CHAPTER 12—APPENDICES

Appendix 1.1

MEDIUM-RANGE and LONG-RANGE PLANS FOR GEOLOGICAL AND HYDROLOGICAL STUDIES OF THE SNODGRASS MOUNTAIN SKI AREA EXPANSION ....

By: GEO-HAZ Consulting, Inc.
Date: 15 Feb 2007

Crested Butte Mountain Resort (CBMR) has proposed a ski area expansion project on Snodgrass Mountain. Geological and hydrological studies in the Snodgrass Mountain expansion area are necessary for three main objectives:
(1) to define the existing “hydrologic and geologic baseline” conditions on Snodgrass Mountain
(2) to form a basis for designing a “stability-neutral” development plan for the proposed ski area development
(3) to permit us to assess any changes in baseline hydrologic and geologic conditions once the ski area is in operation

To date, GEO-HAZ has submitted two proposals to collect baseline geological and hydrological data. These proposals were submitted as soon as CBMR understood the USFS concern with slope movement on the lower east side of Snodgrass Mtn.. The two monitoring proposals (submitted October 11 and 19, 2006) aimed to begin immediate data collection on surface water and groundwater, in a time period that would include the Spring, 2007 snowmelt season. This season is critical because during the spring snowmelt, surface water flows are largest, shallow groundwater levels are highest, and unstable slopes in Colorado are most active (Chleborad, 1998). In order to install the flumes and piezometers before Spring, 2007, we proposed to install them before the snow became too deep to maneuver on Snodgrass Mountain, that is, in October/November 2006. If this could not be accomplished, then the important snowmelt-season data from May, 2007 would not be collected.

However, these two early monitoring proposals cited above are only the 1st phase of a more comprehensive plan of geological and hydrological studies on Snodgrass Mountain. During the Fall of 2006, we will continue detailed geological and landslide mapping to support the design of a “stability-neutral” development plan for the proposed ski area development. In Summer of 2007 we will collect the remainder of the geological and hydrological field data needed to support objectives 1 and 3 listed above.

Some elements of the proposed geological and hydrological data collection, both in Fall 2006 and Summer 2007, involve potential ground-disturbing activities. In response to a request from USFS, we provide in this letter a more detailed description of those potential ground-disturbing activities, as well as a description of the mitigation measures needed to minimize potential impacts. These activities are shown in a chronological table (Table 1) that shows all proposed geological and hydrological studies. The details of proposed activities and our mitigation plan are then explained in detail in the following pages.

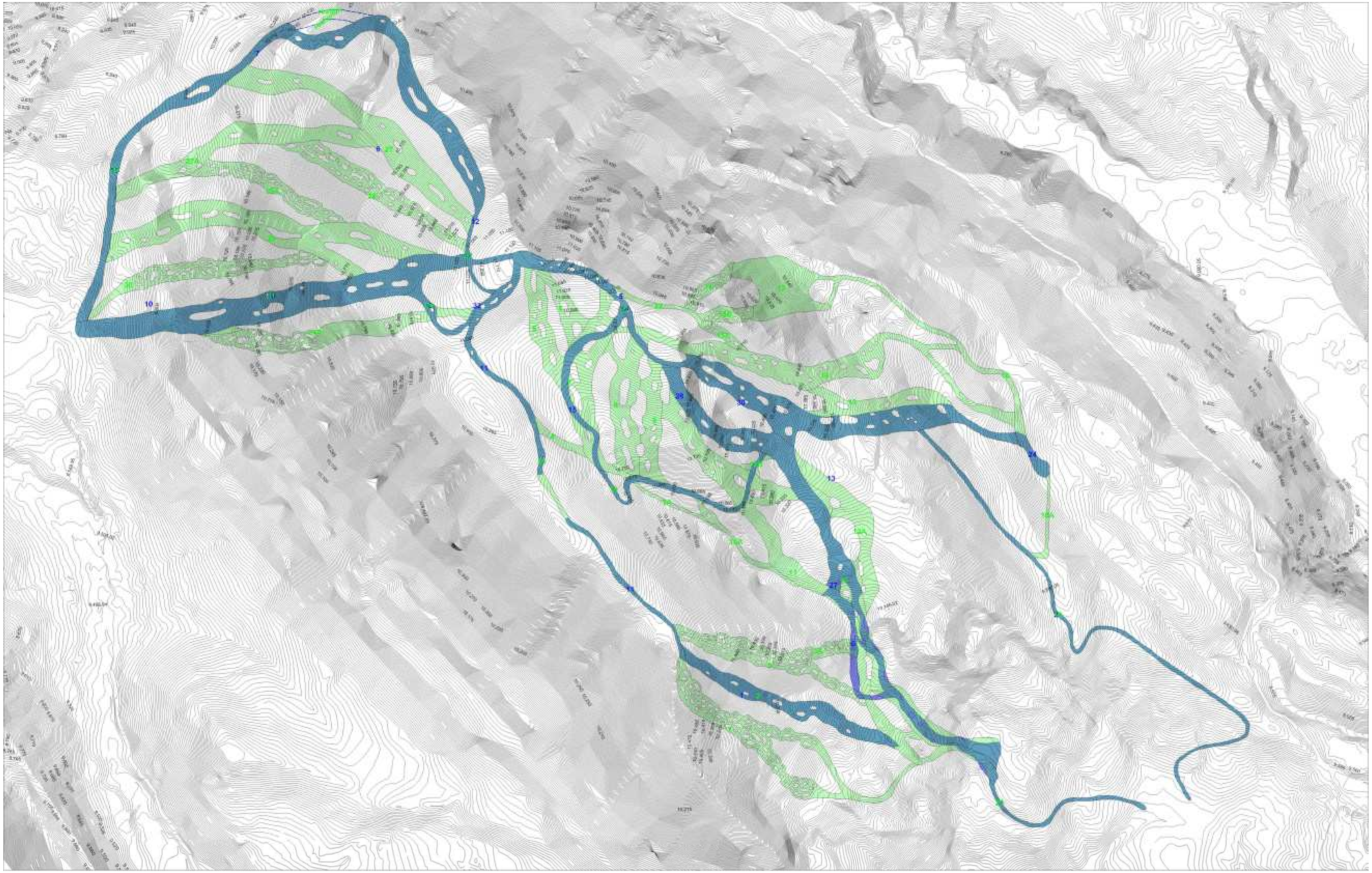
Proposed Geological, Hydrological, and Geophysical Studies of Snodgrass Expansion area **(bold indicates a potential ground-disturbing activity) (shaded areas are in past)**

Year	Month	EIS Process	Surface geology	Subsurface geology	Hydrology-HydroGeo	Hydrology—Resource Engr.	Surveying	Geophysics
2006	Nov		Perform detailed surface geologic mapping before winter snow cover;	**06-1. Drill 2 boreholes (PZ-15, PZ-16) on CBMR land at base of Snodrgrass; several boreholes in GHUs 1-6, before snow depth exceeds 1 ft; continuous split-spoon samples; install piezometers**[1]	Install data loggers in 3 existing RCE piezometers Install data loggers in new piezometers		SGM installs more slide monitor monuments (rebar) in GHUs 1-6	
	Dec		Assemble GIS database; Write comprehensive plan for future geology studies		Once a month, Dec. through June: estimates discharge of axial stream from natural X-section Check and down load dataloggers monthly			
2007	Jan		Consult with IAD on proposed action					
	Feb	Proposed action submitted; NEPA process begins				1-- Finish definition of drainage sub-basins in GIS 2-- Determine appropriate values for input into RUNOFF spreadsheet 3—Run spreadsheet 4—consult with GEO-HAZ and IAD on impacts of development; recommend mitigation		
	March through June					5—Create spreadsheet for total water balance of each sub-basin (all INPUTS and OUTPUTS), including groundwater		
	July			**07-1. Drill remaining**	**07-2. Install flumes**[3]	6—perform field survey of axial stream channel; assess	Survey all borehole and	**07-4. Run geophysical**

				boreholes (of 16 planned) in GHUs 1-6; continuous split-spoon samples; install piezometers; conduct slug tests in all wells; install inclinometers if needed[2]	**Install dataloggers in new piezometers**	likely impacts of increased runoff from development	flume locations	**surveys along 4 slope stability cross-sections[4]**
	Aug-Sept							
	Oct			Perform slope stability calculations along the 4 stability cross-sections			Resurvey monuments 2007	

Appendix 1.2

MAP OF PROPOSED ACTION



Green, proposed trails (version of 23-MAR-2007); blue, proposed snowmaking (version of 21-JUN-2007); contour interval 5 ft. Design by International Alpine Design, Vail, CO.

CHAPTER 2—GEOLOGY

Appendix 2.1—Unpublished reports on the Gold Link landslides of 22-May-2001

Report and Photographs of the May 2001 Landslide on Mount Crested Butte, Beneath the Gold Link Lift

File Code: 2550 Soil Investigation/* **Date:** 6/4/2001
Route To: *

Subject: Review of Crested Butte Slump---Gold Link Area

To: Gunnison District Ranger

On Friday May 25,2001 I participated in a field visit to Crested Butte Ski Area to review a slump that had occurred in the ski run next to the Gold Link lift. Also present were, John Morrisey-USFS, Jeff Burch-USFS, Stewart Johnson-CBMR, Roar Kiklevich-CBMR, Dale Massey-CBMR, and Steve Westbay-City of Mount Crested Butte. The Slump was noticed early Tuesday morning, May 22, 2001. Soon after it was noticed, CBMR personnel began placing sediment/ silt fencing material at the base of the slope to prevent excessive amounts of sediment from entering a small drainage and wetland. I noticed 3-4 rows of the sediment fencing in place on Friday and it appeared to have done a reasonable job of preventing large quantities of sediment from entering into the wetland or the drainage-way.

As I saw the slump on Friday, it had dried considerably and at that time the material at the toe of the slump was firm enough to walk on and water running through the area appeared relatively clear.

The slump appears to actually be a shallow debris flow, earth flow situation on about a 30% slope. The result of this earth flow has left a scare about 60 Ft. wide, 6-8 Ft. deep, and 200 Ft. long. The amount of material displaced was estimated by Stewart Johnson to be roughly 4,000 Cu. Yd.s. This displaced material flowed, mostly as a fluid, down slope for roughly another 200-250 Ft. The flow split 1/3 of the way down slope and followed 2 small drainage ways to the base of the slope. The western most flow washed up against the base of tower 4 and bent the base of the ladder, and left an accumulation of material, but did not appear to have any other visible impact.

This displaced material appeared to be colluvium from mixed sources with a loamy texture with rounded cobble and stone in the matrix. The USGS, "Geologic Map of the Gothic Quadrangle, Gunnison County Colorado, Map GQ-1689, 1991." identifies this area as Qu, an undifferentiated Unit consisting of colluvial slope wash from mixed sources, including glacial material as being on the upper part of the slope, and the lower part of the slope as being Mancos Shale, with Glacial material on top of it in spots. This map also identifies slump scarps and some earth flow patterns or lobes in this vicinity. I observed these features on site and determined that this earth flow is actually an earth flow within an older earth flow. The current head scarp is just below an older series of head scarps. As I walked directly up-slope, I observed 3 small head scarps and the resultant depressional areas above the current movement area. The upper most depression, just below lift 8 had willows in it and could possibly be a wetland. I noticed slope movement features,(small head scarps, head area depressions, and flow lobes) on the run immediately adjacent to this area to the west.

I dug a small excavation pit at the head of the fresh movement area and observed dense gravelly reddish clay layer, which could have acted as a failure plane. Toward the base of the slope, we noticed a small seep or spring like area around lift 3, that Roark had mentioned flows most of the time.

Mechanisms that Caused the Flow.

Based on my observations, I feel this slope failure is the result of a rather rapid earlier snow melt situation, which saturated the soil profile, followed by a final wet snow/rain storm event. The landform position is such, that all the depressional areas up slope hold water and contribute to the ground water conditions down slope. The last storm event apparently added water to the already saturated profile, with the landscape position helping to concentrate the water flow. The saturated situation was probably perched above the clay layer. It may have been dammed up at a point about 185 feet down slope, where there is a slight change in grade. This built up to a point where it could no longer support the weights involved, and released as a fluid debris flow situation. I feel that explains current site conditions that lead to the debris flow. However, the action of clearing the stand of trees to create this ski run may have also been one contributing factor, even though this occurred years ago. I contacted Mike Burke, Geo-Technical Engineer on the San Juan National Forest, and he supports my concepts. He mentioned that often times, removal of trees can lead to progressive slope failure situations. As a result of tree removal, the actual physical support that tree roots may supply, deteriorates over time. Also, growing trees pull a considerable amount of water from the soil as they grow and transpire. When they are no longer there, more water is held in the soil profile. These factors singly, may not appear to explain the slope movement, but when considered cumulatively they provide the best logical explanation, especially in light of the fact that I could find no other sources of water concentrations, construction activities or vegetative disturbances up slope or in the near vicinity.

Recommendations

I strongly recommend that the ski area be required to have this evaluated by a Geo-tech Engineer, or an Engineering Geologist. Some of my initial thoughts and concerns are:

- While I feel for the time being this area has reached a point of equilibrium, this event has left a number of surfaces unsupported. Of main concern is the left flank, on the west side, in and around Lift Tower # 5. While this area is relatively stable currently, soil cracks running up and down the slope were noticed on the east side of the tower base. And since the material supporting this surface is no longer there, the overall stability of the base of this tower could be compromised over time.

- In general I would recommend that all the fresh scarp faces be evaluated in relation to the stability of the slopes around and above them. There is a possibility that with the appropriate reinforcement they could be graded back to a smother profile.

- Drainage of the area should be addressed, although most of the material is no longer there, water relationships in the slope should be evaluated and actions taken to prevent any future progressive slope failures.

- The action of filling in the void left in the slope with the material that traveled down slope needs to be carefully engineered and evaluated. Any type of regrading and filling in will have to be firmly anchored below any failure plane (concrete pilings, steel pilings, treated wood pilings), and the area drained, both surface and subsurface.

- The possibility of a ½ pipe situation in this area was discussed on site. This also should be evaluated very carefully from and engineering and slope hydrology design standpoint.

- It was suggested that the material in the run-out area, just above the wetland, could be very carefully scraped down to the original ground level to allow the existing vegetation to grow up. This may be feasible with a rubber tired front-end loader, if the area is dry enough to support it without causing rutting or compaction, and the operator is very careful in his operation of the machinery. Otherwise, the surface could be scarified somehow, and it could be seeded and mulched. This material has set up fairly firmly and appeared rather stable at the moment, but rain events could dislodge some additional sediment, causing it to be somewhat of a continuous sediment source for a while. Because of this, the silt fences should remain in place for the time being.

Terry J. Hughes
Forest Soil Scientist


5 25 2001


5 25 2001


5 25 2001


5 25 2001


6. 22. 2001

July 9, 2001

Crested Butte Mt. Resort
P. O. Box A
Mt. Crested Butte, CO 81225

Attention: Mr. Edward Callaway

Subject: Engineering Consultation
Goldlink Slope Failure
Crested Butte Ski Area
Mt. Crested Butte, Colorado
Job No. GS-3252

Gentlemen:

This letter summarizes our observations of the slope failure adjacent to the Goldlink ski lift, and provides recommendations for slope reconstruction.

Observations During May 30 and June 21, 2001 Site Visits

Our initial visit to the site was on May 30, 2001 to observe and document the size and shape of the failed portion of the ski slope. Selected photos from our site visit are presented as Appendix A. The failure had occurred in a comparatively narrow section of the ski slope, approximately two-thirds of the way uphill from the Goldlink ski lift loading station. The landslide movement that occurred is commonly referred to as an earth flow or slide/flow. We believe the Goldlink slide/flow occurred very quickly and was caused by uplift pressure from rising ground water. This type of slide/flow is common in steep mountainous terrain after an intense precipitation event, especially when combined with the effects of snow melt on ground water levels. The slide/flow occurred in an area where the natural ground surface slope varies between approximately 20 percent and 40 percent with an average ground surface slope of approximately 31 percent.

The slide/flow evacuation area was 20 to 65 feet wide, 5 to 8 feet deep and about 280 feet long. Figure 1 shows a plan view of the evacuation area and Figure 2 shows cross-section profiles. We estimate the volume of the evacuation area is 2000 cubic yards. The soils which slid were colluvium consisting predominantly of silty to clayey sand with gravels and silty to clay gravel. At the time of failure, the saturated soils lost shear strength and the soils flowed downhill about 300 feet. The evacuation area was well defined with distinguishable boundaries. Soil movements were also expressed at the ground surface by two large cracks extending from the flank scarp nearest the ski lift. An estimated 5 to 10 gallons per minute (gpm) of clear water was seeping from the evacuation area of the slide during our initial visit.

On June 21, 2001, John Mechling visited the site and met with Stewart Johnson - Crested Butte Mountain Resort (CBMR), Steve Westbay - City of Mount Crested Butte, Terry J. Hughs - USFS and a geotechnical engineer with the USFS. The purpose of the meeting was to view the current condition of the slide/flow and present our slope reconstruction recommendations. The evacuation area had dried out considerably since our initial visit. An estimated 2 gpm of clear water was seeping from the evacuation area of the slide. We described in general terms our recommended approach to slope reconstruction. Attendees agreed with our proposed reconstruction concept. It was also decided that the ski lift supports adjacent to the slide/flow area should be monitored for movement until slope reconstruction is completed.

Recommended Slope Reconstruction

The failure area is in a ski slope that will only function as a ski slope in the future. We recommend slope reconstruction consisting of reshaping of the ski slope and installation of an interceptor drain system. The drain system will collect and control subsurface water and subsequently reduce the potential for development of uplift forces from ground water which caused the slide/flow.

Interceptor drain trenches are filled with more permeable material than the surrounding soils. In developed areas, typical interceptor drain construction consists of a slotted drain pipe near the bottom of a trench filled with washed rock. The upper 1 or 2 feet of the trench is backfilled with a clay soil to limit surface infiltration. The location of the Goldlink slide/flow is comparatively remote and import of washed rock to fill a large percentage of the trench was considered impractical and not warranted based on site usage. We noticed corrugated metal pipe (cmp) and PVC pipe stored on ski area property. We suggest that the available pipe material be used in interceptor drain construction.

The interceptor drain trenches should be approximately 2 feet wide and 6 to 8 feet deep. We recommend pipe be placed in the bottom 2 feet of the trenches.

Slotted rigid pipe consisting of a single 24 inch diameter pipe, two 12 inch diameter pipes or four 6 inch diameter pipes could be placed on an approximately 4 inch thick layer of washed rock bedding material in the bottom of the trenches. The top of the pipes should be covered with washed rock to an elevation at least 2 feet above the bottom of the trench bottom. The washed rock should be covered by a geotextile fabric to separate the washed rock from the backfill soils above. The native colluvium consisting of sands and gravels can be used to fill the trench from the top of the pipes to the ground surface.

The following list is a guideline for slope reconstruction. Figure 3 shows the approximate locations of the interceptor drain alignment.

1. To provide a good bonding interface between the fill and native soils in the evacuation area, we recommend excavating a series of flat benches in the native soils.

2. After the bottom of the evacuation area is benched, the slide/flow area should be filled and graded using a medium to large dozer. Areas of fill should be moisture conditioned, spread in thin lifts (approximately 8 inches thick) and compacted by tracking in the fill with the dozer. The final surface shape should not concentrate surface drainage.

3. After the slide/flow area is reshaped interceptor drain trenches should be installed. The trenches should extend from the ground surface to approximately 2 feet below bottom of the evacuation area surface (6 to 8 feet deep). Perforated or slotted pipe should be installed on an at least 4 inch layer of 3/4-inch to 1-inch washed rock. Washed rock should be placed above the top of the pipes to at least 2 feet above the bottom of the trench.

4. A geotextile fabric should be placed over the washed rock layer with the imbedded drain pipes. The fabric is to limit the migration of silt and clay fines into the drain pipe and washed rock.

5. The trench above the gravel should be backfilled with available native soils. This fill can be tracked in by the dozer from the top of the trench.

6. The collector drain pipe at the toe of the evacuation area should extend to an existing drainage channel or other appropriate location.

After you and the excavating contractor have reviewed this letter, we should be notified of any suggested changes or modifications based on available materials or equipment. We can provide clarification and answer questions at that time. We should be advised when slope reconstruction will take place to schedule a site visit to view the reconstruction operation. If we can clarify our opinions or provide additional data to assist in this remediation, please call.

Very Truly Yours

CTL/THOMPSON, INC.

John Mechling, P.E.
Branch Manager

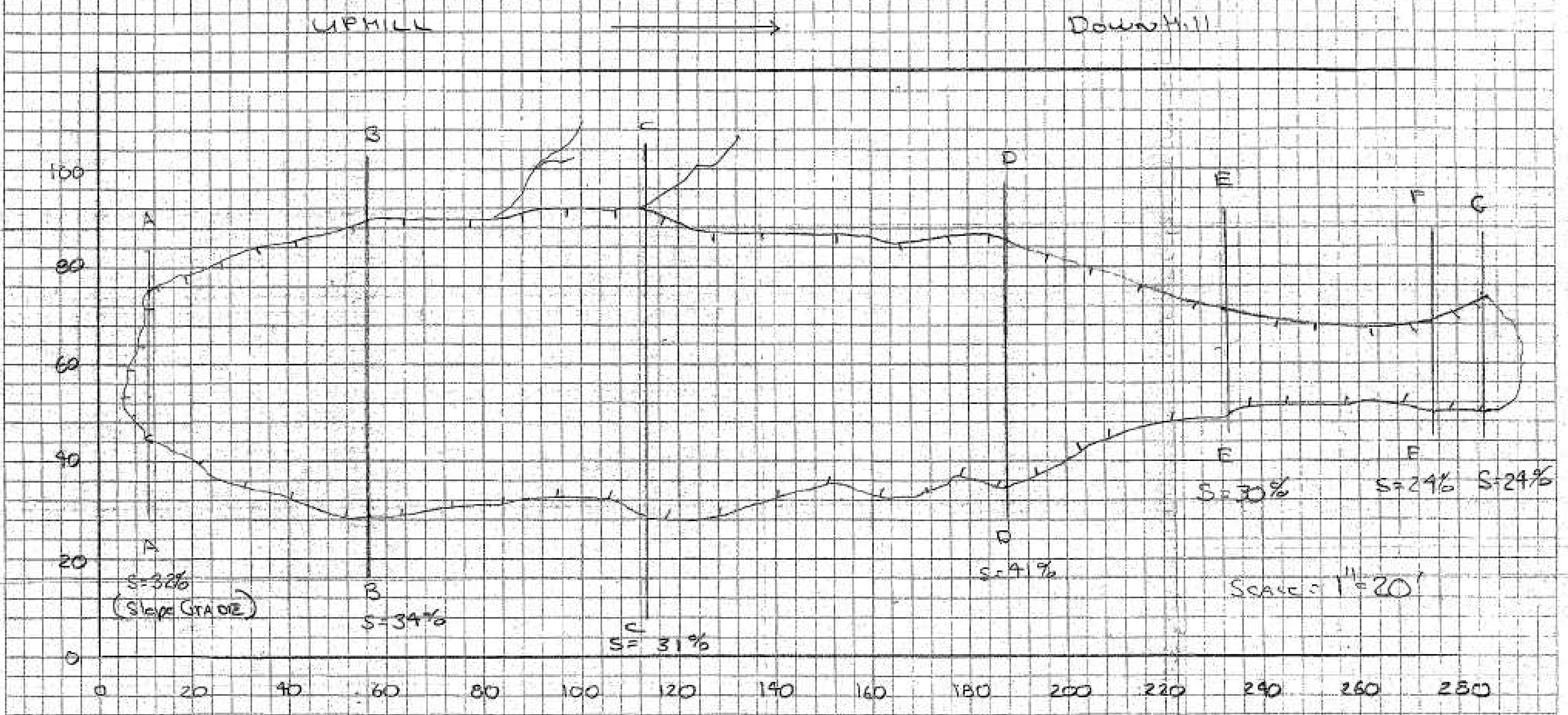
JM:cd

(5 copies sent)

SUBJECT: Goldlink Slide / Debris Flow

CTL/THOMPSON, INC.
CONSULTING GEOTECHNICAL AND MATERIALS ENGINEERS

JOB NO.: GS 3252 DATE: 7/5/01
BY: [signature] PAGE 1 OF ___



LANDSLIDE / FLOW PLAN VIEW

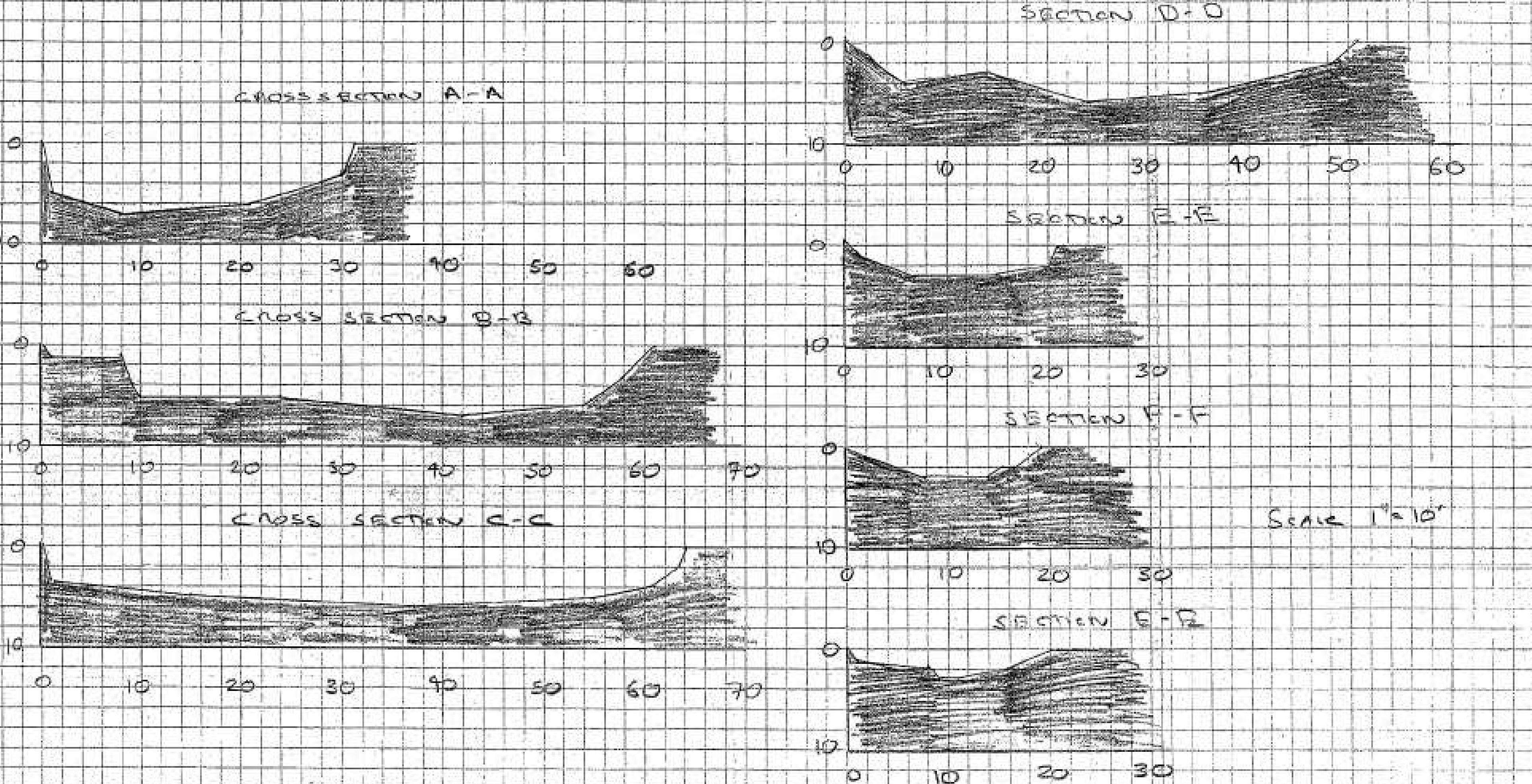
JOB NO GS 3252

FIG 1

SUBJECT: Geldlink
Slide/Flow

CTL/THOMPSON, INC.
CONSULTING GEOTECHNICAL
AND MATERIALS ENGINEERS

JOB NO. CS 3252 DATE: 7/6/01
BY: ___ PAGE 1 OF ___

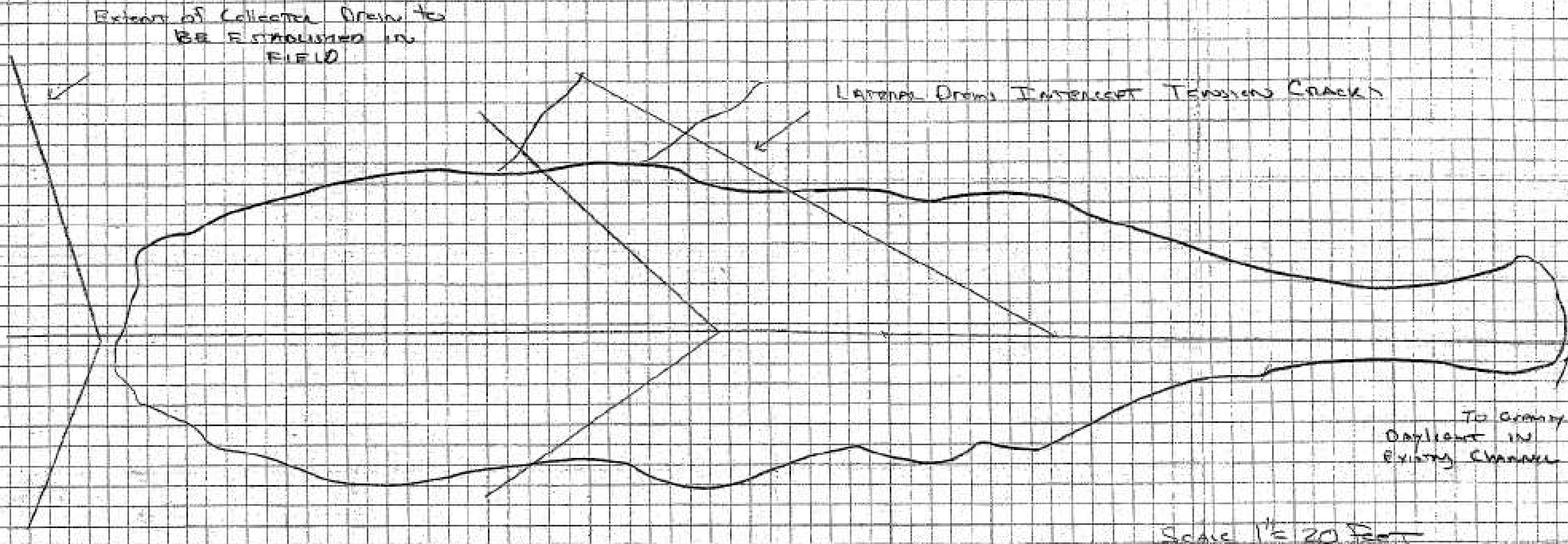


JOB NO CS 3252 CROSS SECTION PROFILES FIG 2

SUBJECT: GoldLink Slide/Flow

CTL/THOMPSON, INC.
CONSULTING GEOTECHNICAL AND MATERIALS ENGINEERS

JOB NO. GS3252 DATE: 7/6/01
BY: PAGE 1 OF



APPROXIMATE INTERCEPTOR DRAIN LAYOUT

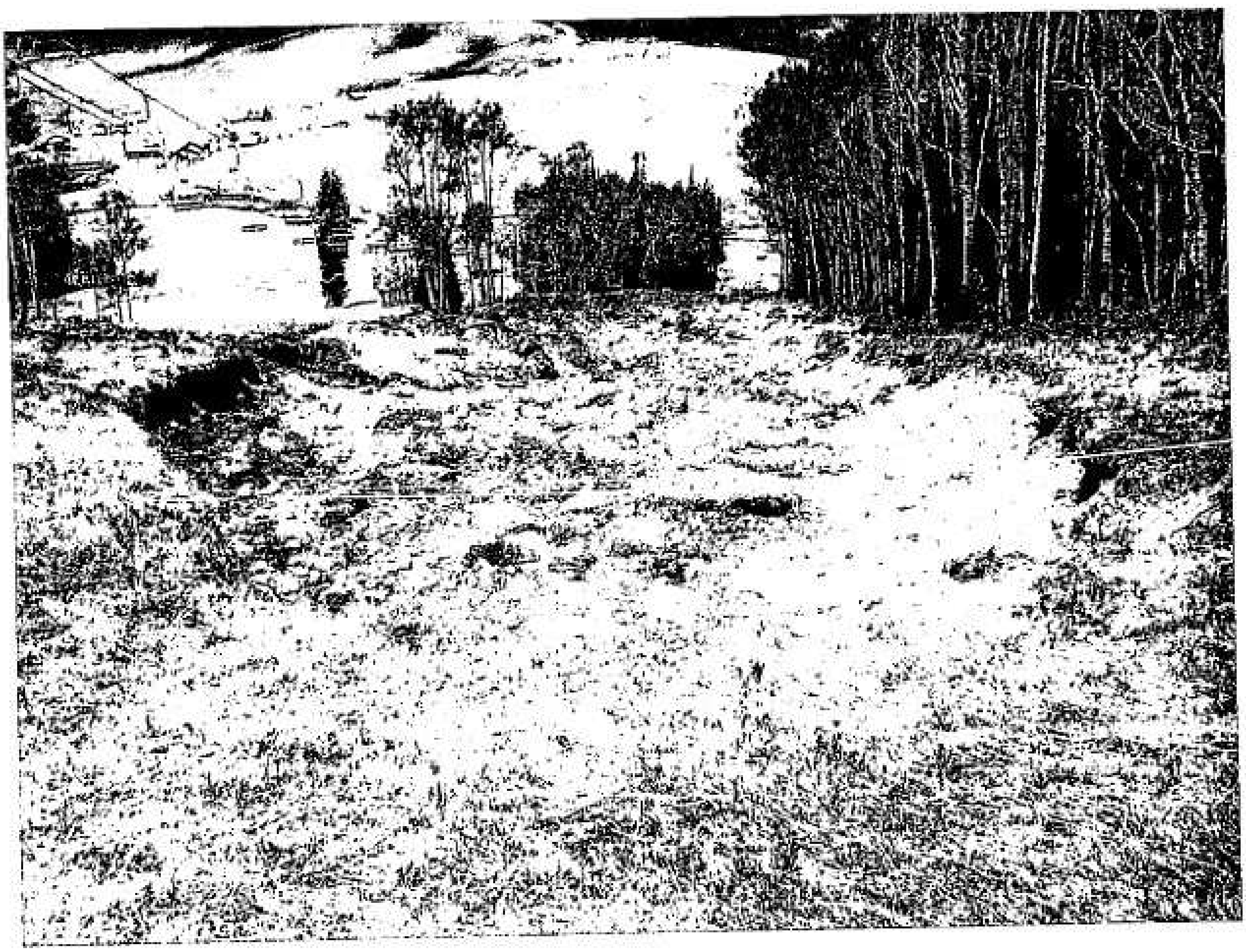
JOB NO. GS 3252

FIG 3

APPENDIX A

SELECTED PHOTOGRAPHS

VIEW FROM APPROXIMATELY 12,000 FEET



LOOKING DOWNHILL FROM ABOVE HEAD SCARP

FLANK OF EVACUATION AREAS

DISPLACED MATERIAL RUN-OUT

CHAPTER 4—GEOTECHNICAL

Appendix 4.1
Landslide Survey Stake Data

Stake 1

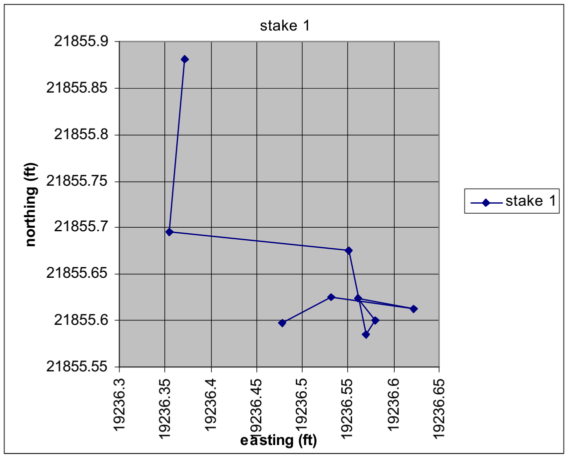
Date	Northing	Easting	Elevation
17-Nov-995	21855.8814	19236.3707	9748.55
21-Jun-996	21855.6949	19236.3552	9748.25
27-Oct-2000	21855.676	19236.551	9748.56
14-Sep-2001	21855.585	19236.57	9748.59
2-Oct-2002	21855.6	19236.58	9748.6
16-Oct-2003	21855.624	19236.561	9748.62
7-Sep-2004	21855.613	19236.622	9748.63
9-Nov-2005	21855.625	19236.532	9748.63
26-Sep-2006	21855.598	19236.478	9748.61

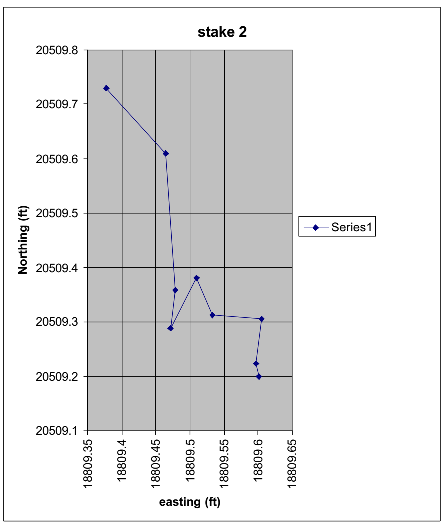
Stake 2

Date	Northing	Easting	Elevation
17-Nov-1995	20509.7296	18809.3778	9539.42
21-Jun-1996	20509.6096	18809.4646	9539.24
27-Oct-2000	20509.358	18809.478	9539.38
14-Sep-2001	20509.289	18809.472	9539.43
2-Oct-2002	20509.38	18809.51	9539.28
16-Oct-2003	20509.313	18809.533	9539.38
7-Sep-2004	20509.305	18809.605	9539.37
9-Nov-2005	20509.224	18809.597	9539.46
26-Sep-2006	20509.199	18809.601	9539.45

Stake 3

Date	Northing	Easting	Elevation
17-Nov-1995	20079.1023	18668.497	9524.29
21-Jun-1996	20079.0806	18668.6538	9524.22
27-Oct-2000	20078.802	18668.34	9524.19
14-Sep-2001	20078.851	18668.377	9524.2
2-Oct-2002	20078.85	18668.43	9524.04
16-Oct-2003	20078.75	18668.391	9524.06
7-Sep-2004	20078.806	18668.443	9524.01
9-Nov-2005	20078.757	18668.398	9524.12
26-Sep-2006	20078.778	18668.376	9523.97


stake 1
21855.9
21855.85
21855.8
21855.75
21855.7
21855.65
21855.6
21855.55
northing (ft)
19236.3
19236.35
19236.4
19236.45
19236.5
19236.55
19236.6
19236.65
easting (ft)
stake 1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20509.4
20509.3
20509.2
20509.1
Northing (ft)
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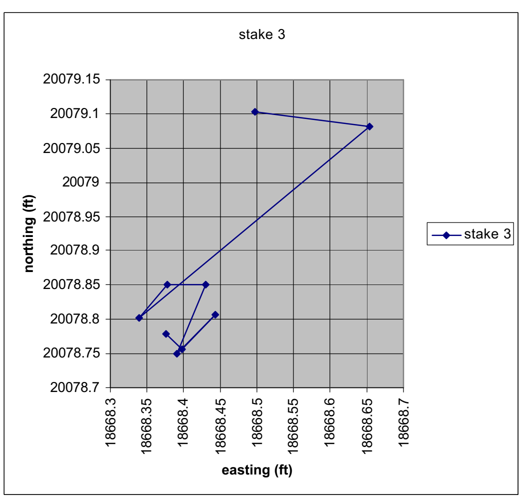
18809.4
18809.45
18809.5
18809.55
18809.6
18809.65
easting (ft)
Series1


stake 3
20079.15
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20079
20078.95
20078.9
20078.85
20078.8
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northing (ft)
18668.3
18668.35
18668.4
18668.45
18668.5
18668.55
18668.6
18668.65
18668.7
easting (ft)
stake 3

Stake 4

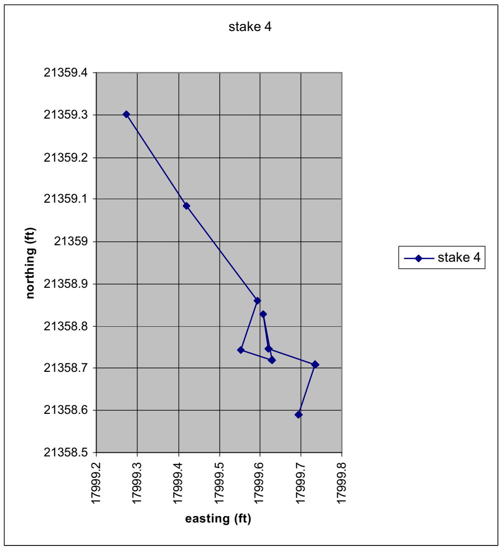
Date	Northing	Easting	Elevation
17-Nov-1995	21359.3011	17999.2725	9767.62
21-Jun-1996	21359.0838	17999.4188	9767.36
27-Oct-2000	21358.861	17999.594	9767.37
14-Sep-2001	21358.744	17999.552	9767.5
2-Oct-2002	21358.72	17999.63	9767.38
16-Oct-2003	21358.828	17999.607	9767.4
7-Sep-2004	21358.746	17999.621	9767.38
9-Nov-2005	21358.71	17999.736	9767.34
26-Sep-2006	21358.591	17999.695	9767.43

Stake 5

Date	Northing	Easting	Elevation
17-Nov-1995	20587.5639	16920.6309	9752.93
21-Jun-1996	20587.4918	16920.9058	9752.71
27-Oct-2000	20587.488	16920.86	9752.81
14-Sep-2001	vandalized		
2-Oct-2002			
16-Oct-2003			
7-Sep-2004	20504.81	16918.883	9737.37
9-Nov-2005	20504.844	16918.756	9737.41
26-Sep-2006	20504.715	16918.813	9737.43

Stake 6

Date	Northing	Easting	Elevation
17-Nov-1995	22099.3372	17391.7047	10010.75
21-Jun-1996	22099.1023	17391.7579	10010.41
27-Oct-2000	22099.1	17391.952	10010.81
14-Sep-2001	22099.06	17391.96	10010.51
2-Oct-2002	22099.06	17391.96	10010.51
16-Oct-2003	22099.132	17392.003	10010.73
7-Sep-2004	22099.073	17392.069	10010.74
9-Nov-2005	22099.1	17391.997	10010.71
26-Sep-2006	22098.952	17391.985	10010.72


stake 4
21359.4
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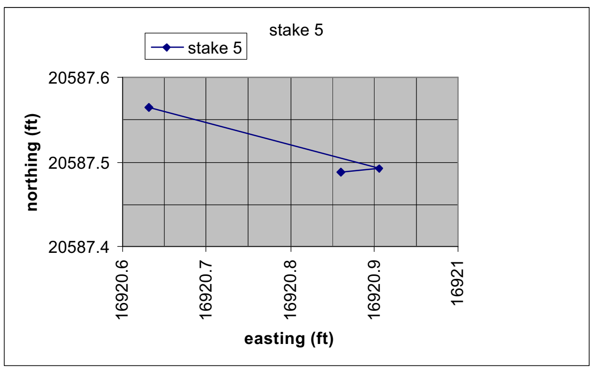
17999.8
easting (ft)
stake 4


stake 5
stake 5
20587.6
20587.5
20587.4
northing (ft)
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16920.7
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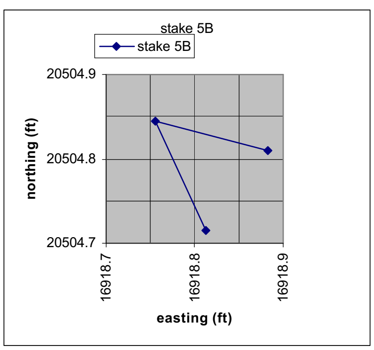
16920.9
16921
easting (ft)


stake 5B
stake 5B
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northing (ft)
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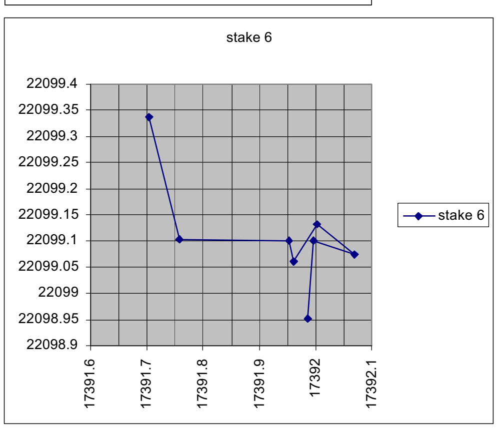
16918.8
16918.9
easting (ft)


stake 6
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22099.35
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22099.2
22099.15
22099.1
22099.05
22099
22098.95
22098.9
17391.6
17391.7
17391.8
17391.9
17392
17392.1
stake 6

Stake 7

Date	Northing	Easting	Elevation
17-Nov-1995	21748.9101	17185.0415	9977.78
21-Jun-1996	21749.0184	17185.4682	9976.99
27-Oct-2000	21748.864	17185.281	9977.23
14-Sep-2001	21748.826	17185.246	9977.26
2-Oct-2002	21748.83	17185.33	9977.24
16-Oct-2003	21748.9	17185.256	9977.34
7-Sep-2004	21748.852	17185.188	9977.15
9-Nov-2005	21748.874	17185.305	9977.26
26-Sep-2006	21748.777	17185.282	9977.2

Stake 8

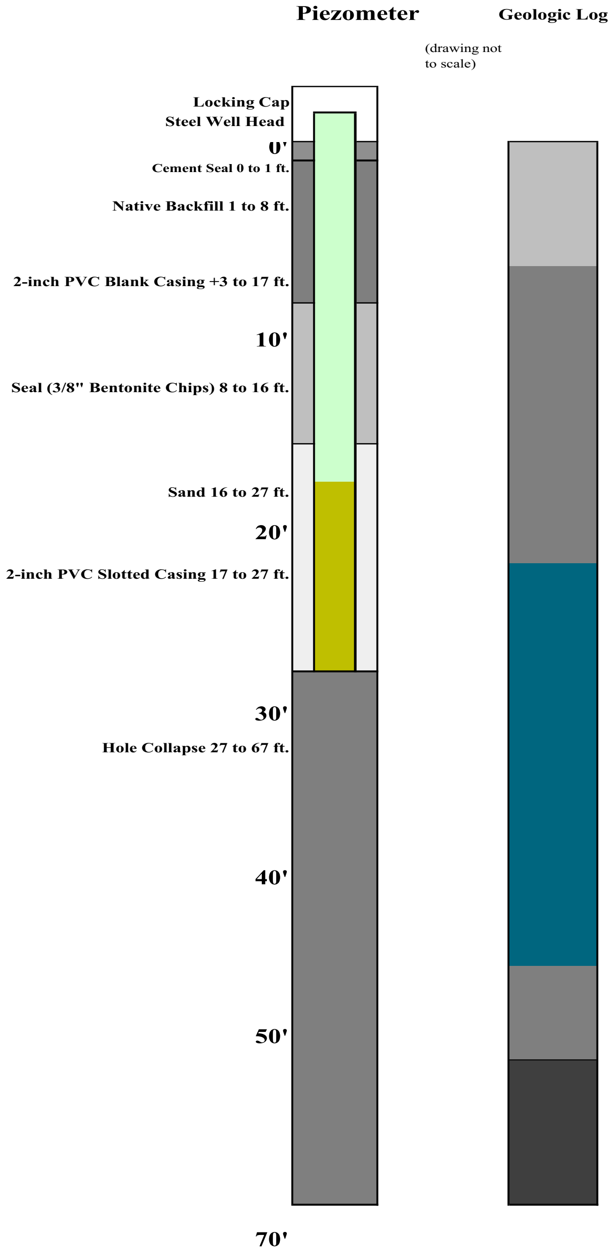
Date	Northing	Easting	Elevation
17-Nov-1995	20561.2576	16353.7006	9909.33
21-Jun-1996	20561.425	16353.9505	9909.22
27-Oct-2000	20561.347	16353.727	9909.33
14-Sep-2001	20561.294	16353.676	9909.23
2-Oct-2002	20561.34	16353.74	9909.29
16-Oct-2003	20561.361	16353.744	9909.32
7-Sep-2004	20561.295	16353.648	9909.3
9-Nov-2005	20561.293	16353.679	9909.32
26-Sep-2006	20561.335	16353.725	9909.3

Stake 9

Date	Northing	Easting	Elevation
17-Nov-1995	22228.0462	16985.7449	10143.98
21-Jun-1996	22227.8815	16985.8148	10143.69
27-Oct-2000	vandalized		
14-Sep-2001	22214.557	17033.064	10138.57
2-Oct-2002	22214.51	17032.93	10138.42
16-Oct-2003	vandalized		
7-Sep-2004	22311.638	17072.725	10151.29
9-Nov-2005	22311.75	17072.754	10151.3
26-Sep-2006	22311.643	17072.766	10151.2

CHAPTER 6-- GROUNDWATER HYDROLOGY

Appendix 6.1— Piezometer\Inclinometer Construction Details and Geologic Logs, of wells drilled in 2007



Location: 38.92731 N, 106.97976 W

Drilled and Completed: July 10, 2007

Split Spoon samples were collected at 5 foot intervals from 5 to 25 feet

Topsoil and Cobbles. (0 - 6 ft.)

Legend

- Cement (Quikrete)
- Inclinometer Grout (2 parts Cement, 1 part Gel-X)
- Bentonite Chips (3/8")
- 10/20 Silica Sand Filter Pack
- 2-inch Sch. 40 PVC Blank Casing
- 2-inch Sch. 40 PVC Slotted Casing (0.020")
- Fill - Gravel\Clay\Silt mix
- Gravely Clay\Silt
- Topsoil
- Clay
- Bedrock - Mancos Shale
- Saturated Zone
- 85 mm. Slope Indicator Casing

Silty Clay and Cobbles. Some Gravel. Scattered Boulders (6 -51 ft.)

Water Table (22.5 - 46 ft.)

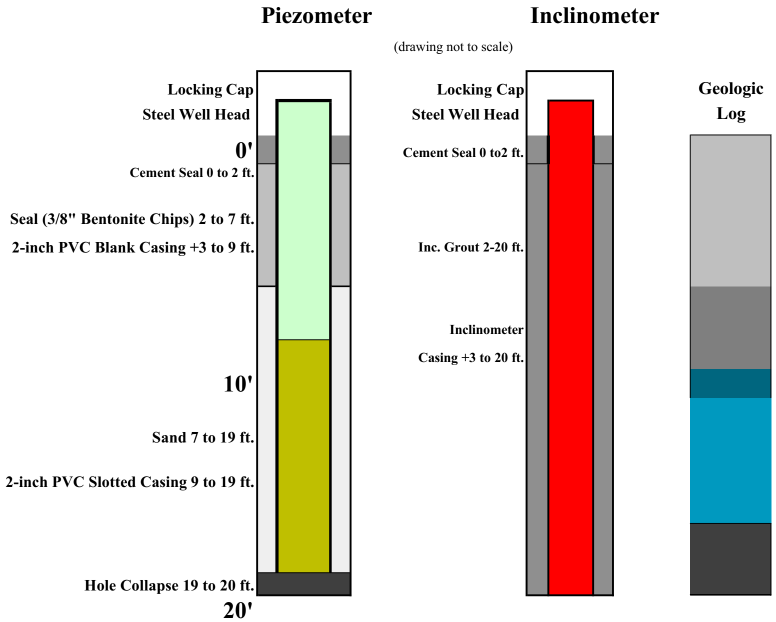
Split-Spoon Hammer Drive Blows per 6 inches

5 to 5.5' -	3
5.5 to 6' -	3
6 to 6.5' -	3
6.5 to 7' -	4
10 to 10.5'-	6
10.5 to 11' -	5
11 to 11.5' -	4
11.5 to 12' -	9
15 to 15.5' -	5
15.5 to 16' -	5
16 to 16.5' -	9
16.5 to 17' -	6
20 to 20.5' -	4
20.5 to 21' -	4
21 to 21.5' -	4
21.5 to 22' -	6
25 to 25.5' -	9
25.5 to 26' -	7
26 to 26.5' -	7
26.5 to 27' -	7

Weathered Shale (51 - 62 ft.)

Mancos Shale Bedrock
(62 - 67 ft.)

Piezometer PZ-1 Construction Detail
Snodgrass Mtn. Landslide Study - Crested Butte Mountain Resort



Location: 38.92366 N, 106.97743 W

Drilled and Completed: July 11, 2007

Split Spoon samples were collected at 5 foot intervals from 5 to 20 feet

Topsoil and Cobbles. (0 - 6 ft.)

Clayey Silt and Cobbles.
Little Gravel (6-11 ft.)

Water Table (10.5 to 16.75 ft.)
Clay and sparse
small cobbles (11-16.75 ft.)

Mancos Shale Bedrock
(16.75-20 ft.)

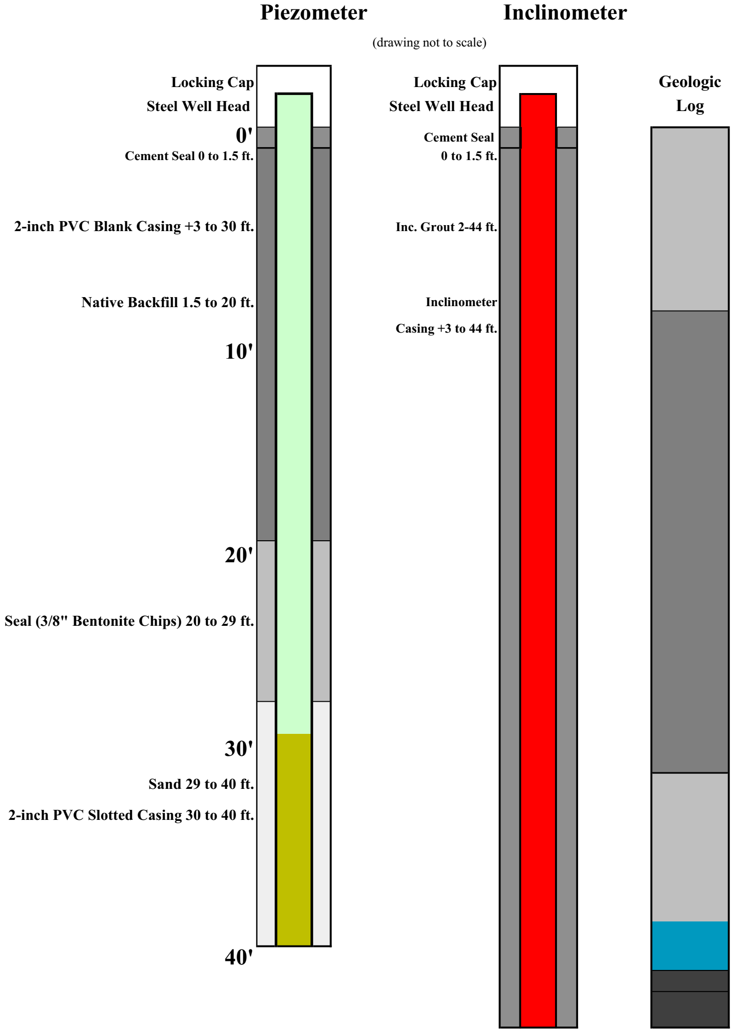
Legend

- Cement (Quikrete)
- Inclinometer Grout (2 parts Cement, 1 part Gel-X)
- Bentonite Chips (3/8")
- 10/20 Silica Sand Filter Pack
- 2-inch Sch. 40 PVC Blank Casing
- 2-inch Sch. 40 PVC Slotted Casing (0.020")
- Fill - Gravel\Clay\Silt mix
- Gravely Clay\Silt
- Topsoil
- Clay
- Bedrock - Mancos Shale
- Saturated Zone
- 85 mm. Inclinometer Casing

Split-Spoon Hammer Drive
Blows per 6 inches

5 to 5.5' -	4
5.5 to 6' -	4
6 to 6.5' -	3
6.5 to 7' -	4
10 to 10.5'-	4
10.5 to 11' -	4
11 to 11.5' -	3
11.5 to 12' -	5
15 to 15.5' -	8
15.5 to 16' -	8
16 to 16.5 -	4
16.5 to 17 -	6
20 to 20.5 -	28

Piezometer PZ-2 Construction Detail
Snodgrass Mtn. Landslide Study - Crested Butte Mountain Resort



Location: 38.92255 N, 106.97664 W

Drilled and Completed: July 12, 2007

Split Spoon samples were collected at 5 foot intervals from 5 to 40 feet

Topsoil and Cobbles. (0 - 9 ft.)

Clayey Silt and Cobbles.
Some Gravel (9 -15 ft.)

Silty Clay and Cobbles
(15 - 31.5 ft.)

Clay and sparse
small cobbles (31.5 - 41 ft.)

Water Table (~38 - 41 ft.)

Mancos Shale Bedrock
(41 - 44 ft.)

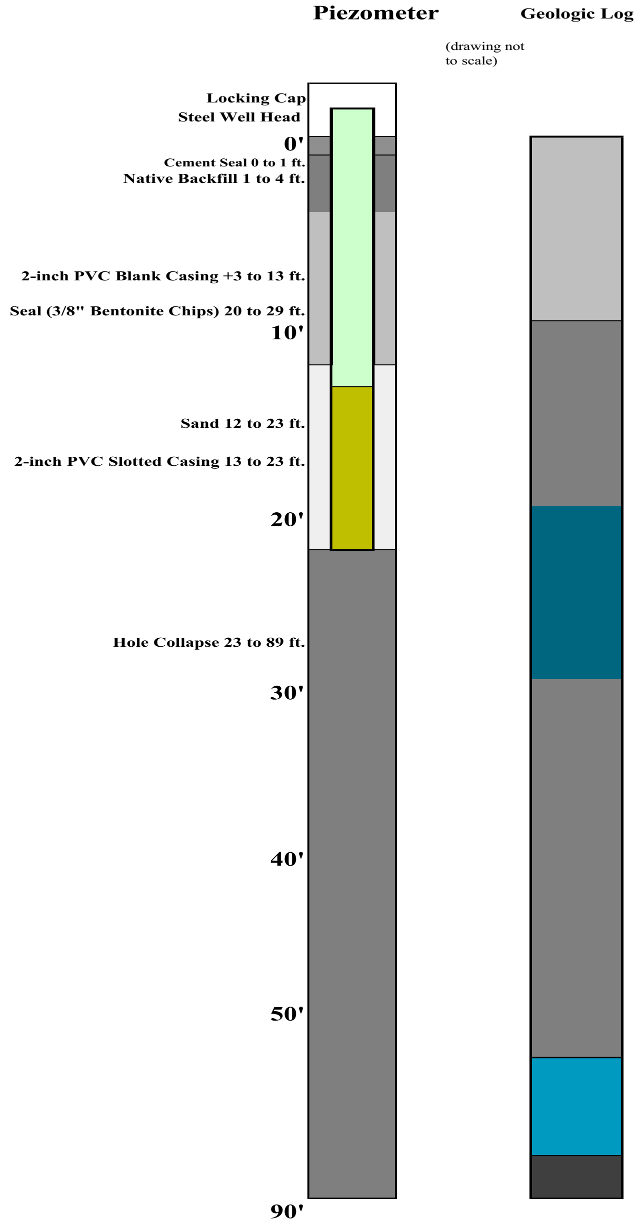
Legend

- **Cement (Quikrete)**
- **Inclinometer Grout (2 parts Cement, 1 part Gel-X)**
- **Bentonite Chips (3/8")**
- **10/20 Silica Sand Filter Pack**
- **2-inch Sch. 40 PVC Blank Casing**
- **2-inch Sch. 40 PVC Slotted Casing (0.020")**
- **Fill - Gravel\Clay\Silt mix**
- **Gravely Clay\Silt**
- **Topsoil**
- **Clay**
- **Bedrock - Mancos Shale**
- **Saturated Zone**
- **85 mm. Slope Indicator Casing**

Split-Spoon Hammer Drive
Blows per 6 inches

10 to 10.5' -	5
10.5 to 11' -	4
11 to 11.5' -	4
11.5 to 12' -	6
15 to 15.5' -	2
15.5 to 16' -	2
16 to 16.5' -	3
16.5 to 17' -	5
20 to 20.5' -	3
20.5 to 21' -	6
21 to 21.5' -	5
21.5 to 22' -	7
25 to 25.5' -	10
25.5 to 26' -	16
26 to 26.5' -	22
26.5 to 27' -	> 50 (refusal)
30 to 30.5' -	12
30.5 to 31' -	16
31 to 31.5' -	20
31.5 to 32' -	25
32 to 32.5' -	21
32.5 to 33' -	17
33 to 33.5' -	27
33.5 to 34' -	> 50 (refusal)
35 to 35.5' -	11
35.5 to 36' -	13
36 to 36.5' -	23
36.5 to 37' -	33
37 to 37.5' -	3
37.5 to 38' -	3
38 to 38.5' -	7

Piezometer PZ-4 Construction Detail
Snodgrass Mtn. Landslide Study - Crested Butte Mountain Resort



Location: 38.92063 N, 106.97614 W

Drilled and Completed: July 13, 2007

Split Spoon samples were collected at 5 foot intervals from 5 to 30 feet

Topsoil and Cobbles. (0 - 10 ft.)

Silty Clay and Cobbles. Some Gravel. Scattered Boulders (10 -64 ft.)

Water Table (21 - 30 ft.)

Small Cobbles. Clay. (64 - 85 ft.)

Water Table (64 - 80 ft.)

Mancos Shale Bedrock (85 - 89 ft.)

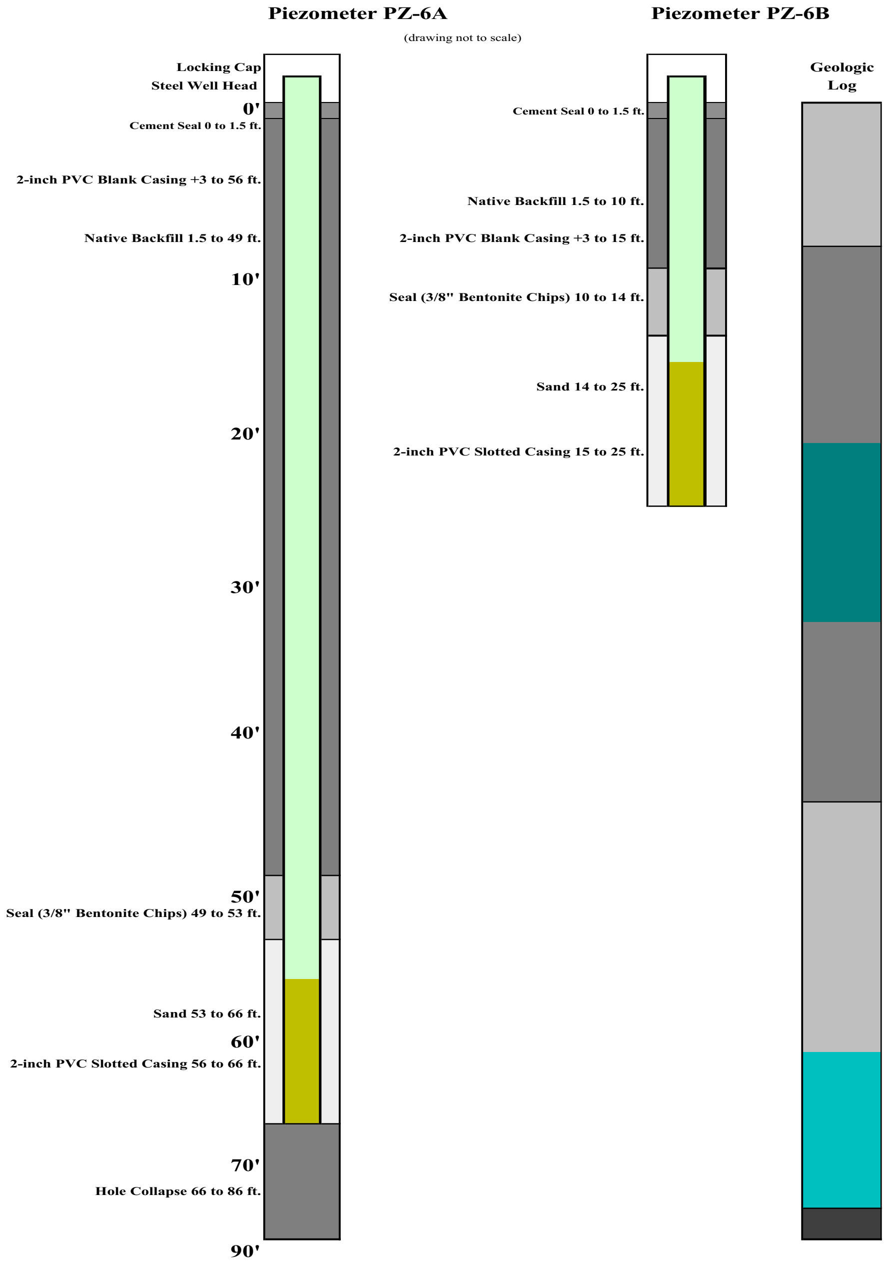
Legend

- **Cement (Quikrete)**
- **Inclinometer Grout (2 parts Cement, 1 part Gel-X)**
- **Bentonite Chips (3/8")**
- **10/20 Silica Sand Filter Pack**
- **2-inch Sch. 40 PVC Blank Casing**
- **2-inch Sch. 40 PVC Slotted Casing (0.020")**
- **Fill - Gravel\Clay\Silt mix**
- **Gravely Clay\Silt**
- **Topsoil**
- **Clay**
- **Bedrock - Mancos Shale**
- **Saturated Zone**
- **85 mm. Slope Indicator Casing**

Split-Spoon Hammer Drive Blows per 6 inches

5 to 5.5' -	10
5.5 to 6' -	11
6 to 6.5' -	11
6.5 to 7' -	9
10 to 10.5'-	4
10.5 to 11' -	4
11 to 11.5' -	5
11.5 to 12' -	7
15 to 15.5' -	3
15.5 to 16' -	2
16 to 16.5' -	4
16.5 to 17' -	5
20 to 20.5' -	4
20.5 to 21' -	3
21 to 21.5' -	6
21.5 to 22' -	4
30 to 30.5' -	7
30.5 to 31' -	11
31 to 31.5' -	11
31.5 to 32' -	14

Piezometer PZ-5 Construction Detail
Snodgrass Mtn. Landslide Study - Crested Butte Mountain Resort



Location: 38.92031 N, 106.97649 W

Drilled and Completed: July 16, 2007

Split Spoon samples were collected at 5 foot intervals from 5 to 32 feet

Topsoil and Cobbles. (0 - 9 ft.)

Silty Clay and Cobbles
Some Gravel
(9 - 46 ft.)

Water Table (21 - ~32 ft.)

Clay and sparse
small cobbles (46 - 65 ft.)

Clay and scattered
boulders (65 - 81 ft.)

Water Table (60 - ~81 ft.)

Mancos Shale Bedrock
(81 - 86 ft.)

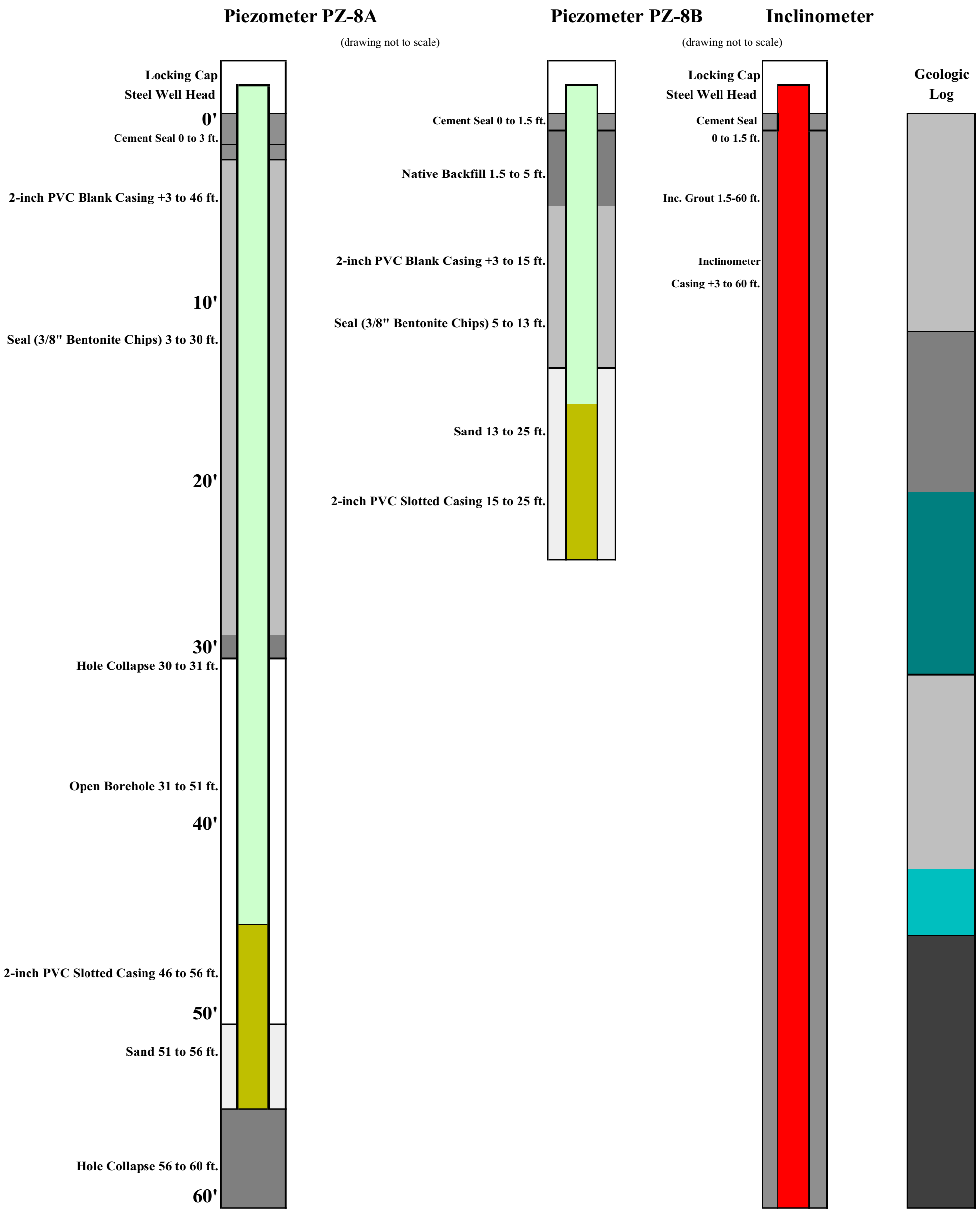
Legend

- **Cement (Quikrete)**
- **Inclinometer Grout (2 parts Cement, 1 part Gel-X)**
- **Bentonite Chips (3/8")**
- **10/20 Silica Sand Filter Pack**
- **2-inch Sch. 40 PVC Blank Casing**
- **2-inch Sch. 40 PVC Slotted Casing (0.020")**
- **Fill - Gravel\Clay\Silt mix**
- **Gravely Clay\Silt**
- **Topsoil**
- **Clay**
- **Bedrock - Mancos Shale**
- **Saturated Zone**
- **85 mm. Slope Indicator Casing**

Split-Spoon Hammer Drive
Blows per 6 inches

5 to 5.5' -	4
5.5 to 6' -	8
6 to 6.5' -	8
6.5 to 7' -	12
10 to 10.5'-	6
10.5 to 11' -	5
11 to 11.5' -	5
11.5 to 12' -	9
15 to 15.5' -	6
15.5 to 16' -	11
16 to 16.5' -	17
16.5 to 17' -	12
20 to 20.5' -	7
20.5 to 21' -	19
21 to 21.5' -	29
21.5 to 22' -	19
25 to 25.5 -	4
25.5 to 26' -	11
26 to 26.5' -	7
26.5 to 27' -	8
30 to 30.5' -	16
30.5 to 31' -	10
31 to 31.5' -	10
31.5 to 32' -	11

Piezometer PZ-6 Construction Detail
Snodgrass Mtn. Landslide Study - Crested Butte Mountain Resort



Location: 38.91899 N, 106.97795 W

Drilled and Completed: July 18, 2007

Split Spoon samples were collected at 5 foot intervals from 5 to 60 feet

Topsoil and Cobbles. (0 - 11 ft.)

Silty Clay and Cobbles
Some Gravel
(11 - 30.25 ft.)

Water Table (19 - 30.25 ft.)

Clay and very sparse
small cobbles (30.25 - 46 ft.)

Water Table (41 - 46 ft.)

Weathered Shale (46 - 56.5 ft.)

Mancos Shale Bedrock
(56.5 - 60 ft.)

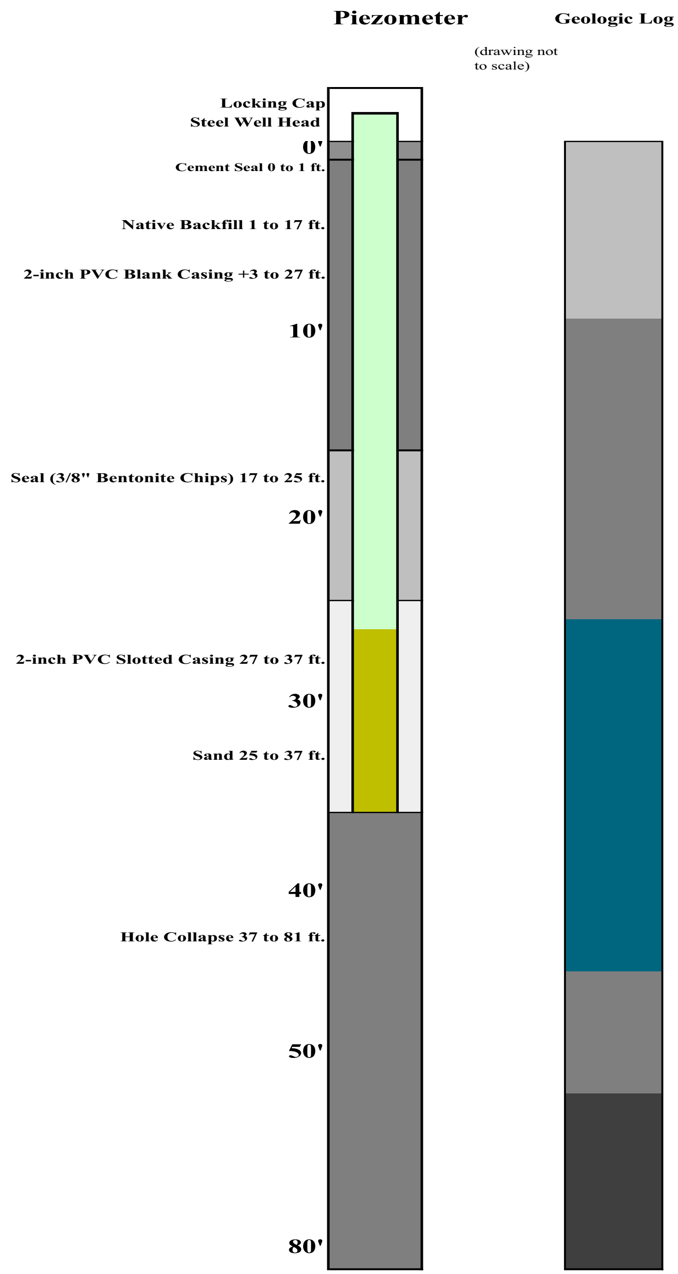
Legend

- **Cement (Quikrete)**
- **Inclinometer Grout (2 parts Cement, 1 part Gel-X)**
- **Bentonite Chips (3/8")**
- **10/20 Silica Sand Filter Pack**
- **2-inch Sch. 40 PVC Blank Casing**
- **2-inch Sch. 40 PVC Slotted Casing (0.020")**
- **Fill - Gravel\Clay\Silt mix**
- **Gravely Clay\Silt**
- **Topsoil**
- **Clay**
- **Bedrock - Mancos Shale**
- **Saturated Zone**
- **85 mm. Slope Indicator Casing**

Split-Spoon Hammer Drive Blows per 6 inches

5 to 5.5' -	13
5.5 to 6' -	13
6 to 6.5' -	13
6.5 to 7' -	14
10 to 10.5'-	4
10.5 to 11' -	4
11 to 11.5' -	7
11.5 to 12' -	8
15 to 15.5' -	9
15.5 to 16' -	6
16 to 16.5' -	8
16.5 to 17' -	8
20 to 20.5' -	5
20.5 to 21' -	7
21 to 21.5' -	7
21.5 to 22' -	12
25 to 25.5 -	6
25.5 to 26' -	7
26 to 26.5' -	10
26.5 to 27' -	11
30 to 30.5' -	5
30.5 to 31' -	6
31 to 31.5' -	9
31.5 to 32' -	10
35 to 35.5' -	8
35.5 to 36' -	12
36 to 36.5' -	23
36.5 to 37' -	13
40 to 30.5' -	7
40.5 to 41' -	14
41 to 41.5' -	13
41.5 to 42' -	17
45 to 45.5' -	8
45.5 to 46' -	9
46 to 46.5' -	15
46.5 to 47' -	20
50 to 50.5' -	10
50.5 to 51' -	13
51 to 51.5' -	15
51.5 to 52' -	22
55 to 55.5' -	9
55.5 to 56' -	16
56 to 56.5' -	> 50 (refusal)
60 to 60.5' -	> 50 (refusal)

Piezometer PZ-8 Construction Detail
Snodgrass Mtn. Landslide Study - Crested Butte Mountain Resort



Location: 38.91783 N, 106.97674 W

Drilled and Completed: July 17, 2007

Split Spoon samples were collected at 5 foot intervals from 5 to 35 feet

Topsoil and Cobbles. (0 - 9 ft.)

Silty Clay and Cobbles. Some Gravel. Scattered Boulders (9 -31 ft.)

Water Table (26 - ~46 ft.)

Mud and mediun cobbles 31 - 36.5 ft.)

Clay and silt Cobbles. Scattered Boulders (36.5 - 60 ft.)

Weathered Shale (60 - ~75 ft.)

Mancos Shale Bedrock (~75 - 81 ft.)

Legend

- **Cement (Quikrete)**
- **Inclinometer Grout (2 parts Cement, 1 part Gel-X)**
- **Bentonite Chips (3/8")**
- **10/20 Silica Sand Filter Pack**
- **2-inch Sch. 40 PVC Blank Casing**
- **2-inch Sch. 40 PVC Slotted Casing (0.020")**
- **Fill - Gravel\Clay\Silt mix**
- **Gravely Clay\Silt**
- **Topsoil**
- **Clay**
- **Bedrock - Mancos Shale**
- **Saturated Zone**
- **85 mm. Slope Indicator Casing**

Split-Spoon Hammer Drive Blows per 6 inches

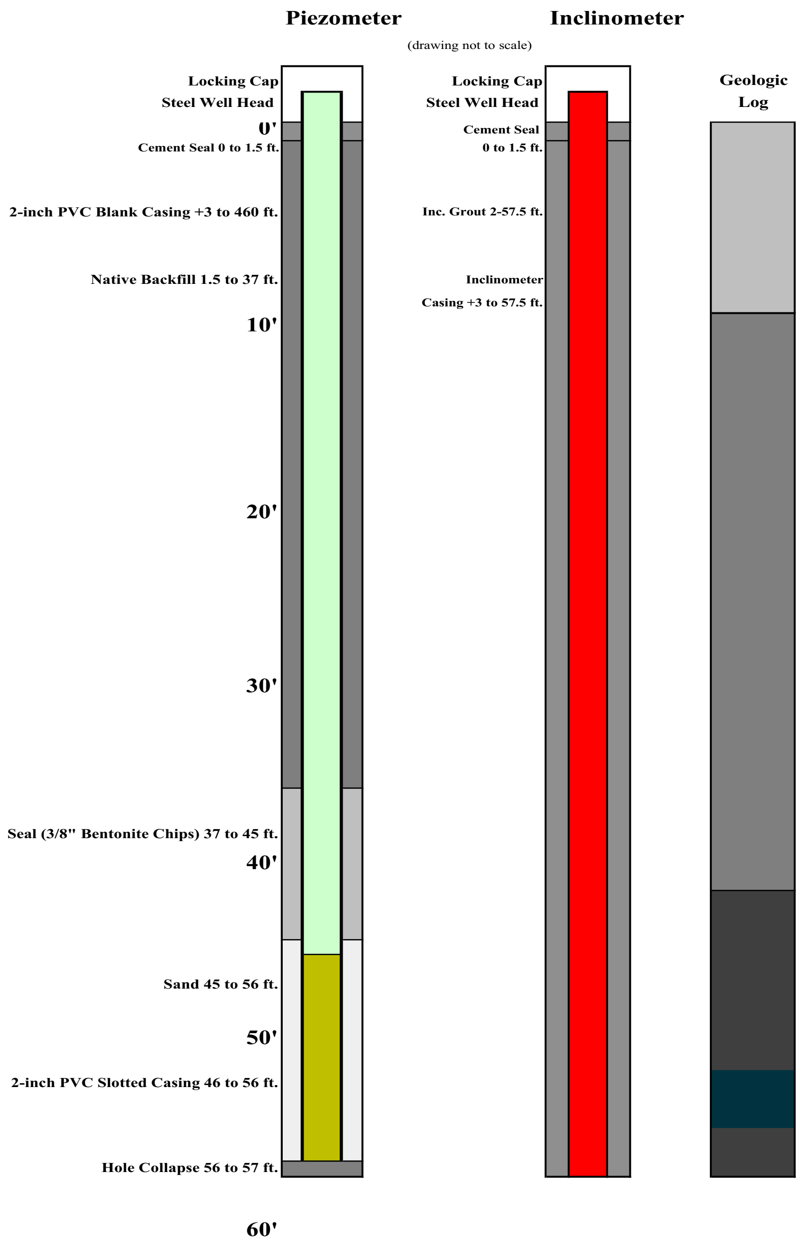
5 to 5.5' -	3
5.5 to 6' -	4
6 to 6.5' -	6
6.5 to 7' -	8
10 to 10.5'-	6
10.5 to 11' -	4
11 to 11.5' -	4
11.5 to 12' -	6
15 to 15.5' -	3
15.5 to 16' -	3
16 to 16.5' -	6
16.5 to 17' -	6
20 to 20.5' -	4
20.5 to 21' -	5
21 to 21.5' -	3
21.5 to 22' -	4
25 to 25.5 -	2
25.5 to 26' -	7
26 to 26.5' -	5
26.5 to 27' -	10
30 to 30.5' -	40
30.5 to 31' -	32
31 to 31.5' -	12
31.5 to 32' -	20
35 to 35.5' -	6
35.5 to 36' -	10
36 to 36.5' -	13
36.5 to 37' -	10

Piezometer PZ-9 Construction Detail
Snodgrass Mtn. Landslide Study - Crested Butte Mountain Resort

Location: 38.92065 N, 106.97279 W

Drilled and Completed: July 29, 2007

Split Spoon samples were collected at 5 foot intervals from 10 to 50 feet



Topsoil and Cobbles. (0 - 10 ft.)

Clayey Silt and Cobbles.
Some Gravel (10 -17 ft.)

Silty Clay and Cobbles
(17 - 42 ft.)

Clay and sparse
small cobbles (31.5 - 42 ft.)

Weathered Shale (42 - 54 ft.)

Water Table (52 - 54 ft.)

Mancos Shale Bedrock
(54 - 57 ft.)

Legend

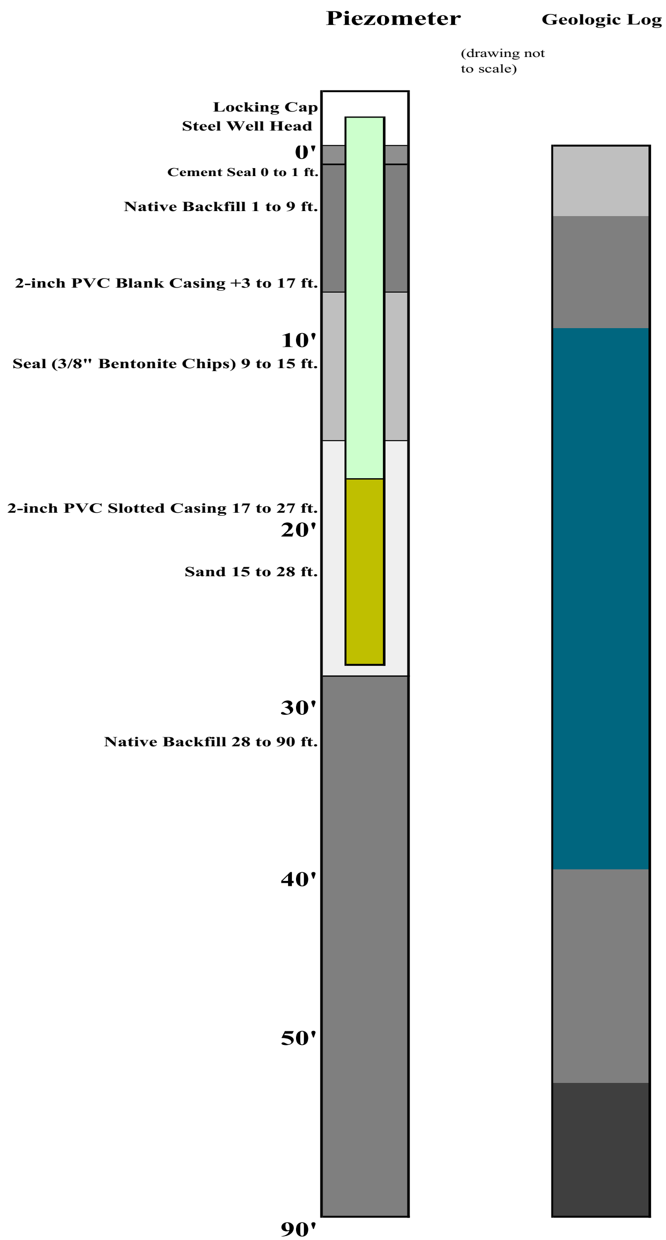
- **Cement (Quikrete)**
- **Inclinometer Grout (2 parts Cement, 1 part Gel-X)**
- **Bentonite Chips (3/8")**
- **10/20 Silica Sand Filter Pack**
- **2-inch Sch. 40 PVC Blank Casing**
- **2-inch Sch. 40 PVC Slotted Casing (0.020")**
- **Fill - Gravel\Clay\Silt mix**
- **Gravely Clay\Silt**
- **Topsoil**
- **Clay**
- **Bedrock - Mancos Shale**
- **Saturated Zone**
- **85 mm. Slope Indicator Casing**

Split-Spoon Hammer Drive
Blows per 6 inches

10 to 10.5'-	4
10.5 to 11' -	5
11 to 11.5' -	5
11.5 to 12' -	3
15 to 15.5' -	17
15.5 to 16' -	3
16 to 16.5' -	3
16.5 to 17' -	3
20 to 20.5' -	4
20.5 to 21' -	4
21 to 21.5' -	4
21.5 to 22' -	5
25 to 25.5 -	5
25.5 to 26' -	4
26 to 26.5' -	6
26.5 to 27' -	8
30 to 30.5' -	6
30.5 to 31' -	6
31 to 31.5' -	7
31.5 to 32' -	9
35 to 35.5' -	7
35.5 to 36' -	9
36 to 36.5' -	12
36.5 to 37' -	14
40 to 30.5' -	7
40.5 to 41' -	14
41 to 41.5' -	23
41.5 to 42' -	20
45 to 47' - -	No Drive. (in shale)
50 to 50.5' -	18
50.5 to 51' -	40
51 to 51.5' -	> 50 (refusal)

Piezometer PZ-11 Construction Detail
Snodgrass Mtn. Landslide Study - Crested Butte Mountain Resort

Location: 38.91985 N, 106.97232 W



Drilled and Completed: July 29, 2007

Split Spoon samples were collected at 5 foot intervals from 5 to 25 feet

Topsoil and Cobbles. (0 - 6 ft.)

Silty Clay and Cobbles. Some Gravel. Scattered Boulders (6 -68 ft.)

Water Table (10 - ~40 ft.)

Weathered Shale (68 - 90 ft.)

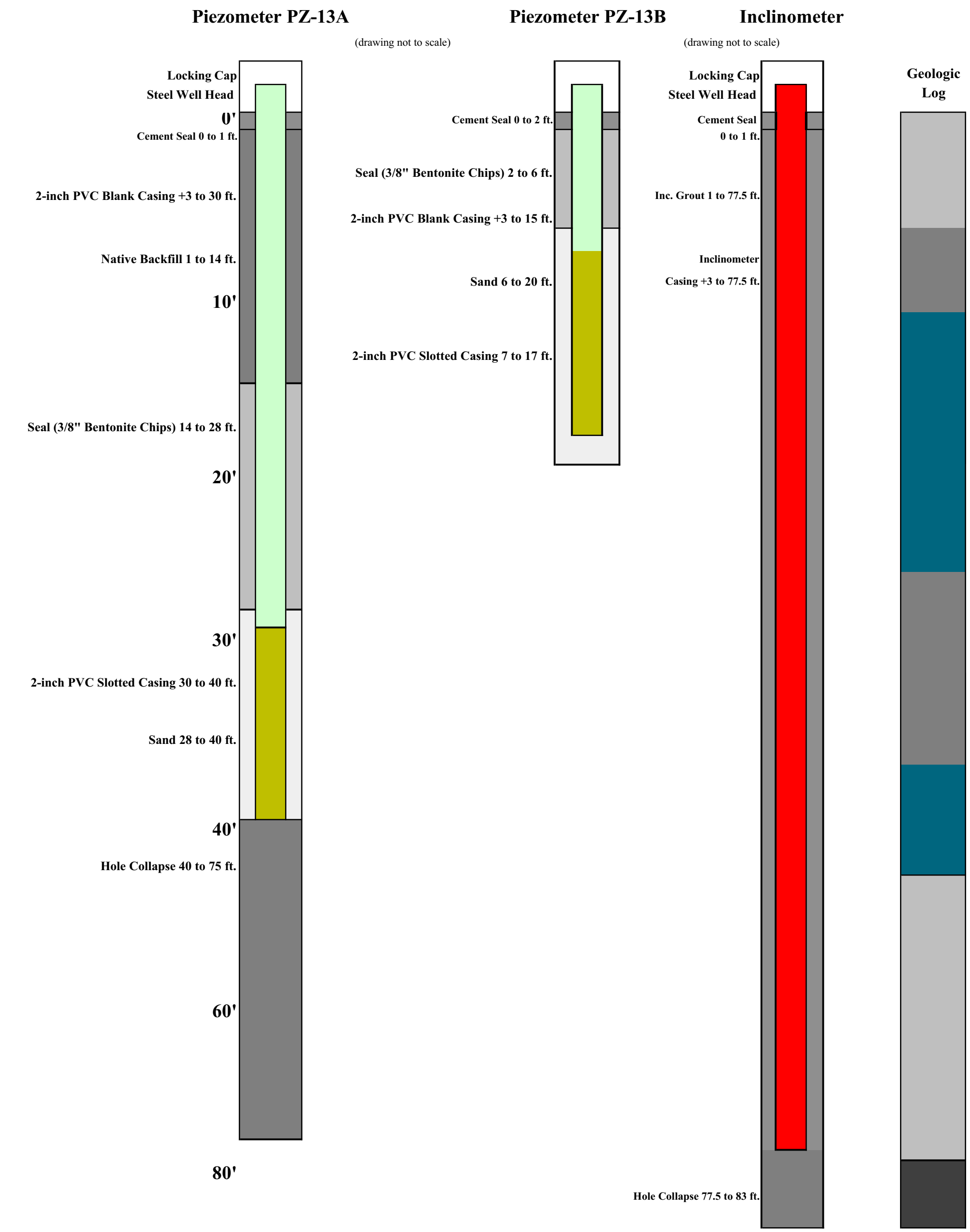
Legend

- Cement (Quikrete)
- Inclinometer Grout (2 parts Cement, 1 part Gel-X)
- Bentonite Chips (3/8")
- 10/20 Silica Sand Filter Pack
- 2-inch Sch. 40 PVC Blank Casing
- 2-inch Sch. 40 PVC Slotted Casing (0.020")
- Fill - Gravel\Clay\Silt mix
- Gravely Clay\Silt
- Topsoil
- Clay
- Bedrock - Mancos Shale
- Saturated Zone
- 85 mm. Slope Indicator Casing

Split-Spoon Hammer Drive Blows per 6 inches

5 to 5.5' -	5
5.5 to 6' -	4
6 to 6.5' -	6
6.5 to 7' -	5
10 to 10.5'-	4
10.5 to 11' -	4
11 to 11.5' -	4
11.5 to 12' -	5
15 to 15.5' -	4
15.5 to 16' -	4
16 to 16.5' -	22
16.5 to 17' -	14
20 to 20.5' -	6
20.5 to 21' -	5
21 to 21.5' -	6
21.5 to 22' -	6
25 to 25.5' -	3
25.5 to 26' -	6
26 to 26.5' -	8
26.5 to 27' -	8

Piezometer PZ-12 Construction Detail
Snodgrass Mtn. Landslide Study - Crested Butte Mountain Resort



Location: 38.91703 N, 106.97256 W

Drilled and Completed: July 26, 2007

Split Spoon samples were collected at 5 foot intervals from 5 to 35 feet

Topsoil and Cobbles. (0 - 6 ft.)

Gravely silt and Cobbles. (6 - 11 ft.)

Silty Clay and Cobbles
Some Gravel
(11 - 45 ft.)

Water Table (11 - ~27 ft.)

Water Table (34 - ~45 ft.)

Clay and sparse
cobbles (45 - 65 ft.)

Clay and many
cobbles (65 - 80 ft.)

Mancos Shale Bedrock
(80 - 83 ft.)

Legend

- Cement (Quikrete)
- Inclinometer Grout (2 parts Cement, 1 part Gel-X)
- Bentonite Chips (3/8")
- 10/20 Silica Sand Filter Pack
- 2-inch Sch. 40 PVC Blank Casing
- 2-inch Sch. 40 PVC Slotted Casing (0.020")
- Fill - Gravel\Clay\Silt mix
- Gravely Clay\Silt
- Topsoil
- Clay
- Bedrock - Mancos Shale
- Saturated Zone
- 85 mm. Slope Indicator Casing

Split-Spoon Hammer Drive Blows per 6 inches

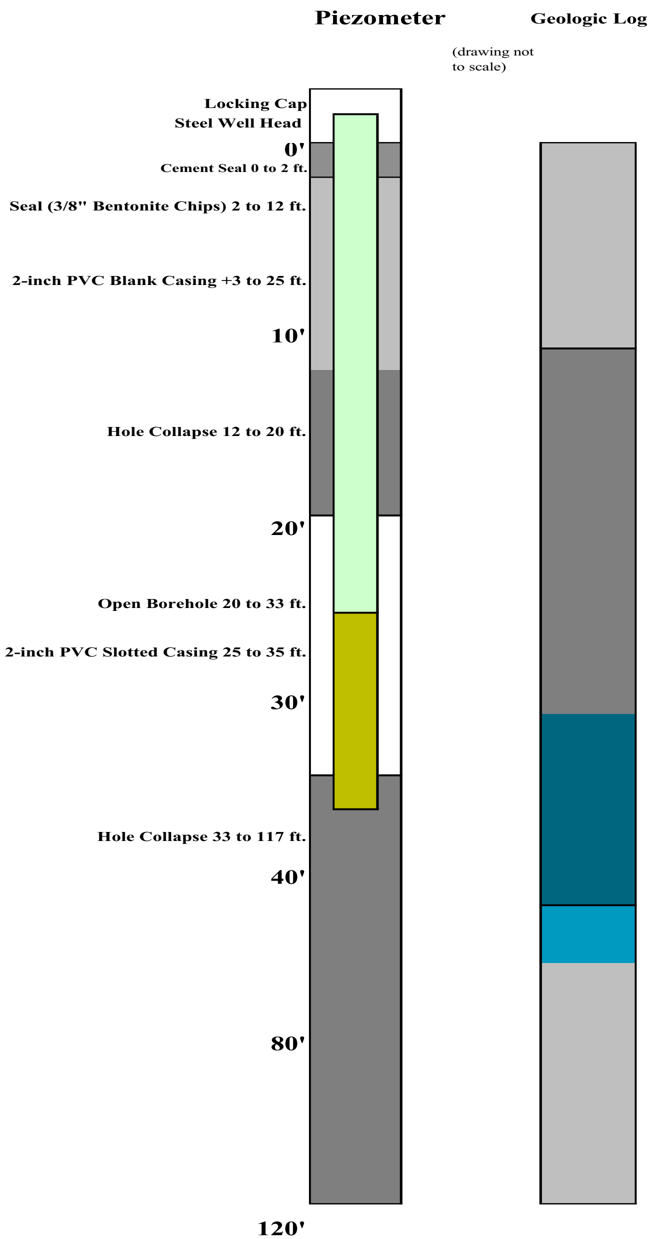
5 to 5.5' -	11
5.5 to 6' -	7
6 to 6.5' -	14
6.5 to 7' -	13
10 to 10.5'-	4
10.5 to 11' -	5
11 to 11.5' -	3
11.5 to 12' -	4
15 to 15.5' -	5
15.5 to 16' -	11
16 to 16.5' -	6
16.5 to 17' -	7
20 to 20.5' -	3
20.5 to 21' -	2
21 to 21.5' -	2
21.5 to 22' -	3
25 to 25.5 -	5
25.5 to 26' -	3
26 to 26.5' -	10
26.5 to 27' -	11
30 to 30.5' -	5
30.5 to 31' -	13
31 to 31.5' -	7
31.5 to 32' -	8
35 to 35.5' -	7
35.5 to 36' -	6
36 to 36.5' -	4
36.5 to 37' -	7

Piezometer PZ-13 Construction Detail
Snodgrass Mtn. Landslide Study - Crested Butte Mountain Resort

Location: 38.91833 N, 106.97177 W

Drilled and Completed: July 28, 2007

Split Spoon samples were collected at 5 foot intervals from 5 to 50 feet



Topsoil and Cobbles. (0 - 11 ft.)

Silty Clay and Cobbles. Some Gravel. Scattered Boulders (11 -33 ft.)

Saturated sm. to med. Cobbles. (33 - 47 ft.)

Water Table (31 - ~65 ft.)

Clay and cobbles. (47 - 90 ft.)

Clay and scattered boulders. (90 - 117 ft.)

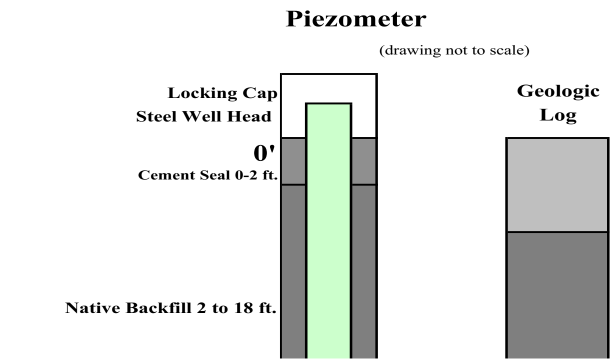
Legend

- **Cement (Quikrete)**
- **Inclinometer Grout (2 parts Cement, 1 part Gel-X)**
- **Bentonite Chips (3/8")**
- **10/20 Silica Sand Filter Pack**
- **2-inch Sch. 40 PVC Blank Casing**
- **2-inch Sch. 40 PVC Slotted Casing (0.020")**
- **Fill - Gravel\Clay\Silt mix**
- **Gravely Clay\Silt**
- **Topsoil**
- **Clay**
- **Bedrock - Mancos Shale**
- **Saturated Zone**
- **85 mm. Slope Indicator Casing**

Split-Spoon Hammer Drive
Blows per 6 inches

5 to 5.5' -	5
5.5 to 6' -	8
6 to 6.5' -	15
6.5 to 7' -	16
10 to 10.5'-	9
10.5 to 11' -	11
11 to 11.5' -	12
11.5 to 12' -	13
15 to 15.5' -	8
15.5 to 16' -	10
16 to 16.5' -	10
16.5 to 17' -	10
20 to 20.5' -	5
20.5 to 21' -	4
21 to 21.5' -	6
21.5 to 22' -	11
25 to 25.5 -	8
25.5 to 26' -	12
26 to 26.5' -	8
26.5 to 27' -	24
30 to 30.5' -	10
30.5 to 31' -	16
31 to 31.5' -	26
31.5 to 32' -	22
35 to 35.5' -	8
35.5 to 36' -	8
36 to 36.5' -	10
36.5 to 37' -	11
40 to 30.5' -	6
40.5 to 41' -	6
41 to 41.5' -	7
41.5 to 42' -	10
45 to 45.5' -	4
45.5 to 46' -	3
46 to 46.5' -	6
46.5 to 47' -	6
50 to 50.5' -	7
50.5 to 51' -	10
51 to 51.5' -	11
51.5 to 52' -	15

Piezometer PZ-14 Construction Detail
Snodgrass Mtn. Landslide Study - Crested Butte Mountain Resort

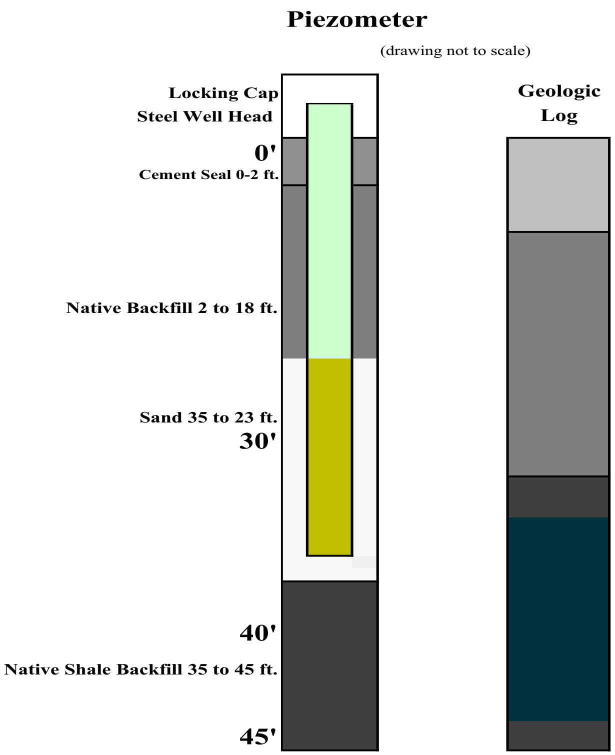


Location: 38.91717 N, 106.96946 W

Drilled and Completed: November 14th, 2006

Sediment grab samples were collected at 5 foot intervals from 5 to 45 feet

Topsoil (0 - 4 ft)

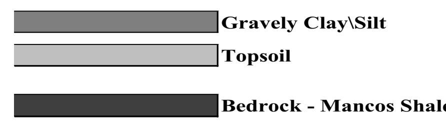


Location: 38.91717 N, 106.96946 W

Drilled and Completed: November 14th, 2007

Sediment grab samples were collected at 5 foot intervals from 5 to 45 feet

Topsoil (0 - 4 ft)

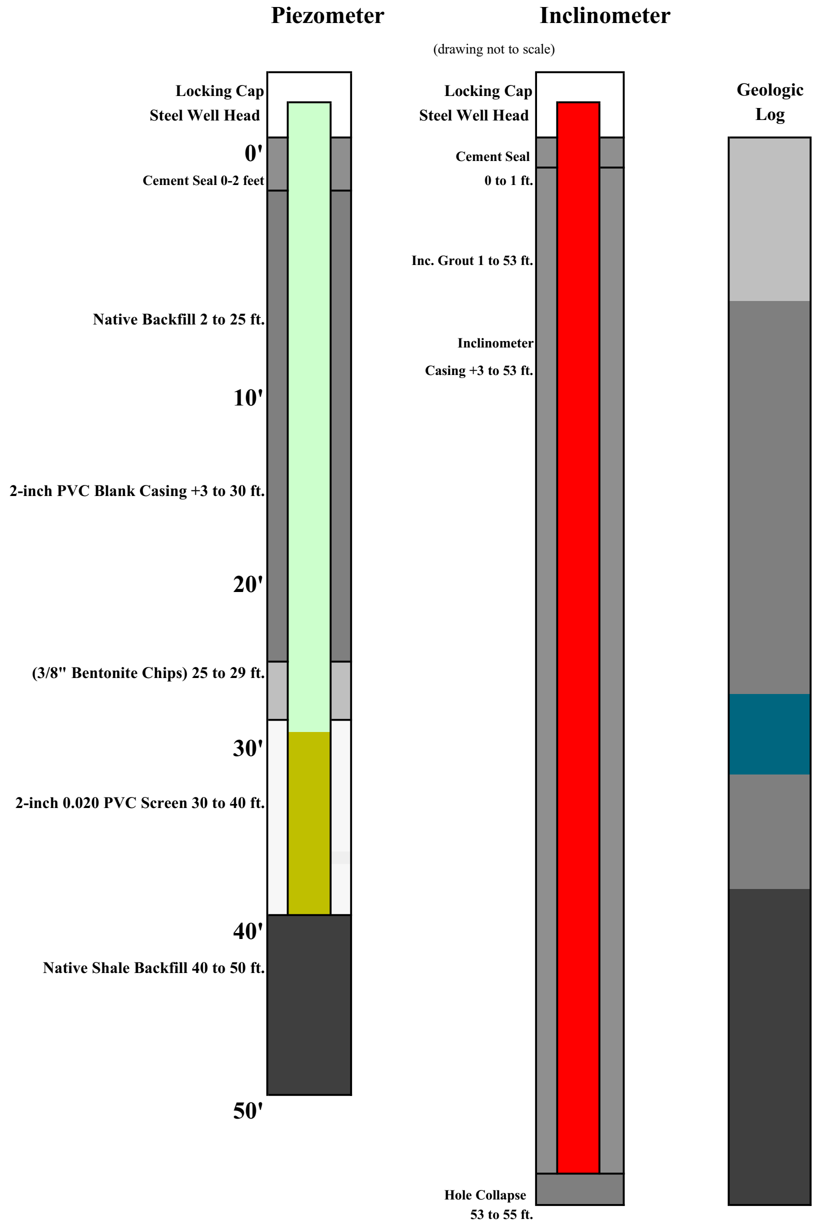


Weathered Shale (31 - 45 ft)

Water Table (~33 - 45 ft)

Mancos Shale Bedrock (45 - 46 ft)

Piezometer PZ-15 Construction Detail
Snodgrass Mtn. Landslide Study - Crested Butte Mountain Resort



Location: 38.91975 N, 106.96959 W

Drilled and Completed: November 14th - 15th, 2006. Inclinometer - July 31, 2007

Split Spoon samples were collected at 5 foot intervals from 10 to 45 feet (July 2007)

Topsoil (0 - 7 ft)

Legend

- **Cement Grout**
- **Bentonite Chips**
- **10/20 Silica Sand Filter Pack**
- **2-inch Sch. 40 PVC Blank Casing**
- **2-inch Sch. 40 PVC Slotted Casing (0.020")**
- **Native Backfill**
- **Clayey Silt and Cobbles. Little Gravel**
- **Topsoil**
- **Bedrock - Mancos Shale**

Clayey Silt and Cobbles.
Little Gravel (7 - 38 ft)

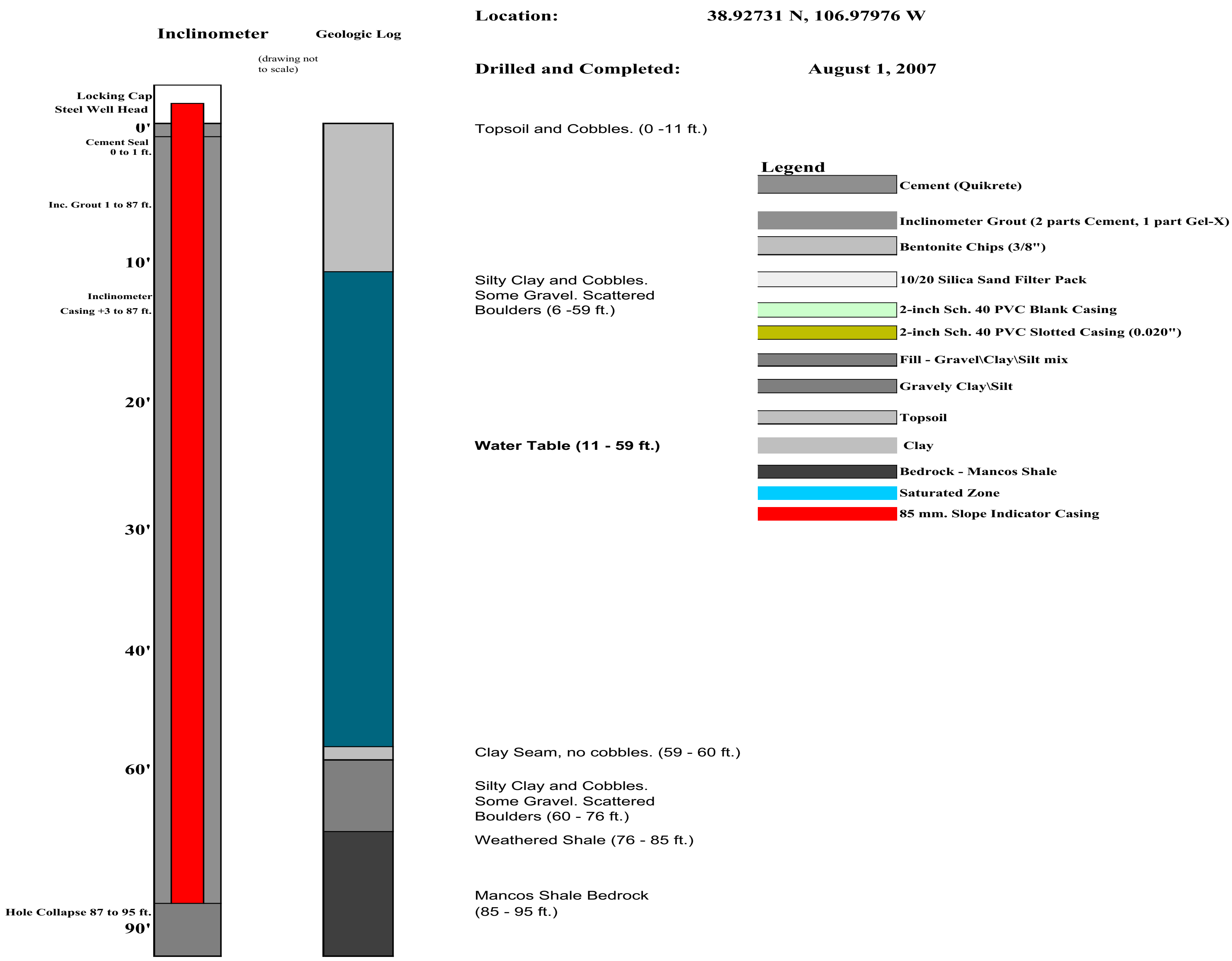
Water Table (27 - 31 ft)

Mancos Shale Bedrock (38 - 55 ft)

Split-Spoon Hammer Drive
Blows per 6 inches

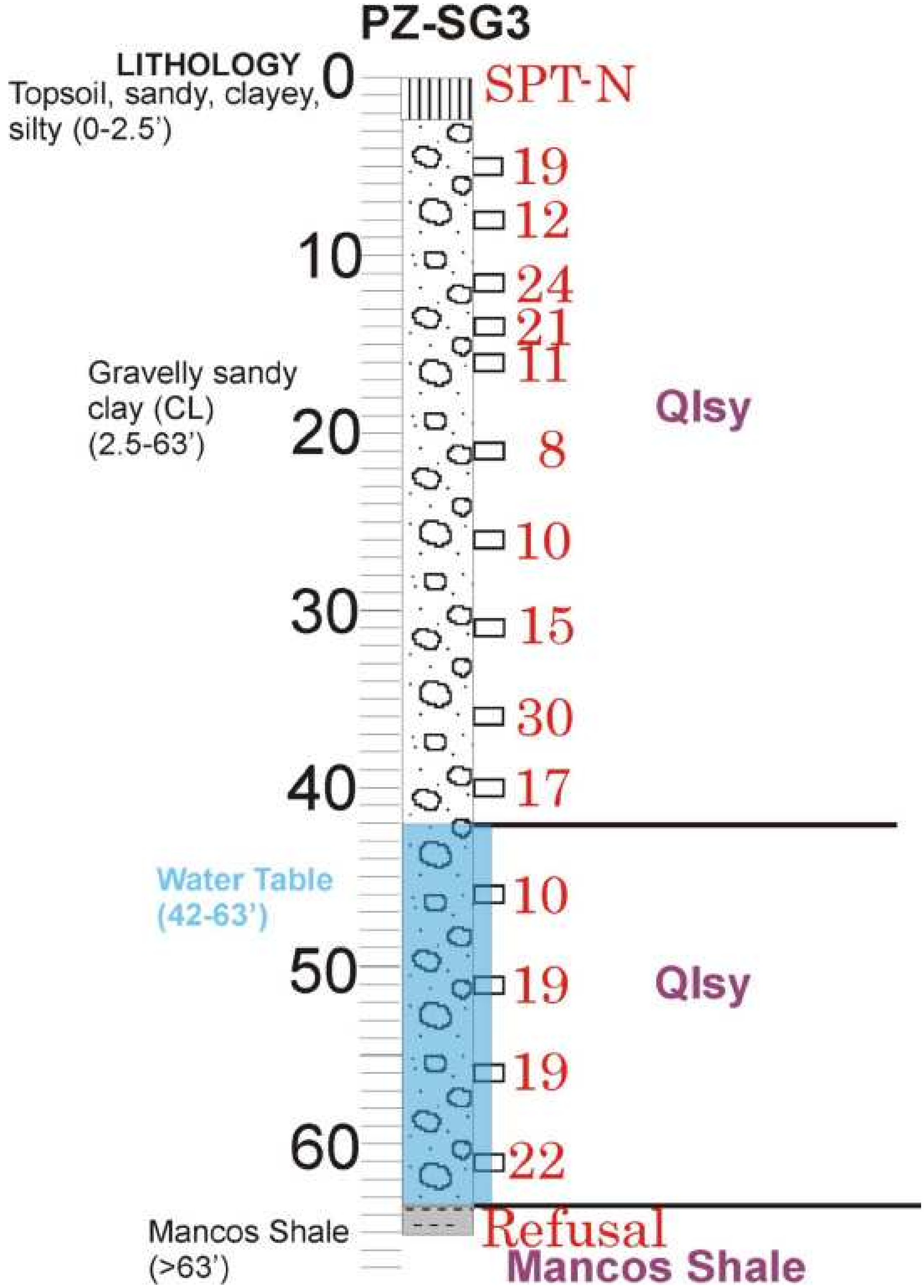
10 to 10.5'-	5
10.5 to 11' -	8
11 to 11.5' -	8
11.5 to 12' -	12
15 to 15.5' -	6
15.5 to 16' -	7
16 to 16.5' -	8
16.5 to 17' -	11
20 to 20.5' -	5
20.5 to 21' -	8
21 to 21.5' -	> 50 (refusal)
25 to 25.5 -	5
25.5 to 26’ -	6
26 to 26.5’ -	11
26.5 to 27’ -	17
30 to 30.5' -	7
30.5 to 31' -	9
31 to 31.5' -	10
31.5 to 32' -	11
35 to 35.5' -	8
35.5 to 36' -	12
36 to 36.5' -	15
36.5 to 37' -	12
40 to 30.5’ -	4
40.5 to 41’ -	8
41 to 41.5’ -	14
41.5 to 42’ -	14
45 to 45.5’ -	12
45.5 to 46’ -	15
46 to 46.5’ -	26
46.5 to 47’ -	30

Piezometer PZ-16 Construction Detail
Snodgrass Mtn. Landslide Study - Crested Butte Mountain Resort

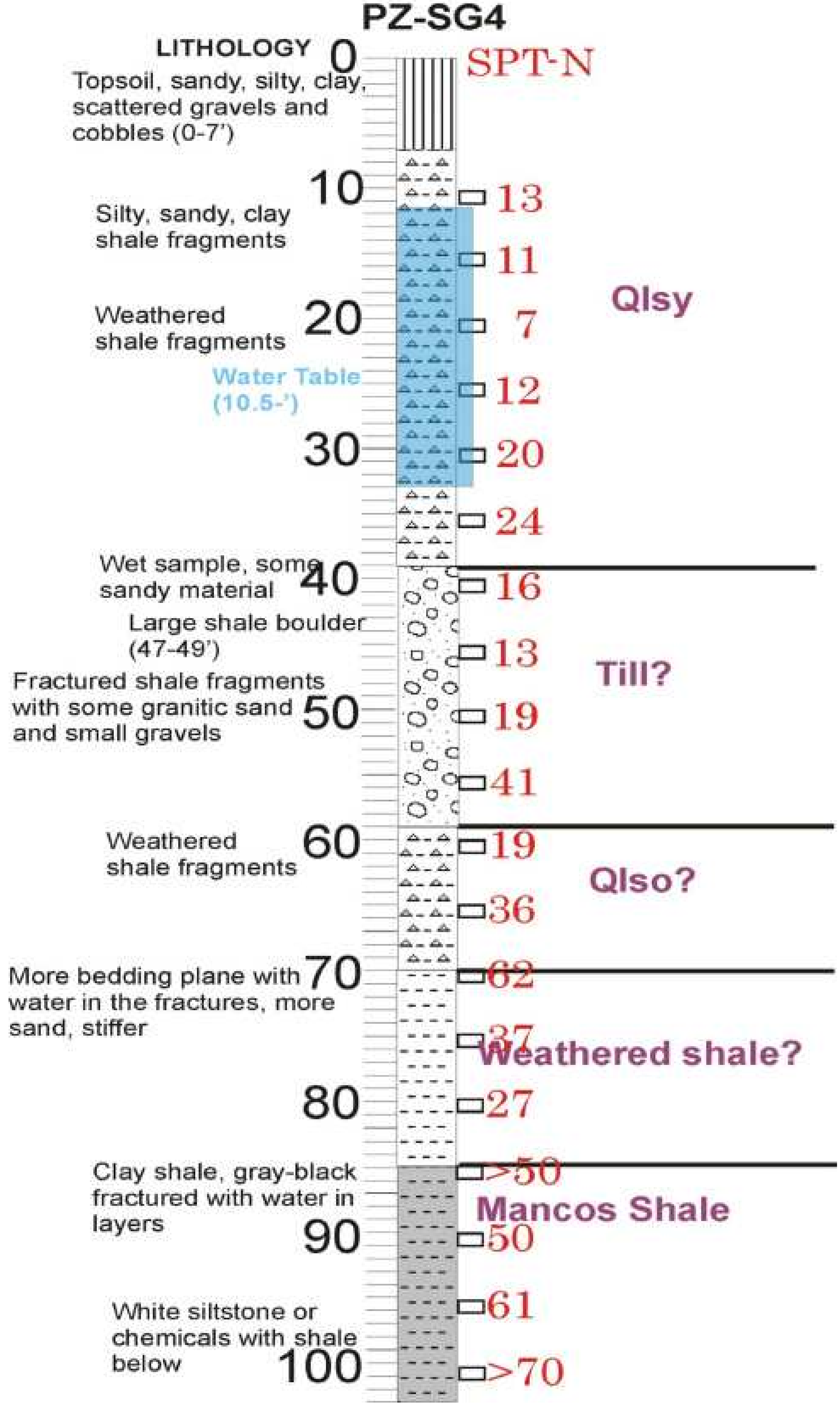


SG-5 Inclinometer Construction Detail
Snodgrass Mtn. Landslide Study - Crested Butte Mountain Resort

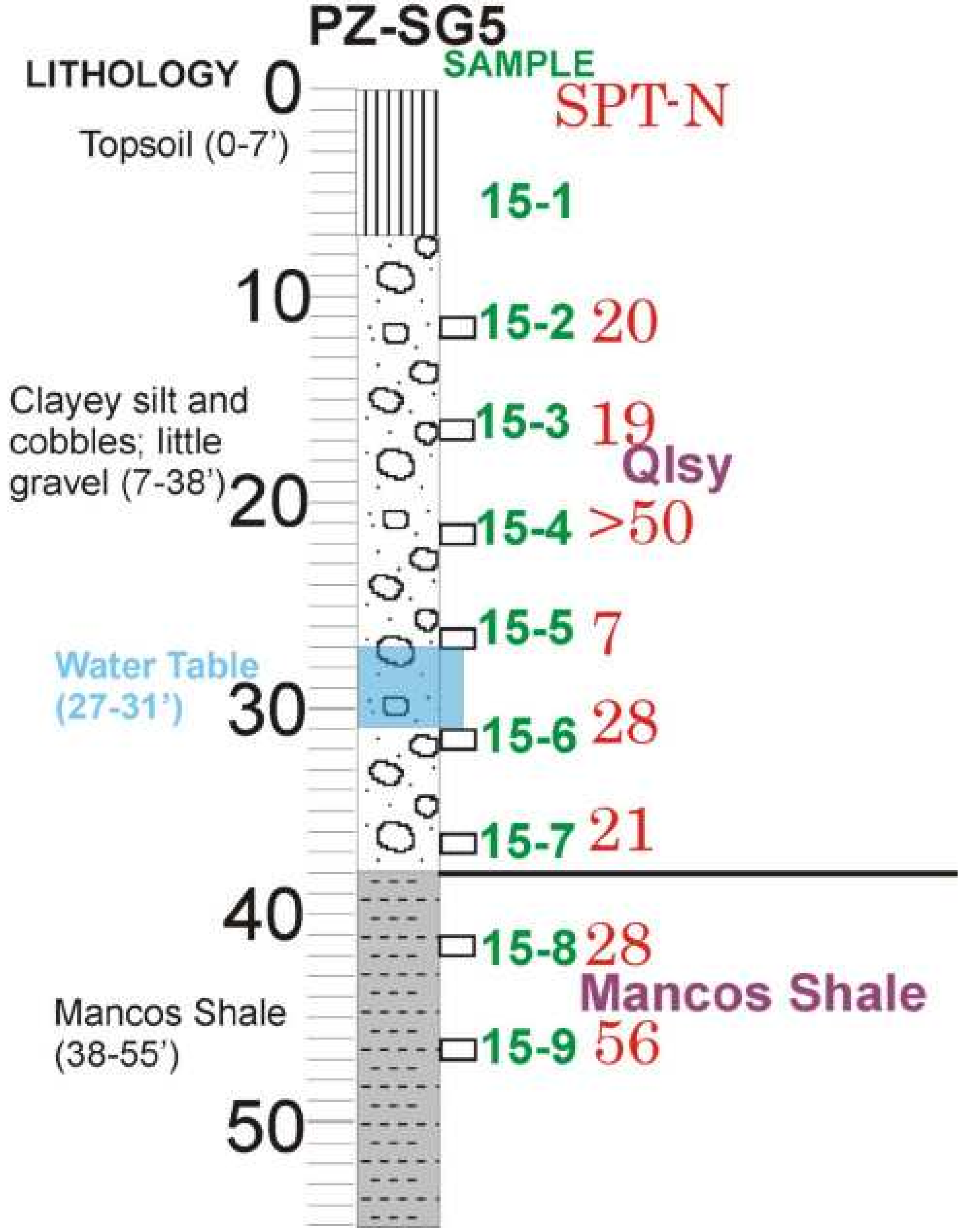
Log of borehole drilled by RCE in 1994



Log of borehole drilled by RCE in 1994



Log of borehole drilled by RCE in 1994



APPENDIX 8.1

Infiltration Ratios for Sub-Watersheds on Snodgrass Mountain

	Precipitation (Inches)						Trail Clearing				Snowmaking				
WS_ID	Annual	Winter	Spring	Summer	WS Area (Acres)	Existing Infiltration (AF)	Trail Area (Acres)	Pre-Clearing Runoff (Inches)	Post-Clearing Runoff (Inches)	Additional Infiltration Due to Trail Clearing (AF)	Snowmaking Precipitation (Inches)	Snowmaking Area (Acres)	Additional Infiltration Due to SM (AF)	Total Additional Infiltration (AF)	Infiltration Ratio (Proposed:Existing)
A0-1	28.83	13.34	8.48	7.01	757.24	-	0.000	-	-	-	0.00	0.000	0.00	-	-
A1-1	25.02	11.58	7.36	6.08	6.87	0.33	0.048	7.50	11.76	0.00	11.28	0.048	0.00	0.00	1.01
A1-2	25.05	11.60	7.37	6.09	164.58	7.80	0.000	8.30	12.85	0.00	11.28	0.571	0.03	0.03	1.00
A1-3	25.46	11.78	7.49	6.19	120.04	5.78	0.000	9.16	13.81	0.00	0.00	0.000	0.00	0.00	1.00
A1-4	25.46	11.78	7.49	6.19	0.66	0.03	0.000	7.85	12.11	0.00	0.00	0.000	0.00	0.00	1.00
A1-5	24.45	11.32	7.19	5.94	0.19	0.01	0.000	6.24	10.43	0.00	0.00	0.000	0.00	0.00	1.00
A1-6	24.67	11.42	7.25	6.00	0.07	0.00	0.000	7.23	11.48	0.00	0.00	0.000	0.00	0.00	1.00
A1-7	24.55	11.36	7.22	5.97	0.57	0.03	0.000	7.90	12.44	0.00	0.00	0.000	0.00	0.00	1.00
A1-8	25.02	11.58	7.36	6.08	6.31	0.30	0.000	6.67	10.88	0.00	0.00	0.000	0.00	0.00	1.00
A2-1	27.79	12.86	8.17	6.76	13.32	0.70	3.274	9.77	14.07	0.08	0.00	0.000	0.00	0.08	1.11
A2-10	24.69	11.43	7.26	6.00	0.39	0.02	0.000	7.25	11.50	0.00	0.00	0.000	0.00	0.00	1.00
A2-11	25.42	11.76	7.47	6.18	0.97	0.05	0.000	6.98	11.19	0.00	0.00	0.000	0.00	0.00	1.00
A2-2	26.32	12.18	7.74	6.40	22.11	1.10	0.705	9.3	13.87	0.02	0.00	0.000	0.00	0.02	1.02
A2-3	26.32	12.18	7.74	6.40	2.75	0.14	0.030	8.54	12.82	0.00	0.00	0.000	0.00	0.00	1.01
A2-4	26.16	12.11	7.69	6.36	12.09	0.60	0.000	8.41	12.69	0.00	0.00	0.000	0.00	0.00	1.00
A2-5	26.16	12.11	7.69	6.36	6.26	0.31	0.000	8.41	12.69	0.00	0.00	0.000	0.00	0.00	1.00
A2-6	25.02	11.58	7.36	6.08	6.51	0.31	0.348	7.5	11.76	0.01	11.28	0.348	0.02	0.03	1.08
A2-7	25.02	11.58	7.36	6.08	9.68	0.46	0.298	6.67	10.88	0.01	11.28	0.298	0.01	0.02	1.05
A2-8	25.17	11.65	7.40	6.12	6.54	0.31	0.000	8.39	12.94	0.00	0.00	0.000	0.00	0.00	1.00
A2-9	25.23	11.68	7.42	6.13	5.69	0.27	0.000	7.67	11.93	0.00	0.00	0.000	0.00	0.00	1.00
A3-1	25.97	12.02	7.64	6.32	1.82	0.09	0.000	8.26	12.54	0.00	0.00	0.000	0.00	0.00	1.00
A3-2	27.79	12.86	8.17	6.76	9.87	0.52	0.000	9.77	14.07	0.00	0.00	0.000	0.00	0.00	1.00
A3-3	26.74	12.38	7.86	6.50	4.90	0.25	0.005	8.89	13.17	0.00	11.28	0.092	0.00	0.00	1.02
A3-4	25.36	11.74	7.46	6.17	1.95	0.09	0.197	6.95	11.15	0.01	11.28	0.201	0.01	0.02	1.16
A3-5	25.44	11.77	7.48	6.18	6.66	0.32	0.128	6.99	11.20	0.00	11.28	1.481	0.07	0.07	1.23
A3-6	26.02	12.04	7.65	6.33	3.25	0.16	0.411	8.3	12.57	0.01	11.28	0.125	0.01	0.02	1.10
A3-7	26.02	12.04	7.65	6.33	3.30	0.16	1.047	8.3	12.57	0.03	11.28	1.800	0.08	0.11	1.68
A3-8	28.72	13.29	8.45	6.98	20.79	1.13	4.567	10.57	14.88	0.10	11.28	1.999	0.09	0.20	1.17
A3-9	31.67	14.66	9.31	7.70	19.98	1.20	7.231	13.21	17.55	0.14	11.28	3.919	0.18	0.33	1.27
A4-1	25.69	11.89	7.55	6.25	3.73	0.18	0.654	8.03	12.30	0.02	11.28	0.963	0.05	0.06	1.34
A4-2	27.27	12.62	8.02	6.63	3.92	0.20	0.718	9.32	13.62	0.02	11.28	1.090	0.05	0.07	1.34
A4-3	27.22	12.60	8.00	6.62	4.26	0.22	1.199	9.28	13.58	0.03	11.28	1.391	0.07	0.09	1.43
A4-4	26.66	12.34	7.84	6.48	1.23	0.06	0.006	8.82	13.10	0.00	11.28	0.001	0.00	0.00	1.00
A4-5	27.84	12.89	8.19	6.77	1.59	0.08	0.000	8.96	13.20	0.00	0.00	0.000	0.00	0.00	1.00
A4-6	27.84	12.89	8.19	6.77	4.65	0.25	0.000	8.96	13.20	0.00	0.00	0.000	0.00	0.00	1.00
A4-7	26.56	12.29	7.81	6.46	9.55	0.48	0.000	8.74	13.02	0.00	0.00	0.000	0.00	0.00	1.00
A4-8	28.35	13.12	8.34	6.89	4.18	0.22	0.000	9.38	13.63	0.00	0.00	0.000	0.00	0.00	1.00
A4-9	27.84	12.89	8.19	6.77	9.76	0.51	0.000	8.96	13.20	0.00	0.00	0.000	0.00	0.00	1.00
A5-1	27.48	12.72	8.08	6.68	6.72	0.35	1.539	9.5	13.80	0.04	11.28	0.501	0.02	0.06	1.17
A6-1	28.35	13.12	8.34	6.89	3.66	0.20	0.365	10.96	15.56	0.01	11.28	0.592	0.03	0.04	1.18
A6-2	27.48	12.72	8.08	6.68	4.07	0.21	1.536	10.25	14.83	0.04	11.28	0.751	0.04	0.07	1.34
A6-3	28.35	13.12	8.34	6.89	3.10	0.17	0.096	9.38	13.63	0.00	11.28	0.927	0.04	0.05	1.28

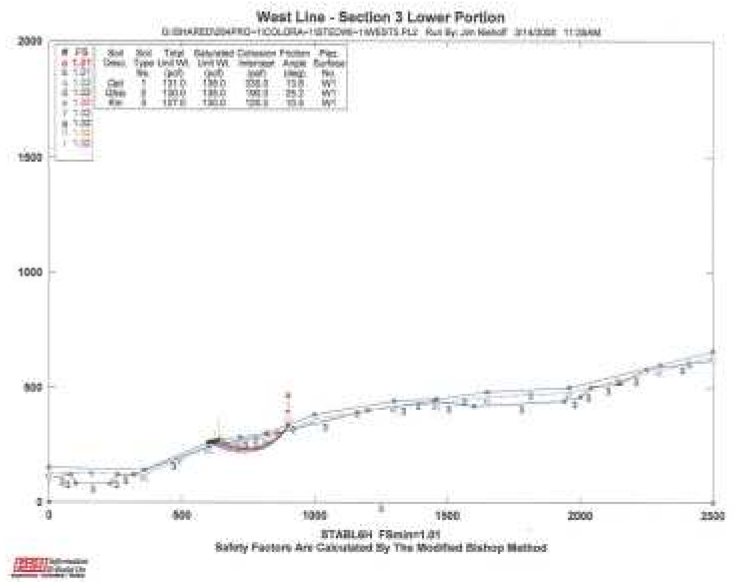
A6-4	27.84	12.89	8.19	6.77	28.96	1.53	2.334	8.96	13.20	0.06	11.28	3.524	0.17	0.22	1.15
A7-1	27.96	12.94	8.22	6.80	0.78	0.04	0.004	9.91	14.21	0.00	11.28	0.383	0.02	0.02	1.44
A7-2	28.52	13.20	8.38	6.93	13.31	0.72	4.199	10.39	14.70	0.09	11.28	2.082	0.10	0.19	1.27
A7-3	27.96	12.94	8.22	6.80	7.30	0.39	0.722	9.91	14.21	0.02	11.28	0.041	0.00	0.02	1.05
A7-4	27.96	12.94	8.22	6.80	3.03	0.16	0.639	9.05	13.30	0.02	11.28	1.925	0.09	0.11	1.66
A8-1	34.50	15.97	10.14	8.39	19.57	1.28	3.145	15.82	20.18	0.06	11.28	2.787	0.13	0.19	1.15
A8-2	29.48	13.64	8.67	7.17	32.07	1.79	16.002	10.35	14.61	0.37	11.28	5.676	0.27	0.63	1.35
A8-3	29.48	13.64	8.67	7.17	116.16	6.48	21.500	11.24	15.56	0.46	11.28	5.970	0.28	0.74	1.11
C1-1	25.05	11.60	7.37	6.09	15.46	0.73	0.000	6.71	10.91	0.00	11.28	1.211	0.06	0.06	1.08
C1-2	25.46	11.78	7.49	6.19	7.71	0.37	0.000	7.01	11.22	0.00	11.28	0.169	0.01	0.01	1.02
C1-3	25.03	11.58	7.36	6.09	6.67	0.32	0.000	7.51	11.77	0.00	11.28	0.103	0.00	0.00	1.02
C1-4	25.44	11.77	7.48	6.18	15.17	0.73	0.000	7.82	12.09	0.00	11.28	0.460	0.02	0.02	1.03
C1-5	25.02	11.58	7.36	6.08	8.35	0.40	0.259	7.5	11.76	0.01	11.28	0.464	0.02	0.03	1.07
C1-6	24.76	11.46	7.28	6.02	3.88	0.18	0.000	6.48	10.67	0.00	0.00	0.000	0.00	0.00	1.00
C2-1	26.55	12.29	7.81	6.45	28.89	1.45	0.000	8.73	13.01	0.00	11.28	1.005	0.05	0.05	1.03
C2-2	25.44	11.77	7.48	6.18	8.46	0.41	0.000	7.82	12.09	0.00	0.00	0.000	0.00	0.00	1.00
C3-1	26.56	12.29	7.81	6.46	12.00	0.60	0.029	9.5	14.07	0.00	11.28	0.711	0.03	0.03	1.06
C3-2	25.44	11.77	7.48	6.18	7.99	0.38	0.000	7.82	12.09	0.00	0.00	0.000	0.00	0.00	1.00
E0-1	24.88	11.51	7.32	6.05	141.33	6.65	0.000	8.16	12.70	0.00	11.28	0.258	0.01	0.01	1.00
E10-1	29.48	13.64	8.67	7.17	30.52	1.70	0.837	12.55	17.26	0.02	0.00	0.000	0.00	0.02	1.01
E1-1	29.52	13.67	8.68	7.18	57.22	3.20	11.436	11.96	16.57	0.25	11.28	9.918	0.47	0.71	1.22
E11-1	29.48	13.64	8.67	7.17	63.14	3.52	1.729	12.55	17.26	0.04	11.28	0.680	0.03	0.07	1.02
E1-2	25.53	11.82	7.51	6.21	22.60	1.09	0.592	8.68	13.24	0.02	11.28	0.612	0.03	0.04	1.04
E12-1	31.60	14.62	9.29	7.68	53.49	3.20	0.117	14.44	19.17	0.00	11.28	0.117	0.01	0.01	1.00
E1-3	26.14	12.10	7.69	6.35	8.59	0.42	0.000	9.16	13.73	0.00	0.00	0.000	0.00	0.00	1.00
E13-1	26.74	12.38	7.86	6.50	35.61	1.80	0.005	10.23	14.91	0.00	11.28	0.005	0.00	0.00	1.00
E1-4	25.61	11.86	7.53	6.23	1.50	0.07	0.000	9.3	13.95	0.00	0.00	0.000	0.00	0.00	1.00
E2-1	25.35	11.73	7.45	6.16	24.27	1.16	1.352	8.52	13.08	0.03	0.00	0.000	0.00	0.03	1.03
E2-2	26.14	12.10	7.69	6.35	11.42	0.57	2.028	9.16	13.73	0.05	11.28	2.609	0.12	0.17	1.31
E2-3	26.14	12.10	7.69	6.35	13.41	0.66	0.344	9.16	13.73	0.01	11.28	1.430	0.07	0.08	1.11
E3-1	25.18	11.65	7.40	6.12	40.04	1.91	6.927	8.39	12.94	0.18	0.00	0.000	0.00	0.18	1.09
E3-2	26.27	12.16	7.73	6.39	11.95	0.59	5.225	9.27	13.84	0.13	11.28	0.063	0.00	0.13	1.22
E3-3	28.73	13.30	8.45	6.99	20.40	1.11	8.357	11.29	15.89	0.19	11.28	4.939	0.23	0.42	1.38
E3-4	29.52	13.67	8.68	7.18	13.98	0.78	5.439	11.96	16.57	0.12	11.28	7.584	0.36	0.47	1.61
E4-1	25.35	11.73	7.45	6.16	33.75	1.62	0.291	9.06	13.71	0.01	0.00	0.000	0.00	0.01	1.00
E5-1	25.18	11.65	7.40	6.12	29.18	1.39	0.502	8.92	13.57	0.01	0.00	0.000	0.00	0.01	1.01
E6-1	25.18	11.65	7.40	6.12	22.73	1.08	0.070	8.92	13.57	0.00	0.00	0.000	0.00	0.00	1.00
E7-1	26.86	12.43	7.90	6.53	14.02	0.71	0.312	10.33	15.01	0.01	0.00	0.000	0.00	0.01	1.01
E8-1	26.86	12.43	7.90	6.53	14.28	0.73	0.000	10.33	15.01	0.00	0.00	0.000	0.00	0.00	1.00
E9-1	26.86	12.43	7.90	6.53	23.31	1.18	0.492	10.33	15.01	0.01	0.00	0.000	0.00	0.01	1.01
F0-1	28.26	13.08	8.31	6.87	0.11	0.01	0.000	10.89	15.48	0.00	0.00	0.000	0.00	0.00	1.00
F0-2	34.30	15.87	10.08	8.34	312.34	20.27	0.352	13.09	17.20	0.01	11.28	0.421	0.02	0.03	1.00
F0-3	27.80	12.87	8.17	6.76	66.37	3.49	0.538	8.24	11.88	0.01	11.28	0.491	0.02	0.04	1.01
F1-1	25.11	11.62	7.38	6.11	3.72	0.18	0.000	5.86	9.34	0.00	0.00	0.000	0.00	0.00	1.00
F1-2	25.11	11.62	7.38	6.11	31.57	1.50	1.627	7.45	11.13	0.04	11.28	0.007	0.00	0.04	1.03
F1-3	25.02	11.58	7.36	6.08	7.27	0.34	0.000	5.81	9.29	0.00	0.00	0.000	0.00	0.00	1.00
F1-4	28.91	13.38	8.50	7.03	35.74	1.95	0.830	8.92	12.67	0.02	11.28	0.048	0.00	0.02	1.01
F1-5	25.69	11.89	7.55	6.25	21.94	1.07	0.000	7.03	10.52	0.00	0.00	0.000	0.00	0.00	1.00
F1-6	28.91	13.38	8.50	7.03	17.48	0.96	0.000	8.92	12.67	0.00	0.00	0.000	0.00	0.00	1.00
F1-7	26.67	12.34	7.84	6.48	140.52	7.09	0.000	6.74	10.28	0.00	0.00	0.000	0.00	0.00	1.00
F2-1	25.56	11.83	7.52	6.21	8.76	0.42	0.000	6.96	10.44	0.00	0.00	0.000	0.00	0.00	1.00
F2-2	25.46	11.78	7.49	6.19	15.61	0.75	2.098	7.66	11.35	0.05	11.28	1.268	0.06	0.11	1.14
F2-3	25.67	11.88	7.55	6.24	26.36	1.28	5.680	7.79	11.48	0.13	11.28	2.633	0.12	0.25	1.20
F2-4	26.45	12.24	7.78	6.43	44.91	2.25	12.572	8.22	11.96	0.29	11.28	16.468	0.77	1.06	1.47

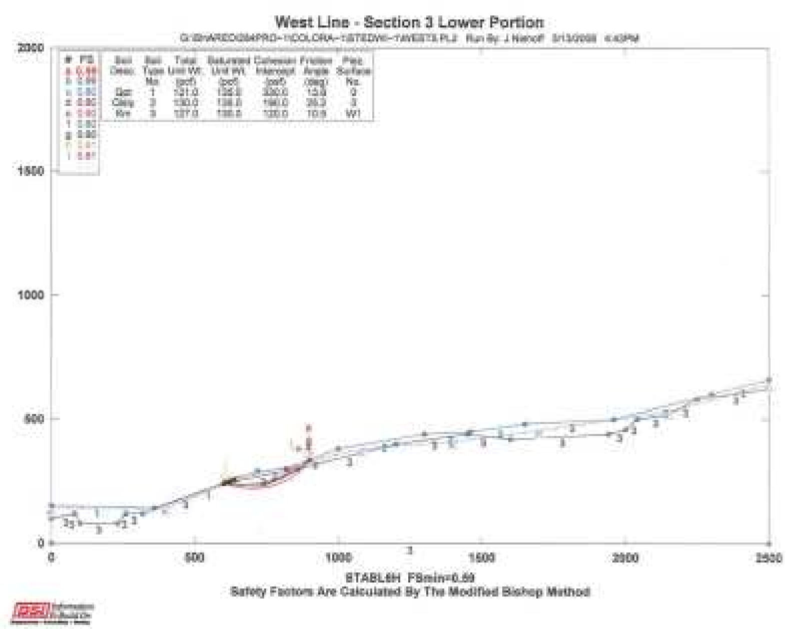
F2-5	25.11	11.62	7.38	6.11	2.39	0.11	0.000	6.69	10.17	0.00	0.00	0.000	0.00	0.00	1.00
F2-6	25.67	11.88	7.55	6.24	14.11	0.69	0.000	6.18	9.67	0.00	0.00	0.000	0.00	0.00	1.00
F2-7	25.18	11.66	7.40	6.12	1.78	0.08	0.000	6.74	10.22	0.00	11.28	0.085	0.00	0.00	1.05
F3-1	29.22	13.53	8.59	7.10	70.30	3.89	0.000	8.25	12.01	0.00	0.00	0.000	0.00	0.00	1.00
F3-2	27.83	12.88	8.18	6.77	139.77	7.36	0.000	7.39	11.03	0.00	0.00	0.000	0.00	0.00	1.00
F3-3	27.28	12.63	8.02	6.63	68.59	3.54	0.000	7.08	10.68	0.00	0.00	0.000	0.00	0.00	1.00
F3-4	27.28	12.63	8.02	6.63	18.87	0.97	0.000	7.08	10.68	0.00	0.00	0.000	0.00	0.00	1.00
F3-5	27.28	12.63	8.02	6.63	5.71	0.29	0.000	7.93	11.53	0.00	0.00	0.000	0.00	0.00	1.00
F3-6	26.98	12.49	7.93	6.56	7.71	0.39	0.000	7.76	11.33	0.00	11.28	0.190	0.01	0.01	1.02
F3-7	25.46	11.78	7.49	6.19	1.14	0.05	0.000	6.89	10.38	0.00	0.00	0.000	0.00	0.00	1.00
F3-8	26.98	12.49	7.93	6.56	50.39	2.57	20.012	8.52	12.29	0.45	11.28	1.859	0.09	0.54	1.21
F3-9	25.46	11.78	7.49	6.19	69.00	3.32	27.036	7.66	11.35	0.63	11.28	7.178	0.34	0.96	1.29
F4-1	27.83	12.88	8.18	6.77	14.80	0.78	0.000	7.39	11.03	0.00	0.00	0.000	0.00	0.00	1.00
F4-2	27.83	12.88	8.18	6.77	25.06	1.32	1.441	8.25	11.90	0.03	11.28	1.441	0.07	0.10	1.08
F4-3	27.70	12.82	8.15	6.74	30.05	1.58	4.365	8.92	12.77	0.10	11.28	4.446	0.21	0.31	1.20
F4-4	27.70	12.82	8.15	6.74	31.11	1.63	9.417	9.53	13.43	0.20	11.28	7.580	0.36	0.56	1.34
F4-5	26.98	12.49	7.93	6.56	20.08	1.03	4.105	7.76	11.33	0.10	11.28	2.884	0.14	0.23	1.23
F4-6	27.83	12.88	8.18	6.77	39.45	2.08	3.436	8.25	11.90	0.08	11.28	0.416	0.02	0.10	1.05
						151.96				**4.82**			**5.60**	**10.42**	**1.10**
														Total	**Average**

APPENDIX 8.2

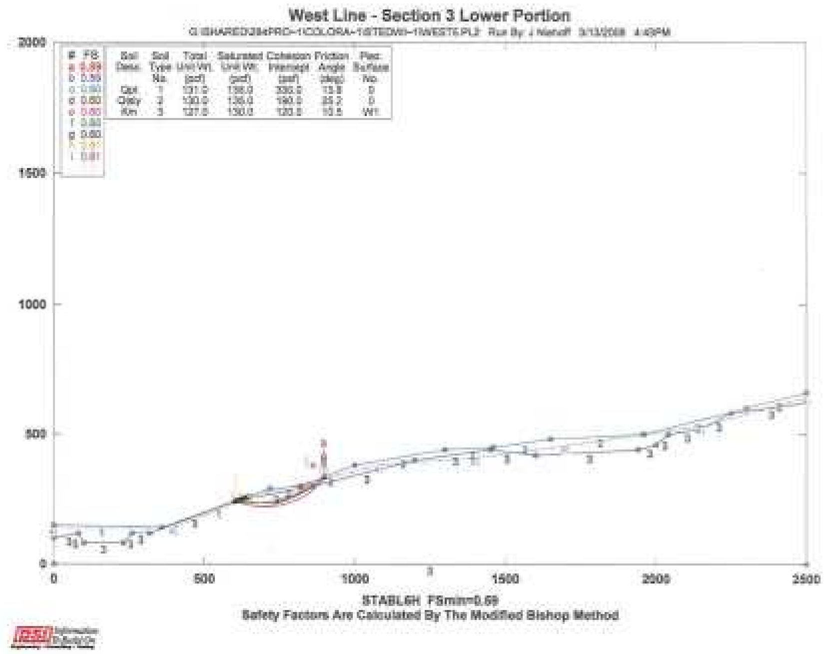
Preliminary LANDSLIDE STABILITY ANALYSES performed for sensitivity analysis

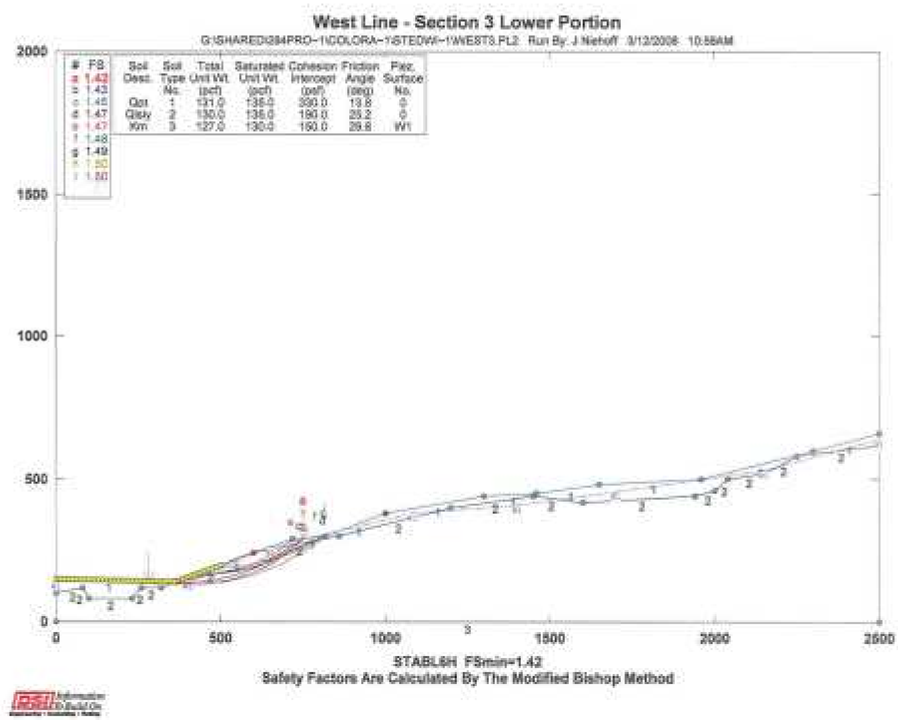
WEST SECTION—Polygon 9—PRE-DEVELOPMENT



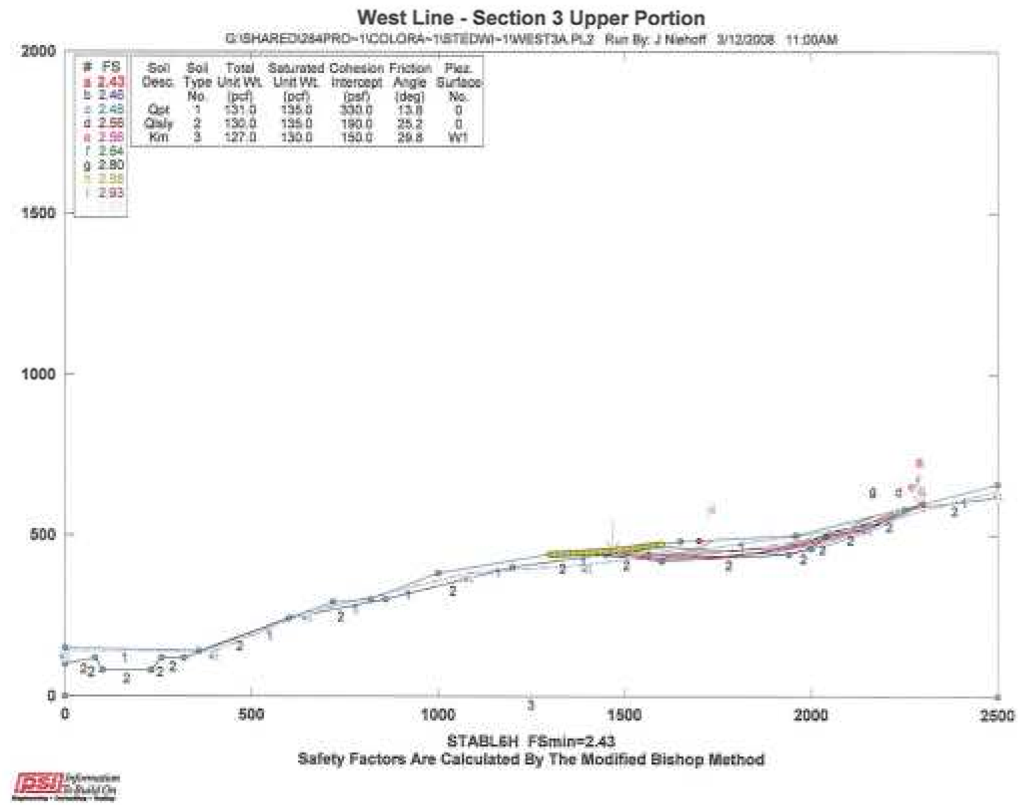


WEST SECTION—Polygon 9—POST-DEVELOPMENT

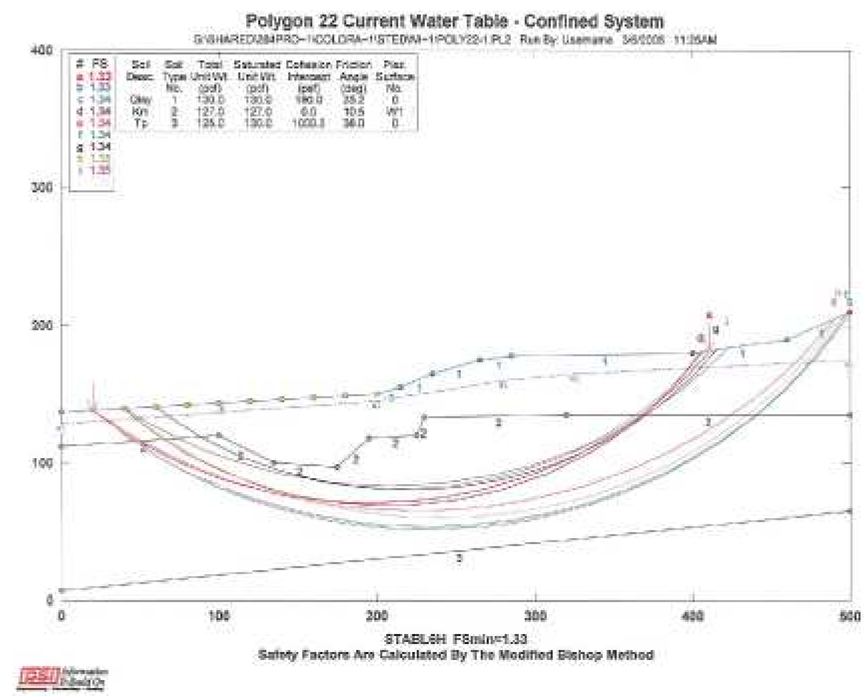

West Line - Section 3 Lower Portion
G:\SHARED\284PRO~1\COLORA~1\STEDWI~1\WEST5.PL2 Run By: J Niehoff 3/13/2008 4:49PM
FS
a 0.59
b 0.59
c 0.60
d 0.60
e 0.60
f 0.60
g 0.60
h 0.61
i 0.61
Soil Desc. | Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Piez. Surface No.
Qpt 1 131.0 135.0 330.0 13.8 0
Qsly 2 130.0 135.0 190.0 25.2 0
Km 3 127.0 130.0 120.0 10.5 W1
2000
1500
1000
500
0
0
500
1000
1500
2000
2500
STABL6H FSmin=0.59
Safety Factors Are Calculated By The Modified Bishop Method

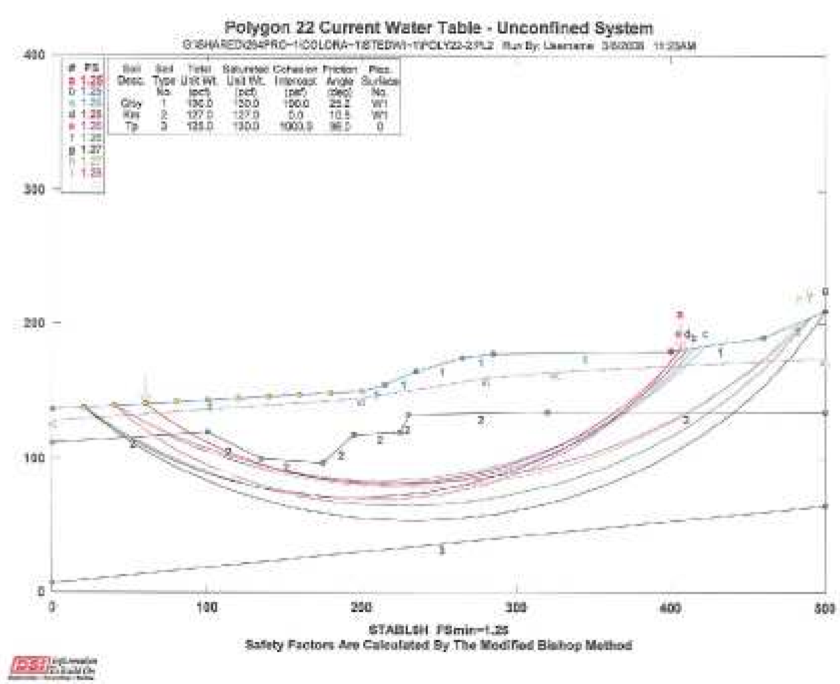

West Line - Section 3 Lower Portion
G:\SHARED\284PRO~1\COLORA~1\STEDWI~1\WEST3.PL2 Run By: J Niehoff 3/12/2008 10:58AM
FS
a 1.42
b 1.43
c 1.45
d 1.47
e 1.47
f 1.48
g 1.49
h 1.50
i 1.50
Soil Desc. | Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Piez. Surface No.
Qpt 1 131.0 135.0 330.0 13.8 0
Qsly 2 130.0 135.0 190.0 25.2 0
Km 3 127.0 130.0 160.0 29.8 W1
2000
1500
1000
500
0
0
500
1000
1500
2000
2500
STABL6H FSmin=1.42
Safety Factors Are Calculated By The Modified Bishop Method

WEST SECTION—Polygon 11—PRE-DEVELOPMENT

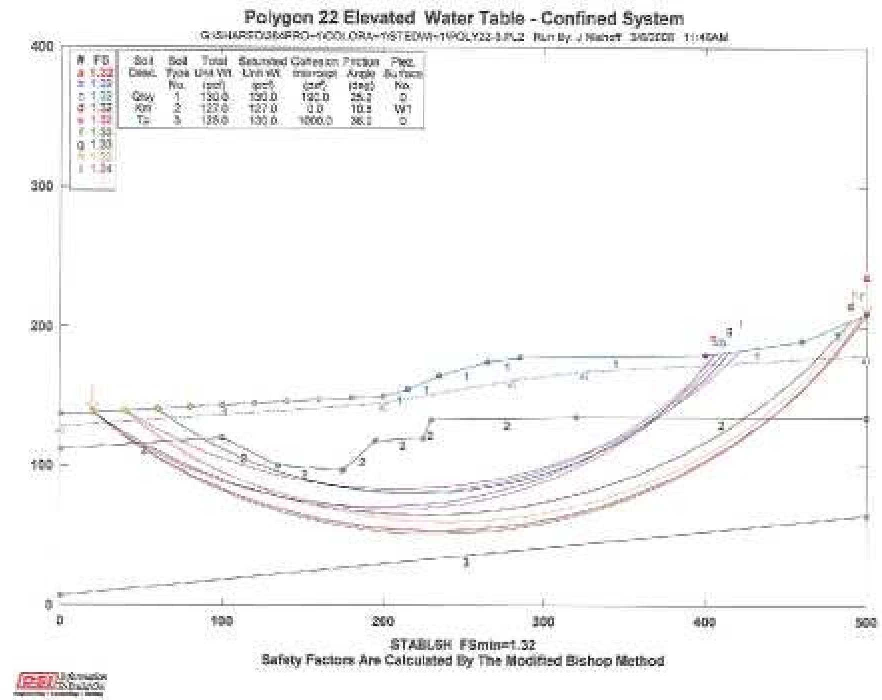


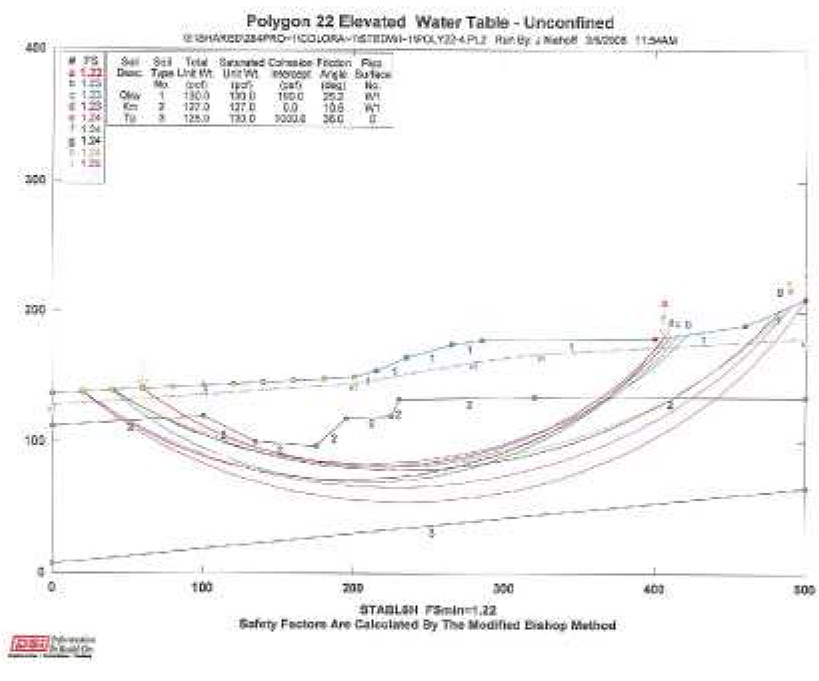
CENTRAL SECTION, NORTH HALF—Polygon 22—PRE-DEVELOPMENT





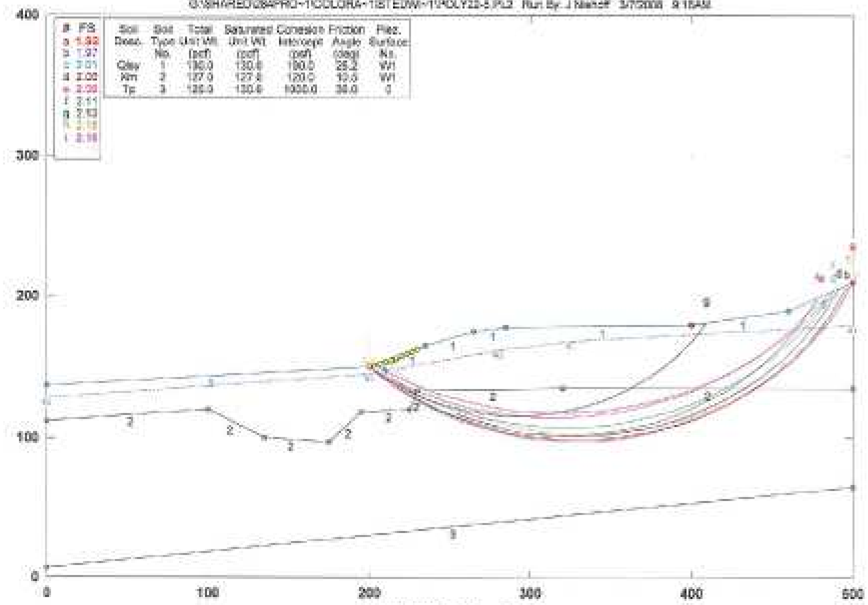
CENTRAL SECTION, NORTH HALF—Polygon 22—POST-DEVELOPMENT





Polygon 22 Elevated Water Table - Unconfined

G:\SHARED\284PRO~1\COLORA~1\STEDW~1\POLY22-5.PL2 Run By: J Niehoff 3/7/2008 9:16AM



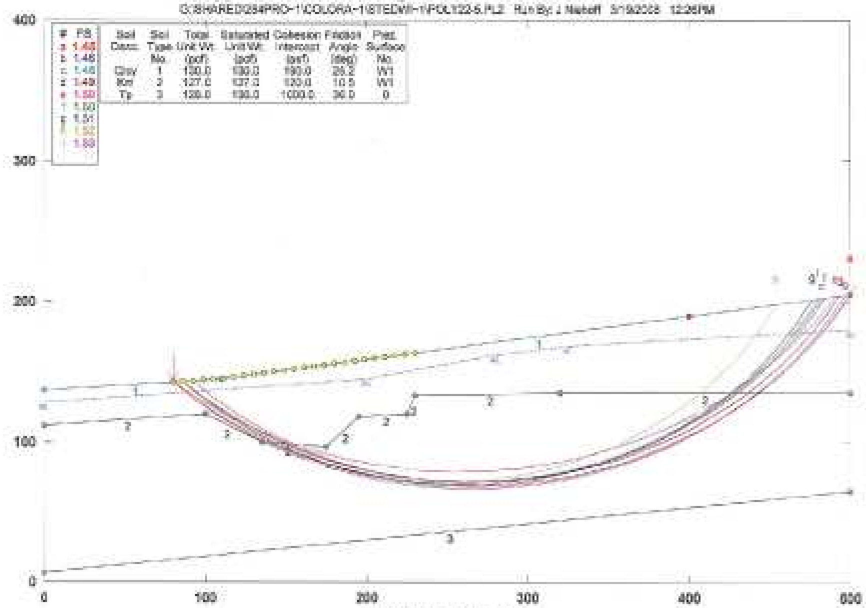
STABL6H FSmin=1.93

Safety Factors Are Calculated By The Modified Bishop Method

PSI Information To Build On

Polygon 22 - Post Grading Elevated Water Table - Unconfined

G:\SHARED\284PRO~1\COLORA~1\STEDW~1\POLY22-5.PL2 Run By: J Niehoff 3/19/2008 12:26PM

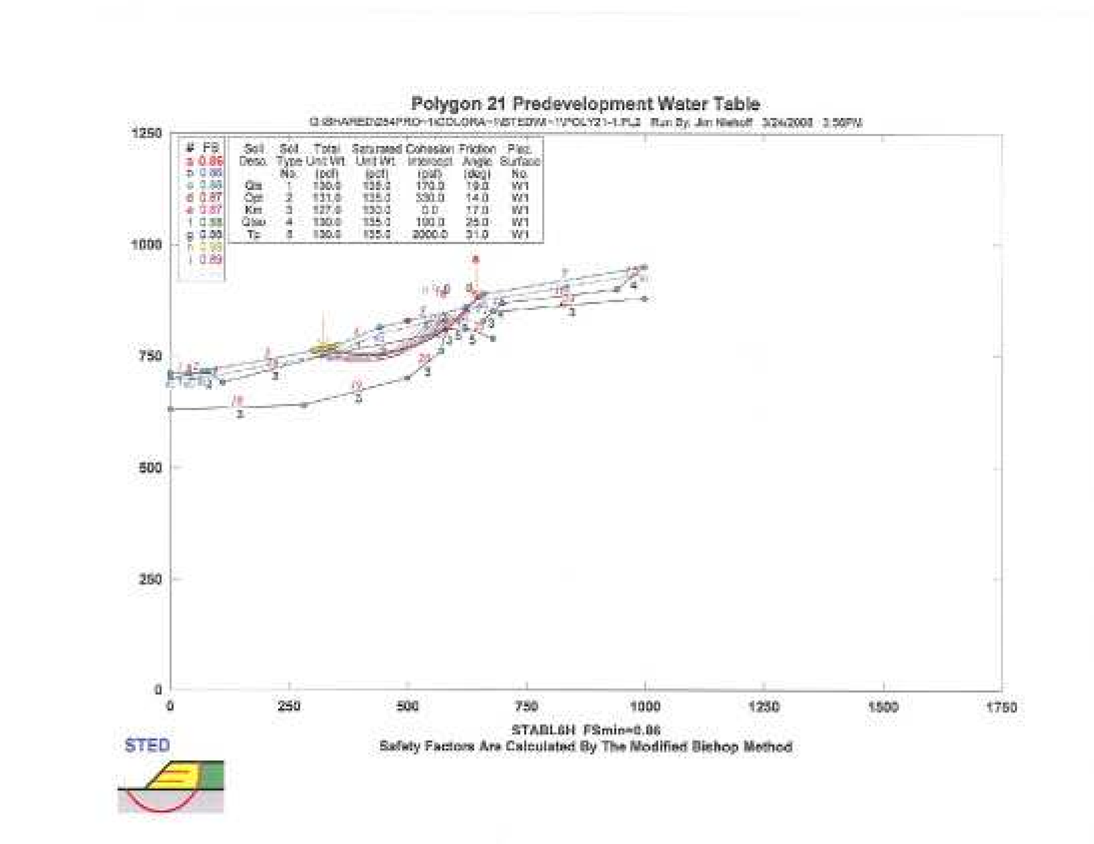


STABL6H FSmin=1.45

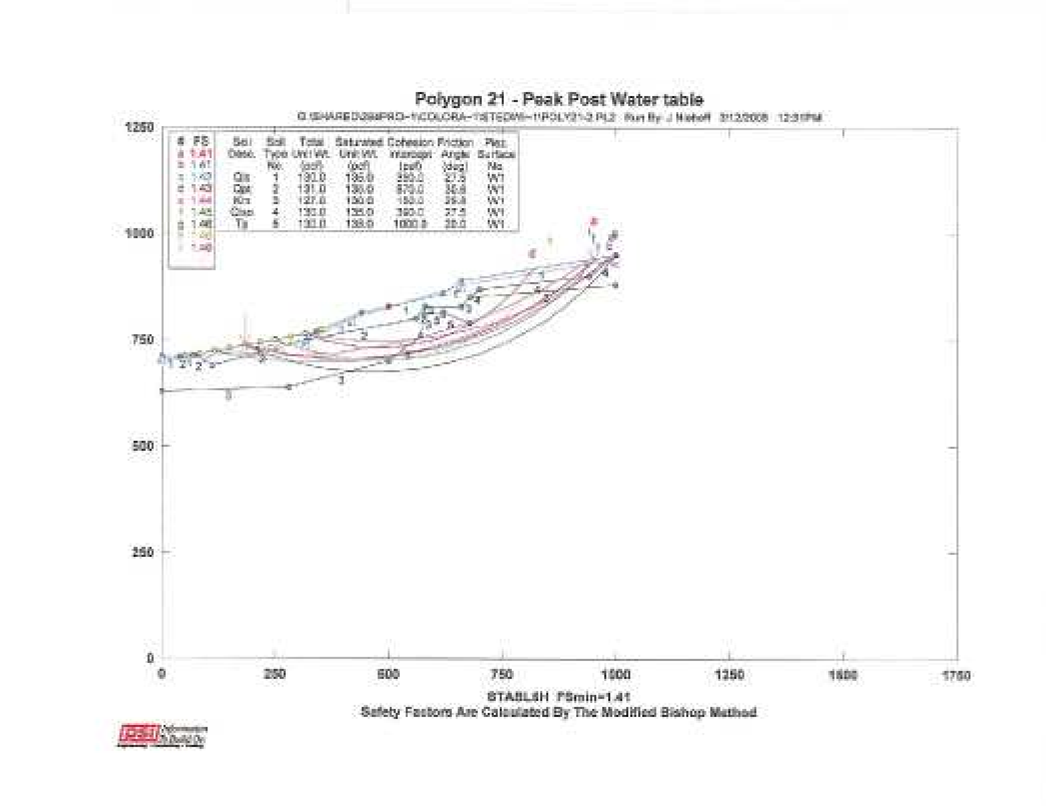
Safety Factors Are Calculated By The Modified Bishop Method

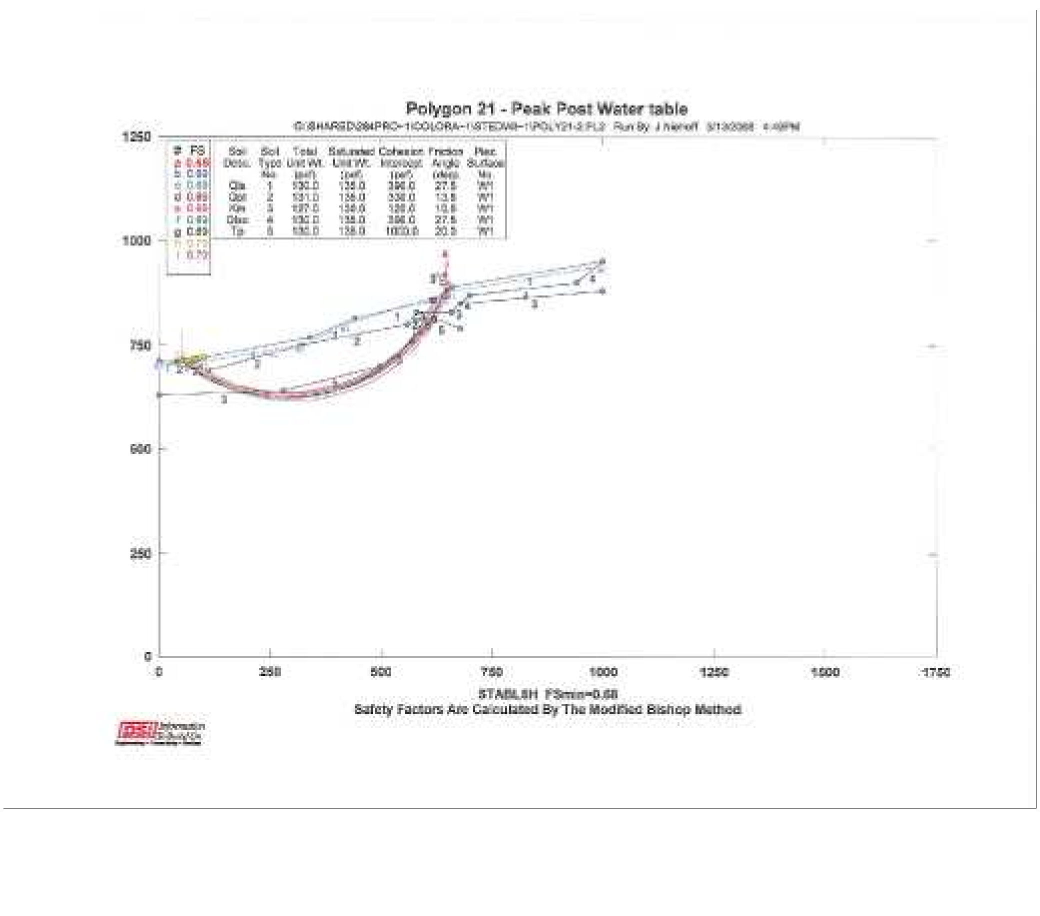
PSI Information To Build On

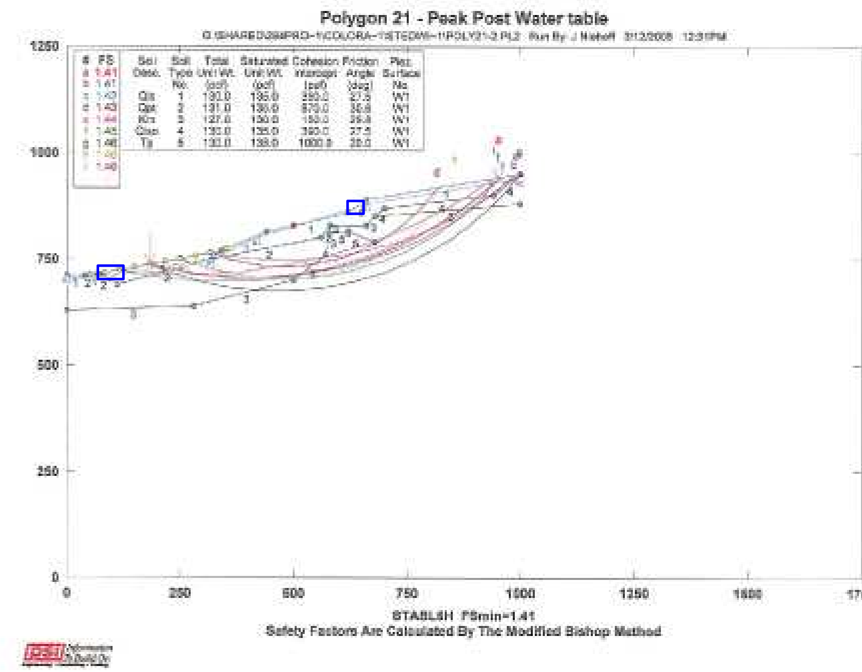
CENTRAL SECTION, NORTH HALF—Polygon 21—PRE-DEVELOPMENT



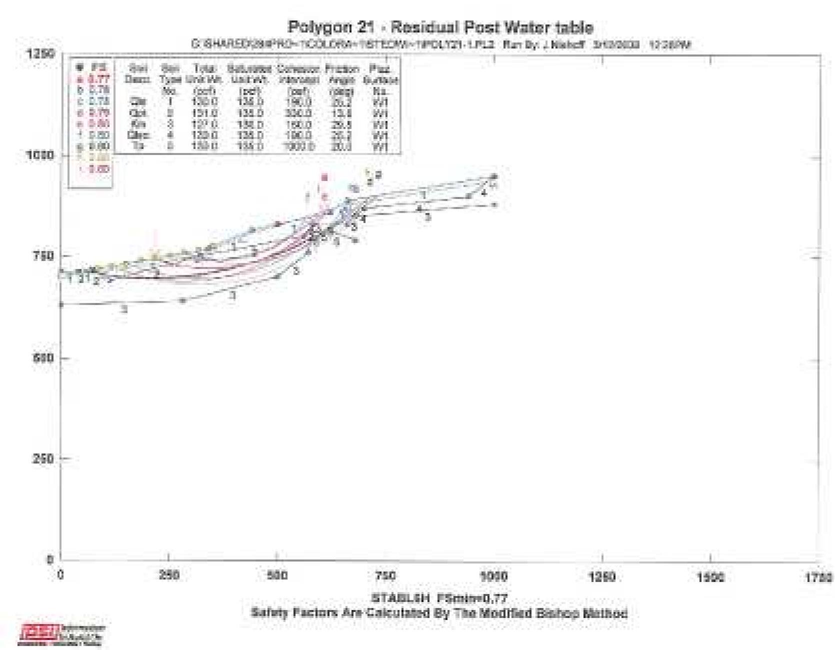
CENTRAL SECTION, NORTH HALF—Polygon 21—POST-DEVELOPMENT



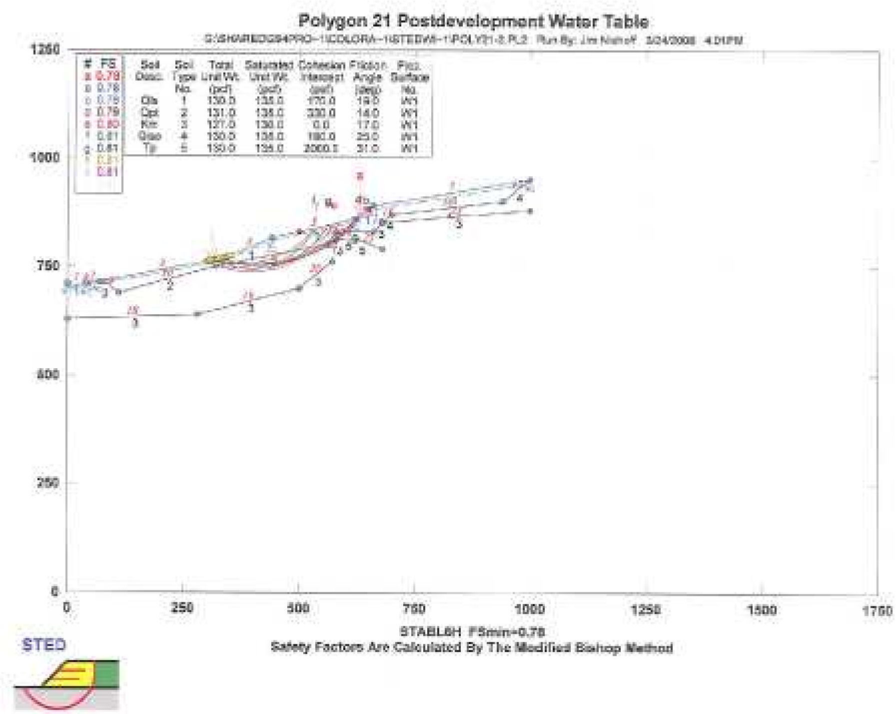




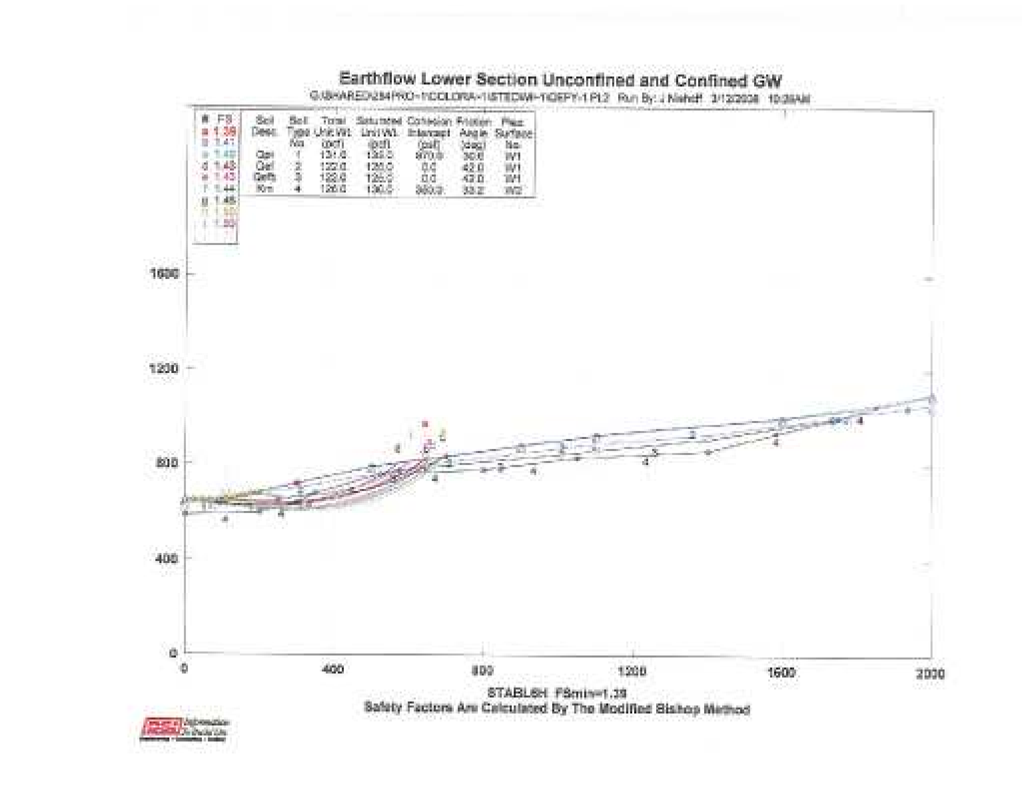
Polygon 21 - Peak Post Water table
1250
1000
750
500
250
0
0
250
500
750
1000
1250
1500
1750
STABL6H FSmin=1.41
Safety Factors Are Calculated By The Modified Bishop Method

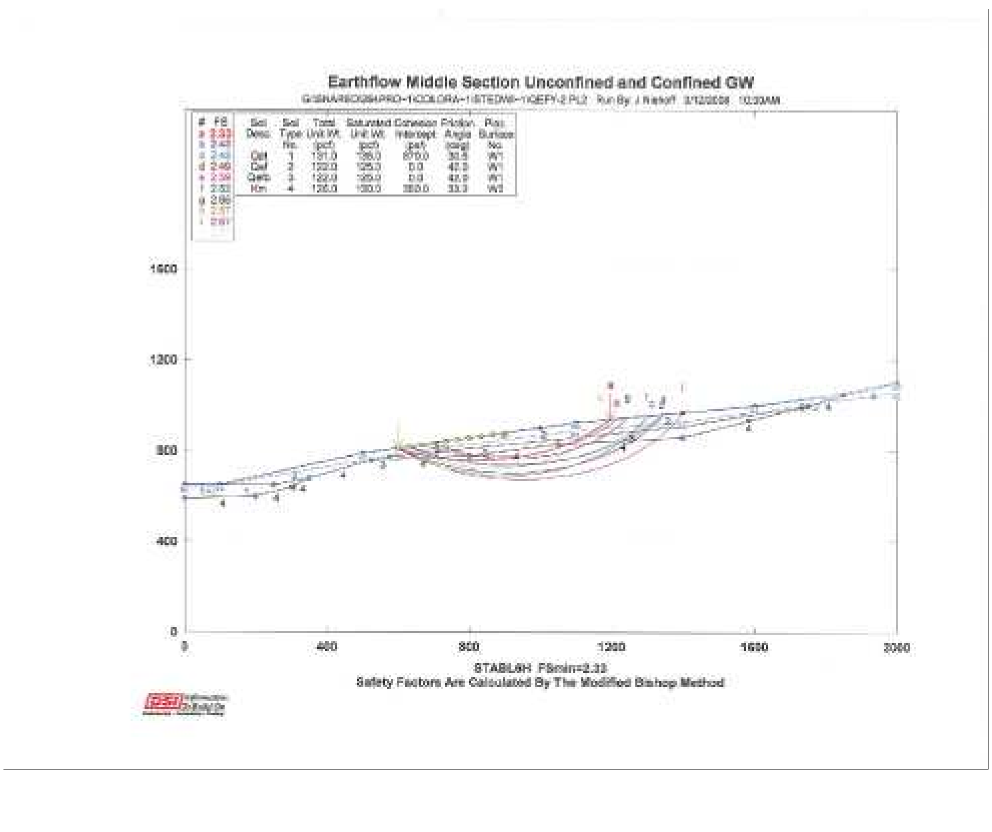


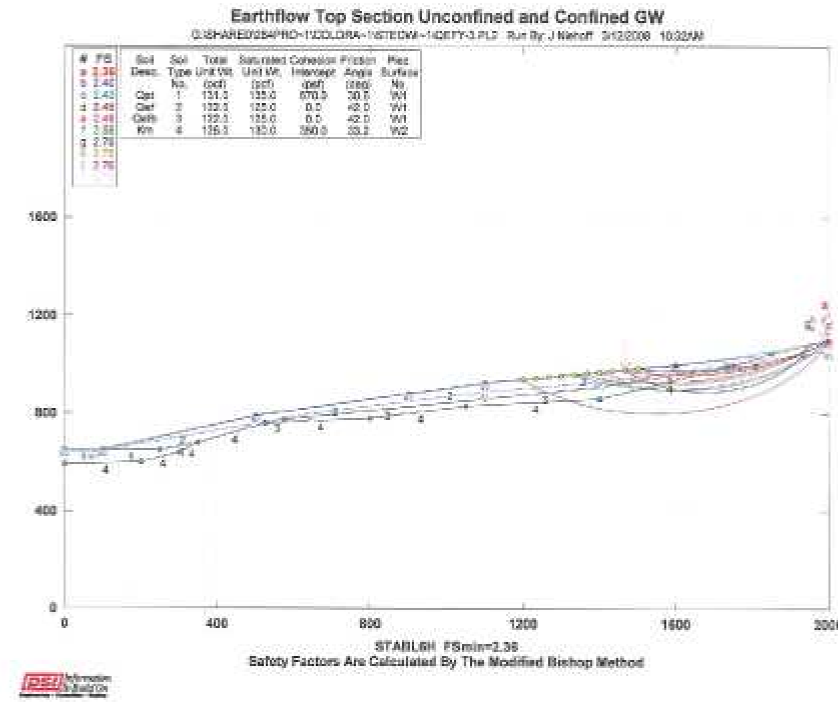
Polygon 21 - Residual Post Water table
1250
1000
750
500
250
0
0
250
500
750
1000
1250
1500
1750
STABL6H FSmin=0.77
Safety Factors Are Calculated By The Modified Bishop Method

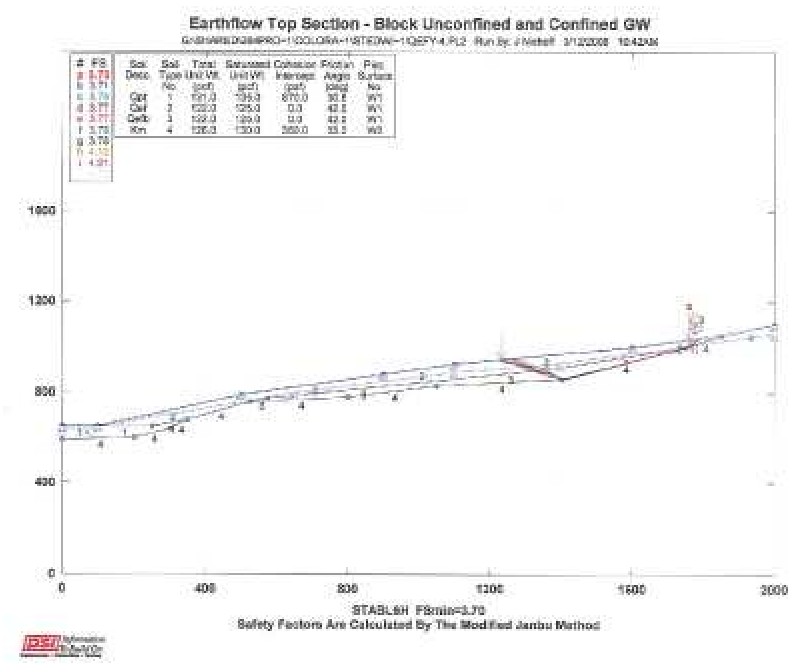

Polygon 21 Postdevelopment Water Table
Run By: Jim Nishoff 3/24/2008 4:01PM
FS
a 0.78
b 0.78
c 0.78
d 0.79
e 0.80
f 0.81
g 0.81
h 0.81
i 0.81
Soil Desc. | Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Piez. Surface No.
Qls | 1 | 130.0 | 135.0 | 170.0 | 19.0 | W1
Qpt | 2 | 131.0 | 135.0 | 330.0 | 14.0 | W1
Km | 3 | 127.0 | 130.0 | 0.0 | 17.0 | W1
Qao | 4 | 130.0 | 135.0 | 180.0 | 25.0 | W1
Tp | 5 | 130.0 | 135.0 | 2000.0 | 31.0 | W1
1250
1000
750
500
250
0
0
250
500
750
1000
1250
1500
1750
STABL6H FSmin=0.78
Safety Factors Are Calculated By The Modified Bishop Method
STED

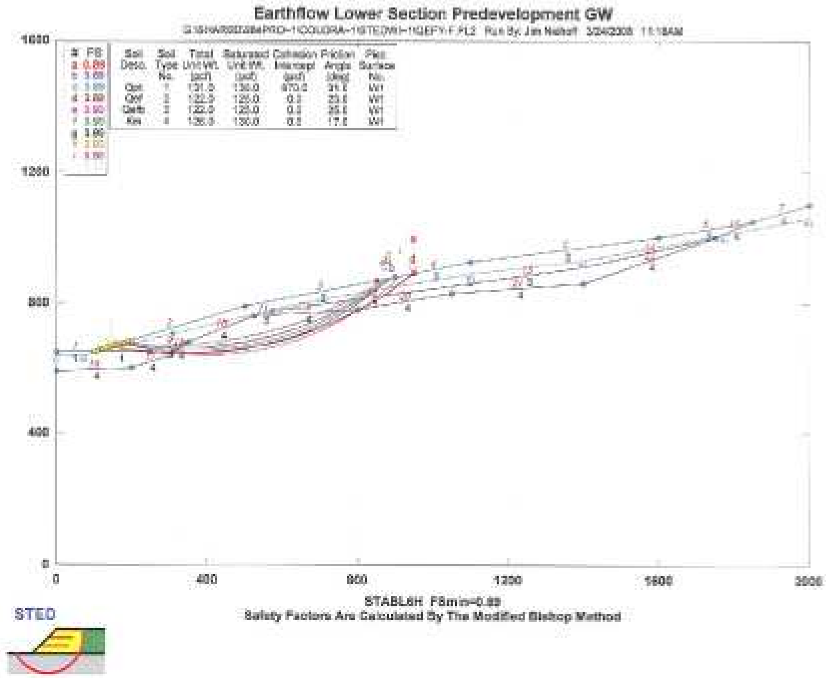
CENTRAL SECTION, NORTH HALF Qefy—Polygon 1—PRE-DEVELOPMENT



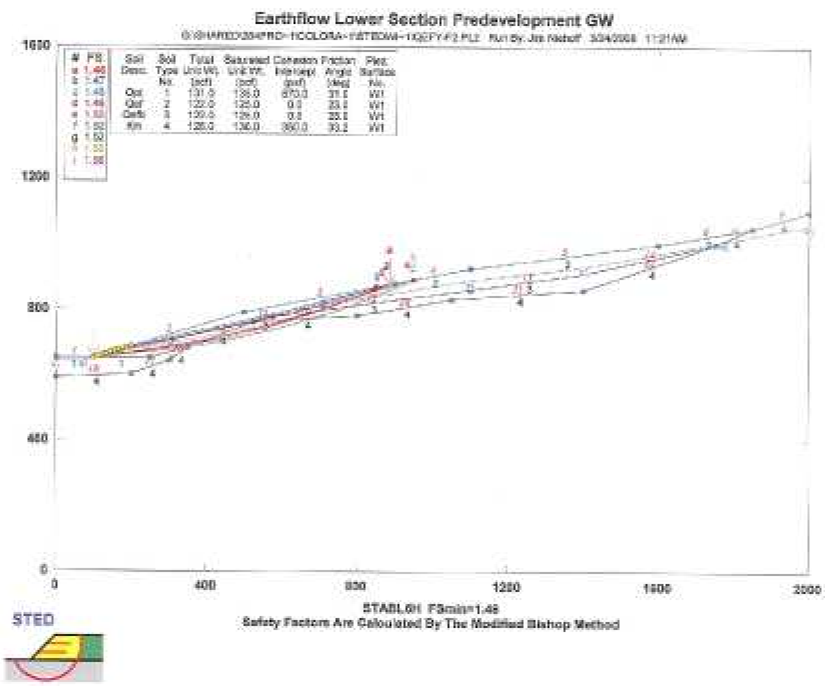



Earthflow Top Section Unconfined and Confined GW
Run By: J Niehoff 3/12/2008 10:32AM
FS
a 2.36
b 2.40
Soil Desc.
Soil Type No.
Total Unit Wt. (pcf)
Saturated Unit Wt. (pcf)
Cohesion Intercept (psf)
Friction Angle (deg)
Piez. Surface No.
Qpt 1 131.0 135.0 670.0 30.0 W1
Qal 2 122.0 125.0 0.0 42.0 W1
Qafb 3 122.0 125.0 0.0 42.0 W1
Km 4 126.0 130.0 360.0 33.2 W2
1600
1200
800
400
0
0
400
800
1200
1600
2000
STABL6H FSmin=2.36
Safety Factors Are Calculated By The Modified Bishop Method

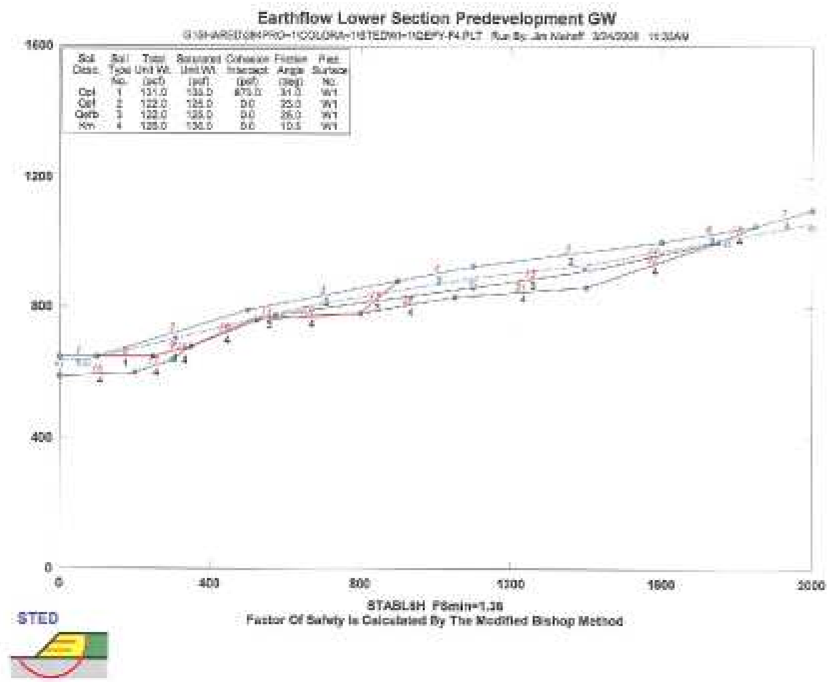

Earthflow Top Section - Block Unconfined and Confined GW
3/12/2008 10:42AM
FS
Soil Desc.
Soil Type No.
Total Unit Wt. (pcf)
Saturated Unit Wt. (pcf)
Cohesion Intercept (psf)
Friction Angle (deg)
Piez. Surface No.
1600
1200
800
400
0
0
400
800
1200
1600
2000
STABL6H FSmin=3.70
Safety Factors Are Calculated By The Modified Janbu Method



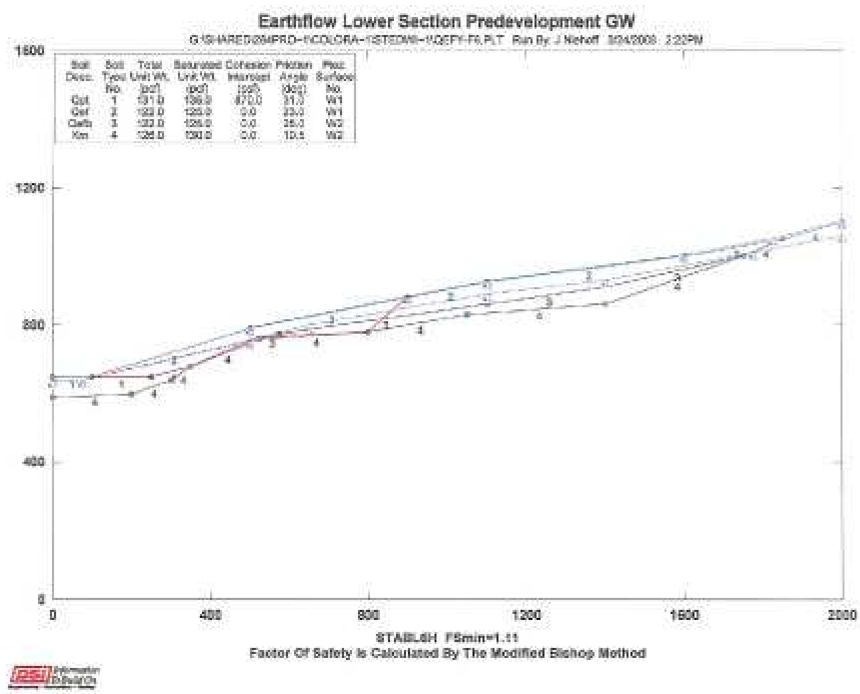
Earthflow Lower Section Predevelopment GW
Run By: Jim Niehoff 3/24/2008
FS
Soil Desc.
Soil Type No.
Total Unit Wt. (pcf)
Saturated Unit Wt. (pcf)
Cohesion Intercept (psf)
Friction Angle (deg)
Piez. Surface No.
Qot
Qof
Qefb
Km
1600
1200
800
400
0
0
400
800
1200
1600
2000
STABL6H FSmin=0.89
Safety Factors Are Calculated By The Modified Bishop Method
STED



Earthflow Lower Section Predevelopment GW
Run By: Jim Niehoff 3/24/2008 11:21AM
FS
Soil Desc.
Soil Type No.
Total Unit Wt. (pcf)
Saturated Unit Wt. (pcf)
Cohesion Intercept (psf)
Friction Angle (deg)
Piez. Surface No.
Qot
Qof
Qefb
Km
1600
1200
800
400
0
0
400
800
1200
1600
2000
STABL6H FSmin=1.46
Safety Factors Are Calculated By The Modified Bishop Method
STED

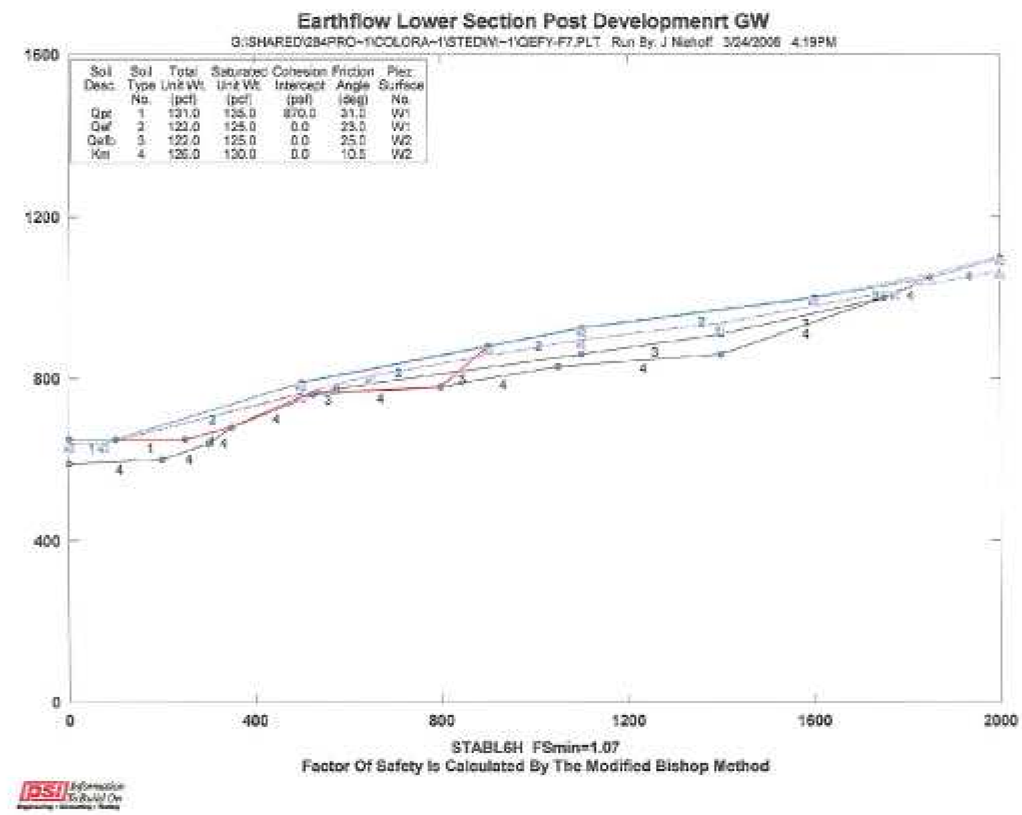


Earthflow Lower Section Predevelopment GW
Soil Desc. | Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Piez. Surface No.
Qpf 1 131.0 135.0 870.0 31.0 W1
Qef 2 122.0 125.0 0.0 23.0 W1
Qefb 3 122.0 125.0 0.0 25.0 W1
Km 4 128.0 130.0 0.0 10.5 W1
1600
1200
800
400
0
0 400 800 1200 1600 2000
STABL6H FSmin=1.38
Factor Of Safety Is Calculated By The Modified Bishop Method
STED

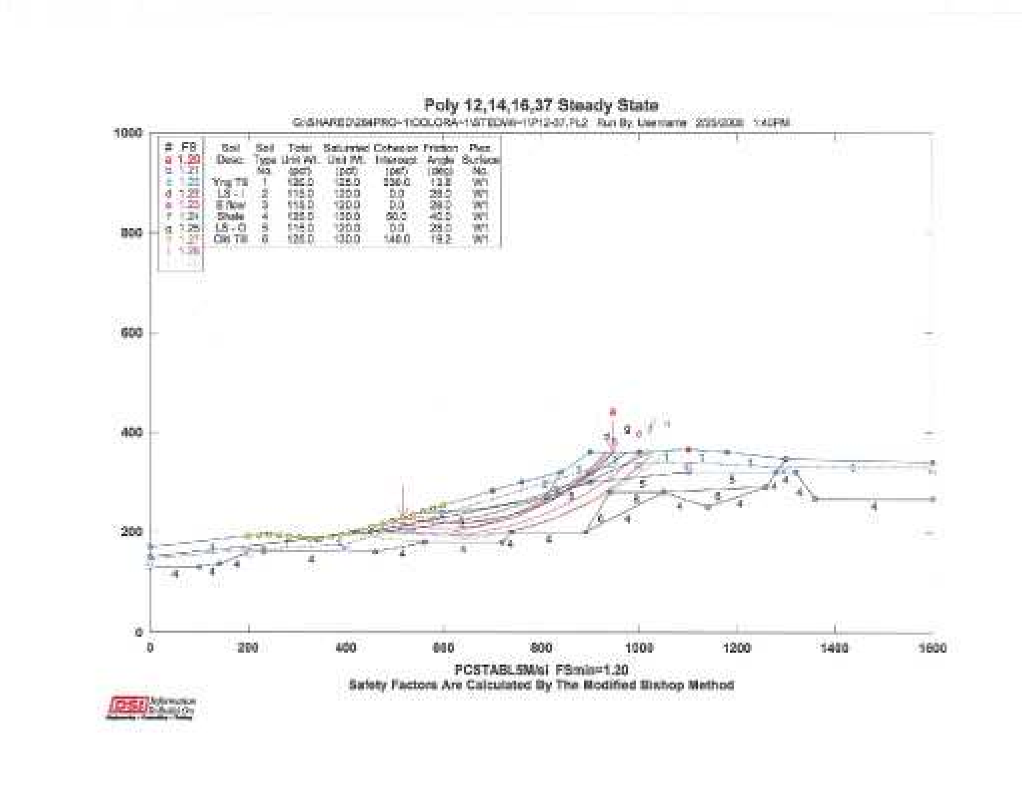


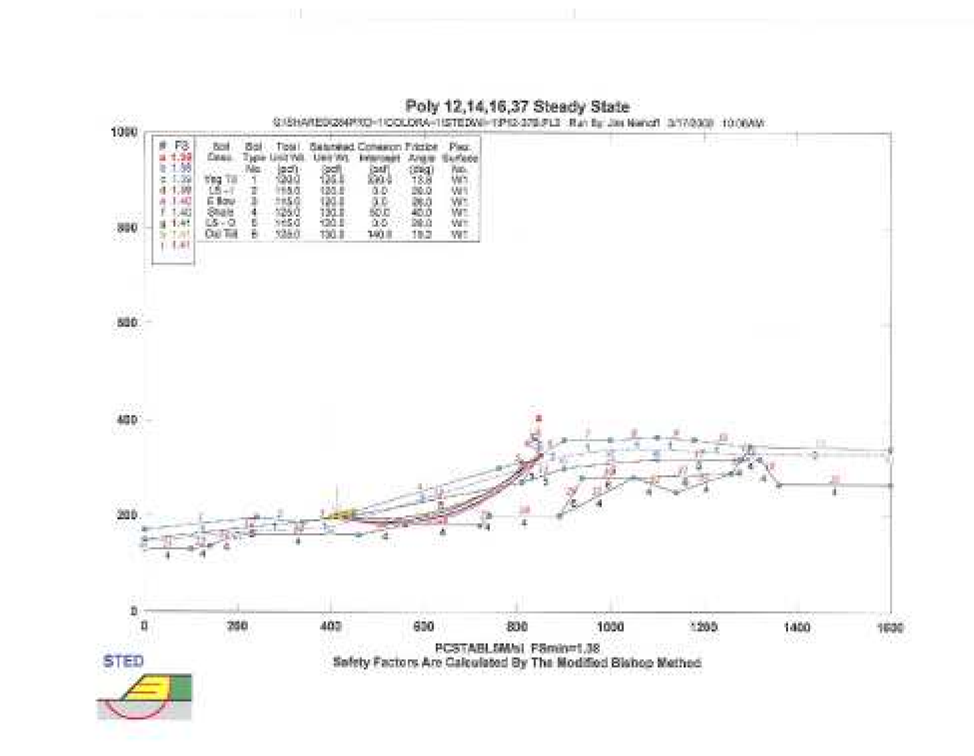
Earthflow Lower Section Predevelopment GW
Soil Desc. | Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Piez. Surface No.
Qpf 1 131.0 136.0 870.0 31.0 W1
Qef 2 122.0 125.0 0.0 23.0 W1
Qefb 3 122.0 125.0 0.0 25.0 W2
Km 4 126.0 130.0 0.0 10.5 W2
1600
1200
800
400
0
0 400 800 1200 1600 2000
STABL6H FSmin=1.11
Factor Of Safety Is Calculated By The Modified Bishop Method

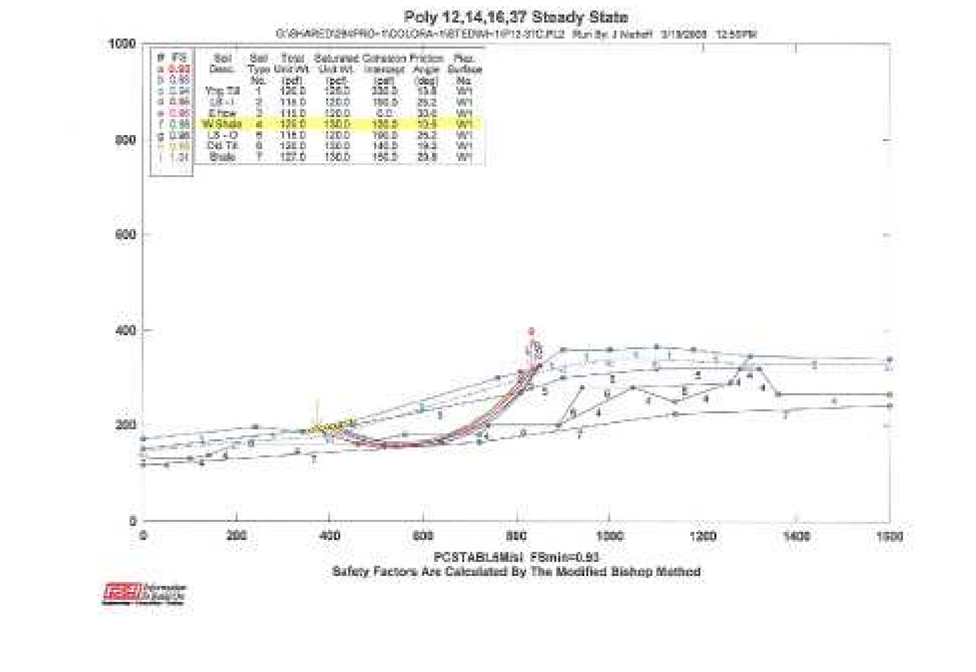
CENTRAL SECTION, NORTH HALF Qefy—Polygon 1—POST-DEVELOPMENT

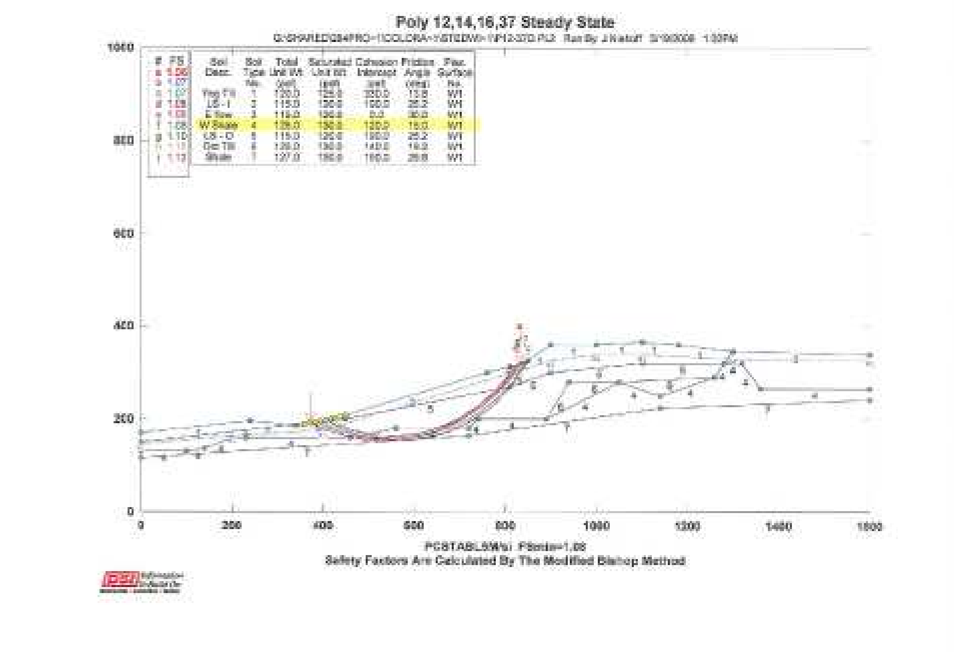


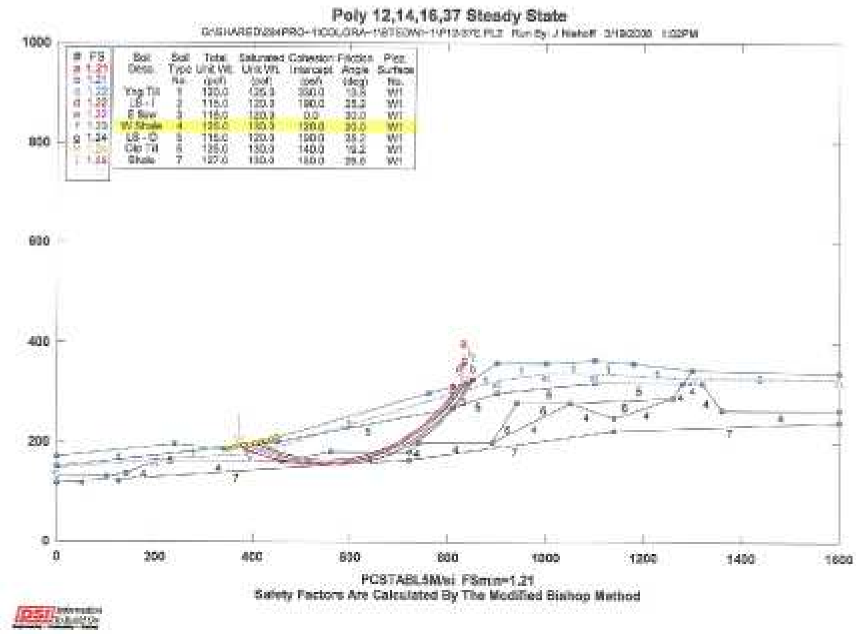
CENTRAL SECTION, SOUTH HALF—Polygon 14—PRE-DEVELOPMENT



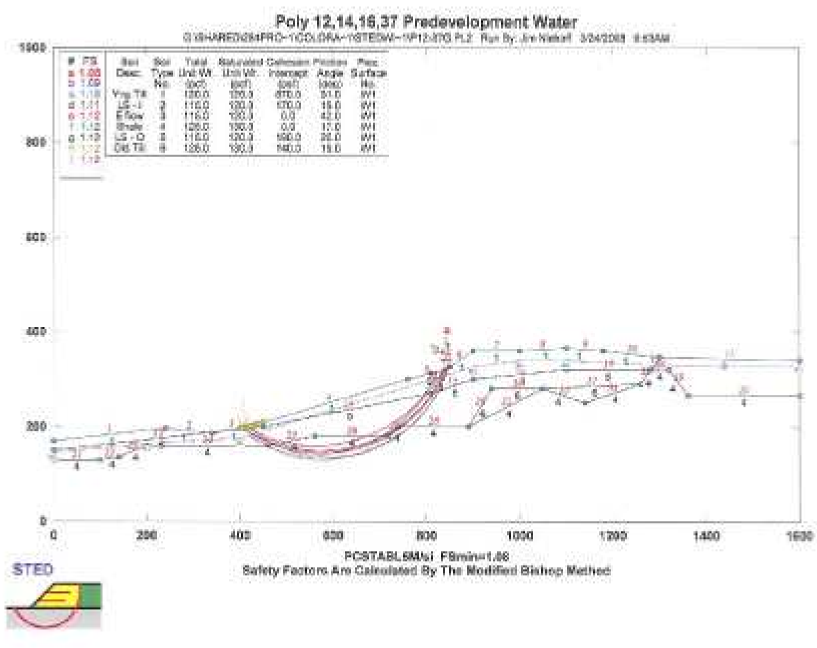



Poly 12,14,16,37 Steady State
1000
800
600
400
200
0
0
200
400
600
800
1000
1200
1400
1600
PCSTABL5M/si FSmin=0.93
Safety Factors Are Calculated By The Modified Bishop Method

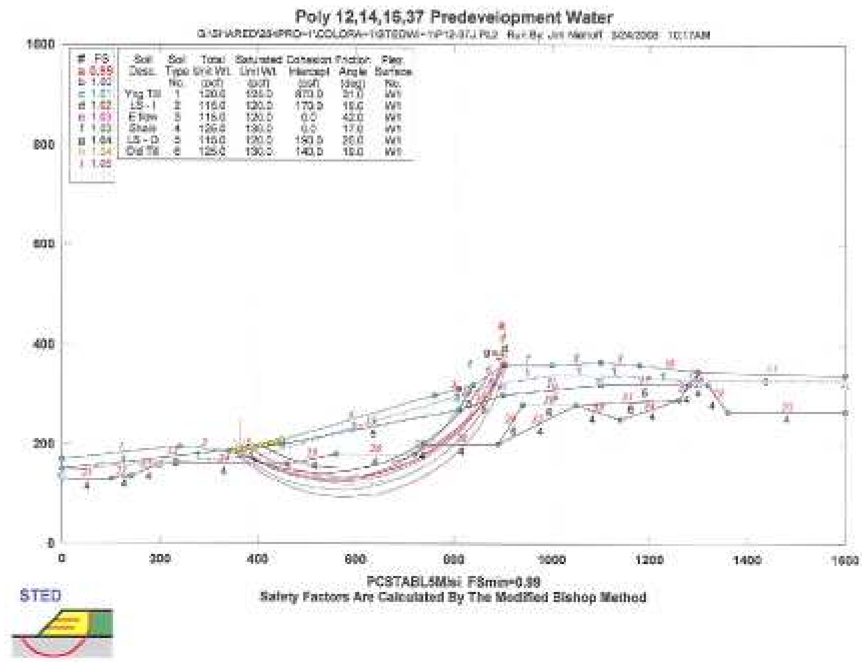

Poly 12,14,16,37 Steady State
1000
800
600
400
200
0
0
200
400
600
800
1000
1200
1400
1600
PCSTABL5M/si FSmin=1.06
Safety Factors Are Calculated By The Modified Bishop Method

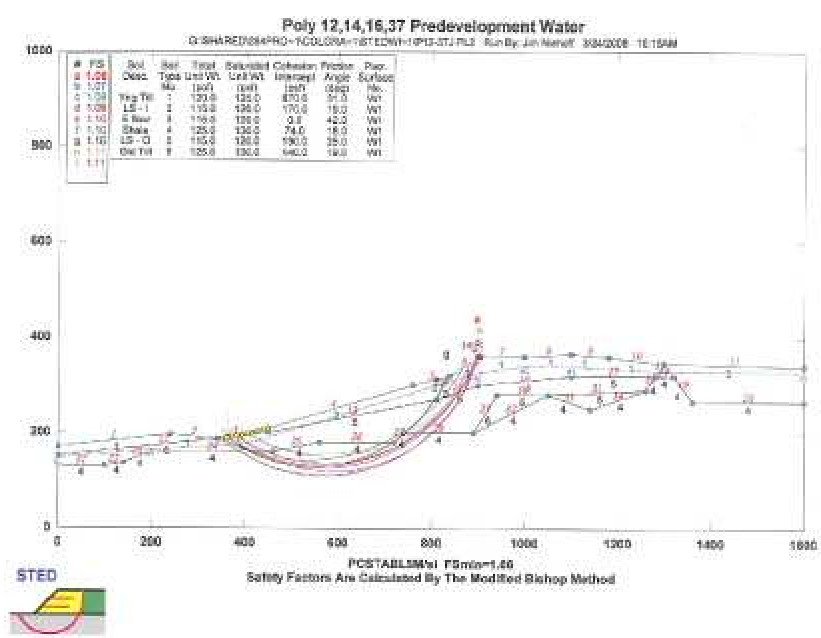


Poly 12,14,16,37 Steady State
Run By: J Niehoff 3/19/2008 1:02PM
FS
a 1.21
b 1.21
c 1.22
d 1.22
e 1.23
f 1.23
g 1.24
h 1.26
i 1.44
Soil Desc. | Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Piez. Surface No.
Yng Till | 1 | 120.0 | 125.0 | 350.0 | 19.5 | W1
LS - I | 2 | 115.0 | 120.0 | 190.0 | 25.2 | W1
E Sow | 3 | 115.0 | 120.0 | 0.0 | 30.0 | W1
W Shale | 4 | 125.0 | 130.0 | 120.0 | 30.0 | W1
LS - O | 5 | 115.0 | 120.0 | 190.0 | 25.2 | W1
Old Till | 6 | 125.0 | 130.0 | 140.0 | 19.2 | W1
Shale | 7 | 127.0 | 130.0 | 150.0 | 25.0 | W1
1000
800
600
400
200
0
0
200
400
600
800
1000
1200
1400
1600
PCSTABL5M/si FSmin=1.21
Safety Factors Are Calculated By The Modified Bishop Method

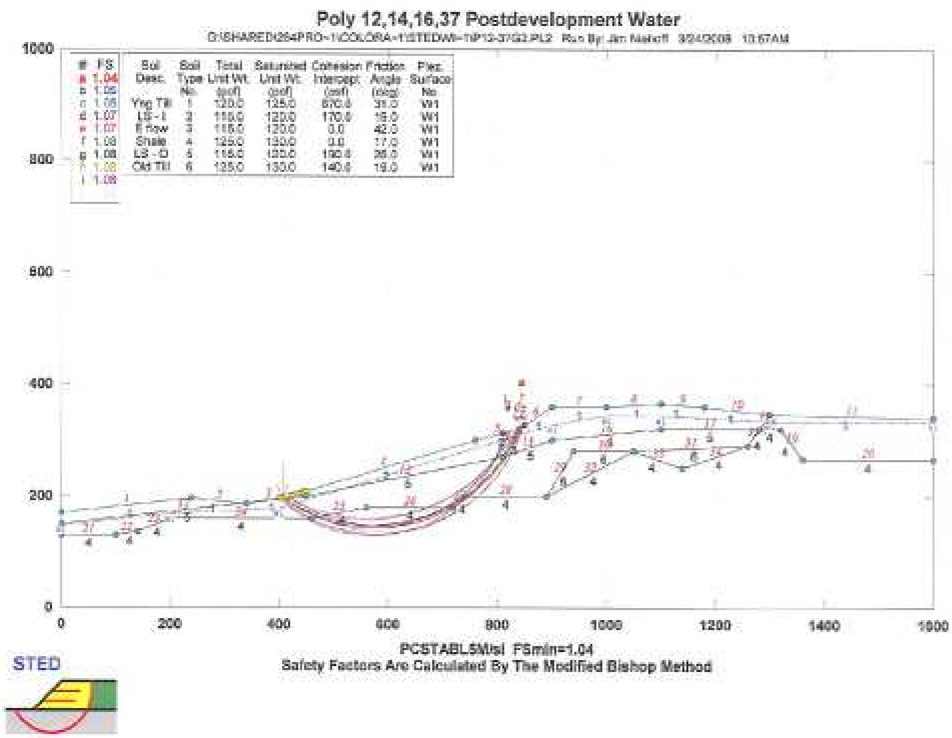


Poly 12,14,16,37 Predevelopment Water
Run By: Jim Niehoff 3/24/2008
FS
a 1.08
b 1.09
c 1.10
d 1.11
e 1.12
f 1.12
g 1.12
h 1.12
i 1.12
Soil Desc. | Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Piez. Surface No.
Yng Till | 1 | 120.0 | 125.0 | 870.0 | 31.0 | W1
LS - I | 2 | 115.0 | 120.0 | 170.0 | 15.0 | W1
E Sow | 3 | 115.0 | 120.0 | 0.0 | 42.0 | W1
Shale | 4 | 125.0 | 130.0 | 0.0 | 17.0 | W1
LS - O | 5 | 115.0 | 120.0 | 190.0 | 26.0 | W1
Old Till | 6 | 125.0 | 130.0 | 140.0 | 15.0 | W1
1000
800
600
400
200
0
0
200
400
600
800
1000
1200
1400
1600
PCSTABL5M/si FSmin=1.08
Safety Factors Are Calculated By The Modified Bishop Method
STED

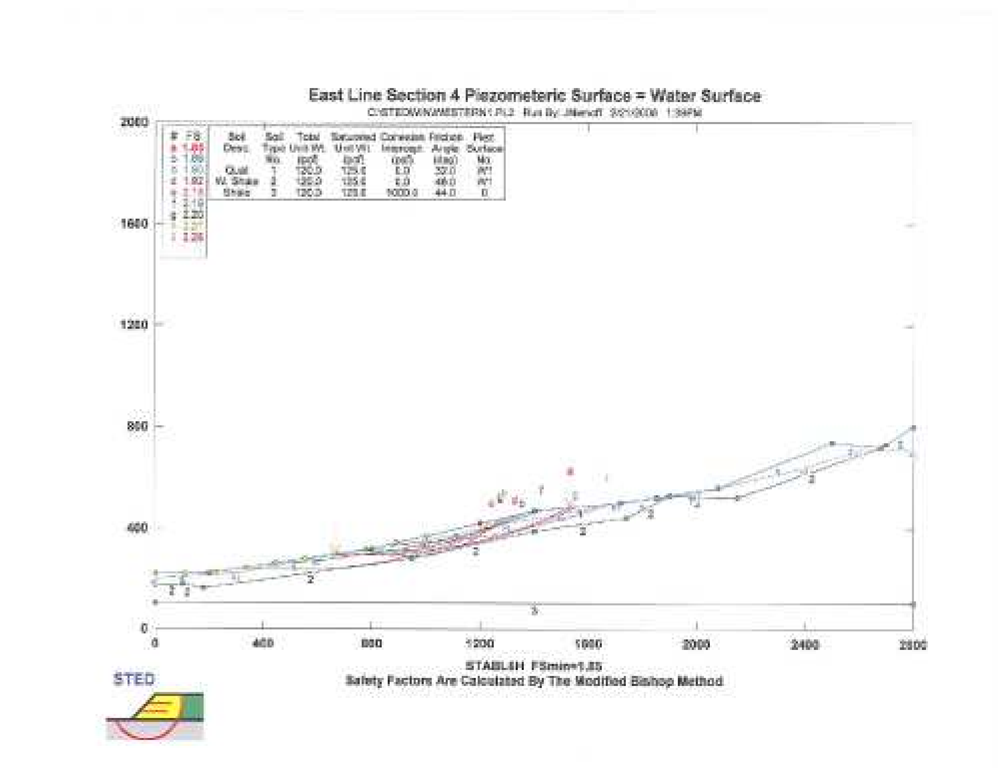

Poly 12,14,16,37 Predevelopment Water
PCSTABL5M/si FSmin=0.99
Safety Factors Are Calculated By The Modified Bishop Method
STED

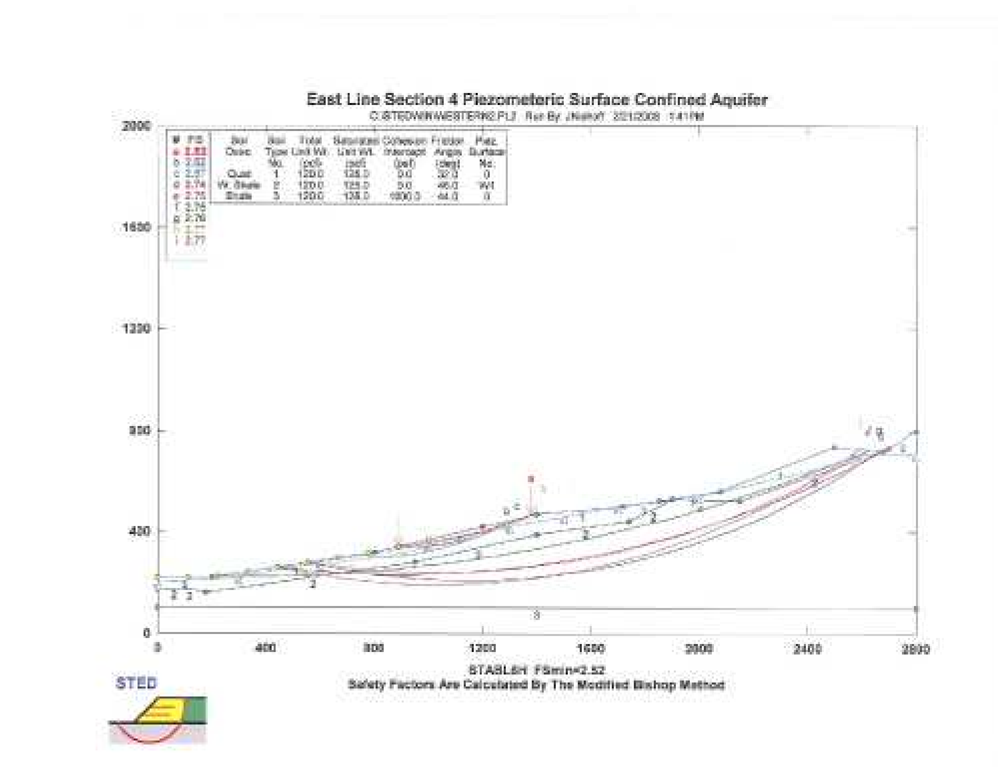

Poly 12,14,16,37 Predevelopment Water
PCSTABL5M/si FSmin=1.06
Safety Factors Are Calculated By The Modified Bishop Method
STED

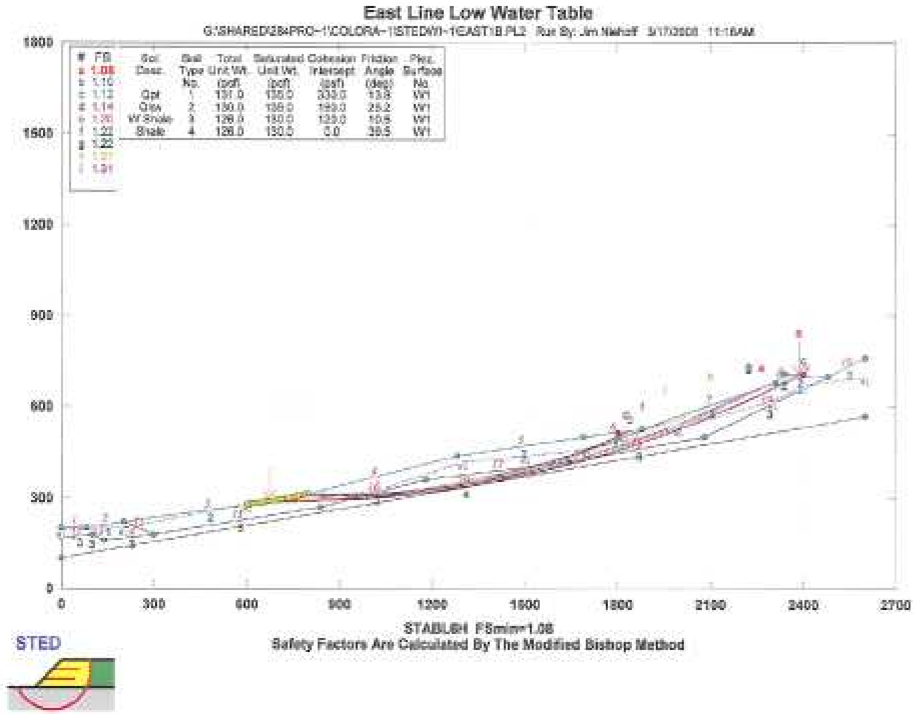
CENTRAL SECTION, SOUTH HALF—Polygon 14—POST-DEVELOPMENT

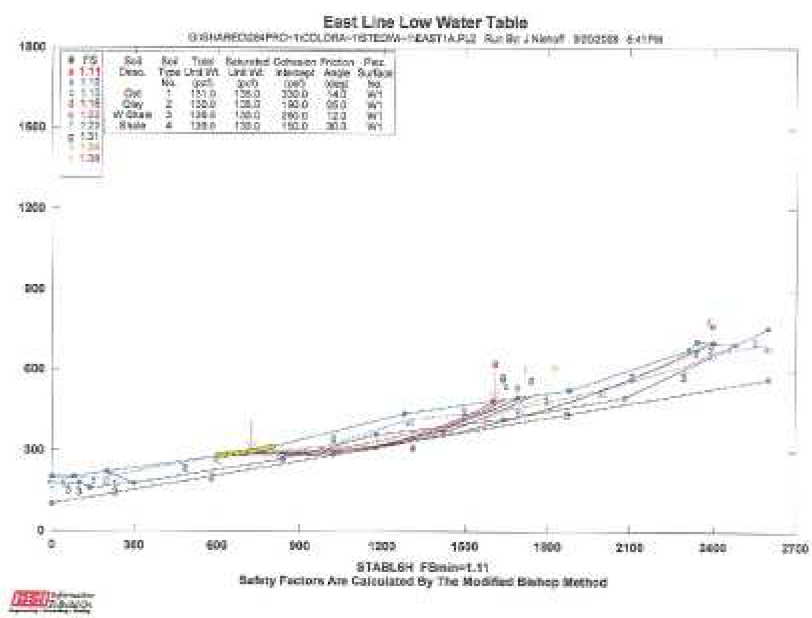


EAST SECTION—Polygon 36—PRE-DEVELOPMENT






East Line Low Water Table
Soil Desc. | Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Piez. Surface No.
Qpt 1 131.0 135.0 330.0 13.8 W1
Clay 2 130.0 135.0 190.0 25.2 W1
W Shale 3 128.0 130.0 120.0 10.6 W1
Shale 4 128.0 130.0 0.0 39.5 W1
0 300 600 900 1200 1500 1800 2100 2400 2700
STABL6H FSmin=1.08
Safety Factors Are Calculated By The Modified Bishop Method
STED


East Line Low Water Table
0 300 600 900 1200 1500 1800 2100 2400 2700
STABL6H FSmin=1.11
Safety Factors Are Calculated By The Modified Bishop Method

EAST SECTION—Polygon 36—POST-DEVELOPMENT