Geotechnical Update Report and Grading Plan Review
Proposed Stonemark Estates Residential Subdivision
County of San Diego Tract #5479
County of San Diego, California
(A.P.N. 169-200-20)

June 24, 2013

Prepared For:

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Job #06-323-P

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June 24, 2013

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GEOTECHNICAL UPDATE REPORT AND GRADING PLAN REVIEW, PROPOSED STONEMARK ESTATES RESIDENTIAL SUBDIVISION, COUNTY OF SAN DIEGO TRACT #5479, COUNTY OF SAN DIEGO, CALIFORNIA (A.P.N. 169-200-20)

Pursuant to your request, Vinje & Middleton Engineering, Inc. has completed the attached Geotechnical Update Report and Grading Plan Review for the proposed Stonemark Estates residential subdivision at the above-referenced project property.

The following report summarizes the results of our reach and review of previous documents repots, current preliminary grading plans and provides updated or amended conclusions and recommendations for the proposed constructions, as understood. From a geotechnical engineering standpoint, it is our opinion that the project property remains suitable for the proposed residential subdivision with the associated improvements provided the recommendations presented in this report are incorporated into the design and construction of the project.

The conclusions and recommendations provided in this study are consistent with the site indicated geotechnical conditions and are intended to aid in preparation of final development plans and allow more accurate estimates of development costs.

If you have any questions or need clarification, please do not hesitate to contact this office. Reference to our **Job #06-323-P** will help to expedite our response to your inquiries.

We appreciate this opportunity to be of service to you.

VINJE & MIDDLETON ENGINEERING, INC.

S. Mehdi S. Shariat
GE #2885

REGISTERED PROFESSIONAL ENGINEER SEYED M. SAMSAM SHARIAT No. 2885 Exp. 12/31/14 GEOTECHNICAL STATE OF CALIFORNIA

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COUNTY OF SAN DIEGO TRACT #5479
COUNTY OF SAN DIEGO, CALIFORNIA
(A.P.N. 169-200-20)

I. INTRODUCTION

Preliminary Grading Plans for the proposed residential subdivision at the above-referenced property has recently been completed by bHA, Inc. (dated March 26, 2013). A copy of the project grading plans is reproduced herein as Geotechnical Maps and enclosed with this report as Plates 1, 2, and 3. The plans depict the creation of a 19-lot subdivision with interior roadways and associated improvements.

Geotechnical conditions at the project property were previously studied by this office with our findings, conclusions and recommendations summarized in the following published technical reports:

A. "Update Grading Plan Review Report, Proposed Stonemark Estates, Buena Vista Drive, County of San Diego (A.P.N. 169-200-20)", Job #06-323-P, report dated September 22, 2003.

B. "Hard Rock Evaluation, Gambian Property, Proposed Residential Subdivision, Miramar Drive, off Buena Vista Drive, California", Job #03-352-P, report dated September 16, 2003.

C. "Preliminary Geotechnical Investigation, Gamboni Property, LLC, Proposed Subdivision, Miramar Drive, County of San Diego," Job #99-215-P, report dated August 3, 1999.

The referenced reports were reviewed as part of this effort and the Referenced "A" report, which is inclusive of pertinent information from the other reports, is enclosed with this update as an Attachment.

The purpose of this work was to review the referenced reports and provide update conclusions and recommendations that are compatible with the project most recent grading plans (Plates 1, 2, and 3), current codes, and engineering standards. Updated and/or amended recommendations provided in following sections will supplement or supersede those given in the referenced reports, where specifically indicated. Our efforts additionally included a recent site visit by our engineering geologist on June 11, 2013.

II. PROJECT DESCRIPTION

Based on our recent site visit, the project property remains substantially unchanged from those conditions described in the referenced reports (see Attachment). The property consists of a west and south descending ridge terrain. Upper easterly areas of the property are marked by bold hard rock outcrops and continue to support a dwelling and barn structures. More gontle westerly portions of the property are utilized for agriculture. Much of the subject property remains in its natural condition. Topographic conditions and the proposed development are shown on the Geotechnical Map, Plates 1, 2, and 3.

Site drainage flows into a west draining canyon that marks the south margin of the property or onto Buena Vista Drive. No evidence of excessive scouring or erosion was noted.

III. PROPOSED DEVELOPMENT

Current plans depict the development of a 19-lot residential subdivision which is more conservative than the 33-Lot subdivision proposed in 2006. Significant grade alterations will be needed to construct the proposed level building pads and achieve interior roadway surfaces. Vertical cuts and fills will approach 30 feet maximum. New fill and cut slopes are programmed for 2:1 gradients maximum and will range up to 18 feet high for exposed cut slopes and 40 feet high for graded fill slopes. Short retaining walls, less than 5 feet high will be used for ground transitioning along the south margin of interior Street "A" adjacent to Buena Vista Drive.

Drainage basins are incorporated into the project designs for storm water control as shown on the enclosed Plates 1 and 2 (north of Lot 1 and south of Lots18 &19). Proposed basins will discharge treated water into the offsite storm drain facilities or detention basins as shown.

Detailed construction plans are not yet available for review. However, conventional wood-frame buildings with exterior stucco supported on shallow foundations with stem-walls and slab-on-grade floors, or slab-on-ground with turned-down footings are anticipated.

IV. GEOTECHNICAL CONDITIONS

Geotechnical conditions at the project property remain the same as reported in detail in the referenced reports (see Attachment). Easterly portions of the property planned for development consist ridge terrain with large natural slopes that are underlain directly or at shallow depths by hard crystalline bedrock units. Exposed bedrock areas include irregular bodies of very hard rock that include spherical corestones. Westerly limits of the property are underlain by weak, clay-bearing younger sedimentary rock (Santiago Formation) which are known to be associated with slope instability. Consequently, all graded cut embankments exposing the sedimentary rocks will need to be reconstructed as stability fill slopes as outlined in the referenced reports (see Attachment).

Specific details of the site earth deposits, as established by prior field explorations which included test pits, large-diameter borings, and air-track logs are presented in the referenced reports enclosed herein as an Attachment. Approximate test pit, boring and air-track locations are transferred onto the enclosed Plates 1, 2, and 3. Added Geologic Cross-Sections depicting the new proposed grades with respect to subsurface conditions as determined by the exploratory excavations are included herein as Plate 4.

V. ROCK HARDNESS AND EXCAVATION CHARACTERISTICS

Project current Preliminary Grading Plans (Plates 1-3) indicate cut excavations ranging largely up to 20 vertical feet (up 23 feet considering transition undercutting), with Lot 6 ranging to 30 vertical feet (including transition undercut) into the underlying bedrock for achieving the proposed finish pad grades. Crystalline bedrock units (Kgr) beneath the project site include harder units and corestones whose excavations can be difficult and costly. In general, the subsurface data generated from our previous exploratory excavations indicate the presence of weathered rocks that transition into much harder rock with depth. Local corestones and harder units are also present which may require more intense and concentrated ripping utilizing larger dozers (Caterpillar D-9 or equivalent). Some "popping" and limited blasting of these units should be expected to additionally fracture the rocks and allow for faster ripping and easier excavations. Blasting efforts will also increase production levels and improve the quality of the generated materials.

Westerly areas of the site are underlain by weak sedimentary units (Tsa) which will excavate to planned grades with minor efforts. Excavations into the sedimentary rocks will result in poor quality plastic, clay-rich soils which will require added mixing and compactive efforts.

Site crystalline bedrock excavations are expected to generate good quality sandy granular soils. However, corestones and harder units are expected to generate larger rocks debris resulting in handling, disposal, processing and compaction difficulties.

Selective grading techniques should be used to bury the expansive clayey soils and rock-laden soils in the deeper fills a minimum of 4 feet below finish grades and 15 feet away from fill slope surfaces.

The approximate distribution of major earth materials at the project site is depicted on Plates 1-3. More detailed descriptions of the project earth materials are provided in the Attachment.

VI. SEISMIC GROUND MOTION VALUES

For design purposes, site specific seismic ground motion values were determined as part of this investigation in accordance with the California Building Code (CBC). The following parameters are consistent with the indicated project seismic environment and our experience with similar earth deposits in the vicinity of the project site, and may be utilized for project design work:

TABLE 1

(Crystalline bedrock and less than 10 feet of fills under building foundations to be confirmed during grading operations.)

Site Class	S_S	S_1	F_a	F_v	S_{MS}	S_{M1}	S_{DS}	S_{D1}
B	1.071	0.410	1.0	1.0	1.071	0.410	0.714	0.273
According to Chapter 16, Section 1613 of the 2007 California Building Code.								

TABLE 2
(Sedimentary rock or more than 10 feet of fill under building foundations to be confirmed during grading operations.)

Site Class	S_S	S_1	F_a	F_v	S_{MS}	S_{M1}	S_{DS}	S_{D1}
D	1.071	0.410	1.072	1.59	1.148	0.652	0.765	0.435
According to Chapter 16, Section 1613 of the 2007 California Building Code.								

Explanation:

Ss: Mapped MCE, 5% damped, spectral response acceleration parameter at short periods.
S1: Mapped MCE, 5% damped, spectral response acceleration parameter at a period of 1-second.
Fa: Site coefficient for mapped spectral response acceleration at short periods.
Fv: Site coefficient for mapped spectral response acceleration at 1-second period.
SMS: The MCE, 5% damped, spectral response acceleration at short periods adjusted for site class effects (SMS=FaSs).
SM1: The MCE, 5% damped, spectral response acceleration at a period of 1-second adjusted for site class effects (SM1=FvS1).
SDS: Design, 5% damped, spectral response acceleration parameter at short periods (SDS=⅔SMS).
SD1: Design, 5% damped, spectral response acceleration parameter at a period of 1-second (SD1=⅔SM1).

Site peak ground accelerations (PGA) based on 2 percent probability of exceedance in 50 years defined as Maximum Considered Earthquake (MCE) with a statistical return period of 2,475 years is also evaluated herein in accordance with the requirements of CBC Section 1613 and ASCE Standard 7-05. Based on our analysis, the site PGA_{MCE} was estimated to be 0.26g using the web-based United States Geological Survey (USGS) ground motion calculator. The design PGA determined as two-thirds of the Maximum Considered Earthquake (MCE) was estimated to be 0.17g.

VII. CONCLUSIONS AND RECOMMENDATIONS

The current residential development concept shown on Plates 1, 2, and 3 represent a feasible design from a geotechnical viewpoint. The site chiefly remains unchanged from conditions outlined in the referenced reports (Attachment). All conclusions and recommendations provided in the referenced reports remain valid and should be incorporated into the final plans and implemented during the consfruction phase except where specifically amended or superseded below. Additional site specific conclusions and recommendations consistent with the new plans and current codes and standards are also provided herein and should be considered where appropriate and applicable:

1. Landslides or other forms of adverse geologic conditions are not present at the site. However, portions of the property are underlain by weak formational rocks which are often associated with slope instability. Graded cut slopes exposing these deposits should be stabilized as specified. Gross and surficial instability is not expected in the planned new 2:1 maximum gradients graded slopes and embankments at the property provided our recommendations for stability fill slopes and deepened keyways, where needed, are followed.

2. Liquefaction, seismically induced settlements, and soil collapse will not be a factor in the planned development of the project property provided our remedial grading recommendations are followed. Post construction settlement of site fill deposits after oompletion of grading works as specified herein, is not expected to exceod approximately 1-inch and should occur below the heaviest loaded footings. The magnitude of post construction differential settlements of site fill deposits as expressed in terms of angular distortion is not anticipated to exceed ½-inch between similar elements in a 20-foot span.

3. All existing underground waterlines, sewer or leach pipes, storm drains, utilities, tanks, and improvements at the project site should be thoroughly potholed, identified and marked prior to the initiation of the actual grading and earthworks. Specific geotechnical engineering recommendations may be required based on the actual field locations and invert elevations, backfill oonditions and proposed grades in the event of a grading conflict.

   Existing utility lines may need to be temporarily redirected, if necessary, prior to earthwork operations and reinstalled upon completion of earthworks operations. Alternatively, permanent relocations may be appropriate as shown on the approved plans. Abandoned lines, irrigation pipes and conduits should be properly removed, capped or sealed-off to prevent any potential for future water infiltrations into the site fills and graded embankments. Voids created by the removals of the abandoned underground pipes, tanks and structures should be properly backfilled with compacted fills in accordance with the requirements of this report.

4. Remove all existing surface and subsurface improvements, structures, vegetation, trees, roots, stumps, boulder rocks, and all other unsuitable materials and deleterious matter from all areas proposed for new fills, improvements, and structures plus a minimum of 10 feet outside the perimeter, where possible and as approved in the field. All organic debris and unsuitable materials generated from site clearing efforts should be properly removed and disposed of from the site. Trash and vegetation debris shall not be allowed to occur or contaminate new site fills and backfills.

   The prepared grounds should be inspected and approved by the project geotechnical consultant or his designated field representative prior to grading and earthworks.

5. The property is underlain by shallow to modest deposits of existing loose surficial soils. Removal and recompaction of site surficial soils, including all existing fills, topsoil, and upper weathered bedrock units will be required as specified in the referenced report. All excavations, grading, earthworks, construction, and bearing soil preparation should be completed in accordance with Chapter 18 (Soils and Foundations) and Appendix "J" (Grading) of the 2010 California Building Code (CBC), the Standard Specifications for Public Works Construction, County of San Diego Grading Ordinances, the requirements of the governing agencies, and this report where appropriate and as applicable:

6. In general, weathered crystalline bedrock (Kgr) and sedimentary rocks (Tsa) at the property are expected to be excavated with light to relatively moderate efforts. However, local corestones and harder units within the crystalline bedrock units are expected to require more intense and concentrated ripping utilizing larger dozers (Caterpillar D-9 or equivalent). Some "popping" or limited blasting of these units should also be expected for the deeper cut areas to facilitate excavations, increase production levels and improve the quality of the generated materials. Added difficulties can be anticipated when excavating side-hill keyways, benching, trenching and undercutting cut portions of cut-fill transition pads.

   Blasting should be conducted by a qualified contractor with experience in similar projects. Care should be taken when blasting in proximity to proposed cut slopes. Over-blasting can result in unstable conditions and the need for costly slope reconstruction.

7. The cut portion of the cut-fill pads plus 10 feet outside the perimeter where possible and as directed in the field, should be undercut and reconstructed to final design grades with compacted fills as specified in the referenced report.

8. Excavations into project formational rocks (Tsa) will produce clay-bearing soils and will expose weak claystone at finish grades. These materials are expansive and will require special grading methods as well as the use of larger foundations and slab-on-grade floors. Excavations into project weathered bedrock units (Kgr) will generate good quality sandy soils that are non-expansive. Consequently, consideration should be given to selective grading methods which utilize excavated decomposed granitic bedrock soils as a 4-foot thick non-expansive cap soils atop graded pads with expansive soils. The outer 15 feet of graded fills slopes should also consist of very low to non-expansive soils generated from the onsite weathered bedrock excavations.

   Project fills shall be clean deposits free of trash, debris, organic matter and deleterious materials consisting of minus 6-inch particles and include at least 40% finer than #4 sieve materials by weight. Wall and trench backfills should consist of minus 3-inch particles and maintain the specified fines to rock ratio.

   Rocks up to 12 inches in maximum diameter may be allowed in compacted fills provided they are individually placed, surrounded with compacted fills and buried a minimum of 5 feet below the rough finish pad grades. The upper 5 feat in the building pad grades, and 10 feet in the areas of public right-of-way and easements should consist of minus 6-inch materials. Rocks up to 2 feet in maximum diameter may also be buried in deeper fills below 10 feet as directed in the field by the project geotechnical engineer. Rocks larger than 24 inches and less than 48 inches may additionally be allowed for burial in larger fills using the "windrow" techniques, if approved by the project geotechnical engineer. Rocks larger than 4 feet in maximum diameter should be properly disposed of from the site. All rock disposal areas should be shown on the final grading plans. Rock disposal should be completed in substantial accordance with the enclosed Rock Disposal Recommendations, Plates included in the referenced reports (see Attachment)

9. Fill and backfill materials, processing, compaction procedures and requirements, engineering observations and testing protocol, reconstruction of existing fill slopes, toe keyway and slope constructions, and laying back existing over-steepened cut slopes will remain the same as specified in the referenced report

10. Project permanent graded fill and cut slopes are programmed for 2:1 gradients maximum. Graded cut and slopes constructed as recommended herein will be grossly stable with respect to deep seated and surficial failures for the indicated design maximum vertical heights.

All fill slopes shall be provided with a lower keyway. The keyway should maintain a minimum depth of 2 feet into the competent formational or bedrock units with a minimum width of 15 feet, or as directed in the field by the project geotechnical consultant. The keyway should expose firm bedrock throughout with the bottom heeled back a minimum of 2% into the natural hillside and inspected and approved by the project geotechnical engineer. Additional level benches should be made into the competent hillside as the fill slope construction progresses. It is also recommended that all fill slopes be overbuilt and then cut back to the proposed design configuration, or backrolled at a minimum 4 feet vertical increments and "track-walked" at the completion of grading. Field density tests should be performed to confirm a minimum 90% compaction levels within the slope face.

Graded cut slopes exposing hard crystalline bedrock (Kgr) will be grossly stable. However, geologic inspection of the cut excavations within the granitic bedrock units at the time of grading operations, will be necessary to confirm geologic stability.

All graded cut/fill slopes 35 feet or more in maximum vertical height, should be provided with a minimum 6 feet wide drainage terrace to control surface drainage and debris. The specified terrace should be provided at 30 feet vertical intervals except where only one terrace is required, it should be placed at mid-height.

Graded cut slopes exposing weak formational siltstone/claystone deposits (Tsa) should be reconstructed as "stabilization fill" slopes. Project stabilization fill slopes should maintain a minimum width of 20 feet and extend to a minimum depth of 5 to 8 feet below lower pad grade levels unless otherwise directed in the field. The need for stabilization fills at the project site are indicated along the south side of Street "A" from 1+00 to 9+00, and possibly Lots 4 and 5.

Stabilization fills will also require a well-developed backdrain system. The proposed drainage systems should consist of a drain pipe wrapped in filter materials. A minimum 4"-diameter Schedule 40 (or SDR 35) perforated drainpipe surrounded with a minimum of 2 cubic feet, per foot, of ¾-inch crushed rocks wrapped in Mirafi 140N filter fabric, or Caltrans Class 2 filter materials should be used. The filter fabric may be deleted if Caltrans Class 2 is used. The subdrainage system should flow at a minimum 1% gradient, and connected to an approved outlet. Typical design and construction details for the recommended stabilization fill structures are given on Plate 41 of the enclosed Attachment. More detailed or undated designs can be given in the field when actual exposures are available.

11. A subsurface toe drainage system may be considered at the base of project cut slopes which are likely to transmit up-slope water. The subsurface toe drain should consist a minimum of 1½ feet wide by 2 feet deep trench with a 4-inch diameter Schedule 40 (SDR 35) perforated pipe surrounded in ¾-inch crushed rocks and

wrapped in Mirafi 140N filter fabric. Collected water should discharge into an approved outlet. Specific recommendations should be given by the project geotechnical engineer at the time of cut slope inspections based on actual field exposures. Cut slope toe drains, if required in the field by the project geotechnical consultant, should be shown on the final as-build grading plans.

12. Soil design parameters including bearing and lateral earth pressures, will also remain the same as specified in the referenced ieports (see Attachment).

13. Clayey soils are present beneath the westerly areas of the site and should be buried in deeper fills, 4 feet below rough pad grades, or throughly mixed with an abundance of granular non-expansive soils generated from the site excavations to manufacture a very low expansive fill mixture, as specified in the referenced report. Accordingly, final bearing soil mixtures are anticipated to consist chiefly of rocky silty sand to sandy silty gravels (SW/GM) with very low expansion potential (expansion index less than 20) based on ASTM D-4829 classification.

14. Foundations and interior slab designs will remain the same as specified in the referenced reports (see Attachment). However, underslab moisture control should consist of a well-performing vapor barrier/moisture retardant (minimum 15-mil Stego) placed mid-height in a minimum of 4 inches of clean sand (SE of 30 or greater). Alternatively, a 4-inch thick base of compacted ½-inch clean aggregate provided with the vapor barrier (minimum 15-mil Stego) in direct contact with (beneath) the concrete may also be considered provided a concrete mix which can address bleeding, shrinkage and curling is used.

    Horizontal setback requirements from bottom outside edge of foundations located at or very near the top of descending slopes to daylight will remain the same as specified in the referenced report. A minimum of 10 feet horizontal distances to daylight or set back shall be required for more sensitive structures and improvements which cannot tolerate minor movements (including swimming pools and spas or portions thereof) located near the top of project descending slopes.

15. Remedial grading, subgrade preparations and preliminary structural sections for the project paving improvements including exterior concrete flatwork and PCC driveways will remain the same as specified in the referenced reports.

    Concrete flatwork and PCC paving reinforcements lying on subgrade will be ineffective and shortly corrode due to lack of adequate concrete cover. Reinforcing bars should be correctly placed extending through the construction joints tying the slab panels. In construction practices where the reinforcements are discontinued or cut at the construction joints, slab panels should be tied together with minimum 18-inch long #3 dowels (dowel baskets) at 18 inches on centers placed mid-height in the slab (9 inches on either side of the joint).

Provide "tool joint" or "softcut" contraction/control joints for PCC pavings as specified Joints shall intersect free-edges at a 90° angle and shall extend straight for a minimum of 1½ feet from the edge. The minimum angle between any two intersecting joints shall be 80°. Align joints of adjacent panels. Also, align joints in attached curbs with joints in slab panels. Provide adequate curing using approved methods (curing compound maximum coverage rate = 200 sq. ft./gal.).

16. Control of site surface drainage and potential for development of post construction subsurface water caused by surface water infiltrations is one of the most significant geotechnical factors on the future performance of project building sites, improvement surfaces and graded embankments. Surface flow, run-off drainage and subsurface water should not impact graded surface, saturate site fills, backfills, bearing and subgrade soils or cause erosion. Drainage structures and erosion control measurements should be provided at as discussed in the referenced report and shown on the project grading and improvement plans.

VIII. GEOTECHNICAL ENGINEER OF RECORD (GER)

Vinje & Middleton Engineering, Inc. is the geotechnical engineer of record (GER) for providing a specific scope of work or professional service under a contractual agreement unless it is terminated or canceled by either the client or our firm. In the event a new geotechnical consultant or soils engineering firm is hired to provide added engineering services, professional consultations, engineering observations and compaction testing, Vinje & Middleton Engineering, Inc. will no longer be the geotechnical engineer of the record. Project transfer should be completed in accordance with the California Geotechnical Engineering Association (CGEA) Recommended Practice for Transfer of Jobs Between Consultants.

The new geotechnical consultant or soils engineering firm should review all previous geotechnical documents, conduct an independent study, and provide appropriate confirmations, revisions or design modifications to his own satisfaction. The new geotechnical consultant or soils engineering firm should also notify in writing Vinje & Middleton Engineering, Inc. and submit proper notification to the City of Vista for the assumption of responsibility in accordance with the applicable codes and standards (1997 UBC Section 3317.8).

IX. LIMITATIONS

The conclusions and recommendations provided herein have been based on all available data obtained from the review of pertinent geotechnical documents, current site observations, as well as our experience with the soils and bedrock materials located in the general site areas.

Of necessity we must assume a certain degree of continuity between available exploratory excavations and/or natural exposures. It is necessary, therefore, that all observations, conclusions, and recommendations are verified during the grading operation. In the event discrepancies are noted, we should be contacted immediately so that an inspection can be made and additional recommendations issued if required. The recommendations made in this report are applicable to the site at the time this report was prepared. It is the responsibility of the owner/developer to ensure that these recommendations are carried out in the field.

It is almost impossible to predict with certainty the future performance of a property. The future behavior of the site is also dependent on numerous unpredictable variables, such as earthquakes, rainfall, and on-site drainage patterns.

The firm of VINJE & MIDDLETON ENGINEERING, INC., shall not be held responsible for changes to the physical conditions of the property such as addition of fill soils, added cut slopes, or changing drainage patterns which occur without our inspection or control.

The property owner(s) should be aware that the development of cracks in all concrete surfaces such as floor slabs and exterior stucco are associated with normal concrete shrinkage during the curing process. These features depend chiefly upon the condition of concrete and weather conditions at the time of construction and do not reflect detrimental ground movement. Hairline stucco cracks will often develop at window/door corners, and floor surface cracks up to ⅛-inch wide in 20 feet may develop as a result of normal concrete shrinkage (according to the American Concrete Institute).

This report is issued with the understanding that the owner or his representative is responsible for ensuring that the information and recommendations are provided to the project architect/structural engineer so that they can be incorporated into the plans. Necessary steps shall be taken to ensure that the project general contractor and subcontractors carry out such recommendations during construction.

The project geotechnical engineer should be provided the opportunity for a general review of the projects final design plans and specifications in order to ensure that the recommendations provided in this report are properly interpreted and implemented. The project geotechnical engineer should also be provided the opportunity to field verify the foundations prior to placing concrete. If the project soil engineer is not provided the opportunity of making these reviews, he can assume no responsibility for misinterpretation of his recommendations.

This report should be considered valid for a period of one year and is subject to review by our firm following that time. In case of plan revisions including changes in the final pad size, graded embankments, actual building and improvement locations, lines and grades, and final elevations, this report should be reviewed and updated by this office for review comments and additional recommendations based on the plan changes, as appropriate.

We appreciate this opportunity to be of service to you. If you have any questions or need clarification, please do not hesitate to contact the undersigned. Reference to our **Job #06-323-F** will help to expedite our response to your inquiries.

VINJE & MIDDLETON ENGINEERING, INC.

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Steven J. Melzer
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Attachment

Distribution: Addressee (e-mail)
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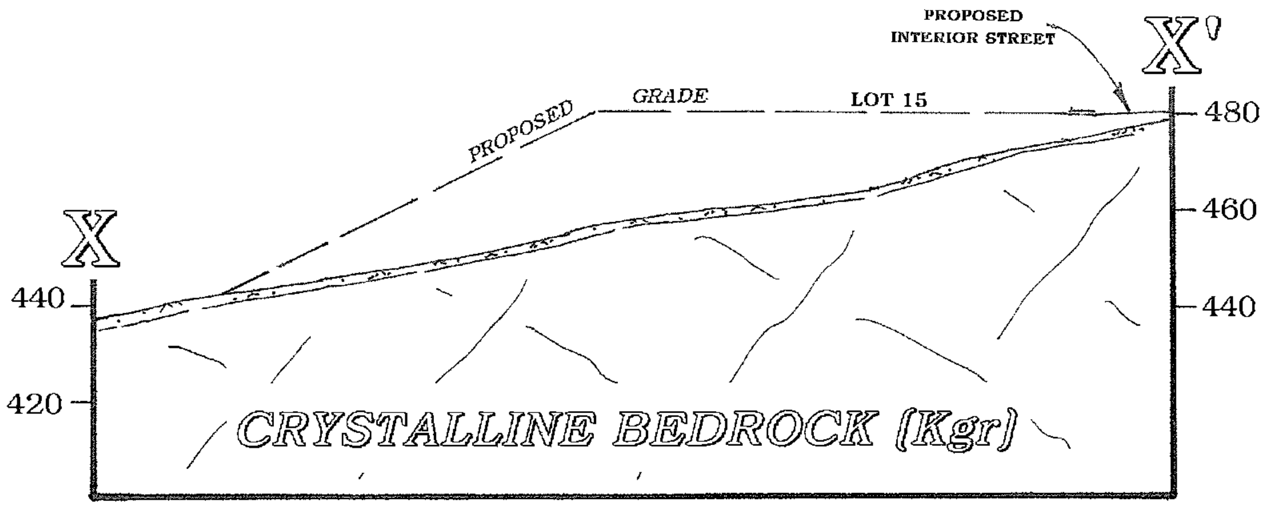
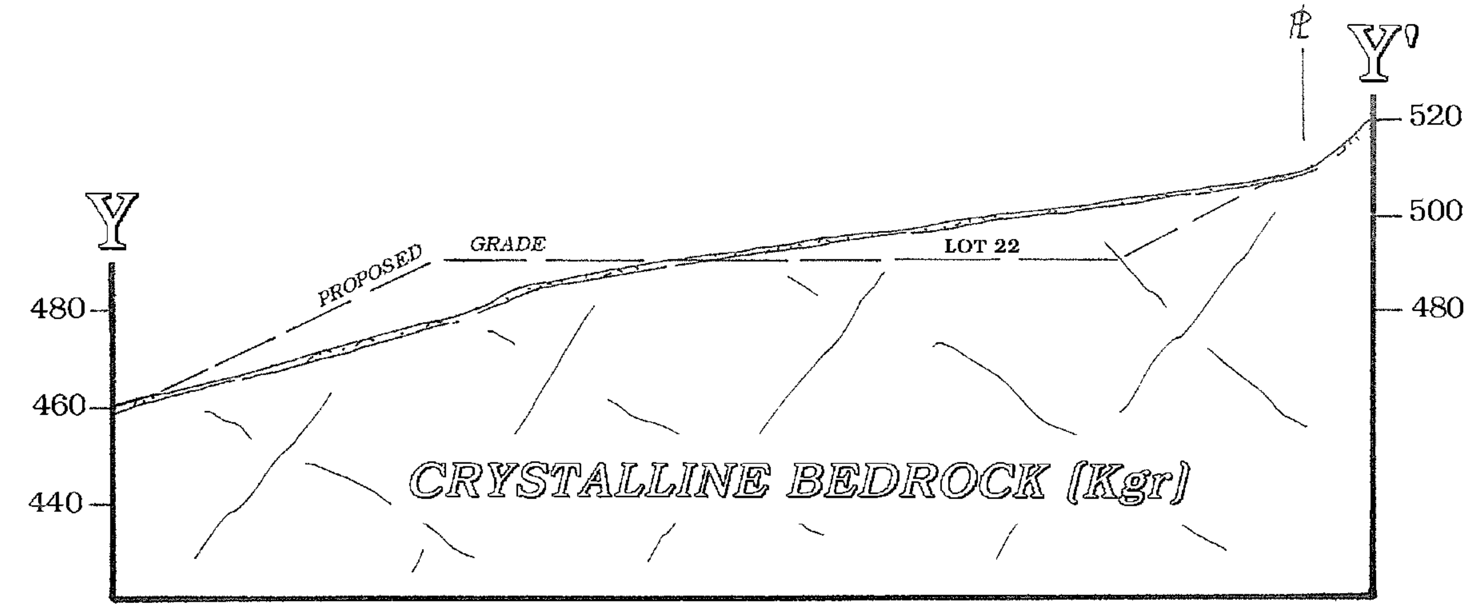
GEOLOGIC CROSS-SECTIONS

SCALE: 1" = 40'





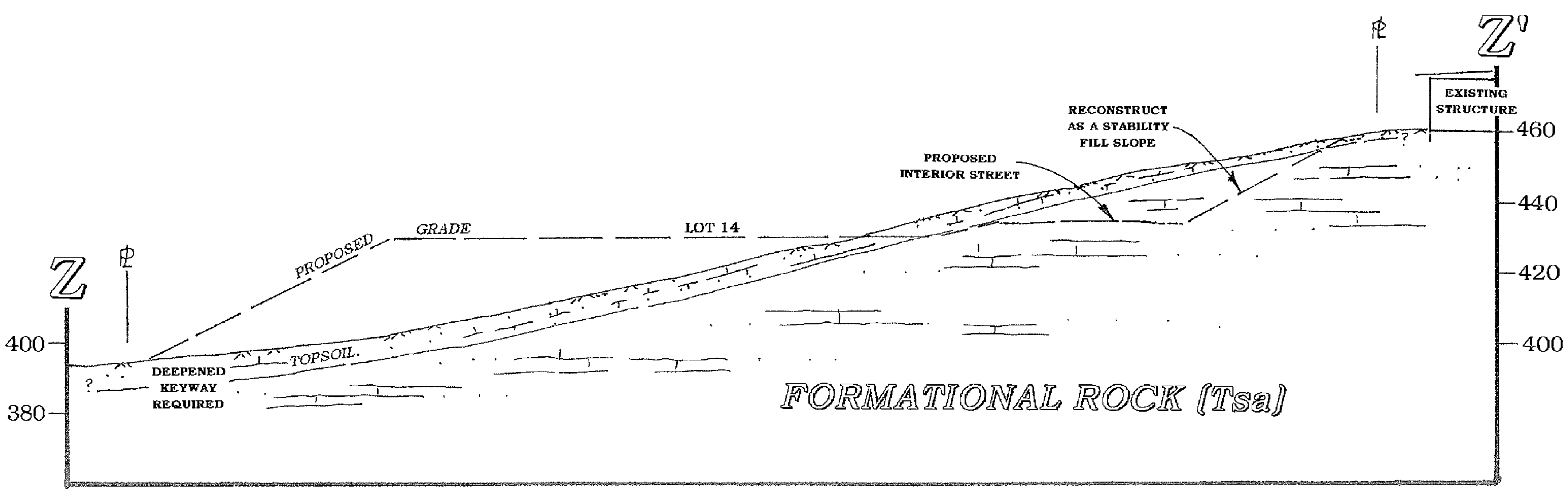


PLATE 4
V&M JOB #06-323-P

ATTACHMENT

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September 22, 2006

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UPDATE GRADING PLAN REVIEW REPORT, PROPOSED STONEMARK ESTATES, BUENA VISTA DRIVE, COUNTY OF SAN DIEGO (APN 169-200-20)

Pursuant to your request, Vinje and Middleton Engineering, Inc., has completed the enclosed Update Grading Plan Review Report for the above-referenced project site.

The following report summarizes the results of our research and review of previous pertinent geotechnical reports and maps, current field inspections, additional subsurface exploratory excavations, field sampling, laboratory testing, engineering analyses and provides update conclusions and recommendations for the proposed development as understood. From a geotechnical engineering standpoint, it is our opinion that the site is suitable for the proposed 33-lot residential subdivision with the associated paving and underground utility improvements provided the recommendations presented in this report are incorporated into the design and construction of the project.

The conclusions and recommendations provided in this study are consistent with the indicated site geotechnical conditions and are intended to aid in preparation of final development plans and allow more accurate estimates of development costs.

If you have any questions or need clarification, please do not hesitate to contact this office. Reference to our **Job #06-323-P** will help to expedite our response to your inquiries.

We appreciate this opportunity to be of service to you.

VINJE & MIDDLETON ENGINEERING, INC.

Dennis Middleton
CEG #980

DM/jt

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STATE OF CALIFORNIA

Update Grading Plan Review Report
Proposed Stonemark Estates
Buena Vista Drive
County of San Diego

(APN 169-200-20)

September 22, 2006

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Job #06-323-P

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BUENA VISTA DRIVE
COUNTY OF SAN DIEGO
(APN 169-200-20)

I. INTRODUCTION

Stonemark Estates is a proposed 33-Lot residential subdivision located in San Diego County, near the City of Vista. The planned project is depicted on a Site Plan enclosed with this report as Plate 1. A Vicinity Map showning the actual location is included on Plate 1. Tentative Subdivision Maps which detail grading of the project have been completed by bHA Engineering, Inc., and have been submitted to this office for review. Copies of the 3 Maps are included with this report as Plates 2-4. As shown, cut-fill grading is planned for the creation of level residential lots and internal roadways.

The project property was previously studied by this office as part of a larger development. Reference is made to the resulting technical reports:

1) "Preliminary Geotechnical Investigation, Gamboni Property, LLC, Proposed Subdivision, Miramar Drive, County of San Diego", report dated August 3, 1999, (Job #99-215-P).

2) "Hard Rock Evaluation, Gambian Property, Proposed Residential Subdivision, Miramar Drive, off Buena Vista Drive, California", report dated September 16, 2003, (Job# 03-352-P).

The referenced reports are on file with our firm and copies can be obtained upon request. Pertinent data resulting from the above-referenced studies have been incorporated in this work and were utilized in the development of recommendations presented herein. The previous work incorporated the excavation of 9 test trenches and 18 air-track drill holes as part of a hard rock evaluation. Two large-diameter borings were also entered and down-hole logged in areas of potential slope instability. Recent work at this site included the excavation of 10 additional test trenches in selected areas now planned for grading. All of the excavations were logged by our project geologist, who also retained representative soil samples for laboratory testing.

Test trenches and drill hole locations are depicted on the enclosed Plates 2-4. Test Trench Logs and Boring Logs of all excavations are enclosed herein as Plates 5-34. Laboratory test data associated with all site work is summarized in a following section herein.

II. PROPOSED DEVELOPMENT

Significant grade changes are planned for the creation of level building pads for the support of future residential dwellings and interior streets as shown on Plates 1-4. In general, cutting of higher ridge terrain and filling over lower areas is proposed as shown.

Cuts and fills approaching 30 and 35 feet respectively, are proposed. New graded slopes constructed in conjunction with site development will be programmed for 2:1 (horizontal to vertical) gradients maximum. Vertical slope heights will approach 30 feet for cuts and more than 45 feet for new fills.

Future residential construction is anticipated to consist of conventional wood-frame with exterior stucco structures supported on shallow foundations with stem-walls and slab-on-grade floors, or slab-on-ground with turned-down footings.

III. SITE DESCRIPTION

The project site is dominated by natural east-west trending ridge terrain, and a west-draining canyon that marks the south margin. Upper ridge areas support a dwelling and associated barn buildings and are marked by bold outcrops of hard bedrock units. Natural terrain descends gently to the west onto Buena Vista Drive, and to the south into canyon areas. Gentle natural areas also ascend from the canyon onto an off-site residential tract along the south property line. Much of the site is in its natural condition and supports a sparse cover of native grasses. The westernmost leg of the property is presently used for agricultural purposes.

Site drainage generally sheetflows into the existing canyon or onte Buena Vista Drive to the west. No evidence of significant erosion or scouring is noted.

IV. GEOTECHNICAL CONDITIONS

Geotechnical conditions at the project site remain the same as previously reported in the referenced reports. Grading procedures at the property will be dictated by the nature of underlying earth materials. These are dominated by very hard bedrock units and softer sedimentary rocks that often associate with slope instability. The following conditions are apparent:

A. Earth Materials

Much of the study site exposes granitic bedrock units (Kgr) that are rooted in the southern California batholith. These rocks are typically dense, massive units which occur in a weathered and friable condition near the surface and grade rapidly to a hard condition with depth. The bedrock also includes harder, spherical bodies of rock which occur within the bedrock, chiefly in ridge terrain in the north portion. Surface exposures of these corestone units occur in steeper hillside terrain below Lots 19-21 and 27-30 as well as beneath Lots 12 and 25.

Portions of the property beneath the west and south margins are underlain by younger formational rocks (Ts). These units include sedimentary sandstone and siltstone/claystone rocks that are characterized by their distinctive green color. Claystone units, which typically occur in a weak (low shear strength) condition, predominate in the upper section along the south property line. The claystone grades downward into more competent sandstone at depth.

Bedrock and younger formational rocks at the project site are mantled by a thin topsoil cover which thickened to alluvial soils (Qal) within site canyon terrain. Fine sandy soils predominate over much of the property. More expansive clay/rich soils characterize the soil cover over site formational (Ts) rocks.

The approximate distribution of major earth materials at the project site is depicted on Plates 2-4. Details of project earth materials are given on the enclosed Test Trench Logs and Boring Logs, Plates 5-16. The indicated subsurface distribution of major rock types is depicted on Geologic Cross-Sections enclosed with this report as Plates 35-37.

B. Geologic Structure - Slope Stability

Project sedimentary rocks are flat-lying units as expressed by poorly developed bedding surfaces chiefly along sandstone/claystone contacts. Structural features noted in project bedrock are typically steeply dipping joint and shear surfaces that diminish with depth. Project structural features do not characteristically influence overall slope stability.

However, sedimentary formational rocks at the property include distinctive claystone units that are most characterized by their frequent association with slope instability. Existing landslide conditions are not indicated on the property. However, a destructive landslide has impacted an adjacent property above Lots 31 and 32 along the south margin of the project site. The slide expressed active failures during the heavy winter rains of 2005 but may have experienced minor movement in the early 1990's. The damaged adjacent property is a large graded fill section that was placed atop claystone units similar to those beneath Lots 30-32. Consequently, project grading within site formational rocks (Ts) should include added effort to create safe and stable surfaces.

The adjacent slide was studied by Geotek, Inc., and repair recommendations were given in a written technical report entitled "Limited Slope Stability Evaluation, Kronebush Residence, 2069 Oak Glen Drive, Vista, California," dated August 8, 2005. The report was reviewed by the undersigned in connection with this work. We understand that the slide repairs above Lots 30-32 as recommended in the Geotek Inc. report are not yet completed.

C. Rock Hardness

Sedimentary units (Ts) at the project site will excavate to desired depths with little difficulty. Remaining bedrock (Kgr) materials are hard rocks which will require blasting procedures to achieve planned surface grades. Much of the bedrock will successfully excavate with moderate to heavy ripping measures utilizing conventional equipment (Caterpillar D-9 or equivalent). However, the need for blasting is indicated chiefly for the excavation of very hard corestone units which crop out in surface exposures and occur at depth below Lots 12, 13, 16 and 27-30. Large corestones are also indicated near the surface below the planned Park Hill Road in the vicinity of Lots 11 and 25. In these areas, blasting can be utilized to fracture the corestones and facilitate their excavation. The blasting will also serve to increase production levels within the surrounding country rock and improve the quality of generated fill soil by reducing the amount of generated rock. Details of hard rock conditions at depth beneath the project site are given on Air Track Drill Data as Plates 17-34.

D. Groundwater

Subsurface water was encountered beneath the project site only in the southeast corner in the vicinity of Lot 31 (see logs for T-108 and B-1 excavations). The water represents natural groundwater confined to fractured claystone units atop more dense units at depth. Development procedures for Lots 31-33 should include subdrain systems along the south margin that will protect the lots from adverse upslope groundwater. Drain recommendations are provided in a following section of this report.

Elsewhere at the project site, granitic bedrock units can transmit upslope irrigation waters along fracture surfaces in graded cut slopes. Subsurface drains located along the toe of impacted slopes can protect sensitive structures constructed near the slopes. However, the need for such drains can only be determined after development based upon unknown fracture patterns and the irrigation practices of upslope property owners.

The proper control of storm waters and site surface drainage is a critical component to overall stability of the graded building pads. Surface water should not pond upon graded surfaces, and irrigation water should not be excessive. Over-watering of site vegetation may also create perched water and the creation of excessively moist areas at finished lot surfaces. Development of the property should include improved site drainage and construction of engineered surface drainage and storm run-off control facilities.

E. Faults / Seismicity

Faults or significant shear zones are not indicated crossing or in near proximity to the project site.

As with most areas of California, the San Diego region lies within a seismically active zone; however, coastal areas of the county are characterized by low levels of seismic activity relative to inland areas to the east. During a 40-year period (1934-1974), 37 earthquakes were recorded in San Diego coastal areas by the California Institute of Technology. None of the recorded events exceeded a Richter magnitude of 3.7, nor did any of the earthquakes generate more than modest ground shaking or significant damages. Most of the recorded events occurred along various offshore faults which characteristically generate modest earthquakes.

Historically, the most significant earthquake events which affect local areas originate along well known, distant fault zones to the east and the Coronado Bank Fault to the west. Based upon available seismic data, compiled from California Earthquake Catalogs, the most significant historical event in the area of the study site occurred in 1800 at an estimated distance of 12 miles from the project area. This event, which is thought to have occurred along an off-shore fault, reached an estimated magnitude of 6.5 with estimated bedrock acceleration values of 0.154g at the project site. The following list represents the most significant faults which commonly impact the region. Estimated ground acceleration data compiled from Digitized California Faults (Computer Program EQFAULT VERSION 2:01) typically associated with the fault is also tabulated:

TABLE 1

Fault Zone	Distance From Site	Maximum Probable Acceleration (R.H.)
Newport-Inglewood	14 miles	0.066 g
Elsinore	20 miles	0.069 g
Coronado Bank	26 miles	0.076 g
San Jacinto	43 miles	0.045 g

The location of significant faults and earthquake events relative to the study site are depicted on a Fault - Epicenter Map enclosed with this report as Plate 38.

More recently, the number of seismic events which affect the region appears to have heightened somewhat. Nearly 40 earthquakes of magnitude 3.5 or higher have been recorded in coastal regions between January 1984 and August 1986. Most of the earthquakes are thought to have boen generated along offshore faults. For the most part, the recorded events remain moderate shocks which typically resulted in low levels of ground shaking to local areas. A notable exception to this pattern was recorded on July 13, 1986. An earthquake of magnitude 5.3 shook County coastal areas with moderate to locally heavy ground shaking resulting in $700,000 in damages, one death, and injuries to 30 people. The quake occurred along an offshore fault located nearly 30 miles southwest of Oceanside.

A series of notable events shook County areas with a (maximum) magnitude 7.4 shock in the early morning of June 28, 1992. These quakes originated along related segments of the San Andreas Fault approximately 90 miles to the north. Locally high levels of ground shaking over an extended period of time resulted; however, significant damages to local structures were not reported. The increase in earthquake frequency in the region remains a subject of speculation among geologists; however, based upon empirical information and the recorded seismic history of county areas, the 1986 and 1992 events are thought to represent the highest levels of ground shaking which can be expected at the study site as a result of seismic activity.

In recent years, the Rose Canyon Fault has received added attention from geologists. The fault is a significant structural foature in metropolitan San Diego which includes a series of parallel breaks trending southward from La Jolla Cove through San Diego Bay toward the Mexican border. Recent trenching along the fault in Rose Canyon indicated that at that location the fault was last active 6,000 to 9,000 years ago. Thus, the fault is classified as "active" by the State of California which defines faults that evidence displacement in the previous 11,000 years as active.

For design purposes, seismic parameters were re-evaluated to conform to present site specific conditions in accordance with the California Buildihg Code. The following parameters are consistent with the indicated project seismic environment, and our experience with similar earth deposits in the vicinity of the project site may be utilized for project design work:

TABLE 2

(crystalline bedrock, and less than 10 feet of fills under building foundations, Lots 8-16, 23, 25, and 26, to be confirmed during grading operations.)

Site Soil Profile Type	Seismic Zone	Seismic Zone Factor	Seismic Source Type	Seismic Response Coefficients					
				Na	Nv	Ca	Cv	Ts	To
SB	4	0.4	B	1.0	1.0	0.40	0.40	0.400	0.080
According to Chapter 16, Divisions IV & V of the 2001 California Building Code.									

TABLE 3

(sedimentary rock, or more than 10 feet of fills under building foundations, remaining Lots to be confirmed during grading operations.)

Site Soil Profile Type	Seismic Zone	Seismic Zone Factor	Seismic Source Type	Seismic Response Coefficients					
				Na	Nv	Ca	Cv	Ts	To
SD	4	0.4	B	1.0	1.0	0.44	0.64	0.582	0.116
According to Chapter 16, Divisions IV & V of the 2001 California Building Code.									

A site specific probabilistic estimation of peak ground acceleration was also performed using the FRISKSP (T. Blake, 2000) computer program. Based upon Boore et al (1997) attenuation relationship, a 10 percent probability of exceedance in 50-years was estimated to produce a site specific peak ground acceleration of 0.20g and 0.30g (Design-Basis Earthquake, DBE) for building pads with less than 10 feet of fill and building pads with greater than 10 feet of fill, respectively. The results were obtained from the corresponding probability of exceedance versus acceleration curve.

F. Laboratory Testing / Results

Earth deposits encountered in our test trenches were closely examined and sampled for laboratory teating to determine their ability to support the planned structures and improvements. Based upon our test data and field exposures site soils have been grouped into the following major soil types:

TABLE 4

Soil Type	Description
1	dark brown silty sand (topsoil/alluvium)
2	red to dark brown clayey silty sand to sandy silty clay (topsoil/alluvium)
3	light brown to tan-gray sandy silt (alluvium)
4	brown to olive silty coarse sand, decomposed granitic (bedrock)
5	red-brown clayey sand (alluvium)
6	pale green to olive fine to coarse sand (sandstone formational rock)
7	pale green silty clay to clayey silt (siltstone/claystone formational rock)
8	tan to gray sandy clayey silt to silty sandy clay (alluvium)

Added laboratory tests were conducted on representative surface soil samples recently collected at the site and are supplemented with test results obtained from testing performed during our original study. The following tests were conducted in support of this investigation:

1. **Maximum Dry Density and Optimum Moisture Content:** The maximum dry density and optimum moisture content of Soil Types 1-8, were determined in accordance with ASTM D-1557-91. The test results are presented in Table 5.

TABLE 5

Location	Soil Type	Maximum Dry Density (Ym-pcf)	Optimum Moisture Content (ωopt-%)
T-2 @ 3'	4	125.7	11.0
T-4 @ 5½'	1	123.4	11.0
T-6 @ 6'	5	129.3	9.1
T-7 @ 4'	3	130.2	8.5
T-8 @ 10'	8	127.2	10.2
T-10 @ 4'	6	121.0	13.1

TABLE 5 (continued)

T-19 @ 4'	7	110.0	19.5
T-25 @ 5'	2	119.3	14.9
T-105 @ 1'	8	119.0	15.3

2. **Moisture-Density Tests**: In-place dry density and moisture contents of representative soil deposits beneath the site were determined from relatively undisturbed chunk samples using the water displacement method. The test results are presented in Table 6 and tabulated on the enclosed Test Trench Logs.

TABLE 6

Sample Location	Soil Type	Field Moisture Content (ω-%)	Field Dry Density (Yd-pcf)	Max. Dry Density (Ym-pcf)	Ratio Of In-Place Dry Density To Max. Dry Density* (Yd/Ym × 100)
T-1 @ 3'	5	11.5	112.1	129.3	86.6
T-3 @ 4'	5	11.5	113.8	129.3	88.0
T-4 @ 2'	1	7.2	123.3	123.4	99.9
T-4 @ 4'	1	8.0	128.9	123.4	100+
T-5 @ 2½'	2	14.9	105.2	119.3	88.2
T-5 @ 3½'	4	4.9	137.7	125.7	100+
T-6 @ 4'	1	7.1	111.7	123.4	90.5
T-6 @ 6'	5	10.2	119.0	129.3	92.0
T-7 @ 4'	3	4.1	105.6	130.2	81.1
T-7 @ 8'	5	6.8	117.7	129.3	91.0
T-7 @ 11'	5	9.1	103.0	129.3	79.6
T-8 @ 4'	8	4.2	108.8	127.2	85.5
T-8 @ 6'	8	7.7	122.7	127.2	96.5
T-8 @ 10'	8	9.0	120.0	127.2	94.3
T-9 @ 2½'	1	17.1	108.1	123.4	87.6

TABLE 6 (continued)

T-10 @ 4'	6	10.3	127.1	121.0	100+
T-11 @ 4'	2	6.3	120.3	119.3	100+
T-18 @ 5'	4	4.2	140.3	125.7	100+
T-20 @ 7'	2	9.0	121.7	119.3	96.8
B-1 @ 9'	7	22.2	97.2	110.0	88.4
B-3 @ 8'	6	14.0	119.4	121.0	98.7
B-4 @ 8'	4	13.7	111.7	125.7	88.9
T-101 @ 2'	2	19.6	93.9	119.3	78.7
T-101 @ 4'	2	21.9	95.2	119.3	79.8
T-101@ 8'	7	23.6	85.7	110.0	77.9
T-103 @ 4'	2	19.4	100.2	119.3	83.9
T-103 @ 9'	7	16.8	109.0	110.0	99.1
T-104 @ 6'	6	3.6	123.8	121.0	100+
T-104 @ 9'	6	6.4	131.9	121.0	100+
T-107 @ 3'	2	23.4	91.5	119.3	76.7
T-107 @ 5'	2	19.6	103.8	119.3	87.0
T-110 @ 6'	6	9.1	128.3	121.0	100+

*Designated as relative compaction for structural fills.
Minimum required relative compaction for structural fill is 90%, unless otherwise specified.

3. **Direct Shear Test:** Direct shear tests were performed on representative samples of Soil Types 2, 4, 6, and 7. The prepared specimens were soaked overnight, loaded with normal loads of 1, 2, and 4 kips per square foot respectively, and sheared to failure in an undrained condition. The test results are presented in Table 7.

TABLE 7

Sample Location	Soil Type	Sample Condition	Wet Density (Yw-pcf)	Angle of Int. Fric. (Φ-Deg.)	Apparent Cohesion (c-psf)
T-10 @ 4'	6	remolded	121.9	23	312
T-19 @ 4'	7	remolded	116.8	26	146
T-25 @ 5'	2	remolded	122.6	28	625
B-1 @ 9'	7	in-place	117.2	31	292
T-101 @ 8'	7	remolded	120.0	17	328
T-102 @ 3'	4	remolded	129.8	31	136

4. **<u>Expansion Index Test</u>:** Expansion index tests were performed on representative samples of Soil Types 2, 4, 7, 8, in accordance with the Uniform Building Code Standard 18-2. The test results are presented in Table 8.

TABLE 8

Sample Location	Soil Type	Remolded ω (%)	Saturation (%)	Saturated ω (%)	Expansion Index (EI)	Expansion Potential
T-19 @ 4'	7	14.6	50.9	31.0	66	medium
T-25 @ 5'	2	12.1	50.0	30.9	141	very high
T-102 @ 3'	4	11.1	49.8	21.3	13	very low
T-105 @ 1'	8	12.6	50.3	28.9	83	medium
ω = moisture content in percent.						

5. **<u>Liquid Limit, Plastic Limit and Plasticity Index</u>:** Liquid limit, plastic limit and plasticity index tests were performed on representative samples of Soil Types 2, 7, 8, in accordance with ASTM D-4318. The test result are presented in Table 9.

TABLE 9

Location	Soil Type	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (PI)
T-25 @ 5'	2	39	12	27
T-103 @ 9'	7	35	20	15
T-105 @ 1'	8	43	17	26

6. **Grain Size Analysis:** Grain size analyses were performed on representative samples of Soil Types 2, 4, 8. The test results are presented in Table 10.

TABLE 10

Sieve Size		½"	#4	#10	#20	#40	#200
Location	**Soil Type**	**Percent Passing**					
T-101 @ 2'	2	100	100	100	99	94	76
T-102 @ 3'	4	100	100	88	61	42	14
T-105 @ 1'	8	100	100	97	86	78	58

7. **pH and Resistivity Test:** pH and resistivity of representative samples of Soil Types 2 and 8 were determined using "Method for Estimating the Service Life of Steel Culverts," in accordance with the California Test Method (CTM) 643. The test results are presented in Table 11.

TABLE 11

Sample Location	Soil Type	Minimum Resistivity (OHM-CM)	pH
T-101 @ 2'	2	560	6.1
T-105 @ 1'	8	1120	5.9

8. **Sulfate Test:** Sulfate tests were performed on representative samples of Soil Types 2 and 8 in accordance with the California Test Method (CTM) 417. The test results are presented in Table 12.

TABLE 12

Sample Location	Soil Type	Amount of Water Soluble Sulfate (SO_4) In Soil (% by Weight)
T-102 @ 2'	2	0.020
T-105 @ 1'	8	0.001

9. **Chloride Test:** Chloride tests were performed on representative samples of Soil Types 2 and 8 in accordance with the California Test Method (CTM) 422. The test results are presented in Table 13.

TABLE 13

Sample Location	Soil Type	Amount of Water Soluble Chloride In Soil (% by Weight)
T-101 @ 2'	2	0.014
T-105 @ 1'	8	0.005

10. **Consolidation Test:** Two consolidation tests were performed on representative remolded samples of on-site Soils Type 7, and on an undisturbed sample of Soil Type 2.

11. **R-value Test:** One R-value test was performed on a representative sample of Soil Type 2 in accordance with the California Test Method (CTM) 301. The test result is presented in Table 14.

TABLE 14

Location	Soil Type	Description	R-value
T-101 @ 2'	2	sandy silty clay	5

V. SITE CORROSION ASSESSMENT

A site is considered to be corrosive to foundation elements, walls and drainage structures if one or more of the following conditions exist:

* Sulfate concentration is greater than or equal to 2000 ppm (0.2% by weight).
* Chloride concentration is greater than or equal to 500 ppm (0.05 % by weight).
* pH is less than 5.5.

For structural elements, the minimum resistivity of soil (or water) indicates the relative quantity of soluble salts present in the soil (or water). In general, a minimum resistivity value for soil (or water) less than 1000 ohm-cm indicates the presence of high quantities of soluble salts and a higher propensity for corrosion. Appropriate corrosion mitigation measures for corrosive conditions should be selected depending on the service environment, amount of aggressive ion salts (chloride or sulfate), pH levels and the desired service life of the structure.

Laboratory test results performed on selected representative site samples indicated that soils with minimum resistivity is less than 1000 ohm-cm are present at the property suggesting a potential for presence of high quantities of soluble salts. However, test results further indicated pH is greater than 5.5, sulfate concentration is less than 2000 ppm, and chloride concentration is less than 500 ppm. Based on the results of the available corrosion analyses, the project site may be considered non-corrosive. However, conformation testing should be completed during the actual earthworks and grading operations to further verify site corrosion conditions. The project site is not located within 1000 feet of salt or brackish water.

Based upon the result of the tested soil sample, the amount of water soluble sulfate (SO4) was found to be 0.02 to 0.001 percent by weight which is considered negligible according to the California Building Code Table No. 19-A-4. Portland cement Type II may be used. Table 15 is appropriate based on the pH-Resistivity test result:

TABLE 15

Design Soil Type	Gage	18	16	14	12	10	8
2	Years to Perforation of Steel Culverts	6	7	9	13	16	20
4	Years to Perforation of Steel Culverts	9	11	14	19	25	30

VI. CONCLUSIONS

Based upon the indicated geotechnical conditions at the project site, development of the property as outlined on the enclosed Plates 1-4 is feasible from a geologic and soils engineering viewpoint. However, the site is underlain by problematic earth materials which will require added grading effort in order to achieve design grades and create safe and stable surfaces for the support of the new structures and improvements. Most notably, these include hard bedrock units that are difficult to excavate and weak formational rocks that often perform poorly in conventional slope conditions. The following geotechnical conditions are unique to the property and will influence site development:

* Higher ridge terrain at the property are underlain by hard bedrock units (Kgr) that will require added effort to excavate. The need for heavy ripping as well as blasting is indicated to achieve design grades. Added undercut excavations are also recommended to allow for capping of pad surfaces with soil, and facilitate footing and utility line excavations.

* Weathered bedrock excavations are expected to generate good quality sandy soils that are non-expansive and will work well in compacted fills. However, excavations of the harder rock units will also generate significant quantities of rock debris that will create handling and disposal difficulties with regard to burial or disposal.

* Side-hill fills are planned at the project below Lots 18-24 and Lots 27-30. The fills will be placed upon a hillside underlain by hard bedrock units (Kgr). Adequate keyways should be constructed that will require difficult excavations. Locally, the need for specialized techniques that may include blasting should be anticipated.

* Project formational rocks (Ts) include claystone units that perform poorly in slope conditions. Graded embankments which expose these deposits should be supported by stabilization fills, and deep keyway excavations should be provided beneath graded fills placed into these units.

* An existing landslide condition above the south margin of the site indicates the need for remedial grading and a perimeter drain above Lots 31-33. In addition, deeper undercuts in the cut portion of the lots and stabilization fill slopes in support of the planned cut embankments, are recommended in the following section of this report. Consideration should be given to a joint grading operation that includes the repair of the adjacent landslide condition with the creation of Lots 31-33. A single updated topographic map of the area will assist in the presentation of more detailed repair and drain design recommendations.

* Excavations into project formational rocks (Ts) can generate clay-rich soils and expose claystone pad surfaces. These materials are expansive and will require special grading methods as well as the use of larger foundations and slab-on-grade floors. Excavations into project weathered bedrock units (Kgr) will generate good quality sandy soils that are non-expansive. Consequently, consideration should be given to selective grading methods which utilize excavated decomposed granitic bedrock soils as non-expansive cap soils atop graded pads with expansive soils.

* Site expansive soils are recommended for deep burial with good quality sandy granular soils available from site granitic and sandstone excavations placed within upper pad grades. Consequently, expansive soils are not anticipated to be a factor in the construction of the planned new structures and improvements. Final bearing

soils are anticipated to consist primarily of gravelly silty sand to silty sandy gravel (SW/GM) deposits with very low expansion potential (expansion index less than 21), according to the California Building Code classification (Table 18A-I-B) provided our remedial grading recommendations are followed. Actual classification and expansion characteristics of the finish grade soil mix can only be provided in the final as-graded compaction report based upon proper testing of bearing soils when rough finish grades are achieved. Added bearing soils moisture conditioning and grading efforts as well as revised foundations/slab and paving recommendations, will be required in the event expansive soils are allowed to occur at or near finish pad grades.

* Liquefaction and seismically induced settlements will not be factors in the development of the project site provided our remedial grading recommendations are followed.

* Post construction settlements after building construction are not expected to be a major factor in the development of the project site provided our grading and foundation recommendations are implemented during the construction phase of the project.

* Soil collapse will not be a factor in development of the study site provided our remedial grading recommendations are followed.

VII. RECOMMENDATIONS

The following recommendations are consistent with project geotechnical conditions and compatible to planned grades as depicted on Plates 2-4. The recommendations should be incorporated in final plans and implemented during the construction phase:

A. Grading and Earthworks

Difficult grading procedures should be anticipated at the project site due to the presence of problematic earth materials.

All grading and earthworks should be completed in accordance with Appendix Chapter 33 of the California Building Code, County of San Diego Grading Ordinances, the Standard Specifications for Public Works Construction, and the requirements of the following sections:

1. **Clearing and Grubbing** - Surface vegetation, trash, deleterious materials, and construction debris generated from the demolition of existing structures / improvements and other unsuitable materials should be removed from the areas proposed for grading, new fills, structures and improvements plus 10 feet

outside the perimeter, or as directed in the field, and properly disposed of. Construction debris and site vegetation shall be allowed to contaminate the new site fills.

All irrigation lines and existing leach lines, septic tanks, pipes and structures should be properly removed from the construction areas. Existing underground utilities in the construction areas should also be pot-holed, identified and marked prior to the actual work. Abandoned lines should be properly capped and sealed off to prevent any future water infiltrations into the foundation bearing and subgrade soils. Voids created by the removals of the abandoned underground pipes, tanks and structures should be properly backfilled with compacted fills in accordance with the requirements of this report.

The prepared ground should be inspected and approved by the project geotechnical engineer or his designated field representative, prior to remedial grading work.

2. **Removals and Over-excavation** - The most effective method to mitigate the upper loose alluvial, fill, and topsoil deposits will utilize removal and recompaction using conventional grading techniques. Site alluvium, fill and topsoil deposits in the areas proposed for new fills, structures and improvements plus 10 feet outside the perimeter where possible, and as directed in the field, should be removed to the underlying competent bedrock or stable formational units prior to filling as approved by the project soils engineer.

   Approximate removal depths in the vicinity of individual exploratory excavations are summarized in Table 16 based upon site soil conditions and proposed grades. The tabulated values are typical and subject to field changes by the project geotechnical consultant based on actual field exposures. Locally deeper removals may be necessary and should be anticipated.

TABLE 16

Location	Estimated Removal/ Keyway Depth (ft)	Comments
Lots 1-6	5-12	Deeper removals for keyway areas.
Lots 7-10	5-7	Deeper removals for keyway areas.
Lots 11-16	-	Cut Lots. Depth of undercut may govern.
Lots 17-23	3-4	Difficult excavations for keyway.
Lot 24	5	Keyway area.

TABLE 16 (continued)

Lots 25-26	-	Cut lots. Depth of undercut may govern.
Lots 27-30	1-5	Difficult excavations for keyway.
Lot 31	5-6	Requires stabilization fills and back drains. Attempt to construct this lot with adjacent landside repairs.
Lot 32	5-8	Requires stabilization fills and back drains. Attempt to construct this lot with adjacent landside repairs.
Lot 33	5-6	Requires stabilization fills and back drains. Attempt to construct this lot with adjacent landside repairs.

Notes:
1. All depths are measured from the existing ground levels.
2. Actual depths may vary at the time of construction based on subsurface exposures.
3. Bottom of all removals should be additionally prepared and recompacted to a minimum depth of 6 inches as directed in the field.
4. Firm native ground is defined as undisturbed natural exposures with in-place densities of 85% or greater as approved in the field.
5. In the case of deeper storm drains or utility trenches where the proposed inverts are below the recommended depths, removals and/or undercuts should be further extended a minimum of 6 inches below the bottom of pipe (or pipe bedding) unless otherwise approved.
6. Exploratory trenches excavated in connection with our study at the indicated locations were backfilled with loose and uncompacted deposits. The loose/uncompacted backfill soils within these trenches shall also be re-excavated and placed back as properly compacted fills as a part of the project grading operations.
7. All grounds steeper than 5:1 receiving fills/backfills should be properly benched and keyed as directed in the field.

3. **Select Grading** - Potentially expansive soils are present at the site and can be detrimental to site structures and improvements if they occur at or near finish grade levels. Potentially expansive soils at the site should be selectively buried in deeper fills, and the building pads capped with good quality sandy granular non-expansive soils generated from the on-site excavations of bedrock and sandstone units. Non-expansive capping soils under the building pads should be a minimum 3 feet thick or extend to a minimum 1-foot below the deepest footing, whichever is more. In the driveway and entrance roadway improvement areas, plus 3 feet, there should also be a minimum 1-foot of compacted non-expansive capping soils below the rough finish subgrade.

   The need for capping expansive units is indicated on Lots 1-3, 7, and 31-33.

4. **Transition Pads and Undercuts** - Building foundations, structures and improvements should be supported entirely on compacted fills or founded uniformly on competent undisturbed bedrock as approved in the field. Cut/fill

transition should not be allowed under buildings, improvements, and the associated structures. The cut portion of the cut/fill transition pads, plus 10 feet where possible and as directed in the field, should be undercut to provide a minimum 3 feet of compacted fill below the rough finish grades, or 1-foot below the deepest footing, whichever is more. There should also be at least 1-foot of compacted fill below the rough finish subgrade underneath all on-site improvements.

The need for capping transition pads at the project site is indicated at Lots 17-22 and Lot 30.

Hard bedrock units will be exposed at finish grade levels on selected lots at the project site. Undercutting cut pads and cut portion of the cut/fill pads and reconstruction to design grades with compacted fills, will accommodate excavations of foundation trenches and underground utilities in an otherwise very hard bedrock units. Impacted areas are Lots 8-17, Lots 20-23 and 25, 26 and 30. Roadway surfaces in cut areas atop project bedrock units (Kgr) should also be over-excavated to allow for utility line excavations. In the case of deeper utility trenches, undercutting to a minimum of 6 inches below the proposed inverts may be considered.

5. **Excavation Characteristics** - Weathered bedrock will successfully excavate with moderate to heavy ripping efforts with larger equipment (Caterpillar D-9 or equivalent). However, the need for blasting is indicated chiefly for the excavation of very hard corestone units which crop out in surface exposures and occur at depth below Lots 12, 13, 16 and 27-30. Large corestones are also indicated near the surface below the planned Park Hill Road in the vicinity of Lots 11 and 25. In these areas, blasting can be utilized to fracture the corestones and facilitate their excavation.

   The blasting will also serve to increase production levels and improve the quality of fill materials by reducing the amount of generated larger rock sizes.

6. **Groundwater and Dewatering** - Groundwater conditions were encountered in the upper portions of Lot 31 in T-108 Test Trench exposures at the depth of approximately 8 feet below the existing ground surfaces. The undercut and stability fill slope key excavations may be expected to encounter groundwater conditions. Groundwater may also be expected in alluvial and canyon areas of the project. Groundwater, where encountered at the site, will require dewatering efforts in order to complete remedial grading and earthwork operations at the Impacted areas. Any dewatering technique suitable to the field conditions which can effectively remove the intruding water and allow soil

removals and fill placement, is considered acceptable provided it is approved by the project engineer. Dewatering should continue until completion of remedial grading operations and should be discontinued only upon approval of the project geotechnical engineer. Groundwater should be lowered a minimum of 2 feet below the specified bottom of over-excavation, toe of temporary slope or trench excavations.

7. **Temporary Construction Slopes and Excavation Setbacks -** Undermining existing improvements and structures by the excavations and removal operations shall not be allowed. A minimum of 1-foot top of excavation setback shall be maintained from the adjacent structures and improvements unless otherwise directed in the field.

   Temporary trench excavations and embankment slopes less than 3 feet high maximum may be constructed at near vertical gradients if approved in the field. Trench and excavation slopes greater than 3 feet high maximum should be laid back at 1:1 gradient with the remaining wedge of soil properly benched and new fill/backfill tightly keyed-in as the fill placement progresses. Vertical excavations, trenching, and grading more than 3 feet high maximum should be provided with adequate shoring and trench shield support based on site conditions and soils parameters given in the following sections unless otherwise approved or specified.

   Protection of existing pipes, utilities, conduits, and underground and nearby embankments and structures, including those in the private and public right-of-way located within the zone of influence of temporary excavations and trenching, should also be considered by the project contractor. In case of a shoring system for vertical excavations or temporary structural support, stiffness and construction sequence shall be designed and carried out to limit horizontal and vertical deflections within allowable tolerances. The project shoring design/build consultant should evaluate the structural capacity of existing pipes, utilities, conduits, embankments as well as underground and nearby structures, and determine the allowable acceptable tolerances for his use in a given shoring system design.

   All temporary trenching and construction slopes greater than 3 feet high maximum require continuous geotechnical inspections. Additional recommendations including revised slope gradients, setbacks and the need for temporary shoring/trench shield support, should be given at that time as necessary. The project contractor shall also obtain appropriate permits, as needed, and conform to Cal-OSHA and local governing agencies' requirements for trenching/open excavations and safety of the workmen during construction.

8. **Fill Materials and Compaction** - On-site sandstone units and weathered bedrock excavations will generate very good quality sandy fill deposits. Soils generated from the excavations of formational siltstone/claystone units and alluvial deposits will be highly to very highly expansive clays. Excavations of harder rock units will likely generate marginal to poor quality rock-laden fills with larger rock sizes which will require special handling and disposal techniques.

   Fill materials should contain at least 40% finer than #4 sieve by weight. Rocks up to 12 inches in maximum diameter may be allowed in compacted fills provided they are individually placed, surrounded with compacted fill and buried a minimum of 5 feet below the rough finish pad grades. The upper 5 feet in the building pad grades and 10 feet in the areas of public right-of-way and easements, should consist of minus 6 inches of materials. Rocks up to 2 feet in maximum diameter may also be buried in deeper fills at least 10 feet below rough finish grades, provided they are also individually placed and surrounded with compacted fill. Rocks larger than 2 feet but smaller than 4 feet maximum, may be buried in the fill slope areas as designated by the project soils engineer, using the "windrow" techniques. Rocks larger than 4 feet in maximum diameter should be properly disposed of from the site. All rock disposal areas should be shown on the final grading plans. Rock disposals should be completed in accordance with the enclosed Rock Disposal Specifications enclosed with this report as Plates 39 and 40.

   Clayey deposits present at the site should be selectively buried in deeper site fills below pad grades as specified, and a minimum of 15 feet from the slope face within the fill mass as directed in the field. Clayey soils typically require additionel processing and moisture conditioning efforts in order to produce a uniform soil mixture suitable for reuse as compacted fill. The clayey deposits should also be moisture conditioned to above 3% to 5%, and compacted as specified. Good quality sandy granular deposits generated from the site sandstone units and weathered bedrock excavations should be placed within the upper pad grades and within the outer 15 feet of fill slopes. Sandy deposits should be moisture conditioned to slightly above (2%) optimum levels, and compacted to the specified compaction levels as directed in the field.

   Fill soils should be thoroughly mixed, moisture conditioned as specified and as directed in the field, and mechanically compacted in thin (8 inches maximum), uniform horizontal lifts to at least 90% of the corresponding maximum dry density, per ASTM D-1557-91, unless otherwise specified.

9. **Permanent Graded Slopes** - Planned graded cut/fill slopes should be programmed for 2:1 gradients maximum. All graded slopes constructed as recommended herein, will be grossly stable with respect to deep seated and surficial failures for the design maximum vertical heights.

   All fill slopes shall be provided with a lower keyway. The keyway should maintain a minimum depth of 2 feet into the competent formational or bedrock units with a minimum width of 15 feet, or as directed in the field by the project geotechnical consultant. More specific keyway depths are given above in Table 16. The keyway should expose firm bedrock throughout with the bottom heeled back a minimum of 2% into the natural hillside and inspected and approved by the project geotechnical engineer. Additional level benches should be made into the competent hillside as the fill slope construction progresses. It is also recommended that all fill slopes be overbuilt and then cut back to the proposed design configuration, or backrolled at a minimum 4 feet vertical increments and "track-walked" at the completion of grading. Field density tests should be performed to confirm a minimum 90% compaction levels within the slope face.

   Graded cut slopes exposing hard granitic bedrock will be grossly stable. Geologic inspections of cut excavation within the granitic bedrock units at the time of grading operations, will be necessary to confirm geologic stability.

   All graded cut/fill slopes 30 feet or more in maximum vertical height, should be provided with a minimum 6 feet wide terraces to control surface drainage and debris. The specified terraces should be provided at 30 feet vertical intervals except where only one terrace is required, it should be placed at mid-height. For cut/fill slopes greater than 60 feet and up to 120 feet in height, one terrace at approximately mid-height should be 12 feet wide. Suitable access should be provided to all slope terraces.

10. **Stabilization Fill Slopes** - Graded cut slopes exposing weak formational siltstone/claystone units should be reconstructed as "stabilization fill" slopes. Stabilization fills are compacted fill mass which maintain a minimum design width and extend to a design depth below the level of the lower pad grade. The stabilization fills should be keyed and benched into the weak formational materials against which the compacted fill mass is placed. Project stabilization fills should maintain a minimum width of 20 feet and extend to a minimum depth of 5 to 8 feet below lower pad grade levels unless otherwise directed in the field. The need for stabilization fills at the project site is indicated above Lots 1-3 and Lots 31-33 as delineated on the enclosed Plates 2 and 3.

The recommended stabilization fills will also require installation of adequate backdrain subdrainage systems. The proposed drainage systems should consist of a drain pipe wrapped in filter materials. A minimum 4"-diameter Schedule 40 (or SDR 35) perforated drainpipe surrounded with a minimum of 2 cubic feet, per foot, of ¾-inch crushed rocks wrapped in Mirafi 140N filter fabric, or Caltrans Class 2 filter materials sheuld be used. The filter fabric may be deleted if Caltrans Class 2 is used. The subdrainage system should flow at a minimum 1% gradient, and connected to an approved outlet. Typical design and construction details for the recommended stabilization fill structures are given on the enclosed Plate 41. Detailed designs can be given In the field when actual exposures are available.

11. **Pad and Stabilization Fill Constructions on Lots 31-33** - A documented landslide occurs above Lots 31-33 which is planned for repairs. Deeper undercuts in the cut portion of the lots and stabilization fill slopes in support of the planned cut embankments are required as specified. Removals and temporary excavations for Lots 31-33 at the base of the landside may cause reactivation of ground movements and should be avoided. Consequently, attempts should be made for a joint grading operation that includes the repair of the adjacent landslide condition with the creation of Lots 31-33. A single update topographic map of the area will assist in the presentation of more detailed repair and drain design recommendations.

    Separate grading and earthwork constructions for these lots may require temporary support and shoring for the adjacent landslide affected offsite areas above Lots 31-33. For this purpose a shoring contractor may be consulted in this regard. A shoring system should consider the effects of the added landslide loads. Additional recommendations, if required, can also be provided by our firm at the time of shoring design and plan review, as necessary.

12. **Canyon Subdrain** - Site canyons receiving fill should be provided with a canyon subdrainage system prior to the actual filling. The recommended canyon drains should be constructed in general accordance with the enclosed Plate 42.

    Subsurface water collected in the recommended canyon drains should outlet to a suitable location, as approved by the project soils engineer. The need for canyon subdrains at the project is indicated beneath canyon fills shown on the enclosed Plates 3 and 4. The need for additional subdrains may be indicated by seepage exposures developed during grading and should be anticipated.

13. **Surface Drainage / Erosion Control** - A critical element to the continued stability of the graded building pads and slopes is an adequate storm water and surface drainage control system, and protection of the slope face. This can most effectively be achieved by appropriate vegetation cover and the installation of the following systems:

    * Drainage swales should be provided at the top and toe of the slopes, per the project civil engineer design.

    * Building pad and slope surface run-off should be collected and directed to a selected location in a controlled manner. Area drains should be installed.

    * The finish slope should be planted soon after completion of grading. Unprotected slope faces will be subject to severe erosion and should not be allowed. Over-watering of the slope faces should not be allowed. Only the amount of water to sustain vegetation life should be provided.

    * Temporary erosion control facilities and silt fences should be installed during the construction phase periods and until landscaping is fully established as indicated and specified on the approved plans.

14. **Engineering Inspections** - All grading operations, including removals, suitability of earth deposits used as compacted fill, and compaction procedures, should be continuously inspected and tested by the project geotechnical consultant and presented in the final as-graded compaction report. The nature of finish subgrade soils should also be confirmed in the final compaction report at the completion of grading.

    Geotechnical engineering inspections shall include, but not limited to the following:

    * Initial inspection - After the grading/brushing limits have been staked but before grading/brushing starts.

    * Keyway/bottom of over-excavation inspection - After the natural ground or bedrock is exposed and prepared to receive fill but before fill is placed.

    * Excavation inspection - After the excavation is started but before the vertical depth of excavation is more than 3 feet. Local and Cal-OSHA safety requirements for open excavations apply.

* Fill/backfill Inspection - After the fill/backfill placement is started but before the vertical height of fill exceeds 2 feet. A minimum of one test shall be required for each 100 lineal feet maximum in every 2 feet vertical gain, with the exception of wall backfills where a minimum of one test shall be required for each 30 lineal feet maximum. Wall backfills shall consist of minus 3-inch particles as approved in the field, and mechanically compacted to a minimum 90% compaction levels unless otherwise specified. Finished rough and final pad grade tests shall be required regardless of fill thickness.

* Foundation trench inspection - After the foundation trench excavations but before steel placement.
* Foundation bearing/slab subgrade soils inspection - Prior to the placement of concrete for proper moisture and specified compaction levels.

* Geotechnical foundation/slab steel inspection - After the steel placement is completed but before the scheduled concrete pour.

* Subdrain/wall back drain inspection - After the trench excavations but during the actual placement. All material shall conform to the project material specifications and approved by the project geotechnical engineer.

* Underground/utility trench inspection - After the trench excavations but before placement of pipe bedding or installation of the underground facilities. Local and Cal-OSHA safety requirements for open excavations apply. Inspection of the pipe bedding may also be required by the project geotechnical engineer.

* Underground utility/plumbing trench backfill inspection - After the backfill placement is started above the pipe zone but before the vertical height of backfill exceeds 2 feet. Testing of the backfill within the pipe zone may also be required by the governing agencies. Pipe bedding and backfill materials shall conform to the governing agencies' requirements and project soils report if applicable. All trench backfills shall consist of minus 3-inch particles as approved in the field, and mechanically compacted to a minimum 90% compaction levels unless otherwise specified. Plumbing trenches over 12 inches deep maximum under the interior floor slabs should also be mechanically compacted and tested for a minimum of 90% compaction levels. Flooding or jetting techniques as a means of compaction method shall not be allowed.

* Pavement/improvements base and subgrade inspections - Prior to the placement of concrete or asphalt for proper moisture and specified compaction levels.

B. Footings and Slab-on-Grade Foundations

The following typical recommendations are consistent with very low expansive (EI less than 21) gravelly silty sand to silty sandy gravels (SW/GM) bearing and subgrade soils anticipated at finish grade levels. Final foundation and slab design will depend on expansion characteristics of finish grade soils, as well as fill soil differential thickness, depending on the actual removal depths and proposed building locations. Additional or modified recommendations may also be necessary for individual building pads and should be given at the completion of rough grading based on the expansion characteristics of the foundation bearing soils and as-graded site geotechnical conditions, and presented in the final as-graded compaction report:

1. **Buildings pads with fill differential thickness less than 5 feet (Lots 1, 2, 10-16, 23, 25, 26):**

   * Continuous strip stem walls and turned-down footings should be sized at least 12 inches wide by 12 inches deep for single-story buildings, and 15 inches wide by 18 inches deep for two-story buildings. Isolated pad footings should be at least 24 inches square and 12 inches deep. Footing depths are measured from the lowest adjacent ground surface, not including the sand/gravel beneath floor slabs. Exterior continuous stem wall foundations and turned-down footings should enclose the entire building perimeter.

     Continuous interior and exterior stem wall foundations should be reinforced by at least two #4 reinforcing bars. Place a minimum of 1-#4 bar 3 inches above the bottom of the footings and a minimum of 1-#4 bar 3 inches below the top of stem walls. Turned-down footings should be reinforced with a minimum of 1-#4 bar at the top and 1-#4 bar at the bottom. Reinforcement details for spread pad footings should be provided by the project architect/structural engineer.
   * All interior slabs should be a minimum 4 inches in thickness reinforced with #3 reinforcing bars spaced 18 inches on center each way placed mid-height in the slab. Slabs should be underlain by 4 inches of clean sand (SE 30 or greater) which is provided with a well-performing moisture barrier/vapor retardant (minimum 15-mil plastic) placed mid-height in the sand.

2. **Buildings Pads with Fill Differential Thickness between 5 and 15 Feet (Lots 3, 8, 9, 17, 18, 28, 31-33):**

   * Continuous strip stem walls and turned-down footings should be sized at least 15 Inches wide by 18 inches deep for single and two-story buildings. Isolated pad footings should be at least 30 inches square and 18 inches

deep. Footing depths are measured from the lowest adjacent ground surface, not including the sand/gravel beneath floor slabs. Exterior continuous stem wall foundations and turned-down footings should enclose the entire building perimeter.

Continuous interior and exterior stem wall foundations should be reinforced by at least four #4 reinforcing bars. Place a minimum of 2-#4 bars 3 inches above the bottom of the footing and a minimum of 2-#4 bars 3 inches below the top of stem walls. Turned-down footings should be reinforced with a minimum of 2-#4 bars at the top and 2-#4 bars at the bottom. Reinforcement details for spread pad footings should be provided by the project architect/ structural engineer.

* All interior slabs should be a minimum of 4 inches in thickness reinforced with #3 reinforcing bars spaced 16 inches on center each way placed mid-height in the slab. Slabs should be underlain by 4 inches of clean sand (SE 30 or greater) which is provided with a well-performing moisture barrier/vapor retardant (minimum 15-mil plastic) placed mid-height in the sand.

3. **Buildings Pads with Fill Differential Greater than 15 feet (Lots 4-7, 19-22, 24, 27, 29, 30):**

* Continuous strip stem walls and turned-down footings should be sized at least 15 inches wide by 24 inches deep for single and two-story buildings. Isolated pad footings should be at least 30 inches square and 18 inches deep. Exterior isolated pad footings should also be tied to the perimeter foundations with a minimum 12 inches wide by 12 inches deep grade beams at least in one direction. Footing depths are measured from the lowest adjacent ground surface, not including the sand/gravel beneath floor slabs. Exterior continuous stem wall foundations and turned-down footings should enclose the entire building perimeter.

  Continuous interior and exterior stem wall foundations should be reinforced by at least four #5 reinforcing bars. Place a minimum of 2-#5 bars 3 inches above the bottom of the footings and a minimum of 2-#5 bars 3 inches below the top of the stem walls. Turned-down footings should be reinforced with a minimum of 2-#5 bars at the top and 2-#5 bars at the bottom. Grade beams should be reinforced with 2-#4 bars top and bottom. Reinforcement details for spread pad footings should be provided by the project architect/structural engineer.

* All interior slabs should be a minimum 5 inches in thickness reinforced with #4 reinforcing bars spaced 18 inches on center each way placed mid-height in the slab. Slabs should be underlain by 4 inches of clean sand (SE 30 or

greater) which is provided with a well-performing moisture barrier/vapor retardant (minimum 15-mil plastic) placed mid-height in the sand.

4. **Control Joints and Re-entrant Corners:**

   * Provide "softcut" contraction/control joints consisting of sawcuts spaced 10 feet on centers each way for all interior slabs. Cut as soon as the slab will support the weight of the saw and operate without disturbing the final finish which is normally within 2 hours after final finish at each control joint location or 150 psi to 800 psi. The sawcuts should be a minimum of 1-inch in depth but should not exceed 1¼-inches deep maximum. Anti-ravel skid plates should be used and replaced with each blade to avoid spalling and raveling. Avoid wheeled equipments across cuts for at least 24 hours.

   Provide re-entrant corner reinforcement for all interior slabs. Re-entrant corners will depend on slab geometry and/or interior column locations. Plate 43 may be used a general outline.

5. **Foundation Trench Inspections:**

   * Foundation trenches and slab subgrade soils should be inspected and tested for proper moisture and specified compaction levels, and approved by the project geotechnical consultant prior to the placement of concrete.

C. <u>Exterior Concrete Slabs / Flatworks</u>

1. All exterior slabs (walkways, and patios) should be a minimum 4 inches in thickness reinforced with 6x6/10x10 welded wire mesh carefully placed mid-height in the slab.

2. Provide "tool joint" or "softcut" contraction/control joints spaced 10 feet on center (not to exceed 12 feet maximum) each way. Tool or cut as soon as the slab will support weight and can be operated without disturbing the final finish which is normally within 2 hours after final finish at each control joint location or 150 psi to 800 psi. Tool or softcuts should be a minimum of 1-inch but should not exceed 1¼-inches deep maximum. In case of softcut joints, anti-ravel skid plates should be used and replaced with each blade to avoid spalling and raveling. Avoid wheeled equipments across cuts for at least 24 hours.

3. All exterior slab designs should be confirmed in the final as-graded compaction report.

4. Subgrade soils should be tested for proper moisture and specified compaction levels and approved by the project geotechnical consultant prior to the placement of concrete.

D. Soil Design Parameters

The following selected soil design parameters are based upon the tested representative samples of on-site earth deposits. Clayey soils should not be used for wall backfills, and good quality sandy granular deposits should occur within the wall active zone. All parameters should be re-evaluated when the characteristics of the final as-graded soils have been specifically determined:

1. Design wet density of soil = 128.7 pcf.
2. Design angle of internal friction of soil = 34 degrees.
3. Design active soil pressure for retaining structures = 25 pcf (EFP), level backfill, cantilever, unrestrained walls.
4. Design active soil pressure for retaining structures = 32 pcf (EFP), 2:1 sloping backfill, cantilever, unrestrained walls.
5. Design active soil pressure for retaining structures = 38 pcf (EFP), 1½:1 sloping backfill, cantilever, unrestrained walls.
6. Design at-rest soil pressure for retaining structures = 41 pcf (EFP), non-yielding, restrained walls.
7. Design passive soil resistance for retaining structures = 450 pcf (EFP), level surface at the toe.
8. Design coefficient of friction of concrete on soils = 0.40.
9. Design net allowable foundation pressure for compacted fills = 2000 psf.
10. Design allowable lateral bearing pressure (all structures except retaining walls) for on-site compacted fill = 200 psf/ft.

Notes:

* Because large movements must take place before maximum passive resistance can be developed, a minimum safety factor of two should be considered for sliding stability where structures and improvements are planned on top of walls.

* When combining passive pressure and frictional resistance, the passive component should be reduced by one-third.

* The allowable foundation pressures provided herein applies to dead plus live loads and may be increased by one-third for wind and seismic loading.

* The allowable lateral bearing earth pressure may be increased by the amount of the designated value for each additional foot of depth to a maximum of 1,500 pounds per square foot.

E. Asphalt and PCC Pavement Design

1. Asphalt Paving: All roadway improvements and paving constructions shall be completed in accordance with the County of San Diego ordinances.

   The following asphalt pavement structural sections are based on a tested R-value of 5 performed on selected on-site earth materials and the indicated assumed traffic indices (TI), and may be considered for initial planning phase cost estimating purposes. A minimum section of 3 inches asphalt (AC) over 6 inches of Class 2 aggregate base (AB) or the minimum structural section required by County of San Diego, whichever is more, will be required and shall govern when a lesser pavement section is indicated by design calculations:

TABLE 17

	Design Traffic Index (TI)			
Design R-value	**4.5**	**5.0**	**6.0**	**6.5**
5	3" AC over 8" AB	3" AC over 10" AB	3" AC over 14" AB	4" AC over 14" AB
The Class 2 aggregate base shall meet or exceed the current Green Book Standard specifications for Public Works Construction and Regional Supplement Amendments, 2003, Sections 400-2.3.				

   Final pavement sections will depend on the actual R-value test results performed on finish subgrade soils, design TI, and approval of the County of San Diego. All design sections should be confirmed and/or revised as necessary at the completion of rough pavement subgrade preparations. Revised pavement sections should be anticipated.

   Base materials should be compacted to a minimum 95% of the maximum dry density. Subgrade soils beneath the pavement base layer should also be compacted to a minimum 95% of the corresponding maximum dry density within the upper 12 inches. Base materials and subgrade soils should be tested for proper moisture and minimum 95% compaction levels and approved by the project geotechnical consultant prior to the placement of the base or asphalt layers.

2. PCC Paving: PCC driveways and perking supported on very low expansive subgrade soils should be a minimum 5 inches in thickness, reinforced with #3 reinforcing bars at 18 inches on center each way, placed 2 inches below the top

of slab. Subgrade soils beneath the PCC driveways and parking should also be compacted to a minimum 90% of the corresponding maximum dry density within the upper 6 inches unless otherwise specified.

Provide "tool Joint" or "softcut" contraction/control joints spaced 12 feet on center (not to exceed 15 feet maximum) each way. Tool or cut as soon as the slab will support weight and can be operated without disturbing the final finish which is normally within 2 hours after final finish at each control joint location or 150 psi to 800 psi. Tool or softcuts should be a minimum of 1-inch but should not exceed 1¼-inches deep maximum. in case of softcut joints, anti-ravel skid plates should be used and replaced with each blade to avoid spalling and raveling. Avoid wheeled equipments across cuts for at least 24 hours.

3. General Paving: Base section and subgrade preparations per structural section design, will be required for all surfaces subject to traffic including roadways, travelways, drive lanes, driveway approaches and ribbon (cross) gutters. Driveway approaches within the public right-of-way should have 12 inches subgrade compacted to a minimum 95% compaction levels, and provided with a 95% compacted Class 2 base section per structural section design.

   Base layer under curb and gutters should be compacted to a minimum 95%, while subgrade soils under curb and gutters, and base and subgrade under sidewalks should be compacted to a minimum 90% compaction levels unless otherwise specified. Specific recommendations should be given in the final as-graded compaction report. Base and subgrade should be tested for proper moisture and specified compaction levels, and approved by the project geotechnical consultant prior to the placement of the base or asphalt/PCC finish surface.

F. General Recommendations

1. The minimum foundation design and steel reinforcement provided herein are based on soil characteristics and are not intended to be in lieu of reinforcement necessary for structural consideration.

2. Adequate staking and grading control is a critical factor in properly completing the recommended remedial and site grading operations. Grading control and staking should be provided by the project grading contractor or surveyor/civil engineer, and is beyond the geotechnical engineering services. Inadequate staking and/or lack of grading control may result in unnecessary additional grading which will increase construction costs.

3. Footings located on or adjacent to the top of slopes should be extended to a sufficient depth to provide a minimum horizontal distance of 7 feet or one-third of slope height, whichever is greater (need not exceed 40 feet maximum) between the bottom edge of the footing and face of slope. This requirement applies to all Improvements and structures including fences, posts, pools, spas, etc. Concrete and AC improvements should be provided with a thickened edge to satisfy this requirement.

4. Open or backfilled trenches parallel with a footing shall not be below a projected plane having a downward slope of 1-unit vertical to 2 units horizontal (50%) from a line 9 inches above the bottom edge of the footing, and not closer than 18 inches form the face of such footing.

5. Where pipes cross under-footings, the footings shall be specially designed. Pipe sleeves shall be provided where pipes cross through footings or footing walls, and sleeve clearances shall provide for possible footing settlement, but not less than 1-inch all around the pipe.

6. Foundations where the surface of the ground slopes more than 1-unit vertical in 10-units horizontal (10% slope) shall be level or shall be stepped so that both top and bottom of such foundations are level. Individual steps in continuous footings shall not exceed 18 inches in height and the slope of a series of such steps shall not exceed 1-unit vertical to 2-units horizontal (50%) unless otherwise specified. The steps shall be detailed on the structural drawings. The local effects due to the discontinuity of the steps shall also be considered in the design of foundations as appropriate and applicable.

7. Expansive clayey soils should not be used for backfilling of any retaining structure. All retaining walls should be provided with a 1:1 wedge of granular, compacted backfill measured from the base of the wall footing to the finished surface and a well constructed back drainage as shown on the enclosed Plate 44.

8. All underground utility and plumbing trenches should be mechanically compacted to a minimum 90% of the maximum dry density of the soil unless otherwise specified. Care should be taken not to crush the utilities or pipes during the compaction of the soil. Non-expansive, granular backfill soils should be used. Trench backfill materials and compaction beneath pavements within the public right-of-way shall conform to the County of San Diego requirements.

9. Site drainage over the finished pad surfaces should flow away from structures onto the street in a positive manner. Care should be taken during the construction, improvements, and fine grading phases not to disrupt the designed

drainage patterns. Roof lines of the buildings should be provided with roof gutters. Roof water should be collected and directed away from the buildings and structures to a suitable location.

10. Final plans should reflect preliminary recommendations given in this report. Final foundations and grading plans may also be reviewed by the project geotechnical consultant for conformance with the requirements of the geotechnical investigation report outlined herein. More specific recommendations may be necessary and should be given when final grading and architectural/structural drawings are available.

11. All foundation trenches should be inspected to ensure adequate footing embedment, and confirm competent bearing soils. Foundation and slab reinforcements should also be inspected and approved by the project geotechnical consultant.

12. The amount of shrinkage and related cracks occurring in the concrete slab-on-grades, flatworks and driveways depend on many factors the most important of which is the amount of water in the concrete mix. The purpose of the slab reinforcement is to keep normal concrete shrinkage cracks closed tightly. The amount of concrete shrinkage can be minimized by reducing the amount of water in the mix. To keep shrinkage to a minimum the following should be considered:

    * Use the stiffest mix that can be handled and consolidated satisfactorily.

    * Use the largest maximum size of aggregate that is practical. For example, concrete made with ⅜-inch maximum size aggregate usually requires about 40-lbs. more (nearly 5-gal.) water per cubic yard than concrete with 1-inch aggregate.

    * Cure the concrete as long as practical.

    The amount of slab reinforcement provided for conventional slab-on-grade construction considers that good quality concrete materials, proportioning, craftsmanship, and control tests where appropriate and applicable are provided.

13. A preconstruction meeting between representatives of this office, the property owner or planner, as well as the grading contractor/builder is recommended in order to discuss grading/construction details associated with site development.

IX. LIMITATIONS

The conclusions and recommendations provided herein have been based on available data obtained from the review of pertinent reports and plans, subsurface exploratory excavations as well as our experience with the soils and formational materials located in the general area. The materials encountered on the project site and utilized in our laboratory testing are believed representative of the total area; however, earth materials may vary in characteristics between excavations.

Of necessity we must assume a certain degree of continuity between exploratory excavations and/or natural exposures. It is necessary, therefore, that all observations, conclusions, and recommendations be verified during the grading operation. In the event discrepancies are noted, we should be contacted immediately so that an inspection can be made and additional recommendations issued if required.

The recommendations made in this report are applicable to the site at the time this report was prepared. It is the responsibility of the owner/developer to ensure that these recommendations are carried out in the field.

It is almost impossible to predict with certainty the future performance of a property. The future behavior of the site is also dependent on numerous unpredictable variables, such as earthquakes, rainfall, and on-site drainage patterns.

The firm of VINJE & MIDDLETON ENGINEERING, INC., shall not be held responsible for changes to the physical conditions of the property such as addition of fill soils, added cut slopes, or changing drainage patterns which occur without our inspection or control.

The property owner(s) should be aware that the development of cracks in all concrete surfaces such as floor slabs and exterior stucco are associated with normal concrete shrinkage during the curing process. These features depend chiefly upon the condition of concrete and weather conditions at the time of construction and do not reflect detrimental ground movement. Hairline stucco cracks will often develop at window/door corners, and floor surface cracks up to ⅛-inch wide in 20 feet may develop as a result of normal concrete shrinkage (according to the American Concrete Institute).

This report should be considered valid for a period of one year and is subject to review by our firm at that time. If significant modifications are made to your tentative development plan, especially with respect to the height and location of cut and fill slopes, this report must be presented to us for review and possible revision.

This report is issued with the understanding that the owner or his representative is responsible to ensure that the information and recommendations are provided to the project architect/structural engineer so that they can be incorporated into the plans. Necessary steps shall be taken to ensure that the project general contractor and subcontractors carry out such recommendations during construction.

The project soils engineer should be provided the opportunity for a general review of the project final design plans and specifications in order to ensure that the recommendations provided in this report are property interpreted and implemented. The project soils engineer should also be provided the opportunity to verify the foundations prior the placing of concrete. If the project soils engineer is not provided the opportunity of making these reviews, he cen assume no responsibility for misinterpretation of his recommendations.

Vinje & Middleton Engineering, Inc., warrants that this report has been prepared within the limits prescribed by our client with the usual thoroughness and competence of the engineering profession. No other warranty or representation, either expressed or implied, is included or intended.

Once again, should any questions arise concerning this report, please do not hesitate to contact this office. Reference to our **Job #06-323-P** will help to expedite our response to your inquiries.

We appreciate this opportunity to be of service to you.

VINJE & MIDDLETON ENGINEERING, INC.

Dennis Middleton
CEG #980

REGISTERED GEOLOGIST · DENNIS MIDDLETON · CEG 980 · CERTIFIED ENGINEERING · Exp 8/31/07 · STATE OF CALIFORNIA

S. Mehdi S. Shariat
RCE #46174

REGISTERED PROFESSIONAL ENGINEER · SEYED M. SAMSAM SHARIAT · No. 46174 · Exp. 12-31-06 · CIVIL · STATE OF CALIFORNIA

Steven J. Melzer
CEG #2362

PROFESSIONAL GEOLOGIST · STEVEN JAY MELZER · No. 2362 · CERTIFIED ENGINEERING GEOLOGIST · Exp. 5-31-07 · STATE OF CALIFORNIA

DM/SMSS/SJM/jt

Distribution: Addressee (5)

c:/jt/myfiles/06 prelims/06-323-P

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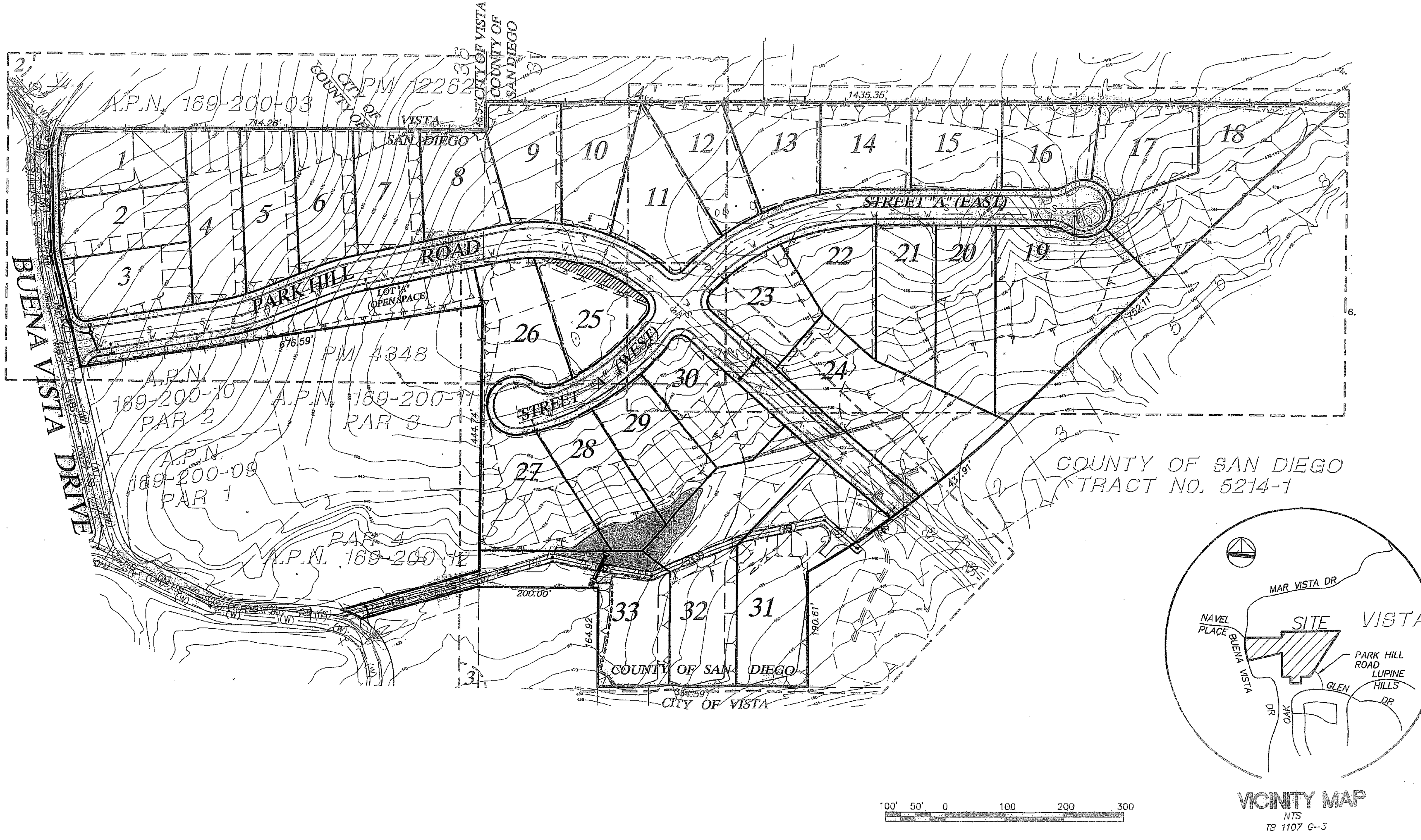
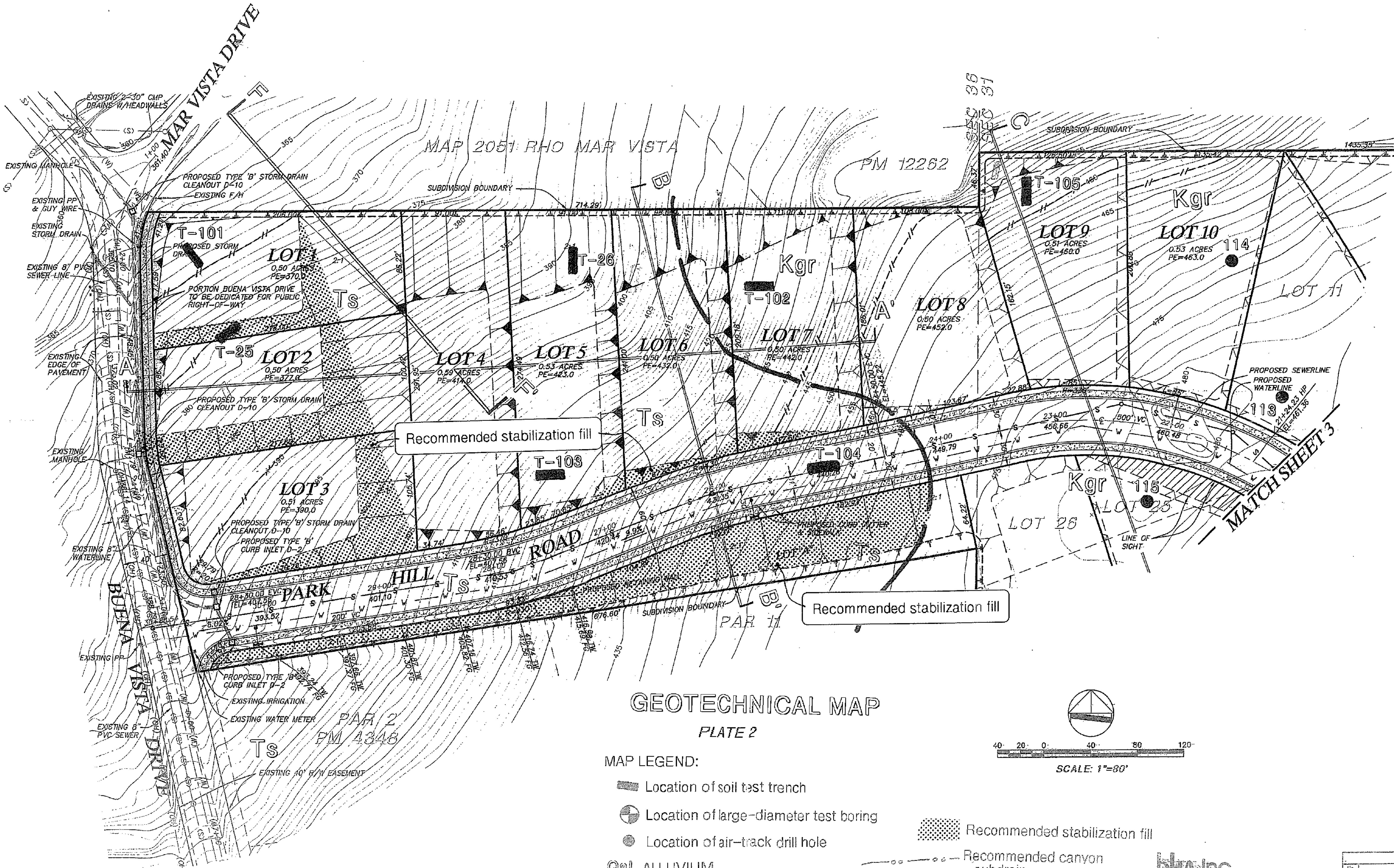
PROPOSED STONEMARK ESTATES, COUNTY OF SAN DIEGO

PLATE 1



TENTATIVE SUBDIVISION MAP
COUNTY OF SAN DIEGO TRACT NO. XXXX
STONEMARK ESTATES



GEOTECHNICAL MAP

PLATE 2

SCALE: 1"=80'

MAP LEGEND:

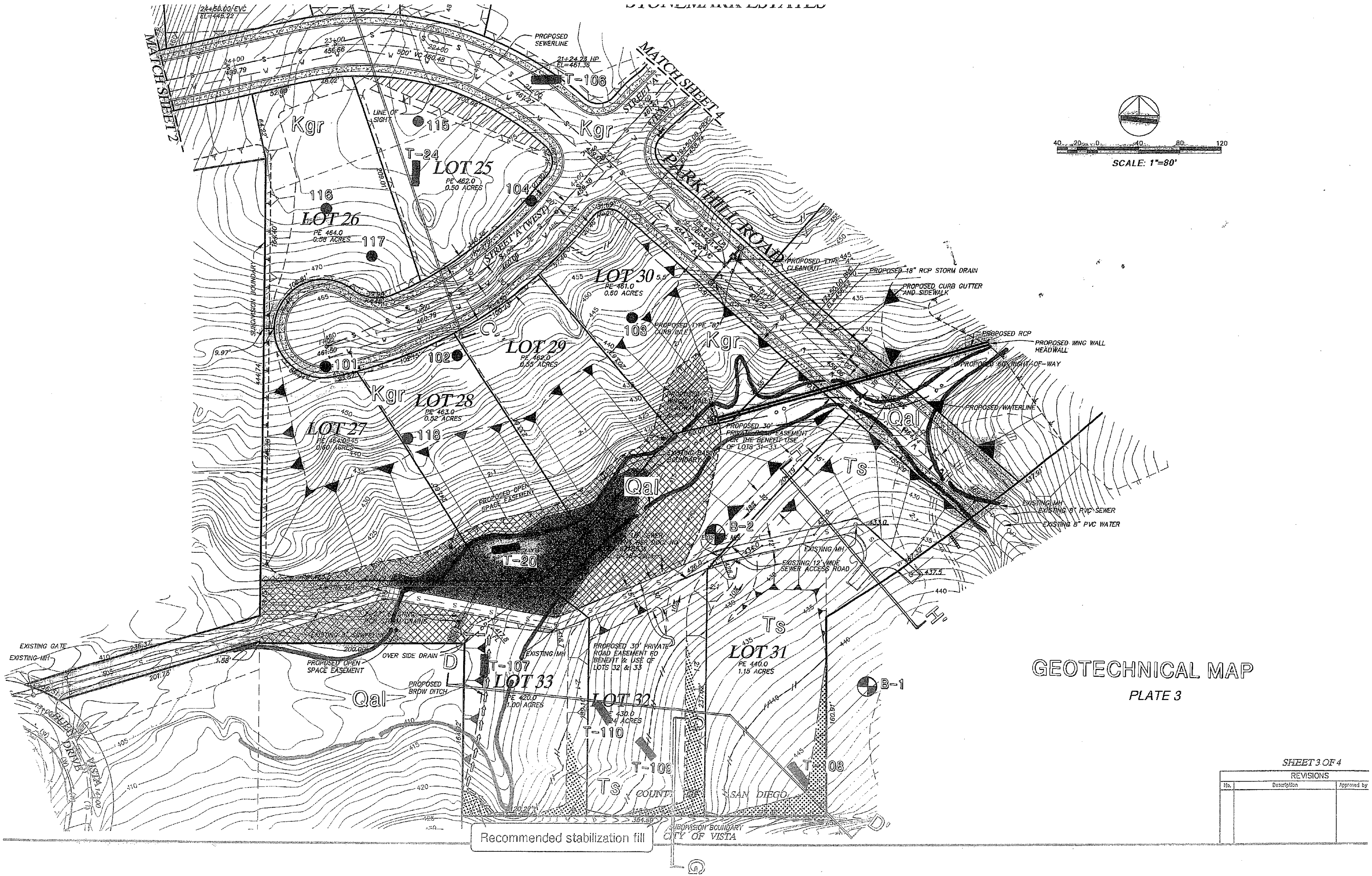
- Location of soil test trench
- Location of large-diameter test boring
- Location of air-track drill hole
- Qal ALLUVIUM
- Ts FORMATIONAL ROCK
- Kgr BEDROCK
- Recommended stabilization fill
- Recommended canyon subdrain

06-323-P SEPT. 2006

bHA, Inc.
land planning, civil engineering, surveying
5115 AVENIDA ENCINAS
SUITE "L"
CARLSBAD, CA. 92008-4387

SHEET 2 OF 4

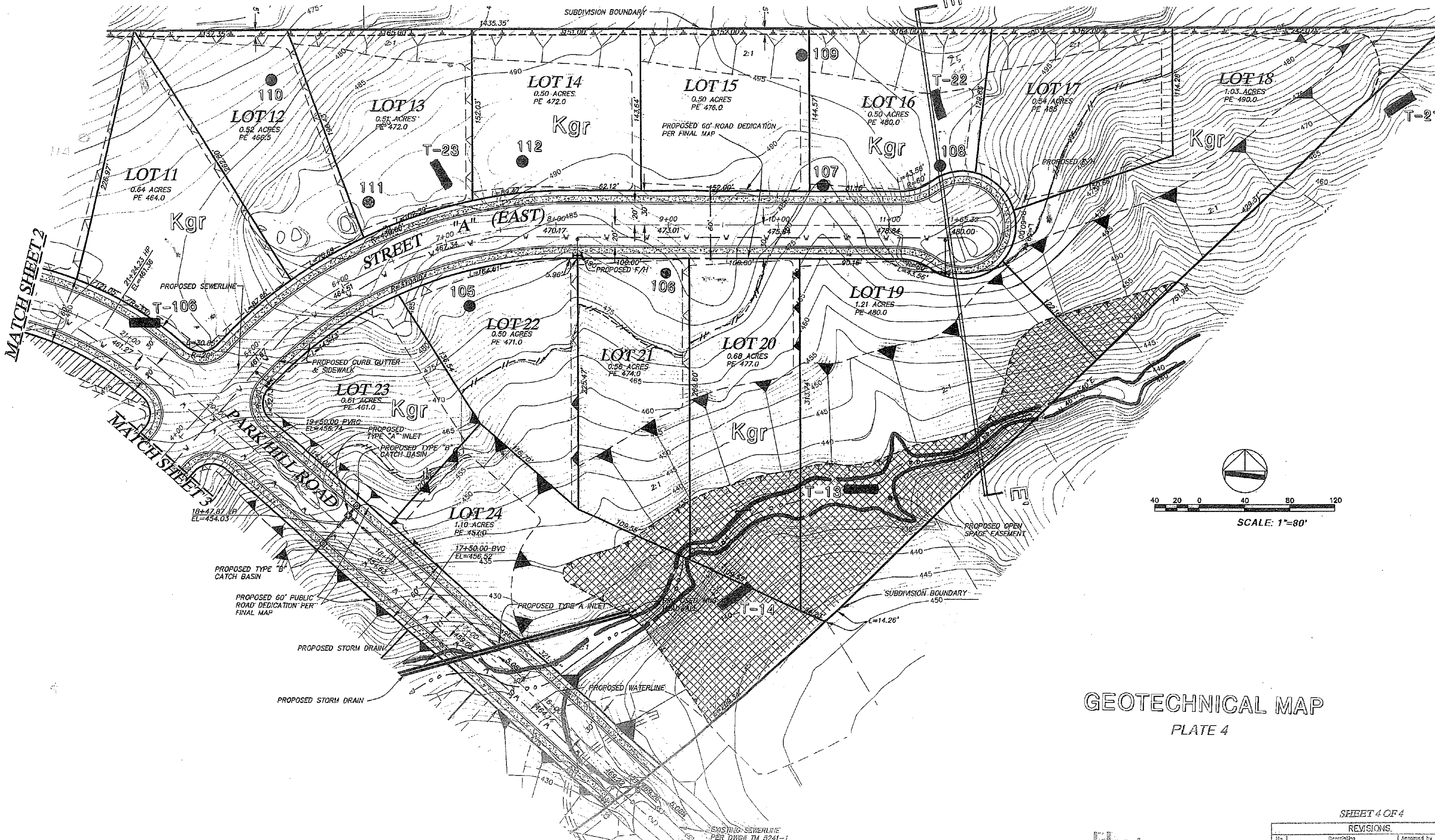
REVISIONS			
No.	Description	Approved by	Date


MATCH SHEET 2
MATCH SHEET 4
PROPOSED SEWERLINE
21+24.23 HP
EL=461.36
T-106
LINE OF SIGHT
115
T-24
LOT 25
PE 462.0
0.50 ACRES
104
116
LOT 26
PE 464.0
0.58 ACRES
117
Kgr
STREET 'A' (WEST)
STREET 'A' (EAST)
PARK HILL ROAD
SUBDIVISION BOUNDARY
LOT 30
PE 461.0
0.60 ACRES
103
PROPOSED TYPE "B" CURB INLET
PROPOSED TYPE "A" CLEANOUT
PROPOSED 18" RCP STORM DRAIN
PROPOSED CURB GUTTER AND SIDEWALK
PROPOSED RCP
PROPOSED WING WALL HEADWALL
PROPOSED 60' RIGHT-OF-WAY
PROPOSED WATERLINE
101
102
LOT 29
PE 462.0
0.55 ACRES
LOT 28
PE 463.0
0.52 ACRES
LOT 27
PE 464.0
0.60 ACRES
118
PROPOSED OPEN SPACE EASEMENT
Qal
PROPOSED 30' PRIVATE ROAD EASEMENT FOR THE BENEFIT USE OF LOTS 31-33
EXISTING BASIN BOUNDARY
Ts
B-2
EXISTING MH
EXISTING 8" PVC SEWER
EXISTING 8" PVC WATER
EXISTING 12' WIDE SEWER ACCESS ROAD
T-20
EXISTING RCP STORM DRAINS
EXISTING GATE
EXISTING MH
PROPOSED OPEN SPACE EASEMENT
OVER SIDE DRAIN
PROPOSED BROW DITCH
T-107
LOT 33
PE 420.0
1.00 ACRES
PROPOSED 30' PRIVATE ROAD EASEMENT FOR BENEFIT & USE OF LOTS 32 & 33
LOT 32
PE 430.0
T-110
T-109
LOT 31
PE 440.0
1.15 ACRES
T-108
B-1
COUNTY OF SAN DIEGO
SUBDIVISION BOUNDARY
CITY OF VISTA
VISTA
DRIVE
SCALE: 1"=80'
GEOTECHNICAL MAP
PLATE 3
SHEET 3 OF 4
REVISIONS
No.
Description
Approved by
Recommended stabilization fill

TENTATIVE SUBDIVISION MAP

COUNTY OF SAN DIEGO TRACT NO. XXXX

STONEMARK ESTATES



GEOTECHNICAL MAP

PLATE 4

SHEET 4 OF 4

REVISIONS			
No.	Description	Approved by	Date

bHA, Inc.
land planning, civil engineering, surveying
5115 AVENIDA ENCINAS

Date: 6-15-99 Logged by: DM

DEPTH (ft)	SAMPLE	T-13 DESCRIPTION	USCS SYMBOL	FIELD MOISTURE (%)	FIELD DRY DENSITY (pcf)	RELATIVE COMPACTION (%)
0 – 3		FILL / ALLUVIUM (Qal): Sandy clay. Gray. Dry and loose in upper 2'. Below, color is mottled tan-brown. Soil is moist and stiff. ST-2	CL			
3 – 5		BEDROCK (Kgr): Granitic rock. Dark olive color. Coarse grained. Westhered friable. ST-4	SM/SW			
5 – 8		End Trench at 5'.				

Date: 6-15-99 Logged by: DM

DEPTH (ft)		T-14 DESCRIPTION	USCS SYMBOL	FIELD MOISTURE (%)	FIELD DRY DENSITY (pcf)	RELATIVE COMPACTION (%
0 – 2		TOPSOIL: Sandy clay. Brown. Slightly moist, hard. ST-2	CL			
2 – 4		BEDROCK (Kgr): Granitic rock. Olive color. Coarse grained. Weathered friable. ST-4	SM/SW			
4 – 7		End Trench at 4'.				

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Escondido, California 92029-1229
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TEST TRENCH LOGS

GAMBONI PROPERTY, LLC

PROJECT NO. 99-215-P PLATE 5

▼ Sand Cone Test ▩ Bulk Sample ❑ Chunk Sample ❍ Driven Rings

Date: 6-15-99 Logged by: DM

DEPTH (ft)	SAMPLE	T-19 DESCRIPTION	USCS SYMBOL	FIELD MOISTURE (%)	FIELD DRY DENSITY (pcf)	RELATIVE COMPACTION (%)
0 - 2		TOPSOIL: Silty clay. Dark gray color. Moist, stiff. ST-2	CL			
2 - 6	■ (at 4)	FORMATIONAL ROCK (Ts): Claystone. Green color. White carbonate deposits throughout. Weathered soft. Includes irregular zones of pale green harder claystone. ST-7	CL			
6 - 7		End Trench at 6'.				

Date: 6-15-99 **Logged by: DM**

DEPTH (ft)		T-20 DESCRIPTION	USCS SYMBOL	FIELD MOISTURE (%)	FIELD DRY DENSITY (pcf)	RELATIVE COMPACTION (%
0 - 5		ALLUVIUM (Qal): Sandy clay. Dark brown. Dry and loose on surface, moist and stiff below. From 6', grades to clayey sand. Soil is firm. ST-2	CL			
5 - 9	❑	BEDROCK (Kgr): Granitic rock. Brown color. Coarse grained. Weathered friable. ST-4	SM/SW	9.0	121.7	96.8
10 - 15		End Trench at 9'.				

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TEST TRENCH LOGS

GAMBONI PROPERTY, LLC

PROJECT NO. 99-215-P PLATE 6

▼ Sand Cone Test ■ Bulk Sample ❑ Chunk Sample ○ Driven Rings

Date: 6-15-99						Logged by: DM
DEPTH (ft)	SAMPLE	T-21 DESCRIPTION	USCS SYMBOL	FIELD MOISTURE (%)	FIELD DRY DENSITY (pcf)	RELATIVE COMPACTION (%)
- 0 - to - 2 -		ALLUVIUM (Qal): Clayey sand. Gray to dark gray, grading to brownl. Moist, soft. ST-5	SC			
- 3 - to - 4 -		Silty sand. Brown. Moist, loose. ST-1	SM			
- 5 -		BEDROCK (Kgr): Granitic rock. Brown. Coarse grained. Friable.				
- 6 - to - 7 -		End Trench at 6'.				

Date: 6-15-99						Logged by: DM
DEPTH (ft)		T-22 DESCRIPTION	USCS SYMBOL	FIELD MOISTURE (%)	FIELD DRY DENSITY (pcf)	RELATIVE COMPACTION (%
- 0 -		TOPSOIL: Silty sand. Brown. Dry, firm. ST-1	SM			
- 1 - to - 6 -		BEDROCK (Kgr): Granitic rock. Brown color. Coarse grained. Weathered. Hard below 5'. ST-4	SM/SW			
- 6 - to - 7 -		End Trench at 6'.				

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TEST TRENCH LOGS

GAMBONI PROPERTY, LLC

PROJECT NO. 99-215-P PLATE 7

▼ Sand Cone Test ■ Bulk Sample ❑ Chunk Sample ○ Driven Rings

Date: 6-15-99						Logged by: DM
DEPTH (ft)	SAMPLE	T-23 DESCRIPTION	USCS SYMBOL	FIELD MOISTURE (%)	FIELD DRY DENSITY (pcf)	RELATIVE COMPACTION (%)
0 – 1		TOPSOIL: Silty sand. Brown. Dry, loose. ST-1	SM			
1 – 7	■ (at 4)	BEDROCK (Kgr): Granitic rock. Olive-brown color. Coarse grained. Weathered friable to hard (below 5'). ST-4	SM/SW			
7		End Trench at 7'.				

Date: 6-15-99						Logged by: BC
DEPTH (ft)		T-24 DESCRIPTION	USCS SYMBOL	FIELD MOISTURE (%)	FIELD DRY DENSITY (pcf)	RELATIVE COMPACTION (%
0 – 3		TOPSOIL: Silty sand. Tan-brown, medium-coarse grained, grades to coarse at 2' ST-1	SM			
3 – 4		BEDROCK (Kgr): Granitic rock. Brown color. Coarse grained. Friable to locally hard. ST-4	SM/SW			
4 – 7		End Trench at 4'.				

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TEST TRENCH LOGS

GAMBONI PROPERTY, LLC

PROJECT NO. 99-215-P PLATE 8

▼ Sand Cone Test ■ Bulk Sample ☐ Chunk Sample ○ Driven Rings

Date: 6-15-99						Logged by: BC
DEPTH (ft)	SAMPLE	T-25 DESCRIPTION	USCS SYMBOL	FIELD MOISTURE (%)	FIELD DRY DENSITY (pcf)	RELATIVE COMPACTION (%)
0		ALLUVIUM (Qal): Sandy clay. Dark gray. Moist, stiff.				
5	▩	From 5', color grades to tan. White carbonate deposits throughout.	CL			
10		From 9', color grades to olive. Soil is dry and hard. ST-2				
15		End Trench at 11'.				

Date: 6-15-99						Logged by: BC
DEPTH (ft)		T-26 DESCRIPTION	USCS SYMBOL	FIELD MOISTURE (%)	FIELD DRY DENSITY (pcf)	RELATIVE COMPACTION (%
0		TOPSOIL: Sandy clay. Gray. Moist. Grades more sandy with depth.				
1						
2		ST-2	CL			
3						
4						
5		FORMATIONAL ROCK (Ts): Sandstone. Olive-green color. Coarse grained. Friable to well-cemented below 5'. ST-6	SM/SW			
6						
7		End Trench at 5½'.				

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TEST TRENCH LOGS

GAMBONI PROPERTY, LLC

PROJECT NO. 99-215-P PLATE 9

▼ Sand Cone Test ▩ Bulk Sample ❑ Chunk Sample ○ Driven Rings

BORING LOG
B-1

DEPTH FT	SAMPLE	Description	USCS SYMBOL	MOISTURE (%)	DRY DENSITY (PCF)	RELATIVE COMPACTION (%)
0		TOPSOIL: Sandy clay. Dark olive gray. Hard and dry on surface, stiff and moist below. ST-2	CL			
5 – 27	■ ○ (10') ▽ (17')	FORMATIONAL ROCK (Ts): Claystone. Dark green color. Highly fractured to popcorn texture with random polished surfaces throughout. Weathered soft. Also includes irregular zones of pale green siltstone and white carbonate deposits. Siltstone is discontinuous, and harder and blocky. At 5', approximate attitude on discontinuous bedding: NS/13 E. At 9', irregular, horizontal attitude on carbonate bed. At 12', attitude on 6" thick carbonate bed: N65E/10SW. At 17', water seepage. From 18', rock grades slightly blocky. Remains fractured. At 23', groundwater seepage into hole. Below bedrock remains similar as above. Unable to down-hole log. ST-2	CL/ML	22.2	97.2	88.4
30		End Boring at 27'.				

PROJECT: GAMBONI PROPERTY, LLC

Project No: 99-215-P **Date Drilled:** 7-20-99 **Logged By:** DM

Drill, Sample Method: 2' bucket-auger, 2400 lb. drive

Bulk Sample ■
Ring Sample ○
SPT Sample ‖
Sand Cone Test ▼

PLATE 10

Vinje & Middleton Engineering, Inc.
2450 Vineyard Avenue #102
Escondido, California 92029-1229

BORING LOG
B-2

DEPTH FT	SAMPLE	Description	USCS SYMBOL	MOISTURE (%)	DRY DENSITY (PCF)	RELATIVE COMPACTION (%)
0 – 5		TOPSOIL: Silty clay. Gray-brown. Moist, stiff to soft. ST-2	CL			
5 – 16		FORMATIONAL ROCK (Ts): Sandstone. Pale green color. Fine to medium grained. Massive. Moderately well cemented. No apparent structure. ST-6	SW			
16 – 20		BEDROCK (KGR): Granitic rock. Pale green color. Coarse grained. Weathered friable. Upper contact is irregular. No weak zones present. ST-4	SW/SM			
20 – 30		End Boring at 20'.				

PROJECT: GAMBONI PROPERTY, LLC

Project No: 99-215-P **Date Drilled:** 7-20-99 **Logged By:** DM

Drill, Sample Method: 2' bucket-auger, 2400 lb. drive

Bulk Sample ■
Ring Sample ○
SPT Sample ‖
Sand Cone Test ▼

PLATE 11

Vinje & Middleton Engineering, Inc.
2450 Vineyard Avenue #102
Escondido, California 92029-1229

Date: 8-4-06 Logged by: SJM

DEPTH (FT)	SAMPLE	T-101 DESCRIPTION	USCS SYMBOL	FIELD MOISTURE (%)	FIELD DRY DENSITY (pcf)	RELATIVE COMPACTION (%)
0–5	❑ ▩ (at ~2'); ❑ (at ~4½')	**TOPSOIL:** Sandy, silty clay. Dark grey color. Moist. Soft plastic. Grades stiff at 2'. Polished surfaces. Color changes to pale green at 4½. Local carbonate deposits. ST-2	CH	19.6 21.9	93.9 95.2	78.7 79.8
5–12	❑ ▩ (at ~8')	**FORMATIONAL ROCK:** Sandy siltstone/claystone. Pale green color. Local rust-staining. Weathered soft. "Popcorn" texture at 9'. Some white carbonate deposits. Becomes somewhat blocky at 12'. ST-7	CH	23.6	85.7	77.9
12–15		End Test Trench at 14'. No caving. No groundwater.				

Date: 8-4-06 Logged by: SJM

DEPTH (ft)	SAMPLE	T-102 DESCRIPTION	USCS SYMBOL	FIELD MOISTURE (%)	FIELD DRY DENSITY (pcf)	RELATIVE COMPACTION (%)
0–2		**TOPSOIL:** Silty fine sand. Dark brown color. Porous. Dry. Blocky. Loose. ST-1	SM			
2–6	▩ (at ~3')	**BEDROCK:** Gabbroic rock. Fine to coarse grained. Golden-brown color. Weathered. Friable. Massive. Grades gravelly to somewhat blocky at 5'. ST-4	SW/GW			
6–15		End Test Trench at 6'. No caving. No groundwater.				

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Office 760-743-1214 Fax 760-739-0343

TEST TRENCH LOGS

33-LOT SUBDIVISION - STONEMARK ESTATES

PROJECT NO. 06-323-P PLATE 12

▼ Sand Cone Test ▩ Bulk Sample ❑ Chunk Sample ○ Driven Rings

Date: 8-4-06 Logged by: SJM

DEPTH (FT)	SAMPLE	T-103 DESCRIPTION	USCS SYMBOL	FIELD MOISTURE (%)	FIELD DRY DENSITY (pcf)	RELATIVE COMPACTION (%)
0–3		**TOPSOIL:** Sandy, silty clay. Dark grey color. Damp. Blocky. ST-2	CH			
4–11	❑	**FORMATIONAL ROCK:** Sandy siltstone/claystone. Pale green color. Fractured. Fractures in-filled with carbonate and sandy deposits. "Popcorn" texture. Irregular trench sidewalls. Grades somewhat blocky at 8½'. Continued fractured. Local carbonate deposits. Tight. Smooth trench sidewalls. ST-7	ML/CH	19.4	100.2	83.9
	❑			16.8	109.0	99.1
11–15		End Test Trench at 11'. No caving. No groundwater.				

Date: 8-4-06 Logged by: SJM

DEPTH (ft)	SAMPLE	T-104 DESCRIPTION	USCS SYMBOL	FIELD MOISTURE (%)	FIELD DRY DENSITY (pcf)	RELATIVE COMPACTION (%)
0–1		**TOPSOIL:** Sandy clay. Brown color. Damp. Blocky. ST-8	CL			
1–4		Silty fine sand. Pale brown color. Damp. Loose. ST-1	SM			
4–8	❑	**FORMATIONAL ROCK:** Siltstone/claystone. Pale green color. Fractured. White carbonate deposits. Local maroon-colored staining. "Popcorn" texture to somewhat blocky. ST-7	ML	3.6	123.8	100+
8–12	❑	Sandstone / siltstone. Light brown to pale green color. Slightly fractured. Local carbonate deposits and rust-colored staining. Cemented. Blocky. ST-6	SM/ML	6.4	131.9	100+
12–15		End Test Trench at 6'. No caving. No groundwater.				

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TEST TRENCH LOGS

33-LOT SUBDIVISION - STONEMARK ESTATES

PROJECT NO. 06-323-P PLATE 13

▼ Sand Cone Test ■ Bulk Sample ❑ Chunk Sample ○ Driven Rings

Date: 8-4-06						Logged by: SJM
DEPTH (FT)	SAMPLE	T-105 DESCRIPTION	USCS SYMBOL	FIELD MOISTURE (%)	FIELD DRY DENSITY (pcf)	RELATIVE COMPACTION (%)
- - - 1 - - -	■	**TOPSOIL:** Sandy clay. Brown color. Moist. Moderately plastic. Firm. ST-8	CH			
- - - 5 - - - - -		**BEDROCK:** Gabbroic rock. Fine to coarse grained. Golden brown color. Weathered. Friable. Grades gravelly to somewhat blocky at 6'. Dense.	SW/GW			
- - - 10 - - - - - - - - - - 15 -		End Test Trench at 7'. No caving. No groundwater.				

Date: 8-4-06						Logged by: SJM
DEPTH (ft)	SAMPLE	T-106 DESCRIPTION	USCS SYMBOL	FIELD MOISTURE (%)	FIELD DRY DENSITY (pcf)	RELATIVE COMPACTION (%)
- - - 1 - - -		**TOPSOIL:** Silty fine sand. Brown color. Dry. Loose. ST-1	SM			
- - - - - 5 - - - - - - - - 10 -		**BEDROCK:** Gabbroic rock. Fine to coarse grained. Golden brown color. Weathered. Friable. Massive. Grades gravelly to somewhat blocky at 5'. Dense. Becomes hard at 7' - slow digging. Color changes to grey. ST-4	SW/GW			
- - - - - - - - - 15 -		End Test Trench at 8 - Refusal. No caving. No groundwater.				

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TEST TRENCH LOGS

33-LOT SUBDIVISION - STONEMARK ESTATES

PROJECT NO. 06-323-P **PLATE 14**

▼ Sand Cone Test ■ Bulk Sample ❑ Chunk Sample ❍ Driven Rings

Date: 8-4-06 Logged by: SJM

DEPTH (FT)	SAMPLE	T-107 DESCRIPTION	USCS SYMBOL	FIELD MOISTURE (%)	FIELD DRY DENSITY (pcf)	RELATIVE COMPACTION (%)
- 1 -		**ALLUVIUM:** Sandy silty clay. Dark grey color. Moist. Plastic. Soft to firm. ST-2	CH			
	❑			23.4	91.5	76.7
- 5 -	❑	**BEDROCK:** Gabbroic rock. Fine to coarse grained. Golden brown color. Deeply weathered. Friable. Massive. Grades somewhat blocky at 9'. Hard at 10'. ST-4	SW/GW	19.6	103.8	87.0
- 10 -						
		End Test Trench at 11'. No caving. No groundwater.				

Date: 8-4-06 Logged by: SJM

DEPTH (ft)	SAMPLE	T-108 DESCRIPTION	USCS SYMBOL	FIELD MOISTURE (%)	FIELD DRY DENSITY (pcf)	RELATIVE COMPACTION (%)
- 1 -		**TOPSOIL:** Sandy, silty clay. Dark brown color. Moist. Blocky. Moderately plastic. Soft. ST-2	CH			
- 5 -	▽	**FORMATIONAL ROCK:** Claystone. Olive green color. Weathered soft. "Popcorn" texture. Polished surfaces. Upper contact marked by a 6" thick off-white friable silt lens. ST-7	CH			
- 10 -		Siltstone, off-white color. Weathered soft and plastic. Irregular upper and lower contact. ST-3	ML			
		Claystone. Olive-green color. Weathered soft. Popcorn" texture. Weeping and significant sidewall caving below 8' on uphill side. ST-7	CH			
- 15 -						
		End Test Trench at 17'. Caving and weeping below 8'. No groundwater.				

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TEST TRENCH LOGS

33-LOT SUBDIVISION - STONEMARK ESTATES

PROJECT NO. 06-323-P **PLATE 15**

▼ Sand Cone Test ■ Bulk Sample ❑ Chunk Sample ○ Driven Rings

Date: 8-4-06 Logged by: SJM

DEPTH (FT)	SAMPLE	T-109 DESCRIPTION	USCS SYMBOL	FIELD MOISTURE (%)	FIELD DRY DENSITY (pcf)	RELATIVE COMPACTION (%)
0–5		**FILL:** Silty clay. Dark grey color. Very moist. Soft. Plastic. (Remnants of nearby landslide repair). Musty oder. ST-2	CH			
5–7		**FORMATIONAL ROCK:** Claystone. Olive-green color. Deeply weathered. Soft. "Popcorn" texture. ST-7 Trench abandoned at 7' when large cracks formed 4-feet away and parallel to trench and subsequently caved into trench.	CH			
		End Test Trench at 7'. Sidewall caving on uphill side. No groundwater.				

Date: 8-4-06 Logged by: SJM

DEPTH (ft)	SAMPLE	T-110 DESCRIPTION	USCS SYMBOL	FIELD MOISTURE (%)	FIELD DRY DENSITY (pcf)	RELATIVE COMPACTION (%)
0–5		**TOPSOIL:** Silty, sand clay. Dark grey color. Moist. Soft. Moderately plastic. White carbonate deposits at 3½'. ST-2	CH			
5–10	❑	**FORMATIONAL ROCK:** Medium sandstone grading to siltstone. Off-white to pale grey color. Very moist at upper contact. Slightly fractured. Fractures filled with white carbonate deposits. Local rust-colored staining. Weathered. Friable. Grades somewhat blocky at 7'. Moderately cemented. Dense. ST-6	SP/ML	9.1	128.3	100+
		End Test Trench at 10'. No caving. No groundwater.				

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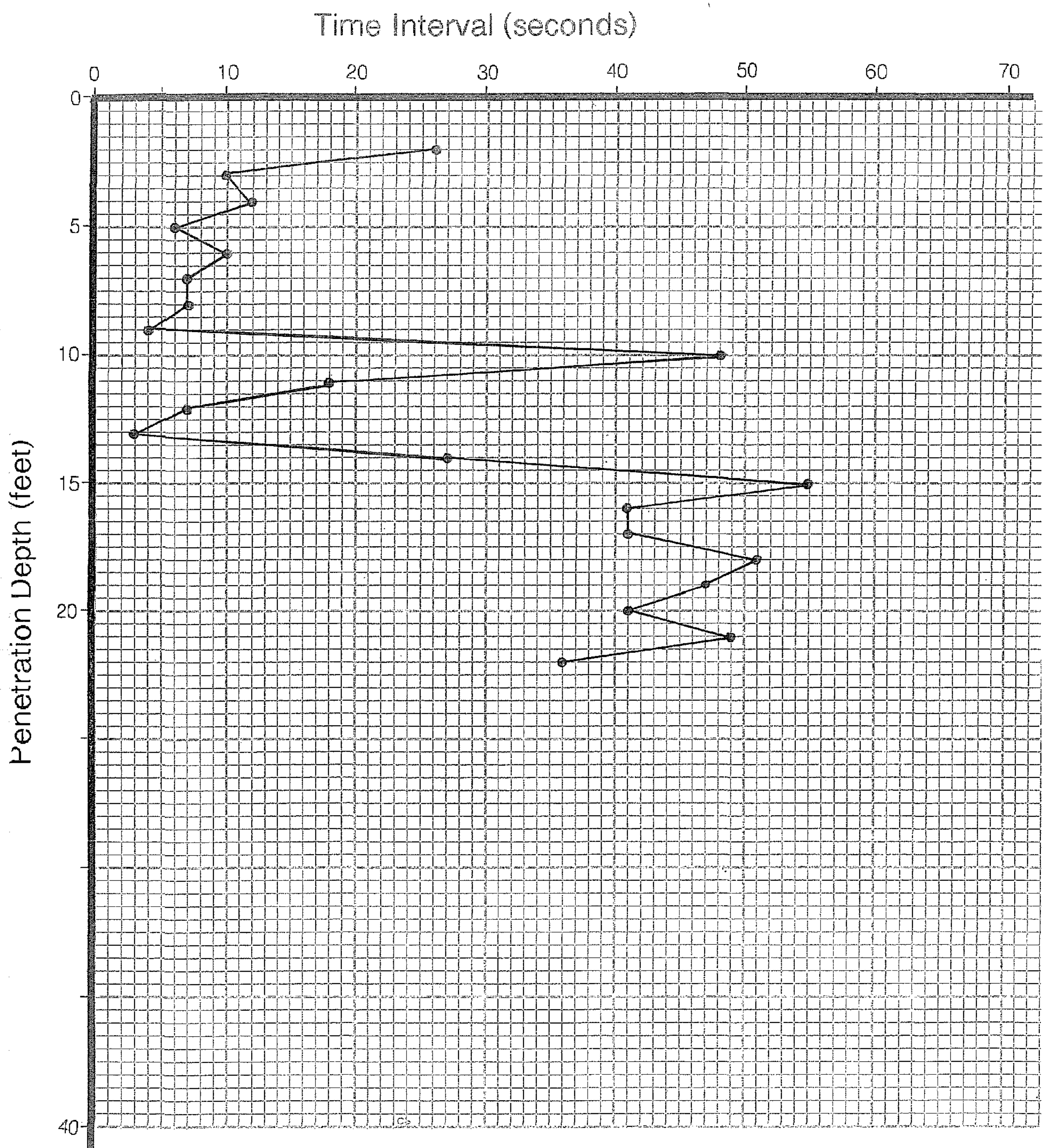
TEST TRENCH LOGS
33-LOT SUBDIVISION - STONEMARK ESTATES
PROJECT NO. 06-323-P PLATE 16

▼ Sand Cone Test ■ Bulk Sample ❑ Chunk Sample ○ Driven Rings

AIR-TRACK DRILL DATA

BORING

B-101



Project 03-352-P

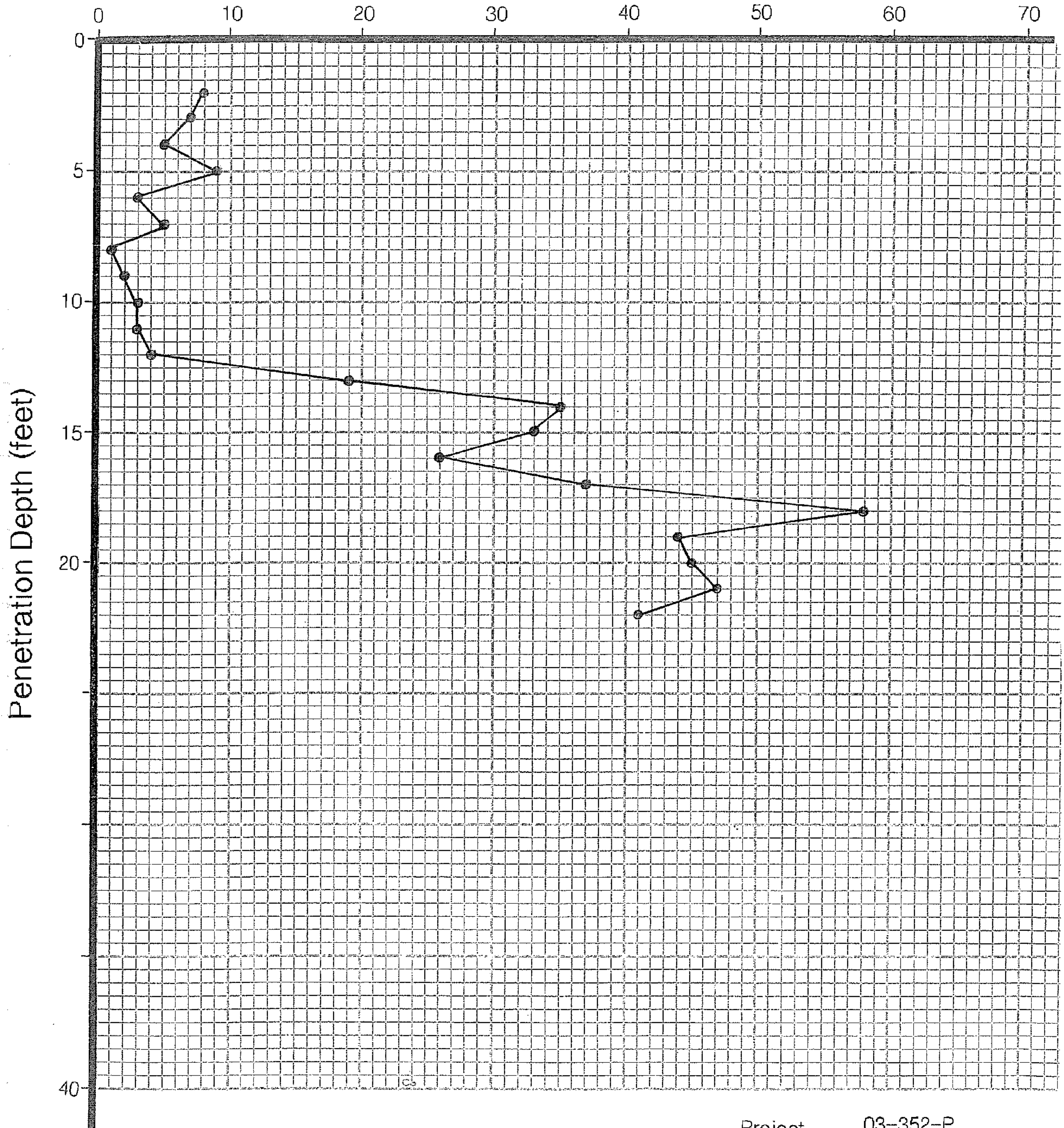
Date 9/5/03 PLATE 17

ELEV 456'

AIR-TRACK DRILL DATA

BORING

B-102



Project 03-352-P

ELEV. 451'

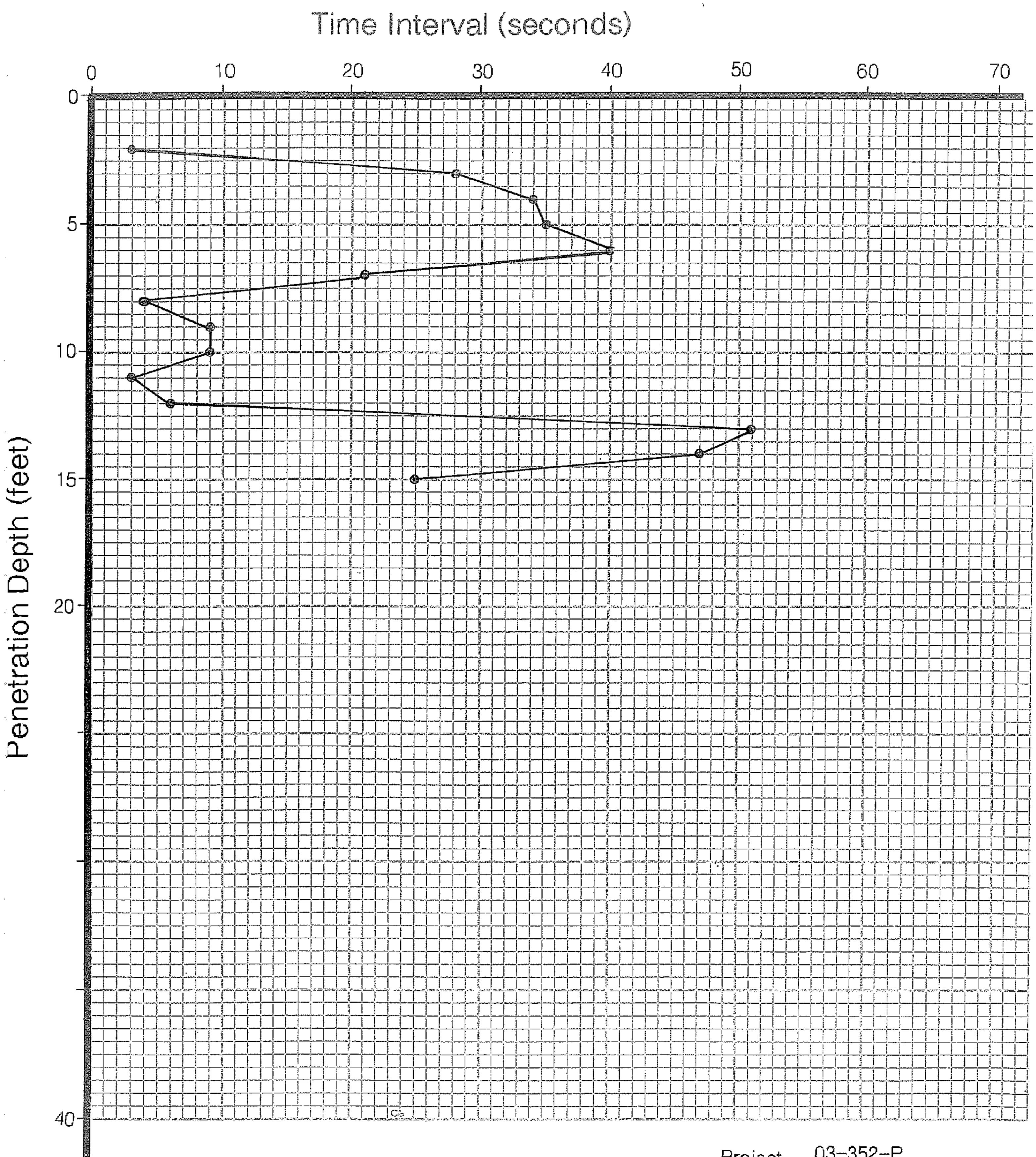
Date 9/5/03

PLATE 18

AIR-TRACK DRILL DATA

BORING

B-103



ELEV. 444'

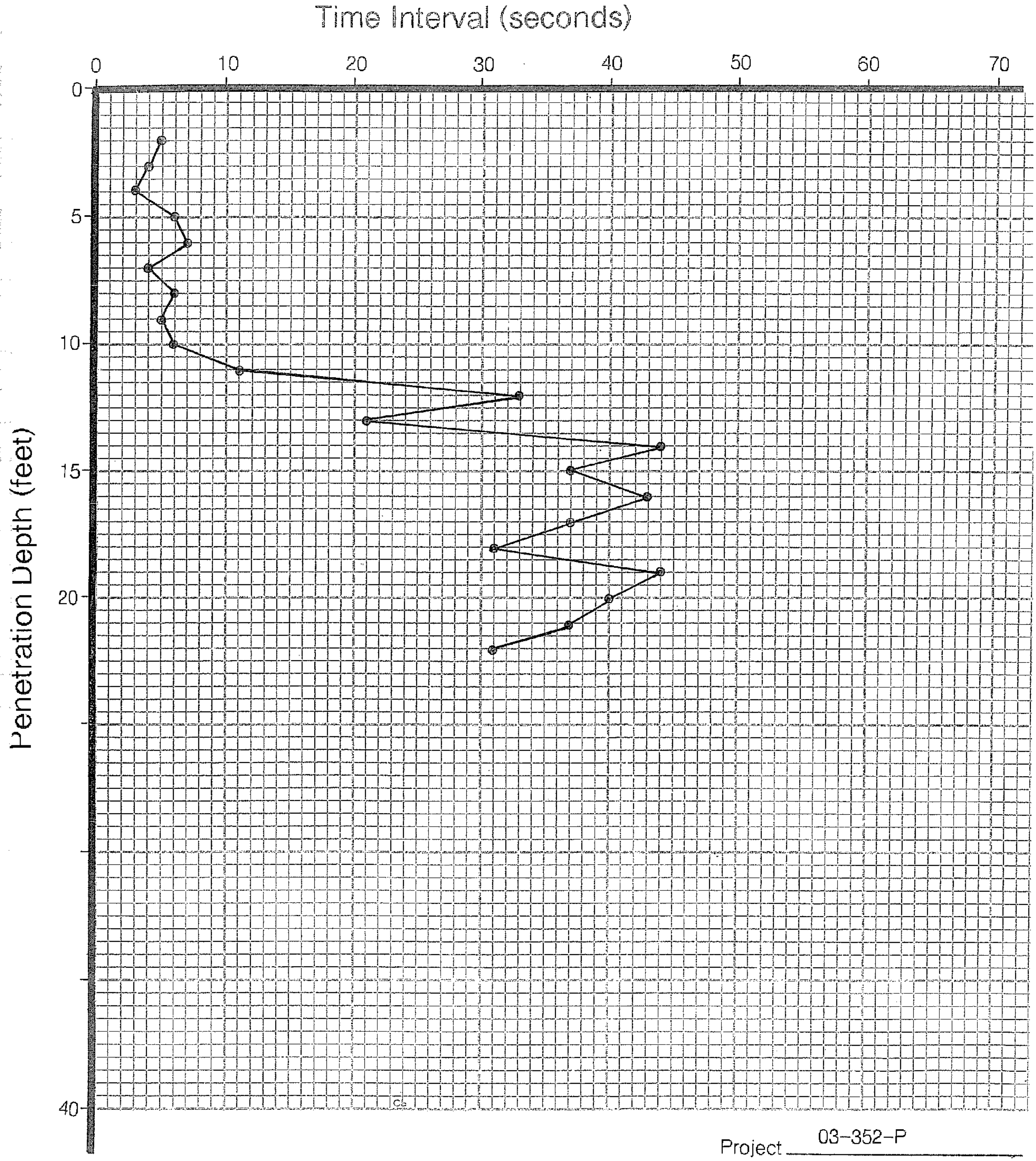
Project 03-352-P

Date 9/5/03 PLATE 19

AIR-TRACK DRILL DATA

BORING

B-104



Project 03-352-P

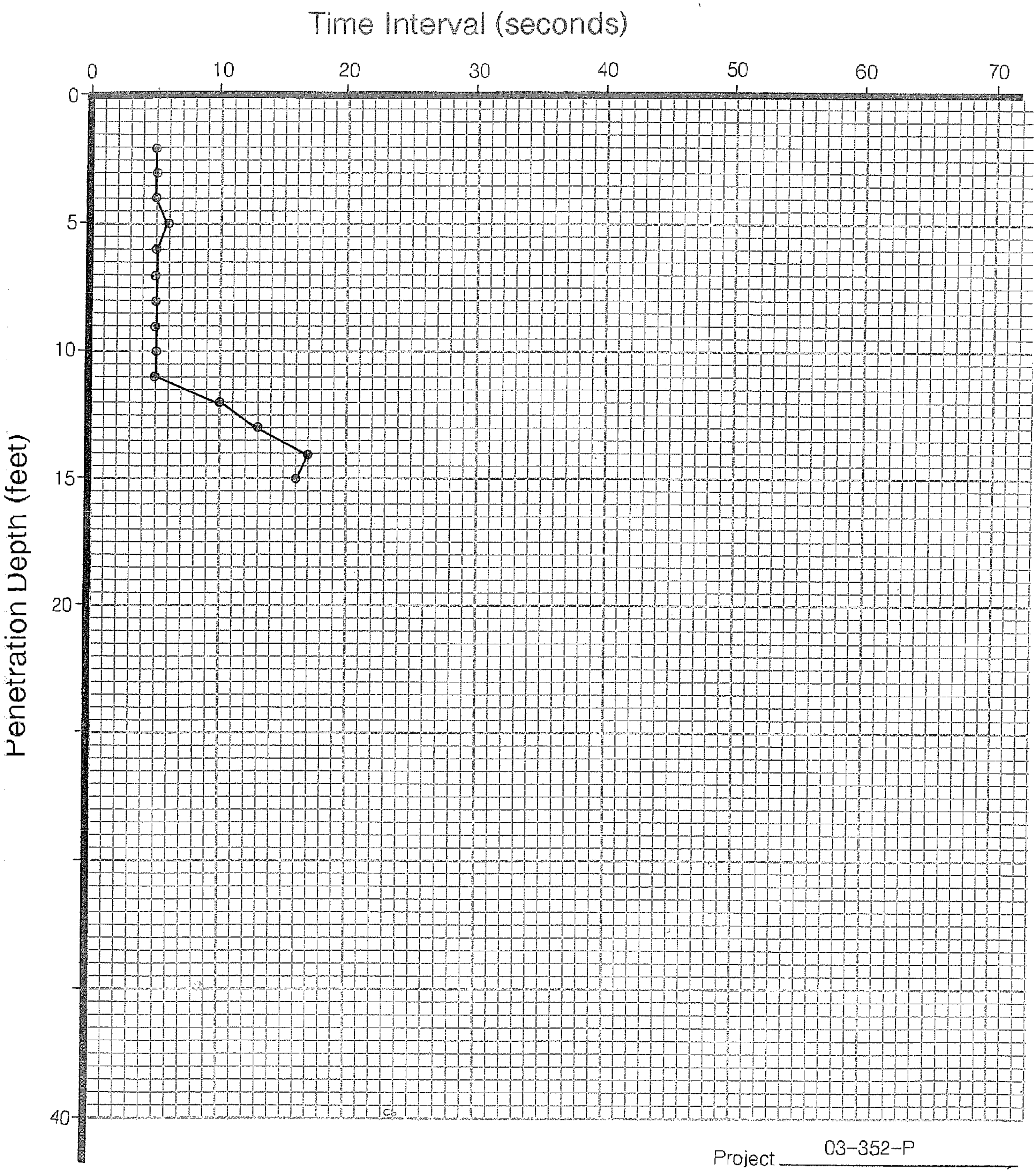
ELEV 471'

Date 9/5/03 PLATE 20

AIR-TRACK DRILL DATA

BORING

B-105



Project 03-352-P

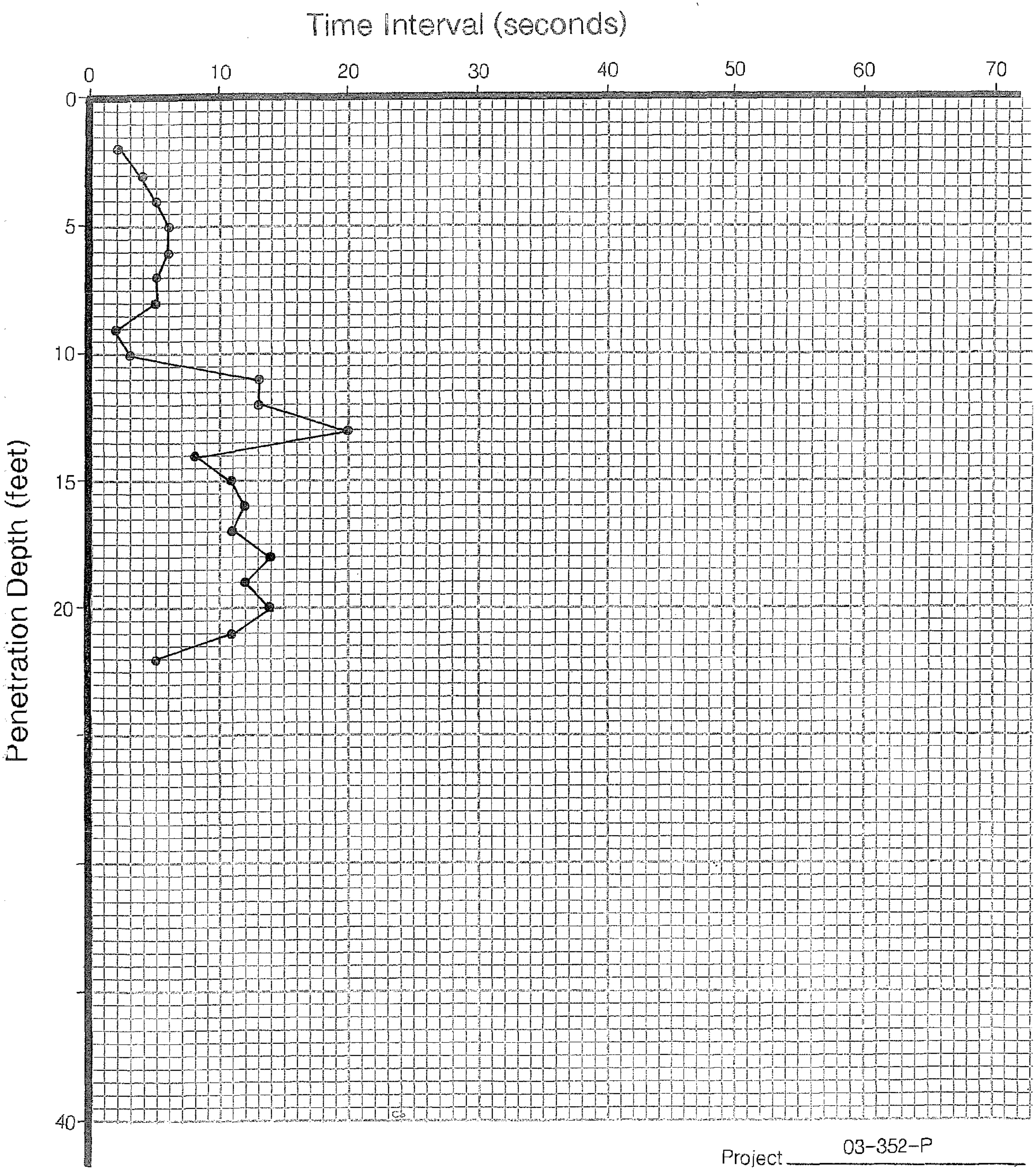
ELEV. 480'

Date 9/5/03 PLATE 21

AIR-TRACK DRILL DATA

BORING

B-106



Project 03-352-P

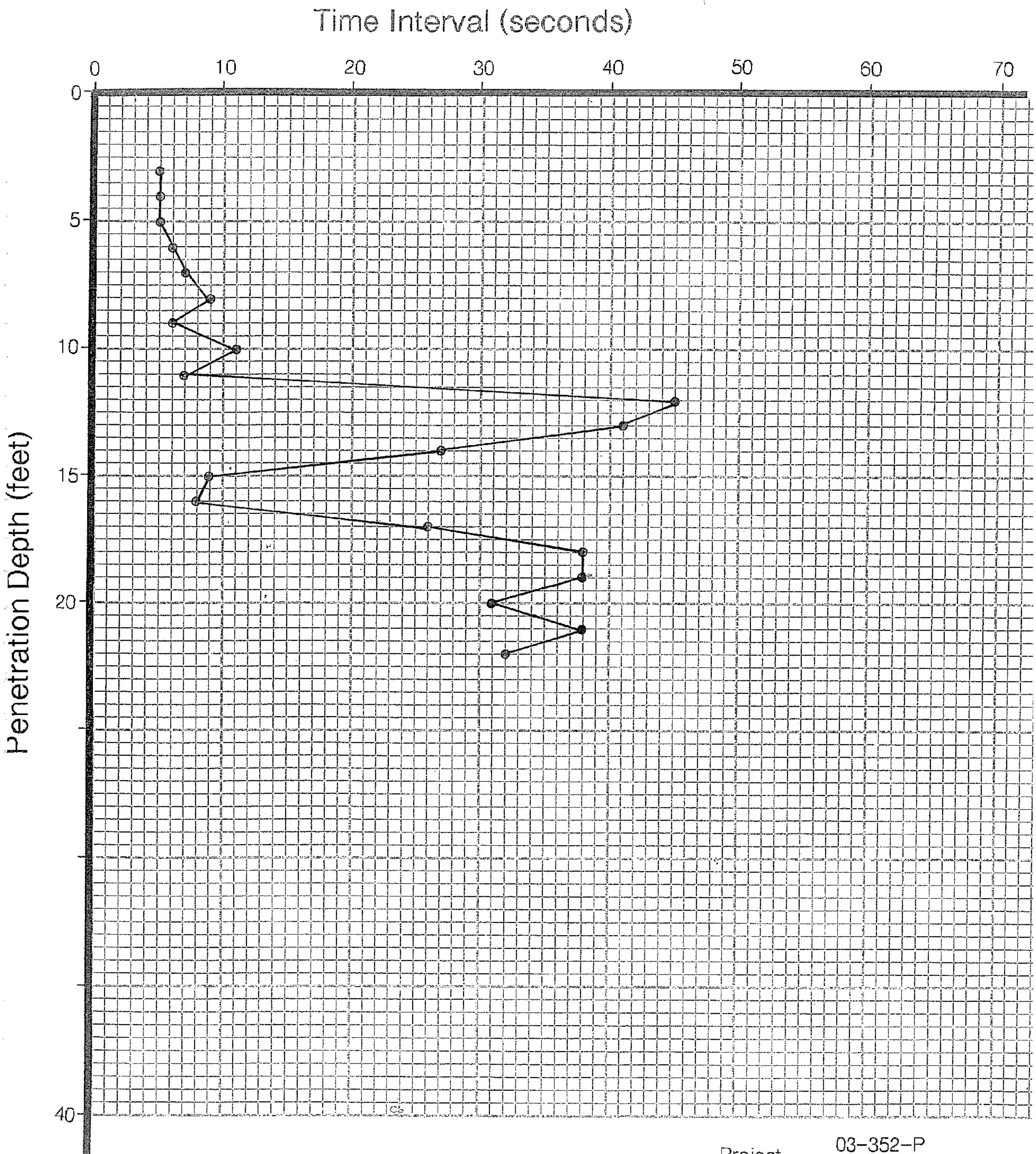
Date 9/5/03 PLATE 22

ELEV. 484'

AIR-TRACK DRILL DATA

BORING

B-107



Project 03-352-P

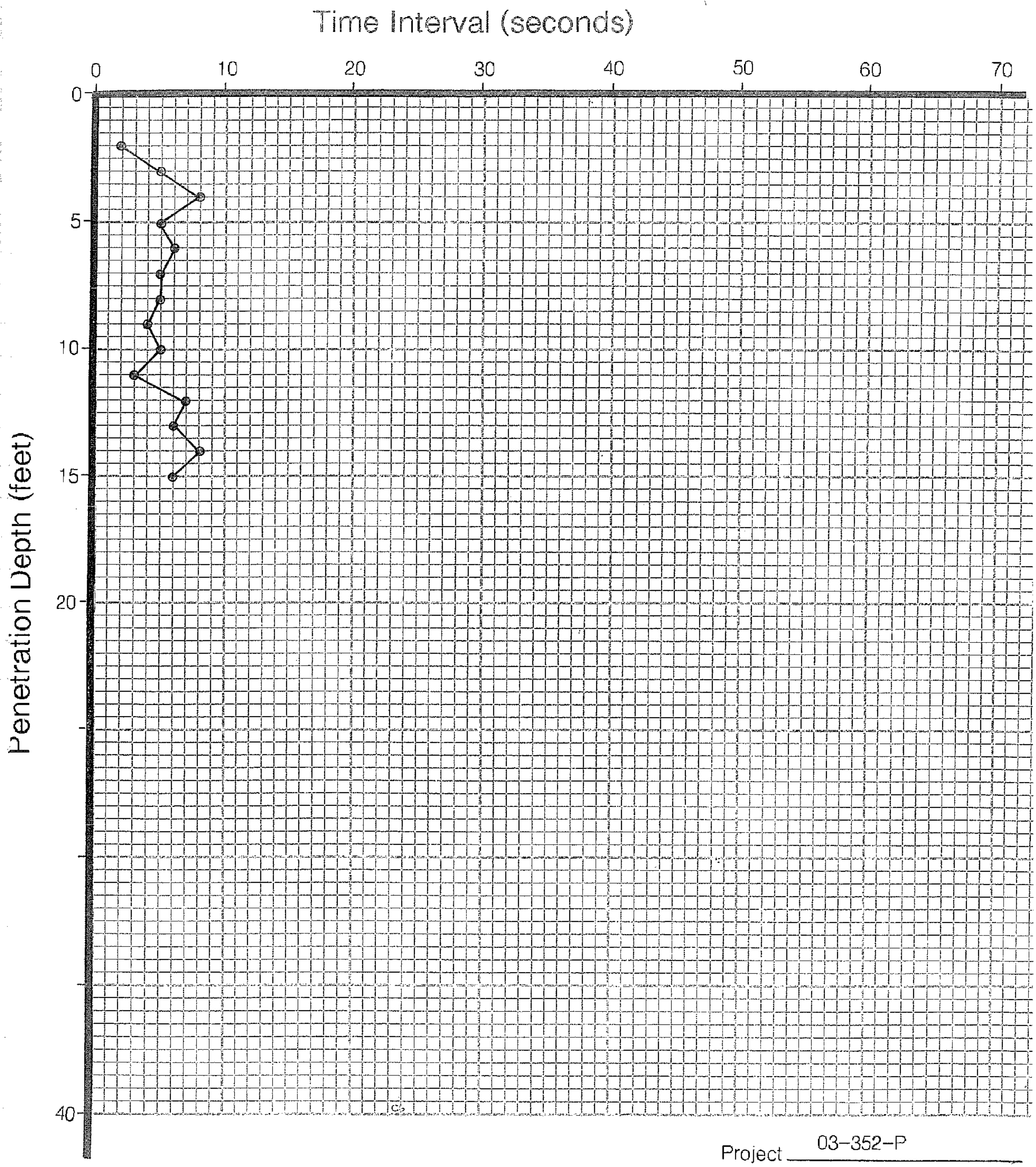
ELEV. 480'

Date 9/5/03 PLATE 23

AIR-TRACK DRILL DATA

BORING

B-108



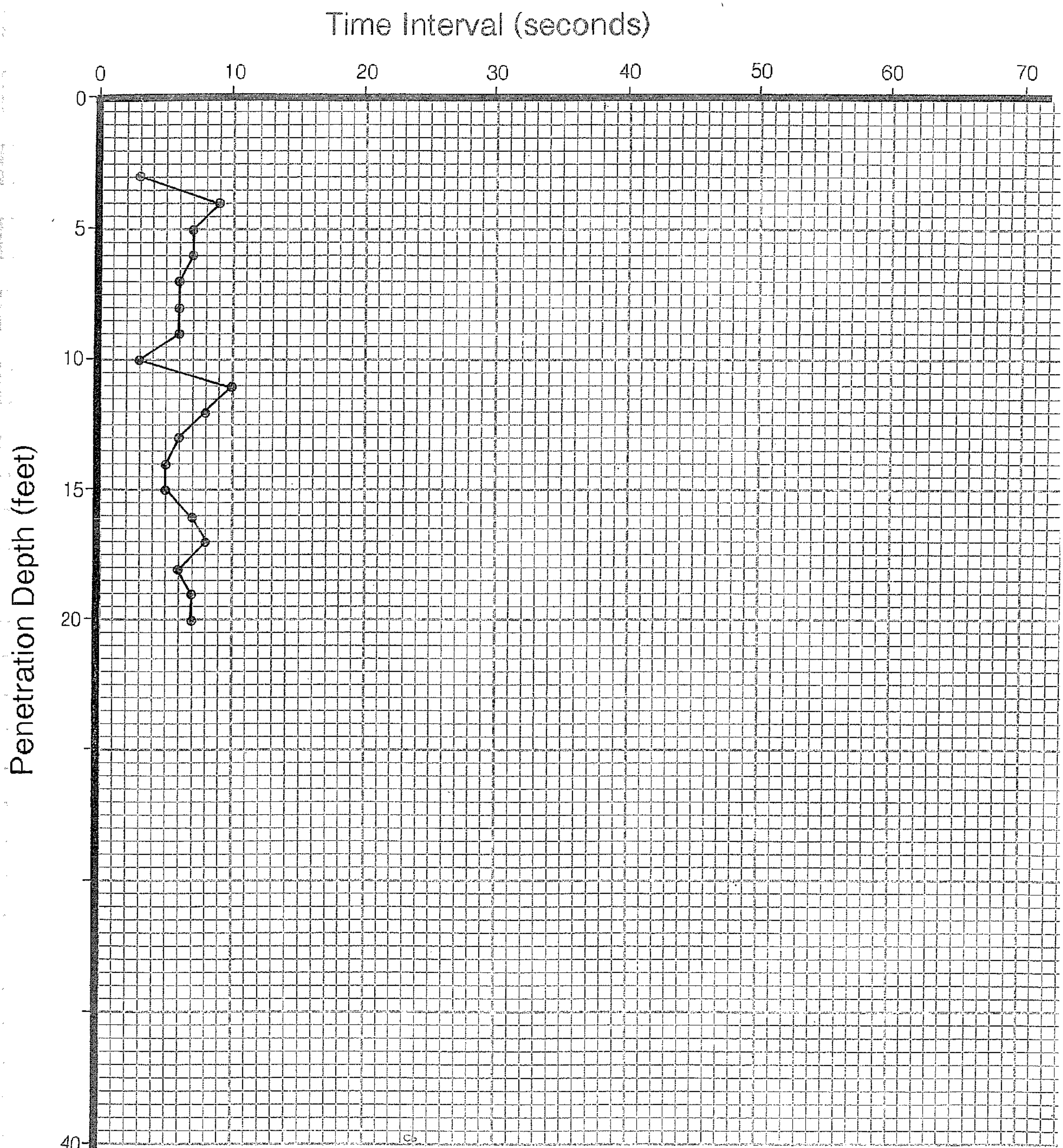
Project 03-352-P

9/5/03

AIR-TRACK DRILL DATA

BORING

B-109



ELEV. 497'

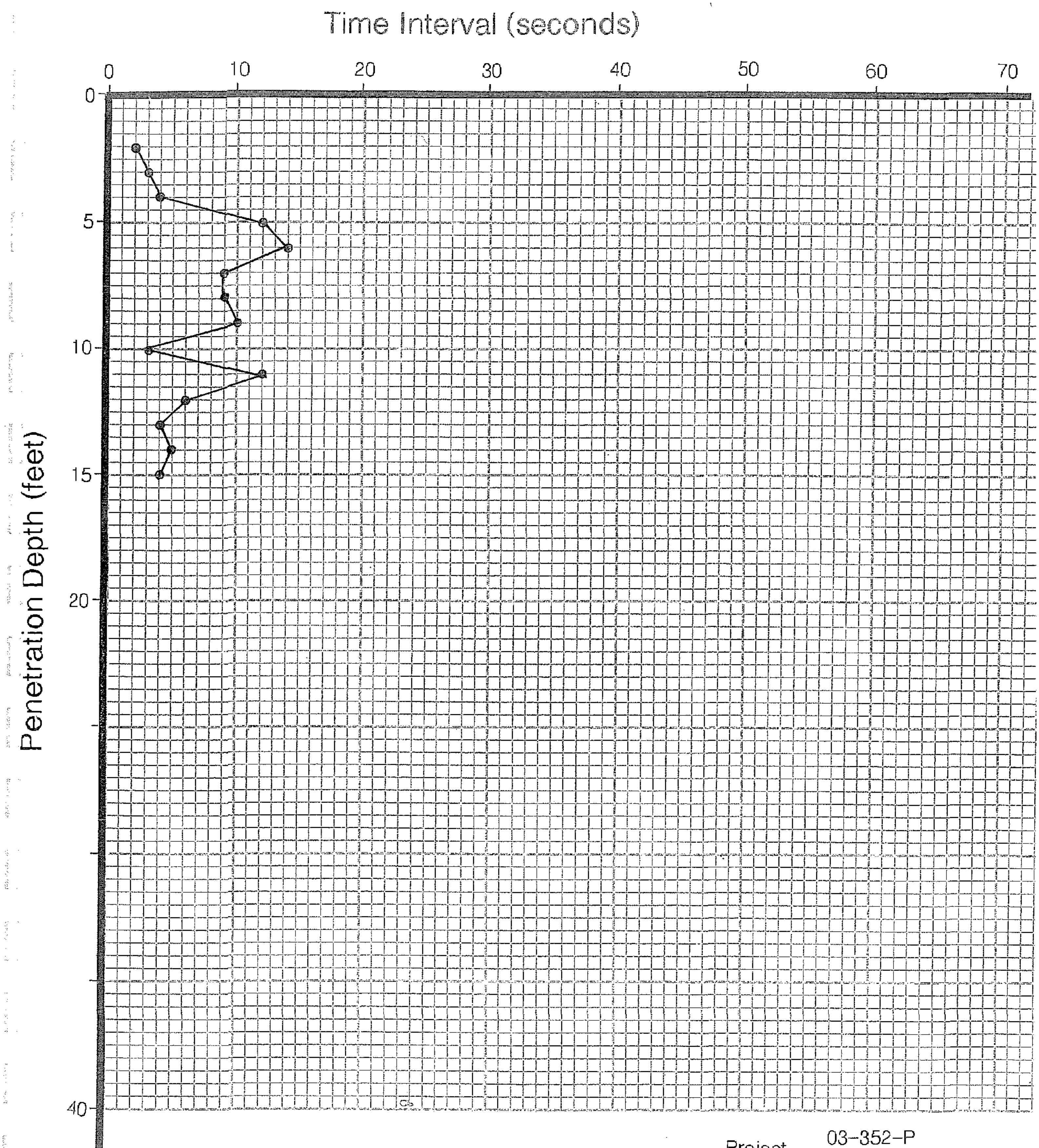
Project 03-352-P

Date 9/5/03 PLATE 25

AIR-TRACK DRILL DATA

BORING

B-110



Project 03-352-P

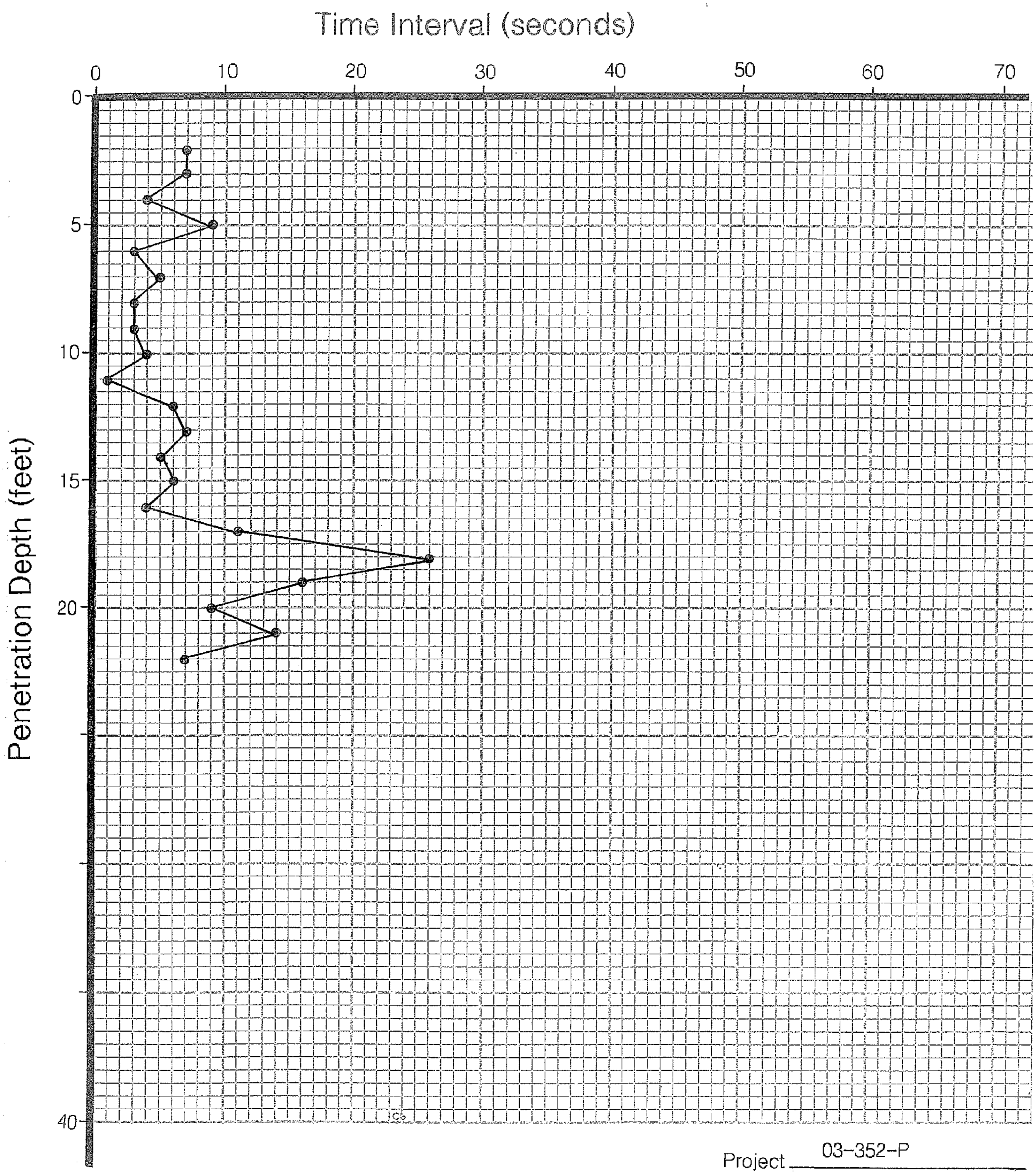
ELEV. 477'

Date 9/5/03 PLATE 26

AIR-TRACK DRILL DATA

BORING

B-111



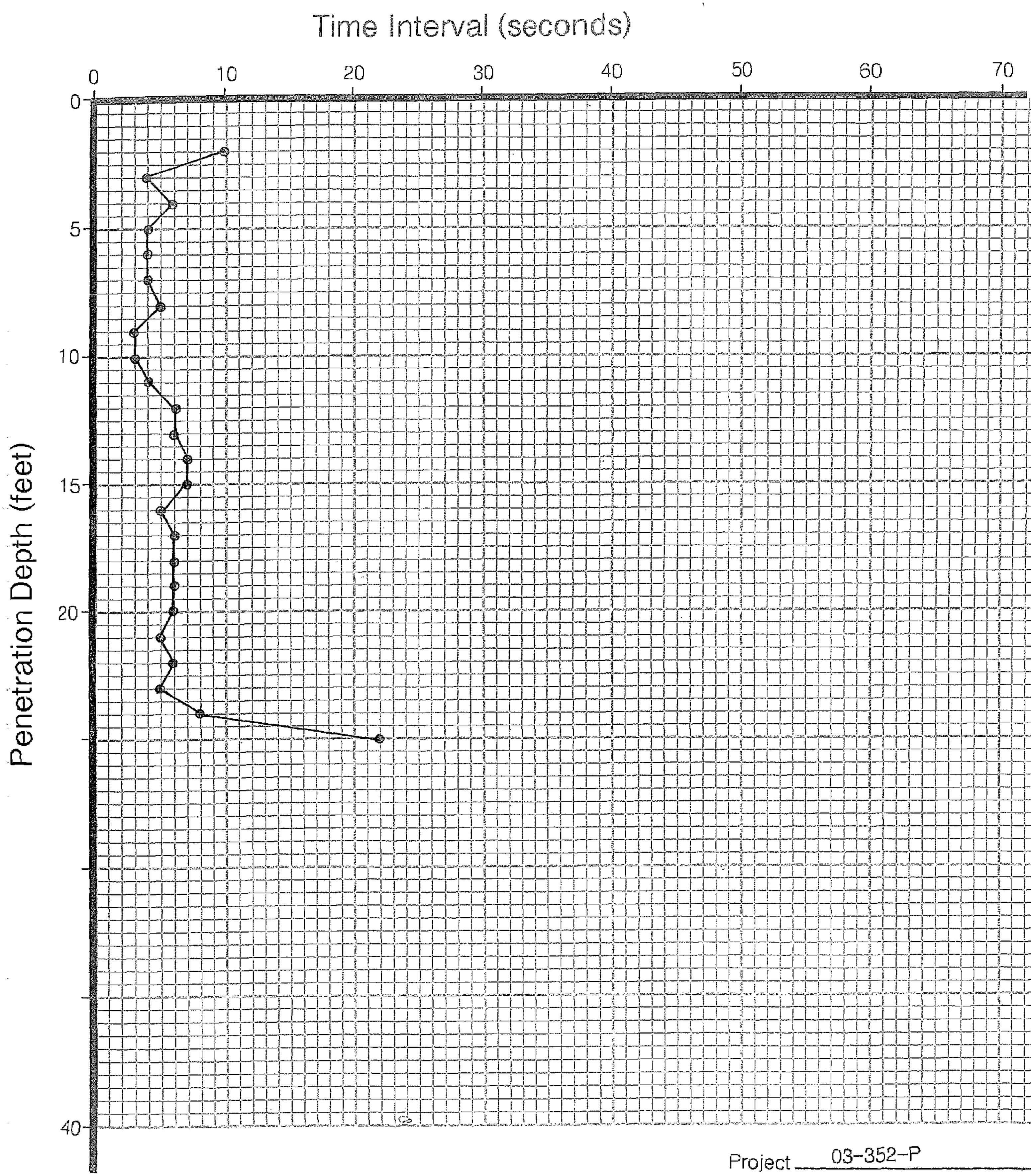
Project 03-352-P

9/5/03

AIR-TRACK DRILL DATA

BORING

B-112



ELEV. 494'

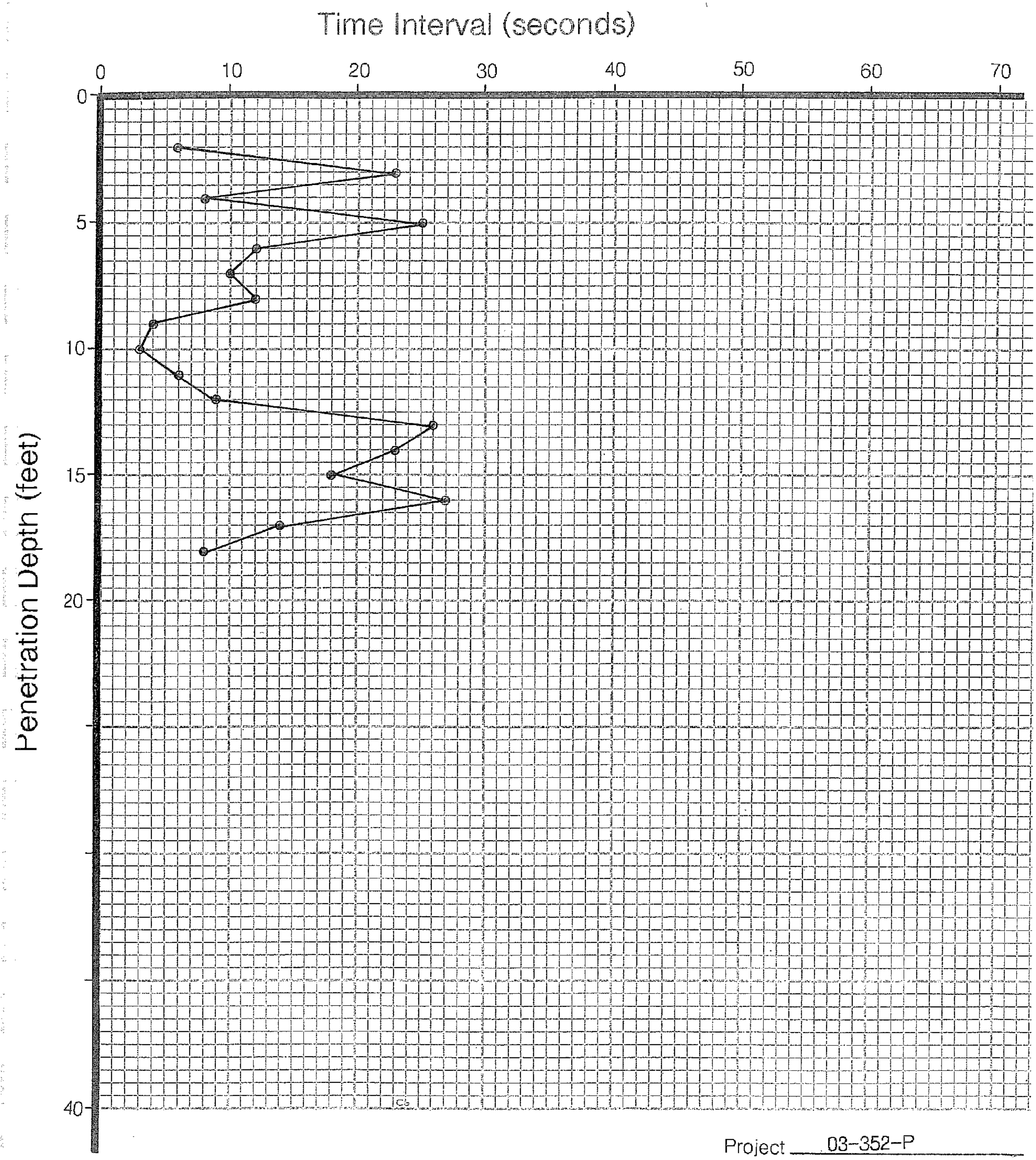
Project 03-352-P

Date 9/5/03 PLATE 28

AIR-TRACK DRILL DATA

BORING

B-113



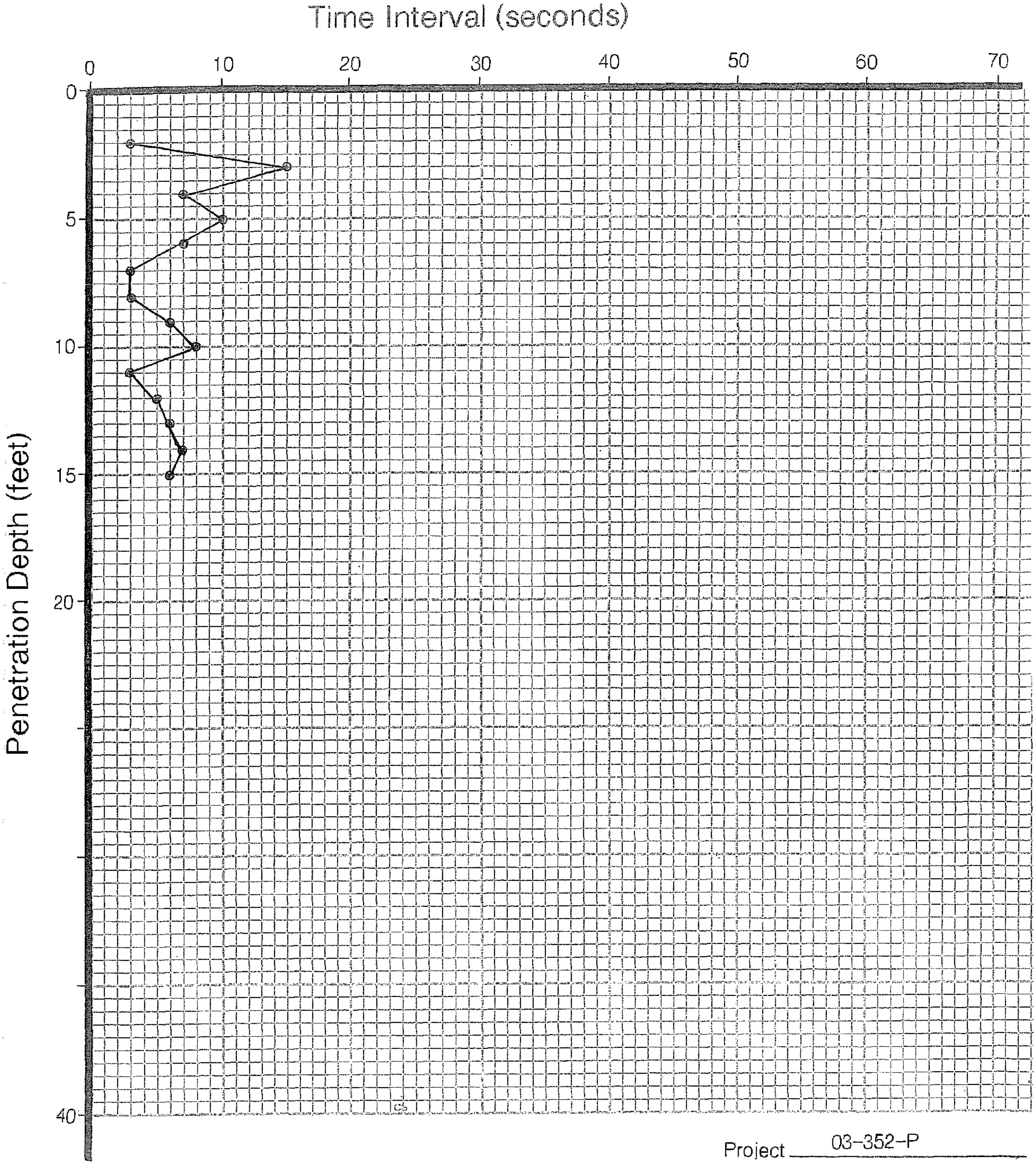
Project 03-352-P

ELEV. 470' Date 9/5/03 PLATE

AIR-TRACK DRILL DATA

BORING

B-114



ELEV. 474'

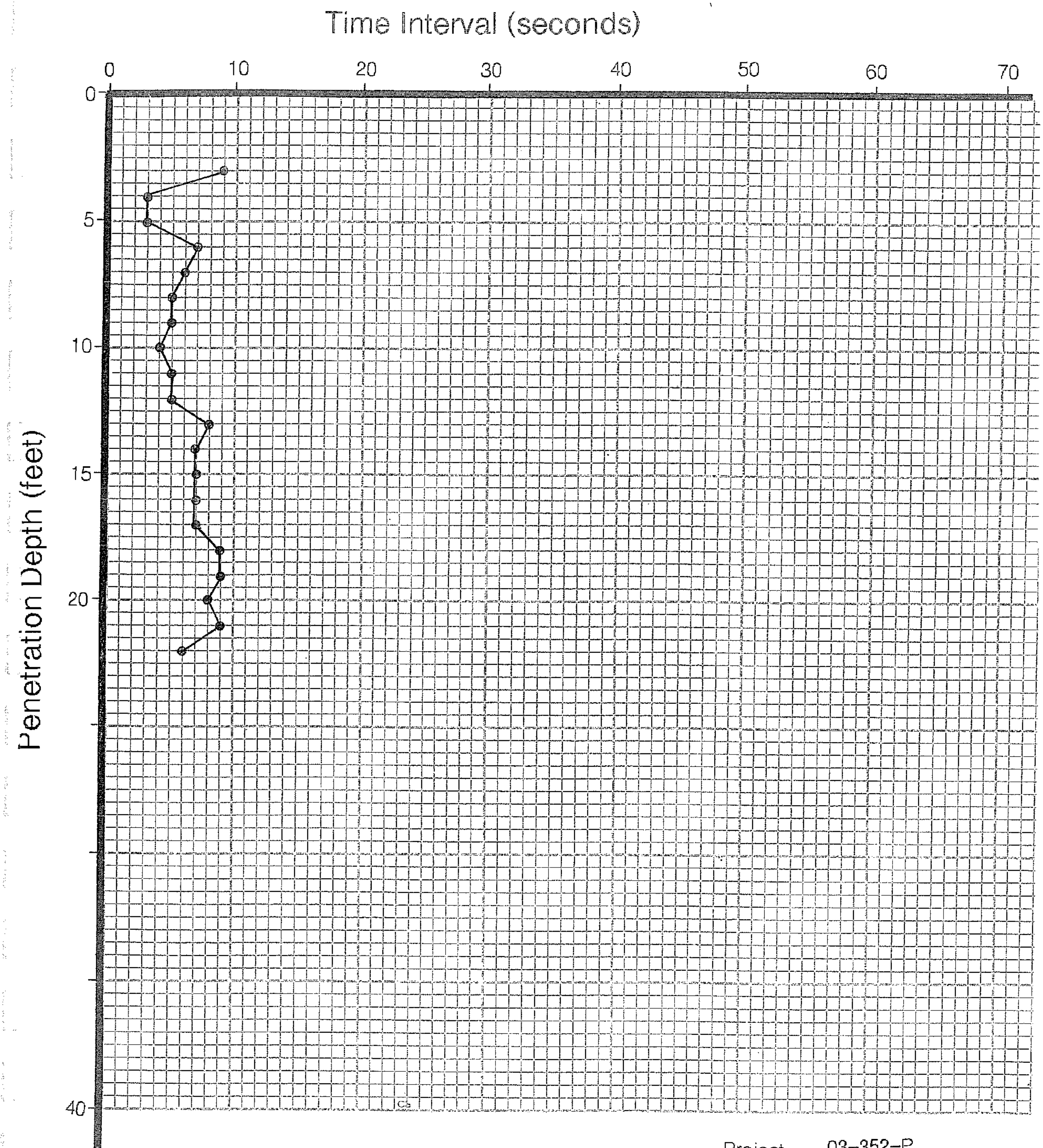
Project 03-352-P

Date 9/5/03 PLATE 30

AIR-TRACK DRILL DATA

BORING

B-115



Project 03-352-P

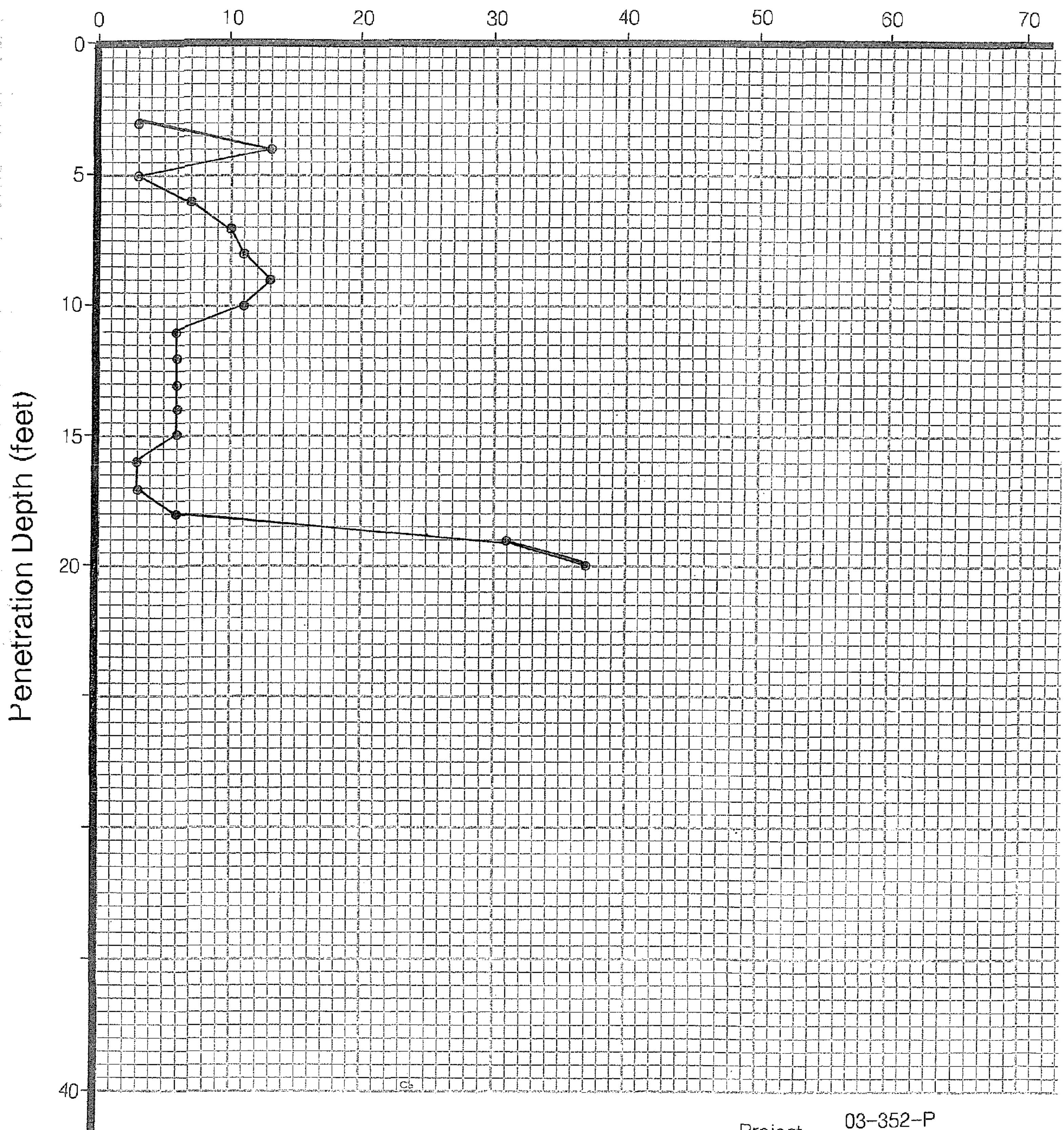
ELEV. 479'

Date 9/5/03 PLATE 31

AIR-TRACK DRILL DATA

BORING

B-116

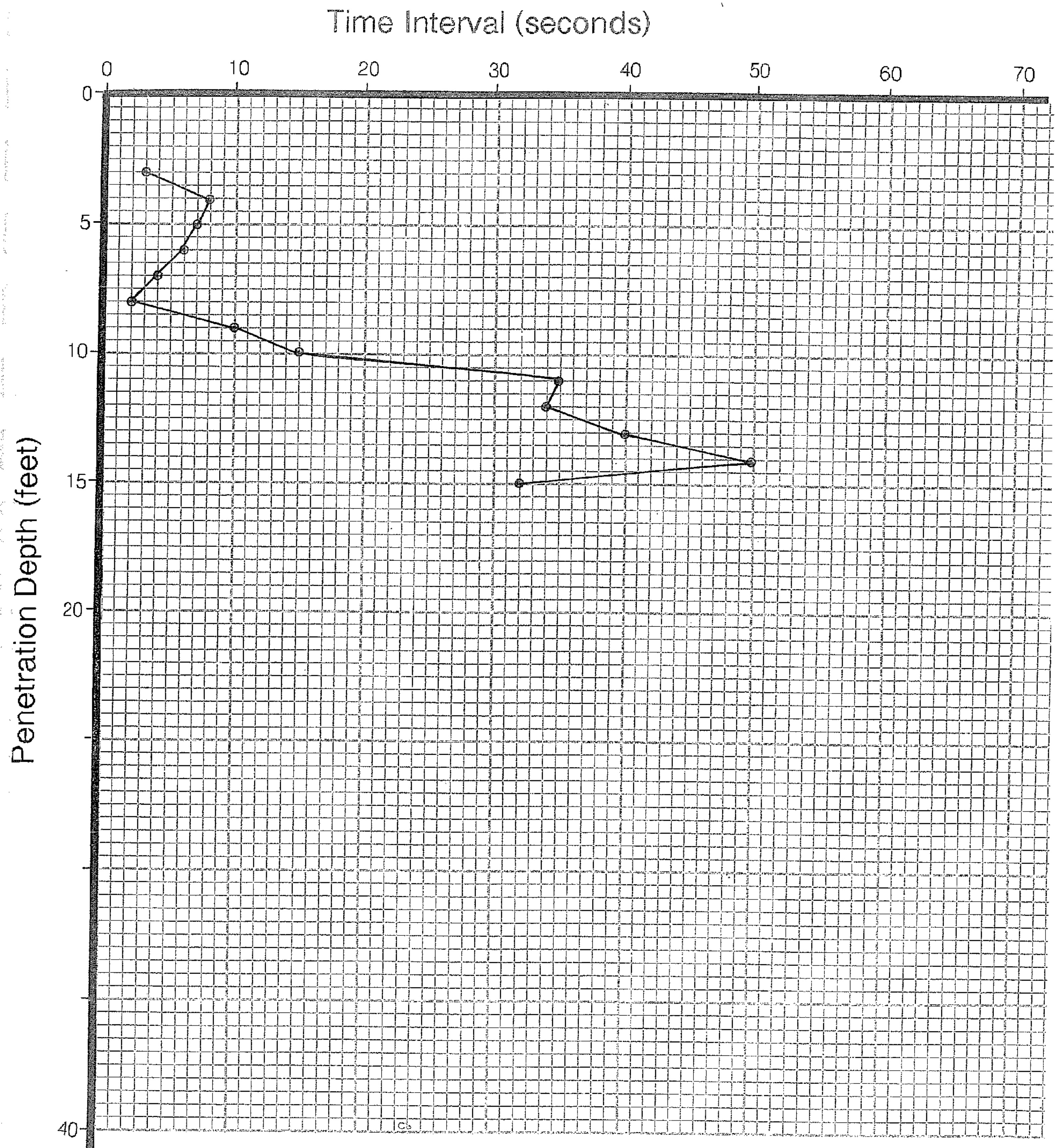


Project 03-352-P

AIR-TRACK DRILL DATA

BORING

B-117



Project 03-352-P

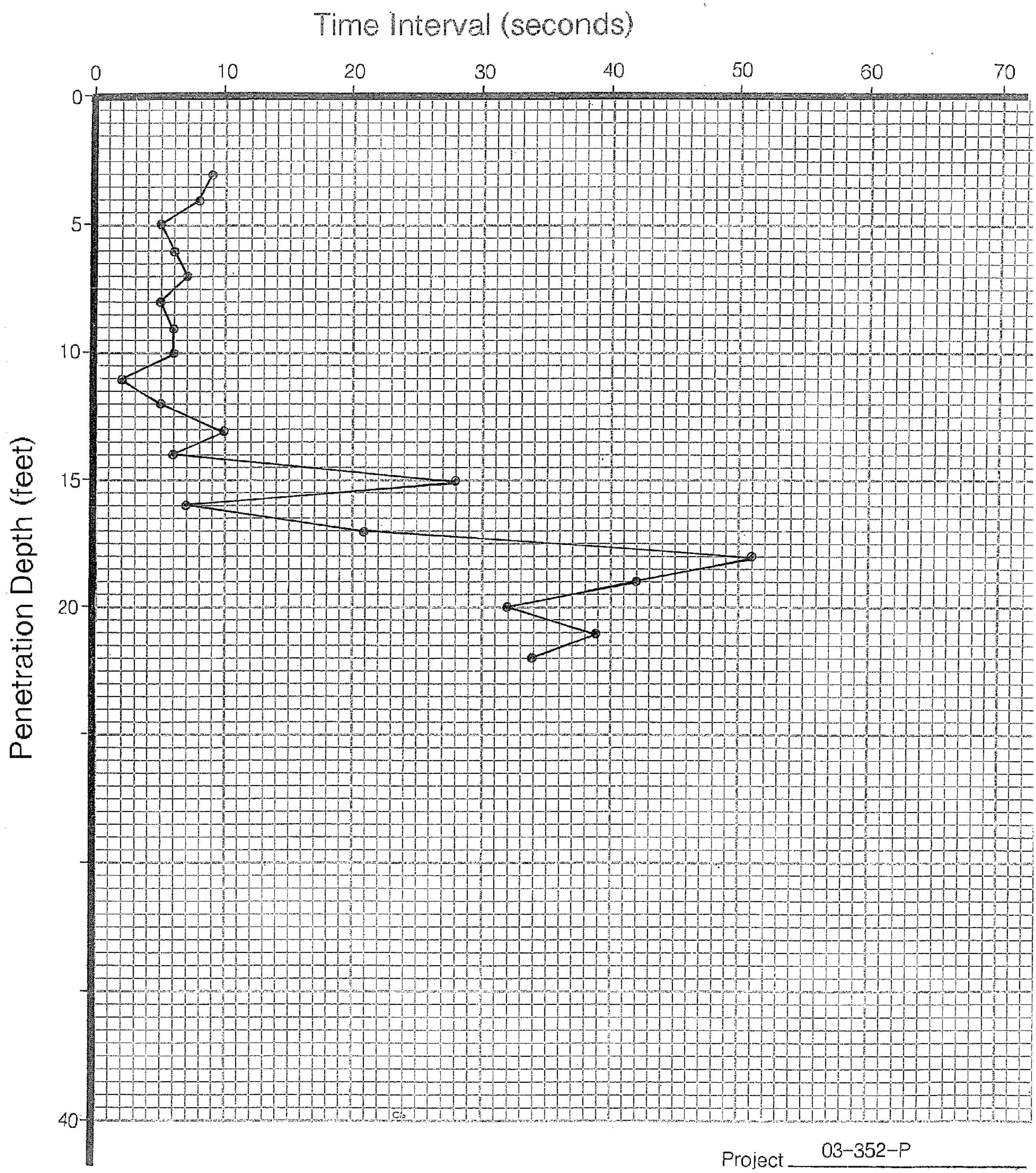
ELEV. 471'

Date 9/5/03 PLATE 33

AIR-TRACK DRILL DATA

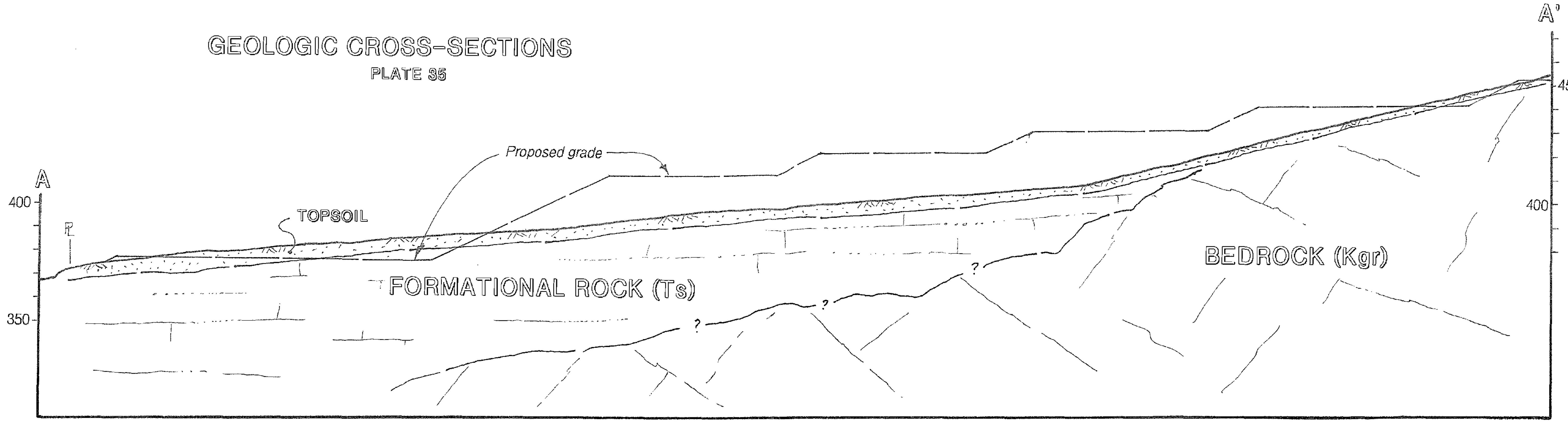
BORING

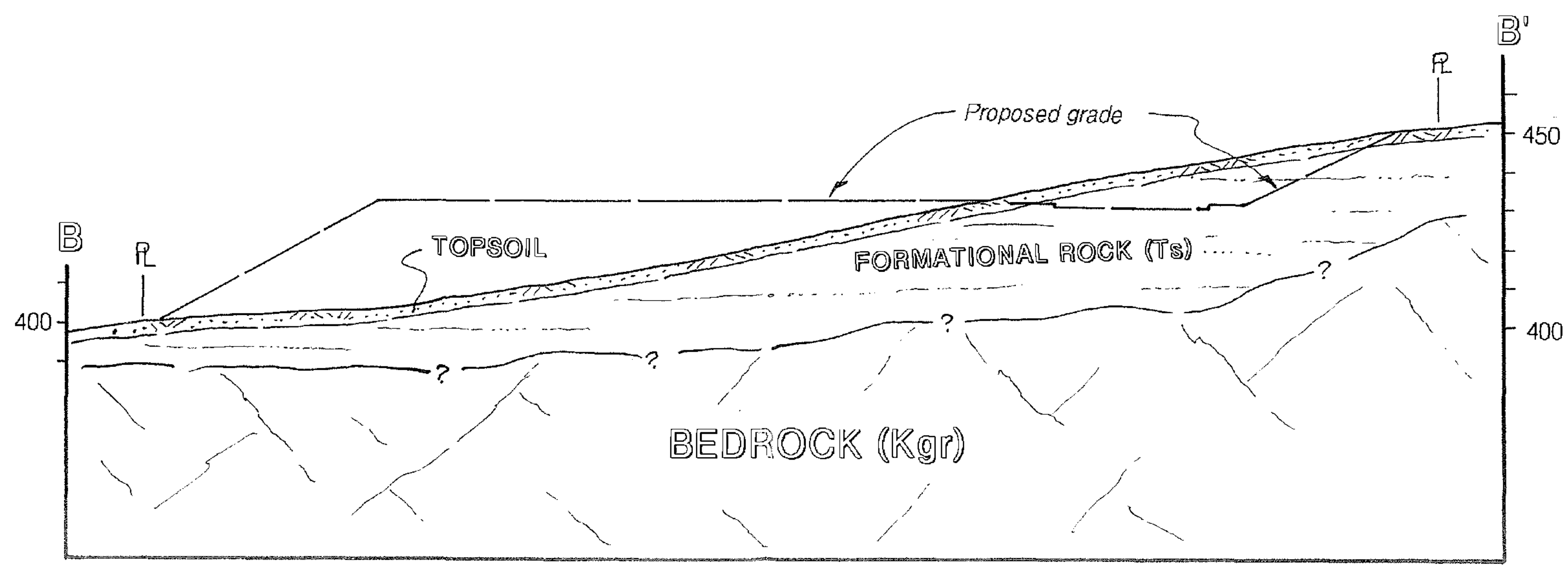
B-118



Project 03-352-P

GEOLOGIC CROSS-SECTIONS
PLATE 35

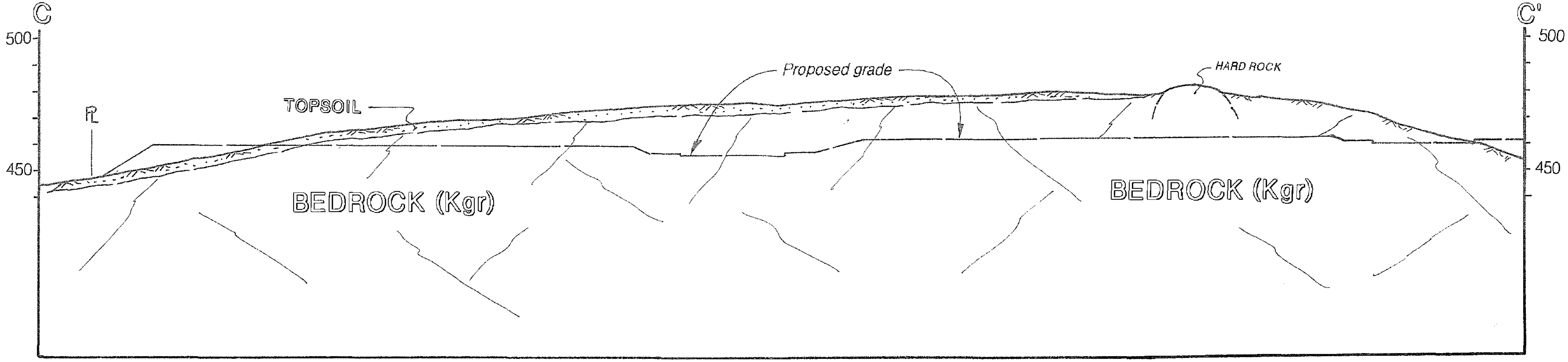


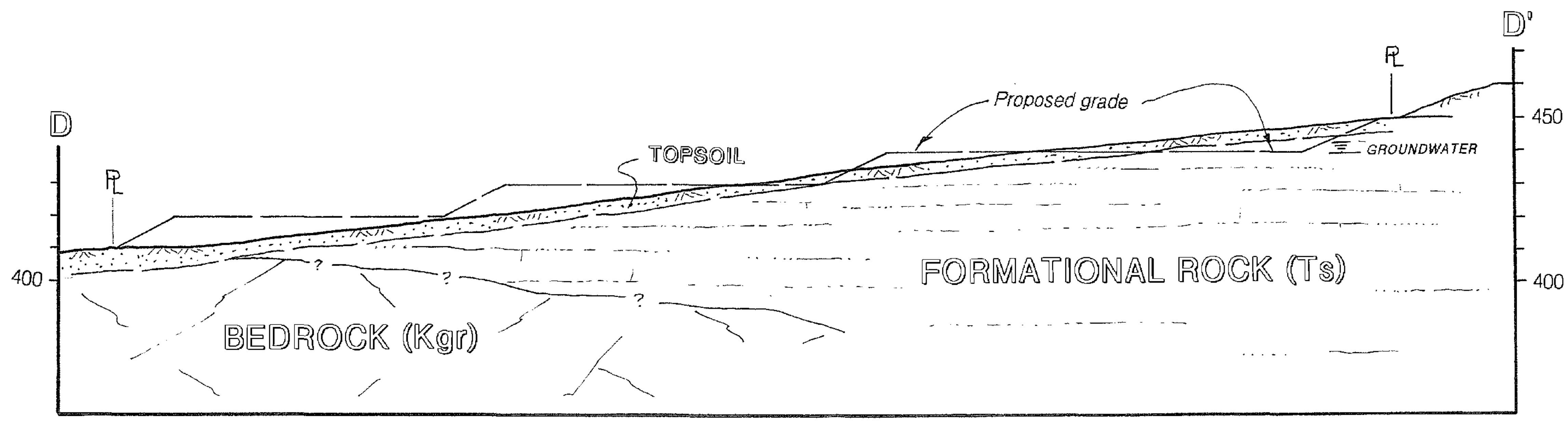


Scale: 1"=40'

GEOLOGIC CROSS-SECTIONS

PLATE 36

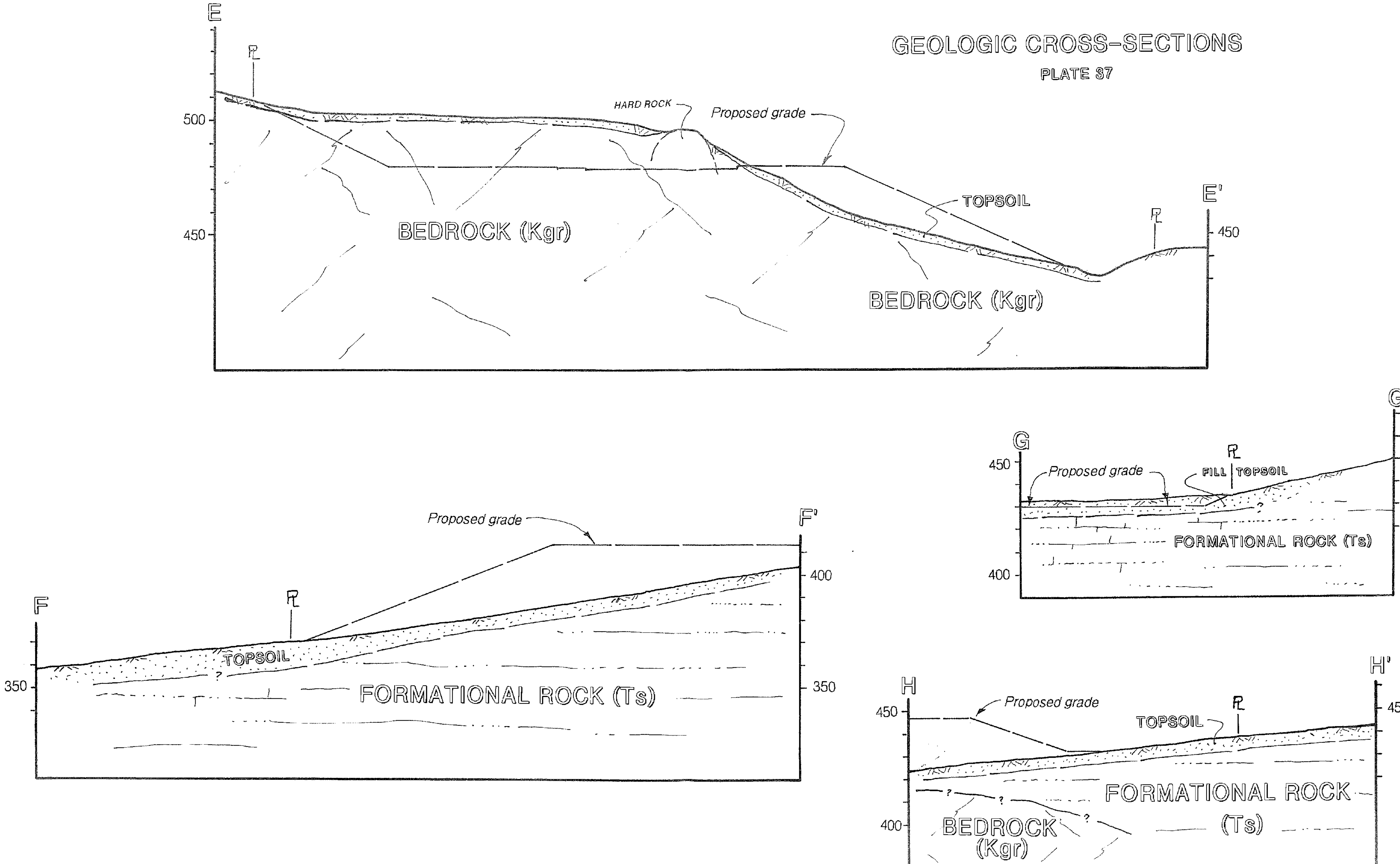




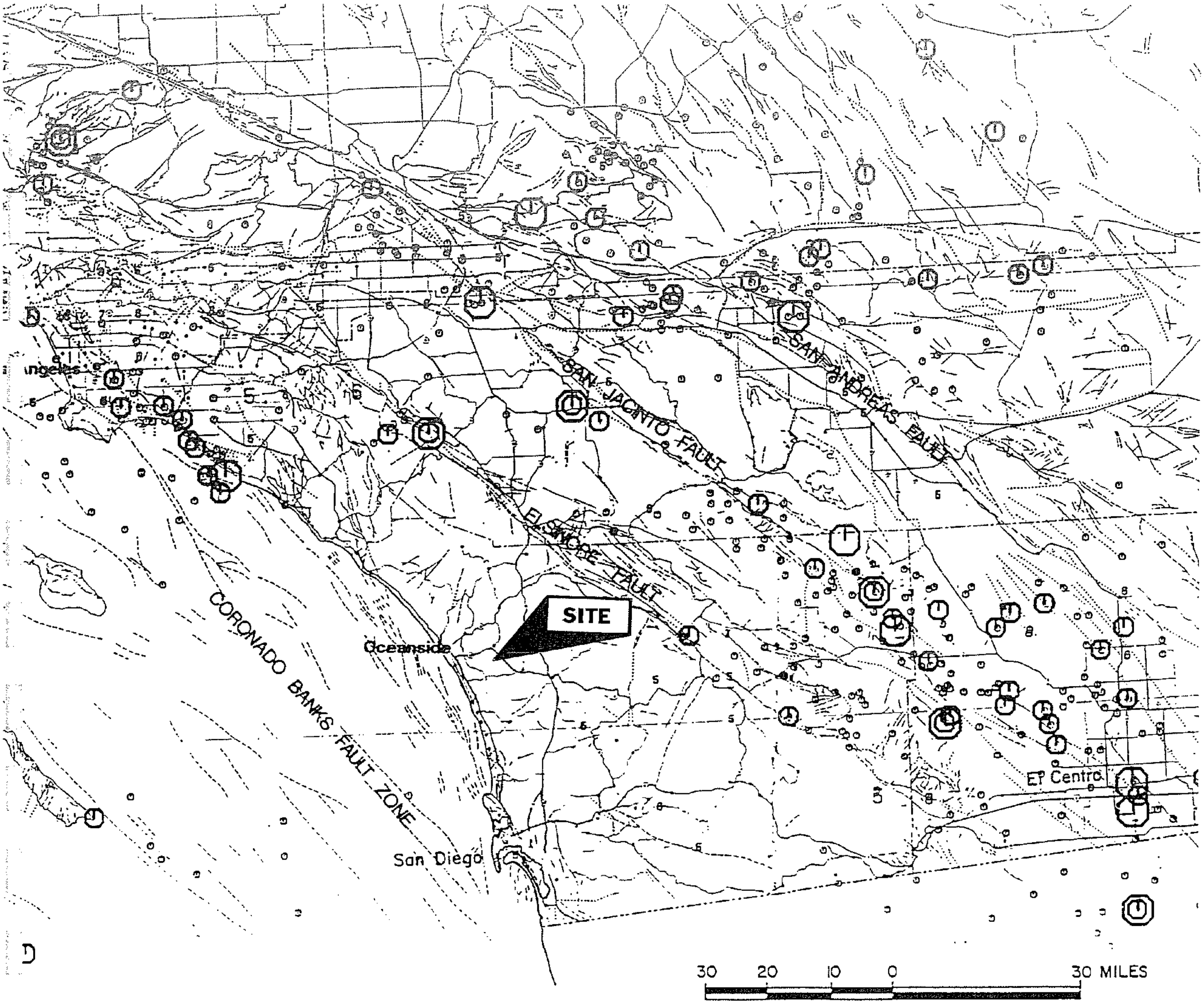
Scale: 1"=40'

GEOLOGIC CROSS-SECTIONS

PLATE 37



Scale: 1"=4'0'



FAULT - EPICENTER MAP

SAN DIEGO COUNTY REGION

INDICATED EARTHQUAKE EVENTS THROUGH 75 YEAR PERIOD (1900-1974)

Map data is compiled from various sources including California Division of Mines and Geology, California Institute of Technology and the National Oceanic and Atmospheric Administration. Map is reproduced from California Division of Mines and Geology, "Earthquake Epicenter Map of California; Map Sheet 39."

Earthquake Magnitude

- .... 4.0 TO 4.9
- .... 5.0 TO 5.9
- .... 6.0 TO 6.9
- .... 7.0 TO 7.9
- ---- Fault

PROJECT: Job #06-323-P

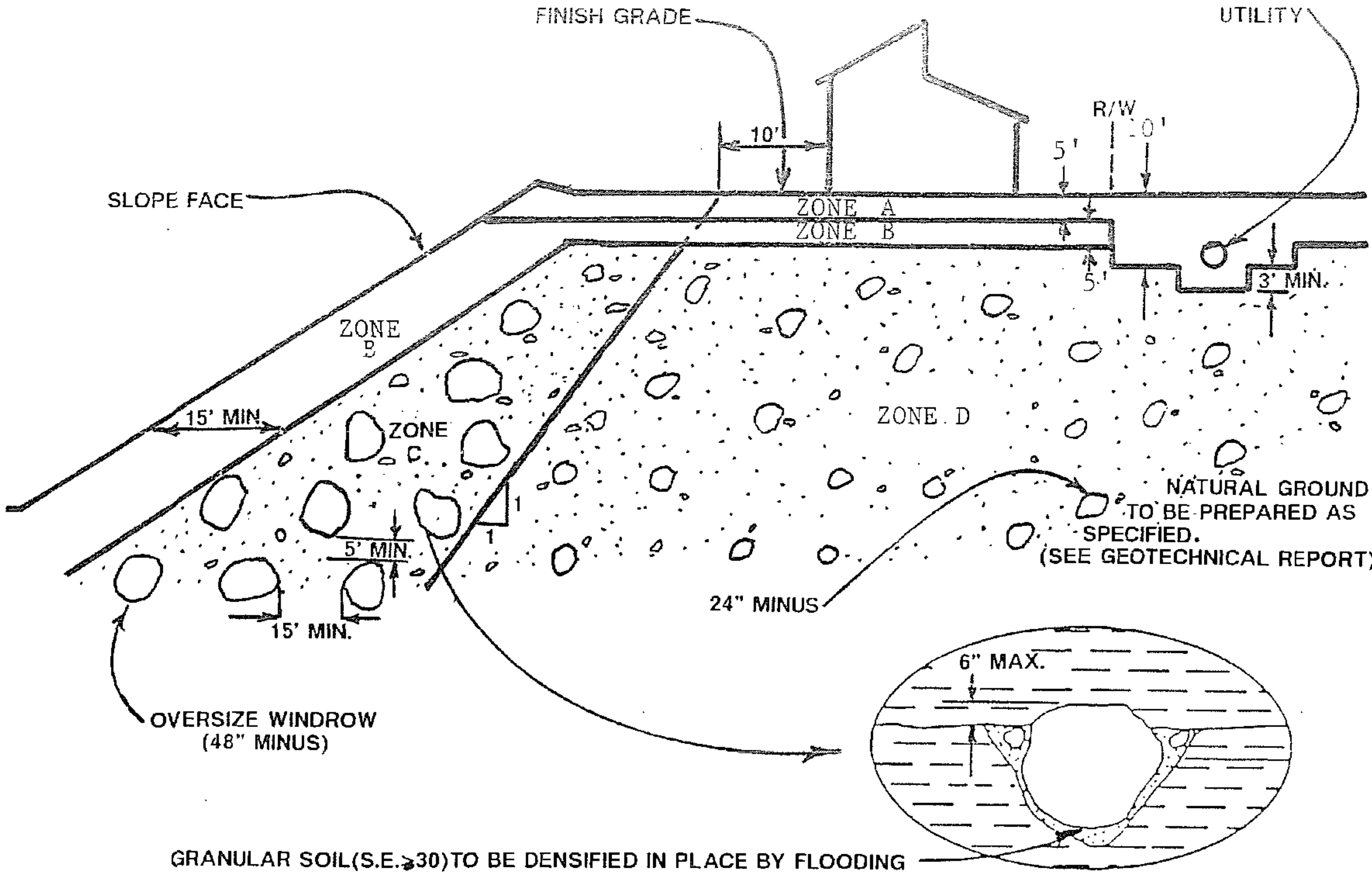
BUENA VISTA DRIVE, SAN DIEGO COUNTY

PLATE: 38

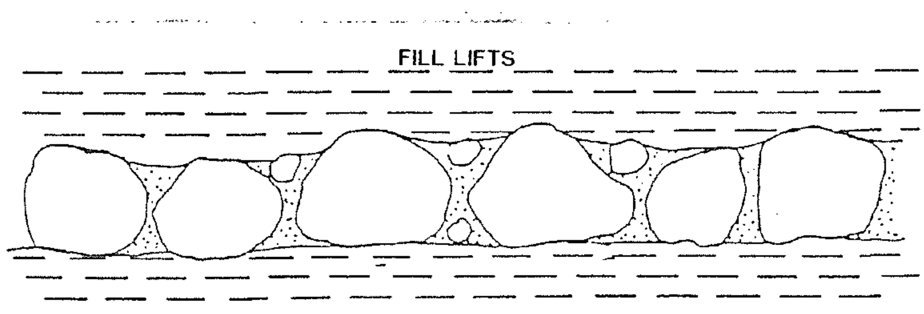
ROCK DISPOSAL RECOMMENDATIONS

WINDROW METHOD

TYPICAL-NO SCALE



DETAIL



WINDROW DETAIL (EDGE VIEW)

MATERIAL AND CONSTRUCTION SPECIFICATIONS ARE PROVIDED IN THE ATTACHED SHEET(ALSO SEE GEOTECHNICAL REPORT)

ROCK DISPOSAL RECOMMENDATIONS

ZONE A:

Shall be measured five feet vertically from the finished building pad grade. In public right-of-way and easement, Zone A shall be 10 feet minimum or must extend three feet below the deepest utility, whichever is greater. Zone A must consist of compacted soil only (no rock fragments over six inches in maximum dimension) and shall contain at least 40% soil sizes passing the ¼-inch sieve.

ZONE B:

Shall be 15 feet measured horizontally from face of slope and five feet measured vertically below Zone A. Zone B shall be similar to Zone A except individual rocks up to 12 inches in maximum dimension shall be allowed.

ZONE C:

Oversize rocks not larger than 48 inches in maximum diameter must either be individually placed or windrowed. For individual placement, rocks must be uniformly distributed and spaced so as to permit placement and compaction of soil conforming to Zone A. For windrows, rocks shall be placed in excavations in well compacted soil conforming to Zone A. Approved granular soil (SE≥ 30) must be flooded in the windrows to completely fill the voids around the beneath rocks. All windrows must be parallel and may be placed either parallel or perpendicular to face of slope depending on site geometry.

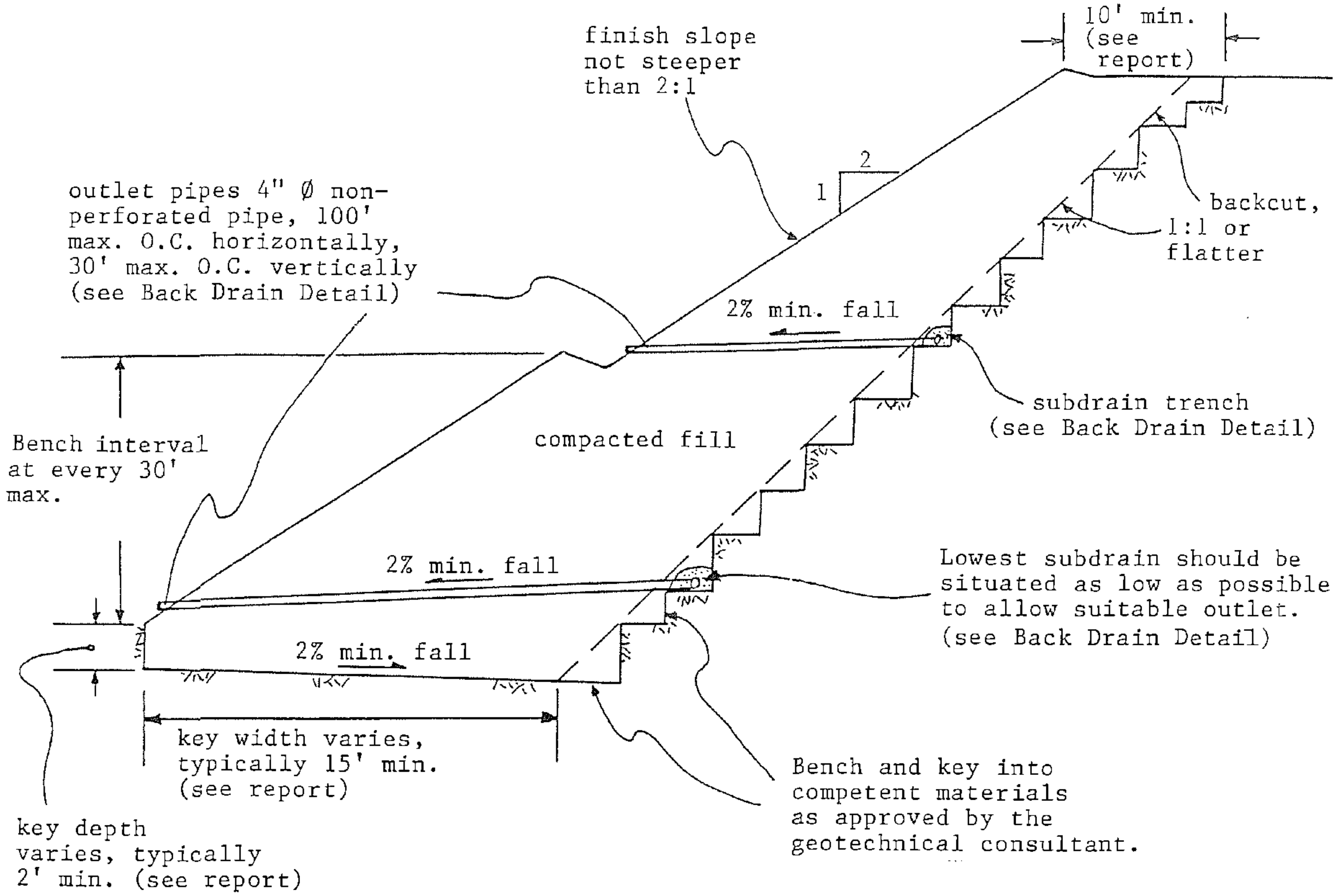
ZONE D:

Shall be similar to Zone A except individual rocks up to two feet in maximum dimension shall be allowed providing rocks larger than approximately 12 inches are well spaced so as to permit placement and compaction of soil around the larger rocks.

All rock placement, fill placement, and flooding of approved granular fill must be continuously observed by the geotechnical engineer.

TYPICAL STABILITY FILL / BUTTRESS DETAIL

Not to Scale

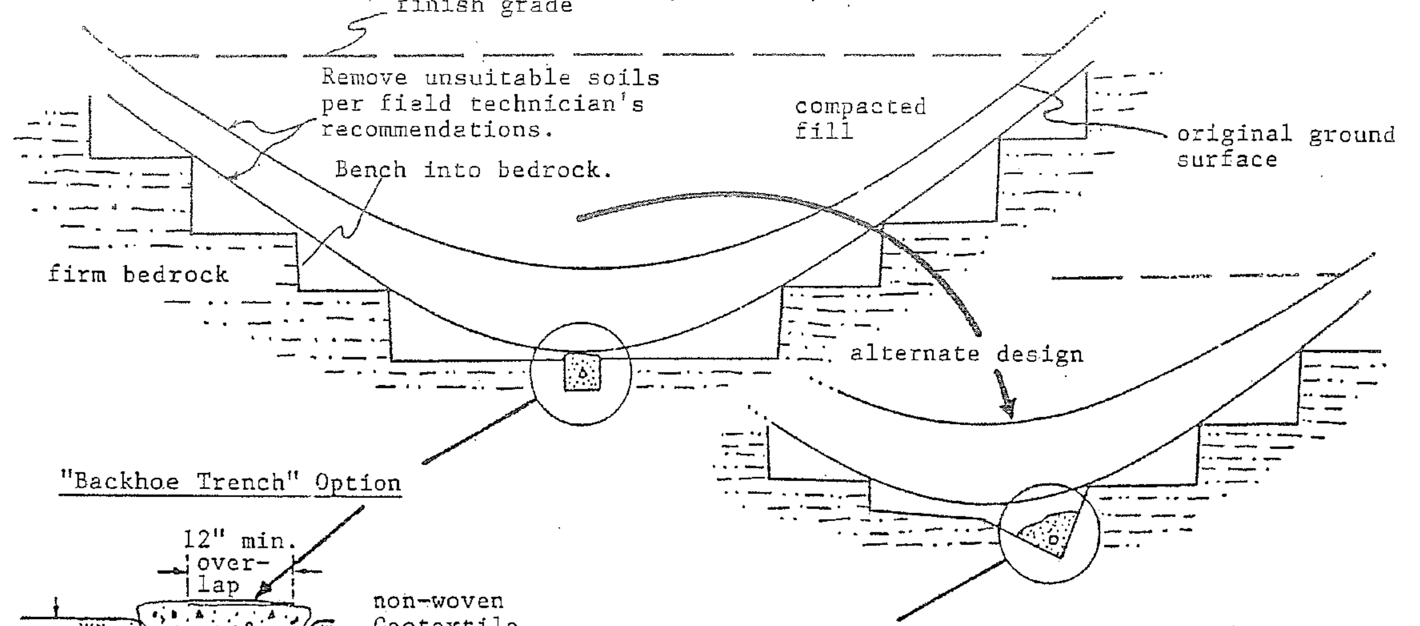


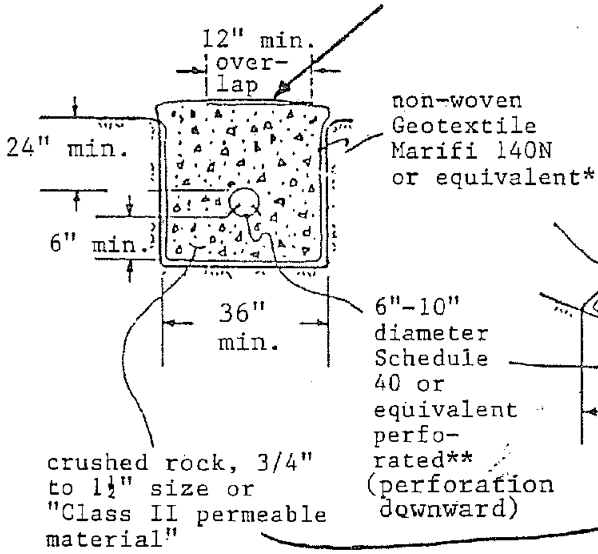
Notes: For buttress dimensions, see geotechnical report/plans. Actual dimensions may be changed by the geotechnical consultant based on field conditions.

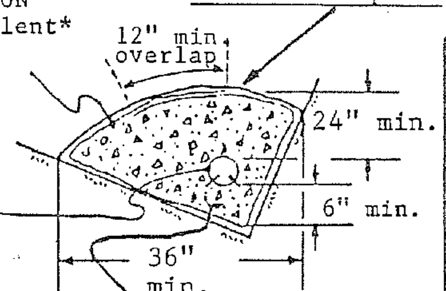
All backcuts will require to be field inspected at the time of grading by the project geotechnical consultant.

TYPICAL CANYON SUBDRAIN DETAILS

(no scale)





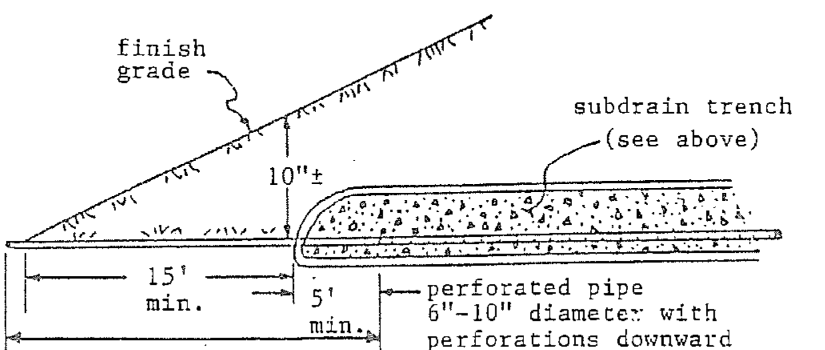


SPECIFICATIONS FOR CALTRANS CLASS II PERMEABLE MATERIAL

U.S. Standard Sieve Size	% Passing
1"	100
3/4"	90-100
3/8"	40-100
No. 4	25-40
No. 8	18-33
No. 30	5-15
No. 50	0-7
No. 200	0-3

Sand Equivalent 75

DETAIL OF CANYON SUBDRAIN TERMINUS



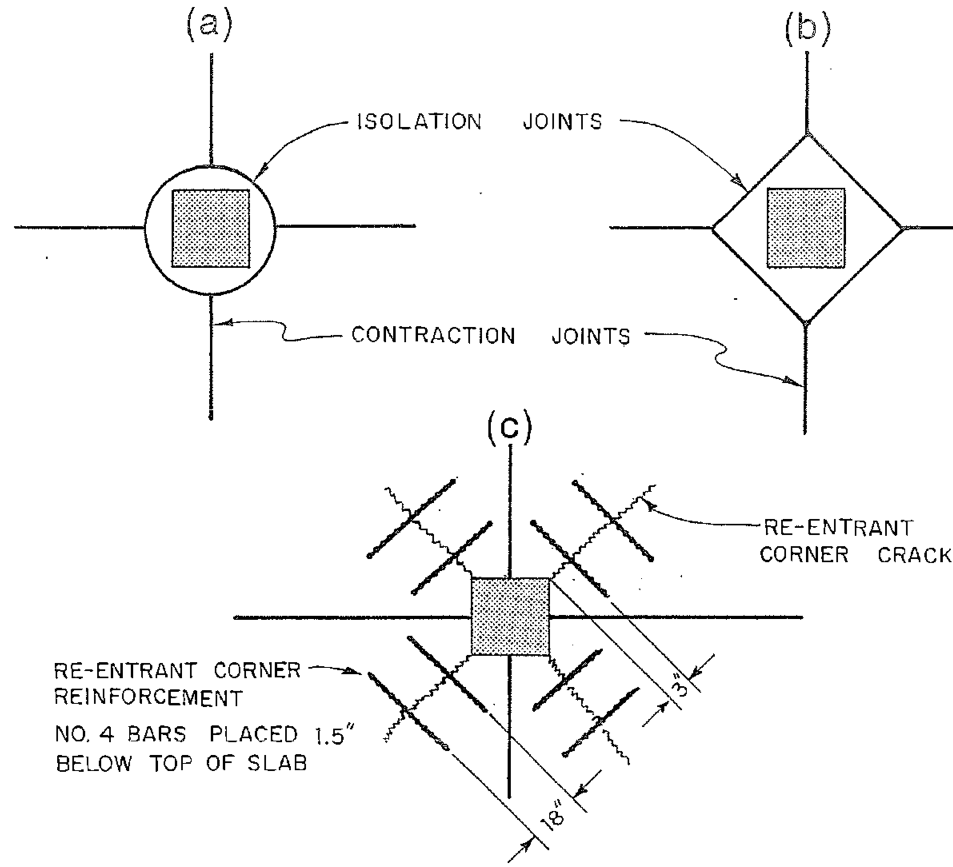
NOTE: Subdrain to be installed in competent material as evaluated by the field representative. Non-perforated pipe to be installed in regions recommended by the field representative.

*If Caltrans Class II permeable material is used in place of 3/4"-1½" gravel, fabric filter may be deleted.

**SUBDRAIN TYPE - Subdrain type should be Acrylonitrile Butadiene Stryene (A.B.S.), Polyvinyl Chloride (PVC) or approved equivalent. Class 125, SDR 32.5 should be used for maximum fill depths of 35 feet. Class 200, SDR 21 should be used for maximum fill depths of 100 feet.

ISOLATION JOINTS AND RE-ENTRANT CORNER REINFORCEMENT

Typical - no scale



NOTES:

1. Isolation joints around the columns should be either circular as shown in (a) or diamond shaped as shown in (b). If no isolation joints are used around columns, or if the corners of the isolation joints do not meet the contraction joints, radial cracking as shown in (c)may occur (reference ACI).

2. In order to control cracking at the re-entrant corners (±270° corners), provide reinforcement as shown in (c).

3. Re-entrant corner reinforcement shown herein is provided as a general guideline only and is subject to verification and changes by the project architect and/or structural engineer based upon slab geometry, location, and other engineering and construction factors.

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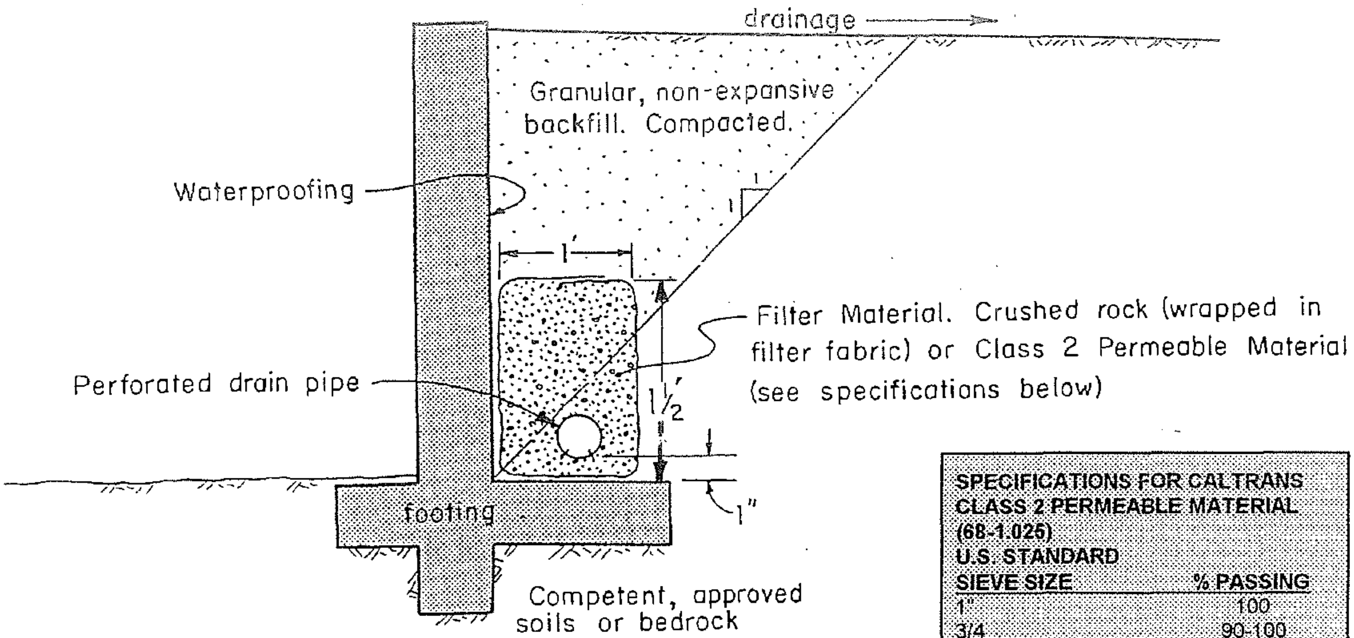
RETAINING WALL DRAIN DETAIL

Typical - no scale



SPECIFICATIONS FOR CALTRANS CLASS 2 PERMEABLE MATERIAL (68-1.025)

U.S. STANDARD SIEVE SIZE	% PASSING
1"	100
3/4	90-100
3/8	40-100
No. 4	25-40
No. 8	18-33
No. 30	5-15
No. 50	0-7
No. 200	0-3

Sand Equivalent > 75

CONSTRUCTION SPECIFICATIONS:

1. Provide granular, non-expansive backfill soil in 1:1 gradient wedge behind wall. Compact backfill to minimum 90% of laboratory standard.
2. Provide back drainage for wall to prevent build-up of hydrostatic pressures. Use drainage openings along base of wall or back drain system as outlined below.
3. Backdrain should consist of 4" diameter PVC pipe (Schedule 40 or equivalent) with perforations down. Drain to suitable outlet at minimum 1%. Provide ¾" - 1½" crushed gravel filter wrapped in filter fabric (Mirafi 140N or equivalent). Delete filter fabric wrap if Caltrans Class 2 permeable material is used. Compact Class 2 material to minimum 90% of laboratory standard.
4. Seal back of wall with waterproofing in accordance with architect's specifications.
5. Provide positive drainage to disallow ponding of water above wall. Lined drainage ditch to minimum 2% flow away from wall is recommended.

* Use 1½ cubic foot per foot with granular backfill soil and 4 cubic foot per foot if expansive backfill soil is used.

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