PHASE II
WORK PLAN
RFP No 3

EMPIRE
SOILS INVESTIGATIONS INC.

GEOTECHNICAL INVESTIGATION
PROPOSED OUTER HARBOR DEVELOPMENT
BUFFALO, NEW YORK

For

Niagara Frontier Transportation Authority
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BTA-86-94B
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I. INTRODUCTION

This report presents the results of our subsurface investigation and geotechnical recommendations for the Outer Harbor Development Plan proposed by the Niagara Frontier Transportation Authority (NFTA). It is our understanding that the results of this investigation will be used by the NFTA to determine the feasibility of the proposed developments. The proposed Outer Harbor Development Plan encompasses approximately 150 acres along the Lake Erie Shoreline in the vicinity of the NFTA Small Boat Harbor Marina and the Buffalo Port Terminal. The location of the proposed development is given on Drawing 1 in Appendix A.

Our subsurface investigation and engineering evaluation were formally authorized on November 3, 1986 by Mr. Raymond F. Gallagher, Chairman of the NFTA (Purchase Order No. 1003069). Our work was performed in general accordance with our NFTA approved work plan dated September 1986. Borehole locations and general information regarding the proposed development were provided in the August 5, 1986 "Request for Proposal" from the NFTA.

The scope of our services included the following:

- Coordinate the layout and determination of elevations of boreholes by our M.B.E. subcontractor, Larsen Engineers of Rochester, New York
- Plan, supervise and coordinate the subsurface investigation by our affiliate company, Empire Soils Investigations, Inc. (ESI)

- Prepare final subsurface boring logs
- Collect monitoring well data
- Prepare subsurface profiles
- Perform laboratory testing (physical) of recovered soil and rock samples
- Characterize subsurface conditions
- Provide feasibility level geotechnical engineering recommendations with respect to the proposed land uses
- Present in an engineering report, all data, observations, evaluations and recommendations regarding the proposed Outer Harbor Development Plan

II. BACKGROUND

A. Site Description

The site for the proposed development is bordered by Lake Erie to the west, Fuhrmann Boulevard to the east, the Seaway Pier to the north and the former U.S. Army Corps of Engineers diked disposal facility to the south (refer to Drawing 1 in Appendix A for a site location map). The northern portion of the site, near the Seaway Pier, is presently used as transfer and storage area for bulk commodities. Several pre-engineered metal buildings and a truck weigh scale are located within this area. An unimproved gravel road runs in a north-south direction across the site and provides access between the bulk cargo facilities and the Buffalo Port terminal. A small sail boat marina exists at the eastern end of the Bell slip. The total area between the Buffalo Port Terminal and the Seaway pier is estimated to be approximately 125 acres.

The surface topography in this area is generally flat to slightly undulating with surface vegetation generally consisting of field grasses and brush with occasional small stands of deciduous trees. We point out that our site reconnaissance at the time of drilling indicates that miscellaneous fill materials have been wasted over the majority of the site. The area immediately south of the Bell slip contained substantial amounts of surface debris consisting of old concrete slabs and other construction materials. It is our understanding that this are has been recently cleared of debris.

At the time of drilling, the surface vegetation at the former diked disposal area consisted of tall swamp grasses, brush and trees. The site topography was generally flat and lower at the middle of the site. Clearing, stripping and filling operations have recently been conducted over most of the site in preparation for developing the area to provide additional parking for the NFTA Small Boat Harbor. Miscellaneous soil fill materials from nearby construction projects have been used to raise site grades on the order of 3 to 5 feet. It is our understanding that the finished grade of the gravel covered parking area will be at approximately El. 584±.

B. Proposed Development

The proposed Outer Harbor Development Plan includes development of approximately 150 acres of waterfront

property in the vicinity of the NFTA Small Boat Harbor Marina and Buffalo Port Terminal. We understand the proposed development will include the following:

- development in the area north of the Bell slip will include paved parking and roads, landscaped areas, multifamily residential units and office buildings
- development in the area south of the Bell slip will include paved roads, light industrial buildings and warehouse/distribution facilities
- it is our understanding that the former diked disposal area (south of the NFTA Small Boat Harbor Marina) will be developed primarily as a parking area for patrons of the Small Boat Harbor Marina. Development of a water sports facility and retail/service establishments is proposed along the eastern edge of the former diked disposal area

We point out that additional developments were originally proposed within the former diked disposal area, however, it is our understanding that the proposed developments have been eliminated within this area. These changes were made by the NFTA on the basis of preliminary geotechnical findings and our environmental study (BTA-86-94A).

Details regarding the proposed Outer Harbor Development Plan (OHDP) are provided on Drawings 2, 3 and 4 in Appendix A. We note that these drawings were taken from a planning study prepared by the consortium of TAMS, Planning Innovations and The Caucus Partnership (Draft Final Report dated January 1987). We point out that

Drawing 2 details the proposed Phase I development for the areas north and south of the Bell slip. Drawing 3 presents the proposed ultimate development of the same area. The proposed Small Boat Harbor development is presented on Drawing 4. It is our understanding that additional details regarding structure types, column spacings, loads, site grading and finished floor elevations are not available at this time.

III. SUBSURFACE INVESTIGATION

All borehole locations were staked in the field by a survey crew from Larsen Engineers of Rochester, New York. Boreholes were staked at locations determined by the NFTA. Elevations of the ground surface adjacent to each of the boreholes were determined by the Larsen Engineer's survey crew using differential leveling techniques. Borehole elevations have been referenced to the International Great Lakes Datum (IGLD 1955). The benchmark that was used to establish the borehole elevations was the top of the westerly 10 feet diameter corrugated metal pipe which is located along the southern shoreline of the NFTA Small Boat Harbor Marina. The elevation of the benchmark is 576.16 IGLD. We point out that elevations referenced to the IGLD can be converted to elevations with respect to the City of Buffalo Datum (CBD) by subtracting 574.13. Elevations referenced to the IGLD can also be converted to the National Geodetic Vertical Datum (NGVD 1929) by adding 1.23

feet (Note: this conversion between IGLD and NGVD is only valid within the project area). We point out that the topographic maps prepared by the United States Geological Survey are referenced to the NGVD. In summary, the borehole elevations are presented with respect to the IGLD. Conversion of elevations between the various datums can be made using the following relationship, El. 0.00 CBD = El. 574.13 IGLD = El. 575.36 NGVD.

The twenty-seven (27) boreholes were advanced by ESI during the period of December 1, 1986 to January 21, 1987. Exploratory boreholes were advanced using hollow stem augering techniques (with center plug) in overburden soils and rotary drilling with diamond impregnated bits in rock. Standard Penetration Tests (SPT) generally conforming to ASTM D-1586 were performed continuously in overburden soils from the ground surface to depths of 10 to 12 feet and at 5-feet intervals thereafter to refusal on bedrock.

In conducting the SPT, disturbed, representative soil samples are obtained by driving a two (2)-inch outside diameter split-spoon sampler into the undisturbed soil beneath the hollow stem augers with a 140-pound hammer falling freely for 30-inches. The number of hammer blows required to advance the split-spoon sampler in three (3) or four (4) six (6)-inch increments is counted. The SPT N-value is the sum of hammer blows required to drive the split-spoon sampler for the second and third six (6)-inch

increments. Refusal was generally considered to be 100-hammer blows for six (6)-inches or less of sampler penetration. Overburden soils were tested and sampled in this manner to a maximum depth of 81.5 feet at borehole location B-23.

Bedrock was cored at the completion of overburden drilling, testing and sampling at borehole locations B-3, B-4, B-5, B-7, B-13, B-14, B-15, B-17, B-18, B-24 and B-27 using an NQ"2" size bit with a core barrel. The resulting NQ"2" size core is approximately two (2)-inches in diameter.

All boreholes were sounded for the presence of and depth to ground water at the completion of drilling. Ground water observation wells, consisting of 1.5-inch inside diameter PVC pipe, were installed at borehole locations B-3, B-5, B-7, B-8, B-13 and B-15. The manufactured slot size on the PVC pipe was 0.01-inches (i.e. No. 10 slot). Each well was constructed with the slotted zone extending from the tip of the well to an elevation approximately 10-feet higher than the tip. Blank (i.e. unslotted) PVC pipe was used to extend the wells above the slotted zone. Filter sand was placed adjacent to the slotted zone. Bentonite pellets were used to make an impervious seal above the sand pack. The remainder of the borehole was backfilled with the miscellaneous soils from the boring.

The locations and elevations of the twenty-seven (27) exploratory boreholes (B-1 through B-27) are given on Drawing 5 in Appendix A. We note that the locations of boreholes previously advanced by ESI in the study area for other NFTA projects are also shown on Drawing 5. The eleven (11) boreholes, in which bedrock was cored are indicated on Drawing 5. Drawing 5 also gives the locations of the six (6) ground water observation wells which were installed. A summary of the subsurface exploration is presented in Table 1.

A total of 1808.3 linear feet of overburden soils were drilled, tested and sampled during the ESI subsurface investigation. In addition, a total of 77.7 linear feet of bedrock was cored. Recovered soil and rock samples were visually classified by an ESI geologist. The individual boring logs presented in Appendix B have been prepared on the basis of the ESI driller's field logs and the visual classification of recovered samples. The logs are prefaced with a sheet titled "General Information and Key to Subsurface Logs" which serves as an explanation of the terms and symbols used in preparing the logs. The logs for boreholes which were previously advanced at the site are presented in Appendix C.

TABLE 1. SUMMARY OF SUBSURFACE EXPLORATION

HOLE NO	SURFACE ELEVATION	FILL DEPTH (FEET)	REFUSAL DEPTH (FEET)	REFUSAL ELEVATION	ROCK CORE (FEET)	ADDITIONAL NOTES
I. OUTER HARBOR NORTH (18 BORINGS)						
B-1	583.64	7.0	61.7	521.94	---	---
B-2	583.71	21.5	48.5	535.21	---	---
B-3	581.19	23.5	43.5	537.69	5.0	CORE 43.5 TO 48.5 FT MW WITH TIP @ 21.6 FT
B-4	584.07	23.5	55.4	528.67	10.0	CORE 55.4 TO 65.4 FT
B-5	586.04	33.0	71.8	514.24	5.2	CORE 71.8 TO 77.0 FT MW WITH TIP @ 21.4 FT
B-6	591.07	32.5	75.2	515.87	---	---
B-7	585.39	15.5	63.0	522.39	9.0	CORE 63.0 TO 72.0 FT MW WITH TIP @ 21.5 FT
B-8	586.62	25.5	67.0	519.62	---	MW WITH TIP @ 22 FT
B-9	587.94	33.0	78.0	509.94	---	---
B-10	586.53	17.5	56.2	530.33	---	---
B-11	586.75	23.0	58.8	527.95	---	---
B-12	583.60	18.0	58.2	525.40	---	---
B-13	579.73	7.0	60.1	519.63	5.0	CORE 60.1 TO 65.1 FT MW WITH TIP @ 20 FT
B-14	588.17	2.0	66.3	521.87	10.0	CORE 66.3 TO 76.3 FT
B-15	585.40	33.5	63.5	521.90	5.0	CORE 63.5 TO 68.5 MW WITH TIP @ 19.1 FT
B-16	582.22	28.5	71.0	511.22	---	---
B-17	586.12	7.5	67.2	518.92	10.0	CORE 67.2 TO 77.2 FT
B-18	579.00	18.0	57.0	522.00	5.0	CORE 57.0 TO 62.0 FT
II. SMALL BOAT HARBOR (9 BORINGS)						
B-19	580.99	18.0	75.1	505.89	---	---
B-20	584.12	28.0	76.6	507.52	---	---
B-21	581.49	28.0	77.0	504.49	---	---
B-22	582.28	23.0	75.0	507.28	---	---
B-23	583.61	22.5	81.5	502.11	---	---
B-24	583.61	25.5	75.9	507.71	5.0	CORE 75.9 TO 80.9 FT
B-25	583.89	28.0	76.5	507.39	---	---
B-26	580.98	22.5	73.0	507.98	---	---
B-27	581.39	18.0	75.3	506.09	8.5	CORE 75.3 TO 83.8 FT

NOTES :

1. TOTAL DRILLING IN OVERBURDEN (FEET) = 1808.3
2. TOTAL DRILLING IN ROCK (FEET) = 77.7
3. NUMBER OF MONITORING WELLS (MW) = 6
4. BOREHOLE ELEVATIONS AND LOCATIONS DETERMINED BY LARSEN ENGINEERS OF ROCHESTER, NY
5. BENCHMARK AND BOREHOLE LOCATIONS GIVEN ON DRAWING 5 IN APPENDIX A
6. SUBSURFACE PROFILES ARE PRESENTED ON DRAWINGS 6 THROUGH 10 IN APPENDIX A

IV. SUBSURFACE CONDITIONS

A. General

Subsurface conditions at the site were evaluated on the basis of the twenty-seven (27) exploratory boreholes advanced during the subsurface investigation. We point out that this feasibility level subsurface investigation, with relatively widely spaced borings, is not intended for use in the design of structures or the designation of areas for particular uses without further subsurface investigation. It is our understanding that this information will be utilized by the NFTA as a feasibility study for the various types of proposed land uses. Due to the geographic separation, differences in proposed developments and distinctly different histories, the subsurface conditions in the areas north and south of the Bell slip (i.e. Outer Harbor North) will be discussed separately from those in the area of the former U.S. Army Corps of Engineers diked disposal facility (i.e. Small Boat Harbor).

B. Outer Harbor North

A total of eighteen (18) boreholes (B-1 through B-18) were advanced in the proposed Outer Harbor North development area. The Outer Harbor North Development area includes the areas north and south of the existing Bell slip. The ground surface elevations at borehole locations within this area were found to range between 579.0 and 591.1, with an average value of about 584.8. A statistical summary of the subsurface exploration, including surface

elevation, fill depth, refusal depth and refusal elevation, is presented in Table 2.

The subsurface investigation indicates that miscellaneous uncontrolled fill has been placed over the entire area (this agrees with historical information). Miscellaneous fill materials were encountered in each of the eighteen (18) boreholes advanced in this area. The fill depth recorded at each borehole is given in Table 1 and on the individual boring logs in Appendix B. The fill depth in the Outer Harbor North development area was found to range from 2.0 to 33.5 feet with an average depth of 20.6 feet (See Table 2).

The miscellaneous fill materials were found to consist of gravelly silty sands (SM according to the Unified Soil Classification System), sandy clayey silts (ML), sandy silts (ML), well graded gravelly sands (SW) and poorly graded sands (SP), with varying amounts of cinders, slag, glass, brick, concrete, metal, and wood fragments. As expected, SPT N-values in the fill materials were very erratic, with values ranging from weight of hammer (WOH) to sampler refusal (i.e. 100 hammer blows for 6-inches or less of sampler penetration). Typical SPT N-values for the fill materials ranged between about 5 and 15 blows per foot (bpf), however we do point out that numerous SPT recorded N-values of 5 bpf or less.

The indigenous (i.e. native) soils encountered beneath the miscellaneous fill materials were generally found to

TABLE 2. STATISTICAL SUMMARY OF SUBSURFACE EXPLORATION

	SURFACE ELEVATION	FILL DEPTH (FEET)	REFUSAL DEPTH (FEET)	REFUSAL ELEVATION
I. OUTER HARBOR NORTH (BOREHOLES B-1 THROUGH B-18)				
AVE =	584.8	20.6	62.4	522.5
STD DEV =	3.0	9.6	8.6	7.3
MAX =	591.1	33.5	78.0	537.7
MIN =	579.0	2.0	43.5	509.9
II. SMALL BOAT HARBOR (BOREHOLES B-19 THROUGH B-27)				
AVE =	582.5	23.7	76.2	506.3
STD DEV =	1.2	3.8	2.2	1.8
MAX =	584.1	28.0	81.5	508.0
MIN =	581.0	18.0	73.0	502.1

consist of very soft to medium stiff silty clays (CL) and clayey silts (ML); loose to very compact sandy silts (ML); and loose to firm gravelly sands (SW) and silty sands (SP and SM). SPT conducted in the indigenous soils indicate N-values in the range of weight of rods (WOR) to about 40 bpf. We note that typical SPT N-values are less than 10 bpf. We further note that numerous SPT recorded N-values less than 5 to 6 bpf.

Auger refusal was encountered at depths between 43.5 and 78.0 feet below the ground surface. The average depth to refusal was determined to be 62.4 feet, with a standard deviation of 8.6 feet. Rock coring performed at borehole locations B-3, B-4, B-5, B-7, B-13, B-14, B-15, B-17 and B-18 indicates that auger refusal corresponds to the top of bedrock. Refusal was generally encountered between El. 509.9 and 537.7, with an average refusal elevation of 522.5. The standard deviation was determined to be 7.3 feet, indicating that 68-percent of all refusal elevations would fall within the range of 515.2 and 529.8. A summary of the refusal depths and elevations recorded at each borehole location is presented in Table 1.

The bedrock beneath the site was found to be medium hard to hard, sound, bedded to massive, fossiliferous, finely crystalline, gray limestone rock. Core recoveries were generally excellent with 83 to 100-percent of cored rock being recovered. Rock Quality Designation (RQD)

values ranged between 75 and 100-percent. RQD of a rock is evaluated by determining the percentage recovery of core in lengths greater than twice its diameter. In the case of NQ"2" size core, all pieces with lengths equal to or greater than 4-inches are summed and divided by the total length of the coring run. RQD's determined for the bedrock at this site are generally indicative of good (75% < RQD < 90%) to excellent (RQD > 90%) rock mass quality.

North-south profiles through the Outer Harbor North development area are presented on Drawings 6, 7 and 8 in Appendix A. The profiles indicate the thickness of the miscellaneous fill layer, indigenous soils encountered beneath the fill materials, top of bedrock, free standing levels at the completion of drilling and observation well readings. SPT N-values are also indicated on the profiles. We note that due to the relatively large distance between borings (approximately 800 feet in the north-south direction and 400 feet in the east-west direction) we were unable to further define the layering (i.e. "connect the boreholes") of the indigenous soils on the profiles. We point out that conditions between the widely spaced borings may actually be different from those conditions which are shown on the profiles.

Ground water observation wells were installed at borehole locations B-3, B-5, B-7, B-8, B-13 and B-15. A summary of the most recent (May 5, 1987) observation well

readings and other pertinent well data is presented in Table 3. The observation well readings indicate that ground water can generally be expected between El. 574.7 and El. 575.8. We expect that the relatively higher ground water level recorded at borehole location B-15 (El. 577.5) reflects "trapped" water conditions within fill materials in the vicinity of the well. Due to the random and relatively pervious nature of the miscellaneous fill materials, perched or "trapped" water conditions are anticipated. We note that the miscellaneous fills are capable of yielding significant quantities of "trapped" water.

A summary of the monthly average Lake Erie water levels recorded at Station No. 3020, Buffalo Harbor, Buffalo, New York is presented in Table 4. We note that the observation well readings indicate that the ground water is generally 2 to 3 feet higher than the monthly average Lake Erie water level. We expect that ground water and lake levels will fluctuate with seasonal and weather changes. The monthly average Lake Erie water level for the period 1860 to 1986 was determined by NOA to be El. 570.59 (Cleveland Station used for historical average). We point out that Lake Erie water levels are currently (as of June 1987) 2.18 feet above the monthly average level for the period 1860 to 1986. We further note that the minimum and maximum monthly Lake Erie water levels have been recorded

TABLE 3. Summary of Most Recent Observation Well Readings

Monitoring Well No.	Ground Surface Elevation	Elevation of Well Tip	Ground Water Elevation
B-3	581.2	559.6	574.7
B-5	586.0	564.6	575.4
B-7	585.4	563.9	574.8
B-8	586.6	564.6	575.8
B-15	585.4	566.3	577.5

Notes:

1. The monitoring well at borehole location B-13 was destroyed as of May 5, 1987 as the result of recent filling activity in the vicinity of the well.

2. Well readings were obtained by an ESI technician on May 5, 1987.

TABLE 4. Monthly Mean Lake Erie Water Levels

Month	Lake Erie Water Level
December 1986	573.34
January 1987	573.19
February 1987	572.61
March 1987	572.47
April 1987	572.78
May 1987	572.77
June 1987	572.77

Notes:

1. Water levels are given in feet with respect to the International Great Lakes Datum (IGLD, 1955).
2. Water levels were recorded by NOA at the gaging station (Station No. 3020, Buffalo Harbor) located at the U.S. Coast Guard Station in Buffalo, New York.
3. Monthly average for period 1860 to 1986, El. 570.59
4. Highest Monthly average, El. 573.59 (July 1986)
5. Lowest Monthly average, El. 567.60 (Feb. 1935)
6. Highest Lake Erie water level, El. 580.65 (Dec. 2, 1985)

(Station No. 3020, Buffalo Harbor) at El. 567.60 (Feb. 1935) and El. 573.59 (July 1986), respectively. The highest Lake Erie water level was recorded (Station No. 3020, Buffalo Harbor) at El. 580.65 during a storm on December 2, 1985.

More detailed descriptions of the subsurface conditions encountered at borehole locations in this area are given on the borehole logs in Appendix B.

C. Small Boat Harbor

A total of nine (9) boreholes (B-19 through B-27) were advanced in the proposed Small Boat Harbor development area. The subsurface investigation in this area was conducted within the former U.S. Army Corps of Engineers diked disposal facility. Borehole locations are given on Drawing 5 in Appendix A. The ground surface elevations, for boreholes advanced in this area, were found to range between El. 581.0 and 584.1, with an average value of El. 582.5.

It is our understanding that this area was used by the U.S. Army Corps of Engineers for placement of dredged materials (maintenance type) from the Buffalo Harbor.

Available records indicate that the lake bottom within the slag dike was at approximately El. 562± (as sounded by the Corps of Engineers in 1967) prior to filling. Boreholes advanced in this area indicate that the thickness of the dredged materials ranged from about 18 to 23 feet (See boreholes B-19, B-22, B-23 and B-27). The borings advanced at locations B-19, B-22, B-23 and B-27 indicate that the bottom of the dredged materials ranged from El. 559.3 to El. 563.4. We note that this information correlates well with available historical information. All other borings, B-20, B-21, B-24, B-25 and B-26, apparently encountered (at least partially) the slag dike. SPT N-values for dredged materials were generally less than about 3 bpf (Refer to borehole logs B-19, B-22, B-23 and B-27 in Appendix B). SPT N-values recorded for tests conducted through the slag dike materials were generally greater than about 30 bpf. We note that many SPT conducted in the slag materials encountered sampler refusal as the result of the larger particle sizes relative to the split-spoon sampler. Such values are relatively useless from a geotechnical standpoint (other than indicating the extent of the larger materials below the ground surface). A summary of the surface elevation, fill depth, refusal depth and refusal elevation at each borehole location is presented in Table 1. A statistical summary of the subsurface exploration is presented in Table 2.

The indigenous soils encountered beneath the dredged and slag fill materials were found to consist primarily of very soft to soft silty clays (CL) and clayey silts (ML). Deposits of loose to firm silty sands (SM), gravelly sands (SP), sandy gravels (GC, GM and GW) and peat (Pt) were also encountered. SPT conducted in the indigenous soils in the Small Boat Harbor development area indicate N-values which are generally less than 4 bpf. Numerous SPT recorded N-values equal to weight of hammer (WOH) and weight of rods (WOR). We point out that the indigenous soils were formerly lake sediments that had not been "loaded" previously until about 1967 when filling of the diked area began. It is our understanding that filling operations at the diked disposal area were terminated in 1979. This represents a critical difference from the indigenous soils encountered in the Outer Harbor North development area. While both areas contain lake bed soil deposits, the indigenous soils in the northern development area have been "loaded" for a longer time period than those to the south.

Auger refusal was encountered in the area of the proposed Small Boat Harbor development at depths between 73.0 and 81.5 feet, with the average depth being 76.2 feet. Rock coring performed at borehole locations B-24 and B-27 indicates that auger refusal corresponds to the top of bedrock. The top of bedrock varies between El. 502.1 and El. 508.0, with an average value of El. 506.3. The

standard deviation was determined to be 1.8-feet, including that 68-percent of all refusal elevations would fall within the range of 504.5 and 508.1 (i.e. average ± one standard deviation). A summary of the refusal depths and elevations recorded at each borehole location is presented in Table 1. A statistical summary is presented in Table 2. The bedrock beneath the site was found to be hard, sound, bedded to massive, occasionally to very fossiliferous, finely crystalline, gray limestone rock. Core recoveries at locations B-24 and B-27 were excellent with 89-percent or more of the cored rock being recovered. RQD values were equal to 89-percent or more, indicating generally excellent rock mass quality.

Profiles through the proposed Small Boat Harbor development area are presented on Drawings 9 and 10 in Appendix A.

We note that no ground water observation wells were installed within this area as part of the geotechnical study, however, water level data is available from our environmental study. The available data indicates that ground water exists within this area (as of April 13, 1987) between El. 573.40 and El. 579.31, with an average of El. 575.7. We point out that the free standing water levels recorded at boring completion (and shown on the subsurface profiles) do not represent stabilized water conditions. We expect that water levels will fluctuate with seasonal and

weather changes. We also note that current development of the area as a parking lot (i.e. placement of relatively impervious fill materials) will reduce the amount of surface water infiltration (recharging of the ground water) and thus, we expect a long term lowering of water levels in this area. More detailed descriptions of the subsurface conditions encountered at borehole locations within the proposed Small Boat Harbor development area are given on the borehole logs in Appendix B.

V. LABORATORY TESTING

A. General

Several representative soil and rock samples recovered from boreholes were tested in our laboratory. The objectives of the laboratory testing program were: (1) confirm visual classifications, (2) characterize the relatively soft silty clay materials beneath the miscellaneous fill materials and above the top of bedrock for use in developing our recommendations for foundation and slab-on-grade construction and (3) perform unconfined compression tests on rock cores to evaluate the compressive strength of bedrock for deep foundation design.

Tests performed consisted of eight (8) liquid and plastic limits and nine (9) unconfined compression tests on rock cores. Water content tests (8 total) were also performed, however, we note that the soil samples had dried considerable in the interim between drilling and testing

(approximately 6 months). We caution that reported "tested" water contents should not be used for anything other than assessing the water content at the time of testing.

B. Index Testing

A summary of laboratory index test results is presented in Table 5. The tests conducted on the relatively soft fine grained soils below the fills and above bedrock indicate that they are generally silty clays (CL) of low to medium plasticity with liquid limits between 23 and 37-percent and plastic limits in the range of 13 to 20-percent. The soil sample from borehole B-2 is classified as a silty clay/clayey silt (CL-ML) with liquid and plastic limits of 20 and 13-percent, respectively. The test results have been plotted on the plasticity chart given on Drawing 11 in Appendix A. We note that clays having a similar geologic origin will usually plot in a narrow band which is parallel to the A-line. We further note that to date no natural soil has been found with coordinates which lie above the U-line.

C. Compressive Strength Testing of Rock Cores

A summary of test results for the compressive strength testing of rock cores is presented in Table 6. The tested rock was found to have unconfined compressive strengths between the range of 3,940 to 25,770 psi. The average unconfined compressive strength, neglecting the highest and

TABLE 5. SUMMARY OF LABORATORY INDEX TESTING

BOREHOLE NO.	SAMPLE NO.	SAMPLE DEPTH RANGE (FEET)	TESTED WATER CONTENT (%)	LIQUID LIMIT LL (%)	PLASTIC LIMIT PL (%)	PLASTICITY INDEX PI=LL-PL (%)	UNIFIED SOIL CLASSIFICATION (ASTM D2487)
B-2	14,15 & 16	30-42	12.0	20	13	7	CL-ML
B-3	10 & 11	30-37	16.9	24	14	10	CL
B-6	9,10,11 & 12	35-52	24.2	36	20	16	CL
B-10	10,11 & 12	35-47	12.4	24	14	10	CL
B-12	9,10 & 11	30-41.5	20.2	24	14	10	CL
B-13	6,7 & 8	15-26.5	19.4	31	17	14	CL
B-15	13 & 14	45-52	9.6	23	13	10	CL
B-27	8,9 & 10	25-36.5	28.6	37	20	17	CL

NOTES:

1. Borehole locations are given on Drawing 5 in Appendix A.

2. Borehole logs are given in Appendix B.

3. Tested water contents cannot be used to determine liquidity index because samples "lost" considerable moisture during prolonged (approximately 6 months) storage in glass jars. Samples were evaluated visually prior to testing and found to be very dry.

TABLE 6. COMPRESSIVE STRENGTH TESTING OF ROCK CORES

SAMPLE NO.	DEPTH (FEET)	RQD (%)	AVE. CORE DIAMETER (IN.)	AVE. CORE LENGTH (IN.)	LENGTH TO DIAMETER RATIO	AVE. X-SECT AREA (SQ.IN.)	MAXIMUM LOAD (LBS.)	TIME TO FAILURE (MINUTES)	UNCONFINED COMPRESSIVE STRENGTH (PSI)	ADDITIONAL COMMENTS
B-4A	56.9-57.7	87	1.93	4.50	2.33	3.03	38,460	11.5	12,690	
B-4B	57.7-58.4	87	1.93	4.45	2.31	2.93	75,500	7.8	25,770	No chipping during loading
B-7A	67.0-67.5	75	1.99	4.45	2.24	3.11	19,000	5.0	6,110	Some chipping noted during loading
B-7B	68.0-68.5	75	1.99	4.72	2.37	3.13	35,270	19.5	11,270	
B-13A	61.1-62.0	100	2.05	4.41	2.15	3.22	49,040	13.3	15,230	
B-13B	62.0-62.5	100	2.05	4.32	2.11	3.30	13,000	3.0	3,940	Failure along hydrocarbon stylotite
B-14A	69.1-70.3	78	2.05	4.99	2.44	3.29	50,490	12.5	15,350	
B-14B	70.3-71.1	78	2.05	4.53	2.21	3.30	62,000	11.3	18,790	Some chipping noted during loading
B-17	69.5-70.5	90	2.00	4.46	2.23	3.14	20,500	5.0	6,530	Large chips noted at 10,000 lb. load

Notes:

1. Test procedure was ASTM D-2938-79.
2. Description of rock: Gray limestone rock, medium hard to hard, sound, bedded to massive, fossiliferous, finely crystalline.
3. Rock samples were air dryed at the time of testing.
4. Borehole locations are given on Drawing 5 in Appendix A.
5. Borehole logs are given in Appendix B.
6. Sample B-13B failed outside the time limits specified by ASTM (5 to 15 minutes). The lower compressive strength may be the result of "rapid loading effects".
7. Samples B-4B, B-7A, B-13B, B-14B and B-17 were loaded to failure on July 2, 1987. Samples B-4A, B-7B, B-13A and B-14A were loaded to failure on July 29, 1987.
9. Longitudinal hydrocarbon stylotite noted for the core from borehole B-13 prior to testing. Cracking observed along stylotite for sample B-7A.
10. It is felt that "sample effects" may be responsible for the relatively lower strengths recorded from B-7, B-13 and B-17.

the lowest test values (i.e. because of their relatively large difference), was determined to be about 12,300 psi. On the basis of the test results and our experience with similar rock in the Buffalo area, we anticipate that unconfined compressive strengths on the order of 10,000 to 15,000 psi would be typical for the limestone bedrock in the area of the proposed developments.

VI. RECOMMENDATIONS FOR OUTER HARBOR NORTH DEVELOPMENT

A. General

Due to the random and highly variable composition and thickness of the existing uncontrolled miscellaneous fill materials which were encountered over the entire Outer Harbor North development area, and the very soft to medium stiff silty clays and clayey silts encountered below the fills and above bedrock, we consider the site (as is) unsuitable for development of even the most lightly loaded structures on conventional spread foundations with slab-on-grade floors. We do point out, however, that we consider it to be both technically and economically feasible to develop this area as planned following the application of insitu soil improvement methods. Following the successful application of soil improvement methods, we anticipate that lightly loaded structures can be constructed using continuous spread footings with slab-on-grade floors. We anticipate that the more heavily loaded structures will require deep foundation systems bearing on bedrock. It is also feasible that other

foundation soil improvement methods (i.e. preloading with vertical prefabricated band-shaped drains) and foundation schemes (i.e. "compensated" foundations) can be used to permit construction of the more heavily loaded structures on continuous footings or rigid concrete mats at relatively shallow depths.

B. Soil Improvement

Following the removal of all vegetation and other unsuitable materials from within the proposed building and pavement areas, we recommend that heavy tamping, also known as dynamic compaction, be used to densify the uncontrolled miscellaneous fills and underlying soils to a depth of approximately 20 feet. Dynamic compaction is considered to be the most feasible means of improving the overall support and settlement characteristics of the uncontrolled miscellaneous fill materials as well as the underlying indigenous soils. Dynamic compaction consists of repeatedly dropping a heavy weight, say 10 to 40 tons, from a height of 40 to 100 feet. The large compactive energy (i.e. weight x drop height) causes materials to densify, thus improving bearing and settlement characteristics. Improvements can easily be verified by conducting a post-treatment subsurface investigation. We also point out that the post-treatment subsurface investigation could be used as a "design level" investigation, to provide additional subsurface information for the design of structures at specific locations. We note that this

particular method of soil improvement is especially effective for compaction of heterogeneous fill materials over relatively large undeveloped areas. In addition to being relatively inexpensive, soil improvement by dynamic compaction is considered to be the most feasible alternative for improving overall site characteristics.

The spatial distribution of the compactive energy and the chronological sequence of its application are critical variables in achieving successful dynamic compaction. The efforts should be directed at improving the uppermost 20 feet of subsurface materials (i.e. generally miscellaneous fill materials). The first phase of treatment consists of widely spaced impacts (termed a pass) designed to improve the deeper materials. The time interval required between passes may range from several days to several weeks. After each pass, imprints are backfilled with surrounding materials. The initial "high energy passes" are followed by "low energy passes" (termed ironing passes) to ensure uniformity and high densities in the near surface zone. We expect that overall surface settlements as the result of dynamic compaction will range from about 1 to 3 feet depending on the composition and thickness of the fill materials.

We recommend that dynamic compaction be utilized to improve the bearing and settlement characteristics of soils to a depth of approximately 20 feet over the entire Outer

Harbor North development area. We recommend that dynamic compaction be performed so as to render subsurface materials suitable for net allowable bearing pressures of 2000 psf. We expect that treatment applied over the entire area will result in fewer problems with respect to differential settlements of buildings, pavements and utilities. We do note, however, that dynamic compaction can also be effectively used only at locations of relatively lightly loaded single story structures to locally improve the soil conditions. This can be an economical and effective means of minimizing total and differential settlements at building locations, however, problems may still be encountered with the settlement of adjacent ground (i.e. pavement grades, utility breaks, etc.). We also point out that improvement of the entire proposed development area is ideally suited to situations where exact building locations are unknown at this time or details regarding the proposed developments are unavailable. We point out that dynamic compaction should be used with caution in areas near existing structures. We note that it may be feasible for the NFTA, under the direction of Empire-Thomsen geotechnical engineers, to perform the dynamic compaction in-house (the alternative would be to retain a specialty contractor to do the work).

C. Site Preparation

Following soil improvement by dynamic compaction, it will be necessary to grade and re-compact exposed

subgrades. Prior to raising site grades, we recommend that exposed subgrades in building and pavement areas be thoroughly proof-rolled and compacted in-place utilizing a vibratory smooth-drum roller weighing 10 tons or more (Caterpillar CS-551, CS-553, Bomag BW213D, BW214D or other approved equivalent). Proof rolling must be continued until the degree of stability, as required by the geotechnical engineer on-site, has been obtained. The intent is to utilize a relatively high compactive effort to improve the supporting characteristics of load bearing subgrades as well as to detect and modify zones of unsuitable miscellaneous fill materials. Any areas which exhibit signs of instability (i.e. pumping or weaving during compaction) and which cannot be stabilized by repeated passes with the roller shall be considered unsuitable and must be undercut. Undercut areas must then be backfilled with controlled structural fill.

Controlled structural fill will be required in building and pavement areas to raise site grades. We point out that substantial ground settlements will occur as a result of dynamic compaction and that an allowance should be made when estimating structural fill quantities. Structural fill materials should generally consist of well graded sand and gravel, crusher run stone or air-cooled blast furnace slag having a maximum size of 4-inches and no more than 12-percent by weight finer than the No. 200

sieve. This type of fill is generally less sensitive to placement moisture and frost action than other "less select" materials. Fill management and compaction will generlly be easier to attain under less desirable conditions and construction related problems will be significantly less. Unprocessed bank run materials, which are available from several local sources, may also be considered for use as structural fill. Other materials may be considered on a case-by-case basis, however, we point out that suitable structural fill materials must be capable of being spread in relatively thin lifts and compacted to a minimum of 95-percent of the maximum dry density determined by ASTM D-1557 or other appropriate test method as the material requires. We recommend that all materials considered for use as structural fill be tested and approved by the geotechnical engineer prior to construction.

We point out that raising site grades generally will induce additional settlement in underlying very soft to soft silty clay materials. Settlements of the underlying silty clay materials can result in considerable downdrag (i.e. negative skin friction) on deep foundations. This potential for downdrag must be considered in design. In order to minimize the effects of settlements associated with raising of site grades, we recommend that all fill materials be placed well in advance of construction.

Vertical prefabricated drains can be used for the purpose of accelerating consolidation in the relatively impervious deposits underlying the site.

D. Building Foundations

1. Lightly Loaded Structures (Single Story)

Following proper execution of dynamic compaction and site preparation as discussed earlier in this report, lightly loaded, single story structures may be constructed using relatively stiff continuous footings. We recommend that continuous footings be a minimum of 2 feet wide and designed using an "inverted tee" (i.e. beam) structural detail. The "inverted tee" detail is essentially a stiff grade beam type foundation which will help to minimize the effects of differential settlements. Depending on the layout of columns, we recommend that consideration be given to using relatively stiff continuous footings, in lieu of isolated column footings, as a means of minimizing differential settlements.

Foundations should be constructed a minimum of 4-feet below the lowest adjacent finished grade for frost protection. To further minimize the potential for differential settlement and improve overall bearing conditions, we recommend that all foundation bearing grades be re-compacted with suitable equipment (i.e. dual drum walk behind rollers, etc.) following excavation. Following excavation and compaction of exposed subgrades, we recommend that all foundation bearing grades be carefully

inspected and approved by knowledgeable geotechnical personnel. We recommend that foundations be sized on the basis of a net allowable bearing pressure of 2000 psf, with the minimum size as previously stated. Net allowable bearing pressure is defined as the bearing pressure in excess of the overburden pressure of the adjacent finished grade.

We anticipate that floor slabs for the low rise structures can be constructed as slabs-on-grade over a relatively thick "mat" of controlled structural fill, however, we do point out that there is potential for consolidation settlement of the underlying soft silty clays. Following thorough proof rolling and approval by the geotechnical engineer, we recommend that a minimum of 1.5-feet of controlled structural fill be placed as a base course beneath the concrete floor slabs. We further recommend that the upper 0.5-feet of the 1.5-feet thick structural fill "mat" consist of select structural fill materials for improved drainage beneath the slab. The select structural fill material should be a well graded crusher run stone conforming to Item No. 304.03 of the NYSDOT Standard Specifications, with a maximum of 7 percent by weight passing a No. 200 sieve. The relatively thick controlled structural fill "mat" will provide uniform bearing and minimize potential differential settlements.

The unreinforced (only temperature and shrinkage steel) concrete floor slabs should be designed following

American Concrete Institute (ACI) procedures using 200 pounds per cubic inch as the modulus of subgrade reaction. A suitable moisture barrier, such as a 6 to 10-mil polyethylene vapor barrier, should be placed over the well compacted select structural fill base course to prevent floor dampness. We recommend that the floor slabs have a minimum thickness of 6-inches. Proper care should be taken to ensure that the slabs are effectively isolated from walls, columns, drain pipes and so forth to accommodate settlement.

We also point out that it is technically feasible to support lightly loaded, single story buildings, which are relatively small in plan, on a stiff structural concrete mat bearing on approximately 1.5 feet of controlled structural fill. The mat should be designed with frost walls to minimize the potential for frost action beneath the mat. The frost walls should extend to a depth of 4-feet below adjacent exterior finished grades. We note that when structural loads are so large that the required continuous footings occupy approximately 50-percent of the building area in plan, it will generally be more economical to use a continuous mat over the entire area. Our recommendations presented earlier for the preparation of subgrades beneath slabs-on-grade must be followed. We point out that the structural mat scheme can greatly reduce

differential settlement, however, we do not anticipate that it will be economically feasible for lightly loaded structures which are relatively large in plan.

2. Heavily Loaded Structures (Multi-Story)

a. General. In our opinion, the subsurface conditions are unsuitable for construction of multi-story structures on continuous spread foundations. We anticipate that settlements of the underlying indigenous soils, both total and differential, will be excessive under the column loads of multi-story buildings. On this basis, we recommend the following methods for eliminating, reducing or coping with settlements: (1) use of driven piles bearing on bedrock, (2) surcharge the site before construction, and (3) compensated foundations.

b. Driven Piles. The proposed multi-story structures can be supported on steel H-piles which are driven to practical refusal (i.e. 5 blows per final 1/4-inch) on the underlying medium hard to hard, sound, limestone bedrock. We also recommend that consideration be given to the use of Raymond Step-Taper piles bearing on bedrock. The step-taper pile is essentially a closed-end steel shell which is driven to practical refusal on bedrock with a mandrel. The mandrel is then withdrawn, the pile is internally inspected and the shell filled with concrete. Due to anticipated construction problems (i.e. advancing the hole and placing concrete) associated with the high

ground water and soft subsurface soils, we do not recommend the use of drilled piers. We expect that driven piles will result in relatively fewer construction related problems.

We point out that the failure loads for steel H-piles driven to practical refusal on medium hard to hard, sound limestone bedrock will correspond to the yield point of the steel (i.e. the pile section, rather than the end bearing conditions will control). Under these conditions, we recommend that the allowable pile loads be computed on the basis of a maximum steel unit stress equal to 35-percent of the yield strength, with a maximum yield of 36,000 pounds per square inch for computation purposes. We do note, however, that the American Iron and Steel Institute advocates design stress levels up to 50 percent of yield, particularly for end bearing piles. We recommend that pile design be based on the 35-percent criteria and that the 50-percent criteria be used to evaluate piles which are driven out of alignment.

Protective measures against steel corrosion must be provided where piles are installed above permanent ground water table or for portions in miscellaneous uncontrolled fill. Alternatively, pile design may include an allowance for steel corrosion (i.e. 10-percent reduction in cross sectional area) where conditions exist (i.e. such as existing miscellaneous fills) which may cause deterioration of the piles.

Other requirements for the design and construction of steel H-piles are as follows:

- Piles bearing on rock must have a minimum center to center spacing 1.75 times the diagonal of the pile, but not less than 24-inches
- Piles may be installed by methods other than impact driving. Allowable design load per pile must be determined by load tests. As an alternative to static load testing, we recommend dynamic testing by a Pile Driving Analyzer (PDA)
- Piles bearing on rock must be driven to resistance such that the net penetration of the last five (5) blows totals one-quarter inch or less under a suitable hammer.
- Previously installed piles which heave must be reseated or redriven to the required resistance
- Splicing of piles is to be avoided as far as practicable. Where used, splices must be such that the resultant vertical and lateral loads at splices are adequately transmitted. Splices must develop not less than fifty (50) percent of the value of the pile in bending
- No lateral loads in excess of one thousand (1,000) pounds per pile shall be permitted on a vertical pile, unless demonstrated by test that such a pile can sustain higher loads

There must be, for stability reasons, a minimum of three (3) piles per pile group (or piles must be connected by properly designed grade beams or slabs). Pile caps must be embedded a minimum of four (4) feet below adjacent finished grades for frost protection. Piles should be designed allowing for a 10-percent reduction in cross sectional area due to potential corrosion (above the water table and in the miscellaneous fills). We point out that

available data indicates that undisturbed soils are so deficient in oxygen at levels a few feet below the ground surface (or water table) that steel H-piles are not appreciable affected by corrosion.

Piles should also be designed to include the effects of potential negative skin friction (approximately 250 psf). Negative skin friction results from downward movement of adjacent soil relative to the pile (i.e. consolidation of the very soft to soft silty clays). Available technical literature indicates that a relative downward movement of about 0.6 inches is generally sufficient to mobilize full negative skin friction. The allowable design loads that can be assigned to specific HP sections are given in Table 7.

TABLE 7. Allowable Steel H-Pile Design Loads

HP Section	Area of Section, A_s (sq. in.)	Box Surface Area, A_B (sq. ft./ft.)	Potential Downdrag (tons)	Recommended Allowable Design Load (tons)
HP 8 x 36	10.6	2.70	17.1	45
HP10 x 42	12.4	3.30	20.9	50
HP10 x 57	16.8	3.37	21.3	75
HP12 x 53	15.5	3.97	25.1	65
HP12 x 63	18.4	4.01	25.4	80
HP12 x 74	21.8	4.06	25.7	100
HP14 x 73	21.4	4.70	29.7	90
HP14 x 89	26.1	4.75	30.1	120
HP14 x 102	30.0	4.80	30.4	140
HP14 x 117	34.4	4.85	30.7	165

NOTES:

1. A pile length of 67.5 feet [length = 62.4 (average refusal depth) + 8.6 (standard deviation) - 3.5 (depth below grade) = 67.5 feet] has been assumed for computational purposes.

2. Potential downdrag in tons = (A_B) x (67.5 feet x 0.75) x (0.125 tsf).

3. Recommended allowable design load in tons = [(A_s x 0.90) x (36 ksi x 0.35 x 0.5)] - (Potential downdrag in tons).

We expect that Raymond step-taper piles, with an 8-inch tip and 12-inch butt, will have allowable design loads of 60 to 70 tons when filled with concrete having 28-compressive strengths of 4000 to 5000 psi. We point out that the pile cross sectional area and concrete compressive strength will govern the design of step-taper piles bearing on medium hard to hard, sound limestone bedrock. Due to the presence of the permanent steel shell, concrete compressive stresses up to 40-percent of the 28-day compressive strength are permitted. We recommend that consideration be given to the use of larger step taper pile sections and high strength concrete mixes if allowable design capacities in excess of 60 to 70 tons are required. As for driven H-piles, the allowable design loads must be verified by full scale load tests.

The HP8 x 36 section is the smallest H-pile section that should be considered for use. We note, however, that larger and heavier sections are preferable because of better driving performance and resistance to bending. Consideration should also be given to equipping the H-piles with driving points, such as the HP-75600 manufactured by Associated Pile and Fitting Corporation or the H-776 manufactured by Dougherty Foundation Products, Inc., to minimize damage while driving, help penetrate obstructions, "seat" the pile on bedrock, prevent local buckling at the pile tip and improve driving alignment.

Obstructions may be encountered within the miscellaneous fill materials which exist over the entire Outer Harbor North development area. Provisions must be included in the specifications for the excavation of near surface obstructions as part of the pile installation. Alternatively, obstructions encountered at pile locations may be penetrated by pre-drilling or spudding to permit unobstructed driving of piles.

We point out that constructing the floor slab as a structural slab on grade beams between pile caps will eliminate potential problems associated with settlement of miscellaneous fill materials and underlying soft silty clays. However, we note that such a scheme is expected to be very costly. In designing the structural slab, we recommend that it be assumed that materials beneath the slab provide no support, as it is quite possible that settlement of miscellaneous fill materials beneath the slab could result in loss of contact. The entire slab load should be carried by grade beams connected to pile caps. If this alternative is selected, it would be unnecessary to perform soil improvement within the proposed building area. The alternative to a structural slab on grade beams is to construct the floor as a slab-on-grade over subgrades which have been dynamically compacted, proof rolled and possibly surcharged (depending on the proposed floor loads) in accordance with our recommendations.

c. Surcharging. We anticipate that a technically feasible and cost effective alternative to supporting structures on driven piles would be to surcharge the entire building area to 1.5 times the building design loads and support the structures on a rigid structural mat or continuous footings. The principle behind surcharging preloading is that the load is applied sufficiently in advance of construction so that consolidation of soft soils is completed prior to development of the site. We point out that this particular scheme is ideally suited to developments where a considerable time lag exists between the initial and final development (i.e. phased developments). We note, however, that there is potential for excessive consolidation settlements if subgrades are not surcharged properly.

Surcharge loads may be placed following dynamic compaction and site preparation as discussed previously in this report. We note that dynamic compaction is directed primarily at improving the engineering characteristics of the miscellaneous fills, while the goal of preloading is to pre-consolidate the underlying soft soils so as to minimize long term total and differential settlements under the proposed building loads. We recommend that the geotechnical engineer be retained to monitor and coordinate the placement of the surcharge load and evaluate resulting

settlements. For this scheme to be successful it must be performed under the direction of the geotechnical engineer.

We recommend that vertical prefabricated band-shaped drains be used in conjunction with surcharge loads to facilitate and accelerate drainage in the relatively impervious deposits. The prefabricated band-shaped drains typically consist of a core of plastic with a sleeve of nonwoven filter fabric. The drains are driven into the ground with a mandrel. As the soft soils consolidate under the surcharge load, water is squeezed out into the vertical drains. The rate at which consolidation will occur is controlled by the spacing of the vertical drains (typically on the order of 5 feet). The ground surface at the top of the drains is covered by a pervious sand or gravel blanket to conduct water away from the vertical drains.

The surcharge load may be placed following the installation of vertical drains and a pervious drainage blanket. We note that the function of the surcharge fill is simply to provide weight, therefore compaction of the surcharge is unnecessary. The surcharge fill may consist any suitable soil materials which can be placed and removed in an expeditious manner. We point out that it may be feasible to surcharge building areas with granular materials (i.e. structural and select structural fill) which could be removed and used as fill beneath floor slabs and pavement in other areas of the proposed development. The thickness of surcharge fill required would be a

function of the material type and the anticipated design loads. We recommend that a minimum surcharge equal to 1.5 times the anticipated design loads be used. With suitable plannings, it may be possible to incorporate the surcharge fill into the phased development as a landscaping berm, mound or other inconspicuous feature. In order to provide assurance that the time allowed for consolidation is neither too short nor unnecessarily long, we recommend that a monitoring program be implemented to verify settlements associated with surcharging. Such a monitoring program would include the installation of settlement plates and piezometers. The settlement plates and piezometers would be read periodically during placement of the surcharge (weekly) and during the stabilization period (bi-monthly). Accurate records should be kept of all installation conditions, monitoring readings and the limits of fill at the time of the readings. This information should be reviewed and evaluated by the geotechnical engineer. Following proper surcharging and evaluation of the monitoring program results, construction of the foundation system (rigid mat or continuous footings) and floor slab can proceed in accordance with recommendations previously presented and discussed in this report.

d. Compensated Foundations. Reduction of net load by excavation is also considered to be viable alternative for construction of multi-story structures. It is possible to compensate for the entire weight of a structure by the weight of the soil excavated for basements (i.e. minimize increases in vertical effective stresses).

A compensated foundation system should be designed in this manner using a stiff concrete mat or continuous footings to minimize the potential for differential settlements. We point out that it is also considered feasible to use the concepts of a compensated foundation in conjunction with surcharging principles. For instance, in cases where time is a factor, it may be feasible to surcharge the building area for a limited amount of time and then construct a fully or partially compensated foundation.

We note that this particular foundation scheme depends heavily on minimizing the changes in the vertical effective stresses within the soil mass. Theoretically, if the building could be constructed without changing the effective stresses, no settlements would occur. The magnitude of heave (if any) during unloading (i.e. excavation of basement) should be monitored. It may be feasible to control the amount of heave by flooding the basement and removing water as the superstructure is constructed.

E. Pavement

Preparation of pavement subgrades should be performed in accordance with recommendations presented under the "Soil Improvement" and "Site Preparation" sections of this report. We expect that pavement subgrades which have been dynamically compacted and proof rolled in accordance with our recommendations will perform satisfactorily. We

recommend that major undercut areas be incorporated into a pavement underdrain system to prevent ponding of water within the more pervious undercut backfill materials.

We point out that proper preparation of the pavement subgrade is essential for satisfactory performance of the pavement. Accumulation of water on the subgrade can be avoided by grading the subgrade to a slope of at least 2-percent and providing underdrains. We point out that failure to adequately drain the pavement courses and subgrade will shorten the life of the pavement structure.

We recommend using a geotextile, such as Mirafi 500X, Exxon GTF 200, DuPont Typar 3401 or approved equivalent, to provide separation (primary function) and stabilization (secondary function) between the miscellaneous fill subgrades and pavement base course. The geotextile will maintain the integrity of the base course (i.e. prevent migration of soil fines into the base course) and result in increased performance and reduced long term maintenance of the pavement structure.

Our general recommendations for the design of flexible pavements are given in Table 8. We point out that equivalent axle load data was not provided, therefore our recommendations were developed based on our understanding of the proposed development.

TABLE 8. Flexible Pavement Recommendations

Material	Thickness (inches) Auto	Truck/ Roadways	Specification
Wearing Course (Asphaltic Concrete)	1	2	NYSDOT Item No. 403.18* (Type 7 Top Course)
Binder Course (Asphaltic Concrete)	2	4	NYSDOT Item No. 403.13* (Type 3 Binder Course)
Base Course (Crusher Run Stone)	9	12	NYSDOT Item No. 304.03* (Select Structural Fill)

Geotextile - Mirafi 500X, Exxon GTF 200, DuPont Typar 3401, or approved equivalent

*NYSDOT - New York State Department of Transportation - Standard Specifications (January 2, 1985)

VII. RECOMMENDATIONS FOR SMALL BOAT HARBOR DEVELOPMENT

It is our understanding that the proposed Small Boat Harbor developments within the confines of the former diked disposal areas have been superseded by a parking lot as the result of environmental related issues. Presently, the gravel parking lot has been constructed over approximately the northern half of the site. From a purely geotechnical standpoint, we see no technical reason why buildings cannot be constructed at this site, however, we do appreciate the concerns regarding environmental related issues. Provided the environmental issues are properly addressed with the governing authorities (i.e. NYSDEC, NYSDOH, etc.) we anticipate that suitable foundation schemes could be developed which would provide adequate structural support while minimizing exposure to, and impacts on, existing environmental conditions.

We anticipate that structures could be developed successfully on Raymond step-taper piles driven to end bearing on the limestone bedrock. The step-taper piles are ideally suited to these conditions for the following reasons: (1) the shape of the pile and the fact that it is a displacement pile would eliminate any potential for migration of potential contaminants along the pile, (2) type V portland cement could be used for the concrete within the steel shell to provide increased resistance to chemical attack and (3) all structural loads would be

carried directly on bedrock thus minimizing any potential for "squeezing" of contaminants through the dike walls into Lake Erie. We recommend that floor slabs be constructed as structural slabs on grade beams between piles to minimize stress increases to the underlying soils and thus eliminate any potential problems with respect to "squeezing" contaminants through the dike walls and settlements.

We expect that settlements on the order of several inches will occur in the dredged materials and underlying soft silty clays as the result of fill materials placed for the gravel parking lot. We recommend that all fill materials be placed in a controlled (i.e. compacted in relatively thin lifts to a minimum of 95-percent of the maximum dry density by ASTM D-1557) manner over properly prepared subgrades to minimize the effects of locally soft areas and ensure an adequate parking surface. Consideration should also be given to the use of a geotextile, such as Mirafi 600 or Exxon GTF300, to provide additional stabilization beneath the controlled fill.

We note that additional borings will be required for the evaluation of foundation alternatives for proposed structures along the eastern edge of the former diked disposal area. It is our understanding that the intent in proposing development in this area was to minimize or eliminate construction on dredged materials.

VIII. SUMMARY AND CONCLUDING REMARKS

Foundation recommendations have been presented herein for the proposed Outer Harbor Development Plan. Our recommendations have been directed at eliminating or minimizing the effects of differential and total settlements associated with the miscellaneous fills and soft soils in the area of the proposed development. In summary, these recommendations include:

- dynamic compaction to improve the engineering characteristics of the miscellaneous fills over the entire Outer Harbor North development area
- support of lightly loaded single story structures on relatively stiff continuous footings with slab-on-grade floors. Relatively stiff structural mats are also considered feasible for support of lightly loaded single story structures
- support of relatively heavily loaded multi-story structures on driven piles bearing on bedrock with floor slabs designed as structural slabs bearing on grade beams between piles. Surcharging with slab-on-grade floors and/or compensated foundations are also considered viable alternatives
- geotextiles should be used to provide additional stabilization beneath pavement structures

Our recommendations are based on the subsurface conditions encountered at the twenty-seven (27) borehole locations investigated by Empire Soils Investigations during the period of December 1, 1986 to January 21, 1987 and our general understanding of the proposed development. We point out that the information contained herein is not intended for final design. It is our understanding that

this information will be used by the NFTA to determine the feasibility of the proposed land uses. We point out that additional subsurface exploration, laboratory testing and engineering evaluation will be required prior to implementation of these recommendations. We recommend that additional soil borings be advanced at proposed building locations (when they have been established) to accurately characterize the existing subsurface conditions. We also recommend that additional laboratory testing, including consolidation tests, be performed to provide the parameters needed to perform detailed settlement analyses.

We recommend that the NFTA retain the geotechnical engineer as a member of the project development team to assist in evaluating the proposed developments with respect to the alternative recommendations contained in this report. We anticipate that it would be very efficient to work closely with the geotechnical engineer during the development phases of the project.

If surcharging is determined by the NFTA to be a cost effective alternative, we recommend that work be started immediately toward implementation so as to take full advantage of the "time factor". In such a case, we recommend that additional borings, testing and evaluation be performed by the geotechnical engineer. We point out that approximate design loads would be required prior to finalizing the surcharge loads. We also note that dynamic

compaction of the existing miscellaneous fills would be required prior to placing the surcharge loads.

We have enjoyed the opportunity to provide the NFTA with conceptual foundation alternatives for the proposed Outer Harbor North Development. If you should have any questions regarding our recommendations or require additional information, please contact our office.

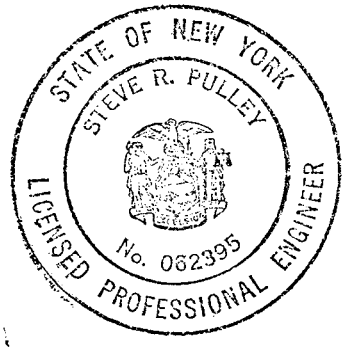
Respectfully submitted,

THOMSEN ASSOCIATES

Steve R. Pulley

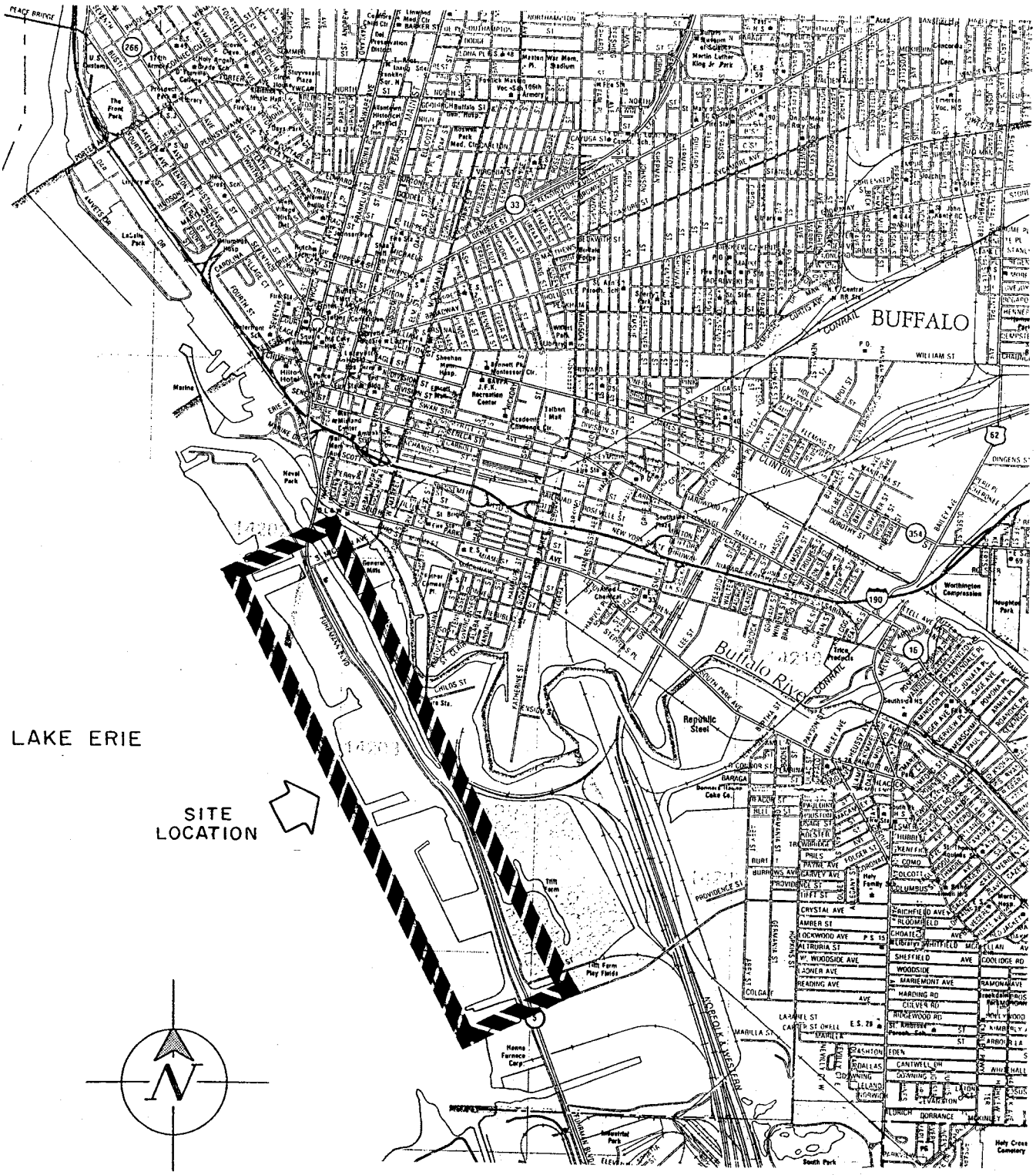
Steve R. Pulley, P.E.
Senior Geotechnical Engineer

map



APPENDIX A

DRAWINGS



THOMSEN ASSOCIATES

CONSULTING GEOTECHNICAL ENGINEERS & GEOLOGISTS

SITE LOCATION MAP
NFTA GEOTECHNICAL STUDY
PORT OF BUFFALO
BUFFALO, NEW YORK

DR.BY: DAW	SCALE: NONE	PROJ. NO. BTA-86-94B
CK'D.BY: SRP	DATE: 7-87	DRWG.NO.

SEAWAY PIERS/HARBORTOWN

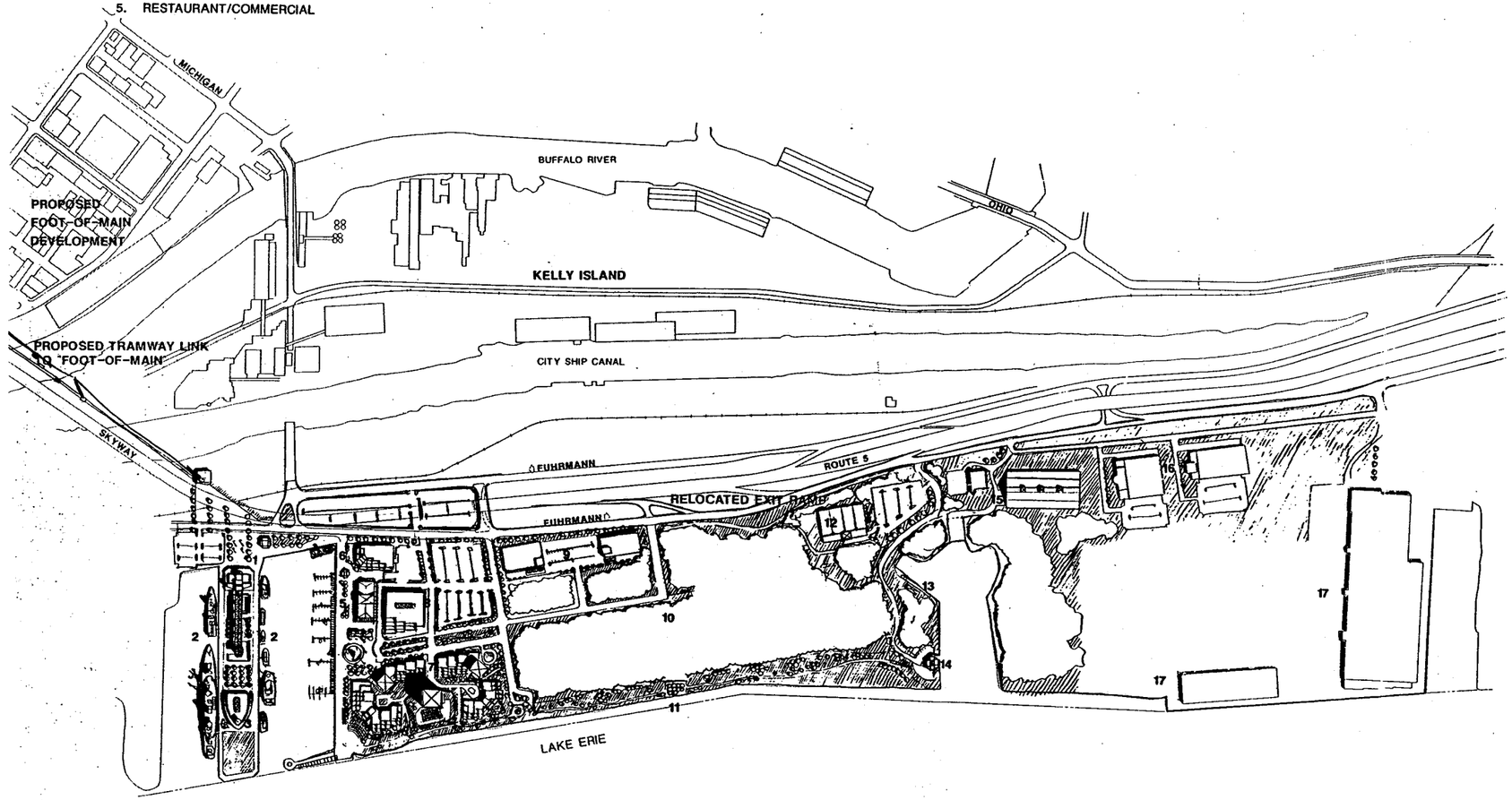
1. NAVAL & MARITIME MUSEUM
2. NAVAL/REPLICA/EXCURSION CRAFT
3. FESTIVAL PAVILION & CONCERT STAGE
4. BOAT SLIPS
5. RESTAURANT/COMMERCIAL
6. GREAT LAKES RESEARCH FACILITY
7. MULTIFAMILY RESIDENTIAL
8. "BACK" OFFICE
9. RACQUET CLUB/SKATING RINK
10. FUTURE DEVELOPMENT SITE
11. LAKEFRONT PROMENADE

BELL SLIP PARK

12. YEAR-ROUND TENNIS
13. PADDLEBOAT RENTAL
14. OBSERVATION TOWER

PORTSIDE INDUSTRIAL PARK

15. WINTER BOAT STORAGE
16. LIGHT INDUSTRIAL
17. WAREHOUSE/DISTRIBUTION



Site Development Plan

NOTES :

1. THIS DRAWING IS A REPRODUCTION OF A PRINT FURNISHED TO THOMSEN ASSOCIATES BY THE NIAGARA FRONTIER TRANSPORTATION AUTHORITY AND IS INTENDED FOR ILLUSTRATIVE PURPOSES ONLY.

OUTER HARBOR DEVELOPMENT PLAN

NIAGARA FRONTIER TRANSPORTATION AUTHORITY

1 acre 0 200

TAMS Planning Innovations, Inc.

THOMSEN ASSOCIATES

CONSULTING GEOTECHNICAL ENGINEERS & GEOLOGISTS

OUTER HARBOR NORTH - PHASE 1 DEVELOPMENT
NFTA GEOTECHNICAL STUDY
PORT OF BUFFALO
BUFFALO, NEW YORK

DR.BY:	DAW	SCALE:	AS NOTED	PROJ. NO.	BTA-86-94B
CK'D.BY:	SRP	DATE:	7-87	DRWG.NO.	2

SEAWAY PIERS

1. NAVAL & MARITIME MUSEUM
2. NAVAL/REPLICA/EXCURSION CRAFT
3. FESTIVAL PAVILION & CONCERT STAGE
4. BOAT SLIPS
5. RESTAURANT/COMMERCIAL
6. GREAT LAKES RESEARCH FACILITY

HARBORTOWN

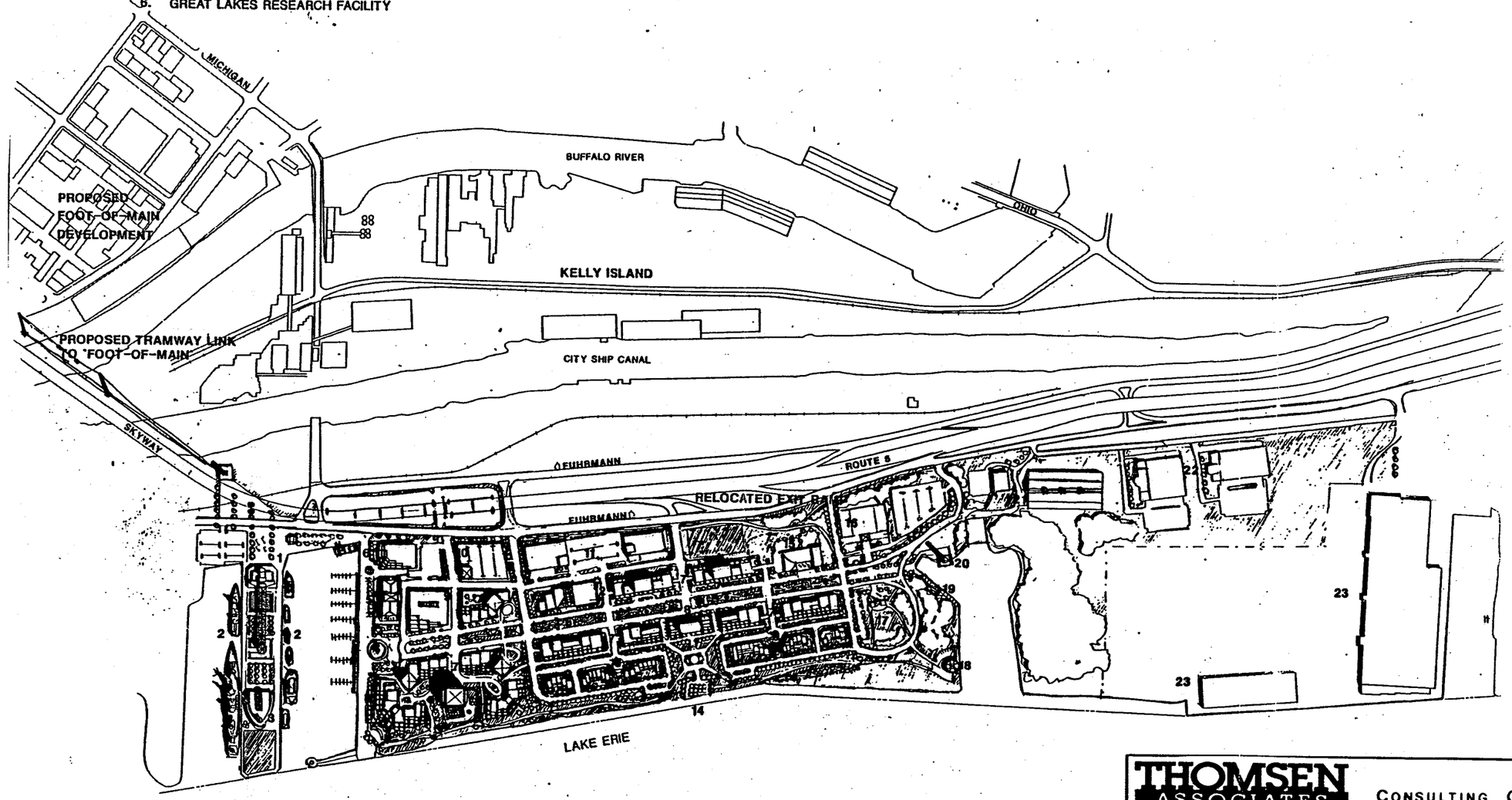
7. MULTIFAMILY RESIDENTIAL
8. MULTIFAMILY/COMMERCIAL
9. "BACK" OFFICE
10. STRUCTURED PARKING
11. RACQUET CLUB/SKATING RINK
12. COMMERCIAL
13. TOWNHOUSE APARTMENTS
14. LAKEFRONT COMMONS
15. SCHOOL

BELL SLIP PARK

16. YEAR-ROUND TENNIS
17. GREAT LAWN
18. OBSERVATION TOWER
19. PADDLEBOAT RENTAL
20. MARITIME MONUMENT

PORTSIDE INDUSTRIAL PARK

21. WINTER BOAT STORAGE
22. LIGHT INDUSTRIAL
23. WAREHOUSE/DISTRIBUTION



Site Development Plan

NOTES :

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THOMSEN ASSOCIATES

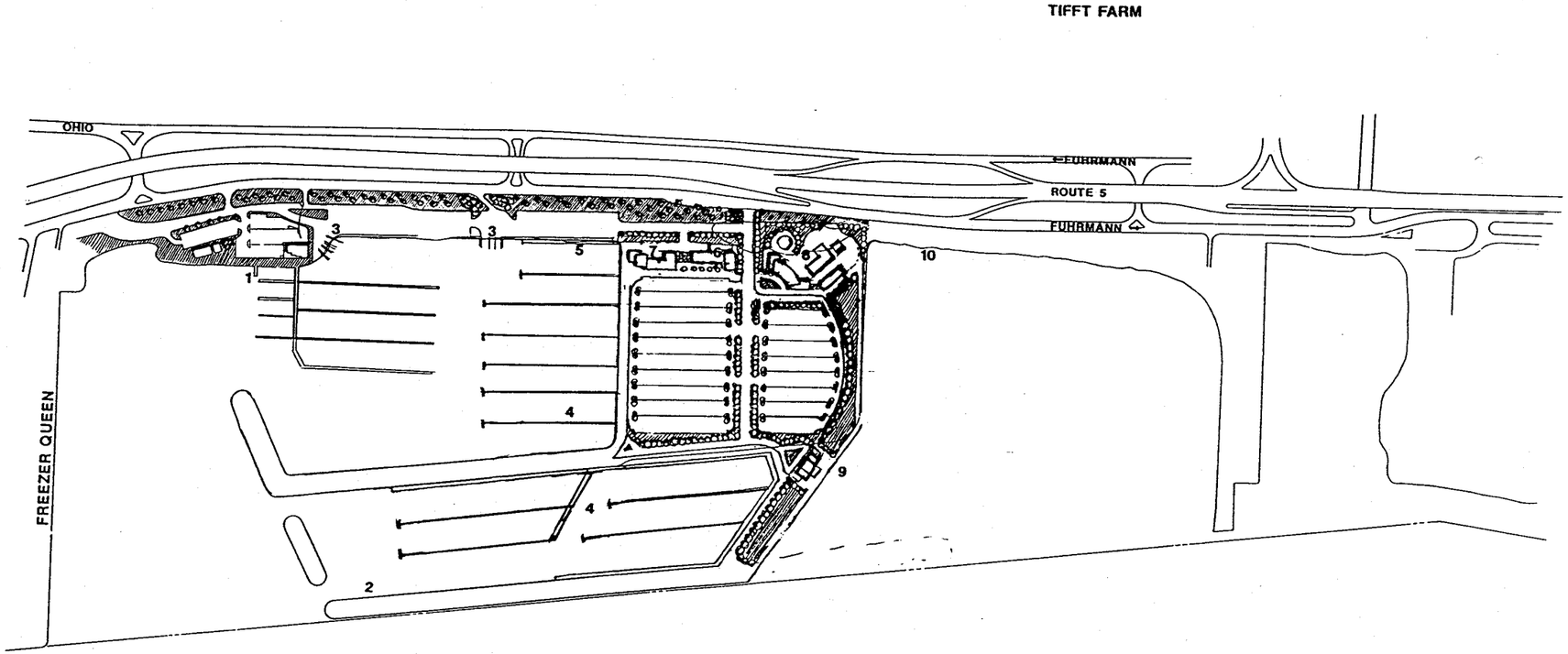
CONSULTING GEOTECHNICAL ENGINEERS & GEOLOGISTS

OUTER HARBOR DEVELOPMENT PLAN
NFTA GEOTECHNICAL STUDY
PORT OF BUFFALO
BUFFALO, NEW YORK

DR.BY:	DAW	SCALE:	NONE	PROJ. NO.	BTA-86-94B
CK'D.BY:	SRP	DATE:	7-87	DRWG.NO.	3

SMALL BOAT HARBOR DEVELOPMENT

1. EXISTING FACILITY
2. PROPOSED BREAKWATER
3. LAUNCHING AREA
4. BOAT SLIPS
5. CHARTER BOAT DOCK
6. BOAT SALES/RETAIL
7. RESTAURANT/COMMERCIAL
8. WATER SPORTS ATTRACTION
9. FISHERMEN'S CENTER
10. POSSIBLE FUTURE BEACH



NOTES :

1. THIS DRAWING IS A REPRODUCTION OF A PRINT FURNISHED TO THOMSEN ASSOCIATES BY THE NIAGARA FRONTIER TRANSPORTATION AUTHORITY AND IS INTENDED FOR ILLUSTRATIVE PURPOSES ONLY.

1 acre

0 200

THOMSEN ASSOCIATES

CONSULTING GEOTECHNICAL ENGINEERS & GEOLOGISTS

SMALL BOAT HARBOR DEVELOPMENT
NFTA GEOTECHNICAL STUDY
PORT OF BUFFALO
BUFFALO, NEW YORK

DR.BY: DAW	SCALE: AS NOTED	PROJ. NO. BTA-86-94C	
CK'D.BY: SRP	DATE: 7-87	DRWG.NO. 4	

BOREHOLE ELEVATIONS:

HOLE NO.	SURFACE ELEVATION
B-1	583.64
B-2	583.71
B-3	581.19
B-4	584.07
B-5	586.04
B-6	591.07
B-7	585.39
B-8	586.62
B-9	587.94
B-10	586.53
B-11	586.75
B-12	583.60
B-13	579.73
B-14	588.17
B-15	585.40
B-16	582.22
B-17	586.12
B-18	579.00
B-19	580.99
B-20	584.12
B-21	581.49
B-22	582.28
B-23	583.61
B-24	583.61
B-25	583.89
B-26	580.98
B-27	581.39

LEGEND:

EXISTING BORING
EMPIRE SOILS INVESTIGATIONS, INC.
PROJECT NO. BD-85-128 (3 TOTAL)

EXISTING BORING
EMPIRE SOILS INVESTIGATIONS, INC.
PROJECT NO. BD-80-24 (5 TOTAL)

BOREHOLE NO. — B-1 R MW — BOREHOLE LOCATION (27 TOTAL)

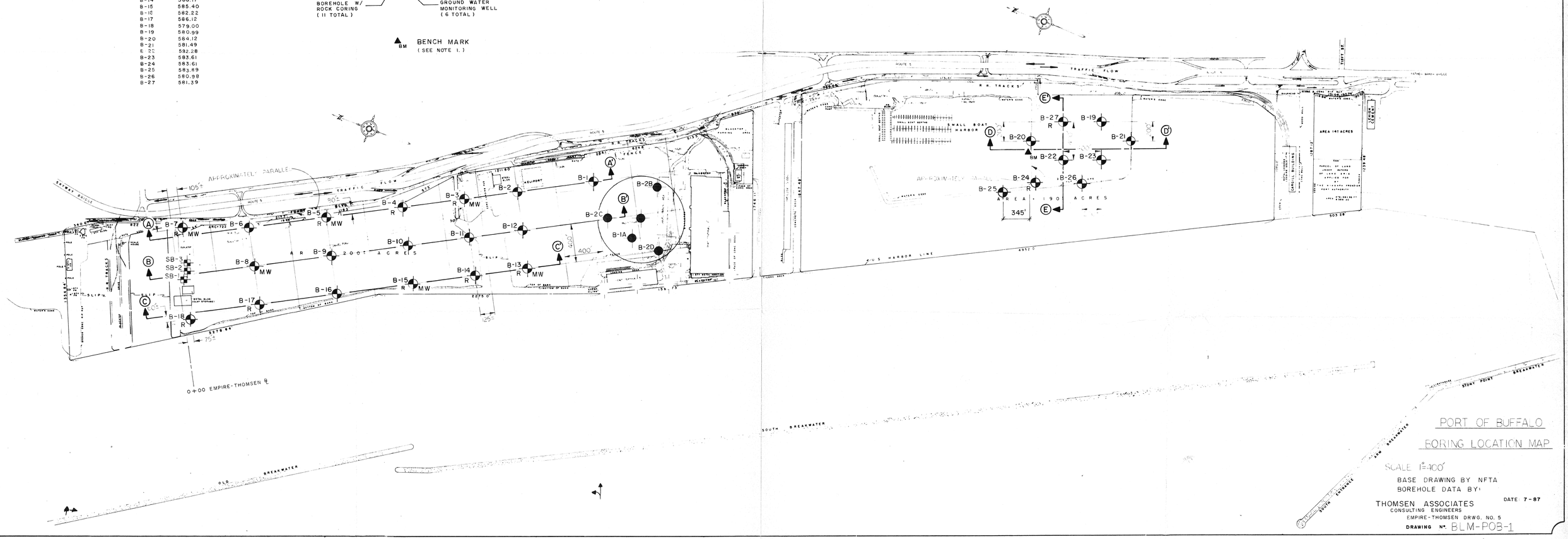
BOREHOLE W/ ROCK CORING (11 TOTAL)

GROUND WATER MONITORING WELL (6 TOTAL)

BM BENCH MARK (SEE NOTE 1.)

NOTES:

1. BENCH MARK IS TOP OF WESTERLY 10 FT. DIA. CMP, EL. 576.16
2. MONITORING WELL DESTROYED AT BOREHOLE LOCATION B-13 AS THE RESULT OF FILLING ACTIVITY IN THE VICINITY OF THE WELL.



PORT OF BUFFALO

BORING LOCATION MAP

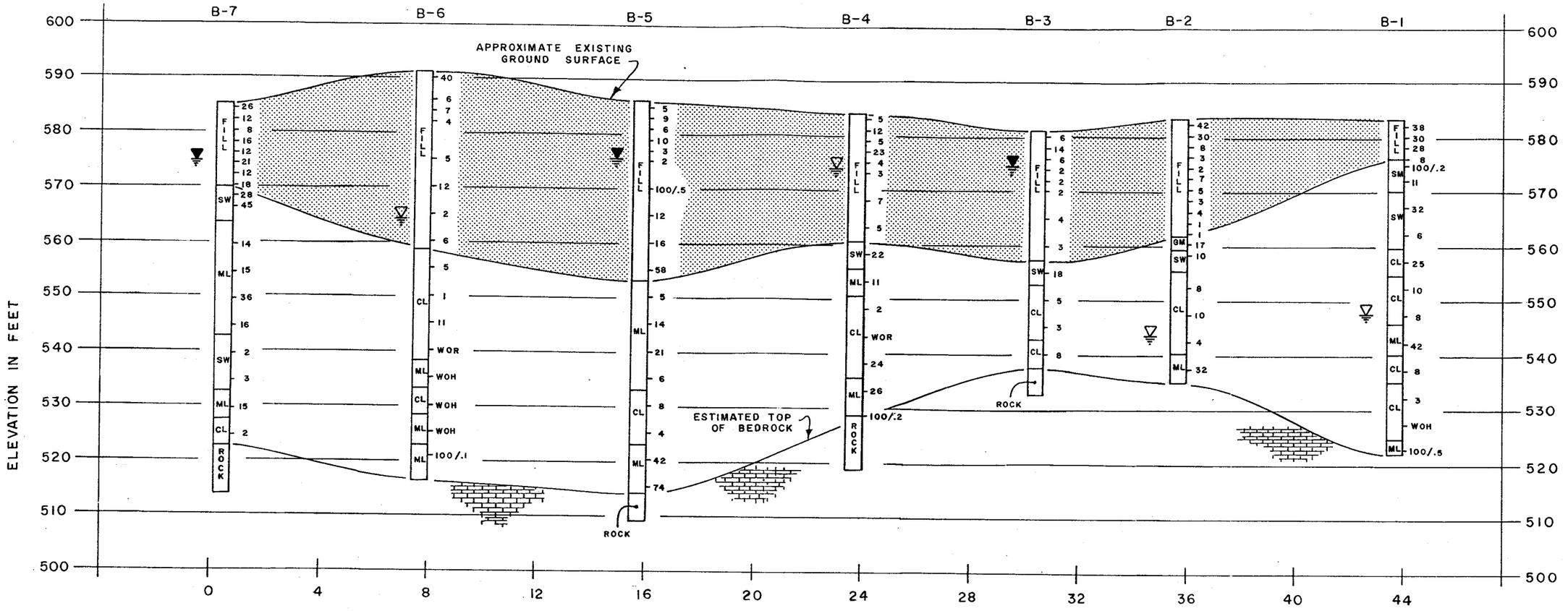
SCALE 1"=400'

BASE DRAWING BY NFTA
BOREHOLE DATA BY:

DATE 7-87

THOMSEN ASSOCIATES
CONSULTING ENGINEERS
EMPIRE-THOMSEN DRWG. NO. 5

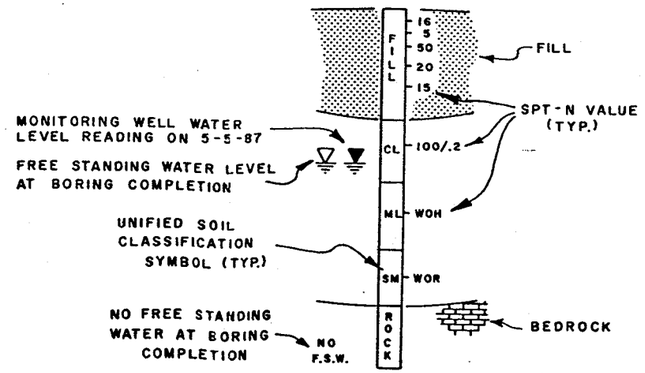
DRAWING N°. BLM-POB-1



CROSS SECTION Ⓐ - Ⓐ'

SCALE : 1" = 400' HORIZ.
1" = 20' VERT.

LEGEND:



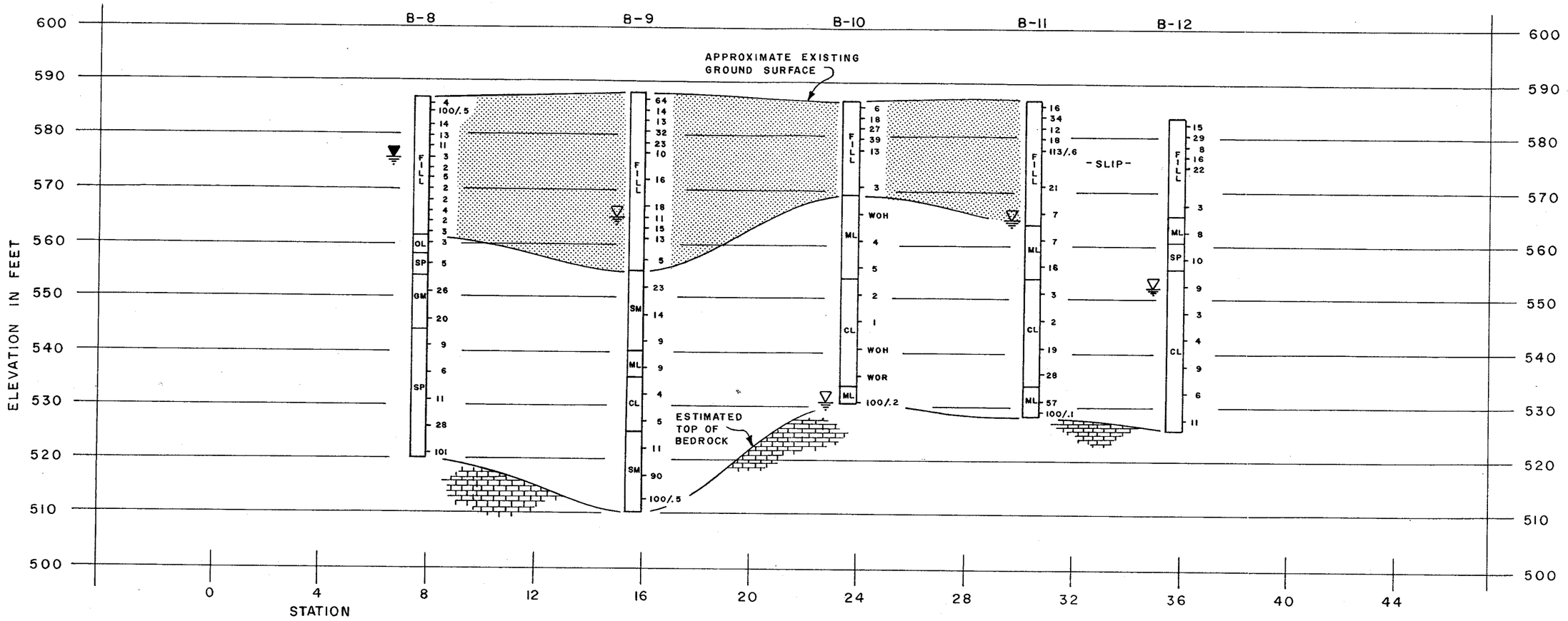
NOTES :

1. REFER TO DRAWING #5 FOR SECTION LOCATIONS

THOMSEN ASSOCIATES
CONSULTING GEOTECHNICAL ENGINEERS & GEOLOGISTS

SUBSURFACE PROFILE
NFTA GEOTECHNICAL STUDY
PORT OF BUFFALO
BUFFALO, NEW YORK

DR.BY: DAW	SCALE: AS NOTED	PROJ. NO. BTA-86-94B
CK'D.BY: SRP	DATE: 5-87	DRWG.NO. 6



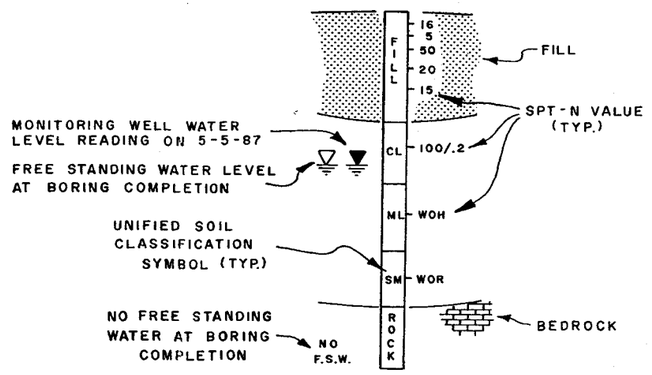
CROSS SECTION Ⓑ - Ⓑ'

SCALE : 1" = 400' HORIZ.
1" = 20' VERT.

NOTES :

1. REFER TO DRAWING #5 FOR SECTION LOCATIONS

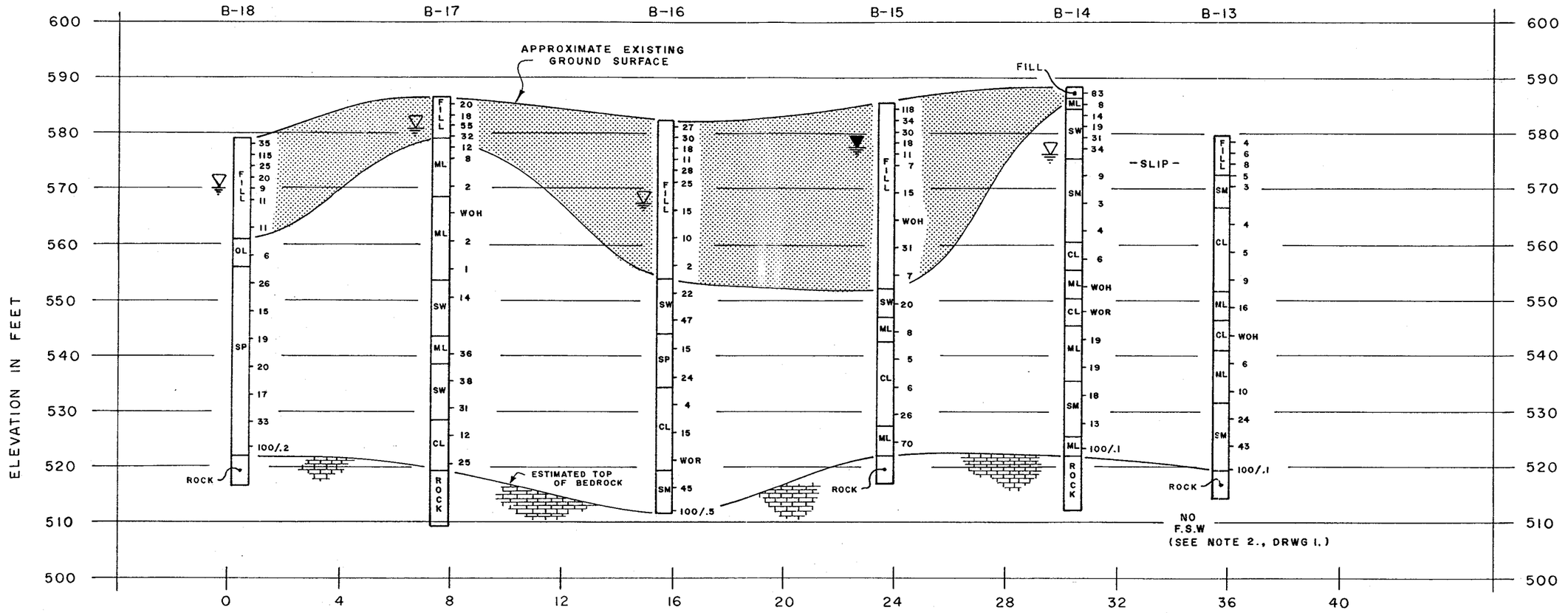
LEGEND:



THOMSEN ASSOCIATES
CONSULTING GEOTECHNICAL ENGINEERS & GEOLOGISTS

SUBSURFACE PROFILE
NFTA GEOTECHNICAL STUDY
PORT OF BUFFALO
BUFFALO, NEW YORK

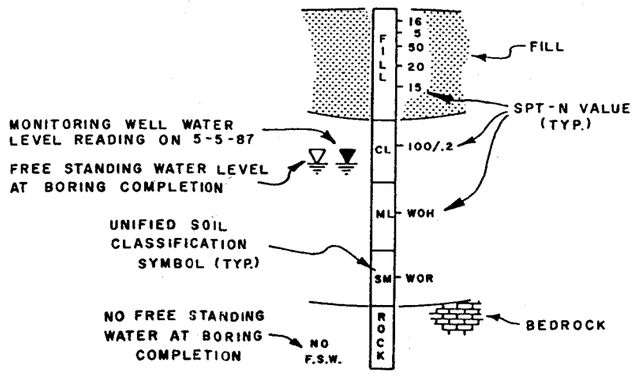
DR.BY: DAW	SCALE: AS NOTED	PROJ. NO. BTA-86-94B
CK'D.BY: SRP	DATE: 5-87	DRWG.NO. 7



CROSS SECTION Ⓒ - Ⓒ'

SCALE: 1" = 400' HORIZ.
1" = 20' VERT.

LEGEND:



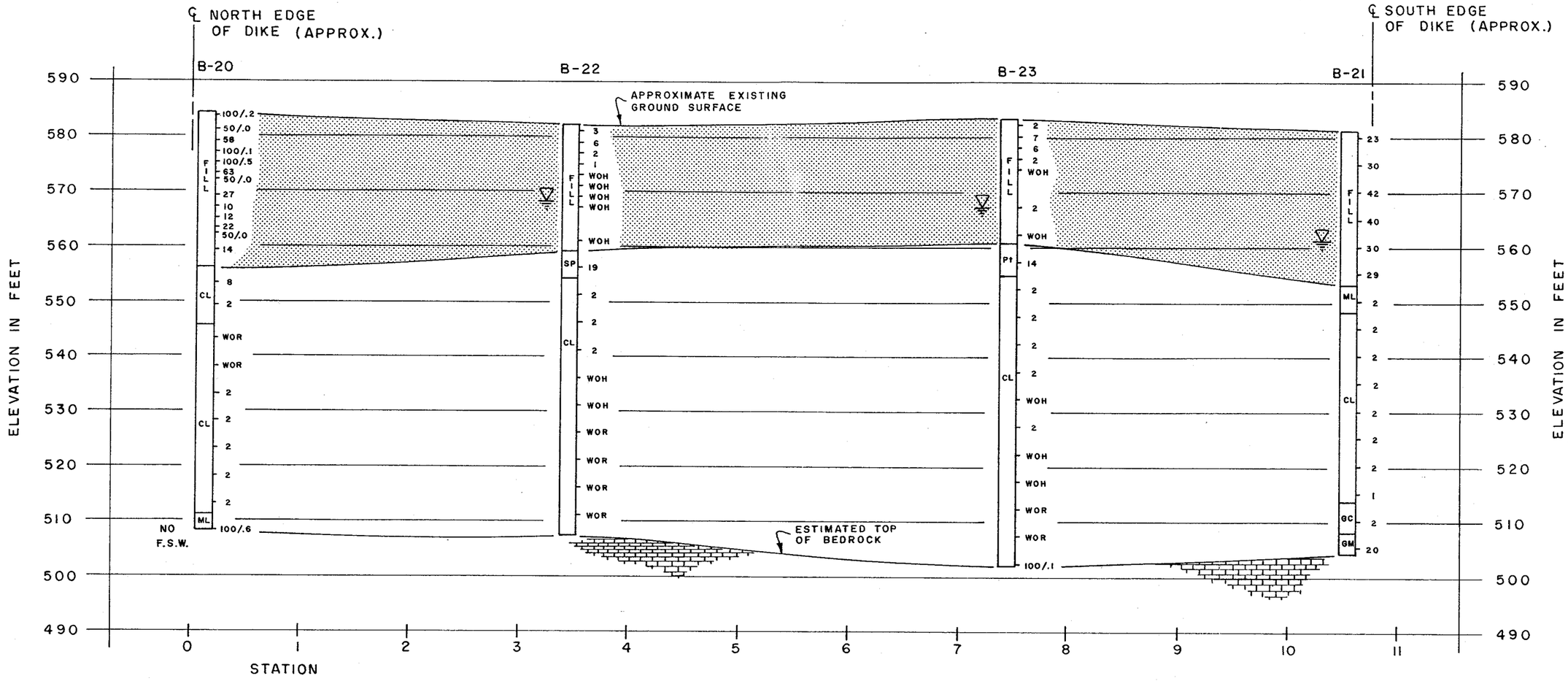
NOTES :

1. REFER TO DRAWING #5 FOR SECTION LOCATIONS

THOMSEN ASSOCIATES
CONSULTING GEOTECHNICAL ENGINEERS & GEOLOGISTS

SUBSURFACE PROFILE
NFTA GEOTECHNICAL STUDY
PORT OF BUFFALO
BUFFALO, NEW YORK

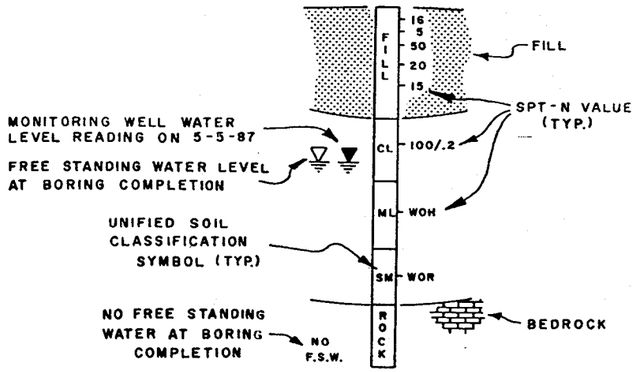
DR.BY: DAW	SCALE: AS NOTED	PROJ. NO. BTA-86-948
CK'D.BY: SRP	DATE: 5-87	DRWG.NO. 8



CROSS SECTION Ⓓ - Ⓓ'

SCALE : 1" = 100' HORIZ.
1" = 20' VERT.

LEGEND:



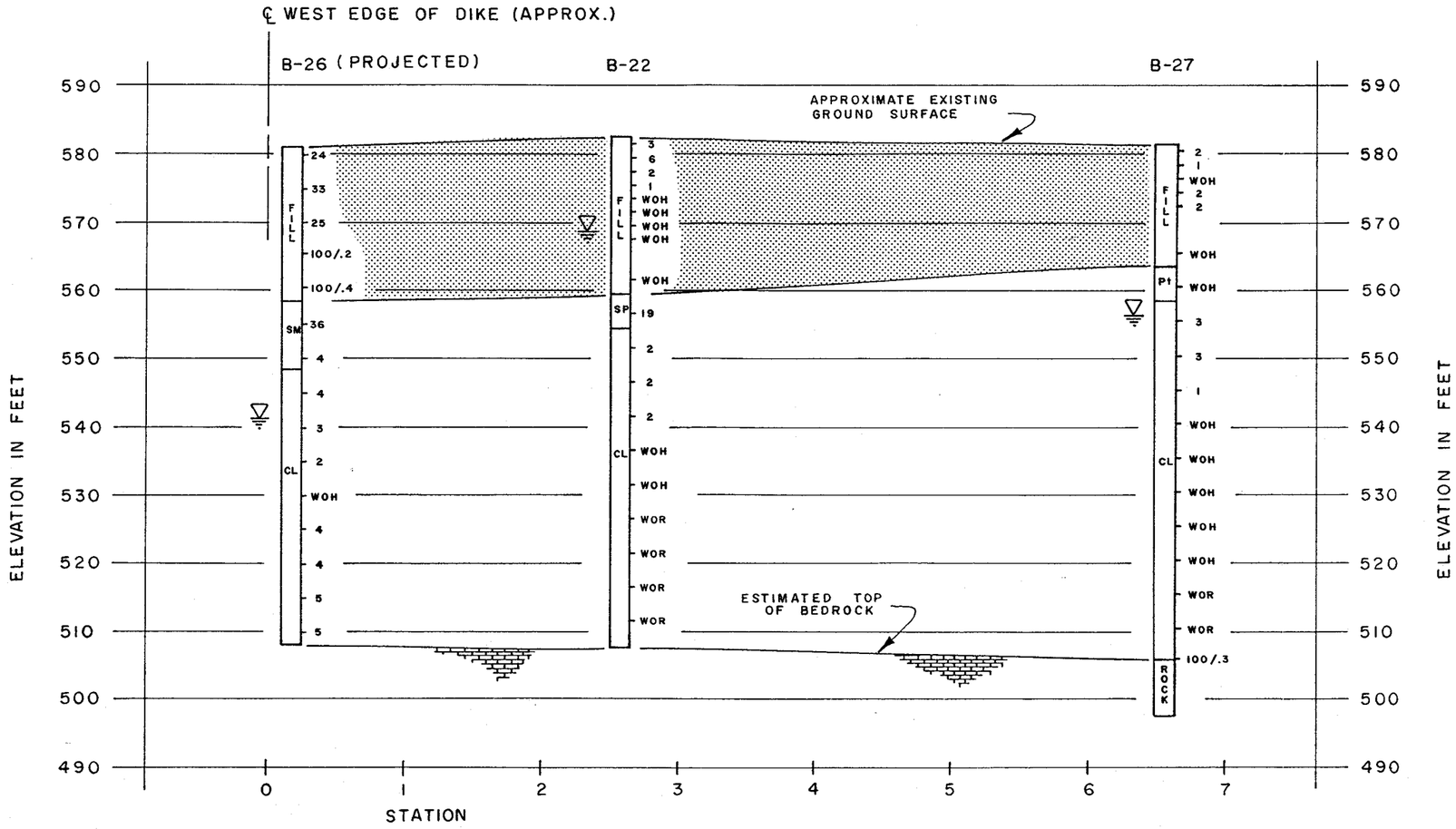
NOTES :

1. REFER TO DRAWING #5 FOR SECTION LOCATIONS

THOMSEN ASSOCIATES
CONSULTING GEOTECHNICAL ENGINEERS & GEOLOGISTS

SUBSURFACE PROFILE
NFTA GEOTECHNICAL STUDY
PORT OF BUFFALO
BUFFALO, NEW YORK

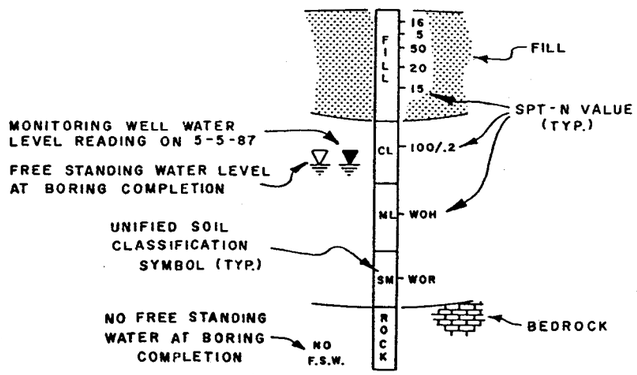
DR.BY: DAW	SCALE: AS NOTED	PROJ. NO. BTA-86-94B
CK'D.BY: SRP	DATE: 6-87	DRWG.NO. 9



SCALE: 1" = 100' HORIZ.
1" = 20' VERT.

CROSS SECTION Ⓔ-Ⓔ'

LEGEND:



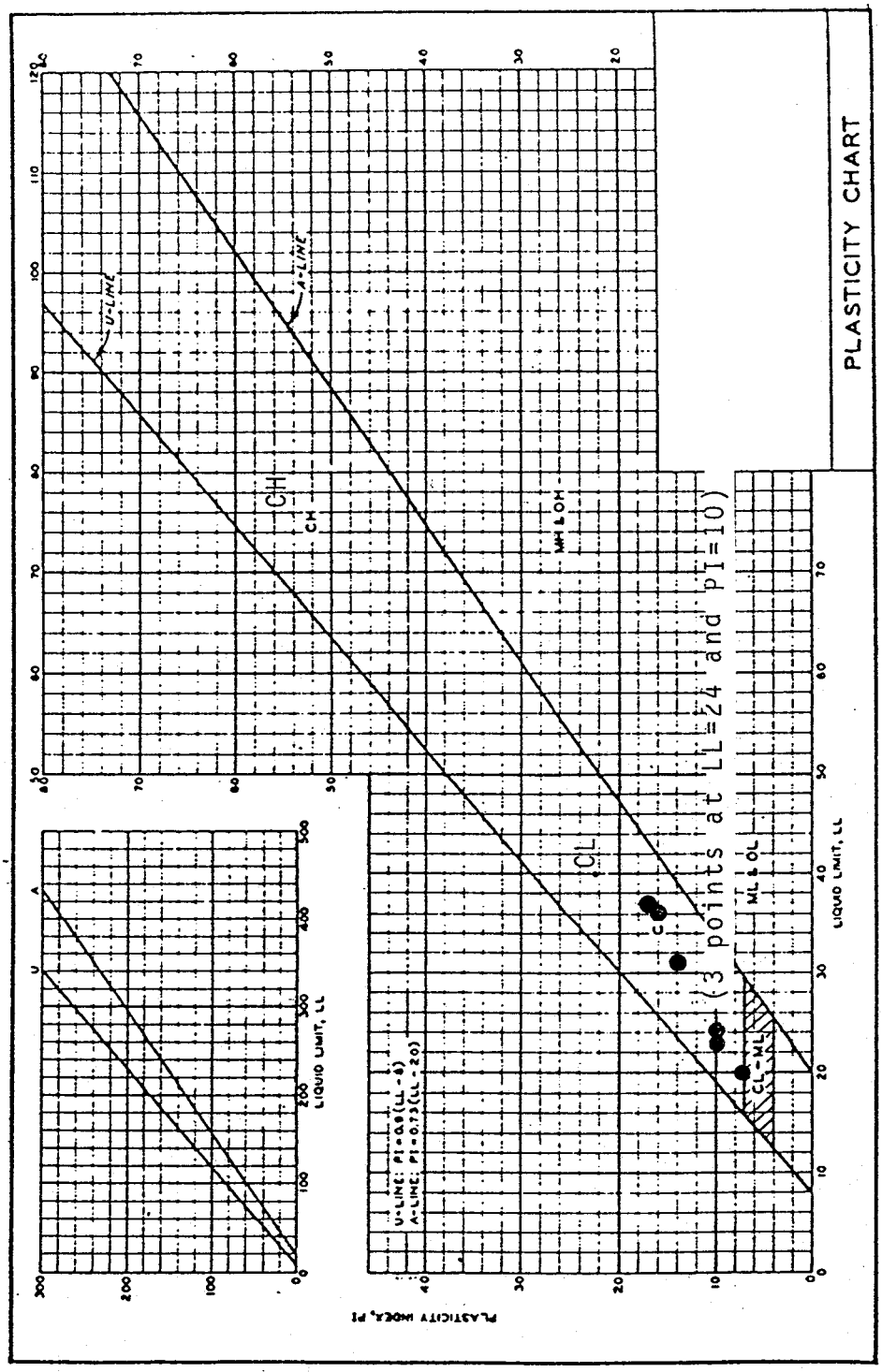
NOTES :

1. REFER TO DRAWING #5 FOR SECTION LOCATIONS

THOMSEN ASSOCIATES
CONSULTING GEOTECHNICAL ENGINEERS & GEOLOGISTS

SUBSURFACE PROFILE
NFTA GEOTECHNICAL STUDY
PORT OF BUFFALO
BUFFALO, NEW YORK

DR.BY: DAW	SCALE: AS NOTED	PROJ. NO. BTA-86-94B
CK'D.BY: SRP	DATE: 7-87	DRWG.NO. 10



NOTE : Refer to Table 5 in the report for a summary of the liquid and plastic limit test results.

THOMSEN ASSOCIATES

CONSULTING GEOTECHNICAL ENGINEERS & GEOLOGISTS

Plasticity Chart
Geotechnical Study
Proposed Outer Harbor Development Plan
Buffalo, New York

DR.BY: ---	SCALE: None	PROJ. NO. BTA-86-945
CK'D.BY: SRP	DATE: July 1987	DRWG.NO. 11

APPENDIX B

BOREHOLE LOGS

GENERAL INFORMATION & KEY TO SUBSURFACE LOGS

The Subsurface Logs attached to this report present the observations and mechanical data collected by the driller at the site, supplemented by classification of the material removed from the borings as determined through visual identification by technicians in the laboratory. It is cautioned that the materials removed from the borings represent only a fraction of the total volume of the deposits at the site and may not necessarily be representative of the subsurface conditions between adjacent borings or between the sampled intervals. The data presented on the Subsurface Logs together with the recovered samples will provide a basis for evaluating the character of the subsurface conditions relative to the project. The evaluation must consider all the recorded details and their significance relative to each other. Often analyses of standard boring data indicate the need for additional testing or sampling procedures to more accurately evaluate the subsurface conditions. Any evaluation of the contents of this report and the recovered samples must be performed by Professionals. The information presented in the following defines some of the procedures and terms used on the Subsurface Logs to describe the conditions encountered.

1. The figures in the Depth column defines the scale of the Subsurface Log.

2. The sample column shows, graphically, the depth range from which a sample was recovered. See Table 1 for a description of the symbols used to signify the various types of samples.

3. The Sample No. is used for identification on sample containers and/or Laboratory Test Reports.

4. Blows on Sampler — shows the results of the "Penetration Test", recording the number of blows required to drive a split spoon sampler into the soil. The number of blows required for each six inches of penetration is recorded. The first 6 inches of penetration is considered to be a seating drive. The number of blows required for the second and third 6 inches of penetration is termed the penetration resistance, N. The outside diameter of the sampler, the hammer weight and the length of drop are noted at the bottom of the Subsurface Log.

5. Blows on Casing — shows the number of blows required to advance the casing a distance of 12 inches. The casing size, the hammer weight and the length of drop are noted at the bottom of the Subsurface Log. If the casing is advanced by means other than driving, the method of advancement will be indicated in the Notes column or under the Method of Investigation at the bottom of the Subsurface Log.

6. All recovered soil samples are reviewed in the laboratory by an engineering technician, geologist or geotechnical engineer, unless note otherwise. The visual descriptions are made on the basis of a combination of the driller's field descriptions and observations and the sample as received in the laboratory. The method of visual classification is based primarily on the Unified Soil Classification (ASTM D 2487-83) with regard to the particle size and plasticity. (See Table No. II) Additionally, the relative portion, by weight, of two or more soil types is described for granular soils in accordance with "Suggested Methods of Test for Identification of Soils" by D. M. Burmister, ASTM Special Technical Publication 479, June 1970. (See Table No. III) The description of the relative soil density or consistency is based upon the penetration records as defined on Table No. IV. The description of the soil moisture is based upon the relative wetness of the soil as recovered and is described as dry, moist, wet and saturated. Water introduced in the boring either naturally or during drilling may have affected the moisture condition of the recovered sample. Special terms are used as required to describe materials in greater detail; several such terms are listed in Table V. When sampling gravelly soils with a standard two inch diameter split spoon, the true percentage of gravel is often not recovered due to the relatively small sampler diameter. The presence of boulders and large gravel is sometimes, but not necessarily, detected by an evaluation of the casing and samplers blows or through the "action" of the drill rig as reported by the driller.

7. The description of the rock shown is based on the recovered rock core and the driller's observations. The terms frequently used in the description are included in Table VI.

8. The stratification lines represent the approximate boundary between soil types and the transition may be gradual. Solid stratification lines are based on the driller's field observations.

9. Miscellaneous observations and procedures noted by the driller are shown in this column, including water level observations. It is important to realize the reliability of the water level observations depends upon the soil type (water does not readily stabilize in a hole through fine grained soils), and that drill water used to advance the boring may have influenced the observations. The ground water level typically will fluctuate seasonally. One or more perched or trapped water levels may exist in the ground seasonally. All the available readings should be evaluated. If definite conclusions cannot be made, it is often prudent to examine the conditions more thoroughly through test pit excavations or water observation wells.

10. The length of core run is defined as the length of penetration of the core barrel. Core recovery is the length of core recovered divided by the core run. The RQD (Rock Quality Designation) is the total pieces of NX core exceeding 4 inches in length divided by the core run. The size core barrel used is also noted.

DATE
STARTED 12/16/86
FINISHED 12/16/86
SHEET 1 OF 2

EMPIRE SOILS INVESTIGATIONS INC. — **SUBSURFACE LOG**

HOLE NO. B-1
SURF. ELEV. 583.64
G. W. DEPTH See Note

PROJECT NFTA - Port of Buffalo
BTA-86-94B

LOCATION Fuhrmann Blvd.
Buffalo, NY

DEPTH-FT.	SAMPLES	SAMPLE NO	BLOWS ON SAMPLER 0/6	6/12	12/18	N	Qu tsf	SOIL OR ROCK CLASSIFICATION	NOTES
0		1	1	16				0.5' TOPSOIL	Unconfined compressive strength tests performed using a Soiltest CL-700 Pocket Penetrometer
			22	28		38		Gy. Silty SAND, little f-c Gravel, tr. rock fragments (moist, FILL, SM)	
		2	14	16				Becomes brn.-gy. contains some Rock Frags. (SM)	
			14	8		30			
5		3	33	20				Brn. Clayey SILT, tr. sand, tr. rock frags., tr. brick (moist, FILL, ML)	Water first encountered at 5 feet
			8	3		28			
		4	2	3					
			5	3		8			
		5	1	100/.2		Ref.		Gy. Silty SAND, some Rock Frags. (moist, loose, SM)	
10									Driller notes encountering boulder from 9 to 10 feet
		6	7	7					
			4	3		11		Contains trace rock frags. (firm)	
15								Brn.-gy. f-c SAND, tr. silt (moist, compact, SW)	
		7	21	17					
			15	15		32			
20									
		8	3	3				Contains tr. clay (loose, SW-SC)	
			3	6		6			
25									
		9	7	11			2.5	Gy. CLAY, occ. Silt partings (moist, stiff, CL)	
			14	16		25			
30									
		10	6	6			0.8	Red-brn. & gy. CLAY, occ. Silt seams and partings, tr. gravel (moist, medium, CL)	
			4	8		10			
35									
		11	5	4					
			4	5		8			
40									

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.

C = No. blows to drive _____ " casing _____ " with _____ lb. weight falling _____ "per blow.

CLASSIFICATION Visual by Geologist

METHOD OF INVESTIGATION: ASTM D-1586 Using hollow stem augers

DATE
STARTED 12/16/86
FINISHED 12/16/86
SHEET 2 OF 2

EMPIRE SOILS INVESTIGATIONS INC.

SUBSURFACE LOG

HOLE NO. B-1
SURF. ELEV. 583.64
G. W. DEPTH See Note

PROJECT NFTA - Port of Buffalo
BTA-86-94B

LOCATION Fuhrmann Blvd.
Buffalo, NY

DEPTH-FT.	SAMPLES	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	Qu tsf	SOIL OR ROCK CLASSIFICATION	NOTES
40		12	9	20				Red-brn. SILT, tr. sand, tr. clay (moist, compact, ML)	
			22	28		42			
45		13	2	3			1.0	Red-brn. CLAY(moist, medium, CL)	
			5	3		8			
50		14	1	1				Red-brn. & gy. CLAY, occ. Silt seams or partings, tr. sand(moist, soft,CL)	
			2	2		3			
55		15	WOH	WOH				Becomes varved (very soft)	
			WOH	3		WOH			
60		16	17	100/.5		Ref.		Gy. Clayey SILT, some f-c Sand, little rock fragments (moist, firm, ML)	
								Boring Complete with auger refusal at 61.7'	Free Standing Water recorded at 36' at Boring Completion Driller noted free standing water @ 4' after removing augers from hole.
65									

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.

C = No. blows to drive _____ " casing _____ " with _____ lb. weight falling _____ "per blow.

CLASSIFICATION Visual by Geologist

METHOD OF INVESTIGATION: ASTM D-1586 Using hollow stem augers

DATE
STARTED 12/17/86
FINISHED 12/17/86
SHEET 1 OF 2

EMPIRE SOILS INVESTIGATIONS INC. SUBSURFACE LOG

HOLE NO. B-2
SURF. ELEV. 583.71
G. W. DEPTH See Note

PROJECT NFTA - Port of Buffalo
BTA-86-94B

LOCATION Fuhrmann Blvd.
Buffalo, NY

DEPTH-FT.	SAMPLES	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
0								0.1' TOPSOIL	
		1	11	19				Brn. Silty SAND, tr. gravel, tr. glass tr. brick (moist, fill, SM)	
			23	17		42			
		2	14	16				Blk. Silty SAND, tr. glass, tr. brick tr. cinders (moist, fill, SM)	
			14	12		30			
5		3	6	5				Contains trace slag	
			3	2		8			
		4	2	2					
			1	3		3			
		5	1	1				Contains some Wood Fragments, tr. roots (wet)	
10			1	4		2			
		6	2	5				Contains trace rubber	
			2	4		7			
		7	3	3					
			2	2		5			
15		8	2	2				Blk. SILT, tr. glass, tr. sand, tr. gravel (wet, FILL, ML)	Sample No. 8, 9 and 10: Organic decay odor noted
			1	1		3			
		9	3	3				Contains rubber fragments (wet)	
			1/1.0'			4			
		10	WOR/1.0'						
20			1	1		1			
		11	WOR	1/1.0'				Contains glass, metal fragments	
				1		1			
		12	5	9				Brn. gravelly SAND, tr. silt, (wet, firm, GM)	
			8	9		17			
25		13	5	5				Brn. f-c SAND, tr. gravel, tr. silt (wet, loose, SW)	
			5	6		10			
30								Red-brn. & gy. CLAY, occ. Silt partings and seams, tr. sand (moist, medium, CL)	
		14	5	4					
			4	4		8			
35									
		15	5	6				Contains some f-c Sand	
			4	3		10			
40									

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.

C = No. blows to drive _____ " casing _____ " with _____ lb. weight falling _____ "per blow.

CLASSIFICATION Visual by Geologist

METHOD OF INVESTIGATION: ASTM D-1586 Using hollow stem augers

DATE
STARTED 12/17/86
FINISHED 12/17/86
SHEET 2 OF 2

EMPIRE SOILS INVESTIGATIONS INC.

SUBSURFACE LOG

HOLE NO. B-2
SURF. ELEV. 583.71
G. W. DEPTH See Note

PROJECT NFTA - Port Of Buffalo
BTA-86-94B

LOCATION Fuhrmann Blvd.
Buffalo, NY

DEPTH-FT.	SAMPLES	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
40		16	1	2					
			2	3		4		Becomes gy., contains tr. gravel (soft)	
45		17	14	19				Gy. SILT, little f-c gravel, tr. sand (moist, compact, ML)	
			13	23		32			
50								Boring Complete with auger refusal at 48.5'	Free Standing Water upon boring Completion at 40.0'

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.

C = No. blows to drive _____ " casing _____ " with _____ lb. weight falling _____ "per blow.

CLASSIFICATION Visual by Geologist

METHOD OF INVESTIGATION: ASTM D-1586 Using hollow stem augers

DATE
STARTED 1/7/87
FINISHED 1/8/87
SHEET 1 OF 2

EMPIRE SOILS INVESTIGATIONS INC.

SUBSURFACE LOG

HOLE NO. B-3
SURF. ELEV. 581.19
G. W. DEPTH See Note

PROJECT NFTA - Port of Buffalo
BTA-86-94B

LOCATION Fuhrmann Blvd.
Buffalo, New York

DEPTH-FT	SAMPLES	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
0		1	3	2				TOPSOIL	
			4	10		6		Blk. CINDERS, and Silt, little f-c gravel, tr. sand, tr. roots, tr. glass (moist, FILL, SP)	
		2	7	8				Contains tr. paper, tr. roots	
			6	3		14			
5		3	4	3					
			3	3		6			
		4	2	1				Contains tr. slag	
			1	1		2			
		5	1	1				Grey SILT, and f-c Sand, tr. wire, tr. glass, tr. paper (wet, FILL, SM)	
10			1	1		2			
		6	WOR	1					WOR = Weight of rods
			1	1		2			WOH = Weight of hammer
15		7	2	2				Blk. & orange SILT, some glass, tr. iron shavings, tr. paper (wet, FILL, ML)	
			2	5		4			
20		8	2	1				Becomes black (moist)	
			2	2		3			
25		9	10	10				Grey f-c SAND, and fine Gravel, tr. silt (wet, firm, SW)	
			8	4		18			
30		10	8	3				Red-brn. & gry. Silty CLAY, tr. sand (moist, soft, CL)	
			2	4		5			
35		11	WOR	2					
			1	2		3			
40									

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.
CLASSIFICATION Visual by Geologist

C = No. blows to drive ____ " casing ____ " with ____ lb. weight falling ____ "per blow.

METHOD OF INVESTIGATION: ASTM D-1586, using hollow stem augers

DATE STARTED 1/7/87 FINISHED 1/8/87 SHEET 2 OF 2

EMPIRE SOILS INVESTIGATIONS INC. — **SUBSURFACE LOG**

HOLE NO. B-3
SURF. ELEV. 581.19
G. W. DEPTH See Notes

PROJECT NFTA - Port of Buffalo
BTA-86-94B

LOCATION Fuhrmann Blvd.
Buffalo, New York

DEPTH-FT.	SAMPLES	SAMPLE NO	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
40		12	2	4				Grey Silty CLAY, and f-c Sand, tr. gravel(moist, medium, CL)	
			4	100/.3'		8			Auger refusal @ 43.5'
45								Grey LIMESTONE ROCK, hard, sound, bedded to thickly bedded, occ. fossil finely crystalline	NQ"2" CORE Run #1: 43.5'-48.5' REC - 100% RQD - 100%
50								Boring complete @ 48.5'	1½" PVC monitoring well installed @ 21.6' @ boring completion Free standing water reading on 1/8/87 @ El. 573.1

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.

C = No. blows to drive _____ " casing _____ " with _____ lb. weight falling _____ "per blow.

CLASSIFICATION Visual by Geologist

METHOD OF INVESTIGATION: ASTM D-1586, using hollow stem augers

DATE
STARTED 12/26/86
FINISHED 12/26/86
SHEET 1 OF 2

EMPIRE SOILS INVESTIGATIONS INC. SUBSURFACE LOG

HOLE NO. B-4
SURF. ELEV. 584.07
G. W. DEPTH See Note

PROJECT NFTA - Port of Buffalo
BTA-86-94B

LOCATION Fuhrmann Blvd.
Buffalo, NY

DEPTH-FT.	SAMPLES	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
0		1	2	2				Brn. f-c SAND, tr. silt (moist, FILL, SW)	
			3	6		5		Contains tr. gravel	
		2	6	6					
			6	8		12		Brn. SILT, some f-c Sand (moist, FILL, ML)	
5		3	2	3					
			2	2		5			
		4	5	13				Blk. CINDERS, some f-c Sand, tr. silt, tr. glass (moist, FILL, SP)	
			10	6		23			
		5	2	3				Contains tr. slag (wet)	
10			1	3		4			
		6	1	2				Contains some Slag	
			1	1		3			
15		7	5	4					
			3	3		7			
20		8	4	2				Contains tr. slag	
			3	3		5			
25		9	9	11				Brn. f-c SAND, some f-c Gravel, tr. silt (moist, firm, SW)	
			11	8		22			
30		10	10	8				Brn, SILT, tr. sand (moist, firm, ML)	
			3	5		11			
35		11	4	1				Brn. Silty CLAY, occ. Silt partings and seams, tr. f-c sand (moist, very soft, CL)	
			1	2		2			
40									

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.

C = No. blows to drive _____ " casing _____ " with _____ lb. weight falling _____ "per blow.

METHOD OF INVESTIGATION: ASTM D-1586 Using hollow stem augers

CLASSIFICATION Visual by Geologist

DATE
STARTED 12/26/86
FINISHED 12/26/86
SHEET 2 OF 2

EMPIRE SOILS INVESTIGATIONS INC. **SUBSURFACE LOG**

HOLE NO. B-4
SURF. ELEV. 584.07
G. W. DEPTH See Note

PROJECT NFTA - Port of Buffalo
BTA-86-94B

LOCATION Fuhrmann Blvd.
Buffalo, NY

DEPTH-FT.	SAMPLES	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
40		12	WOR	WOR				Contains some f-c Sand	WOR - Weight of Rods WOH - Weight of Hammer
			WOR	WOR		WOR			
45		13	13	8				Contains some f-c Gravel (stiff)	
			16	23		24			
50		14	9	11				Gy. Clayey SILT, some f-c Sand, tr. gravel (moist, firm) (ML)	
			15	48		26			Free Standing Water recorded at 10.0' prior to coring
55								Auger refusal at 55.4'	
		15	100/.2			Ref.		Gy. LIMESTONE ROCK, medium hard, sound bedded to thick bedded, fossiliferous, fine crystalline.	NQ"2" CORE RUN #1 - 55.4'-65.4' REC - 87% RQD - 87%
60								Void at 60.1'-60.3'	Coring water lost at 60.1'
65								Boring Complete at 65.4'	
70									

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.

C = No. blows to drive _____ " casing _____ " with _____ lb. weight falling _____ "per blow.

CLASSIFICATION Visual by Geologist

METHOD OF INVESTIGATION: ASTM D-1586 Using Hollow stem augers

DATE
STARTED 1/2/87
FINISHED 1/2/87
SHEET 1 OF 2

EMPIRE SOILS INVESTIGATIONS INC. SUBSURFACE LOG

HOLE NO. B-5
SURF. ELEV. 586.04
G. W. DEPTH See Note

PROJECT NFTA - Port of Buffalo
BTA-86-94B

LOCATION Fuhrmann Blvd.
Buffalo, New York

DEPTH-FT.	SAMPLES	SAMPLE NO	BLOWS ON SAMPLER 0/6	6/12	12/18	N	Qu tsf	SOIL OR ROCK CLASSIFICATION	NOTES
0		1	2	2				TOPSOIL	
			3	4		5		Brn. f-c SAND, tr. silt. tr. gravel tr. roots(moist, FILL, SW)	
		2	5	4					First water encountered during drilling @ 4.0'
			5	4		9			
5		3	2	3				Blk. CINDERS, some Slag, some f-c Sand tr. glass(moist, FILL, SP)	Unconfined compressive strength(Qu) determined by using a "Soiltest" CL-700 Pocket Penetrometer
			3	5		6			
		4	4	4				Becomes white-grey	
			6	3		10			
		5	1	1				Becomes blk., contains tr. wood	
			2	5		3			
10		6	2	1				(wet)	
			1	2		2			
15		7	2	1					
			100/.5						
20		8	4	4				Blk. f-c SAND, tr. silt, tr. gravel (moist, FILL, SW-SP)	
			8	9		12			
25		9	19	7				Contains some f-c Gravel(wet)	
			9	9		16			
30		10	60	45				Contains tr. wire, tr. plastic	
			13	6		58			
35		11	4	4				Brn. SILT, and f-c Sand (moist, loose, ML)	
			1	2		5			
40									

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow. CLASSIFICATION Visual by Geologist

C = No. blows to drive _____ " casing _____ " with _____ lb. weight falling _____ "per blow.

METHOD OF INVESTIGATION: ASTM D-1586, using hollow stem augers

DATE
STARTED 1/2/87
FINISHED 1/2/87
SHEET 2 OF 2

EMPIRE SOILS INVESTIGATIONS INC. SUBSURFACE LOG

HOLE NO. B-5
SURF. ELEV. 586.04
G. W. DEPTH See Note

PROJECT NFTA - Port of Buffalo
BTA-86-94B

LOCATION Fuhrmann Blvd.
Buffalo, New York

DEPTH-FT.	SAMPLES	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	Qu (tsf)	SOIL OR ROCK CLASSIFICATION	NOTES
40		12	5	6				(firm)	
			8	8		14			
45		13	6	12				Contains little f-c Sand(wet)	
			9	5		21			
50		14	8	3				(moist, loose)	
			3	3		6			
55		15	3	4			0.1	Brn. Silty CLAY, occ. Silt seams, (moist, medium, CL)	
			4	4		8			
60		16	1	1				Contains tr. sand, tr. gravel(soft)	
			3	4		4			Free Standing Water reading on 5/5/87 at El. 575.4
65		17	19	18				Gry. SILT, some f-c Sand, tr. gravel (moist, compact, ML)	
			24	36		42			
70		18	28	34				Contains "and" f-c Sand(v. compact)	
			40	100/.3"		74		Grey LIMESTONE ROCK, hard, sound, bedded to thickly bedded, fossiliferous finely crystalline	NQ"2" CORE Run #1: 71.8'-77.0' REC - 88% RQD - 82%
75								Boring complete @ 77.0'	1½" PVC monitoring well installed @ 21.4' at boring completion

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.

C = No. blows to drive _____ " casing _____ " with _____ lb. weight falling _____ "per blow.

CLASSIFICATION Visual by Geologist

METHOD OF INVESTIGATION: ASTM D-1586, using hollow stem augers

DATE
STARTED 1/6/87
FINISHED 1/6/87
SHEET 1 OF 2

EMPIRE SOILS INVESTIGATIONS INC. SUBSURFACE LOG

HOLE NO. B-6
SURF. ELEV. 591.07
G. W. DEPTH See Notes

PROJECT NFTA - Port of Buffalo
BTA-86-94B

LOCATION Fuhrmann Blvd.
Buffalo, New York

DEPTH-FT.	SAMPLES	SAMPLE NO	BLOWS ON SAMPLER 0/6	6/12	12/18	N	Qu (tsf)	SOIL OR ROCK CLASSIFICATION	NOTES
0		1	12	19					Unconfined compressive strength tests performed using a Soil test CL-700 Pocket Penetrometer
			21	100/.0		40			
5		2	3	3				Brn.-blk. CINDERS, some Slag, tr. wood(moist, FILL, SP)	No rec. due to soil nature - SLAG PARKING LOT between 0 & 2 feet
			3	3		6			
		3	4	3					
			4	3		7			
		4	3	2				Contains some Brick Fragments	Auger through Rocks & Bolders - no. rec. between 2 and 4 feet
10			2	2		4			
15		5	2	1				Blk. Silt, tr. wood, tr. gravel, tr. sand(moist, FILL, ML)	
			4			5			
20		6	8	7				Contains some Sand, little Glass, tr. brick(wet)	Water first enc. @ 20.0'
			5			12			
25		7	4	1				Contains tr. sand, tr. glass, tr. iron fragments	
			1			2			
30		8	3	3					
			3			6			
35		9	2	2			0.7	Brn. & Gry. Silty CLAY, occ. Silt partings & seams, tr. sand(moist, soft, CL)	
			3			5			
40									

N = No. blows to drive 2" spoon 12" with 140 lb. pin wt. falling 30" per blow.
C = No. blows to drive ____" casing ____" with ____ lb. weight falling ____" per blow.

CLASSIFICATION Visual by Geologist

METHOD OF INVESTIGATION: ASTM D-1586, using hollow stem augers

B/T Form 11

DATE
STARTED 1/6/87
FINISHED 1/6/87
SHEET 2 OF 2

EMPIRE SOILS INVESTIGATIONS INC — SUBSURFACE LOG

HOLE NO. B-6
SURF. ELEV. 591.07
G. W. DEPTH See Notes

PROJECT NFTA - Port of Buffalo
BTA-86-94B

LOCATION Fuhrmann Blvd.
Buffalo, New York

DEPTH-FT.	SAMPLES	SAMPLE NO	BLOWS ON SAMPLER 0/6	6/12	12/18	N	Qu (tsf)	SOIL OR ROCK CLASSIFICATION	NOTES
40		10	WOR/12"				0.2		WOR = Weight of rod WOH = Weight of hammer
			1						
45		11	2	3					
			8			11			
50		12	WOR/1.5'			WOR			
55		13	WOR/1.0'			WOH		Grey SILT, little fine Sand(wet, loose, ML)	
			WOH						
60		14	WOH/1.5'			WOH		Brn. Silty CLAY, tr. sand(moist, soft CL)	
65		15	WOH/1.5'			WOH		Brn-Gry. SILT, tr. sand(wet, loose, ML)	
70		16	100/.1'			REF.		Grey SILT, and f-c Sand, tr. gravel (moist, v. compact, ML)	Pushed to refusal
75								Boring complete with auger refusal @ 75.2'	Free standing water @ 27.0' at boring completion

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.
C = No. blows to drive _____ " casing _____ " with _____ lb. weight falling _____ "per blow.
METHOD OF INVESTIGATION: ASTM D-1586, using hollow stem augers

CLASSIFICATION Visual by Geologist

DATE
STARTED 12/30/86
FINISHED 12/30/86
SHEET 1 OF 2

EMPIRE SOILS INVESTIGATIONS INC. SUBSURFACE LOG

HOLE NO. B-7
SURF. ELEV. 585.39
G. W. DEPTH See Note

PROJECT NFTA - Port of Buffalo
BTA-86-94B

LOCATION Fuhrmann Blvd
Buffalo, New York

DEPTH-FT.	SAMPLES	SAMPLE NO	BLOWS ON SAMPLER 0/6	6/12	12/18	N	Qu (tsf)	SOIL OR ROCK CLASSIFICATION	NOTES
0		1	6	17				Brn. f-c SAND, some Silt, tr. slag, tr. glass(moist, FILL, SW-SP)	Unconfined compressive strength(Qu) determined by using a "Soiltest" CL-700 Pocket Penetrometer
			9	7		26			
		2	5	5				Blk. SILT, some f-c Sand, tr. wood, tr. cinders(moist, FILL, ML)	
			7	5		12			
5		3	2	3					
			5	6		8			
		4	7	7				Blk. CINDERS, tr. sand, tr. slag, (moist, FILL, SP)	
			9	5		16			First free standing water recorded @ 9.0'
		5	6	6				Contains tr. glass(wet)	
			6	10		12			
10		6	11	11					
			10	11		21			
		7	11	9					
			3	4		12			
15		8	7	11					
			7	6		18			
		9	12	17				Brn. f-c SAND, tr. silt(wet, firm, SW)	
			11	10		28			
		10	16	20				(compact)	
20			25	29		45			
25									
		11	4	6				Gry. Clayey SILT, tr. sand, tr. wood (moist, firm, ML)	
			8	8		14			
30									
		12	5	9					
			6	7		15			
35									
		13	7	15				Becomes brn.(compact)	
			21	30		36			
40									

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.
C = No. blows to drive ____ " casing ____ " with ____ lb. weight falling ____ "per blow.
METHOD OF INVESTIGATION: ASTM D-1586, using hollow stem augers

CLASSIFICATION Visual by Geologist

DATE
STARTED 12/30/86
FINISHED 12/30/86
SHEET 2 OF 2

EMPIRE SOILS INVESTIGATIONS INC. SUBSURFACE LOG

HOLE NO. B-7
SURF. ELEV. 585.39
G. W. DEPTH See Note

PROJECT NFTA - Port of Buffalo
BTA-86-94B

LOCATION Fuhrmann Blvd.
Buffalo, New York

DEPTH-FT.	SAMPLES	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	Qu (tsf)	SOIL OR ROCK CLASSIFICATION	NOTES
40		14	4	7					
			9	8		16			
45		15	WOH	1				Brn.-gry. f-c SAND, tr. silt(wet, loose, SW)	WOH = Weight of hammer WOR = Weight of rod
			1	1		2			
50		16	1	1				Contains some Silt(moist)	
			2	1		3			
55		17	6	7				Brn. SILT, tr. sand(moist, firm, ML)	Driller installed 3" flush joint casing after 55.0'
			8	10		15			
60		18	WOH	1			0.3	Brn-gry. Silty CLAY(moist, v. soft)	Auger refusal @ 63.0' Free standing water rec. @ 0.0' prior to coring
			1	1		2			
65								Grey LIMESTONE ROCK, hard, sound, thin to thickly bedded, v. fossiliferous fine to coarsely crystalline	NQ "2" CORE Run #1: 63.0'-72.0' REC - 85% RQD - 75%
70									
75								Boring complete @ 72.0'	1¼" PVC monitoring well installed @ 21.5' Free Standing Water reading on 5/5/87 at El. 574.8

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.
CLASSIFICATION Visual by Geologist

C = No. blows to drive _____ " casing _____ " with _____ lb. weight falling _____ "per blow.

METHOD OF INVESTIGATION: ASTM D-1586, using hollow stem augers

B/T Form H

DATE
STARTED 12/31/86
FINISHED 12/31/86
SHEET 1 OF 2

EMPIRE SOILS INVESTIGATIONS INC. **SUBSURFACE LOG**

HOLE NO. B-8
SURF. ELEV. 586.62
G. W. DEPTH See Note

PROJECT NFTA - Port of Buffalo
BTA-86-94B

LOCATION Fuhrmann Blvd.
Buffalo, NY

DEPTH-FT.	SAMPLES	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
0		1	2	1				Brn. fine SAND, tr. gravel (moist, FILL, SP)	
			3	3		4			
		2	100/.5			Ref.		Contains trace silt	
5		3	6	8				Brn. f-c SAND, some f-c Gravel, tr. cinders, tr. brick (moist, FILL, SW)	
			6	4		14			
		4	4	7				Contains occ. Clay seams	
			6	10		13			
		5	4	5				Contains trace slag	First Free Standing water recorded at 10'
10			6	8		11			
		6	2	1				Blk. CINDERS, tr. silt, tr. glass (wet, FILL, SP)	WOH=Weight of hammer
			2	1		3			
		7	WOH	1				Contains trace rubber, trace wood	WOR=Weight of rods
			1	1		2			
15		8	3	3					Samples #8, #9 and #10: Organic decay odor noted
			2	2		5			
		9	1	1					
			1	3		2			
		10	2	1					
20			1	1		2			
		11	1	2					
			2	2		4			
		12	1	1					
			1	1		2			
25		13	2	1				Contains tr. brick, tr. iron frags.	
			2	3		3			
		14	1	2				Brn.-blk. organic SILT, tr. sand, tr. gravel (moist, loose, OL)	
			1	3		3			
30									
		15	3	2				Gy. fine SAND, tr. silt (moist, loose, SP)	
			3	1		5			
35									
		16	6	12				Gy. f-c GRAVEL and f-c Sand, tr. silt (wet, firm, GM)	
			14	16		26			
40									

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.

C = No. blows to drive _____ " casing _____ " with _____ lb. weight falling _____ "per blow.

CLASSIFICATION Visual by Geologist

METHOD OF INVESTIGATION: ASTM D-1586 Using hollow stem augers

B/T Form H

DATE
STARTED 12/31/86
FINISHED 12/31/86
SHEET 2 OF 2

EMPIRE SOILS INVESTIGATIONS INC.

SUBSURFACE LOG

HOLE NO. B-8
SURF. ELEV. 586.62
G. W. DEPTH See Note

PROJECT NFTA - Port of Buffalo
BTA-86-94B

LOCATION Fuhrmann Blvd.
Buffalo, NY

DEPTH-FT	SAMPLES	SAMPLE NO	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
40		17	8	10					
			10	16		20			
45		18	4	5				Gy. fine SAND, tr. silt (moist, loose, SP)	
			4	3		9			
50		19	3	2				Contains some Silt (wet, SM)	
			4	5		6			
55		20	6	5				Becomes brn-gy., contains tr. gravel (moist, firm)	
			6	10		11			
60		21	8	11				Becomes brown	
			17	21		28			
65		22	15	41				(very compact)	
			60	100		101			
70								Boring Complete w/Sampler Refusal at 67.0'	Free Standing Water recorded at 10' at Boring Completion 1¼" PVC monitoring well installed at 22.0' Free Standing Water reading on 5/5/87 at El. 575.8

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.

C = No. blows to drive _____ " casing _____ " with _____ lb. weight falling _____ "per blow.

CLASSIFICATION Visual by Geologist

METHOD OF INVESTIGATION: ASTM D-1586 Using hollow stem augers

R/T Form H

DATE
STARTED 12/17/86
FINISHED 12/19/86
SHEET 1 OF 2

EMPIRE SOILS INVESTIGATIONS INC. — SUBSURFACE LOG

HOLE NO. B-9
SURF. ELEV. 587.94
G. W. DEPTH See Note

PROJECT NFTA - Port Of Buffalo
BTA-86-94B

LOCATION Fuhrmann Blvd.
Buffalo, NY

DEPTH-FT.	SAMPLES	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
0		1	19	22				Gy. f-c SAND and concrete frags., some brick frags.(damp, FILL, SW)	
			42	26		64			
		2	9	7				Brn. f-c SAND, some Gravel, tr. glass (moist, FILL, SW)	
			7	6		14			
5		3	3	4				Brn.-blk. f-c SAND, some Silt, tr. paper, tr. slag (moist, FILL, SW)	First Free Standing Water encountered at 5'
			9	10		13			
		4	8	7				Brn. fine SAND, some Silt (moist, FILL, SM)	
			25	20		32			
		5	5	12					
10			11	10		23		Becomes grey	
		6	2	4				Brn.-blk. organic SILT, occ. Clay partings, tr. sand (moist, FILL, OL)	
			6	9		10			
15		7	6	9					
			7	8		16			
20		8	14	8				Gy. Concrete frags., some Wood, some Silt, some Sand(moist, fill, GP)	
			10	8		18			
		9	8	5				Blk. f-c SAND, some	
			6	7		11			
25		10	7	8				Blk. SILT, some f-c Sand, some Wood tr. glass (moist, FILL, ML)	Sample #10 and #11: Oil or petroleum odor noted
			7	8		15			
		11	7	4				(wet)	
			9	11		13			
30		12	3	3				Contains trace gravel	
			2	5		5			
35		13	5	11				Brn. Silty SAND, tr. gravel(moist, firm, SM)	
			12	12		23			
40									

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.

C = No. blows to drive _____ " casing _____ " with _____ lb. weight falling _____ "per blow.

CLASSIFICATION Visual by Geologist

METHOD OF INVESTIGATION: ASTM D-1586 Using hollow stem augers

R/T Form H

DATE
STARTED 12/17/86
FINISHED 12/19/86
SHEET 2 OF 2

EMPIRE SOILS INVESTIGATIONS INC. — **SUBSURFACE LOG**

HOLE NO. B-9
SURF. ELEV. 587.94
G. W. DEPTH See Note

PROJECT NFTA - Port of Buffalo
BTA-86-94B

LOCATION Fuhrmann Blvd.
Buffalo, NY

DEPTH-FT.	SAMPLES	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	Qu tsf	SOIL OR ROCK CLASSIFICATION	NOTES
40		14	6	6					Unconfined compressive strength tests performed using a Soiltest CL-700 Pocket Penetrometer
			8	20		14			
45		15	9	5				Contains occ. Clay seams	
			4	4		9			
50		16	5	5				Brn. SILT, tr. sand (moist, loose, ML)	
			4	8		9			
55		17	4	2			.7	Brn. Silty CLAY, tr. sand (moist, soft, CL)	
			2	2		4			
60		18	2	2			.8		
			3	4		5			
65		19	3	3				Brn. SILT, and f-c Sand, occ. Clay seams, tr. gravel (moist, firm, SM)	
			8	26		11			
70		20	26	40				Becomes gray (very compact)	Driller notes encountering cobbles at 75' to 78'
			50	80		90			
75		21	100/.5			Ref.			Auger Refusal at 78.0'
80								Boring Complete w/Auger Refusal at 78.0'	F.S.W. recorded at 23' at Boring Completion

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.

C = No. blows to drive _____ " casing _____ " with _____ lb. weight falling _____ "per blow.

CLASSIFICATION Visual by Geologist

METHOD OF INVESTIGATION: ASTM D-1586 Using hollow stem augers

R/T Form H

DATE
STARTED 1/7/87
FINISHED 1/7/87
SHEET 1 OF 2

EMPIRE SOILS INVESTIGATIONS INC. SUBSURFACE LOG

HOLE NO. B-10
SURF. ELEV. 586.53
G. W. DEPTH See Notes

PROJECT NFTA - Port of Buffalo
BTA-86-94B

LOCATION Fuhrmann Blvd.
Buffalo, New York

DEPTH-FT.	SAMPLES	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	Qu (tsf)	SOIL OR ROCK CLASSIFICATION	NOTES
0		1	2	2				Brn. fine SAND(moist, FILL, SP)	Unconfined compressive strength(Qu) determined by using a "Soiltest" CL-700 Pocket Penetrometer
			4	2		6			
		2	4	8				Brn. f-c SAND, tr. brick(moist, FILL SW)	
			10	16		18			
5		3	12	14				Contains tr. cinders	
			13	13		27			
		4	15	17					
			22	24		39			
		5	4	5				Contains tr. silt(wet)	
			8	8		13			
10									
15		6	1	1					
			2			3			
20		7	WOH/1.5'			WOH		Gry. SILT, tr. sand(moist, loose, ML)	WOH= Weight of hammer WOR = Weight of rod
25		8	2	2					
			2			4			
30		9	1	1					
			4			5			Driller reports enc. "Running Sands" @ 30'.
35		10	WOH/1'				0.2	Brn. Silty CLAY, little f-c Sand (moist, v. soft, CL)	
			2			2			
40									

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.
C = No. blows to drive _____ " casing _____ " with _____ lb. weight falling _____ "per blow.
CLASSIFICATION Visual by Geologist
METHOD OF INVESTIGATION: ASTM D-1586, using hollow stem augers

B/T Form H

DATE
STARTED 1/7/87
FINISHED 1/7/87
SHEET 2 OF 2

EMPIRE SOILS INVESTIGATIONS INC. **SUBSURFACE LOG**

HOLE NO. B-10
SURF. ELEV. 586.53
G. W. DEPTH See Note

PROJECT NFTA - Port of Buffalo
BTA-86-94B

LOCATION Fuhrmann Blvd.
Buffalo, NY

DEPTH-FT.	SAMPLES	SAMPLE NO.	BLOWS ON SAMPLER 0/6 | 6/12 | 12/18	N	Qu (tsf)	SOIL OR ROCK CLASSIFICATION	NOTES
40							
		11	WOH/1.0' 1	1	0.1		
45		12	WOH/1.5'	WOH			
50		13	WOR/1.5'	WOR			
55		14	12 15 100/.2	REf.		Gry.-brn. SILT and f-c Sand(moist, v. compact, ML)	
						Boring complete with refusal @ 56.2'	Free standing water rec. @ 56.0' at boring completion
60							

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.
C = No. blows to drive _____ " casing _____ " with _____ lb. weight falling _____ "per blow.

CLASSIFICATION Visual by Geologist

METHOD OF INVESTIGATION: ASTM D-1586, using hollow stem augers

R/T Form H

DATE
STARTED 1/8/87
FINISHED 1/8/87
SHEET 1 OF 2

EMPIRE SOILS INVESTIGATIONS INC. SUBSURFACE LOG

HOLE NO. B-11
SURF. ELEV. 586.75
G. W. DEPTH See Note

PROJECT NFTA - Port of Buffalo
BTA-86-94B

LOCATION Furhmann Blvd.
Buffalo, New York

DEPTH-FT.	SAMPLES	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	Qu (tsf)	SOIL OR ROCK CLASSIFICATION	NOTES
0		1	6	8				Blk. SILT, and f-c Gravel, some cinders, tr. brick(moist, FILL, ML)	Unconfined compressive strength(Qu) determined by using a "Soiltest" CL-700 Pocket Penetrometer
			8	20		16			
		2	27	26					
			8	6		34			
		3	14	8				Contains tr. gravel, tr. clay	
5			4	4		12			
		4	4	6				Grey SLAG, tr. silt(moist, FILL,SP-GP)	
			12	14		18			
		5	12	13				Grey fine SAND, little Slag(moist, FILL, SP)	
			100/.1			Ref.			
10									
15		6	11	11				(wet)	
			10			21			
20		7	5	3				Contains tr. brick	
			4			7			
25		8	5	4				Brn.-Blk. Clayey SILT and f-c Sand (moist, loose, ML)	
			3			7			
30		9	4	7				Becomes red-brn. contains occ Sand seams(firm)	
			9			16			
35		10	2	2			0.2	Red-brn. Silty CLAY, tr. sand(moist, soft, CL)	
			1			3			
40									

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.
C = No. blows to drive ____ " casing ____ " with ____ lb. weight falling ____ "per blow.
METHOD OF INVESTIGATION: ASTM D-1586, using hollow stem augers

CLASSIFICATION Visual by Geologist

R/T Form H

DATE
STARTED 1/8/87
FINISHED 1/8/87
SHEET 2 OF 2

EMPIRE SOILS INVESTIGATIONS INC. SUBSURFACE LOG

HOLE NO. B-11
SURF. ELEV. 586.75
G. W. DEPTH See Note

PROJECT NFTA - Port of Buffalo

LOCATION Fuhrmann Blvd.
Buffalo, New York

DEPTH-FT.	SAMPLES	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	Qu (tsf)	SOIL OR ROCK CLASSIFICATION	NOTES
40		11	WOH/1.0'			2	0.2	(v. soft)	WOH = Weight of hammer WOR = Weight of rod
			2						
45		12	3	7				Contains "and" f-c Sand, tr. gravel (stiff)	
			12			19			
50		13	20	15					
			13			28			
55		14	14	28				Gry. SILT, and f-c Sand, little f-c Gravel (moist, v. compact, ML)	
			29			57			
		15	100/0.1'			Ref.		Boring complete with auger refusal at 58.8'	Free standing water rec. @ 22.2' at boring completion
60									

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.

C = No. blows to drive _____ " casing _____ " with _____ lb. weight falling _____ "per blow.

CLASSIFICATION Visual by Geologist

METHOD OF INVESTIGATION: ASTM D-1586, using hollow stem augers

R/T Form H

DATE
STARTED 1/8/87
FINISHED 1/8/87
SHEET 1 OF 2

EMPIRE SOILS INVESTIGATIONS INC. — **SUBSURFACE LOG**

HOLE NO. B-12
SURF. ELEV. 583.60
G. W. DEPTH See Note

PROJECT NFTA- Port of Buffalo
BTA-86-94B

LOCATION Fuhrmann Blvd.
Buffalo, New York

DEPTH-FT.	SAMPLES	SAMPLE NO	BLOWS ON SAMPLER 0/6	6/12	12/18	N	Qu (tsf)	SOIL OR ROCK CLASSIFICATION	NOTES
0		1	4	7				Brn. SILT, some f-c Sand, tr. gravel tr. brick, tr. roots(moist, FILL, ML)	Unconfined compressive strength(Qu) determined by using a "Soiltest" CL-700 Pocket Penetrometer
			8	16		15			
		2	11	12				Contains tr. sand	
			17	26		29			
5		3	10	4				Contains some f-c Sand	
			4	9		8			
		4	6	7				Blk. Wood Fragments(moist, FILL)	
			9	9		16			
		5	8	10					
10			12	15		22			
15		6	3	2					
			1			3			
20		7	2	3				Brn.-gry. SILT and f-c Sand, tr. gravel(wet, loose, ML)	
			5			8			
25		8	5	5				Gry.-blk. fine SAND, tr. silt (moist, loose, SP)	
			5			10			
30		9	3	4			0.5	Brn. Silty CLAY, occ. Silt seams & partings, tr. sand(moist,medium, CL)	
			5			9			
35		10	1	2			0.5	Contains tr. gravel(soft)	
			1			3			
40									

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.
C = No. blows to drive _____ " casing _____ " with _____ lb. weight falling _____ "per blow.

CLASSIFICATION Visual by Geologist

METHOD OF INVESTIGATION: ASTM D-1586, using hollow stem augers

R/T Form H

DATE
STARTED 1/8/87
FINISHED 1/8/87
SHEET 2 OF 2

EMPIRE SOILS INVESTIGATIONS INC. — **SUBSURFACE LOG**

HOLE NO. B-12
SURF. ELEV. 583.60
G. W. DEPTH See Note

PROJECT NFTA - Port of Buffalo
BTA-86-94B

LOCATION Fuhrmann Blvd.
Buffalo, New York

DEPTH-FT.	SAMPLES	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	Qu (tsf)	SOIL OR ROCK CLASSIFICATION	NOTES
40		11	1	2			0.3	Contains little f-c Sand	
			2			4			
45		12	4	4				Contains "and" f-c Sand(medium)	
			5			9			
50		13	3	3					
			3			6			
55		14	4	4				Contains little f-c Gravel	
			7			11			
		15	100/0.0'			Ref.			
60								Boring complete with auger and sampler refusal @ 58.2'	Free standing water rec. @ 31.5' @ boring completion

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.

C = No. blows to drive _____ " casing _____ " with _____ lb. weight falling _____ "per blow.

CLASSIFICATION Visual by Geologist

METHOD OF INVESTIGATION: ASTM D-1586, using hollow stem augers

B/T Form H

DATE STARTED 1/13/87 FINISHED 1/13/87 SHEET 1 OF 2

EMPIRE SOILS INVESTIGATIONS INC. **SUBSURFACE LOG**

HOLE NO. B-13 SURF. ELEV. 579.73 G. W. DEPTH See Notes

PROJECT NFTA - Port of Buffalo BTA-86-94B

LOCATION Fuhrmann Blvd. Buffalo, New York

DEPTH-FT.	SAMPLES	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
0		1	1	2				0.4' TOPSOIL	
			2	2		4		Brn. SILT, and f-c Sand, tr. roots, tr. brick, tr. plastic(moist, FILL,ML)	
		2	2	3					
			3	3		6			
		3	3	4					
5			4	3		8			
		4	2	2					
			3	2		5			
		5	WOH	2				Brn. f-c SAND, and Silt, tr. gravel (wet, loose, SM)	WOH = Weight of hammer WOR = Weight of rods
10			1	WOH		3			
15		6	WOH	2				Red-brn. Silty CLAY, little f-c Gravel, little f-c Sand(wet, soft, CL)	
			2			4			
20		7	2	2				Contains occ. Sand seams	
			3			5			
25		8	2	3					
			6			9			
30		9	5	7				Brn. SILT, tr. sand(moist, firm,ML)	
			9			16			
35		10	WOH	WOH				Brn. Silty CLAY, some f-c Sand, tr. gravel(wet, v. soft, CL)	
			WOH			WOH			
40									

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.

C = No. blows to drive ____ " casing ____ " with ____ lb. weight falling ____ "per blow.

CLASSIFICATION Visual by Geologist

METHOD OF INVESTIGATION: ASTM D-1586, using hollow stem augers

B/T Form H

DATE
STARTED 1/13/87
FINISHED 1/13/87
SHEET 2 OF 2

EMPIRE SOILS INVESTIGATIONS INC. SUBSURFACE LOG

HOLE NO. B-13
SURF. ELEV. 579.73
G. W. DEPTH See Notes

PROJECT NFTA - Port of Buffalo
BTA-86-94B

LOCATION Fuhrmann Blvd.
Buffalo, New York

DEPTH-FT.	SAMPLES	SAMPLE NO	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
40		11	2	3				Gry.-brn. SILT and f. Sand(wet,	
			3			6		loose, ML)	
45		12	3	4				Contains little f-c Gravel	
			6			10			
50		13	8	12				Gry.-brn. fine SAND, tr. silt(moist,	
			12			24		firm, SP)	
55		14	14	16				Contains "and" Silt(compact, SM)	
			27			43			
60		15	100/.1'			Ref.		Gry. LIMESTONE ROCK, hard, sound, thickly bedded to massive, occ. fossils, fine to medium crystalline	NQ"2" CORE Run #1: 60.1'-65.1' REC - 100% RQD - 100%
65								Boring complete at 65.1'	No free standing water enc. before coring 1½" PVC well installed @ 20.0'
70									

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.

C = No. blows to drive ____ " casing ____ " with ____ lb. weight falling ____ "per blow.

CLASSIFICATION Visual by Geologist

METHOD OF INVESTIGATION: ASTM D-1586, using hollow stem augers

P/T Form U

DATE
STARTED 12/20/86
FINISHED 12/20/86
SHEET 1 OF 2

EMPIRE SOILS INVESTIGATIONS INC. SUBSURFACE LOG

HOLE NO. B-14
SURF. ELEV. 588.17
G. W. DEPTH See Note

PROJECT NFTA -Port of Buffalo
BTA-86-94B

LOCATION Fuhrmann Blvd.
Buffalo, NY

DEPTH-FT.	SAMPLES	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
0		1	4	8				TOPSOIL	
			75	80		83		Blk. Asphaltic Concrete and Gravel (damp, FILL, GP)	
		2	18	4				Brn. Clayey SILT, some f-c Sand,	
			4	5		8		little fractured Rock fragments (moist,loose,ML)	
5		3	5	7				Brn. f-c SAND, tr. gravel, tr. silt	
			7	10		14		(damp, firm, SW)	
		4	9	8					
			11	15		19			
		5	8	15				(compact)	
10			16	22		31			
		6	10	16					
			18	20		34			
15		7	5	4				Gy.-brn. SILT and f-c Sand, tr. gravel	
			5	11		9		(moist, loose, SM)	
20		8	2	1					
			2	2		3			
25		9	WOR	2				Contains occ. Clay partings	WOR = Weight of rods WOH = Weight of hammer
			2	2		4			
30		10	5	2				Gy.-brn. Silty CLAY, some f-c Sand,	
			4	2		6		tr. gravel (moist, medium, CL)	
35		11	WOR	WOR				Brn.-blk. Clayey SILT, tr. sand, tr.	
			WOR	2		WOR		gravel (moist, loose, ML)	
40									

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.
C = No. blows to drive ____ " casing ____ " with ____ lb. weight falling ____ "per blow.

CLASSIFICATION Visual by Geologist

METHOD OF INVESTIGATION: ASTM D-1586 Using hollow stem augers

B/T Form H

DATE
STARTED 12/20/86
FINISHED 12/20/86
SHEET 2 OF 2

EMPIRE SOILS INVESTIGATIONS INC. **SUBSURFACE LOG**

HOLE NO. B-14
SURF. ELEV. 588.17
G. W. DEPTH See Note

PROJECT NFTA - Port of Buffalo
BTA-86-94B

LOCATION Fuhrmann Blvd.
Buffalo, NY

DEPTH-FT.	SAMPLES	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
40		12	WOR	WOR				Red-brn. and gy. varved CLAY and Silt tr. sand (moist, very soft, CL)	
			WOR	WOR		WOR			
45		13	7	8				Gy. SILT, tr. sand (moist, firm, ML)	
			11	15		19			
50		14	10	10					
			9	9		19			
55		15	5	8				Gray f-c SAND, some Silt, tr. gravel (moist, firm, SM)	
			10	15		18			
60		16	11	7					Driller notes encountering saturated sands at 60.0'
			6	6		13			
65		17	8	100/0.1		Ref.		Red-by. SILT, some f-c Sand, tr. gravel (moist, ML)	Free Standing Water recorded at 12.2' prior to coring
70								Gray LIMESTONE ROCK, medium hard, sound, bedded to thick bedded, finely crystalline, fossiliferous.	NQ"2" CORE RUN #1: 66.3'-76.3' REC - 83% RQD - 78%
								Void at 71.8'-71.9'.	Coring water "lost" at 71.8'
75								Boring Complete at 76.3'	

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.

C = No. blows to drive _____ " casing _____ " with _____ lb. weight falling _____ "per blow.

CLASSIFICATION Visual by Geologist

METHOD OF INVESTIGATION: ASTM D-1586 Using hollow stem augers

B/T Form H

DATE
STARTED 1/5/87
FINISHED 1/6/87
SHEET 1 OF 2

EMPIRE SOILS INVESTIGATIONS INC. SUBSURFACE LOG

HOLE NO. B-15
SURF. ELEV. 585.40
G. W. DEPTH See Notes

PROJECT NFTA - Port of Buffalo
BTA-86-94B

LOCATION Fuhrmann Blvd.
Buffalo, New York

DEPTH-FT.	SAMPLES	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
0		1	2	18				Brn. fine SAND, and Brick Frags., (moist, FILL, SP)	
			100			118			
		2	19	16				Brn. f-c SAND, little f-c Gravel (moist, FILL, SW)	
			18	6		34			
5		3	13	15				Contains tr. brick pieces	
			15	18		30			
		4	11	8				Brn. fine SAND, little f-c Gravel (moist, FILL, SP)	
			10	13		18			
		5	4	5				Contains "and" Silt(SM)	
10			6	9		11			
		6	6	4					
			3	6		7			
15		7	5	7				Contains some Silt	
			8	11		15			
									WOH = Weight of hammer
20		8	WOH	WOH					WOR = Weight of rod
			WOH	WOH		WOH			
25		9	5	9				Brn. Clayey SILT, some fine Sand, tr. brick, tr. wood, tr. salt(moist, FILL, ML)	
			22	7		31			
30		10	7	5				Blk. WOOD(moist, FILL)	
			2	7		7			
35		11	8	8				Brn. f-c SAND, some f-c Gravel, tr. silt(moist, firm, SW)	
			12	15		20			
40									

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.
CLASSIFICATION Visual by Geologist

C = No. blows to drive _____ " casing _____ " with _____ lb. weight falling _____ "per blow.

METHOD OF INVESTIGATION: ASTM D-1586, using hollow stem augers

B/T Form H

DATE
STARTED 1/5/87
FINISHED 1/6/87
SHEET 2 OF 2

EMPIRE SOILS INVESTIGATIONS INC. — **SUBSURFACE LOG**

HOLE NO. B-15
SURF. ELEV. 585.40
G. W. DEPTH See Notes

PROJECT NFTA - Port of Buffalo
BTA-86-94B

LOCATION Fuhrmann Blvd.
Buffalo, New York

DEPTH-FT.	SAMPLES	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
40		12	6	4				Brn. SILT, tr. sand(moist,loose, ML)	
			4	5		8			
45		13	2	3				Brn. Silty CLAY, some f-c Sand(moist soft, CL)	
			2	4		5			
50		14	2	3				Contains little f-c Sand(medium)	
			3	4		6			
55		15	4	12				Contains some f-c Sand, tr. gravel (hard)	
			14	27		26			
60		16	15	25				Brn. SILT, and fine Sand(moist, v. compact, ML)	Auger refusal @ 63.5'
			45	65		70			
65								Grey LIMESTONE ROCK, hard, sound, thickly bedded to massive, occ. fossils, finely crystalline Void @ 67.9'-68.1'	NQ"2" CORE Run #1: 63.5'-68.5' REC - 100% RQD - 100% 80% Coring water lost @ 67.9'
								Boring complete @ 68.5'	1½" PVC well installed @ 19.1' Free standing water reading on 1/7/87 at El. 571.1 Free Standing Water reading on 5/5/87, at El. 577.5

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.

C = No. blows to drive _____ " casing _____ " with _____ lb. weight falling _____ "per blow.

CLASSIFICATION Visual by Geologist

METHOD OF INVESTIGATION: ASTM D-1586, using hollow stem augers

DATE
STARTED 1/9/87
FINISHED 1/9/87
SHEET 1 OF 2

EMPIRE SOILS INVESTIGATIONS INC — SUBSURFACE LOG

HOLE NO. B-16
SURF. ELEV. 582.22
G. W. DEPTH See Note

PROJECT NFTA - Port of Buffalo
BTA-86-94B

LOCATION Fuhrmann Blvd.
Buffalo, New York

DEPTH-FT.	SAMPLES	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
0		1	12	13				Brn. fine SAND, tr. silt, tr. salt (moist, FILL, SP)	Unconfined compressive strength(Qu) determined by using a "Soiltest" CL-700 Pocket Penetrometer
			14	15		27			
		2	9	15				Becomes blk., contains "and" Silt	
			15	11		30			
5		3	3	7				Brn. blk. SILT, tr. sand(moist, FILL,ML)	
			11	12		18			
		4	6	6				Becomes brown	
			5	4		11			
		5	7	13				Blk. CINDERS, tr. gravel, tr. glass, tr. silt, tr. brick(moist, FILL,SP GP)	
10			15	25		28			
		6	17	13					
			12	12		25			
15		7	12	9				Blk. SILT, some Glass, tr. sand, tr. slag(moist, FILL, ML)	
			6	11		15			
20		8	7	5					
			5	12		10			
25		9	1	1				Becomes brn.-gry.	
			1	8		2			
30		10	10	10				Brn.-gry. f-c SAND, some f-c Gravel tr. silt(wet, firm, SW)	
			12	14		22			
35		11	29	22				(compact)	
			25	25		47			
40									

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.
C = No. blows to drive _____ " casing _____ " with _____ lb. weight falling _____ "per blow.

CLASSIFICATION Visual by Geologist

METHOD OF INVESTIGATION: ASTM D-1586, using hollow stem augers

R/T Form H

DATE
STARTED 1/9/87
FINISHED 1/9/87
SHEET 2 OF 2

EMPIRE SOILS INVESTIGATIONS INC. SUBSURFACE LOG

HOLE NO. B-16
SURF. ELEV. 582.22
G. W. DEPTH See Notes

PROJECT NFTA - Port of Buffalo
BTA-86-94B

LOCATION Fuhrmann Blvd.
Buffalo, New York

DEPTH-FT.	SAMPLES	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
40		12	6	7				Brn. fine SAND, tr. silt(moist, firm	
			8	12		15		SP)	
45		13	10	18					
			6	4		24			
50		14	3	2				Red-brn. Silty CLAY, tr. sand, (moist	
			2	2		4		soft, CL)	
55		15	3	5				Contains little f-c SAND, tr. gravel	
			10	10		15		(medium)	
60		16	WOR	WOR					WOR = Weight of rod WOH = Weight of hammer Sample #16: No sample recovery due to soil nature
			WOR	WOR		WOR			
65		17	31	15				Gry. f-c SAND, and Silt, some f-c	
			30	37		45		Gravel(moist, compact, SM)	
70		18	100/.5'			Ref.			
								Boring complete with auger refusal at 71.0'	Free standing water rec. @ 15.0' at boring completion
75									

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.
C = No. blows to drive ____ " casing ____ " with ____ lb. weight falling ____ "per blow.

CLASSIFICATION Visual by Geologist

METHOD OF INVESTIGATION: ASTM D-1586, using hollow stem augers

B/T Form H

DATE
STARTED 12/29/86
FINISHED 12/29/86
SHEET 1 OF 2

EMPIRE SOILS INVESTIGATIONS INC.

SUBSURFACE LOG

HOLE NO. B-17
SURF. ELEV. 586.12
G. W. DEPTH See Note

PROJECT NFTA - Port of Buffalo
BTA-86-94B

LOCATION Fuhrmann Blvd.
Buffalo, New York

DEPTH-FT	SAMPLES	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	Qu (t$f)	SOIL OR ROCK CLASSIFICATION	NOTES
0		1	6	8				Brn. f-c SAND, some Silt, tr. gravel tr. slag, tr. glass(moist, FILL, SW)	Unconfined compressive strength(Qu) determined by using a "Soiltest" CL-700 Pocket Penetrometer
			12	14		20			
		2	7	7				Contains some fract. Rock. Frags, tr. brick	
			11	17		18			
		3	17	21				(wet)	
5			34	26		55			
		4	20	20					First free standing water recorded at 6.0'
			12	7		32			
		5	8	6				Brn. SILT, tr. sand(moist, firm, ML)	
			6	6		12			
10		6	2	3				Contains little f-c Sand(loose)	
			5	4		8			
15		7	WOH	1				Contains "and" f-c Sand	WOH = Weight of hammer WOR = Weight of rod
			1	1		2			
20		8	WOR	WOH				Brn. Clayey SILT, tr. sand(moist, loose, ML)	
			WOH	1		WOH			
25		9	1	1				Contains occ. clay, seams & partings tr. gravel	
			1	2		2			
30		10	WOR/1.0'						
			1	1		1			
35		11	3	4				Brn. f-c SAND, tr. gravel, tr. silt (wet, firm, SW)	Driller notes enc. saturated(running) sands @ 35 feet.
			10	14		14			
40									

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.
C = No. blows to drive ____ " casing ____ " with ____ lb. weight falling ____ "per blow.
METHOD OF INVESTIGATION: ASTM D-1586, using hollow stem augers

CLASSIFICATION Visual by Geologist

DATE
STARTED 12/29/86
FINISHED 12/29/86
SHEET 2 OF 2

EMPIRE SOILS INVESTIGATIONS INC. — **SUBSURFACE LOG**

HOLE NO. B-17
SURF. ELEV. 586.12
G. W. DEPTH See Note

PROJECT NFTA - Port of Buffalo
BTA-86-94B

LOCATION Fuhrmann Blvd.
Buffalo, New York

DEPTH-FT.	SAMPLES	SAMPLE NO	BLOWS ON SAMPLER 0/6	6/12	12/18	N	Qu (tsf)	SOIL OR ROCK CLASSIFICATION	NOTES
40		12	No Sample						"Blow-in" in augers
45		13	15	16				Brn.-gry. SILT, tr. sand (moist, compact, ML)	
			20	21		36			
50		14	10	17				Brn. f-c SAND, tr. silt(moist, compact, SW)	
			21	20		38			
55		15	6	13					
			18	21		31			
60		16	4	4			0.3	Red-brn. Silty CLAY, some f-c Sand, tr. gravel(moist, medium, CL)	
			8			12			
65		17	19	11			0.8	(stiff)	Free standing water @ 6.0' prior to coring
			14	18		25			
70								Gry. LIMESTONE ROCK, hard, sound, thinly to thickly bedded, very fossiliferous, finely to coarsely crystalline Void 72.0'-72.1'	NQ"2" CORE Run #1: 67.2'-71.2' REC - 95% RQD - 90% Run #2 - 71.2'-77.2' REC - 100% RQD - 100% Lost water @ 72.0'
75								Boring complete at 77.2'	Free standing water rec. @ 51' at boring completion

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.

C = No. blows to drive _____ " casing _____ " with _____ lb. weight falling _____ "per blow.

CLASSIFICATION Visual by Geologist

METHOD OF INVESTIGATION: ASTM D-1586, using hollow stem augers

B-T Form H

DATE STARTED 12/30/86
FINISHED 12/30/86
SHEET 1 OF 2

EMPIRE SOILS INVESTIGATIONS INC. SUBSURFACE LOG

HOLE NO. B-18
SURF. ELEV. 579.00
G. W. DEPTH See Note

PROJECT NFTA - Port of Buffalo
BTA-86-94B

LOCATION Fuhrmann Blvd.
Buffalo, New York

DEPTH-FT.	SAMPLES	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
0		1	6	17				White SALT(damp, FILL)	
			18	16		35			
		2	30	60				Blk. CINDERS and Rock frags., tr. wood(moist, FILL, SP-GP)	
			55	33		115			
5		3	15	14				Blk. f-c SAND, and Cinders, tr. glass tr. gravel(moist, FILL, SW)	
			11	19		25			
		4	17	11					
			9	11		20			
		5	2	4				Becomes blk., contains tr. silt, tr. wood, tr. gravel(wet)	
10			5	5		9			
		6	2	4				Contains tr. brick(moist)	
			7	11		11			
15		7	5	6					
			5	6		11			
20		8	5	3				Blk. SILT, tr. sand(moist, loose, OL)	Sample No. 8: Petroleum odor noted
			3	6		6			
25		9	7	11				Gry.-brn. fine SAND, tr. silt, tr. gravel(moist, firm, SP)	
			15	22		26			
30		10	4	6					
			9	13		15			
35		11	6	9					
			10	18		19			
40									

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.

C = No. blows to drive _____ " casing _____ " with _____ lb. weight falling _____ "per blow.

CLASSIFICATION Visual by Geologist

METHOD OF INVESTIGATION: ASTM D-1586, using hollow stem augers

R/T Form V

DATE
STARTED 12/30/86
FINISHED 12/30/86
SHEET 2 OF 2

EMPIRE SOILS INVESTIGATIONS INC. — **SUBSURFACE LOG**

HOLE NO. B-18
SURF. ELEV. 579.00
G. W. DEPTH See Note

PROJECT NFTA - Port of Buffalo
BTA-86-94B

LOCATION Fuhrmann Blvd.
Buffalo, New York

DEPTH-FT.	SAMPLES	SAMPLE NO	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
40		12	13	10					
			10	18		20			
45		13	5	7				Contains some Silt (SM)	
			10	14		17			
50		14	6	13				(compact)	
			20	21		33			
55		15	8	100/.2		REF.		(v. compact)	Auger refusal @ 57.0'. Free standing water rec. @9.0'prior to coring
								Grey LIMESTONE ROCK, hard, sound, bedded to thickly bedded, occ. fossils, finely crystalline	NQ"2" CORE Run #1: 57'-61' REC - 95% RQD - 83% Run #2: 61'-62' REC - 100% RQD - 100%
60								Boring complete @ 62.0'	
65									

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.
C = No. blows to drive ____ " casing ____ " with ____ lb. weight falling ____ "per blow.

CLASSIFICATION Visual by Geologist

METHOD OF INVESTIGATION: ASTM D-1586, using hollow stem augers

B/T Form H

DATE
STARTED 1/19/87
FINISHED 1/20/87
SHEET 1 OF 3

EMPIRE SOILS INVESTIGATIONS INC. — **SUBSURFACE LOG**

HOLE NO. B-19
SURF. ELEV. 580.99
G. W. DEPTH See Notes

PROJECT NFTA - Port of Buffalo
BTA-86-94B

LOCATION Fuhrmann Blvd.
Buffalo, New York

DEPTH-FT.	SAMPLES	SAMPLE NO	BLOWS ON SAMPLER 0/6	6/12	12/18	N	Qu (tsf)	SOIL OR ROCK CLASSIFICATION	NOTES
0		1	2	2				0.4' TOPSOIL	Unconfined compressive strength tests performed using a Soiltest CL-700 Pocket Penetrometer WOH = Weight of hammer WOR = Weight of rod Samples #3, #4: Organic decay odor noted
			2	2		4		Blk.-brn. SILT, tr. sand, tr. wood (moist, FILL, ML)	
		2	2	2				Contains tr. roots, tr. clay	
			1	1		3			
5		3	WOH	WOH				Becomes blk., contains tr. organics (OL)	
			1	1					
		4	WOH	1					
			1	1		2			
		5	WOH	WOH					
10			1	1		1			
15		6	1	1					
			1			2			
20		7	5	9				Grey Clayey SILT, tr. sand (moist, firm, ML)	
			12			21			
25		8	1	1			0.5	Grey Silty CLAY, occ. Silt partings (wet, v. soft, CL)	
			1			2			
30		9	1	1			0.7		
			1			2			
35		10	1	1			0.3	Becomes red-brn. & grey; bedded (wet)	
			1			2			
40									

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.
C = No. blows to drive _____ " casing _____ " with _____ lb. weight falling _____ "per blow.

CLASSIFICATION Visual by Geologist

METHOD OF INVESTIGATION: ASTM D-1586, using hollow stem augers

B/T Form H

DATE
STARTED 1/19/87
FINISHED 1/20/87
SHEET 2 OF 3

EMPIRE SOILS INVESTIGATIONS INC. — **SUBSURFACE LOG**

HOLE NO. B-19
SURF. ELEV. 580.99
G. W. DEPTH See Notes

PROJECT NFTA - Port of Buffalo
BTA-86-94B

LOCATION Fuhrmann Blvd.
Buffalo, New York

DEPTH-FT.	SAMPLES	SAMPLE NO	BLOWS ON SAMPLER 0/6	6/12	12/18	N	Qu (tsf)	SOIL OR ROCK CLASSIFICATION	NOTES
40		11	1	1			0.3		
			1			2			
45		12	1	1			0.9		
			1			2			
50		13	WOH/1.5'			WOH		(very soft)	
55		14	WOH/1.5'			WOH			
60		15	WOH/1.5'			WOH			
65		16	WOH/1.5'			WOH			
70		17	13	15				Contains "and" f-c Sand, some Gravel (moist, compact)	
			17			32			
75		18	100/.1'			REF.		Grey f-c GRAVEL, and f-c Sand, tr. silt(moist, v. compact, GW)	
								Boring complete with sampler refusal at 75.1'	No free standing water enc. @ boring completion
80									

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.
C = No. blows to drive ____ " casing ____ " with ____ lb. weight falling ____ "per blow.
METHOD OF INVESTIGATION: ASTM D-1586, using hollow stem augers

CLASSIFICATION Visual by Geologist

B/T Form H

DATE
STARTED 12/2/86
FINISHED 12/2/86
SHEET 1 OF 2

EMPIRE SOILS INVESTIGATIONS INC. — **SUBSURFACE LOG**

HOLE NO. B-20
SURF. ELEV. 584.12
G. W. DEPTH See Note

PROJECT NFTA - Port of Buffalo
BTA-86-94B

LOCATION Fuhrmann Blvd.
Buffalo, NY

DEPTH-FT.	SAMPLES	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
0		1	100/.2			Ref.		Brn. SILT and SLAG little f-c Sand (damp, FILL, ML)	
		2	50/.0			Ref.			
5		3	24	30				Gy. SLAG, little f-c Sand (damp, FILL, (SP-GP)	
			28	34		58			
		4	100/.1			Ref.			
		5	100/.5			Ref.			
10		6	41	38					
			25	100		63		(wet)	First Free Standing Water encountered at 10.5'
		7	50/.0			Ref.			
15		8	15	16					Sample No. 9, 10, & 11 chemical odor noted
			11	12		27			
		9	7	6					
			4	6		10			
		10	4	6				Contains some f-c Sand	
20			7	9		12			
		11	8	12					
			10	18		22			
		12	50/.0			Ref.			
25		13	5	7				Gy. f-c SAND, tr. gravel, tr. brick fragments (wet, FILL, SW)	
			7	9		14			
30		14	6	4				Gy. Silty CLAY, tr. f-c sand (moist, medium, CL)	
			4	3		8			
35		15	1	1					
			1	1		2		(very soft)	
40									

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.
C = No. blows to drive ____ " casing ____ " with ____ lb. weight falling ____ "per blow.
METHOD OF INVESTIGATION: ASTM D-1586 Using hollow stem augers

CLASSIFICATION Visual by Geologist

B/T Form H

DATE
STARTED 12/2/86
FINISHED 12/2/86
SHEET 2 OF 2

EMPIRE SOILS INVESTIGATIONS INC. SUBSURFACE LOG

HOLE NO. B-20
SURF. ELEV. 584.12
G. W. DEPTH See Note

PROJECT NFTA - Port of Buffalo
BTA-86-94B

LOCATION Fuhrmann Blvd.
Buffalo, NY

DEPTH-FT	SAMPLES	SAMPLE NO	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
40		16	WOR	/2'		WOR		Red-brn. & gy. varved CLAY (moist, very soft, CL)	
45		17	WOR	/2'		WOR			
50		18	1	1				Contains occ. Silt seams	
			1	1		2			
55		19	1	1					
			1	1		2			
60		20	1	1					
			1	1		2			
65		21	1	1				Becomes brown	
			1	1		2			
70		22	1	1					
			1	1		2			
75		23	7	31				Gy. SILT and Rock Fragments (moist, v. comp., ML)	
			100	/.6		Ref.			
80								Boring Complete w/Sampler Refusal at 76.6'	No Free Standing Water encountered at Boring Completion

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.

C = No. blows to drive _____ " casing _____ " with _____ lb. weight falling _____ "per blow.

CLASSIFICATION Visual by Geologist

METHOD OF INVESTIGATION: ASTM D-1586 Using hollow stem augers

DATE
STARTED 12/4/86
FINISHED 12/4/86
SHEET 1 OF 2

EMPIRE SOILS INVESTIGATIONS INC. — **SUBSURFACE LOG**

HOLE NO. B-21
SURF. ELEV. 581.49
G. W. DEPTH See Note

PROJECT NFTA - Port of Buffalo
BTA-86-94B

LOCATION Fuhrmann Blvd.
Buffalo, NY

DEPTH-FT.	SAMPLES	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
0		1	5	7				Brn. f-c SAND, some Silt, tr. slag	
			16	20		23		(moist, FILL, SM)	
5		2	20	18	12	30		Contains trace brick	
									Driller notes first encountering water at 10'
10		3	15	23	19	42		Blue-gray SLAG, tr. silt (wet, FILL, SP-GP	
15		4	15	15	25	40			
20		5	11	12	18	30		Contains trace sand (moist)	
25		6	7	13	16	29		(wet)	
								Gy. Clayey SILT, occ. Clay partings	
30		7	1	1	1	2		(moist, loose, ML)	
35		8	1	1	1	2		Gy. Silty CLAY, occ. Silt seams and partings (moist, very soft, CL)	
40									

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.

C = No. blows to drive _____ " casing _____ " with _____ lb. weight falling _____ "per blow.

CLASSIFICATION Visual by Geologist

METHOD OF INVESTIGATION: ASTM D-1586 Using hollow stem augers

B/T Form H

DATE
STARTED 12/4/86
FINISHED 12/4/86
SHEET 2 OF 2

EMPIRE SOILS INVESTIGATIONS INC. — **SUBSURFACE LOG**

HOLE NO. B-21
SURF. ELEV. 581.49
G. W. DEPTH See Note

PROJECT NFTA - Port of Buffalo
BTA-86-94B

LOCATION Fuhrmann Blvd.
Buffalo, NY

DEPTH-FT.	SAMPLES	SAMPLE NO	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
40		9	1	1	1	2		(wet)	
45		10	WOH	1	1	2		Becomes red-brn.	
50		11	1	1	1	2			
55		12	1	1	1	2			
60		13	1	1	1	2		Contains occ. Silt seams (CL)	
65		14	WOR	WOH	1	1			WOH = Weight of hammer WOR = Weight of rods
								Gy. f-c GRAVEL, some f-c Sand, some Clayey Silt (moist, loose, GC)	
70		15	WOH	1	1	2			
75		16	7	9	11	20		Gy. f-c GRAVEL, some f-c Sand, some Silt (moist, firm, GM)	
80								Boring Complete w/Auger Refusal at 77.0'	Free Standing Water recorded at 20' at Boring Completion

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.
C = No. blows to drive ____ " casing ____ " with ____ lb. weight falling ____ "per blow.
METHOD OF INVESTIGATION: ASTM D-1586 Using hollow stem augers

CLASSIFICATION Visual by Geologist

B/T Form H

DATE
STARTED 12/1/86
FINISHED 12/1/86
SHEET 1 OF 2

EMPIRE SOILS INVESTIGATIONS INC. — **SUBSURFACE LOG**

HOLE NO. B-22
SURF. ELEV. 582.28
G. W. DEPTH See Note

PROJECT NFTA- Port of Buffalo
BTA-86-94B

LOCATION Fuhrmann Blvd.
Buffalo, NY

DEPTH-FT.	SAMPLES	SAMPLE NO	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
0		1	1	1				Brn. SILT, tr. clay, tr. roots, tr. wood fragments (moist, FILL, ML)	
			2	3		3			Sample No. 2 - Organic decay odor noted
		2	2	3				Brn.-blk. Sandy SILT, tr. clay, tr. roots(moist, FILL, ML)	
			3	3		6			
5		3	1	1					
			1	1		2			Sample No. 4 - Petroleum odor noted
		4	1/1.0					Contains trace wood fragments	
			1/1.0			1			
		5	WOH/2.0'			WOH		Brn.-blk. Clayey SILT, tr. sand, tr. roots (moist, FILL, ML)	
10		6	WOH/2.0'			WOH			Sample No. 6 - Strong organic odor noted
		7	WOH/2.0'			WOH			
15		8	WOH/2.0'			WOH			WOH - Weight of hammer
20		9	WOH/1.0'			WOH		Contains some f-c Sand	
			T/1.0'						
25		10	1	7				Blk. f-c SAND, tr. gravel, tr. silt (wet, firm, SP)	Driller notes first encountering water at 25'
			12	18		19			
30		11	1	1				Brn. CLAY(moist, very soft, CL)	
			1	1		2			
35		12	1	1				Becomes red-brn. & gray, contains tr. gravel	3" Undisturbed (Shelby Tube) sample obtained from 38.0'-40.0' with 2.0' recovery
			1	1		2			
40									

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.

C = No. blows to drive _____ " casing _____ " with _____ lb. weight falling _____ "per blow.

CLASSIFICATION Visual by Geologist

METHOD OF INVESTIGATION: ASTM D-1586 Using hollow stem augers

B/T Form H

DATE
STARTED 12/1/86
FINISHED 12/1/86
SHEET 2 OF 2

EMPIRE SOILS INVESTIGATIONS INC. SUBSURFACE LOG

HOLE NO. B-22
SURF. ELEV. 582.28
G. W. DEPTH See Note

PROJECT NFTA - Port of Buffalo
BTA-86-94B

LOCATION Fuhrmann Blvd.
Buffalo, NY

DEPTH-FT.	SAMPLES	SAMPLE NO	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
40		13	1	1					WOH - Weight of hammer
			1	1		2			WOR - Weight of rods
45		14	WOR/1.0'						
			WOH/1.0'			WOH			
50		15	WOH/1.5'			WOH			
55		16	WOR/1.5'			WOR			
60		17	WOR/1.5'			WOR			
65		18	WOR/1.5'			WOR		Contains occ. Silt partings	
70		19	WOR/1.5'			WOR			
75								Boring Complete w/Auger Refusal at 75.0'	Free Standing Water encountered at 14', 12-hours after boring completion

Visual by Geologist

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.

C = No. blows to drive ____ " casing ____ " with ____ lb. weight falling ____ "per blow.

CLASSIFICATION

METHOD OF INVESTIGATION: ASTM D-1586 Using hollow stem augers

B/T Form H

DATE
STARTED 1/21/87
FINISHED 1/21/87
SHEET 1 OF 3

EMPIRE SOILS INVESTIGATIONS INC. — **SUBSURFACE LOG**

HOLE NO. B-23
SURF. ELEV. 583.61
G. W. DEPTH See Notes

PROJECT NFTA - Port of Buffalo
BTA-86-94B

LOCATION Fuhrmann Blvd.
Buffalo, New York

DEPTH-FT.	SAMPLES	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	Qu (tsf)	SOIL OR ROCK CLASSIFICATION	NOTES
0		1	1	1				0.6' TOPSOIL	
			1	2		2		Brn. fine SAND, little f-c Gravel, tr. silt, tr. brick, tr. wood(moist, FILL SP)	
		2	4	3					
			4	3		7		Contains "and" f-c Gravel(wet)	
5		3	3	2				Contains little f-c Gravel	
			4	2		6			
		4	1	1				Brn-Gry. SILT, tr. sand, tr. roots (wet, FILL, OL)	
			1	1		2			WOH = Weight of hammer
		5	WOH/2.0'					Becomes blk., contains tr. clay	WOR = Weight of rod
10						WOH			
15		6	WOH	1					
			1			2			
20		7	WOH/1.5'			WOH			
25		8	WOH	4				Brn. PEAT, some f-c Sand(moist, firm, Pt)	
			10			14			
30		9	1	1			0.3	GREY Silty CLAY, occ. Silt partings, tr. sand(wet, v. soft, CL)	
			1			2			
35		10	1	1			0.6	Contains occ. Silt seams(moist)	
			1			2			
40									

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.

C = No. blows to drive _____ " casing _____ " with _____ lb. weight falling _____ "per blow.

CLASSIFICATION Visual by Geologist

METHOD OF INVESTIGATION: ASTM D-1586, using hollow stem augers

DATE STARTED 1/21/87
FINISHED 1/21/87
SHEET 2 OF 3

EMPIRE SOILS INVESTIGATIONS INC. SUBSURFACE LOG

HOLE NO. B-23
SURF. ELEV. 583.61
G. W. DEPTH See Notes

PROJECT NFTA - Port of Buffalo
BTA-86-94B

LOCATION Fuhrmann Blvd.
Buffalo, New York

DEPTH-FT.	SAMPLES	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	Qu (tsf)	SOIL OR ROCK CLASSIFICATION	NOTES
40		11	1	1			0.3	Becomes red-brn. & gray	WOH = Weight of hammer
			1			2			WOR = Weight of rods
45		12	1	1			0.2		
			1			2			
50		13	WOH/1.5'				0.3		
						WOH			
55		14	WOH	1			0.3		
			1			2			
60		15	WOH/1.5'				0.3		
						WOH			
65		16	WOH/1.5'				0.3	Becomes brn.	
						WOH			
70		17	WOR/1.5'			WOR			
75		18	WOR/1.5'			WOR			
80									

N = No. blows to drive 2" spoon 12" with 140 lb. pin wt. falling 30" per blow.
C = No. blows to drive ____" casing ____" with ____ lb. weight falling ____" per blow.

CLASSIFICATION Visual by Geologist

METHOD OF INVESTIGATION: ASTM D-1586, using hollow stem augers

DATE STARTED 1/21/87
FINISHED 1/21/87
SHEET 3 OF 3

EMPIRE SOILS INVESTIGATIONS INC. SUBSURFACE LOG

HOLE NO. B-23
SURF. ELEV. 583.61
G. W. DEPTH See Note

PROJECT NFTA - Port of Buffalo
BTA-86-94B

LOCATION Fuhrmann Blvd.
Buffalo, New York

DEPTH-FT.	SAMPLES	SAMPLE NO.	BLOWS ON SAMPLER 0/6 6/12 12/18 N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
80		19	100/.1' WOR			Sampler spoon refusal @ 80.1'
					Boring complete with auger refusal at 81.5'	Free standing water recorded @ 16.0' @ boring completion

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.

C = No. blows to drive _____ " casing _____ " with _____ lb. weight falling _____ "per blow.

CLASSIFICATION Visual by Geologist

METHOD OF INVESTIGATION: ASTM D-1586, using hollow stem augers

B/T Form H

DATE
STARTED 1/21/87
FINISHED 1/21/87
SHEET 1 OF 3

EMPIRE SOILS INVESTIGATIONS INC. **SUBSURFACE LOG**

HOLE NO. B-24
SURF. ELEV. 583.61
G. W. DEPTH See Note

PROJECT NFTA - Port of Buffalo
BTA-86-94B

LOCATION Fuhrmann Blvd.
Buffalo, NY

DEPTH-FT.	SAMPLES	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
0		1	46	54				Gray f-c SLAG (moist, FILL, SW)	
			36	42		90			
		2	14	100/.1		Ref.			
5		3	100/.3'			Ref.			
		4	100/.4'			Ref.			
		5	30	83				Contains trace silt (wet)	
10			100/.2'			Ref.			
15		6	12	100/.5		Ref.			
20		7	20	100/.1'		Ref.		Gray f-c SAND, tr. slag (moist, FILL, SW)	
25		8	7	9	11	20		Gray f-c SAND, tr. silt (moist, firm, SW)	
30		9	WOH	1				Gray Clayey SILT, tr. sand (wet, loose, ML)	WOH = Weight of Hammer WOR = Weight of Rods
			1			2			
35		10	WOH	1				Contains occ. Clay seams and partings	
			1			2			
40									

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.

C = No. blows to drive _____ " casing _____ " with _____ lb. weight falling _____ "per blow.

CLASSIFICATION Visual by Geologist

METHOD OF INVESTIGATION: ASTM D-1586 Using hollow stem augers

B/T Form H

DATE
STARTED 1/21/87
FINISHED 1/21/87
SHEET 2 OF 3

EMPIRE SOILS INVESTIGATIONS INC. SUBSURFACE LOG

HOLE NO. B-24
SURF. ELEV. 583.61
G. W. DEPTH See Note

PROJECT NFTA - Port of Buffalo
BTA-86-94B

LOCATION Fuhrmann Blvd.
Buffalo, NY

DEPTH-FT.	SAMPLES	SAMPLE NO	BLOWS ON SAMPLER 0/6 6/12 12/18 N	Qu tsf	SOIL OR ROCK CLASSIFICATION	NOTES
40		11	WOH/1.5' WOH		Red-brn. Silty CLAY, tr. sand (wet, very soft, CL)	Unconfined compressive strength tests performed using a Soil-test CL-700 Pocket Penetrometer
45		12	WOH/1.5' WOH	0.2	Contains occ. Silt seams	
50		13	WOH/1.5' WOH	0.2		
55		14	WOH/1.5' WOH			
60		15	WOH/1.5' WOH	0.3		
65		16	WOH/1.5' WOH	0.3		
70		17	WOH/1.5' WOH		Contains "and" f-c Sand	
75		18	WOH 100/.4 Ref.		Gray f-c SAND and Silt, tr. gravel (wet, very compact, SM)	Free Standing Water recorded at 21.0' prior to coring
80					Gray LIMESTONE ROCK, hard, sound, bedded to thickly bedded, occ. fossils, finely crystalline	NQ"2" CORE Run #1: 75.9'-80.9' REC - 90% RQD - 90%

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.

C = No. blows to drive _____ " casing _____ " with _____ lb. weight falling _____ "per blow.

CLASSIFICATION Visual by Geologist

METHOD OF INVESTIGATION: ASTM D-1586 Using hollow stem augers

B/T Form H

DATE
STARTED 1/21/87
FINISHED 1/21/87
SHEET 3 OF 3

EMPIRE SOILS INVESTIGATIONS INC. **SUBSURFACE LOG**

HOLE NO. B-24
SURF. ELEV. 583.61
G. W. DEPTH See Note

PROJECT NFTA - Port of Buffalo
BTA-86-94B

LOCATION Fuhrmann Blvd.
Buffalo, NY

DEPTH-FT.	SAMPLES	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
80								Boring Complete at 80.9'	No Free Standing Water encountered at Boring Completion after coring
85									

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.

C = No. blows to drive _____ " casing _____ " with _____ lb. weight falling _____ "per blow.

CLASSIFICATION Visual by Geologist

METHOD OF INVESTIGATION: ASTM D-1586 Using hollow stem augers

B-T Form H

DATE
STARTED 1/13/87
FINISHED 1/13/87
SHEET 1 OF 2

EMPIRE SOILS INVESTIGATIONS INC.

SUBSURFACE LOG

HOLE NO. B-25
SURF. ELEV. 583.89
G. W. DEPTH See Notes

PROJECT NFTA - Port Of Buffalo
BTA-86-94B

LOCATION Fuhrmann Blvd.
Buffalo, New York

DEPTH-FT.	SAMPLES	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	Qu (tsf)	SOIL OR ROCK CLASSIFICATION	NOTES
0									Unconfined compressive strength tests performed using a "Soil-test" CL-700 Pocket Penetrometer
5								OVERBURDEN FILLS	Driller notes augering through dike fill to a depth of 15.0'- no samples taken
10									
15		1	21	16				Grey f-c SLAG(wet, FILL, GW)	
			14	14		30			
20		2	9	9					
			6	9		15			
25		3	6	8				Grey fine SAND, tr. slag(wet, FILL,SP)	
			12	12		20			
30		4	2	2			0.5	Grey Silty CLAY, tr. sand(moist, soft, CL)	
			2	3		4			
35		5	1	2			0.3	Contains occ. Silt seams & partings	
			2	1		4			
40									

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.

C = No. blows to drive _____ " casing _____ " with _____ lb. weight falling _____ "per blow.

CLASSIFICATION Visual by Geologist

METHOD OF INVESTIGATION: ASTM D-1586, using hollow stem augers

DATE
STARTED 1/13/87
FINISHED 1/13/87
SHEET 2 OF 2

EMPIRE SOILS INVESTIGATIONS INC. — **SUBSURFACE LOG**

HOLE NO. B-25
SURF. ELEV. 583.89
G. W. DEPTH See Notes

PROJECT NFTA - Port of Buffalo
BTA-86-94B

LOCATION Fuhrmann Blvd.
Buffalo, New York

DEPTH-FT.	SAMPLES	SAMPLE NO	BLOWS ON SAMPLER 0/6	6/12	12/18	N	Qu (tsf)	SOIL OR ROCK CLASSIFICATION	NOTES
40		6	WOR	WOR			0.3	Becomes Red-brn. & gray	WOR = Weight of rods WOH = Weight of hammer
			1	1					
45		7	2	2			0.5		
			2	2		4			
50		8	2	2			0.3		
			2	3		4			
55		9	WOR	WOR			0.3	Becomes brn.	
			1	3					
60		10	2	2			0.3		
			2	3		4			
65		11	1	1			0.5		
			2	3		3			
70		12	3	3			0.5		
			5	5		8			
75		13	16	40				GREY f-c GRAVEL, and f-c Sand, tr. silt(wet, v. compact, GW)	
			100/.5			140			
80								Boring complete with auger refusal @ 76.5'	Free standing water recorded @ 15.2' @ boring completion

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.

C = No. blows to drive _____ " casing _____ " with _____ lb. weight falling _____ "per blow.

CLASSIFICATION Visual by Geologist

METHOD OF INVESTIGATION: ASTM D-1586, using hollow stem augers

R/T Form H

DATE
STARTED 12/5/86
FINISHED 12/5/86
SHEET 1 OF 2

EMPIRE SOILS INVESTIGATIONS INC.

SUBSURFACE LOG

HOLE NO. B-26
SURF. ELEV. 580.98
G. W. DEPTH See Note

PROJECT NFTA - Port of Buffalo
BTA-86-94B

LOCATION Fuhrmann Blvd.
Buffalo, NY

DEPTH-FT.	SAMPLES	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
0		1	30	15				0.2' TOPSOIL	
			9	9		24		Brn. Silty SAND, tr. gravel (moist, FILL, SM)	
5		2	12	15	18	33		Blue-gray SLAG, tr. silt (moist, FILL, (SP-GP)	
10		3	23	15	10	25		Contains some Rock Fragments (wet)	
15		4	100/0.2			Ref.			
20		5	100/.4			Ref.			
25		6	11	16	20	36		Blk.-brn. Silty SAND, tr. gravel (moist, compact, SM)	
30		7	WOH	2	2	4		(wet)	WOH = Weight of Hammer
35		8	WOH	2	2	4		Gray CLAY, occ. Silt seams and partings (moist, soft, CL)	
40									

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.

C = No. blows to drive _____ " casing _____ " with _____ lb. weight falling _____ "per blow.

CLASSIFICATION Visual by Geologist

METHOD OF INVESTIGATION: ASTM D-1586 Using hollow stem augers

B/T Form H

DATE
STARTED 12/5/86
FINISHED 12/5/86
SHEET 2 OF 2

EMPIRE SOILS INVESTIGATIONS INC.

SUBSURFACE LOG

HOLE NO. B-26
SURF. ELEV. 580.98
G. W. DEPTH See Note

PROJECT NFTA - Port of Buffalo
BTA-86-94B

LOCATION Fuhrmann Blvd.
Buffalo, NY

DEPTH-FT.	SAMPLES	SAMPLE NO	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
40		9	3	2	1	3			
45		10	WOR	WOH	2	2		Becomes red-brn. (very soft)	WOR = Weight of rods
50		11	WOR	WOH	WOH	WOH			
55		12	1	2	2	4		(wet, soft)	
60		13	2	2	2	4			
65		14	2	2	3	5			
70		15	1	2	3	5		Contains trace gravel	
75								Boring Complete w/Auger Refusal at 73.0'	Free Standing Water encountered @ 40.0' at Boring Completion

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.
C = No. blows to drive _____ " casing _____ " with _____ lb. weight falling _____ "per blow.

CLASSIFICATION Visual by Geologist

METHOD OF INVESTIGATION: ASTM D-1586 Usign hollow stem augers

R/T Form H

DATE
STARTED 1/15/87
FINISHED 1/15/87
SHEET 1 OF 3

EMPIRE SOILS INVESTIGATIONS INC. SUBSURFACE LOG

HOLE NO. B-27
SURF. ELEV. 581.39
G. W. DEPTH See Notes

PROJECT NFTA - Port of Buffalo
BTA-86-94B

LOCATION Fuhrmann Blvd.
Buffalo, New York

DEPTH-FT.	SAMPLES	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	Qu (tsf)	SOIL OR ROCK CLASSIFICATION	NOTES
0		1	1	1				TOPSOIL	Uncontined compressive strength tests performed using a "Soil test" CL-700 Pocket Penetrometer WOH = Weight of hammer WOR = Weight of rod Sample #2, 3, 4,5,6: Organic decay odor noted
			1	2		2		Brn. SILT, tr. sand, tr. roots(moist, FILL, ML)	
		2	1	1				Becomes blk., contains tr. organics (wet, OL)	
			WOH	1					
5		3	WOH	WOH		WOH			
			WOH	WOH					
		4	1	1					
			1	1		2			
		5	1	1				Contains tr. WOOD	
10			1	1		2			
15		6	WOH	1.5'		WOH		Contains tr. clay	
20		7	WOH	1.5'		WOH		Blk.-brn. PEAT(wet, loose, Pt)	
25		8	1	2			0.3	Grey Silty CLAY, occ. Silt partings (wet, soft, CL)	
			1			3			
30		9	1	2			0.5		
			1			3			
35		10	1	WOH			0.3	Contains occ. Silt Seams & partings (very soft)	
			1			1			
40									

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.
C = No. blows to drive ____ " casing ____ " with ____ lb. weight falling ____ "per blow.

CLASSIFICATION Visual by Geologist

METHOD OF INVESTIGATION: ASTM D-1586, using hollow stem augers

B/T Form H

DATE
STARTED 1/15/87
FINISHED 1/15/87
SHEET 2 OF 3

EMPIRE SOILS INVESTIGATIONS INC.

SUBSURFACE LOG

HOLE NO. B-27
SURF. ELEV. 581.39
G. W. DEPTH See Notes

PROJECT NFTA - Port of Buffalo
BTA-86-94B

LOCATION Fuhrmann Blvd.
Buffalo, New York

DEPTH-FT.	SAMPLES	SAMPLE NO.	BLOWS ON SAMPLER 0/6 6/12 12/18	N	Qu (tsf)	SOIL OR ROCK CLASSIFICATION	NOTES
40		11	WOH/1.5'	WOH	0.3	Becomes brn. & gray, interbedded	
45		12	WOR WOH WOH	WOH	0.3	Contains tr. sand	
50		13	WOR WOH WOH	WOH	0.2	Becomes red-brn. & gray	
55		14	WOR WOH WOH	WOH	0.2		
60		15	WOR WOH WOH	WOH			
65		16	WOR/1.5'	WOR		Becomes Grey, contains "and" f-c sand, tr. gravel	
70		17	WOR/1.5'	WOR			Sampler & auger refusal @ 75.3'
75		18	100/.3'	REF.		Grey LIMESTONE ROCK, hard, sound, thickly bedded to massive, very fossiliferous, finely crystalline	Free standing water rec. @ 25.2' before coring Run #1: 75.3'-78.8' REC - 89% RQD - 89% Cobble noted @ 75.3'-75.6'
80							

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.
C = No. blows to drive ____ " casing ____ " with ____ lb. weight falling ____ "per blow.

CLASSIFICATION Visual by Geologist

METHOD OF INVESTIGATION: ASTM D-1586, using hollow stem augers

B/T Form H

DATE
STARTED 1/15/87
FINISHED 1/15/87
SHEET 3 OF 3

EMPIRE SOILS INVESTIGATIONS INC.

SUBSURFACE LOG

HOLE NO. B-27
SURF. ELEV. 581.39
G. W. DEPTH See Notes

PROJECT NFTA - Port of Buffalo
BTA-86-94B

LOCATION Fuhrmann Blvd.
Buffalo, New York

DEPTH-FT.	SAMPLES	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
80									NQ"2" CORE Run #2: 78.8'-83.8' REC - 90% RQD - 90%
								Boring complete @ 83.8'	
85									

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.

C = No. blows to drive _____ " casing _____ " with _____ lb. weight falling _____ "per blow.

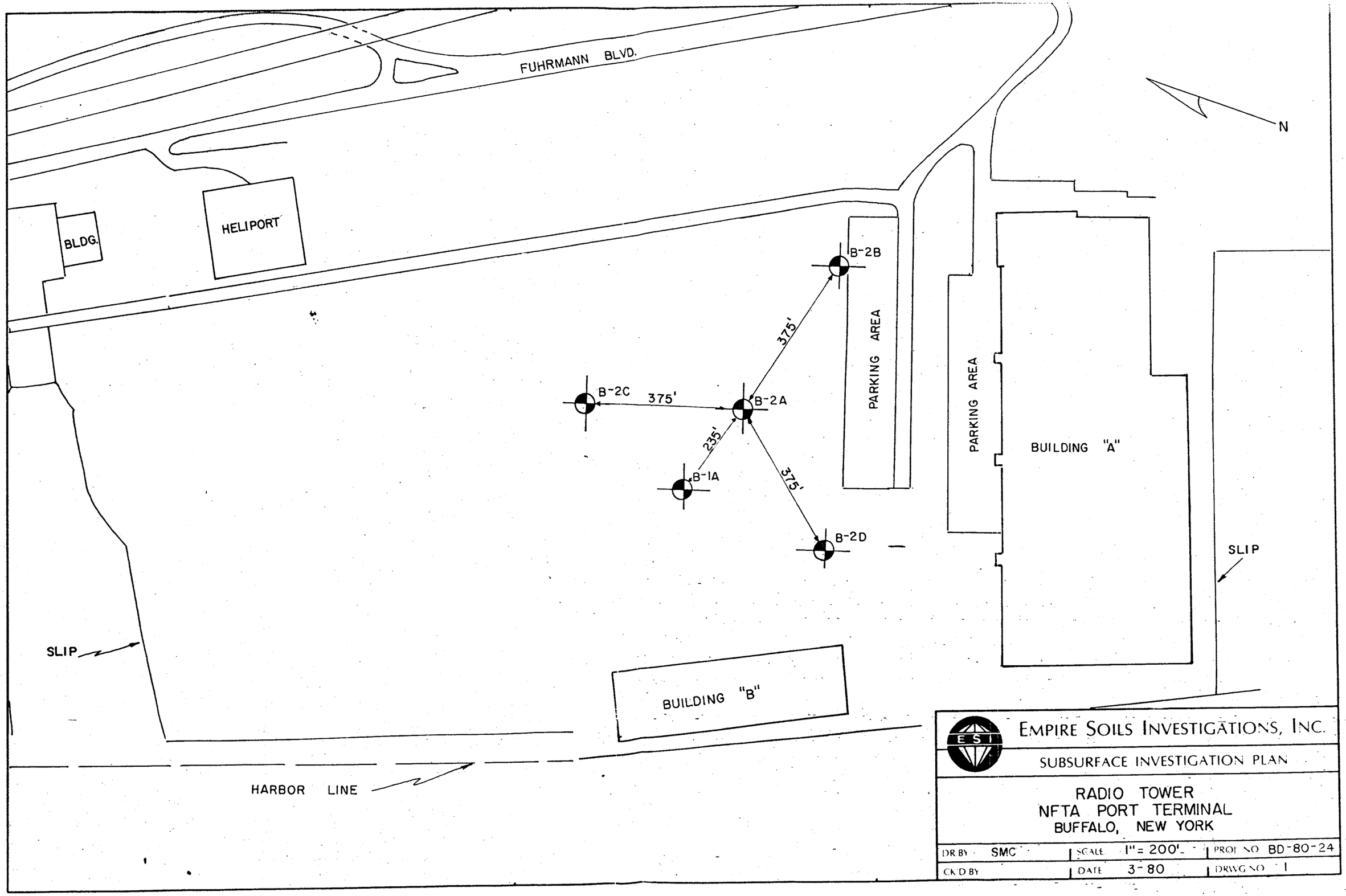
CLASSIFICATION Visual by Geologist

METHOD OF INVESTIGATION: ASTM D-1586, using hollow stem augers

B/T Form H

APPENDIX C

PREVIOUSLY ADVANCED
BOREHOLE LOGS



EMPIRE SOILS INVESTIGATIONS, INC.

SUBSURFACE INVESTIGATION PLAN

RADIO TOWER
NFTA PORT TERMINAL
BUFFALO, NEW YORK

DR BY SMC	SCALE 1"= 200'-	PROJ NO BD-80-24
CK'D BY	DATE 3-80	DRWG NO 1

DS-4

DATE
STARTED 3-10-80
FINISHED 3-11-80
SHEET 1 OF 2

EMPIRE SOILS INVESTIGATIONS, INC.

SUBSURFACE LOG

HOLE NO. B-1A
SURF. ELEV. 586.1
G. W. DEPTH See Note #1

PROJECT Proposed Radio Tower
NFTA Port Terminal

LOCATION Buffalo, NY
BD-80-24

DEPTH-FT	SAMPLES	SAMPLE NO	BLOWS ON SAMPLER 0/6	6/12	12/18-	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION
0								Fill: Black ASH & SAND
		1	8	10				
			10	13		20		
		2	9	15				
			12	11		27		- Concrete @ 6.4'
5		3	22	30				(Moist) 6.4'
			100/.4'					Brown ORGANIC SILT, INORGANIC SILT & DECOMPOSED WOOD (Petroleum Odor), grades trace fibrous matter in sample #5
		4	2	3				-grades SILT, little organic silt in sample #6
			3	4		6		(Wet-Loose) 13.0'
10		5	3	4				Gray SILT, trace clay
			4	5		8		
		6	2	3				-grade SILT, Some Clay @ 15.0'
			3	4		6		
		7	1	1				- grades layered SILT & CLAY
15			2	1		3		
		8	WR	WR				
			WR	WR		0		
		9	WH	WH				
			WH	WH		0		
20								(Wet-Very Soft) 23.0'
								Gray fine SAND, trace silt
25		10	3	11	16	27		
30								(Wet-Firm) 30.5'
		11	11	29	30	59		Gray SILT, little clay
35								(Wet-Hard) 35.0'
		12	4	5	6	11		Reddish gray CLAY, Some Silt
40								

NOTES

Note #1:
Groundwater information:

3-10-80 4:30 p.m.
Depth of boring @ 19.0', Casing @ 19.0'
No free water in casing

3-11-80 12:00 noon
Boring complete,
Casing @ 69.3'
No free water in casing

Note #2 - WR - Weight of Drill Rods

WH - Weight of Drill Rods and 140# Hammer

N = No. blows to drive 2 "spoon 12 "with 140 lb. pin wt. falling 30 "per blow.
C = No. blows to drive ____ "casing ____ "with ____ lb. weight falling ____ "per blow.
METHOD OF INVESTIGATION 2½" I.D. Hollow Stem Auger Casing -

CLASSIFICATION Visual By Geotechnical Engineer

/ - G

DS-4

DATE
STARTED 3-10-80
FINISHED 3-11-80
SHEET 2 OF 2

EMPIRE SOILS INVESTIGATIONS, INC.

SUBSURFACE LOG

HOLE NO. B-1A cont.
SURF. ELEV 586.1
G. W. DEPTH

PROJECT Proposed Radio Tower
NFTA Port Terminal

LOCATION Buffalo, NY
BD-80-24

DEPTH-FT	SAMPLES	SAMPLE NO	BLOWS ON SAMPLER 0/6	6/12	12/18-	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
40		13	3	4	4	8		(Wet-Medium) 42.5'	
								Reddish Gray SILT	
45		14	13	17	17	34			
50		15	14	20	23	43		- Gray	
55		16	7	7	5	12		-Grades layered SILT & CLAY	
								(Wet-Compact to Firm) 58.0'	
60		17	WR	WR	WR	0		Reddish Gray CLAY	
65		18	WR	WR	WR	0			
								(Wet- Very Soft) 69.3'	
70								Refusal @ 69.3'	

N = No. blows to drive 2 "spoon 12 "with 140 lb. pin wt. falling 30 "per blow.
C = No. blows to drive ____ "casing ____ "with ____ lb. weight falling ____ "per blow.
METHOD OF INVESTIGATION: 2½" I. D. Hollow Stem Auger Casing

CLASSIFICATION Visual by Geotechnical Engineer

VCTG.

DS-4

DATE.
STARTED 3-11-80
FINISHED 3-11-80
SHEET 1 OF 2

EMPIRE SOILS INVESTIGATIONS, INC.

SUBSURFACE LOG

HOLE NO. B-2A
SURF. ELEV 584.1
G. W. DEPTH See Note #1

PROJECT Proposed Radio Tower
NFTA Port Terminal

LOCATION Buffalo, NY
BD-80-24

DEPTH-FT	SAMPLES	SAMPLE NO	BLOWS ON SAMPLER 0/6	6/12	12/18-	N	N.M.C.	SOIL OR ROCK CLASSIFICATION	NOTES
0								Fill: Fine to medium SAND, little gravel, trace glass	Note #1: Groundwater information:
		1	15	20			11.6		
			11	14		31			B 3-12-80 8:00 a.m.
		2	10	10			16.5	- SILT, SAND, trace clay, brick, concrete	Casing @ 65.7'
5			8	13		18			Water in Casing @ 13.0'
		3	4	5			23.4		(Over night reading)
			4	4		9		-SILT, CLAY, trace brick, coal	
		4	3	4			21.7	(Moist) 8.0'	
			4	5		8		Gray fine SAND, little silt	Note #2 - WR - Weight of Drill Rods
10		5	3	4			26.5	(Petroleum Odor)	
			6	4		10			
		6	4	4			22.7	-grades SILT & fine SAND	
			4	5		8		(Wet-Firm) 13.0'	
		7	WR	WR			22.7	Gray SILT, trace SAND	
15			WR	WR		0			
		8	WH	WH			23.6	-grades SILT, little sand	
			WH	WH		0			
		9	WR	WR			30.2	-grades SILT, trace sand, trace clay	WH- Weight of Drill Rods and 140# Hammer
			WR	1		0			
20									
								(Wet-Loose) 23.0'	
								Gray fine to medium SAND	6' Running Sand Inside Casing @ 25.0'
25									No Sample attempted.
									Note #3: N.M.C. - Natural Moisture Content
30									
		10	11	15	17	32			
								(Wet-Compact) 33.0'	
								Reddish Gray CLAY & SILT	
35									
		11	4	4	5	9	25.5		
40								(Wet-Medium) 40.0'	

N = No. blows to drive 2 "spoon 12 "with 140 lb. pin wt. falling 30 "per blow.
C = No. blows to drive ____ "casing ____ "with ____ lb. weight falling ____ "per blow.
METHOD OF INVESTIGATION 2½" I.D. Hollow Stem Auger Casing

CLASSIFICATION Visual by Geotechnical Engineer

VCTG

DS-4

DATE
STARTED 3-11-80
FINISHED 3-11-80
SHEET 2 OF 2

EMPIRE SOILS INVESTIGATIONS, INC.

SUBSURFACE LOG

HOLE NO. B-2A cont.
SURF. ELEV 584.1
G. W. DEPTH

PROJECT Proposed Radio Tower
NFTA Port Terminal

LOCATION Buffalo, NY
BD-80-24

DEPTH-FT	SAMPLES	SAMPLE NO	BLOWS ON SAMPLER 0/6	6/12	12/18	N	N.M.C.	SOIL OR ROCK CLASSIFICATION	NOTES
40		12	25	45	40	85	14.0	Reddish Gray SILT, trace clay	
45		13	14	19	23	42	16.6	- gray	
50		14	10	14	14	28	17.0	(Wet-Compact) 53.5'	
55		15	2	3	4	7	25.8	Reddish Gray CLAY	
60		16	1	1	2	3	25.8		
65		17	1	100/.2				(Wet-Very Soft)	
70								Gray limestone, hard, sound, fossiliferious, thick bedded to massive 70.7'	Cored 65.7'-70.7' Recovery 5.0'
75								Bottom of Hole @ 70.7'	

N = No. blows to drive 2 "spoon 12 "with 140 lb. pin wt. falling 30 "per-blow.
C = No. blows to drive "casing "with lb. weight falling "per blow.
METHOD OF INVESTIGATION: 2½" I. D. Hollow Stem Auger Casing

CLASSIFICATION Visual by Geotechnical Engineer

DS-4

DATE
STARTED 3-12-80
FINISHED 3-12-80
SHEET 1 OF 1

EMPIRE SOILS INVESTIGATIONS, INC.

SUBSURFACE LOG

HOLE NO. B-2B
SURF. ELEV 585.9
G. W. DEPTH

PROJECT Proposed Radio Tower
NFTA Port Terminal

LOCATION Buffalo, NY
BD-80-24

DEPTH-FT	SAMPLES	SAMPLE NO	BLOWS ON SAMPLER 0/6	6/12	12/18-	N	N.M.C.	SOIL OR ROCK CLASSIFICATION	NOTES
0								Fill: Dark Brown fine SAND & SILT	Note #1 - WR - Weight of Drill Rods
		1	30	100					
		2	25	75				- w/ concrete Fragments	
5			20	15		95		(Moist) 5.0'	
		3	4	2			19.9	Fill: Fine SAND, trace wood	WH - Weight of Drill Rods and 140# Hammer
			2	3		4			
		4	2	3			21.5	-SAND, SILT, little clay, trace organic silt	
			3	1		6			
10		5	WR	WR			19.3	-gray SILT, Some Fine Sand @ 9.0'	
			2	3		2		-gray & reddish gray SILT, little clay trace brick	Ntoe #2 - N.M.C. - Natural Moisture Content
		6	3	5			18.8		
			4	5		9			
		7	WH	2			20.2		
15			4	5		6			
		8	45	25			21.8	(Moist to Wet) 16.0'	
			27	22		52		Gray fine SAND, little silt	
		9	8	9			22.4		
			6	8		15		-trace silt	
20		10	3	3			28.3		
			3	4		6		(Wet-Compact to Loose)	
								Sampling Completed @ 21.0'	
								Boring advanced to refusal @ 64.3' without sampling	
25									
30									
35									
40									

N = No. blows to drive 2 "spoon 12 "with 140 lb. pin wt. falling 30 "per blow.
C = No. blows to drive ____ "casing ____ "with ____ lb. weight falling ____ "per blow.
METHOD OF INVESTIGATION: 2½" I.D. Hollow Stem Auger Casing

CLASSIFICATION Visual by Geotechnical Engineer

DS-4

DATE
STARTED 3-12-80
FINISHED 3-12-80
SHEET 1 OF 1

EMPIRE SOILS INVESTIGATIONS, INC.

SUBSURFACE LOG

HOLE NO. B-2C
SURF. ELEV. 587.4
G. W. DEPTH

PROJECT Proposed Radio Tower
NFTA Port Terminal

LOCATION Buffalo, NY
BD-80-24

DEPTH-FT	SAMPLES	SAMPLE NO	BLOWS ON SAMPLER 0/6	6/12	12/18-	N	N.M.C.	SOIL OR ROCK CLASSIFICATION	NOTES
0								Fill: Black ASH & fine SAND (Moist)	Note #1: WR - Weight of Drill Rods
		1	8	9					
			10	10		19			
		2	7	10					
5			10	13		20			
		3	10	6				-Wet w/trace wood	WH - Weight of Drill Rods and 140# Hammer
			6	8		12			
		NR	4	4					
			5	5		9			Note #2 - A 3" O.D. Shelby Tube was obtained from 18' - 20' in an adjacent hole advanced only to obtained an undisturbed sample of the very soft clay between 15.0' & 22.0'
10		4	2	2					
			3	4		5			
		5	2	3				(Moist to Wet) 12.0'	
			2	3		5	25.8	Gray SILT, Organic SILT, w/roots & decomposed wood	
		6	2	2			42.6		
15			3	3		5		(Wet-Loose) 15.0'	
		7	WH	WH			28.4	Gray CLAY, Some Silt	
			1	1		1			
		8	1	2			28.8	-Layered CLAY & SILT	
			2	1		4			
20		9	WH	WH			42.6		Note #3: N.M.C. - Natural Moisture Content
			1	2		1			
		10	1	4				(Wet-Very Soft) 22.0'	
			11	30		15		Gray fine SAND, Some Silt, trace decomposed wood (Wet-Firm) 23.0'	
25									Note #4: NR No Recovery
								Bottom of Hole @ 23.0'	

N = No. blows to drive 2 - "spoon 12 "with 140 lb. pin wt. falling 30 "per blow.
C = No blows to drive "casing "with lb. weight falling "per blow.

CLASSIFICATION Visual by Geotechnical Engineer

METHOD OF INVESTIGATION: 2¼" I.D. Hollow Stem Auger Casing

DS-4

DATE
STARTED 3-13-80
FINISHED 3-13-80
SHEET 1 OF 1

EMPIRE SOILS INVESTIGATIONS, INC.

SUBSURFACE LOG

HOLE NO B-2D
SURF ELEV 583.8
G W DEPTH

PROJECT Proposed Radio Tower
NFTA Port Terminal

LOCATION Buffalo, NY
BD-80-24

DEPTH-FT	SAMPLES	SAMPLE NO	BLOWS ON SAMPLER 0/6	6/12	12/18	24	N.M.C.	SOIL OR ROCK CLASSIFICATION	NOTES
0									
		1	14	15				Fill: Brown SILT & fine SAND	Note #1: N.M.C. - Natural Moisture Content
			11	12		26			
		2	11	10					
5			13	21		23			
		3	10	15				(Moist) 6.0'	
			3	4		18		Gray SILT, little sand, trace decomposed wood	
		4	1	2					
			2	2		4	27.3	(Wet-Firm) 8.0'	
10		5	9.0' - 11.0'					Reddish Gray CLAY	
			Recovered						
		6	1	1			28.4		
			1	2		2			
		7	WH	1			28.4		
15			2	1		3		(Wet-Very Soft) 15.0'	
		8	15.0' - 17.0'					Gray SILT, little fine sand	
			Recovered 0.6'						
		9	8	9					
			8	10		17		(Wet-Firm) 19.0'	
20								Bottom of Hole @ 19.0'	

N = No. blows to drive 2 "spoon 12 "with 140 lb pin wt. falling 30 "per blow
C = No. blows to drive ____ "casing ____ "with ____ lb weight falling ____ "per blow
METHOD OF INVESTIGATION 2½" I.D. Hollow Stem Auger Casing

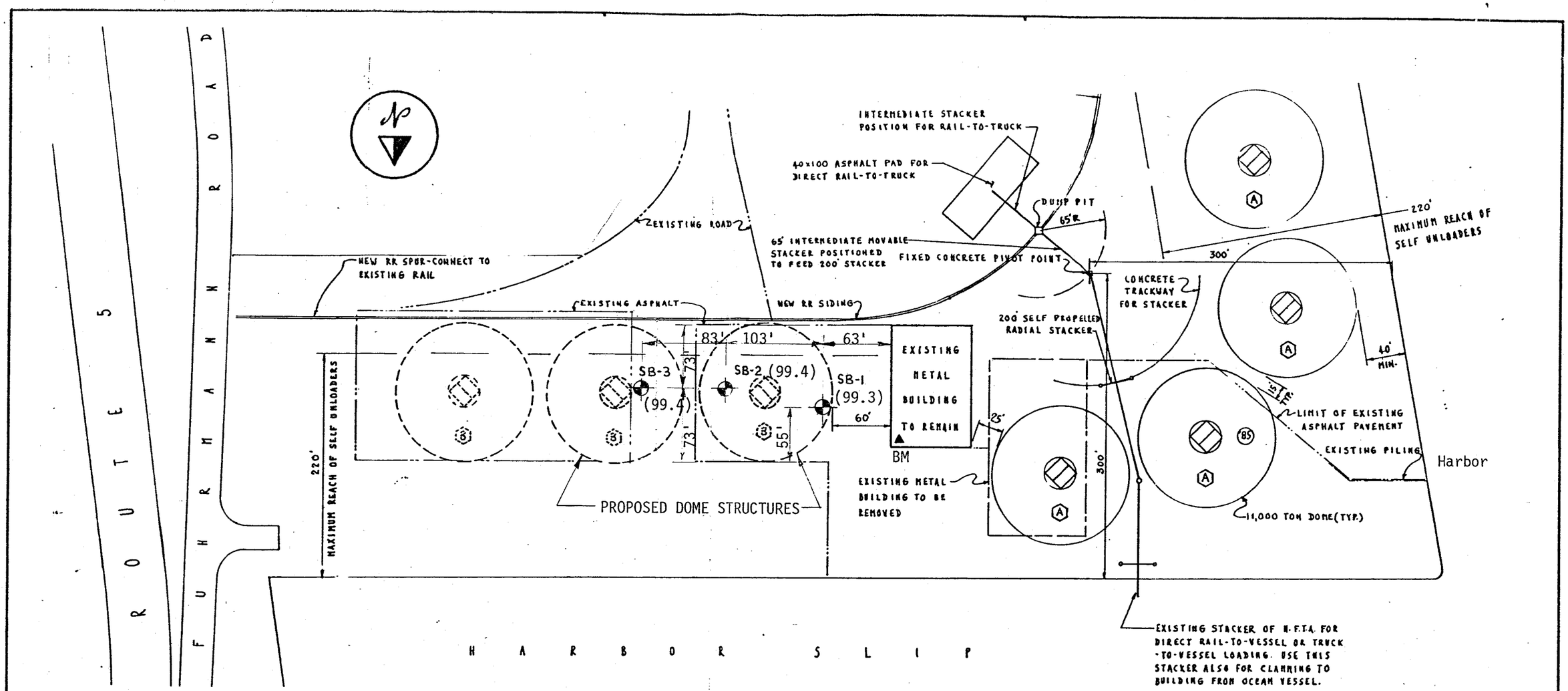
CLASSIFICATION Visual by Geotechnical Engineer

SUMMARY OF LABORATORY TESTING

Boring No.	Sample No.	Depth (ft.)	Natural Water Content (%)	pH	Atterberg Limits Liquid Limit	Plastic Limit	Plasticity Index.
B-2A	1	1.0-3.0	11.6				
	2	3.0-5.0	16.5				
	3	5.0-7.0	23.4				
	4	7.0-9.0	21.7				
	5	9.0-11.0	26.5				
	6	11.0-13.0	22.7				
	7	13.0-15.0	22.7				
	8	15.0-17.0	23.6				
	9	17.0-19.0	30.2				
	11	35.0-36.5	25.5		27.5	15.9	11.6
	12	40.0-41.5	14.0				
	13	45.0-46.5	16.6				
	14	50.0-51.5	17.0				
	15	55.0-56.5	25.8				
▼	16	60.0-61.5	25.8		25.1	15.6	9.5

SUMMARY OF LABORATORY TESTING (page 2)

Boring No.	Sample No.	Depth (ft.)	Natural Water (Content (%)	pH	Atterberg Limits Liquid Limit	Plastic Limit	Plasticity Index
B-2B	3	5.0-7.0	19.9				
	4	7.0-9.0	21.5				
	5	9.0-11.0	19.3				
	6	11.0-13.0	18.8				
	7	13.0-15.0	20.2				
	8	15.0-17.0	21.8				
	9	17.0-19.0	22.4				
	10	19.0-21.0	28.3				
B-2C	2	3.0-5.0		7.8			
	4	9.0-11.0		7.9			
	5B	12.0-13.0	25.8				
	6	13.0-15.0	42.6				
	7	15.0-17.0	28.4				
	8	17.0-19.0	28.8		22.5	18.2	4.3
	9	19.0-21.0	42.6				
B-2D	4B	8.0-9.0	27.3				
	6	11.0-13.0	28.4		27.2	15.3	11.9
	7	13.0-15.0	28.4				



LEGEND

SB-1 (99.3) Boring Location, Ground Surface Elevation

▲ Benchmark
Finished floor = 100.0' (assumed)

NOTE

This drawing is a reproduction of a portion of Drawing No. C85-116-1 prepared by Sub-Con Engineering Corp. dated July 12, 1985, and is for illustration only.

REVISION 1.(3-87) BOREHOLE NUMBERS CHANGED FROM B-1, B-2, B-3 TO SB-1, SB-2, SB-3

EMPIRE SOILS INVESTIGATIONS INC

SUBSURFACE INVESTIGATION PLAN

Proposed Bulk Commodity Storage Complex
Port of Buffalo
Buffalo, NY

DR.BY: -	SCALE: As shown	PROJ. NO. BD-85-128
CK'D.BY: F.M.	DATE: 10/24/85	DRWG.NO. 1

R/T FORM R-2

BOREHOLE NO. REVISED 3-87

DATE
STARTED 10/13/85
FINISHED 10/14/85
SHEET 1 OF 2

EMPIRE SOILS INVESTIGATIONS INC

SUBSURFACE LOG

HOLE NO. SB-1
SURF. ELEV. 99.3
G. W. DEPTH See Note

PROJECT Proposed Bulk Commodity Storage Complex
BD-85-128

LOCATION Port of Buffalo
Buffalo, N.Y.

DEPTH-FT	SAMPLES	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
0								0.3' Asphaltic Concrete 0.7' Crushed Stone	
		1	9	21				Brown-Black f-c SAND, some Cinders, little slag, trace brick frags, trace trace glass frags, trace asphalt, trace concrete - Misc. FILL, (moist)	
			27	60		48			
		2	65	32					
			28	29		60		Contains trace wood frags	
5		3	7	8					
			5	4		13		Contains trace cinders	
		4	4	3					
			2	3		5		Brown - contains some clay (Wet)	
		5	6	6					
10			8	8		14		Black - contains some Cinders, little Slag.	
								Contains trace slag	
15		6	4	5					
			6	8		11			
								Gray fine SAND, little Silt, trace fine gravel (Wet, Firm)	
20		7	9	10					
			18	22		28		Contains some Silt (Moist, Compact)	
25		8	7	13	21	34			
								Contains "and" Silt (Wet, Firm)	
30		9	7	11	13	24			
								Gray SILT and fine Sand (Wet, Firm)	
35		10	9	12	15	27			
40								Contains some fine Sand, trace clay	

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow. CLASSIFICATION Visual By

C = No. blows to drive ____ " casing ____ " with ____ lb. weight falling ____ "per blow. Civil Engineer

METHOD OF INVESTIGATION: 3" diam. flush-joint, driven casing, washed using rotary drilling

DATE
STARTED 10/13/85
FINISHED 10/14/85
SHEET 2 OF 2

EMPIRE SOILS INVESTIGATIONS INC. SUBSURFACE LOG

HOLE NO. SB-1 (Cont.)
SURF. ELEV. 99.3
G. W. DEPTH See Note

PROJECT Proposed Bulk Commodity Storage Complex BD-85-128
LOCATION Port of Buffalo Bufffalo, New York

DEPTH-FT.	SAMPLES	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
40		11	7	9	11	20			
								(Compact)	
45		12	14	22	27	49			
								(Very Compact)	
50		13	18	24	27	51			
								Brown Silty CLAY, trace fine sand (Wet, Medium)	
55		14	WOR	3	7	10			
60		15	21	15	100/4			Gray ROCK frags, little Clay, trace fine sand (Wet. Very Compact)	
								Boring Completion with refusal at 61.4 feet	First free standing water encountered at 7.0 feet
65									

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.
C = No. blows to drive _____ " casing _____ " with _____ lb. weight falling _____ "per blow.
CLASSIFICATION Visual By Civil Engineer
METHOD OF INVESTIGATION: 3" diam. flush-jointed driven casing, washed using rotary drilling

BOREHOLE NO. REVISED 3-87

DATE
STARTED 10/14/85
FINISHED 10/14/85
SHEET 1 OF 2

EMPIRE SOILS INVESTIGATIONS INC — **SUBSURFACE LOG**

HOLE NO. SB-2
SURF. ELEV. 99.4
G. W. DEPTH See Note

PROJECT Proposed Bulk Commodity Storage Complex
BD-85-128
LOCATION Port of Buffalo
Buffalo, N.Y.

DEPTH-FT.	SAMPLES	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
0									
		1	19	17				0.3' Asphaltic Concrete 0.7' Crushed Stone	
			14	16		31		Gray-Black f-c SAND, little Cinders, trace fine gravel, trace wood frags, trace brick frags, Misc. FILL-(moist)	
		2	14	22					
			15	9		37			
5		3	10	7					
			8	6		15			
		4	9	11				(Wet)	
			8	12		19			
		5	19	11					
10			20	16		31			
		6	16	17					No sample recovery between 14.0 and 16.0 feet
15			20	12		37			
								Gray fine-coarse SAND, little Silt, trace fine gravel, (Wet, Compact)	
		7	14	20					
20			26	28		46			
								Gray Clayey SILT, and fine Sand, trace fine gravel (Wet, Compact)	
		8	42	30	19	49			
25									
								Contains trace fine sand (Firm)	
		9	6	7	7	14			
30									
								Contains some fine Sand, trace clay (Compact)	
		10	10	26	22	48			
35									
								(Firm)	
40		11	*8	8	11	19			

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.
C = No. blows to drive _____ " casing _____ " with _____ lb. weight falling _____ "per blow.

CLASSIFICATION Visual By Civil Engineer

METHOD OF INVESTIGATION: 3" dia. flush-jointed, driving casing, washed using rotary drilling

B/T Form H

DATE
STARTED 10/14/85
FINISHED 10/14/85
SHEET 2 OF 2

EMPIRE SOILS INVESTIGATIONS INC. SUBSURFACE LOG

HOLE NO. SB-2 (Cont.)
SURF. ELEV. 99.4
G. W. DEPTH See Note

PROJECT Proposed Bulk Commodity Storage Complex
BD-85-128
LOCATION Port of Buffalo
Buffalo, New York

DEPTH-FT.	SAMPLES	SAMPLE NO	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
40									
								Gray fine SAND and Silt, trace clay (Wet, Compact)	
45		12	23	28	19	47			
		13	5	5	4	9			
50								Brown Silty CLAY, trace fine sand (Wet, Medium)	
		14	3	2	4	6			
55									
			100/0					Boring Completion with refusal at 59.5 feet	First free standing water encountered at 7.0 feet
60									

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.
CLASSIFICATION Visual By Civil Engineer

C = No. blows to drive _____ " casing _____ " with _____ lb. weight falling _____ "per blow.

METHOD OF INVESTIGATION: 3" dia. flush-jointed, driven casing, washed using rotary drilling

B/T Form H

BOREHOLE NO. REVISED 3-87

DATE
STARTED 10/14/85
FINISHED 10/14/85
SHEET 1 OF 2

EMPIRE SOILS INVESTIGATIONS INC. SUBSURFACE LOG

HOLE NO. SB-3
SURF. ELEV. 99.4'
G. W. DEPTH See Note

PROJECT Proposed Bulk Commodity Storage Complex
BD-85-128

LOCATION Port of Buffalo
Buffalo, N.Y.

DEPTH-FT	SAMPLES	SAMPLE NO	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
0		1	24	26	100/.2			Brown-Gray f-c SAND, little Slag, trace fine gravel, trace glass frags, Misc. FILL (moist)	
		2	8	8				Black, some Cinders, trace brick frags	
			7	7		15			
		3	24	36				Brown Clayey SILT, little f-c Sand, trace brick frags, (Moist) Misc. FILL	
5			30	20		66			
		4	19	36				Black f-c SAND and Cinders, trace brick frags, trace slag, Misc. FILL (Moist)	Petroleum odor noted by the driller below 6-foot depth.
			19	20		55			
		5	6	4				Contains trace wood frags	
			13	8		17			
10		6	7	7				Gray Clayey SILT, little f-c Sand, trace f-c gravel, trace cinders, trace wire frags - misc. FILL (wet)	
			10	8		17			
15		7	3	4	4	8			No sample recovery between 15.0-16.5'
								Gray fine SAND, some Silt, little decomposed wood frags, (Wet, Loose)	
20		8	4	4	5	9			
25		9	7	10	15	25		Contains "and" Silt	
								Black-Gray f-c SAND and fine Gravel, trace silt, (Wet, Firm)	
								Gray Clayey SILT, trace fine sand- contains black f-c SAND - trace fine gravel seam (Wet, Firm)	
30		10	4	12	15	27			
35		11	14	19	22	41		Contains little fine Sand (Compact)	
								Gray fine SAND some Clayey Silt (Wet, Compact)	
40									

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.

C = No. blows to drive _____ " casing _____ " with _____ lb. weight falling _____ "per blow.

CLASSIFICATION Visual By Civil Engineer

METHOD OF INVESTIGATION: ASTM D-1586 Using drilled in casing

B/T Form H

DATE
STARTED 10/14/85
FINISHED 10/14/85
SHEET 2 OF 2

EMPIRE SOILS INVESTIGATIONS INC.

SUBSURFACE LOG

HOLE NO. SB-3 (Cont.)
SURF. ELEV. 99.4
G. W. DEPTH See Note

PROJECT Proposed Bulk Commodity Storage Complex LOCATION Port of Buffalo
BD-85-128 Buffalo, N.Y.

DEPTH-FT.	SAMPLES	SAMPLE NO	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
40		12	7	12	19	31		Gray fine SAND some Clayey Silt (wet, compact)	
45		13	14	18	19	37			
50		14	12	12	17	29		(Firm)	
								Boring Completion at 51.5 feet	First free standing water encountered at 10.0 feet
55									

N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 "per blow.
C = No. blows to drive _____ " casing _____ " with _____ lb. weight falling _____ "per blow.

CLASSIFICATION Visual By Civil Engineer

METHOD OF INVESTIGATION: ASTM D-1586 Using drilled in casing

R/T Form H