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Earth & Environmental

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April 17, 1997
Job No. 7-817-000929

Blaser & Jenkins Associates
3260 South Redwood Road
West Valley City, Utah 84119

Attention: Mr. Steve Blaser

Gentlemen:

Re: Report
Supplemental Soil and Groundwater Study
Farm Meadows Subdivision Phase 1
North Side of 1500 South at Approximately 950 West
Woods Cross, Utah

1. INTRODUCTION

1.1. GENERAL

This report presents the results of our supplemental soil and groundwater study performed primarily within the Phase 1 portion of the Farm Meadows Subdivision which is located at the referenced site. The report supplements this writer's reports dated July 15, 1986[1] and May 24, 1994[2].

1.2. OBJECTIVES AND SCOPE

The objectives and scope of this supplemental study were planned in discussions between Messrs. Steve Blaser and Chris Jenkins of Blaser & Jenkins Associates, and Mr. Bill Gordon of AGRA Earth & Environmental, Inc. (AGRA).

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1 "Report, Soil and Foundation Investigation, Proposed Single-Family Residential Development. North of 1500 South Between Denver Rio Grande Western and Union Pacific Rail Road Tracks, Woods Cross, Utah" For Landforms, Inc.

2 "Discussions Soil and Groundwater Concerns, Eakles/Linda Loama/Crouch Property, North of 1500 South Street and Approximately 950 West, Woods Cross City, Utah", SHB Job No. E94-2257.

In general, the primary objective of this study was to further define the subsurface soil and groundwater conditions across the site in anticipation of initiation of construction of proposed single-family residential homes.

In accomplishing this objective, our scope has included the logging of 44 test pits and the preparation of this summary report.

1.3. AUTHORIZATION

Authorization was provided by Messrs. Steve Blaser and Chris Jenkins of Blaser & Jenkins Associates.

1.4. PROFESSIONAL STATEMENTS

Supporting data upon which our recommendations are based, are presented in subsequent sections of this report. Recommendations presented herein are governed by the physical properties of the soils encountered in the exploration test pits, projected groundwater conditions, and the layout and design data discussed in Section 2, Proposed Construction, of this report. If subsurface conditions other than those described in this report are encountered and/or if design and layout changes are implemented, AGRA must be informed so that our recommendations can be reviewed, if necessary.

Our professional services have been performed, our findings obtained, and our recommendations prepared in accordance with generally accepted engineering principles and practices at this time.

2. PROPOSED CONSTRUCTION

At this time, curb and gutter, utilities, and the roadbase for the roadways within the 67 lot Phase 1 portion of the overall development have been completed. This initial development has also included the construction of a detention pond at the northwest corner of the Phase 1 area. In the future, the roadways and overall development will be extended further to the north in three additional phases.

In conjunction with site development an area subdrain system was installed beneath the roadways within the Phase 1 area. It is our understanding that at the time of installation, there was a significant amount of groundwater flow from the system to the discharge point near the detention pond. However with time and as anticipated, the volume of flow diminished. The installation of the subdrain and subsequent utility lines were reportedly not as difficult as initially anticipated considering the original high groundwater conditions. It

should be noted that the originally proposed subdrain running north-south along the far eastern limit of the overall development has not been installed.

It is proposed that construction of the single-family residential homes be started as quickly as possible. These structures will be generally two and possibly three-levels above grade and are desired to include partial or full-depth basements, if possible. Below grade, the structures will be of reinforced concrete construction. Above grade, they will be of standard wood-frame construction with some stone, brick, stucco, or wood veneer. Structural loads will be transmitted down through bearing walls and columns to the supporting foundations. At this time, we project that maximum wall and column loads will be on the order of 2 to 3 kips per lineal foot and 15 to 20 kips, respectively. Floor slab loads will light. To facilitate the possibility of basements some lot grading is anticipated.

3. SITE INVESTIGATIONS

To further define the subsurface soil and groundwater conditions across the proposed building lot area of Phase 1, a series of 44 test pits were excavated to depths generally ranging from 4.5 to 9.0 feet. Subsequent to the excavation of the test pits, the subsurface conditions encountered were logged a by representative of AGRA. A summary of pertinent conditions encountered in the test pits is present on the attached Table 1, Summary of Test Pit Data.

Following logging the test pits were backfilled with the excavated soils. The backfill was not placed and compacted as a structural fill.

4. SITE CONDITIONS

4.1. SURFACE

The Phase 1 area, as previously discussed, is for construction of single-family residential homes. In conjunction with installation of utilities and roadways, excess fill materials have been placed over portions of the original ground surface to a point where significant numbers of the lots are blanketed by as much four feet of fill. These fills must be considered as non-engineered. In a number of the lots especially along the northern and far eastern portions of Phase 1, minimal amounts of fill have been placed.

The areas further to the north are presently open and undeveloped and covered with a moderate growth of short grasses and weeds.

4.2. SUBSURFACE SOIL CONDITIONS

A tabulation of primary subsurface conditions encountered in the test pits is presented on the attached Table 1. The fill which were encountered up to depth of four feet consist predominantly of fine-grained silty clays and clayey silts with some zones of sands and are basically the natural soils removed from the excavations for the subsurface utilities. These soils when excavated were saturated and near-saturated and placed without specific compactive effort. These soils must be considered as non-engineered fills which will exhibit variable and generally poor engineering characteristics.

In most cases, the non-engineered fills were spread over the original surface vegetation and topsoil layer. Where observed, this topsoil layer is generally four inches thick. Topsoil is generally dark gray to dark grayish-brown in color and contains major roots associated with the natural grasses and weeds. In many cases, the dark gray to dark brown coloration extends to depths as much as 18 to 24 inches; however, these soils without the major root systems are not classified as topsoil for the purposes of this study. Topsoil will also exhibit variable and generally poor engineering characteristics.

The soils beneath the topsoil and the non-engineered fills consist primarily of the silty clays and clayey silts with zones of sandy silt and silts and on occasion highly organic fine-grained soils. Generally the upper one to two feet of this soils are dark gray to gray in color but grade brown to light grayish-brown with depth. The majority of the soils when undisturbed will exhibit moderate strength and compressibility characteristics when referenced to the proposed single-family residential homes. The more highly organic soils when encountered will exhibit lower strength and higher compressibility characteristics. Maximum thickness of any highly organic soils encountered below the topsoil layer are generally on the order of 2 to 18 inches.

It should be noted that most of the soils below a depth of three to four feet are saturated or near-saturated and very easily disturbed. When disturbed, these soils will exhibit significantly lower strength and higher compressibility characteristics.

The depth of groundwater measured in the test pits are referenced on the attached summary. Groundwater conditions were found to be somewhat variable but not to the extent as encountered and projected prior to the installation of the area subdrain system. Seasonal and longer-term groundwater fluctuations, now that the area subdrain system is in place are not anticipated to exceed one-half to one foot. Highest seasonal levels will generally occur during the late spring through summer months.

5. DISCUSSIONS AND RECOMMENDATIONS

5.1. SUMMARY OF FINDINGS

Discussions and recommendations pertaining to foundations, earthwork, subdrain and pavement were presented in our previously referenced reports and generally remain applicable. Supplemental discussions pertaining to foundations and groundwater/subdrain considerations are presented in the following sections.

5.2. SPREAD AND CONTINUOUS WALL FOUNDATIONS

The proposed single-family residential homes may be supported upon conventional spread and continuous wall foundations. We recommend that a maximum net bearing pressure of 1,000 pounds per square foot be utilized for the site soils. The footings must be established upon undisturbed suitable natural soils and/or granular structural fill extending to suitable natural soils. Under no circumstances should the footings be established upon non-engineered fills, topsoil, or highly organic natural soils or loose and disturbed soils. If unsuitable soils are encountered, they must be removed and replaced with compacted granular fill. It must be noted that in only three of the test pits were zones of highly organic soils encountered below the topsoil layer. These layers range from 2 to 18 inches thick. Where observed in footing excavations, they must be removed.

In some of the mass/footing excavations for basement area, the soils encountered will be saturated or near-saturated and very easily disturbed. In order to facilitate construction, it may be advisable to over-excavate the easily disturbed soils in footing areas four to six inches and replace the over-excavation with the one and one-half to two-inch minus clean gap-graded angular gravel. To reduce disturbance of the soils, it is recommended that all excavation be carried out utilizing a backhoe equipped with a smooth-lip bucket.

Settlements of foundations designed and installed in accordance with the above recommendations should not exceed three-eighths to one-half of an inch.

5.3. GROUNDWATER-SUBDRAINS

The areas subdrains, as installed, have lowered and moderated the overall groundwater system across the site and will reduce seasonal and longer-term groundwater fluctuations. The question has been raised as to whether it is essential that the subdrain line as originally proposed along the far eastern portion of the Phase 1 area be installed at this time. This line was originally recommended as being the first subdrain in order to facilitate installation of subsequent utilities. The fact that the utilities and area subdrains, except for this easterly

most line, have been installed without great difficulty, essential states that this north-south line along the eastern portion of Phase 1 is no longer necessary.

It is our opinion that the home can be constructed with at least partial-depth basements. The factors controlling to how deep the basements can extend include the depth of the area subdrains and the required depth and slope of the perimeter foundation/chimney subdrain system around the below-grade portions of the home. The criteria for the subdrains around the homes have been previously presented. In general, we recommend that the invert of the perimeter foundation/chimney subdrain around the homes be a minimum of 12 inches and preferably 18 inches below the top of the lowest adjacent slab. This perimeter foundation/chimney subdrain should then slope at a minimum of 0.25 percent to the top of the area subdrain system beneath the adjoining roadways. These parameters, as stated above, will dictate the maximum depth to which the lower level slabs can be established.

5.4. SUPPLEMENTAL DISCUSSIONS

As discussed previously, significant portions of the Phase 1 area are blanketed by non-engineered fills. These fills are unsuitable support of the foundations for the proposed structures. In addition, it is our strong recommendation that driveways, outside patios, and floor slabs and also supplemental footings associated with porches, etc. not be established over these non-engineered fill materials.

We appreciate the opportunity of providing this service for you. If you have any questions or require additional information, please do not hesitate to contact us.

Respectfully submitted,

AGRA Earth & Environmental, Inc.

William J. Gordon, State of Utah No. 146417
Professional Engineer

WJG/sn (97-4-3b)

Encl. Table 1, Summary of Test Pit Data

Addressee (3)

TABLE 1
Summary of Test Data

Lot Number	Depth of Test Pit (feet)	Depth of Groundwater (feet)	Thickness of Surface Fill (feet)	Comments
115	5.7	4.7		
116	5.0	4.5		
117	5.0	4.5		
118	5.0	GWNE		
119	5.0	GWNE		
120	4.5	GWNE		
121	4.5	GWNE		
122	6.0	GWNE		
123	5.5	GWNE		
124	5.8	GWNE	0.5	
125	6.5	GWNE	3.5	
125 - 236*	6.0	GWNE	2.0 to 2.5	
128	7.6	GWNE	3.0	
129	7.0	GWNE	3.0	
132	7.7	GWNE	1.0	
133	6.5	GWNE	2.5 to 3.0	
134	6.5	GWNE	2.5	
136	6.0	GWNE	2.0 to 2.5	
137	5.9	GWNE	1.5	
137 - 138*	6.0	GWNE	1.5 to 2.0	
138 - 139*	6.0	GWNE	2.0	
140	7.0	GWNE	2.0	
141	6.0	GWNE	1.0	
142	6.1	5.1	1.5	
142 - 143*	5.5	4.5	1.5	

Lot Number	Depth of Test Pit (feet)	Depth of Groundwater (feet)	Thickness of Surface Fill (feet)	Comments
143 - 144*	5.5	4.7	1.5	
144 - 145*	7.0	GWNE	3.0 to 4.0	
146	6.0	GWNE	2.0 to 2.5	
147	6.6	6.6	2.5 to 3.0	
148	6.6	GWNE	2.5 to 3.0	
149	6.3	GWNE	1.0 to 2.0	4" topsoil
149 - 150*	7.0	7.0	0	4" topsoil
150	6.0	6.0	1.0	2" layer of organic soil at 4.0'
152	6.5	GWNE	2.5	
155	8.0	GWNE	3.0	
156	7.0	GWNE	3.0 to 3.5	4" topsoil
160	8.0	7.4	2.0 to 3.0	18" layer of organic soil at 4.0'
161	7.6	GWNE	2.0 to 3.0	
162	7.7	GWNE	2.5	
163	7.5	6.7	2.0	
165	7.0	6.0	2.5	6" layer of organic soil at 3.0'
168	6.0	5.0	0	4" topsoil
169	7.0	6.0	1.5 to 2.0	
235	9.0	GWNE	3.0	

* Test Pit at approximate boundary of the indicated lots.

GWNE = Groundwater not encountered.

Note: Test Pits logged and groundwater measured on April 7, 1997 and April 9, 1997.