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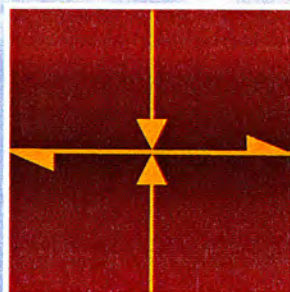
PRELIMINARY EVALUATION

GEOLOGIC HAZARDS AND SLOPE STABILITY

COYOTE RUN OPEN SPACE LANDSLIDE
BEHIND 583-597 W. SAGEBRUSH CT
LOUISVILLE, CO

PROJECT NO. 0180-D15

AUGUST 3, 2015



CLIENT:

CITY OF LOUISVILLE, CO

888-276-4027



AMERICAN GEOSERVICES, LLC

Geotechnical, Geoststructural, Environmental, Groundwater, Pavements, and Building Assessments

August 3, 2015

PROJECT NO: 0180-D15

Ms. Ember Brignull
Open Space Manager
City of Louisville, Colorado

Reference: Preliminary Geologic Hazards and Slope Stability Evaluation, Stage I Investigation Report, Coyote Run Open Space, Behind 583-597 W. Sagebrush Ct, Louisville, CO

Dear Ms. Brignull,

At your request, we have completed the Preliminary Geologic Hazards and Slope Stability Evaluation (Stage I investigation) for the referenced site in accordance with the American GeoServices, LLC (AGS) Proposal No. 020115 dated May 29, 2015. Results of our Stage I investigation are described below.

PROJECT INFORMATION

The site is located north of 583-597 W. Sagebrush Ct in Louisville, Colorado as shown in Figure 1 and Figure 2. The site consists of a shallow landslide which recently occurred in the Coyote Run Open Space situated within the Saddle Ridge residential neighborhood of the City of Louisville, Colorado.

The purpose of our Stage I investigation (investigation) was to evaluate the impact of the existing landslide on the site and adjacent residential properties. The scope of our investigation included the following specific work items.

- Detailed site reconnaissance to evaluate onsite-surface conditions including the surficial characteristics of the slide area and the slope features related to the site stability;
- Detailed review of geological literature and geotechnical literature on the site vicinity to evaluate geologic and slope stability conditions;
- Review of available literature on soils, geology, natural hazards landslides and slope stability, and USGS maps to evaluate geologic hazards, including earthquakes;

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- Review of available abandoned coal mines maps and its impact on site stability;
- Review of dipping bedrock hazard maps and its impact on site stability;
- Evaluation of surface and near-surface drainage and vegetation characteristics related to site stability;
- Preliminary computer modeling (SLOPE/W) and estimation of preliminary factor of safety against slope instability; and
- Reconnaissance report preparation.

Detailed landslide investigation including subsurface exploration, inclinometer installation and monitoring, laboratory testing, and engineering analyses was beyond the current scope of services. Investigation of any kind of the adjacent and nearby houses and residential properties was beyond the scope of our services. Geotechnical evaluation, environmental assessment, contamination assessment, property and utility damage assessment, property surveys, flood and fire hazards evaluation, and public safety hazards evaluation of any kind was beyond our current scope of services. Wetlands evaluation and wetland impact study of any kind was beyond our scope of services.

LANDSLIDE RECONASSANCE

In June 2015, we visited the site to visually observe the slide area. We documented site surface conditions as shown in the attached site photographs. Based on the results of our visual observations and preliminary analyses, in our opinion, the existing slide characteristics are as summarized below:

Slope: The general slope area in the slide vicinity consists of a natural slope covered with dense brush/grass. General slope topography consists of a 15-20 degree downward angle towards the north. General slope surface appearance is straight, however, in the slide area the appearance is hummocky as discussed below.

Slide Area: Slide appears to be an active, shallow, northerly-downward, rotational earth slide roughly 250ft wide and 150ft long with a 3-6ft deep head scarp, 1-3ft deep minor scarps, crown cracks, tension cracks, transverse cracks, transverse ridges, some radial cracks, slump blocks, and a toe bulge up to 3ft high. Evidence of active springs was not noted at the time of the site visit, however, visual evidence of wet toe area and wetland type vegetation was noted at the toe and within 50ft of the toe of the slide.

Adjacent Area: Within and adjacent to the slide area, there was no visual evidence of human activity such as grading, excavation, undercutting, water leakage from pipes, groundwater pumping, waste dumping, and soil stockpiling.

Our curbside reconnaissance of the houses situated at 597, 593, 587, and 583 W. Sagebrush Ct did not reveal the presence of slide related damage such as tension cracks, severe foundation settlement, twisted

columns, and uneven flatwork. At present, as we understand, there are no known complaints or reported damage resulting from the slide area at the four aforementioned houses.

SOILS AND GEOLOGY

Based on the results of our soils and geologic literature review (Figure 3 through Figure 5), and visual observations of the exposed soils in the headscarp area of the slide, in our opinion, subsurface conditions in the site vicinity are as follows.

Verdosa Alluvium: Below topsoil, the site is most likely underlain by mixtures of sandy to clayey silt, pebbles, and cobbly gravel interbedded with pebbly sand. Near the surface, some of the sandy to clayey silt is possibly of the 'eolian' origin (wind blown deposit). This alluvial deposit can range in thickness from 5ft to 35ft in the site vicinity area.

Laramie Formation: Upper alluvial deposit is generally underlain by siltstone, silty claystone, shale, and sandstone of the Laramie Formation which is known to extend to about 100-150ft below the alluvial deposit. The claystone of Laramie Formation is known to have high potential for landslides.

Fox Hills Formation: Laramie formation at the site is primarily underlain by the sandstone and some claystone of Fox Hills Formation extending to several tens of feet.

East Matchless Fault: Site is located in the close proximity of the East Matchless Fault (within 100-300 ft). This is a normal fault with an estimated maximum vertical throw of 250ft. In general, slickenslide along the fault planes show that the major movement on this fault is probably dip slip.

Groundwater: At the time of our site visit, visual evidence of active springs was not noted. Groundwater seepage was not noted within the slide mass or at the toe of the slide mass. However, as noted earlier, visual evidence of wet toe area and wetland type vegetation was noted at the toe and within 50ft of the toe of the slide.

Our review of the available water well logs obtained from the Colorado Division of Water Resources revealed the possibility of the presence of water levels at depths of 7ft to 30ft below the ground surface in the site vicinity. It appears that the reported water levels are mostly likely perched and the variation in the depth to water level is most likely related to the variations in the ground surface elevations and soils/geologic conditions. Copies of the available water well logs are included in an appendix.

GEOLOGIC HAZARDS

As shown in Figure 6 through Figure 9, the site is either situated within the abandoned coal mine area or in close proximity of the abandoned coal mine area. The site is also surrounded by areas that are designated as prone to subsidence due to abandoned coal mines and prone to landslides. Specifically, the site is situated within 250-500ft of the Fireside Coal Mine air shaft. We understand this air shaft has been capped and sealed in the recent past.

The site is not located within the Dipping Bedrock Overlay District (DBOD). The site is, however, located within the collapsible soils hazard zone as shown in Figure 10. The collapsible potential is due to the possibility of the presence of wind-blown (loess) deposits present in the site vicinity.

PRELIMINARY SLOPE STABILITY ANALYSIS

We performed preliminary slope stability analysis using SLOPE/W computer modeling software and several analytical methods (Bishop, Janbu, Spencer, etc.) in order to obtain the lowest factor of safety against slope failures. The SLOPE/W computer software calculates the most likely failure plane based on topography, subsurface conditions (including soil parameters), and groundwater conditions. The stability of this most likely failure plane is calculated as the factor of safety (FOS), which is a ratio of the resisting forces or shear strength to the driving forces or shear stress required for equilibrium of the slope. A FOS of 1.0 indicates the resistive forces and driving forces are equal. A FOS below 1.0 indicates the driving forces are greater and the landslide is active. A FOS above 1.0 indicates the resisting forces are greater and the slope is stable. Based on the engineering community and our experience, a factor of safety in the range of 1.5-2.0 is generally acceptable to assure slope stability in residential applications.

Preliminary slope stability analysis was performed using various input soil parameters derived from the results of our preliminary soils and geologic investigation. Of particular importance were surface and subsurface profiles (slope geometry), soil strength parameters, groundwater conditions, as well as the location and shape of the estimated design failure surface. An inclinometer was not installed at the site; however, a "design failure surface" was estimated based on our knowledge of the subsurface conditions, including the general geologic profile, results of our slope stability analysis trials, and our experience with slope failures in similar geologic environments.

Based on our experience with past slope stability evaluations in similar geologic conditions, soil strength parameters can vary considerably. Notwithstanding, we used soil strength values typical of on-site soils and native soils/bedrock based on our experience with soil strength testing, as well as back-calculation of soil strength parameters for failed slopes in similar geologic conditions.

During preliminary slope stability analyses, both translational and circular failure surfaces were considered. A sensitivity analysis was also performed using various soil strength values, groundwater configurations

and slip surface profiles. Results of our preliminary slope stability analyses are illustrated in Figure 11 and Figure 12.

PRELIMINARY CONCLUSIONS

Based on the results of our Stage I investigation including preliminary slope stability analyses, in our opinion, the shallow slide at the site has occurred, most likely due to one or a combination of the following conditions:

- Relatively steep slope angle,
- Near-surface and subsurface soil conditions that are prone to landsliding and/or subsidence under wet conditions,
- Presence of an inclined discontinuity such as 'a geologic fault,' possibly facilitating soil and groundwater movement,
- **Subsurface soil/bedrock saturation due to excessive rainfall that has occurred in the recent past. This is possibly a triggering condition and a significant contributing factor. Excessive rainfall can lead to significant changes in the groundwater regime and excessive pore water pressures that lead to slope instability.**
- Bedrock formations that are susceptible to landsliding, and
- Presence of abandoned coal mines at the site or in the immediate site vicinity.

Based on the results of preliminary slope stability analyses (Figure 11 and Figure 12), we make following preliminary conclusions:

- Existing slide has occurred, most likely within the upper Verdose Alluvium and the failure plane is most likely the interface between the upper Verdose Alluvium and the lower Laramie Formation.
- As illustrate in Figure 11 by faint gray lines representing various possible slope failure scenarios, there is a possibility for the presence of deeper slide planes or the potential for future slides, however at this time, majority of the possible slide scenarios do not adversely impact the stability of the existing residential structures located immediately uphill from the slide area (583-597 W. Sagebrush Ct). In other words, for these structures, there is an adequate safety setback currently present from the slide area. Notwithstanding, due to the limited scope of work, this preliminary conclusion can be confirmed only be performing Stage II Investigation which may include soil borings, laboratory testing for soil strength parameters, proper determination of groundwater table, inclinometer installation and monitoring, and detailed slope stability analyses.

- The existing slide may lead to further slope instability in the uphill areas and may cause future slides over the period of several years. However, as illustrated in Figure 12, the slide scenario that is most likely to adversely impact the existing structures along W. Sagebrush Ct has the safety factor in the range of 1.25-1.30. In other words, future sliding in the uphill slope areas is less likely to reach the existing houses, assuming there is no unusual event such as the abandoned mine collapse, loess subsidence, or the 500-year storm event. It should be noted that, due to the limited scope of work, this preliminary conclusion can be confirmed only by performing Stage II Investigation which may include soil borings, laboratory testing for soil strength parameters, proper determination of groundwater table, inclinometer installation and monitoring, and detailed slope stability analyses.

PRELIMINARY RECOMMENDATIONS

Based on the results of our Stage I investigation, we make following preliminary recommendations with the corresponding degree of risk.

Disclaimer: Historically, with construction in hilly areas like the site, there is an inherent risk associated with slope failures. Although the proposed improvements summarized below will minimize potential for future slope failures, the owner is still responsible for taking any risks associated with any existing or future potential for instability at the site or in the site vicinity. Since this report and recommendations continued herein have been prepared in order to maintain a certain degree of safety against future slope instability, all our recommendations should be strictly followed.

Option I-Low to Moderate Risk: If the property owners are willing to assume low to moderate risk of landslide-related damage to property and life, then following preliminary recommendations may be considered. Because these are preliminary recommendations, the property owners are assuming any and all risk associated with their implementation.

- As a minimum, install a safety fence or equivalent structure so that the slide area is not accessible throughout the year. Install adequate hazard signs, irrespective of aesthetic issues. The slide mass is highly unstable and should not be accessible under any condition without proper safety training.
- Check all public and private utilities for leakage and proper discharge mechanism. Avoid discharging water from roof downspouts directly onto the slope areas. For nearby residential structures uphill from the slide, recommend roof downspout discharge towards the street and not towards the slope or slide area.
- At the time of our site visit, groundwater springs were not noted. However, if any springs are noted in future, they should be properly channelized and discharged into the wetlands area, at least 50ft beyond the toe of the slide mass.

Option II-Low Risk: If the property owners are willing to assume low risk of landslide-related damage to property and life, then following preliminary recommendations may be considered. Because these are preliminary recommendations, the property owners are assuming any and all risk associated with their implementation.

Note that the following recommendations are 'in addition' to the list of recommendations mentioned under Option I.

- Install an interceptor drain 25ft above the slide mass near the top of the hill so that surface water runoff towards the slide area is minimized. As an option, install dewatering wells uphill from the slide mass.
- Excavate and/or grade uppermost portion of the slide to unload the slide and to seal headscarp area as much as possible.
- Install a berm and/or a gabion retaining wall/buttruss at the toe of the slide.

Option III-Minimal Risk: This is a 'stand-alone' option. Excavate the slide area and backfill with a recomacted buttress fill using keying and benching, mass grading, proper subsurface drainage, and adequately deep keyways. This is probably the most economical repair method for the given degree of risk, if adequate site access and work area is available.

PRELIMINARY COST ESTIMATES

A Stage II investigation should be performed including the detailed investigation and actual design for slide stability. This investigation should include soil borings, laboratory testing for soil strength parameters, proper determination of groundwater table, inclinometer installation and monitoring, detailed slope stability analyses and computer modeling for slope stability, structural design for stability mitigation, and drawings stamped by a Colorado PE along with a detailed comprehensive report. A Stage II investigation cost is estimated to be in the range of \$24,000.00 - \$28,000.00.

The cost estimate for the proposed improvements cannot be accurately estimated until a Stage II investigation is completed. Following cost estimates are based on our past experience and knowledge of the current industry practices and prices; therefore, these numbers should be considered for planning purposes only:

Option I Repair Cost Estimate: \$10,000.00 - \$25,000.00

Option II Repair Cost Estimate: \$125,000.00 - \$175,000.00

Option III Repair Cost Estimate: \$225,000.00 - \$275,000.00

LIMITATIONS

Recommendations contained in this report are based on our visual field observations and preliminary analyses only. It is possible that soil conditions could vary between or beyond the points explored. If soil conditions are encountered during construction that differ from those described herein, we should be notified so that we can review and make any supplemental recommendations necessary. If the scope of the proposed construction, including the proposed loads or structural locations, changes from that described in this report, our recommendations should also be reviewed and revised by AGS.

Our Scope of Work for this project did not include research, testing, or assessment relative to past or present contamination of the site by any source. If such contamination were present, it is very likely that the exploration and testing conducted for this report would not reveal its existence. If the Owner is concerned about the potential for such contamination, additional studies should be undertaken. We are available to discuss the scope of such studies with you. No tests were performed to detect the existence of mold or other environmental hazards as it was beyond Scope of Work.

Local regulations regarding land or facility use, on and off-site conditions, or other factors may change over time, and additional work may be required with the passage of time. Based on the intended use of the report within one year from the date of report preparation, AGS may recommend additional work and report updates. Non-compliance with any of these requirements by the client or anyone else will release AGS from any liability resulting from the use of this report by any unauthorized party. Client agrees to defend, indemnify, and hold harmless AGS from any claim or liability associated with such unauthorized use or non-compliance. In this report, we have presented judgments based partly on our understanding of the proposed construction and partly on the data we have obtained. This report meets professional standards expected for reports of this type in this area. Our company is not responsible for the conclusions, opinions or recommendations made by others based on the data we have presented. Refer to American Society of Foundation Engineers (ASFE) general conditions included in an appendix.

This report has been prepared exclusively for the client, its' engineers and subcontractors for the purpose of design and construction of the proposed structure. No other engineer, consultant, or contractor shall be entitled to rely on information, conclusions or recommendations presented in this document without the prior written approval of AGS. We appreciate the opportunity to be of service to you on this project.

Sincerely,

Sam Adettiwar, MS, PE, GE, P.Eng, M.ASCE
Senior Engineer

Attachments



SITE PHOTOGRAPHS



Site topography with evidence of landslide





Tension cracks





Headscarp





Headscarp closeup





Slide toe area: Evidence of wetlands





Houses immediately uphill from the slide with adequate setback



FIGURES



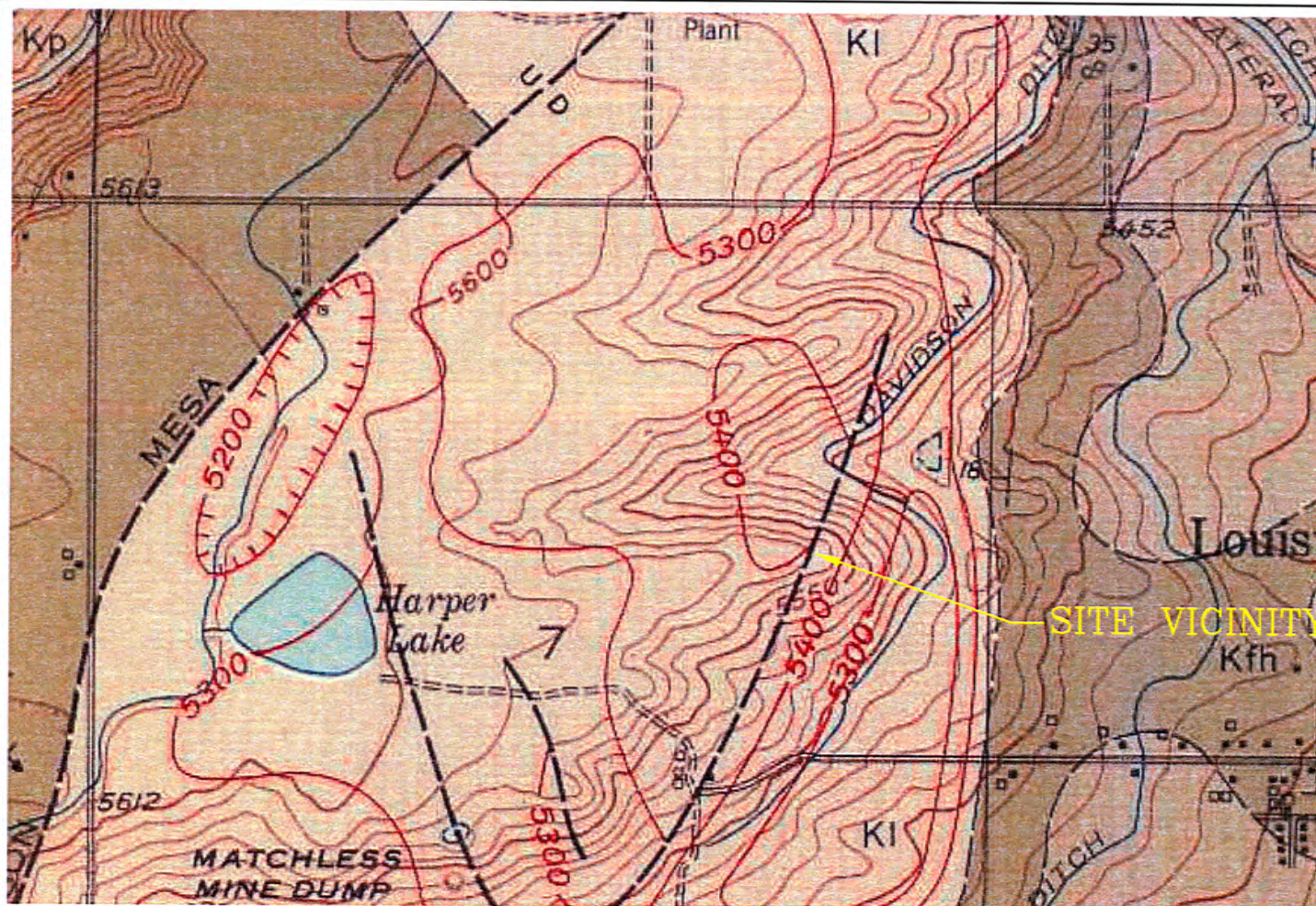
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Google Maps, 2015



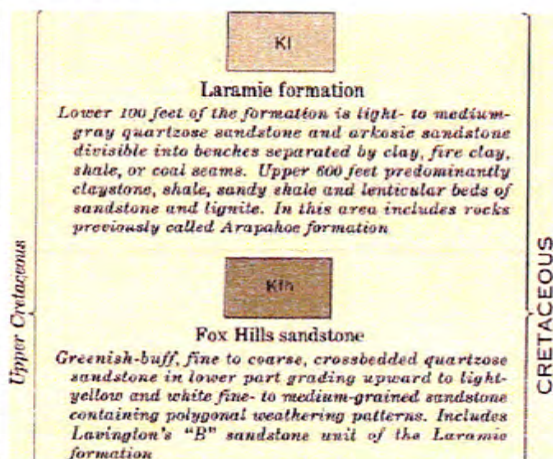
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SITE LOCATION MAP
Coyote Run Open Space Slide
Behind 597-583 W. Sagebrush Ct
Louisville, Colorado

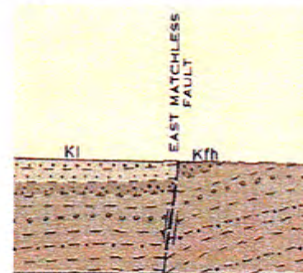
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EXPLANATION



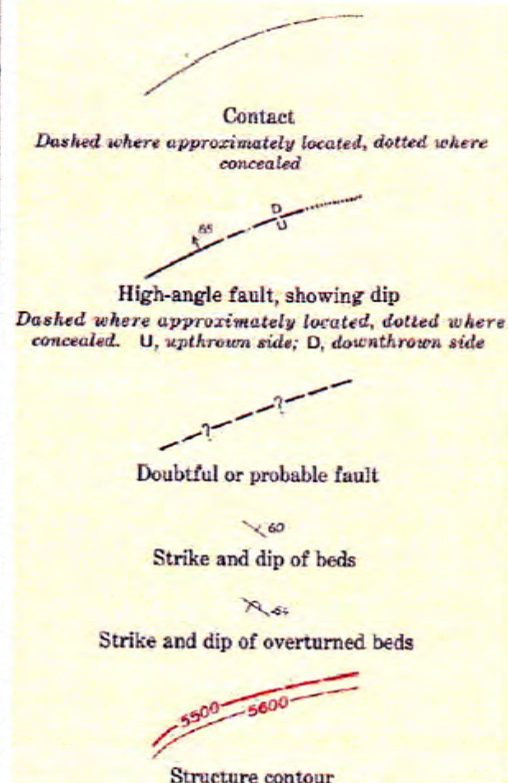
TYPICAL CROSS-SECTION



NOTES:

Site is located in the close proximity of the EAST MATCHLESS FAULT. In general, slickenside along faultplanes show that the major movement on the fault is probably dip slip. This fault is a normal fault and estimated to have a maximum vertical throw of about 250 feet.

LEGEND



Drawn on the top of the Fox Hills sandstone; solid where well-controlled by subsurface information, dashed where information is sparse. Subsurface intersections of structure contours and faults that do not dip vertically are drawn as though faults were vertical; contours do not reflect minor faults and folds or unconformities that cause bedding attitudes at surface to differ from bedding attitudes at depth. Contour interval, 100 feet

REFERENCE

Bedrock Geology, Louisville Quadrangle, Colorado, 1961

GEOLOGIC MAP

Coyote Run Open Space Slide
Behind 597-583 W. Sagebrush Ct
Louisville, Colorado

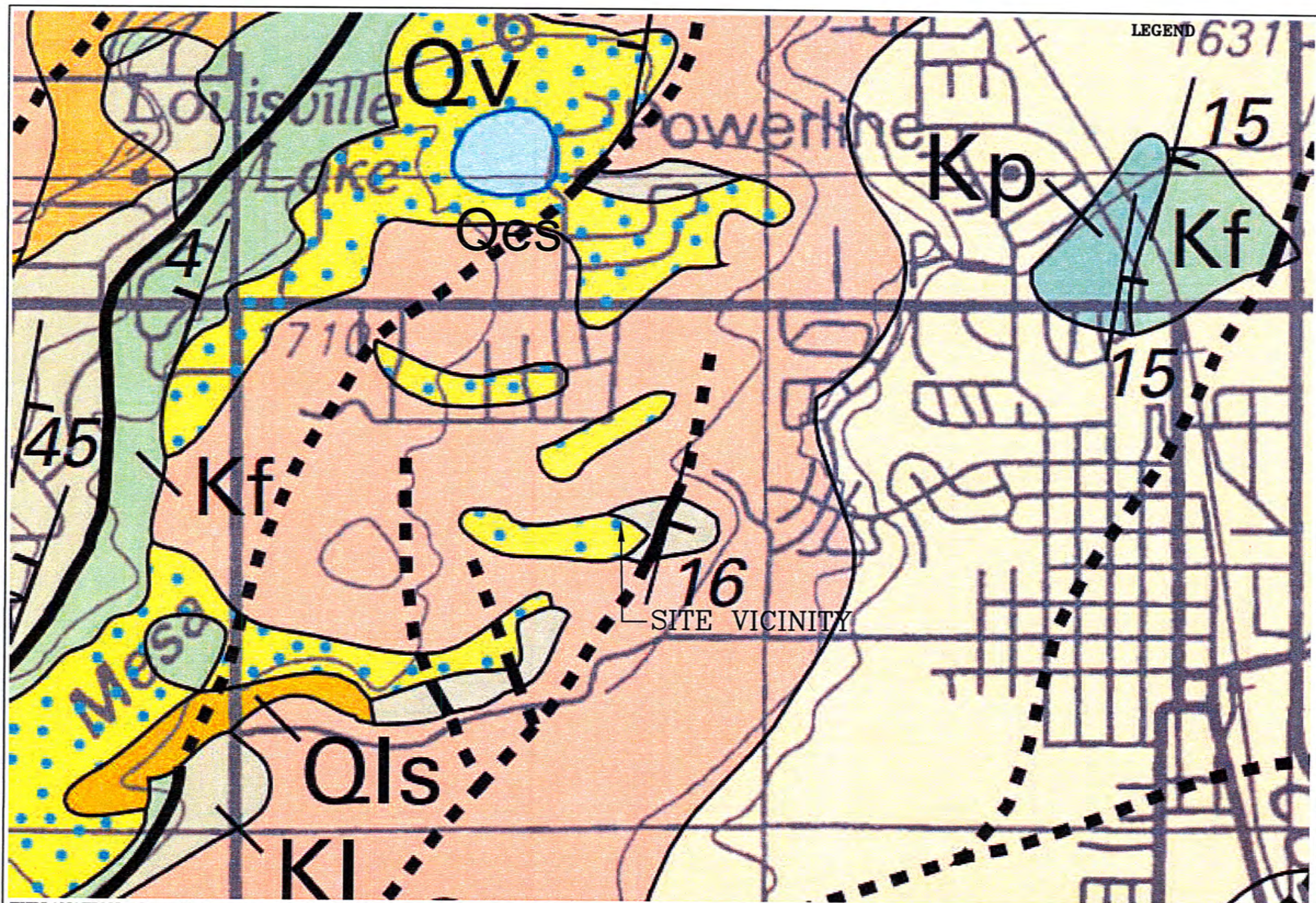


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EXPLANATION: Qes: Eolian sand; Qv: Verdose Alluvium

Kl: Laramie Formation; Kf: Fox Hills Sandstone

REFERENCE: Geologic Map of the Denver West Quad,
North-Central CO, Scientific Investigations Map3000,USGS



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SURFICIAL GEOLOGY MAP

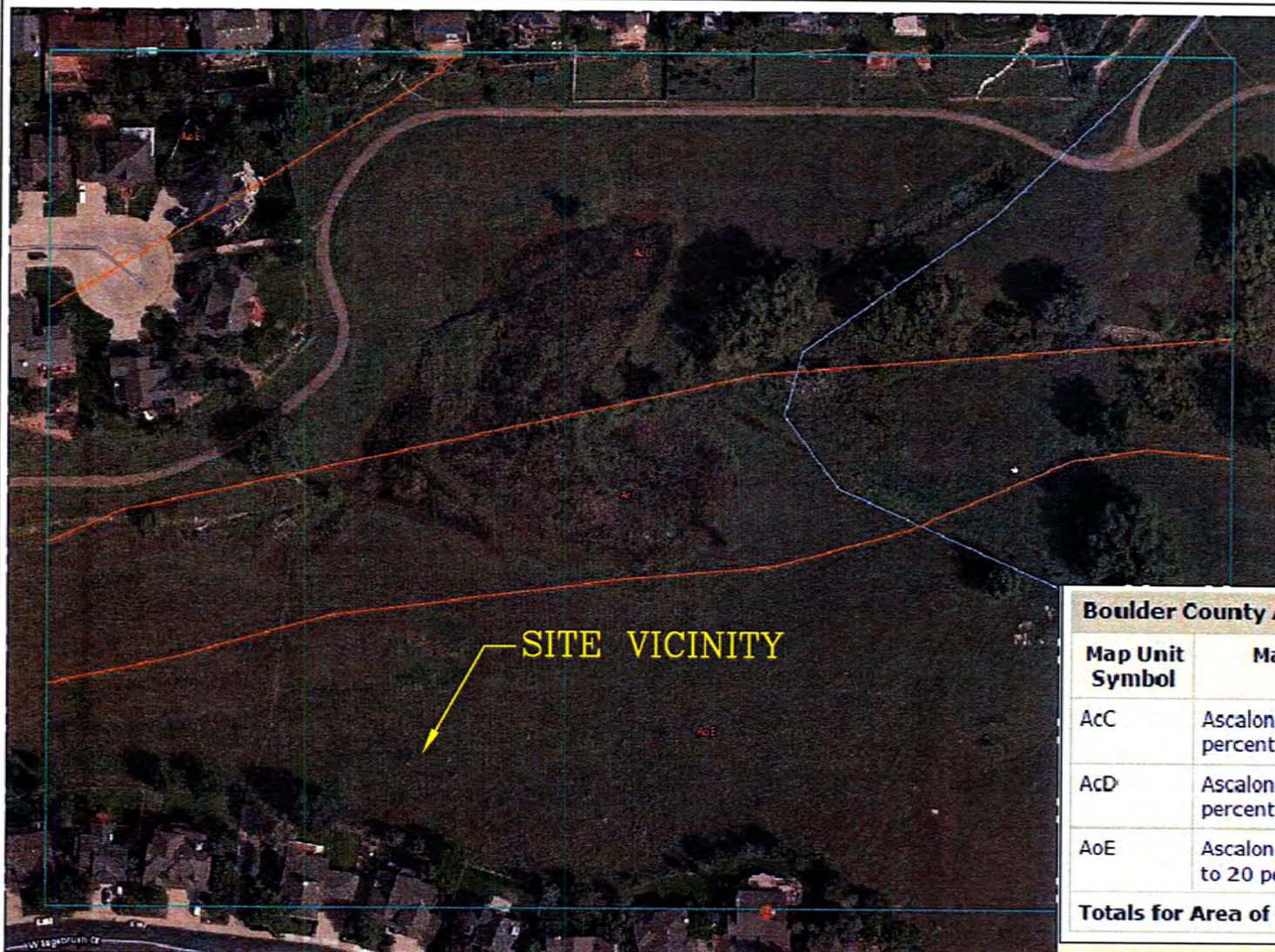
Coyote Run Open Space Slide
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Boulder County Area, Colorado (C0643)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
AcC	Ascalon sandy loam, 3 to 5 percent slopes	3.5	18.1%
AcD	Ascalon sandy loam, 5 to 9 percent slopes	7.1	36.6%
AoE	Ascalon-Otero complex, 9 to 20 percent slopes	8.8	45.2%
Totals for Area of Interest		19.5	100.0%

REFERENCE:

Web Soil Survey, 2015



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SOIL SURVEY MAP

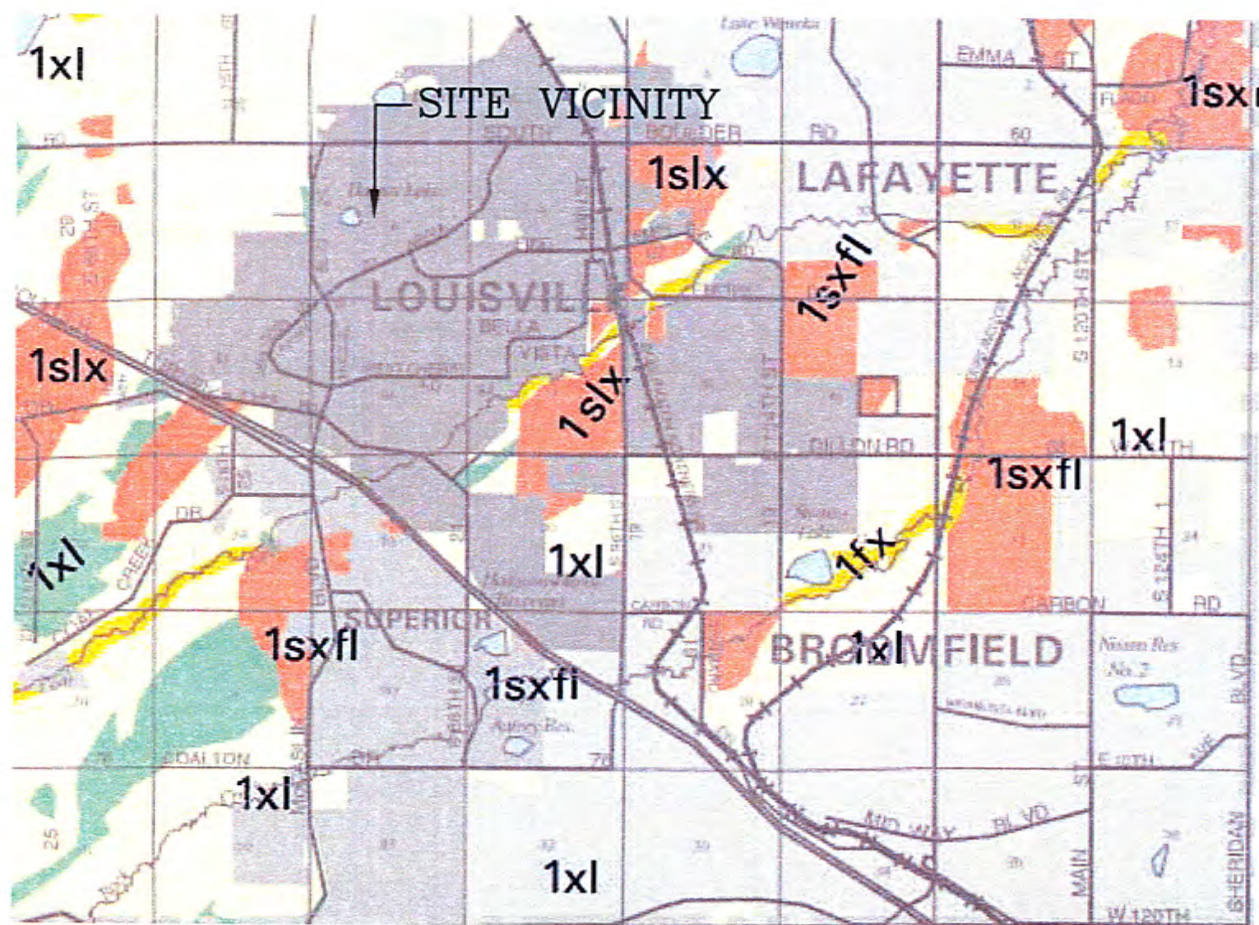
Coyote Run Open Space Slide
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Legend

RELATIVE GEOTECHNICAL RATING: GEOLOGIC HAZARD AREAS

- Major**
Extensive Problems
High Risk
- Moderate**
Significant Problems
Provisional Risk

GEOLOGIC CONSTRAINT AREAS

- Moderate**
Significant Problems
Provisional Risk
- Minor**
Few Problems
Nominal Risk
- Incorporated Areas**
(As of April 20, 1999)

Decreasing Geotechnical Problems ↓

MAP SYMBOL DEFINITIONS

First Number Indicates Subprovince

- 1 Piedmont
- 2 Foothills
- 3 Montane
- 4 Alpine

Subsequent Placed Letters Indicate Geologic Hazard or Constraint in Order of Impact
(See Example Given)

- a Snow Avalanche
- c Soil Creep
- f Flooding
- ff Flash Flooding Corridors and Associated alluvial (Debris) Fans
- l Landslides, Mudslides, Mudfalls, Debris Fans
- r Rockfalls, Rock Avalanches
- s Subsidence (Abandoned Coal Mines)
- x Expansive Soil or Claystone

NOTES:

1. Site is not part of the map due to City incorporation. However, site is surrounded by '1slx,' areas which stand for following potential hazards as listed under the Legend:

Subsidence (Abandoned Coal Mines), Landslides, Expansive Soils

REFERENCE:

Boulder County Geologic Hazards & Constraints Areas Map, 1978, 1999



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GEOLOGIC HAZARDS MAP

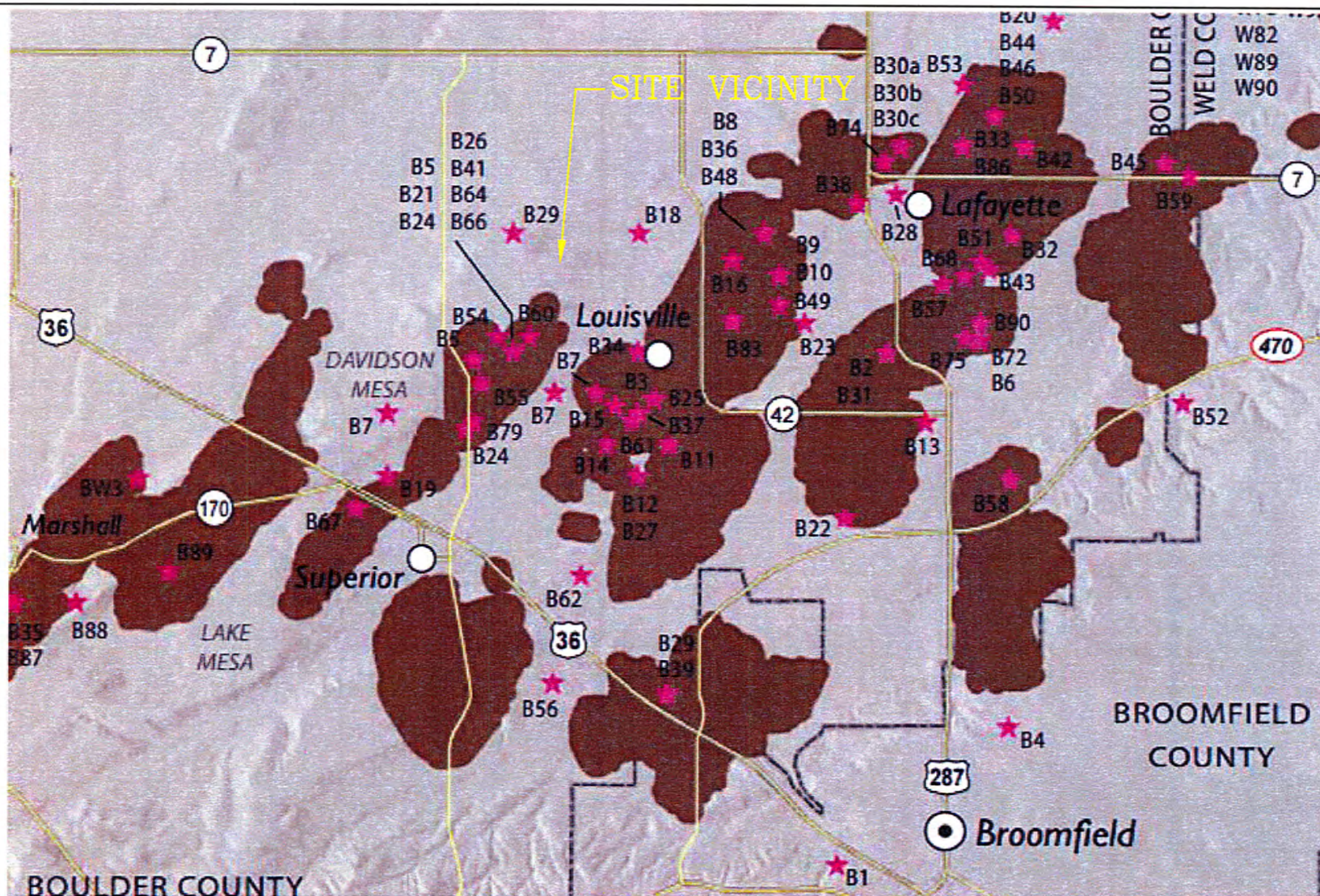
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Louisville, Colorado

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FIGURE NO.
6

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7/30/2015



LEGEND:

 Illustrates areas known to be undermined by historic coal mines.

NOTE: Site is in close proximity of the undermined area by historic coal mines.

REFERENCE: Figure 2 of the Colorado Geological Survey publication ISBN#978-1884216-55-8 (formerly Information Series 22)

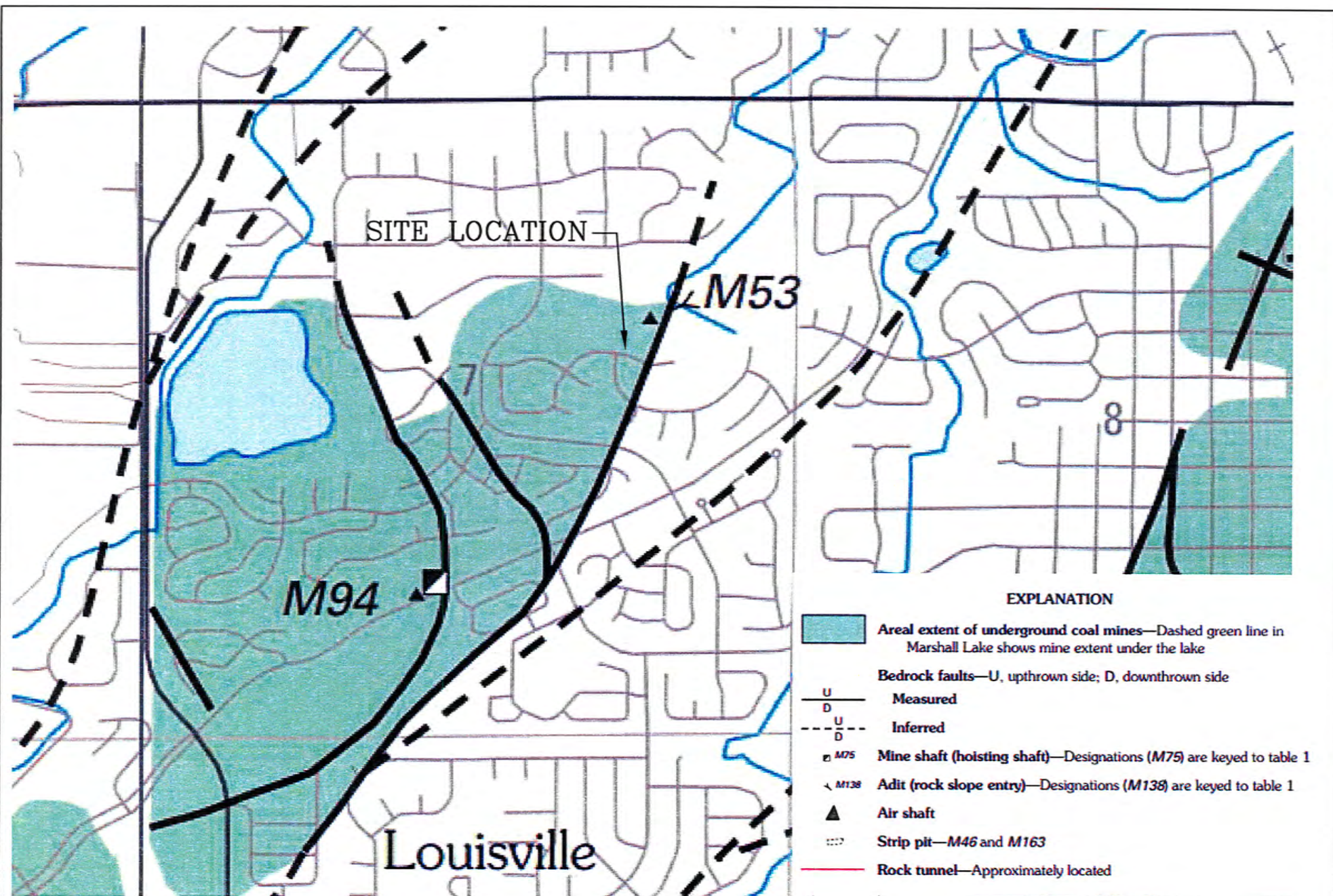


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ABANDONED COAL MINES MAP

Coyote Run Open Space Slide
 Behind 597-583 W. Sagebrush Ct
 Louisville, Colorado

SCALE As Shown	FIGURE NO 7	PROJECT NO. 0180-D15	DATE 7/30/2015
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LEGEND: M53 designates "Fireside Coal Mine," Dates of Operation 1831–1944. M94 designates "Matchless Coal Mine."

REFERENCE: USGS, Colorado Geological Survey, Geologic Investigation Series I2735



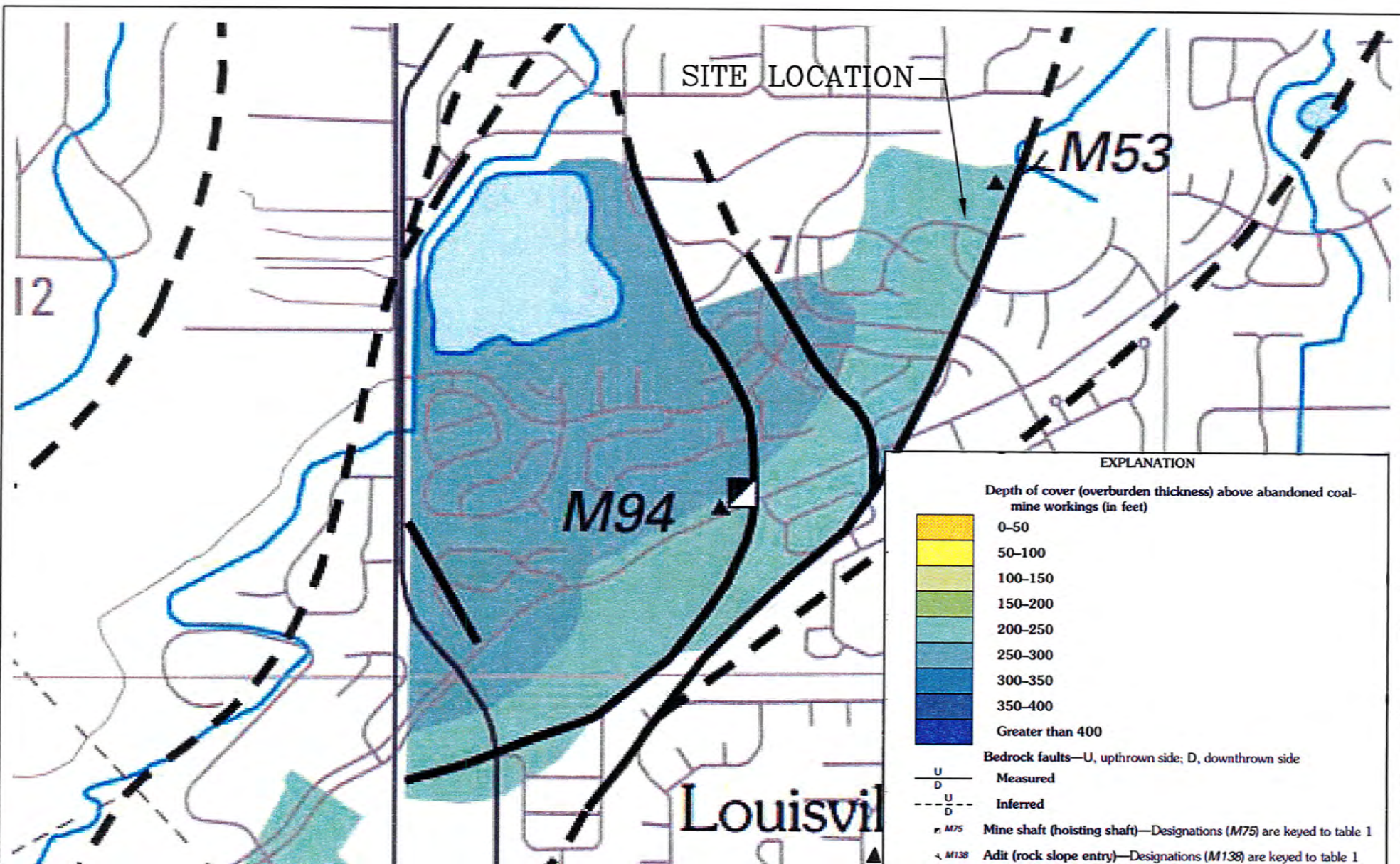
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ABANDONED COAL MINES MAP 2

Coyote Run Open Space Slide
Behind 597–583 W. Sagebrush Ct
Louisville, Colorado

SCALE As Shown	FIGURE NO. 8	PROJECT NO. 0180–D15	DATE 7/30/2015
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LEGEND: Light Green color indicates the possibility of 150–200 ft of overburden above the abandoned coal mine workings in the site vicinity.

REFERENCE: USGS, Colorado Geological Survey, Geologic Investigation Series I2735



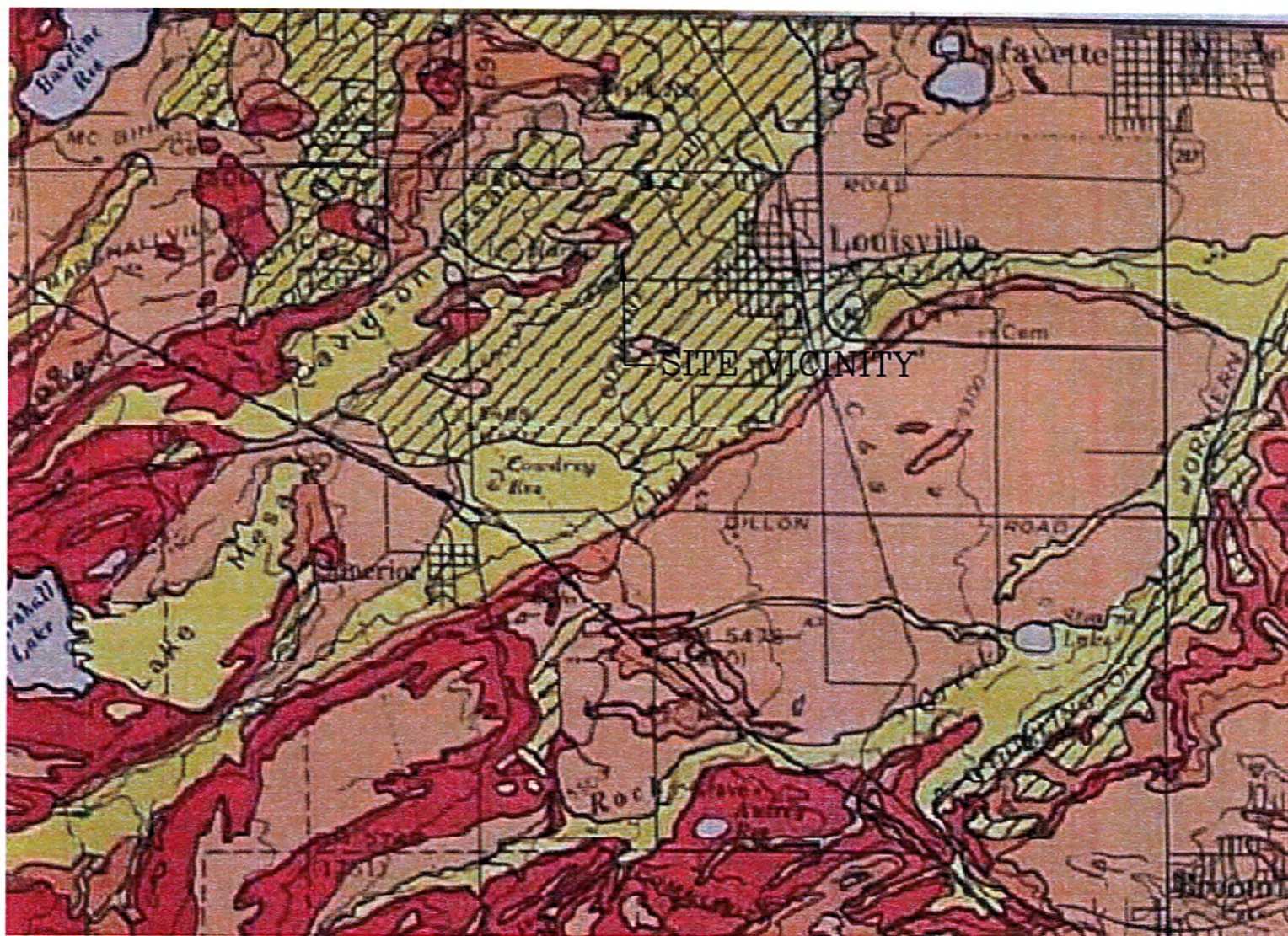
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ABANDONED COAL MINES MAP 3

Coyote Run Open Space Slide
Behind 597–583 W. Sagebrush Ct
Louisville, Colorado

SCALE As Shown	FIGURE NO 9	PROJECT NO. 0180–D15	DATE 7/30/2015
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LEGEND:



Designates wind blown sand or silt; may be subjected to severe settlement or hydrocompaction when water is allowed to saturate the deposit.

REFERENCES:

USGS, Potentially swelling soil and rock in the Front Range Urban COrridor, Colorado, Sheet 2 of 4, 1973-74.



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LOESS DEPOSIT HAZARD MAP

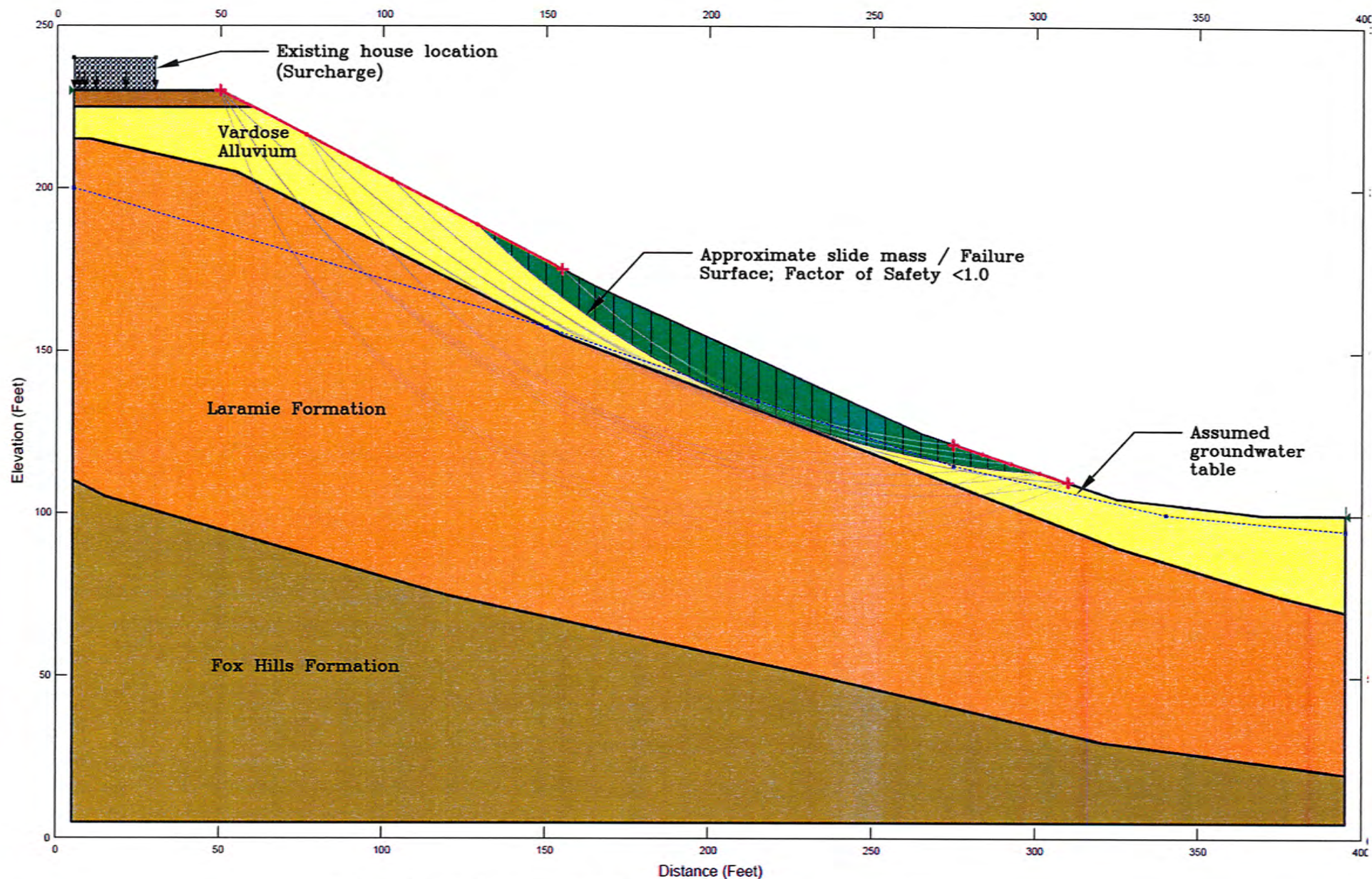
Coyote Run Open Space Slide
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Louisville, Colorado

SCALE
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FIGURE NO.
10

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7/30/2015



PRELIMINARY SLOPE STABILITY ANALYSES

REFERENCE:
SLOPE/W Software, 2012

NOTE: Soil/groundwater parameters and profile is assumed. No subsurface exploration data available at this time.



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EXISTING SLIDE

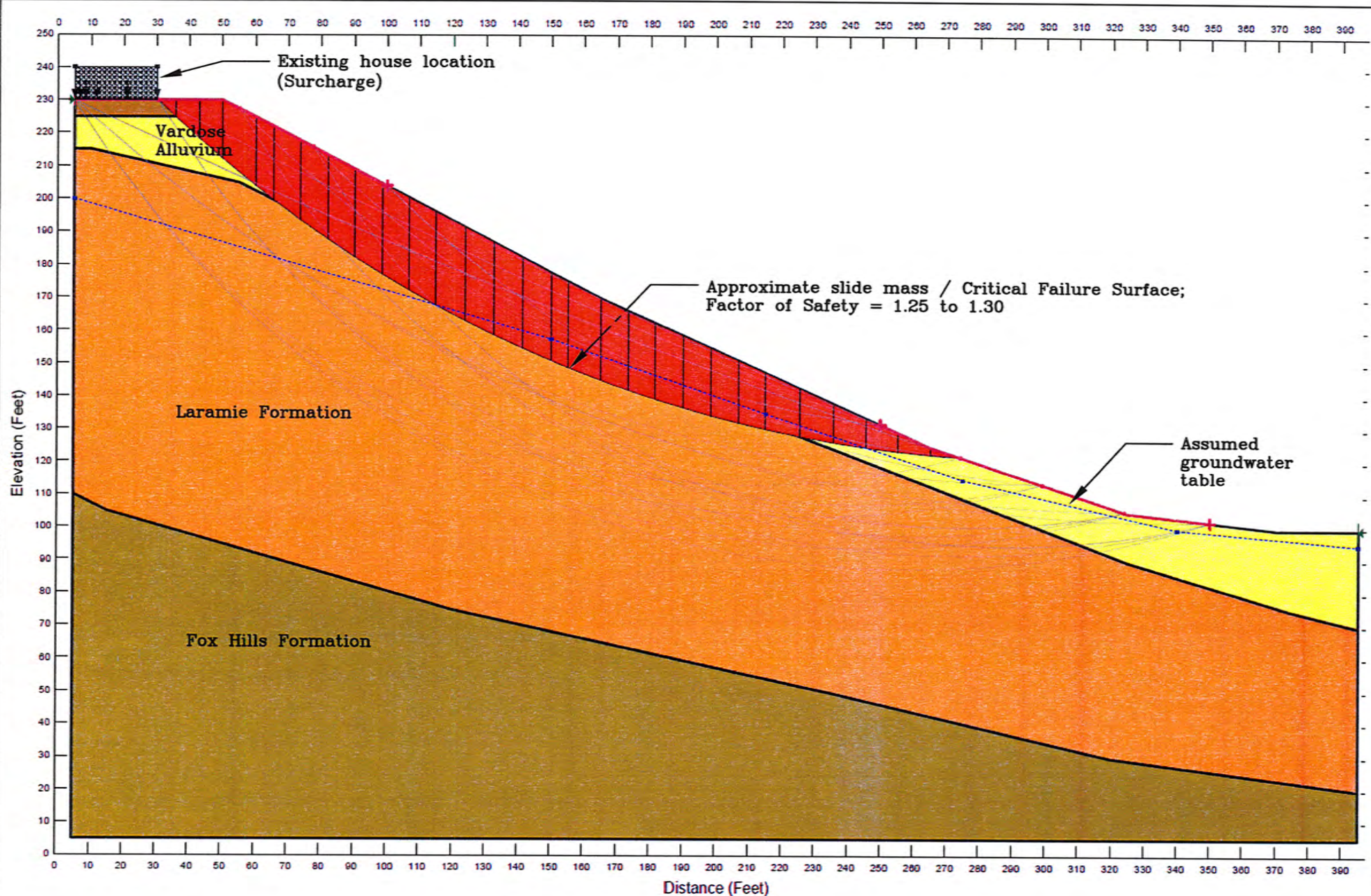
Coyote Run Open Space Slide
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Louisville, Colorado

SCALE
As Shown

FIGURE NO.
11

PROJECT NO.
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7/30/2015



PRELIMINARY ANALYSES

REFERENCE:
SLOPE/W Software, 2012

NOTE: Soil/groundwater parameters and profile is assumed. No subsurface exploration data available at this time.



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SLOPE STABILITY HAZARD

Coyote Run Open Space Slide
Behind 597-583 W. Sagebrush Ct
Louisville, Colorado

SCALE As Shown	FRAME NO. 12	PROJECT NO. 0180-D15	DATE 7/30/2015
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APPENDIX

GWS-51
03/05

NOTICE OF INTENT TO CONSTRUCT MONITORING HOLE(S)

RECEIVED

Please type or print legibly in black or blue ink

SEP 12 2006

Colorado Division of Water Resources 1313 Sherman St-Room 821 Denver CO 80203
Phone 303-866-3581 Fax 303-866-3589WATER RESOURCES
STATE ENGINEER
COLD

AUTHORIZED INDIVIDUAL OR DRILLER

Contact William Close
Company Scott, Cox + Associates
Address 1530 55th St
City, State, Zip Boulder, CO 80303
Phone (303) 444-3308 Fax No. (303) 444-3387
Driller Lic. No. (if applicable) _____Location: NE 1/4, SW 1/4, Section 7
Township 1 N 10 E Range 69 E 10 PM 6
County Boulder
Subdivision Centennial
Lot — Blk. — Flg. 6Site/Property Address Three
Trailridge Drive R.O.W.
Hole(s) to be constructed: Number 4Estimated depth 7 Ft. Aquifer —Purpose of Monitoring Hole(s) Verify ifwater is contributing to road deteriorationApproximate Date of Construction 9/12/2006
(Must be at least 3 days prior to construction)Sarah C. Borgen
Authorized Signature

Well Owner (Client) Information

Name City of Louisville
Address 749 Main St.
Louisville, CO 80027
Well Owner's Phone (303) 335-4608
Landowner's Name: City of Louisville

ACKNOWLEDGEMENT FROM STATE ENGINEER'S OFFICE

FOR OFFICE USE ONLY

MH- 26569PROCESSED BY Brenda HolsengDIV. 1WD 50BAS —MD —DATE ACKNOWLEDGED 09/12/06

CONDITIONS OF MONITORING HOLE ACKNOWLEDGEMENT

A COPY OF THE WRITTEN NOTICE OR ACKNOWLEDGEMENT SHALL BE AVAILABLE AT THE DRILLING SITE.

Notice was provided to the State Engineer at least 3 days prior to construction of monitoring & observation hole(s). Construction of the hole(s) must be completed within 90 days of the date notice was given to the State Engineer. Testing and/or pumping shall not exceed a total of 200 hours unless prior written approval is obtained from the State Engineer. Water diverted during testing shall not be used for beneficial purposes. The owner of the hole(s) is responsible for obtaining permit(s) and complying with all rules and regulations pertaining to the discharge of fluids produced during testing.

All work must comply with the Water Well Construction Rules, 2 CCR 402-2. Minimum construction standards must be met or a variance obtained. Standard permit application and work report forms are found on the DWR website at <http://www.water.state.co.us>. Well Construction and Test Reports (GWS-31) must be completed for each hole drilled. The licensed contractor or authorized individual must submit the completed forms to this office within 60 days of drilling.

Unless a well permit is obtained, the hole(s) must be plugged and sealed within one (1) year after construction.

An Abandonment Report (form GWS-8) must be submitted for each hole plugged within 60 days of plugging & sealing. The monitoring hole acknowledgement number, owner's structure name, and hole owner's name and address must be provided on all well permit application(s), well construction and abandonment reports.

The owner of the hole(s) should maintain records of water quality testing and submit this data to the State Engineer upon request.

A monitoring hole cannot be converted to a production water well, except for purposes of remediation (recovery) or as a permanent dewatering system, if constructed in accordance with the Water Well Construction Rules and policies of the State Engineer.

THIS ACKNOWLEDGEMENT OF NOTICE DOES NOT INDICATE THAT WELL PERMIT(S) CAN BE APPROVED.

IF HOLES WILL NOT BE CONSTRUCTED UNDER THIS NOTICE WITHIN 90 DAYS, PLEASE WRITE, "NO HOLES CONSTRUCTED" ON A COPY OF THE ACKNOWLEDGED NOTICE WITH THE FILE NUMBER AND FAX THE COPY TO THE DIVISION OF WATER RESOURCES.

Additional Conditions _____

Index No.	2764
IDWD	1-6
Completion	use 1
Yield	
Checked By	

STATE OF COLORADO
DIVISION OF WATER RESOURCES
OFFICE OF THE STATE ENGINEER

MAP AND STATEMENT FOR WATER WELL FILING

PERMIT NUMBER 46569 - SE-911

STATE OF COLORADO) SS

CLAIMANT (s)

John M. Bridge

being duly sworn upon oath deposes and says that he (they) is (are) the owner (s) of the well described hereon; the total number of acres

of land irrigated from this well is 1; work was commenced on this well by actual construction on the15 day of June 1971; the sustainedyield from said well is 15 gpm, for which claim is hereby madefor Domestic purpose (s);the average annual amount to be diverted is 24-19 acre-feet; this map and statement is filed in compliance with law; he (they) has (have) read the statements made hereon; knows the content thereof; and that the same are true of his (their) own knowledge.X Signature (s) John M. BridgeAddress: 450 Oak DriveBoulder, Colo. 80303Subscribed and sworn to before me on this 9th dayof July, 1971My Commission expires: Jan. 22, 1974

(Seal)

Bo A. Hollenbeck
Notary Public

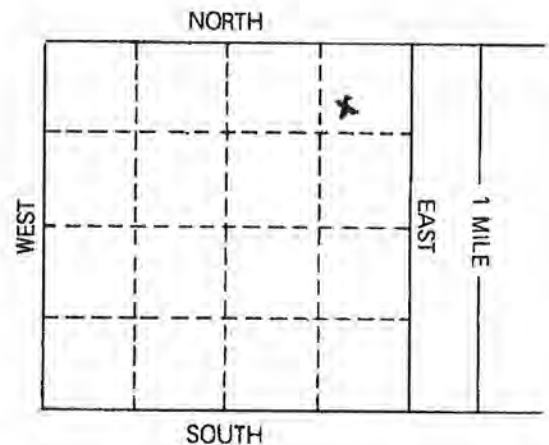
WELL DATA

Date Completed June 14 - 71Static Water Level 30 ftTotal Depth of Well 220 ft

WELL LOCATION

Boulder07 CountyNE $\frac{1}{4}$ of NE $\frac{1}{4}$, sec. 1T. 1 South R. 70 W 6 P.M.

INDICATE WELL LOCATION ON DIAGRAM



WELL SHALL BE LOCATED WITH REFERENCE TO GOVERNMENT SURVEY CORNERS OR MONUMENTS, OR SECTION LINES BY DISTANCE AND BEARING.

_____ ft. from _____ section line.
(North or South)_____ ft. from _____ section line.
(East or West)

Ground Water Basin _____

Water Management
District _____

Domestic wells may be located by the following:

LOT _____, BLOCK _____

SUBDIVISION _____

FILING # _____

ACCEPTED FOR FILING IN THE OFFICE OF THE STATE ENGINEER OF COLORADO ON THIS _____ DAY

OF _____, 19____.

STATE ENGINEER

FORM TO BE MADE OUT IN QUADRUPLICATE: WHITE FORM must be an original copy on both sides and signed. WHITE AND GREEN copies must be filed with the State Engineer within 30 days after the well is completed or within 7 days after expiration date of the permit, whichever is sooner; PINK COPY is for the Owner and YELLOW COPY is for the Driller.

WELL LOG

From	To	Type & Color of Material	Water Loc.
0	15	Clay	
15	40	Fox Hill Sand stone	-
40	41	Lime stone	
41	220	Fox Hill Sand stone	

Use additional paper if necessary to complete log.

WELL DATA

Type Drilling Rotary

HOLE DIAMETER:

8 in. from 0 ft. to 21
 5 5/8 in. from 21 ft. to 220
 _____ in. from _____ ft. to _____

CASING RECORD

Plain Casing

Size 6, kind Steel from 0 ft. to 21
 Size _____, kind _____ from _____ ft. to _____
 Size _____, kind _____ from _____ ft. to _____

Perforated Casing

Size 5 5/8 kind OPEN from 21 ft. to 220
 Size _____, kind _____ from _____ ft. to _____
 Size _____, kind _____ from _____ ft. to _____

GROUTING RECORD

Material Cement
 Intervals From 5 ft to 21 ft
 Placement Method Poured Back Casing

GRAVEL PACK RECORD

Size _____ Interval _____

TEST DATA

Date Tested June 17 - 71
 Type of Pump Bailor
 Length of Test 4 hrs
 Sustained Yield (Metered) 15 gal
 Drawdown 140 ft

WELL DRILLERS STATEMENT

The undersigned, being duly sworn, deposes and says: he is the driller of the well hereon described; he has read the statement made here knows the content thereof, and the same is true of his own knowledge.

x Pon WanekaLicense No. #2

State of Colorado, County of _____ ss

Subscribed and sworn to before me this _____ day of _____, 19____

My Commission expires _____, 19____.

Notary Public

DIVISION OF WATER RESOURCES, DEPARTMENT OF NATURAL RESOURCES

101 Columbine Bldg., 1845 Sherman Street, Denver, Colorado 80203

APPLICATION FOR:

- ☐ A PERMIT TO USE GROUND WATER
☒ A PERMIT TO CONSTRUCT A WELL
☐ REPLACEMENT FOR NO. _____
☐ A PERMIT TO INSTALL A PUMP
☐ OTHER

PRINT OR TYPE

LOCATION OF WELL

APPLICANT JOHN M. BRIDGECOUNTY BOULDERStreet Address 450. ORD. DRIVENE $\frac{1}{4}$, of the NE $\frac{1}{4}$, sec. 1City & State Boulder COLO 80302T. 1 SOUTH, R. 70 W., 10 P.M.Use of ground water DOMESTIC

Street or

Owner of land on which well

Lot & Block

is located ABOVE

City or

Owner of irrigated

Subdiv. Filing

land

Number of acres

Ground Water Basin

to be irrigated 1

Water Management

Legal description of

District

irrigated land

LOCATE WELL ON THE BACK OF THIS SHEET

Other water rights on

Driller Don Waneka No. 2this land ITAP

Driller's

Aquifer (s) ground water is to be obtained

Address 326. 50. 112st Lafayette Colo 80026from FOX HILL SAND STONEJohn M. Bridge

Signature of Applicant

Storage capacity 42 GAL TANK AF

CONDITIONS OF APPROVAL

ANTICIPATED PUMPING RATE 15 GPM

AVERAGE ANNUAL AMOUNT OF GROUND WATER TO

BE APPROPRIATED 24 - 19 Acre-feet

ESTIMATED WELL DATA

Anticipated start of drilling JUNE 12 1971Anticipated start of use JUNE 15 1971

Hole Diameter:

8 in. from 0 ft. to 21 ft.
5 5/8 in. from 21 ft. to 200 ft.

Casing:

Plain 6 in. from 0 ft. to 21 ft.
 in. from _____ ft. to _____ ft.

OPEN Perf. 5 5/8 in. from 21 ft. to 200 ft.
 in. from _____ ft. to _____ ft.

ESTIMATED PUMP DATA

Type SUBM HP 1 Outlet Size 1 1/4NO. GW 12051

APPLICATION APPROVED:

VALID FOR ONE (1) YEAR AFTER DATE ISSUED
 UNLESS EXTENDED FOR GOOD CAUSE SHOWN TO
 THE ISSUING AGENCY

PERMIT NO. 46569 CONDITIONAL ☐DATE ISSUED JUN 14 1971

STATE ENGINEER

BY

Barlan W. Esher

APPLICATION MUST BE COMPLETED SATISFACTORILY BEFORE ACCEPTANCE

(OVER)

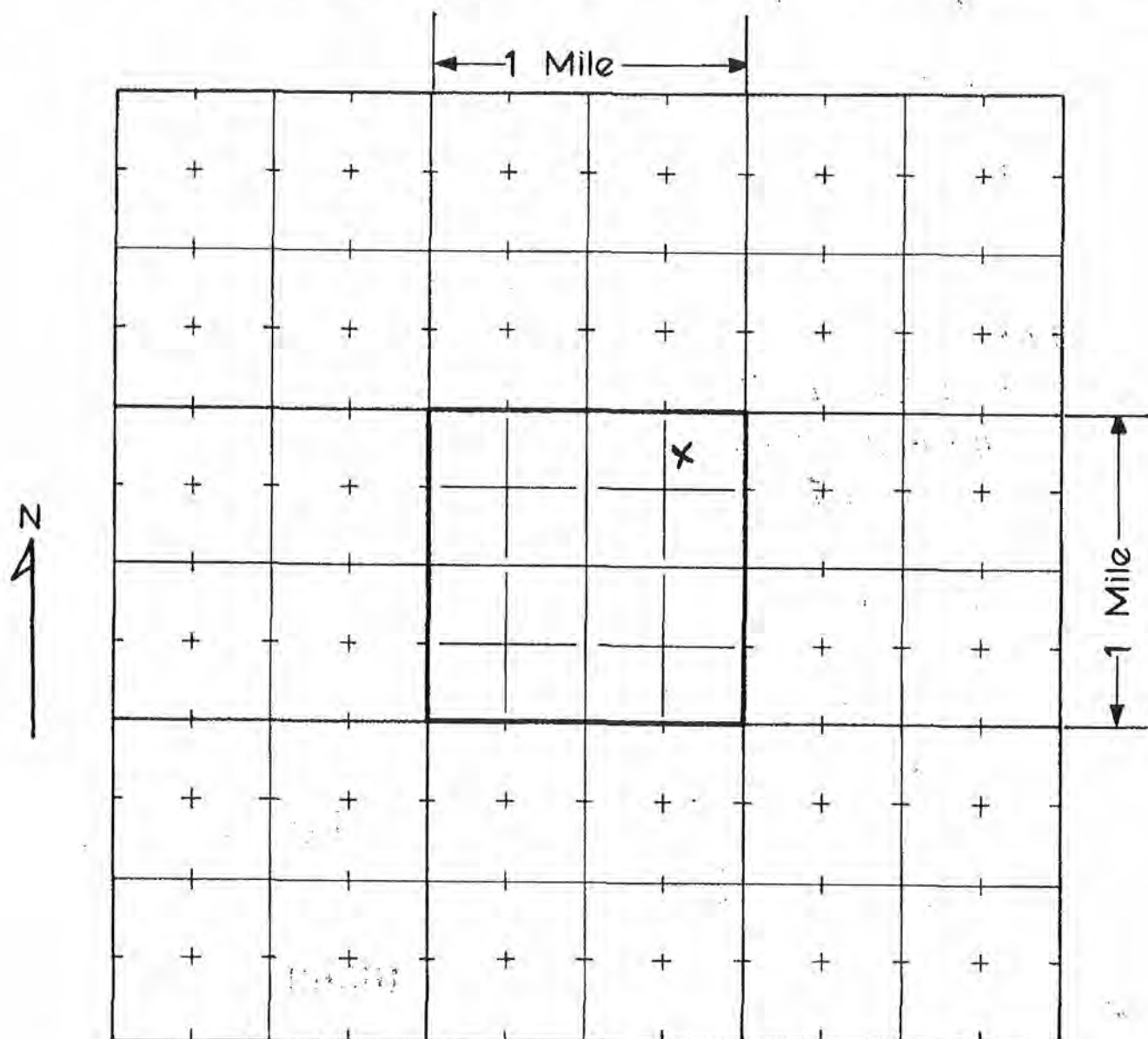
THE LOCATION OF THE PROPOSED WELL SHALL BE SHOWN ON THE DIAGRAM BELOW WITH REFERENCE TO SECTION LINES OR GOVERNMENT SURVEY CORNERS OR MONUMENTS.

_____ feet from _____ (North or South) section line

_____ feet from _____ (East or West) section line

IF WELL IS FOR IRRIGATION, THE AREA TO BE IRRIGATED MUST BE SHADED OR CROSS-HATCHED.

This diagram represents nine (9) sections. Use the CENTER SQUARE (one section) to indicate the location of the well.



THE SCALE OF THE DIAGRAM IS TWO INCHES EQUALS ONE-MILE

WELL CONSTRUCTION AND TEST REPORT
STATE OF COLORADO, OFFICE OF THE STATE ENGINEER
1313 Sherman St., Rm 818, Denver, CO 80203For Office Use only
RECEIVED

DEC 24 2001

WATER RESOURCES
STATE ENGINEER
COLO.

0474147B

1. WELL PERMIT NUMBER 756 R R2. OWNER NAME(S) Town of Fowler
Mailing Address 317 S Main
City, St. Zip Fowler Colo 81039
Phone ()3. WELL LOCATION AS DRILLED: NE 1/4 NE 1/4, Sec. 17 Twp. 22S, Range 59W 61N
DISTANCES FROM SEC. LINES:
3990 ft. from S Sec. line. and 40 ft. from E Sec. line. OR
(North or South) (East or West)
SUBDIVISION: LOT BLOCK FILING(UNIT)
STREET ADDRESS AT WELL LOCATION:4. GROUND SURFACE ELEVATION _____ ft. DRILLING METHOD Auger
DATE COMPLETED 10-25-01 TOTAL DEPTH 42 ft. DEPTH COMPLETED 46 ft.

5. GEOLOGIC LOG:

Depth Description of Material (Type, Size, Color, Water Location)

0-3
sand gravel 3-39
shale 39-426. HOLE DIAM. (in.) From (ft) To (ft)
4 1/2 0 42

7. PLAIN CASING

OD (in) Kind Wall Size From (ft) To (ft)
16 steel 4 14 20PERF. CASING: Screen Slot Size:
16 plastic 50H40 20 42

8. FILTER PACK:

Material gravel
Size 3/4
Interval 10-42

9. PACKER PLACEMENT:

Type _____
Depth _____

10. GROUTING RECORD:

Material Amount Density Interval Placement
Cement 4 1/2 350 PSI 0-10 P

REMARKS:

11. DISINFECTION: Type HTH Amt. Used 5 lb12. WELL TEST DATA: ☐ Check box if Test Data is submitted on Form No. GWS 39 Supplemental Well Test.TESTING METHOD 3UBStatic Level 7 ft. Date/Time measured 10-25 6 PM, Production Rate 1400 gpm.
Pumping level 3 1/2 ft. Date/Time measured 10-25 7 PM, Test length (hrs.) 1
Remarks

13. I have read the statements made herein and know the contents thereof, and that they are true to my knowledge. [Pursuant to Section 24-4-104 (13) (a) C.R.S., the making of false statements herein constitutes perjury in the second degree and is punishable as a class 1 misdemeanor.]

CONTRACTOR B+B Drilling Phone (719) 384 7568 Lic. No. 72
Mailing Address

Name/Title (Please type or print)

Signature

Date

DEAN BECHTOLDDean Bechtold10-26-01

IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL ENGINEERING REPORT

As the client of a consulting geotechnical engineer, you should know that site subsurface conditions cause more construction problems than any other factor. ASFE/the Association of Engineering Firms Practicing in the Geosciences offers the following suggestions and observations to help you manage your risks.

A GEOTECHNICAL ENGINEERING REPORT IS BASED ON A UNIQUE SET OF PROJECT-SPECIFIC FACTORS

Your geotechnical engineering report is based on a subsurface exploration plan designed to consider a unique set of project-specific factors. These factors typically include: the general nature of the structure involved, its size, and configuration; the location of the structure on the site; other improvements, such as access roads, parking lots, and underground utilities; and the additional risk created by scope-of-service limitations imposed by the client. To help avoid costly problems, ask your geotechnical engineer to evaluate how factors that change subsequent to the date of the report may affect the report's recommendations.

Unless your geotechnical engineer indicates otherwise, do not use your geotechnical engineering report:

MOST GEOTECHNICAL FINDINGS ARE PROFESSIONAL JUDGMENTS

Site exploration identifies actual subsurface conditions only at those points where samples are taken. The data were extrapolated by your geotechnical engineer who then applied judgment to render an opinion about overall subsurface conditions. The actual interface between materials may be far more gradual or abrupt than your report indicates. Actual conditions in areas not sampled may differ from those predicted in your report. While nothing can be done to prevent such situations, you and your geotechnical engineer can work together to help minimize their impact. Retaining your geotechnical engineer to observe construction can be particularly beneficial in this respect.

- when the nature of the proposed structure is changed, for example, if an office building will be erected instead of a parking garage, or a refrigerated warehouse will be built instead of an unrefrigerated one;
- when the size, elevation, or configuration of the proposed structure is altered;
- when the location or orientation of the proposed structure is modified;
- when there is a change of ownership; or .for application to an adjacent site.

Geotechnical engineers cannot accept responsibility for problems that may occur if they are not consulted after factors considered in their report's development have changed.

A REPORT'S RECOMMENDATIONS CAN ONLY BE PRELIMINARY

The construction recommendations included in your geotechnical engineer's report are preliminary, because they must be based on the assumption that conditions revealed through selective exploratory sampling are indicative of actual conditions throughout a site.

Because actual subsurface conditions can be discerned only during earthwork, you should retain your geotechnical engineer to observe actual conditions and to finalize recommendations. Only the geotechnical engineer who prepared the report is fully familiar with the background information needed to determine whether or not the report's recommendations are valid and whether or not the contractor is abiding by applicable recommendations. The geotechnical engineer who developed your report cannot assume responsibility or liability for the adequacy of the report's recommendations if another party is retained to observe construction.

SUBSURFACE CONDITIONS CAN CHANGE

A geotechnical engineering report is based on conditions that existed at the time of subsurface exploration. Do not base construction decisions on a geotechnical engineering report whose adequacy may have been affected by time. Speak with your geotechnical consultant to learn if additional tests are advisable before construction starts. Note, too, that additional tests may be required when subsurface conditions are affected by construction operations at or adjacent to the site, or by natural events such as floods, earthquakes, or ground water fluctuations. Keep your geotechnical consultant apprised of any such events.

GEOTECHNICAL SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND PERSONS

Consulting geotechnical engineers prepare reports to meet the specific needs of specific individuals. A report prepared for a civil engineer may not be adequate for a construction contractor or even another civil engineer. Unless indicated otherwise, your geotechnical engineer prepared your report expressly for you and expressly for purposes you indicated. No one other than you should apply this report for its intended purpose without first conferring with the geotechnical engineer. No party should apply this report for any purpose other than that originally contemplated without first conferring with the geotechnical engineer.

GEOENVIRONMENTAL CONCERNS ARE NOT AT ISSUE

Your geotechnical engineering report is not likely to relate any findings, conclusions, or recommendations

about the potential for hazardous materials existing at the site. The equipment, techniques, and personnel used to perform a geoenvironmental exploration differ substantially from those applied in geotechnical engineering. Contamination can create major risks. If you have no information about the potential for your site being contaminated, you are advised to speak with your geotechnical consultant for information relating to geoenvironmental issues.

A GEOTECHNICAL ENGINEERING REPORT IS SUBJECT TO MISINTERPRETATION

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a geotechnical engineering report. To help avoid misinterpretations, retain your geotechnical engineer to work with other project design professionals who are affected by the geotechnical report. Have your geotechnical engineer explain report implications to design professionals affected by them, and then review those design professionals' plans and specifications to see how they have incorporated geotechnical factors. Although certain other design professionals may be familiar with geotechnical concerns, none knows as much about them as a competent geotechnical engineer.

BORING LOGS SHOULD NOT BE SEPARATED FROM THE REPORT

Geotechnical engineers develop final boring logs based upon their interpretation of the field logs (assembled by site personnel) and laboratory evaluation of field samples. Geotechnical engineers customarily include only final boring logs in their reports. Final boring logs should not under any circumstances be redrawn for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process. Although photographic reproduction eliminates this problem, it does nothing to minimize the possibility of contractors misinterpreting the logs during bid preparation. When this occurs, delays, disputes, and unanticipated costs are the all-too-frequent result.

To minimize the likelihood of boring log misinterpretation, give contractors ready access to the complete geotechnical engineering report prepared or authorized for their use. (If access is provided only to the report prepared for you, you should advise contractors of the report's limitations, assuming that a contractor was not one of the specific persons for whom the report was prepared and that developing

construction cost estimates was not one of the specific purposes for which it was prepared. In other words, while a contractor may gain important knowledge from a report prepared for another party, the contractor would be well-advised to discuss the report with your geotechnical engineer and to perform the additional or alternative work that the contractor believes may be needed to obtain the data specifically appropriate for construction cost estimating purposes.) Some clients believe that it is unwise or unnecessary to give contractors access to their geotechnical engineering reports because they hold the mistaken impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems. It also helps reduce the adversarial attitudes that can aggravate problems to disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY

Because geotechnical engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against geotechnical engineers. To help prevent this problem, geotechnical engineers have developed a number of clauses for use in their contracts, reports, and other documents. Responsibility clauses are not exculpatory clauses designed to transfer geotechnical engineers' liabilities to other parties. Instead, they are definitive clauses that identify where geotechnical engineers' responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your geotechnical engineering report. Read them closely. Your geotechnical engineer will be pleased to give full and frank answers to any questions.

RELY ON THE GEOTECHNICAL ENGINEER FOR ADDITIONAL ASSISTANCE

Most ASFE-member consulting geotechnical engineering firms are familiar with a variety of techniques and approaches that can be used to help reduce risks for all parties to a construction project, from design through construction. Speak with your geotechnical engineer not only about geotechnical issues, but others as well, to learn about approaches that may be of genuine benefit. You may also wish to obtain certain ASFE publications. Contact a member of ASFE or ASFE for a complimentary directory of ASFE publications.



8811 Colesville Road/Suite G106/Silver Spring, MD 20910
Telephone: 301/565-2733 Facsimile: 301/589-2017