APPENDIX 2C

GEOLOGIC INVESTIGATIONS OF THE SCOTLAND ROAD FAULT (CLINTON - NEWBURY FAULT), NEWBURY, MASSACHUSETTS, AND PORTSMOUTH FAULT INVESTIGATIONS

The information contained in this appendix was not revised, but has been extracted from the original FSAR and is provided for historical information.

SCOTLAND ROAD FAULT INVESTIGATIONS

CONTENTS

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

SEABROOK STATION

SCOTLAND ROAD FAULT INVESTIGATIONS

Investigations have been conducted over a portion of the Scotland Road fault in Newbury, Massachusetts, to determine the presence, location, orientation and physical characteristics of the fault, and to examine the nature and structure of the unconsolidated Pleistocene deposits which overlie the fault trace. The investigations have indicated that the fault structure is of Permian age, and that Pleistocene deposits overlying the fault zone show no evidence of movement on the fault subsequent to their deposition.

I. LOCATION OF FAULT INVESTIGATIONS

The Scotland Road fault was inferred by A. F. Shride of the U. S. Geological Survey (Shride; 1971) to trend easterly through the towns of West Newbury, Newbury and Newburyport, Massachusetts, about 7 miles to the south of the proposed Seabrook Station (see Figure 1). Shride has interpreted the Scotland Road fault to represent the eastern portion of the Clinton-Newbury fault, which is inferred to trend northeasterly for about 60 miles from the area of Worcester, Massachusetts, to project offshore at Plum Island, Newbury.

Detailed investigations to locate and examine the fault and its overlying Pleistocene deposits have been carried out just to the north of Scotland Road near the north corner of Newbury, Massachusetts, in an open field owned by the Marion H. Marshall Estate (see Figure 2). In this area, the fault forms the boundary between Newburyport granodiorite of presumed Devonian age on the north, and an unnamed complex of diorite and schist of unknown geologic age on the south. Diabase dikes of probable Triassic age intrude both the Newburyport and the unnamed diorite/schist on both sides of the fault.

II. INVESTIGATION PROCEDURES

A. Preliminary - General Area

As preliminary investigation of the Scotland Road fault zone, J. R. Rand walked portions of the fault trace, and inquired of A. F. Shride by telephone as to his studies of the fault zone in the area. R. J. Holt of Weston Geophysical Research, Inc., and J. R. Rand together viewed the inferred trace of the fault zone between Plum Island and Groveland, Massachusetts, by helicopter flying at various altitudes. Diorite ridges aligned parallel to, and about 1000 feet to the south of the trace of the Scotland Road fault in West Newbury are readily seen from the air, but no anomalous physiographic features were noted along the trace of the fault itself. Backhoe trenching investigations over the inferred trace of the fault were attempted on the farm of Miss Alice Elwell, adjacent to Holman Lane,

West Newbury. This exploration, ultimately involving a 232-foot trench excavation in boulder till, sand-cobble till and clay till, was terminated because these glacial materials did not appear suitable for demonstrating the presence or absence of tectonic fault deformation.

B. Final - Property of Marion H. Marshall Estate

As geographic control for all investigations at the final study area on property owned by the Marion H. Marshall Estate in Newbury, a stadia survey of the area and a base map showing all pertinent features were provided by McKenna Associates, Engineers, Portsmouth, New Hampshire (see Plate 1). Technical investigations in the study area have included a seismic refraction survey; the excavation of four backhoe trenches; and the drilling of nine core borings. Laboratory investigations conducted on drill core samples from the study area have included petrographic examinations and radiometric age dating.

III. TECHNICAL INVESTIGATIONS

A. Seismic Refraction Survey

A seismic refraction survey was conducted across the study area during the period November 5-19, 1973, by Weston Geophysical Engineers, Inc., Weston, Massachusetts, to determine thicknesses of unconsolidated overburden and weathered rock materials, as well as velocities of the various geologic materials in the study area. Technical details of this survey are presented in a report by Weston Geophysical Engineers, Inc., attached herewith.

This seismic survey report concludes:

"The bedrock surface, as interpreted from seismic data, does not have any sharp breaks indicating faulting. The seismic velocities of the bedrock do not change sufficiently along the 1000-foot line of investigation to indicate the presence of any significant bedrock anomaly. The fault zone does not exhibit significant velocity differences from adjacent bedrock."

B. Borings Investigations

During the period December 4, 1973, to February 13, 1974, nine borings were put down along the centerline of the seismic refraction survey (Seismic Line "A") to locate, define and sample the Scotland Road fault zone (see Plates 2 and 3). These borings, designated SRF-1 through SRF-9, were drilled by American Drilling and Boring Co., Inc., East Providence, Rhode Island, under the supervision of Geotechnical Engineers, Inc., Winchester, Massachusetts. Geotechnical Engineers' personnel logged the unconsolidated soils materials in these borings, and J. R. Rand logged the bedrock cores. Detailed logs of these borings are attached herewith.

1. Soils

The unconsolidated soils materials encountered in 7 of the study area borings include a blanket of silty clay ranging to 40 feet in thickness,

overlying sandy deposits of varying grain sizes which range to 55 feet in thickness. Locally, a basal section of boulders of a few feet in thickness underlies the sand deposits immediately upon the bedrock surface. Soils materials were not sampled in the two angle borings, SRF-5 and SRF-7.

Plates 3 and 4 describe J. R. Rand's interpretation of the stratigraphy of the soils materials along the line of borings. The geologic interpretation is that of a blanket of glacial-marine clay of late Pleistocene age overlying glacial outwash and marine sands, all underlain by a smooth bedrock surface on which were deposited discontinuous thin sheets of glacial till or ground moraine. The sands in borings SRF-1 and SRF-4, on the southeastern end of the line of borings, are largely yellow-brown, medium- to coarse-grained, and resemble glacial outwash. The sands in SRF-6, SRF-9, SRF-2, SRF-8 and SRF-3 are commonly finer-grained and gray in color, and contain occasional thin interbeds of gray clay. These sands underlying the northern part of the line of borings are interpreted as having been derived from erosion of the outwash, with redeposition in the near-shore marine environment prior to, but historically essentially contemporaneously with deposition of the marine clays. The boundary between the two types of sandy deposits is in the area of SRF-6, where the elevation of the top of the sandy material is low, and the overlying clay blanket is thick.

2. Bedrock

The bedrock in the study area has been defined by outcrops of Newburyport granodiorite at the north end of Seismic Line "S", and by the nine borings which extend intermittently from the outcrop area on the north to Scotland Road on the south. The Newburyport outcrops at the north end of the line consist of massive, mottled pink and green, medium-grained granodiorite which exhibits saussurite alteration of feldspars and chloritization of biotite. The rock does not show evidence of shearing on the outcrop surfaces.

Proceeding southeasterly along the line of borings, the bedrock is seen in cores from SRF-5, SRF-7 and SRF-3 to become progressively more altered chemically and more deformed mechanically, becoming light tannish-green in color, and medium-fine grained and foliated in texture and fabric. With continued distance to the southeast, the bedrock in the hangingwall of the fault is seen in SRF-7, -8, -2, -9 and -6 to be an intensely deformed, light yellow-green welded breccia or cataclastic rock. All of the rock in the fault zone is compact and well consolidated, and no zones of clay gouge or other unconsolidated crushed or sheared materials were encountered in borings in the study area.

Borings SRF-7, SRF-8 and SRF-9 all progressed through the intensely deformed portion of the Scotland Road fault zone into unaltered, dark gray diorite and schist of the unnamed complex which lies to the south of the fault.

In each of these borings, a thin (1" to 2"), tan aphanitic rock layer was cored about 5 feet stratigraphically above the horizon where alteration and cataclastic deformation ceased, and this thin marker has been termed "mylonite" on Plates 3 and 4. Borings SRF-4 and SRF-2 drilled only unaltered bedrock of the diorite/schist complex.

Core in borings SRF-2, -3, -7, -8 and -9 was taken with an orienting barrel. Orientation measurements made by Geotechnical Engineers consistently show schistosity or foliation fabric of cores of the fault zone in these borings to dip in the range 35° to 60° toward the north or N10°W. On Plate 2, the subcrop of the footwall of the fault is interpreted to strike N80°E and to dip to the north at an average of about 44°. The trace of the footwall lies within only about 150 feet of the location inferred by A. F. Shride from his regional mapping studies. The true thickness of the rock section subject to mechanical deformation in the fault zone approaches 300 feet, indicating that the Scotland Road fault is a regional tectonic feature of major geologic significance.

C. Trenching Investigations

At various times during the period November 20, 1973, to March 4, 1974, four backhoe trenches were excavated in the study area to expose and examine the glacial-marine clay which overlies the Scotland Road fault zone (see Plate 2). In all trenches, the organic topsoil zone was about 6 inches to 8 inches thick overlying weathered clay, and was continuous and lay parallel with the nearly planar surface of the study area field.

1. Trench 1

Trench 1, near the north edge of the fault zone, was excavated on November 20, 1973, in massive olive-gray clay to a depth of about 12 feet at the north end of the trench, and was carried for about 150 feet toward the southeast with a depth of 4 feet to 5 feet. A 2-inch to 3-inch layer of fine laminated silty sand occurred in the clay at a depth of 3 feet to 3½ feet below ground surface, sloping gradually to the south. This laminated sand-silt layer was continuous and not disrupted in the southern 100 feet of the trench. At the northern end of the trench, the sand-silt layer merged upward into the weathered portion of the soil zone and became unidentifiable.

2. Trench 2

Trench 2, to the south of the fault trace, was excavated on December 12, 1973, to a depth of 7 feet to 8 feet in clay, and was carried northwesterly for about 50 feet until collapse of the trench walls terminated the work. This trench exposed a thin, flat-lying laminated sand-silt layer in the clay at a depth of about 6 feet. This sand-silt layer generally resembled that found in Trench 1, although the layer was saturated in Trench 2, and small springs issued from it locally when cut by the backhoe bucket.

3. Trench 3

Trench 3 was excavated across the fault zone from south to north on February 26-27, 1974, for a total length of 435 feet and to an average depth of about 7 feet. The trench was cut in olive-gray clay which was internally

massive, but which had a thick-bedded characteristic which permitted measuring the gentle undulating layering structure in the clay. Strike-and-dip plots of these layering features are shown in plan on Plate 2, and the projected layering of the clay is shown schematically in profile on Plate 4.

In addition to gross layering structure seen in the clay throughout the length of the trench, a 2-inch to 4-inch laminated fine sand and silt layer was identified within the clay overlying the footwall trace of the underlying fault zone. This sand-silt marker layer dipped northerly out of the weathered soil zone at about 100 feet north of the south end of the trench, and sloped northerly into a synclinal sag at 135 feet north of the south end of the trench, to rise back into the weathered soil zone and be lost about 170 feet north of the south end of the trench.

The structure of layering in the clay throughout Trench 2 forms gently undulating, open folds which appear generally to parallel the upper surface of the underlying outwash and marine sand deposits. No tight or abrupt folds were seen to disrupt the continuity of layering in the clay, and close examination throughout the length of the trench failed to detect any drag folding within the clay beds. The clay is jointed throughout the trench area, with joints tending to change orientations to conform to changing attitudes of the broad undulations in clay layering. No slickensides or other evidence of displacement were detected on any joints in the trench. No

sand dikes cutting across clay layering or filling joints were found. No offsets were found in the thin, sagged sand-silt marker horizon which was interbedded in the clay between Stations 100 and 170 in Trench 3.

Between 55 feet to 65 feet north of the south end of Trench 3, the backhoe excavated a pocket into the floor of the trench to a depth of about 14 feet, to determine whether there were any stratigraphic changes to that depth which might be useful to examine while proceeding northerly with the excavation across the fault zone. To the 14-foot depth tested, no sand layers were seen in the clay, and the pocket was backfilled to restore the trench floor to the normal 7-foot depth. Within a few moments of completing and tamping the backfill, several springs erupted from the trench floor within the backfill area, with artesian flows rising 1 inch to 2 inches above the floor of the trench. Fine gray sand suspended in the flowing waters of the several springs rapidly built sand cones several inches thick around the springs. A dam was built across the trench to the north of the springs, to protect the proposed excavation to the north from flooding, and thereafter the southern 80 feet of the trench filled to within 2 feet of ground surface, with the highly mobile fine gray sand continuing to be deposited from the springs onto the floor of the flooding trench.

4. Trench 4

Trench 4 was excavated on March 4, 1974, in an attempt to locate the westerly projection of the laminated sand-silt marker horizon found between

Stations 100 and 170 in Trench 3. A similar layer was found in Trench 4, taking the form of an open synclinal sag which plunged gently to the northeast toward Trench 3. Spoon sampling of the soils in Boring SRF-6, between the two trenches, also had detected a sand-silt layer in the clay at an elevation corresponding with that which projected between the two trenches.

Various points on the sand-silt horizon in each of the two trenches were then surveyed in by McKenna Associates in order to provide locations and elevations with which to define the structure of the horizon as it passed over the footwall and portions of the intensely deformed base of the Scotland Road fault. These surveyed points are designated points "A" through "J" on Plate 2. The structure of the horizon is defined in plan in an insert on Plate 2, and in profiles showing the east wall of Trench 3 and the east and west walls of Trench 4 on Plate 4.

As shown on Plate 2, the structure of the sand-silt marker horizon takes the form of an open, doubly-plunging syncline which strikes southwesterly across the footwall of the fault. No offsets of the sand-silt layer were detected in either trench, and no abrupt folding or drag folds were detected in this layer or in the clay beds in either trench. The sand-silt layer in both trenches does not apparently thicken or show increased grain sizes toward the trough of the syncline. No sand dikes were found in Trench 4, nor were joints slickensided.

No evidence was found to suggest that the synclinal structure of the sand-silt layer crossing the fault in the area of Trenches 3 and 4 was formed by other than passive deformation due to differential settlement of the underlying clay. The relatively non-compressible outwash and marine sands underlying the clay in the study area are at a low elevation beneath the area of this synclinal sag, and the relatively compressible clay section is thick. Conversely, the sand elevation is high and the clay is thin as seen in borings put down to the north and south of the sag. With the gradual post-depositional compaction of the clay materials through time, the thicker clay sections settled more deeply than the thin clay sections, passively producing sags in the originally horizontal layering of the fine-grained clay deposits.

There is no detectable sag in the topsoil zone which overlies the synclinal sag in the sand-silt marker horizon in Trenches 3 and 4, and there is no noticeable variation in thickness of the topsoil zone in these trenches. Since the sand-silt layer does not thicken or show coarser grain sizes toward the trough of the synclinal sag, the sand-silt layer appears to have been deposited on an originally horizontal surface which lay stratigraphically above the present ground surface. Differential settlement and sagging of the sand-silt horizon must have been completed prior to the last erosional beveling of the present ground surface, presumably upon retreat of the last post-glacial marine transgression, since the topsoil zone built

upon this beveled horizon shows no evidence of having sagged over the sand-silt sag or over any other of the gently undulations seen in the clay layering throughout the length of Trench 3. There is no evidence of disruption of any of the sedimentary layers overlying the fault zone in any of the trenches, to suggest movement on the Scotland Road fault subsequent to deposition of the overlying Pleistocene deposits.

D. Age of Pleistocene Deposits

No shells or other organic materials were found in the clay in the study area with which to establish an age of deposition of the clay. The clay deposit is, however, considered correlative with similar glacial-marine clays which blanket portions of the seaboard lowland throughout eastern New England.

Borns (1973) reports that "a major amelioration of climate began prior to 14,200 years ago which resulted in a rapid dissipation of the ice sheet in New England at least by 12,500 years ago". The recession of the ice sheet was accompanied by a marine invasion of the seaboard lowland, with deposition of glacial-marine clay sediments. Borns brackets the time of deposition of the glacial-marine clay in the region between 13,500 and 12,500 years ago.

Schafer and Hartshorn (1965) report that radiocarbon dates of shells from glacial-marine sediments on the seaboard lowland in Maine range from 11,800 to 12,800 years old. Kaye and Barghoorn (1964) have constructed

a curve of sea-level fluctuations for the Boston, Massachusetts, area which describes the last marine submergence as having ended about 12,500 years ago in that area.

It appears, therefore, that the glacial-marine clays of the Newbury study area are at least older than 11,800 years, and are probably in the range of 12,500 to 13,500 years old.

E. Petrographic Examinations

The petrography of eight samples of drill core from borings in and adjacent to the Scotland Road fault has been described by Professor Gene Simmons and Dorothy Richter of Massachusetts Institute of Technology.

Sample	Boring	Depth (feet)	Description
SRF-1A	SRF-1	74.0 to 74.4	Amphibolite breccia
SRF-2A	SRF-2	60.0 to 60.4	Mylonized quartz-muscovite schist
SRF-2B	SRF-2	72.9 to 73.4	Brecciated quartz-muscovite schist
SRF-3A	SRF-3	67.0 to 67.5	Muscovite mylonite
SRF-4A	SRF-4	92.9 to 93.3	Chlorite augen gneiss
SRF-5A	SRF-5	42.1 to 42.6	Sheared granodiortie
SRF-5B	SRF-5	175.1 to 175.6	Altered olivine basalt
SRF-7A	SRF-7	115.9 to 116.4	Ultramylonite

Simmons and Richter conclude from their studies that "the samples (with the exception of sample SRF-5B) all show evidence of dynamic deformation; that is, cataclasis, brecciation and intense crushing--all probably due to motion along the fault. The deformation clearly took place after the regional metamorphism of the rocks (which was probably associated with the Devonian Acadian orogeny). The microcracks produced in the deformational

events appear in thin section to have either annealed, or have been filled by secondary minerals. There is no firm petrographic evidence of recent deformation of these samples". The complete text of the Simmons and Richter report is attached herewith.

A further indication of the old age of deformation of the fault zone is evidenced by sample SRF-5B, from a diabase dike which is enclosed within deformed rocks of the fault zone. Petrographically the dike is seen to be completely undeformed. The dike has been dated radiometrically (K-Ar) at 199 ± 9 million years.

F. Radiometric Age Dating

K-Ar age determination have been obtained on six samples of drill core from borings in and adjacent to the Scotland Road fault by Geochron Laboratories, Division of Krueger Enterprises, Inc., Cambridge, Massachusetts.

Sample	Boring	Depth (feet)	Material	Age
SRF-5A	SRF-5	42.1 to 42.6	whole rock	272 10 M.Y.
SRF-3A	SRF-3	67.0 to 67.5	whole rock	269 10 M.Y.
SRF-2A	SRF-2	60.0 to 60.4	whole rock	256 10 M.Y.
SRF-8A	SRF-8	155.6 to 156.0	sericite/ feldspar	248 9 M.Y.
SRF-1A	SRF-1	74.0 to 74.4	amphibole	324 14 M.Y.
SRF-5B	SRF-5	175.1 to 175.6	whole rock	199 9 M.Y.

Samples SRF-5A, -3A, -2A, and -8A are from within the fault zone; SRF-1A is from the diorite/schist complex which lies to the south of the fault zone; SRF-5B is from an undeformed diabase dike which is enclosed within deformed rocks of the fault zone (see Plate 3). Of apparent geologic

interest is the fact that radiometric ages increase progressively with distance from the footwall of the fault zone. SRF-8A is from about 5 feet above the mylonite band near the footwall of the fault, whole SRF-5A is in relatively undeformed granodiorite about 250 feet stratigraphically above the footwall. Radiometric dating of rocks within the Scotland Road fault zone indicates that the fault is of Permian age, and suggests that deformation in the zone may have been active through a period of as much as 20 million years. The dike (SRF-5B) which intruded the fault zone is completely undeformed, indicating that movement on the fault had ceased by Triassic time.

IV. CONCLUSIONS

The Scotland Road fault has been located within 150 feet of the location inferred by A. F. Shride on the basis of his regional field studies. Nine core borings have defined the fault zone as being about 300 feet thick and dipping at about 44° to the north adjacent to Scotland Road in Newbury, Massachusetts. Chemical alteration and mechanical deformation in the fault zone increases progressively from north to south across the fault zone, and alteration effects of faulting terminate abruptly at the footwall of the fault zone, about 5 feet stratigraphically below a thin mylonite band. The fault is a feature of major geological significance in the region.

The fault is geologically very old, of early to middle Permian age, and the altered and deformed bedrock materials in the fault zone are annealed and compact. No unconsolidated gouge, shear zones or polished joint surfaces

were detected in cores from borings drilled across the width of the fault zone. The bedrock surface overlying the fault zone slopes gradually up to undeformed bedrock outcrops at the north edge of the fault zone, and appears from refraction seismic surveys and borings data to be smooth and sub-planar, with no detectable topographic anomalies.

Surficial materials overlying the fault zone include glacial till, glacial outwash and marine sands, and glacial-marine clays, all of Pleistocene age. The youngest of these Pleistocene deposits are the glacial-marine clays, estimated from regional studies to be older than 11,800 years. A thin, essentially horizontal layer of post-Pleistocene topsoil covers the glacial-marine clay in the area.

Examination of the glacial-marine clay in four trenches excavated over the area of the fault zone failed to detect any evidence of tectonic fault displacement in the clay and its interbedded sand-silt layers. Bedding in the clay displayed no abrupt monoclinal or drag folds. Joints were not slickensided. The thin laminated sand-silt horizons interbedded in the clay were not offset. No sand dikes were found in the clay, which directly overlies deposits of highly mobile fine sand.

All evidence observed in the current investigations indicate that Pleistocene deposits overlying the Scotland Road fault have not been subjected to disruption by tectonic faulting.

John R. Rand
Consulting Geologist

References:

Borns, H. W., Jr. (1973) Late Wisconsin Fluctuations of the Laurentide Ice Sheet in Southern and Eastern New England. in The Wisconsinan Stage; Geological Society of America, Memoir 136; Boulder, Colorado.

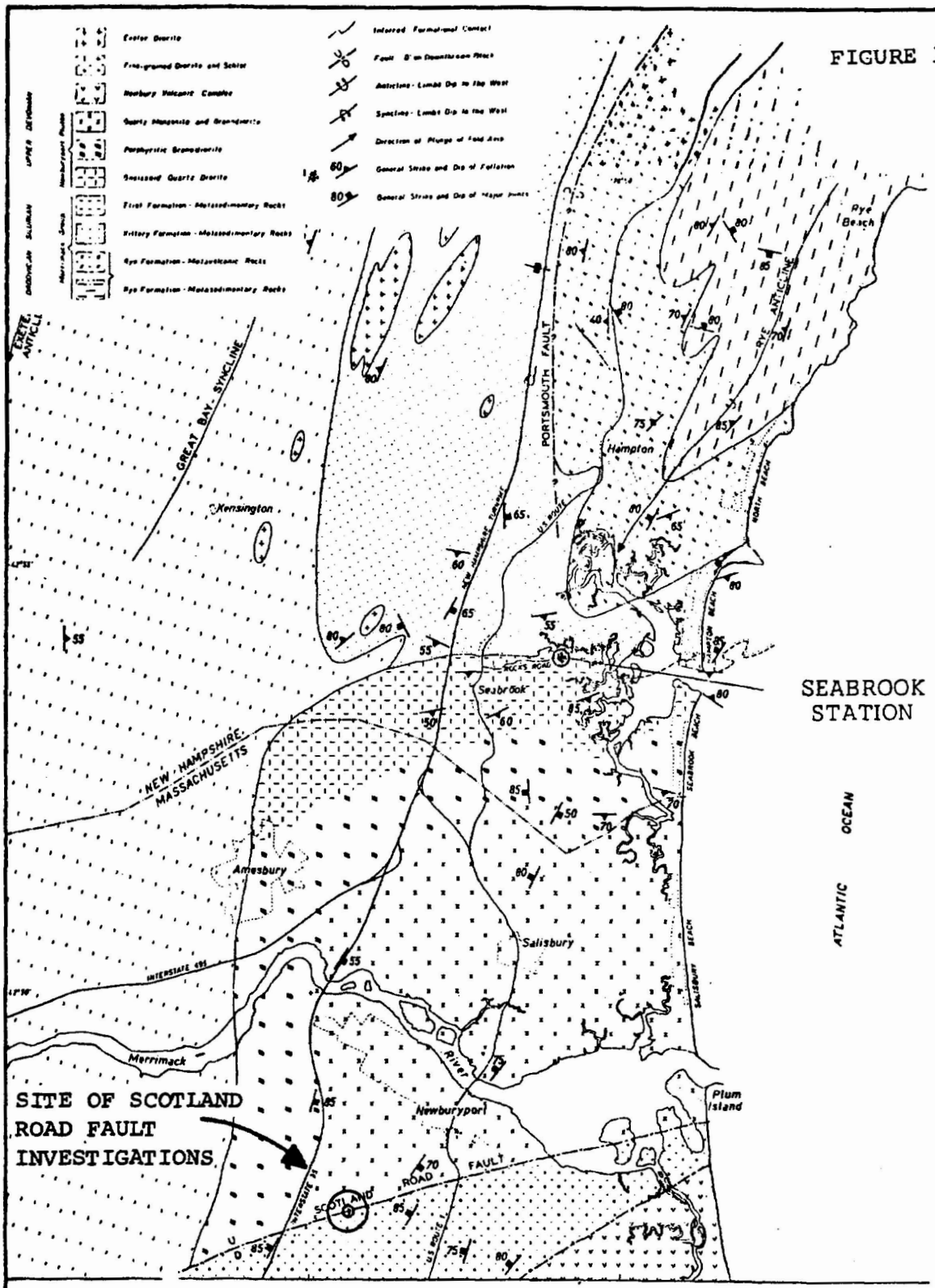
Kaye, C. A. and E. S. Barghoorn (1964) Late Quarternary Sea-Level Change and Crustal Rise at Boston, Massachusetts, with Notes on the Autocompaction of Peat. Geological Society of America, Bulletin Vol. 75, 63-80.

Schafer, J. P. and J. H. Hartshorn (1965) The Quaternary of New England. in The Quaternary of the United States; Princeton University Press; Princeton, New Jersey.

Shride, A. F. (1971) Igneous Rocks of the Seabrook, New Hampshire-Newbury, Massachusetts, Area. in Guidebook for Field Trips in Central New Hampshire and Contiguous Areas. New England Intercollegiate Geological Conference - 1971.

NOTE: The study area was visited on March 13, 1974, by M. H. Pease, Jr. and P. J. Barosh, U. S. Geological Survey, Boston. Trenches 3 and 4 were inspected. The trenches were thereupon filled in.

FIGURE 1

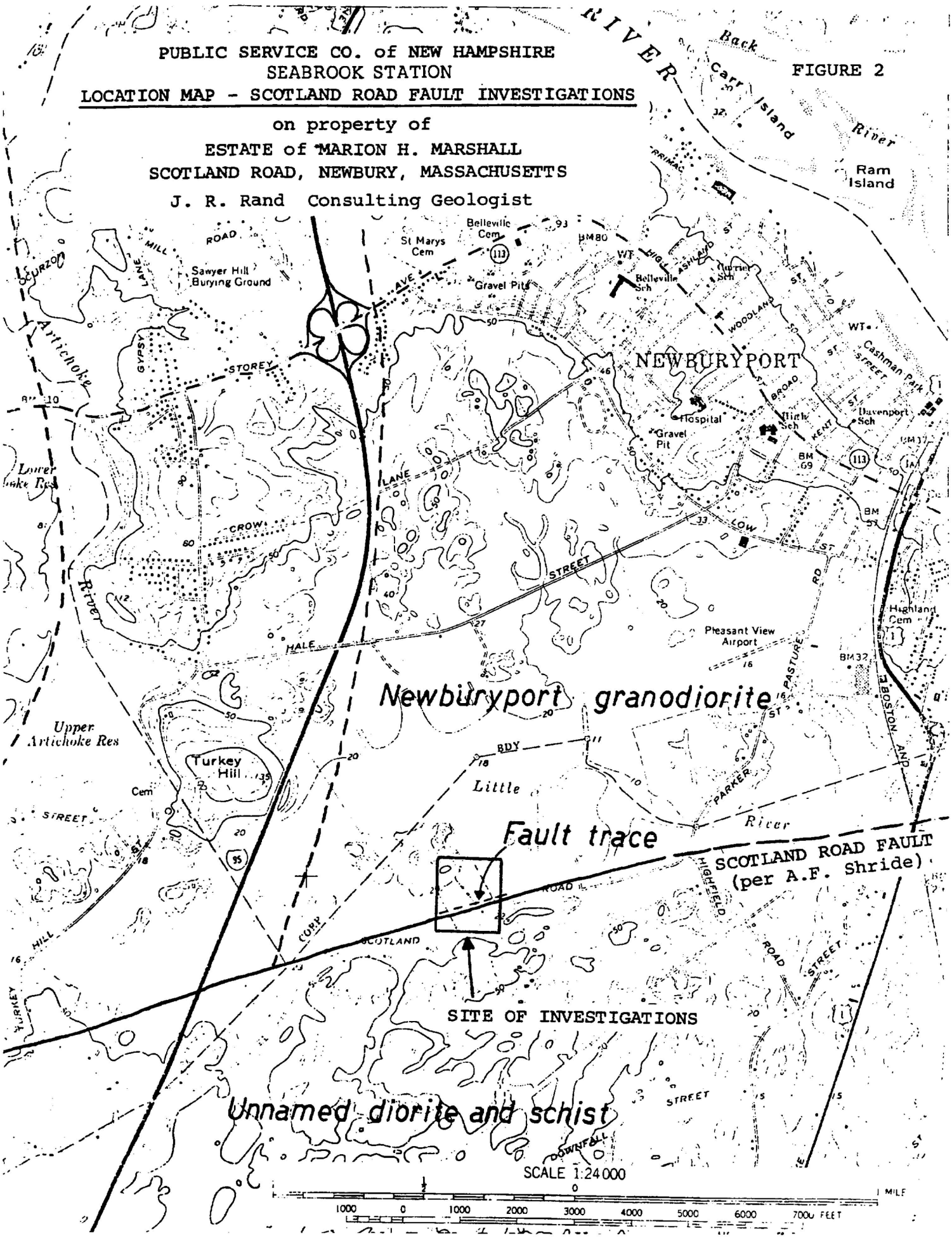


BEDROCK GEOLOGY OF THE SEABROOK REGION, NEW HAMPSHIRE - MASSACHUSETTS

LOCATION MAP
REGIONAL FAULT INVESTIGATIONS
PUBLIC SERVICE CO. of NEW HAMPSHIRE
SEABROOK STATION
J. R. Rand, Consulting Geologist

PUBLIC SERVICE CO. of NEW HAMPSHIRE
SEABROOK STATION
LOCATION MAP - SCOTLAND ROAD FAULT INVESTIGATIONS
on property of
ESTATE of MARION H. MARSHALL
SCOTLAND ROAD, NEWBURY, MASSACHUSETTS
J. R. Rand Consulting Geologist

FIGURE 2



ATTACHMENT No. 1

SEISMIC REFRACTION SURVEY
SCOTLAND ROAD FAULT ZONE
NEWBURY, MASSACHUSETTS

WESTON GEOPHYSICAL ENGINEERS, INC.
for
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

SEISMIC REFRACTION SURVEY

SCOTLAND ROAD FAULT ZONE

NEWBURY, MASSACHUSETTS

for

PUBLIC SERVICE COMPANY

OF NEW HAMPSHIRE

WESTON GEOPHYSICAL ENGINEERS, INC.
WESTON, MASSACHUSETTS

SEISMIC REFRACTION SURVEY
SCOTLAND ROAD FAULT ZONE
NEWBURY, MASSACHUSETTS

INTRODUCTION

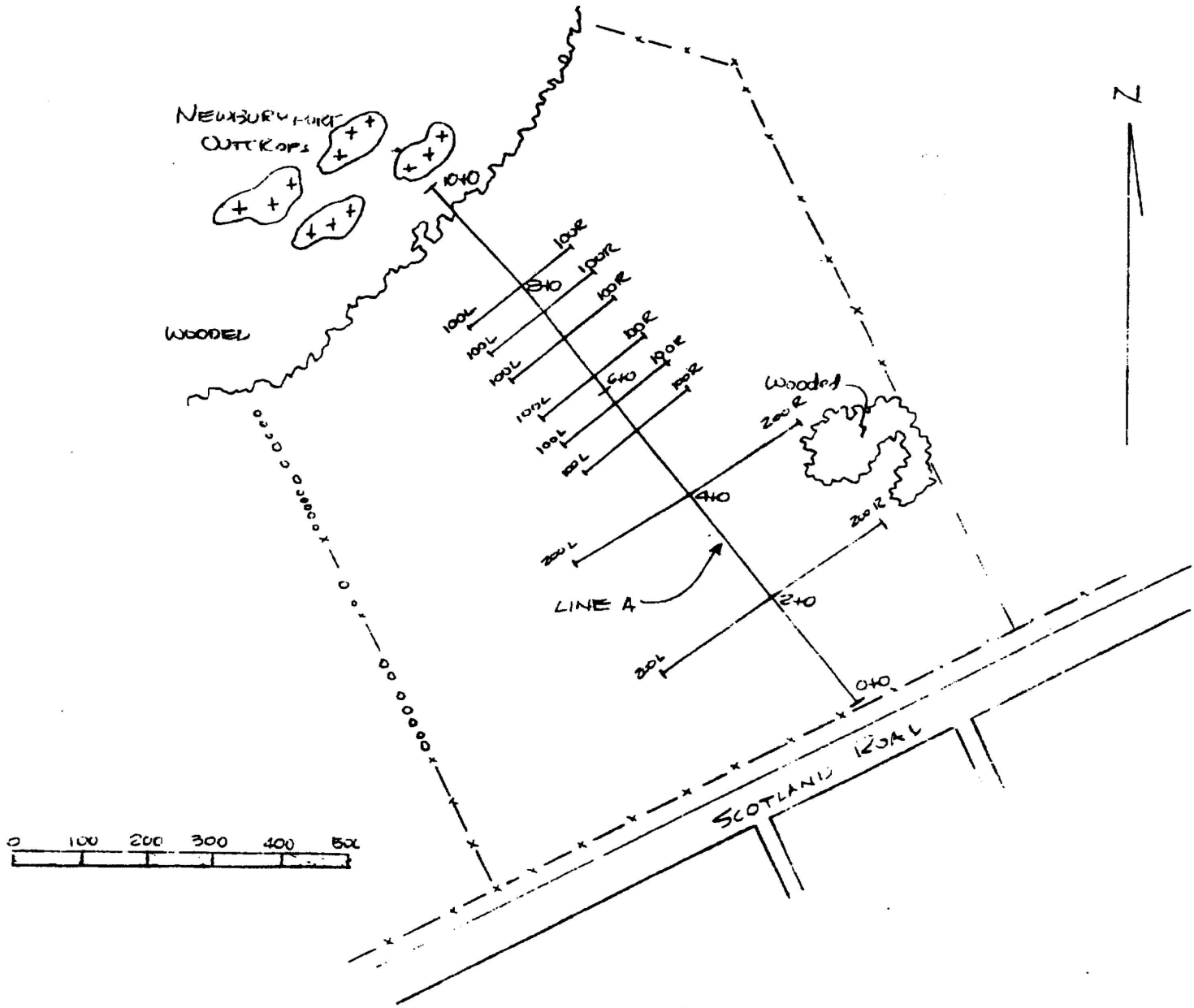
A seismic refraction survey was conducted across the mapped location of the Scotland Road fault, as originally mapped by A. F. Shride (1971) and shown on Figure 1 and Plate 2 of the report. Seismic field work took place during the period of November 5 through 19, 1973. The location of this survey is shown on Figure 1 of this attachment.

The general purpose of this work was to determine thicknesses of overburden and weathered rock materials as well as the velocities of the verious geologic materials existing at this location.

RESULTS

The results of this refraction survey are shown on a profile of the bedrock surface (Figure 2). Also shown on this profile are overburden and bedrock seismic velocities, boring locations, and bedrock depths as found from borings as well as the fault zone, as indicated by J. R. Rand.

The bedrock surface, as interpreted from seismic data, does not have any sharp breaks indicating faulting. The seismic velocities of the bedrock do not change sufficiently along the 1,000-foot line of investigation to indicate the presence of any significant bedrock anomaly. The fault zone does not exhibit significant velocity differences from the adjacent bedrock.



SEISMIC LINE LOCATIONS

SCOTLAND ROAD FAULT

PUBLIC SERVICE CO. of NEW HAMPSHIRE

SEABROOK NUCLEAR STATION

Figure 1

ATTACHMENT No. 2

GEOLOGIC AND SOILS LOGS OF BORINGS
SRF-1 THROUGH SRF-9

BORING LOCATION See Scotland Rd. site plan | INCLINATION Vertical | BEARING _____ | DATE START/FINISH Dec. 4, 1973 / Dec. 6, 1973

CASING ID 3 in. | CORE SIZE 1-7/8 in. | TOTAL DEPTH 68.0 ft | DRILLED BY American Drilling & Boring Co.; W. Manco

GROUND EL (MSL) 18.1 ft | DEPTH TO WATER/DATE 0.5 ft / Dec. 28, 1973 | LOGGED BY Soil - K. Polk; Rock - J. R. Rand

EL. MSL ft	SAMPLE Depth ft	Type and No.	N or Rec.	RATE OF ADV. min/ft	WATER CONTENT %	or RQD Graphic	PRESSURE TEST gpm psi	Computed k 10^{-4} cm/sec	STRIKE, DIP F = Foliation J = Joint C = Contact B = Bedding S = Slickenside	CORE BREAKS	SOIL AND ROCK DESCRIPTIONS (Weathering, defects, etc.)	(Type, texture, mineralogy, color, hardness, etc.)
18.1						0 100						
		S1	7		33.5				TOP	OF CLAY	Mottled gray, olive-gray, and brown silty clay. Low plasticity; w > P. L.; s_u(tor)=0.0 tsf	
		S2	7		29.4						Slightly mottled gray & olive brown silty clay. Low to med. plasticity. s_u(tor) > 1.0 tsf	
		S3	21		32.3						Olive-brown silty clay. Low to medium plasticity; w ≯ P. L. s_u(tor) > 1.0 tsf [1]	
		S4	29		31.9						Similar to Sample S3. s_u(tor) > 1.0 tsf	
		S5	30		32.4						Similar to S3, but somewhat softer; contains few gray spots to 8 mm. s_u(tor) = 0.95 tsf	
		S6	31		34.9						Similar to S3, but softer; some gray spots. s_u(tor) = 0.65 tsf	
	-10	S7	5		37.6						Similar to Sample S3, but medium stiff; contains a gray silt layer < 0.5 mm thick; color varies slightly olive-brown to olive-gray. s_u(tor) = 0.34 tsf	
	13.0								TOP	OF SAND		
0		S8	0								Gray layered silty clay and clayey fine sand. Silty clay is soft; medium to high plasticity; slightly sticky; very soft when remolded. Layers vary 0.5-10 mm. s_u(tor) = 0.22 tsf	
	-20	S9	9								Gray silty fine sand. Uniform; fines are nonplastic; very fast reaction to shaking test.	
		S10	10								Similar to Sample S8, but also contains a few gray clay layers 1-2 mm thick.	
	-30	S11	9/6"								Similar to Sample S9, but also contains some gray clay layers.	
		S11A	19								Brown silty fine sand. Uniform; fines are nonplastic; contains a few rusty-brown fine sand layers.	
		S12	24								Brown slightly silty fine to medium sand. Uniform; fines are nonplastic; contains a layer of gray clayey gravelly sand with subrounded gravel up to 20 mm in size.	
-20	-40	S13	26								Brown very slightly silty uniform fine to medium sand.	
		S14	31								Light brown silty fine sand. Uniform; fines are nonplastic; contains a few subrounded coarse sand grains and some rusty-brown medium sand layers.	
	-50	S15	17								Similar to Sample S14.	
		S16A	59						TOP	OF TILL	Similar to Sample S14.	
	55.0	S16B	15/6"								Gray-brown silty sandy gravel. Widely graded; angular grains; contains gravel pieces up to 30 mm in size; fines are nonplastic.	
-40	-60	S17A	79								Light gray fine to medium sand. Uniform; angular to subrounded grains; clean.	
		S17B	28/6"								Light gray silty sandy gravel. Angular grains; appears to decomposed rock and rock fragments up to 30 mm in size.	
		S18	92/6"								Gray silty gravelly fine sand. Uniform; fines are nonplastic; contains angular gravel pieces up to 15 mm in size.	
		NX-1	41								Cored boulders.	
	65.0	NX-2	100	3.0					TOP	OF ROCK		
	-70	NX-3	93	4.2	43						75° Joint Clean; 75° Joint Minor wx. Fresh and hard. Drills well. Only very slight surface wx effects on joints and partings.	Diorite. Dark gray with large (?)hornblend cyrstals (1/2") in fine-grained quartz diorite matrix.
-60		NX-4	98	3.6	83							76.3' Gradational contact - fused. Diorite. Massive, fine-grained, dk. gray
	78.0								BOTTOM	OF BORING		

CORE RECOVERY

LEGEND

N - Standard penetration resistance, blows/ft
Rec - Length recovered/length cored, %
RQD - Length of sound core 4 in. and longer/length cored, %
S - Split spoon sample ▽ Groundwater
U - Undisturbed samples
S - Shelby tube N - Denison
F - Fixed piston P - PRober
O - Osterberg G - GEI
D - Drilling break k - Coefficient of
wx - Weathered, weathering permeability

NOTES

1) - s_u(tor) = Shear strength measured with Torvane.

SEABROOK STATION

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

YANKEE ATOMIC ELECTRIC COMPANY

united engineers

Date: January 10, 1974 Project 7284

PAGE 1 of 1 | LOG OF BORING SRF1

BORING LOCATION See Scotland Rd. site plan | INCLINATION Vertical | BEARING | DATE START/FINISH Dec. 7, 1973 / Dec. 10, 1973

CASING ID 3 in. | CORE SIZE 2-1/8 to 1-5/8 | TOTAL DEPTH 77.5 ft | DRILLED BY American Drill. & Boring Co.; W. Mann, R. Lamoureux

GROUND EL (MSL) 17.6 ft | DEPTH TO WATER/DATE 0.0 ft / Dec. 31, 1973 | LOGGED BY Soil - K. Polk; Rock J. R. Rand

EL. MSL ft	SAMPLE Depth ft	Type and No.	N or Rec.	RATE OF ADV. min/ft	WATER CONTENT or RQD %	Graphic (0 ... 100)	PRESSURE TEST gpm psi	Computed k 10^{-4} cm/sec	STRIKE, DIP F = Foliation J = Joint C = Contact B = Bedding S = Slickenside	CORE BREAKS	SOIL AND ROCK DESCRIPTIONS (Weathering, defects, etc.) (Type, texture, mineralogy, color, hardness, etc.)
17.6	1	S1A SB 2.4/6"			31				TOP	OF CLAY	S1A - Dark brown soft fibrous peat. S1B - Mottled gray and olive-brown silty clay.
		S2	16		29.0						Similar to sample S1B, contains some rusty brown layers to 3 mm thick. s_u(tor) > 1.0 tsf
		S3	26		30.1						Olive brown silty clay. Low to medium plasticity; w > P. L.; s_u(tor) >1.0 tsf 2)
		S4	24		33.8						Similar to Sample S3, but fewer brown spots; gray streaks to 5 mm. s_u(tor) > 1.0 tsf
		S5	13		35.6						Similar to S3, but fewer brown spots; more gray streaks; somewhat softer. s_u(tor)=.90tsf
	-10	S6	5		35.5						Olive-brown silty clay. Low to medium plasticity. s_u(tor) = 0.50 tsf
		S7	5		48.8						Similar to S6, but no dark brown spots; soft to medium stiff; slightly sticky. s_u(tor) = 0.23-0.30 tsf
0		S8	2		52.5						Gray to olive-gray silty clay. Very soft to soft; medium to high plasticity; slightly sticky. s_u(tor) = 0.15 tsf
	-20	S9	0		37.8						Similar to Sample S8. s_u(tor) = 0.18 tsf
	-24.0								TOP	OF SAND	
	-30	S10	7								Gray very silty fine sand. Uniform; fines are generally nonplastic, but contains a few gray clay pockets up to 8 mm in size.
		S11	10								Similar to Sample S10.
		S12	13								Gray-brown fine to medium sand. Uniform; subrounded grains; clean.
-20	-40	S13	4								Light gray fine sand. Uniform; clean; contains one 8 mm size subrounded piece gravel.
		S14	8								Similar to Sample S13.
	-50	NX-1	93		1) 22				TOP	OF ROCK	
	50.5			4)						52°	No slickensides. Not notably wx. Altered by metamorphic process to light yellow green color. Not slickensided. Fresh. Drills well. Partings and some high-angle joints show crusty surface wx effects. No slickensides or other recent movements. 50° Joint Minor rusty 85° Joint Irregular 60° Joint, striated Not slickensided Clean joints. Cataclastic rock. Mottled light yellowish green, fine-grained matrix. Foliated with rounded pebble-like breccia, and swirled feldspathic and chloritic foliations. Thin feldspathic stringers and irregular veinlets dip 35° to 40° opposite to dip of foliation. Cross-stringers. Cross-stringers
		NX-2	100		32					45°	
-40	-60	NX-3	100		23					53°	
										45°	
										55°	
		BX-4	100	4.7	67					46°	
	-70	BX-5	100	2.6	55					47°	
										40°	
		BX-6	100	2.0	100					42°	
-60	77.5								BOTTOM	OF BORING	

LEGEND

N - Standard penetration resistance, blows/ft
Rec - Length recovered/length cored, %
RQD - Length of sound core 4 in. and longer/length cored, %
S - Split spoon sample ▽ Groundwater
U - Undisturbed samples
S - Shelby tube N - Denison
F - Fixed piston P - Pitcher
O - Osterberg G - GEI
D - Drilling break k - Coefficient of permeability
wx - Weathered, weathering

NOTES

1) Cored two boulders from 47.5 ft to 50.5 ft.
2) s_u(tor) = Shear strength measured with Torvane
3) S1A = 146.2, S1B = 31.7
4) Rate of advance not available for NX-1 through 3.

SEABROOK STATION

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

YANKEE ATOMIC ELECTRIC COMPANY

united engineers

Date: January 10, 1974 | Project 7286

PAGE 1 of 1 | LOG OF BORING BRF 2

BORING LOCATION See Scotland Rd. site plan INCLINATION Vertical BEARING ____ DATE START/FINISH Dec. 11, 1973 / Dec. 19, 1973

CASING ID 3 in. CORE SIZE 2-1/8 to 1-7/8 in. TOTAL DEPTH 95.0 ft DRILLED BY American Drilling & Boring Co.; Manco

GROUND EL (MSL) 17.9 ft DEPTH TO WATER/DATE 0.0 ft / Dec. 31, 1973 LOGGED BY Soil - K. Polk; Rock - J. R. Rand

EL. MSL ft	SAMPLE Depth ft	Type and No.	N or Rec.	RATE OF ADV. min/ft	WATER CONTENT or RQD %	Graphic (0 … 100)	PRESSURE TEST gpm psi	Computed k 10^{-4} cm/sec	STRIKE, DIP F = Foliation J = Joint C = Contact B = Bedding	CORE BREAKS	SOIL AND ROCK DESCRIPTIONS (Weathering, defects, etc.) (Type, texture, mineralogy, color, hardness, etc.)
									S = Slickenside		
17.9		S1	4		40.0						Slightly mottled brown and gray peaty silty clay. Low plasticity. s_u(tor) = 0.60 tsf 1)
		S2	19		29.1						Mottled olive-gray and rusty brown silty clay. Low plasticity; w > P. L. s_u(tor)=0.90tsf
		S3	33		27.8						Similar to Sample S2. s_u(tor) > 1.0 tsf.
		S4	9		36.3						Olive-brown silty clay. Medium plasticity; w > P. L.; s_u(tor) = 0.80 tsf
		S5	7		37.7						Similar to Sample S4, but contains several silt laters < 0.5mm thick. s_u(tor) = 0.48 tsf
		S6	4		45.0						Similar to S4, but medium stiff; contains several very thin silt layers. s_u(tor) = 0.45 tsf
		S7	2		43.5						Olive-brown to gray silty clay. Slightly sticky; s_u(tor) = 0.12-0.17 tsf
-10		S7A	2/6"		51.9						Gray silty clay. Very soft to soft; medium plasticity; sticky. s_u(tor) = 0.18 tsf
		S8	2		55.4						Similar to Sample S7A. s_u(tor) = 0.12 tsf.
0											
-20		S9	3		50.9						Similar to Sample S7A. s_u(tor) = 0.15-0.19 tsf
		S10	2		36.3						Similar to Sample S7A, but also contains a few silt layers < 0.5 mm thick; color varies slightly lighter and darker. s_u(tor) = 0.18 tsf
								TOP	OF SAND		
-30		S11	16								Gray layered soft silty clay and silty fine sand. Layers are 1-5 mm thick.
		S12	8								Gray silty fine sand. Uniform; fines are nonplastic; very fast reaction to shaking test; contains a few gray clay layers up to 5 mm thick.
-20	38.0							TOP	OF TILL		
	40	S13	57								Gray-green silty angular rock fragments up to 30 mm in size.
	42	S14	5/6"					TOP	OF ROCK		Similar to Sample S13, but larger pieces. Appears to be decomposed rock
		NX-1	97	3.0	43						45° joint-rusty; 50° joint minor wx; Vuggy; 40° joint. Fairly fresh (as for wx) but is altered, presumably hydrothermally, to a light gray-green to tan green color. Joints show slight rusty wx effects. Altered diorite (?). Fine-grained, light gray-green matrix with medium-grained feldspar phenocrysts. Sense of vague foliation throughout.
-50		NX-2	97	3.2	47						Tan diabase
		NX-3	100	4.0	77						
-40											
		NX-4	100	3.8	87						Quartz-Pink feldspar 61.5'
		NX-5	100	4.2	75						Fresh, but altered hydrothermally to light greenish (epidote) gray. Joints and partings are not slickensided, not polished. Epidote; Clayslone; Gouge; Epidote. Fault block (?) Fused, tight contacts-notable epidotization; strong foliation. Fine-grained to very fine-grained, locally feldspathized light gray to light green.
-70		NX-6	100	4.0	82				2) N50E, 3RNW F		
		NQ-7	100		68				N83W, 46NE J; N89E, 51NW F		Rough
-60		NQ-8	100	3)	52						Driller ground. Fresh, but altered hydrothermally. Quartz/pyrite mineralization conforms to foliation. Joints are not slickensided. Altered diorite (?). Moderately foliated, saussuritized feldspar phenocrysts in fine-grained matrix. Appears to be moderately foliated Newburyport Diorite.
	80										Pyrite
		NQ-9	95		67				N56W, 27SW F; N80W, 64NE J; N69E, 39NW J; N25E, 42NW J; N55W, 46NE J		61° joint; Rough surface
		NQ-10	100		72						Fairly fresh, but altered. Joints not slickensided or polished.
-90									N52W, 56NE J; N26W, 25NE J; N58W, 27NE J		
		NQ-11	100		63				N 9W, 24NE J; N85W, 52NE J		
	95							BOTTOM	OF BORING		

LEGEND

N - Standard penetration resistance, blows/ft
Rec - Length recovered/length cored, %
RQD - Length of sound core 4 in. and longer/length cored, %
S - Split spoon sample ▽ Groundwater
U - Undisturbed samples
S - Shelby tube N - Denison
F - Fixed piston P - Pitcher
O - Osterberg G - GEI
D - Drilling break k - Coefficient of permeability
wx - Weathered, weathering

NOTES

1) s_u(tor) = Shear strength measured with Torvane.
2) This is only a partial list of dip and strike data.
3) Rate of advance not available for NQ-8 through NQ-11.

* Used 300 lb hammer.

SEABROOK STATION

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

YANKEE ATOMIC ELECTRIC COMPANY

united engineers

Date: February 13, 1974 Project 7286

PAGE 1 of 1 LOG OF BORING SBF-3

GEOTECHNICAL ENGINEERS INC.

BORING LOCATION See Scotland Rd. site plan | INCLINATION Vertical | BEARING | DATE START/FINISH Dec. 20, 1973 / Jan. 3, 1974

CASING ID 3 in. | CORE SIZE 2-1/8 to 1-7/8 in. | TOTAL DEPTH 96.0 ft | DRILLED BY American Drilling & Boring Co.; W. Manco

GROUND EL (MSL) 17.6 ft | DEPTH TO WATER/DATE 8.0 ft / Jan. 2, 1974 | LOGGED BY Soil - K. Polk; Rock - J. R. Rand

EL. MSL ft	SAMPLE Depth ft	Type and No.	N or Rec.	RATE OF ADV. min/ft	WATER CONTENT or RQD %	Graphic (0 … 100)	PRESSURE TEST gpm psi	Computed k 10^{-4} cm/sec	STRIKE, DIP F = Foliation J = Joint C = Contact B = Bedding S = Slickensided	CORE BREAKS	SOIL AND ROCK DESCRIPTIONS (Weathering, defects, etc.) (Type, texture, mineralogy, color, hardness, etc.)
17.6		S1 SIA	1 6		27.5						S1-Dark brown peaty topsoil. SIA-Mottled brown, olive-brown, and gray silty clay. Med. stiff to stiff; low plasticity; contains roots < 0.5mm in dia.; w above PL. s_u(tor) = 0.75 tsf. S2-Similar to SIA, but very stiff; somewhat blocky, some layering; w slightly above PL. s_u(tor) > 1.0 tsf S3-Olive-brown silty clay. Very stiff; low to medium plasticity; somewhat blocky. s_u(tor) > 1.0 tsf S4-Similar to Sample S3, with some dark brown spots up to 3 mm thick. s_u(tor) > 1.0 tsf S5-Olive-brown silty clay. Medium stiff to stiff; medium plasticity; contains several dark brown spots. s_u(tor) = 0.62 tsf S6-Similar to Sample S5. s_u(tor) = 0.45 tsf S7-Similar to Sample S5. s_u(tor) = 0.35 tsf
		S2	19		28.0						
		S3	17		30.7						
		S4	31		33.7						
		S5	6		40.8						
		S6	9		38.5						
	10	S7	11		41.3						
	16.6	S8	13		33.0			TOP	OF SAND		Gray silty clay. Medium stiff; medium to high plasticity; contains some silty fine sand layers up to 20 mm thick near bottom. s_u(tor) = 0.30 tsf
0	20	S9	10								Light gray silty fine sand. Uniform; fines are nonplastic; very fast reaction to shaking test; contains a few clay layers up to 1 mm thick.
		S10	30								Similar to Sample S8, but contains clay layers up to 5 mm thick.
	30	S11	34					TOP	OF TILL		Brown medium to coarse sand. Uniform; subrounded grains; contains a few olive-brown clay layers up to 5 mm thick and a few gravel pieces up to 15 mm in size.
	34.0	S12	15								Gray-brown silty gravelly sand. Widely graded; subangular to subrounded grains; fines are nonplastic; contains a few gravel pieces up to 20 mm in size.
-20	40	S13	17								Brown gravelly silty sand. Widely graded; subrounded grains; fines are nonplastic; contains a few gravel pieces up to 20 mm in size.
		S14	18								Similar to Sample S13, but also contains subangular grains.
	50	S15	9								Similar to Sample S13, but clean.
		S16	15*								Brown medium sand. Uniform; subrounded grains; clean.
-40	60							TOP	OF ROCK		
		NX-1	100	3.6	0						Rusty; Soft-flasile; Striated Chlorite; Fault-narrow; 82.5 Faulted 85.0 — Fresh internally. Locally is subject to severe wx, softening. Parts on foliation. Not slickensided. Fresh. Closely broken on high-angle joints or on partings on high-angle foliation. Fresh, not wx. Schist. Feldspathic, fine-grained medium dark gray foliation matrix with disseminated medium-grained feldspars. Not altered. May be foliated diorite. Apparent narrow fault zones or shears at 77', 82.5-85' and 88.5' have feldspar stringers, and micaceous "gouge".
		NX-2	77	5.7	0						
	70	NX-3	100	3.1	14						
		NX-4	83	4.0	0						
-60		NX-5	100	3.0	0						
	80	NX-6	100	2.8	33						
				2)							
		NQ-7	100		7				N20W, 44NW J N 2E, 44SE J		Feldspar veining apparent faulted zone 82.5-85' — Sense of drag-folding at 90.6 ft is up.
	90	NQ-8	95		45				N80W, 60NE J		
		NQ-9	100		0				N66W, 55NE J		
	96							BOTTOM	OF BORING		

LEGEND

N - Standard penetration resistance, blows/ft
Rec - Length recovered/length cored, %
RQD - Length of sound core 4 in. and longer/length cored, %
S - Split spoon sample ▽ Groundwater
U - Undisturbed samples
S - Shelby tube N - Denison
F - Fixed piston P - Pitcher
O - Osterberg G - GEI
D - Drilling break k - Coefficient of permeability
wx - Weathered, weathering

NOTES

1) s_u(tor) = Shear strength measured with Torvane
2) Rate of advance not available for NQ-7 to 9.
* - Used 300 lb hammer
x - Oriented core

SEABROOK STATION

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

YANKEE ATOMIC ELECTRIC COMPANY

united engineers

Date: January 10, 1974 | Project 7286

PAGE 1 of 1 | LOG OF BORING SRF 4

GEOTECHNICAL ENGINEERS INC.

BORING LOCATION See Scotland Road site plan INCLINATION 45 - 46° BEARING S30E DATE START/FINISH December 26, 1973 / January 8, 1974

CASING ID 3 in. CORE SIZE 1-7/8 in. TOTAL DEPTH 197.7 [1] ft DRILLED BY American Drilling & Boring Co., T. Canning.

GROUND EL (MSL) 17.6 ft DEPTH TO WATER/DATE 0.0 ft / Dec. 26, 1973 LOGGED BY Soil - K. Polk; Rock - J. B. Rand

EL. MSL ft	Depth ft	Sample Type and No.	N or Rec.	Rate of Adv. min/ft	Water Content %	Graphic (0 — 100)	Pressure Test: Applied psi	Pressure Test: Computed k 10^{-4} cm/sec	Strike, Dip (F = Foliation, J = Joint, C = Contact, B = Bedding; S = Slickensided)	Core Breaks	Soil and Rock Descriptions (Weathering, defects, etc.)	Soil and Rock Descriptions (Type, texture, mineralogy, color, hardness, etc.)
17.6					3) None							
	10											
	20		2)									
0	30											
	34.0							TOP	OF ROCK			
				4)								
	40	NQ-1	88	1.6	71				40°		Most partings are joints	Fresh with minor powdery wx effects on joint surfaces. Joint surfaces are not slickensided.
		NQ-2	100	1.5	58						Chlorite	
		NQ-3	92	1.6	62						Rusty joint - Strikes ± NW	
	50	NQ-4	100	1.7	50							
-20		NQ-5	88	1.9	70						Rusty joint	Fresh. Drills well. Joint and partings show minor surface wx effects. Not slickensided.
	60	NQ-6	95	2.0	77				30°		Minor rusty	
		NQ-7	75	2.0	75				40°			
	70	NQ-8	100	2.5	52				35°		Minor rusty	
		NQ-9	93	2.5	48							Fresh. Partings locally show minor wx effects, but not slickensided.
-40	80	NQ-10	95	2.8	28				40°		Minor rusty	
		NQ-11	98	3.5	27						Minor rusty	
	90	NQ-12	97	3.8	0							
		NQ-13	97	4.8	35				40°			Fresh. Not wx, but is altered hydrothermally to light greenish gray color. Partings are not slickensided.
									30°			
	100	NQ-14	100	1.7	35				35°		Minor rusty	
		NQ-15	100	1.6	72							
-60	110	NQ-16	100	1.6	72				23°		Minor rusty	Fresh and hard. Drills well. Relatively minor hydrothermal alteration.
		NQ-17	98	1.7	85							
	120	NQ-18	102	1.7	67				47°		Minor rusty Bleached	
		NQ-19	100	1.7	68				50°			
	130	NQ-20	100	1.8	78						Bleached Joints striated Rough not slickensided.	Fresh and hard. Local minor bleaching. Partings show minor wx effects, but are not slickensided.
		NQ-21	100	1.9	42							
-80	140	NQ-22	100	2.0	32						Minor wx	
	148	NQ-23	98	2.2	63						Minor bleached	

Granodiorite. Typical Newburyport, medium-grained, medium gray, with greenish gray hue, and pink feldspar spotting. Generally massive. Locally shows foliated zones. Cut by fused feldspar quartz stringers. Biotite speckling. Becomes medium-fine grained at 56', foliation develops locally vague. First mechanical effects of fault zone apparently at around 56-58'.

Med. Grained / Finer Grained — Pyrrhotite

Fused fault material

Diorite. Medium-fine grained. Medium greenish gray. Locally foliated. Foliation is sometimes drag-folded. Rock is mechanically deformed, approaching fault-carbonate veinlets.

Cherty Vein

Fine-grained rock, with chlorite (?) speckling. Locally foliated, cut throughout by feldspar veinlets.

103' Contact(open) dips 45°

Granodiorite. Medium grained, medium greenish gray, massive, chlorite specks, (not fully altered)

109' Contact dips 20°

Fine-grained rock fused

1161 contact dips 50°

Granodiorite. Medium-grained. Locally shows tendency to foliation. Medium greenish gray.

Foliated-fused Cataclastic

Granodiorite. Medium-grained, medium greenish gray. Fairly massive. Dark chlorite speckling. (Chlorites not altered appreciably)

Fine inclusion

LEGEND

N - Standard penetration resistance, blows/ft
Rec - Length recovered/length cored, %
RQD - Length of sound core 4 in. and longer/length cored, %
S - Split spoon sample ▽ Groundwater
U - Undisturbed samples
S - Shelby tube N - Denison
F - Fixed piston P - Pitcher
O - Osterberg G - GEI
D - Drilling break k - Coefficient of permeability
wx - Weathered, weathering

NOTES

1) Depths noted were measured "along the boring", not vertically
2) Washed through clay to 34.0' - no samples taken
* - Roller bitted to 36.0'
3) No clays present; therefore no water contents were determined.
4) Roller bitted to 52.0 ft.

SEABROOK STATION

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

YANKEE ATOMIC ELECTRIC COMPANY

united engineers

Date: January 11, 1974 Project 7288

PAGE 1 of 2 LOG OF BORING SBF 5

GEOTECHNICAL ENGINEERS INC

BORING LOCATION See Scotland Road site plan INCLINATION 45 - 46° BEARING ____ DATE START/FINISH December 26, 1973 / January 8, 1974

CASING ID 3 in. CORE SIZE 1-7/8 in. TOTAL DEPTH 197.7 ft DRILLED BY American Drilling & Boring Co., T. Canning.

GROUND EL /MSL) 17.6 ft DEPTH TO WATER/DATE 0.0 ft / Dec. 26, 1973 LOGGED BY Soil - K. Polk; Rock - J. R. Rand

EL. MSL ft	SAMPLE Depth ft	Type and No.	N or Rec.	RATE OF ADV. min/ft	WATER CONTENT or RQD %	Graphic	PRESSURE TEST gpm psi	Computed k 10^{-4} cm/sec	STRIKE, DIP F = Foliation J = Joint C = Contact B = Bedding S Slickenside	CORE BREAKS	SOIL AND ROCK DESCRIPTIONS (Weathering, defects, etc.)	(Type, texture, mineralogy, color, hardness, etc.)
					0 100						CONTINUED FROM PREVIOUS PAGE	
-100	150	NQ-24	97	2.5	70						Fresh and hard. Partings are not slickensided.	Chlorites are still dark green.
		NQ-25	100	2.7	60						Slight wx	
	160	NQ-26	97	3.1	68							Becomes vaguely foliated. Apparently cataclastic. Light greenish gray.
		NQ-27	98	3.4	47				27°		Fresh and hard. Partings are not slickensided.	
	170	NQ-28	102	3.2	47						Slight wx	
		NQ-29	92	3.5	35				30°			174.2 Open contact dips 0°
	180	NQ-30	93	3.1	57							176.4 Diabase. Dark gray, not altered. Open contact dips 50. Not slickensided. Cataclastic, lt. greenish gray, fine-grained, foliated.
		NQ-31	97	3.1	62				40°			181.7 Fused, brecciated contact. Diabase, dark gray, unaltered.
	190	NQ-32	100	3.2	63				30°		Note: At 171.2' Fresh diabase butts against light green fine-grained cataclasite (calcite) stringer in diabase does not extend across into cataclasite.	Note: At 181.7', contact of diabase is brecciated, and re-cemented by calcite. Diabase is not appreciably altered.
-120		NQ-33	100	2.5	53				30°			
	197.7								BOTTOM		OF BORING	

LEGEND

N - Standard penetration resistance, blows/ft
Rec - Length recovered/length cored, %
RQD - Length of sound core 4 in. and longer/length cored, %
S - Split spoon sample ▽ Groundwater
U - Undisturbed samples
S - Shelby tube N - Denison
F - Fixed piston P - Pitcher
O - Osterberg G - GEI
D - Drilling break k - Coefficient of
wx - Weathered, weathering permeability

NOTES

SEABROOK STATION

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

YANKEE ATOMIC ELECTRIC COMPANY

united engineers

Date: January 11, 1974 Project 7286

PAGE 2 of 2 LOG OF BORING SRF 5

GEOTECHNICAL ENGINEERS INC

BORING LOCATION See Scotland Rd. site plan INCLINATION Vertical BEARING _____ DATE START/FINISH Jan. 4, 1974 / Jan. 8, 1974

CASING ID 3 in. CORE SIZE 1-5/8 in. HX TOTAL DEPTH 58.0 ft DRILLED BY American Drilling & Boring; Manco

GROUND EL (MSL) 17.8 ft DEPTH TO WATER/DATE 0.0 ft / Jan. 30, 1974 LOGGED BY Soil - K. L. Polk; Rock - J. R. Rand

EL. MSL ft	Depth ft	SAMPLE Type and No.	N or Rec.	RATE OF ADV. min/ft	WATER CONTENT or RQD %	Graphic	PRESSURE TEST spen psi	Computed k 10^{-4} cm/sec	STRIKE, DIP F = Foliation J = Joint C = Contact B = Bedding	CORE BREAKS	SOIL AND ROCK DESCRIPTIONS (Weathering, defects, etc.)	(Type, texture, mineralogy, color, hardness, etc.)
					0 ——— 100				S = Slickensided			
17.8		S1, S1A	1.0', 3								S1-Brown organic silt. S1A - Mottled gray and brown silty clay; low plasticity.	
		S2	15								Olive-brown silty clay. Stiff to very stiff; low plasticity; somewhat blocky structure.	
		S3	15								Similar to Sample S2, but fewer brown spots. s_u(tor) > 1.0 tsf 1)	
		S4	18								Olive-brown silty clay. V. stiff; low to med. plasticity; w above PL; somewhat blocky.	
		S5	13								Similar to Sample S4. s_u(tor) > 1.0 tsf	
		S6	8								Similar to Sample S4, but also contains some gray streaks up to 3 mm thick.	
	10	S7	5								Similar to Sample S4, but medium stiff. s_u(tor) = 0.45 tsf.	
		S8	3								Gray silty clay. Soft; medium plasticity; slightly sticky. s_u(tor) = 0.26 tsf	
0	20	S9	4								Similar to Sample S8, but more sticky. s_u(tor) = 0.15 tsf	
		S10	5								Similar to Sample S8, but more sticky. s_u(tor) = 0.14 tsf	
	30	S11	5								Similar to Sample S8, but more sticky. s_u(tor) = 0.20 tsf	
		S12	5								Similar to Sample S8. s_u(tor) = 0.25-0.30 tsf	
-20		S13	4					TOP	OF SAND		Similar to Sample S8, few silty fine sand layers to 1 mm thick. s_u(tor) = 0.30 tsf	
	41.0	S14	1.3/6"								Layered gray silty clay and silty fine sand. Clay is soft; low to medium plasticity;	
		S15	12								in layers up to 30 mm thick. Sand is uniform; in layers up to 10 mm thick.	
		S16	9/6"					TOP	OF TILL			
	46.5											
	50	S17	70								Gray-brown silty medium to coarse sand. Widely graded; fines are nonplastic; sub-	
		S18	85/6"					TOP	OF ROCK		angular to subrounded grains; contains a few gravel pieces up to 8 mm in size.	
	53											
		BX-1	92	3.0	57						Minor rusty Not wx. Altered by hydro- Cataclastic, foliated. Fused	
-40	58										Minor rusty thermal bleaching. breccia, medium-light greenish gray.	
								BOTTOM	OF BORING			

Note: Casing bent at ± 14 ft while driving and hole could not accept N-barrel for 5 ft only. Could not risk a second run due to caving potential at base of casing.

Note: Rock is medium-fine grained, groundmass contains sub-rounded fragments and micro-faulted piece. All fused. Joints show minor rusty surface wx effects. Not slickensided.

LEGEND

N - Standard penetration resistance, blows/ft
Rec - Length recovered/length cored, %
RQD - Length of sound core 4 in. and longer/length cored, %
S - Split spoon sample ▽ Groundwater
U - Undisturbed samples
S - Shelby tube N - Denison
F - Fixed piston P - Pitcher
O - Osterberg G - GEI
D - Drilling break k - Coefficient of
wx - Weathered, weathering permeability

NOTES

1) S_u(tor) = Shear strength measured with Torvane

SEABROOK STATION

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

YANKEE ATOMIC ELECTRIC COMPANY

united engineers

Date: March 9, 1974 Project 7298

PAGE 1 of 1 LOG OF BORING SRF 6

GEOTECHNICAL ENGINEERS INC.

BORING LOCATION See Scotland Road site plan INCLINATION 45° BEARING SSE or 136° T DATE START/FINISH Jan. 8, 1974 / Jan. 18, 1974

CASING ID 3 in. CORE SIZE 1-7/8 in. TOTAL DEPTH 235.0 ft DRILLED BY American Drilling & Boring; T. Canning,

GROUND EL (MSL) 17.5 ft DEPTH TO WATER/DATE 8.3 ft / Jan. 18, 1974 LOGGED BY Soil - K. Polk; Rock - J. R. Rand

EL. MSL ft	SAMPLE Depth ft	Type and No.	N or Rec.	RATE OF ADV. min/ft	WATER CONTENT or RQD %	Graphic	PRESSURE TEST gpm psi	Computed k 10^{-4} cm/sec	STRIKE, DIP F = Foliation J = Joint C = Contact B = Bedding	CORE BREAKS	SOIL AND ROCK DESCRIPTIONS (Weathering, defects, etc.)	(Type, texture, mineralogy, color, hardness, etc.)
17.5					0 100				S : Slickensides			
		1)			None							
		2)										
	10											
	20											
0	30											
	40											
	50											
-20	60											
65.5							TOP	OF ROCK				
	70	NQ-1	92	1.5	42						Minor rusty	Fairly fresh and hard throughout but altered by bleaching. Partings are not slickensided.
		NQ-2	83	1.3	47						Minor rusty 1' core lost	
		NQ-3	100	1.3	13						Minor rusty	
	80	NQ-4	77	1.3	23						Driller broken at close intervals	Not wx. Core broken throughout into 1' to 4' pieces by poor drilling.
-40		NQ-5	100	1.4	8							
	90	NQ-6	100	1.4	0							
		NQ-7	93	2.0	25						Discontinuous vertical joint strikes NW	
	100	NQ-8	100	2.1	55							Not wx. Bleached by hydrothermal alteration to greenish-gray.
		NQ-9	97	1.9	47						Striated	
-60	110	NQ-10	85	2.1	12						2' core lost Soft, some talc	112' to 114' core lost in soft zone. Minor rough slickensides.
		NQ-11	80	2.1	7							
	120	NQ-12	100	2.2	55				5)			Not wx. Hydrothermally altered throughout. Fairly hard. Drills well. Partings tend to parallel foliation.
		NQ-13	98	2.1	73				N18E, 43NW N68W, 38NE N46E, 38NW		Slickensided-minor polish	
	130	NQ-14	95	1.6	43				N41E, 68NW N48E, 81NE N20W, 58NE		Internal slickensides parallel to foliation Fused	
-80		NQ-15	97	2.6	63							
	140	NQ-16	83	2.3	33						Mislatch 1' core lost Somewhat softened by alteration	Not wx. Hydrothermally altered. Light tan bleach. Joints and partings are not slickensided.
148		NQ-17	92	2.0	23							

95.2	Calcite vein		Fused intrusive contact, NE strike Diabase. Dark gray fine grained Younger than alteration in country rock. Calcite veinlets.
99.2			Cataclastic. Medium grained foliated diorite to 103'. Fine-grained, foliated with small quartz eyes below. Becomes very fine-grained.
114.0			Greenish tan (?)Diabase (?)-Bleached to greenish tan, aphanitic. May be mylonite. Hairline foliation.
	Welded breccia		Welded breccia Cataclastic. Fine-grained, medium light greenish gray. Does not resemble diabase. Irreg. veining (feldspar) throughout.
133'			Light greenish tan
			Diorite-granodiorite. Medium grained, light greenish gray. Locally foliated.
			Granodiorite. Light tannish gray (extensive bleaching), foliated, medium grained.

LEGEND

N - Standard penetration resistance, blows/ft
Rec - Length recovered/length cored, %
RQD - Length of sound core 4 in. and longer/length cored, %
S - Split spoon sample ▼ Groundwater
U - Undisturbed samples
S - Shelby tube N - Denison
F - Fixed piston P - Pitcher
O - Osterberg G - GEI
D - Drilling break k - Coefficient of permeability
wx - Weathered, weathering

NOTES

1) Angle hole
2) Washed through soil from 0-65.5' - no sample taken.
3) Roller bitted to 66.0'
4) No clays present; therefore, no water contents were determined.
5) This is only a partial list of dip and strike data.

SEABROOK STATION

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

YANKEE ATOMIC ELECTRIC COMPANY

united engineers

Date: February 13, 1974 Project 7286

PAGE 1 of 2 LOG OF BORING SBE 7

GEOTECHNICAL ENGINEERS INC

BORING LOCATION Sec Scotland Road site plan INCLINATION 45° BEARING S44E or 136° DATE START/FINISH Jan. 8, 1974 / Jan. 18, 1974

CASING ID 3 in. CORE SIZE 1-7/8 in. TOTAL DEPTH 255.0 ft DRILLED BY American Drilling & Boring; T. Canning

GROUND EL (MSL) 17.5 ft DEPTH TO WATER/DATE 0.3 ft / Jan. 18, 1974 LOGGED BY Soil - K. L. Polk; Rock - J. R. Rand

EL. MSL ft	SAMPLE Depth ft	Type and No.	N or Rec.	RATE OF ADV. min/ft	WATER CONTENT or RQD %	Graphic (0 ... 100)	PRESSURE TEST gem psi	Computed k 10^{-4} cm/sec	STRIKE, DIP F = Foliation J = Joint C = Contact B = Bedding S = Slickenside	CORE BREAKS	SOIL AND ROCK DESCRIPTIONS (Weathering, defects, etc.)	(Type, texture, mineralogy, color, hardness, etc.)

CONTINUED FROM PREVIOUS PAGE

-150		NQ-18	92	2.0	35							
		NQ-19	100	2.4	48							
-160		NQ-20	100	2.2	32							
-100		NQ-21	100	1.9	45							
-170		NQ-22	97	1.9	28							
		NQ-23	100	2.0	51							
-180		NQ-24	100	2.3	55							
		NQ-25	100	1.7	28							
-190		NQ-26	100	1.6	72							
-120		NQ-27	100	1.7	25							
	x	NQ-28	100	1.8	40				N53E, 24NW	J		
-200	x	NQ-29	100	1.9	87				N78E, 38NW N20E, 82NW N40E, 45SE	J J F		
	x	NQ-30	100	1.7	80				N86W, 42NE N84W, 90 N80E, 70NE	F J S		
-210	x	NQ-31	100	1.9	52				N66E, 17NW Horizontal N80E, 73NW N75E, 59NW	S F S S		
	x	NQ-32	100	2.3	55							
-220		NQ-33	100	2.1	53							
-140	x	NQ-34	100	2.1	90				N59E, 52NW	S		
									N52E, 78NW N42E, 80NW N61E, 77SE	S S J		
-230	x	NQ-35	100	2.5	54							
									N67W, 81NE N81E, 44NW N35W, 33NW	S S J		
	x	NQ-36	100	2.6	65				N35W, 72NE N60W, 59NE N61W, 13NE N72E, 58NW	J J J J		
-240	x	NQ-37	100	2.3	50							
	x	NQ-38	100	2.6	43				N61E, 60NW N30E, 16NW	J S		
-160	x	NQ-39	100	2.6	46				N70E, 61NW N85E, 60NW N72E, 56NW N52E, 44NW	J F S J		
-255	x	NQ-40	64	2.5	18							
								BOTTOM	OF BORING			

Breccia-fused Driller ground	Not wx. Minor surface wx effects on partings. Partings generally parallel to foliation. Not so bleached as above. Not slickensided.	149.7	Broken contact. No visible attitude. Cataclastic. Fine-grained, medium gray fused breccia. Hairline veinlets. Medium dark green (epidote) beginning 155'
Slight wx Not extensively bleached, moderate alteration only	Not wx. Some minor wx effects locally on joints. Tends to part parallel to foliation. Not slickensided. Competent, fairly hard. Drills fairly well.	Less bleached Epidote Offset veinlets Fused Fused breccia throughout	Cataclastic. Fine-grained, locally foliated and brecciated (fused). Medium-dark greenish gray. Epidotized. Cataclastic. Fine-grained becoming prominently foliated, brecciated. Not cut by cross-cutting veinlets. Hard, breccia is fused (annealed). Not fissile or slickensided. Medium greenish gray.
Moderate bleaching alteration	Not wx. Minor surface wx effects on joints and partings. Not slickensided.		Cataclastic. Fine-grained matrix, epidote banding. Extensive fused breccia fabric. Light yellow-green mylonite (aphanitic) at 210.6-211.6'. Fused throughout. Not slickensided.
Smooth. Moderate wx, minor striated Slickensided on folintion Pyrite xtals Smooth, soft Moderate wx Smooth, chlorite	Not wx internally. Joints and partings not polished. Some slickensides. Some slickensides and softened rock at 222.4'.	mylonite	
	Fresh and hard. Drills well. Joints and partings show minor surface wx. Not slickensided.	213.7	Clinton-Newbury fault. Contact fused. Moderate wx at 213.2' Diorite. Slight alteration and foliation to about 218'. Medium grained, medium gray. Veined below 218'. Diorite. Medium grained, medium dark to dark gray. Not altered hydrothermally. Irregularly calcite-veined throughout. Fused.
Hematite Moderate wx Minor slickensided Moderate wx	Fresh and hard. Local zones of slight to moderate wx. Not hydrothermally altered.		Diorite. Mixed medium-grained dark gray diorite enclosing fine-grained, dark gray diorite inclusions. Extensively irregularly veined.
9' left in hole			

LEGEND

N - Standard penetration resistance, blows/ft
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U - Undisturbed samples
S - Shelby tube N - Denison
F - Fixed piston P - Pitcher
O - Osterberg G - GEI
D - Drilling break k - Coefficient of
wx - Weathered, weathering permeability

NOTES
x - Oriented core

SEABROOK STATION

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

YANKEE ATOMIC ELECTRIC COMPANY

united engineers

Date: April 18, 1974 Project 7286

PAGE 2 of 2 LOG OF BORING SBF 7

GEOTECHNICAL ENGINEERS INC

BORING LOCATION See Scotland Rd. site plan | INCLINATION Vertical | BEARING | DATE START/FINISH Jan. 25, 1974 / Feb. 19, 1974

CASING ID 3 in. | CORE SIZE 1-7/8 in. | TOTAL DEPTH 172.0 ft | DRILLED BY American Drilling & Boring; T. Canning

GROUND EL (MSL) 17.6 ft | DEPTH TO WATER/DATE Tidal ft / - | LOGGED BY Soil - K. L. Polk; Rock - J. R. Rand

EL. MSL ft	Depth ft	Type and No.	N or Rec.	RATE OF ADV. min/ft	WATER CONTENT or RQD %	Graphic (0 — 100)	PRESSURE TEST: Open psi	PRESSURE TEST: Computed k 10^{-4} cm/sec	STRIKE, DIP (F = Foliation, J = Joint, C = Contact, B = Bedding, S = Slickensides)	CORE BREAKS	SOIL AND ROCK DESCRIPTIONS (Weathering, defects, etc.)	(Type, texture, mineralogy, color, hardness, etc.)
17.6		S1,SA	0,5		3)						Similar to Sample S1A, but very stiff. s_u(tor) > 1.0 tsf	2)
		S2	24		29.4						Similar to Sample S1A, but very stiff. s_u(tor) > 1.0 tsf	
		S3	29		27.4							
		S4	14		33.8						Similar to Sample S4, but fewer brown spots; softer. s_u(tor) = 0.58 tsf	
		S5	7		40.4						Similar	
		S6	4		41.9							
	-10	S7	2/18"		46.9						Gray silty clay. Soft; medium plasticity; slightly sticky; contains one brown spot 10 mm in size. s_u(tor) = 0.15 tsf	
0		S8	0		51.1						Similar to Sample S7, but contains some slightly darker and lighter colored layering. s_u(tor) = 0.15 tsf	
	-20	S9	3		33.1						Similar to Sample S7, but contains some darker and lighter colored layers dipping ~10°. s_u(tor) = 0.18 tsf	
		S10	8		43.3						Similar to Sample S7, but contains a silty fine sand layer; sticky (very disturbed).	
	-30	S11	2		44.3						Similar to Sample S7, but very soft and sticky (very disturbed).	
	33.0							TOP	OF SAND			
-20		S12	5								Gray-brown slightly silty fine to medium sand. Uniform; fines are nonplastic.	
	-40	S13	0								Similar to Sample S12, but contains a clay layer and few gravel pieces up to 5 mm in size.	
		S14	39								Similar to Sample S12, but contains a clay layer and a few gravel pieces up to 15 mm in size.	
	48.0							TOP	OF ROCK			
	-50	1)							3)			
		NQ-1	52	1.5	0						Slight wx	Generally not wx internally. Breaks on foliation with slight powdery wx effects on partings surfaces. Medium greenish-gray hydrothermal alteration.
-40		NQ-2	95	1.3	25						Slight wx on partings D	
	-60	NQ-3	98	1.4	83						Slight wx	
		NQ-4	100	1.4	74							
	-70	NQ-5	93	1.5	82				N78W, 57NE	F	Slight wx D	Not wx. Minor wx effects on some partings as well as some striated, but not polished surfaces
		NQ-6	100	1.0	95				N88E, 60NW	F		
-60		NQ-7	100	1.0	86				N81E, 36NW N36W, 40NE N49W, 27NE	J F J		
	-80	NQ-8	100	1.0	63				N10E, 25SE N79W, 54NE	S J		
		NQ-9	100	1.1	82				N36W, 29NE	J	Foliation	Not wx. Drills well. Light green-gray hydrothermal alteration. Soft, powdery zone at 96 ft probably wx associated with joint. Local striated joints or partings usually parts on foliation.
	-90	NQ-10	100	1.1	87				N87W, 75NE	J		
-80		NQ-11	100	1.2	31				N50W, 27NE N35W, 36NE N87E, 64NW	S J B	Soft-striated Powdery surface Chips	
	-100	NQ-12	83	1.2	75				N 7E, 35SE	J		
		NQ-13	100	1.2	78				N72E, 47NW N57W, 29NE N54W, 47NE	F J F		Not wx. Joints show minor slippery chlorite-talc coatings. Not polished. Subject to hydrothermal alteration, epidotization.
		NQ-14	98	1.2	93				N82E, 37NW N70E, 36NW N5E, 54NW	J J F		
	-110	NQ-15	100	1.0	80				N71W, 76NE N40W, 12NE	J J		
-100		NQ-16	92	1.0	23						Chips	Not wx. Minor surface wx effects on partings. Partings also show some striated, not polished surfaces.
	-120	NQ-17	100	1.0	83							
		NQ-18	100	0.8	58							
		NQ-19	100	1.0	100							
	-130	NQ-20	100	1.1	82							
-120		NQ-21	100	1.1	70						Minor rusty	Not wx. Medium-gray green bleaching due to hydrothermal alteration. Minor surface wx effects on partings. Some partings striated.
	-140	NQ-22	100	1.0	62						Chlorite	
	145											

Highly deformed welded breccia

Welded breccia throughout

Less bleached

Fused contact, deformed dip 60°

80.0' Cataclastic. Medium dark greenish gray. Deformed veins.

83.6'

Fused breccia

Epidote Cataclastic. Fine-grained, medium greenish gray. Foliated. Local fused breccia zones.

Diorite

Cataclastic. Fine-grained, medium greenish gray. Zones of welded breccia, hairline epidote stringers.

Welded breccia

Welded breccia throughout

Cataclastic. Fine-grained, medium light greenish-gray. Local welded breccias. Fairly well foliated.

Light tan

Medium grained

Cataclastic. Fine-grained, fused breccia throughout. Medium greenish-gray.

Cataclastic. Fine-grained, bleached to light tan-green gray.

LEGEND

N - Standard penetration resistance, blows/ft
Rec - Length recovered/length cored, %
RQD - Length of sound core 4 in. and longer/length cored, %
S - Split spoon sample ▼ Groundwater
U - Undisturbed samples
S - Shelby tube N - Denison
F - Fixed piston P - Pitcher
O - Osterberg G - GEI
D - Drilling break k - Coefficient of permeability
wx - Weathered, weathering

NOTES

1) Roller bitted to 53 ft.
2) s_u(tor) = Shear strength measured with Torvane
3) This is only a partial list of dip and strike data.

x - Oriented core

SEABROOK STATION

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

YANKEE ATOMIC ELECTRIC COMPANY

united engineers

Date: March 9, 1974 Project 7286

PAGE 1 of 2 | LOG OF BORING SRF 6

GEOTECHNICAL ENGINEERS INC.

BORING LOCATION See Scotland Rd. site plan | INCLINATION Vertical | BEARING _____ | DATE START/FINISH Jan. 25, 1974 / Feb. 19, 1974

CASING ID 3 in. | CORE SIZE 1-7/8 in. | TOTAL DEPTH 172.0 ft | DRILLED BY American Drilling & Boring; T. Canning

GROUND EL (MSL) 17.6 ft | DEPTH TO WATER/DATE Tidal ft / - | LOGGED BY Soil - K. L. Polk; Rock - J. R. Rand

EL. MSL ft	SAMPLE Depth ft	Type and No.	N or Rec.	RATE OF ADV. min/ft	WATER CONTENT %	or RQD Graphic 0 100	PRESSURE TEST gpm psi	Computed k 10^{-4} cm/sec	STRIKE, DIP F = Foliation J = Joint C = Contact B = Bedding S = Slickenside	CORE BREAKS	SOIL AND ROCK DESCRIPTIONS (Weathering, defects, etc.) (Type, texture, mineralogy, color, hardness, etc.)
									CONTINUED FROM PREVIOUS PAGE		
-145											
		NQ-23	100	1.1	57				N72E, 68NW J,F N85W, 81SW J N85W, 28NE S		Not polished.
-150											
		NQ-24	100	1.2	78				N86W, 60NE F N82E, 28NW J		
-140		NQ-25	100	1.2	77				N59W, 40SW J N85E, 56NW F		Not wx. hydrothermally altered to 163.6'. Fresh, essentially unaltered below partings generally parallel foliation. A few striated surfaces, not polished.
-160									N34W, 19NE J N75E, 51NW F		Chips
		NQ-26	98	1.2	47						Chips Not slickensided
		NQ-27	98	1.5	57				N63W, 56NE F N21W, 34SW S		
-170									N27E, 70NW F		Smooth joint
		NQ-28	100	1.2	71				N89E, 46NW F		
	172								BOTTOM OF BORING		

160.2' to 160.4' Mylonite

Intensely deformed, rewelded. Not cut by cross-cutting veinlets. No observable calcite.

Cataclastic. Fine-grained fused breccia, hairline epidote. Medium greenish gray-tan at 159-160.6 ft

Fault zone-transitional-not slick.

Diorite. Slight alteration and foliated to about 168 ft. Medium-fine grained, medium gray.

LEGEND

N - Standard penetration resistance, blows/ft
Rec - Length recovered/length cored, %
RQD - Length of sound core 4 in. and longer/length cored, %
S - Split spoon sample ▽ Groundwater
U - Undisturbed samples
S - Shelby tube N - Denison
F - Fixed piston P - Pitcher
O - Osterberg G - GEI
D - Drilling break k - Coefficient of permeability
wx - Weathered, weathering

NOTES

SEABROOK STATION

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

YANKEE ATOMIC ELECTRIC COMPANY

united engineers

Date: March 9, 1974 Project 7286

PAGE 2 of 2 | LOG OF BORING SRF 8

GEOTECHNICAL ENGINEERS INC.

BORING LOCATION See Scotland Rd. site plan | INCLINATION Vertical | BEARING | DATE START/FINISH Dec. 20, 1973 / Jan. 3, 1974

CASING ID 3 in. | CORE SIZE 1-7/8 in. | TOTAL DEPTH 118.3 ft | DRILLED BY American Drilling & Boring: T. Canning, T. Paquette

GROUND EL (MSL) 17.8 ft | DEPTH TO WATER/DATE 0.2 ft / Dec. 20, 1973 | LOGGED BY Soil - K. L. Polk; Rock J. R. Rand

EL. MSL ft	SAMPLE Depth ft	Type and No.	N or Rec.	RATE OF ADV. min/ft	WATER CONTENT or RQD %	Graphic (0 — 100)	PRESSURE TEST rpm / psi	Computed k 10^{-4} cm/sec	STRIKE, DIP F = Foliation J = Joint C = Contact B = Bedding S = Slickenside	CORE BREAKS	SOIL AND ROCK DESCRIPTIONS (Weathering, defects, etc.)	(Type, texture, mineralogy, color, hardness, etc.)
17.8		S1, S1A			*						Dark brown clayey topsoil; some small roots; organic odor. S1A-Mottled gray, brown, and rusty-brown silty clay. Low plasticity. s_u(tor) > 1.0 tsf. S2-Similar to Sample S1A, with blocky structure. s_u(tor) > 1.0 tsf. S3-Olive-brown silty clay. Low to medium plasticity; w above P.L.; nonsticky; somewhat blocky structure. s_u(tor) > 1.0 tsf. S4-Similar to Sample S3. s_u(tor) > 1.0 tsf. S5-Similar to Sample S3; but stiff; spots. s_u(tor) = 0.5-0.6 tsf. S6-Olive-brown to olive-gray silty clay. Medium plasticity; nonsticky; contains a few silt layers < 0.5 mm thick. s_u(tor) = 0.36-0.42 tsf. S7-Similar to Sample S6, but slightly sticky. s_u(tor) = 0.32 tsf.	
		S2			27.4							
		S3			28.2							
		S4			33.0							
		S5			37.9							
		S6			40.3							
	10	S7			40.0							
0		S8	0		45.8						Gray silty clay. Soft; medium to high plasticity; sticky. s_u(tor) = 0.15 tsf	
	20	S9	3		41.9						Similar to Sample S8, but has a blocky structure; appears disturbed. s_u(tor) = 0.23 tsf	
		S10	3		44.1						Similar to Sample S8, but has a blocky structure; appears very disturbed. s_u(tor) = 0.10 tsf	
	30	S11	8		29.5						Similar to Sample S8, but medium stiff; blocky structure; appears very disturbed. s_u(tor) = 0.43 tsf	
		S12	9		29.6			TOP	OF SAND		Similar to Sample S8, but has a blocky structure; contains layers of silty fine sand up to 20 mm thick.	
-20	37.0											
	40	S13	11								Gray fine sand. Uniform; clean; very fast reaction to shaking test.	
		S14	0								Similar to Sample S13, but also contains a layer of coarse sand.	
	50	S15	24								Light gray fine to coarse sand. Widely graded; very slightly silty; subangular grains; contains a few gravel pieces up to 15 mm in size.	
	55.0							TOP OF	TILL			
	57.0							TOP OF	ROCK			
-40	60	NQ-1	90								Chips: Not wx internally, but is bleached by hydrothermal alteration. Minor wx effects on partings. Parts on foliation. No polished slickensides. Some partings striated. Moderate wx 72.5' to 74.5'.	Welded breccia throughout: Cataclastic. Generally fine-grained, medium greenish gray (epidotized). Predominantly welded breccia throughout quartz veinlets x-cut foliation.
		NQ-2	100	1.0	33							
		NQ-3	100	1.2	26							
	70	NQ-4	100	1.2	7						Chips 72.5' Ground chips 74.5' Chlorite	
-60		NQ-5	97	1.2	43				N81E, 58NW F			
	80	NQ-6	100	1.5	28				N42E, 34NW F N14E, 36NW F N84E, 18NW F N74W, 15NW F N74W, 65NE J N34W, 46SW F		Chips: Not wx internal. Joints and partings are not polished. Some striated surfaces.	Tan mylonite: Light yellow-green alteration 80' to 81.7'.
		NQ-7	100	1.9	53				N76E, 48NW F N15E, 51SE J		Chips-slight wx	
	90	NQ-8	96	2.0	65				North, 78E J N75W, 30NE J East, 55N F		Chlorite-striated	Diorite. Medium-grained, medium gray. Unaltered rock - feldspar veinlets. Foliated to about 89' depth.
-80		NQ-9	98	2.0	98							
	100	NQ-10	100	2.0	100				N34W, 56NE F		Fresh and hard. Drills well. Joints and partings not slickensided. Not affected by hydrothermal alteration or mechanical deformation.	
		NQ-11	64	1.9	7						D Driller mislatch	Diorite - amphibolite. Medium-grained, dark gray, irregular feldspathic veinlets.
		NQ-12	100	1.8	48							
	110	NQ-13	100	2.0	83						Slight wx	
		NQ-14	100	2.0	62						Fresh and hard. Not deformed or altered by faulting effects.	Diorite - amphibolite. Medium-grained, dark gray, not foliated.
-100	118.3							BOTTOM	OF BORING			Pink quartzite (?)

LEGEND

N - Standard penetration resistance, blows/ft
Rec - Length recovered/length cored, %
RQD - Length of sound core 4 in. and longer/length cored, %
S - Split spoon sample ▽ Groundwater
U - Undisturbed samples
S - Shelby tube N - Denison
F - Fixed piston P - Pitcher
O - Osterberg G - GEI
D - Drilling break k - Coefficient of permeability
wx - Weathered, weathering

NOTES

1) s_u(tor) = Shear strength measured with Torvane.

* 1 - 103.4, 1A - 30.6

x - Oriented core

SEABROOK STATION

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

YANKEE ATOMIC ELECTRIC COMPANY

united engineers

Date: May 8, 1974 | Project 7286

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GEOTECHNICAL ENGINEERS INC.