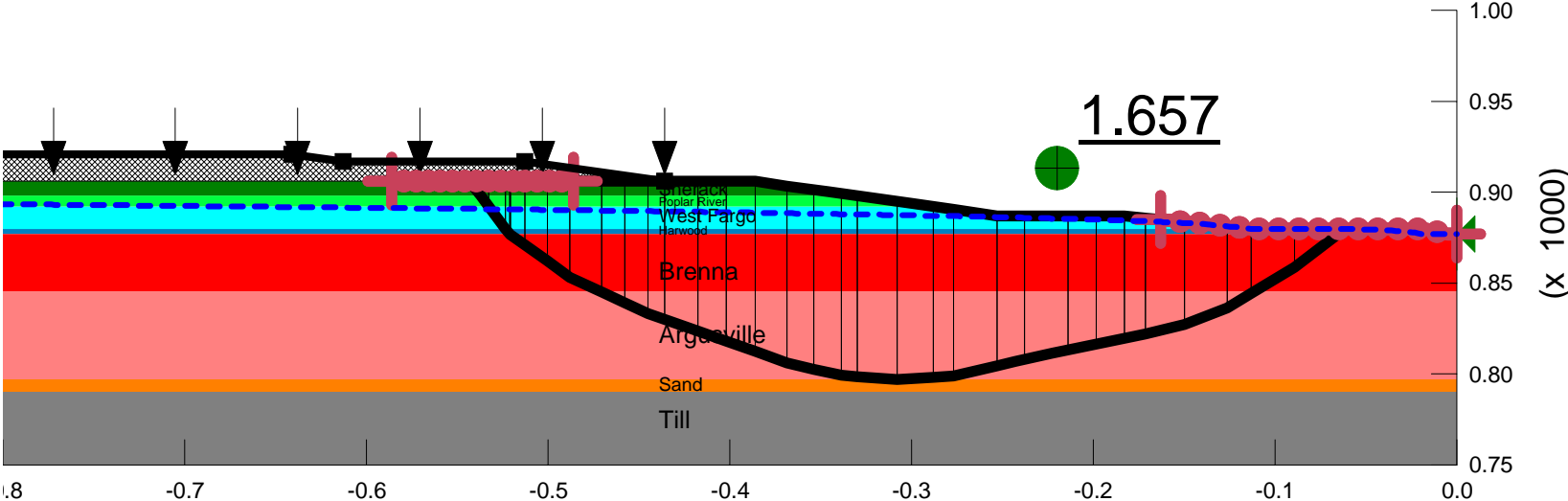
Soil Properties

Name: Sherack	Model: Mohr-Coulomb	Unit Weight: 118 pcf	Cohesion: 0 pcf	Phi: 28°	Phi-B: 0°
Name: Poplar River	Model: Mohr-Coulomb	Unit Weight: 119 pcf	Cohesion: 0 pcf	Phi: 26°	Phi-B: 0°
Name: West Fargo	Model: Mohr-Coulomb	Unit Weight: 123 pcf	Cohesion: 0 pcf	Phi: 34°	Phi-B: 0°
Name: Harwood	Model: Mohr-Coulomb	Unit Weight: 116 pcf	Cohesion: 0 pcf	Phi: 25°	Phi-B: 0°
Name: Brenna	Model: ShearNormal Fn.	Unit Weight: 104 pcf	Strength Function: Brenna		Phi-B: 0°
Name: Argusville	Model: ShearNormal Fn.	Unit Weight: 105 pcf	Strength Function: Argusville		Phi-B: 0°
Name: Till	Model: Mohr-Coulomb	Unit Weight: 122 pcf	Cohesion: 0 pcf	Phi: 31°	Phi-B: 0°
Name: Sand	Model: Mohr-Coulomb	Unit Weight: 125 pcf	Cohesion: 0 pcf	Phi: 32°	Phi-B: 0°

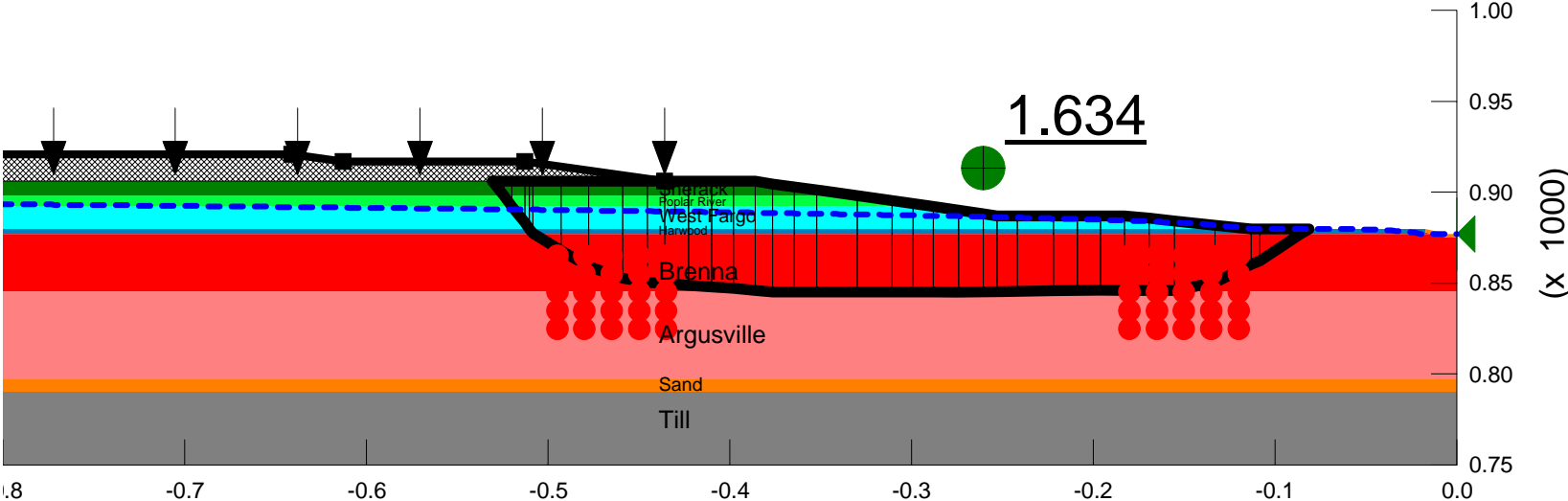


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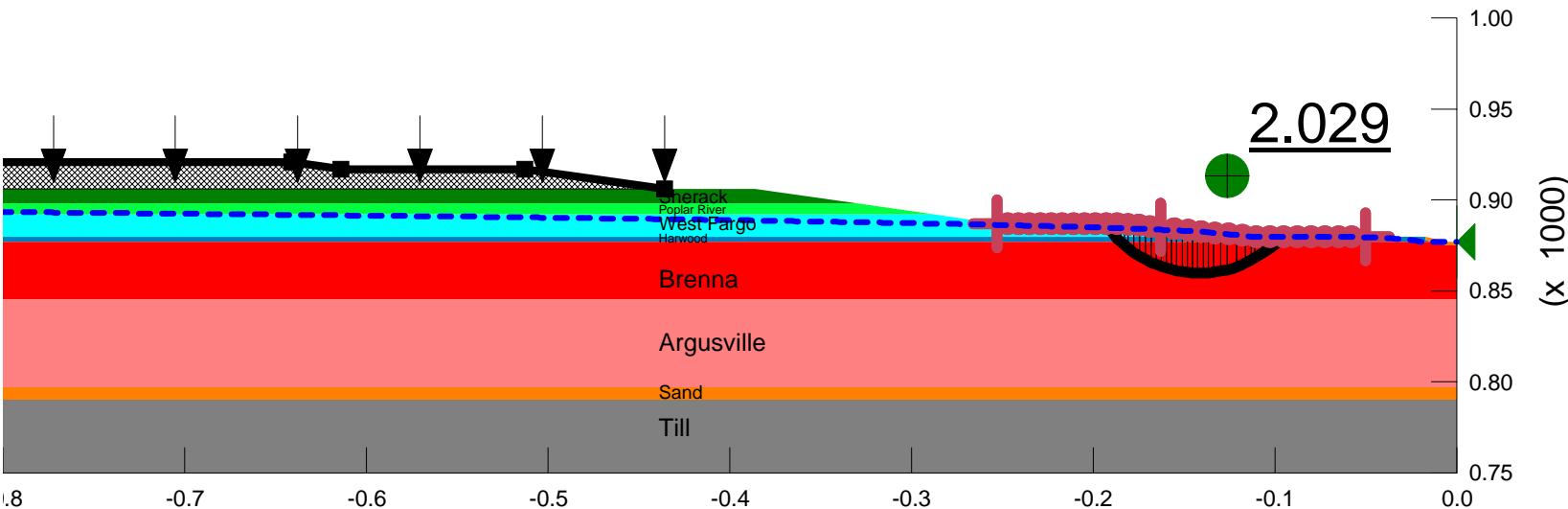
FMMFS: Phase 3, MN Diversion Section 3
FM_P3_MN_Div_Sect_03_DSGN.gsz
(A) Slope Stability (2)



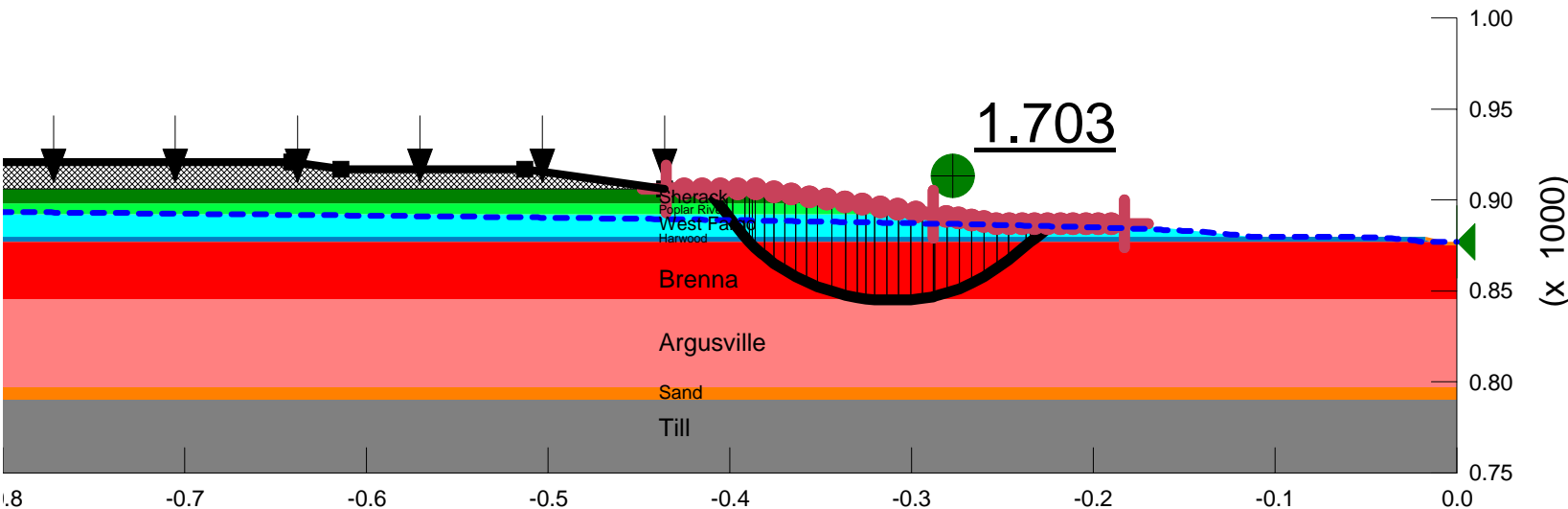
FMMFS: Phase 3, MN Diversion Section 3
FM_P3_MN_Div_Sect_03_DSGN.gsz
(B) Wedge Slope Stability



FMMFS: Phase 3, MN Diversion Section 3
FM_P3_MN_Div_Sect_03_DSGN.gsz
(C) Lower Localized Stability



FMMFS: Phase 3, MN Diversion Section 3
FM_P3_MN_Div_Sect_03_DSGN.gsz
(D) Upper Localized Stability



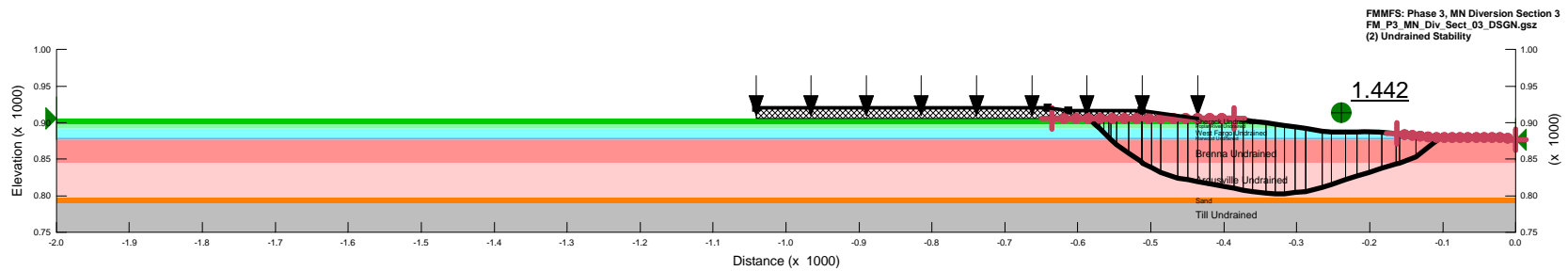
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Fargo-Moorhead Metro Feasibility Study Phase 3 Analysis MN Diversion Channel Stability Section 3

(2) Undrained Stability

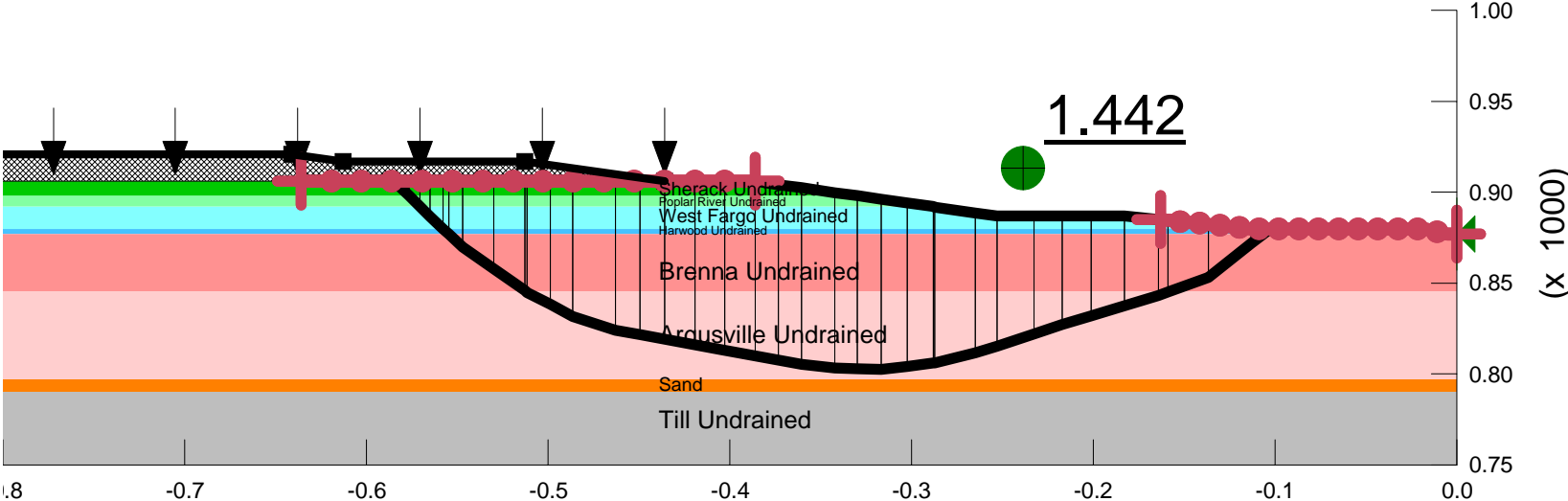
Soil Properties

Name: Sherack Undrained Model: Undrained (Phi=0) Unit Weight: 118 pcf Cohesion: 900 psf
Name: Poplar River Undrained Model: Undrained (Phi=0) Unit Weight: 119 pcf Cohesion: 1200 psf
Name: West Fargo Undrained Model: Undrained (Phi=0) Unit Weight: 123 pcf Cohesion: 1900 psf
Name: Harwood Undrained Model: Undrained (Phi=0) Unit Weight: 119 pcf Cohesion: 1300 psf
Name: Brenna Undrained Model: Undrained (Phi=0) Unit Weight: 134 pcf Cohesion: 525 psf
Name: Argoville Undrained Model: S-Edge) Unit Weight: 106 pcf C-Top of Layer: 525 psf C-Rate of Change: 10 psf/ft Limiting C: 1025 psf
Name: Till Undrained Model: Undrained (Phi=0) Unit Weight: 122 pcf Cohesion: 1900 psf
Name: Sand Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion: 0 psf Phi: 32° Phi/B: 0°



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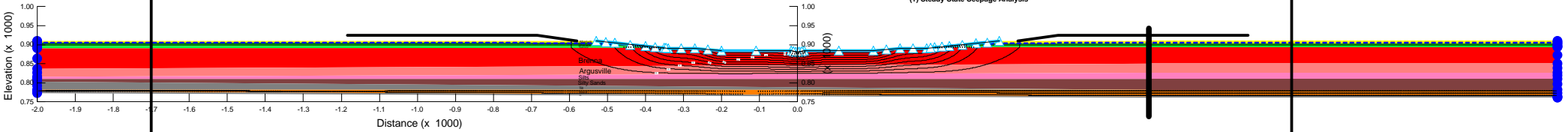
FMMFS: Phase 3, MN Diversion Section 3
FM_P3_MN_Div_Sect_03_DSGN.gsz
(2) Undrained Stability



File Name: FM_P3_MN_Div_Sect_04A_Raise4FT_70.gsz

Fargo-Moorhead Metro Feasibility Study Phase 3 Analysis MN Diversion Channel Stability Section 4A (1) Steady-State Seepage Analysis

Soil Properties			
Name: Alluvium	Model: Saturated / Unsaturated	K-Function: Alluv/Sherack	Vol. WC: Function: Alluv/Sherack K-Ratio: 1 K-Direction: 0*
Name: Sherack	Model: Saturated / Unsaturated	K-Function: Alluv/Sherack	Vol. WC: Function: Alluv/Sherack K-Ratio: 1 K-Direction: 0*
Name: Papler River	Model: Saturated / Unsaturated	K-Function: Alluv/Sherack	Vol. WC: Function: Alluv/Sherack K-Ratio: 1 K-Direction: 0*
Name: Brenna	Model: Saturated Only	K-Sat: 0.0028 l/ldays	Volumetric Water Content: 0.63 l/ft ³ Mr: 3e-006 /psf K-Ratio: 1 K-Direction: 0*
Name: Argusville	Model: Saturated Only	K-Sat: 0.0028 l/ldays	Volumetric Water Content: 0.6 l/ft ³ Mr: 3e-005 /psf K-Ratio: 1 K-Direction: 0*
Name: Till	Model: Saturated Only	K-Sat: 0.007 l/ldays	Volumetric Water Content: 0.45 l/ft ³ Mr: 3e-005 /psf K-Ratio: 0.25 K-Direction: 0*
Name: Sand	Model: Saturated / Unsaturated	K-Function: Sand	Vol. WC: Function: Sand K-Ratio: 1 K-Direction: 0*
Name: Silts	Model: Saturated Only	K-Sat: 0.0028 l/ldays	Volumetric Water Content: 0.4 l/ft ³ Mr: 3e-006 /psf K-Ratio: 1 K-Direction: 0*
Name: Silty Sands	Model: Saturated Only	K-Sat: 0.28 l/ldays	Volumetric Water Content: 0.4 l/ft ³ Mr: 3e-006 /psf K-Ratio: 1 K-Direction: 0*

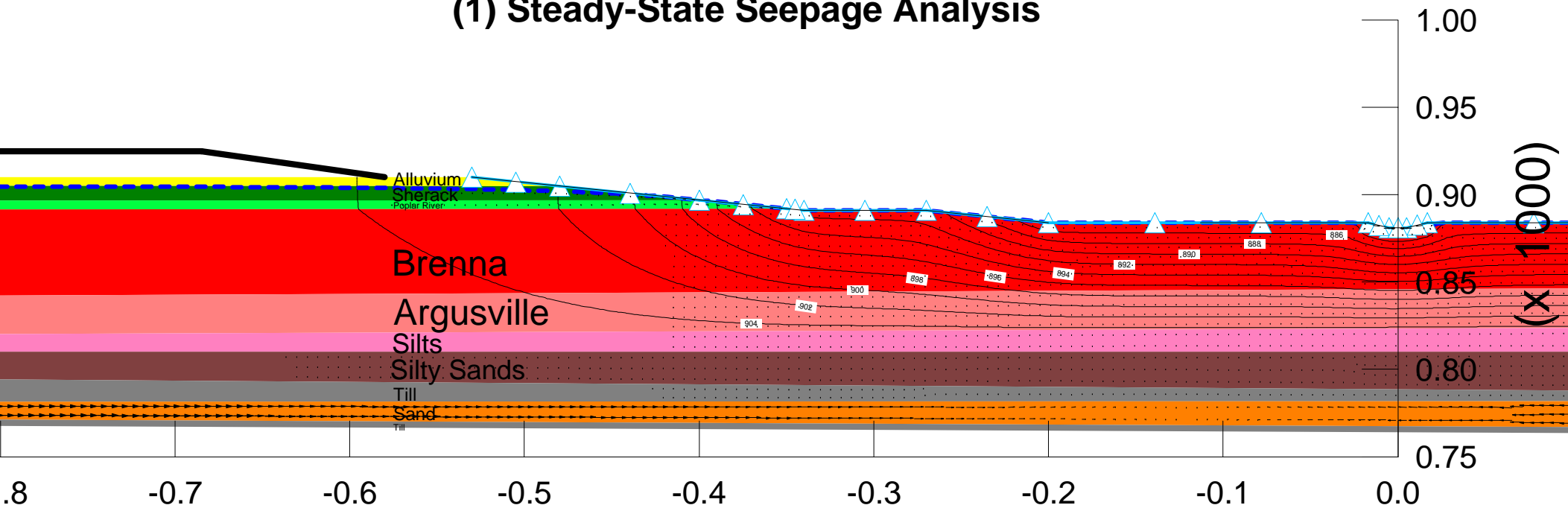


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Date: 8/19/2010

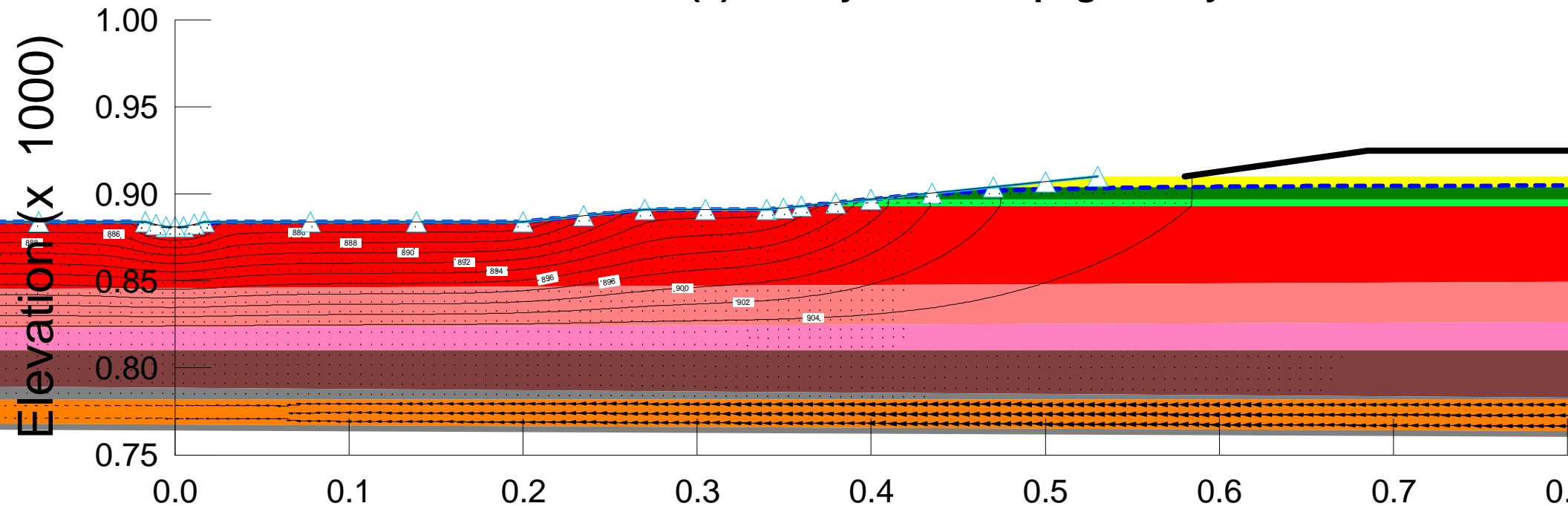
FMMFS: Phase 3, MN Diversion Section 4A

FM_P3_MN_Div_Sect_04A_Raise4FT_70.gsz

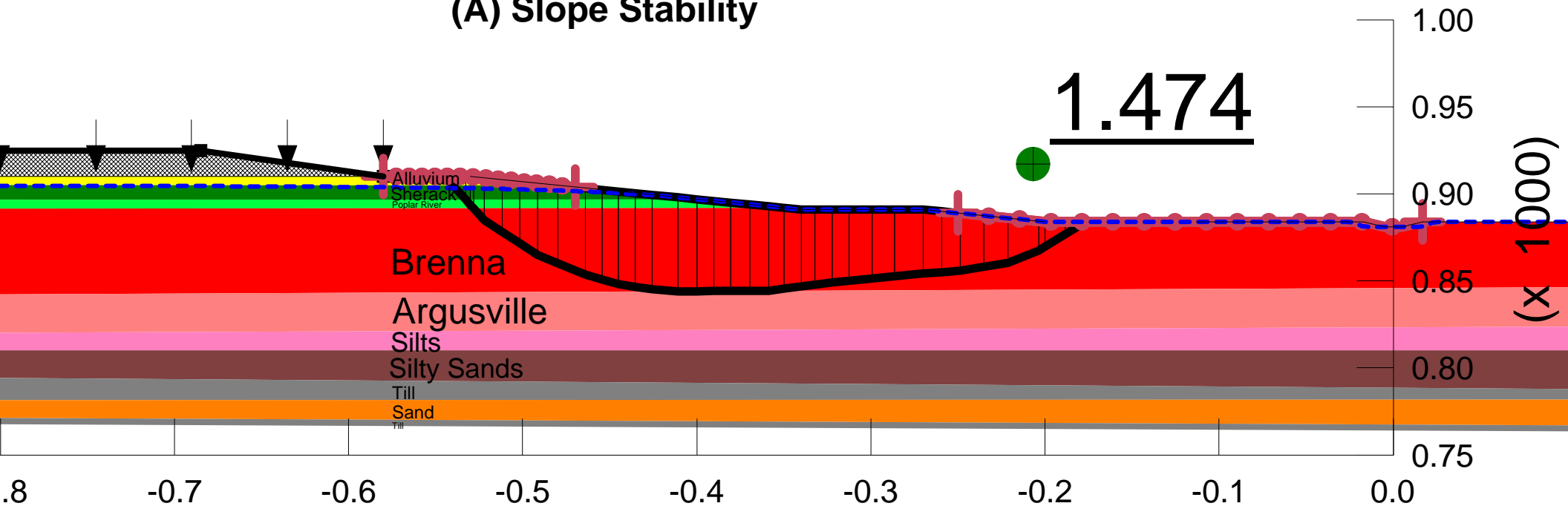
(1) Steady-State Seepage Analysis



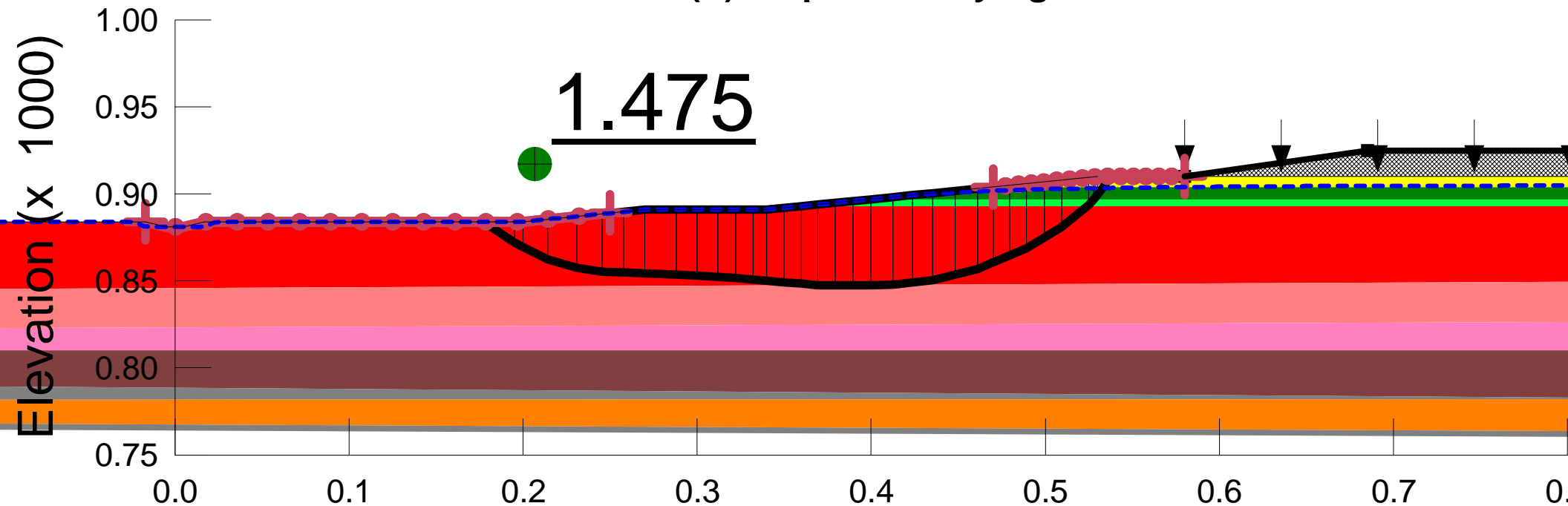
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(1) Steady-State Seepage Analysis



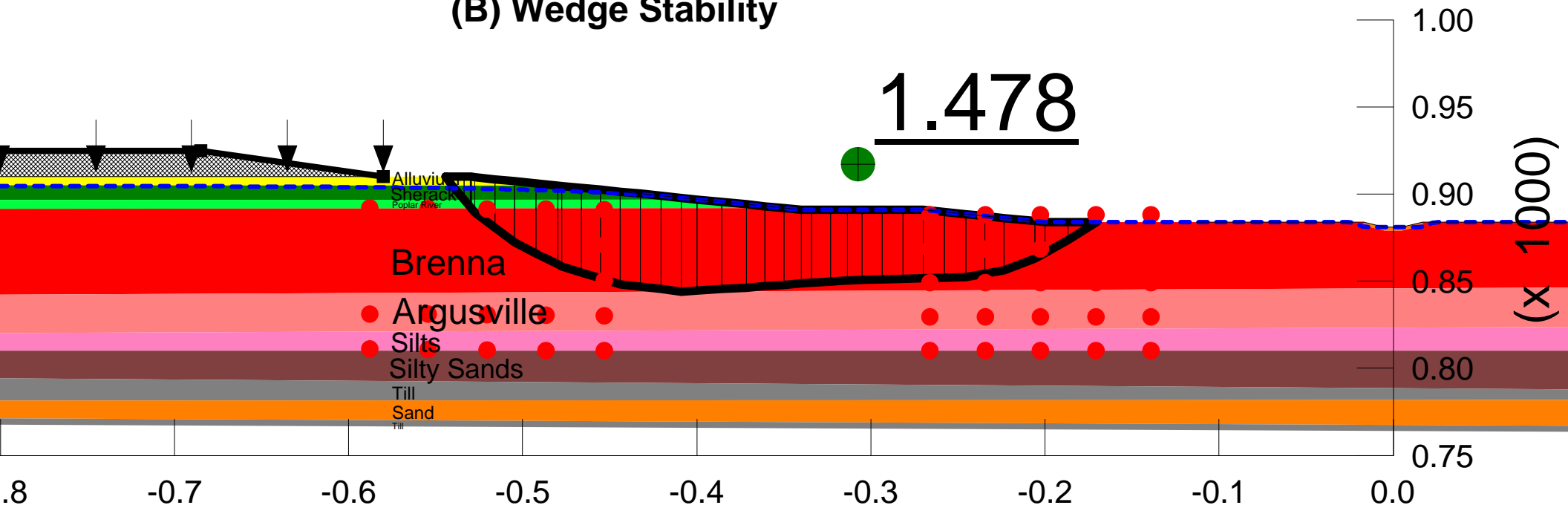
FMMFS: Phase 3, MN Diversion Section 4A
FM_P3_MN_Div_Sect_04A_Raise4FT_70.gsz
(A) Slope Stability



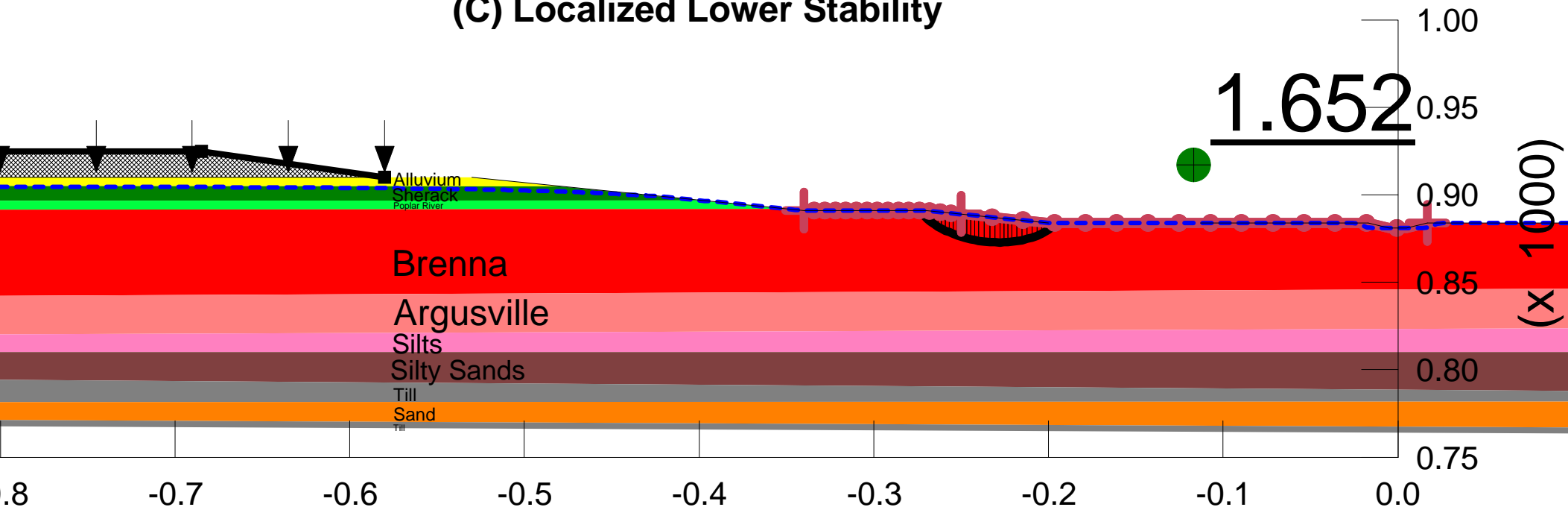
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(E) Slope Stability right



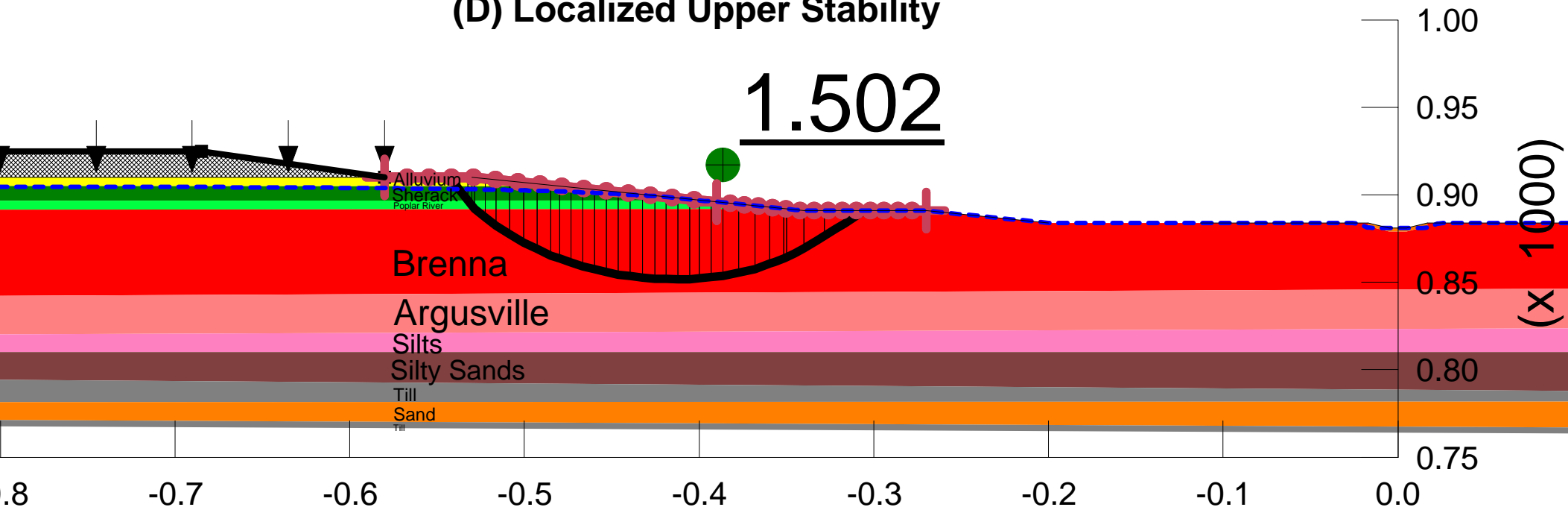
FMMFS: Phase 3, MN Diversion Section 4A
 FM_P3_MN_Div_Sect_04A_Raise4FT_70.gsz
 (B) Wedge Stability



FMMFS: Phase 3, MN Diversion Section 4A
FM_P3_MN_Div_Sect_04A_Raise4FT_70.gsz
(C) Localized Lower Stability



FMMFS: Phase 3, MN Diversion Section 4A
FM_P3_MN_Div_Sect_04A_Raise4FT_70.gsz
(D) Localized Upper Stability



File Name: FM_P3_MN_Div_Sect_04A_Raise4FT_70.gsz

Fargo-Moorhead Metro Feasibility Study

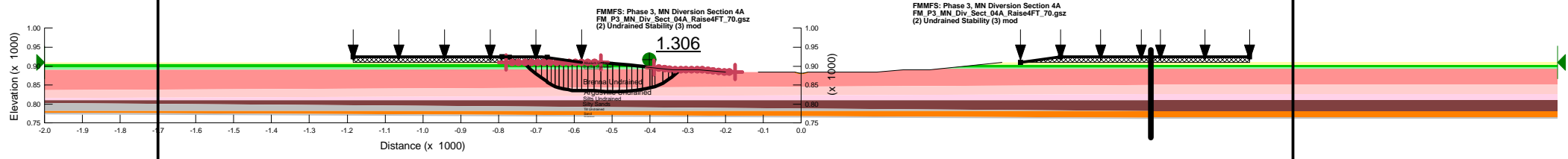
Phase 3 Analysis

MN Diversion Channel Stability

Section 4A

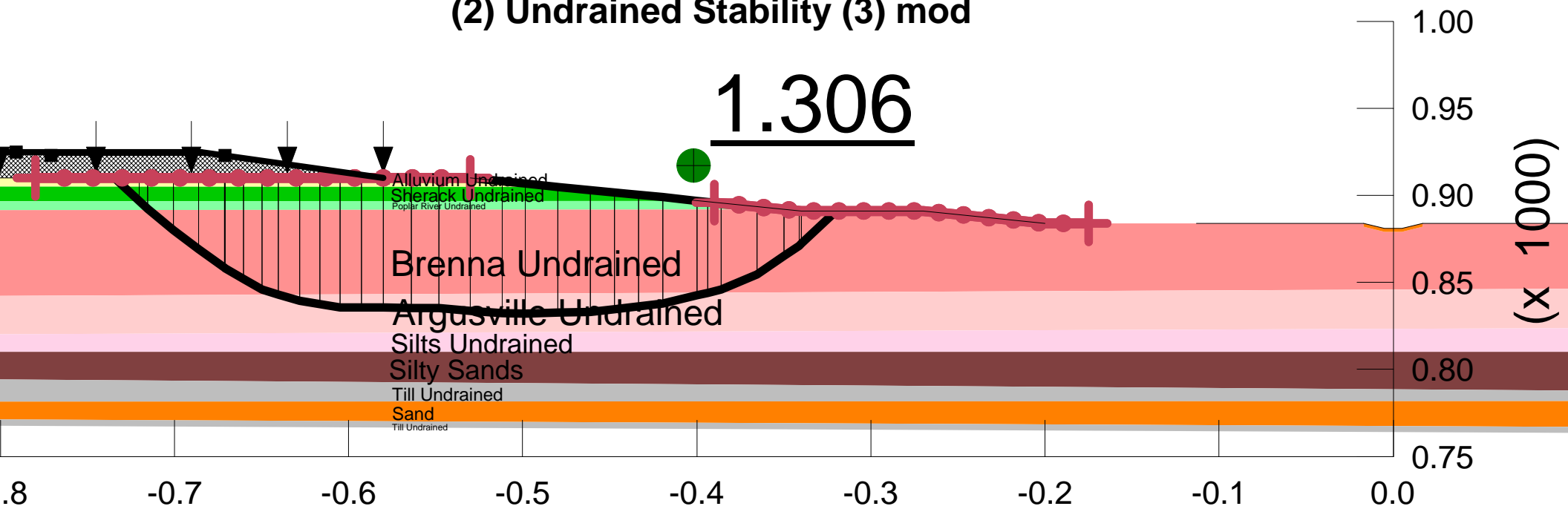
(2) Undrained Stability (3) mod

Soil Properties			
Name: Alluvium Undrained	Model: Undrained (Phi=0)	Unit Weight: 119 pcf	Cohesion: 900 psf
Name: Sherack Undrained	Model: Undrained (Phi=0)	Unit Weight: 118 pcf	Cohesion: 900 psf
Name: Poplar River Undrained	Model: Undrained (Phi=0)	Unit Weight: 119 pcf	Cohesion: 1200 psf
Name: Brenna Undrained	Model: Undrained (Phi=0)	Unit Weight: 104 pcf	Cohesion: 825 psf
Name: Argusville Undrained	Model: Self-Depth	Unit Weight: 156 pcf	C-Top of Layer: 525 psf C-Rate of Change: 10 psf/ft Limiting C: 1025 psf
Name: Till Undrained	Model: Undrained (Phi=0)	Unit Weight: 122 pcf	Cohesion: 1900 psf
Name: Silt	Model: Mohr-Coulomb	Unit Weight: 120 pcf	Cohesion: 0 psf Phi: 32° Phi-B: 0°
Name: Silty Sands	Model: Mohr-Coulomb	Unit Weight: 106 pcf	Cohesion: 0 psf Phi: 15° Phi-B: 0°
Name: Silt Undrained	Model: Undrained (Phi=0)	Unit Weight: 106 pcf	Cohesion: 825 psf

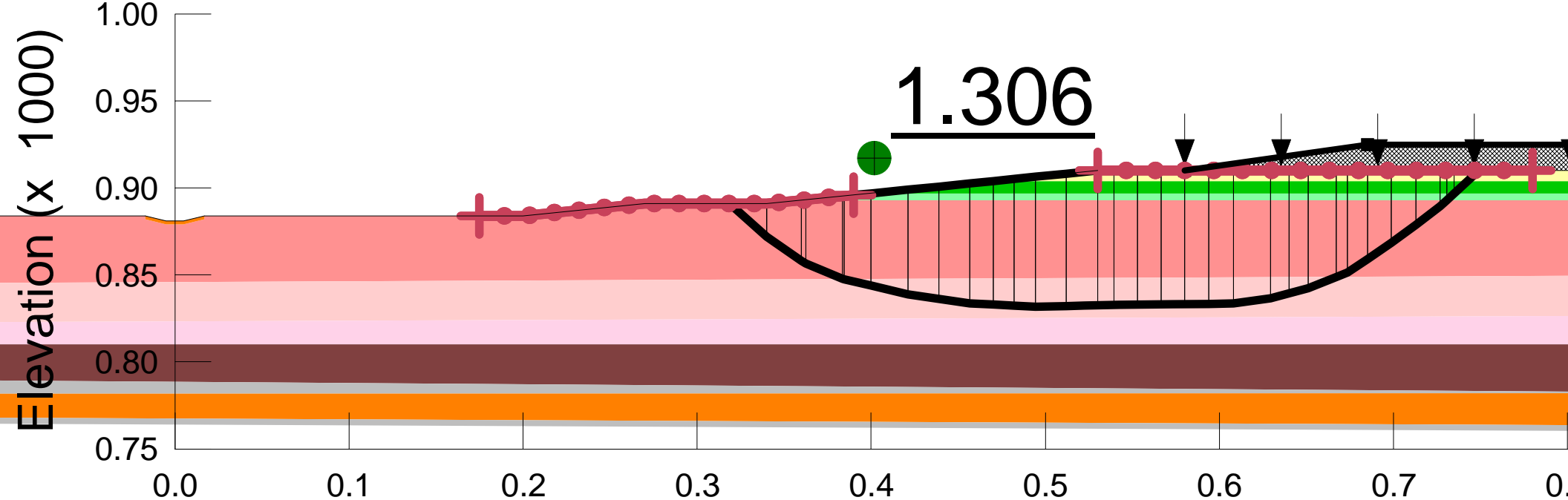


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FMMFS: Phase 3, MN Diversion Section 4A
FM_P3_MN_Div_Sect_04A_Raise4FT_70.gsz
(2) Undrained Stability (3) mod



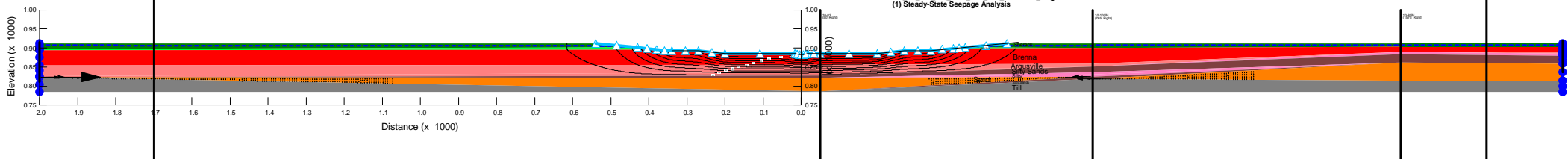
FMMFS: Phase 3, MN Diversion Section 4A
FM_P3_MN_Div_Sect_04A_Raise4FT_70.gsz
(3) Undrained Stability right (2)



File Name: FM_P3_MN_Div_Sect_04B_35k_Raise4FT_70.gsz

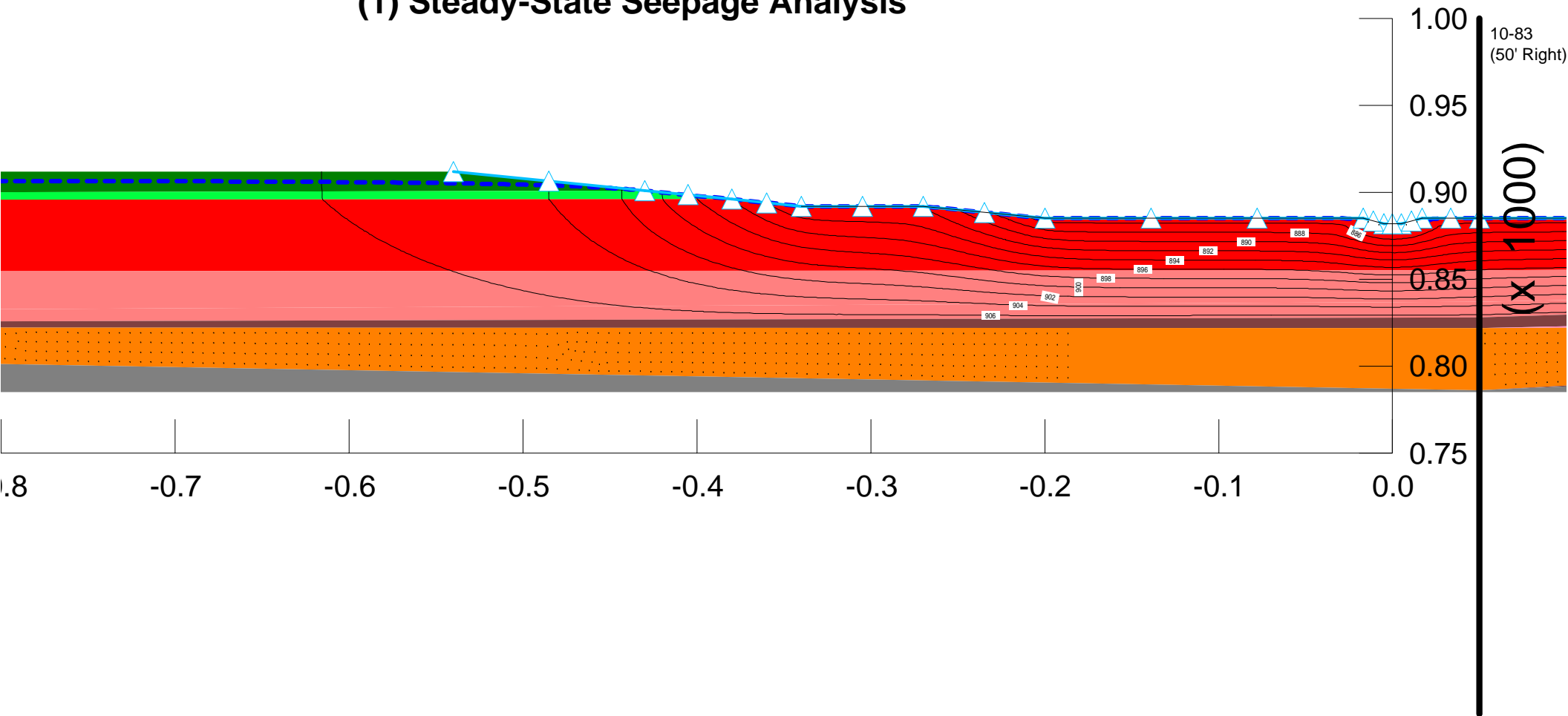
Fargo-Moorhead Metro Feasibility Study Phase 3 Analysis MN Diversion Channel Stability Section 4B (1) Steady-State Seepage Analysis

Soil Properties			
Name: Sherack	Model: Saturated / Unsaturated	K-Function: Alluv/Sherack	Vol. WC: Function: Alluv/Sherack K-Ratio: 1 K-Direction: 0°
Name: Prople River	Model: Saturated / Unsaturated	K-Function: Alluv/Sherack	Vol. WC: Function: Alluv/Sherack K-Ratio: 1 K-Direction: 0°
Name: Berona	Model: Saturated Only	K-Sat: 0.0028 10days	Volumetric Water Content: 0.63 100% Mr: 3e-005 gpd K-Ratio: 1 K-Direction: 0°
Name: Argoville	Model: Saturated Only	K-Sat: 0.0028 10days	Volumetric Water Content: 0.6 100% Mr: 3e-005 gpd K-Ratio: 1 K-Direction: 0°
Name: Till	Model: Saturated Only	K-Sat: 0.057 10days	Volumetric Water Content: 0.45 100% Mr: 3e-005 gpd K-Ratio: 0.25 K-Direction: 0°
Name: Sand	Model: Saturated / Unsaturated	K-Function: Sand	Vol. WC: Function: Sand K-Ratio: 1 K-Direction: 0°
Name: Silts	Model: Saturated Only	K-Sat: 0.0028 10days	Volumetric Water Content: 0.4 100% Mr: 3e-006 gpd K-Ratio: 1 K-Direction: 0°
Name: Silty Sands	Model: Saturated Only	K-Sat: 0.28 10days	Volumetric Water Content: 0.4 100% Mr: 3e-006 gpd K-Ratio: 1 K-Direction: 0°

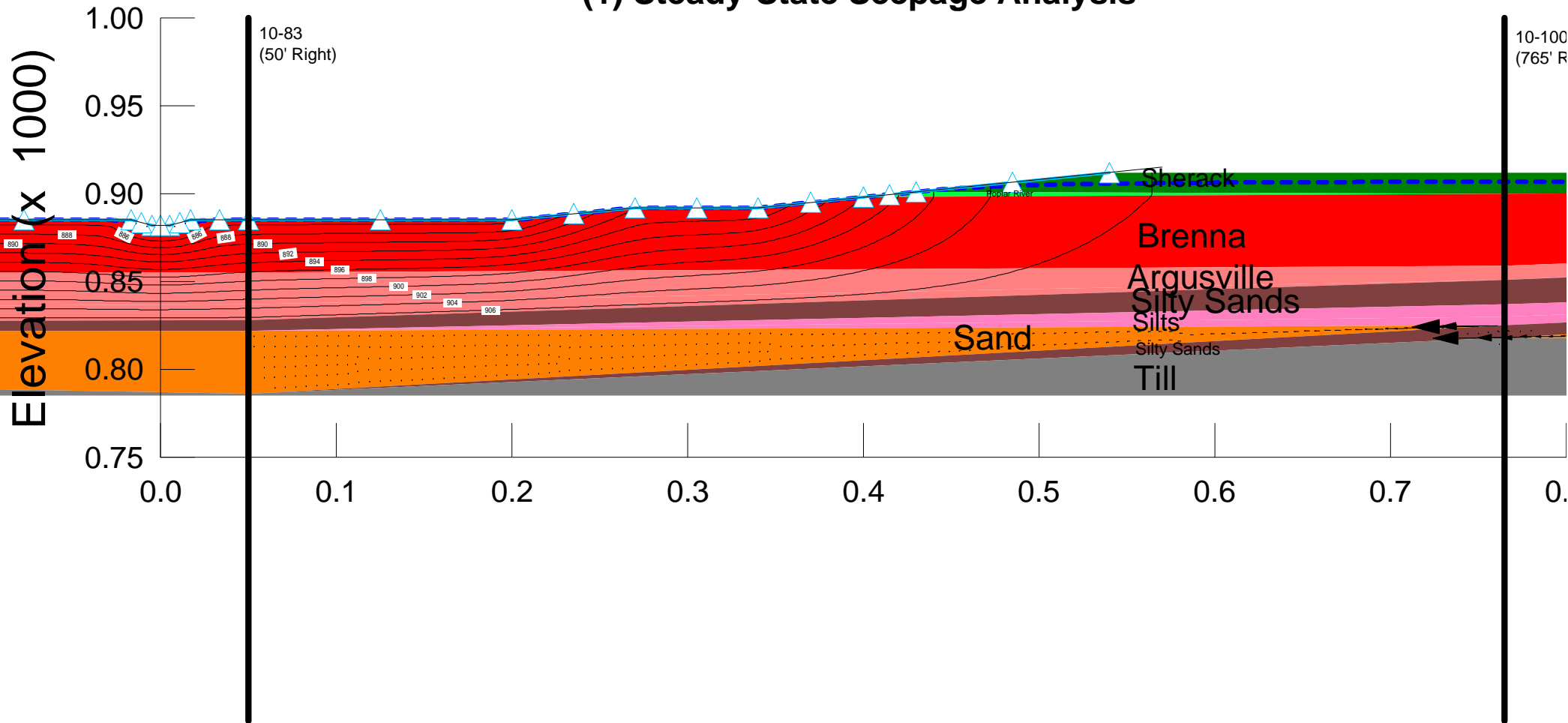


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Date: 8/16/2010

FMMFS: Phase 3, MN Diversion Section 4B
FM_P3_MN_Div_Sect_04B_35k_Raise4FT_70.gsz
(1) Steady-State Seepage Analysis



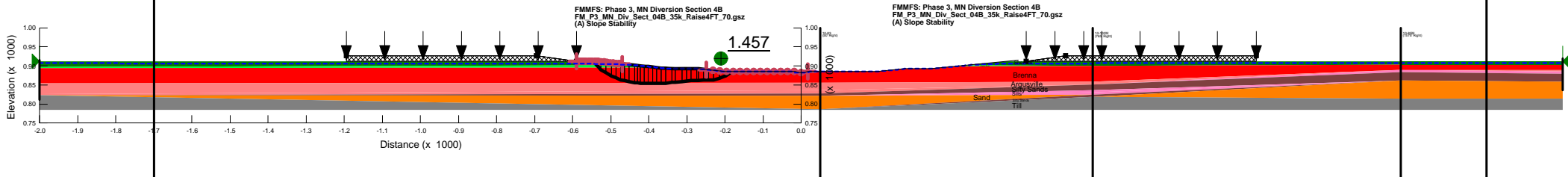
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(1) Steady-State Seepage Analysis



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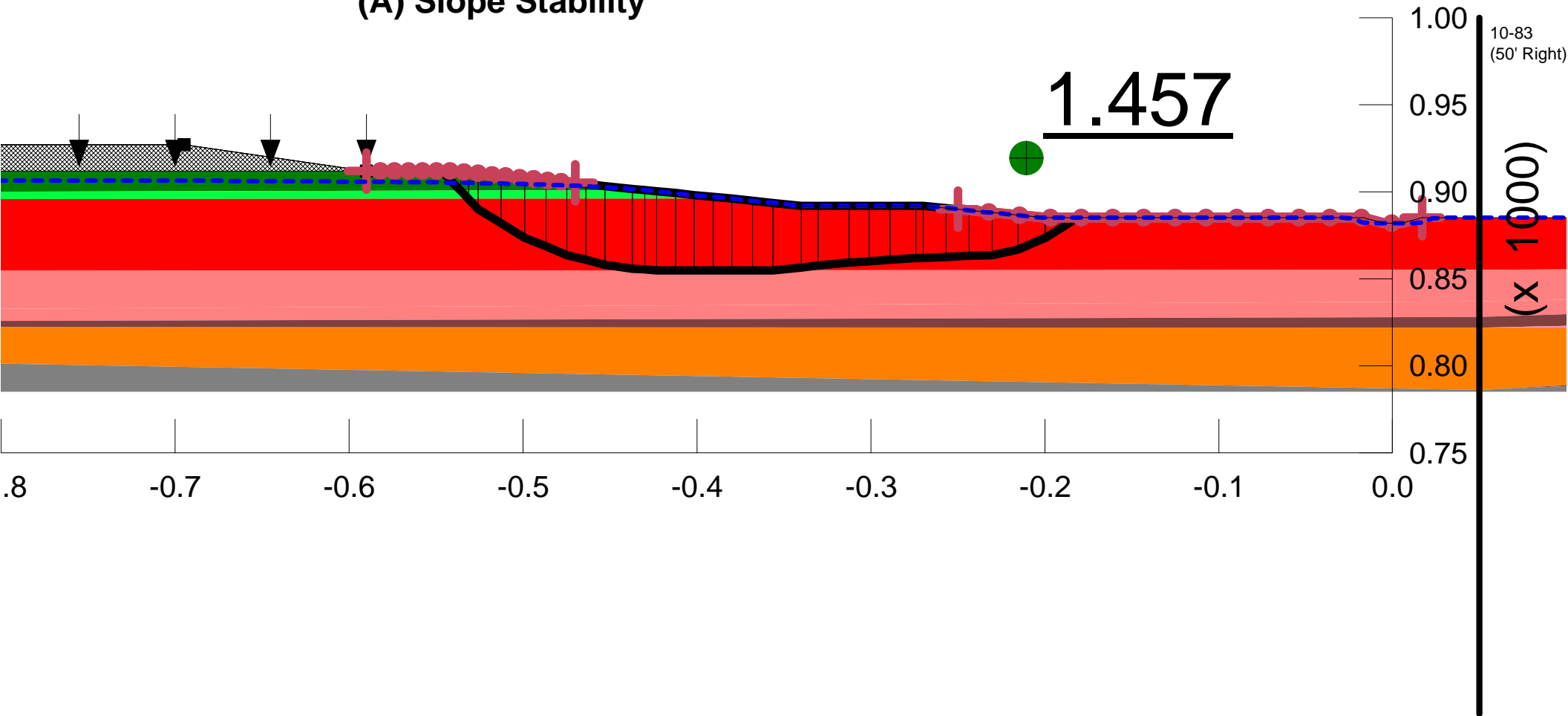
Fargo-Moorhead Metro Feasibility Study Phase 3 Analysis MN Diversion Channel Stability Section 4B (A) Slope Stability

Soil Properties			
Name:	Sherack	Model:	Mohr-Coulomb
Unit Weight:	118 pcf	Cohesion:	0 pcf
Phi:	28 °	Phi-B:	0 °
Name:	Prople River	Model:	Mohr-Coulomb
Unit Weight:	119 pcf	Cohesion:	0 pcf
Phi:	26 °	Phi-B:	0 °
Name:	Brenna	Model:	ShearNormal Fr.
Unit Weight:	104 pcf	Strength Function:	Brenna
Phi-B:	0 °		
Name:	Agassiz	Model:	ShearNormal Fr.
Unit Weight:	100 pcf	Strength Function:	Agassiz
Phi-B:	0 °		
Name:	Till	Model:	Mohr-Coulomb
Unit Weight:	122 pcf	Cohesion:	0 pcf
Phi:	31 °	Phi-B:	0 °
Name:	Sand	Model:	Mohr-Coulomb
Unit Weight:	125 pcf	Cohesion:	0 pcf
Phi:	32 °	Phi-B:	0 °
Name:	Silt	Model:	Mohr-Coulomb
Unit Weight:	106 pcf	Cohesion:	0 pcf
Phi:	15 °	Phi-B:	0 °
Name:	Silty Sand	Model:	Mohr-Coulomb
Unit Weight:	109 pcf	Cohesion:	0 pcf
Phi:	15 °	Phi-B:	0 °

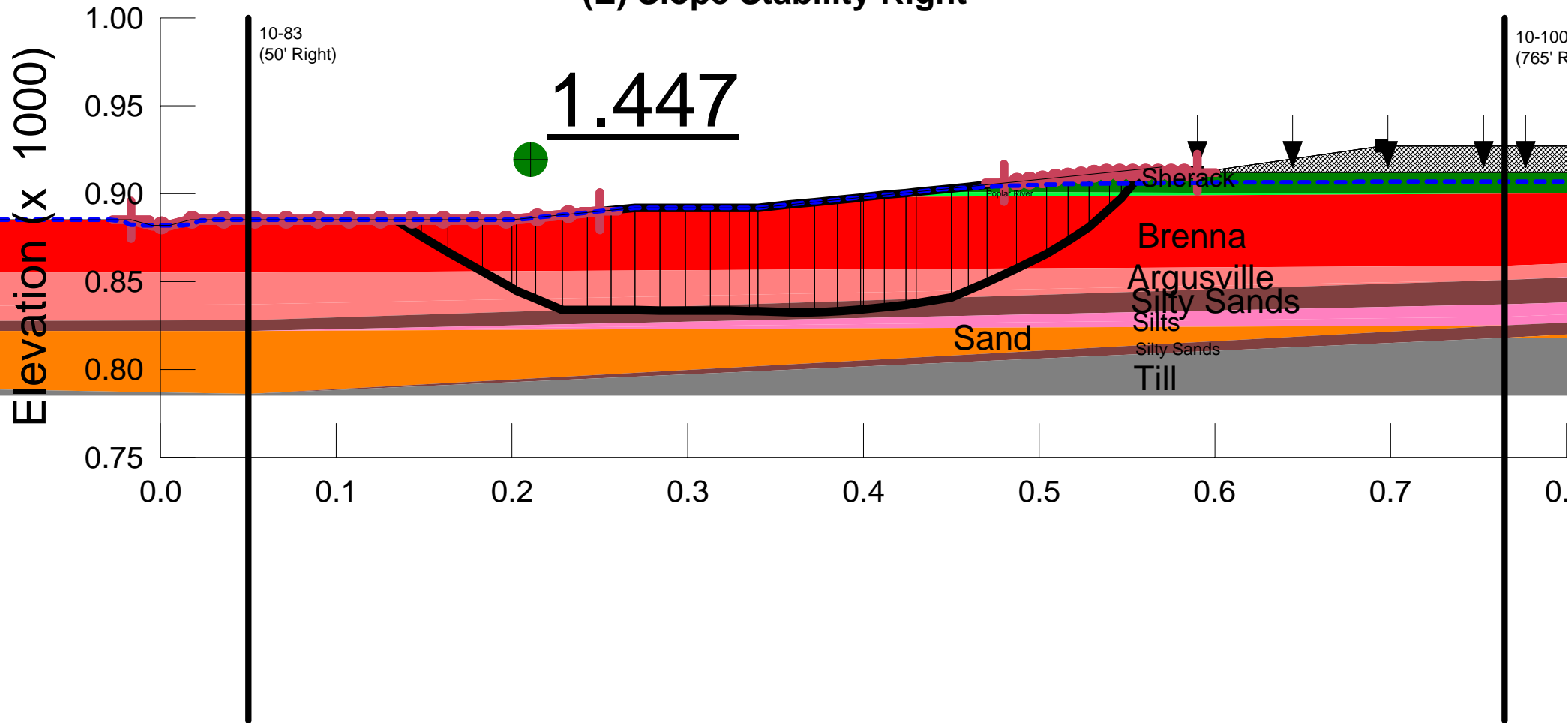


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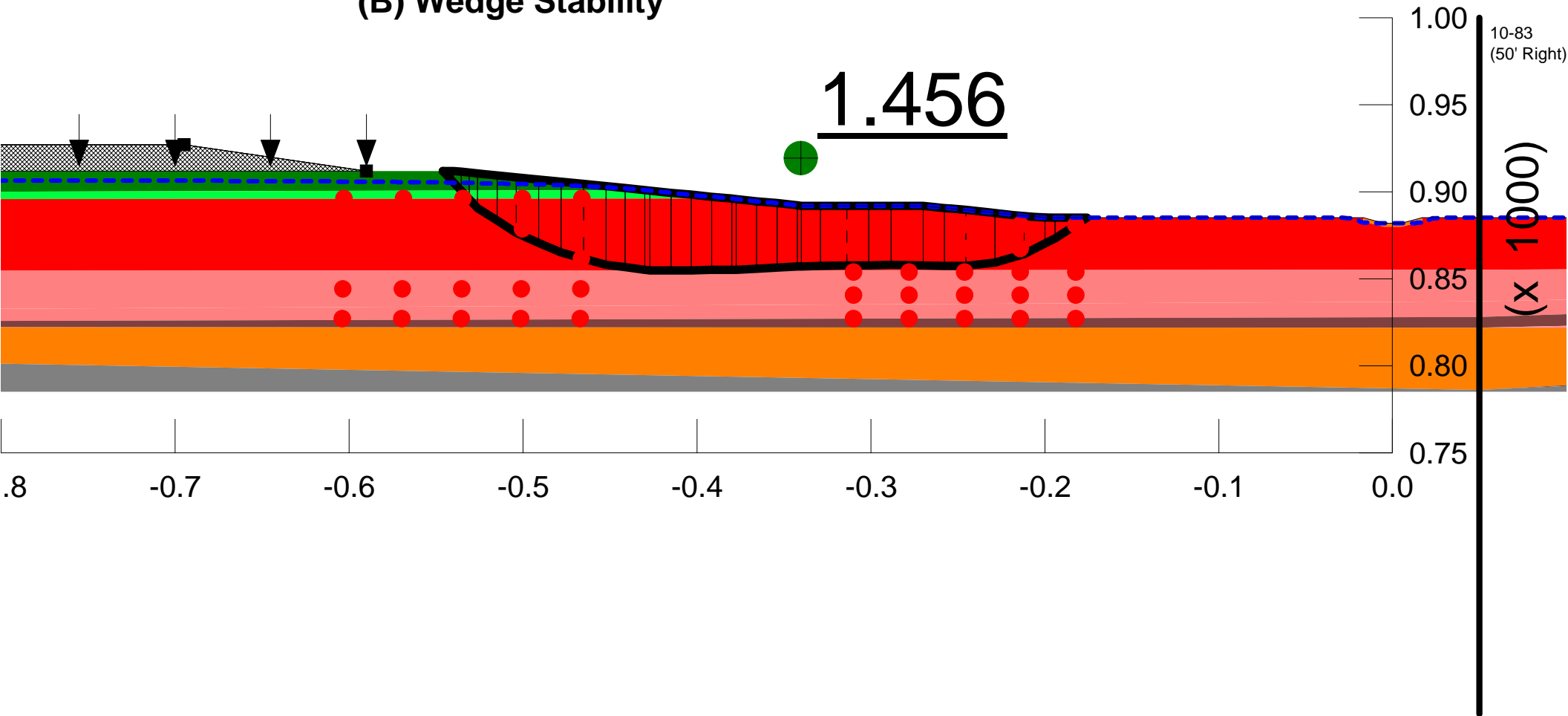
FMMFS: Phase 3, MN Diversion Section 4B
FM_P3_MN_Div_Sect_04B_35k_Raise4FT_70.gsz
(A) Slope Stability



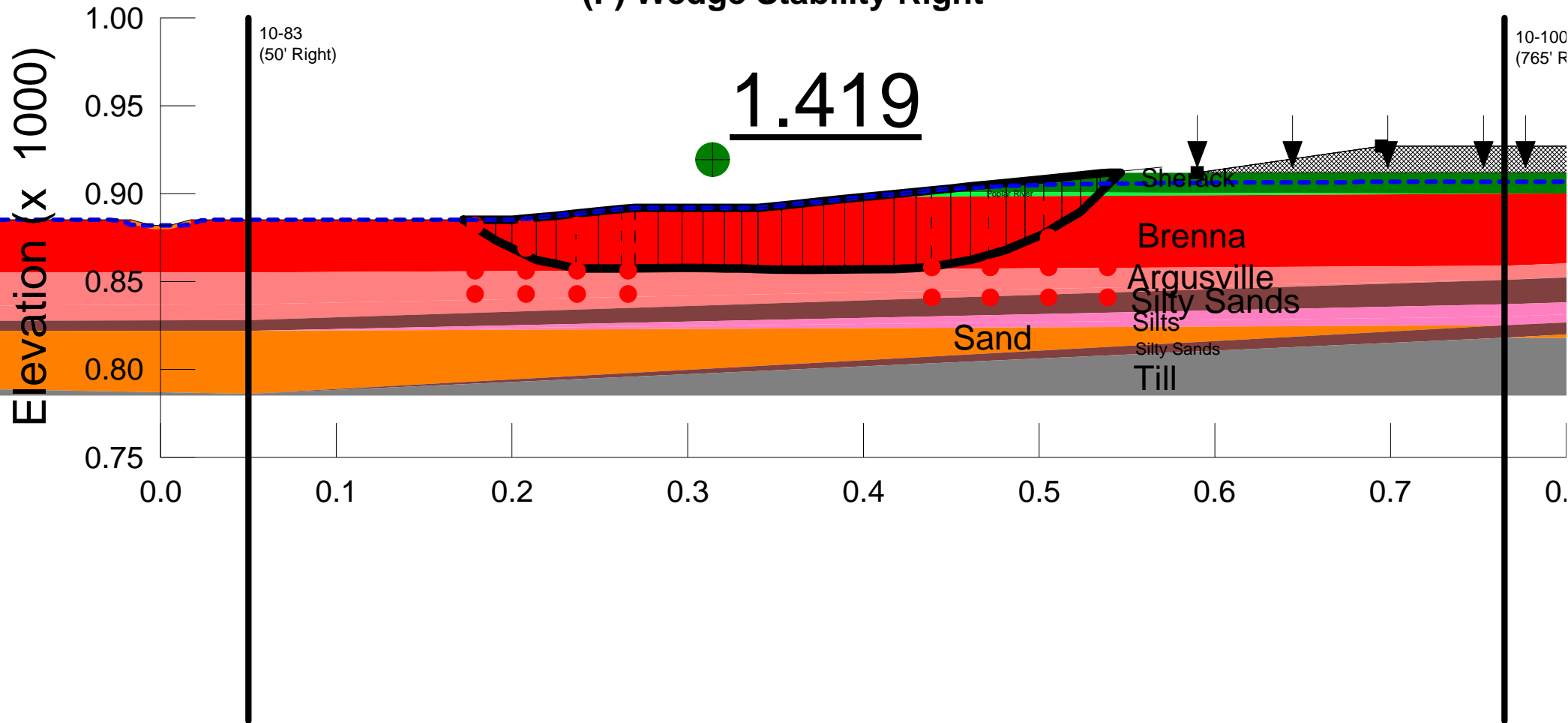
FMMFS: Phase 3, MN Diversion Section 4B
FM_P3_MN_Div_Sect_04B_35k_Raise4FT_70.gsz
(E) Slope Stability Right



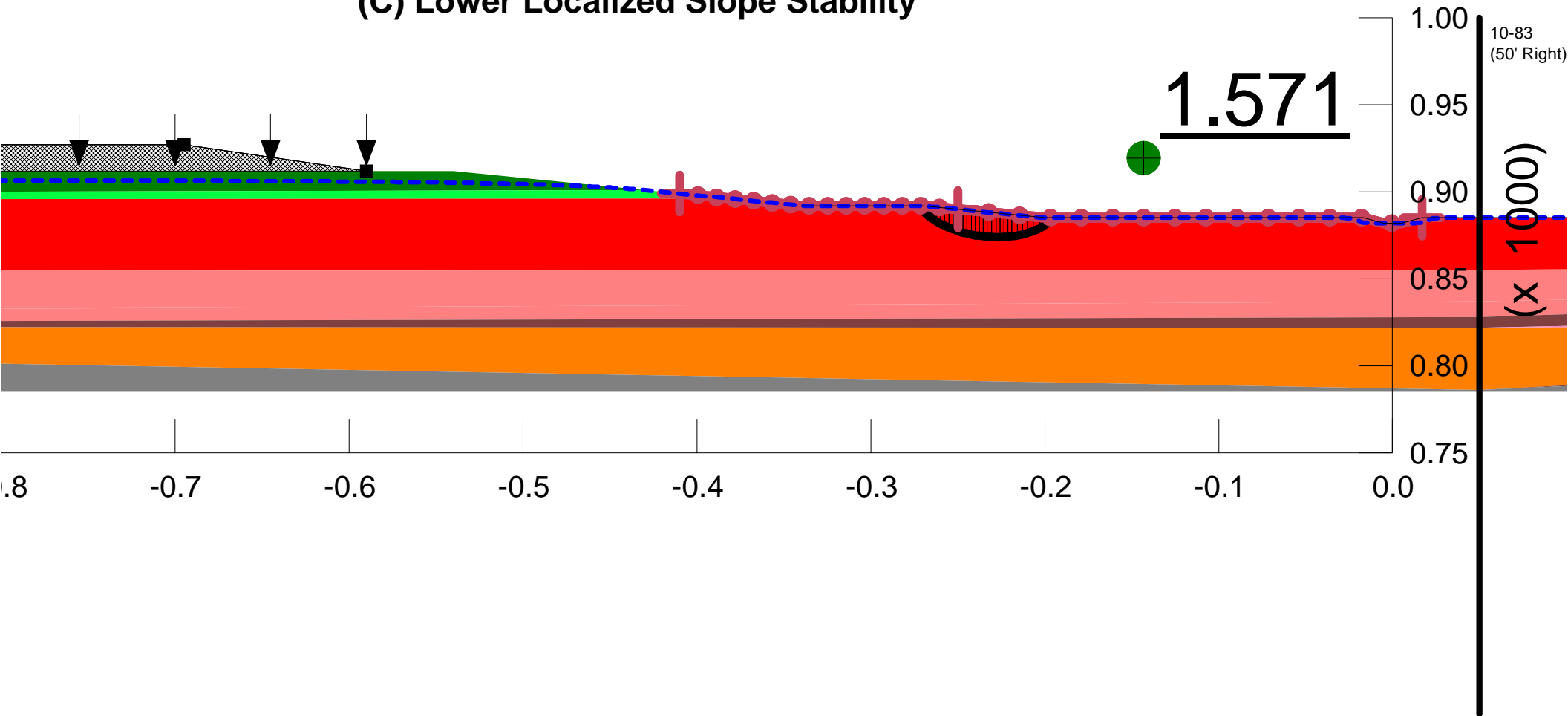
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FM_P3_MN_Div_Sect_04B_35k_Raise4FT_70.gsz
(B) Wedge Stability



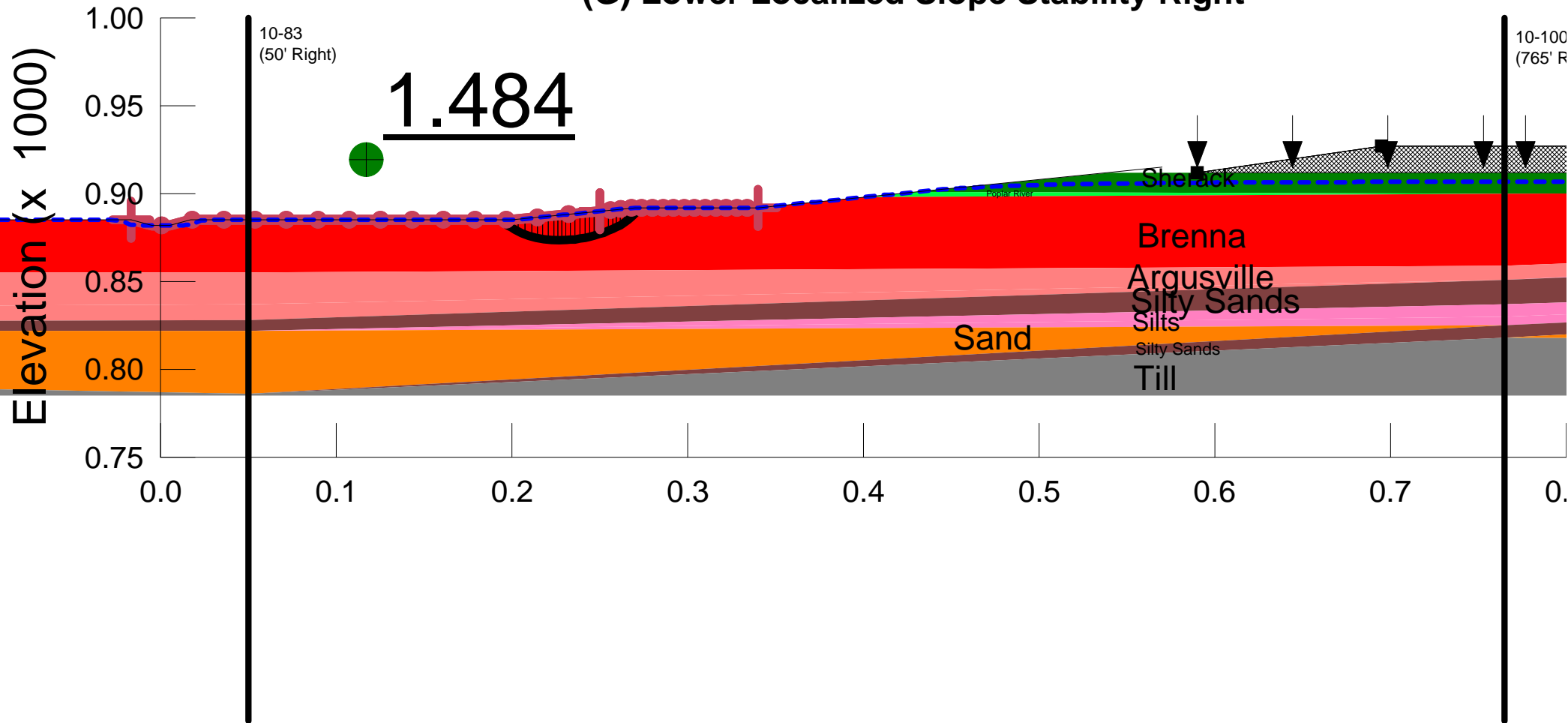
FMMFS: Phase 3, MN Diversion Section 4B
FM_P3_MN_Div_Sect_04B_35k_Raise4FT_70.gsz
(F) Wedge Stability Right



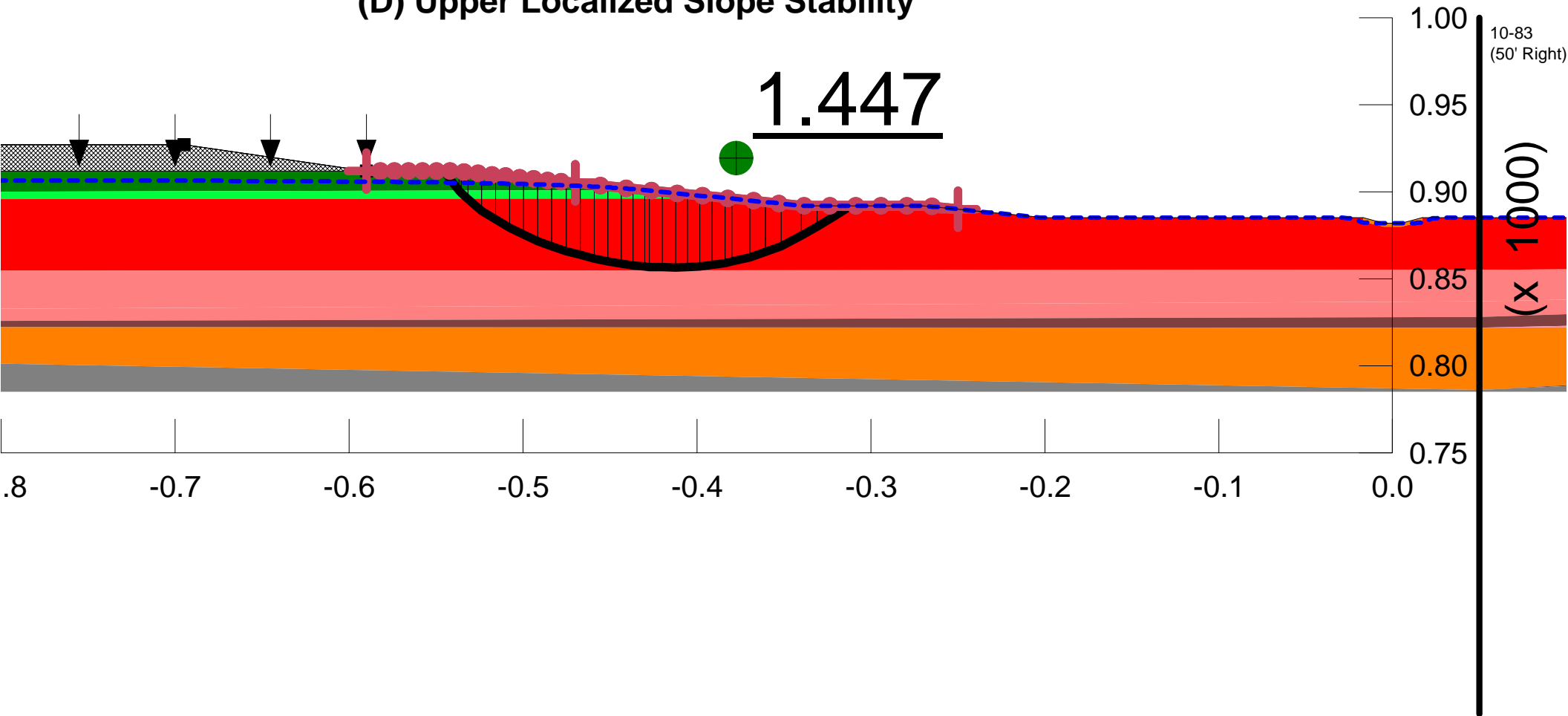
FMMFS: Phase 3, MN Diversion Section 4B
FM_P3_MN_Div_Sect_04B_35k_Raise4FT_70.gsz
(C) Lower Localized Slope Stability



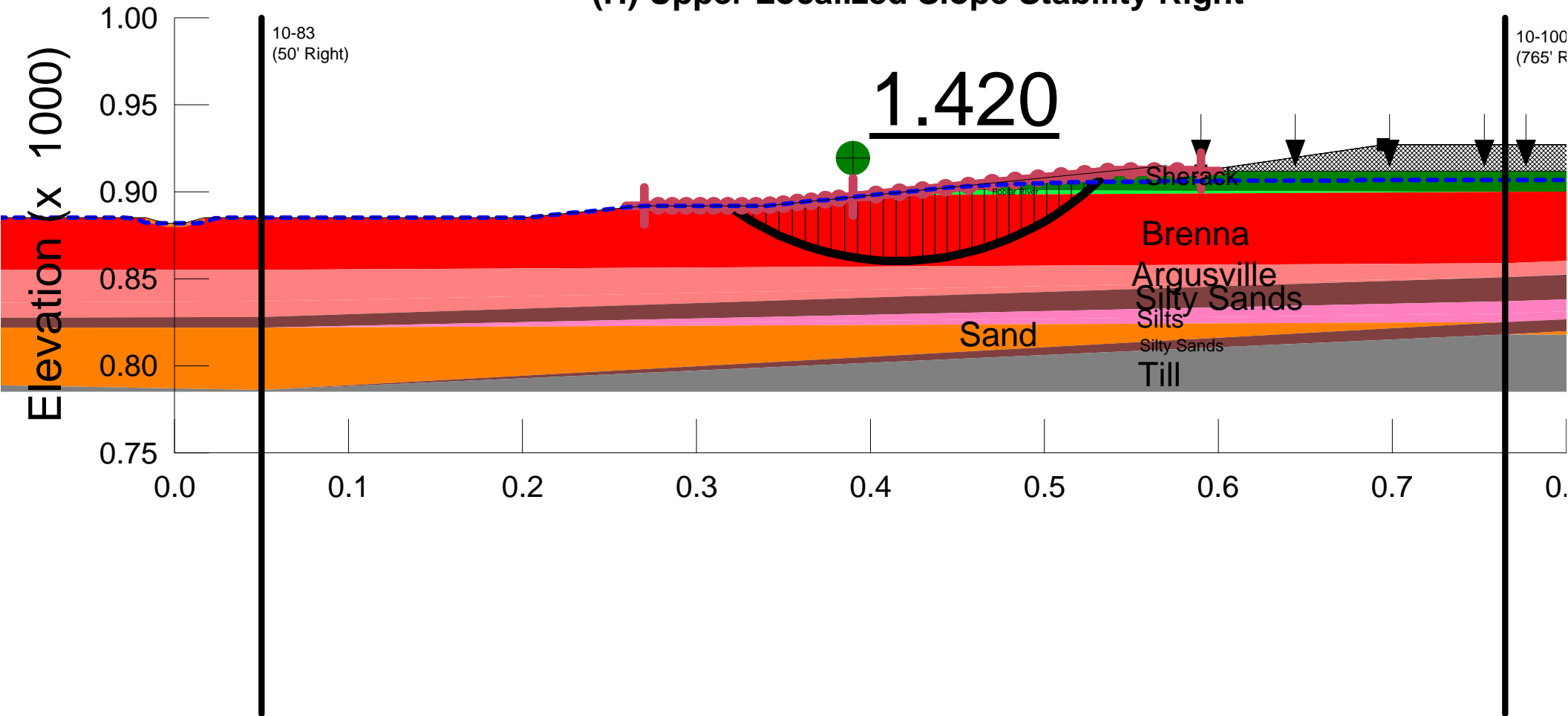
FMMFS: Phase 3, MN Diversion Section 4B
FM_P3_MN_Div_Sect_04B_35k_Raise4FT_70.gsz
(G) Lower Localized Slope Stability Right



FMMFS: Phase 3, MN Diversion Section 4B
FM_P3_MN_Div_Sect_04B_35k_Raise4FT_70.gsz
(D) Upper Localized Slope Stability



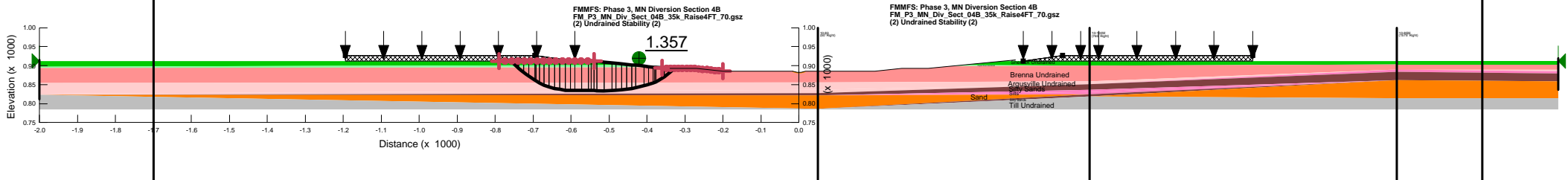
FMMFS: Phase 3, MN Diversion Section 4B
FM_P3_MN_Div_Sect_04B_35k_Raise4FT_70.gsz
(H) Upper Localized Slope Stability Right



File Name: FM_P3_MN_Div_Sect_04B_35k_Raise4FT_70.gsz

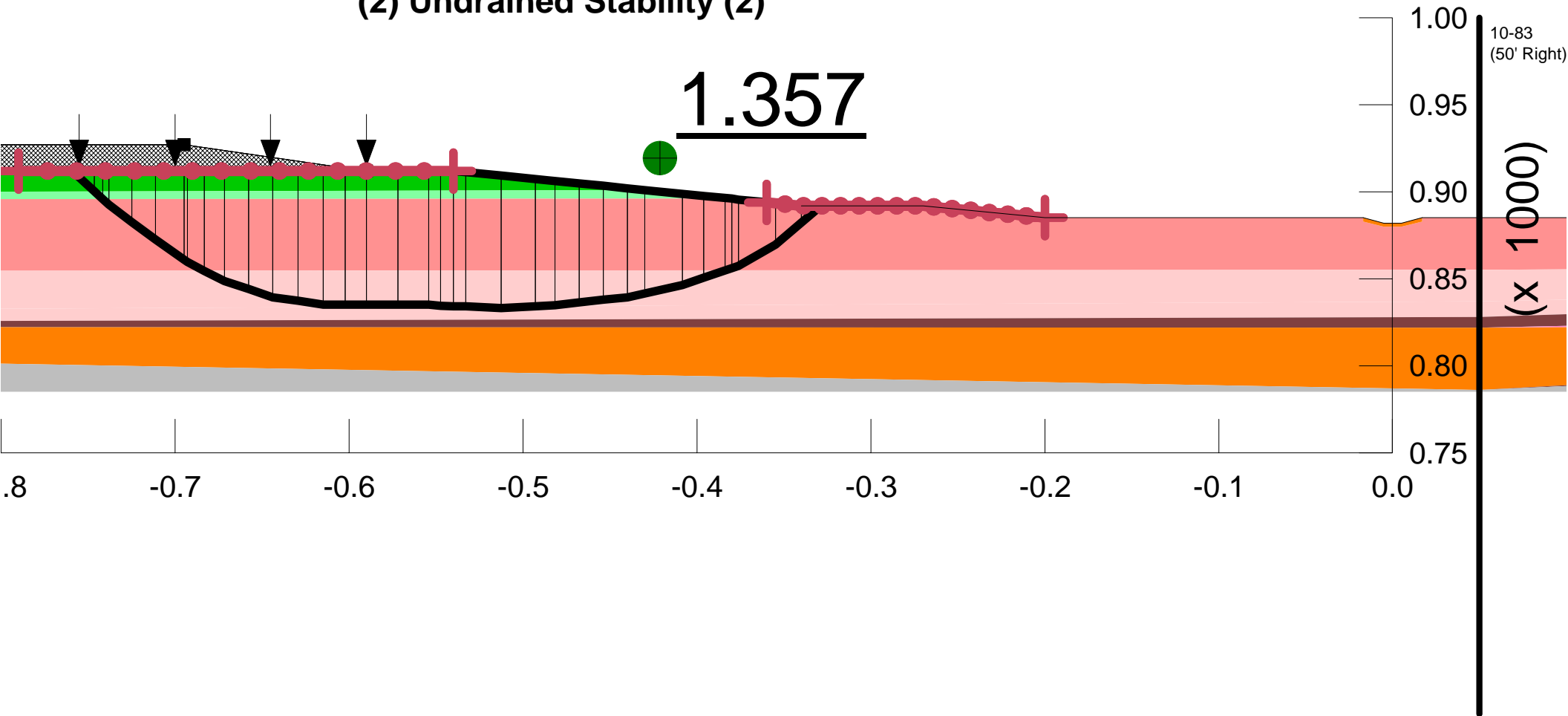
Fargo-Moorhead Metro Feasibility Study Phase 3 Analysis MN Diversion Channel Stability Section 4B (2) Undrained Stability (2)

Soil Properties			
Name: Sherack Undrained	Model: Undrained (Phi=0)	Unit Weight: 118 pcf	Cohesion: 900 pcf
Name: Poplar River Undrained	Model: Undrained (Phi=0)	Unit Weight: 119 pcf	Cohesion: 1200 pcf
Name: Brenna Undrained	Model: Undrained (Phi=0)	Unit Weight: 124 pcf	Cohesion: 525 pcf
Name: Agassiz Undrained	Model: Spill/Seal	Unit Weight: 126 pcf	C-Top of Layer: 525 pcf C-Rate of Change: 10 pcf/ft Limiting C: 1025 pcf
Name: Till Undrained	Model: Undrained (Phi=0)	Unit Weight: 122 pcf	Cohesion: 1900 pcf
Name: Sand	Model: Mohr-Coulomb	Unit Weight: 125 pcf	Cohesion: 0 pcf Phi: 32° Phi-B: 0°
Name: Silty	Model: Mohr-Coulomb	Unit Weight: 126 pcf	Cohesion: 0 pcf Phi: 15° Phi-B: 0°
Name: Silty Sand	Model: Mohr-Coulomb	Unit Weight: 128 pcf	Cohesion: 0 pcf Phi: 15° Phi-B: 0°

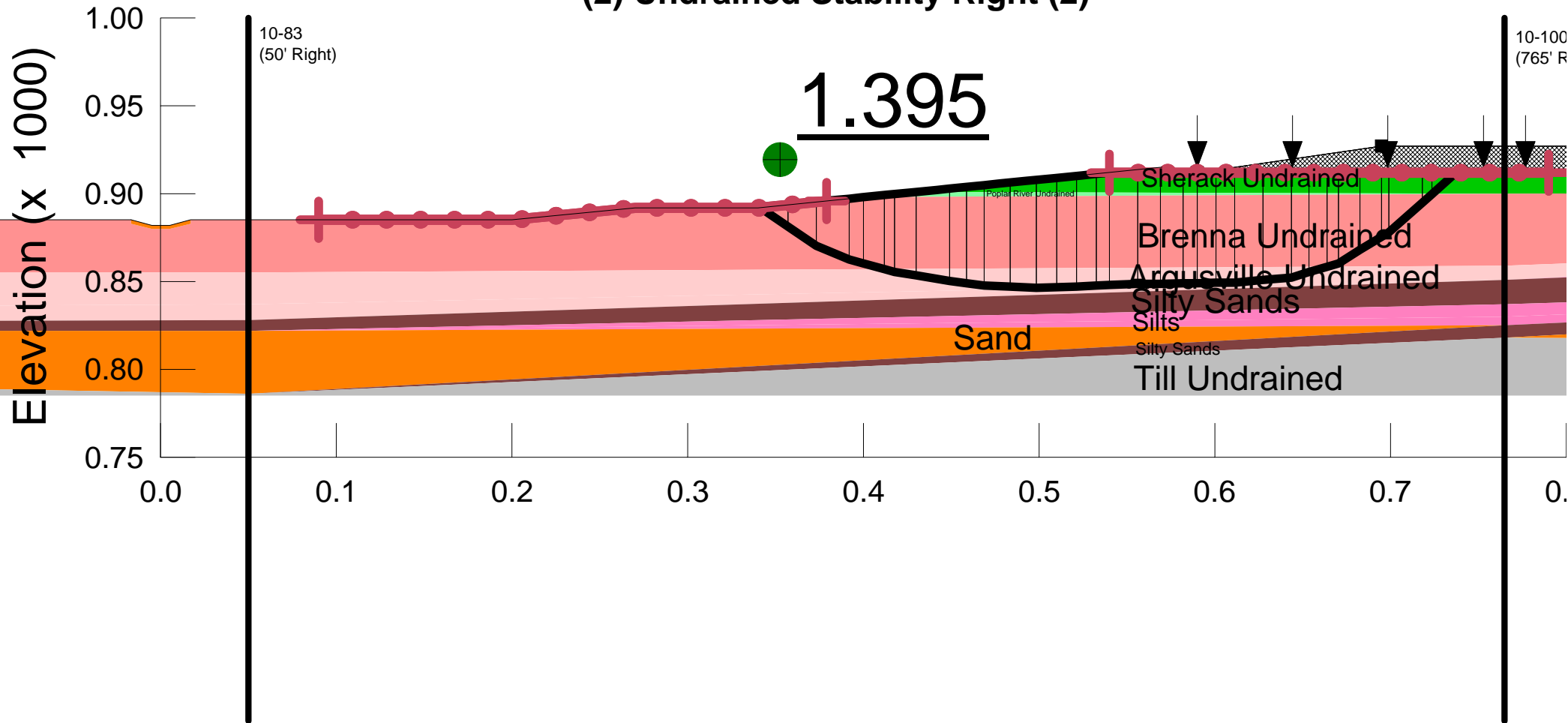


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FMMFS: Phase 3, MN Diversion Section 4B
FM_P3_MN_Div_Sect_04B_35k_Raise4FT_70.gsz
(2) Undrained Stability (2)



FMMFS: Phase 3, MN Diversion Section 4B
FM_P3_MN_Div_Sect_04B_35k_Raise4FT_70.gsz
(2) Undrained Stability Right (2)



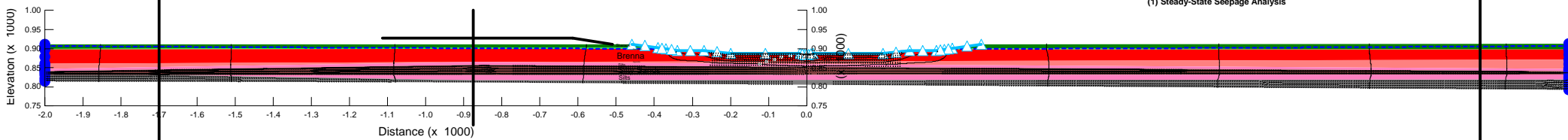
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Fargo-Moorhead Metro Feasibility Study Phase 3 Analysis MN Diversion Channel Stability Section 5B (1) Steady-State Seepage Analysis

Soil Properties

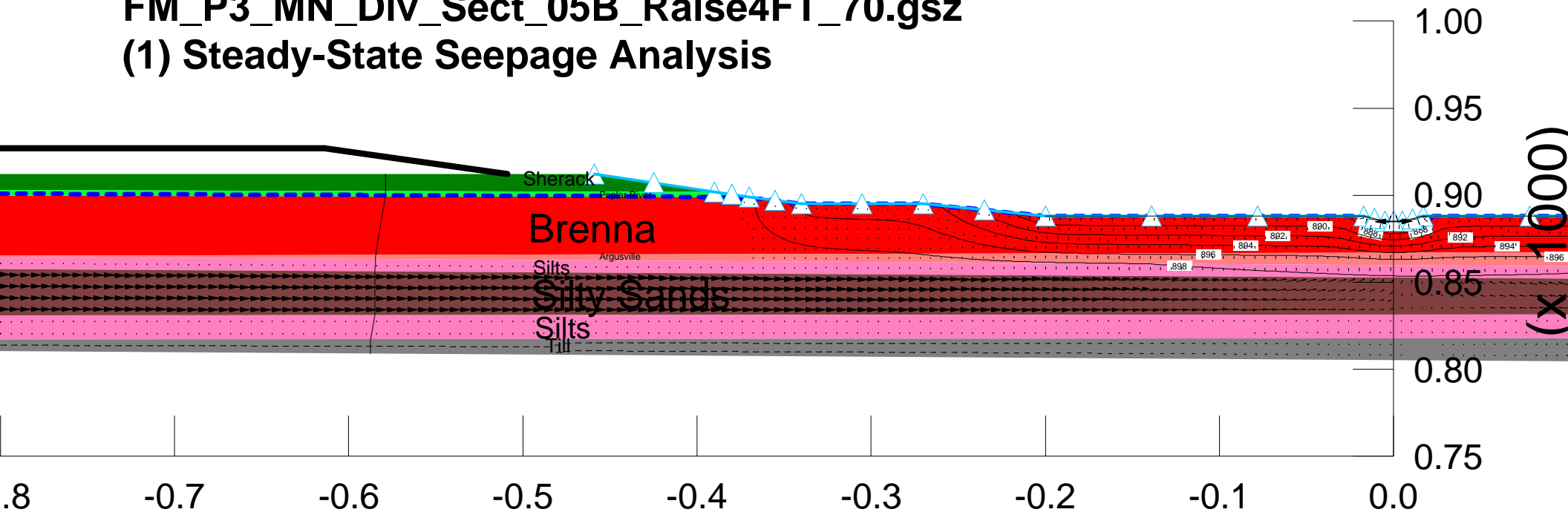
Name: Sherack Model: Saturated / Unsaturated K-Function: Alluv/Sherack Vol. WC. Function: Alluv/Sherack K-Ratio: 1 K-Direction: 0°
Name: Poplar River Model: Saturated / Unsaturated K-Function: Alluv/Sherack Vol. WC. Function: Alluv/Sherack K-Ratio: 1 K-Direction: 0°
Name: Brenna Model: Saturated Only K-Sat: 0.00028 ft/days Volumetric Water Content: 0.63 ft³/ft³ Mv: 3e-005 psf K-Ratio: 1 K-Direction: 0°
Name: Argoville Model: Saturated Only K-Sat: 0.00028 ft/days Volumetric Water Content: 0.6 ft³/ft³ Mv: 3e-005 psf K-Ratio: 1 K-Direction: 0°
Name: Till Model: Saturated Only K-Sat: 0.057 ft/days Volumetric Water Content: 0.45 ft³/ft³ Mv: 3e-005 psf K-Ratio: 0.25 K-Direction: 0°
Name: Sand Model: Saturated / Unsaturated K-Function: Sand Vol. WC. Function: Sand K-Ratio: 1 K-Direction: 0°
Name: Silt Model: Saturated Only K-Sat: 0.0028 ft/days Volumetric Water Content: 0.4 ft³/ft³ Mv: 3e-006 psf K-Ratio: 1 K-Direction: 0°
Name: Silty Sands Model: Saturated Only K-Sat: 0.28 ft/days Volumetric Water Content: 0.4 ft³/ft³ Mv: 3e-006 psf K-Ratio: 1 K-Direction: 0°

FMMFS: Phase 3, MN Diversion Section 5B
FM_P3_MN_Div_Sect_05B_Raise4FT_70.gsz
(1) Steady-State Seepage Analysis

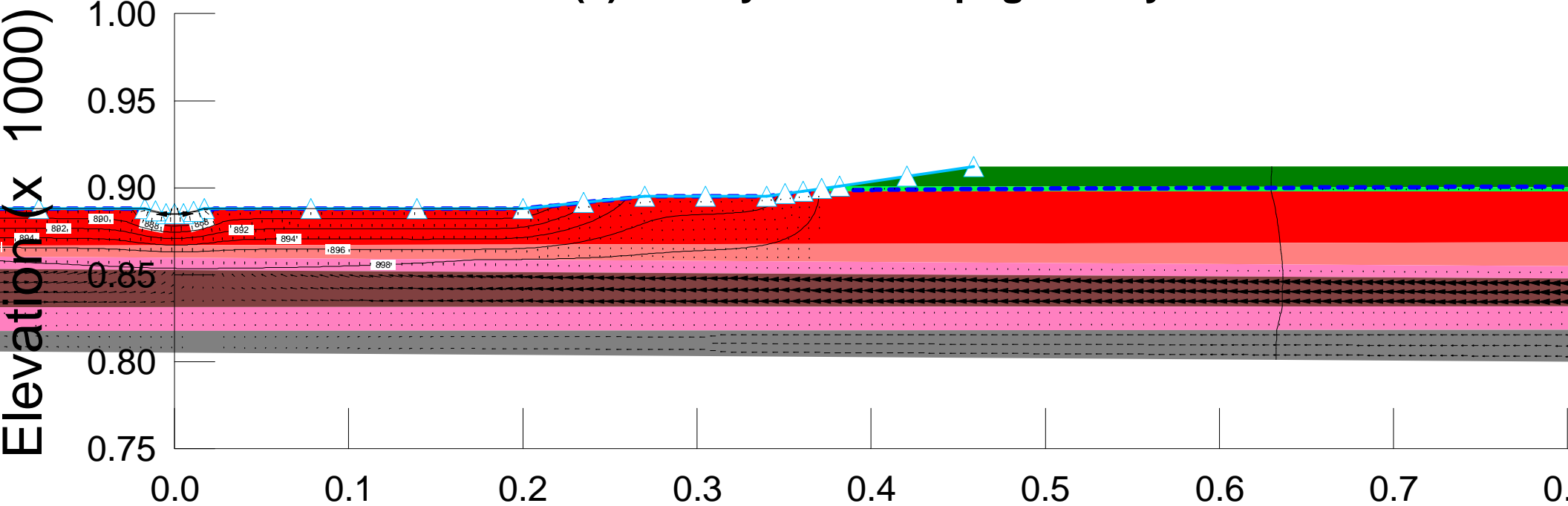


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FMMFS: Phase 3, MN Diversion Section 5B
FM_P3_MN_Div_Sect_05B_Raise4FT_70.gsz
(1) Steady-State Seepage Analysis



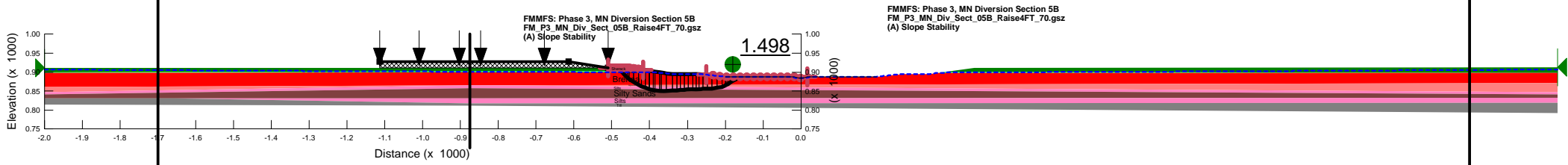
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(1) Steady-State Seepage Analysis



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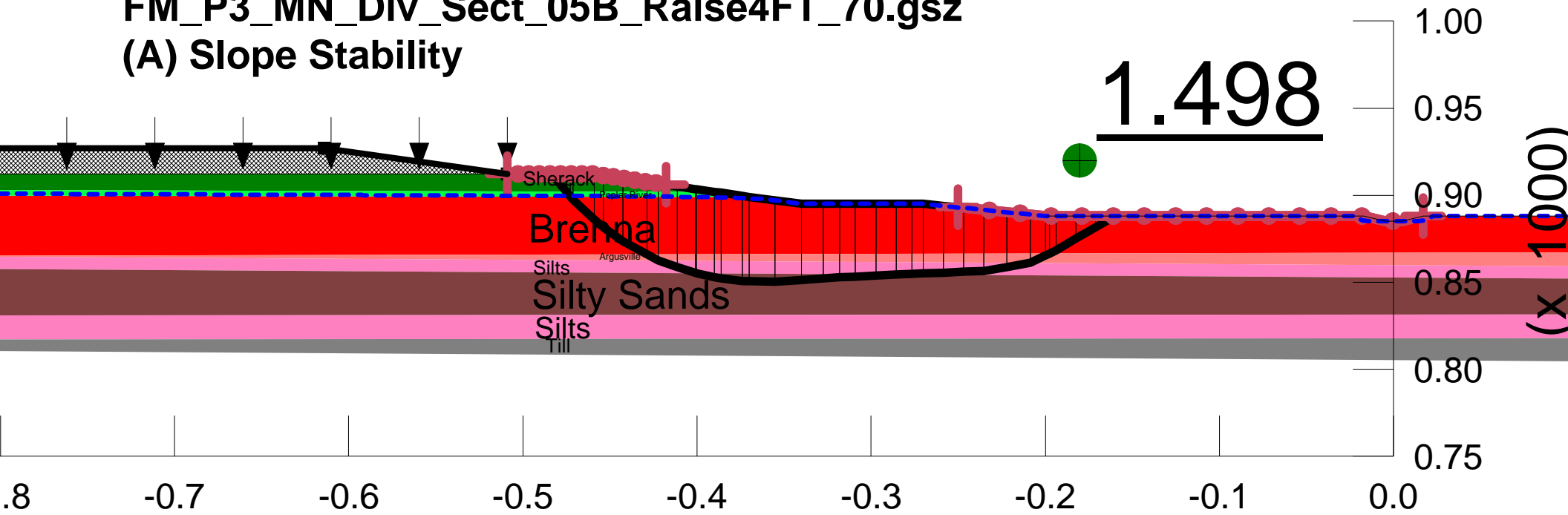
Fargo-Moorhead Metro Feasibility Study Phase 3 Analysis MN Diversion Channel Stability Section 5B (A) Slope Stability

Soil Properties					
Name: Sherack	Model: Mohr-Coulomb	Unit Weight: 118 pcf	Cohesion: 0 psf	Phi: 28°	Phi-B: 0°
Name: Poplar River	Model: Mohr-Coulomb	Unit Weight: 118 pcf	Cohesion: 0 psf	Phi: 26°	Phi-B: 0°
Name: Brenna	Model: Shear/Normal Fr.	Unit Weight: 104 pcf	Strength Function: Brenna	Phi-B: 0°	
Name: Argoville	Model: Shear/Normal Fr.	Unit Weight: 106 pcf	Strength Function: Argoville	Phi-B: 0°	
Name: Till	Model: Mohr-Coulomb	Unit Weight: 122 pcf	Cohesion: 0 psf	Phi: 31°	Phi-B: 0°
Name: Sand	Model: Mohr-Coulomb	Unit Weight: 125 pcf	Cohesion: 0 psf	Phi: 32°	Phi-B: 0°
Name: Silt	Model: Mohr-Coulomb	Unit Weight: 106 pcf	Cohesion: 0 psf	Phi: 15°	Phi-B: 0°
Name: Silty Sands	Model: Mohr-Coulomb	Unit Weight: 106 pcf	Cohesion: 0 psf	Phi: 15°	Phi-B: 0°

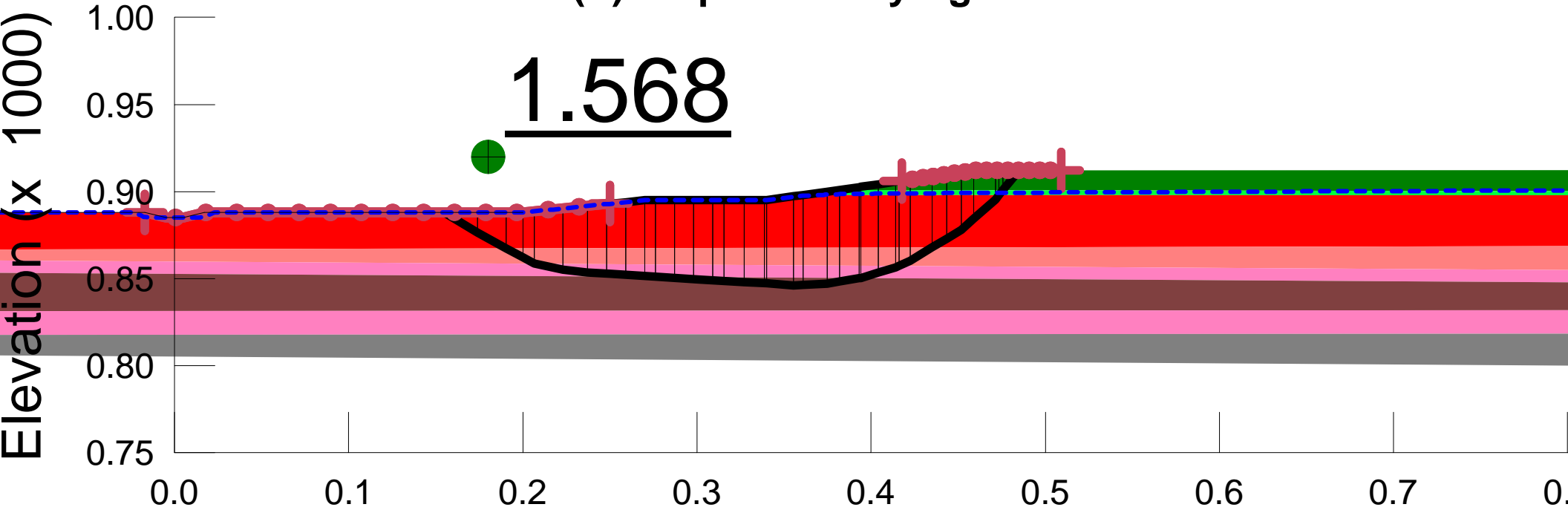


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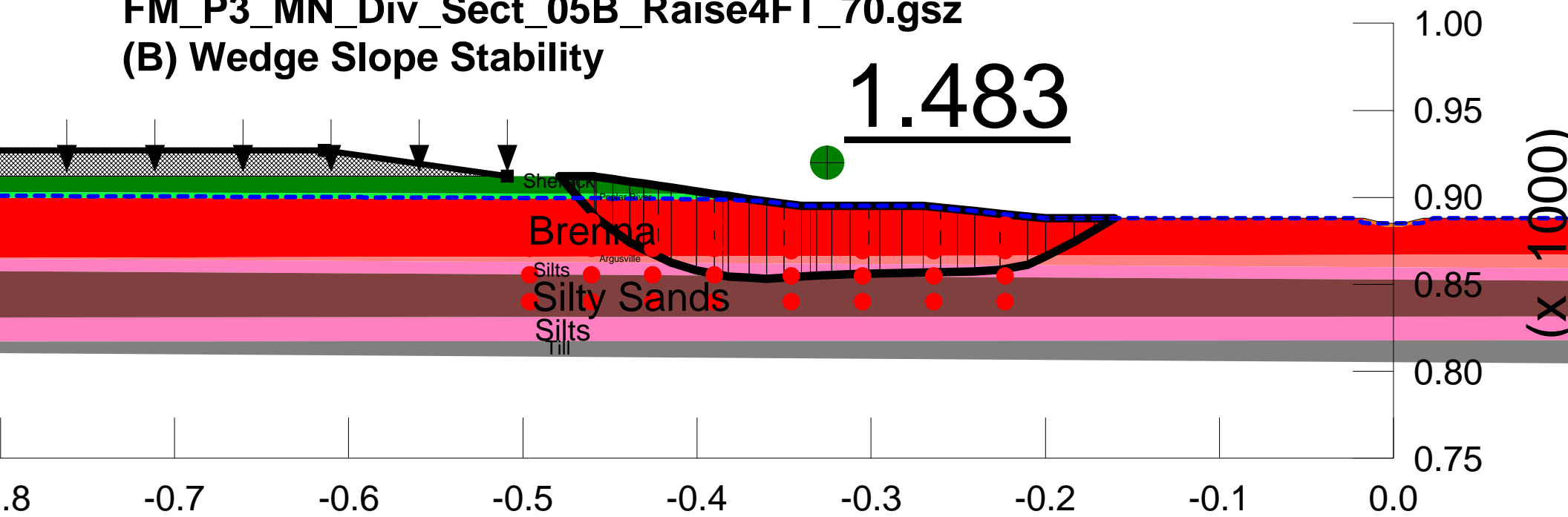
FMMFS: Phase 3, MN Diversion Section 5B
FM_P3_MN_Div_Sect_05B_Raise4FT_70.gsz
(A) Slope Stability



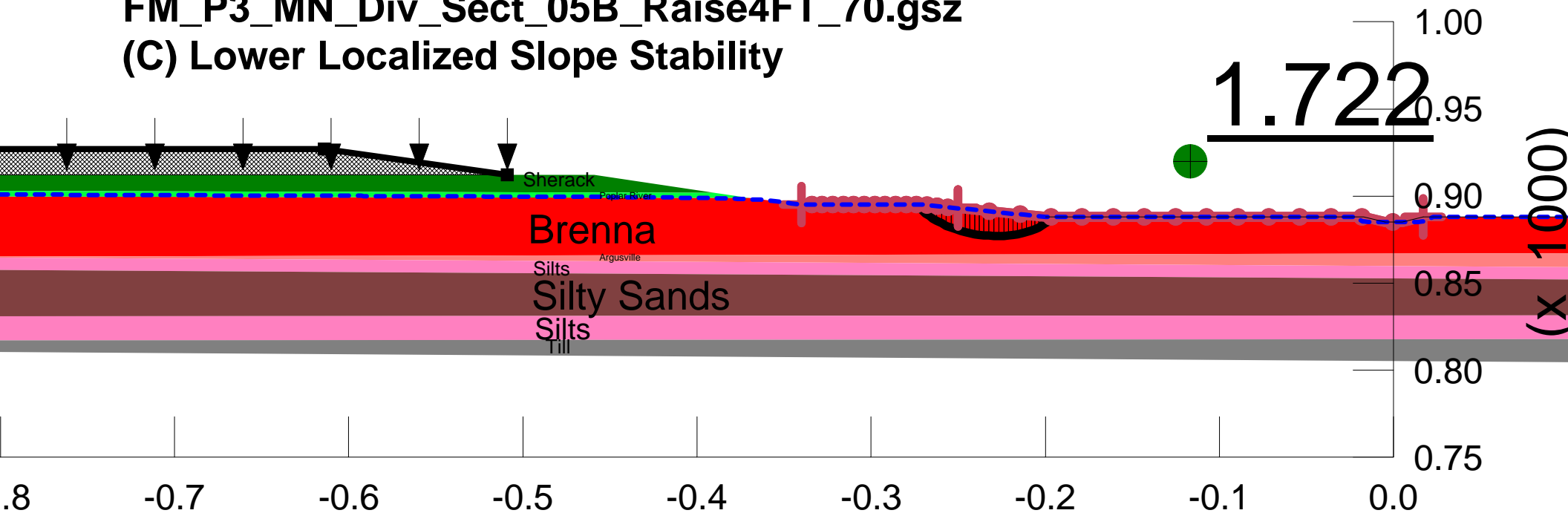
FMMFS: Phase 3, MN Diversion Section 5B
FM_P3_MN_Div_Sect_05B_Raise4FT_70.gsz
(E) Slope Stability right



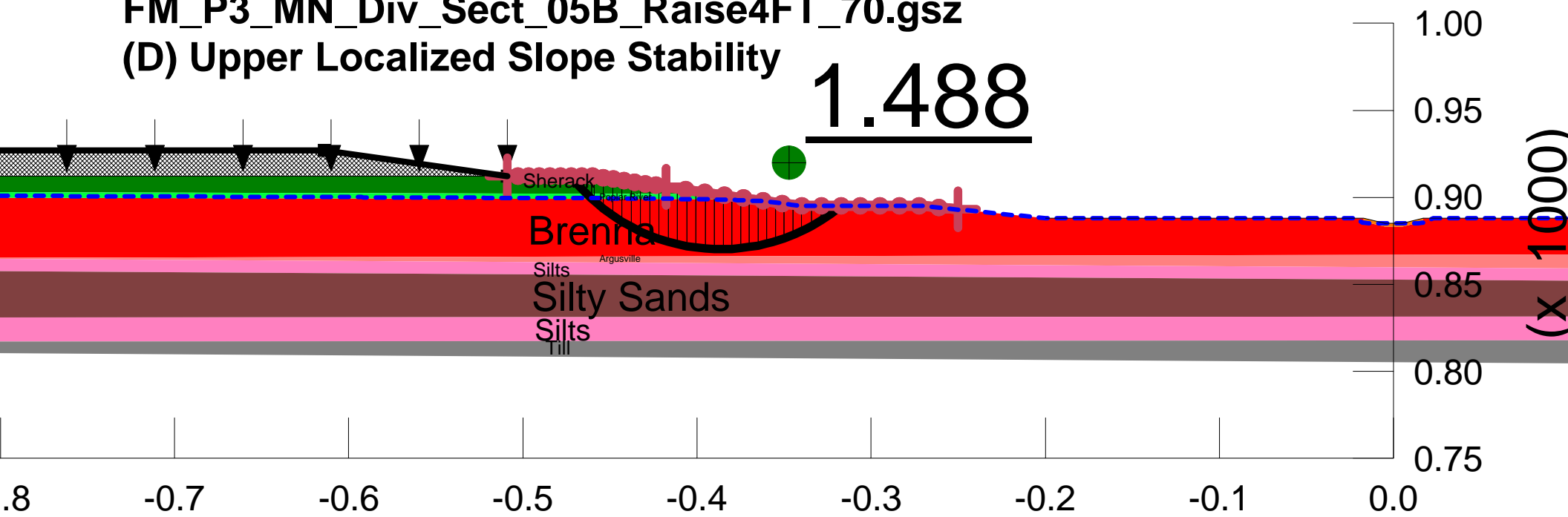
FMMFS: Phase 3, MN Diversion Section 5B
FM_P3_MN_Div_Sect_05B_Raise4FT_70.gsz
(B) Wedge Slope Stability



FMMFS: Phase 3, MN Diversion Section 5B
FM_P3_MN_Div_Sect_05B_Raise4FT_70.gsz
(C) Lower Localized Slope Stability



FMMFS: Phase 3, MN Diversion Section 5B
FM_P3_MN_Div_Sect_05B_Raise4FT_70.gsz
(D) Upper Localized Slope Stability



File Name: FM_P3_MN_Div_Sect_05B_Raise4FT_70.gsz

Fargo-Moorhead Metro Feasibility Study

Phase 3 Analysis

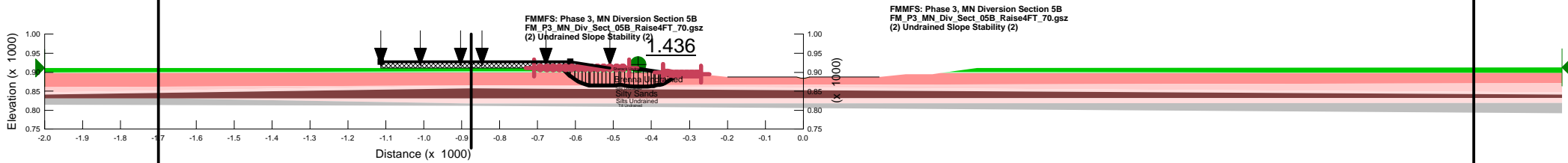
MN Diversion Channel Stability

Section 5B

(2) Undrained Slope Stability (2)

Soil Properties

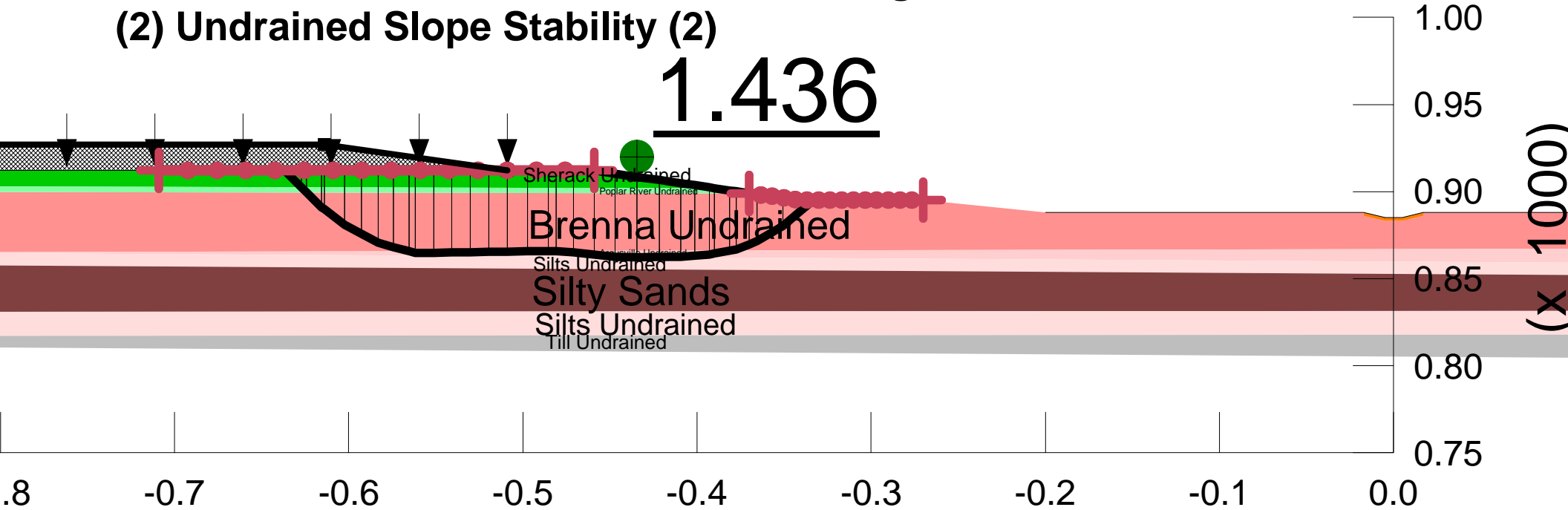
Name: Sherack Undrained	Model: Undrained (Phi=0)	Unit Weight: 118 pcf	Cohesion: 900 psf
Name: Poplar River Undrained	Model: Undrained (Phi=0)	Unit Weight: 119 pcf	Cohesion: 1200 psf
Name: Brenna Undrained	Model: Undrained (Phi=0)	Unit Weight: 104 pcf	Cohesion: 525 psf
Name: Argoville Undrained	Model: S/(depth)	Unit Weight: 108 pcf	C-Top of Layer: 525 psf C-Rate of Change: 10 psf/ft Limiting C: 1025 psf
Name: Till Undrained	Model: Undrained (Phi=0)	Unit Weight: 122 pcf	Cohesion: 1900 psf
Name: Sand	Model: Mohr-Coulomb	Unit Weight: 125 pcf	Cohesion: 0 psf Phi: 32° Phi-B: 0°
Name: Silty Sands	Model: Mohr-Coulomb	Unit Weight: 100 pcf	Cohesion: 0 psf Phi: 15° Phi-B: 0°
Name: Silt Undrained	Model: Undrained (Phi=0)	Unit Weight: 106 pcf	Cohesion: 825 psf



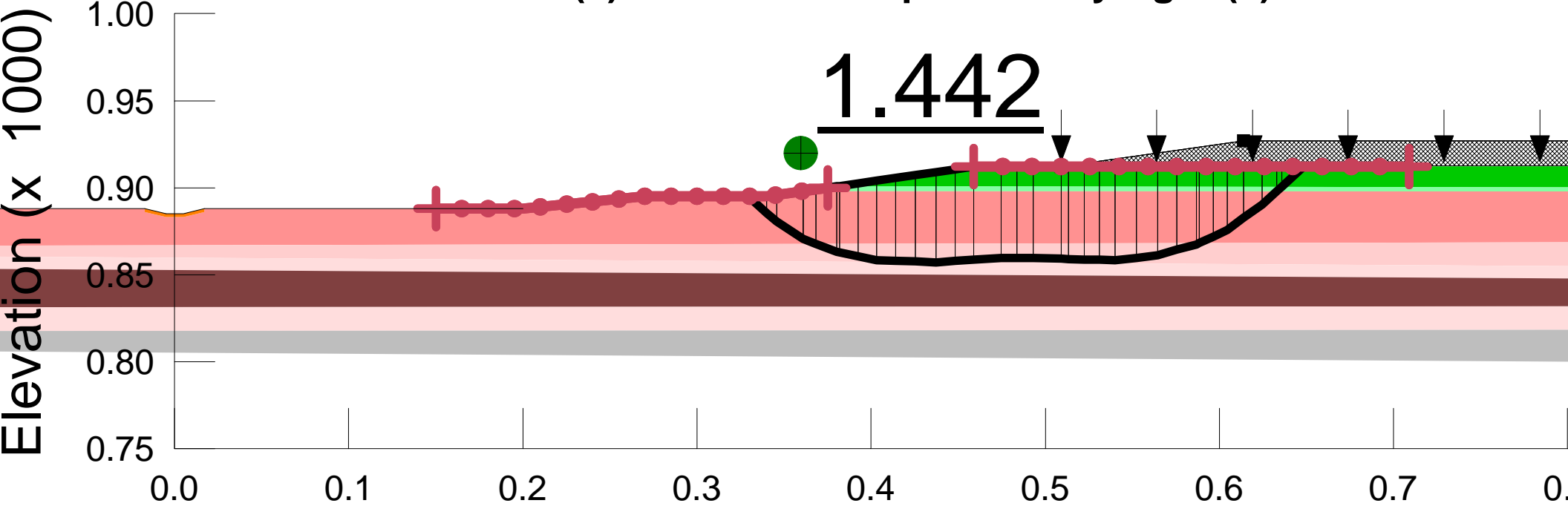
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Date: 8/16/2010

FMMFS: Phase 3, MN Diversion Section 5B
FM_P3_MN_Div_Sect_05B_Raise4FT_70.gsz
(2) Undrained Slope Stability (2)

1.436



FMMFS: Phase 3, MN Diversion Section 5B
FM_P3_MN_Div_Sect_05B_Raise4FT_70.gsz
(3) Undrained Slope Stability right (2)



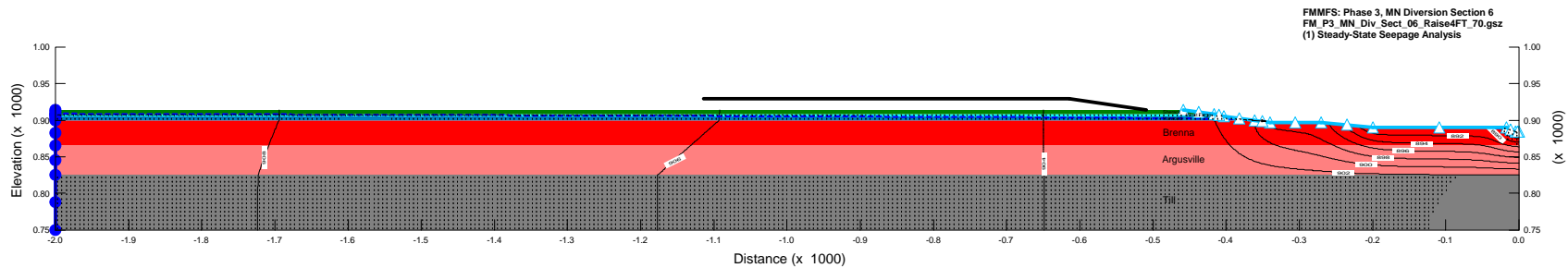
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Fargo-Moorhead Metro Feasibility Study Phase 3 Analysis MN Diversion Channel Stability Section 6

(1) Steady-State Seepage Analysis

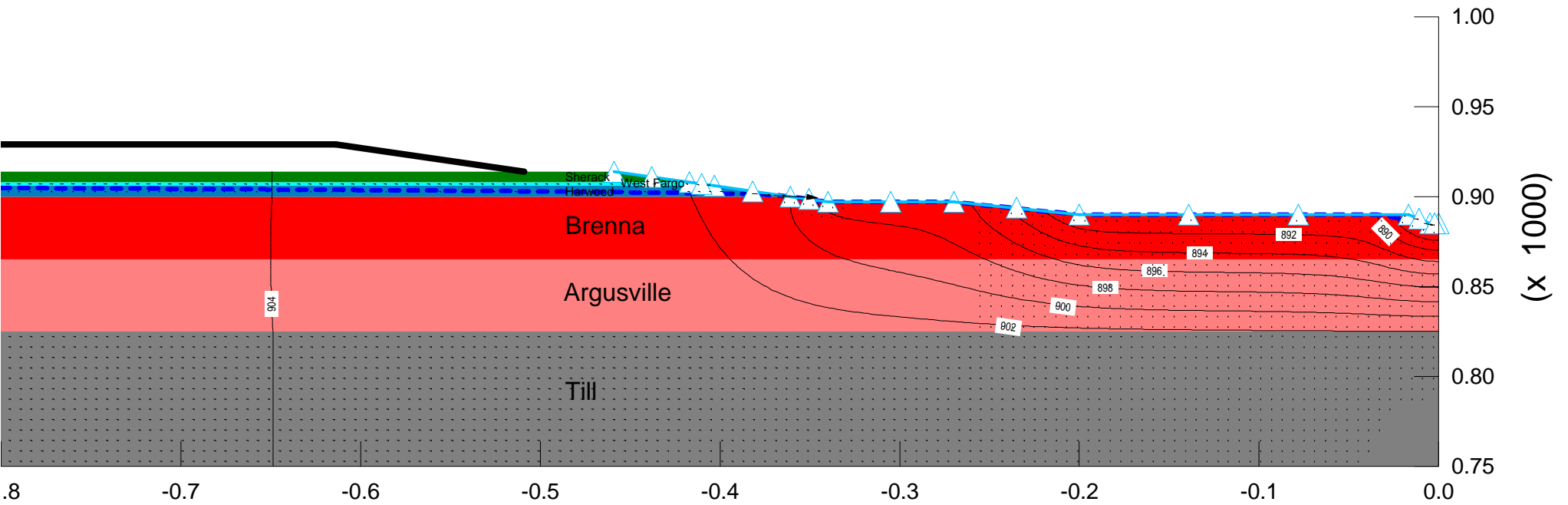
Soil Properties

Name: Sherack Model: Saturated / Unsaturated K-Function: Alluv/Sherack Vol. WC. Function: Alluv/Sherack K-Ratio: 1 K-Direction: 0°
Name: West Fargo Model: Saturated / Unsaturated K-Function: West Fargo Vol. WC. Function: West Fargo K-Ratio: 1 K-Direction: 0°
Name: Harwood Model: Saturated / Unsaturated K-Function: Harwood Vol. WC. Function: Harwood K-Ratio: 1 K-Direction: 0°
Name: Brenna Model: Saturated Only K-Sat: 0.00028 1/days Volumetric Water Content: 0.83 1/m³ Mv: 3e-005 psf K-Ratio: 1 K-Direction: 0°
Name: Argusville Model: Saturated Only K-Sat: 0.00028 1/days Volumetric Water Content: 0.6 1/m³ Mv: 3e-005 psf K-Ratio: 1 K-Direction: 0°
Name: Fill Model: Saturated Only K-Sat: 0.007 1/days Volumetric Water Content: 0.45 1/m³ Mv: 3e-005 psf K-Ratio: 0.25 K-Direction: 0°
Name: Sand Model: Saturated / Unsaturated K-Function: Sand Vol. WC. Function: Sand K-Ratio: 1 K-Direction: 0°



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Date: 8/16/2010

**FMMFS: Phase 3, MN Diversion Section 6
FM_P3_MN_Div_Sect_06_Raise4FT_70.gsz
(1) Steady-State Seepage Analysis**

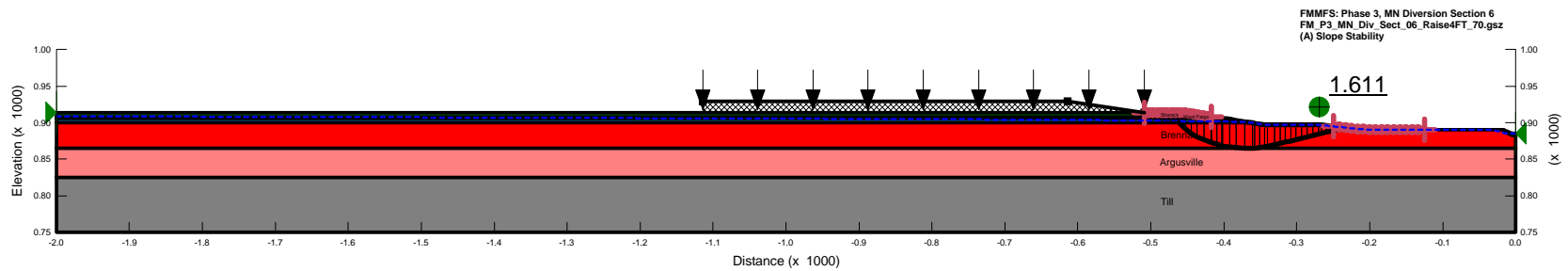


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Fargo-Moorhead Metro Feasibility Study Phase 3 Analysis MN Diversion Channel Stability Section 6

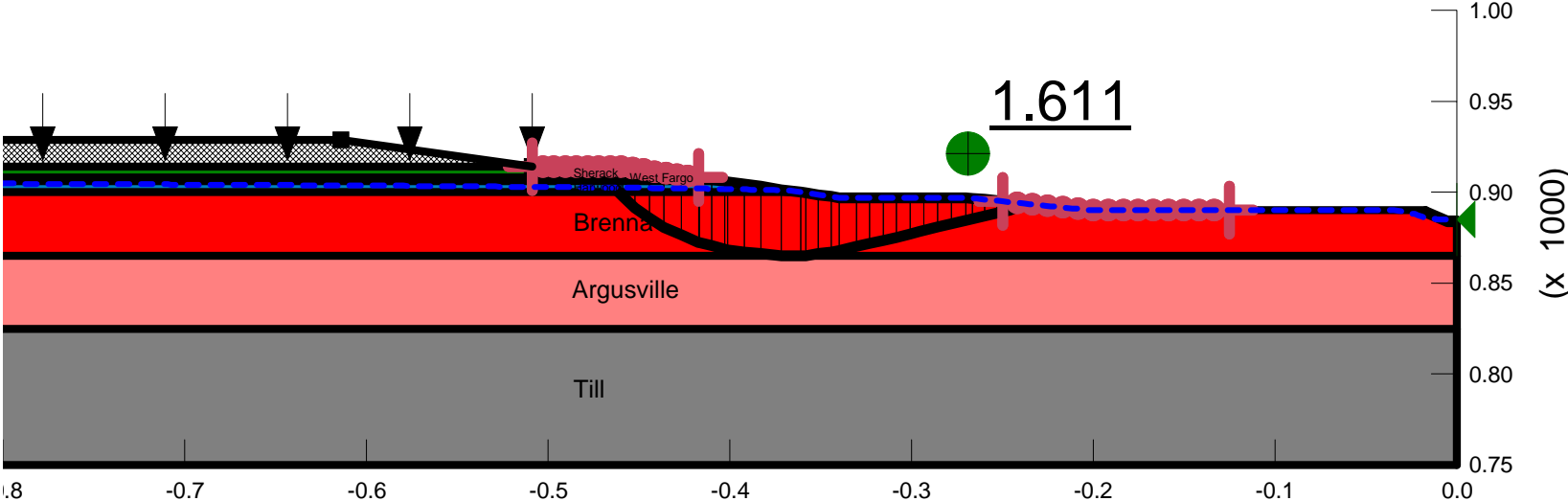
(A) Slope Stability

Soil Properties						
Name: Sherack	Model: Mohr-Coulomb	Unit Weight: 118 pcf	Cohesion: 0 pcf	Phi: 28 °	Phi-B: 0 °	
Name: West Fargo	Model: Mohr-Coulomb	Unit Weight: 123 pcf	Cohesion: 0 pcf	Phi: 34 °	Phi-B: 0 °	
Name: Hamwood	Model: Mohr-Coulomb	Unit Weight: 118 pcf	Cohesion: 0 pcf	Phi: 26 °	Phi-B: 0 °	
Name: Brenna	Model: Shear/Normal Fr.	Unit Weight: 104 pcf	Strength Function: Brenna	Phi-B: 0 °		
Name: Argusville	Model: Shear/Normal Fr.	Unit Weight: 116 pcf	Strength Function: Argusville	Phi-B: 0 °		
Name: Till	Model: Mohr-Coulomb	Unit Weight: 122 pcf	Cohesion: 0 pcf	Phi: 31 °	Phi-B: 0 °	
Name: Sand	Model: Mohr-Coulomb	Unit Weight: 125 pcf	Cohesion: 0 pcf	Phi: 32 °	Phi-B: 0 °	

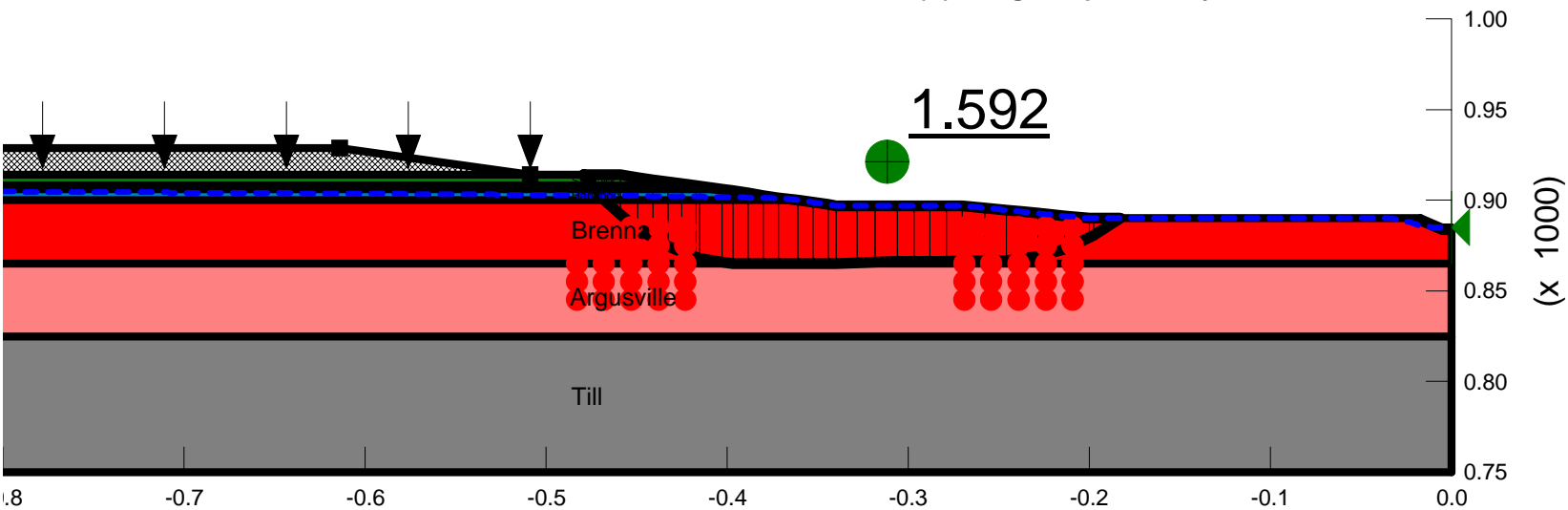


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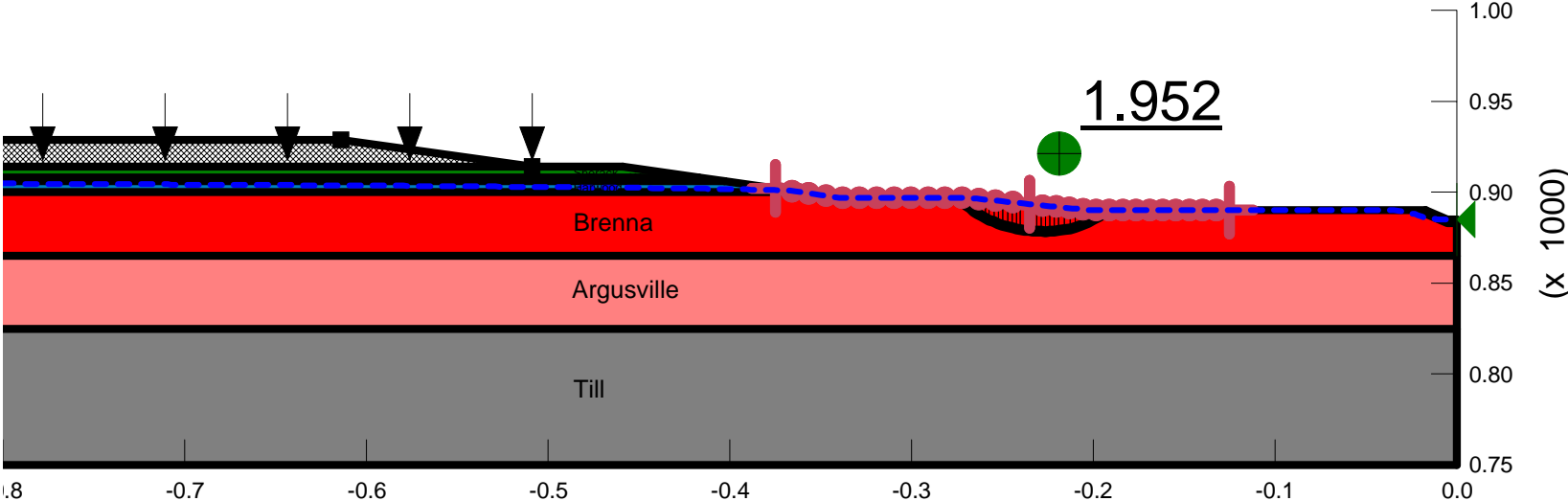
FMMFS: Phase 3, MN Diversion Section 6
FM_P3_MN_Div_Sect_06_Raise4FT_70.gsz
(A) Slope Stability



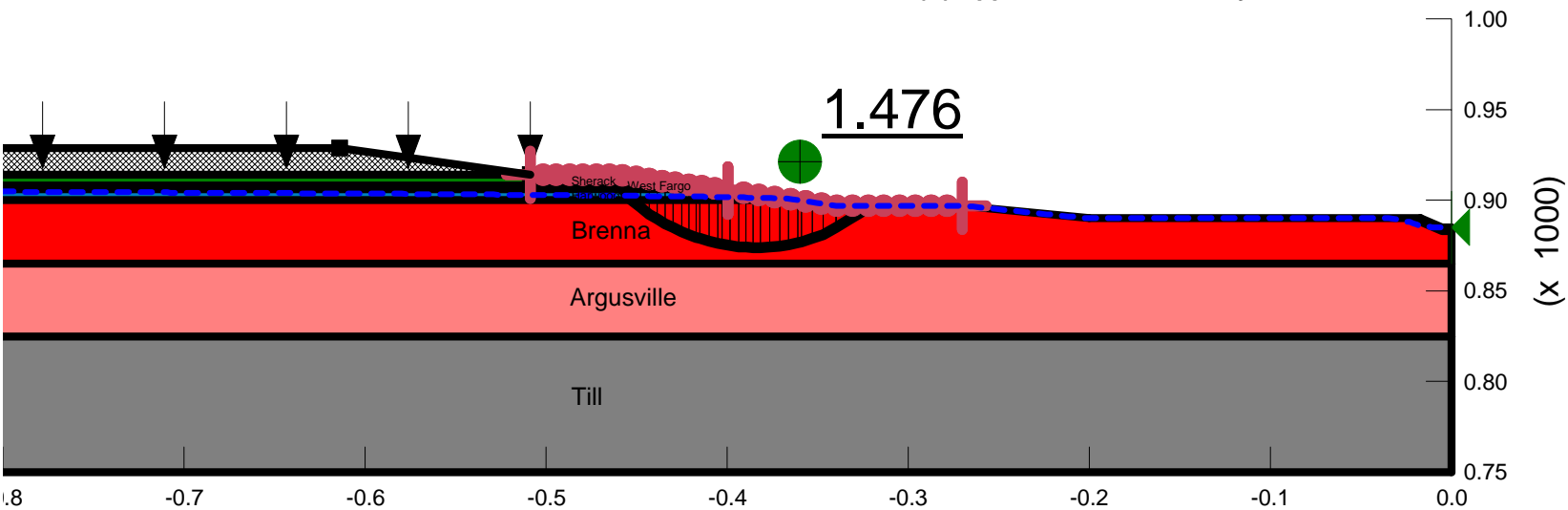
FMMFS: Phase 3, MN Diversion Section 6
FM_P3_MN_Div_Sect_06_Raise4FT_70.gsz
(B) Wedge Slope Stability



FMMFS: Phase 3, MN Diversion Section 6
FM_P3_MN_Div_Sect_06_Raise4FT_70.gsz
(C) Lower Localized Stability



FMMFS: Phase 3, MN Diversion Section 6
FM_P3_MN_Div_Sect_06_Raise4FT_70.gsz
(D) Upper Localized Stability



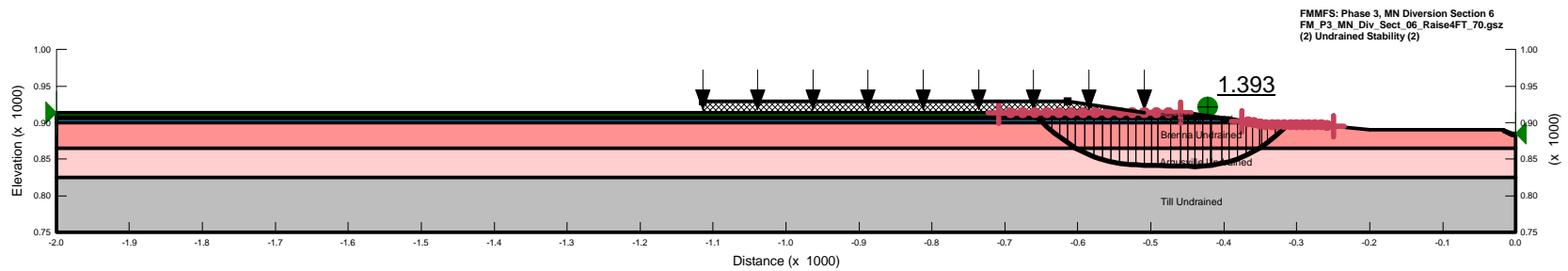
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Fargo-Moorhead Metro Feasibility Study Phase 3 Analysis MN Diversion Channel Stability Section 6

(2) Undrained Stability (2)

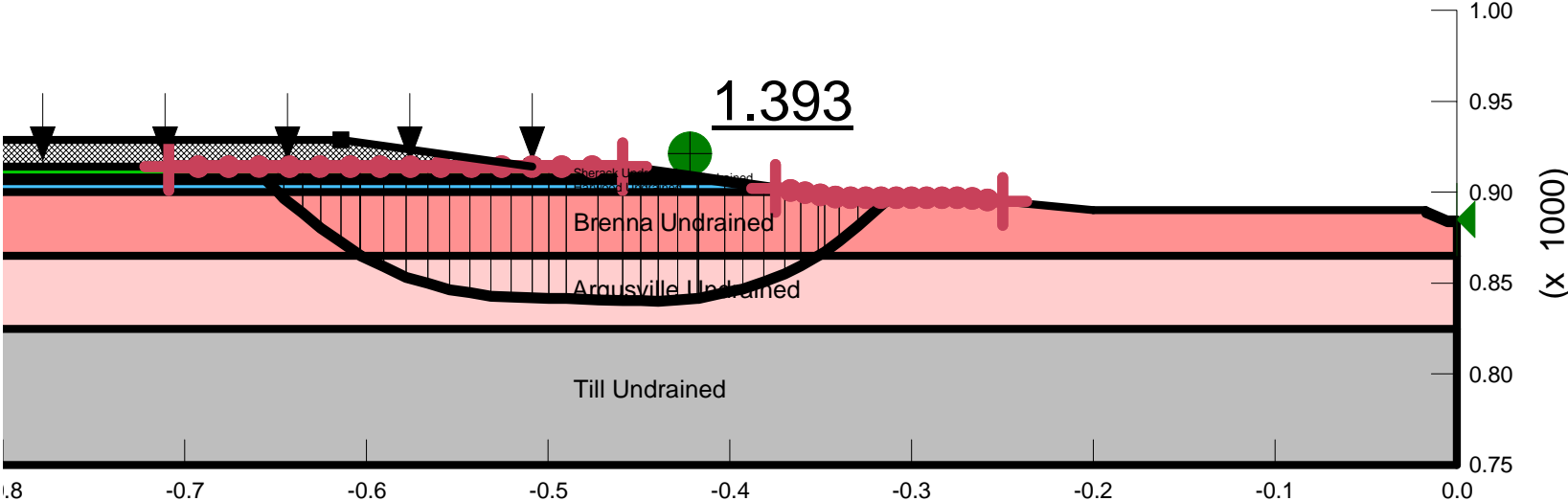
Soil Properties

Name: Sherack Undrained Model: Undrained (Phi=0) Unit Weight: 118 pcf Cohesion: 900 pcf
Name: West Fargo Undrained Model: Undrained (Phi=0) Unit Weight: 123 pcf Cohesion: 1900 pcf
Name: Hamwood Undrained Model: Undrained (Phi=0) Unit Weight: 118 pcf Cohesion: 1300 pcf
Name: Brenna Undrained Model: Undrained (Phi=0) Unit Weight: 134 pcf Cohesion: 525 pcf
Name: Argoville Undrained Model: S-Heavy Unit Weight: 106 pcf C-Top of Layer: 525 pcf C-Rate of Change: 10 pcf/ft Limiting C: 1025 pcf
Name: Till Undrained Model: Undrained (Phi=0) Unit Weight: 122 pcf Cohesion: 1900 pcf
Name: Sand Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion: 0 pcf Phi: 32° Phi/B: 0°



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FMMFS: Phase 3, MN Diversion Section 6
FM_P3_MN_Div_Sect_06_Raise4FT_70.gsz
(2) Undrained Stability (2)



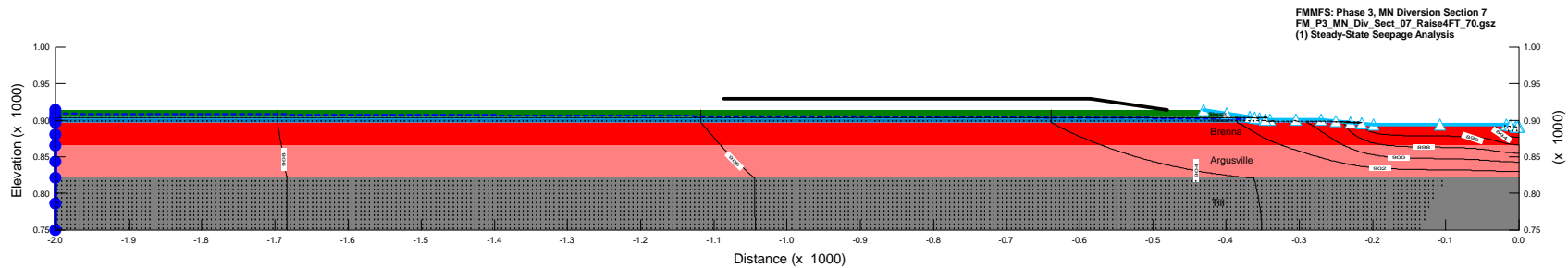
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Fargo-Moorhead Metro Feasibility Study Phase 3 Analysis MN Diversion Channel Stability Section 7

(1) Steady-State Seepage Analysis

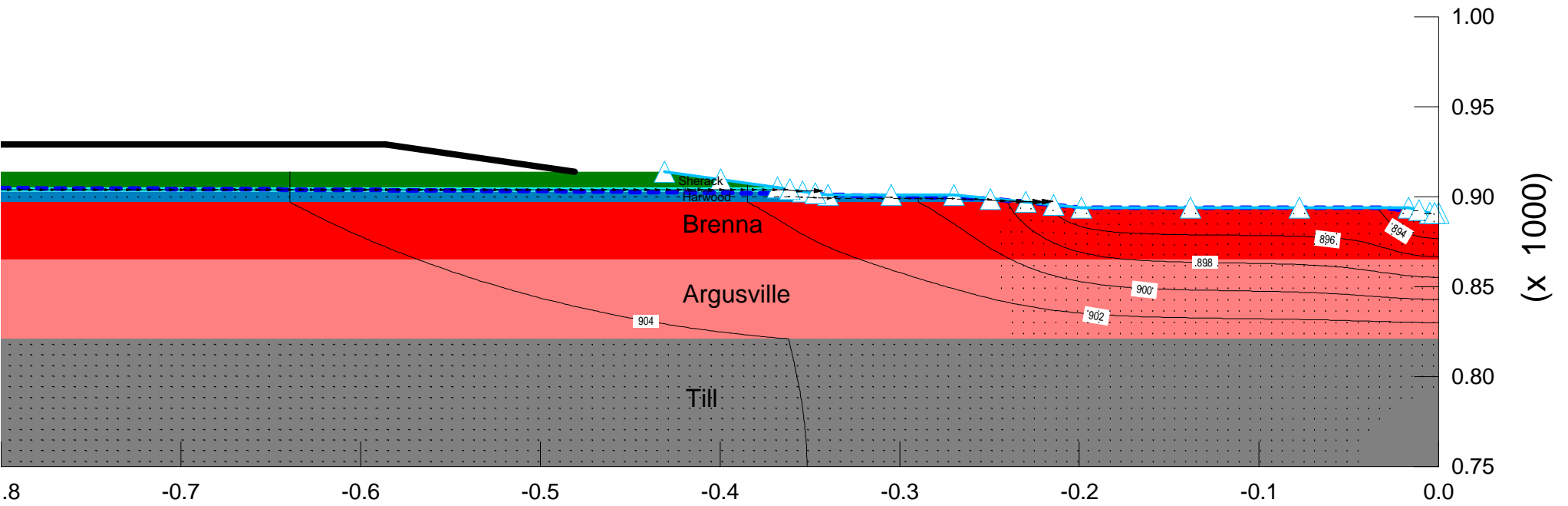
Soil Properties

Name: Sherack Model: Saturated / Unsaturated K-Function: Alluv/Sherack Vol. WC. Function: Alluv/Sherack K-Ratio: 1 K-Direction: 0°
Name: West Fargo Model: Saturated / Unsaturated K-Function: West Fargo Vol. WC. Function: West Fargo K-Ratio: 1 K-Direction: 0°
Name: Harwood Model: Saturated / Unsaturated K-Function: Harwood Vol. WC. Function: Harwood K-Ratio: 1 K-Direction: 0°
Name: Brenna Model: Saturated Only K-Sat: 0.00028 10days Volumetric Water Content: 0.23 100% Mu: 3e-005 psf K-Ratio: 1 K-Direction: 0°
Name: Argusville Model: Saturated Only K-Sat: 0.00028 10days Volumetric Water Content: 0.6 100% Mu: 3e-005 psf K-Ratio: 1 K-Direction: 0°
Name: Fill Model: Saturated Only K-Sat: 0.007 10days Volumetric Water Content: 0.45 100% Mu: 3e-005 psf K-Ratio: 0.25 K-Direction: 0°
Name: Sand Model: Saturated / Unsaturated K-Function: Sand Vol. WC. Function: Sand K-Ratio: 1 K-Direction: 0°



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Date: 8/16/2010

FMMFS: Phase 3, MN Diversion Section 7
FM_P3_MN_Div_Sect_07_Raise4FT_70.gsz
(1) Steady-State Seepage Analysis



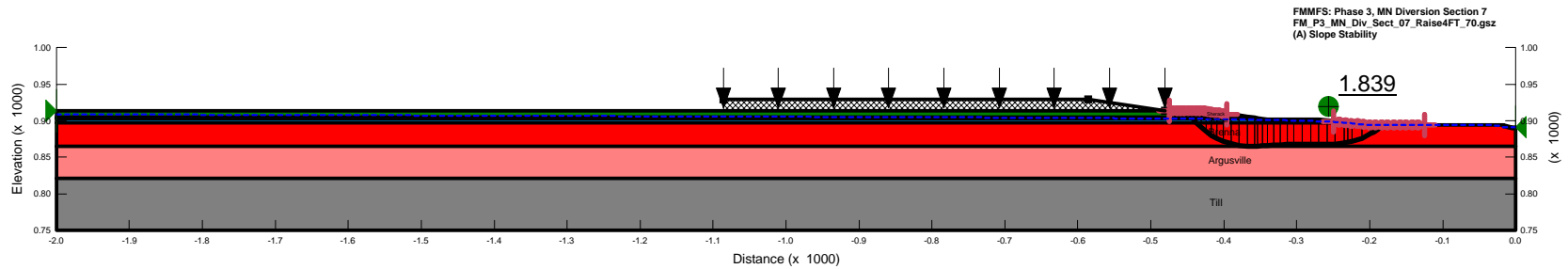
File Name: FM_P3_MN_Div_Sect_07_Raise4FT_70.gsz

Fargo-Moorhead Metro Feasibility Study Phase 3 Analysis MN Diversion Channel Stability Section 7

(A) Slope Stability

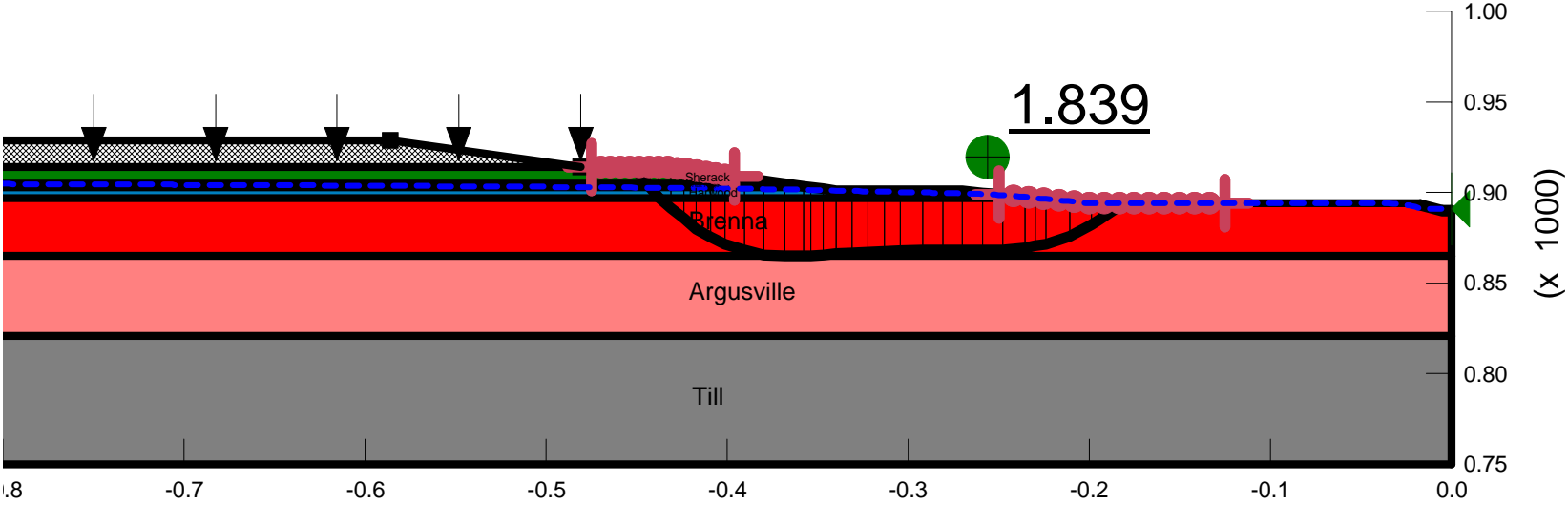
Soil Properties

Name: Sherack Model: Mohr-Coulomb Unit Weight: 118 pcf Cohesion: 0 pcf Phi: 28° PhiB: 0°
Name: West Fargo Model: Mohr-Coulomb Unit Weight: 123 pcf Cohesion: 0 pcf Phi: 34° PhiB: 0°
Name: Hamwood Model: Mohr-Coulomb Unit Weight: 118 pcf Cohesion: 0 pcf Phi: 26° PhiB: 0°
Name: Brenna Model: Shear/Normal Fr. Unit Weight: 104 pcf Strength Function: Brenna PhiB: 0°
Name: Argusville Model: Shear/Normal Fr. Unit Weight: 116 pcf Strength Function: Argusville PhiB: 0°
Name: Till Model: Mohr-Coulomb Unit Weight: 122 pcf Cohesion: 0 pcf Phi: 31° PhiB: 0°
Name: Sand Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion: 0 pcf Phi: 32° PhiB: 0°

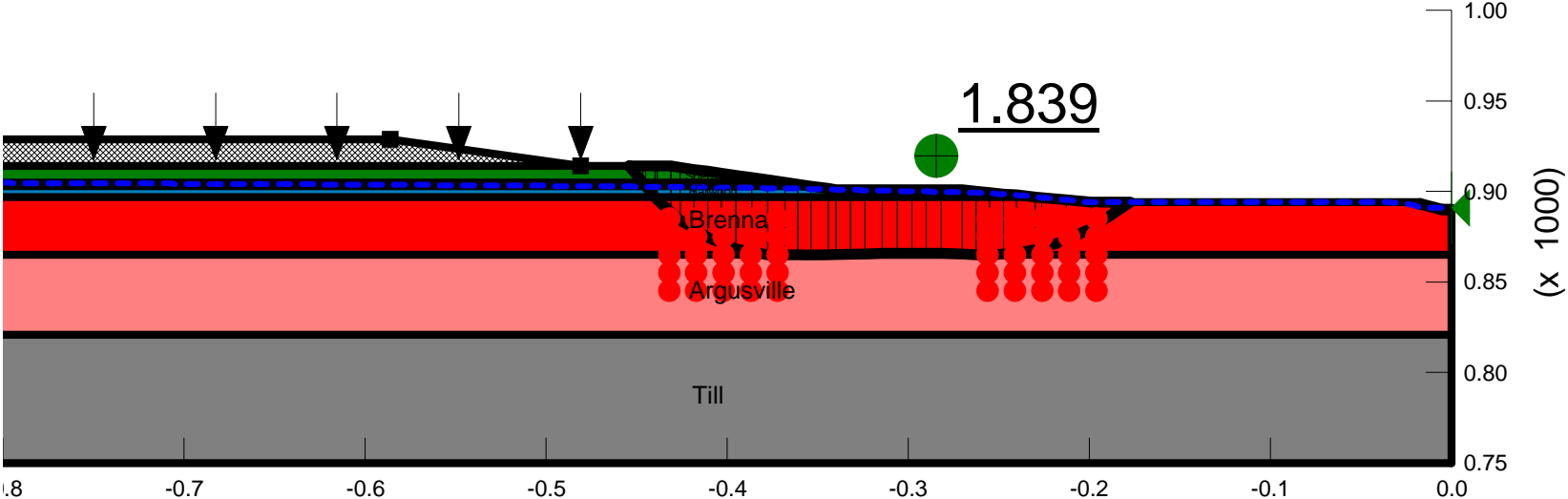


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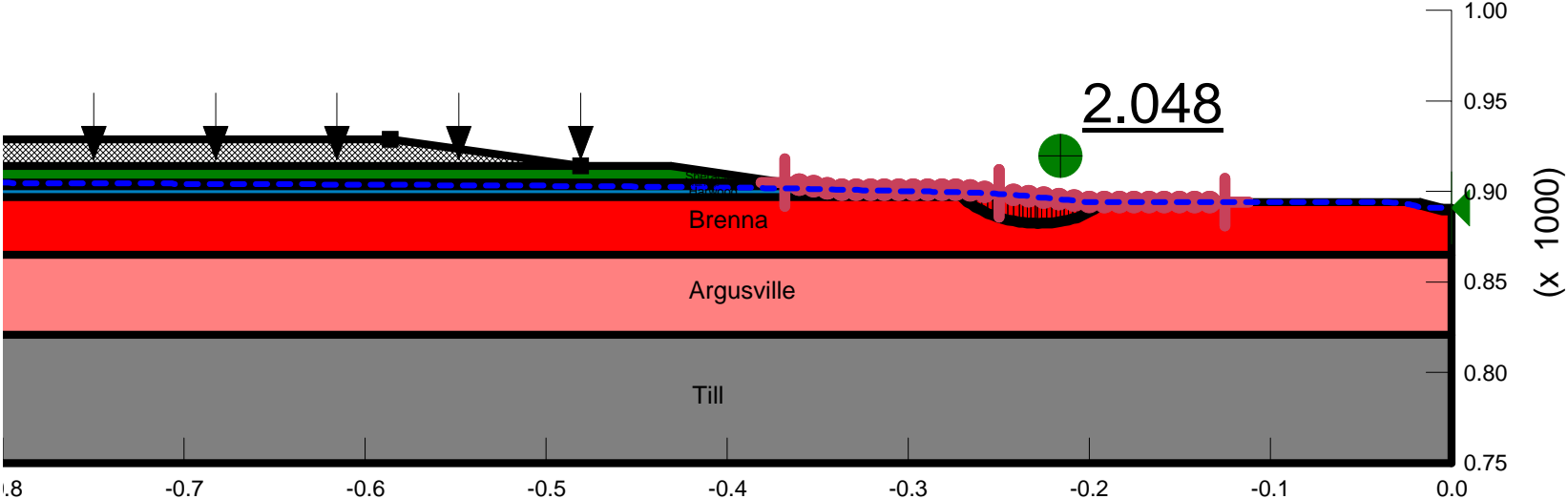
FMMFS: Phase 3, MN Diversion Section 7
FM_P3_MN_Div_Sect_07_Raise4FT_70.gsz
(A) Slope Stability



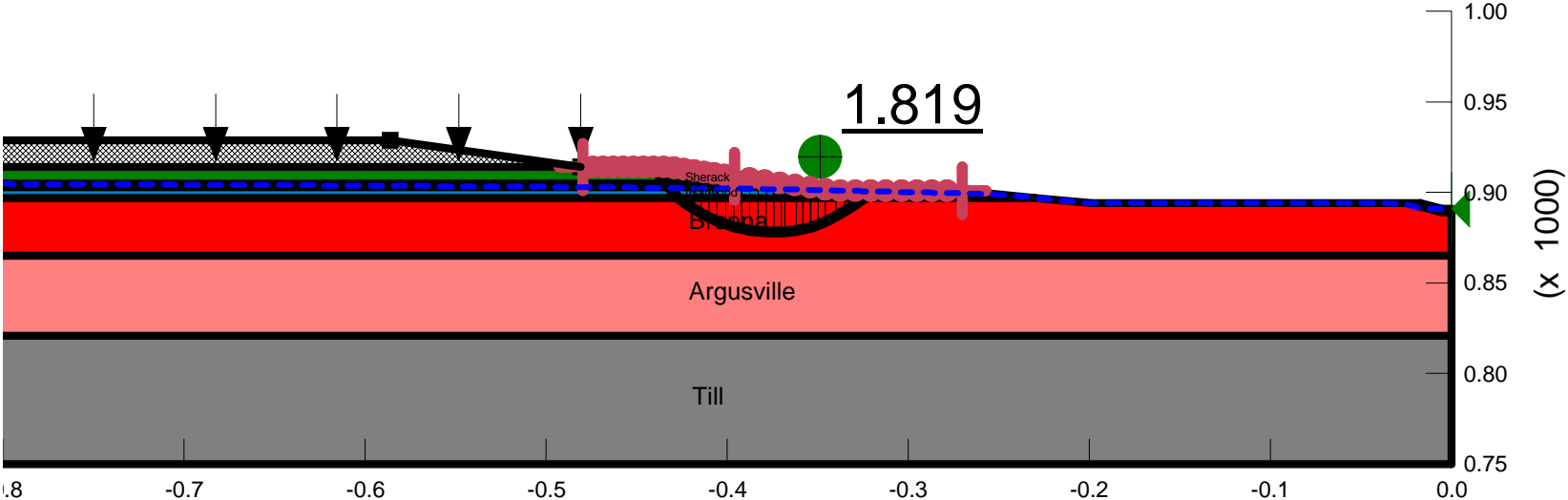
FMMFS: Phase 3, MN Diversion Section 7
FM_P3_MN_Div_Sect_07_Raise4FT_70.gsz
(B) Wedge Slope Stability



FMMFS: Phase 3, MN Diversion Section 7
FM_P3_MN_Div_Sect_07_Raise4FT_70.gsz
(C) Lower Localized Stability



FMMFS: Phase 3, MN Diversion Section 7
FM_P3_MN_Div_Sect_07_Raise4FT_70.gsz
(D) Upper Localized Stability



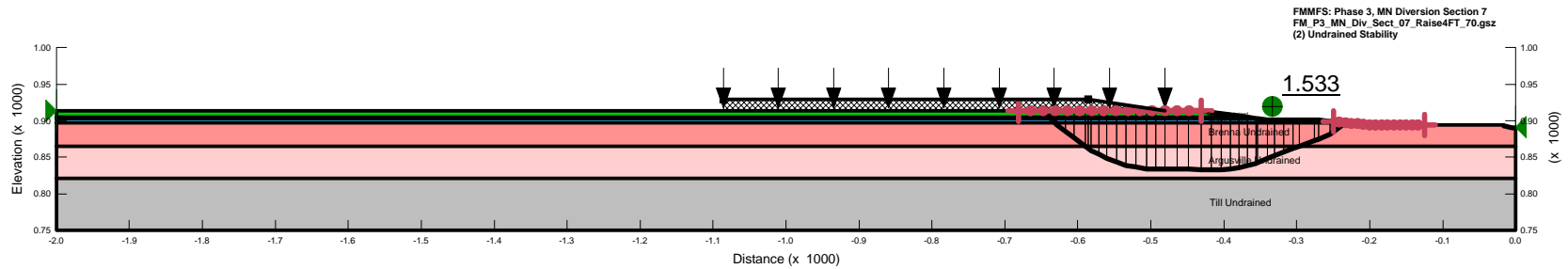
File Name: FM_P3_MN_Div_Sect_07_Raise4FT_70.gsz

Fargo-Moorhead Metro Feasibility Study Phase 3 Analysis MN Diversion Channel Stability Section 7

(2) Undrained Stability

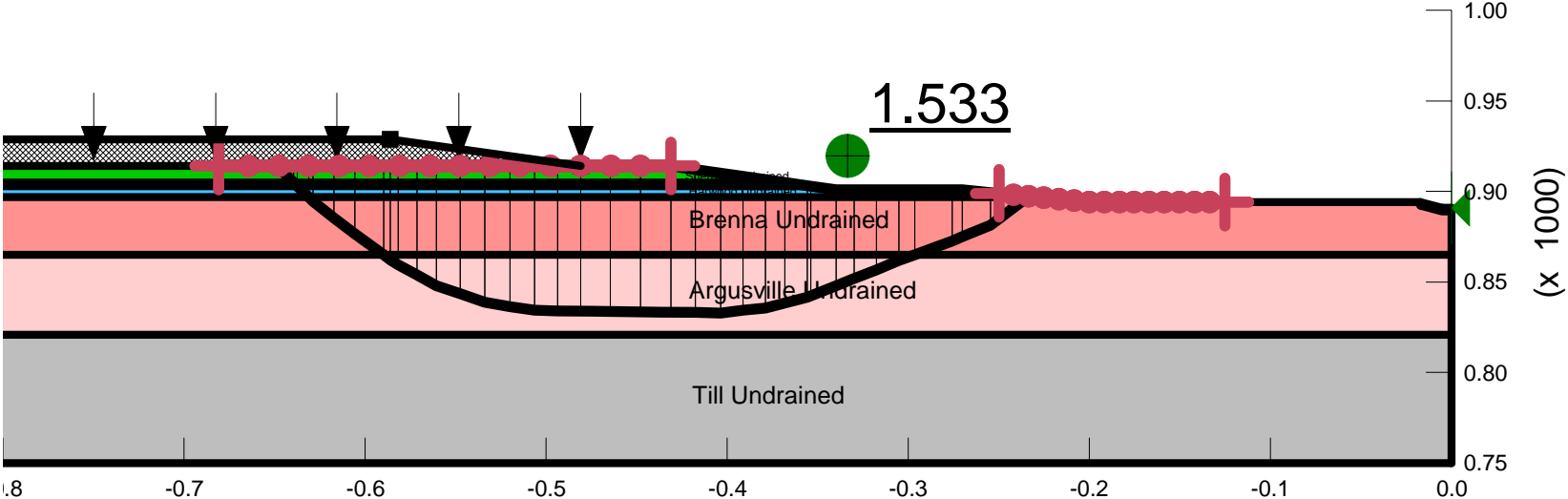
Soil Properties

Name: Sherack Undrained Model: Undrained (Phi=0) Unit Weight: 118 pcf Cohesion: 900 pcf
Name: West Fargo Undrained Model: Undrained (Phi=0) Unit Weight: 123 pcf Cohesion: 1900 pcf
Name: Hamwood Undrained Model: Undrained (Phi=0) Unit Weight: 118 pcf Cohesion: 1300 pcf
Name: Brenna Undrained Model: Undrained (Phi=0) Unit Weight: 134 pcf Cohesion: 525 pcf
Name: Argoville Undrained Model: S-4(heavy) Unit Weight: 106 pcf C-Top of Layer: 525 pcf C-Rate of Change: 10 pcf/ft Limiting C: 1025 pcf
Name: Till Undrained Model: Undrained (Phi=0) Unit Weight: 122 pcf Cohesion: 1900 pcf
Name: Sand Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion: 0 pcf Phi: 32° Phi/B: 0°



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FMMFS: Phase 3, MN Diversion Section 7
FM_P3_MN_Div_Sect_07_Raise4FT_70.gsz
(2) Undrained Stability



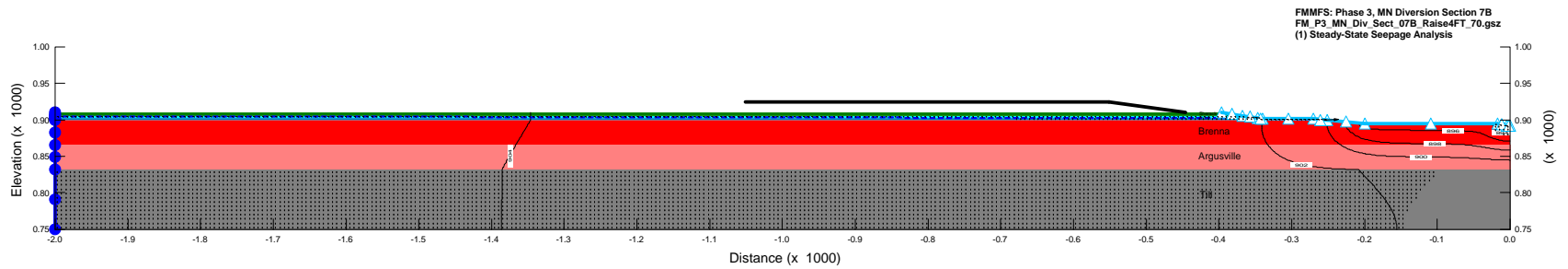
File Name: FM_P3_MN_Div_Sect_07B_Raise4FT_70.gsz

Fargo-Moorhead Metro Feasibility Study Phase 3 Analysis MN Diversion Channel Stability Section 7B

(1) Steady-State Seepage Analysis

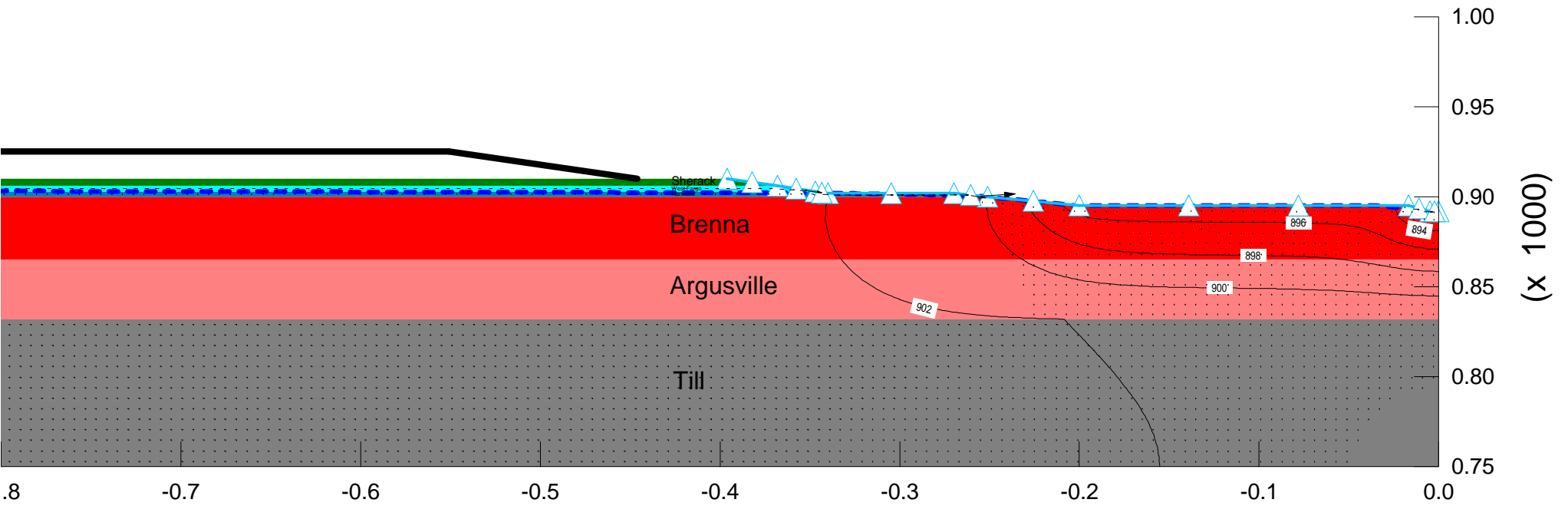
Soil Properties

Name: Sherack Model: Saturated / Unsaturated K-Function: Allow/Sherack Vol. WC. Function: Allow/Sherack K-Ratio: 1 K-Direction: 0°
Name: West Fargo Model: Saturated / Unsaturated K-Function: West Fargo Vol. WC. Function: West Fargo K-Ratio: 1 K-Direction: 0°
Name: Harwood Model: Saturated / Unsaturated K-Function: Harwood Vol. WC. Function: Harwood K-Ratio: 1 K-Direction: 0°
Name: Brenna Model: Saturated Only K-Sat: 0.00028 Days Volumetric Water Content: 0.03 80% Mu: 3e-005 psf K-Ratio: 1 K-Direction: 0°
Name: Argusville Model: Saturated Only K-Sat: 0.00028 Days Volumetric Water Content: 0.6 80% Mu: 3e-005 psf K-Ratio: 1 K-Direction: 0°
Name: Fill Model: Saturated Only K-Sat: 0.007 Days Volumetric Water Content: 0.45 80% Mu: 3e-005 psf K-Ratio: 0.25 K-Direction: 0°
Name: Sand Model: Saturated / Unsaturated K-Function: Sand Vol. WC. Function: Sand K-Ratio: 1 K-Direction: 0°



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**FMMFS: Phase 3, MN Diversion Section 7B
FM_P3_MN_Div_Sect_07B_Raise4FT_70.gsz
(1) Steady-State Seepage Analysis**



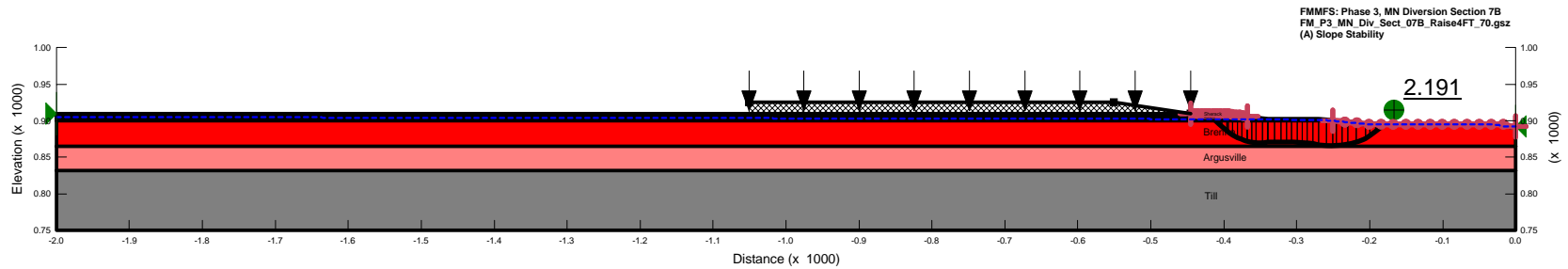
File Name: FM_P3_MN_Div_Sect_07B_Raise4FT_70.gsz

Fargo-Moorhead Metro Feasibility Study Phase 3 Analysis MN Diversion Channel Stability Section 7B

(A) Slope Stability

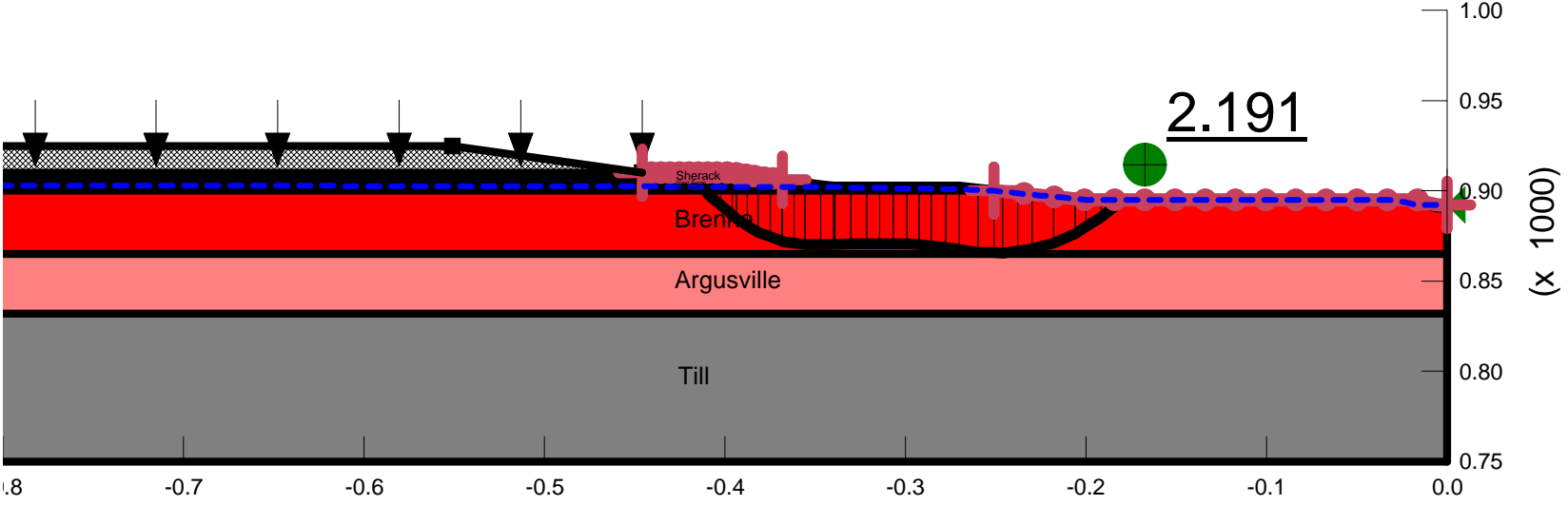
Soil Properties

Name: Sherack Model: Mohr-Coulomb Unit Weight: 118 pcf Cohesion: 0 pcf Phi: 28° Phi-B: 0°
Name: West Fargo Model: Mohr-Coulomb Unit Weight: 123 pcf Cohesion: 0 pcf Phi: 34° Phi-B: 0°
Name: Hamwood Model: Mohr-Coulomb Unit Weight: 118 pcf Cohesion: 0 pcf Phi: 26° Phi-B: 0°
Name: Brenna Model: Shear/Normal Fr. Unit Weight: 104 pcf Strength Function: Brenna Phi-B: 0°
Name: Argusville Model: Shear/Normal Fr. Unit Weight: 116 pcf Strength Function: Argusville Phi-B: 0°
Name: Till Model: Mohr-Coulomb Unit Weight: 122 pcf Cohesion: 0 pcf Phi: 31° Phi-B: 0°
Name: Sand Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion: 0 pcf Phi: 32° Phi-B: 0°

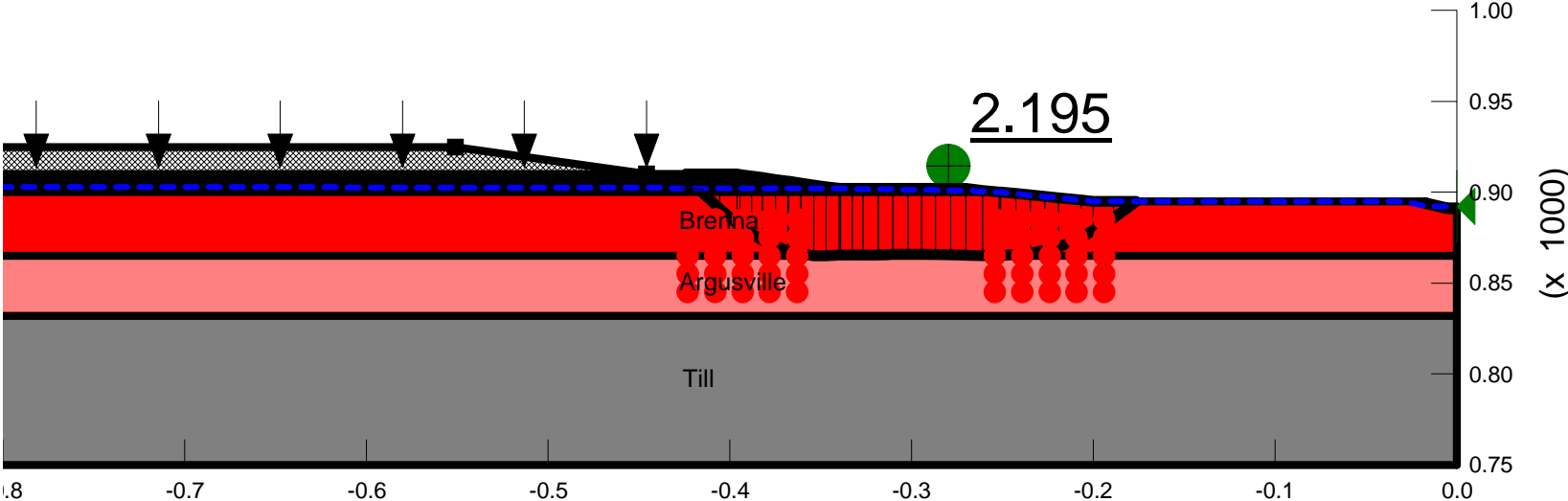


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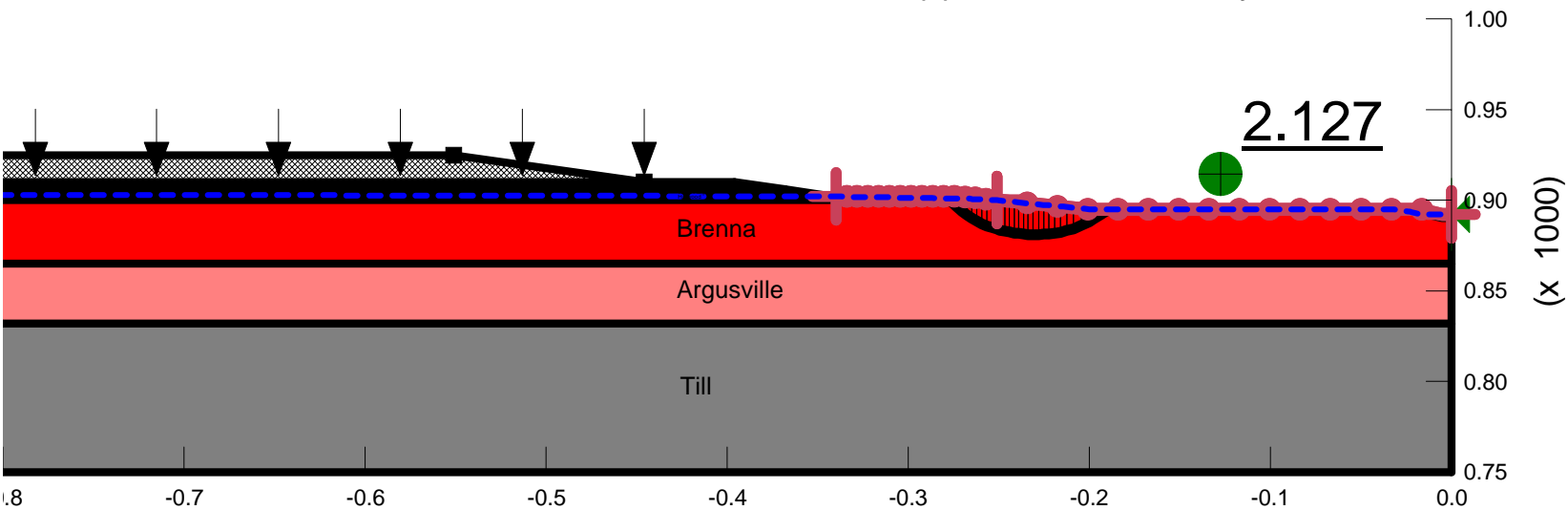
FMMFS: Phase 3, MN Diversion Section 7B
FM_P3_MN_Div_Sect_07B_Raise4FT_70.gsz
(A) Slope Stability



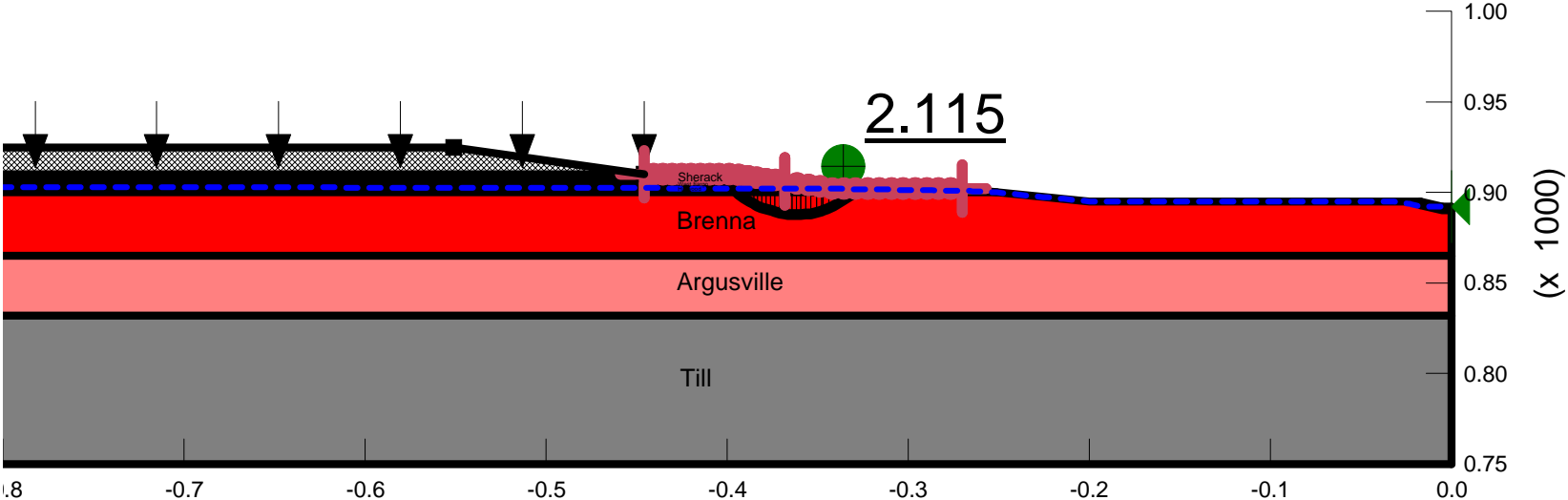
FMMFS: Phase 3, MN Diversion Section 7B
FM_P3_MN_Div_Sect_07B_Raise4FT_70.gsz
(B) Wedge Slope Stability



FMMFS: Phase 3, MN Diversion Section 7B
FM_P3_MN_Div_Sect_07B_Raise4FT_70.gsz
(C) Lower Localized Stability



FMMFS: Phase 3, MN Diversion Section 7B
FM_P3_MN_Div_Sect_07B_Raise4FT_70.gsz
(D) Upper Localized Stability



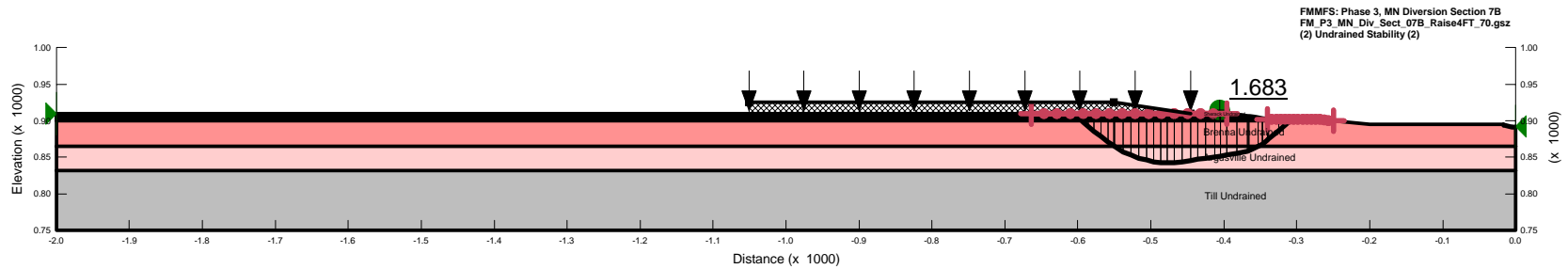
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Fargo-Moorhead Metro Feasibility Study Phase 3 Analysis MN Diversion Channel Stability Section 7B

(2) Undrained Stability (2)

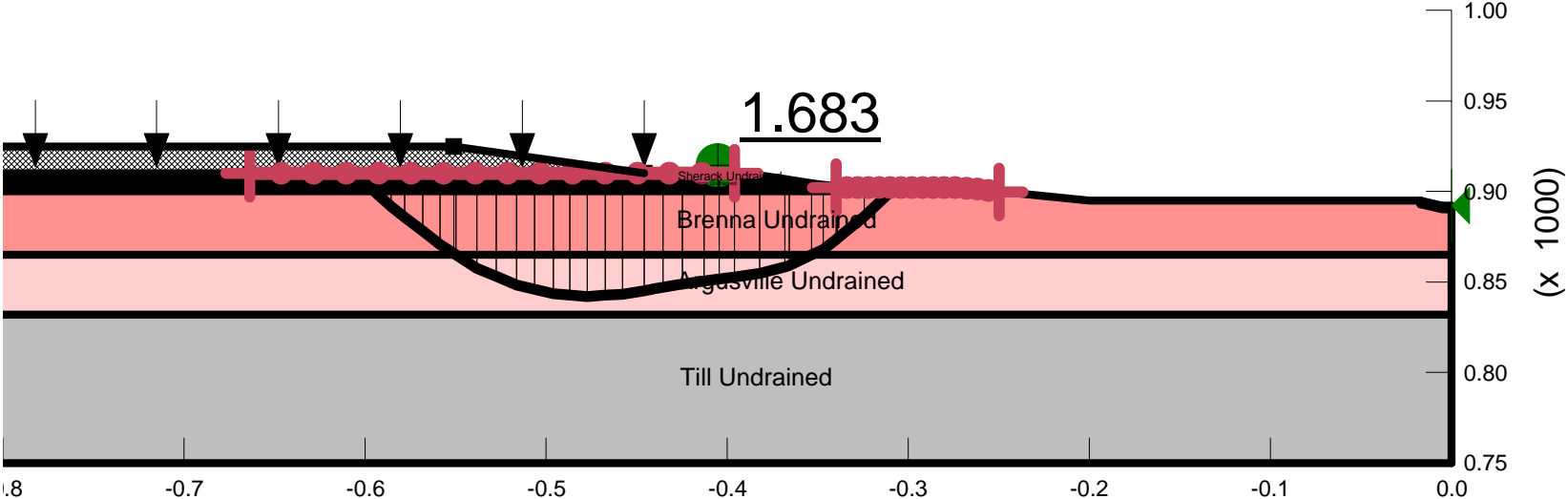
Soil Properties

Name: Sherack Undrained Model: Undrained (Phi=0) Unit Weight: 118 pcf Cohesion: 900 pcf
Name: West Fargo Undrained Model: Undrained (Phi=0) Unit Weight: 123 pcf Cohesion: 1900 pcf
Name: Hamwood Undrained Model: Undrained (Phi=0) Unit Weight: 118 pcf Cohesion: 1300 pcf
Name: Brenna Undrained Model: Undrained (Phi=0) Unit Weight: 134 pcf Cohesion: 525 pcf
Name: Argoville Undrained Model: S-4(heavy) Unit Weight: 106 pcf C-Top of Layer: 525 pcf C-Rate of Change: 10 pcf/ft Limiting C: 1025 pcf
Name: Till Undrained Model: Undrained (Phi=0) Unit Weight: 122 pcf Cohesion: 1900 pcf
Name: Sand Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion: 0 pcf Phi: 32° Phi/B: 0°

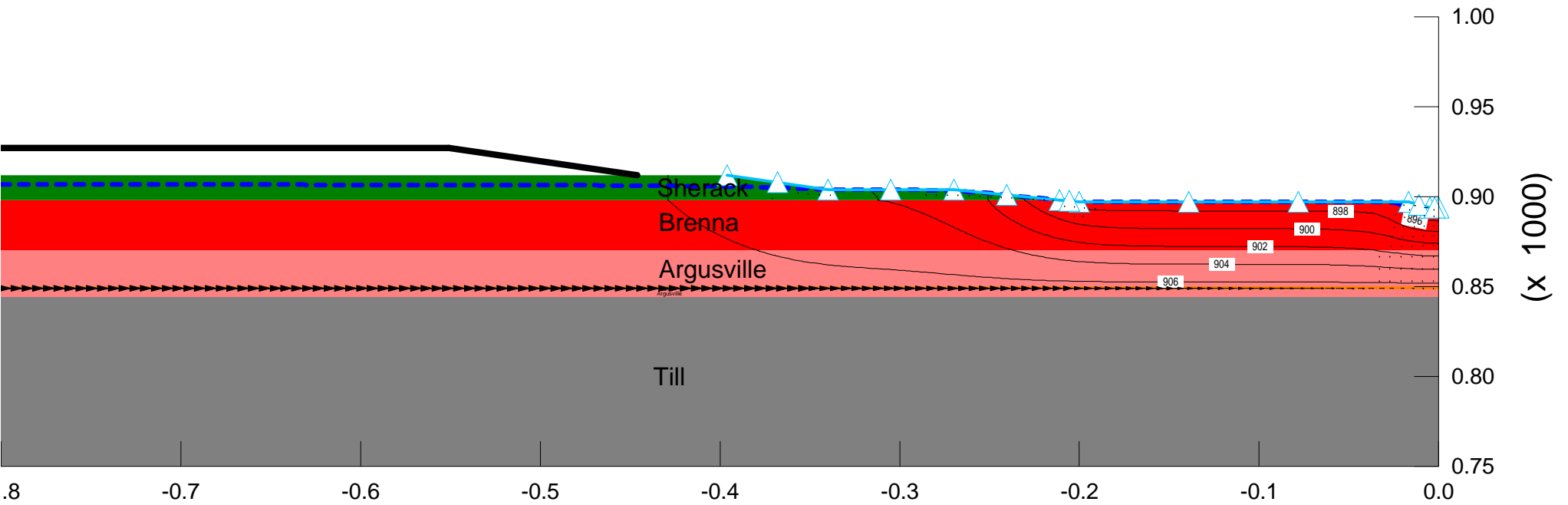


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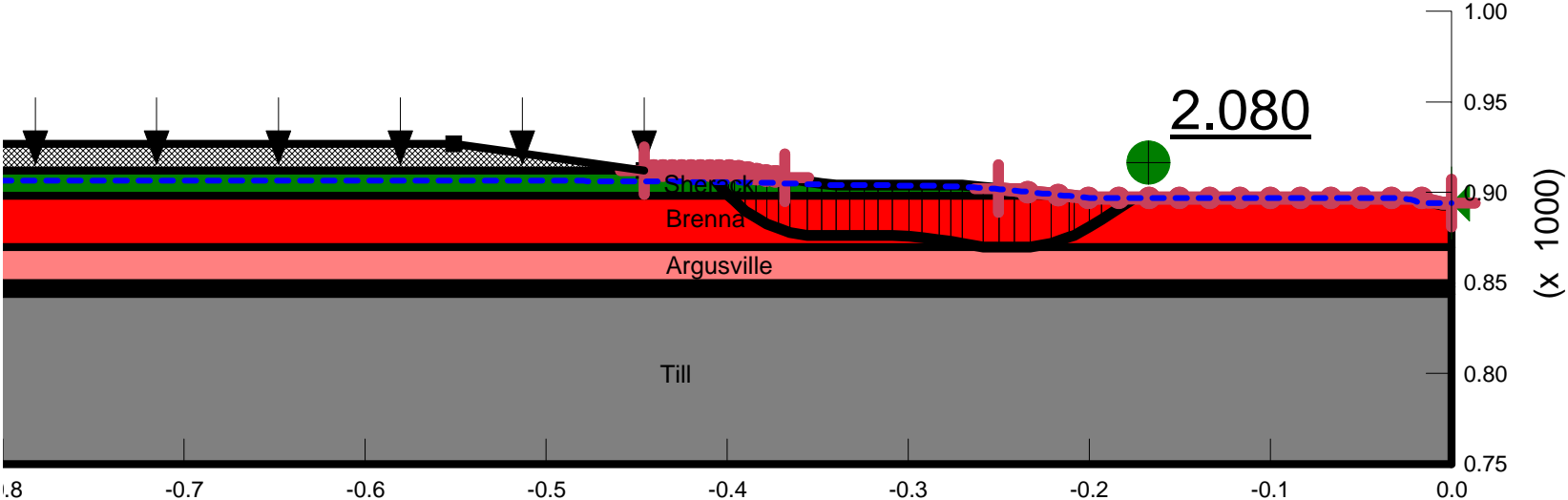
FMMFS: Phase 3, MN Diversion Section 7B
FM_P3_MN_Div_Sect_07B_Raise4FT_70.gsz
(2) Undrained Stability (2)



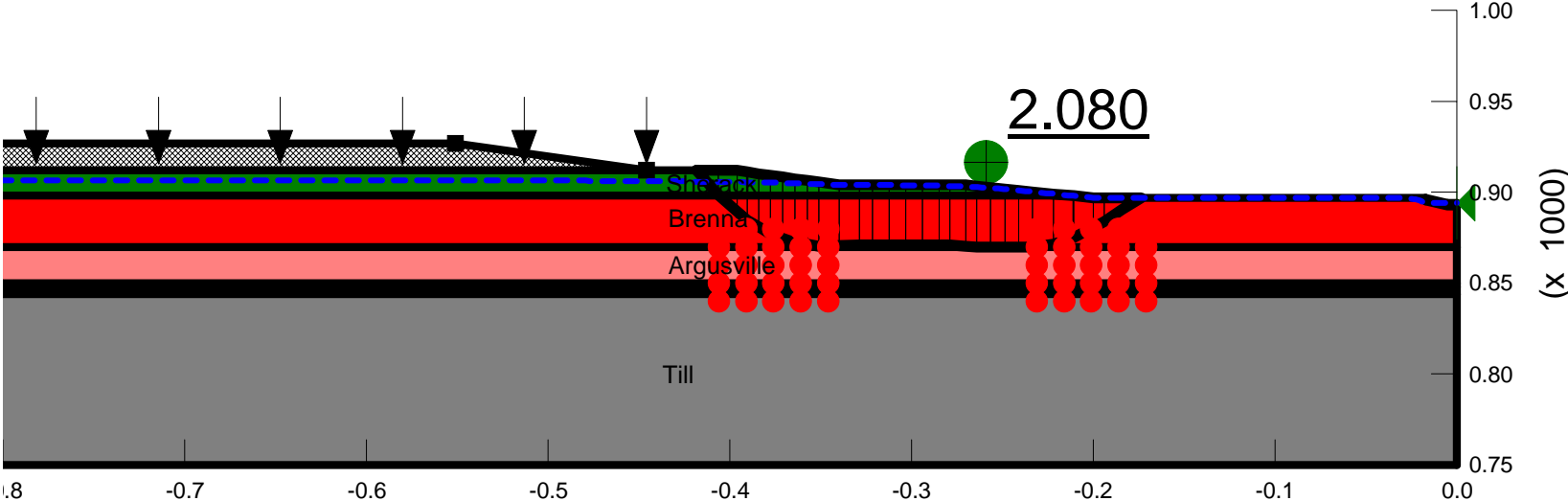
FMMFS: Phase 3, MN Diversion Section 8
FM_P3_MN_Div_Sect_08_Raise4FT_70.gsz
(1) Steady-State Seepage Analysis



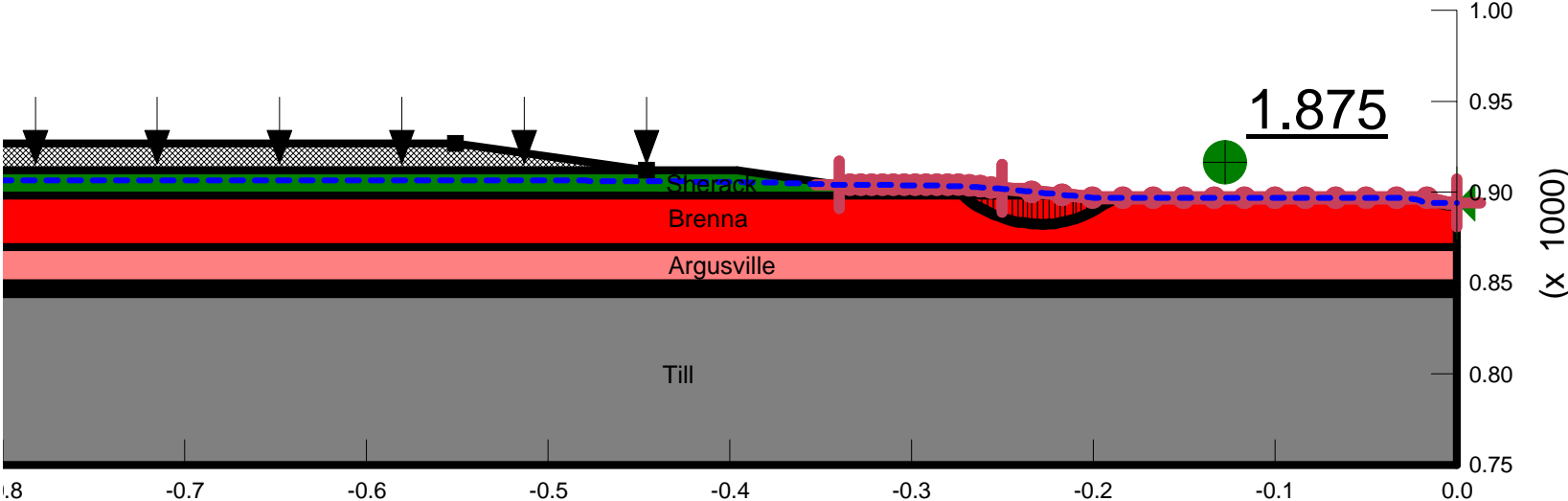
FMMFS: Phase 3, MN Diversion Section 8
FM_P3_MN_Div_Sect_08_Raise4FT_70.gsz
(A) Slope Stability



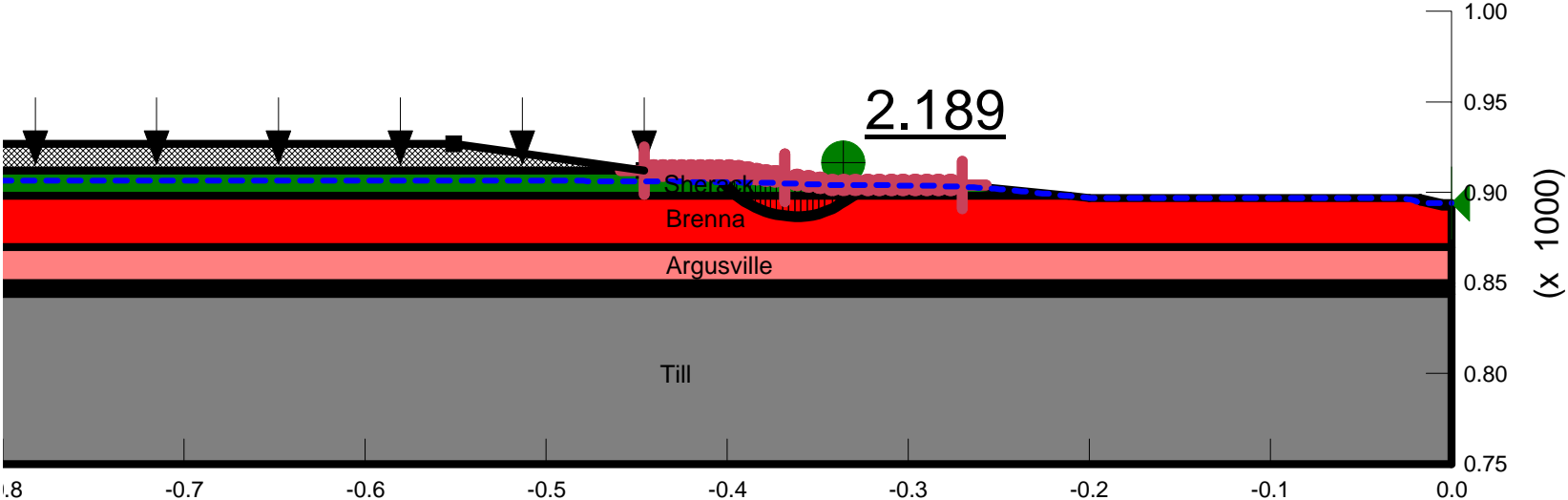
FMMFS: Phase 3, MN Diversion Section 8
FM_P3_MN_Div_Sect_08_Raise4FT_70.gsz
(B) Wedge Slope Stability



FMMFS: Phase 3, MN Diversion Section 8
FM_P3_MN_Div_Sect_08_Raise4FT_70.gsz
(C) Lower Localized Stability



FMMFS: Phase 3, MN Diversion Section 8
FM_P3_MN_Div_Sect_08_Raise4FT_70.gsz
(D) Upper Localized Stability



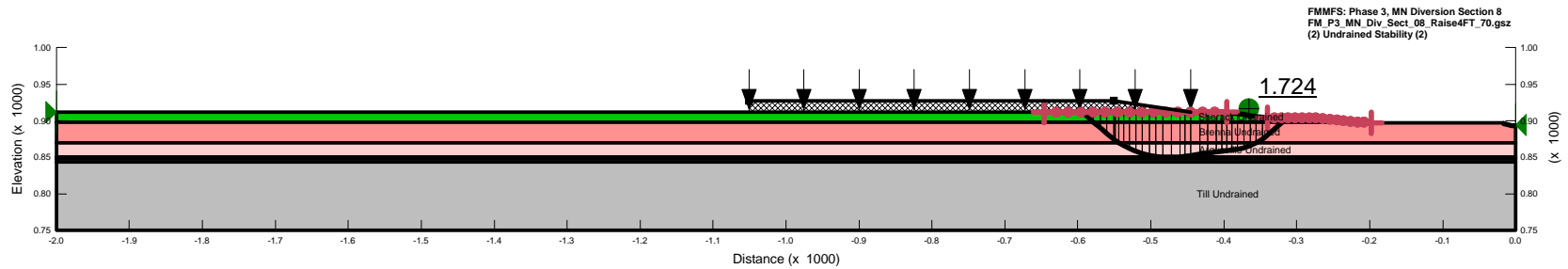
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Fargo-Moorhead Metro Feasibility Study Phase 3 Analysis MN Diversion Channel Stability Section 8

(2) Undrained Stability (2)

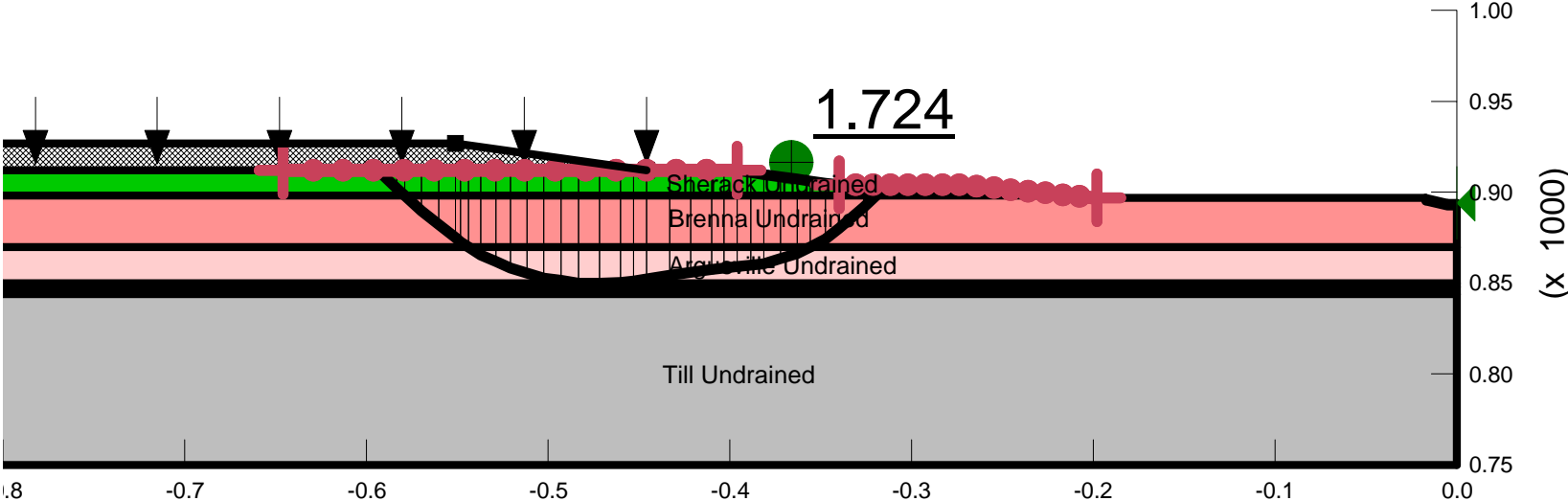
Soil Properties

Name: Sherack Undrained Model: Undrained (Phi=0) Unit Weight: 118 pcf Cohesion: 900 pcf
Name: Brerina Undrained Model: Undrained (Phi=0) Unit Weight: 104 pcf Cohesion: 525 pcf
Name: Argovilla Undrained Model: S-Heavy Unit Weight: 106 pcf C-Top of Layer: 525 pcf C-Rate of Change: 10 pcf/ft Limiting C: 1025 pcf
Name: Till Undrained Model: Undrained (Phi=0) Unit Weight: 122 pcf Cohesion: 1800 pcf
Name: Sand Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion: 0 pcf Phi: 32° Phi/B: 0°



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FMMFS: Phase 3, MN Diversion Section 8
FM_P3_MN_Div_Sect_08_Raise4FT_70.gsz
(2) Undrained Stability (2)



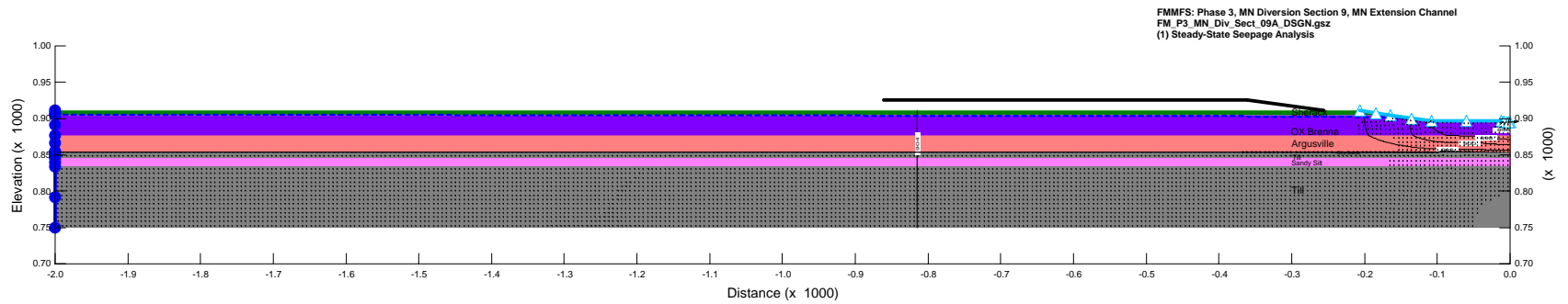
File Name: FM_P3_MN_Div_Sect_09A_DSGN.gsz

Fargo-Moorhead Metro Feasibility Study Phase 3 Analysis MN Diversion Channel Stability Section 9A

(1) Steady-State Seepage Analysis

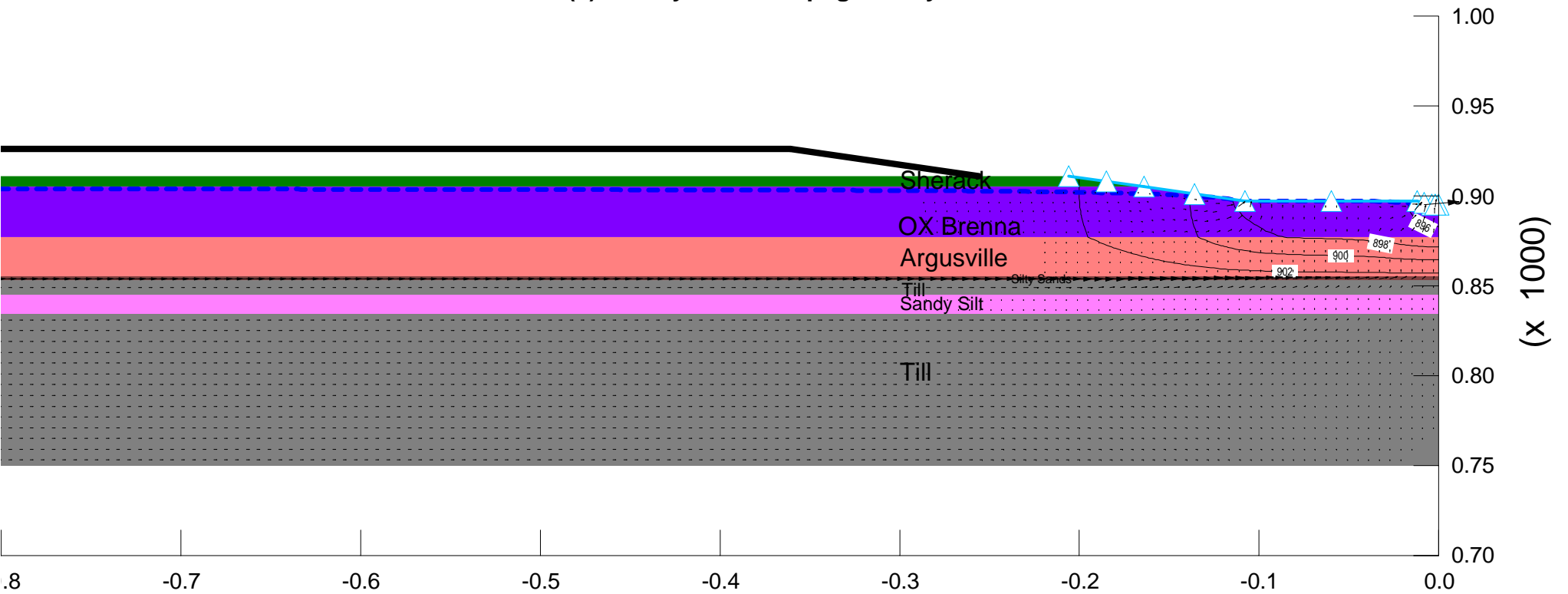
Soil Properties

Name: Sherack	Model: Saturated / Unsaturated	K-Function: Alluv/Sherack	Vol. WC. Function: Alluv/Sherack	K-Ratio: 1	K-Direction: 0°	
Name: Argusville	Model: Saturated Only	K-Sat: 0.0028 ft/days	Volumetric Water Content: 0.6 ft ³ /ft ³	Mv: 3e-005 psf	K-Ratio: 1	K-Direction: 0°
Name: Till	Model: Saturated Only	K-Sat: 0.057 ft/days	Volumetric Water Content: 0.45 ft ³ /ft ³	Mv: 3e-006 psf	K-Ratio: 0.25	K-Direction: 0°
Name: Sand	Model: Saturated / Unsaturated	K-Function: Sand	Vol. WC. Function: Sand	K-Ratio: 1	K-Direction: 0°	
Name: OX Brenna	Model: Saturated / Unsaturated	K-Function: OX Brenna	Vol. WC. Function: OX Brenna	K-Ratio: 1	K-Direction: 0°	
Name: Silty Sand	Model: Saturated Only	K-Sat: 0.26 ft/days	Volumetric Water Content: 0.4 ft ³ /ft ³	Mv: 3e-006 psf	K-Ratio: 1	K-Direction: 0°
Name: Silty Silt	Model: Saturated Only	K-Sat: 0.0028 ft/days	Volumetric Water Content: 0.4 ft ³ /ft ³	Mv: 3e-006 psf	K-Ratio: 1	K-Direction: 0°



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FMMFS: Phase 3, MN Diversion Section 9, MN Extension Channel
 FM_P3_MN_Div_Sect_09A_DSGN.gsz
 (1) Steady-State Seepage Analysis



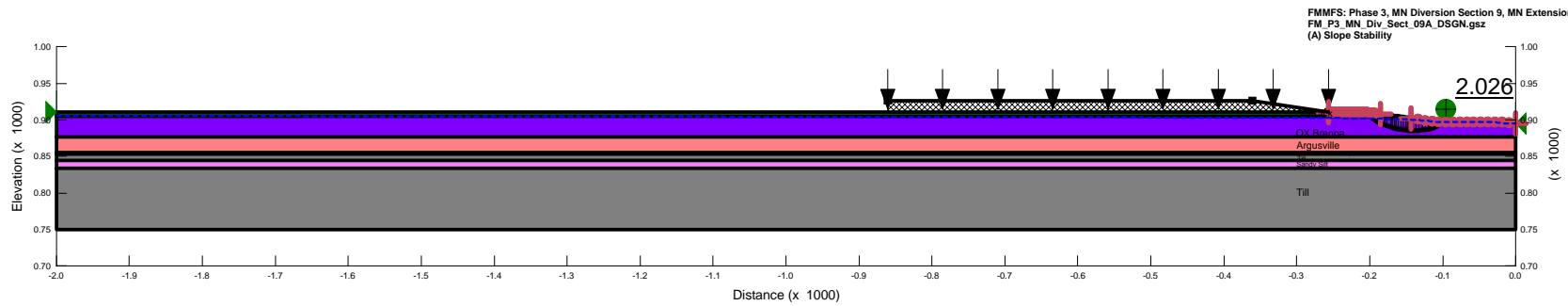
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Fargo-Moorhead Metro Feasibility Study Phase 3 Analysis MN Diversion Channel Stability Section 9A

(A) Slope Stability

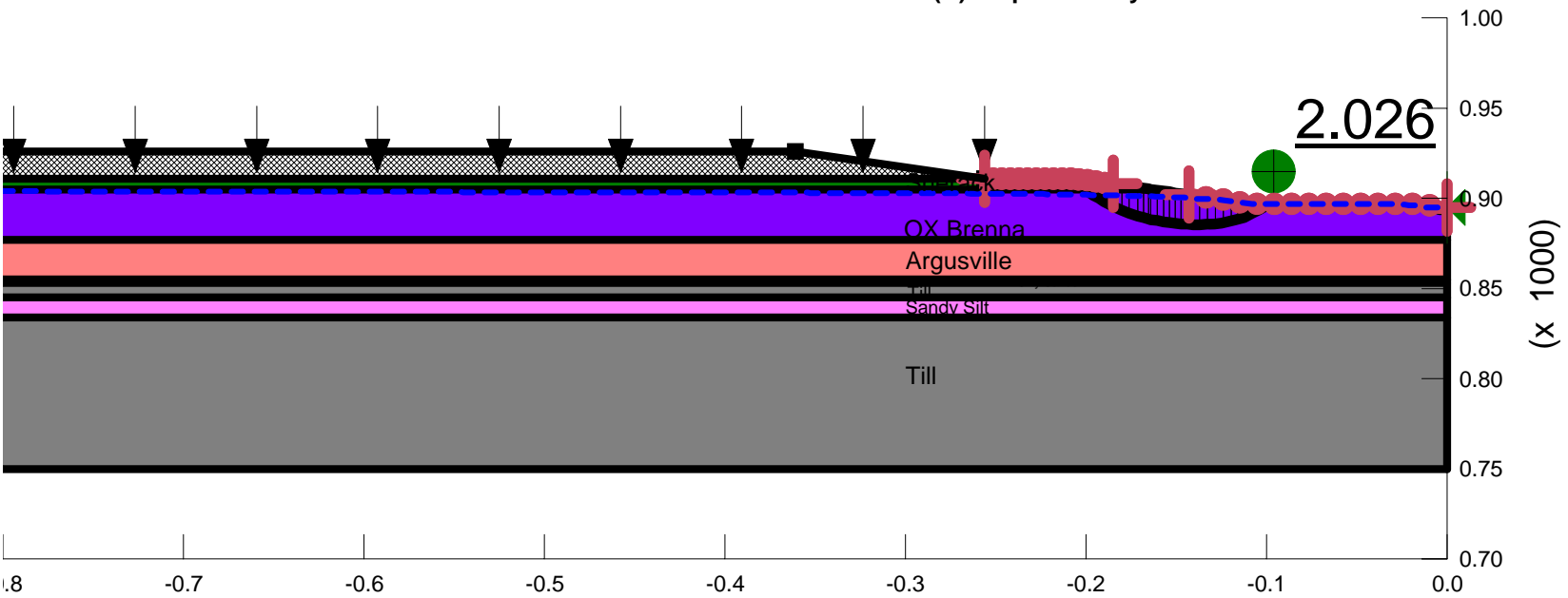
Soil Properties

Name: Sharack	Model: Mohr-Coulomb	Unit Weight: 118 pcf	Cohesion: 0 pcf	Phi: 28°	Phi-B: 0°
Name: Argusville	Model: ShearNormal Fr.	Unit Weight: 106 pcf	Strength Function: Argusville	Phi-B: 0°	
Name: Till	Model: Mohr-Coulomb	Unit Weight: 122 pcf	Cohesion: 0 pcf	Phi: 31°	Phi-B: 0°
Name: Sand	Model: Mohr-Coulomb	Unit Weight: 125 pcf	Cohesion: 0 pcf	Phi: 32°	Phi-B: 0°
Name: OX Breina	Model: ShearNormal Fr.	Unit Weight: 111 pcf	Strength Function: OX Breina	Phi-B: 0°	
Name: Silty Sands	Model: Mohr-Coulomb	Unit Weight: 125 pcf	Cohesion: 0 pcf	Phi: 30°	Phi-B: 0°
Name: Sandy Silt	Model: Mohr-Coulomb	Unit Weight: 119 pcf	Cohesion: 0 pcf	Phi: 26°	Phi-B: 0°

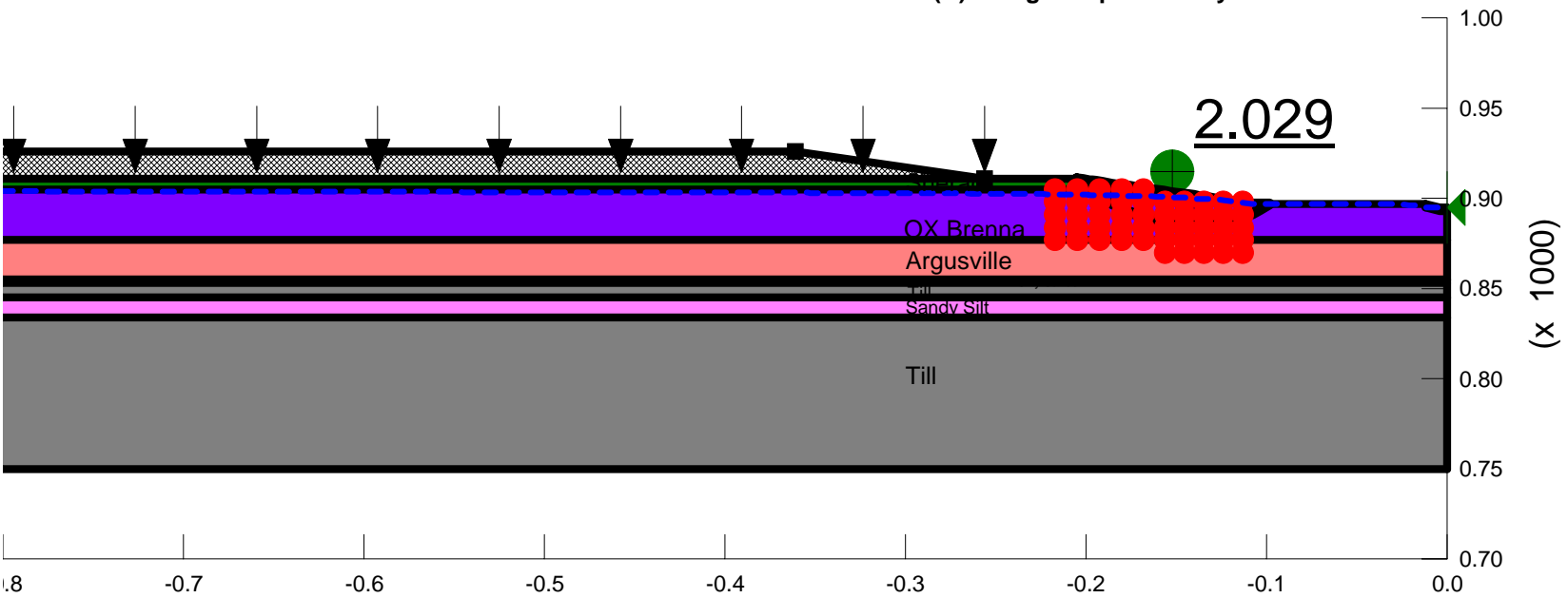


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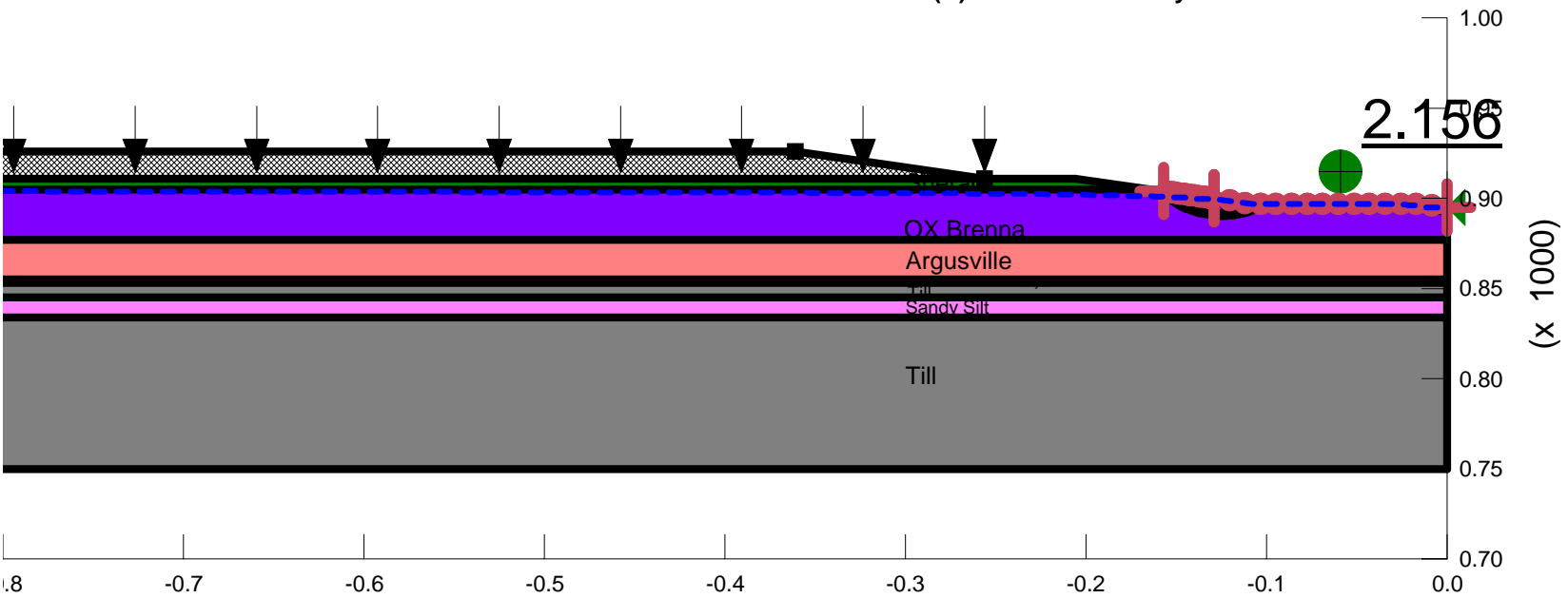
FMMFS: Phase 3, MN Diversion Section 9, MN Extension Channel
FM_P3_MN_Div_Sect_09A_DSGN.gsz
(A) Slope Stability



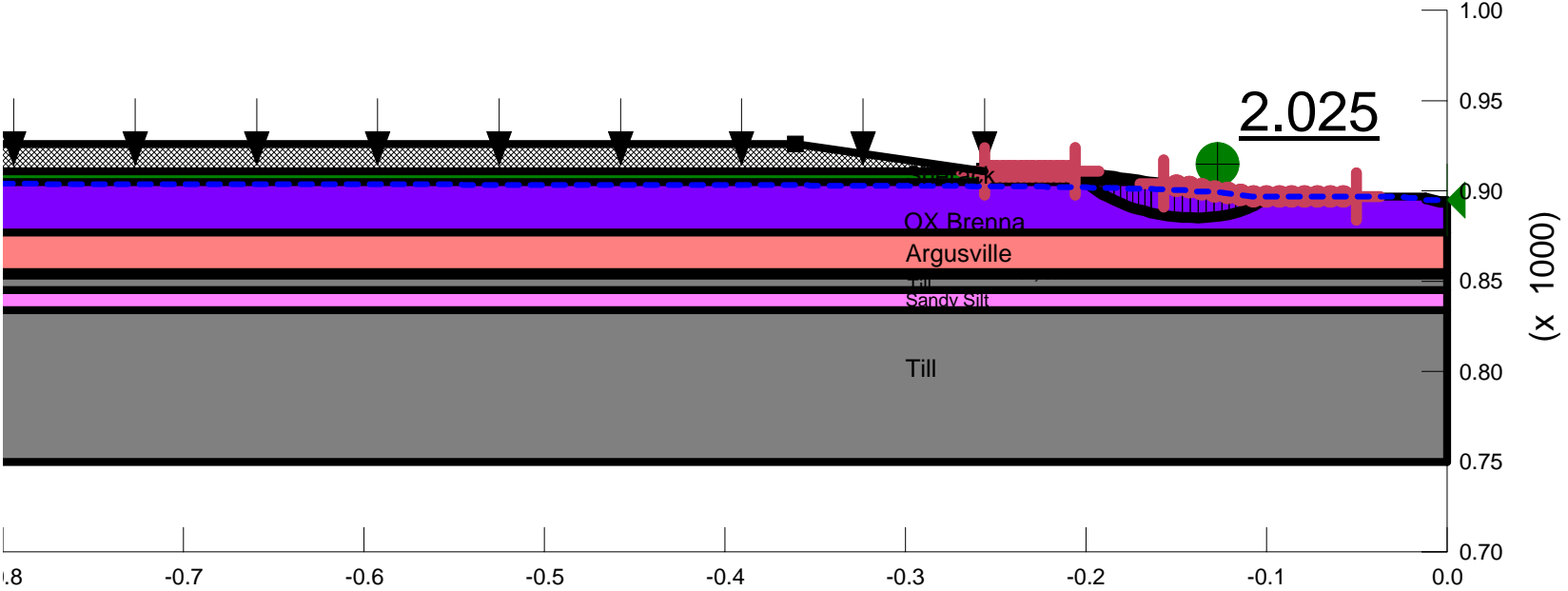
FMMFS: Phase 3, MN Diversion Section 9, MN Extension Channel
 FM_P3_MN_Div_Sect_09A_DSGN.gsz
 (B) Wedge Slope Stability



FMMFS: Phase 3, MN Diversion Section 9, MN Extension Channel
 FM_P3_MN_Div_Sect_09A_DSGN.gsz
 (C) Localized Stability



FMMFS: Phase 3, MN Diversion Section 9, MN Extension Channel
FM_P3_MN_Div_Sect_09A_DSGN.gsz
(D) Localized Stability



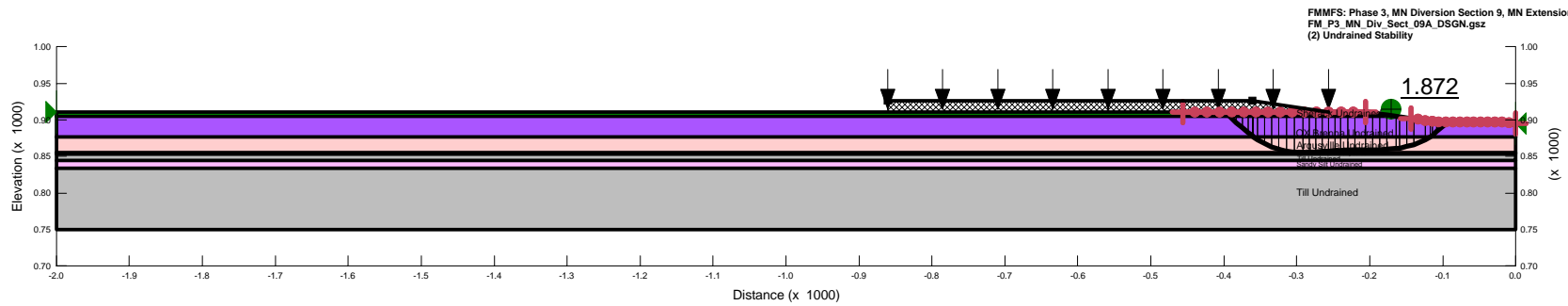
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Fargo-Moorhead Metro Feasibility Study Phase 3 Analysis MN Diversion Channel Stability Section 9A

(2) Undrained Stability

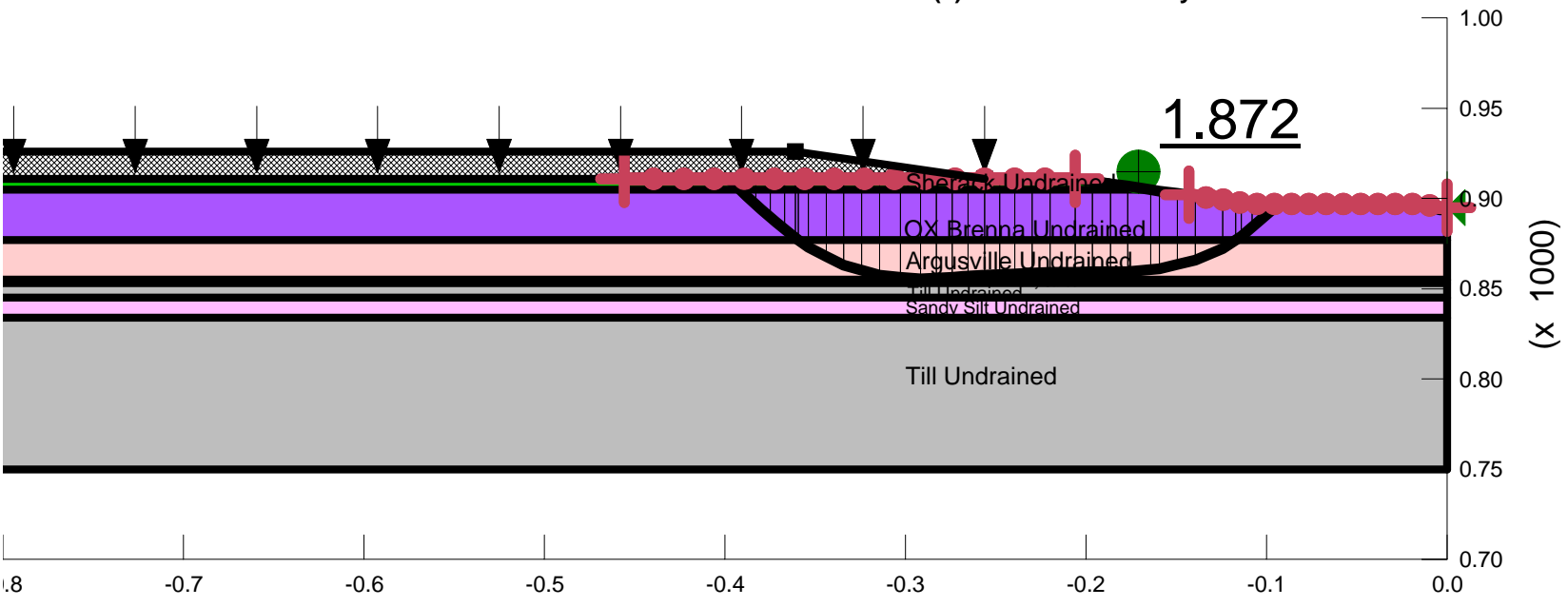
Soil Properties

Name: Sherack Undrained Model: Undrained (Phi=0) Unit Weight: 118 pcf Cohesion: 900 pcf
Name: Argoville Undrained Model: S-(depth) Unit Weight: 106 pcf C-Top of Layer: 625 pcf C-Rate of Change: 10 psf/ft Limiting C: 1025 pcf
Name: Till Undrained Model: Undrained (Phi=0) Unit Weight: 122 pcf Cohesion: 1800 pcf
Name: Sand Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion: 0 pcf Phi: 32° Phi-B: 0°
Name: Silty Sand Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion: 0 pcf Phi: 30° Phi-B: 0°
Name: Ox. Brnna Undrained Model: Undrained (Phi=0) Unit Weight: 111 pcf Cohesion: 900 pcf
Name: Sandy Sil. Undrained Model: Undrained (Phi=0) Unit Weight: 119 pcf Cohesion: 1200 pcf



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FMMFS: Phase 3, MN Diversion Section 9, MN Extension Channel
 FM_P3_MN_Div_Sect_09A_DSGN.gsz
 (2) Undrained Stability



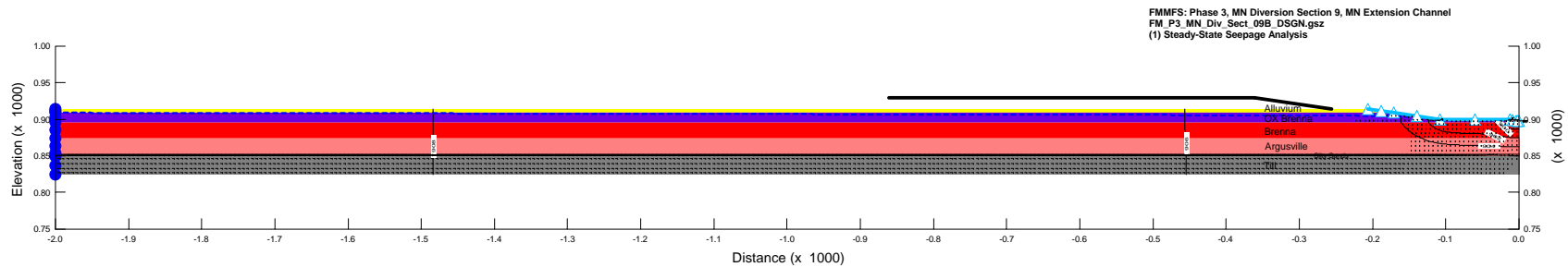
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Fargo-Moorhead Metro Feasibility Study Phase 3 Analysis MN Diversion Channel Stability Section 9B

(1) Steady-State Seepage Analysis

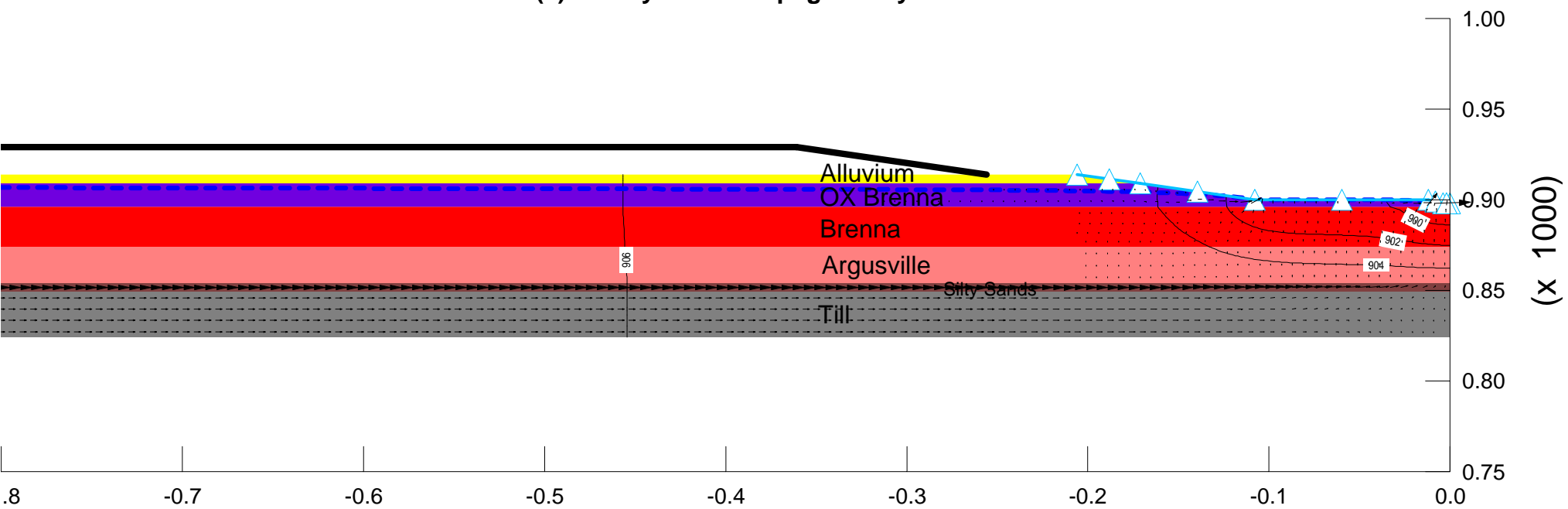
Soil Properties

Name: Brenna Model: Saturated Only K-Sat: 0.00028 ft/days Volumetric Water Content: 0.63 ft³/ft³ Mr: 3e-005 psf K-Ratio: 1 K-Direction: 0°
Name: Argusville Model: Saturated Only K-Sat: 0.00028 ft/days Volumetric Water Content: 0.6 ft³/ft³ Mr: 3e-005 psf K-Ratio: 1 K-Direction: 0°
Name: Fill Model: Saturated Only K-Sat: 0.057 ft/days Volumetric Water Content: 0.45 ft³/ft³ Mr: 3e-005 psf K-Ratio: 0.25 K-Direction: 0°
Name: Sand Model: Saturated/Unsat. K-Function: Sand Vol. WC. Function: Sand K-Ratio: 1 K-Direction: 0°
Name: OX Brenna Model: Saturated/Unsat. K-Function: OX Brenna Vol. WC. Function: OX Brenna K-Ratio: 1 K-Direction: 0°
Name: Silty Sands Model: Saturated Only K-Sat: 0.26 ft/days Volumetric Water Content: 0.4 ft³/ft³ Mr: 3e-005 psf K-Ratio: 1 K-Direction: 0°
Name: Alluvium Model: Saturated/Unsat. K-Function: Alluv/Sherack Vol. WC. Function: Alluv/Sherack K-Ratio: 1 K-Direction: 0°



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Date: 8/16/2010

**FMMFS: Phase 3, MN Diversion Section 9, MN Extension Channel
 FM_P3_MN_Div_Sect_09B_DSGN.gsz
 (1) Steady-State Seepage Analysis**



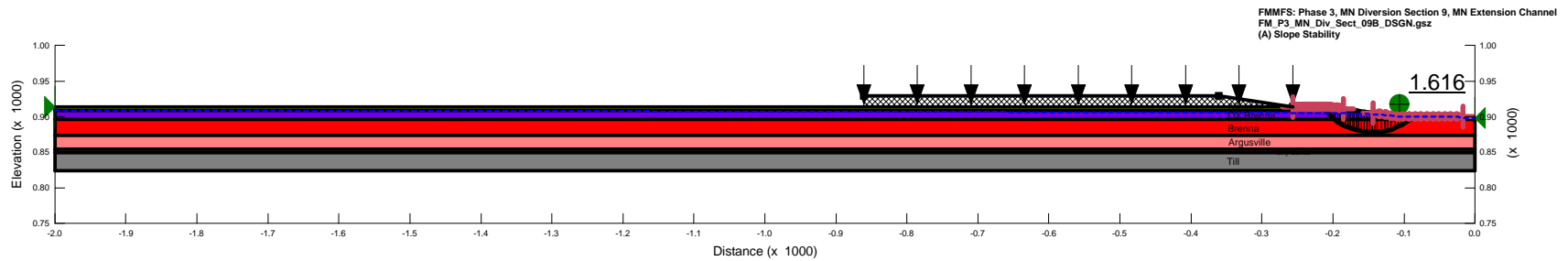
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Fargo-Moorhead Metro Feasibility Study Phase 3 Analysis MN Diversion Channel Stability Section 9B

(A) Slope Stability

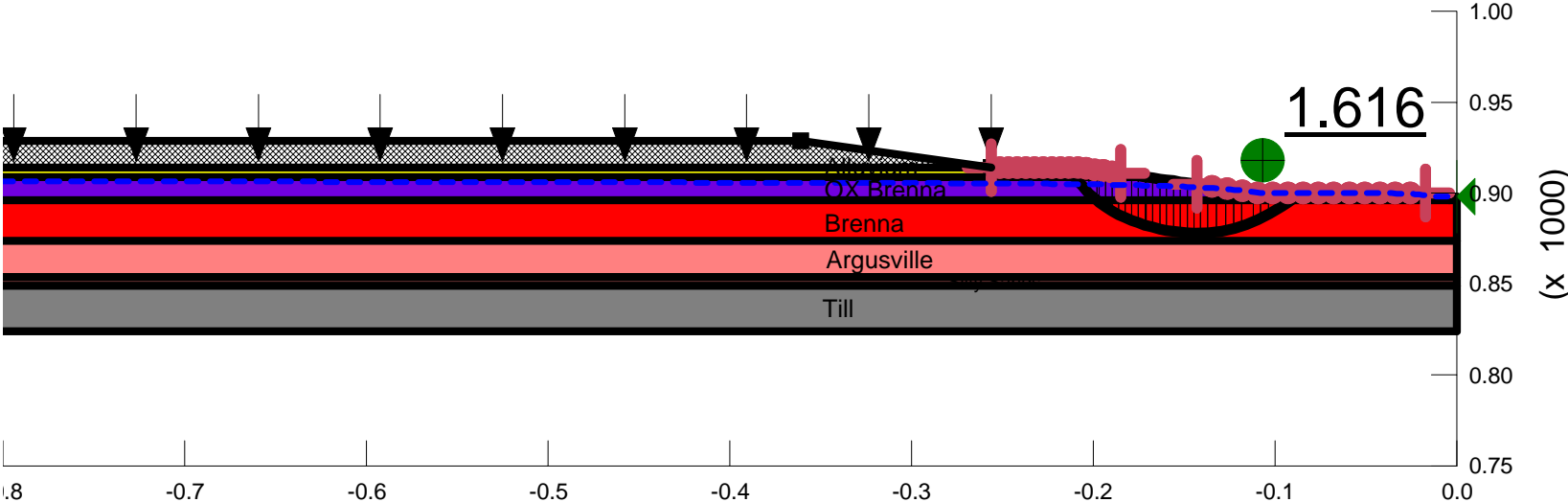
Soil Properties

Name: Brenna	Model: Shear/Normal Fr.	Unit Weight: 104 pcf	Strength Function: Brenna	Phi-B: 0°
Name: Argusville	Model: Shear/Normal Fr.	Unit Weight: 106 pcf	Strength Function: Argusville	Phi-B: 0°
Name: Till	Model: Mohr-Coulomb	Unit Weight: 122 pcf	Cohesion: 0 pcf	Phi: 31°
Name: Sand	Model: Mohr-Coulomb	Unit Weight: 125 pcf	Cohesion: 0 pcf	Phi: 32°
Name: OX Brenna	Model: Shear/Normal Fr.	Unit Weight: 111 pcf	Strength Function: OX Brenna	Phi-B: 0°
Name: Silty Sands	Model: Mohr-Coulomb	Unit Weight: 125 pcf	Cohesion: 0 pcf	Phi: 30°
Name: Alluvium	Model: Mohr-Coulomb	Unit Weight: 119 pcf	Cohesion: 0 pcf	Phi: 31°

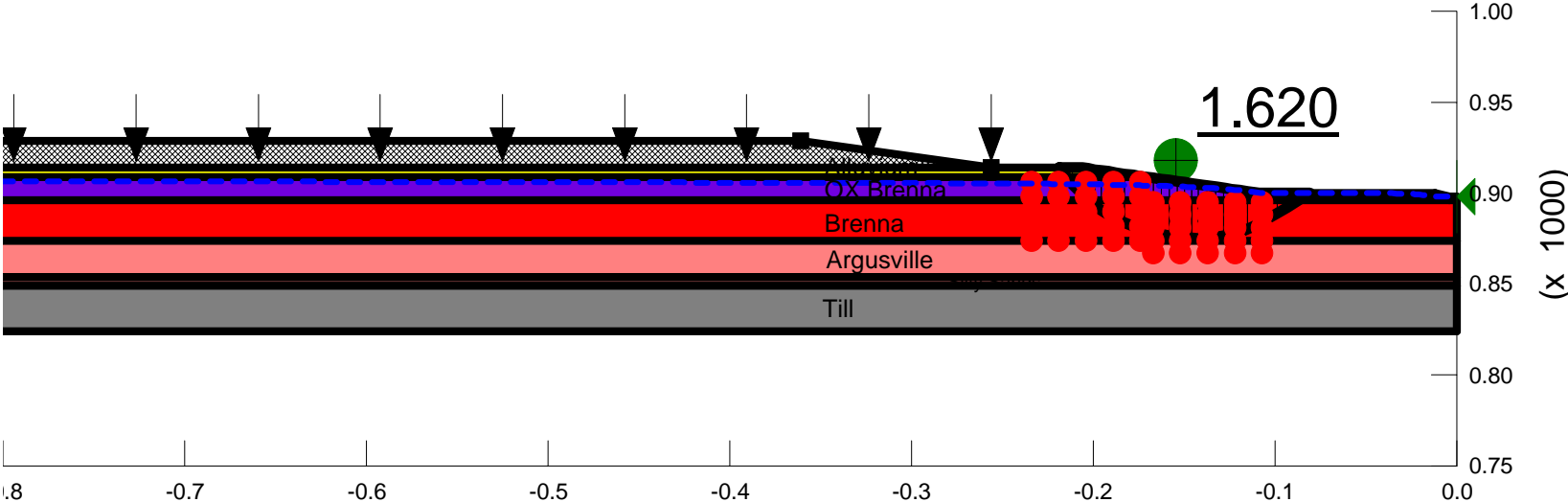


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Date: 8/16/2010

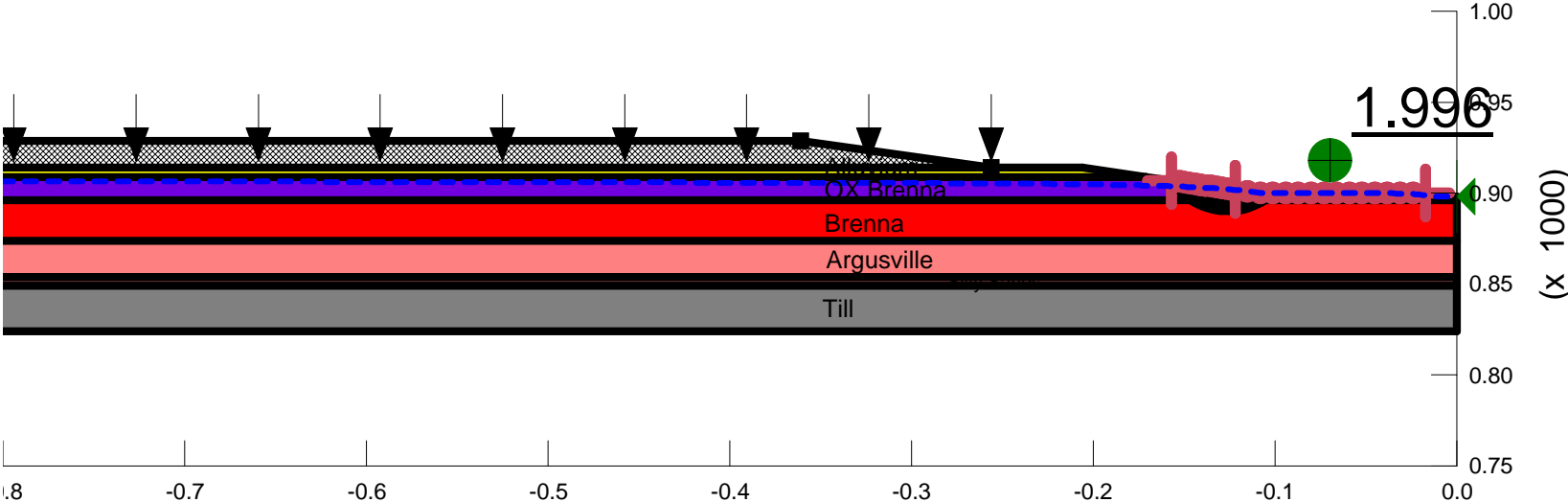
FMMFS: Phase 3, MN Diversion Section 9, MN Extension Channel
FM_P3_MN_Div_Sect_09B_DSGN.gsz
(A) Slope Stability



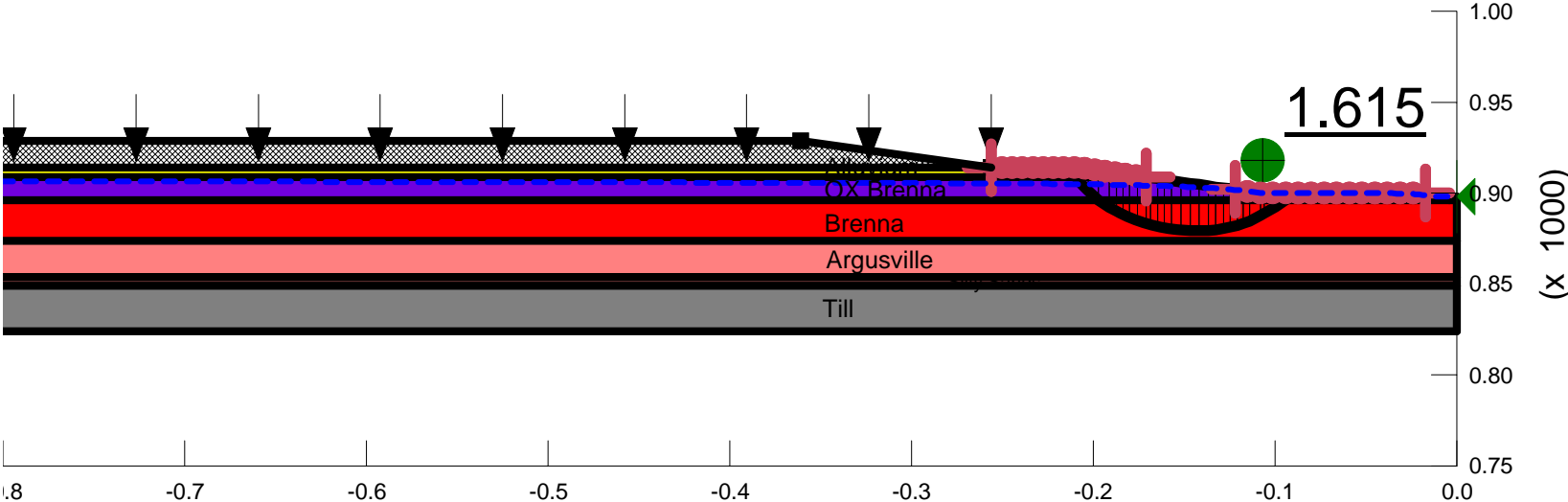
FMMFS: Phase 3, MN Diversion Section 9, MN Extension Channel
FM_P3_MN_Div_Sect_09B_DSGN.gsz
(B) Wedge Slope Stability



FMMFS: Phase 3, MN Diversion Section 9, MN Extension Channel
FM_P3_MN_Div_Sect_09B_DSGN.gsz
(C) Localized Stability



FMMFS: Phase 3, MN Diversion Section 9, MN Extension Channel
FM_P3_MN_Div_Sect_09B_DSGN.gsz
(D) Localized Stability



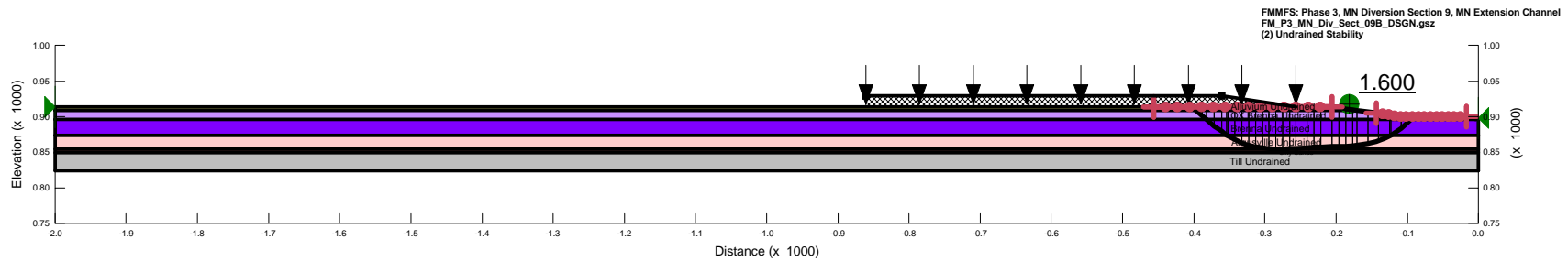
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Fargo-Moorhead Metro Feasibility Study Phase 3 Analysis MN Diversion Channel Stability Section 9B

(2) Undrained Stability

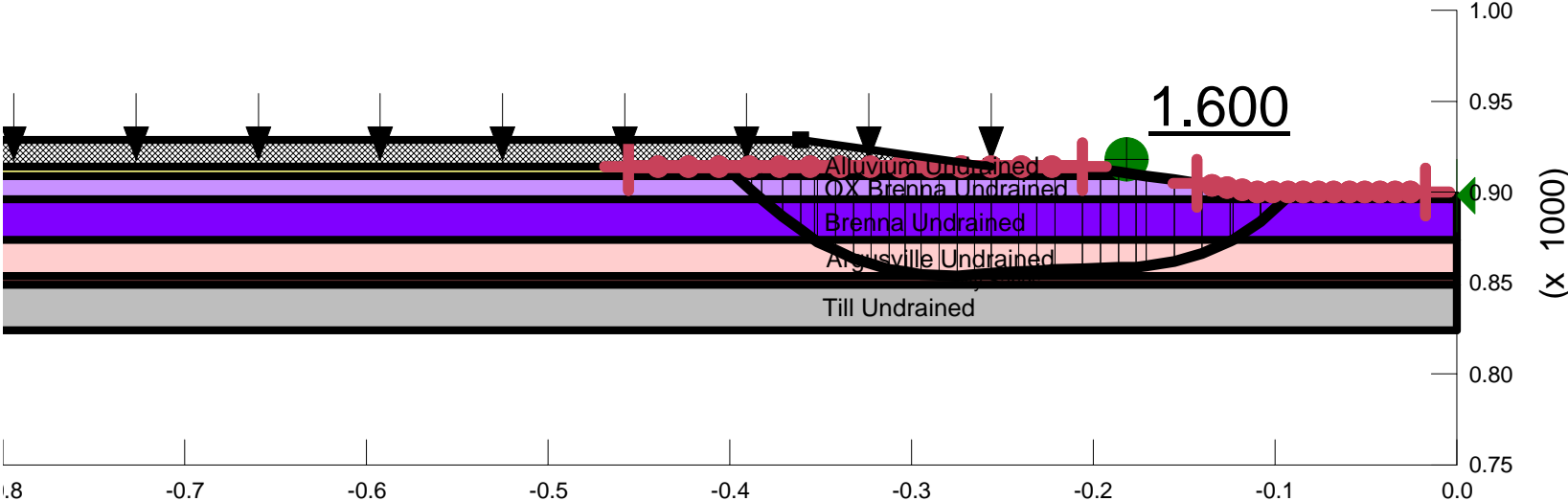
Soil Properties

Name: Brenna Undrained Model: Undrained (Phi=0) Unit Weight: 104 pcf Cohesion: 525 pcf
Name: Argoville Undrained Model: S-(depth) Unit Weight: 106 pcf C:Top of Layer: 525 pcf C-Rate of Change: 10 psf/ft Limiting C: 1025 pcf
Name: Till Undrained Model: Undrained (Phi=0) Unit Weight: 122 pcf Cohesion: 1800 pcf
Name: Sand Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion: 0 pcf Phi: 32° Phi-B: 0°
Name: Silty Sand Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion: 0 pcf Phi: 30° Phi-B: 0°
Name: Alluvium Undrained Model: Undrained (Phi=0) Unit Weight: 119 pcf Cohesion: 900 pcf
Name: OX Brenna Undrained Model: Undrained (Phi=0) Unit Weight: 111 pcf Cohesion: 900 pcf



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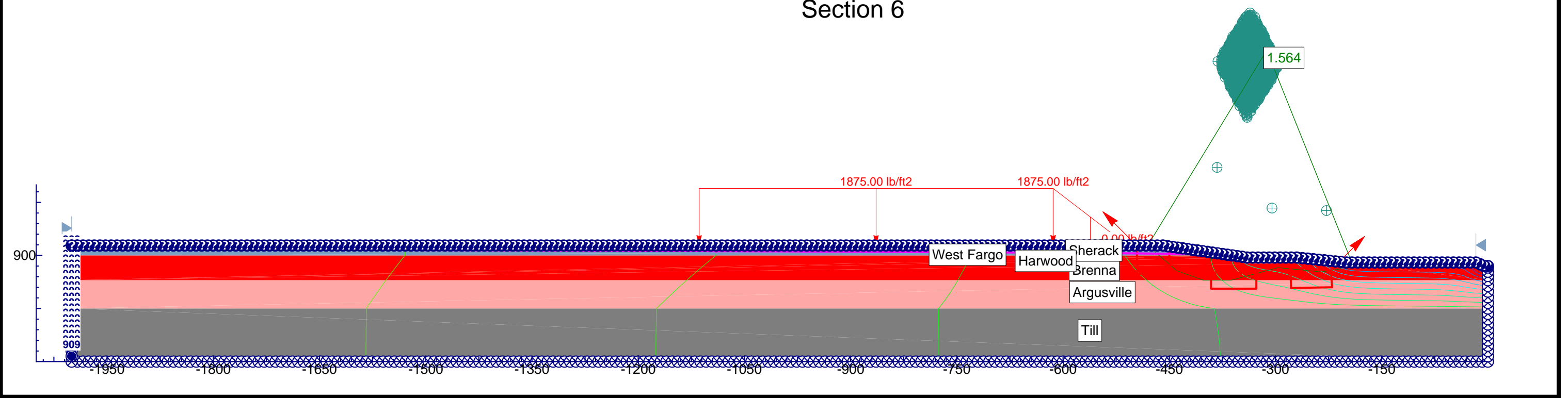
FMMFS: Phase 3, MN Diversion Section 9, MN Extension Channel
FM_P3_MN_Div_Sect_09B_DSGN.gsz
(2) Undrained Stability



Fargo - Moorhead Metro Feasibility Study Phase 3 Analysis MN Diversion Channel Stability Section 6

Created By: Killian, Elizabeth A MVP
Last Edited By: Killian, Elizabeth A MVP
Date: 9/1/2010

Document Name
File Name: Slide_MN_Section_6_raise4FT_70.sli



Slide Analysis Information

Document Name

File Name: Slide_MN_Section_6_raise4FT_70.sli

Project Settings

Project Title: SLIDE - MN Section 6 raise 4FT 70
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft³
Groundwater Method: Finite Element Analysis
Tolerance (groundwater): 1e-006
Maximum number of iterations (groundwater): 500
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Spencer

Number of slices: 30
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Non-Circular Block Search
Number of Surfaces: 15000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Left Projection Angle (Start Angle): 135
Left Projection Angle (End Angle): 135
Right Projection Angle (Start Angle): 45
Right Projection Angle (End Angle): 45
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

2 Distributed Loads present:
Distributed Load Triangular Distribution, Orientation: Vertical, Magnitudes 1,2: 0 and 1875 lb/ft²
Distributed Load Constant Distribution, Orientation: Vertical, Magnitude: 1875 lb/ft²

Groundwater Analysis

Maximum Number of Iterations: 500

Iteration Tolerance: 1e-006
Mesh Element Type: 4 noded quadrilaterals
Number of Elements: 9552
Number of Nodes: 9619

Material Properties

Material: Sherack

Ks: 3.24074e-008

K2/K1: 1

K Angle: 0

Model: User Defined - Alluv/Sherack

Material: West Fargo

Ks: 3.24074e-006

K2/K1: 1

K Angle: 0

Model: User Defined - West Fargo

Material: Harwood

Ks: 3.24074e-007

K2/K1: 1

K Angle: 0

Model: User Defined - Harwood

Material: Brenna

Ks: 3.24e-009

K2/K1: 1

K Angle: 0

Model: Simple

Material: Argusville

Ks: 3.24e-009

K2/K1: 1

K Angle: 0

Model: Simple

Material: Till

Ks: 6.59e-007

K2/K1: 0.25

K Angle: 0

Model: Simple

Material: Sand

Ks: 0.000324074

K2/K1: 1

K Angle: 0

Model: User Defined - Sand

List of All Coordinates

Material Boundary

-2000.000	908.000
-417.000	908.000

Material Boundary

-2000.000	906.000
-403.000	906.000

Material Boundary

-17.000	890.000
-17.000	888.000
-5.000	883.000
0.000	883.000

Material Boundary

-2000.000	900.000
-361.000	900.000

Material Boundary

-2000.000	865.000
0.000	865.000

Material Boundary

-2000.000	825.000
0.000	825.000

External Boundary

0.000	750.000
0.000	825.000
0.000	865.000
0.000	883.000
0.000	885.000
-5.000	885.000
-17.000	890.000
-200.000	890.000
-270.000	897.000
-340.000	897.000
-361.000	900.000
-403.000	906.000
-417.000	908.000
-459.000	914.000
-2000.000	914.000
-2000.000	908.000
-2000.000	906.000
-2000.000	900.000
-2000.000	865.000
-2000.000	825.000
-2000.000	750.000