Raba Kistner
Engineers, Geologists, Hygienists and Environmental Scientists

# GEOTECHNICAL STUDY
# 1906 BARTON CREEK BOULEVARD
# LOT 2, BLOCK C
# GOVERNOR'S HILL AT BARTON CREEK
# AUSTIN, TEXAS

RKBCI Project No. AAA04-007-13

San Antonio, TX
Austin, TX
Brownsville, TX
El Paso, TX
Houston, TX
McAllen, TX
Mexico

June 22, 2004

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# LOT 2, BLOCK C
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# AUSTIN, TEXAS

*Prepared For:*
Partners In Building, L.P.
1803 R.R. 620 North
Austin, Texas 78734

Prepared By:
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RKBCI Project No. AAA04-007-13

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AAA04-007-13
June 22, 2004

Partners In Building, L.P.
1803 R.R. 620 North
Austin, Texas 78734

ATTN: Ms. Jane Burks

RE: Geotechnical Study
1906 Barton Creek Boulevard
Lot 2, Block C
Governor's Hill at Barton Creek
Austin, Texas

Enclosed is our report of the Geotechnical Study for the proposed residential foundation located at 1906 Barton Creek Boulevard in Austin, Texas.

This engineering report has been prepared for the use of Partners In Building, L.P. and their design consultants for foundation design purposes in accordance with accepted Geotechnical Engineering practices. This report may not contain sufficient information for purposes of other parties or other uses.

We appreciate the opportunity to be of service to you on this project. If you have any questions, please do not hesitate to call.

Very truly yours,

**RABA-KISTNER-BRYTEST CONSULTANTS, INC.**

STATE OF TEXAS
Emmett Fulton Irby, Jr.
49160
REGISTERED PROFESSIONAL ENGINEER
06/22/04

Emmett F. Irby, Jr., P.E.
Vice President

Gabriel Ornelas, Jr., P.E.
Project Manager

cc: Addressee (2)

EFI/GO:mml

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# GEOTECHNICAL STUDY
# 1906 BARTON CREEK BOULEVARD
# LOT 2, BLOCK C
# GOVERNOR'S HILL AT BARTON CREEK
# AUSTIN, TEXAS

**RKBCI Project No. AAA04-007-13**

## INTRODUCTION

A geotechnical study has been performed at the site of the proposed residential lot at 1906 Barton Creek Boulevard in the Governor's Hill at Barton Creek Subdivision of Austin, Texas. The purpose of this study was to determine subsurface materials and conditions present at the site and to provide design and construction criteria for the residential foundation. This study was authorized by Mr. Donny Thomas on January 27, 2004 by acknowledgement of Proposal No. PAA03-093-00, dated October 3, 2003.

## SCOPE OF SERVICES

The following scope of services was performed in connection with the preparation of this report.

1) One sample boring was drilled in order to:

   a) Determine the general subsurface strata present at the site;

   b) Obtain samples of subsurface materials for laboratory analysis; and

   c) Observe groundwater conditions at the site.

2) Samples of subsurface materials from the boring were analyzed in the laboratory by:

   a) Visual classification;

   b) Atterberg limits tests;

   c) Moisture content determinations;

3) The information obtained by our subsurface exploration and laboratory tests was used in engineering studies to determine desirable foundation types and to establish recommendations regarding construction of the residential foundation. Details and results of this study are discussed in the following paragraphs.

## SUBSURFACE EXPLORATION

Subsurface materials at the location of the proposed residential home foundation were explored by one boring drilled to a depth of 15 feet beneath the existing ground surface. The approximate location of the boring was defined by Mr. Brad Blankholm with Partners In Building as being 50 feet to the right of a chained gate located at the site.

The boring was advanced using a truck-mounted rotary drilling rig equipped with continuous flight augers and a penetration hammer for split-spoon sampling and standard penetration tests (SPT).

Representative portions of samples obtained from the boring were enclosed in plastic bags to reduce moisture loss, labeled, packaged, and transported to our laboratory for subsequent testing and classification.

Results of this subsurface exploration are presented on the attached Log of Boring, Figure 1. A key to classification terms and symbols used on the log follows the Log of Boring.

## LABORATORY TESTS

Samples of subsurface materials retrieved from the boring were reviewed and classified in the laboratory. Laboratory classifications of the subsurface materials are provided on the attached Log of Boring.

Index properties of the soil were analyzed by a single Atterberg limits test. The apparent shear strength of the soil was determined by standard penetration tests. Results of these tests are presented on the Log of Boring.

Samples will be retained in our laboratory for thirty days after submittal of this report. After thirty days the samples will be discarded. We should be notified in writing by the client prior to this time for other arrangements.

## SITE LOCATION AND GEOLOGY

The project site is located at 1906 Barton Creek Boulevard in Governor's Hill at Barton Creek Subdivision in Austin, Texas.

A cursory review of the Geologic Atlas of Texas, Austin Sheet, dated 1981, published by the Bureau of Economic Geology at the University of Texas at Austin, indicates that the site soil is in the Glen Rose formation of the lower Cretaceous age. This formation is typically comprised of limestone, dolomite, and marl overlain by clay soil.

## SUBSURFACE MATERIALS AND CONDITIONS

On the basis of the results obtained from one exploratory boring and the laboratory testing program, the subsurface stratigraphy at this site can be described by two generalized strata, each with similar physical and engineering characteristics. For purposes of this report, we have designated the subsurface strata as Stratum I and Stratum II. The lines designating the interfaces represent approximate boundaries between strata on the boring logs; transitions between strata may be gradual.

**Stratum I** consists of tan clay with limestone cobbles. This stratum was encountered at the existing ground surface and extended to a depth of approximately 1 foot. A single plasticity index (PI) of this stratum of 10 was measured.

**Stratum II** consists of tan limestone and extends throughout the remaining depth of exploration. The results of Standard Penetration Tests (SPTs) conducted in this stratum were in excess of 50 blows with no penetration.

## GROUNDWATER

Groundwater was not encountered at the time drilling operations were conducted. The permanent groundwater table is thought to be well below the depth of any planned foundations. However, seasonal groundwater may be encountered at relatively shallow depths when excavating after periods of significant rainfall. Groundwater of this type is typically trapped or perched above less permeable soil and rock layers. Although it is not typically encountered in large quantities, it may require addressing if encountered during construction.

## FOUNDATION ANALYSIS AND RECOMMENDATIONS

Project Description: The foundation loads for the proposed residential home are unknown, but anticipated to be relatively light structural loads.

Foundation Considerations: The existing Stratum I soil is adequate to support the building structure on a shallow foundation. Either a rigid engineered beam and slab-on-grade foundation or post-tensioned floor slab maybe used for the residential home. Recommendations for these foundation options are presented in the paragraphs that follow.

Potential Vertical Rise: A review of the boring log and laboratory test data indicates that the moderately plastic clay of Stratum I exhibits a plasticity index of 10. PVR values were calculated using the TxDOT test method Tex-124-E, which correlates the relationships between the PI, layer thickness, and the in situ moisture content. These calculations indicate that the PVR is less than 1-inch. The PVR was determined based upon a dry moisture content condition and an overburden pressure of 1 psi (weight of the floor slab and 1 foot of select compacted fill). All, or the majority of the vertical movements, would likely be differential and may be damaging to the structure.

The final design PVR will depend upon site grading improvements, if any. If fill material is imported to the site and the fill material utilized has expansive characteristics, the PVR will increase. Conversely, if site grading calls for the removal of the Stratum I clays, a decrease in PVR will occur.

Rigid Engineered Beam and Slab-On-Grade: A rigid engineered beam and slab-on-grade foundation may be used to support the structural loads. If a rigid engineered beam and slab-on-grade foundation is chosen to support the structure, the grade beams should be designed to withstand the anticipated differential vertical movements. The grade beams should be founded at a minimum depth of 18 inches below finished grade with a minimum beam width of 12 inches. Grade beams may be founded in either the native soil or compacted select structural fill. We recommend that structural fill materials meet the requirements of TxDOT Item 247, Type A, Grade 2 (crushed stone), or better, which is typically used as pavement base. Recommended net allowable bearing capacity values are shown below. These bearing capacities will provide a factor of safety in excess of 2 with respect to the design soil shear strength.

Table 1

| Bearing Material | Allowable Bearing Capacity (psf) | |
|---|---|---|
| | Grade Beam | Spread Footing * |
| Clay Soil (Stratum I or Alternate Select Structural Fill) | 3,000 | 3,900 |
| Select Structural Fill or Stratum II tan limestone (TxDOT, Type A, Grade 2 or better) | 4,000 | 5,200 |

* Represents allowable bearing capacity when grade beam intersections are widened to act as spread footings

Post Tensioned Foundation: The Post-Tensioning Institute (PTI) slab-on-ground method was used to develop foundation design criteria. Recently, PTI has issued Technical Notes 12, which is a supplement to the 1996 "Design and Construction of Post-Tensioned Slabs-on-Ground, Second Edition." Technical Notes 12 has resulted in substantial changes in the calculated

differential movements for both edge and center lift conditions. Numerous assumptions and judgements must be made when using the PTI design method. The method is based on the assumption that climate will be the only contributing factor to changes in soil moisture content. Other man-induced soil moisture changes, such as surface drainage, landscape irrigation, and plumbing leaks may have significant effects on the foundation performance.

The PTI foundation soil design criteria is shown below. If thicker clay deposits are encountered during construction RKBCI should be notified. Significant changes in the site conditions will require modifications of the foundation design parameters. The recommended PTI foundation design values are shown below for the existing soil conditions with no improvements to the site to reduce PVR.

| Center Lift Condition | | Edge Lift Condition | |
|---|---|---|---|
| Edge Moisture Variation Distance, $e_m$ (Feet) | Differential Movement, $y_m$ (Inches) | Edge Moisture Variation Distance, $e_m$ (Feet) | Differential Movement, $y_m$ (Inches) |
| 5.5 | 0.30 | 2.8 | 0.55 |

A vapor barrier conforming to ASTM E1745 Class C should be placed on top of the fill pad and below the floor slab.

## FOUNDATION CONSTRUCTION GUIDELINES

Site Drainage: Drainage is an important key to the successful performance of any foundation scheme. Good surface drainage should be established prior to, and maintained during and after, construction to prevent water from ponding within or adjacent to the home. Gutters with downspouts, which collect storm waters from the roof and direct them away from the foundation are recommended. Planters adjacent to the structure should be fitted with watertight bottoms or french drains to transport water away from the structure.

Site Preparation: Subgrades to support structural fill should be stripped of all vegetation or organic topsoil. The exposed subgrade should be scarified just prior to fill placement and compacted to a minimum of 95 percent of the maximum density and within ± 3 percentage points of the optimum moisture content as determined by test method Tex-114-E. The water content of the subgrade should be maintained near the optimum moisture content until permanently covered. Subgrade compacted at moisture contents beyond the above specified range should not be accepted without approval of the Geotechnical Engineer. Subgrade preparation should extend beyond the building limits a sufficient distance to allow the completed building pad (in both cut and fill areas) to extend at least 5 feet beyond the building limits. Soft, weak areas identified by proof-rolling should be removed and replaced with suitable fill. Proof-rolling should be done under the continuous observation of the geotechnical engineer's representative.

Select Structural Fill: Materials used as select structural fill preferably should be a crushed stone or gravel aggregate. We recommend that materials specified for use as select structural fill meet the Texas Department of Transportation 1993 Standard Specification for Construction of Highways, Streets, and Bridges, Item 247: Type A or B, Grade 2; or better. Select structural fill should be placed in loose lifts not exceeding 8 inches in thickness and compacted to at least 95 percent of maximum density and within ± 2 percentage points of the optimum moisture content

as determined by test method Tex-113-E. The water content of the fill also should be maintained near the optimum moisture content until the fill is permanently covered. Alternative materials proposed for use as select structural fill should be submitted to the geotechnical engineer for testing and evaluation before they are accepted for use.

Alternate Select Structural Fill: If an alternate select fill is chosen to replace the excavated soil from the building pad, we recommend the criteria below as alternate select fill. Furthermore, we should be retained to recalculate the PVR values based on the actual thickness of alternate select fill and to re-evaluate our recommendations in light of the changed conditions.

1. Gradation shall be as follows:

| Sieve Size | Percent Finer by Weight |
|---|---|
| 2 ½" | 100 |
| 7/8" | 50 – 95 |
| ½" | 35 – 75 |
| No. 4 | 25 – 65 |
| No. 40 | 10 – 40 |

2. Material passing the No. 40 sieve shall meet the following:

| Percent Passing No. 40 | Maximum PI | Minimum PI |
|---|---|---|
| 25 – 40 | 15 | 3 |
| 10 – 25 | 20 | 4 |

3. Maximum liquid limit of the minus No. 40 material shall be 35.

4. No organic material is permitted.

Foundation Construction: Prior to placement of reinforcing steel and concrete, foundation excavations for grade beams should be examined by the geotechnical engineer or his representative. The purpose of this examination is to see that the foundation dimensions are as specified by the project plans, that the bearing soil at the bottom of the excavations are either similar to those encountered in our boring, or that select fill materials have been selected and placed in accordance with the project documents, and loose materials and water are NOT present in the excavation.

If soft materials are encountered in the foundation excavations, they should be removed as directed by the geotechnical engineer and replaced with either compacted non-expansive fill material or lean concrete up to the specified foundation bearing elevation. Reinforcing steel should be checked for size and proper placement prior to concrete placement.

Utilities: Utilities which project through slab-on-grade or slab-on-fill foundations should be designed with either some degree of flexibility or with sleeves to prevent damage to the utility lines as vertical movements occur. Backfill in areas requiring structural support should be compacted to a minimum of 95 percent of the maximum dry density as determined by TxDOT Tex-114-E and the moisture content should be within ± 3 percentage points of optimum moisture. Non-structural support areas should be compacted to at least 90 percent of the maximum dry density as determined by TxDOT Tex-114-E. The moisture requirements should remain as previously stated.

Concrete Placement: Placement of concrete should be accomplished as soon as possible after completion of the foundation preparation operations to reduce changes in the moisture content or the state of stress of the foundation soil.

## QUALITY ASSURANCE CONSIDERATIONS

Additional analyses and comment may be necessary during the design phase as final plans are developed. Raba-Kistner Consultants, Inc. should be given the opportunity to review the final plans and specifications so our recommendations are properly interpreted. Raba-Kistner Consultants, Inc. cannot accept responsibility for misinterpretation of our recommendations if we have not been provided an opportunity to review the final plans and specifications.

During construction, we strongly recommend that we be retained so that our design is properly implemented into the project. Furthermore, we recommend the QA program in the Quality Assurance Considerations that are found at the end of this report. Raba-Kistner Consultants, Inc. should be retained to provide these services to check that construction is in accordance with the intentions of this report.

## LIMITATIONS

The analyses and recommendations submitted in this report are based on the data obtained from: a) one exploratory boring drilled at this site; and b) information provided by the architect.

This report may not reflect the exact variations of the subsurface conditions across the site. The nature and extent of variations across the site may not become evident until construction begins. If variations then appear evident, it may be necessary to reevaluate our recommendations after performing on-site observations and tests to establish the engineering significance of the variations.

If the final grade elevations are substantially different from the existing grades our office should be informed about these changes. Significant changes may require re-examination and analyses to evaluate the effects of the changes on the foundation recommendations provided herein.

This report is not intended for use in determining construction means, methods, or sequences. Prospective contractors should not rely upon the information in this report to select excavation means, methods, or sequences, but should rely upon their own evaluation prior to submitting bids.

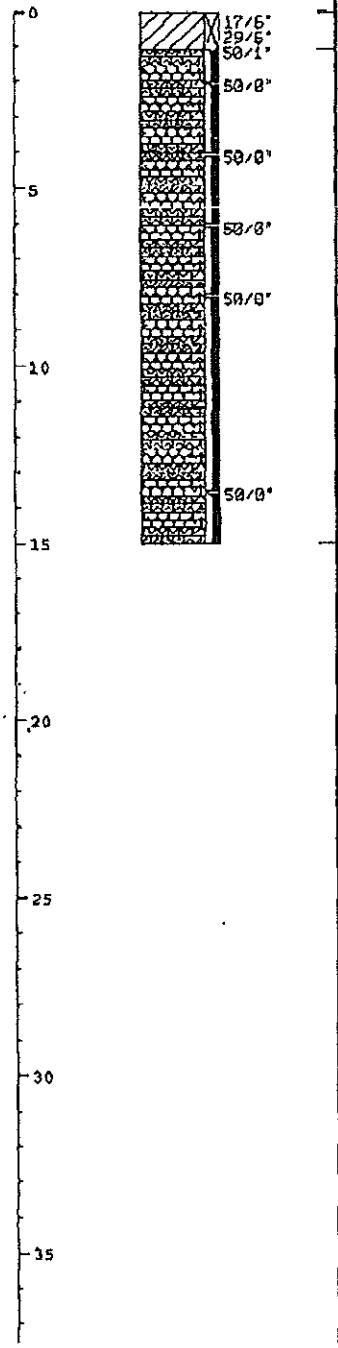
# LOG OF BORING

*BORING B-1*

Project: **1906 Barton Creek Blvd**
Location: **Austin, Texas**
Date Drilled: **6/14/04**
Drill Methods: **Continous**
Caving Depth:
Station:

Elevation: **Exst. Grade**
Water Detected: **No**
Water Depth After Drilling: **n/a**
Easting:

Job No.: **AAA04-007-13**
Scale: **5**
Depth Water Detected: **n/a**
Date Checked: **n/a**
Northing:




| ELEVATION/ DEPTH | SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA | Material Description | DD pcf | MC % | LL % | PL % | PI % | -200 % | Qu tsf | RQD % | PP tsf |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | CLAY, tan with limestone cobbles | | 7 | 28 | 18 | 10 | | | | |
| | | LIMESTONE, tan | | | | | | | | | |
| | | TD @ 15' | | | | | | | | | |

Figure 1

Raba-Kistner Consultants, Inc.

# KEY TO SYMBOLS

Symbol Description

Strata Symbols

Lean Clay

Limestone, tan

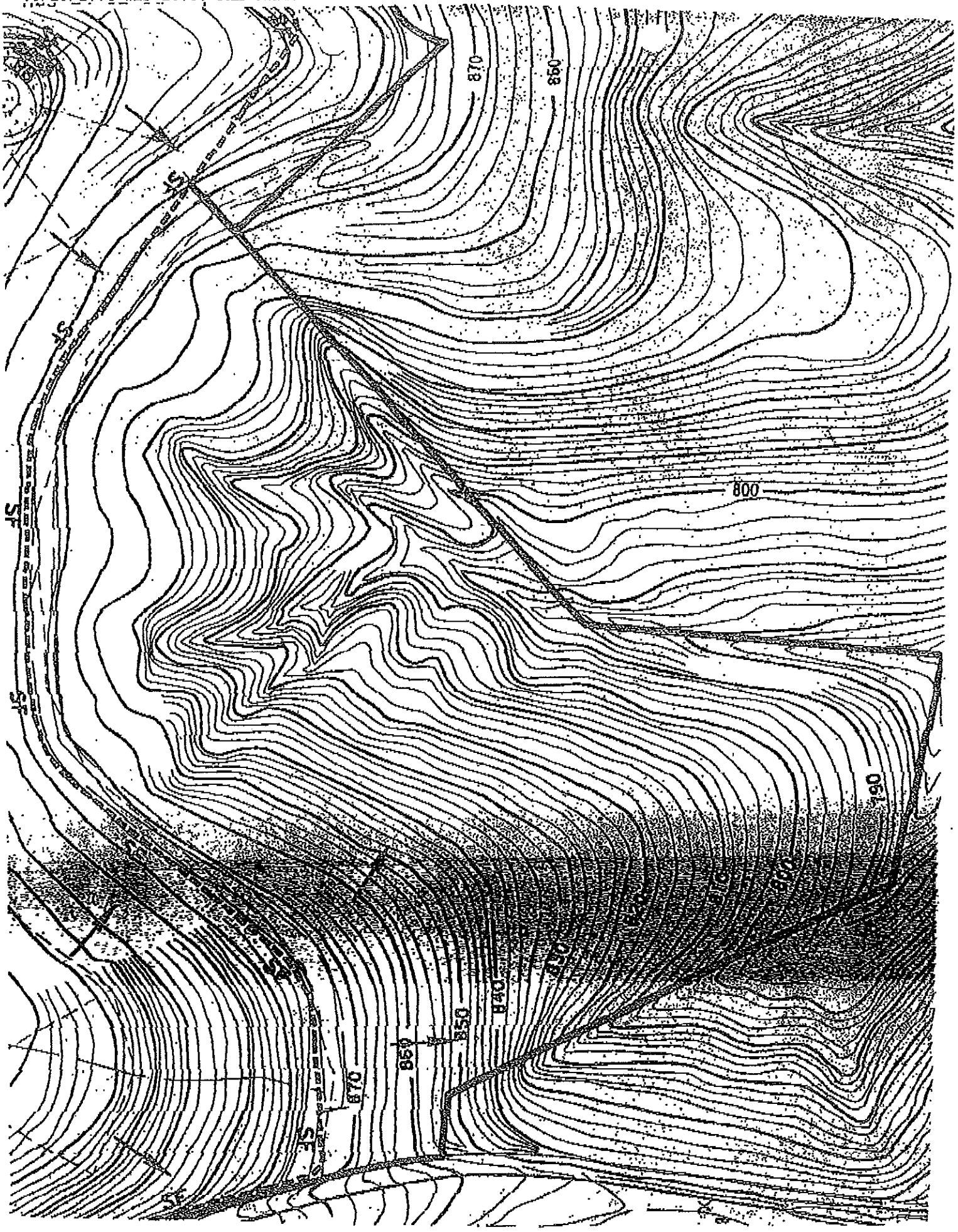
Soil Samplers

2" split spoon

Auger

Notes:

1. An exploratory boring was drilled on 6/14/04 using auger and standard penetration test sampling techniques.
2. Free water was not encountered at the time of drilling.
3. The boring location was staked in the field by RKCI personnel.
4. This log is subject to the limitations, conclusions, and recommendations in this report.
5. Results of tests conducted on samples recovered are reported on the log.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