REPORT # 1

SERGENT, HAUSKINS & BECKWITH CONSULTING GEOTECHNICAL ENGINEERS
SOIL & FOUNDATION ENGINEERING • ENGINEERING GEOLOGY • HYDROGEOLOGY
MATERIALS ENGINEERING • MATERIALS TESTING • ENVIRONMENTAL SERVICES

May 19, 1992

Mr. Chet L. Vanorden
c/o Ms. Janet B. Bean
2593 Bonneville Terrace Dr.
South Ogden, Utah 84403

SHB Job No. E92-2167

Re: Report
Slope Stability Reconnaissance
Lots 7, 8, 9, 10, and 11
Eastwood Subdivision No. 8
Uintah, Weber County, Utah
For Ms. Janet B. Bean

Dear Mr. Vanorden:

1. INTRODUCTION

Presented in this report are the results of our slope stability reconnaissance conducted at Lots 7 through 11 of the Eastwood Subdivision in Uintah, Utah. Our reconnaissance consisted of reviewing available information, making observations of the surface conditions on the lots, observing shallow exposures created with a trackhoe, and preparing this summary report, as outlined in our Professional Services Agreement dated May 1, 1992.

The site consists of five lots located between Osmond Drive and 2850 East Street nearly on the boundary separating Section 23 and 24, T. 5 N., R. 1 W., as shown on Figure 1, Vicinity Map. The lots are shown on Figure 2, Location Map, with respect to selected features of significance, notably the location of a profile and landslide headscarps. The profile is shown on Figure 3, along with subsurface information collected in six test pits excavated along the profile.

The site reconnaissance was conducted on Saturday, May 2, 1992. Mr. Vanorden had estimated the locations of the property corners and staked them; Bluestakes had identified the location of a buried electric line on the west shoulder of 2850 East Street. Based on the general conditions visible on the five lots, a location for trenching on a profile was selected. Mr. Vanorden operated a Komatsu PC120 trackhoe, excavating six test pits on a profile in Lot 9. The location of the profile is shown on Figure 2; the materials encountered in the test pits are indicated on Figure 3. The slope is uniformly and relatively densely covered by scrub oak with scattered maple. Near the north end of the five-lot site, large cottonwood trees and "snake grass" are present.

2. GEOLOGIC SETTING

The site is located in the eastern part of the Basin and Range Physiographic Province. This province is characterized by linear mountain ranges separated by wide valleys. Many of the mountain ranges are bounded by faults which exhibit evidence of geologically youthful displacement of the ground surface. The Wasatch Range is located adjacent to the east of the site; the Wasatch fault zone marks the western base of the Range (Nelson and Personius , 1990*). The

* Nelson, A.R., and Personius, S.F., 1990, Preliminary surficial geologic map of the Weber segment, Wasatch fault zone, Weber and Davis Counties, Utah: U.S. Geological Survey Map MF-2132.

REPLY TO: 4030 S. 500 WEST, SUITE 90, SALT LAKE CITY, UTAH 84123

PHOENIX	TUCSON	ALBUQUERQUE	SANTA FE	SALT LAKE CITY	EL PASO	RENO/SPARKS
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FAX 272-7239	FAX 888-0014	FAX 884-1694	FAX 438-7156	FAX 266-0727	FAX 562-7739	FAX 331-4153

Wasatch fault zone is located approximately 1/4 miles east of the site; it is considered capable of generating earthquakes in the range of Magnitude 7.5.

The geology of the site is dominated by sediments deposited in Lake Bonneville between about 17,000 and 15,000 years ago. Water in Lake Bonneville rose to about elevation 5180 feet for this time interval, during which the water flowed out of the basin at the north end of Cache Valley into the Portneuf River in southern Idaho. About 15,000 years ago, catastrophic erosion in the Portneuf River resulted in Lake Bonneville dropping approximately 365 feet to the Provo Shoreline at elevation 4800 feet. The site ranges in elevation from about 4950 feet, along Osmond Drive, to about 5020 feet, along 2850 East Street. Thus, only the high stand of the Lake Bonneville could have deposited lake sediments on the site.

Since the lake dropped below the elevation of the site, the geology has been dominated by slope processes and soil formation. Slope processes include minor processes, such as colluvial creep due to cycles of freezing and thawing and wetting and drying, and more significant processes, such as landsliding. During the time the lake level was declining, slope instability potential would have been at its highest, because the lake sediments would have been in a saturated, loose or soft condition. Intermittent reactivation of slides could have occurred since the lake receded.

Four kinds of materials were observed in excavations on the site: 1) the modern soil at the ground surface, 2) colluvial deposits, 3) a buried soil under the colluvial deposits, and 4) stratified lake deposits.. The modern soil consist of dark brown silty sand with abundant organic material, such as roots. This is the modern soil, but, because of its thickness (1 to 3 or 4 feet), probably has been forming in a generally stable landscape for at least several thousand years. The modern soil formed on colluvial deposits that blanketed the slope after Lake Bonneville declined past the elevation of the site. The colluvial deposits are red brown silty fine to medium sand that are massively bedded. Seven to ten feet of colluvial material were found in the test pits, burying an older soil. The older soil is mottled white and red brown silty coarse sand with gravel. The white color is carbonate probably derived from windblown carbonate-rich silt eroded from the playa lake beds that would have existed about 13,000 to 8,000 years ago in the up-wind region to the west of the site. Alternatively, although less likely, the white carbonate in the soil could have been deposited from carbonate-rich groundwater seeping preferentially through the silty coarse sand with gravel. We believe this alternative explanation for the carbonate is less likely than windblown silt because the bedrock in the up-slope area is dominated by non-carbonate metamorphic rocks. The oldest deposits exposed at the site are stratified silty clays with fine sand partings which were deposited in Lake Bonneville when it was above the elevation of the site, approximately 16,000 years ago.

At the time of our reconnaissance, the cul-de-sac at the north end of 2850 East Street had been blocked by a small debris slide, as indicated on Figure 2. Mr. Vanorden informed us that this slide occurred in late April, 1992. A portion of a steep cut at the cul-de-sac slid down the cut slope and out onto the pavement of 2850 East Street. Landslide headscarps are shown on the geologic map by Nelson and Personius (1990) in the vicinity of the site. Our interpretation of stereoscopic aerial photographs generally conforms with the landslide features mapped by them.

Groundwater was not encountered in the 8- to 12-foot deep test pits on the site. However, seepage was observed and water-tolerant vegetation is abundant in Lot 11, as shown by the hachured pattern on Figure 2. The vegetation includes large cottonwood trees and "snake grass".

3. DISCUSSION AND RECOMMENDATIONS

Based on the results of our slope stability reconnaissance, it is our opinion that residential structures can be constructed on Lots 7, 8, and 9 without undue risk of landslide damage if surface and subsurface water are controlled and grading on the upper (eastern) part of the site is done in such a way that soil is removed without placing significant amounts of fill. We believe that conditions are generally more favorable from a landslide hazard perspective toward the south and less favorable toward the north of the five-lot site. Development on Lot 10 may be feasible, but should be confirmed with a specific study. Lot 11 has abundant water-tolerant vegetation and seepage; development on this lot will require extensive remedial treatment of the subsurface water and may be economically unfeasible.

The remaining sections of this report contain discussions of the landslide hazard, and general recommendations for controlling water.

3.1. LANDSLIDE HAZARD

The subsurface information collected from the six test pits on the profile (Figure 3) indicate that landsliding has occurred on this site in the past. Published geologic information (Nelson and Personius, 1990) indicates that the site is underlain by landslide deposits and the eastern-most headscarp is considerably east of the site; farther than suggested on Figure 2. The uppermost test pit, shown on Figure 3, displayed nearly horizontally-bedded silty clay deposited in Lake Bonneville. Since this material is nearly horizontal, it probably indicates that no substantial rotational landslide movement has occurred above it. Some movement could have occurred, but not enough to rotate the lake-deposited sediments appreciably.

The uppermost test pit is on the steepest part of the slope, as shown on Figure 3. The next test pit is below a break in slope and exposes different sediments. In this test pit, silty coarse sand and gravel weakly cemented with carbonate was encountered at a depth of about eight feet. This carbonate-cemented material is interpreted to be soil formed after the decline of Lake Bonneville and before burial by the overlying red brown silty fine to medium sand. A dark brown silty fine sand with abundant roots is present at the ground surface and represents the modern soil.

The test pit information is interpreted to indicate that a slump with relatively minor movement occurred after formation of the buried soil and largely before accumulation of the red brown silty sand. The scarp of the landslide is subdued with uniform vegetation type and density across it. Minor scarplets, on the order of four to six inches high, were observed in one small area of Lot 8 in the position of the dashed line indicating "probable landslide headscarp". These minor scarps expose bare soil and could have occurred during the wet period of 1983 and 1984.

Landslides in a Rocky Mountain-type climate have been classified in terms of age based on several factors by McCalpin (1984†). Except for the minor scarplets in Lot 8, the landslide features are generally subdued and smooth. Vegetation is abundant across the headscarps and lateral flanks, and of the same apparent type, density, and age as the vegetation off of the landslide mass. In the age classification described by McCalpin (1984), the landslides at the site would be mature to old, corresponding to an estimated age of most recent movement of more than 5,000 years, and possibly more than 10,000 years. The minor scarplets are relatively sharp and unvegetated, indicating an age of active (less than 100 years old) in McCalpin's (1984) classification.

† McCalpin, J., 1984, Preliminary age classification of landslides for inventory mapping: Proceedings of the 21st Symposium on Engineering Geology and Soils Engineering, Moscow, Idaho, p. 99-111.

3.2. RECOMMENDATIONS FOR CONTROLLING WATER

The wet period of the early to mid-1980s caused numerous slope failures in northern Utah. We suspect that the minor scarplets in Lot 8 occurred at this time. Since it appears that only minor slippage occurred at the site during the wet period, we believe that adequate stability can be maintained if subsurface water is controlled. The subsurface water can be controlled by constructing north-trending drainage trenches along the up-slope sides of the lots and grading them to allow any collected water to flow to west-trending lateral drains which slope toward Osmond Drive on the west side of the property. The drainage trench should be approximately 15 feet deep, with a perforated plastic pipe two inches in diameter placed in a bed of free-draining gravel and covered with at least one foot of gravel, as shown on Figure 4, Drainage Trench Detail. The perforations in the pipe should be on the order of one-quarter inch wide (holes or slots), spaced at intervals no wider than four inches, and be located on the bottom of the pipe as it is placed in the trench.. Filter fabric (geotextile), such as Mirafi 140N or equivalent, should be used to encase the gravel and perforated plastic pipe. The filter fabric should be folded over the gravel, and the trench should be backfilled with relatively free draining material, such as sand or gravel, to effectively intercept subsurface water. The drainage ditch backfill should be compacted to minimize settlement at the ground surface that would tend to collect surface water.

Secondary north-trending drainage trenches, similar to the primary trenches, should be constructed near the down-slope edges of residential structures, as shown on Figure 4. These trenches should be graded to flow by gravity into the west-trending lateral drains which slope toward Osmond Drive. The lateral drains should be constructed to discharge into mounds of gravel near the drainage ditch on the east side of Osmond Drive. At some future date, the lateral drains could be connected to a storm drainage system, if one is constructed along Osmond Drive.

Retaining walls and basement walls should be designed and constructed to permit positive drainage. We recommend that provisions be made to discharge water collected behind walls into the drainage trenches described above, as shown on Figure 4.

Because landslide hazards in the site area are so closely related to water, we recommend that landscaping be done in as natural a way as possible to minimize the need for watering. Furthermore, rainwater and snowmelt collected on roofs and driveways should be conveyed into the drainage trenches without being allowed to pond or percolate into the subsurface. The importance of controlling surface and subsurface water at the site is critical and cannot be over emphasized.

The risk associated with potential reactivation of landslides at the site cannot be eliminated. It is our opinion that design and construction at the site conforming to the recommendations described above will minimize the risk to a reasonable and acceptable level. We strongly recommend that a qualified geotechnical engineer observe the drainage trench excavations prior to placing filter fabric, gravel, and perforated plastic pipe in them to verify that the intended purpose will be achieved.

It is important to note that houses in the site area stopped using septic systems and became connected to a sewer system in the early 1980s. This change is a significant improvement for slope stability because water formerly being introduced into the ground by the septic systems is now being piped beyond the site area. Because of the connection to sewers, we believe that natural subsurface water can be collected effectively in a series of subdrains, as recommended above, and discharged in such a manner that slope instability will not be promoted.

3.3. EARTHQUAKE CONSIDERATIONS

The site, along with the rest of the Wasatch Front, is located in Seismic Zone 3 of the Uniform Building Code. We recommend that, as a minimum, the provisions of Seismic Zone 3 be incorporated into design and construction at the site. The trace of the Wasatch fault, as mapped by Nelson and Personius (1990), is located a short distance east of the property, but does not appear to pose a surface rupture hazard at the site. The response of the site to strong earthquake shaking could be worse on Lots 10 and 11 than on Lots 7, 8, and 9 due to the presence of shallow groundwater and seepage.

We trust that this report is satisfactory for your present needs. If you have questions or require additional information, please contact us.

Sincerely,
Sergent, Hauskins & Beckwith Geotechnical Engineers, Inc.

By

Jeffrey R. Keaton, Ph.D., P.E., P.G.
Senior Engineering Geologist and
Vice President

Reviewed By

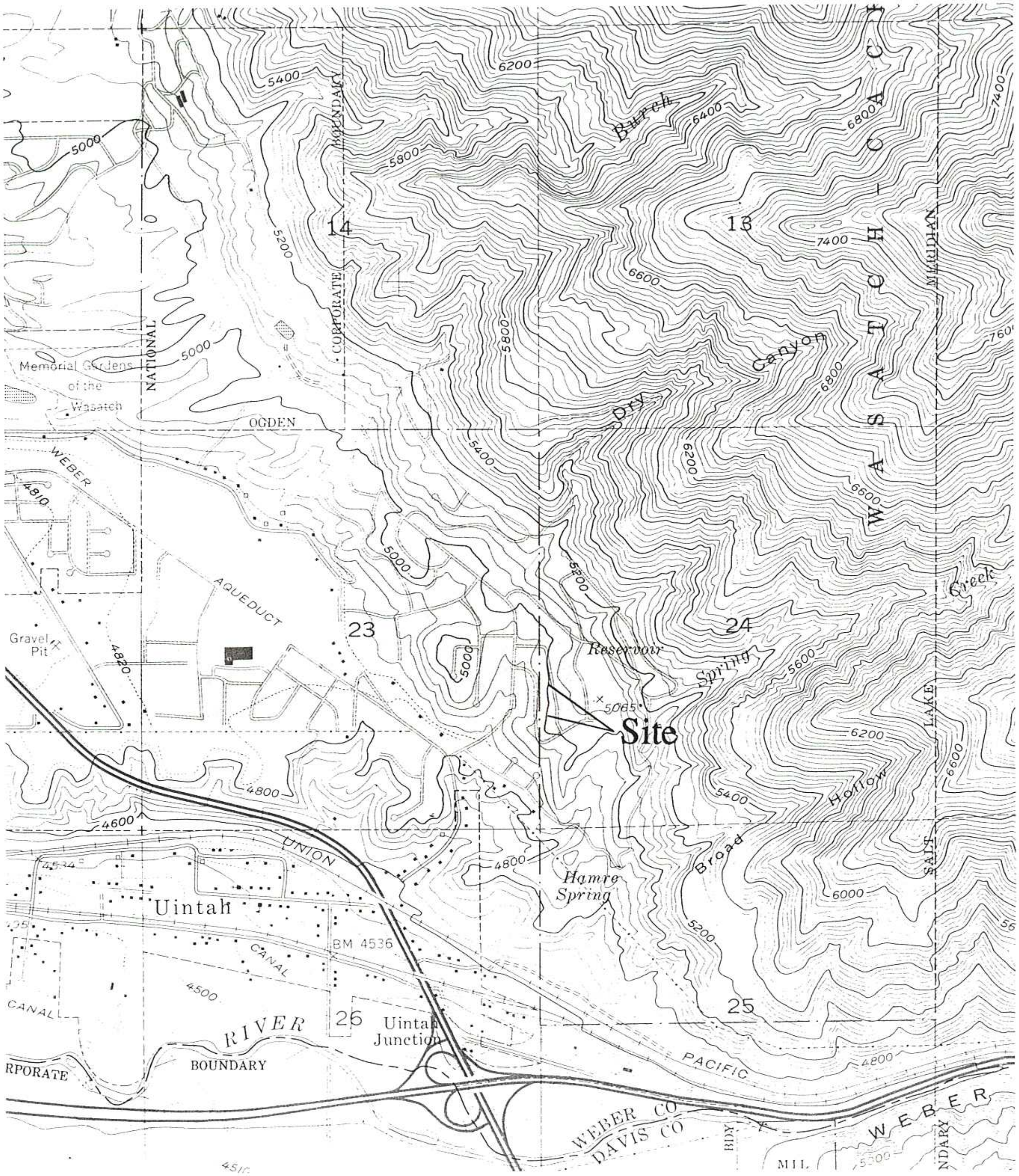
William J. Gordon, P.E.
Vice President

copies submitted (3)

Attachments:

Figure 1	Vicinity Map
Figure 2	Location Map
Figure 3	Profile Across Southern Part of Lot 9
Figure 4	Drainage Trench Detail

Mr. Chet L. Vanorden
SHB Job No. E92-2167
May 15, 1992



SCALE IN FEET
1000 0 1000 2000

FIGURE 1
VICINITY MAP

Reference: U.S.G.S., 1986, Ogden, Utah, 7.5 Minute Topographic Quadrangle

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FILE NO. ______ BY ______ DATE ______ CHECKED BY ______ DATE ______

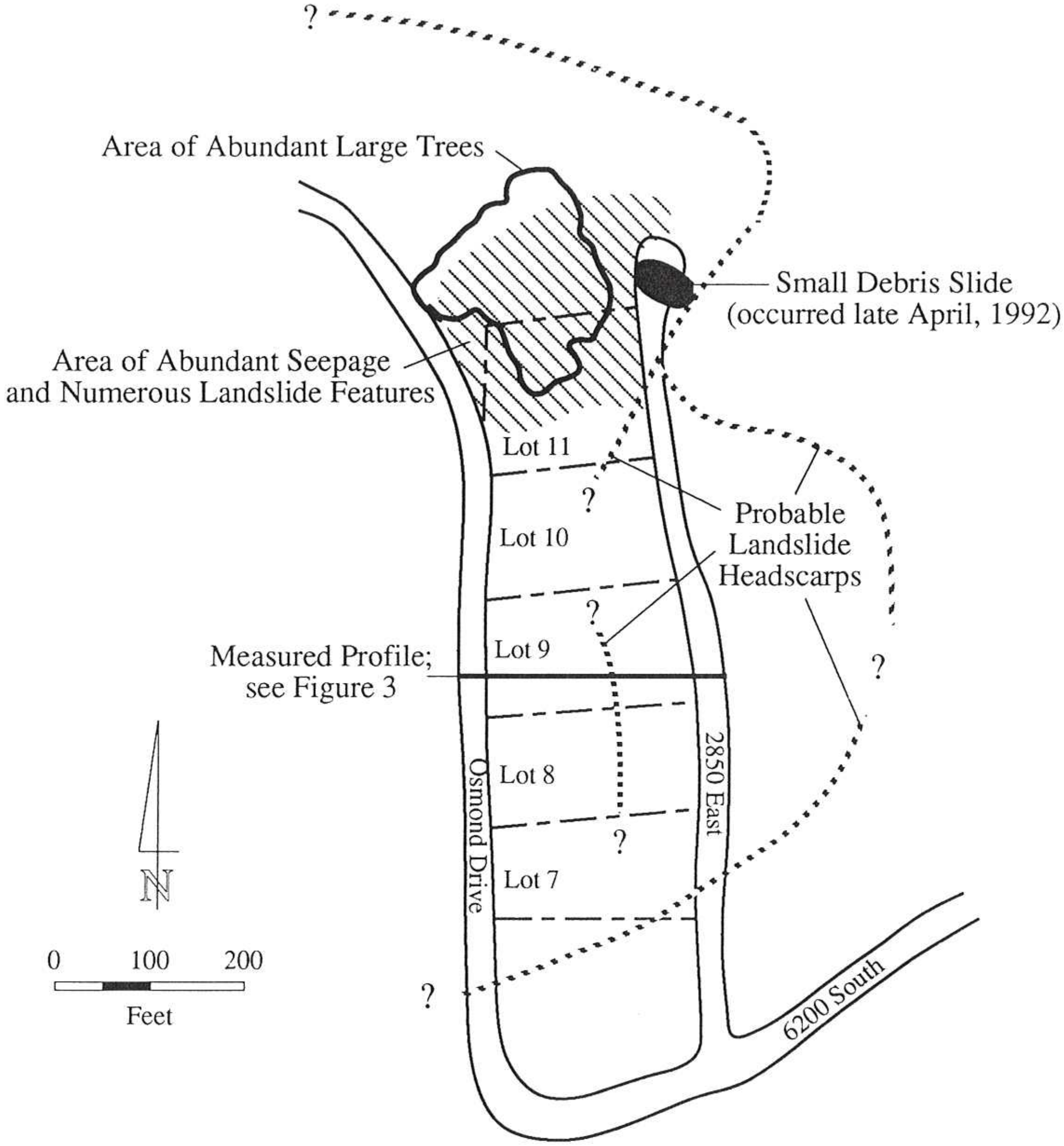

Figure 2
Location Map

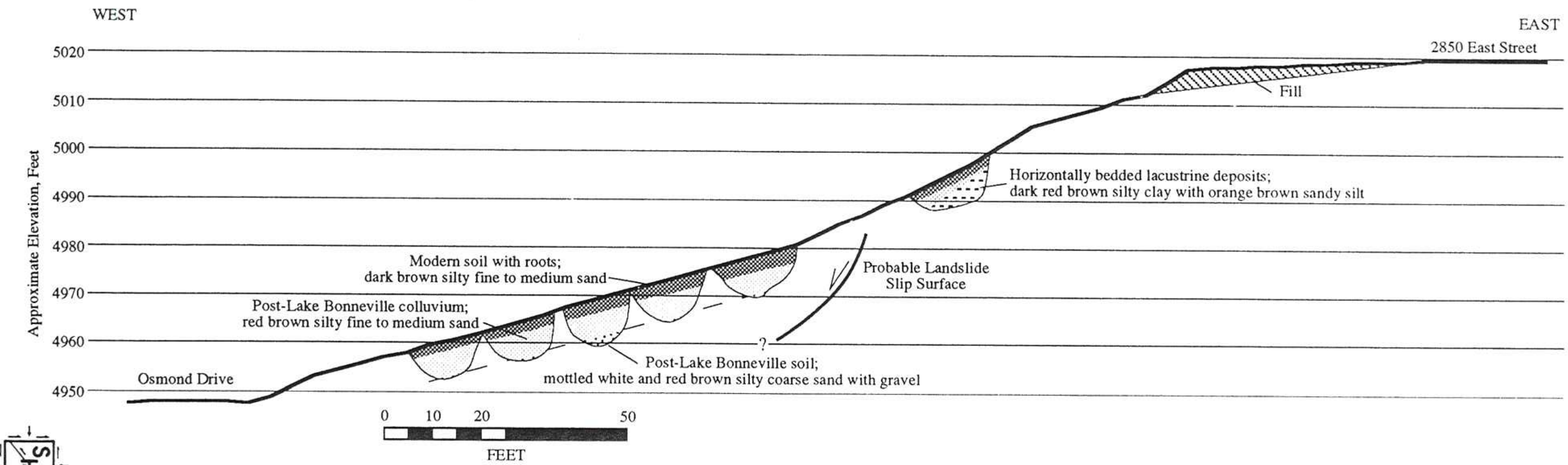

Figure 3
Profile Across Southern Part of Lot 9, Eastwood Subdivision No. 8, Uintah, Weber County, Utah

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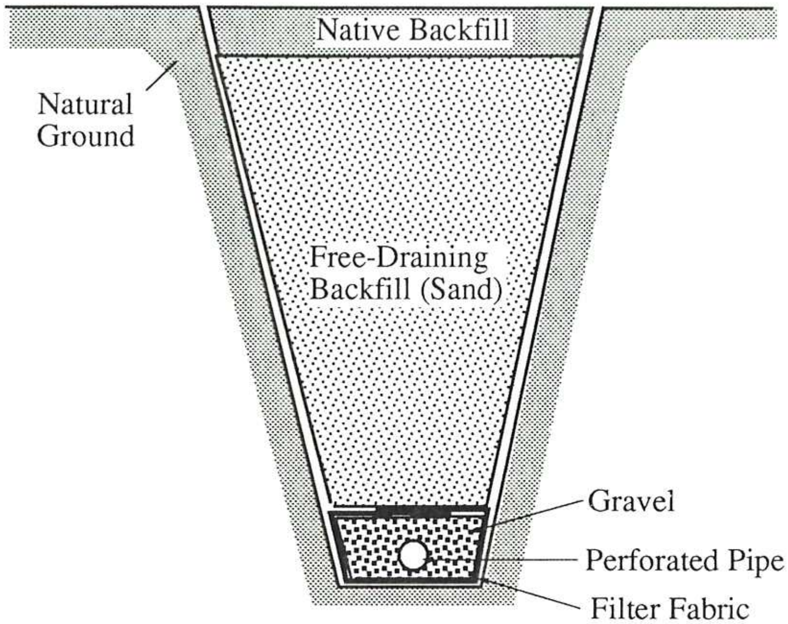
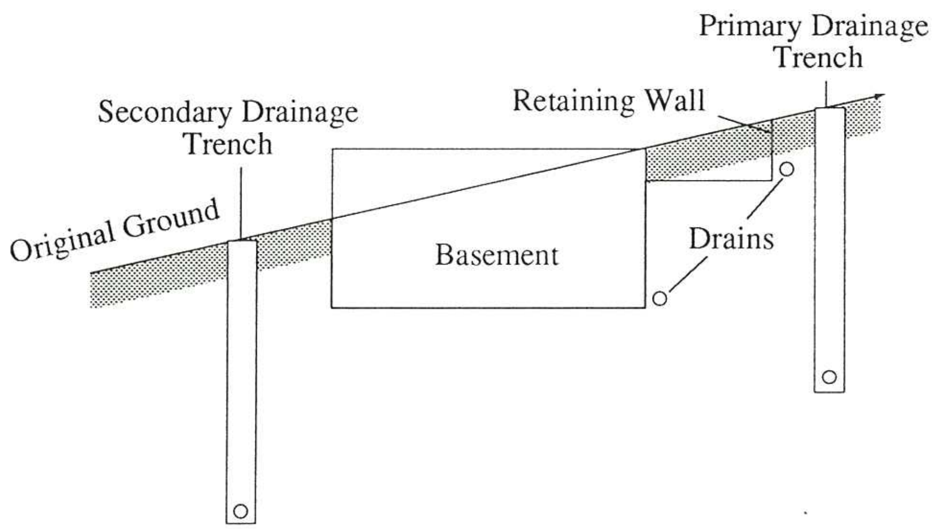


Drainage Trench Detail
Not to scale



Schematic of Drain Location
Not to scale

Figure 4
Drainage Trench Detail

PROJECT Eastwood Subdivision No. 8
Ogden, Utah

LOG OF TEST BORING NO. B-1

JOB NO. E92-2167 DATE 07-14-92

RIG TYPE CME-750
BORING TYPE 3 3/4" I.D. Hollow Stem Auger
SURFACE ELEV.
DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows/foot 140 lb. 30" free-fall drop hammer	Dry Density lbs. per cubic foot	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0								SM FILL	slightly moist loose	**SILTY SAND** with trace gravel and major roots (topsoil) to 2"; fine to medium sand, fine and coarse gravel, brown, **FILL**
								SM	slightly moist medium dense	**SILTY SAND**; fine sand, light brown
5				D	24					grades to brown with occasional coarse sand and fine gravel, massive
									grades dense	grades to light brown and with less silt
10				D	40					horizontal layering
15				D	46			CL	slightly moist very stiff	**SILTY CLAY** with thin layers of silt and trace organics; brown horizontal layering
20				D	40					grades to 1/2" layers of gray fine sand and greenish-gray silty clay and brown silty clay
25										

GROUNDWATER

DEPTH	HOUR	DATE
	*	

SAMPLE TYPE

A - Auger cuttings.
S - 2" O.D. 1.38" I.D. tube sample.
U - 3" O.D. 2.42" I.D. tube sample.
T - 3" O.D. thin-walled Shelby tube.
D - 3 1/4" O.D. 2.42" I.D. tube sample.
C - Cored sample.

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PROJECT Eastwood Subdivision No. 8
Ogden, Utah
JOB NO. E92-2167 DATE 07-14-92

LOG OF TEST BORING NO. B-1

RIG TYPE CME-750
BORING TYPE 3 3/4" I.D. Hollow Stem Auger
SURFACE ELEV.
DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows/foot 140 lb. 30" free-fall drop hammer	Dry Density lbs. per cubic foot	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
25			X	D	47					grades to include layers of reddish-brown horizontal layering
								GM	slightly moist very dense	**SANDY GRAVEL** with some clay, fine to coarse sand, fine and coarse gravel, brown, massive
30			X	D	100/5"					boulder from 30.5' to 31.5'
								SP	slightly moist very dense	**SAND**; fine sand, light brown, massive
35			X	D	105					
40			X	D	107					
45										Stopped drilling at 40' Stopped sampling at 41.5' * Groundwater not encountered The discussion in the text under the section titled, New Findings, is necessary to a proper understanding of the nature of the subsurface materials.
50										

GROUNDWATER

	DEPTH	HOUR	DATE
▽		*	
▼			

SAMPLE TYPE
A - Auger cuttings.
S - 2" O.D. 1.38" I.D. tube sample.
U - 3" O.D. 2.42" I.D. tube sample.
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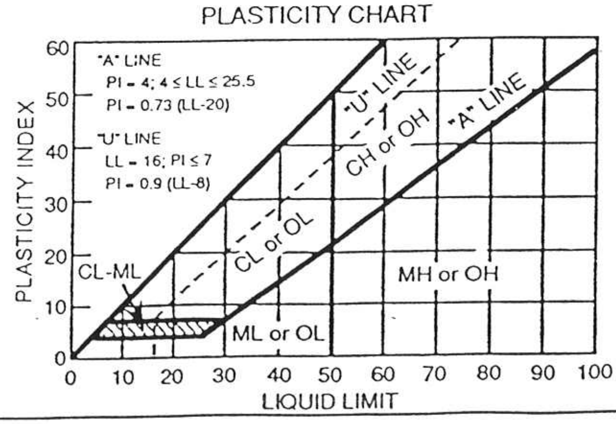
UNIFIED SOIL CLASSIFICATION SYSTEM

Soils are visually classified for engineering purposes by the Unified Soil Classification System. Grain-size analyses and Atterberg Limits tests often are performed on selected samples to aid in classification. The classification system is briefly outlined on this chart. Graphic symbols are used on boring logs presented in this report. For a more detailed description of the system, see "Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)" ASTM Designation: 2488-84 and "Standard Test Method for Classification of Soils for Engineering Purposes" ASTM Designation: 2487-85.

MAJOR DIVISIONS				GRAPHIC SYMBOL	GROUP SYMBOL	TYPICAL NAMES
COARSE-GRAINED SOILS (Less than 50% passes No. 200 sieve)	GRAVELS (50% or less of coarse fraction passes No. 4 sieve)	CLEAN GRAVELS (Less than 5% passes No. 200 sieve)			GW	Well graded gravels, gravel-sand mixtures, or sand-gravel-cobble mixtures
					GP	Poorly graded gravels, gravel-sand mixtures, or sand-gravel-cobble mixtures
		GRAVELS WITH FINES (More than 12% passes No. 200 sieve)	Limits plot below "A" line & hatched zone on plasticity chart		GM	Silty gravels, gravel-sand-silt mixtures
			Limits plot above "A" line & hatched zone on plasticity chart		GC	Clayey gravels, gravel-sand-clay mixtures
	SANDS (50% or more of coarse fraction passes No. 4 sieve)	CLEAN SANDS (Less than 5% passes No. 200 sieve)			SW	Well graded sands, gravelly sands
					SP	Poorly graded sands, gravelly sands
		SANDS WITH FINES (More than 12% passes No. 200 sieve)	Limits plot below "A" line & hatched zone on plasticity chart		SM	Silty sands, sand-silt mixtures
			Limits plot above "A" line & hatched zone on plasticity chart		SC	Clayey sands, sand-clay mistures
FINE-GRAINED SOILS (50% or more passes No. 200 sieve)	SILTS (Limits plot below "A" line & hatched zone on plasticity chart)	SILTS OF LOW PLASTICITY (Liquid Limit less than 50)			ML	Inorganic silts, clayey silts of low to medium plasticity
		SILTS OF HIGH PLASTICITY (Liquid Limit 50 or more)			MH	Inorganic silts, micaceous or diatomaceous silty soils, elastic silts
	CLAYS (Limits plot above "A" line & hatched zone on plasticity chart)	CLAYS OF LOW PLASTICITY (Liquid Limit less than 50)			CL	Inorganic clays of low to medium plasticity, gravelly, sandy, and silty clays
		CLAYS OF HIGH PLASTICITY (Liquid Limit 50 or more)			CH	Inorganic clays of high plasticity, fat clays, sandy clays of high plasticity
	ORGANIC SILTS AND CLAYS	ORGANIC SILTS AND CLAYS OF LOW PLASTICITY (Liquid Limit less than 50)			OL	Organic silts and clays of low to medium plasticity, sandy organic silts and clays
		ORGANIC SILTS AND CLAYS OF HIGH PLASTICITY (Liquid Limit 50 or more)			OH	Organic silts and clays of high plasticity, sandy organic silts and clays
ORGANIC SOILS		PRIMARILY ORGANIC MATTER (dark in color and organic odor)			PT	Peat

NOTE: Coarse-grained soils with between 5% and 12% passing the No. 200 sieve and fine-grained soils with limits plotting in the hatched zone on the plasticity chart have dual classifications.

PLASTICITY CHART



DEFINITION OF SOIL FRACTIONS

SOIL COMPONENT	PARTICLE SIZE RANGE
Boulders	Above 12 in.
Cobbles	12 in. to 3 in.
Gravel	3 in. to No. 4 sieve
Coarse gravel	3 in. to 3/4 in.
Fine gravel	3/4 in. to No. 4 sieve
Sand	No. 4 to No. 200 sieve
Coarse sand	No. 4 to No. 10 sieve
Medium sand	No. 10 to No. 40 sieve
Fine sand	No. 40 to No. 200 sieve
Fines (silt and clay)	Less than No. 200 sieve

July 23, 1992

State of Utah Dept. of
Natural Resources
Utah Geological Survey
2363 S. Foothill Dr.
Salt Lake City, UT 84109-1491

Attn: Gary Christensen

SUBJECT: Slope Stability Issues for Lots 7-11 of Eastwood Sub. No. 8 in Weber County

Dear Gary:

The Weber County Planning Commission Office received an addendum of results of a supplemental studies to address slope stability issues at Lots 7 through 11 of the Eastwood Subdivision #8 in the Uintah, Utah area in Weber County.

The original study review was made by Ms. Kim M. Hart, Geologist with the Utah Geological Survey Dept.

Please review the latest data and comment. If you have any questions, please call 399-8791.

Sincerely,

Edward T. Reed, Planner IV
Weber County Planning Commission

/ss

HILLSIDE REVIEW COMMITTEE
FOR EASTWOOD # 8 ?
JANET BEAN 479-9234

REPORT # 1 ADDENDUM

SERGENT, HAUSKINS & BECKWITH CONSULTING GEOTECHNICAL ENGINEERS

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MATERIALS ENGINEERING • MATERIALS TESTING • ENVIRONMENTAL SERVICES

July 16, 1992

Mr. Chet L. Van Orden
c/o Ms. Janet B. Bean
2593 Bonneville Terrace Dr.
South Ogden, Utah 84403

SHB Job No. E92-2167

Re: Report - Addendum
Slope Stability Reconnaissance
Lots 7, 8, 9, 10, and 11
Eastwood Subdivision No. 8
Uintah, Weber County, Utah
For Ms. Janet B. Bean

Dear Mr. Van Orden:

1. INTRODUCTION

Presented in this addendum are the results of our supplemental studies to address slope stability issues at Lots 7 through 11 of the Eastwood Subdivision in Uintah, Utah. The results of our initial reconnaissance were summarized in our report dated May 19, 1992. Our supplemental studies consisted of drilling one boring to a depth of 40 feet and preparing this summary report, as outlined in an addendum to our Professional Services Agreement dated July 6, 1992. Two of the scope items in that addendum were laboratory testing and engineering analysis of stability. These scope items were not needed because of the nature of the materials encountered in the boring, as described below.

2. BACKGROUND

In our report dated May 19, 1992, we summarized the geologic conditions at the site and concluded that residential structures could be constructed on Lots 7, 8, and 9 without undue risk of landslide damage if surface and subsurface water are controlled, and other mitigating elements incorporated into design and construction. Our report was submitted to the Weber County Planning Commission who, in turn, requested a technical review by the Utah Geological Survey. This review was done by Kimm M. Harty, a geologist with the Applied Geology Program at the Utah Geological Survey, in a letter transmitted to Weber County on June 1, 1992. Ms. Harty generally agreed with our findings and conclusions, but recommended that "a factor-of-safety analysis [be done] to assess the current stability of the landslide, thereby providing information to the used to determine if the risk is acceptable."

3. NEW FINDINGS

A boring was drilled to a depth of 40 feet at the west edge of 2850 East Street on the projection of the profile along which six test pits were dug as part of our initial reconnaissance. The log of this boring is attached to this report addendum. The soils encountered consist of medium dense to dense silty sand to a depth of about 14 feet. Below the silty sand, a deposit of interbedded very stiff silty clay and dense fine sand was encountered to a depth of approximately 26.5 feet. Below this deposit, very dense sandy gravel and clean sand was found to the depth explored. A boulder 1.5 feet in dimension was encountered at a depth of 30.5 feet. Groundwater was not encountered in the boring.

Of particular importance to the issue of past landslide stability at the site is the orientation of layering in the subsurface materials. From a depth of about 10 feet to 26.5 feet, the layering was consistently horizontal or nearly horizontal. Above 10 feet and below 26.5 feet, the soils were massive, and layering was not observable. The horizontal nature of the layering found in the boring matches the horizontal layering observed in the upper-most test pit shown on Figure 3 in our May 19, 1992, report.

4. DISCUSSION AND CONCLUSIONS

Based on the results of the current investigation, it is our opinion that the eastern part of Lots 7, 8, and 9 probably have not been involved in past landsliding. The layering of sediments encountered in the boring and the upper-most test pit could not be horizontal if significant landslide deformation had occurred in the past. The probable landslide headscarp shown on Figure 2 in our May 19, 1992, report must represent either a shallow landslide that does not extend into the area of the boring and test pit, or a non-landslide feature. We have not performed laboratory testing, nor a stability (factor-of-safety) analysis, because we believe they are not warranted in light of the nature of the soils encountered in the boring.

Based on our current understanding of the site geology, confirm the opinion stated in our May 19, 1992, report that residential structures can be constructed on Lots 7, 8, and 9 without undue risk of landslide damage if surface and subsurface water are controlled and grading on the upper (eastern) part of the site is done in such a way that soil is removed without placing significant amounts of fill..Despite the indication that the eastern part of the site has not been involved in past landsliding, we still recommend that the drainage provisions described in our May 19, 1992, report be incorporated into design and construction at the site.

We trust that this report is satisfactory for your present needs. If you have questions or require additional information, please contact us.

Sincerely,
Sergent, Hauskins & Beckwith Geotechnical Engineers, Inc.

By ______________________
Jeffrey R. Keaton, Ph.D., P.E., P.G.
Senior Engineering Geologist and
Vice President

Reviewed By ______________________
William J. Gordon, P.E.
Vice President

copies submitted (3)

Attachments:
Log of Boring

the landslide. The report also recommends (p. 5) that the lots be landscaped with natural vegetation to minimize the need for watering. Although the hazard-reduction measures detailed in the SH&B report are valid recommendations, instituting these measures may not preclude the possibility of further movement of the landslide or portions of the landslide in the future. This point is also made in the SH&B report (p. 4), which states, "The risk associated with potential reactivation of landslides at the site cannot be eliminated." Although not directly addressed in the report, the slope profile in figure 3 of the SH&B report shows portions of the subdivision to be on steep slopes of at least 25 degrees (nearly 2:1). Because the subdivision is in an area of steep slopes where recent landslide movement has occurred, I agree that the possibility of future landslide movement cannot be dismissed.

I concur with the statement on page 3 of the SH&B report that any grading at the eastern part of the subdivision be done without placing significant amounts of fill in the area, and I further recommend that <u>any</u> grading of the subdivision lots be done under the supervision of a qualified geotechnical engineer.

The SH&B report advises (p. 5) that "...rainwater and snowmelt collected on roofs and driveways should be conveyed into the drainage trenches without being allowed to pond or percolate into the subsurface." This recommendation may be interpreted as placing some responsibility for landslide-hazard reduction on potential homeowners. If this is the case, information on landslide hazards at the site, including the existence of this report, must be disclosed to all potential lot owners. Buyers of subdivision lots must be made aware that the lots are in a landslide-hazard area, and that homeowners are responsible for diverting water into designated drainage structures.

Another concern regarding rejuvenated landslide movement is the possible effect of water introduced into the landslide from areas outside the subdivision. The main body of the landslide extends farther upslope of these lots, and disturbance of the slope geometry and/or introduction of water into the subsurface in upslope areas could rejuvenate movement of the landslide and adversely impact the subdivision.

On page 4, the SH&B report states that "It is our opinion that design and construction at the site conforming to the recommendations described above will minimize the risk to a reasonable and acceptable level." This statement infers that the risk from landsliding will be reduced, but it does not define what is an acceptable level of risk, nor does the report attempt to quantify the current and potential risk at the site. Quantifying the stability of the landslide underlying the subdivision could be achieved by performing a factor-of-safety analysis, whereby landslide stability is determined by considering site factors such as soil conditions, hydrology, and failure geometry. This analysis could also evaluate the effects of earthquake ground shaking on slope stability. Varying the depth of the water table in the analysis could be done to determine under what hydrologic conditions the landslide may fail. The Utah Geological Survey recommends that a factor-of-safety analysis be performed at the subdivision to assess the current stability of the subdivision lots and to determine under what conditions the underlying landslide might reactivate. The results of this study would provide information that could be used by the town of Uintah and Weber County to assess whether or not the risk is acceptable to them.

Citing the work of Personius and Nelson (1990), the SH&B report states that the Weber segment of the Wasatch fault is about 1/4 mile (1,320 feet) east of the subdivision. However, both Lowe (1988b) and Nelson and Personius (1990) show the main trace of the fault to be about 900 feet to the east of the area, and an antithetic fault about 700 feet east of the lots in the southern part of the subdivision. Although traces of the Wasatch fault appear to be closer to the subdivision than stated in the SH&B report, no known fault traces have been identified within the subdivision. Due to a curve in the fault to the north of the subdivision, the 500-foot wide surface-fault-rupture-hazard zone as mapped by Lowe (1988b) encompasses the northeastern half of lot 11. If development on lot 11 is planned, further site-specific study of faulting as well as slope stability would be required.

With the exception of lot 11 of the subdivision being in a surface-fault-rupture-hazard zone, the SH&B report adequately outlines geologic hazards present at the proposed subdivision site. Although instituting the recommended landslide-hazard-reduction measures cited in the report will likely reduce the possibility of future landslide movements, the measures do not guarantee that the site will remain stable in the future. Additionally, the report states that instituting the recommended measures will minimize the risk from landsliding to a "reasonable and acceptable level" without defining or quantifying this level of risk. Performing a factor-of-safety analysis would help to assess the current stability of the landslide, thereby providing information to be used to determine if the risk is acceptable. However, because the subdivision is on a landslide that has shown evidence of recent movement, the possibility remains that the landslide could reactivate in the future, regardless of its current state of stability.

REFERENCES CITED

Lowe, Mike, 1988a, Slope-failure inventory map - Ogden quadrangle: Weber County Planning Commission unpublished map, scale 1:24,000.

Lowe, Mike, 1988b, Potential surface-fault rupture sensitive area overlay zone - Ogden quadrangle: Weber County Planning Commission unpublished map, scale 1:24,000.

Nelson, A.R., and Personius, S.F., 1990, Preliminary surficial geologic map of the Weber segment, Wasatch fault zone, Weber and Davis Counties, Utah: U.S. Geological Survey Miscellaneous Field Studies Map MF-2132, 22 p., scale 1:50,000.

Project:			Requesting Agency:
Review of a slope-stability report for lots in the Eastwood Subdivision No. 8, Uintah, Weber County, Utah.			Weber County Planning Commission
By: Kimm M. Harty	Date: 5-29-92	County: Weber County	Job No: 92-09
USGS Quadrangle: Ogden (1345)			

INTRODUCTION

In response to a request by Ed Reid, Weber County Planning Commission, the Utah Geological Survey (UGS) reviewed a consultant's report (Job No. F92-2167) by Sergent, Hauskins & Beckwith (SH&B) entitled "Slope stability reconnaissance, lots 7, 8, 9, 10, and 11, Eastwood Subdivision No. 8, Uintah, Weber County, Utah." The purpose of this review was to evaluate whether geologic hazards, particularly landslide hazards, were adequately addressed in the report. The subdivision is between Osmond Drive and 2858 E. Street in the town of Uintah, and is in sections 23 and 24, T. 5 N., R. 1 W., Salt Lake Baseline and Meridian. The scope of the review was limited to an evaluation of the SH&B report, and other geologic literature and maps available for the area. No field work was undertaken.

In general, the report satisfactorily explains the geologic conditions present at the site. However, there are some aspects of the report that warrant further comment.

Lowe (1988a) mapped an active landslide in the northern part of the subdivision that impacts lot 11 and possibly lot 10. This area is shown on SH&B figure 2 as an "area of abundant seepage and numerous landslide features." Because of the presence of a possible active landslide in this area, I concur with the statement in the report (p. 3) that development on lot 10 would require further site-specific study, and that lot 11 may require extensive remedial treatment that may be economically unfeasible.

Maps by Lowe (1988a), Nelson and Personius (1990), and the SH&B report all show a number of landslide scarps in and near the subdivision, although the locations of these scarps differ among reports. However, all three reports suggest that the entire subdivision is underlain by a landslide, and there is general agreement that the landslide is likely "old" and inactive. However, the SH&B report identified a number of small (4- to 6-inch-high) minor scarps in lot 8 (SH&B figure 2) that are believed to have formed by minor earth movements during the wet period of 1983-1984. Because the SH&B report characterizes these scarps (p. 3) as "relatively sharp and unvegetated", they may have formed even more recently that eight or nine years ago.

Because of the presence of a landslide underlying the lots, the SH&B report recommends installing a network of subsurface drains to reduce the possibility of further rejuvenated movement of

State of Utah
DEPARTMENT OF NATURAL RESOURCES
UTAH GEOLOGICAL SURVEY

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June 1, 1992

Ed Reed
Weber County Planning Commission
2510 Washington Blvd.
Ogden, UT 84401

Dear Mr. Reed:

Enclosed please find a copy of my review of the Sergent, Hauskins and Beckwith slope-stability report for the Eastwood Subdivision No. 8 in Uintah.

If you have any questions, or would like to discuss any of my review comments, feel free to call me.

Sincerely,

Kimm M. Harty, Geologist
Applied Geology Program

KMH/sw