

**INITIAL ASSESSMENT:****Lawson Hill Landslide  
May 3, 2008****Prepared for:**

*San Miguel County  
Sheriff's Department  
851 County Road 63L  
Telluride, CO 81435*

**Prepared by:**

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222 South Park Ave.  
Montrose, CO 81401*

**May 13, 2008**

## Introduction

The Lawson Hill Landslide occurred on Saturday, May 3<sup>rd</sup> at approximately 5:45 pm. There were several eye-witnesses who said that the event occurred in well less than a minute, from initial rumblings to the mass movement event (personal communication on 5/12 and 5/13: Daryl Bonin and Tom Gallon). The slide is located on a north-facing slope below West Meadows, and it extends from an elevation of around 9,200 feet down to 8,850 feet, just above homes within the Lawson Hill development. Buckhorn Geotech was called out on Sunday (May 4<sup>th</sup>) by the San Miguel County Sheriff's Department to provide initial judgment of the severity of the slide and the potential hazard to residents in the area. Residents of a portion of the development were evacuated from their homes and allowed to return on Monday (May 5<sup>th</sup>). Buckhorn Geotech was retained to monitor the landslide on a daily basis for a one-week period and provide a report of findings and recommendations for further analysis and/or mitigation at the end of that period. Buckhorn supplied a staff of professional geologists and geotechnical engineers to walk the slide area each day and document the observed activity and features of the slide. This report is a summary of our findings and recommendations for the County and residents for future monitoring, remediation, and actions in the event of threatening activity of the slide.

### I. Lawson Hill Landslide Characterization

#### A. Description of the Landslide

The Lawson Hill Landslide is classified as a rotational slump with a classic headwall scarp at the crest and an earthflow/debris flow lobe at the toe, consisting of a massive log jam in a muddy matrix. Issuing from the toe are smaller watery mudflows. The slide has not been surveyed, but estimates of the size of the slide are that it drops roughly 300 feet from headwall scarp to mudflows at the toe and it is roughly 660 feet long. It is estimated to be 80 to 100 feet wide and it varies from a few feet to 10 to 15 feet in depth. The amount of displaced soil is estimated to be between 3,000 and 4,000 cubic yards. The Lawson Hill Landslide is shown on Map 1, a topographic map imported from *Google Earth*. This map is schematic in nature and is meant to serve as a general reference, not for detailed measurements. Keep in mind that the width of the slide has been exaggerated to allow for the depiction of features within the slide.

A number of springs are located near the base of the headwall scarp, which are the "smoking gun" evidence of what triggered the landslide (see Map 1). Rapid and intense snowmelt from an approximately 150% of normal snowpack saturated the soils in the hillside above the scarp, infiltrated into the porous glacial moraine deposits and encountered a more impervious surface that perched the excess groundwater. This supposition is supported by an eyewitness account by Daryl Bonin (personal communication: 5/12/08), who observed the slide event and hiked up the hillside shortly after the event to observe the headwall scarp. He saw a "seam of rock about 15 feet down from the top of the escarpment where water was gushing out of the hillside on top of the line of rocks." He indicated that the seam of rock appeared to be sandstone (not shale) and that angular slabs were strewn downslope of the outcrop, evidently plucked and carried downhill during the slide event and subsequent debris flow activity. Mr. Bonin also indicated that the debris flow material throughout the slide had the consistency of "runny pancake mix," as it was saturated and very fluid. By the time we arrived the following day (roughly 16 hours after the event), the bedrock outcrop exposed in the headwall scarp had

been covered by soil, rock and debris that had sloughed down the face of the scarp, which was now roughly 10 feet high. Water was still “gushing” out of the base of the scarp, through the colluvium, and it was very turbid. Except for the angular blocks of sandstone that were plucked from the outcrop, most of the rocks entrained in the slide mass are subrounded and primarily igneous gravels, cobbles and small boulders, typical of glacial moraine deposits found on the West Meadows mesa and along the canyon walls.

Without the aid of subsurface testing we cannot know for sure, but we surmise that the impervious surface that perched the groundwater is clayey shale layer that sits on top of a more massive sandstone layer. This outcrop of sandstone is either the base of the Mancos Shale, which can contain thin fine-grained sandstone strata interbedded with gray to black shale or the top of the Dakota Sandstone formation, which underlies the Mancos Shale and has similar characteristics at the top of the unit as the base of the Mancos Shale. The lowest (oldest) member of the Mancos Shale formation is the Graneros Member, which is a black shale that weathers to “fat” (expansive) clay (personal communication: 5/8/08, David Noe, Colorado Geological Survey). Although it appears like more seeps have occurred over the course of the week of observations, the source is still controlled by an impervious strata that is becoming more buried with debris and the water seeks paths of least resistance to the surface, resulting in multiple springs. Further evidence of the stratigraphic control of the groundwater is the linear orientation of the seeps near the base of the headwall scarp, where they are within 1 to 2 feet of each other in elevation.

Observations made in the field indicate that the steep, middle portion of the slide contains a waterfall that cascades over an outcrop of interbedded sandstone and shale (see Map 1). The water draining from the seeps in the headwall scarp coalesce at the head of this zone and the stream has washed off this exposed surface. The sandstone beds are generally less than 1-foot thick and dip 5 to 6° to the northeast. This outcrop is at roughly the same elevation of a more massive sandstone cliff at the northwest corner of the mesa, around 2,000 feet to the west of the slide, as seen from across the valley and on the geologic map (*Preliminary Geologic Map of the Gray Head Quadrangle*, Bush et al., 1961: USGS Map MF-176). Although the bedrock dips to the north into the valley, which is not generally a desirable direction of dip to preserve slope stability because it can carry water towards the slope surface and lubricate planes of weakness, the sandstone within the Dakota Sandstone formation is typically competent, not highly weathered, and is well-cemented. It appears to us that this more resistant, predominately sandstone unit forms a confining surface for the depth of the failure plane of the landslide. In other words, the depth of the failure could have been much greater, given the steepness of the slope, had it not been for the presence of the harder Dakota Sandstone layers underlying the unconsolidated glacial till and weak, clayey, weathered, Mancos Shale.

The lower portion of the slide consists of the depositional or runout zone which contains a large “log jam” with many trees, mud and rock collected in a mass (see Map 1). Water ponded in this area for the first part of the week of observations, but it slowly drained and was drying substantially by the end of the week. The new stream channel drains through this material, but it appears to reemerge from the downhill side of the pile fairly intact as a channel. This area slows the stream and likely allows for infiltration into the soils, as there appears to be some loss of surface flow. However, it is also a fairly porous debris pile consisting of a chaotic and fairly open mass of trees with retained muddy debris. Although the log jam is an eyesore and a source for potential tree fall, it appears that it is responsible for saving the homes in the immediate path of the mudflow as it served as a dam and a filter. As long as this material stays

relatively open for water and mud to pass through it, it will continue to serve as a natural mitigation feature to larger debris and it buttresses the toe of the slope. Eventually, this surface will revegetate and further stabilize the hillside.

Mudflow streams emanated from the base of the log jam for several days after the event, but were effectively managed around the houses at the base of the slope with sandbags and trenches. Mudflows and shallow flooding should be expected to continue periodically this spring and summer until mitigation measures take hold and the site revegetates.

## **B. Methodology of Evaluation**

We set up three transects (named A, B and C) on Monday, May 5<sup>th</sup> across the landslide area to aid in monitoring slide movement. The transects are shown on Map 1 and were placed generally perpendicular to the direction of flow with end stakes placed on stable land on each (east and west) side that did not move during the landslide event and will not likely move in the near future. Each transect consists of 6 survey stakes with orange tips placed in a straight line. The stakes within the transects are numbered from east to west such that the eastern-most stake on each transect is A1, B1 or C1 and the western-most stake is A6, B6 or C6. The lowest transect (A) was placed below the "log jam" portion of the slide in the earthflow/mudflow runout zone. The middle transect (B) was placed in the steep portion of slide below the headwall scarp and above the "waterfall" or bedrock area in the middle portion of the slide. The upper transect (C) was placed above the headwall scarp to track potential uphill migration of the scarp.

Each day we walked the slide area from bottom to top up one side and down the other side. When possible, forays into the slide mass were also done to further understand the nature and danger of the slide. Starting on Tuesday, May 6<sup>th</sup>, we measured the discharge of the main stream that drains the toe of the slide. This was done simply by timing the filling of a 5 gallon bucket at a location approximately 20 feet downhill of the stream's road crossing, where the channel is narrow and it falls nearly vertically in one location. Observations of the surface water turbidity, streamflow quantities, movement of stakes, newly fallen trees, soil cracks, springs, and other features were noted on a daily basis. We compared notes and observations and discussed the implications of the findings. This report is a compilation of those observations, recommendations, and conclusions.

## **C. Field Observations**

During the course of the week of observations, a significant amount of snowmelt occurred on the hillside on and around the slide. On Sunday (May 4<sup>th</sup>), for example, the hillside alongside the slide was frozen, containing patches of snow and frost throughout and both frozen ground and blocks of snow were entrained within the slide material. By Wednesday (May 7<sup>th</sup>), the frost was gone and the patches of snow were significantly reduced. The depth and extent of snow on the sides of the slide were less each day. This additional snowmelt has added to the moisture in the hillside during our observation period.

1. **Lower depositional or runout zone (earthflow/mudflow debris)** – This area is represented by Transect A. It contains the previously discussed “log jam” and mudflow lobes that extend below the jam. Some areas within this zone were observed to be still moving slowly on Monday (May 5<sup>th</sup>), two days after the slide event. Although the stream channel is located on the eastern portion of this zone, the western portion receives a significant amount of subsurface water as evidenced by movement and active mudflows in this area. Stake A5 was placed on the 5<sup>th</sup> within one of the mudflow flows and moved on the first day approximately 2 inches downhill, but remained vertical. No other stakes moved in this zone for the week of observations. By Wednesday, May 7<sup>th</sup>, the mud was drying and cracking in the mudflow area below the log jam.

Discharge measurements were made on the downhill side of Society Drive by timing the collection of water in a 5 gallon bucket. The following measurements were made: Tuesday (May 6<sup>th</sup>) = 30 gallons per minute (gpm), Wednesday = 15 gpm, Thursday = 16 gpm, Friday = 14 gpm, and Saturday = 11 gpm in the morning and 10 gpm in the evening. Despite steady rain and 1 to 2 inches of snow on Friday night, the Saturday readings continued to drop from the previous flows.

It should be mentioned, that the stream that has developed in the slide and crosses Society Drive is the main concentration of flow, but it does not represent the total flow of water draining the slide. For example, on Thursday (May 8<sup>th</sup>) a flow of 2.5 gpm was measured from a foundation drain for the house on the west side of the stream channel. Other small channels were observed to carry flowing water in the mudflow zone. It is estimated that these other drainage points may have been producing a combined 10 gpm mid-week to be added to the overall volume of water draining the slide. In addition to the observed surface water, there is no doubt an increased flow of groundwater at the toe of the slope and under some of the houses. In addition to volume changes, drainage patterns also changed during the week. By mid-week, the channel that had been cut by the Fire Department to facilitate drainage was only a minor contributor to the main stream flow and by the Saturday it was abandoned and the main flow was coming from channels to the east.

2. **Middle depositional zone with incised channel to bedrock** – This area is represented by Transect B. It begins in the depositional area below the headwall scarp, extends down a very steep slope where the stream cascades down a bedrock outcrop zone (previously discussed) as a waterfall, and terminates at the log jam, which created a break in slope. This area was inaccessible for the first few days due to the deep, saturated mud along the margins of this depositional zone and very steep, slippery slopes. Although none of the sandstone layers that are interbedded with black shale in the waterfall zone are thicker than 1-foot, they are competent and well-cemented, offering resistance to deepening of the slide and erosion.

Transect B is located on the less steep slope above the waterfall and bedrock is not exposed at the surface or in the stream channel. Stake B4 was observed to move downhill approximately 2 inches between Monday (May 5<sup>th</sup>) and Wednesday (May 7<sup>th</sup>). It has remained vertical and did not move any further during the week.

3. **Headwall scarp (depletion zone)** – This is the source area for the debris strewn downslope and it contains several seeps at the base of the headwall scarp. This area has been inaccessible until the latter part of the week of observations due to potential instability, deep mud, and small-scale sloughing. Early observations noted several (5 to 6) seep sources and a small sag pond. On Saturday (May 10<sup>th</sup>), eight (8) individual seeps were observed and all were running clear water. The largest spring appeared to be producing around 10 gpm of clear water and it is located west of the center of the scarp. All of the springs except for the western-most spring, which is oozing through a small slump block, are emanating from the hillside at around the same elevation (within 1 to 2 feet of each other). As previously discussed, this line of seeps supports the presence of bedrock control of the daylighting of groundwater.

Transect C is located uphill of the headwall scarp and will be a good indicator of headward slumping or erosion of the scarp. The base of Stake C4 has moved slightly (1 to 2 inches) downhill by Saturday (May 10<sup>th</sup>), but this may be due to snow movement or disturbance by nearby footsteps in the snow. This area has retained the most snow cover and, as of Saturday (May 10<sup>th</sup>), snow was still 2 to 3 feet deep. This is also the area where a deep and long (approximately 75 feet) crack in the snow was observed since Sunday (May 4<sup>th</sup>). It is possible that this crack reflects movement of the underlying ground surface, but no evidence has been found to support this. Instead, it appears that the crack in the snow formed in response to the landslide, when part of the snow slab was torn away. When the snow fully melts, this area should be carefully examined for soil tension cracks.

As snow melted over the course of the week, some small soil cracks were observed in the vicinity of the headwall scarp. When material was removed during the landslide, support for the remaining hillside is reduced adjacent to the scarp. It is common for this unsupported material to slump into the scarp, as can be seen throughout the base of the scarp face. This area is also susceptible to erosion during heavy rains. The springs at the base of the scarp have generally been running clear water, indicating little or no movement or internal erosion. If the seeps begin to run muddy, as one or two did for the first few days, this may be a sign of shifting and eminent movement around the scarp. The springs in this area should be drying over time, but only time will tell whether they are ephemeral and tied to snowmelt or perennial and related to a larger aquifer system that is recharged from a higher and larger basin.

Although discharge was not measured in the headwall scarp area due to difficult access and measuring conditions, it was estimated that in the first 24 hours of the landslide event, the “gushing” flows at the scarp were on the order of 50 to 60 gpm. Local observers in the first two days noted obvious pulses in the discharge amount in both the scarp source area and downstream. In the ensuing few days, the flow decreased, but in general, it appeared that the flow emanating from the springs exceeded the flow observed at the toe of the slope in the stream channel, indicating a loss of channelized surface flow. By Saturday (May 10<sup>th</sup>), the largest spring in the scarp, located in the western half of the scarp, was producing and estimated 10 to 12 gpm, while the other 7 seeps were each producing well less than this amount. It appears that a large amount of water was infiltrating the slide mass and hillside below the headwall scarp following the slide, but the amount of absorption/infiltration has gradually decreased. It is difficult to sum the total inflow at the scarp and outflow at the road. However, it is our

impression that the flows have become nearly equal during the course of our observations. This is a good sign.

## **II. Projections for Future Activity in the Landslide Area**

Based on our observations and conclusions presented above, the nature and behavior of the landslide can be estimated. Although we cannot predict the future, this landslide exhibits certain characteristics typical of a rotational landslide with a debris outflow component. As we are still in the spring snowmelt period and the summer monsoons are ahead, the next 6 months are the most critical for managing the landslide and minimizing its potential impacts. Beyond that period, the slide should still be considered a potential threat that will require management. These short-term and long-term hazards are discussed below.

### **A. Short-term Concerns (next 6 months)**

1. **Erosion and mudflows/debris flows** – The denuded slope will be susceptible to erosion and additional debris flows until vegetation is re-established on the slope. These flows will most likely be triggered by intense rainfall events. The flows may follow the paths observed during the past week or may migrate outside of the observed paths. Debris will likely include clay- to boulder- sized material, and possibly trees and any other debris in the flow path.
2. **Additional slope failures** – Additional slope failures (outside the limits of the current failure) similar in nature and magnitude to this failure are possible. The risk of such failures is difficult to quantify, but is likely closely related to the local groundwater conditions. The seepage observed at the existing failure is probably relieving elevated pore pressures in the adjacent slopes, thus improving the short-term stability. However, additional failures should not be ruled out.
3. **Falling trees** – Many of the spruce, fir and aspen trees that are on the north-facing hillside are tall, with the mature trees being 50 to 100 feet tall. Additional debris flows and slope failures may bring more trees down the slope towards homes. These trees present the obvious threat as a dangerous moving object, but also may change the course of other debris and water flows.
4. **Changes in surface water conditions** – It is difficult to predict the short-term nature of surface water from the springs emerging from the head scarp of the failure. The water flow may be short-lived, and diminish shortly after the late spring snowmelt season, or may continue into summer or fall with reduced flows, or even as a permanent water course. Debris flows or additional failures may change the water course direction or distribution thus impacting other homes or structures in the area.

### **B. Long-term Concerns (next 10 years)**

1. **Upslope/lateral migration of the headwall scarp** – If the existing rotational failure is left unmitigated, additional minor sloughing and migration of the head scarp should be anticipated. Although such minor sloughing will not present immediate risk to the homes in the Lawson Hill subdivision, it will provide additional source material for future

debris flows and will increase the disturbed land area thus further increasing potential for erosion.

2. **Surface water conditions** – At this time, it is difficult to predict the long-term nature of surface water from the springs emerging from the head scarp of the failure. The water flow may be short-lived, and diminish shortly after the spring snowmelt season, or may continue as a perennial water course. Seasonal changes in flow rate should be expected. Debris flows or additional failures may change the water course direction or distribution, thus impacting other homes or structures in the area.
3. **Erosion and mudflows/debris flows** – As discussed above the “Short-term Concerns”, the denuded slope will be susceptible to erosion and debris flows until vegetation is firmly re-established on the slope. These processes may be expected to occur during spring snowmelt periods and during or immediately following intense rainfall events. Mitigation measures to reduce the risk and impact of these processes are discussed in later sections of this report.
4. **Snow Avalanche** – The denuded slope will be more susceptible to snow avalanche, as resistance provided by the mature trees has been eliminated. The denuded slope approaches 35° at its steepest location. Snow conditions such as weak snow layers, and storm and wind loading contribute to avalanche risk. If conditions are right, it is possible that larger avalanches could reach the homes in the Lawson Hill subdivision.

### **III. Recommendations for Management of the Landslide**

#### **A. Monitoring Program**

1. A person within the HOA should be designated as the point person for information or observations made of the slide and careful records should be kept of activity on the slide. This HOA representative should be someone who is or becomes intimately familiar with the slide and its characteristics. This representative should report unusual or relevant observations to a Buckhorn point person so that the urgency of the situation can be quickly and effectively determined. If eminent danger is perceived to either people or property, the HOA representative should also contact 911 to initiate emergency response by the local authorities.
2. If any movement of more than a few inches is observed in any of the transects, soil cracks widen or lengthen near the headwall scarp area, or if drainage at the toe increases in volume or makes a distinct change in location of discharge, Buckhorn should be contacted immediately.
3. Regular observations of the slide should be made by an individual trained in filling out the observation report. Buckhorn can provide this training, but once a few people are trained, it will not be difficult to educate new observers within the HOA. During the spring snowmelt, it would be optimum if these logs are kept daily. However, if this is not possible, at least 3 times per week would suffice if the weather is mild. However, it will be very important after rapid snowmelt periods or after a heavy rain that an observer log any changes to the slide area. Also, if any witnesses hear activity,

observer(s) should be sent up to attempt to identify and document the causes. If activity is suspected, observers should travel in pairs or as a team so that all members are accounted for and safe. Also, members can be alerted to developing dangerous conditions.

4. It is recommended that Buckhorn Geotech visit the site on a monthly basis through the spring and summer months, when the risk of movement is the highest, and walk the landslide area with the HOA representative to discuss observations and concerns. It will also give Buckhorn Geotech the opportunity to provide oversight to the collection of accurate and relevant information. This not only ensures quality control of the observations for all HOA members, but it also gives us the opportunity to view the landslide periodically as it changes over time. Also, if new measurements or type of observations need to be made in response to changes in the slide area, we can help formulate and implement new procedures.

## **B. Additional Work Needed**

1. An evaluation of the surface drainage on the hillside above the landslide should be undertaken to determine if any surface features or changed conditions could have contributed to the slide. Infiltration basins and drainages should be identified and assessed as to their potential contributions of surface or subsurface water towards the slide area. This should be done as soon as possible so that poor surface drainage can be rectified, if possible, but it must occur after the hillside is free of snow.
2. The springs within the headwall scarp (source area) should be inventoried, flagged, and flows estimated or measured, where possible. This is a fairly simple task and can be completed in approximately one hour when we are on-site for other purposes.
3. When snow has completely melted on the hillside around the headwall scarp and the soils have begun to dry, this area should be closely examined for soil tension cracks. This should be done within the narrow window of time between melt-off and vegetative growth. It will be important to minimize expansion of the scarp area and if cracks are observed that indicate this potential growth, measures can be taken to buttress or protect this material from failure. However, cracks need to be identified before too much movement has occurred.
4. A drainage plan will need to be developed for the homeowners at the base of the slide area. This would involve an evaluation of the drainage points at the toe of the slide in the vicinity of the homes, identification of pathways for drainage and mudflows, and placement of culverts, swales, and berms to control runoff and debris originating from the hillside. It is imperative that this drainage be integrated into the development-wide drainage system to preserve global stability. The installation of monitor wells may be necessary to track shallow groundwater that may need to be intercepted so that it does not impact homes.
5. A mitigation plan should be developed to recommend specifics for a course of action to reduce the hazards associated with the landslide. Remediation concepts are offered below for each of the three main components of the slide, but the HOA will need to

decide what options are practical, affordable, and desirable for the community. Since remediation of the slide will require modifications to the hillside and its vegetation, the plan will need to be approved and permitted by the U.S. Forest Service for property under its control. We are of the opinion that if the goal of the remediation plan is to create a more stable slope and protect life and property downhill of the public land, then the Forest Service should be agreeable to such a plan.

### **C. Remediation Concepts**

Once the volume of water outflow at the base of the headwall scarp has diminished and the mass of slide material has dewatered and stabilized sufficiently, remediation work can commence. This remediation work should take three forms. The first is to address drainage control above the headwall scarp, the second is to control erosion of the denuded slide path, and the third is to control and direct the drainage path at the toe of the slide.

1. **Drainage control above headwall scarp** - The first remediation work would include construction of a surface diversion swale above the headwall scarp. This should be in the form of an eyebrow that intercepts surface drainage sheet flowing towards the slide and directs the water around and away from the slide. The final disposal of any collected water should be dispersed rather than concentrated so that it does not inadvertently destabilize the adjacent areas. In conjunction with this, a careful investigation should be conducted to identify areas of infiltration, irrigation, or drainage discharge that may be a source of groundwater.
2. **Erosion control in denuded slide path** - The second measure should include grooming the slide to a somewhat smooth surface, primarily to eliminate all areas of potential ponding and water infiltration. Part of the grooming effort should include construction of a stabilized flow channel to carry seep water from the base of the headwall scarp, that is concentrated at the waterfall, down to the bottom of the runout zone (just above the houses). This stabilized channel may be lined with cobbles, weir-shaped boulder stacks, or erosion control mats. After final slope grooming, a series of alternating water bars should be constructed at intervals of about 50-feet on-center. As with the diversion swales discussed above, the points of discharge for the water bars should be offset (not one directly above another) so that collected water is not concentrated. The existing log-jams should either be integrated into the constructed drainage pattern (if they are deemed stable), or, carefully removed to prevent future sliding if they are judged to be potentially unstable or unsafe. At the least, trees that have been damaged by the sliding mass of debris and are in danger of falling should be carefully cut and removed from the slope.
3. **Drainage control at the toe of the slide** - An assessment of drainage in the vicinity of the toe of the slide should be made. This should include roadside and landscape drainage in the affected area of the Lawson Hill Subdivision. This assessment should then be used to determine the best place for termination of the stabilized drainage channel that will carry water from the headwall scarp to the toe of the slide. Again, the goal is to disperse the runoff in a way that replicates, to the extent possible, the natural (pre-development) pattern of surface drainage while preventing or minimizing infiltration of water into the ground. This resultant drainage feature may include a berm or

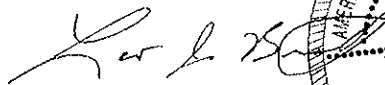
multiple berms to deflect mud/debris flows in conjunction with drain swales or channels to convey water.

### Closure

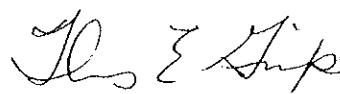
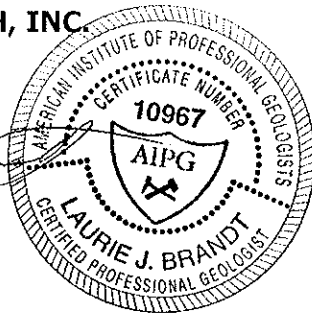
The Lawson Hill Landslide is a rotational slump formed in glacial moraine deposits with an earthflow/debris flow at the toe. The slide was triggered by groundwater flowing on top of impervious bedrock that dips into the valley. The depth of the slide appears to have been controlled by hard sandstone strata. A number of mitigation measures can be employed to reduce the risk to homeowners in the Lawson Hill development, but hazards from this slide will continue for at least several years. Intense thunderstorms or rapid spring snowmelts can trigger future activity, including mudflows and small-scale slumping, but we feel that regular monitoring and employing proactive remediation measures can effectively manage this slide.

We appreciate the opportunity to evaluate the Lawson Hill Landslide. We can provide any of the additional services we outlined in this report and we look forward to working with this community to monitor, evaluate, and reduce the risk to homeowners in the area. We have an office in Lawson Hill and have worked in the Telluride area for 30 years, so we share concerns with the residents and will work diligently to help in any way we can to mitigate effects of this natural disaster.

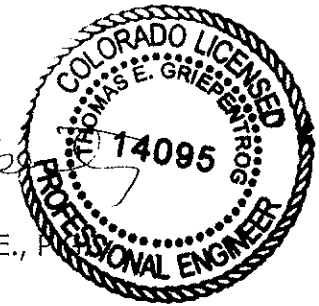
Respectfully Submitted,  
**BUCKHORN GEOTECH, INC.**  
May 13, 2008



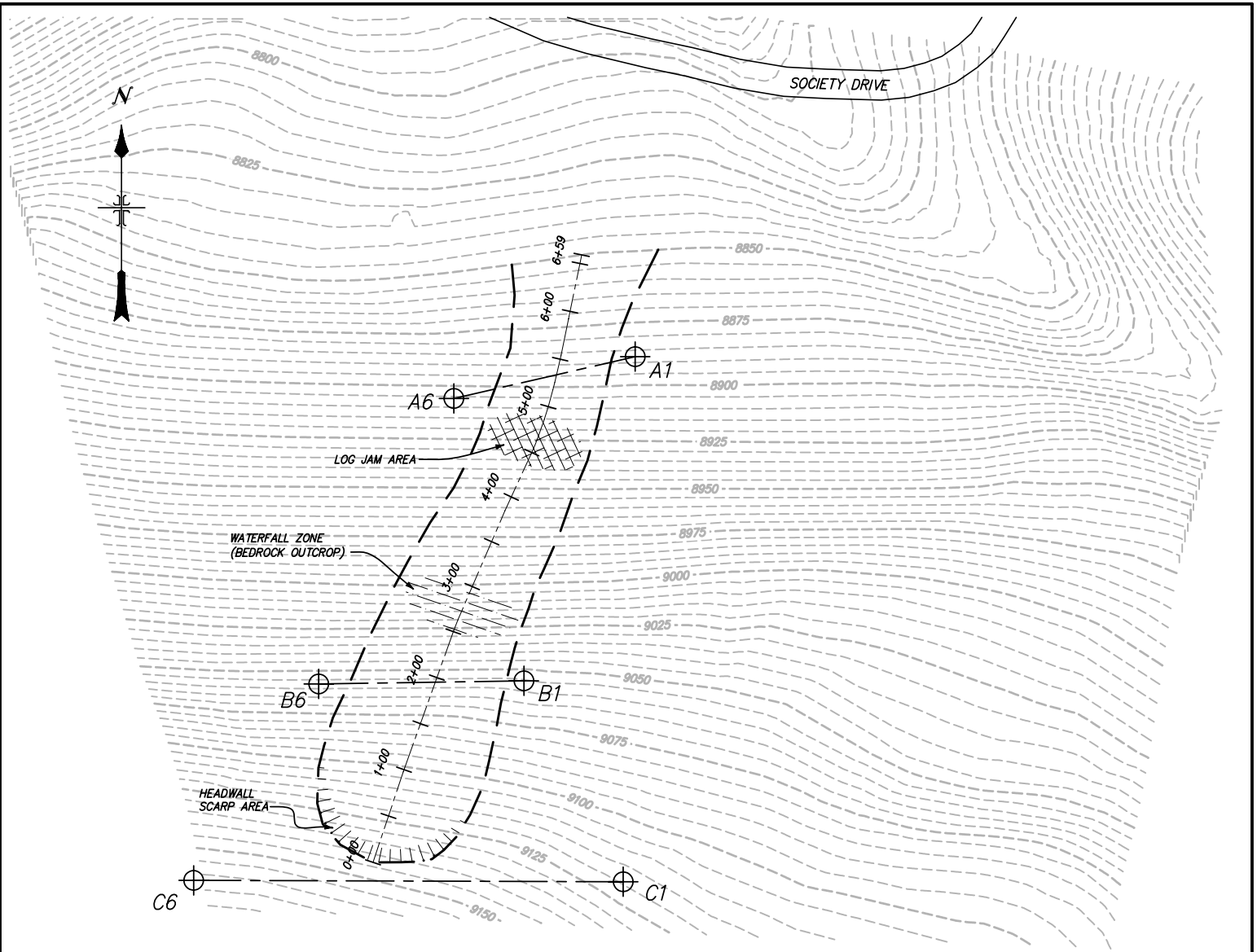
Laurie J. Brandt, P.G.  
Professional Geologist



Thomas E. Griepentrog, P.E.,  
Principal



Enclosures: Map 1



(TOPOGRAPHY PROVIDED BY GOOGLE EARTH)

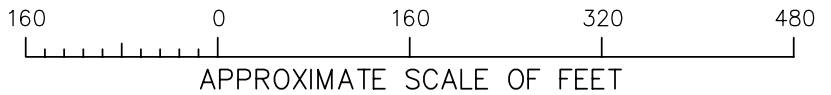
**SCHEMATIC LANDSLIDE SITE PLAN**

NOTE:  
WIDTH OF SLIDE HAS BEEN EXAGGERATED TO BETTER DEPICT FEATURES WITHIN THE SLIDE

APPROXIMATE LENGTH OF LANDSLIDE: 660'  
APPROXIMATE VERTICAL EXTENT OF LANDSLIDE: 300'

**LEGEND**

- — — — — ESTIMATED LIMITS OF LANDSLIDE
- — — — — TRANSECTS



MAP 1

DESIGNER LB  
DRAFTER CB  
DATE 5/13/08  
JOB NO. 08-153-GEO

LAWSON HILL LANDSLIDE  
SCHEMATIC SITE PLAN AND PROFILE



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