SUPPLEMENTAL INVESTIGATION

SERVICE WATER POND WEST EMBANKMENT

VIRGIL C. SUMMER NUCLEAR STATION

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TABLE OF CONTENTS

ATTACHMENTS

LIST OF FIGURES

LIST OF TABLES

1.0 INTRODUCTION

The investigation described herein was conducted to provide additional documentation of the as-built condition of the West Embankment of the Service Water Pond at the Virgil C. Summer Nuclear Station. The additional data obtained supplements the original investigations and construction control documentation presented in the Final Safety Analysis Report (FSAR), as well as testing, analysis and monitoring presented in three reports entitled "Service Water Intake Structure, Settlement Effects and Related Work", submitted in December, 1977; June, 1978 (Report No. 2); and October, 1979 (Final Report).

The scope of the present investigation included additional test borings and laboratory testing in order to confirm the strength, stability and stratigraphy of the West Embankment and underlying foundation materials, as well as to evaluate the long-term compression characteristics of these materials. The results of this study are presented in the following sections, together with a brief summary of the construction history of the West Embankment and the results of monitoring of West Embankment structures.

2.0 CONSTRUCTION HISTORY

The West Embankment consists of an engineered fill forming the western side of the Service Water Pond and located to the east of the generating station. A plan view of the West Embankment is presented on Figure 1, which shows the contours of the foundation grade after stripping of unsuitable surficial materials, as well as the location of the Service Water Intake Structure and Pumphouse. A typical section view of the West Embankment is shown on Figure 2.

As shown on Figure 2, the West Embankment is a safety class fill which is separated from non-safety class general plant site fill by an imaginary plane which extends downward toward the plant site with a slope of 45 degrees. The crest width of the West Embankment is 50 feet. Specification requirements for placement and compaction of the plant site fill were similar to those for the West Embankment fill. Within the boundaries of the West Embankment, in-place density tests were required for each 2000 cubic yards of fill and the maximum liquid limit and plasticity index allowed for the fill materials were 70 percent and 25 percent, respectively. However, the West Embankment and adjacent plant site fill were constructed concurrently and are essentially comprised of the same materials.

The West Embankment and adjoining plant site fill foundation areas were as stripped of loose, soft, or otherwise unsuitable surficial materials between June 28 and August 13, 1973. The maximum thickness of materials removed was about 15 feet, occurring within the valley at the maximum section of the West Embankment. Compacted fill was then placed in the West Embankment and adjacent plant site area up to about elevation 390, this work being completed by September 30, 1973.

Work was resumed on the West Embankment for a short duration in April and May of 1974, when fill was placed between about elevation 396 and 420 in the portion of the embankment near the south dam (Stations 0+00 to 5+00). In October-November, 1975 and February-March, 1976, fill was placed from elevation 390 to 435 (finished grade) between Stations 0+00 and about 12+50. North of Station 12+50, the fill was raised from elevation 390 to finished grade between February and October, 1977, being constructed concurrently with the Service Water Pumphouse.

During construction of the West Embankment, a total of 37 laboratory compaction tests were conducted in order to provide standards for controlling field compaction. These tests are summarized on Figure 3. This number of tests was required because of the use of various borrow sources for the saprolite fill during the four-year construction period, as well as natural variations occurring with location and depth within each borrow source. To aid in the selection of the appropriate compaction standard for each in-place density test, the location within the borrow area from where the sample for the standard was obtained was correlated with the location from which the compacted fill was obtained. In addition, a jar sample of the material associated with each compaction standard was kept in the field so that Quality Control personnel could readily correlate the visual appearance of the fill material with the compaction standard material.

As shown in Table 1, generally only about 2 to 6 compaction standards were in use during any given month. As further shown in Table 1, the variability of the materials being placed during any particular period was generally small. Therefore, although it might appear from Figure 3 that the fill materials were very variable and difficult to control, when the length of the construction period is taken into account the materials were actually quite uniform over significant periods of time, and thus compaction could be readily controlled.

As described in FSAR Section 2.5.6.4.6, a block sample testing program was conducted during the period when fill was being placed in order to verify the as-built engineering properties of the compacted fill. These tests confirmed that the strength, compressibility and permeability properties of the select fill were similar to or exceeded the values assumed for design. During this testing program it was noted that the unit weight (and hence, degree of compaction) of the block samples as measured in the laboratory was lower than that measured by in-place density tests in the field. This reduction in unit weight is attributed to the three-dimensional expansion of the block samples due to stress release after sampling and removal from the ground. The elastic nature of the mica particles within the saprolite-derived select fill makes this material especially susceptible to such expansion. The results of the laboratory unit weight measurements, expressed as a percent of the maximum modified dry density (ASTM D 1557), are summarized in Table 2, together with associated moisture content tests. It can be seen that the average degree of compaction of the West Embankment was 88.3 percent when measured in the laboratory, as opposed to a minimum value of 90.0 percent which was acceptable in the field as measured by in-place density tests. The average degree of compaction of the block samples from the West Embankment is greater than that measured for the North and South Dams, although the average moisture content of 4.0 percent above optimum is slightly higher for the West Embankment. The range of acceptable compaction moisture content in the field was 1.0 percent below optimum to 6.0 percent above optimum, as determined by ASTM D 1557.

3.0 SUBSURFACE EXPLORATION

In order to supplement existing documentation on the stratigraphy and properties of the West Embankment fill and the underlying natural foundation materials, eight test borings were drilled in December 1980 and January, 1981. These borings are numbered WE-14 through WE-21, and were located as shown on Figure 1. Logs of the borings are presented in Appendix A and subsurface profiles through the borings are shown on Figures 4 and 5. The borings were advanced using rotary drilling techniques and with water used as the drilling fluid, except in Boring WE-15 where a bentonite drilling fluid was used.

Disturbed samples of the subsurface materials were recovered from the borings at 5 feet intervals for visual identification by means of a 2-inch O.D. split-barrel sampler driven 18 inches by a 140-pound hammer falling 30 inches (the Standard Penetration Resistance test, ASTM D 1586). The number of blows required to drive the sampler for the final 12 of the 18 inches is the Standard Penetration Resistance (SPR), which is shown on the boring logs and profiles. Relatively undisturbed samples of the subsoils were recovered for laboratory analysis by means of a 3-inch O.D. thin-walled Shelby tube sampler (ASTM D 1587), either pushed into the soil by hydraulic pressure or in conjunction with a rotary operated Pitcher sampler.

As shown on the boring logs and subsurface profiles, the borings penetrated successively compacted select fill, saprolite and decomposed rock. All borings were terminated at practical refusal and are therefore presumed to define the top of essentially intact rock. The materials encountered in the borings are described in the following subsections.

3.1 COMPACTED SELECT FILL

The surficial materials encountered in the borings is a red-brown, non-plastic micaceous medium to fine sandy clayey silt, identified as compacted select fill. Based on visual observation, field pocket penetrometer readings and SPR values, the select fill is generally rated as having a very stiff to hard consistency. In the borings immediately adjacent to the Service Water Intake Structure and Pumphouse, and above the foundation levels of these structures, the consistency is generally rated as firm to stiff. In these areas adjacent to the structures it was necessary to use lighter compaction equipment than in the mass fill areas below and farther away from the structures. SPR values in the mass fill areas were generally found to range from 16 to 40 blows per foot, with only

10 percent of the values measured being in the range of 8 to 15 blows per foot. Immediately adjacent to the structures, SPR values were generally found to range from 8 to 22 blows per foot, with 15 percent in the range of 4 to 7 blows per foot.

In the lower portion of the select fill, below elevation 390, seams of material with similar texture and consistency as described above, but with gray, tan and brown color, were also encountered. These materials were placed during the 1973 construction season.

In Boring WE-18, adjacent to the north side of the Service Water Pumphouse, dense Zone I filter sand was encountered from elevation 385.5 to 382.0. This material was placed as a granular base course for construction of the Pumphouse foundation. Also in Boring WE-18, a zone of medium dense to very dense granular backfill adjacent to the 36-inch diameter by-pass pipe (which provides the interconnection of the Service Water Pond with Monticello Reservoir) was encountered from elevation 425.2 to 412.0. The design invert elevation of this pipe is 415.0. Below the granular backfill, a relatively soft zone of select fill, about 18 inches in thickness, was encountered. This material was probably disturbed during excavation of the pipe trench. Because of the location and limited extent of this soft zone, it will have no influence on the stability of the West Embankment or performance of the Service Water Pumphouse.

The base of the select fill was encountered at elevations ranging from 375.0 to 344.3. These elevations are consistent with the contours shown on Figure 1, which represent the West Embankment foundation surface after stripping of unsuitable surficial soils. No evidence that any unsuitable soil was left in place was found in the borings.

The SPR values in the select fill were found to be less than those recorded in Borings WE-6 and WE-7, drilled in 1977. Those values ranged from 32 to 81 blows per foot. This reduction in SPR values is attributed to the relaxation with time of lateral stresses induced by compaction, the increase in soil moisture content due to filling of the Service Water Pond and the subsequent rise in the groundwater level, and the reduction in effective stress due to the same cause.

3.2 SAPROLITE

Saprolite materials were encountered directly beneath the select fill. The saprolite is generally identified as a dark gray, green, gold and white micaceous soil, derived from in-place weathering of parent rock, with a non-plastic silty fine sand and fine sandy silt texture. Based on SPR values, the saprolite is rated as being in a medium dense to dense condition. The SPR values were found to range from 19 to 82 blows per foot, and were most frequently in the range of 25 to 60 blows per foot. The thickness was found to range from about 11 to 35 feet.

During the 1977 investigation, the SPR values in the saprolite were found to range from 54 to 130 blows per foot. The reduction in SPR value is again attributed to the reduction of effective stress and saturation.

3.3 DECOMPOSED ROCK

Decomposed rock was encountered below the saprolite, consisting of dark gray, green, gold and white partially friable rock fragments with a generally silty coarse to fine sand and gravel texture. Consistent with SPR values ranging from 37 blows per foot to far in excess of 100 blows per foot, and with 90 percent of the SPR values greater than 50 blows per foot, the decomposed rock generally is rated as being very dense. The thickness of decomposed rock was found to be quite variable, ranging from about 11 to 44 feet, and was found to be greatest within the deepest part of the former valley located just north of the Service Water Pumphouse and Intake Structure.

During the previous investigation in 1977, the SPR values in decomposed rock ranged from 67 to far in excess of 100 blows per foot, with 88 percent of the values greater than 100 blows per foot. Again, the present reduction of SPR values is attributed to reduction of effective stress and saturation.

4.0 LABORATORY INVESTIGATION

Laboratory tests have been conducted on representative samples of select fill and saprolite to document and verify the existing properties of these materials. The tests included physical properties, one-dimensional consolidation and triaxial compression (shear). The test results are presented in Appendix B and are summarized in the following subsections.

Undrained creep tests are also being conducted on representative samples. However, since these tests are of lengthy duration, the results will be presented in a subsequent report.

4.1 PHYSICAL PROPERTY TESTS

Physical property tests were conducted to measure water content, Atterberg limits, specific gravity, grain size distribution and unit weight. The results are summarized in Table 3.

The physical property tests indicate that the natural moisture content of the select fill samples tested ranged from 22.7 percent to 33.0 percent and averaged 27.3 percent. The average degree of saturation was 94.9 percent. The optimum compaction moisture contents for these samples, based on correlation of sample locations with compaction standards used during construction, ranges from 17.2 percent to 19.0 percent. Since the block sample tests indicated an average moisture content of 4 percentage points above optimum, the moisture content of the West Embankment has increased an average of about 5 to 6 percentage points due to filling of the Service Water Pond. As previously reported (FSAR Question 362.19), the average increase in moisture content below the groundwater level in borings WE-6 and WE-7 was also 6 percentage points, when compared to samples obtained from above the groundwater level. The increase in moisture content to about 9 or 10 percentage points above optimum is about the increase to be expected from analysis of the compaction curves shown on Figure 3, assuming a degree of compaction of about 90 percent.

The degree of compaction for the select fill samples tested during the present investigation was found to range from 83.1 to 94.8 percent, and averaged 88.7 percent. Again, this is based on correlation of sample location with compaction standards used during construction. The average degree of compaction for block samples from the West Embankment was 88.3 percent. The reduction in degree of compaction below the minimum specified for construction, 90 percent, is due to stress relief and disturbance during sampling of these micaceous soils, as described previously in Section 2.0.

4.2 CONSOLIDATION TESTS

A total of 13 one-dimensional consolidation tests were conducted, six tests on relatively undisturbed samples of select fill, six tests on samples of saprolite, and one test on relatively saprolitic decomposed rock. The test results are summarized in Tables 4 and 5.

Three of the select fill tests, three of the saprolite tests and the one decomposed rock test were conducted with load increment durations of 24 hours, although the plots of time vs. deformation (Appendix B) show that primary consolidation was completed within 6 minutes for almost every load increment, and usually within one minute per load increment. During the 1977 investigation, load increment durations were generally 15 or 60 minutes. The 24 hour load increment duration in the present investigation was found to increase the total compression in the samples tested by about 15 to 20 percent in the select fill and about 17 to 25 percent in the saprolite, when compared to compression at 15 minutes for the same samples. This additional deformation consisted of secondary compression. As shown in Tables 4 and 5, the load increment duration had no significant effect on the compression index, with the average values for select fill being 0.140 and 0.131 for short and long durations, respectively, and the average values for saprolite being 0.143 and 0.139, respectively. The test results also show that the estimated preconsolidation pressure interpreted from the test curves was increased for select fill and decreased for saprolite, using the longer load increments. The average strain at stress levels above the preconsolidation pressure (8 tons per square foot was selected in Tables 4 and 5 for purpose of example) was correspondingly decreased for select fill and increased for saprolite. Because of the test scatter and natural soil variability, therefore, no trend is apparent between the load increment duration and the total strain when the samples are compared in total. The longer increment duration did produce larger strains for the saprolite samples, as would be anticipated. However, the additional strain is composed of secondary compression which was not observed during settlement monitoring in the field and which is not normally included in consolidation tests for estimating the preconsolidation pressure.

Three tests on select fill materials and three tests on saprolite were conducted using load increment durations of one hour. For these tests, each set of three samples were taken from the same Shelby tube in order to reduce sample variability as much as possible. One sample from each set was tested in the normal fashion without back pressure, while one sample per set was tested with a back pressure equivalent to 30 feet of water (13.0 psi) and one sample per set with a back pressure equivalent to 60 feet of water (26.0 psi). The test results are summarized on Figures 6 and 7, as well as Tables 4 and 5. The purpose of these tests, requested by NRC staff, was to determine if the increase in pore water pressure due to filling of the Service Water Pond would have any influence on the consolidation parameters.

As shown on Figures 6 and 7, the test results for back pressures of 0.0 psi and 13.0 psi were virtually identical for both select fill and saprolite. For a back pressure of 26.0 psi, the compressibility of the select fill appears to be decreased, while that of the saprolite appears to be increased, leading to an inconclusive result. However, analysis of the physical properties of the samples indicates that the water content of the saprolite sample tested with a 26.0 psi back pressure was significantly higher than for the other two samples, and the unit dry weight significantly lower. Thus, an increase in compressibility would be expected. For the select fill, the sample tested with a 26.0 psi back pressure appeared to be from a different construction lift, based on visual observation. In addition, the moisture content was lower and the unit weight higher. Thus, a lesser compressibility would be expected. It is concluded, therefore, that back pressure has no significant influence on consolidation parameters, and any slight influence which might exist is masked by natural material variability.

4.3 TRIAXIAL TESTS

A total of 12 consolidated-undrained ($\overline{CIU}$) triaxial compression tests with pore pressure measurements were conducted on relatively undisturbed samples of select fill and saprolite. The test results are summarized on Figures 8 and 9.

The tests on select fill indicate that the design parameters of $\overline{a}$ = 260 psf and $\overline{\alpha}$ = 25.1 degrees (equivalent to $\overline{c}$ = 300 psf and $\overline{\phi}$ = 28 degrees) are slightly conservative. Tests were conducted on samples of both the firm to stiff fill adjacent to the Pumphouse and the very stiff to hard fill below the Pumphouse foundation level. While the fill with the higher consistency indicated somewhat higher strength, the test results indicate that the strength of the lower consistency fill is also in accordance with design.

Five of the six triaxial tests on saprolite samples indicate a very close agreement with the design envelope of $\overline{\alpha}$ = 29.8 degrees ($\overline{\phi}$ = 35 degrees). The average effective friction angle of these five samples is 35.2 degrees, ranging from 32.9 degrees to 38.0 degrees. A sixth sample failed prematurely, with a friction angle of only 26.7 degrees. It is believed that this sample contained a relic rock joint, foliation plane or other defect which caused the failure along a predisposed plane at a low level of strain. During initial design studies, in 1971-1972, of 5 triaxial compresion tests on saprolite samples, one sample of that series also failed prematurely, with a friction angle of about 28 degrees, as shown on FSAR Figure 2.5-113, Sheet 2 of 3. This is a common occurrence when conducting tests on weathered rock material.

The triaxial tests on saprolite were conducted on samples with Standard Penetration Resistance values in the range of 19 to 45 blows per foot, based on split-spoon samples taken immediately below the undisturbed samples. Since this represents the lower end of the range of SPR values in the saprolite (19 to 82 blows per foot), the strength which was measured would represent a lower bound of the saprolite strength.

5.0 SETTLEMENT ESTIMATES AND FIELD MONITORING

As described in detail in previous reports, vertical movement of the Service Water Intake Structure and Pumphouse have been monitored at several locations since the beginning of construction of the Pumphouse. At the present time, the Pumphouse is monitored at four points, near the corners of the pump room. The Intake Structure is monitored by scales on three masts which protrude above the level of the Service Water Pond as shown on Figure 10. In addition, the groundwater level in the West Embankment is monitored by seven piezometers.

Prior to construction, it was estimated that the Pumphouse would experience a settlement of about 4 inches. It was estimated that the west end of the Intake Structure would experience less settlement, about 2 inches, and that the settlement at the east end would be negligible. It was also estimated that these structures would experience a net rebound about 1.5 to 2 inches following filling of the Service Water Pond.

From April through July, 1977, the amount of settlement monitored was of the same magnitude as previously estimated for the amount of construction completed at the corresponding dates. In August, 1977, a large, unexpected increase in settlement occurred, such that the total settlement of the Pumphouse and Intake Structure was about 6 inches and 5 inches, respectively, at that time. Construction work was then temporarily halted while two additional test borings were drilled (WE-6 and WE-7), testing and analysis was conducted, and field instrumentation was installed. Based on this work, in October, 1977, it was estimated that the Pumphouse would experience a total settlement on the order of 12 to 14 inches and the west end of the Intake Structure about 10 to 12 inches. It was also estimated that net rebound of the Pumphouse and the west end of the Intake Structure due to filling of the Service Water Pond would be on the order of 1 inch. As described in detail in previous reports (e.g., Report No. 2, June 1978), the reason for the unexpected settlement was primarily that the preconsolidation pressure of the saprolite had been over-estimated in the original settlement calculations.

Placement of West Embankment fill around the Pumphouse was resumed on October 10, 1977. Upon completion of the West Embankment fill and virtual completion of the Pumphouse structure in February, 1978, the average total settlement of the Pumphouse was measured to be about 12.5 inches. The settlement of the Intake Structure was about 11.1 inches at the west end, 2.8 inches at the middle and -0.6 inches at the east end.

Because of the unexpected magnitude of settlement, cracks occurred in the Service Water Intake Structure. The cracks were repaired by injection grouting in December, 1977 and January, 1978. The movement of the Intake Structure and the Pumphouse since that time is shown on Figure 11 and summarized in Table 6. (Data points in Figure 11 are plotted at three-month intervals in order to smooth month-to-month scatter.) Prior to grouting, the area around the Pumphouse was preloaded with an additional 5 feet of fill above finished grade in order to accelerate the settlement. In this manner, the settlement would be essentially complete before the repairs were made, except that due to filling of the pond.

During filling of the Service Water Pond, the Pumphouse experienced an average of 0.19 inches of settlement in February and March, 1978, due to the weight of the water. The Intake Structure experienced 0.52, 0.42 and 0.22 inches of settlement at the east end, middle and west end, respectively. (Since some rebound occurred after grouting of the Intake Structure cracks and prior to pond filling, the net settlement shown on Figure 11 and in Table 6, is somewhat less these amounts.)

After filling of the Service Water Pond was completed in March, 1978, the Pumphouse and Intake Structure began to rebound, as expected. Through December, 1980, the net rebound of the Pumphouse has been 0.61 inches. The net rebound of the Intake Structure has been 0.10, 0.78 and 0.64 inches at the east end, middle and west end, respectively. The rate of rebound has been steadily decreasing from 1978 through 1980.

Figure 11 also shows the average groundwater level in seven piezometers located within the West Embankment. The piezometers show a gradual rise in the groundwater level in response to the filling of Monticello Reservoir and the Service Water Pond. The rebound of the Service Water Intake Structure and Pumphouse is caused by the bouyancy effects of the groundwater rise. It is anticipated that the groundwater will attain an equilibrium position between about elevation 420 and 423. Shortly after this has been attained, possibly during 1981, it is anticipated that rebound of the Pumphouse and Intake Structure will essentially cease. It is possible that the secondary compression characteristics of the saprolite and compacted select fill could result in some very minor and relatively insignificant settlements after saturation of the embankment has been completed.

6.0 SURVEY OF SERVICE WATER LINES

6.1 PURPOSE

At the request of the NRC staff, a survey was made of the buried 30-inch diameter service water lines, to establish if significant differential movement has occurred since placing the pipes, sufficient to cause concern. The service water piping is 0.375 inches nominal wall thickness, of carbon steel material SA-155, KC-60 Class 1 and is designated Safety Class 2B. The section of pipe requested to be considered is a length of about 320 feet. This section of the piping lies between the east end of the Auxiliary Boiler House and the west side of the Service Water Pumphouse, being between dresser couplings as shown on Figure 12. Sections of the pipe lines to the east and west of this 320-foot section have dresser couplings of sufficiently close spacing designed to accommodate differential movement.

6.2 HISTORY

When the accelerated settlement of the Pumphouse was first observed in August, 1977, a "hold" was placed on all incoming service lines to the Pumphouse. This hold was to allow for the total settlement to take place before connecting incoming services to components in the structure. By August, 1977, none of the incoming services had yet been placed in close proximity to the Pumphouse, since the compacted fill at this stage had only been placed to elevation 420. A minimum distance of 50 feet from the Pumphouse was specified for temporarily terminating incoming services. In the case of the 30-inch service water lines, after the fill had reached elevation 435, a series of pipe sections were placed in a trench excavated into the fill along the 320 feet length of pipe. The bottom of the trench was sloped to the east of field weld FW #14 to align with the settled elevation of the Pumphouse. The joints were welded on the dates shown on Figure 12. The final two joints to be welded, at FW #10 and #13, were delayed until March, 1978, after all settlement in the region of the Pumphouse had ceased. At this time, the pipe sections between dresser couplings immediately adjacent to the Pumphouse were leveled and aligned to suit the settled elevation of the Pumphouse (about 13 inches lower than the originally specified datum). The service water lines were placed into operation during 1979 for start-up and test purposes.

6.3 SURVEY PROCEDURE

Several alternative procedures for obtaining the required survey data were investigated, and the final method was selected for its minimum impact on current field construction and start-up and test requirements. It was decided to survey only line 'A' because small bore piping is buried over the top of Line 'B' making access for surveying difficult. The center line of Line 'A' is 3.5 feet from, and parallel to, Line 'B'; therefore, it was considered that settlement conditions would not change significantly between the two pipe lines and survey results of line 'A' can also be used as representative of line 'B'.

A trench was excavated over the top of the 30 inch service line 'A' to expose the top surface of the pipe for all sections of the 320 feet of pipe not obstructed by the Flammable Storage Building, rail track and buried electrical duct bank (See Figure 13). The elevation of the top of the pipe was surveyed during February, 1981, at a maximum of 5 foot intervals in the accessible sections between the obstructions.

Care was taken to reinstate the corrosion protective wrapping where it was removed to make the survey readings on the metal surface of the pipe. The trench was opened in 40 feet lengths and the excavation was progressively backfilled in accordance with existing field procedures as the survey progressed.

6.4 SURVEY RESULTS

The survey results are shown on Table 7 and plotted on Figure 13. It should be noted that the survey plot has a vertical scale 40 times greater than the horizontal scale which exaggerates the slopes and curvature.

The survey in general confirms the history of placement and welding sequence, showing the pipe sloped downwards east of field weld FW #14 to the Pumphouse. The overall level of the pipe west of FW #14 is a little lower than elevation 428.25 $\pm$ 0.25 feet specified on the piping drawings. No detailed data is available on the elevational profile of the pipe as it existed immediately prior to backfilling of the open trench when the pipe was first placed.

6.5 ANALYSIS

The survey for the section of the pipe between stations 1 through 25 shows curvature and slopes for which an analysis was made. This analysis was based on the conservative assumption that the pipeline was originally straight. It was also assumed that the pipe is a uniformly loaded beam which was deflected to the curvature of the survey plot entirely by settlement. This analysis indicated the location of the highest stress to be near station 18 and the magnitude of stress to be in the region of 20 ksi.

The analysis assumption that the pipe was originally straight and that all of the surveyed curvature was produced by settlement resulted in a calculated stress much higher than actually exists in the pipe. Field welding and manufacturing tolerances would affect the original straightness of the pipe as described below:

a) *A small change in angle at the weld joint made during construction.* For example, a change in angle of ½ degree at the joint will produce a differential of 4.75 inches over a 45 feet length.

b) *The manufacturers requirement for pipe straightness is 1/8 inch in 10 feet.* For a 45 foot length of pipe this could result in the pipe being over 0.5 inches out of alignment from end to end.

c) *The out of roundness manufacturing tolerance is ±1%.* For a 30-inch diameter, the pipe can be out of round by 0.3 inches.

All of the above would have affected to some degree the profile of the pipeline before it was originally buried. In addition, the accuracy of the survey was specified to be only within a tolerance of 1/8 inch.

It is widely acknwoledged that it is inconceivable that a continuously supported and properly backfilled steel pipe could be subject to stresses anywhere approaching a failure unless there is a gross localized deformation or distortion of the soil. Since the pipe was welded and backfilled after the West Embankment and surrounding area settlement had ceased, there is no basis for localized gross distortion in the soil to have occurred. It has been demonstrated repeatedly that even where a steel pipeline crosses a seismic fault that failure of the pressure boundary during a severe earthquake will not occur except at elbows or tees unprotected by flexible connections. Based on the foregoing analysis and comments, it is concluded that the service water lines will perform their safety related function adequately throughout the life of the plant.

7.0 CONCLUSIONS

Based on the data presented in the previous sections of this report, the following conclusions have been determined.

A. The West Embankment was constructed in accordance with the applicable drawings and specifications, including removal of unsuitable existing foundation soils and compaction of select fill materials.

B. The present shear strength properties of the compacted select fill and underlying saprolite are in accordance with values used for design.

C. As shown by back pressure consolidation tests, saturation of the select fill and saprolite resulting from filling of the Service Water Pond has no influence on the one-dimensional compression parameters of these materials.

D. Filling of the Service Water Pond has caused a reduction of effective stress in the saprolite and the select fill below the pond level, causing swelling of these materials, and resulting in a rebound of the Service Water Intake Structure and Pumphouse. Because of this rebound, significant secondary compression, resulting in renewed settlement, is not expected. However, monitoring of the structures will continue for the life of the plant, and if settlement should occur it would be observed.

E. The net rebound of the Service Water Intake Structure and Pumphouse has been about 1/2 to 3/4 inch since grouting of the cracks in the Intake Structure. The rate of rebound is diminishing and is not expected to exceed about one inch.

F. Based on evidence from the survey and the method by which the service water pipelines were welded and backfilled, it is concluded that differential settlement which would cause concern has not occurred.

TABLES

TABLE 1
SUMMARY OF COMPACTION TEST DATA

Month	Compaction Standard No.	Range of Maximum Density (pcf)	Range of Optimum Moisture Content (%)
August, 1973	A, 1, 3, 7, 9, 10, 11	106.4 - 110.4	15.0 - 18.6
September, 1973	2, 3, 4, 6, 9, 11	107.3 - 110.4	15.0 - 18.6
April-May, 1974	28, 29	108.6 - 109.9	14.1 - 18.5
October-November, 1975	67, 68, 69	100.6 - 101.0	23.8 - 25.5
February-March, 1975	67, 68, 69	100.6 - 101.0	23.8 - 25.5
February, 1977	91, 102, 104	104.2 - 104.4	22.1 - 22.4
April, 1977	96, 104, 178	100.5 - 105.7	20.0 - 24.5
May, 1977	178, 193	105.5 - 105.7	19.5 - 20.0
June, 1977	193, 200, 201	105.5 - 107.7	17.0 - 20.0
July, 1977	74, 201	106.6	19.0
August, 1977	237, 257, 265	108.3 - 108.7	17.7 - 18.0
September, 1977	91, 92, 262, 265, 279	104.2 - 110.8	15.8 - 22.1
October, 1977	67, 72, 85, 92, 178, 265 282, 283, 284, 289, 293	100.7 - 108.3	18.0 - 23.8

Note: Ranges exclude standards used only once (Nos. 1, 2, 4, 6, 74, 85, 102, 282).

TABLE 2
SUMMARY OF LABORATORY DENSITY TESTS ON BLOCK SAMPLES

Structure	No. of Block Samples	Total No. of Tests	Average Degree of Compaction (%)	Average Moisture Content Deviation from Optimum (%)
West Embankment	8	35	88.3	+4.0
North Dam	13	48	88.1	+2.6
South Dam	6	22	85.4	+2.3
East Dam	1	4	91.5	+3.0
All Structures	28	109	87.7	+3.0

TABLE 3

SUMMARY OF PHYSICAL PROPERTY TESTS

Property	No. of Tests	Maximum	Minimum	Average
SELECT FILL:				
Water Content (%)	12	33.0	22.7	27.3
Liquid Limit (%)	12	NP	NP	NP
Plasticity Index (%)	12	NP	NP	NP
Specific Gravity	12	2.76	2.64	2.69
Unit Dry Weight (pcf)	12	102.3	88.6	94.9
Degree of Compaction[(a)] (%)	12	94.8	83.1	88.7
Fines Content (%)	12	78.1	47.2	61.4
Degree of Saturation (%)	12	100.0	89.1	94.9
SAPROLITE:				
Water Content (%)	13[(b)]	42.6	15.0	29.0
Liquid Limit[(c)] (%)	13[(b)]	47	NP	---
Plasticity Index[(c)] (%)	13[(b)]	16	NP	---
Specific Gravity	13[(b)]	2.93	2.67	2.81
Unit Dry Weight (pcf)	13[(b)]	116.6	80.0	95.7
Fines Content (%)	12	55.9	9.5	41.1
Degree of Saturation (%)	13[(b)]	100.0	78.5	94.2

(a) Degree of compaction based on correlation of sample location with compaction standards used during construction

(b) Includes one sample of saprolitic decomposed rock

(c) All Atterberg limit tests in saprolite except one were non-plastic

TABLE 4
SUMMARY OF CONSOLIDATION TESTS
ON SELECT FILL

Boring No.	Depth (ft)	Unit Dry Weight (pcf)	Water Content (%)	Compression Index [f]	Recompression Index [f]	Preconsolidation Pressure (tsf)	Strain at 8 TSF (%)
1977 Tests [a]							
WE-6	16	84.6	22.4	0.205	0.017	3.2±	11.93
WE-6	56	93.3	27.6	0.128	0.007	6.0±	8.22
WE-6	56	86.4	29.8	0.152	0.006	3.5±	5.15
WE-7	56	100.1	24.5	0.073	0.012	7.2±	2.37
Average	---	91.1	26.1	0.140	0.011	5.0±	6.92
1981 Tests [b]							
WE-14	64	98.9	24.7	0.106	0.010	6.0±	3.56
WE-18	38	101.1	24.9	0.090	0.010	6.2±	2.79
WE-18	79	99.0	23.3	0.196	0.016	7.2±	6.41
Average	---	99.7	24.3	0.131	0.012	6.5±	4.25
1981 Tests [c]							
WE-19	58	89.8	28.8	0.146	0.021	7.2±	4.79
WE-19 [d]	58	97.1	24.8	0.126	0.020	5.7±	4.90
WE-19 [e]	59	100.8	22.8	0.104	0.014	7.2±	3.54
Average	---	95.9	25.4	0.125	0.018	6.7±	4.41

NOTES:
(a) Load increment duration 15 to 60 minutes
(b) Load increment duration 24 hours
(c) Load increment duration 60 minutes
(d) Back pressure of 13 psi
(e) Back pressure of 26 psi
(f) Unit strain basis

TABLE 5
SUMMARY OF CONSOLIDATION TESTS
ON SAPROLITE

Boring No.	Depth (ft.)	Unit Dry Weight (pcf)	Water Content (%)	Compression Index [f]	Recompression Index [f]	Preconsolidation Pressure (tsf)	Strain at 8 TSF (%)
1977 Tests [a]							
WE-6	71	110.0	21.0	0.091	0.004	7.2±	3.55
WE-6	71	94.4	31.4	0.140	0.008	4.5±	7.10
WE-6	86	102.1	25.4	0.122	0.004	6.5±	6.13
WE-6	86	93.1	30.1	0.218	0.009	10.0±	4.80
Average	---	99.9	27.0	0.143	0.006	7.1±	5.40
1981 Tests [b]							
WE-16	85	116.6	15.0	0.069	0.003	5.0±	3.57
WE-18	93	80.0	42.6	0.240	0.018	4.7±	11.82
WE-18	113	103.9	25.2	0.127	0.008	5.6±	8.12
WE-20	68	88.7	34.0	0.118	0.013	2.7±	8.31
Average	---	97.3	29.2	0.139	0.011	4.5±	7.96
1981 Tests [c]							
WE-18	104	104.4	23.6	0.165	0.008	12.0±	4.51
WE-18 [d]	104	103.9	25.0	0.184	0.012	14.0±	4.50
WE-18 [e]	104	95.8	29.5	0.178	0.009	10.5±	5.82
Average	---	101.4	26.0	0.176	0.010	12.2±	4.94

NOTES:
- (a) Load increment duration 15 to 60 minutes
- (b) Load increment duration 24 hours
- (c) Load increment duration 60 minutes
- (d) Back pressure of 13 psi
- (e) Back pressure of 26 psi
- (f) Unit strain basis

TABLE 6

SUMMARY OF SERVICE WATER INTAKE STRUCTURE AND PUMPHOUSE MOVEMENT SINCE FEBRUARY, 1978[1]

	Net Movement, Inches[2]			
		Intake Structure		
Date	Pumphouse	MM-1	MM-2	MM-3
February, 1978	0.00	0.00	0.00	0.00
March, 1978	0.13	0.35	0.31	0.24
June, 1978	-0.31	-0.02	-0.19	-0.26
December, 1978	-0.32	-0.13	-0.43	-0.37
December, 1979	-0.56	-0.19	-0.67	-0.55
December, 1980	-0.61	-0.10	-0.78	-0.64

---

(1) Shortly after grouting of cracks

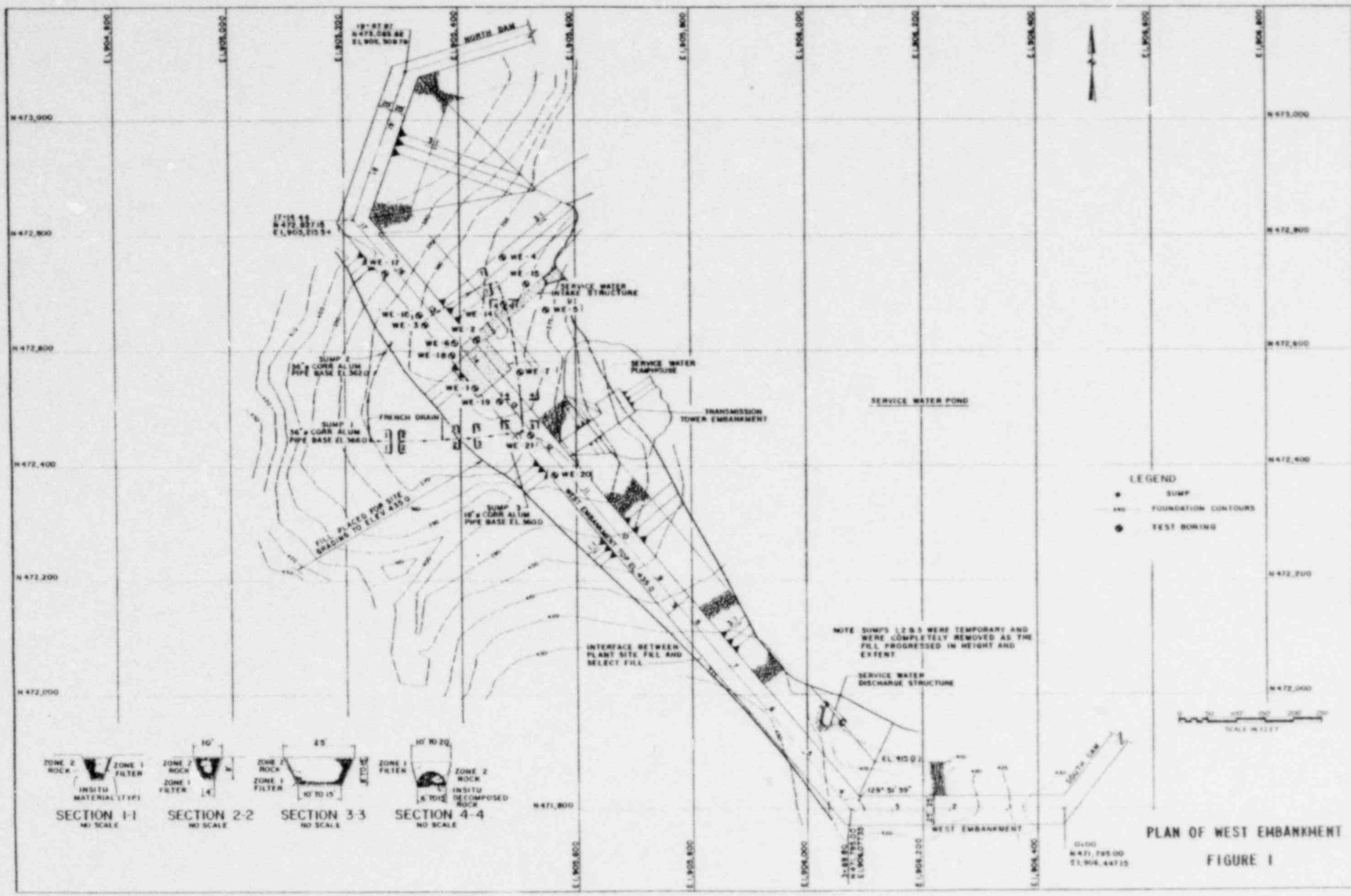
(2) Negative values indicate net rebound, positive values indicate net settlement

TABLE 7

SURVEY RESULTS FOR SERVICE WATER LINE 'A'

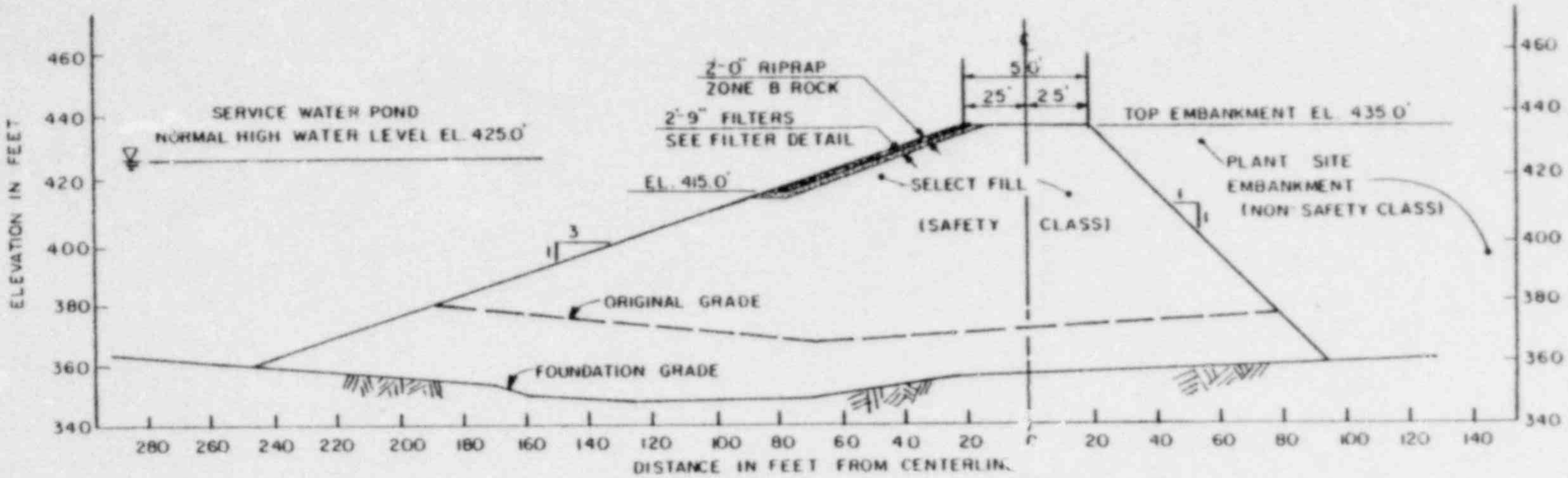
Station	Field Weld	Distance East of Coupling At E. 1,905,095.5 (Feet)	Elevation at Top of Pipe (Feet)
1		1.0	427.778
2		5.0	427.807
3		10.0	427.839
4		15.0	427.867
5		20.0	427.894
	F.W. #16	24.3	427.901
6		25.0	427.905
7		30.0	427.903
8		35.0	427.911
9		40.0	427.919
10		45.0	427.902
11		50.0	427.888
12		55.0	427.881
13		60.0	427.878
14		65.0	427.878
	F.W. #15	69.3	427.882
15		70.0	427.897
16		75.0	427.938
17		80.0	427.981
18		85.0	428.032
19		90.0	428.041
20		95.0	428.044
21		100.0	428.036
22		105.0	428.019
23		110.0	427.997
	F.W. #14	114.4	427.976
24		115.0	427.978
25		120.0	427.964
26		170.0	427.836
27		175.0	427.840
	F.W. #12	178.4	427.844
28		180.0	427.837
29		185.0	427.821
	F.W. #11	185.4	427.820
30		190.0	427.808
31		195.0	427.800
32		200.0	427.799
33		205.0	427.800
34		210.0	427.801
34A		272.5	427.548
35		295.0	427.352
36		300.0	427.304
37		305.0	427.245
38		310.0	427.166
39		315.0	427.091
40		320.0	427.022
Dresser Coupling		321.4	No Data

PLATES



PLAN OF WEST EMBANKMENT

FIGURE 1



TYPICAL FILTER DETAIL
NO SCALE

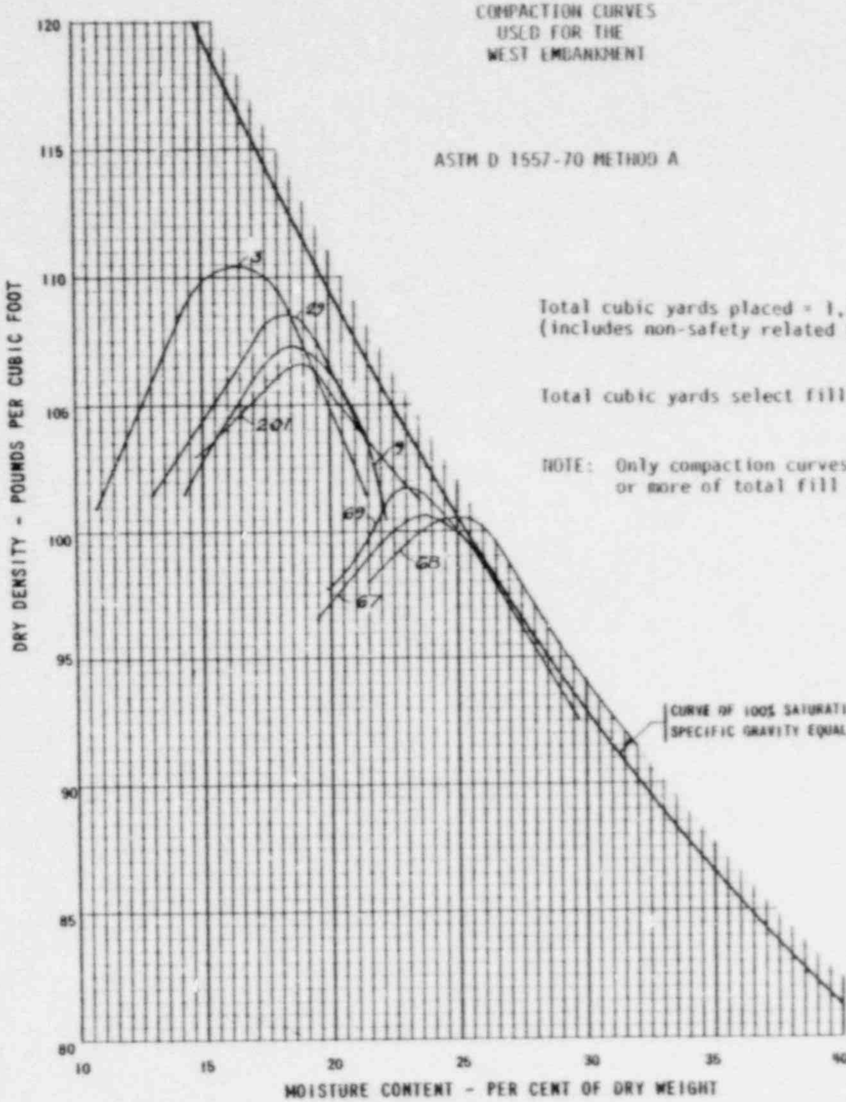
TYPICAL SECTION - WEST EMBANKMENT

FIGURE 2

Curve No.	γ_{dmax} (pcf)	Opt. m/c %	No. of samples compared	% of total cu. yds. placed
A	107.0	17.2	3	1
1	116.3	12.5	1	<1
2	117.1	12.5	1	<1
3	110.4	16.8	52	13
4	114.6	13.6	1	<1
6	114.4	13.5	1	<1
7	108.9	17.4	2	<1
9	107.3	18.6	22	6
10	106.4	17.0	10	3
11	108.5	15.0	2	<1
28	109.9	14.1	4	1
29	108.6	18.5	19	5
67	100.7	23.8	58	15
68	100.6	25.5	28	7
69	101.0	24.2	25	6
72	106.0	18.5	2	<1
74	99.0	27.0	1	<1
85	103.0	22.5	1	<1
91	104.2	22.1	7	2
92	107.2	20.5	4	1
96	100.5	24.5	3	1
102	101.0	23.0	1	<1
104	104.4	22.4	3	1
178	105.7	20.0	17	4
193	105.5	19.5	4	1
200	107.7	17.0	3	1
201	106.6	19.0	45	12
237	108.7	17.7	6	2
257	108.5	17.9	14	4
262	110.8	16.8	4	1
265	108.3	18.0	14	4
279	109.5	15.8	5	2
282	112.4	16.2	1	<1
283	107.8	19.5	3	1
284	104.4	22.7	9	2
289	106.9	19.7	7	2
293	107.9	19.4	3	1

SUMMARY OF
COMPACTION CURVES
USED FOR THE
WEST EMBANKMENT

ASTM D 1557-70 METHOD A



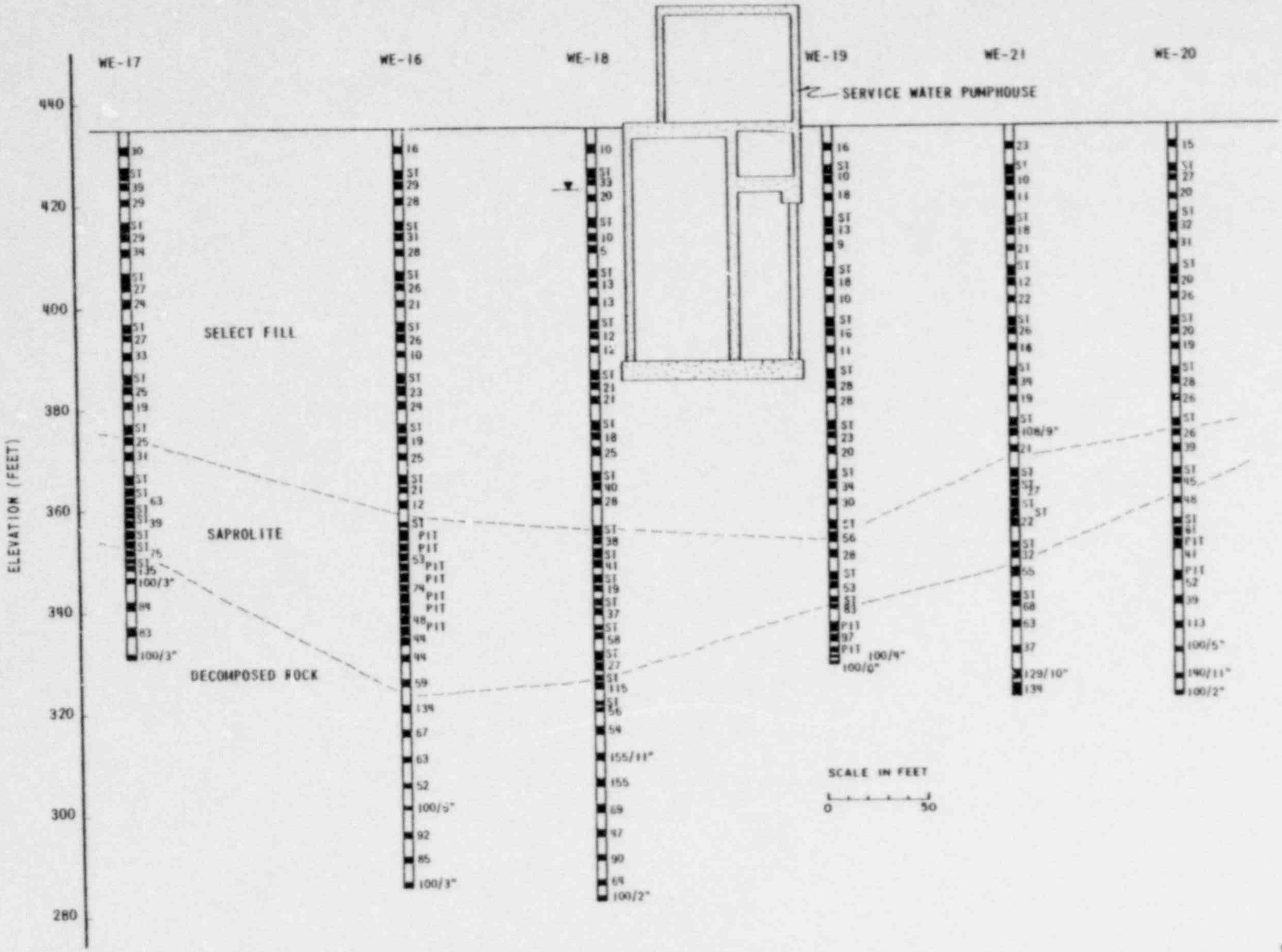
Total cubic yards placed = 1,169,087
(includes non-safety related fill)

Total cubic yards select fill = 590,000

NOTE: Only compaction curves representing 5% or more of total fill volume are shown.

SUMMARY OF COMPACTION STANDARDS

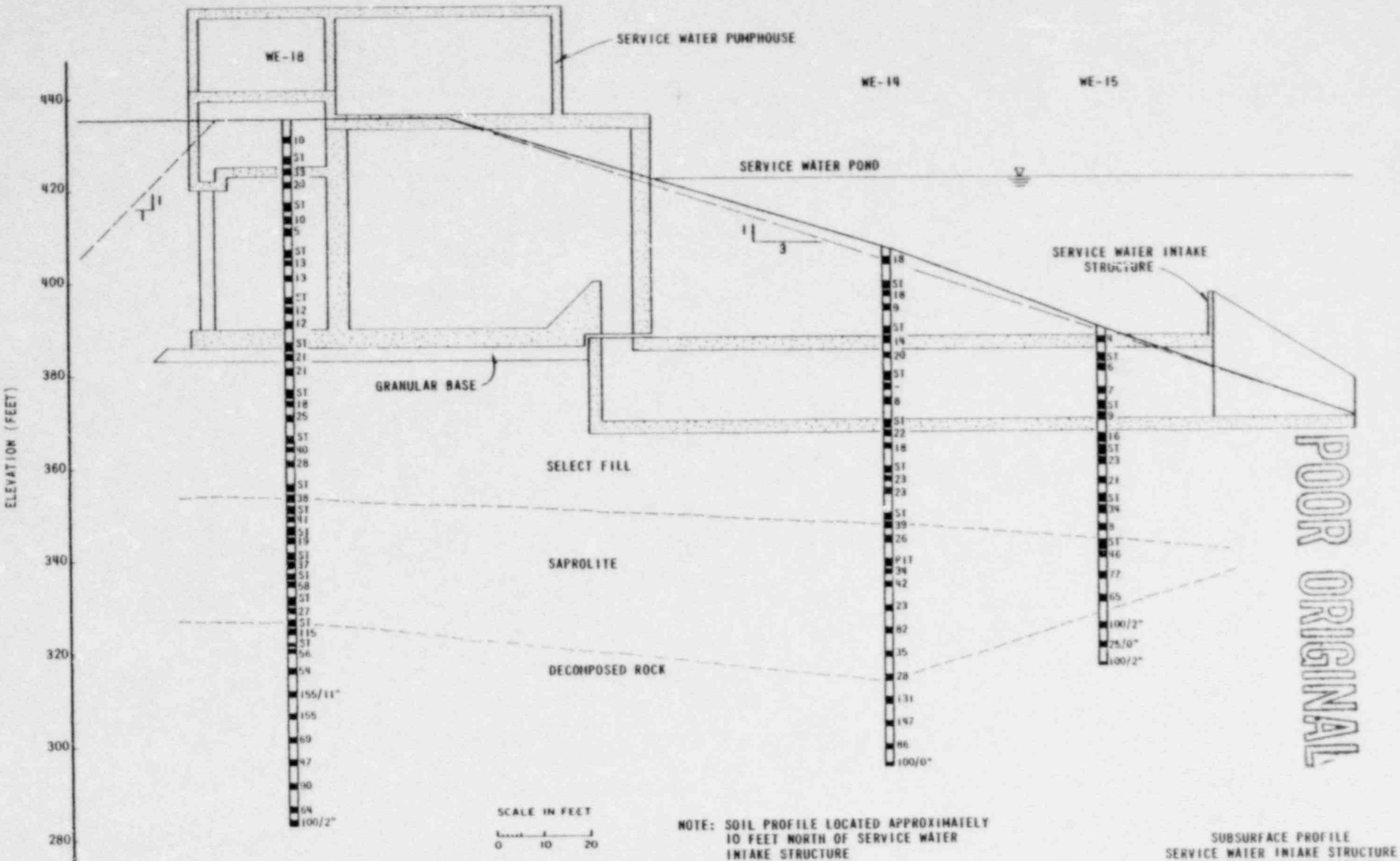
FIGURE 3



SUBSURFACE PROFILE
WEST EMBANKMENT CREST
V.C. SUMMER NUCLEAR STATION

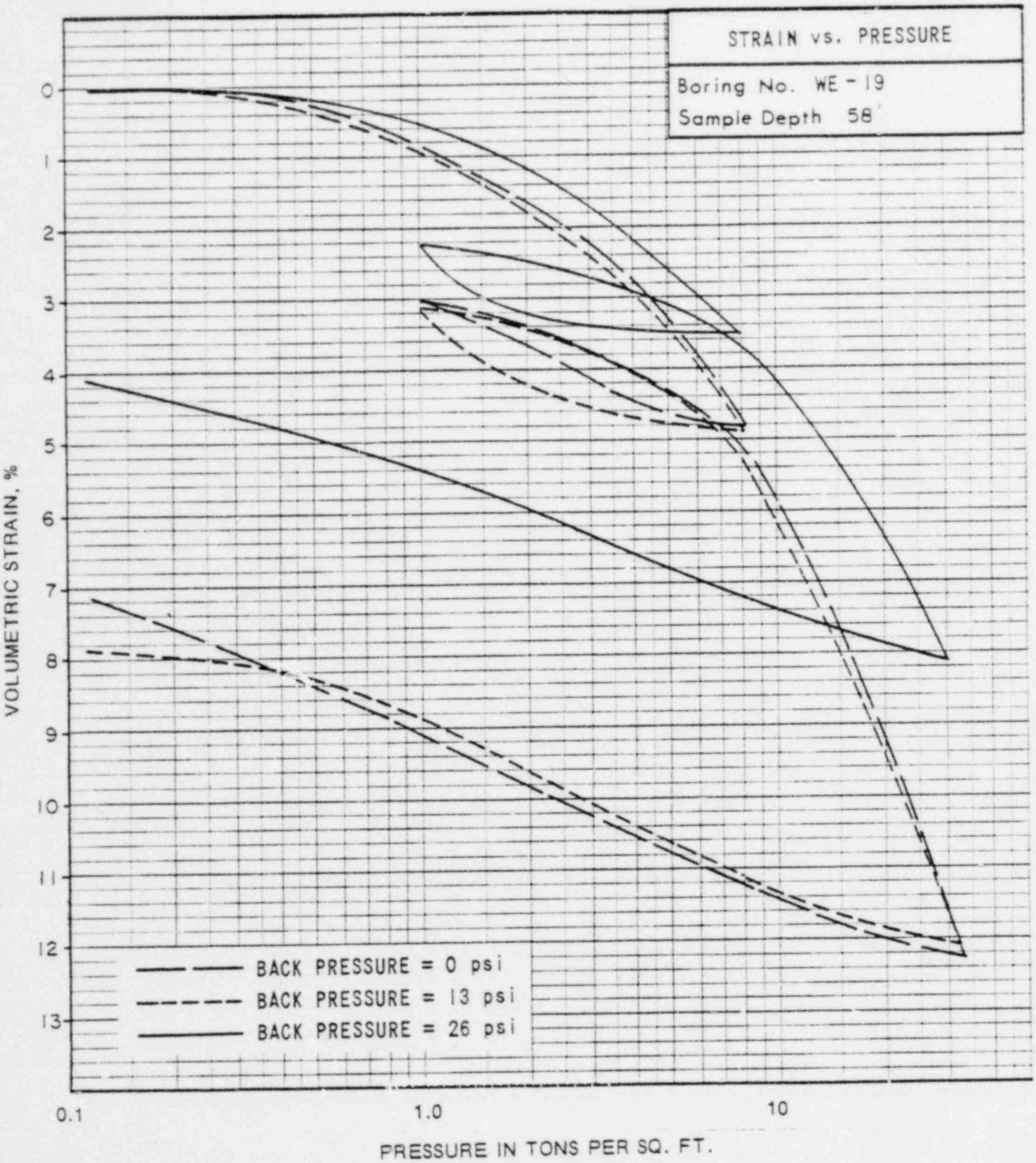
FIGURE 4

POOR ORIGINAL



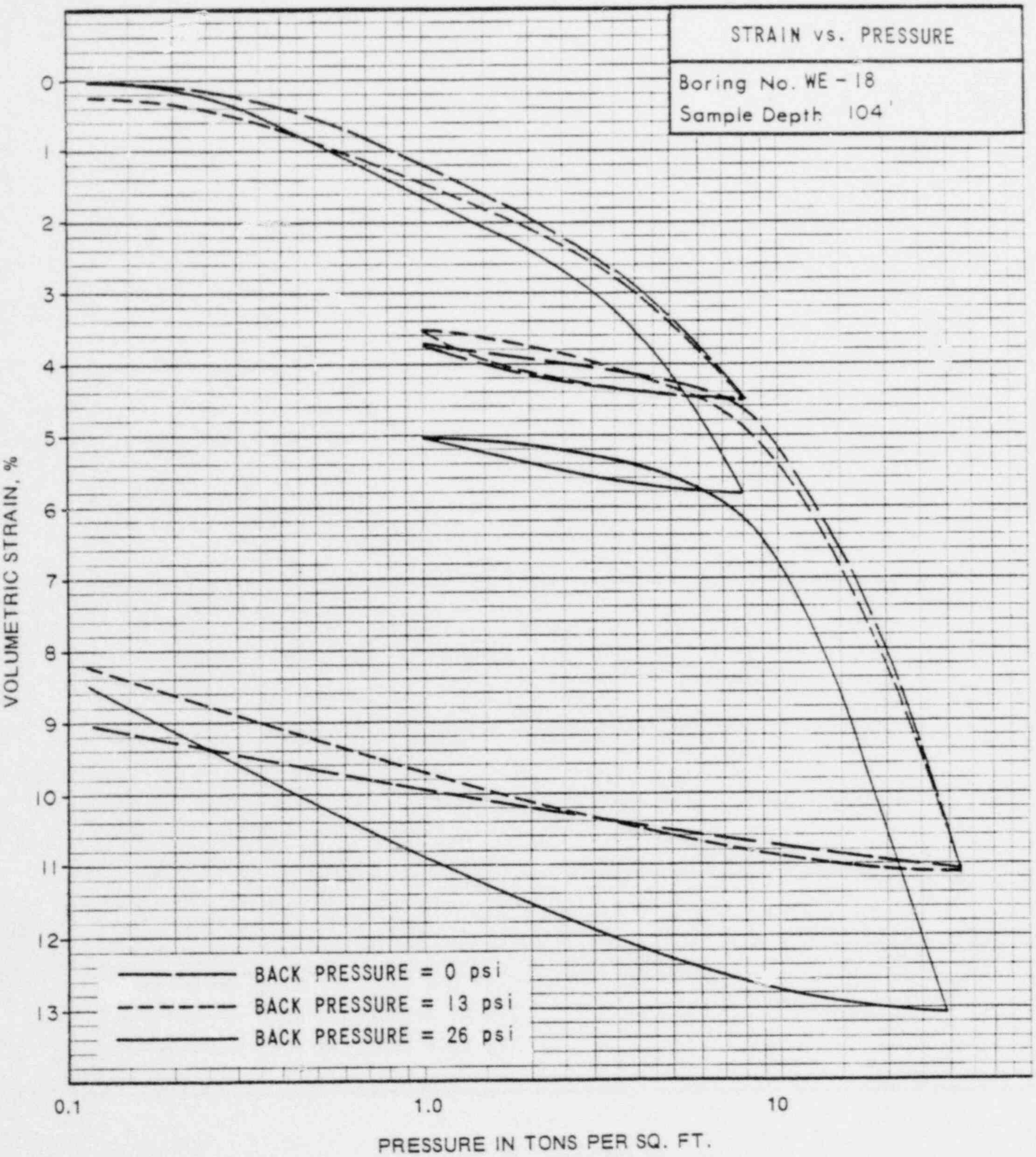
SUBSURFACE PROFILE
SERVICE WATER INTAKE STRUCTURE
V.C. SUMMER NUCLEAR STATION

FIGURE 5



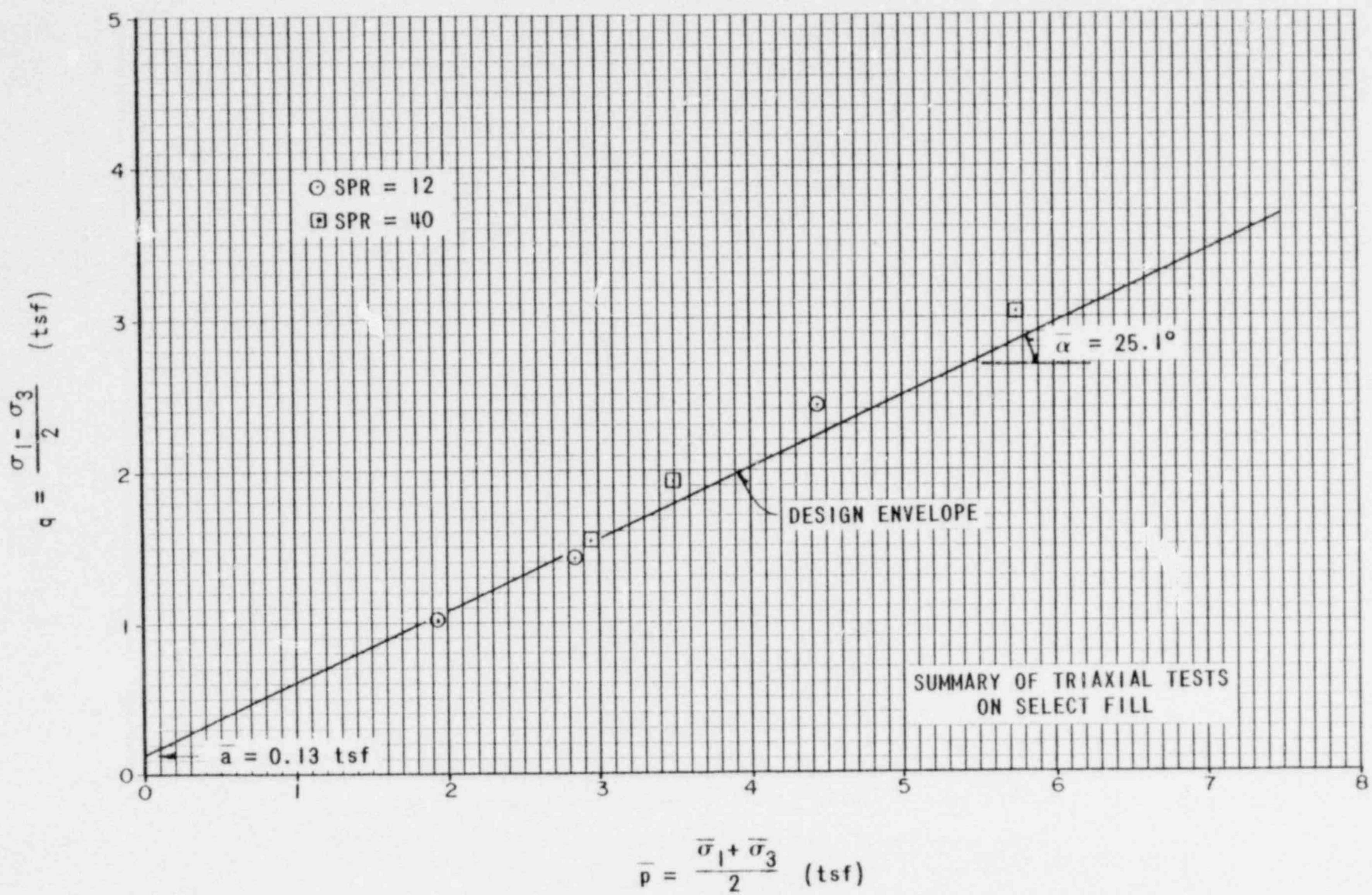
SUMMARY OF BACK PRESSURE
CONSOLIDATION TESTS ON SELECT FILL

FIGURE 6



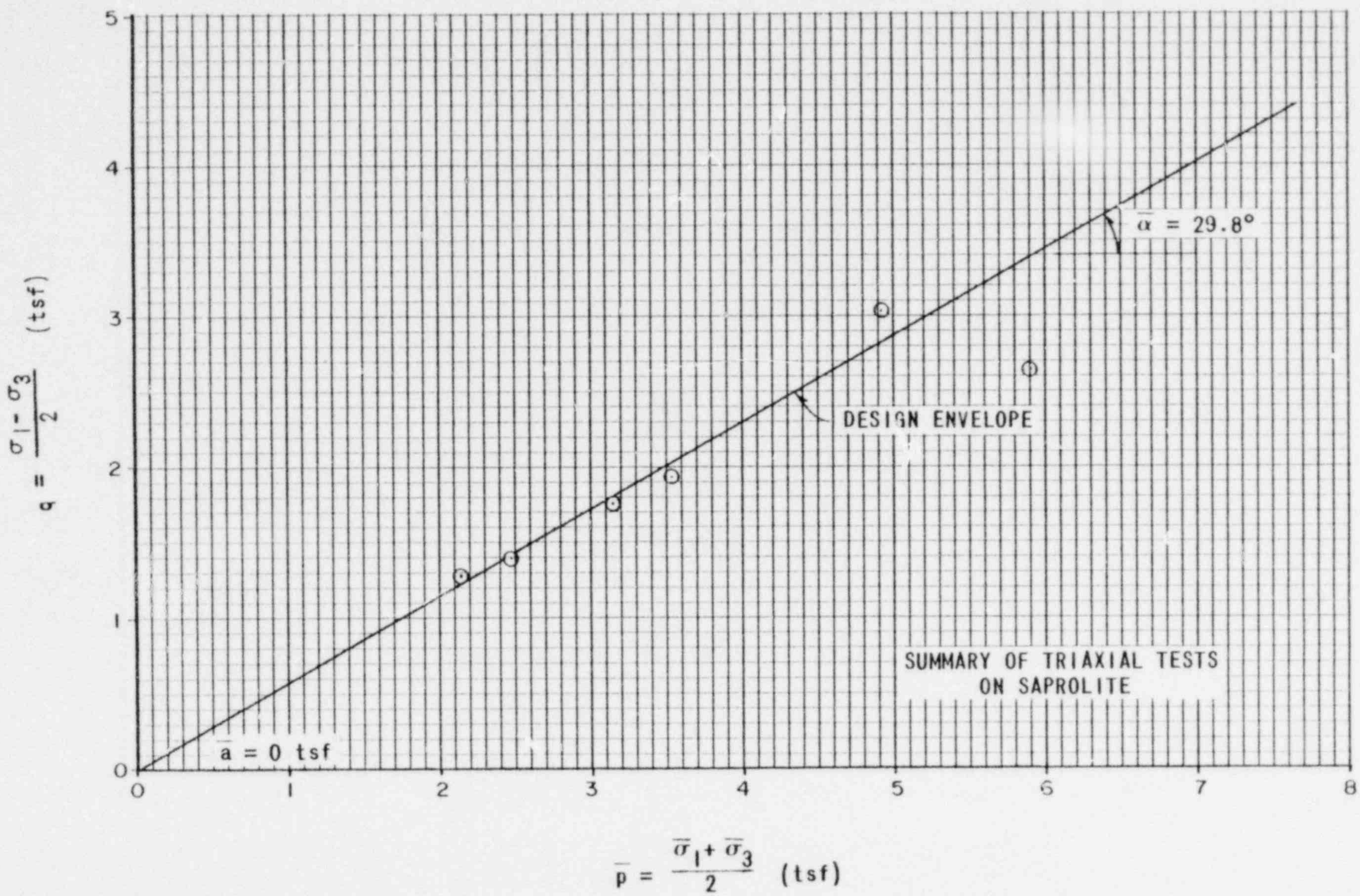
SUMMARY OF BACK PRESSURE
CONSOLIDATION TESTS ON SAPROLITE

FIGURE 7



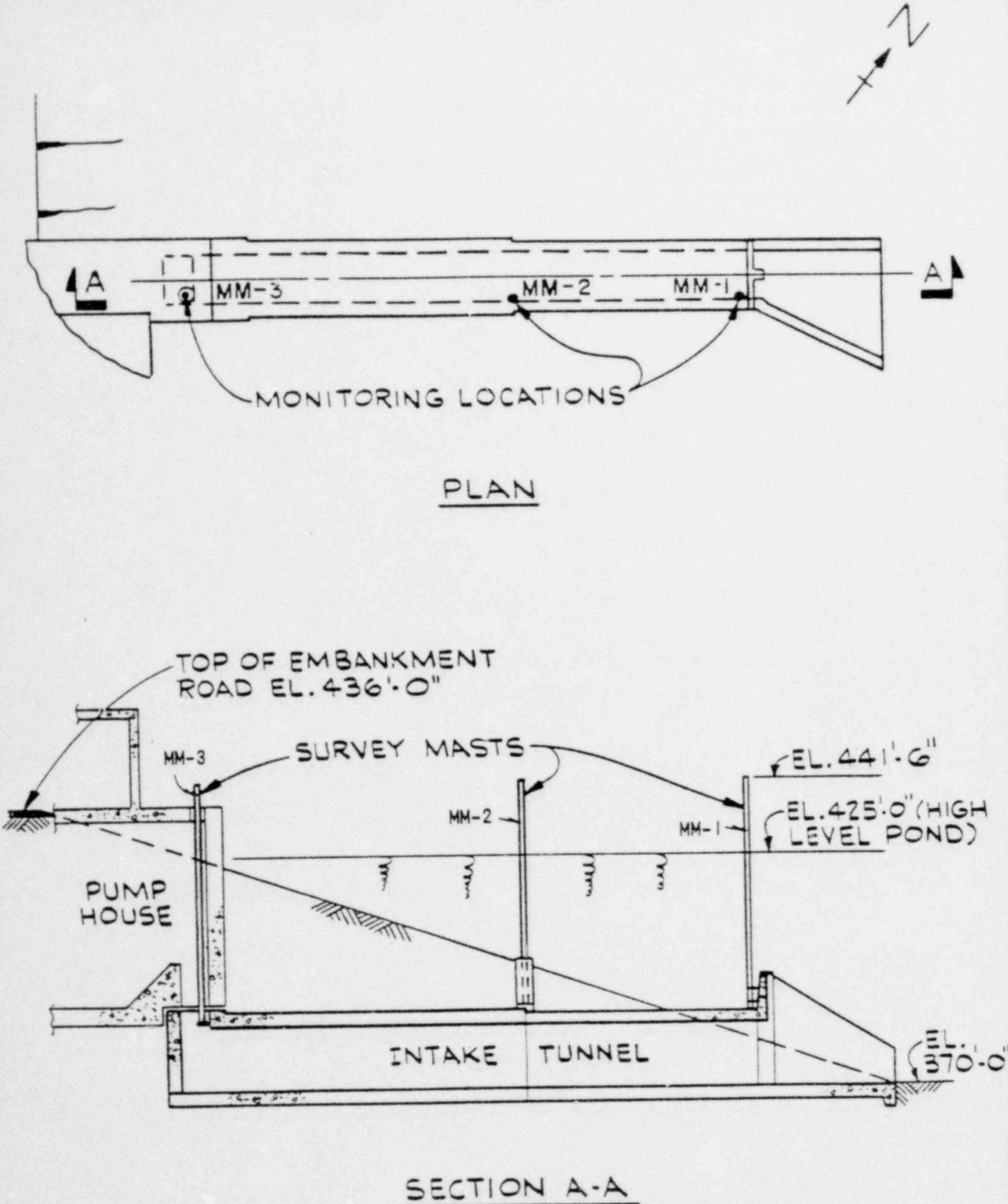
○ SPR = 12
⊡ SPR = 40
$\bar{a}$ = 0.13 tsf
DESIGN ENVELOPE
$\bar{\alpha}$ = 25.1°
SUMMARY OF TRIAXIAL TESTS
ON SELECT FILL
$q = \frac{\sigma_1 - \sigma_3}{2}$ (tsf)
$\bar{p} = \frac{\bar{\sigma}_1 + \bar{\sigma}_3}{2}$ (tsf)
0
1
2
3
4
5
6
7
8

FIGURE 8



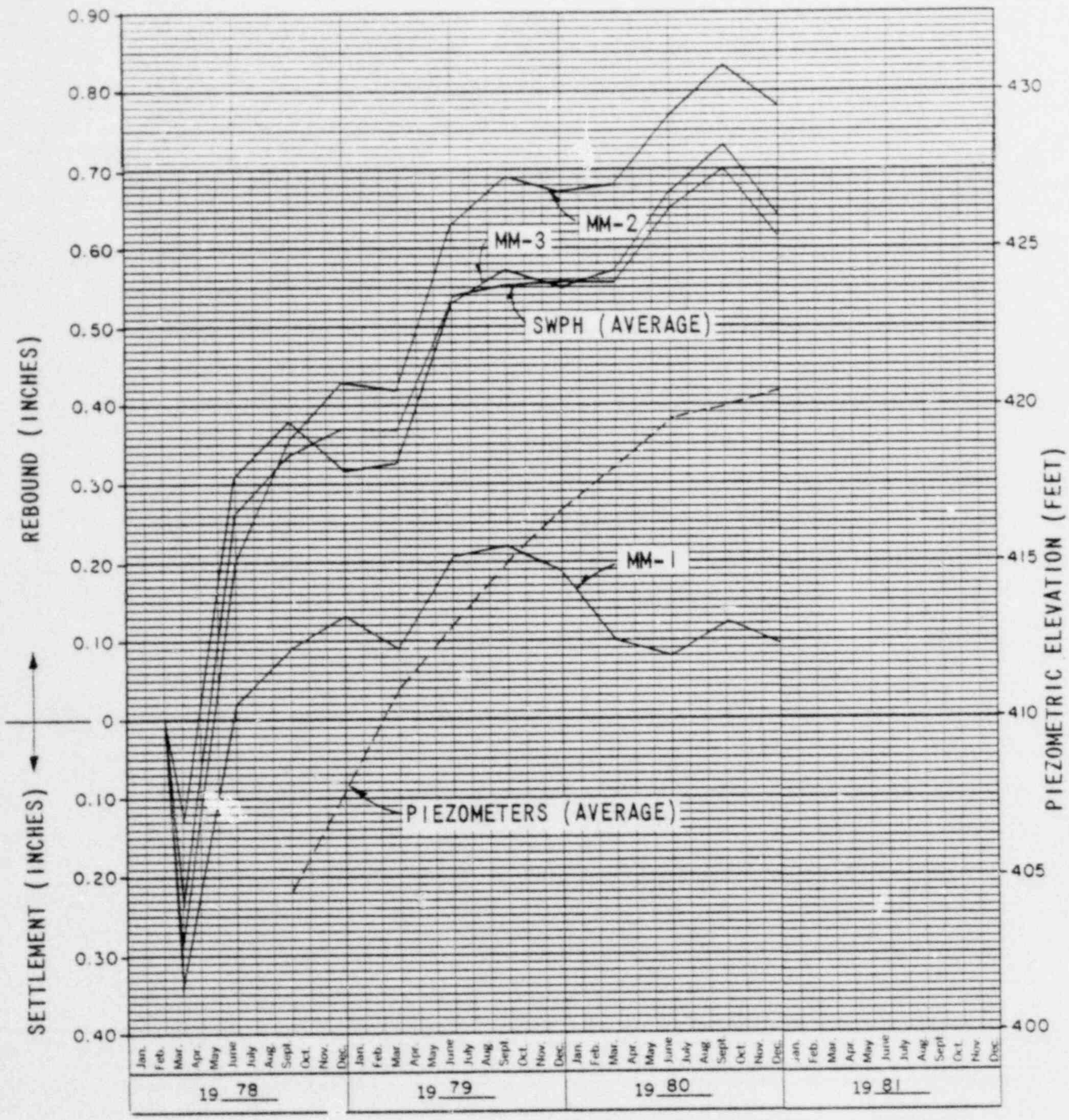
SUMMARY OF TRIAXIAL TESTS ON SAPROLITE
DESIGN ENVELOPE
$\bar{\alpha}$ = 29.8°
$\bar{a}$ = 0 tsf
$q = \frac{\sigma_1 - \sigma_3}{2}$ (tsf)
$\bar{p} = \frac{\bar{\sigma}_1 + \bar{\sigma}_3}{2}$ (tsf)
0
1
2
3
4
5
6
7
8

FIGURE 9



MONITORING SYSTEM DURING AND
AFTER POND FILLING
SERVICE WATER INTAKE STRUCTURE

FIGURE 10

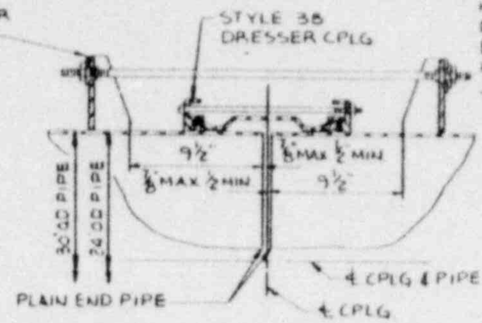


NOTE: SETTLEMENT AND REBOUND PLOTTED AT 3 MONTH INTERVALS TO SMOOTH MONTHLY SCATTER

SERVICE WATER INTAKE STRUCTURE AND PUMPHOUSE
MOVEMENT SINCE FEBRUARY, 1978
VIRGIL C. SUMMER NUCLEAR STATION

Fig. 11

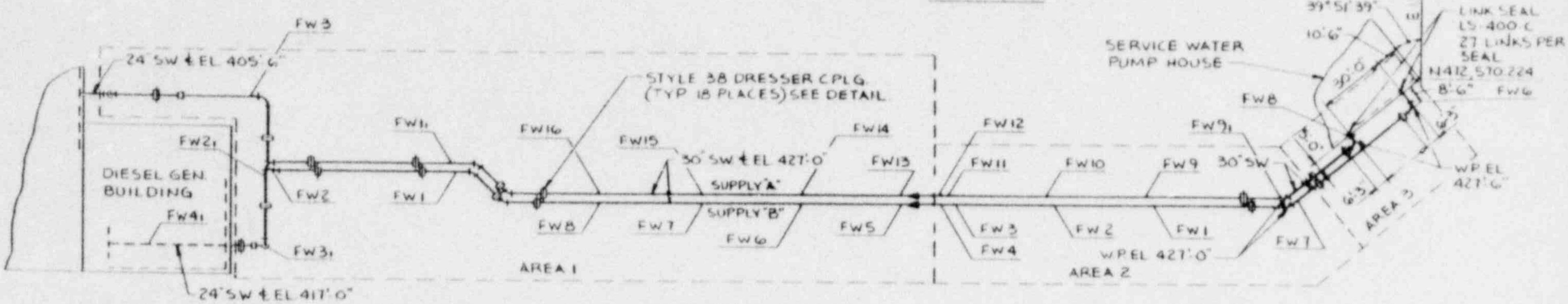
AREA	CPLG INSTALLATION DATE	BACKFILL DATE
1	MID NOV. 1977	2-27-78 THRU 3-2-78
2	MID MARCH 1978	4-6-78 THRU 4-24-78
3	FIRST PART APRIL 1978	3-31-78 THRU 6-1-78



DRESSER CPLG DETAIL

SCALE: NONE

NOTE:
HARNESS TO BE TIGHT ONLY DURING HYDRO, LOOSENED 1" BEFORE BACKFILLING AFTER HYDRO. MAXIMUM ALLOWABLE JOINT DEFLECTION NOT TO EXCEED 2°



FIELD WELD NUMBER	AREA	WELD COMPLETION DATE
FW 1	1	7-28-77
FW 2	1	7-11-77
FW 3	1	7-5-77
FW 5	1	3-29-78
FW 6	1	11-9-77
FW 7	1	12-21-77
FW 8	1	11-2-77
FW 13	1	3-28-78
FW 14	1	10-19-77
FW 15	1	12-20-77
FW 16	1	11-2-77
FW 1₁	1	8-16-77
FW 2₁	1	7-20-77
FW 3₁	1	11-8-77

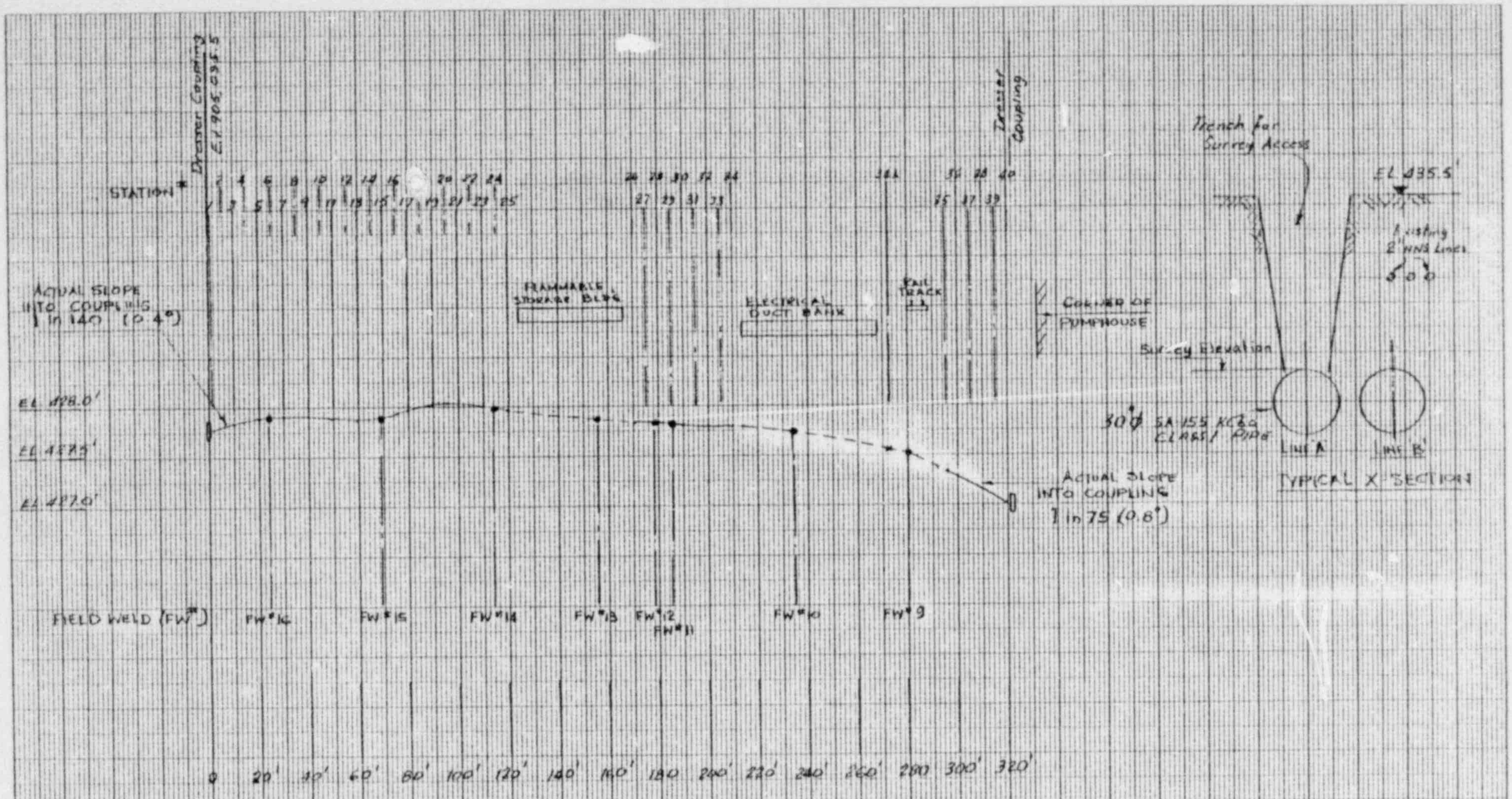
FIELD WELD NUMBER	AREA	WELD COMPLETION DATE
FW 4₁	1	5-8-77
FW 1	2	12-8-77
FW 2	2	3-30-78
FW 3	2	11-22-77
FW 4	2	11-22-77
FW 7	2	1-12-78
FW 9	2	12-8-77
FW 10	2	3-22-78
FW 11	2	11-23-77
FW 12	2	11-17-77
FW 9₁	2	1-12-78
FW 6	3	4-1-78
FW 8	3	4-5-78

POOR ORIGINAL

NOTES:
1. SERVICE WATER PIPE MATERIAL IS SA-155 KC60 Cl.1 WALL THICKNESS IS 0.375"
2. EXCAVATION DITCH SIZE WAS APPROX. 8 FEET WIDE BY 8 FEET DEEP

INSTALLATION DATA
30" SERVICE WATER PIPING

FIGURE 12



NOTE: VERTICAL SCALE = 40 x HORIZONTAL SCALE

SURVEY PLOT FOR SERVICE WATER
30 INCH LINE 'A' - FEBRUARY 1981

FIGURE 13

APPENDIX

A

LOG of BORING No. WE-14

DATE 12/15-17/80 SURFACE ELEV. 422.9 LOCATION N 472,688 E 1,905,479

DEPTH, FEET	SAMPLES / SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0–10		Water	406.7				
20–50	18, ST, 18, 9, ST, 14, 20, ST, **, 8, ST, 22	Stiff red-brown micaceous medium to fine sandy clayey silt (Compacted Select Fill)	366.9				
60–70	18, ST, 23, 23, ST, 39	Very stiff gray, tan and red-brown micaceous medium to fine sandy clayey silt (Compacted Select Fill)	347.1	24.7	NP	NP	*
80–90	26, PIT, 34, 42	Dense to very dense dark gray, green and gold micaceous silty fine sand and fine sandy silt (Saprolite)					

Continued on Sheet 2

COMPLETION DEPTH 127.5 feet Water Depth Surface Date ---

SAMPLER: 2" O.D. SPLIT BARREL SAMPLER

JOB NO 71 C 72 WE

Sheet 2 of 2

LOG of BORING No. WE-14

DATE 12/15-17/80 SURFACE ELEV. 422.9 LOCATION N 472,688 E 1,905,479

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
90								
	■	23	Same as above (Saprolite)					
100	■	82						
	■	35						
	■	28		312.9				
110	■	131	Very dense dark gray and white, with green and gold intrusions, micaceous silty fine sand with rock fragments					
	■	147						
120	■	86	(Decomposed Rock)					
		100/0"		295.4				
130			Refusal at 127.5 feet					
140								

* See Summary of Laboratory Test Results, Appendix B

** Sampling resistance not valid at 44.5 to 46.0 feet due to sediment in boring

ST = Shelby Tube sample
PIT = Pitcher sample

COMPLETION DEPTH 127.5 feet Water Depth Surface Date ---

SAMPLER: 2" O.D. SPLIT BARREL SAMPLER

LOG of BORING No. WE-15

DATE 12/18-19/80 SURFACE ELEV. 422.9 LOCATION N 472,713 E 1,905,514

DEPTH, FEET	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0–34		Water	389.2				
	4	Firm to stiff red-brown micaceous fine sandy clayey silt (Compacted Select Fill)					
40	ST						
	6						
	7						
50	ST						
	9		366.9				
	16	Very stiff red-brown micaceous fine sandy clayey silt (Compacted Select Fill)					
	ST						
60	23						
	21						
70	ST						
	34		348.3				
	8	Medium-dense gray green and red-brown fine sandy silt, trace rock fragments (Mixed Saprolite and Compacted Select Fill)	344.3				
80	ST	Very dense gray, green, black and white micaceous fine sandy silt with seams of silty medium to fine sand (Saprolite)					
	46						
	77						
90							

Continued on Sheet 2

COMPLETION DEPTH 107.0 feet Water Depth Surface Date ---

SAMPLER: 2" O.D. SPLIT BARREL SAMPLER

JOB NO 71 C 72 WE

LOG of BORING No. WE-15

DATE 12/18-19/80 SURFACE ELEV. 422.9 LOCATION N 472,713 E 1,905,514

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
90	■	65	Same as above (Saprolite)	327.6				
100	■ ■ ■	100/2" 25/0" 100/2"	Very dense gray, green, black and white micaceous fine sandy silt and silty fine sand with rock fragments (Decomposed Rock)	315.9				
110			Refusal at 107.0 feet					
120			ST = Shelby Tube sample					

COMPLETION DEPTH 107.0 feet Water Depth Surface Date ---

SAMPLER: 2" O.D. SPLIT BARREL SAMPLER

JOB NO 71 C 72 WE

Sheet 1 of 2

LOG of BORING No. WE-16

DATE 12/17-19/80 SURFACE ELEV. 434.6 LOCATION N 472,669 E 1,905,327

DEPTH, FEET	SAMPLES / SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0 – 10 – 20 – 30 – 40 – 50	16, ST, 29, 28, ST, 31, 28, ST, 26, 21, ST, 26, 10, ST, 23, 24	Very stiff red-brown micaceous fine sandy and medium to fine sandy clayey silt (Compacted Select Fill)	378.6				
60	ST, 19, 25	Very stiff gray, tan and red-brown micaceous fine sandy clayey silt with seams of silty fine sand (Compacted Select Fill)	368.6				
70	ST, 21, 12	Stiff to very stiff red-brown micaceous fine sandy clayey silt (Compacted Select Fill)	358.6				
80 – 90	ST, PIT, PIT, 53, PIT, PIT, 74	Dense to very dense gray, green and white micaceous silty decomposed rock, friable to silty coarse to fine sand and gravel size rock fragments (Saprolite/Decomposed Rock)			NP	NP	*

Continued on Sheet 2

COMPLETION DEPTH 149.3 feet Water Depth Not Determined Date ---

SAMPLER: 2" O.D SPLIT BARREL SAMPLER

45 LOG JOB NO 71 C 72 WE

WCC 88 1

LOG of BORING No. WE-16

DATE 12/17-19/80 SURFACE ELEV. 434.6 LOCATION N 472,669 E 1,905,327

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
90		PIT PIT 48 PIT	Same as above (Saprolite/Decomposed Rock)	334.6				
100		44 44 59	Dense dark gray and green micaceous silty fine sand with seams of white silty coarse to fine sand (Saprolite)	323.4				
110 120 130 140		134 67 63 52 100/5" 92 85 100/3"	Very dense dark gray, white and green micaceous silty fine sand (Decomposed Rock)	285.3				
150 160			Refusal at 149.3 feet * = See Summary of Laboratory Test Results, Appendix B ST = Shelby Tube sample PIT = Pitcher sample					

COMPLETION DEPTH 149.3 feet Water Depth Not Determined Date ---

SAMPLER: 2" O.D. SPLIT BARREL SAMPLER

LOG of BORING No. WE-17

Sheet 1 of 2

DATE 1/5-7/81 SURFACE ELEV. 435.0 LOCATION N 472,731 E 1,905,271

DEPTH, FEET	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	Other Tests
0							
	30						
10	ST 39						
	29						
20	ST 29	Very stiff to hard red-brown micaceous fine sandy clayey silt (Compacted Select Fill)					
	34						
30	ST 27						
	24						
40	ST 27						
	33						
50	ST 25						
	19		379.0				
60	ST 25	Very stiff red-brown and yellow-brown fine sandy clayey silt (Compacted Select Fill)	375.0				
	31						
70	ST ST 63 ST ST 39	Dense to very dense dark gray, green and gold micaceous silty fine sand and fine sandy silt (Saprolite)					
80	ST ST 75 ST 135 100/3"	Very dense gray, green, gold, and black micaceous silty fine sand with seam of white silty coarse to fine sand (Decomposed Rock)	353.7				
90							

Continued on Sheet 2

COMPLETION DEPTH 103.8 feet Water Depth Not Determined Date ---

SAMPLER: 2" O.D. SPLIT BARREL SAMPLER

45 LOG JOB NO 71 C 72 WE

WC BR 1

Sheet 2 of 2

LOG of BORING No. WE-17

DATE 1/5-7/81 SURFACE ELEV. 435.0 LOCATION N 472,731 E 1,905,271

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
90		84	Same as above (Decomposed Rock)					
100		83						
		100/3"		331.2				
110			Refusal at 103.8 feet					
			ST = Shelby Tube sample					
120								

COMPLETION DEPTH 103.8 feet Water Depth Not Determined Date ---

SAMPLER: 2" O.D. SPLIT BARREL SAMPLER

JOB NO 71 C 72 WE

LOG of BORING No. WE-18

DATE 12/11-13/80 SURFACE ELEV. 435.0 LOCATION N 472,6C1 E 1,905,388

DEPTH, FEET	SAMPLES / SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0		Asphalt Pavement	434.5				
	10	Stiff red-brown micaceous fine sandy clayey silt (Compacted Select Fill)	425.2				
10	ST, 33, 20, [illegible], 10	Medium dense to very dense dark gray and white silty medium to fine sand with stiff red-brown micaceous fine sandy clayey silt from 13.5 to 14.5 feet (Backfill of 36" by-pass pipe)	412.0				
20	5	Soft red-brown micaceous fine sandy clayey silt	410.5				
30	ST, 13	Stiff red-brown micaceous medium to fine sandy clayey silt (Compacted Select Fill)		31.5 30.9 30.0	NP	NP	*
40	13, ST, 12, 12			24.9	NP	NP	*
50	ST, 21	Dense Zone I Filter Sand	385.5 382.0				
60	21, ST, 18, 25	Very stiff to hard red-brown micaceous medium to fine sandy clayey silt (Compacted Select Fill)					
70	ST, 40, 28			33.0 30.6 22.7	NP	NP	*
80	ST, 38		355.0	23.3	NP	NP	*
	ST, 41, ST	Medium dense to dense dark gray, green and gold micaceous silty fine sand and fine sandy silt (Saprolite)		42.6 39.1	NP	NP	*
90		Continued on sheet 2					

COMPLETION DEPTH 152.4 feet Water Depth 12.0 feet Date 12/14/80

SAMPLER: 2" O.D. SPLIT BARREL SAMPLER

JOB NO 71 C 72 WE

WCC RP 1

LOG of BORING No. WE-18

DATE 12/11-13/80 SURFACE ELEV. 435.0 LOCATION N 472,601 E 1,905,388

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
90	■	19	Same as above (Saprolite)					
	■	ST			42.6	NP	NP	*
	■	37						
	■	ST						
100	■	58			23.6			
	■	ST			25.0	NP	NP	*
	■	27			29.5			
	■	ST		326.0				
110	■	115	Dense to very dense dark gray, green, gold and white interbedded zones of silty coarse to fine sand with rock fragments, silty fine sand and fine sandy silt (Decomposed Rock)					
	■	ST			25.2	NP	NP	*
	■	56						
120	■	54						
	■	155/11"						
130	■	155						
	■	69						
140	■	47						
	■	90						
150	■	64						
		100/2"		282.6				
160			Refusal at 152.4 feet					

Refusal at 152.4 feet

* See Summary of Laboratory Test Results, Appendix B

ST = Shelby Tube sample

COMPLETION DEPTH 152.4 feet Water Depth Not Determined Date ---

SAMPLER: 2" O.D. SPLIT BARREL SAMPLER

LOG of BORING No. WE-19

Sheet 1 of 2

DATE 12/15-16/80 SURFACE ELEV. 434.9 LOCATION N 472,518 E 1,905,462

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0								
		16						
	ST							
10		10						
		18						
	ST							
20		13	Stiff to very stiff red-brown micaceous medium to fine sandy clayey silt, with occasional seams of tan color					
		9						
	ST		(Compacted Select Fill)					
30		18						
		10						
	ST							
40		16						
		11		387.9				
	ST							
50		28						
		28						
	ST		Very stiff to hard red-brown micaceous medium to fine sandy clayey silt, with seams of gray, tan and brown, especially below 70 feet		28.8 24.8 22.8	NP	NP	*
60		23						
		20						
	ST		(Compacted Select Fill)					
70		34						
		30						
	ST			353.7				
80		56	Medium dense to dense green, gray, brown and white silty fine sand and fine sandy silt with zones of rock fragments					
		28						
	ST		(Saprolite)					
90		53						

Continued on Sheet 2

COMPLETION DEPTH 105.8 feet Water Depth Not Determined Date ---

SAMPLER: 2" O.D. SPLIT BARREL SAMPLER

LOG of BORING No. WE-19

Sheet 2 of 2

DATE 12/15-16/80 SURFACE ELEV. 434.9 LOCATION N 472,518 E 1,905,462

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
90			Same as above (Saprolite)	341.3				
	■	ST 83	Very dense green and gray partially friable rock with seams of fine sandy silt					
100	■	PIT 97	(Decomposed Rock)					
	■	PIT 100/4"		329.1				
	■	100/0"						
110			Refusal at 105.8 feet					
			ST = Shelby Tube sample PIT = Pitcher sample					
120			*See Summary of Laboratory Test Results, Appendix B.					

COMPLETION DEPTH 105.8 feet Water Depth Not Determined Date ---

SAMPLER: 2" O.D. SPLIT BARREL SAMPLER

45' LOG JOB NO 71 C 72 WE

WCC RP 1

LOG of BORING No. WE-20

N 472,387

DATE 12/8-10/80 SURFACE ELEV. 435.6 LOCATION E 1,905,559

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0								
	■	15						
10	■	ST 27						
	■	20	Very stiff red-brown micaceous medium to fine sandy clayey silt					
20	■	ST 32	(Compacted Select Fill)					
	■	31						
30	■	ST 20						
	■	26						
40	■	ST 20						
	■	19		389.1				
50	■	ST 28	Very stiff red-brown and tan micaceous medium to fine sandy clayey silt					
	■	26	(Compacted Select Fill)					
60	■	ST 26		374.1				
	■	39	Dense dark gray, green and white micaceous medium to fine sandy silt		34.0	47	31	*
70	■	ST 45	(Saprolite)	363.0				
	■	48	Dense to very dense green, black, white and gold alternating zones of silty medium to fine sand with rock fragments, micaceous silty fine sand, and partially friable rock					
80	■	ST 61 PIT 41						
90	■	PIT 52	(Decomposed Rock)					

Continued on Sheet 2

COMPLETION DEPTH 112.7 feet Water Depth Not Determined Date ---

SAMPLER: 2" O.D. SPLIT BARREL SAMPLER

JOB NO 71 C 72 WE

WCC-RP 1

LOG of BORING No. WE-20

DATE 12/8-10/80 SURFACE ELEV. 435.6 LOCATION N 472,387 E 1,905,559

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
90								
	■	39						
100	■	113	Same as above (Decomposed Rock)					
	■	100/5"						
110	■	140/11"						
	■	100/2"		322.9				
			Refusal at 112.7 feet					
120			* See Summary of Laboratory Test Results, Appendix B					
130			ST = Shelby Tube sample PIT = Pitcher sample					
140								
150								

COMPLETION DEPTH 112.7 feet Water Depth Not Determined Date ---

SAMPLER: 2" O.D. SPLIT BARREL SAMPLER

JOB NO 71 C 72 WE

45' LOG

WCC RP 1

LOG of BORING No. WE-21

Sheet 1 of 2

DATE 1/7-8/81 SURFACE ELEV. 435.1 LOCATION N 472,453 E 1,905,513

Depth, Feet	Samples / Sampling Resistance	Description	Elevation	Water Content, %	Liquid Limit, %	Plastic Limit, %	Other Tests
0							
	23	Stiff to very stiff red-brown micaceous medium to fine sandy clayey silt (Compacted Select Fill)					
10	ST 10						
	11						
20	ST 18						
	21						
30	ST 12						
	22						
40	ST 26						
	16						
50	ST 34		382.6				
	19	Very stiff red-brown, gray-brown and gray micaceous medium to fine sandy clayey silt; boulder encountered at 61 feet (Compacted Select Fill)					
60	ST 108/9"						
	21		368.5				
70	ST	Medium dense to dense green, black and brown micaceous medium to fine sandy silt and silty medium to fine sand with seams of gravel size partially friable rock fragments (Saprolite)		23.5	NP	NP	*
	ST 27						
	ST			20.2			
	ST			29.4	NP	NP	*
80	22			27.2			
	ST 32		348.1				
90	55	Same as Below (Decomposed Rock)					

Continued on Sheet 2

COMPLETION DEPTH 112.7 feet Water Depth Not Determined Date ---

SAMPLER: 2" O.D. SPLIT BARREL SAMPLER

45 LOG JOB NO 71 C 72 WE

LOG of BORING No. WE-21

Sheet 2 of 2

DATE 1/7-8/81 SURFACE ELEV. 435.1 LOCATION N 472,453 E 1,905,513

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
90								
	■	ST 68	Dense to very dense gray, black, brown, gold and green rock, friable to silty coarse to fine sand with gravel size non-friable rock fragments					
100	■	63						
	■	37	(Decomposed Rock)					
110	■	129/10"						
	■	134		322.4				
120			* See Summary of Laboratory Test Results, Appendix B					
			ST = Shelby Tube sample					
130								

COMPLETION DEPTH 112.7 feet Water Depth Not Determined Date ---

SAMPLER: 2" O.D. SPLIT BARREL SAMPLER

APPENDIX

B

WGA - RP-11

JOB No. 71 C 72-WE

SUMMARY OF LABORATORY TEST RESULTS

BORING and SAMPLE No.	DEPTH feet	CLASSIFICATION	SPECIAL TESTS	NATURAL WATER CONTENT (%)	ATTERBERG LIMITS		UNCON COMPRESS.		UNIT DRY WGT (pcf)	SPECIFIC GRAVITY	GRAIN SIZE		OPT. MOIST	CONSOLID.	TRIAXIAL			
					LIQUID LIMIT	PLASTIC LIMIT	STRESS (tsf)	STRAIN (%)			SIEVE	HYDR.			U.U.	$\overline{CIU}$	CELL PRESSURE (psi)	BACK PRESSURE (psi)
WE-14 S-14	63.0-64.5	Select Fill		24.7	NP	NP			98.9	2.67	*	*		*				
WE-16 P-3	84.5-87.0	Saprolite		15.0	NP	NP			116.6	2.82	*	*		*				
WE-18 S-8	28.0-30.0	Select Fill		31.5	NP	NP			88.6	2.72	*	*				*		
		Select Fill		30.9	NP	NP			90.2	2.70	*	*				*		
		Select Fill		30.0	NP	NP			93.0	2.67	*	*				*		
S-11	38.0-40.0	Select Fill		24.9	NP	NP			101.1	2.76	*	*		*				
S-20	68.0-70.0	Select Fill		33.0	NP	NP			87.2	2.67	*	*				*		
		Select Fill		30.6	NP	NP			91.3	2.71	*	*				*		
		Select Fill		22.7	NP	NP			102.3	2.69	*	*				*		
S-23	78.5-80.5	Select Fill		23.3	NP	NP			99.0	2.68	*	*		*				
S-27	88.0-90.0	Saprolite		42.6	NP	NP			80.4	2.84	*	*				*		
		Saprolite		39.1	NP	NP			83.7	2.88	*	*				*		
S-29	93.0-95.0	Saprolite		42.6	NP	NP			80.0	2.78	*	*		*				

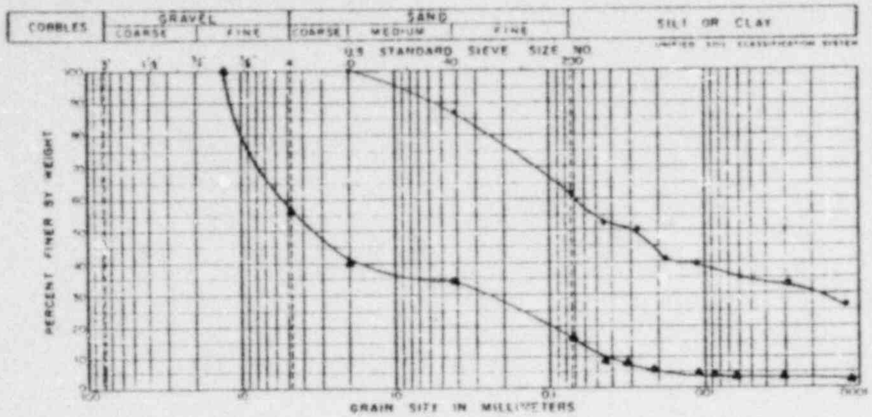
* See Test Curves

SUMMARY OF LABORATORY TEST RESULTS

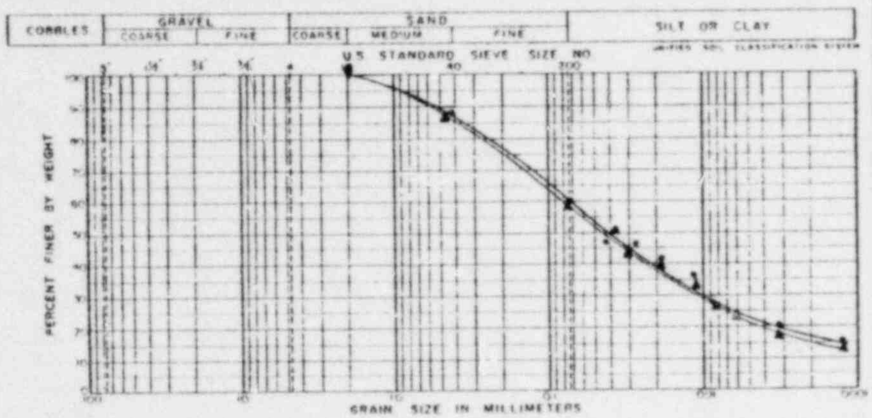
BORING and SAMPLE No	DEPTH - feet	CLASSIFICATION	SPECIAL TESTS	NATURAL WATER CONTENT (%)	ATTERBERG LIMITS		UNCON. COMPRESS		UNIT DRY WGT (pcf)	SPECIFIC GRAVITY	GRAIN SIZE		OPT. MOIST.	CONSOLID.	TRIAXIAL			
					LIQUID LIMIT	PLASTIC LIMIT	STRESS (tsf)	STRAIN (%)			SIEVE	HYDR.			UU	$\overline{CIU}$	CELL PRESSURE (psi)	BACK PRESSURE (psi)
WE-18 S-33	103.0-105.0	Saprolite		23.6	NP	NP			104.4	2.88	*	*		*				
		Saprolite		25.0	NP	NP			103.9	2.90	*	*		*				
		Saprolite		29.5	NP	NP			95.8	2.85	*	*		*				
S-37	113.0-113.5	Decomposed Rock		25.2	NP	NP			103.9	2.93				*				
WE-19 ST-6	58.0-60.0	Select Fill		28.8	NP	NP			89.8	2.69	*	*		*				
		Select Fill		24.8	NP	NP			97.1	2.71	*	*		*				
		Select Fill		22.8	NP	NP			100.8	2.64	*	*		*				
WE-20 S-20	68.0-69.5	Saprolite		34.0	47	31			88.7	2.77	*	*		*				
WE-21 ST-6	68.0-70.0	Saprolite		23.5	NP	NP			97.6	2.67	*	*				*		
ST-8	74.0-76.0	[illegible]lite		20.2	NP	NP			99.4	2.70	*	*				*		
		Saprolite		29.4	NP	NP			96.2	2.85	*	*				*		
		Saprolite		27.2	NP	NP			93.7	2.72	*	*				*		

* See Test Curves

MECHANICAL ANALYSIS

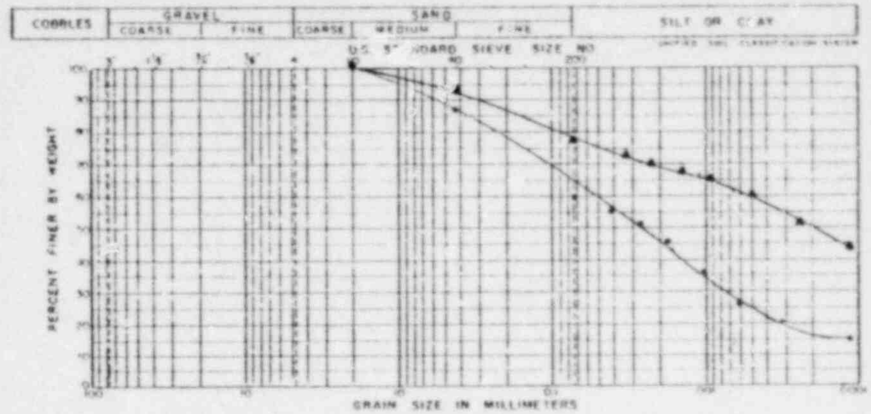


BORING	SAMPLE	DEPTH	SYMBOL	CLASSIFICATION	MC	LL	PL
WE-14	S-14	68.7	•	Red-brown micaceous medium to fine sandy silt (Select fill)	24.7	NP	NP
WE-16	P-3	85.5	▲	Grey-brown micaceous silty coarse to fine sand and gravel (Saprolite)	15.0	NP	NP

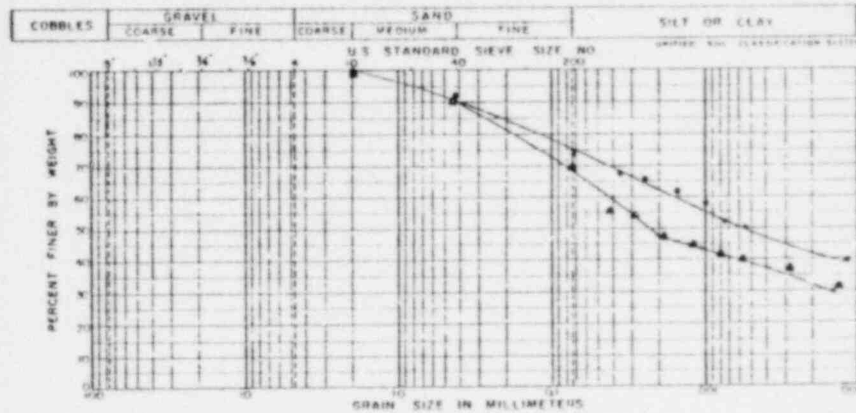


BORING	SAMPLE	DEPTH	SYMBOL	CLASSIFICATION	MC	LL	PL
WE-18	S-8	28.0-28.5	•	Brown micaceous medium to fine sandy clayey silt (Select fill)	31.5	NP	NP
WE-18	S-8	28.5-29.0	▲	Brown micaceous medium to fine sandy clayey silt (Select fill)	30.9	NP	NP

MECHANICAL ANALYSIS



BORING	SAMPLE	DEPTH	SYMBOL	CLASSIFICATION	MC	LL	PL
WE-18	S-8	29.0-29.5	•	Brown micaceous medium to fine sandy clayey silt (Select fill)	30.0	NP	NP
WE-18	S-11	38.4	▲	Red-brown medium to fine micaceous sandy clayey silt (Select fill)	24.9	NP	NP

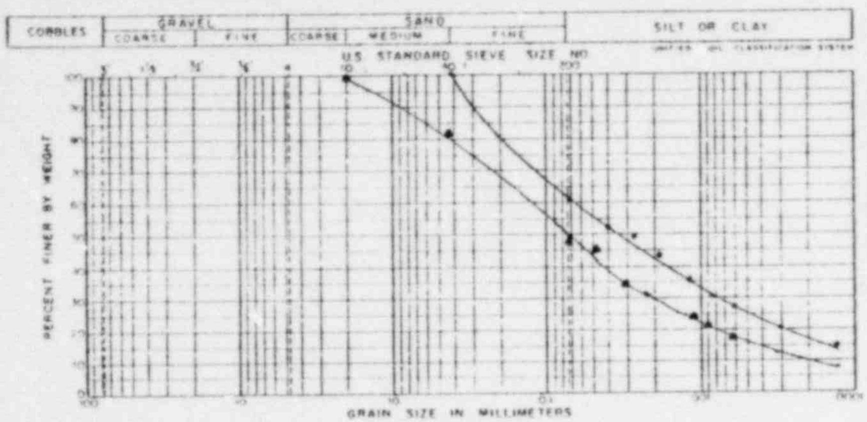


BORING	SAMPLE	DEPTH	SYMBOL	CLASSIFICATION	MC	LL	PL
WE-18	S-20	68.0-68.5	•	Brown micaceous medium to fine sandy clayey silt (Select fill)	33.0	NP	NP
WE-18	S-20	68.5-69.0	▲	Red-brown micaceous medium to fine sandy clayey silt (Select fill)	30.6	NP	NP

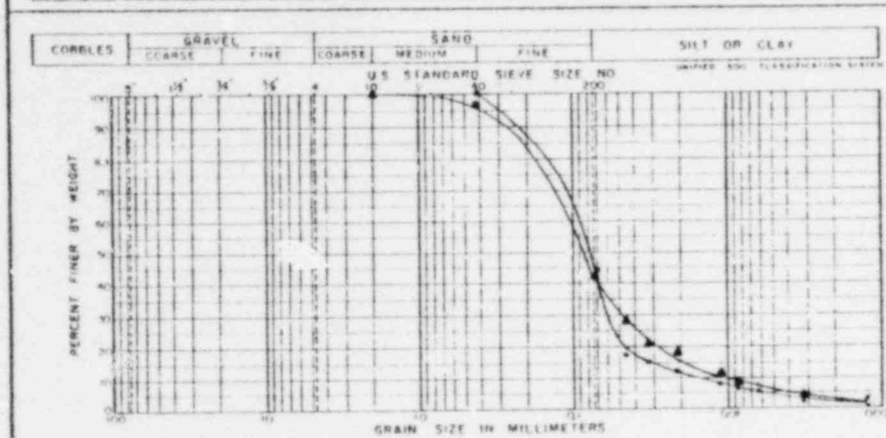
JOB NO 71 C 72-WE

POOR ORIGINAL

MECHANICAL ANALYSIS



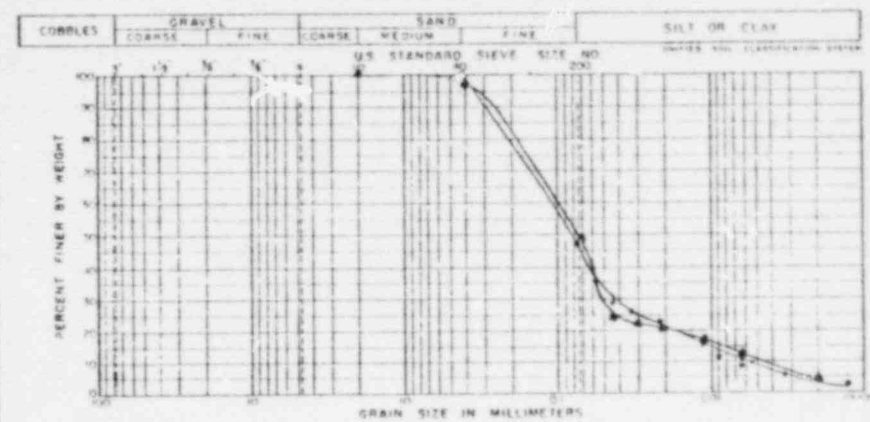
BORING	SAMPLE	DEPTH	SYMBOL	CLASSIFICATION	MC	LL	PL
WE-18	S-20	69.0-69.5	•	Brown micaceous fine sandy clayey silt (select fill)	22.7	NP	NP
WE-18	S-23	78.8	▲	Brown micaceous silty medium to fine sand (select fill)	23.3	NP	NP



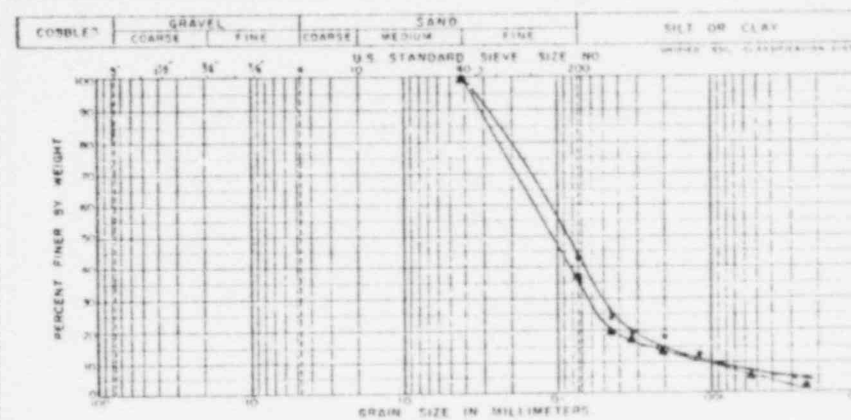
BORING	SAMPLE	DEPTH	SYMBOL	CLASSIFICATION	MC	LL	PL
WE-18	S-27	88.0-88.5	▲	Gray micaceous silty fine sand (Saprolite)	42.6	NP	NP
WE-18	S-27	88.5-89	•	Gray micaceous silty fine sand (Saprolite)	39.1	NP	NP

POOR ORIGINAL

MECHANICAL ANALYSIS

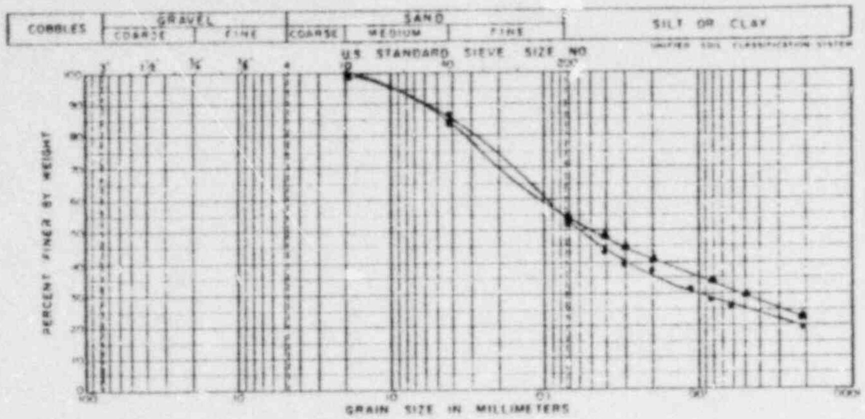


BORING	SAMPLE	DEPTH	SYMBOL	CLASSIFICATION	MC	LL	PL
WE-18	S-29	93.3	•	Greenish brown micaceous silty fine sand (Saprolite)	42.6	NP	NP
WE-18	S-33	103.5	▲	Gray micaceous silty fine sand (Saprolite)	23.6	NP	NP

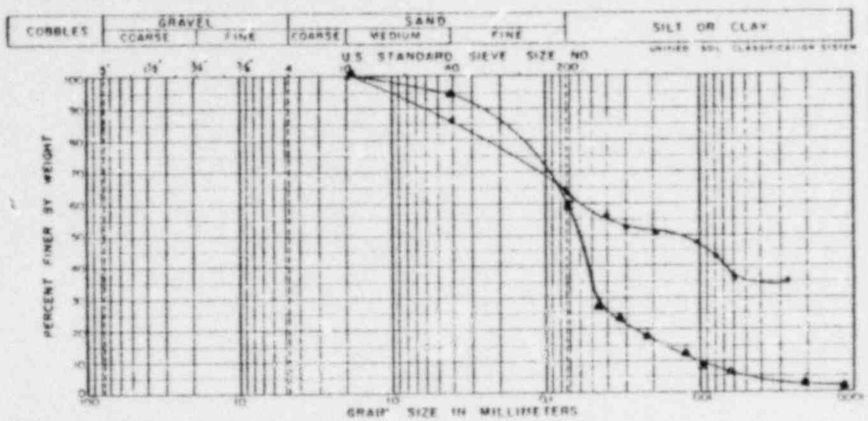


BORING	SAMPLE	DEPTH	SYMBOL	CLASSIFICATION	MC	LL	PL
WS-18	S-33	103.8	•	Gray and brown micaceous silty fine sand (Saprolite)	25.0	NP	NP
WE-18	S-33	104.0	▲	Gray and brown micaceous silty fine sand (Saprolite)	29.5	NP	NP

MECHANICAL ANALYSIS



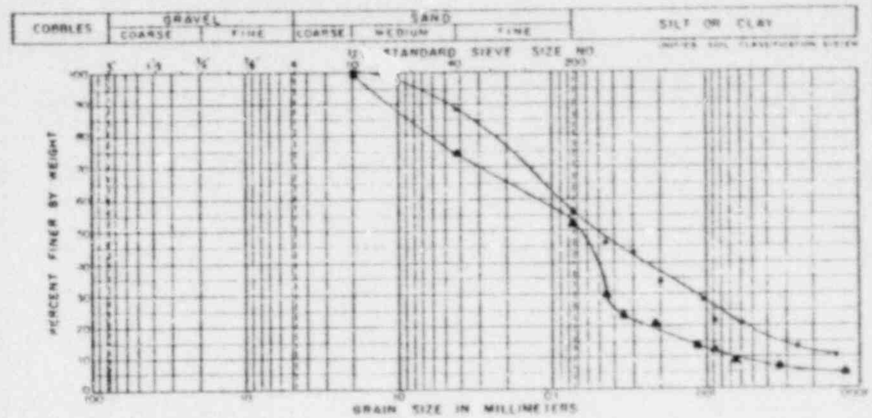
BORING	SAMPLE	DEPTH	SYMBOL	CLASSIFICATION	MC	LL	PL
WE-19	ST-6	58.3	•	Red-brown micaceous medium to fine sandy clayey silt (select fill)	28.8	NP	NP
WE-19	ST-6	58.5	▲	Red-brown micaceous medium to fine sandy clayey silt (select fill)	24.8	NP	NP



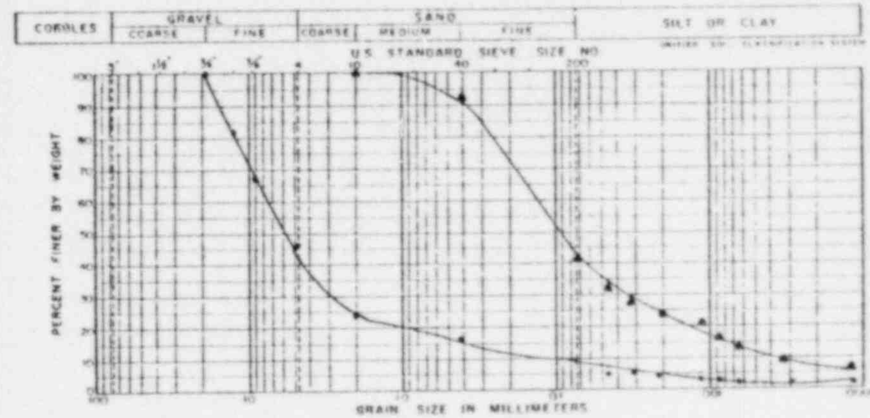
BORING	SAMPLE	DEPTH	SYMBOL	CLASSIFICATION	MC	LL	PL
WE-19	ST-6	58.8	•	Red-brown micaceous medium to fine sandy clayey silt (select fill)	22.8	NP	NP
WE-20	S-20	68.3	▲	Grayish brown micaceous fine sandy clayey silt, trace medium sand (Saprolite)	34.0	47	31

POOR ORIGINAL

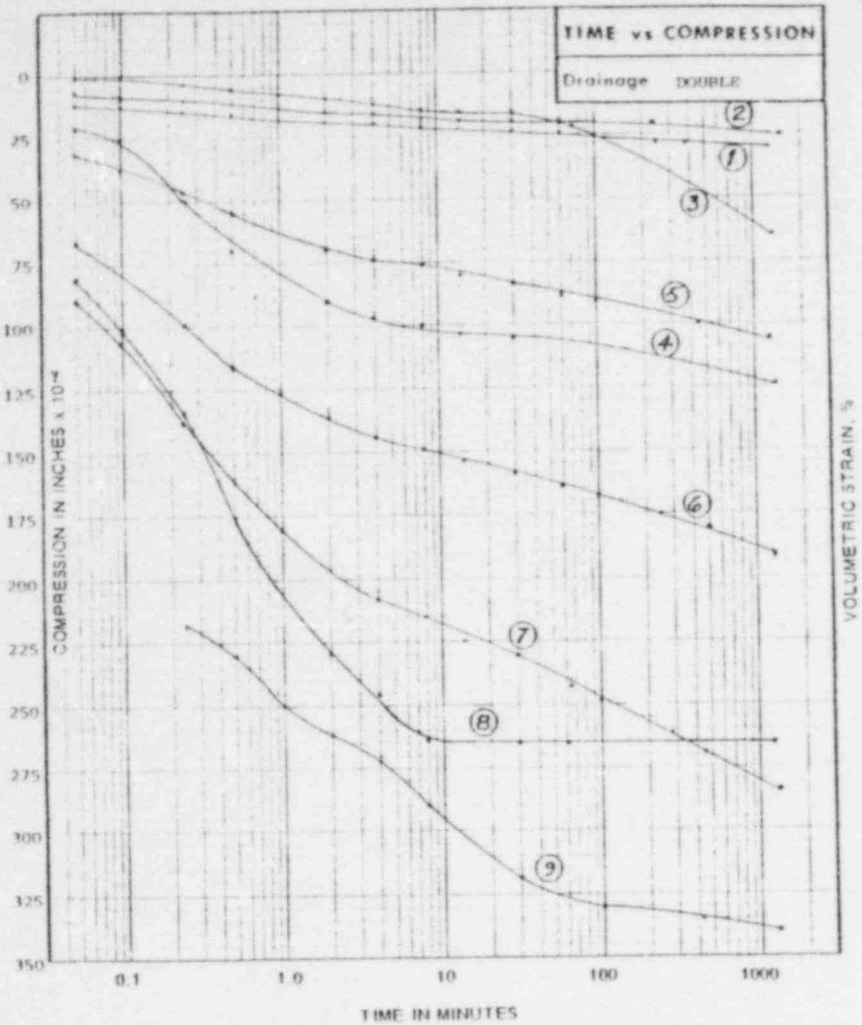
MECHANICAL ANALYSIS

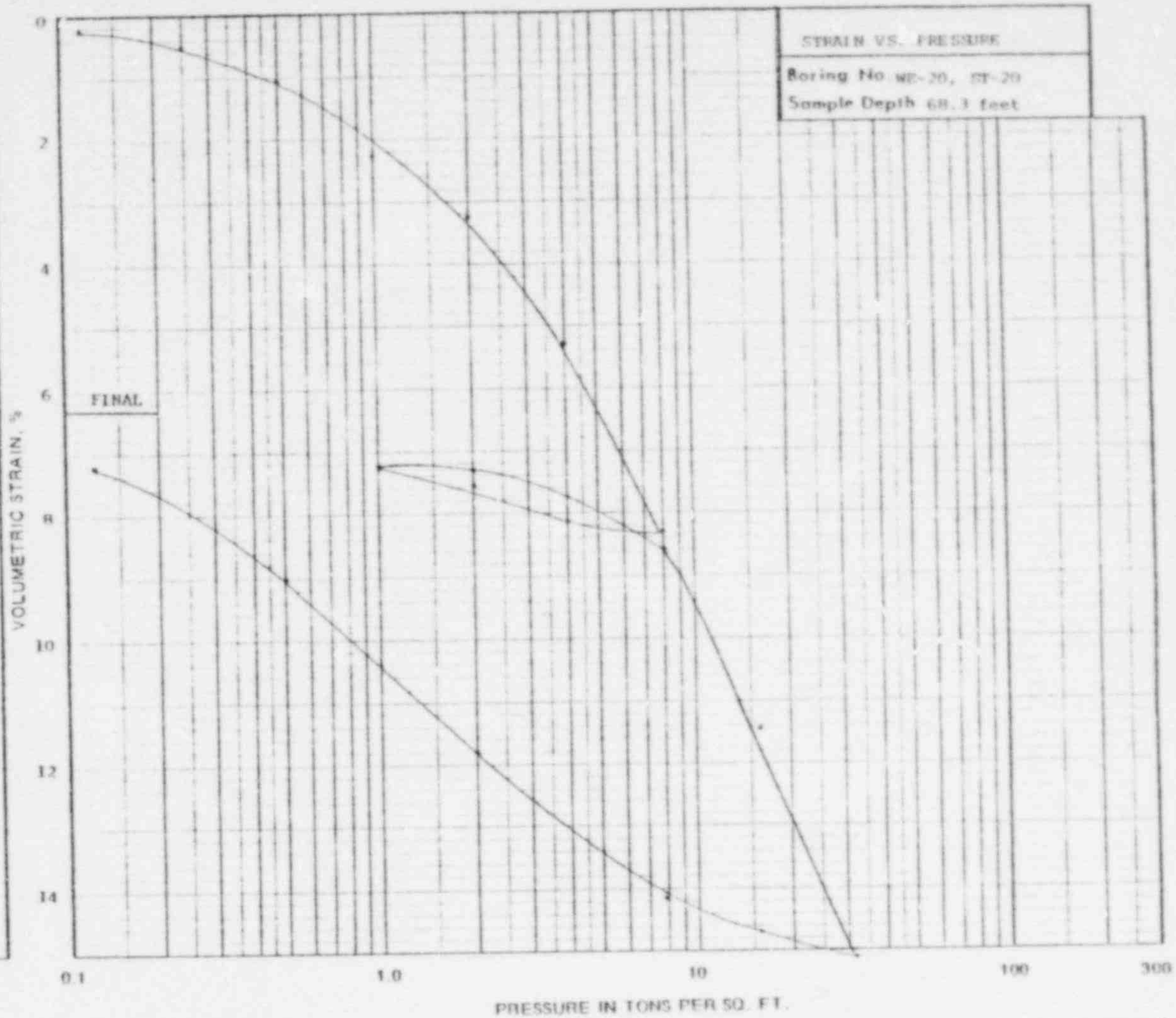


BORING	SAMPLE	DEPTH	SYMBOL	CLASSIFICATION	MC	LL	PL
WE-21	ST-6	68.2-68.7	•	Light brown micaceous medium to fine sandy clayey silt (Saprolite)	23.5	NP	NP
WE-21	ST-8	74.0-74.6	▲	Brown micaceous medium to fine sandy clayey silt (Saprolite)	20.2	NP	NP



BORING	SAMPLE	DEPTH	SYMBOL	CLASSIFICATION	MC	LL	PL
WE-21	ST-8	74.6-75.1	•	Brown coarse to fine sandy fine gravel, trace silt (Saprolite)	29.4	NP	NP
WE-21	ST-8	75.1-75.6	▲	Brown micaceous silty fine sand, trace medium sand (Saprolite)	27.2	NP	NP





PRESSURE INCREMENTS OF TIME COMPRESSION CURVES

CURVE No.	PRESSURE INCREMENT FROM(tsf)	TO(tsf)	COEFFICIENT of CONS. (FT²/DAY)
1	0	1/8	
2	1/8	1/4	
3	1/4	1/2	
4	1/2	1	
5	1	2	
6	2	4	
7	4	8	
8	8	16	
9	16	32	

DESCRIPTION OF SPECIMEN: Gray-green micaceous sandy clayey silt (Saprolite)

CONSOLIDATION PROPERTIES	
COMPRESSION INDEX *	0.118
RECOMPRESSION INDEX *	0.013
SWELLING INDEX	---
PRECONSOLIDATION STRESS, tsf	2.7±
EXISTING OVERBURDEN STRESS, tsf	2.4±

* FROM VOLUMETRIC STRAIN

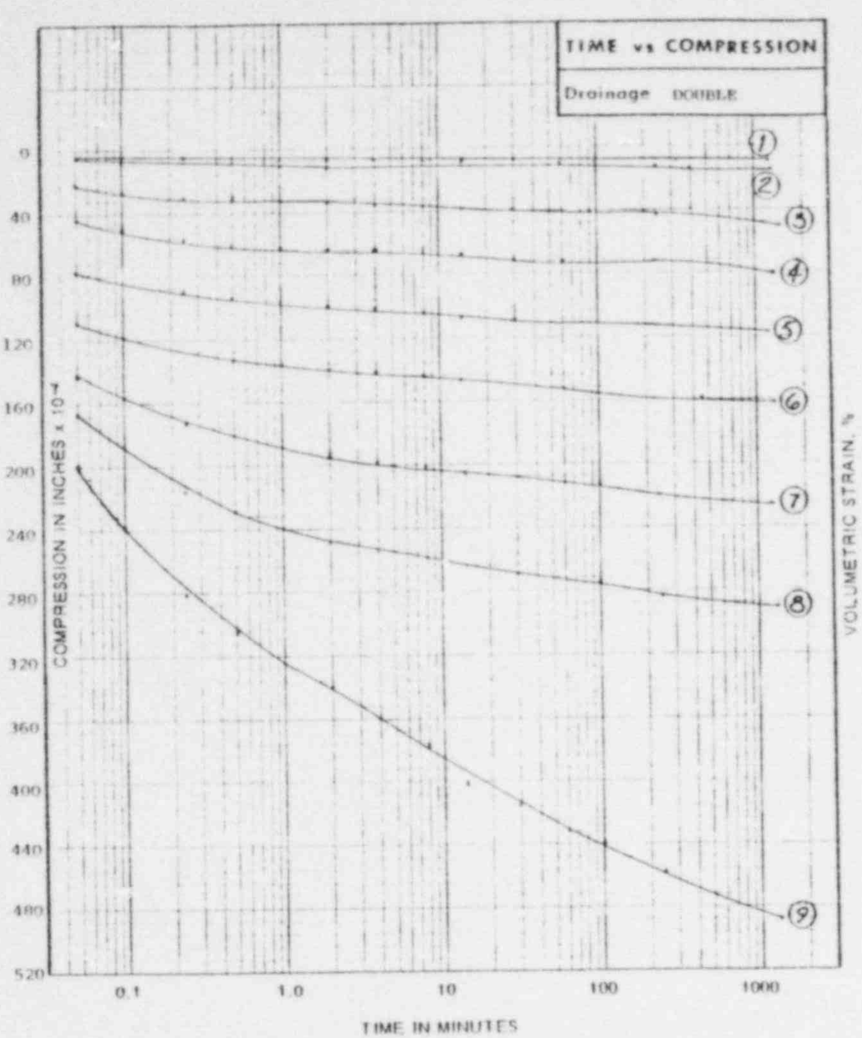
TEST SPECIMEN PROPERTIES	INITIAL	FINAL
WATER CONTENT, %	34.0	31.2
VOID RATIO	0.949	0.825
SATURATION, %	95.3	100.0
SAMPLE HEIGHT, In.	0.881	0.825
SAMPLE DIAMETER, In.	2.495	
UNIT DRY WEIGHT, pcf	88.7	
LIQUID LIMIT, %	47	
PLASTIC LIMIT, %	31	
SPECIFIC GRAVITY	2.77	

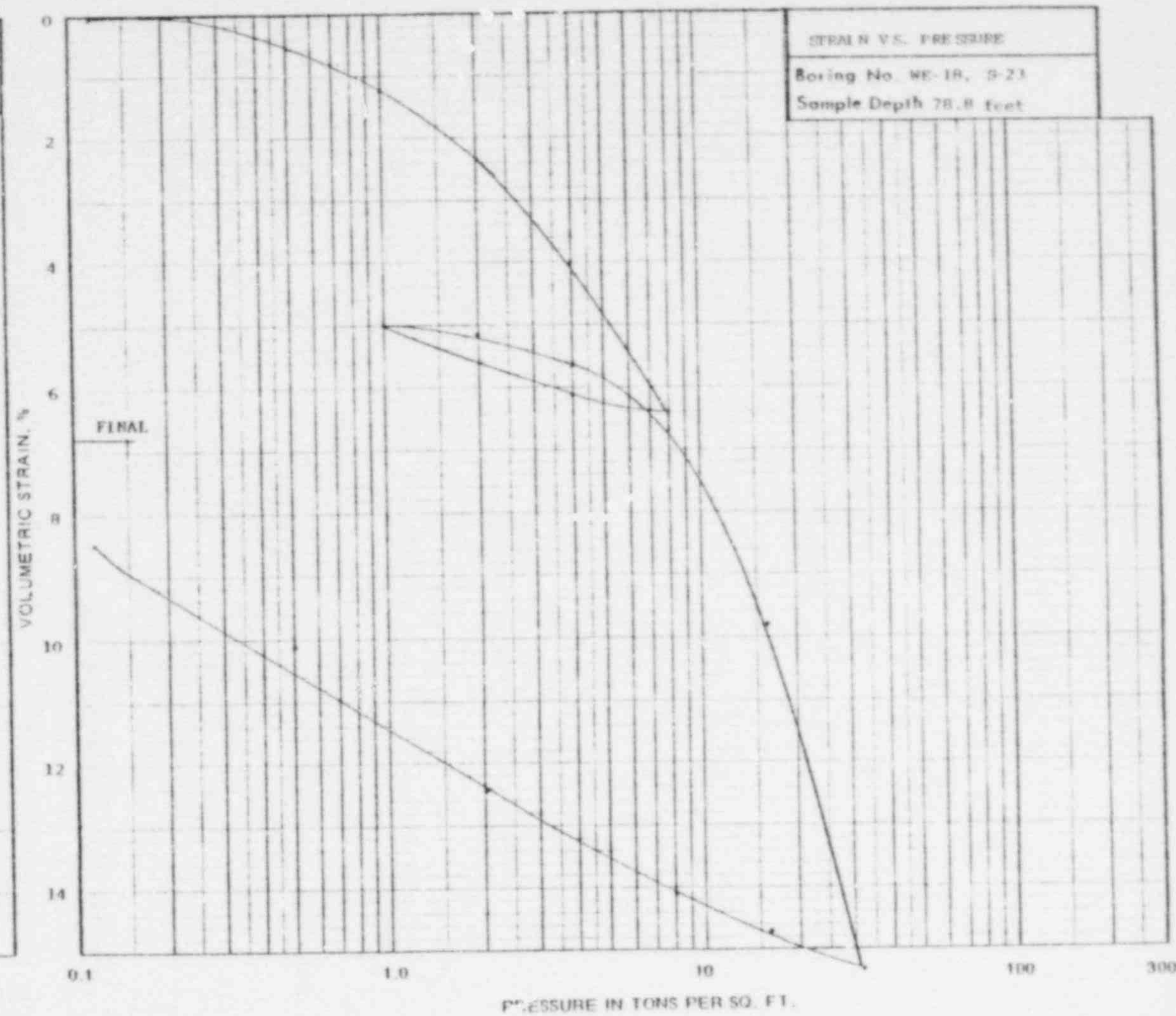
CONSOLIDATION TEST

WOODWARD CLYDE CONSULTANTS

TESTED BY EH	DATE 2/9/81
CHKD BY EH	JOB No 71 C 72 WE

POOR ORIGINAL





PRESSURE INCREMENTS OF TIME COMPRESSION CURVES

CURVE No.	PRESSURE INCREMENT FROM(tsf)	PRESSURE INCREMENT TO(tsf)	COEFFICIENT of CONS. (ft²/DAY)
1	0	1/8	
2	1/8	1/4	
3	1/4	1/2	
4	1/2	1	
5	1	2	
6	2	4	
7	4	8	
8	8	16	
9	16	32	

DESCRIPTION OF SPECIMEN: Brown and red-brown micaceous silty medium to fine sand (select fill)

CONSOLIDATION PROPERTIES	
COMPRESSION INDEX *	0.196
RECOMPRESSION INDEX *	0.016
SWELLING INDEX	---
PRECONSOLIDATION STRESS, tsf	7.2±
EXISTING OVERBURDEN STRESS, tsf	2.7±

* FROM VOLUMETRIC STRAIN

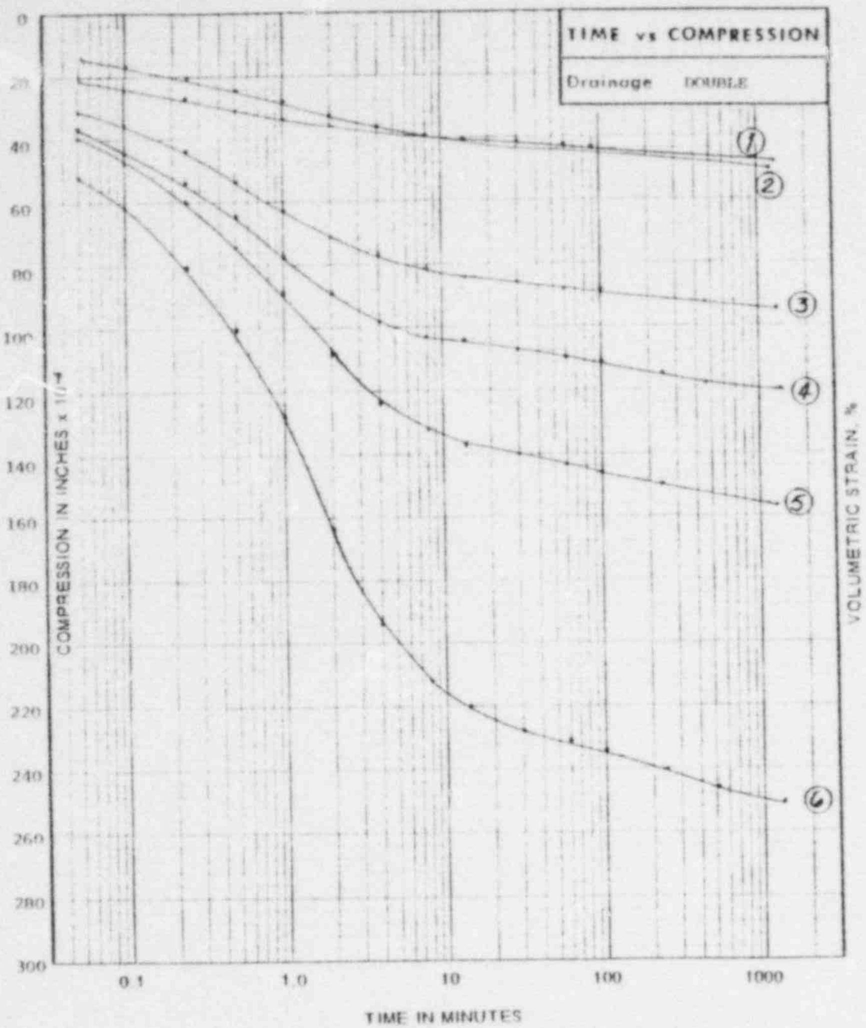
TEST SPECIMEN PROPERTIES	INITIAL	FINAL
WATER CONTENT, %	23.3	23.6
VOID RATIO	0.687	0.599
SATURATION, %	90.8	100.0
SAMPLE HEIGHT, in.	0.879	0.833
SAMPLE DIAMETER, in.	2.495	---
UNIT DRY WEIGHT, pcf	99.0	
LIQUID LIMIT, %	NP	
PLASTIC LIMIT, %	NP	
SPECIFIC GRAVITY	2.68	

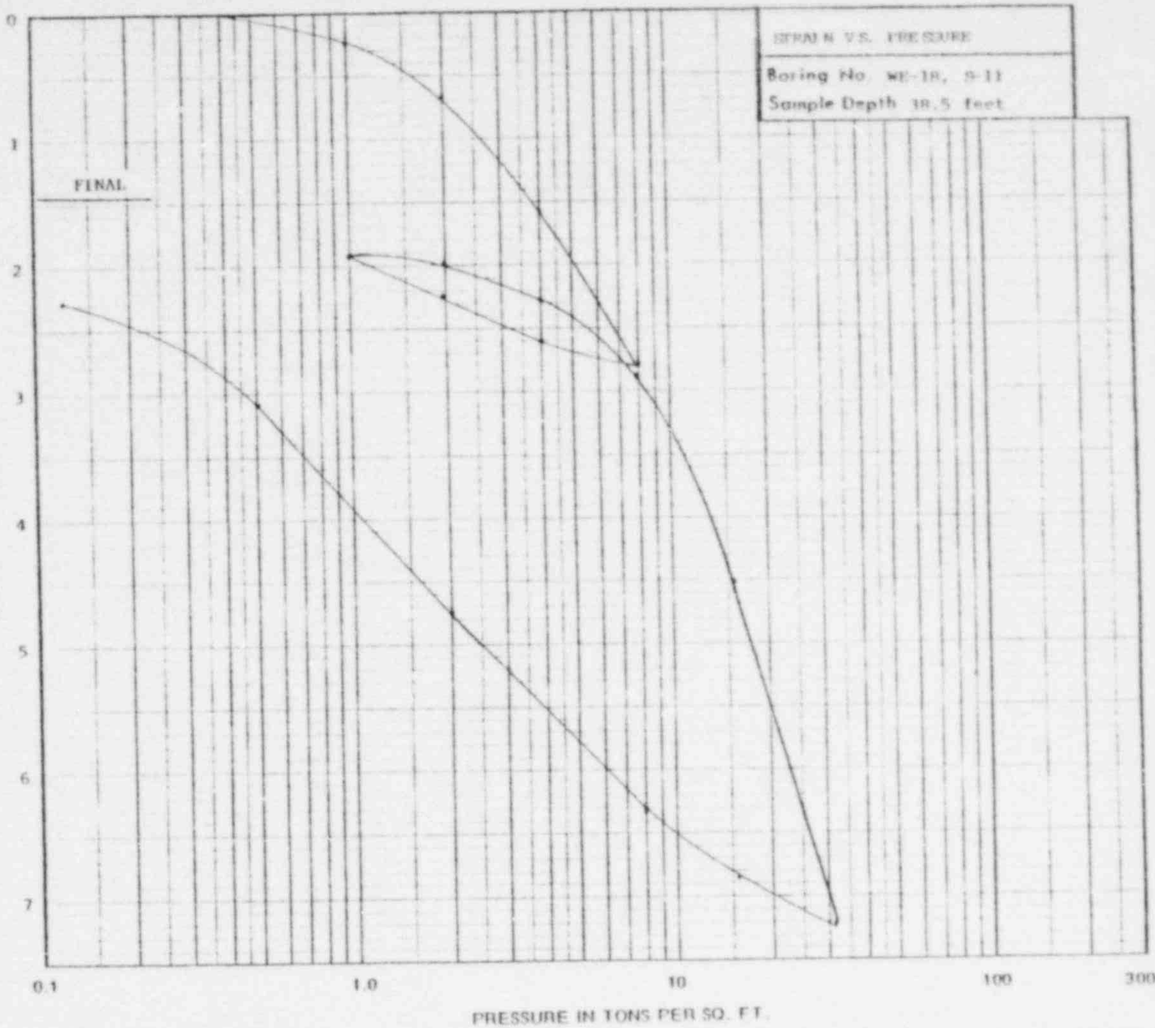
CONSOLIDATION TEST

WOODWARD-CLYDE CONSULTANTS

TESTED BY EM	DATE 1/14/81
CHKD BY RH	JOB No 71 C 72 WE

POOR ORIGINAL





PRESSURE INCREMENTS OF TIME COMPRESSION CURVES

CURVE No.	PRESSURE INCREMENT FROM(tsf)	TO(tsf)	COEFFICIENT of CONS. (FT^2/DAY)
1	1/2	1	
2	1	2	
3	2	4	
4	4	8	
5	8	16	
6	16	32	

DESCRIPTION OF SPECIMEN: Red-brown micaceous sandy clayey silt (select fill)

CONSOLIDATION PROPERTIES	
COMPRESSION INDEX *	0.090
RECOMPRESSION INDEX *	0.010
SWELLING INDEX	---
PRECONSOLIDATION STRESS, tsf	6.2±
EXISTING OVERBURDEN STRESS, tsf	1.5±

* FROM VOLUMETRIC STRAIN

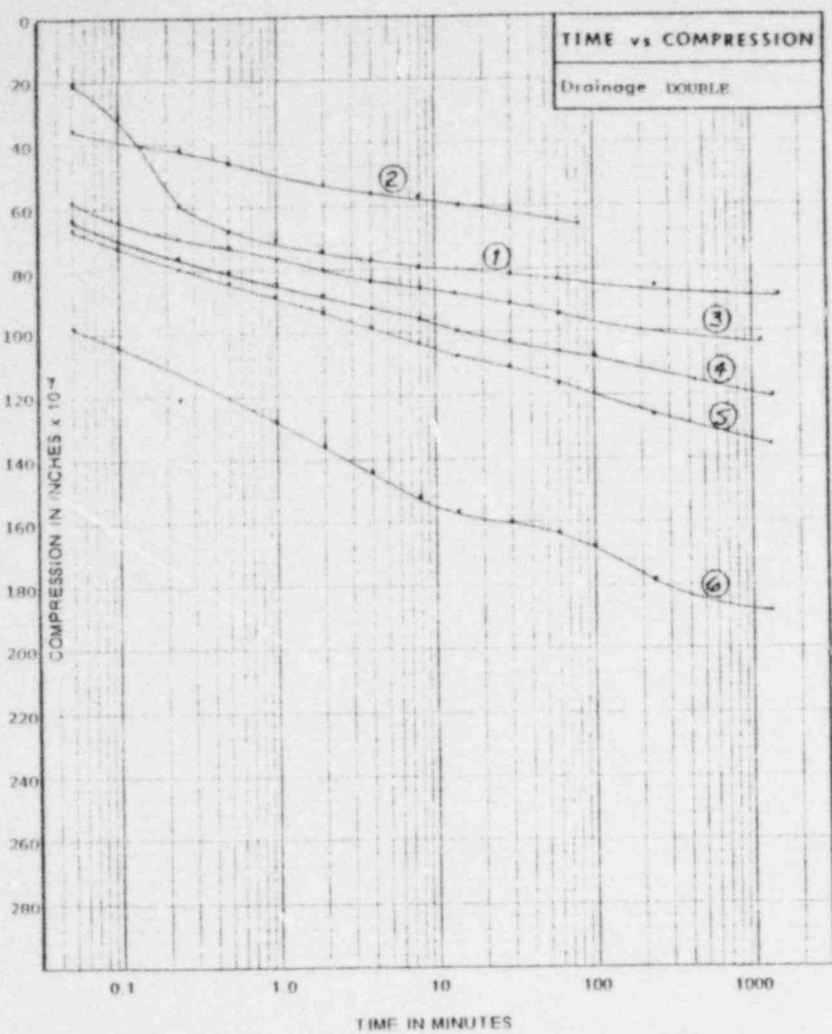
TEST SPECIMEN PROPERTIES	INITIAL	FINAL
WATER CONTENT, %	24.9	25.4
VOID RATIO	0.713	0.708
SATURATION, %	96.4	99.0
SAMPLE HEIGHT, in.	0.874	0.871
SAMPLE DIAMETER, in.	2.495	---
UNIT DRY WEIGHT, pcf	101.1	
LIQUID LIMIT, %	NP	
PLASTIC LIMIT, %	NP	
SPECIFIC GRAVITY	2.76	

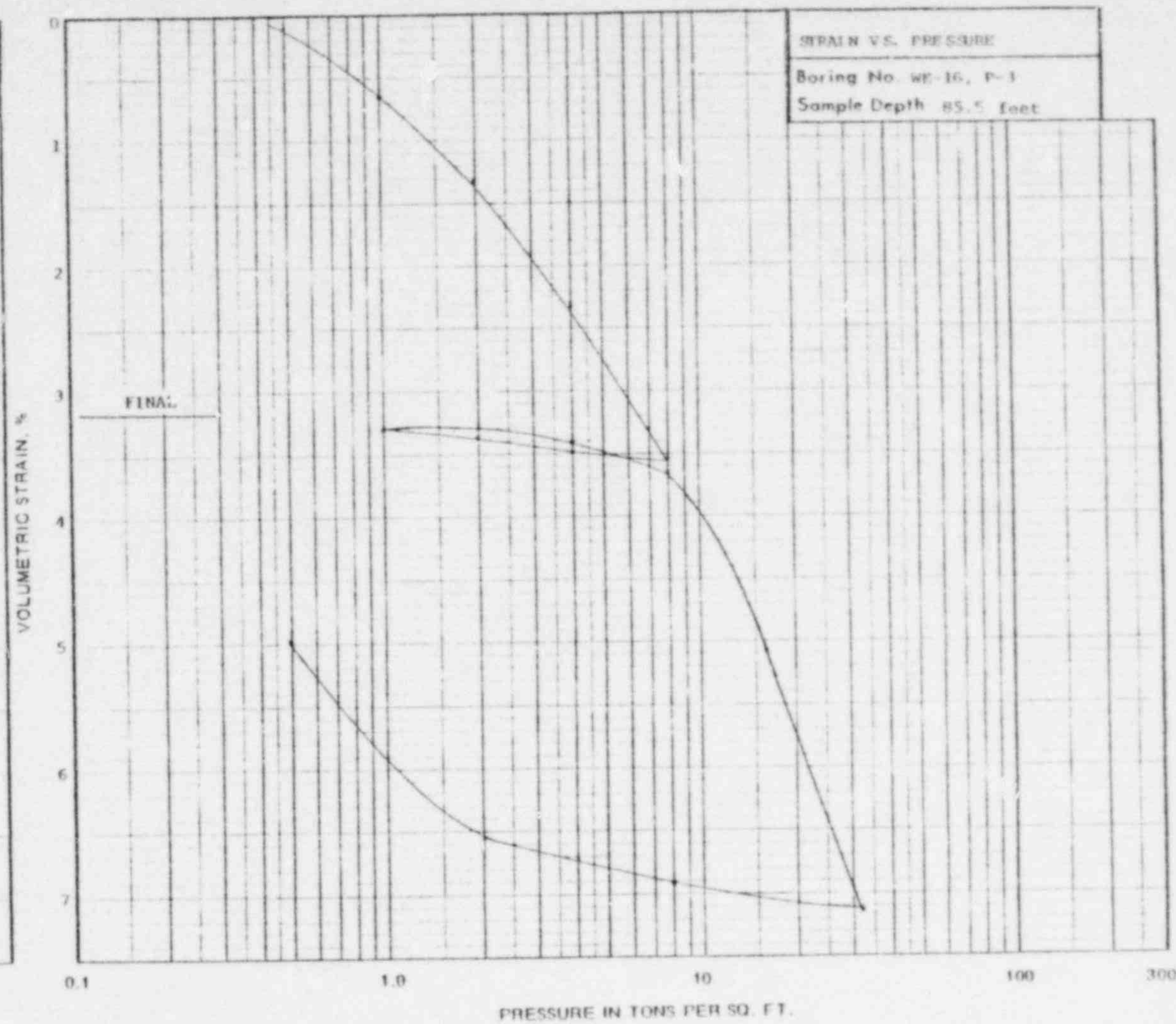
CONSOLIDATION TEST

WOODWARD CLYDE CONSULTANTS

TESTED BY EH	DATE 2/1/81
CHKD BY EH	JOB No. 71 C 72 WE

POOR ORIGINAL





CURVE No.	PRESSURE INCREMENT FROM(tsf)	TO(tsf)	COEFFICIENT of CONS. (FT²/DAY)
1	1/2	1	
2	1	2	
3	2	4	
4	4	8	
5	8	16	
6	16	32	

PRESSURE INCREMENTS OF TIME COMPRESSION CURVES

DESCRIPTION OF SPECIMEN: Grayish-green micaceous clayey silt (Saprolite)

CONSOLIDATION PROPERTIES	
COMPRESSION INDEX *	0.069
RECOMPRESSION INDEX *	0.003
SWELLING INDEX	---
PRECONSOLIDATION STRESS, tsf	5.0±
EXISTING OVERBURDEN STRESS, tsf	2.9±

* FROM VOLUMETRIC STRAIN

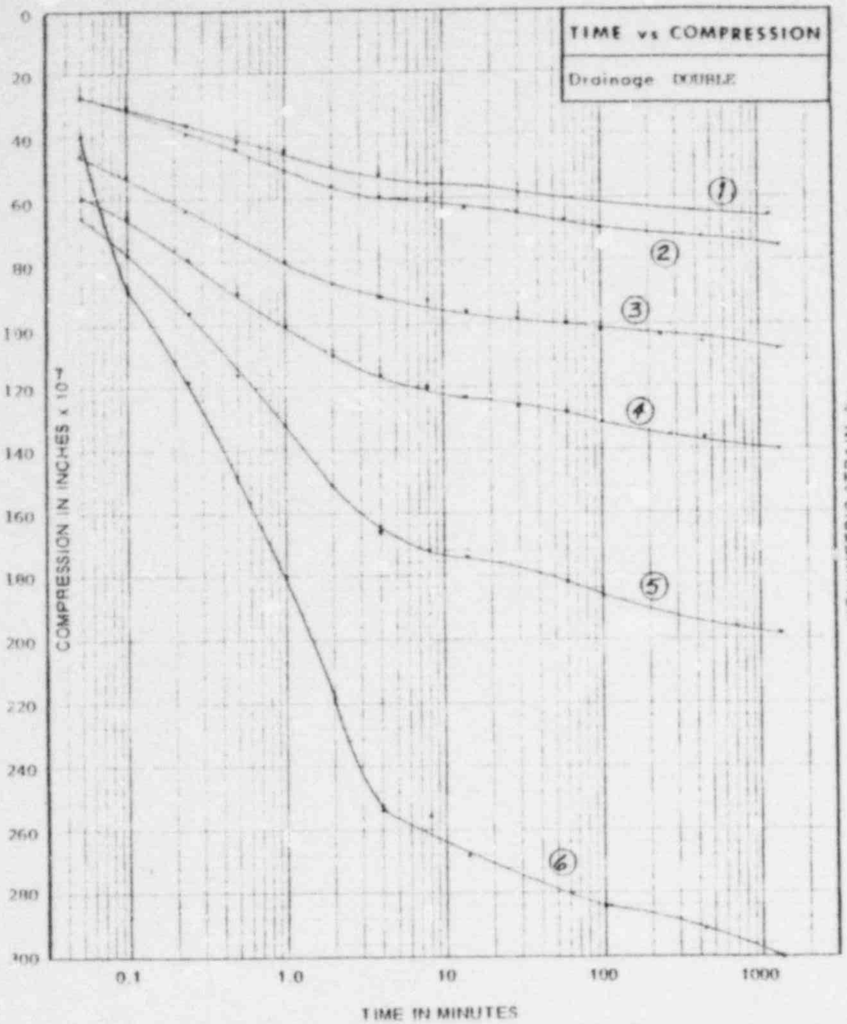
TEST SPECIMEN PROPERTIES	INITIAL	FINAL
WATER CONTENT, %	15.0	15.8
VOID RATIO	0.509	0.455
SATURATION, %	83.1	98.3
SAMPLE HEIGHT, in.	0.880	0.848
SAMPLE DIAMETER, in.	2.495	---
UNIT DRY WEIGHT, pcf	116.6	
LIQUID LIMIT, %	NP	
PLASTIC LIMIT, %	NP	
SPECIFIC GRAVITY	2.82	

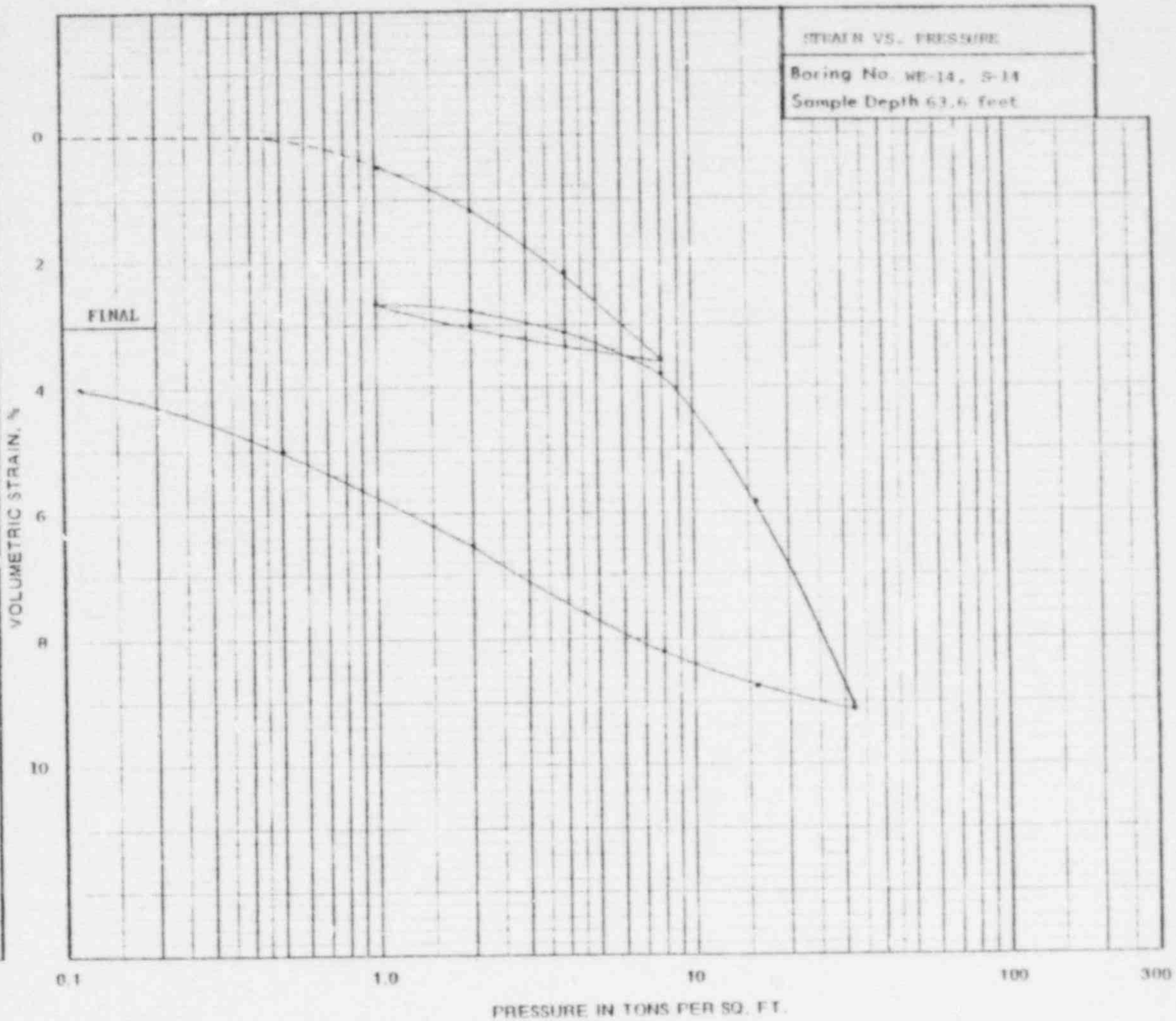
CONSOLIDATION TEST

WOODWARD-CLYDE CONSULTANTS

TESTED BY EH	DATE 2/5/81
CHKD BY EH	JOB No. 71 C 72 WE

POOR ORIGINAL





PRESSURE INCREMENTS OF TIME COMPRESSION CURVES

CURVE No.	PRESSURE INCREMENT FROM(tsf)	PRESSURE INCREMENT TO(tsf)	COEFFICIENT of CONS. (ft^2/DAY)
1	1/2	1	
2	1	2	
3	2	4	
4	4	8	
5	8	16	
6	16	32	

DESCRIPTION OF SPECIMEN: Red-brown micaceous medium to fine sandy clayey silt (Select Fill)

CONSOLIDATION PROPERTIES	
COMPRESSION INDEX *	0.106
RECOMPRESSION INDEX *	0.010
SWELLING INDEX	---
PRECONSOLIDATION STRESS, tsf	6.0±
EXISTING OVERBURDEN STRESS, tsf	2.2±

* FROM VOLUMETRIC STRAIN

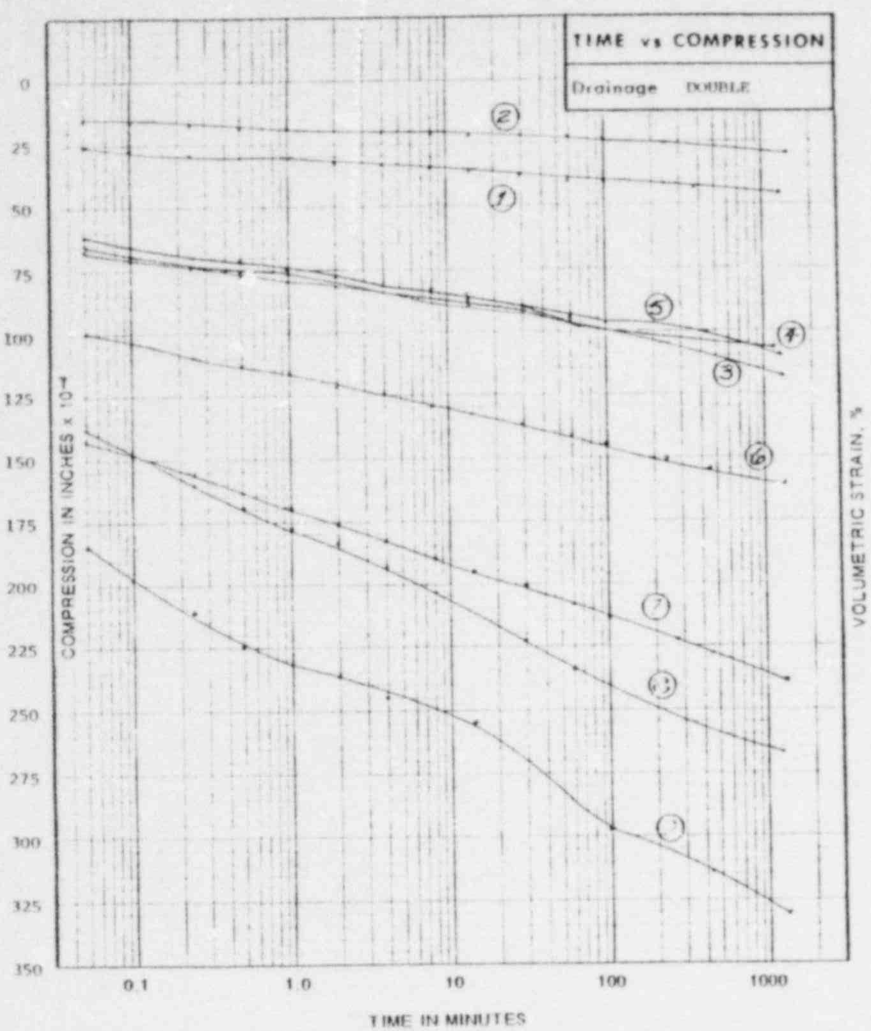
TEST SPECIMEN PROPERTIES	INITIAL	FINAL
WATER CONTENT, %	24.7	25.6
VOID RATIO	0.686	0.635
SATURATION, %	90.8	100.0
SAMPLE HEIGHT, in.	0.882	0.861
SAMPLE DIAMETER, in.	2.495	---
UNIT DRY WEIGHT, pcf	98.9	
LIQUID LIMIT, %	NP	
PLASTIC LIMIT, %	NP	
SPECIFIC GRAVITY	2.67	

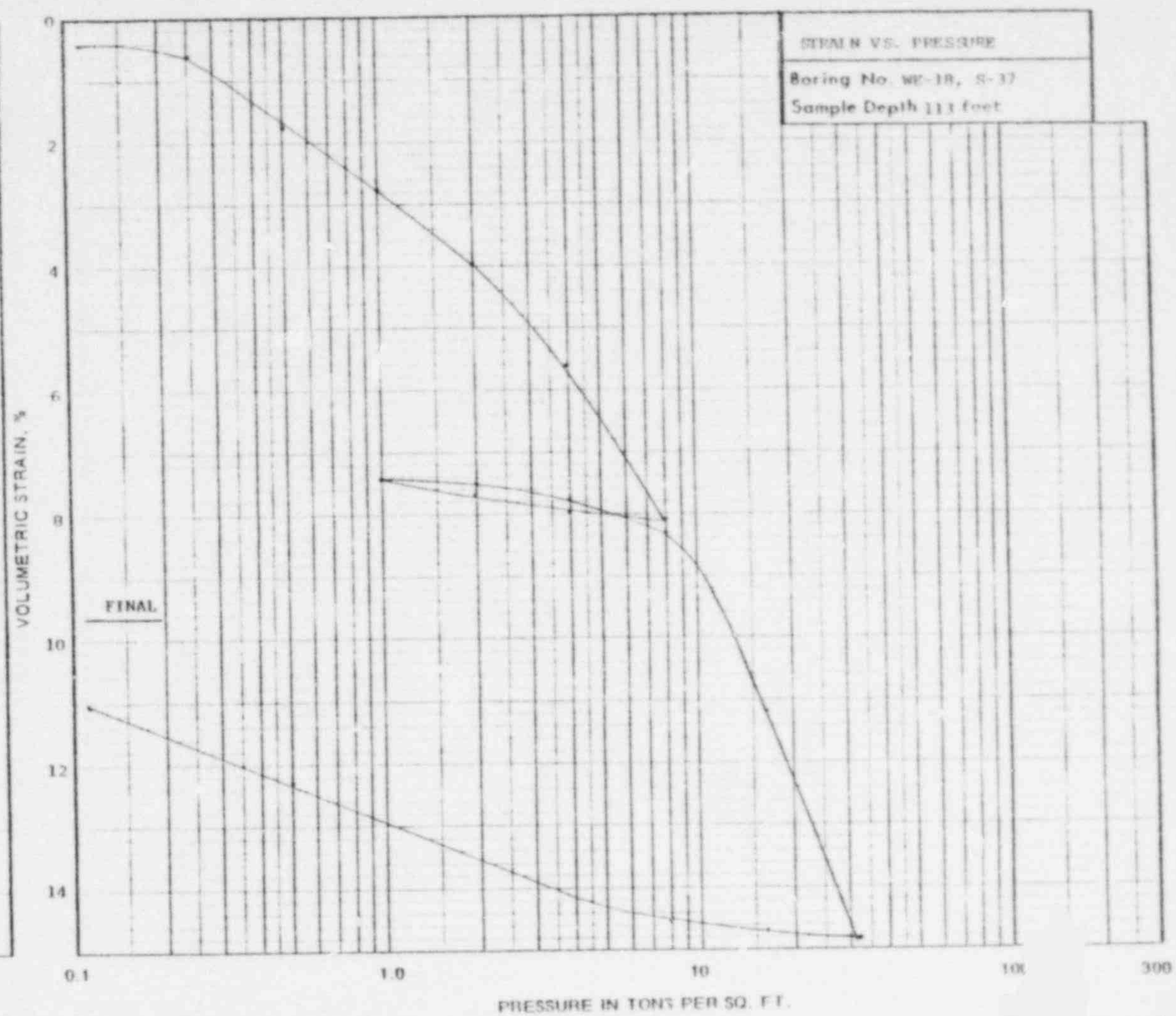
CONSOLIDATION TEST

WOODWARD-CLYDE CONSULTANTS

TESTED BY JM	DATE 1/14/83
CHKD BY RM	JOB No. 71C72 WE

POOR ORIGINAL





PRESSURE INCREMENTS OF TIME COMPRESSION CURVES

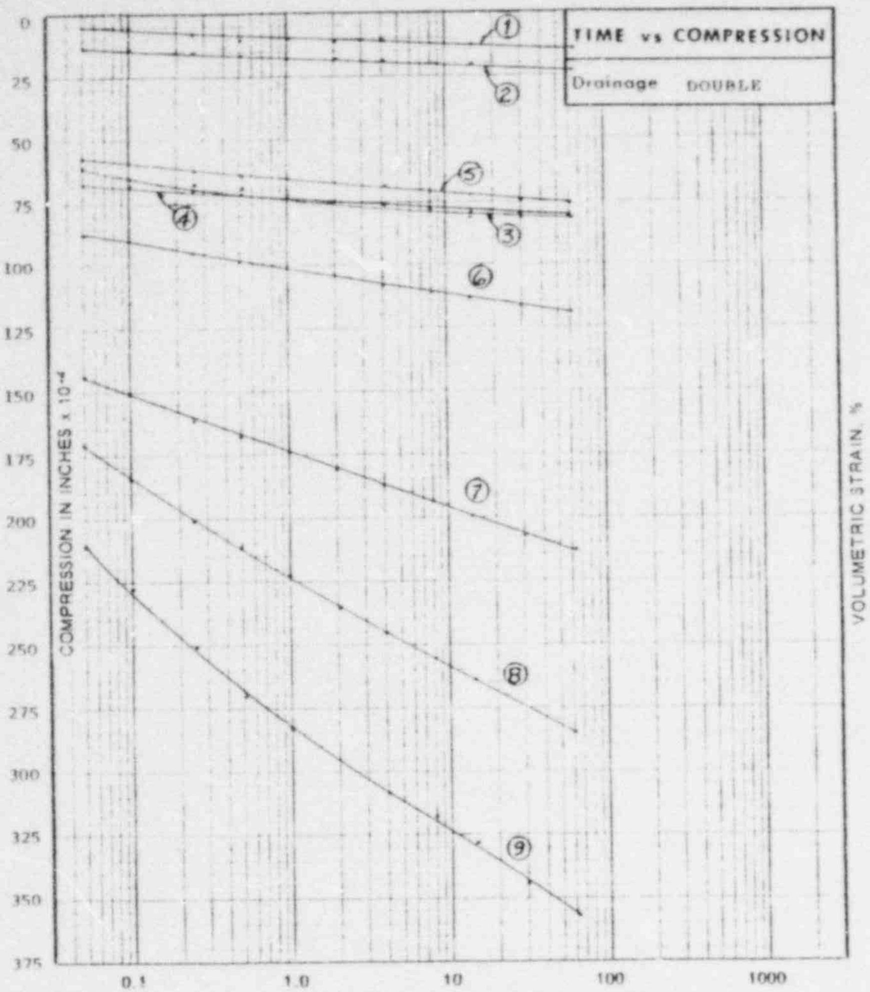
CURVE No.	PRESSURE INCREMENT FROM(tsf)	PRESSURE INCREMENT TO(tsf)	COEFFICIENT of CONS. (FT²/DAY)
1	0	1/8	
2	1/8	1/4	
3	1/4	1/2	
4	1/2	1	
5	1	2	
6	2	4	
7	4	8	
8	8	16	
9	16	32	

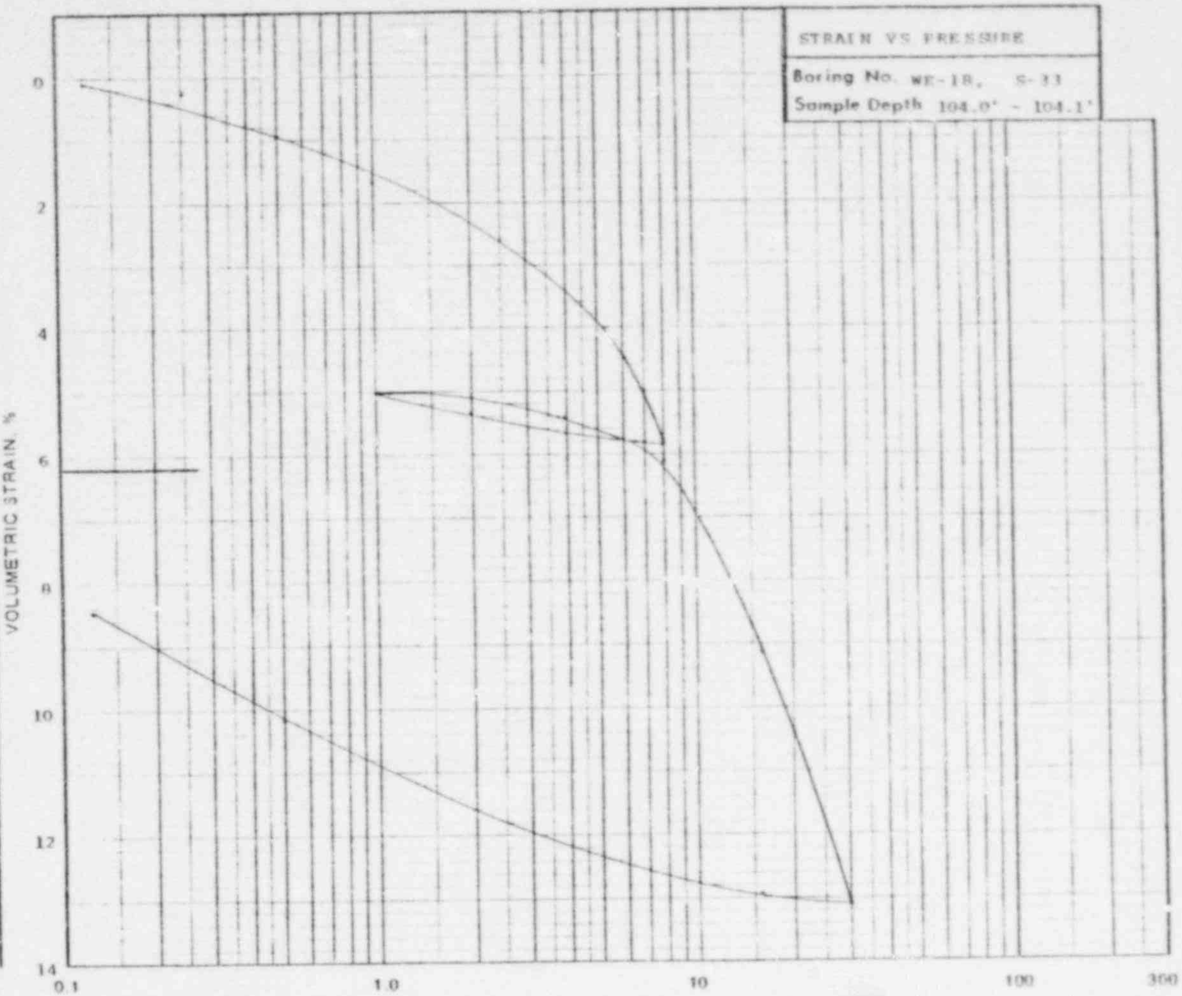
DESCRIPTION OF SPECIMEN: Brown, gray and green micaceous sandy clayey silt (Decomposed Rock)

CONSOLIDATION PROPERTIES		TEST SPECIMEN PROPERTIES	INITIAL	FINAL
COMPRESSION INDEX *	0.127	WATER CONTENT, %	25.2	22.6
RECOMPRESSION INDEX *	0.008	VOID RATIO	0.757	0.608
SWELLING INDEX	---	SATURATION, %	97.5	100.0
PRECONSOLIDATION STRESS, tsf	5.6±	SAMPLE HEIGHT, in.	0.879	0.804
EXISTING OVERBURDEN STRESS, tsf	3.7±	SAMPLE DIAMETER, in.	2.495	---
		UNIT DRY WEIGHT, pcf	103.9	
		LIQUID LIMIT, %	NP	
		PLASTIC LIMIT, %	NP	
* FROM VOLUMETRIC STRAIN		SPECIFIC GRAVITY	2.93	

CONSOLIDATION TEST	
WOODWARD-CLYDE CONSULTANTS	
TESTED BY EM	DATE 2/6/81
CHKD BY PM	JOB No. 71C72WE

POOR ORIGINAL





PRESSURE INCREMENTS OF TIME COMPRESSION CURVES

CURVE No.	PRESSURE INCREMENT FROM(tsf)	TO(tsf)	COEFFICIENT of CONS. (FT²/DAY)
1	0	1/8	
2	1/8	1/4	
3	1/4	1/2	
4	1/2	1	
5	1	2	
6	2	4	
7	4	8	
8	8	16	
9	16	30	

DESCRIPTION OF SPECIMEN: Gray-green, brown, black and white micaceous silty fine sand (Saprolite)

CONSOLIDATION PROPERTIES	
COMPRESSION INDEX *	0.178
RECOMPRESSION INDEX *	0.009
SWELLING INDEX	-
PRECONSOLIDATION STRESS, tsf	10.5±
EXISTING OVERBURDEN STRESS, tsf	3.3±
Back Pressure, (P S I)	26

*FROM VOLUMETRIC STRAIN

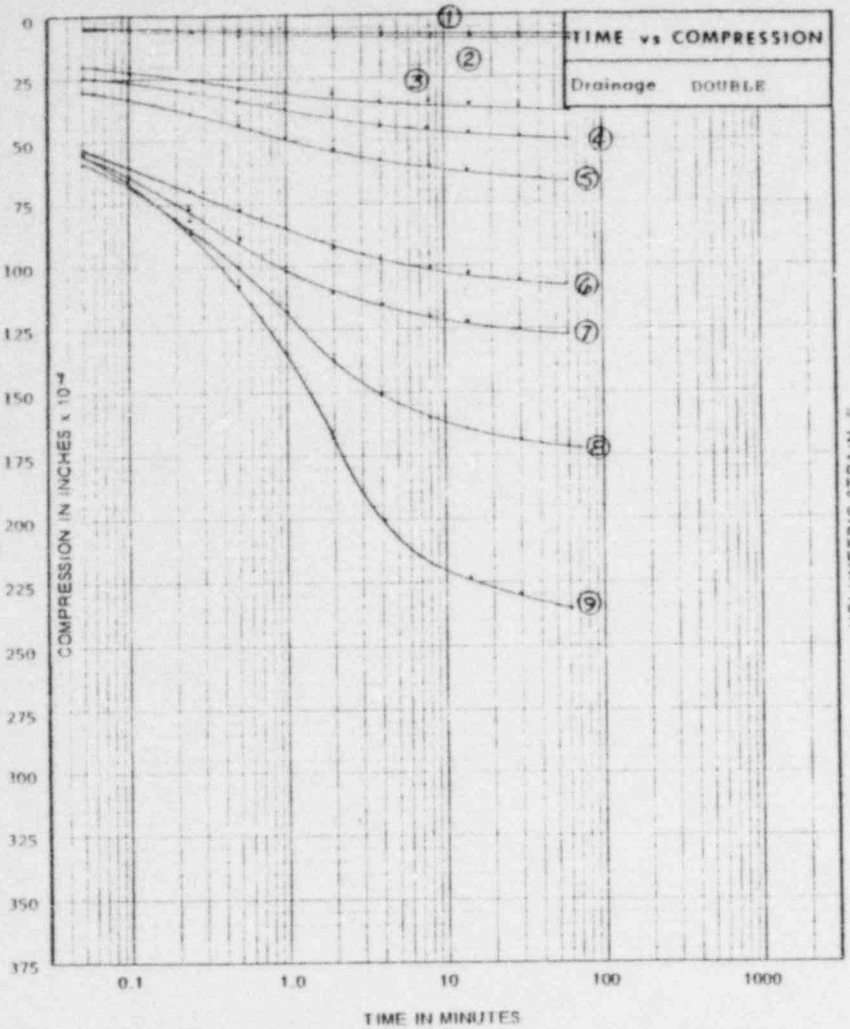
TEST SPECIMEN PROPERTIES	INITIAL	FINAL
WATER CONTENT, %	29.5	27.3
VOID RATIO	0.855	0.741
SATURATION, %	98.3	100.0
SAMPLE HEIGHT, in.	0.881	0.827
SAMPLE DIAMETER, in.	2.495	-
UNIT DRY WEIGHT, pcf	95.8	
LIQUID LIMIT, %	NP	
PLASTIC LIMIT, %	NP	
SPECIFIC GRAVITY	2.85	

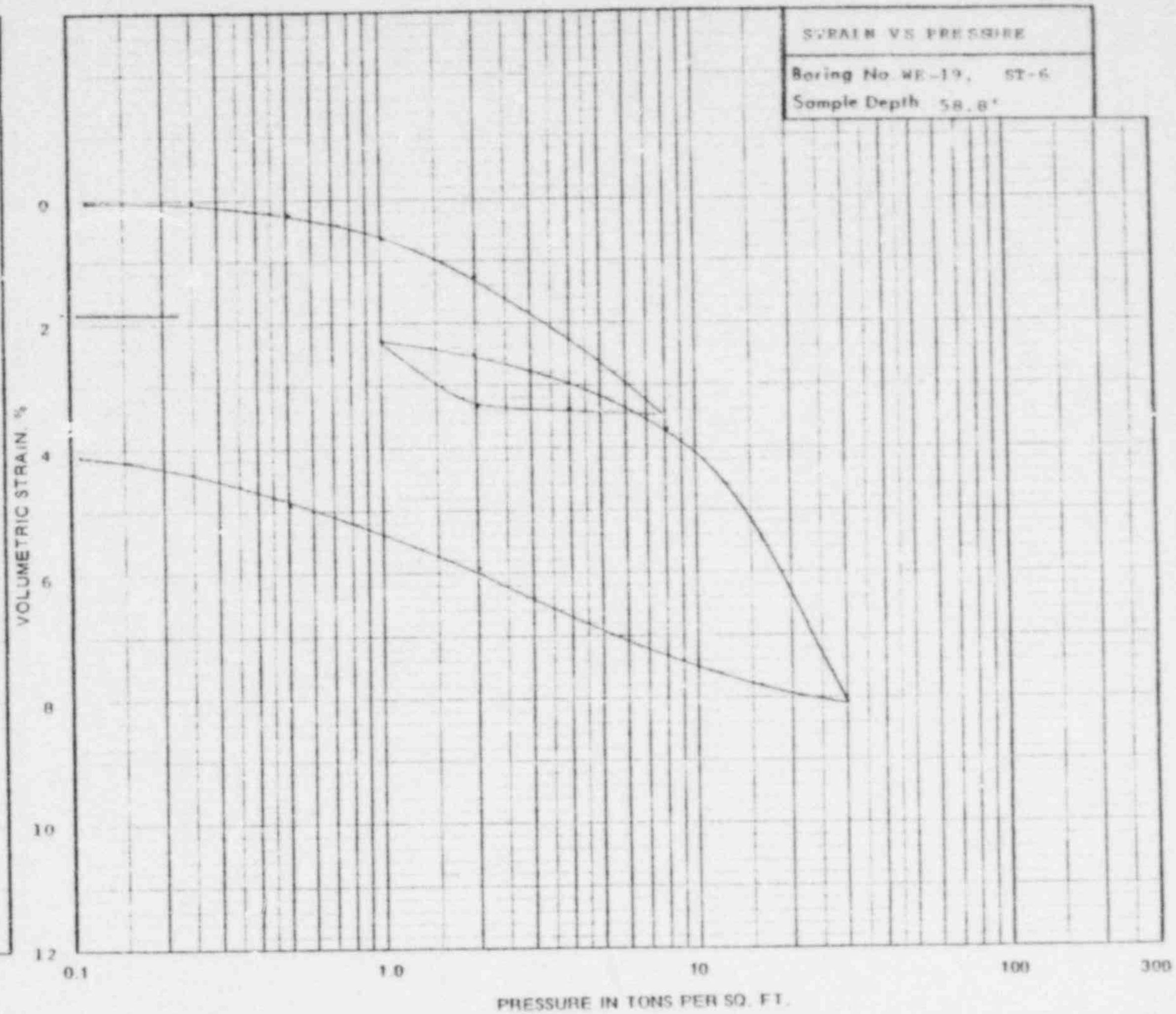
CONSOLIDATION TEST

WOODWARD-CLYDE CONSULTANTS

TESTED BY RH | DATE 2/16/81
CHKD BY EZ | JOB No. 71C32-WE

POOR ORIGINAL





CURVE No.	PRESSURE INCREMENT FROM(tsf)	TO(tsf)	COEFFICIENT of CONS. (ft^2/DAY)
1	0	1/8	
2	1/8	1/4	
3	1/4	1/2	
4	1/2	1	
5	1	2	
6	2	4	
7	4	8	
8	8	16	
9	16	30	

PRESSURE INCREMENTS OF TIME COMPRESSION CURVES

DESCRIPTION OF SPECIMEN: Red-brown micaceous medium to fine sandy clayey silt with white nodules (Select Fill)

CONSOLIDATION PROPERTIES	
COMPRESSION INDEX *	0.104
RECOMPRESSION INDEX *	0.014
SWELLING INDEX	-
PRECONSOLIDATION STRESS, tsf	7.2±
EXISTING OVERBURDEN STRESS, tsf	2.0±
Back Pressure, (PSI)	26.0

* FROM VOLUMETRIC STRAIN

TEST SPECIMEN PROPERTIES	INITIAL	FINAL
WATER CONTENT, %	22.8	23.6
VOID RATIO	0.638	0.615
SATURATION, %	94.5	100.0
SAMPLE HEIGHT, in.	0.881	0.869
SAMPLE DIAMETER, in.	2.495	-
UNIT DRY WEIGHT, pcf	100.8	
LIQUID LIMIT, %	NP	
PLASTIC LIMIT, %	NP	
SPECIFIC GRAVITY	2.64	

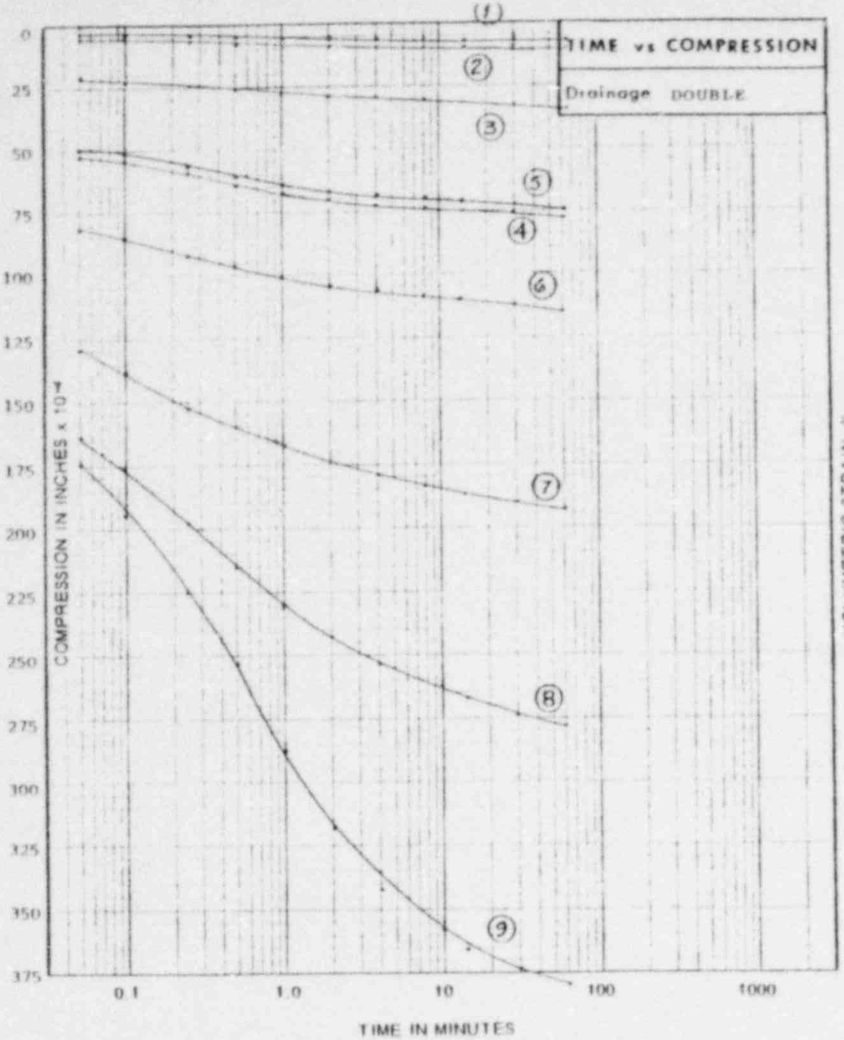
CONSOLIDATION TEST

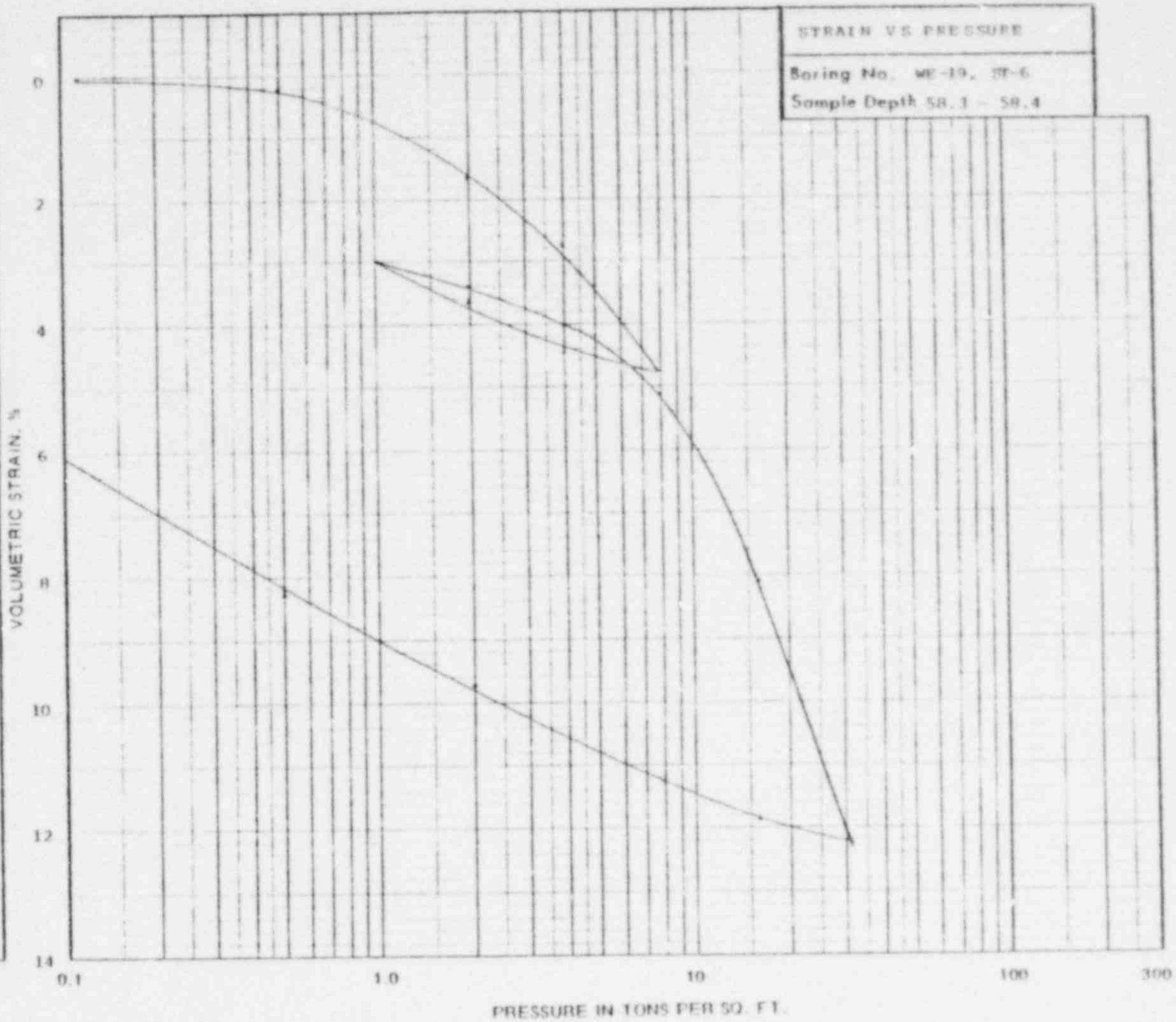
WOODWARD-CLYDE CONSULTANTS

TESTED BY RH — DATE 2/13/81

CHKD BY TJM — JOB No 71C72-WE

POOR ORIGINAL





PRESSURE INCREMENTS OF TIME COMPRESSION CURVES			
CURVE No.	PRESSURE INCREMENT FROM(tsf)	TO(tsf)	COEFFICIENT of CONS. (ft²/DAY)
1	0	1/8	
2	1/8	1/4	
3	1/4	1/2	
4	1/2	1	
5	1	2	
6	2	4	
7	4	8	
8	8	16	
9	16	32	

DESCRIPTION OF SPECIMEN: Brown and red-brown medium to fine sandy clayey silt (Select Fill)

CONSOLIDATION PROPERTIES	
COMPRESSION INDEX *	0.146
RECOMPRESSION INDEX *	0.021
SWELLING INDEX	-
PRECONSOLIDATION STRESS, tsf	7.2±
EXISTING OVERBURDEN STRESS, tsf	2.0±
Back Pressure, (PSI)	0.0
* FROM VOLUMETRIC STRAIN	

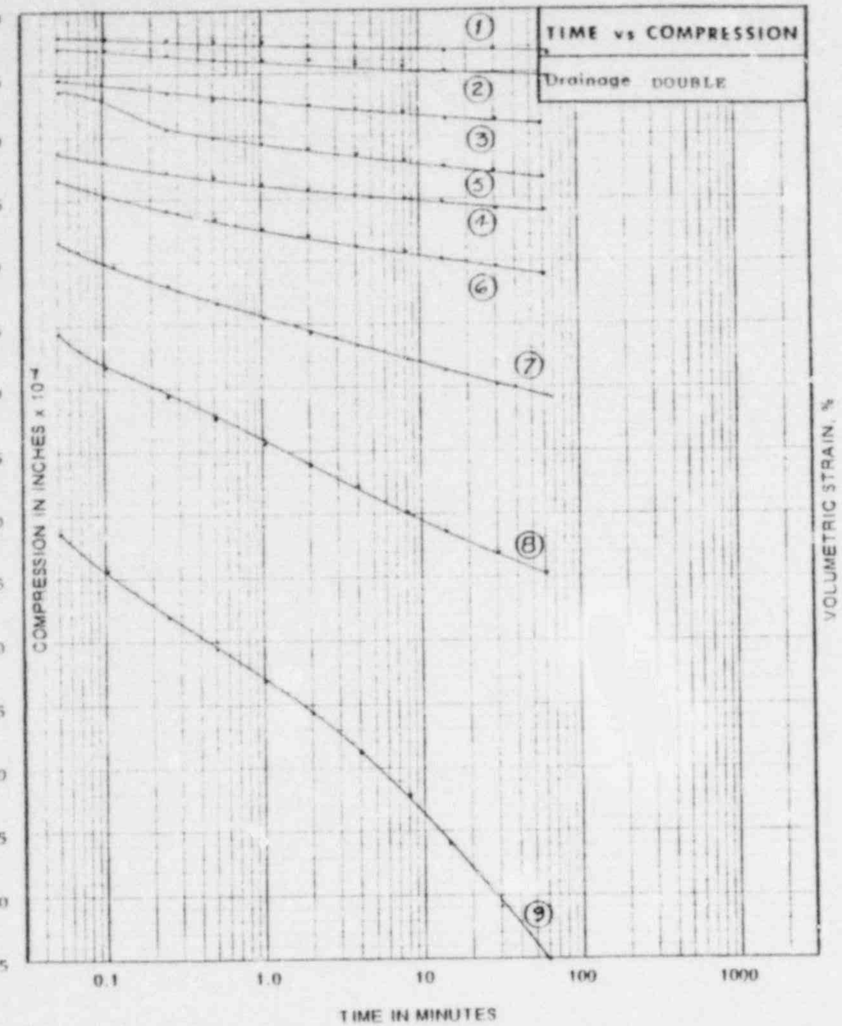
TEST SPECIMEN PROPERTIES	INITIAL	FINAL
WATER CONTENT, %	28.8	28.2
VOID RATIO	0.867	0.755
SATURATION, %	89.3	100.0
SAMPLE HEIGHT, in.	0.883	0.830
SAMPLE DIAMETER, in.	2.495	-
UNIT DRY WEIGHT, pcf	89.8	
LIQUID LIMIT, %	NP	
PLASTIC LIMIT, %	Np	
SPECIFIC GRAVITY	2.69	

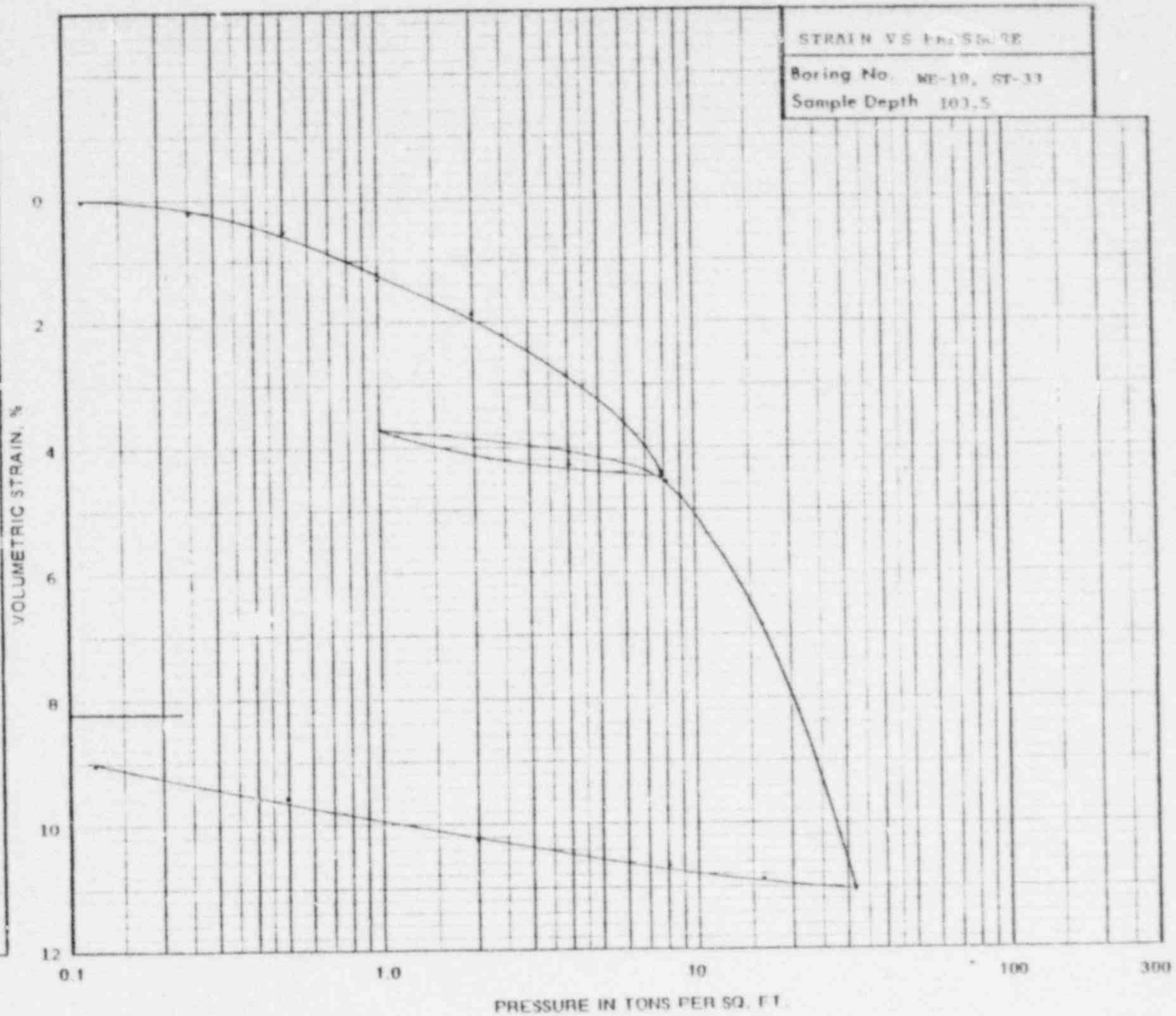
CONSOLIDATION TEST

WOODWARD CLYDE CONSULTANTS

TESTED BY	RH	DATE	2/13/81
CHKD BY	RH	JOB No.	71C72-WE

POOR ORIGINAL





PRESSURE INCREMENTS OF TIME COMPRESSION CURVES: CURVE No.	PRESSURE INCREMENT FROM(tsf)	TO(tsf)	COEFFICIENT of CONS.(FT²/DAY)
1	0	1/8	
2	1/8	1/4	
3	1/4	1/2	
4	1/2	1	
5	1	2	
6	2	4	
7	4	8	
8	8	16	
9	16	32	

DESCRIPTION OF SPECIMEN: Gray-green, brown, black and white micaceous silty fine sand (Saprolite)

CONSOLIDATION PROPERTIES	
COMPRESSION INDEX *	0.165
RECOMPRESSION INDEX *	0.008
SWELLING INDEX	-
PRECONSOLIDATION STRESS, tsf	12.0 ±
EXISTING OVERBURDEN STRESS, tsf	3.3 ±
Back Pressure, (PSI)	0.0

* FROM VOLUMETRIC STRAIN

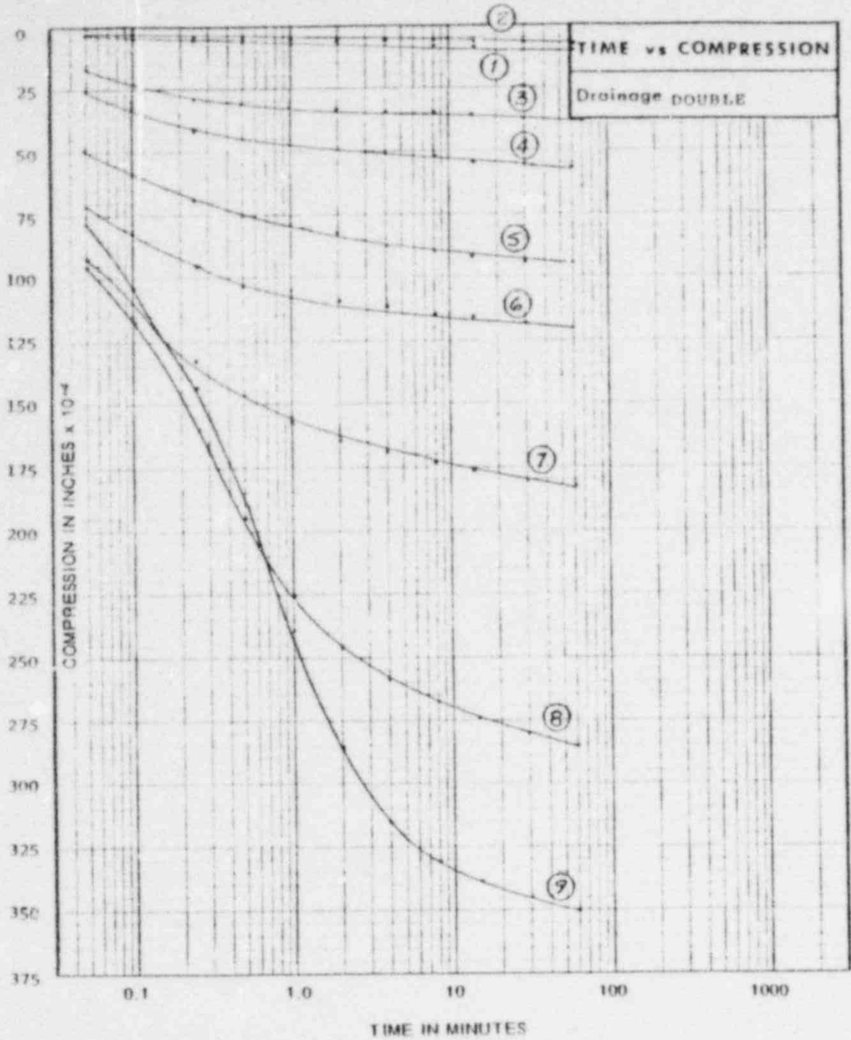
TEST SPECIMEN PROPERTIES	INITIAL	FINAL
WATER CONTENT, %	23.6	20.7
VOID RATIO	0.724	0.603
SATURATION, %	93.8	99.0
SAMPLE HEIGHT, in.	0.881	0.819
SAMPLE DIAMETER, in.	2.495	-
UNIT DRY WEIGHT, pcf	104.4	
LIQUID LIMIT, %	NP	
PLASTIC LIMIT, %	NP	
SPECIFIC GRAVITY	2.88	

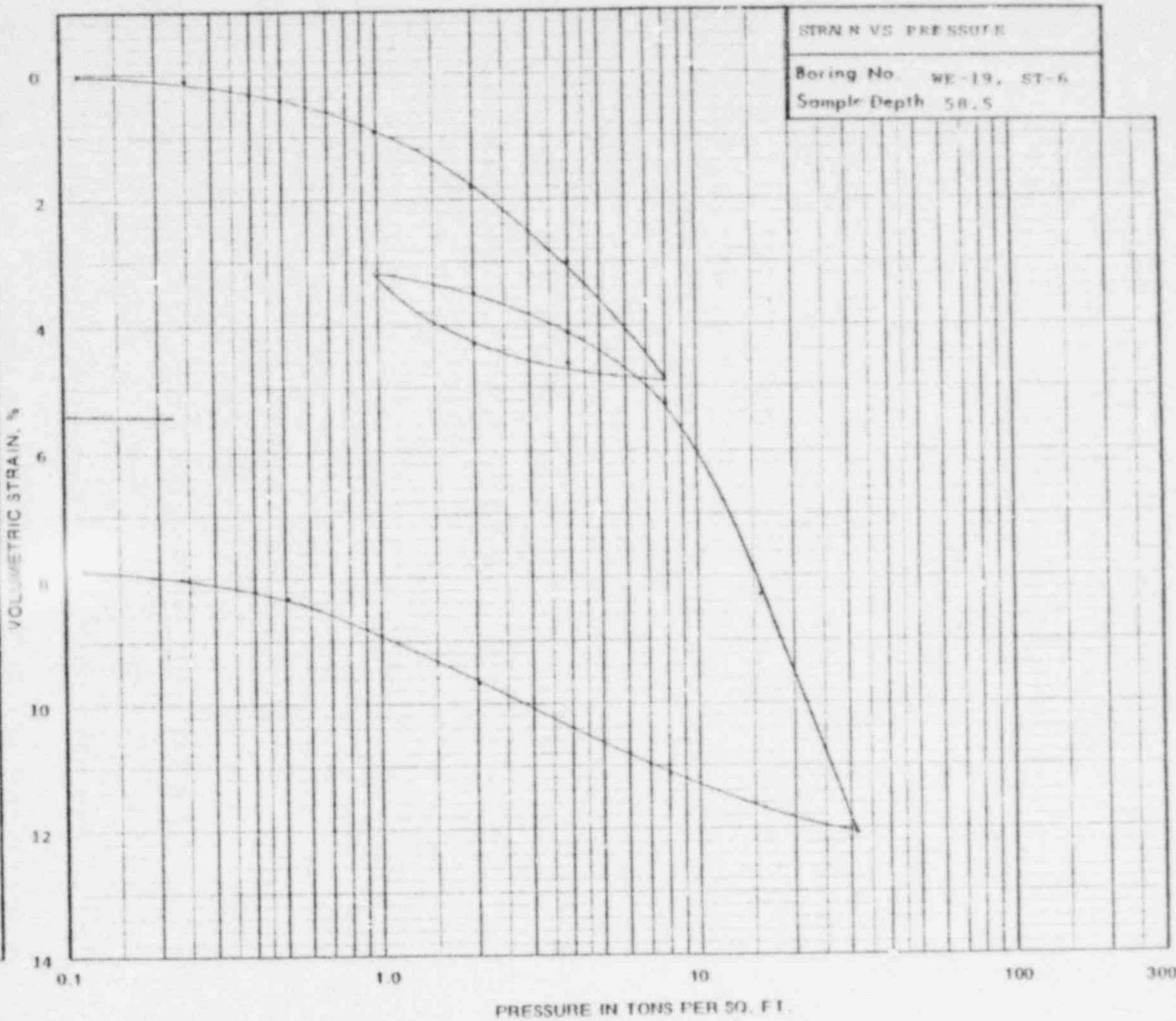
CONSOLIDATION TEST

WOODWARD-CLYDE CONSULTANTS

TESTED BY DM	DATE 2/16/81
CHKD BY EM	JOB No. 71C72-WE

POOR ORIGINAL





PRESSURE INCREMENTS OF TIME COMPRESSION CURVES

CURVE No.	PRESSURE INCREMENT FROM(tsf)	PRESSURE INCREMENT TO(tsf)	COEFFICIENT of CONS. (FT^2/DAY)
1	0	1/8	
2	1/8	1/4	
3	1/4	1/2	
4	1/2	1	
5	1	2	
6	2	4	
7	4	8	
8	8	16	
9	16	32	

DESCRIPTION OF SPECIMEN: Brown and red brown micaceous medium to fine sandy clayey silt (Select Fill)

CONSOLIDATION PROPERTIES	
COMPRESSION INDEX *	0.126
RECOMPRESSION INDEX *	0.020
SWELLING INDEX	-
PRECONSOLIDATION STRESS, tsf	5.7±
EXISTING OVERBURDEN STRESS, tsf	2.0±
Back Pressure, (PSI)	13.0
* FROM VOLUMETRIC STRAIN	

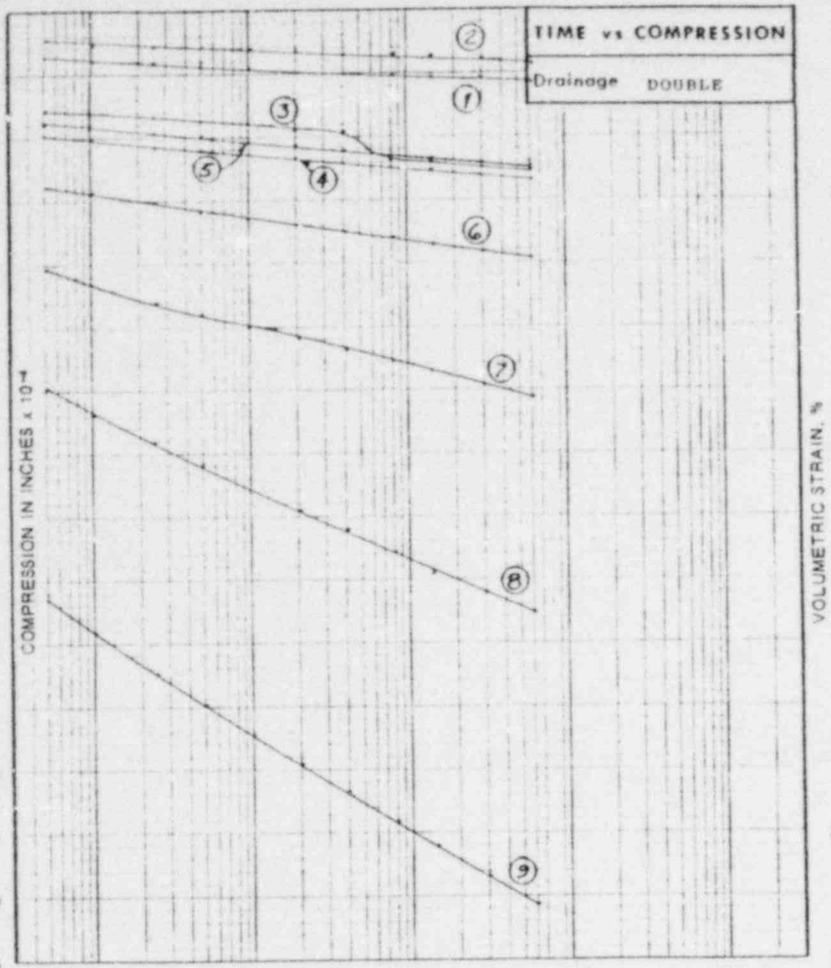
TEST SPECIMEN PROPERTIES	INITIAL	FINAL
WATER CONTENT, %	24.8	25.4
VOID RATIO	0.747	0.665
SATURATION, %	90.2	100.0
SAMPLE HEIGHT, in.	0.882	0.841
SAMPLE DIAMETER, in.	2.495	-
UNIT DRY WEIGHT, pcf	97.1	
LIQUID LIMIT, %	NP	
PLASTIC LIMIT, %	NP	
SPECIFIC GRAVITY	2.71	

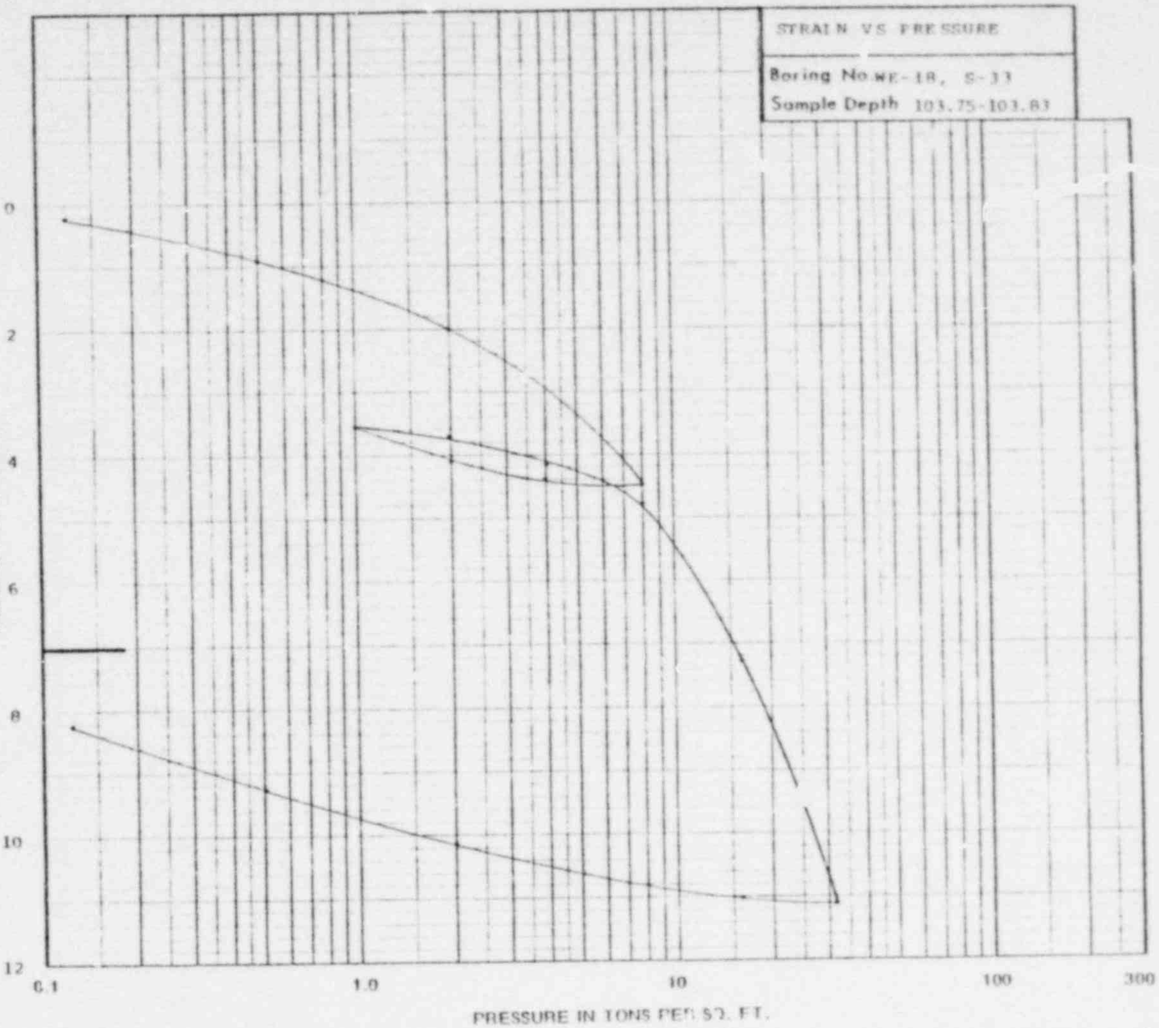
CONSOLIDATION TEST

WOODWARD CLYDE CONSULTANTS

TESTED BY RM	DATE 2/13/81
CHKD BY EM	JOB No. 71C77-WE

POOR ORIGINAL





CURVE No.	PRESSURE INCREMENT FROM(tsf)	TO(tsf)	COEFFICIENT of CONS. (FT^2/DAY)
1	0	1/8	
2	1/8	1/4	
3	1/4	1/2	
4	1/2	1	
5	1	2	
6	2	4	
7	4	8	
8	8	16	
9	16	32	

PRESSURE INCREMENTS OF TIME COMPRESSION CURVES

DESCRIPTION OF SPECIMEN: Gray-green, brown, black and white micaceous silty fine sand (Saprolite)

CONSOLIDATION PROPERTIES	
COMPRESSION INDEX *	0.184
RECOMPRESSION INDEX *	0.012
SWELLING INDEX	-
PRECONSOLIDATION STRESS, tsf	14.0±
EXISTING OVERBURDEN STRESS, tsf	3.2±
Back Pressure, (PSI)	13.0

*FROM VOLUMETRIC STRAIN

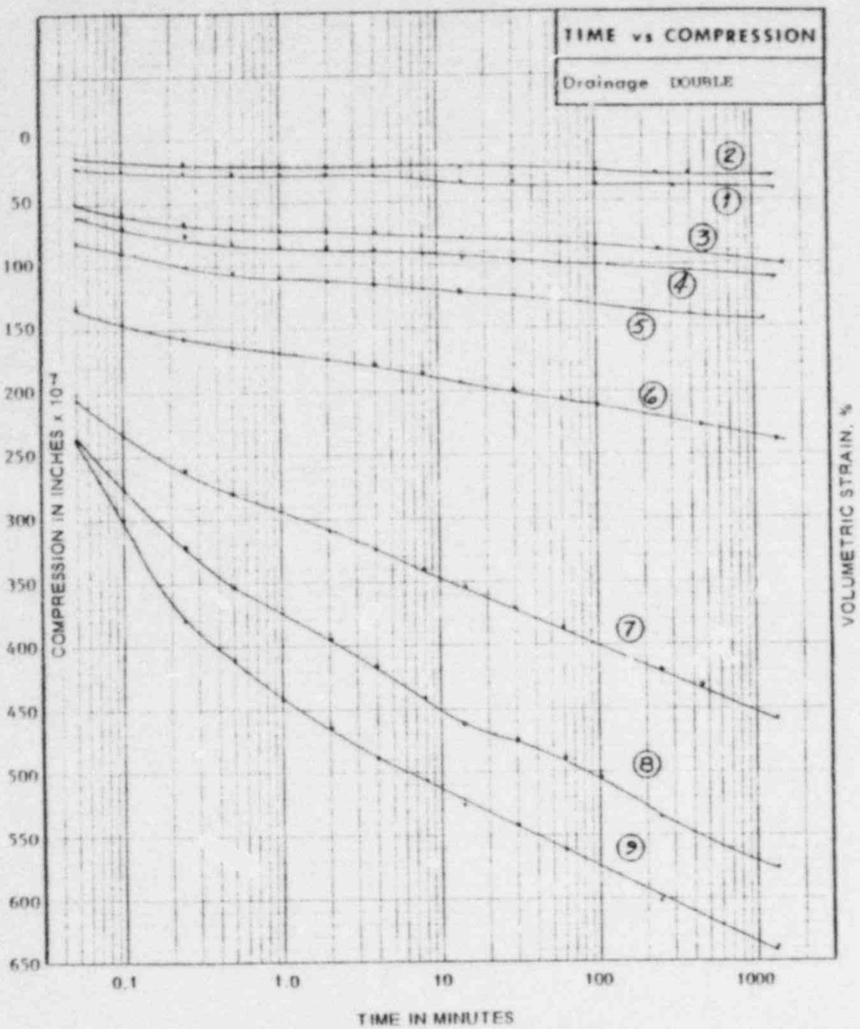
TEST SPECIMEN PROPERTIES	INITIAL	FINAL
WATER CONTENT, %	25.0	22.7
VOID RATIO	0.739	0.638
SATURATION, %	97.9	100.0
SAMPLE HEIGHT, in.	0.880	0.829
SAMPLE DIAMETER, in.	2.495	-
UNIT DRY WEIGHT, pcf	103.9	
LIQUID LIMIT, %	NP	
PLASTIC LIMIT, %	NP	
SPECIFIC GRAVITY	2.90	

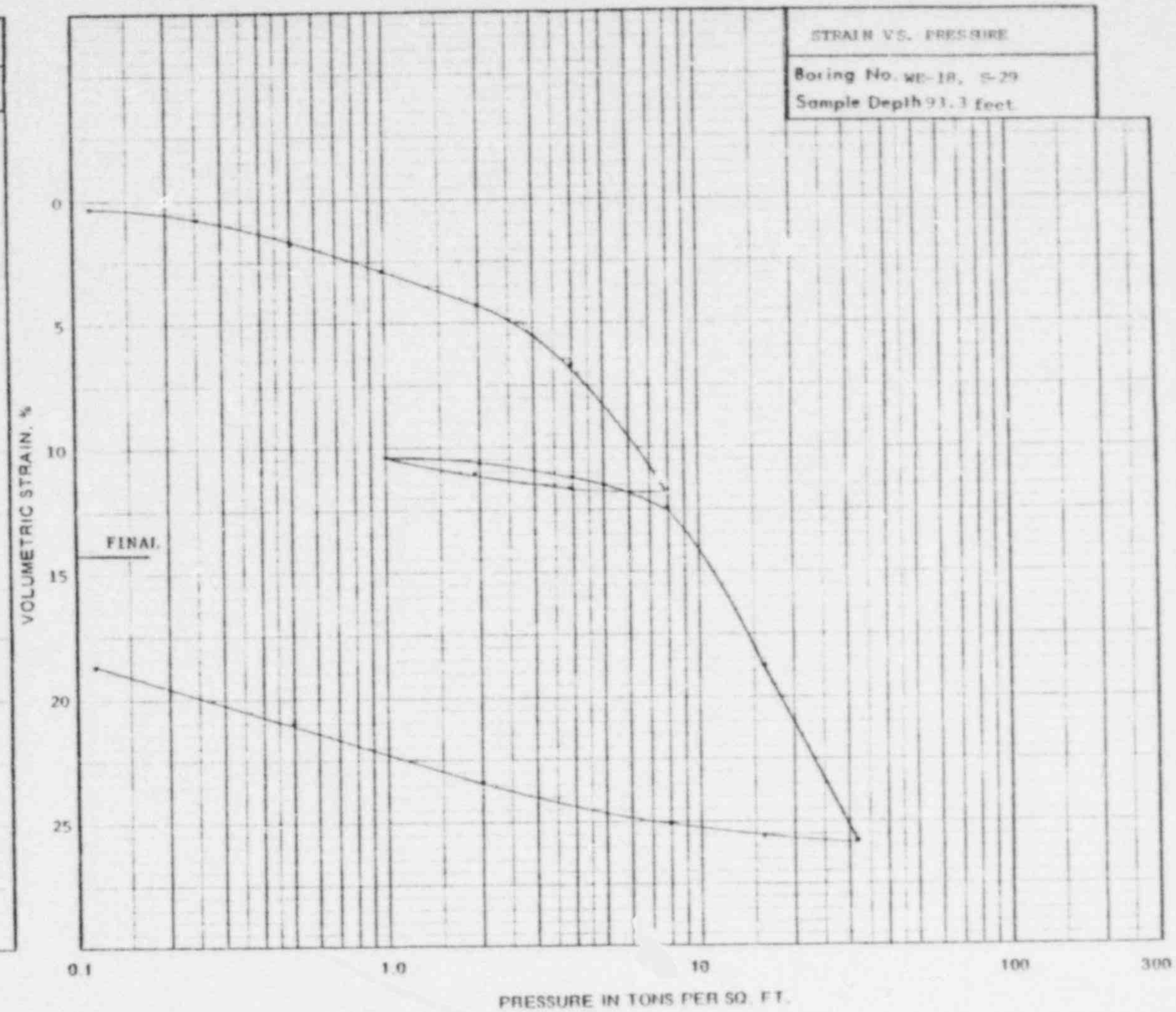
CONSOLIDATION TEST

WOODWARD CLYDE CONSULTANTS

TESTED BY RH	DATE 2/16/81
CHKD BY EM	JOB No 71C72-WE

POOR ORIGINAL





PRESSURE INCREMENTS OF TIME COMPRESSION CURVES: CURVE No.	PRESSURE INCREMENT FROM(tsf)	TO(tsf)	COEFFICIENT of CONS. (ft²/DAY)
1	0	1/8	
2	1/8	1/4	
3	1/4	1/2	
4	1/2	1	
5	1	2	
6	2	4	
7	4	8	
8	8	16	
9	16	32	

DESCRIPTION OF SPECIMEN: Brown, gray and green micaceous silty fine sand (Saprolite)

CONSOLIDATION PROPERTIES	
COMPRESSION INDEX *	0.240
RECOMPRESSION INDEX *	0.018
SWELLING INDEX	---
PRECONSOLIDATION STRESS, tsf	4.7±
EXISTING OVERBURDEN STRESS, tsf	3.1±

* FROM VOLUMETRIC STRAIN

TEST SPECIMEN PROPERTIES	INITIAL	FINAL
WATER CONTENT, %	42.6	33.3
VOID RATIO	1.168	0.855
SATURATION, %	100.0	100.0
SAMPLE HEIGHT, in.	0.880	0.753
SAMPLE DIAMETER, in.	2.495	
UNIT DRY WEIGHT, pcf	80.0	
LIQUID LIMIT, %	NP	
PLASTIC LIMIT, %	NP	
SPECIFIC GRAVITY	2.78	

CONSOLIDATION TEST

WOODWARD-CLYDE CONSULTANTS

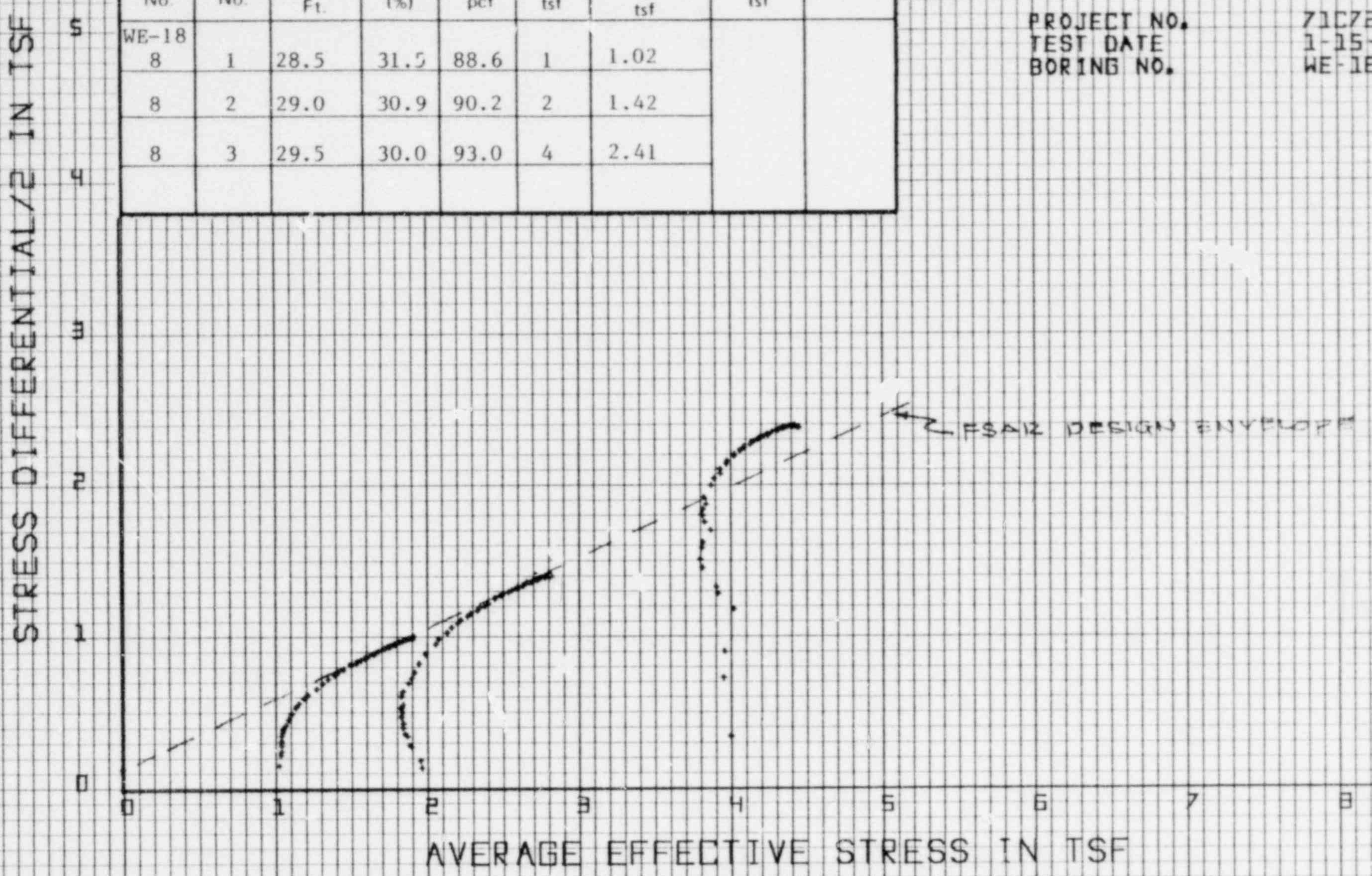
TESTED BY EM	DATE 1/17/81
CHKD BY [illegible]	JOB No 71C72 WE

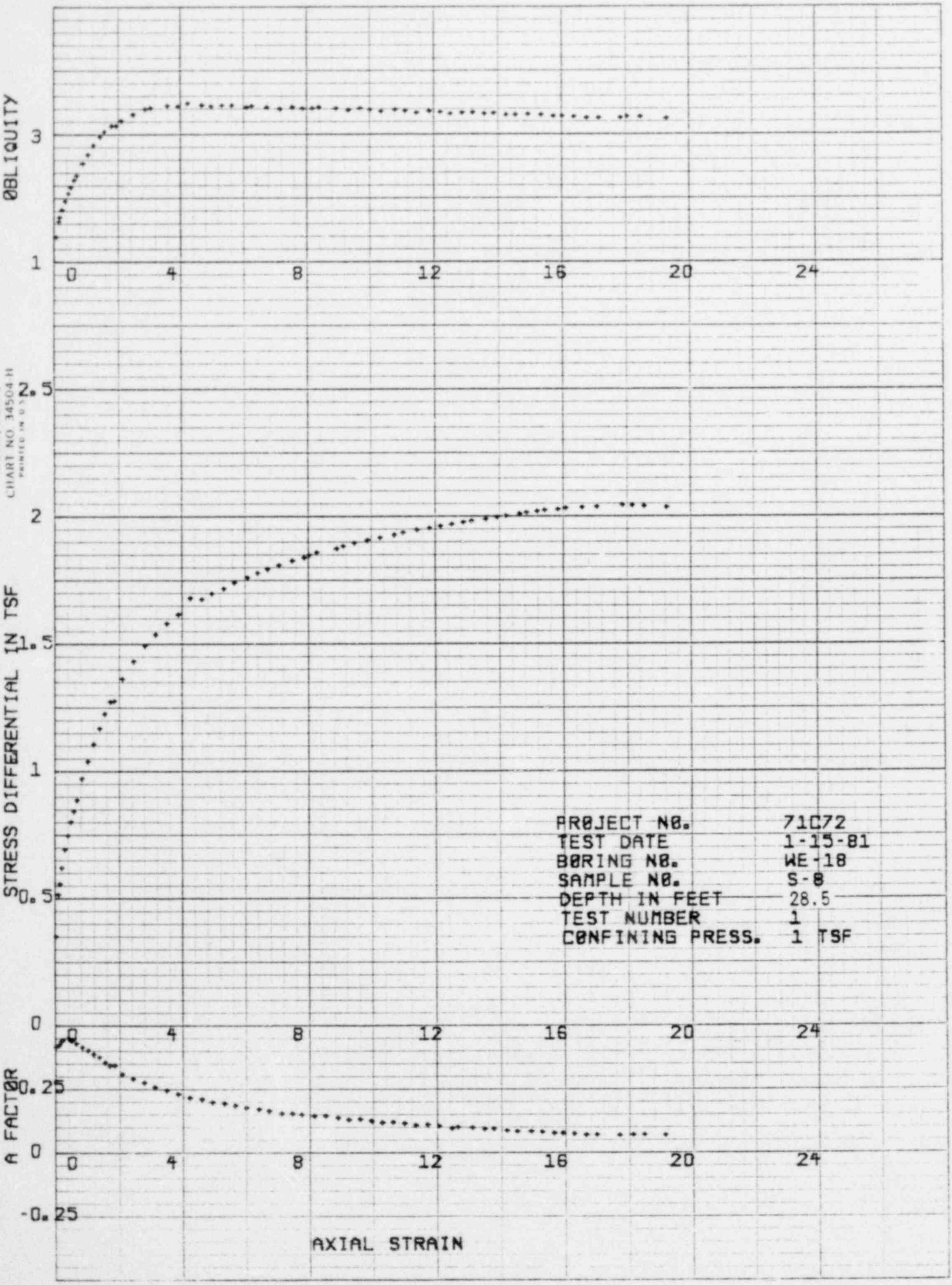
E-18

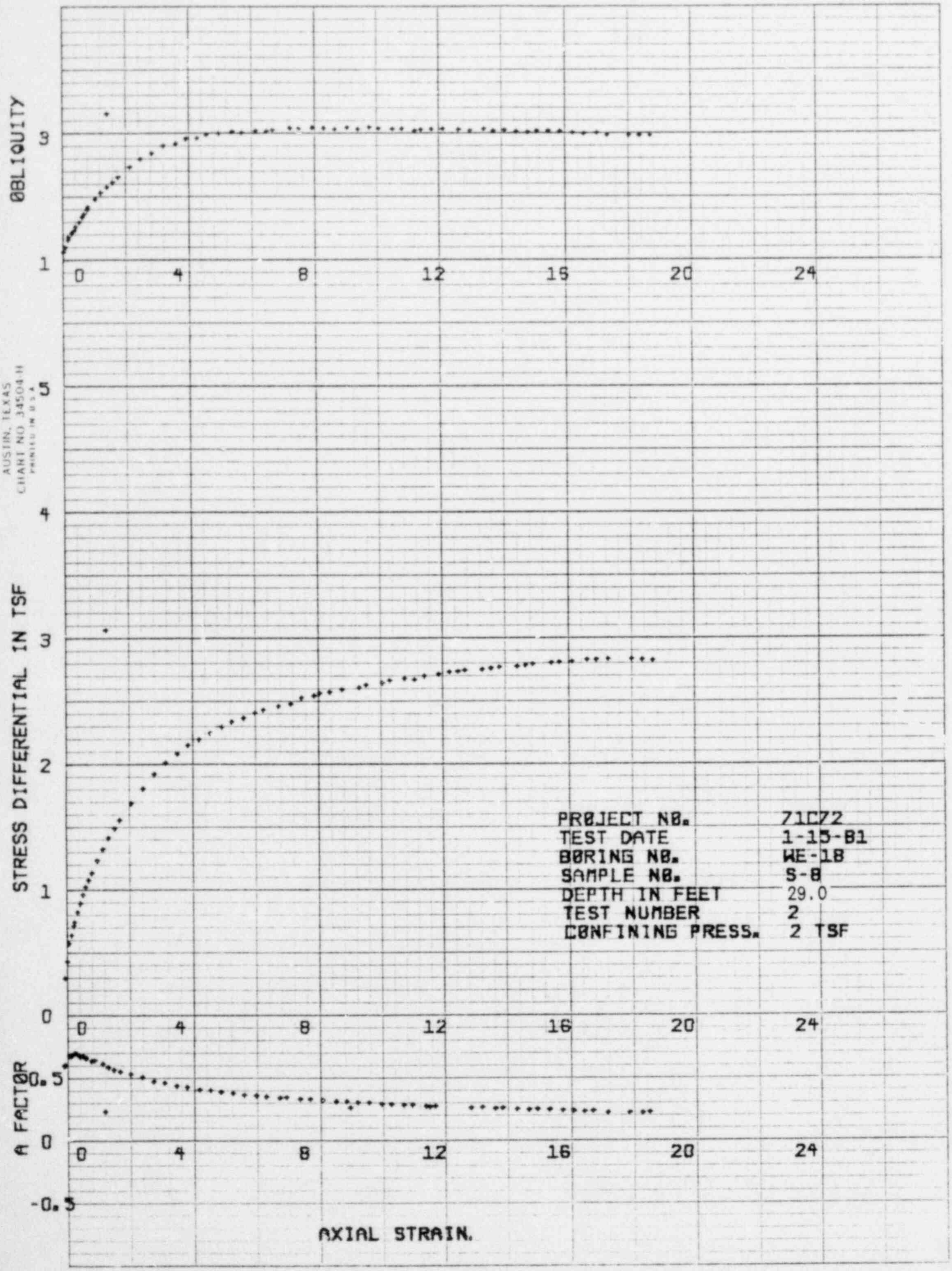
POOR ORIGINAL

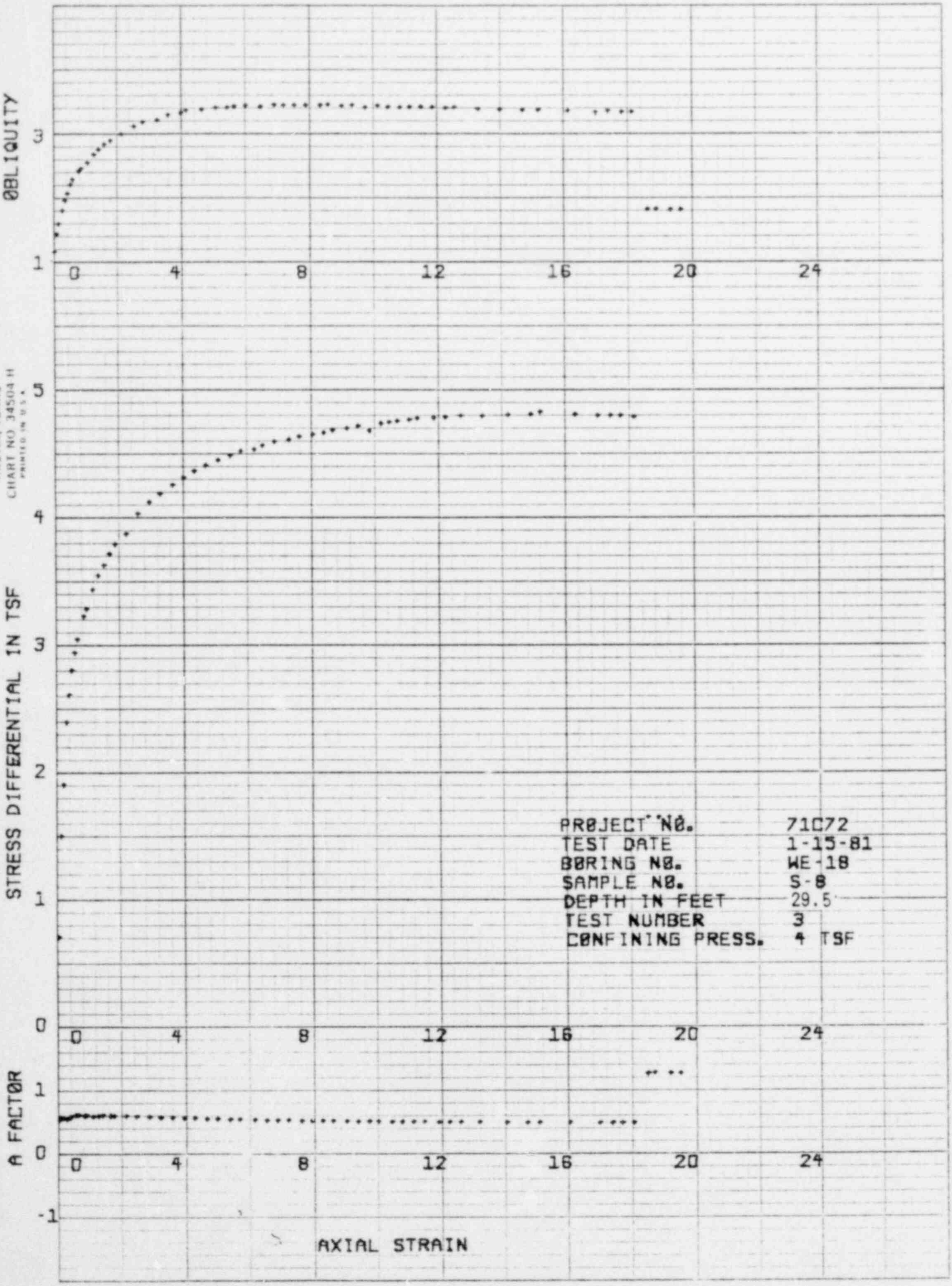
PROJECT NO. 71C72
TEST DATE 1-15-81
BORING NO. WE-18

Sample No.	Test No.	Sample Depth Ft.	W_n (%)	γ_d pcf	$\bar{\sigma}_c$ tsf	$\frac{(\bar{\sigma}_1 - \bar{\sigma}_3)}{2}_{max}$ tsf	$\bar{c}$ tsf	$\bar{\phi}$
WE-18 8	1	28.5	31.5	88.6	1	1.02		
8	2	29.0	30.9	90.2	2	1.42		
8	3	29.5	30.0	93.0	4	2.41		



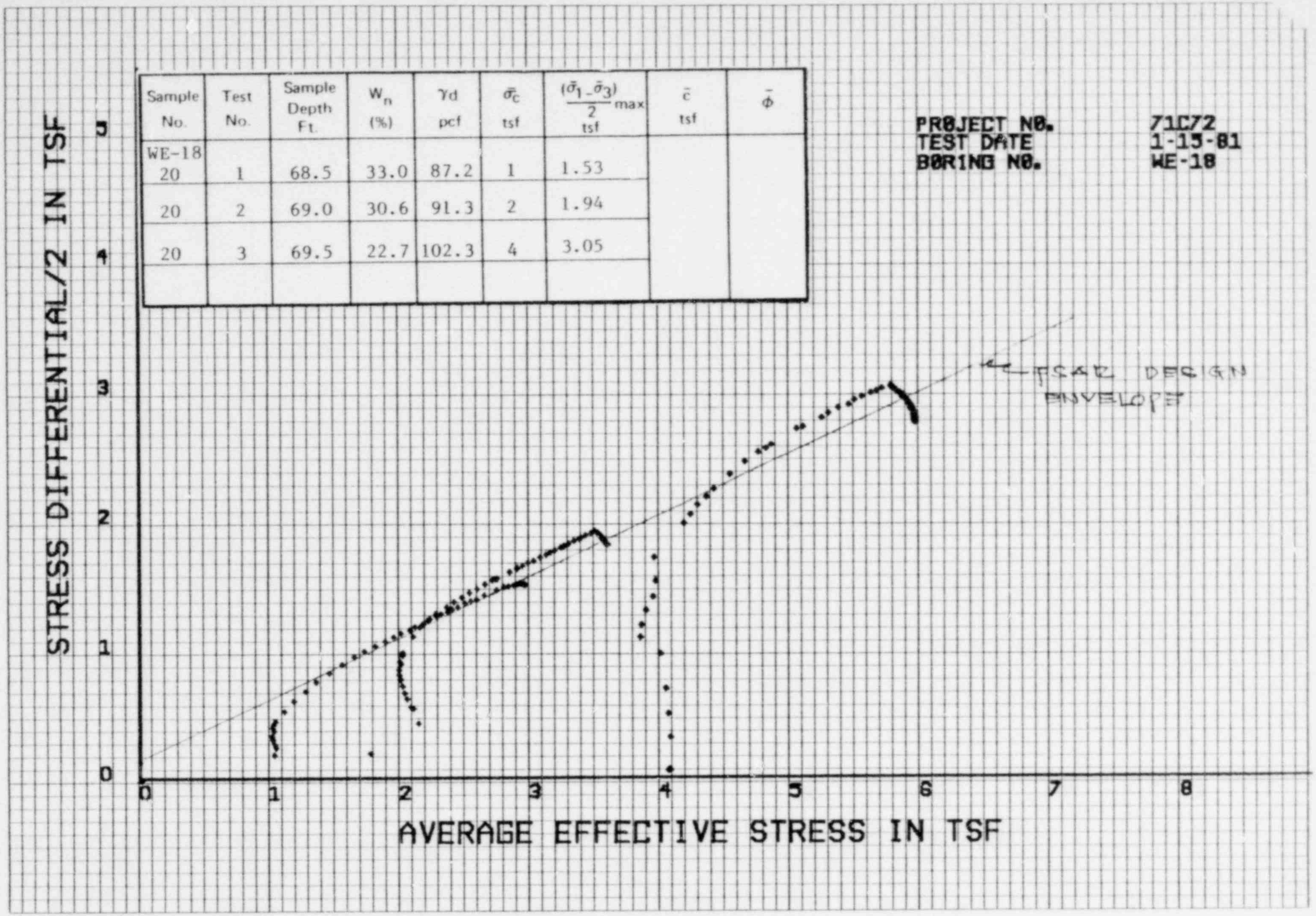

ØBLIQUITY
3
1
0
4
8
12
16
20
24
2.5
2
STRESS DIFFERENTIAL IN TSF
1.5
1
0.5
0
PRØJECT NØ. 71C72
TEST DATE 1-15-81
BØRING NØ. WE-18
SAMPLE NØ. S-8
DEPTH IN FEET 28.5
TEST NUMBER 1
CØNFINING PRESS. 1 TSF
A FACTØR
0.25
-0.25
AXIAL STRAIN
AUSTIN, TEXAS
CHART NO 34504 H

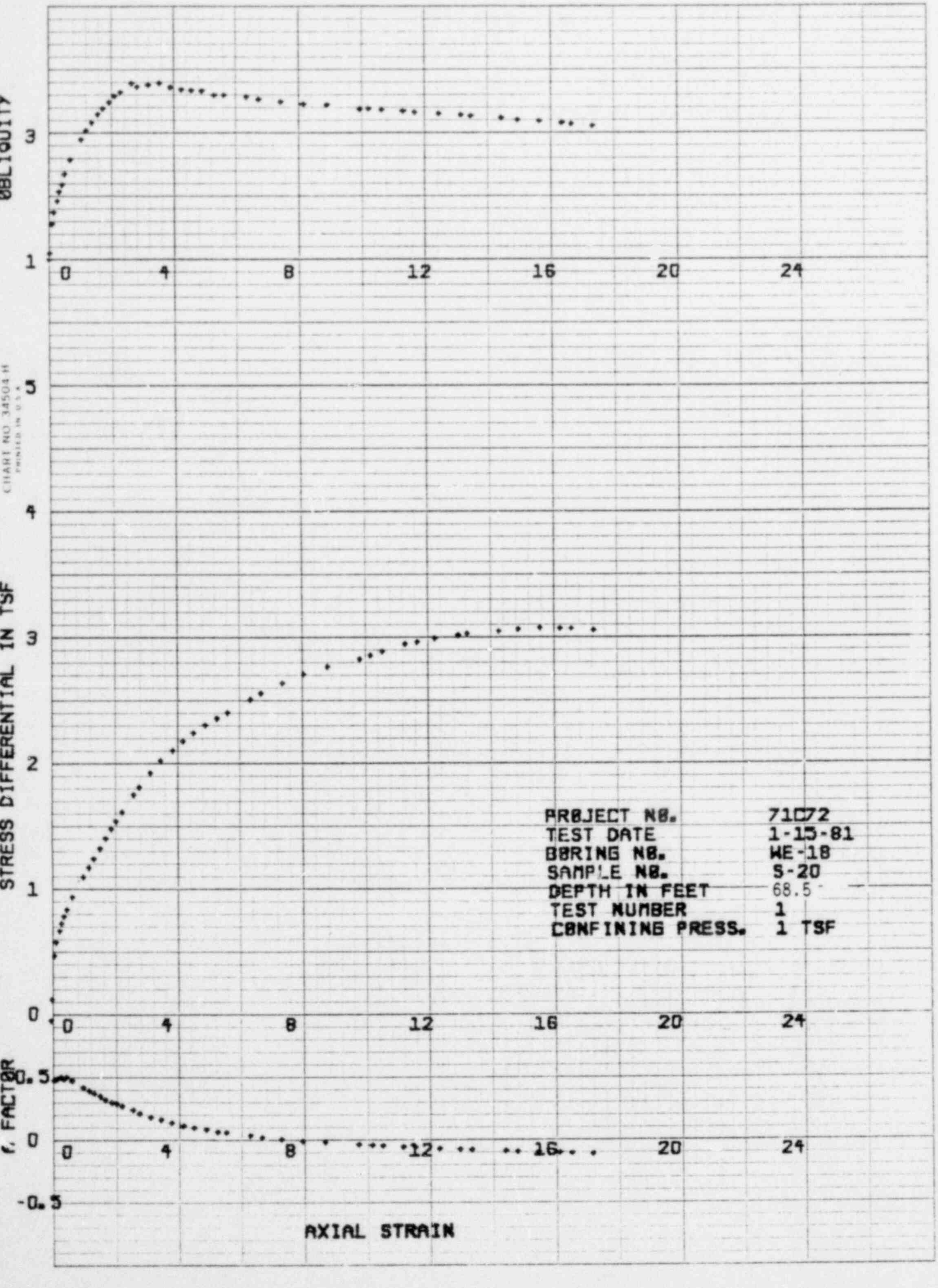

OBLIQUITY
1
3
0
4
8
12
16
20
24
STRESS DIFFERENTIAL IN TSF
0
1
2
3
4
5
PROJECT NO. 71C72
TEST DATE 1-15-81
BORING NO. WE-18
SAMPLE NO. S-8
DEPTH IN FEET 29.0
TEST NUMBER 2
CONFINING PRESS. 2 TSF
A FACTOR
0.5
0
-0.5
AXIAL STRAIN.


ØBLIQUITY
3
1
0
4
8
12
16
20
24
AUSTIN, TEXAS
CHART NO 34504 H
STRESS DIFFERENTIAL IN TSF
5
4
3
2
1
0
PRØJECT NØ. 71C72
TEST DATE 1-15-81
BØRING NØ. WE-18
SAMPLE NØ. S-8
DEPTH IN FEET 29.5
TEST NUMBER 3
CØNFINING PRESS. 4 TSF
A FACTØR
1
0
-1
AXIAL STRAIN

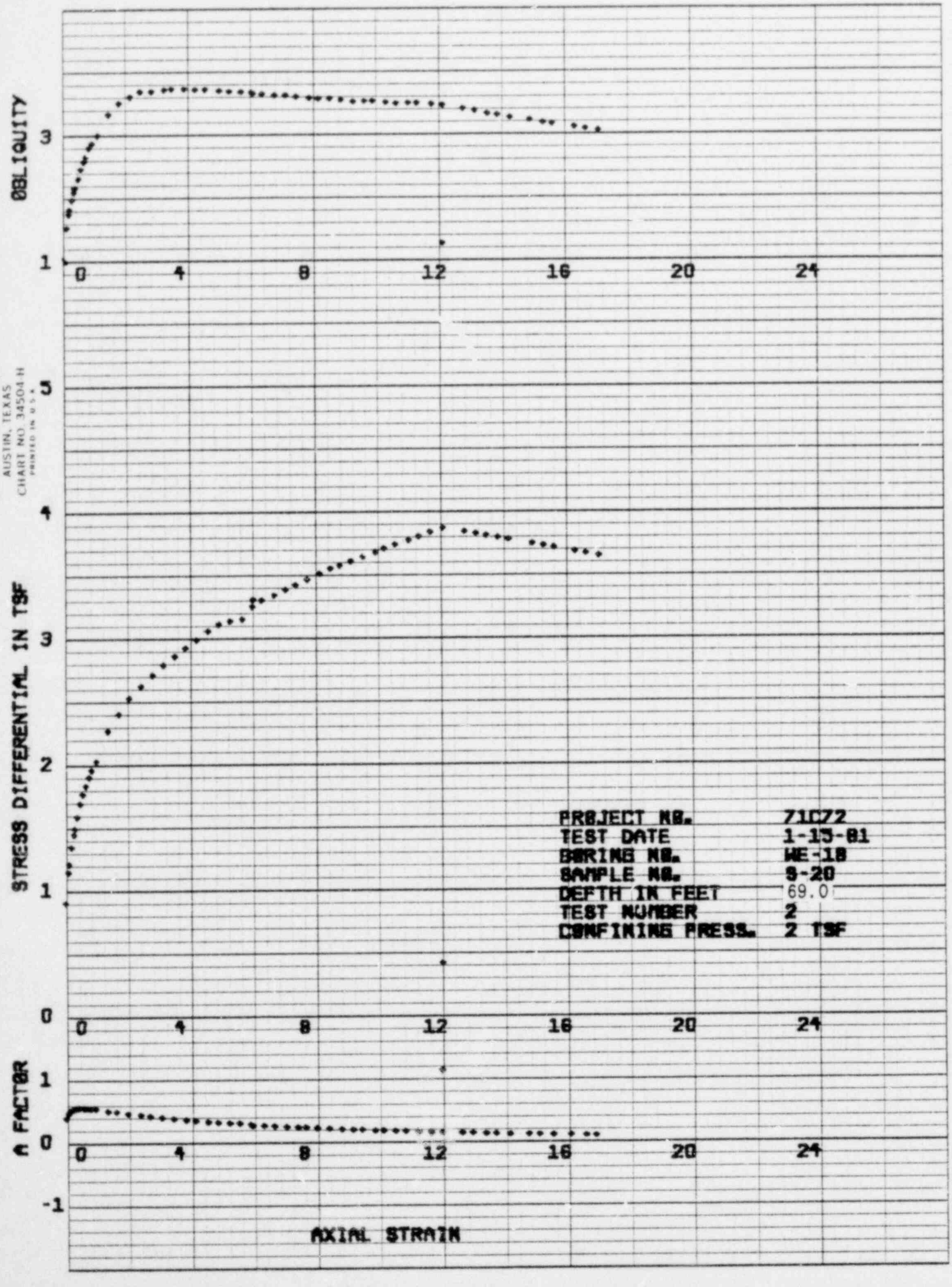
Sample No.	Test No.	Sample Depth Ft.	W_n (%)	γ_d pcf	$\bar{\sigma}_c$ tsf	$\left(\frac{\bar{\sigma}_1 - \bar{\sigma}_3}{2}\right)_{max}$ tsf	$\bar{c}$ tsf	$\bar{\phi}$
WE-18 20	1	68.5	33.0	87.2	1	1.53		
20	2	69.0	30.6	91.3	2	1.94		
20	3	69.5	22.7	102.3	4	3.05		

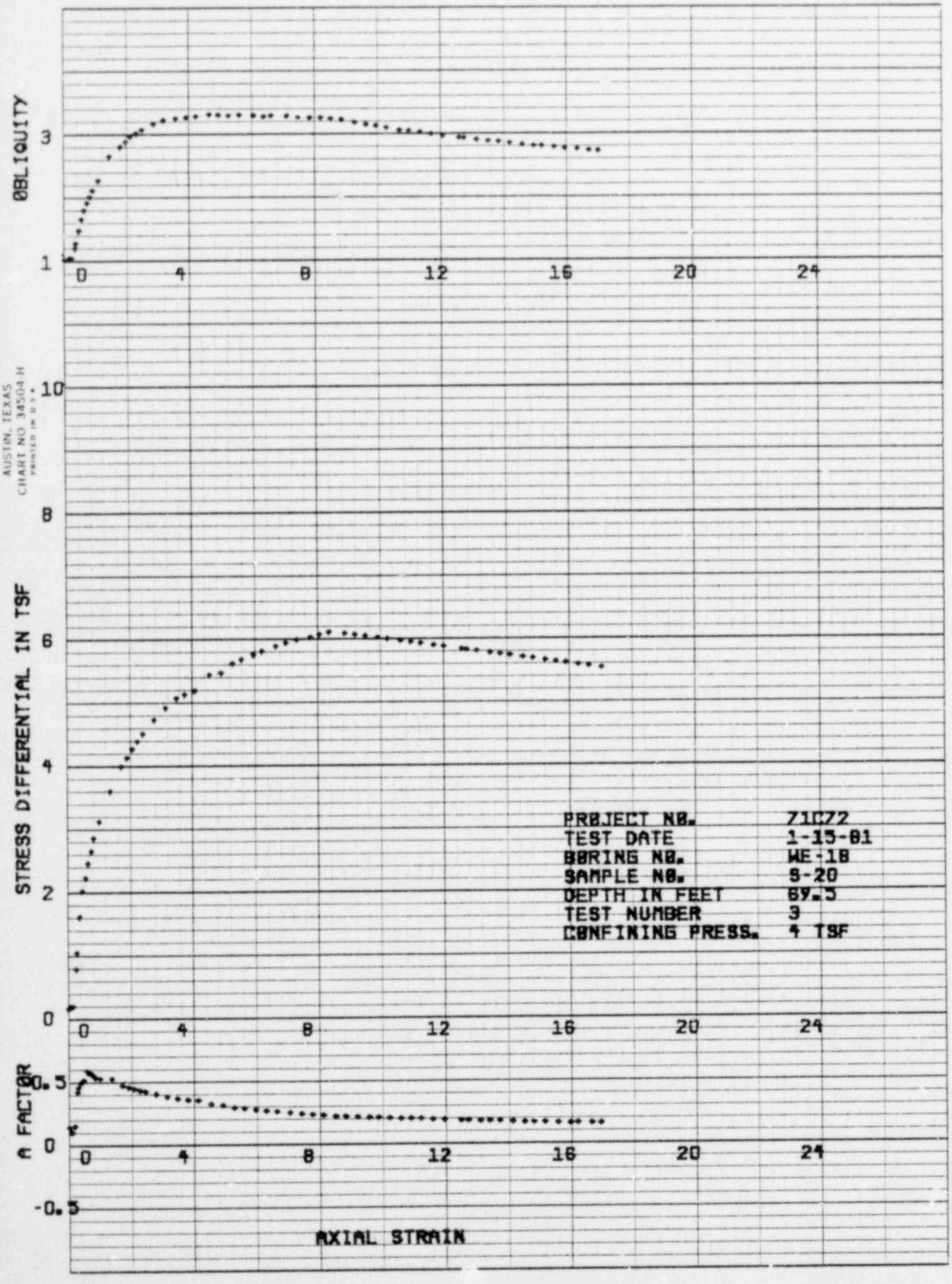
PROJECT NO. 71C72
TEST DATE 1-15-81
BORING NO. WE-18





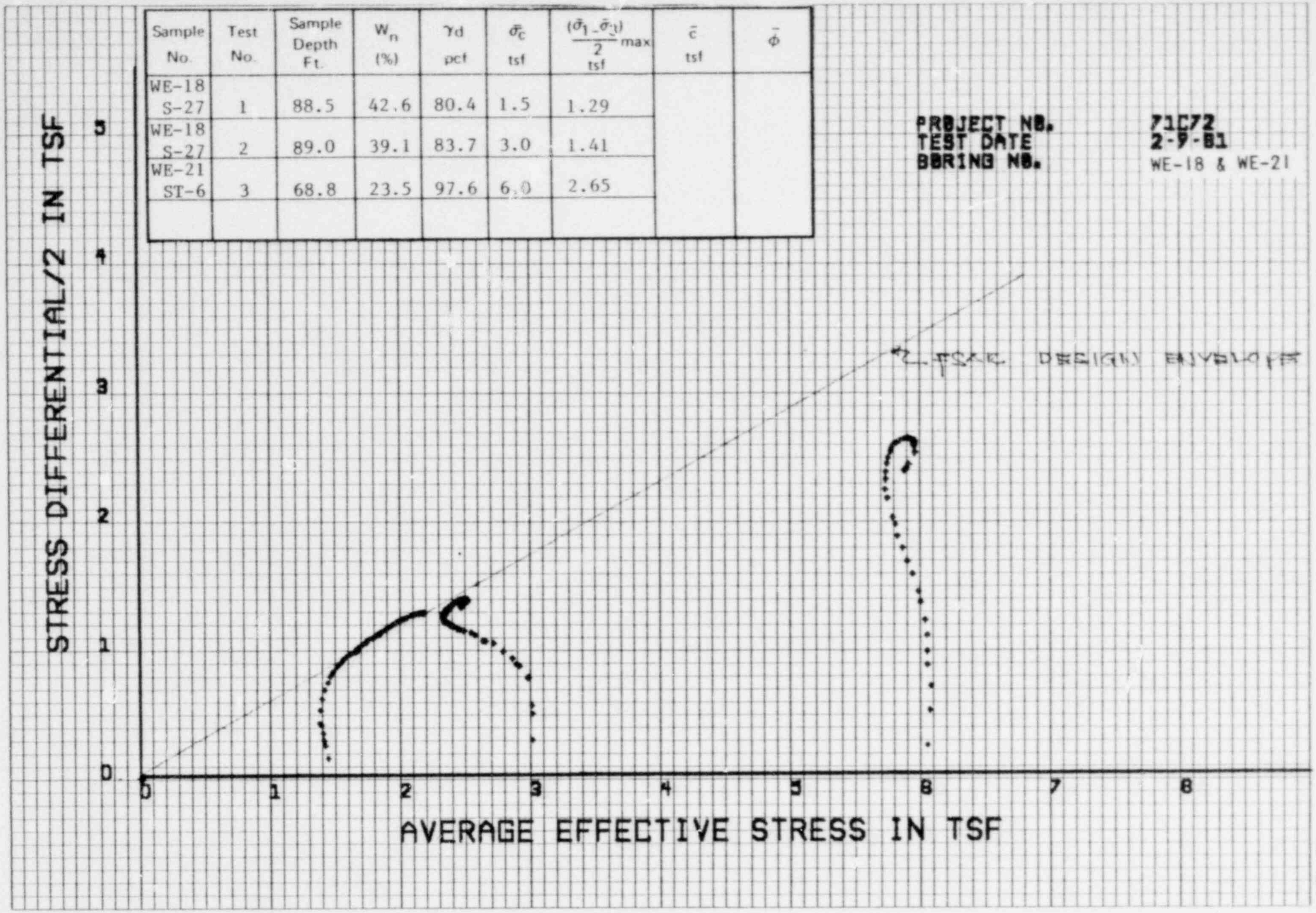
OBLIQUITY
3
1
0
4
8
12
16
20
24
STRESS DIFFERENTIAL IN TSF
5
4
3
2
1
0
PROJECT NO. 71072
TEST DATE 1-15-81
BORING NO. WE-18
SAMPLE NO. S-20
DEPTH IN FEET 68.5
TEST NUMBER 1
CONFINING PRESS. 1 TSF
f, FACTOR
0.5
-0.5
AXIAL STRAIN


OBLIQUITY
3
1
0
4
8
12
16
20
24
5
4
3
2
1
0
STRESS DIFFERENTIAL IN TSF
PROJECT NO. 71C72
TEST DATE 1-15-81
BORING NO. WE-18
SAMPLE NO. S-20
DEPTH IN FEET 69.0
TEST NUMBER 2
CONFINING PRESS. 2 TSF
A FACTOR
-1
AXIAL STRAIN
AUSTIN, TEXAS
CHART NO. 34504 H

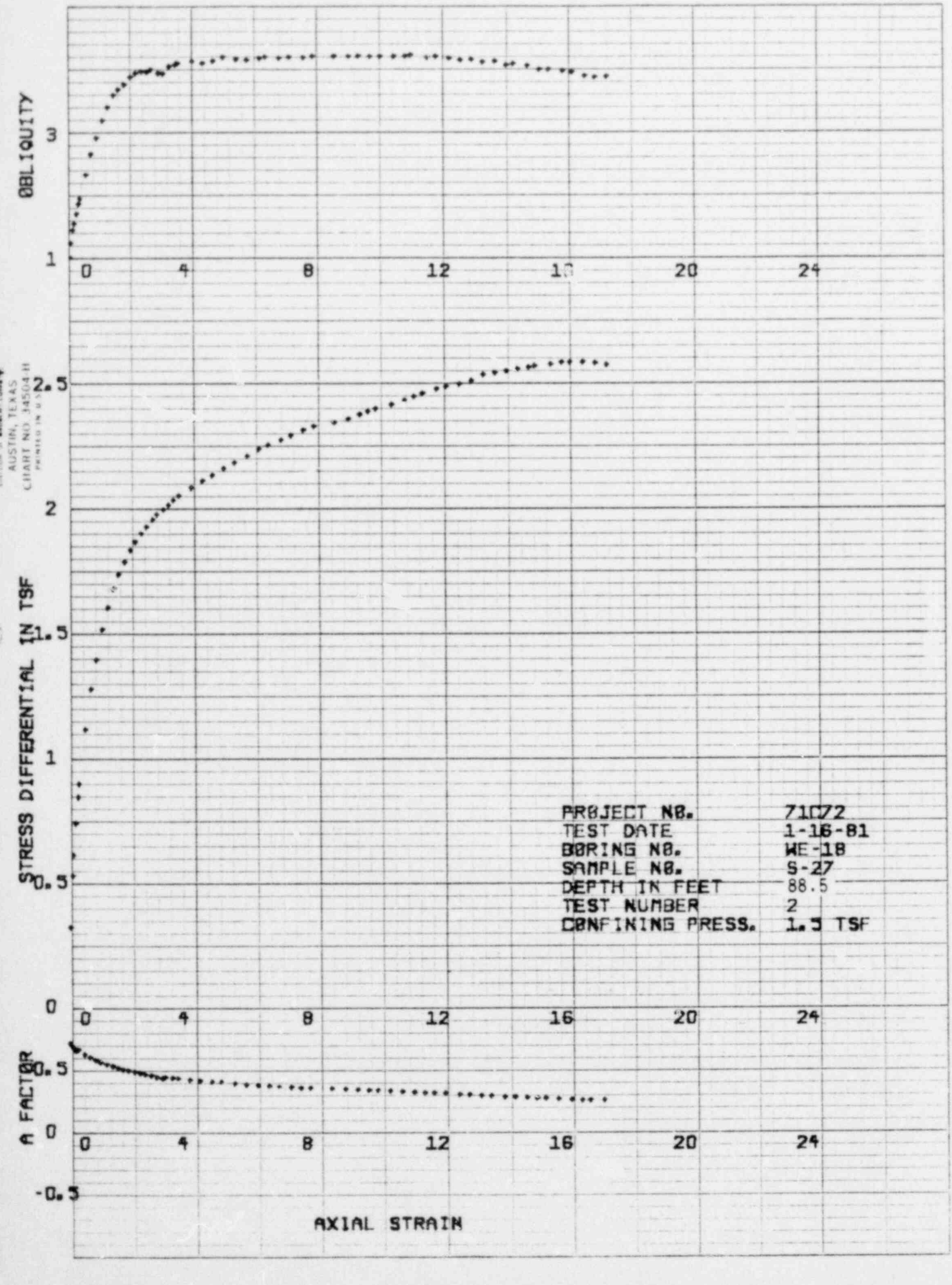

OBLIQUITY
3
1
0
4
8
12
16
20
24
10
8
6
4
2
0
STRESS DIFFERENTIAL IN TSF
A FACTOR
0.5
-0.5
AXIAL STRAIN
PROJECT NO. 71C72
TEST DATE 1-15-81
BORING NO. WE-18
SAMPLE NO. S-20
DEPTH IN FEET 69.5
TEST NUMBER 3
CONFINING PRESS. 4 TSF
AUSTIN, TEXAS
CHART NO 34504 H

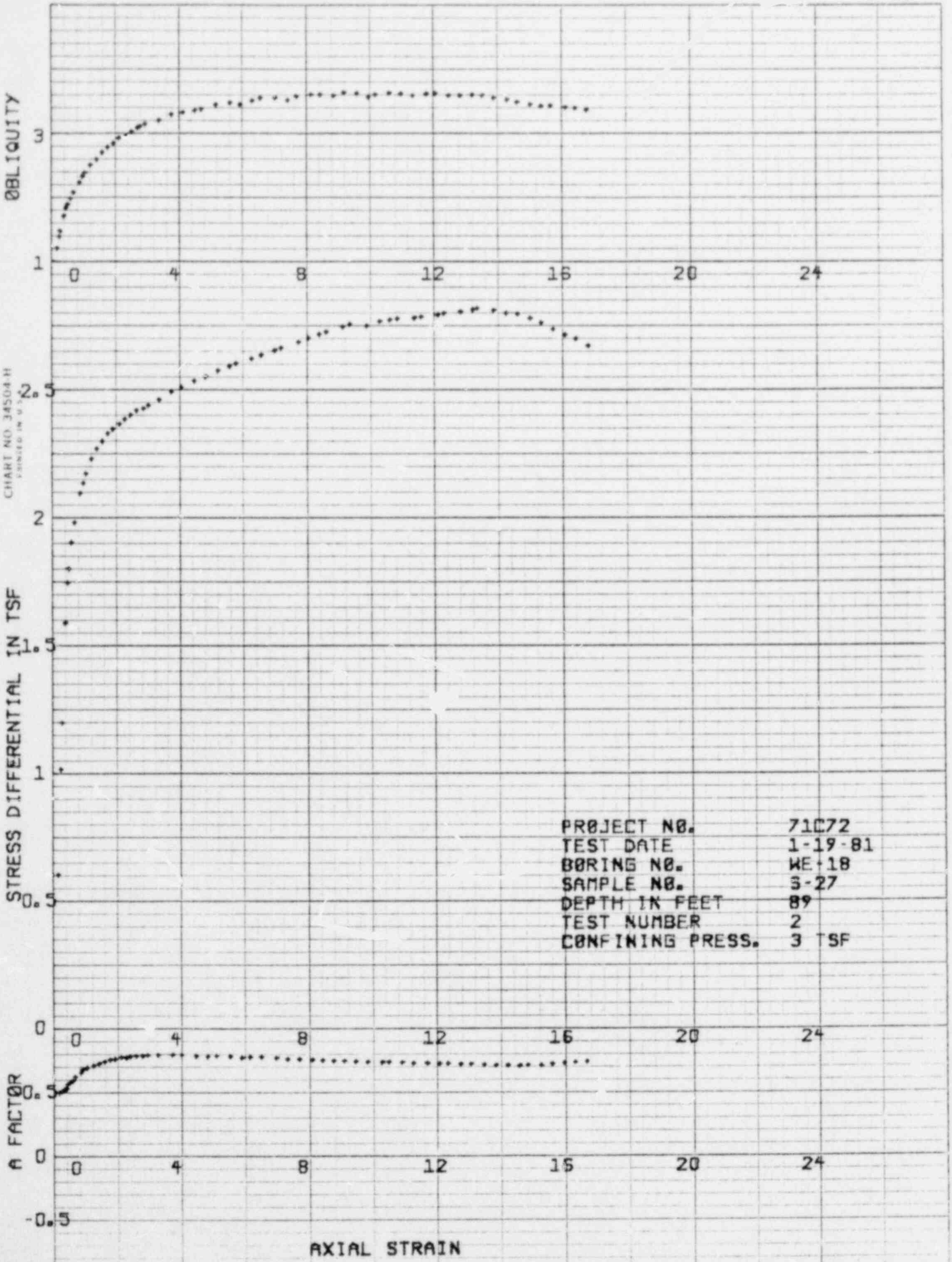
Sample No.	Test No.	Sample Depth Ft.	W_n (%)	γd pcf	$\bar{\sigma}_c$ tsf	$\frac{(\bar{\sigma}_1 - \bar{\sigma}_3)}{2}$ max tsf	$\bar{c}$ tsf	$\bar{\phi}$
WE-18 S-27	1	88.5	42.6	80.4	1.5	1.29		
WE-18 S-27	2	89.0	39.1	83.7	3.0	1.41		
WE-21 ST-6	3	68.8	23.5	97.6	6.0	2.65		

PROJECT NO. 71C72
TEST DATE 2-9-81
BORING NO. WE-18 & WE-21

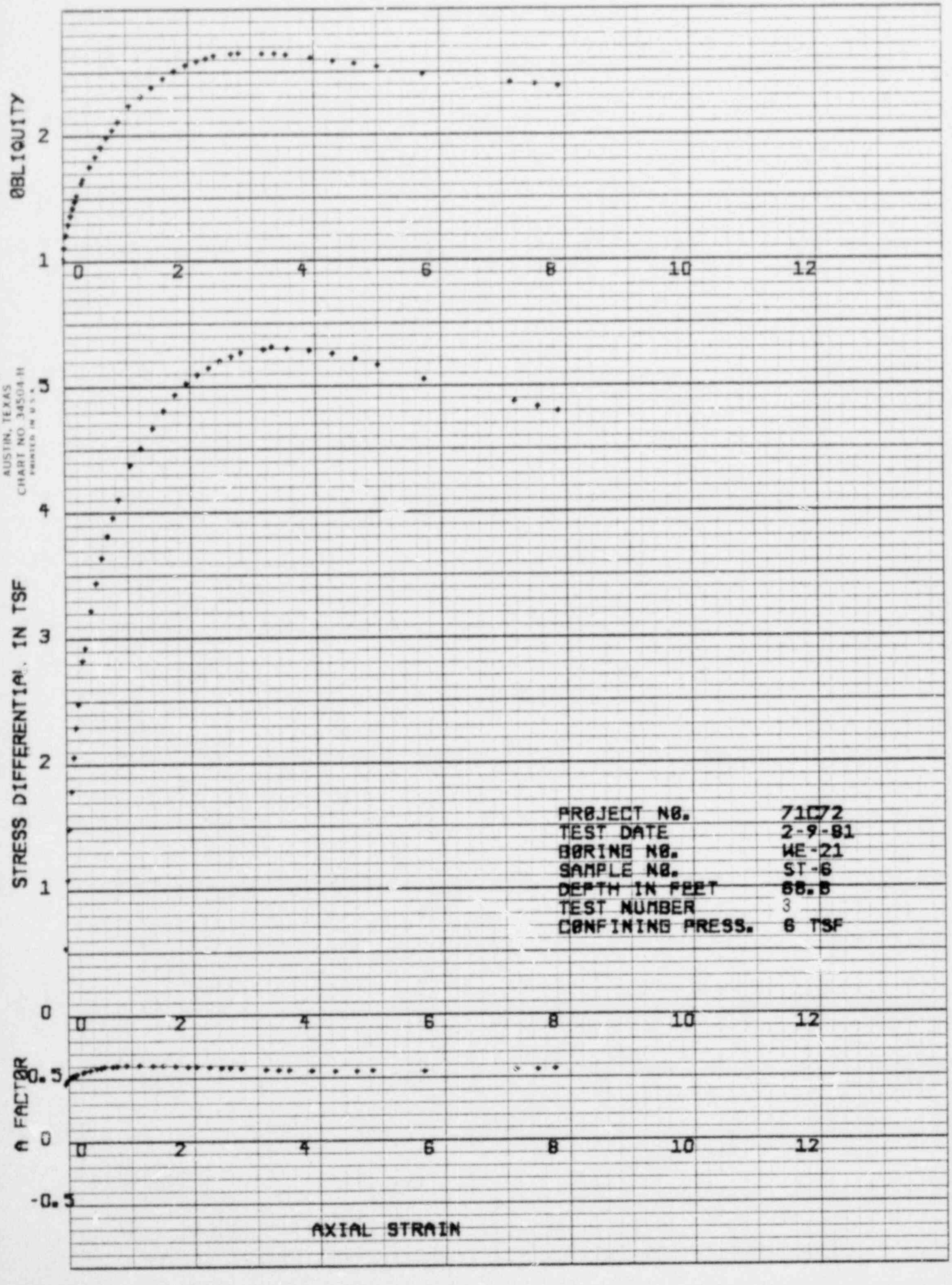


46 0703


OBLIQUITY
3
1
0
4
8
12
16
20
24
STRESS DIFFERENTIAL IN TSF
2.5
2
1.5
1
0.5
0
A FACTOR
0.5
0
-0.5
AXIAL STRAIN
PROJECT NO. 71072
TEST DATE 1-16-81
BORING NO. WE-18
SAMPLE NO. S-27
DEPTH IN FEET 88.5
TEST NUMBER 2
CONFINING PRESS. 1.5 TSF
AUSTIN, TEXAS
CHART NO. 34504-H



ØBLIQUITY
3
1
0
4
8
12
16
20
24
STRESS DIFFERENTIAL IN TSF
2.5
2
1.5
1
0.5
0
A FACTØR
0.5
0
-0.5
15
AXIAL STRAIN
PRØJECT NØ. 71C72
TEST DATE 1-19-81
BØRING NØ. WE-18
SAMPLE NØ. S-27
DEPTH IN FEET 89
TEST NUMBER 2
CØNFINING PRESS. 3 TSF
AUSTIN, TEXAS
CHART NO. 34504-H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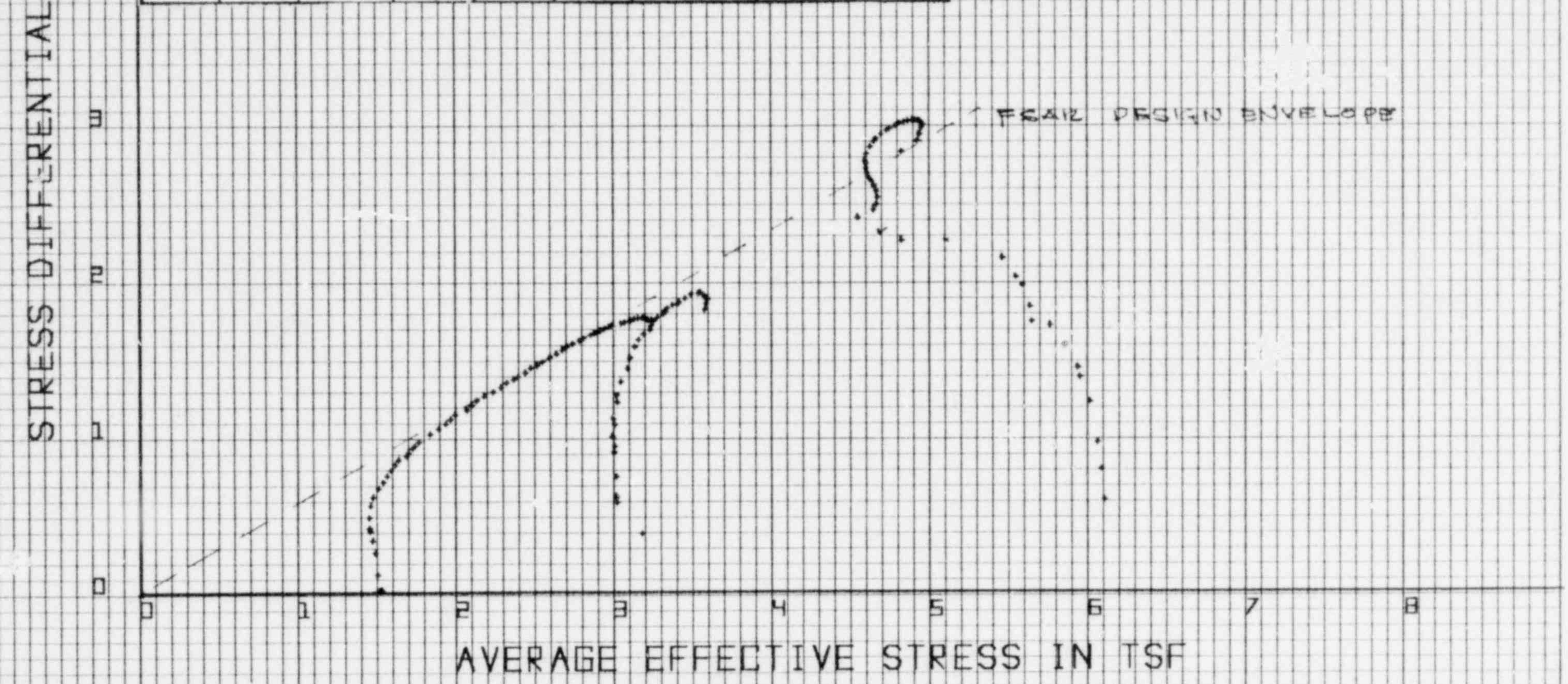
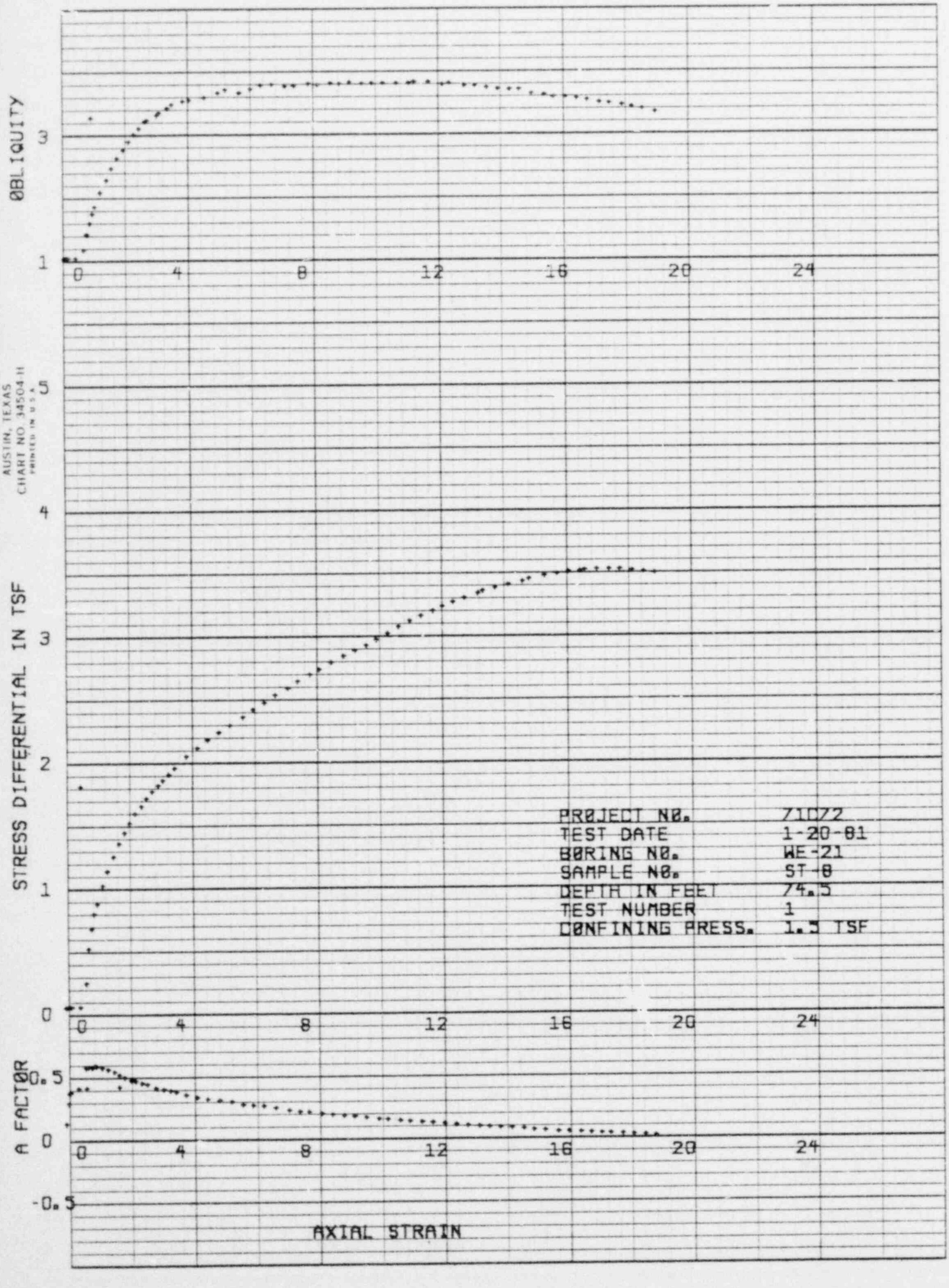
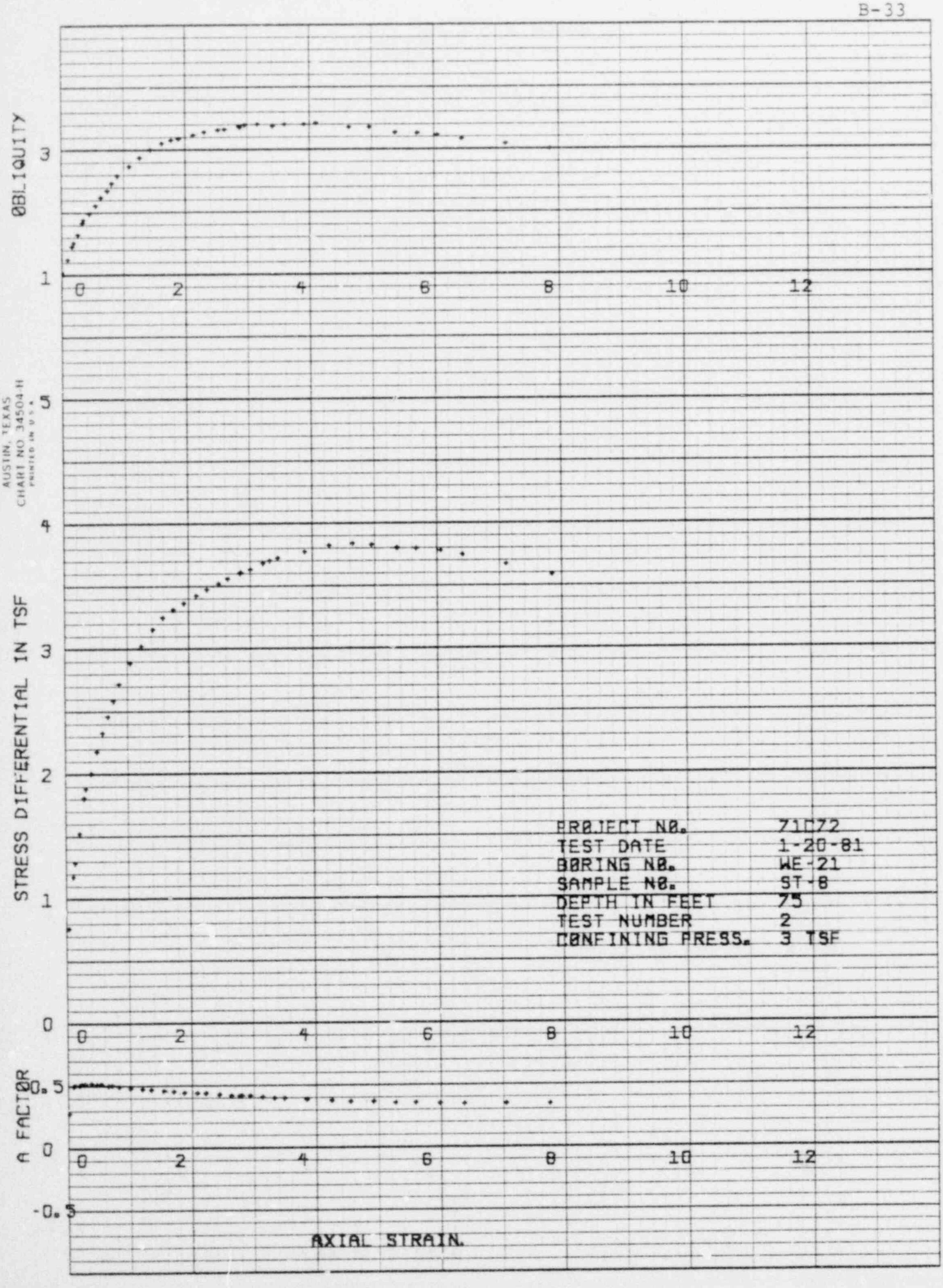
STRESS DIFFERENTIAL, IN TSF
n FACTØR
AXIAL STRAIN
0 2 4 6 8 10 12
AUSTIN, TEXAS
PRØJECT NØ. 71C72
TEST DATE 2-9-81
BØRING NØ. WE-21
SAMPLE NØ. ST-6
DEPTH IN FEET 88.8
TEST NUMBER 3
CØNFINING PRESS. 6 TSF

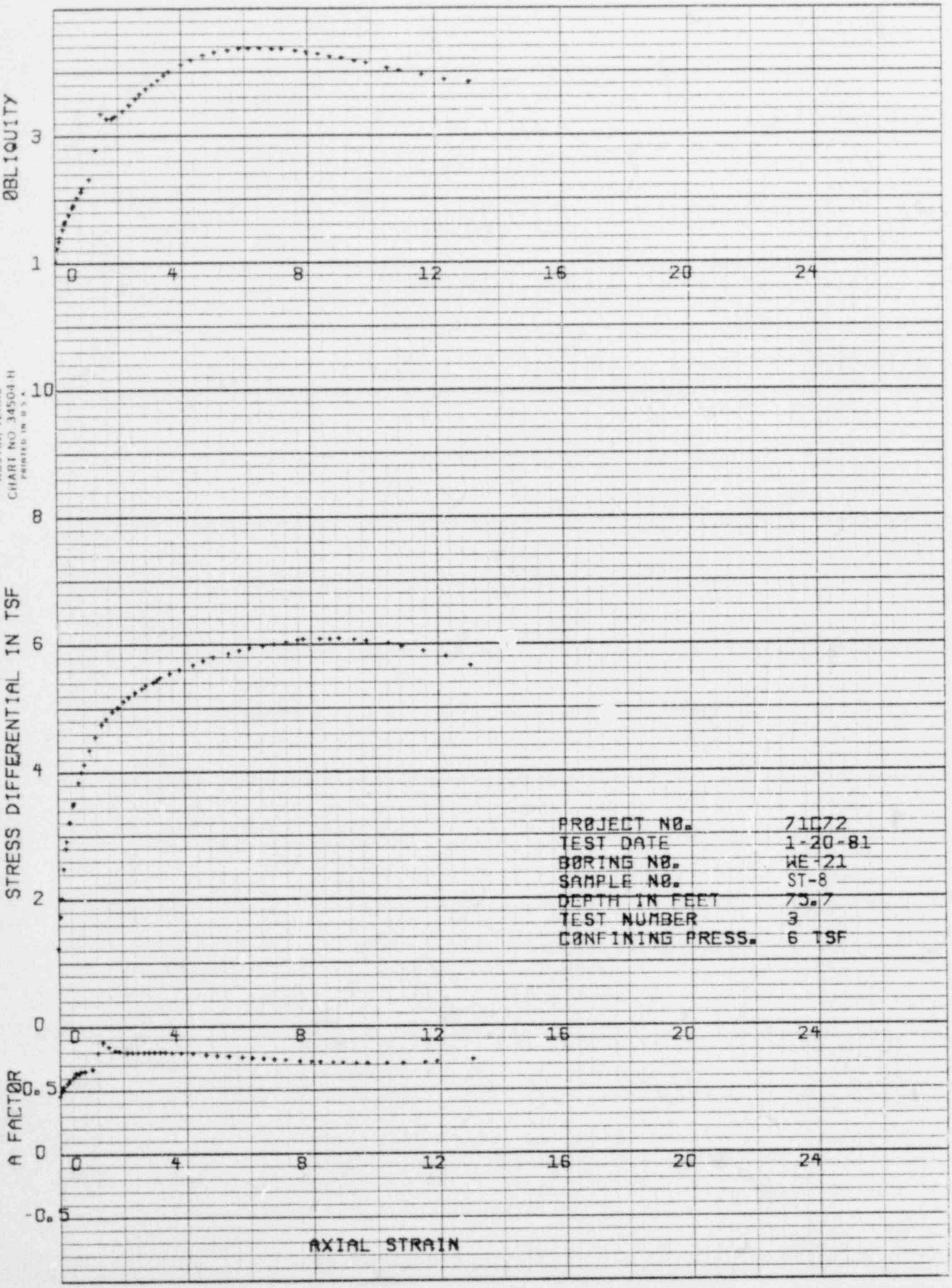
Sample No.	Test No.	Sample Depth Ft.	W_n (%)	γ_d pcf	$\bar{\sigma}_c$ tsf	$\frac{(\bar{\sigma}_1 - \bar{\sigma}_3)}{2}$ max tsf	$\bar{c}$ tsf	$\bar{\phi}$
WE-21 ST-8	1	74.6	20.2	99.4	1.5	1.76		
ST-8	2	75.1	29.4	96.2	3.0	1.93		
ST-8	3	75.6	27.2	93.7	6.0	3.02		

PROJECT NO. 71C72
TEST DATE 1-20-81
BORING NO. WE-21




OBLIQUITY
STRESS DIFFERENTIAL IN TSF
A FACTOR
AXIAL STRAIN
0 4 8 12 16 20 24
1
3
0
1
2
3
4
5
0.5
0
-0.5
PROJECT NO. 71C72
TEST DATE 1-20-81
BORING NO. WE-21
SAMPLE NO. ST-8
DEPTH IN FEET 74.5
TEST NUMBER 1
CONFINING PRESS. 1.5 TSF
AUSTIN, TEXAS
CHART NO. 34504 II


ØBLIQUITY
1
3
0
2
4
6
8
10
12
STRESS DIFFERENTIAL IN TSF
0
1
2
3
4
5
PRØJECT NØ. 71C72
TEST DATE 1-20-81
BØRING NØ. WE-21
SAMPLE NØ. ST-8
DEPTH IN FEET 75
TEST NUMBER 2
CØNFINING PRESS. 3 TSF
A FACTØR
0.5
0
-0.5
AXIAL STRAIN.
AUSTIN, TEXAS
CHART NO 34504-H



ØBLIQUITY
3
1
0
4
8
12
16
20
24
STRESS DIFFERENTIAL IN TSF
10
8
6
4
2
0
PRØJECT NØ. 71072
TEST DATE 1-20-81
BØRING NØ. WE-21
SAMPLE NØ. ST-8
DEPTH IN FEET 73.7
TEST NUMBER 3
CØNFINING PRESS. 6 TSF
A FACTØR
0.5
0
-0.5
AXIAL STRAIN