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The soils map and engineering conditions map have been removed from this report. Additionally, this report indicates the presence of seasonal groundwater. This report also needs to include an identification of what constitutes a geologic hazard and what constitutes a geologic constraint per the Land Development Code definitions below.

Geologic Constraint — A geologic condition, including but not limited to potentially unstable slopes, expansive soils/bedrock, high groundwater levels, soils creep, hydrocompaction, shallow bedrock, erosion, corrosive soils, radon, or drainage way, which may be mitigated or avoided to allow for development.

Geologic Hazard — A geologic condition, including but not limited to avalanches, debris flows-fans/mudslides, earthquakes, floodway, floodplain, ground subsidence, landslides, rockfall, ponded water, undermining, faulting, or similar naturally occurring dangerous features or soil conditions or natural features unfavorable to development, which may pose a significant threat to persons or property.

Please ensure this report has the level of detail needed for this note to be added to the plat

Soil and Geology Conditions:
Geologic Hazard Note-Final Plat: (to be customized based upon the individual circumstances)
The following lots have been found to be impacted by geologic hazards. Mitigation measures and a map of the hazard area can be found in the report (Title of Report, generally from the Preliminary Plan file) by (author of the report) (date of report) in file (name of file and file number) available at the El Paso County Planning and Community Development Department:
- Downslope Creep: (name lots or location of area)
- Rockfall Source:(name lots or location of area)
- Rockfall Runout Zone:(name lots or location of area)
- Potentially Seasonally High Groundwater:(name lots or location of area)
- Other Hazard:

In Areas of High Groundwater:
Due to high groundwater in the area, all foundations shall incorporate an underground drainage system.

GEOTECHNICAL INVESTIGATION
SOLACE APARTMENT COMPLEX
POWERS BOULEVARD AND GALLEY ROAD
EL PASO COUNTY, COLORADO

Prepared for:

SUB4 DEVELOPMENT CORPORATION
2301 West Bradley Avenue, Suite 2
Champaign, Illinois 61821

Attention: Josh Stroot

CTL|T Project No. CS19163.001-125

January 15, 2020

TABLE OF CONTENTS

SCOPE

This report presents the results of our Geotechnical Investigation for the Solace Apartment Complex to be located east of Powers Boulevard and north of Galley Road in El Paso County, Colorado. The investigated parcel is planned for development of multi-family, apartment buildings. The purpose of our investigation was to evaluate the sub-surface conditions at the site and provide geotechnical recommendations and criteria for design and construction of foundations, floor systems, and pavement section alternatives, as well as surface drainage precautions. The scope of our services is described in our proposal (CS-20-0134) dated September 4, 2020.

The report was prepared based on conditions interpreted from field reconnaissance of the site, review of previous information, conditions found in our exploratory borings, results of laboratory tests, engineering analysis, and our experience. Observations made during grading or construction may indicate conditions that require revision or re-evaluation of some of the preliminary criteria presented in this report. The criteria presented are for the development as described. Revision in the scope of the project could influence our recommendations. If changes occur, we should review the development plans and the effect of the changes on our preliminary design criteria. Evaluation of the property for the possible presence of potentially hazardous materials (Environmental Site Assessment) was beyond the scope of this investigation.

The following section summarizes the report. A more complete description of the conditions found at the site, our interpretations, and our recommendations are included in the report.

SUMMARY

1. The near-surface soils encountered in the nineteen (19) borings drilled during this investigation consisted of 25 to thirty feet of clean to silty, sand soils with widely scattered lenses of clayey sand and sandy clay.
2. At the time of drilling, groundwater was encountered in fifteen of the exploratory borings at depths of 19 to 27 feet below the existing ground surface. When water levels were checked again several days after the com-

pletion of drilling operations, water was measured in sixteen of the borings at depths of 15 to 25 feet. Groundwater levels will vary with seasonal precipitation and landscaping irrigation.

3. We understand a post tensioned slab is the desired foundation option. In our opinion, a post-tensioned slab-on-grade (PTS) foundation is an acceptable foundation alternative for the proposed apartment buildings and clubhouse. Foundation design and construction criteria are presented in the report.
4. For the PTS system, the foundation is structurally integrated with the floor slab and should therefore exhibit a low risk of differential movement and cracking. Conventional slab-on-grade floors constructed in the garage buildings that are underlain by the natural sands and/or densely compacted sand fill will also exhibit a low risk of movement and damage.
5. Full-depth asphalt concrete and composite asphalt and aggregate base course pavement section alternatives are presented in the report for the planned parking lots and access driveways.
6. Surface drainage should be designed, constructed, and maintained to provide rapid removal of runoff away from the proposed buildings. Conservative irrigation practices should be followed to avoid excessive wetting.
7. The design and construction criteria for foundations and slabs-on-grade included in this report were compiled with the expectation that all other recommendations presented related to surface drainage, landscaping irrigation, backfill compaction, etc. will be incorporated into the project and that the property manager will maintain the structures, use prudent irrigation practices, and maintain surface drainage. It is critical that all recommendations in this report are followed.

SITE CONDITIONS

The investigated parcel of land is situated northeast of the intersection of Powers Boulevard and Galley Road (a portion of the northwest quarter of Section 7, Township 14 South, Range 65 West of the 6th Principal Meridian), in El Paso County, Colorado. Current development plans were provided by LCM Architects on September 3, 2020.

The overall ground surface across the property slopes very gently downward to the south at grades of between about 2 and 3 percent. Vegetation on the site consists of a slight to moderate stand of mostly grasses and weeds and scattered deciduous trees. Somewhat heavier vegetation and a thicker concentration of deciduous trees are present along the eastern edge of the property in the vicinity of an existing drainage channel that runs in a generally north-to-south direction and separates the investigated parcel from existing commercial buildings to the east of the site. The northern half of the channel is up to about 10 to 15 feet in depth. The channel depth decreases to the south. Areas of erosion and steep downcutting of the channel banks are present, especially in the northern half. Large concrete pieces and other construction debris have been placed as a type of riprap material in an attempt to stabilize the steep banks, primarily in the northern half of the channel and the northern portion of the southern half. Household trash, furniture, and organic materials are present in the channel bottom. The channel exits the site at the south property line through three, parallel culverts under Galley Road.

The parcel is crisscrossed by several narrow, dirt paths. Scattered, small piles of dumped trash and construction debris were observed at several locations on the site. Low earth berms (maximum height of about 5 feet) are present in the center of the property and near the southern edge of the parcel. The berms appear to have been constructed at some point in the property history to control storm runoff. An existing, sanitary sewer main is present in the Paonia Street right-of-way located near the eastern edge of the site.

The land to the north and east is developed with commercial/retail buildings and some light industrial structures. A one-story commercial building that has served as a bank and as a day care center in the recent past is present west of the southern end of the investigated parcel. It is unknown if this building is occupied.

PROPOSED DEVELOPMENT

We understand the proposed apartment complex is to be developed for approximately 350, one to three-bedroom apartment units. The fifteen apartment buildings are anticipated to be three-story, wood-frame structures. Foundation loads are expected to be light to moderate. No habitable, below-grade construction is expected. The complex will include a clubhouse and pool area, paved access roads and automobile parking stalls, and carports. We anticipate the complex will be serviced by a centralized sanitary sewer collection system and potable water distribution system. Two full-spectrum detention ponds are planned along the eastern edge of the property adjacent to the existing drainage channel.

PREVIOUS INVESTIGATION

We previously conducted a Geologic Hazards Evaluation and Preliminary Geotechnical Investigation, CTL|T Project Number CS19163.000-105, report dated December 10, 2019. This report was reviewed as part of this investigation, and the boring information was used in developing our recommendations.

SUBSURFACE INVESTIGATION

Subsurface conditions at the site were investigated by drilling an additional nineteen exploratory borings to supplement the previous twelve exploratory borings at the locations shown in Fig. 1. Graphical logs of the conditions found in our exploratory borings, the results of field penetration resistance tests, and some laboratory data are presented in Appendix A. Gradation test results are presented in Appendix B. Laboratory test data are summarized in Table B-1. Summary logs from our previous investigation are shown in Appendix D.

Soil samples obtained during this study were returned to our laboratory and visually classified. Laboratory testing was then assigned to representative samples. Testing included moisture content and dry density, gradation analysis, and water-soluble sulfate content tests.

SUBSURFACE CONDITIONS

The near-surface soils encountered in the nineteen borings drilled during this investigation consisted of 25 to 30 feet of sand and silty sand soils with widely scattered lenses of clayey sand and sandy clay. Some of the pertinent engineering characteristics of the soils encountered and groundwater conditions are discussed in the following paragraphs.

Sand Soils

The predominant soils encountered at the ground surface in each of the borings consisted of clean to silty sand. The sand layer encountered in the borings extended to the maximum depth explored of 30 feet below the existing ground surface. The sand was loose to very dense based on the results of field penetration resistance tests. Samples of the sand tested in our laboratory contained 2 to 46 percent clay and silt-sized particles (passing the No. 200 sieve). Our experience indicates the clean to silty sands are non-expansive when wetted.

Clay Soils

Isolated layers of clayey sand were found to be interbedded with the predominant clean to silty sand in six of the borings. Samples of the clayey sands tested in our laboratory contained 20 to 36 percent clay and silt-sized particles (passing the No. 200 sieve). The clayey sand was loose to dense. Swell consolidation testing on two samples of the clayey sand materials exhibit low measured swell values when wetted.

Pockets of very sandy clay were encountered in two borings (TH-102 and TH-116). The clay was medium stiff to very stiff. Two samples of the clay tested in our laboratory contained 50 and 58 percent clay and silt-sized particles (passing the No. 200 sieve). Swell consolidation testing on the clay materials exhibit low measured swell values when wetted.

Groundwater

At the time of drilling, groundwater was encountered in fifteen of the exploratory borings at depths of 19 to 27 feet below the existing ground surface. When water levels were checked again several days after the completion of drilling operations, water was measured in sixteen of the borings at depths of 19.5 to 25 feet. Groundwater levels will vary with seasonal precipitation and landscaping irrigation.

Seismicity

This area, like most of central Colorado, is subject to a degree of seismic activity. Geologic evidence has been interpreted to indicate that movement along some Front Range faults has occurred during the last two million years (Quaternary). This includes the Rampart Range Fault, which is located several miles west of the site. We believe the soils on the property classify as Site Class D (stiff soil profile) according to the 2015 International Building Code (2015 IBC).

SITE DEVELOPMENT

We do not expect significant issues due to geotechnical considerations to impact the development of the site. The most significant item identified is the presence of un-documented fill and debris. The following sections provide considerations and recom-mendations as they relate to site development

Undocumented Fill

Undocumented fill was identified at the site. The fill was generally associated with berms present throughout the site. Debris and household trash were also observed along the drainage channel. Other areas of fill or debris may be present; however, they were not identified at the boring locations.

Undocumented fill increases the risk of poor structure performance, as it is pos-sible that poorly compacted or unstable materials may be present within the fill. The most reliable approach is to remove all existing, undocumented fill from below the pro-posed structures. Based on the finished floor elevations, the depth to existing fills will vary. We believe some fill may remain below structures, provided the owner accepts the risk of potential movements and associated damage, although debris and household waste should be removed, where identified. This approach will still require some remov-al of existing fill, as discussed in the foundation section of this report.

Site Grading

Current grading plans were provided by LCM Architects on September 3, 2020 and do not appear to differ from the grading plans prepared by JR Engineering (dated December 4, 2019) that were made available for our review during our preliminary geotechnical investigation. The plans suggest comparatively shallow cuts and fills (about 5 feet or less) will be necessary to achieve the desired building pad elevations for the area that will be developed with structures. We believe site grading can be accomplished using conventional, heavy-duty earthmoving equipment. We recommend grading plans consider long-term cut and fill slopes no steeper than 3:1 (horizontal to vertical). This ratio considers that no seepage of groundwater occurs. If groundwater seepage does occur, a drain system and flatter slopes may be appropriate.

Excavation

We believe the soils encountered in our exploratory borings can be excavated with conventional, heavy-duty excavation equipment. We recommend the contractor become familiar with applicable local, state, and federal safety regulations, including the current Occupational Safety and Health Administration (OSHA) Excavation and Trench Safety Standards, to determine appropriate excavation slopes. We anticipate the grading fill (existing and new) and the near-surface, natural soils will classify as Type C materials. Temporary excavations in Type C soils require a maximum slope inclination of 1.5:1 (horizontal to vertical), unless the excavation is shored or braced. If groundwater seepage occurs, flatter slopes will likely be required. The contractor's "competent person" should review excavation conditions and refer to OSHA standards when worker exposure is anticipated. Stockpiles and equipment should not be placed within a horizontal distance equal to one-half the excavation depth, from the edge of the excavation. Excavations deeper than 20 feet should be designed by a registered professional engineer.

Fill Placement

The properties of the fill will affect the performance of foundations, slabs-on-grade, and pavements. The on-site soils, when free of debris, can be used as site grading fill. We anticipate most of the grading fill will consist of silty to clayey sand soils that are generated from cuts into the near surface, the existing fill layer as well as the stockpiles of soils present at the site. We understand import materials will be used from a nearby source. Import should preferably consist of granular soils, similar to the on-site soils. Import fill materials should exhibit liquid limits of less than 30 and plasticity indices of less than 10. A sample of the import fill should be submitted to our office for testing before transporting to the site.

Vegetation, topsoil, and organic materials should be removed from the ground surface where fill will be placed at the site. Soft or loose soils, if encountered, should be stabilized or removed to stable material prior to placement of grading fill. Organic soils should be wasted in landscaped areas. The ground surface in areas to receive fill should be scarified, moisture conditioned to near optimum moisture contents, and compacted to a high density to provide a firm base.

We recommend the fill be placed at relatively uniform moisture contents within 2 percent of optimum moisture content and compacted in thin lifts to at least 95 percent of maximum modified Proctor dry density (ASTM D 1557) for granular materials. Cohesive materials should be moisture conditioned to higher moisture contents of 1 to 4 percent over optimum and compacted to at least 95 percent of maximum standard Proctor dry density (ASTM D 698). Placement and compaction of the grading fill should be observed and tested by our representative during construction.

Water and sewer lines are often constructed beneath slabs and pavements. Compaction of utility trench backfill can have a significant effect on the life and serviceability of floor slabs, pavements, and exterior flatwork. We recommend utility trench backfill be placed in compliance with City of Colorado Springs specifications. Personnel from our firm should periodically observe utility trench backfill placement and test the density of the backfill materials during construction.

Detention Ponds

We understand two full-spectrum detention ponds are to be constructed along the eastern edge of the property, adjacent to the existing drainage channel. Grading plans provided to our office indicated the ponds will drain to the existing channel and will be constructed mostly below surrounding grades. We anticipate any detention pond embankments that are needed to achieve the desired storage capacity will be less than 5 feet in height and will consist of fill materials generated from the on-site, sand soils. We recommend the proposed pond embankments have a maximum slope of 3:1 (horizontal to vertical). The embankment fill materials should be moisture conditioned and compacted as specified previously.

Subsurface conditions encountered in exploratory borings drilled within the proposed sites of the detention ponds (borings TH-5 and TH-12 CTL Project No. CS19163.000-105) consisted of 15 feet of medium dense to dense, slightly silty to silty sand. In our opinion, the anticipated subgrade materials are suitable to underlie the planned embankment fills with minimal subgrade compression.

FOUNDATIONS

Based on the conditions encountered in our exploratory borings and the planned site grading cuts and fills, we anticipate the near-surface soils found at or near shallow foundation levels for the proposed apartment buildings, clubhouse, and garages will consist predominantly of natural, clean to silty sand and new, sand grading fill. These granular materials are non-expansive when wetted. Existing fill encountered within the proposed building footprints should be excavated to expose the underlying natural soil and then moisture conditioned and compacted as specified previously in the FILL PLACEMENT section of the report.

We understand current plans call for the proposed apartment buildings and the clubhouse to be constructed with post-tensioned, slab-on-ground (PTS) foundations. In our opinion, the on-site soils are suitable for construction of the planned PTS foundations. Conditions encountered in our borings suggest that the complex can be considered a “Non-Active Site” as defined in Section 3.2.3 of the “Design of Post-Tensioned Slabs-on-Ground” manual developed by the Post-Tensioning Institute (PTI, 3rd Edition, 2004). The design of a PTS foundation for a non-active site requires that the foundation need only be checked for bearing and lightly reinforced against shrinkage and temperature cracking.

Post-tensioned slab foundations structurally integrate the floor slabs and foundations and should exhibit more reliable, long-term performance than conventional slabs-on-grade and isolated shallow foundations. Criteria for post-tensioned, slabs-on-grade are presented in the Post-Tensioned, Slabs-on-Grade section. In our opinion the proposed garages can be constructed with spread footing foundations. Criteria for spread footings are presented in the Spread Footings section. We are available to discuss foundation alternatives, as desired.

Post-Tensioned, Slabs-On-Grade (PTS)

1. PTS foundations should be constructed on the natural sands, newly placed grading fill, and/or reconditioned existing fill. Below-foundation fill materials, soils loosened during excavation or in the forming process, or soft or loose soils exposed in the excavation should be moisture conditioned and compacted as specified previously in the FILL PLACEMENT section of the report.
2. The PTS foundations should be designed for a maximum allowable soil pressure of 2,000 psf.
3. Perimeter stiffening beams may be poured “neat” into trenches excavated in the building pads. The on-site sands may cave or slough during trench excavation for the stiffening beams. Disturbed soils should be removed from trench bottoms prior to placement of concrete. Formwork or other methods may be required for proper beam installation.
4. For slab tensioning design, a coefficient of friction value of 0.75 or 1.0 can be used for slab construction on polyethylene sheeting or a sand layer, respectively. A coefficient of friction of 2 should be used for slabs on fill or native soil.
5. Exterior stiffening beams must be protected from frost action. Normally, 30 inches of frost cover is provided in this area.
6. A representative of our firm should observe the completed excavations. We should also observe the placement of the reinforcing tendons and re-

inforcement prior to placing the slabs and beams, as well as observe the tensioning of the tendons.

<u>Spread Footing Foundations</u>

1. We recommend the spread footing foundations be constructed on the natural sand soils and/or new, compacted granular fill. Loose natural sands encountered in the foundation excavations and materials loosened during the excavation process should be moisture conditioned and compacted in accordance with the criteria presented in FILL PLACEMENT, prior to the placement of concrete.
2. Spread footings can be designed for a maximum allowable soil pressure of 2,000 psf.
3. Spread footings beneath continuous foundation walls should be at least 16 inches wide. Footings beneath isolated column pads should be at least 24 inches square. Larger footing sizes could be required to accommodate the anticipated foundation loads.
4. We recommend designs consider total settlement of 1-inch and differential settlement of 3/4-inch.
5. Continuous foundation stem walls should be reinforced, top and bottom, to span local anomalies in the subsoils. We recommend the reinforcement required to simply span an unsupported distance of at least 10 feet.
6. Exterior spread footings within the garages must be protected from frost action. Typically, at least 30 inches of soil cover is provided in this area.
7. A representative of our firm should observe the completed foundation excavations to confirm the exposed conditions are similar to those encountered in our exploratory borings. The placement and compaction of below-foundation fill and foundation subgrade preparation should be observed and tested by a representative of our firm during construction.

FLOOR SYSTEMS

As previously discussed, soils below the post tensioned slab will consist of a layer of fill over the existing soils. For a 15-foot depth of wetting, our calculations indicate potential ground heave within the building footprint of less than 1 inch to about 2 inches. For the PTS system, the foundation is structurally integrated with the floor slab and should exhibit more reliable long-term performance, as compared to conventional slab-on-grade floors. Under-slab utilities such as water and sewer lines should be pressure tested prior to installing slabs. Utilities that penetrate slabs should be provided with sleeves and flexible connections that allow for independent movement of the slab and that reduce the likelihood of damaging buried pipes. We recommend these details allow at least 2 inches of differential movement between the slabs and pipes.

Exterior Flatwork

Exterior flatwork is normally constructed as a slab-on-grade. Performance of conventional slabs-on-grade on expansive soils is erratic. Various properties of the soils and environmental conditions influence the magnitude of movement and other performance characteristics of slabs underlain by expansive soils. Increases in the moisture content of expansive soils will cause heaving and may result in cracking of slabs-on-grade. Exterior flatwork should be designed and constructed to move independently relative to the proposed building foundations.

SWIMMING POOL AND POOL DECK

We understand a swimming pool is planned in association with the proposed clubhouse. No plans were available at the time of this investigation. We anticipate the pool structure may consist of spray-applied gunite against natural soil, or possibly a steel or a fiberglass shell. Because of the granular nature of the on-site soils, vertical excavation of the pool walls required for gunite pool construction may not be possible. A fiberglass or steel shell placed in an enlarged excavation may then be the more feasible option. If gunite methods are used, the cement slurry should be properly reinforced.

We recommend the pool be underlain by a drain system that collects water leakage and provides for discharge of the water to a sump or gravity outfall. The drain system should consist of free-draining gravel covering the bottom of the pool excavation. The excavation should slope to a 3 to 4-inch diameter, perforated or slotted pipe placed within the gravel layer. The drain should lead to a positive gravity outlet, such as a subdrain located beneath the sewer, or to a sump where water can be removed by pumping. A conceptual pool drain system is presented in Fig. 2. Overall surface drainage patterns should be planned to provide for the rapid removal of storm runoff and water that splashes over the edges of the pool.

The swimming pool structure may settle more than the flatwork surrounding the pool. To avoid damage to the pool structure, a slip joint should be used around the perimeter of the pool structure and adjacent to any other structural elements. Utility lines that penetrate the pool structure should be separated and isolated with joints to allow for free vertical movement. All ducts with connections between the pool structure and surrounding soil should be flexible or “crushable,” to allow some relative movement.

Pool decking should be constructed directly on the newly moisture conditioned and densely compacted sub-excavation backfill and be isolated from the swimming pool. Movement of the deck should not be transmitted to the swimming pool. The deck slab should be reinforced to function as an independent unit. Frequent control joints should be provided to reduce problems associated with potential soil movements. Panels that are approximately square generally perform better than rectangular areas.

PAVEMENTS

Our exploratory borings and understanding of the proposed construction suggest the subgrade soils within the planned access driveways and parking lots will consist of natural, silty sand, existing sand fill, and new grading fill. The anticipated subgrade soil sample tested in our laboratory classified as A-1-b to A-4 material, according to the American Association of State Highway Transportation Officials (AASHTO) classification system. A-1-b sandy subgrade materials generally exhibit good pavement support characteristics. A-4 silty subgrade materials generally exhibit fair to poor pavement support characteristics. Based on our laboratory classification testing (Atterberg Limits and sieve analysis) and experience with similar soils in the area a Hveem Stabilometer (“R”) value of 35 was assigned to the subgrade materials for design purposes.

We anticipate the access driveways could be subjected to occasional heavy vehicle loads such as trash trucks and moving vans. We considered daily traffic numbers (DTN) of 2 for the parking stalls and 10 for the access driveways, which correspond to 18-kip Equivalent Single-Axle Loads (ESAL) of 14,600 and 73,000, respectively, for a 20-year pavement design life. We believe the parking stalls can be paved with 5 inches of asphalt concrete or 3 inches of asphalt concrete over 6 inches of aggregate base course. The access driveways and other portions of the proposed paved areas subjected to occasional truck traffic should be paved with 6 inches of asphalt concrete or 4 inches of asphalt underlain by 6 inches of aggregate base course.

We recommend a concrete pad be provided at the trash dumpster sites. The pads should be at least 6 inches thick and long enough to support the entire length of the trash truck and dumpster. The concrete pad should extend at least 5 feet outside of the anticipated truck dimensions. Joints between concrete and asphalt pavements should be sealed with a flexible compound.

Our design considers pavement construction will be completed in accordance with the City of Colorado Springs "Standard Specifications" and the Pikes Peak Region Asphalt Paving Specifications. The specifications contain requirements for the pavement materials (asphalt, base course, and concrete) as well as the construction practices used (compaction, materials sampling, and proof-rolling). Of particular importance are those recommendations directed toward subgrade and base course compaction and proof-rolling. During proof-rolling, particular attention should be directed toward the areas of confined backfill compaction. Soft or loose subgrade or areas that pump excessively should be stabilized prior to pavement construction. A representative of our office should be present at the site during placement of fill and construction of pavements to perform density testing.

CONCRETE

Concrete in contact with soils can be subject to sulfate attack. We measured the water-soluble sulfate concentration in three samples from the site at less than 0.1 percent. Sulfate concentrations of less than 0.1 percent indicate Class 0 exposure to sulfate attack for concrete in contact with the subsoils, according to ACI 201.2R-01, as published in the 2008 American Concrete Institute (ACI) Manual of Concrete Practice. For this level of sulfate concentration, the ACI indicates Type I cement can be used for concrete in contact with the subsoils. Superficial damage may occur to the exposed surfaces of highly permeable concrete, even though sulfate levels are relatively low. To control this risk and to resist freeze-thaw deterioration, the water-to-cementitious material ratio should not exceed 0.50 for concrete in contact with soils that are likely to stay moist due to surface drainage or high-water tables. Concrete subjected to freeze-thaw cycles should be air entrained.

LIMITATIONS

The recommendations and conclusions presented in this report were prepared based on conditions disclosed by our exploratory borings, geologic reconnaissance, engineering analyses, and our experience. Variations in the subsurface conditions not indicated by the borings are possible and should be expected.

We believe this report was prepared with that level of skill and care ordinarily used by geologists and geotechnical engineers practicing under similar conditions. No warranty, express or implied, is made.

Should you have any questions regarding the contents of this report or the project from a geotechnical engineering point-of-view, please call.

CTL | THOMPSON, INC.

COLORADO LICENSED PROFESSIONAL ENGINEER GWENDOLYN ELIZABETH EBERHART 45929 01/15/2021

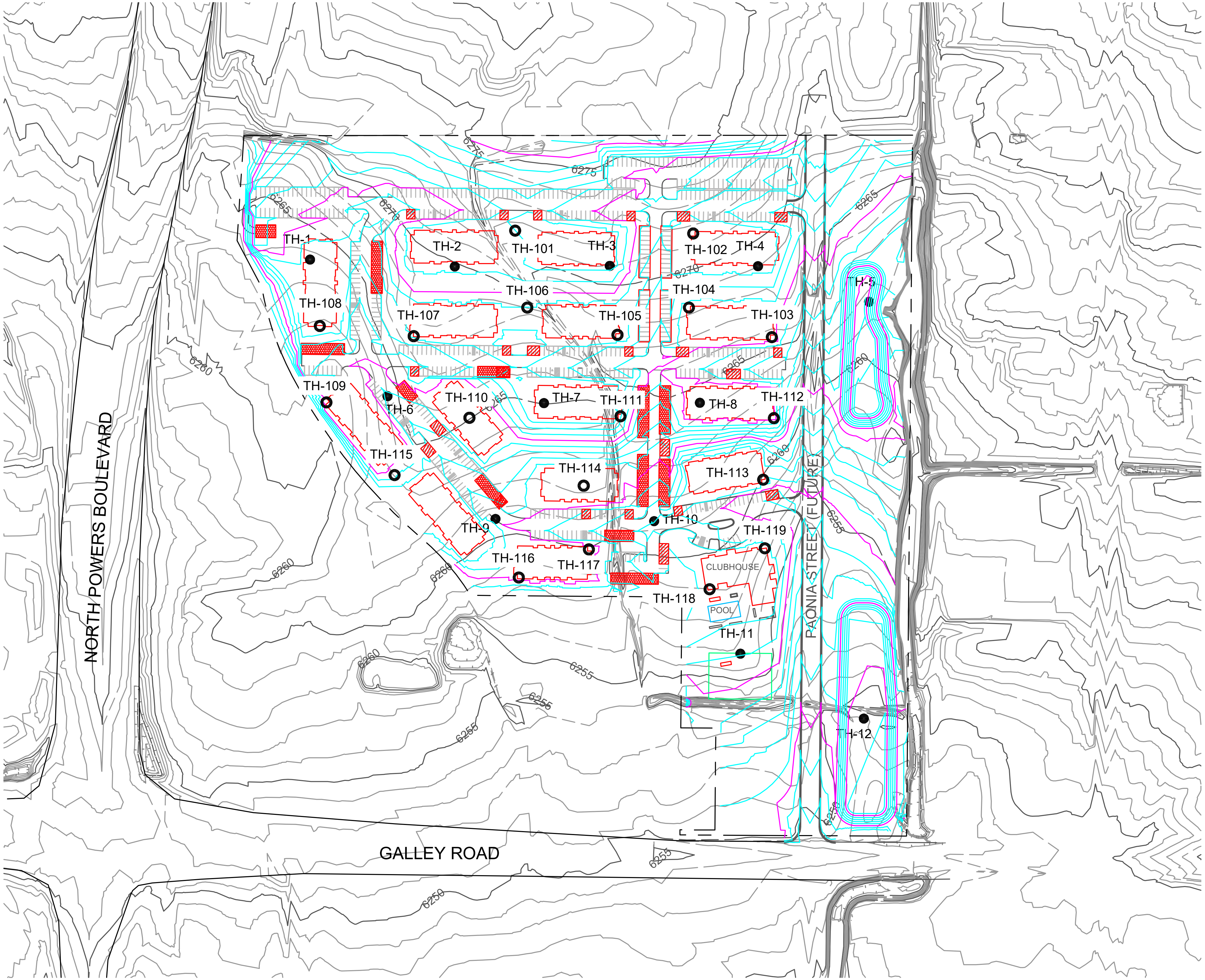
Gwendolyn E. Eberhart, P.E.
Project Engineer

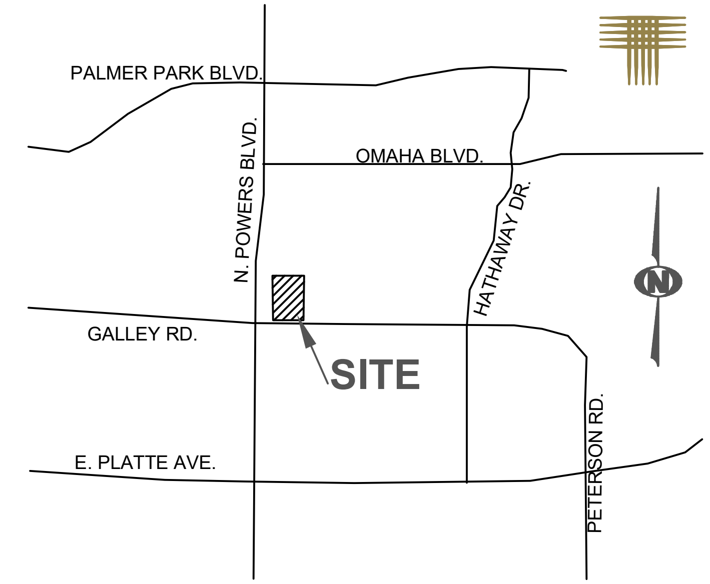
Reviewed by:

Timothy A Mitchell

Timothy A. Mitchell, P.E.
Division Manager

GE:TAM:ge
(3 copies sent)
Via email: josh@sub4dev.com





VICINITY MAP

(NOT TO SCALE)

LEGEND:

TH-101 APPROXIMATE LOCATION OF EXPLORATORY BORING.

TH-1 APPROXIMATE LOCATION OF EXPLORATORY BORING DRILLED DURING PREVIOUS INVESTIGATION (PROJECT NO. CS19163--125)

PROJECT BOUNDARY

LOCATION OF PROPOSED BUILDING FOOTPRINT.

EXISTING TOPOGRAPHY

PROPOSED GRADING CONTOURS

CARPORT

GARAGE

0 100' 200'

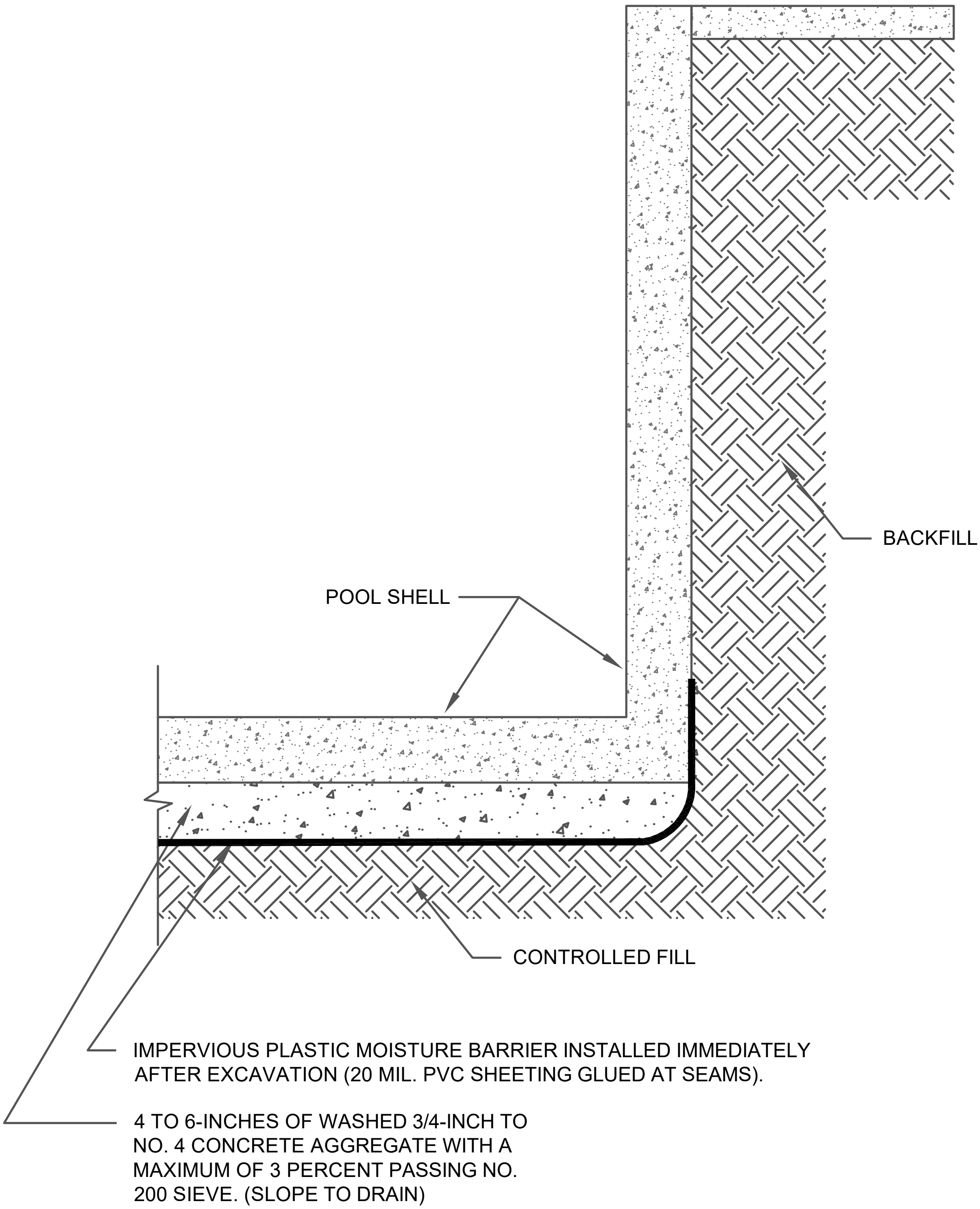
SCALE: 1" = 200'

NOTE:
BASE DRAWING WAS PROVIDED BY NES IN AN EMAIL DATED DECEMBER 4, 2019.

SUB4 DEVELOPMENT CORPORATION
SOLACE COLORADO SPRINGS
CTL|T PROJECT NO. CS19163.001-125

Location of Exploratory Borings

FIG. 1



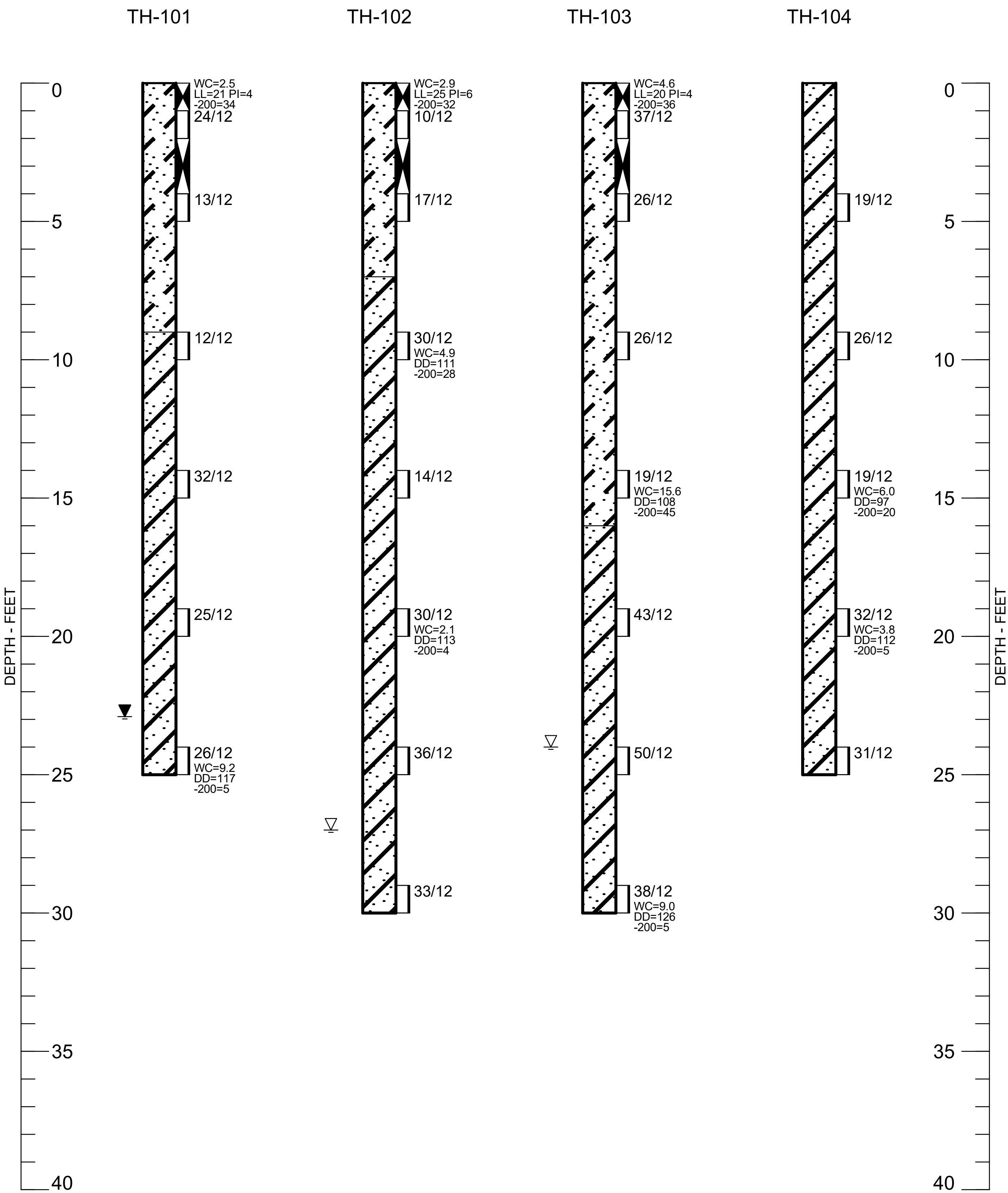
NOTE:
DRAIN PIPE SHOULD CONSIST OF A 3 OR 4-INCH DRAIN PIPE WITH A MINIMUM SLOPE OF 1/8 INCH DROP PER FOOT, TO A POSITIVE GRAVITY OUTLET OR TO A SUMP WHERE WATER CAN BE REMOVED BY PUMPING.

Recommended Pool Drain Detail

FIG. 2

APPENDIX A

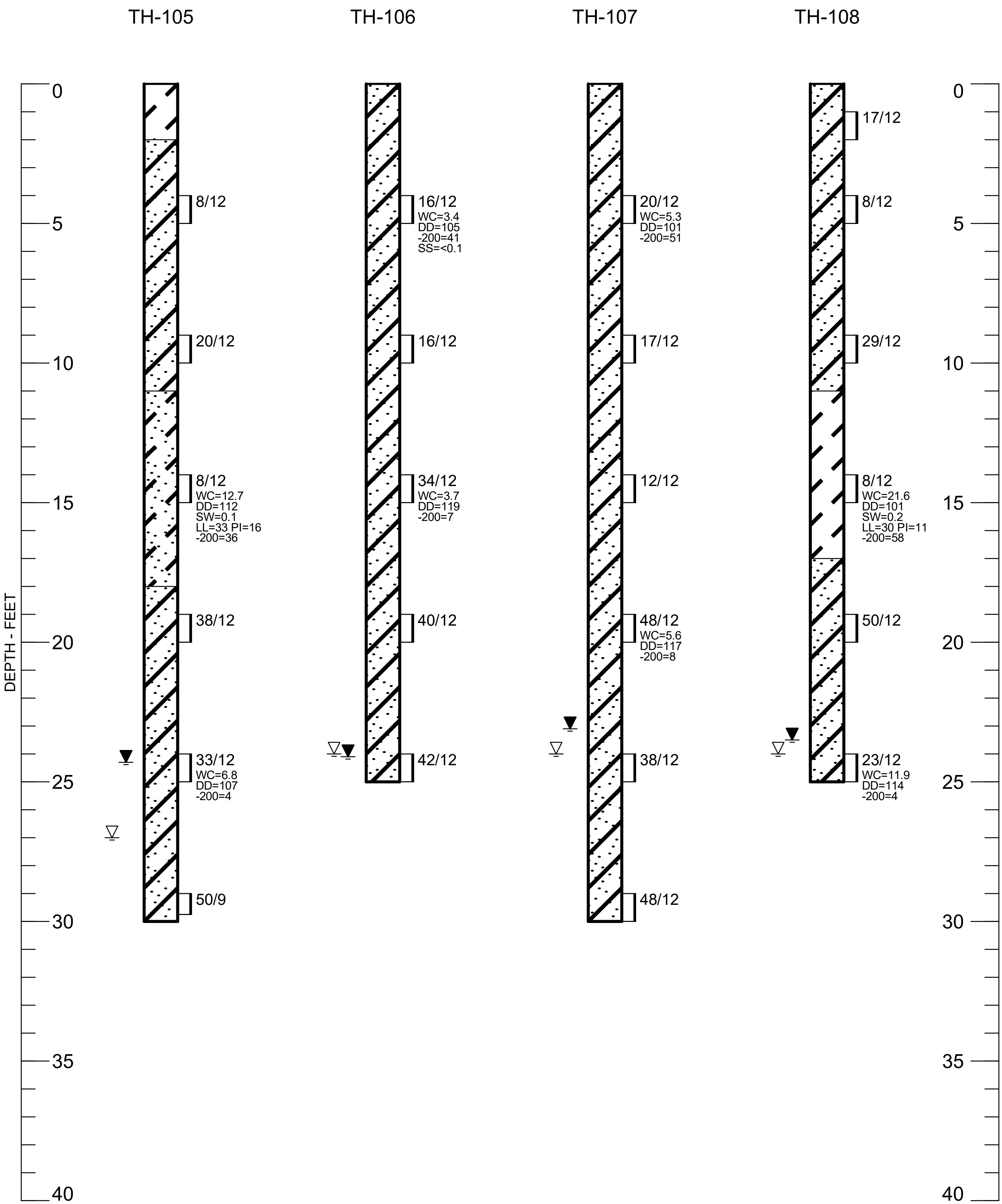
SUMMARY LOGS OF EXPLORATORY BORINGS



SUMMARY LOGS OF EXPLORATORY BORINGS

SUB4 DEVELOPMENT CORPORATION
SOLACE APARTMENT COMPLEX
CTL|T PROJECT NO. CS19163.001-125

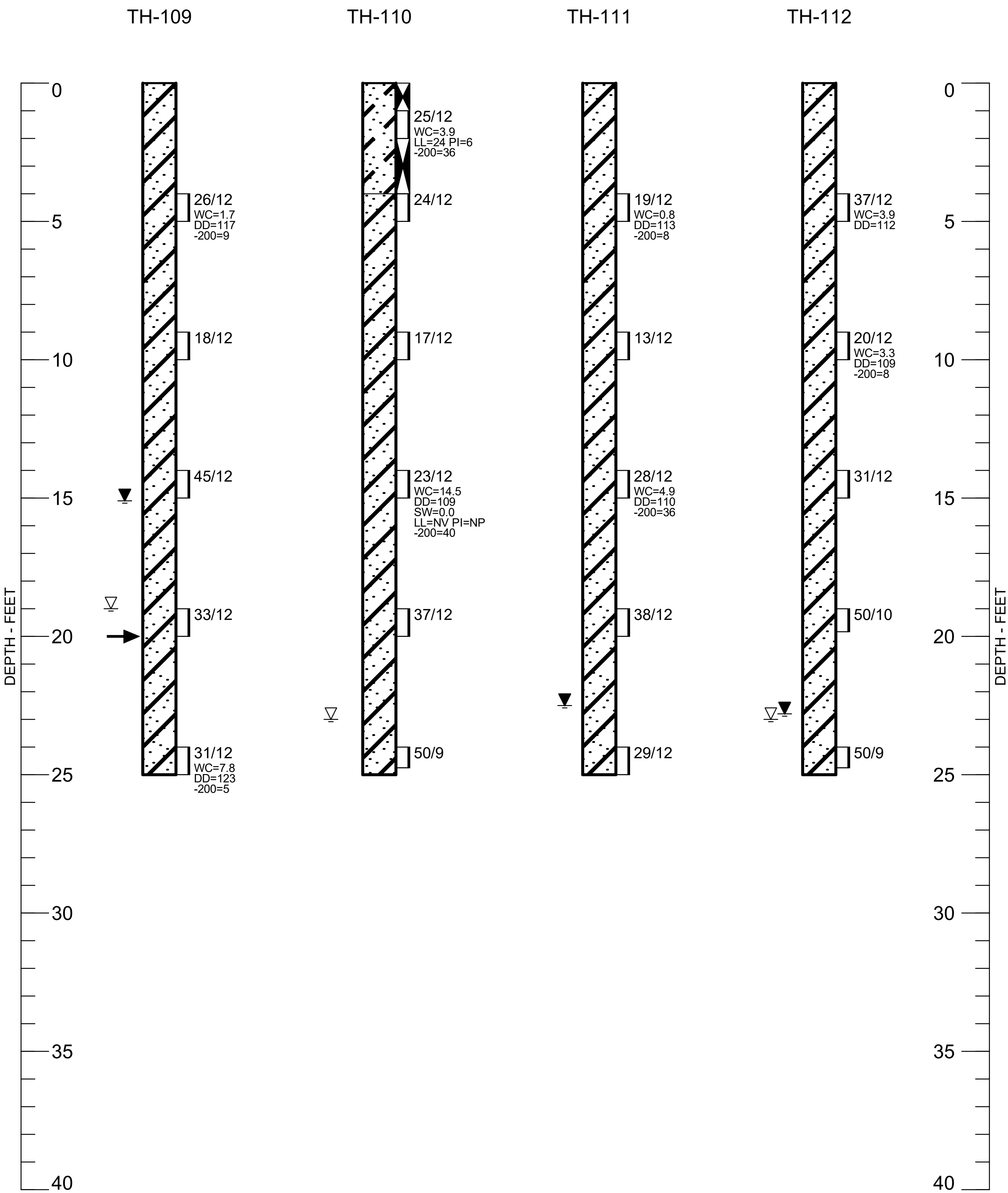
FIG. A- 1



SUMMARY LOGS OF EXPLORATORY BORINGS

SUB4 DEVELOPMENT CORPORATION
SOLACE APARTMENT COMPLEX
CTL|T PROJECT NO. CS19163.001-125

FIG. A- 2



SUMMARY LOGS OF EXPLORATORY BORINGS

SUB4 DEVELOPMENT CORPORATION
SOLACE APARTMENT COMPLEX
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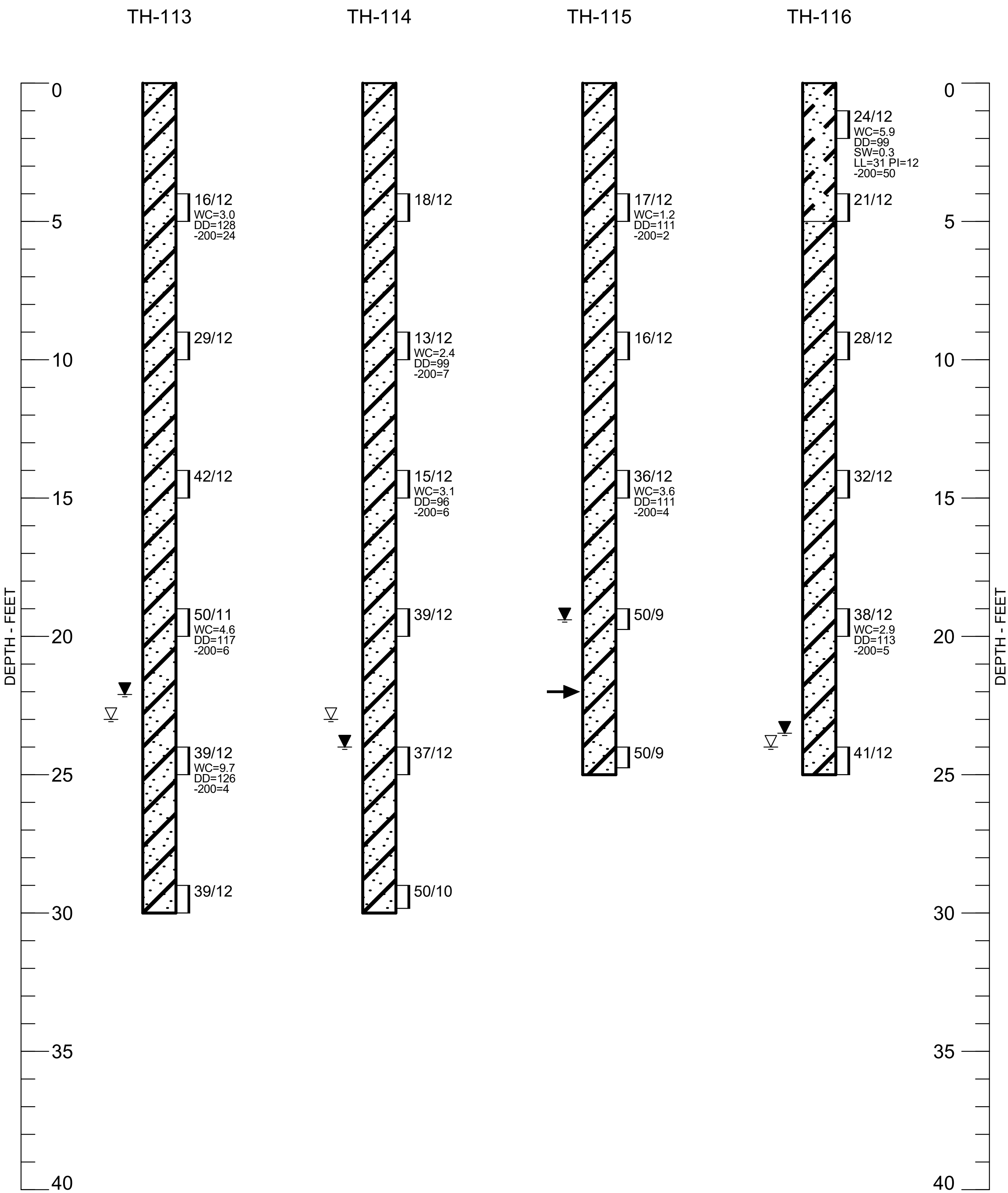
FIG. A- 3



SUMMARY LOGS OF EXPLORATORY BORINGS

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SOLACE APARTMENT COMPLEX
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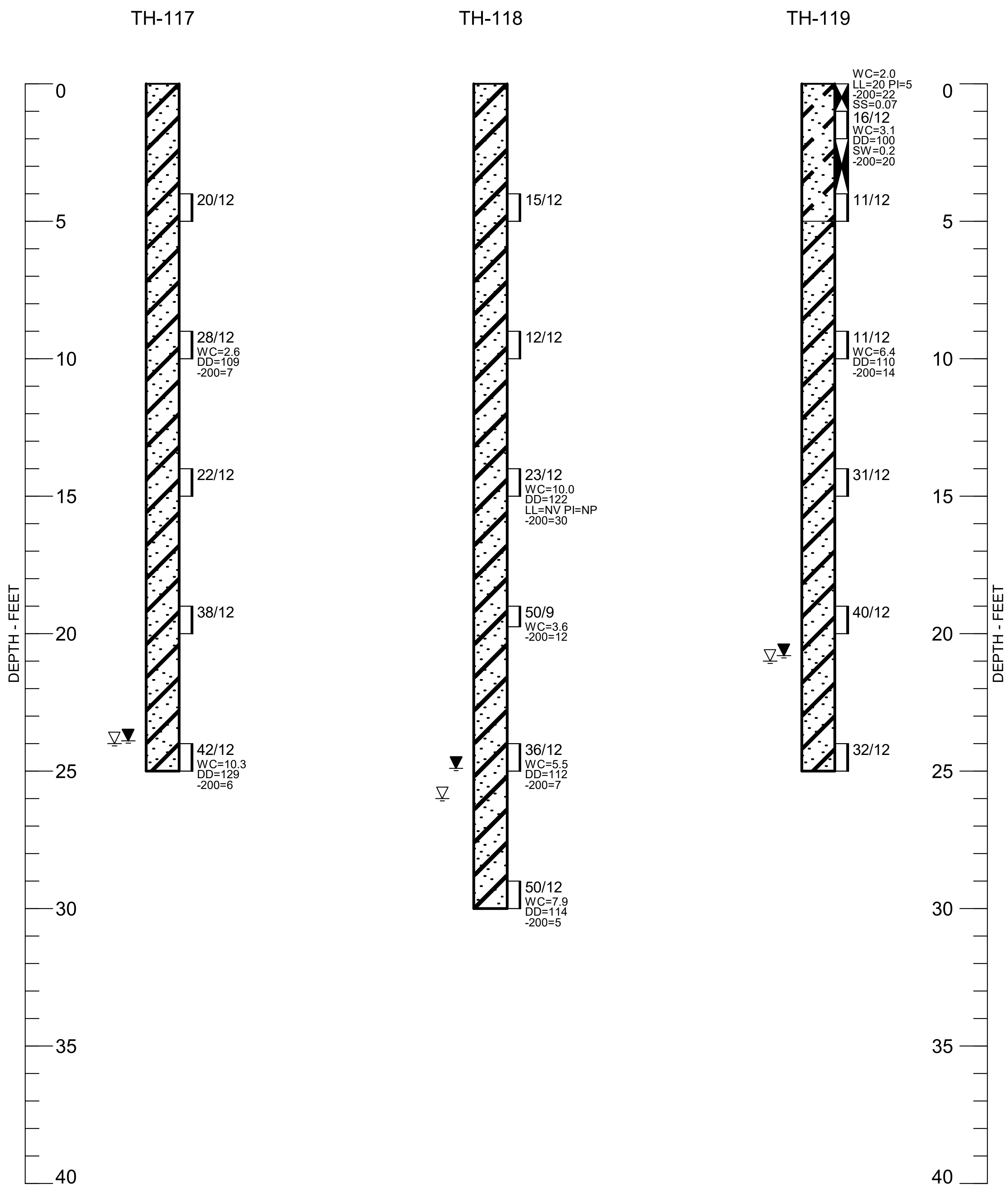
FIG. A- 4



SUMMARY LOGS OF EXPLORATORY BORINGS

LEGEND:

SAND, CLEAN TO VERY SILTY, LOOSE TO DENSE, SLIGHTLY MOIST TO WET, LIGHT TO MEDIUM BROWN, LIGHT GRAY (SP, SP-SM, SW-SM, SM).

SAND, CLAYEY AND SILTY TO CLAYEY, MEDIUM DENSE, DARK BROWN (SC, SC-SM).

CLAY, SANDY TO VERY SANDY, STIFF, VERY MOIST, GRAY, BROWN (CL).

DRIVE SAMPLE. THE SYMBOL 24/12 INDICATES 24 BLOWS OF AN AUTOMATIC 140-POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE A 2.5-INCH O.D. SAMPLER 12 INCHES.

BULK SAMPLE COLLECTED FROM AUGER CUTTINGS.

WATER LEVEL MEASURED AT TIME OF DRILLING.

WATER LEVEL MEASURED SEVERAL DAYS AFTER DRILLING.

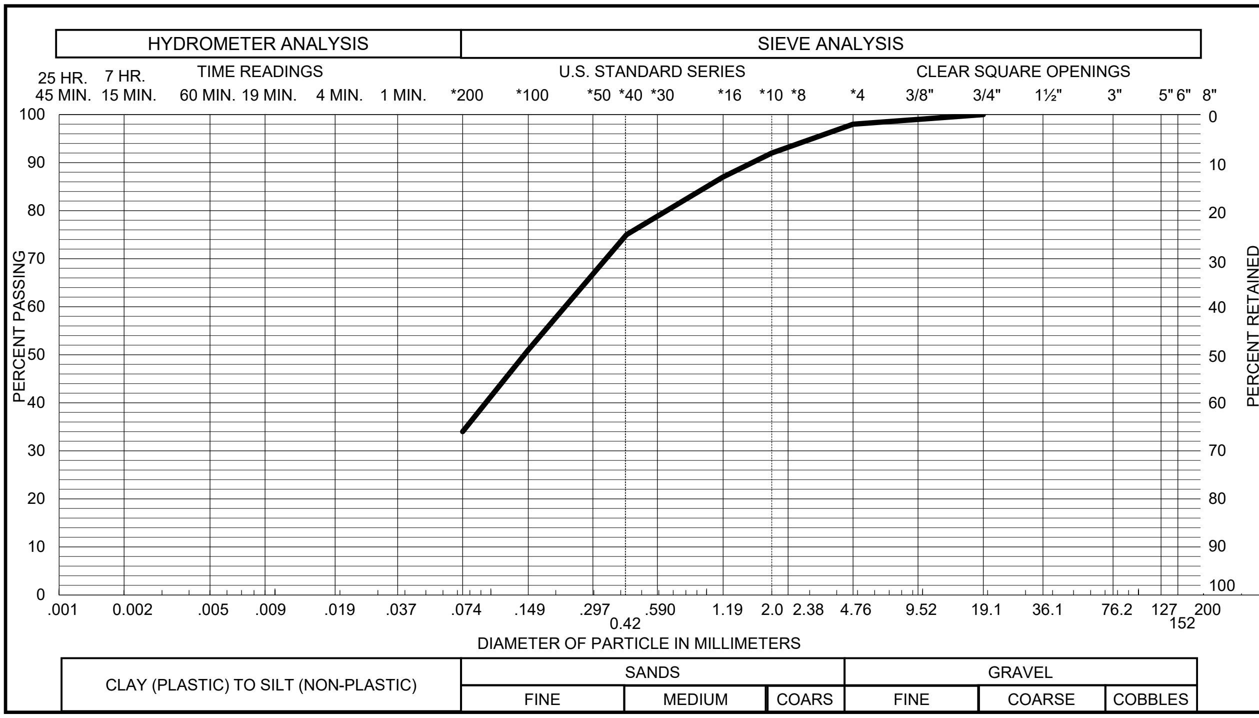
INDICATES DEPTH WHERE HOLE CAVED.

NOTES:

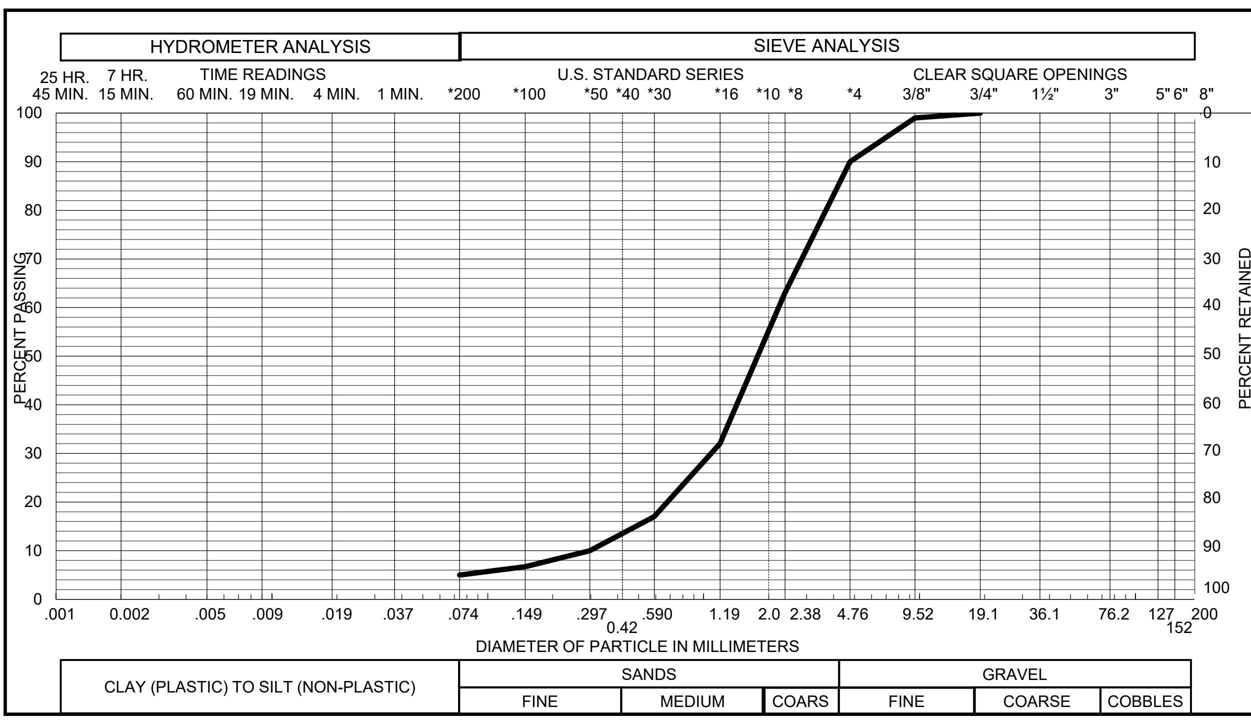
1. THE BORINGS WERE DRILLED ON SEPTEMBER 28 AND 29, 2020 USING 4-INCH DIAMETER, CONTINUOUS-FLIGHT SOLID-STEM AUGER AND TRUCK-MOUNTED CME-45 DRILL RIG.
2. WC - INDICATES MOISTURE CONTENT (%).
   DD - INDICATES DRY DENSITY (PCF).
   SW - INDICATES SWELL WHEN WETTED UNDER APPLIED PRESSURE (%).
   COM - INDICATES COMPRESSION WHEN WETTED UNDER APPLIED PRESSURE (%).
   LL - INDICATES LIQUID LIMIT.
   PI - INDICATES PLASTICITY INDEX.
   -200 - INDICATES PASSING NO. 200 SIEVE (%).
   SS - INDICATES WATER-SOLUBLE SULFATE CONTENT (%).
3. THESE LOGS ARE SUBJECT TO THE EXPLANATIONS, LIMITATIONS AND CONCLUSIONS CONTAINED IN THIS REPORT.

APPENDIX B

LABORATORY TEST RESULTS
TABLE B-1: SUMMARY OF LABORATORY TESTING



Sample of	SAND, CLAYEY AND SILTY (SC-SM)	GRAVEL 2 %	SAND 64 %
From	TH - 101 AT 0-4 FEET	SILT & CLAY 34 %	LIQUID LIMIT 21 %
		PLASTICITY INDEX 4 %	



Sample of	SAND, SLIGHTLY SILTY (SW-SM)	GRAVEL 10 %	SAND 85 %
From	TH - 101 AT 24 FEET	SILT & CLAY 5 %	LIQUID LIMIT %
		PLASTICITY INDEX %	

SUB4 DEVELOPMENT
SOLACE APARTMENT COMPLEX
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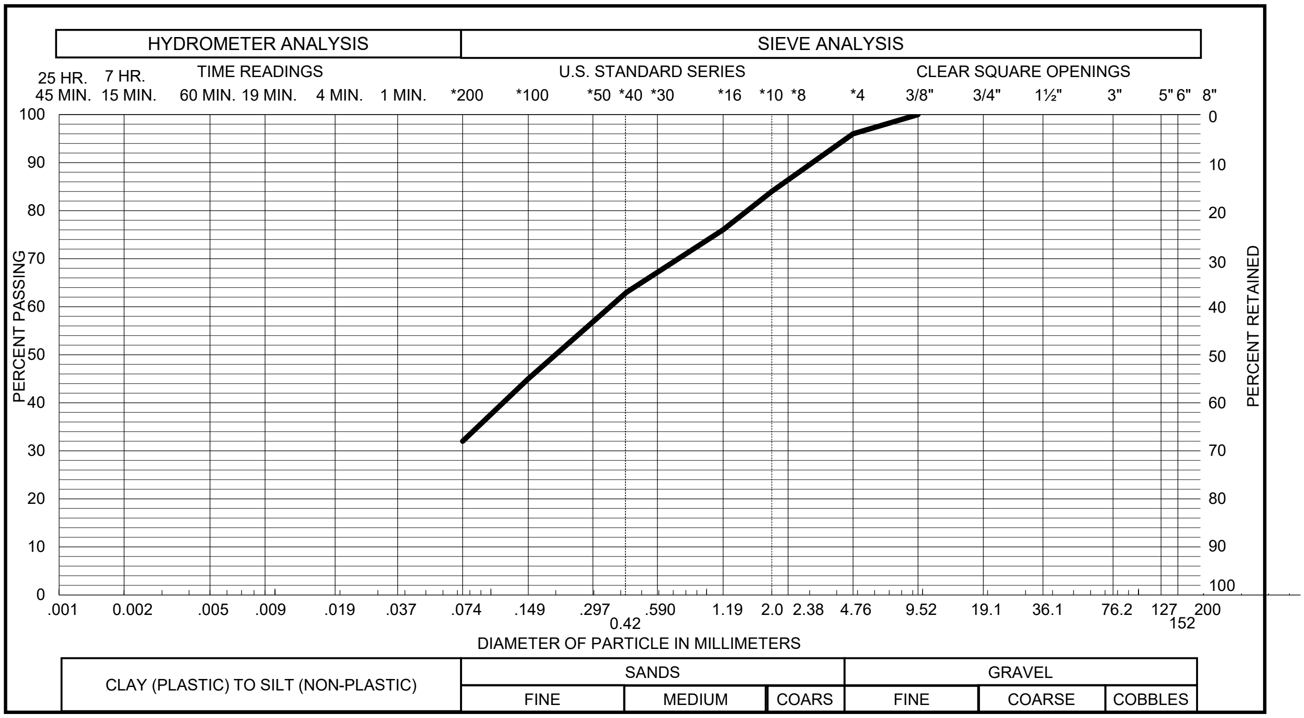
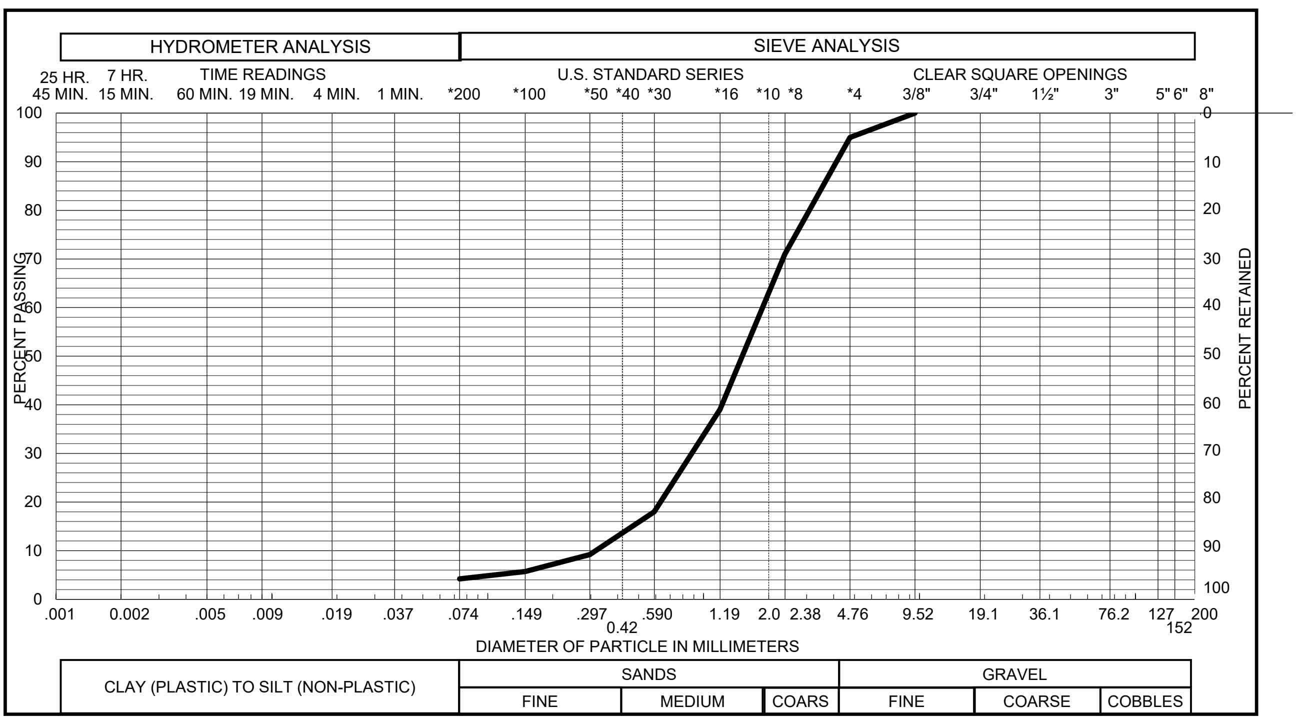
Gradation Test Results

FIG. B-1



Sample of SAND, CLAYEY AND SILTY (SC-SM)
From TH - 102 AT 0-4 FEET

GRAVEL	4 %	SAND	64 %
SILT & CLAY	32 %	LIQUID LIMIT	%
PLASTICITY INDEX	%		



Sample of SAND (SP)
From TH - 102 AT 19 FEET

GRAVEL	5 %	SAND	91 %
SILT & CLAY	4 %	LIQUID LIMIT	%
PLASTICITY INDEX	%		

SUB4 DEVELOPMENT
SOLACE APARTMENT COMPLEX
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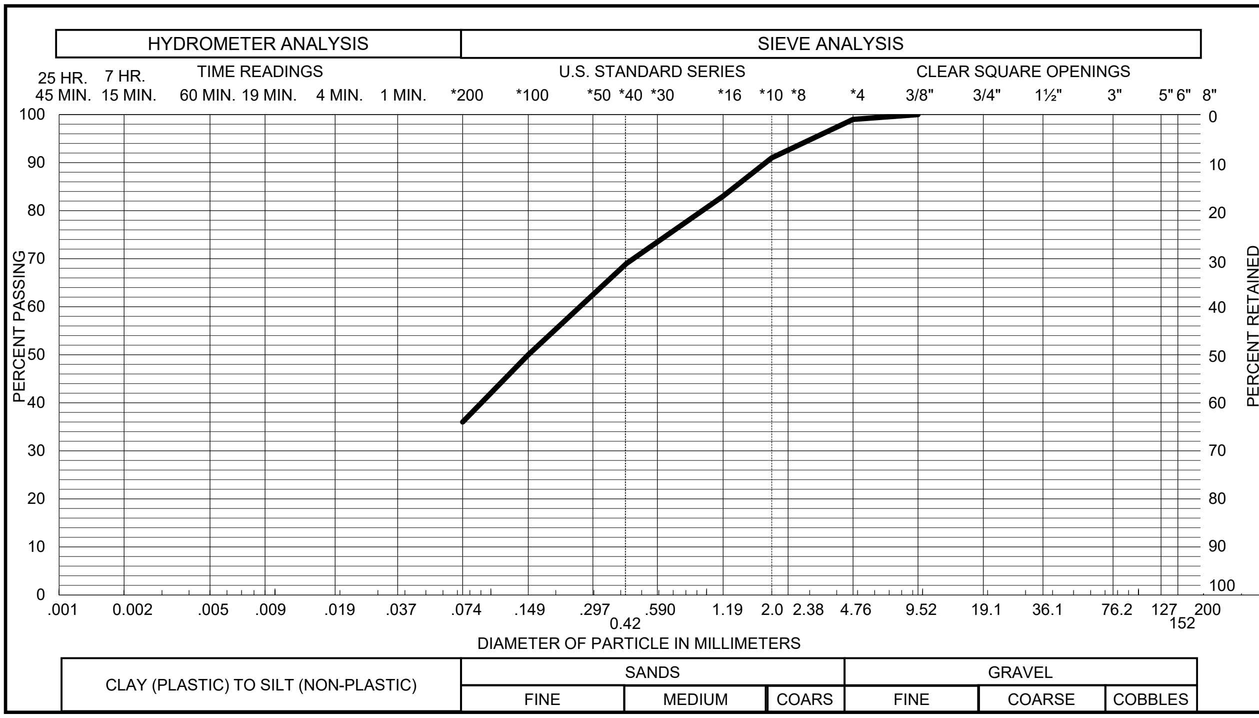
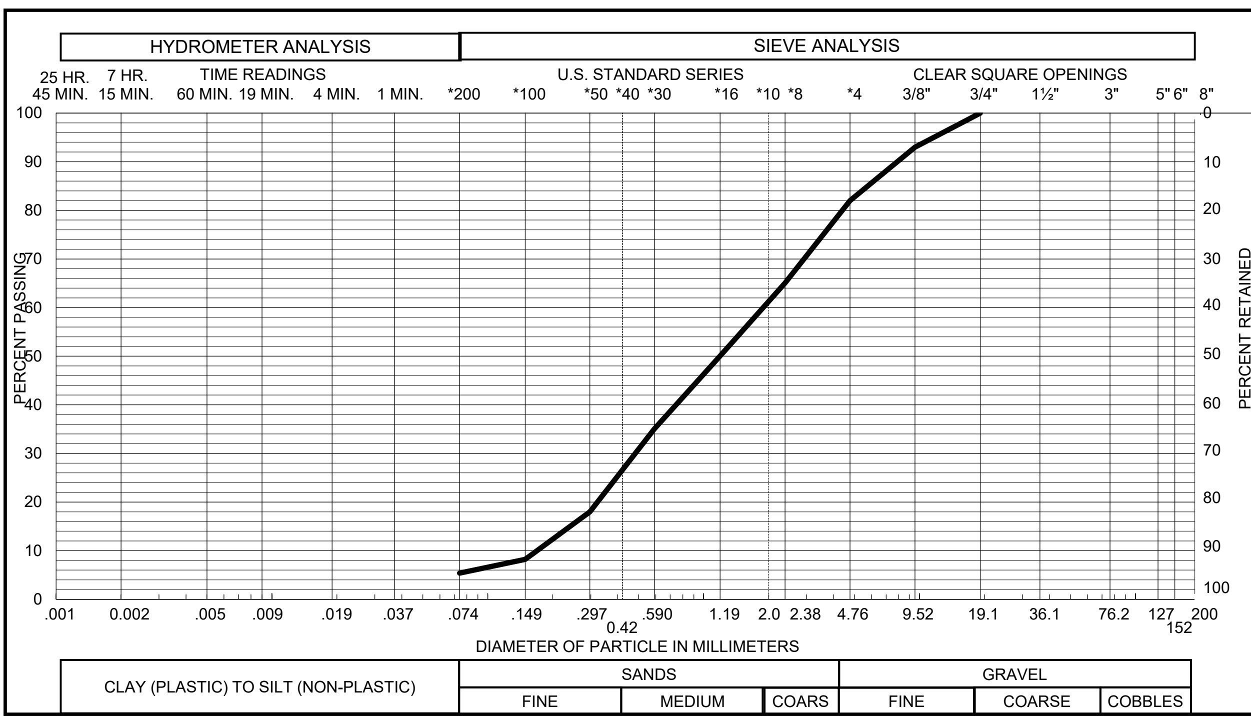
Gradation Test Results

FIG. B-2



Sample of SAND, CLAYEY AND SILTY (SC-SM)
From TH - 103 AT 0-4 FEET

GRAVEL 1 % SAND 63 %
SILT & CLAY 36 % LIQUID LIMIT 20 %
PLASTICITY INDEX 4 %



Sample of SAND, SLIGHTLY SILTY (SP-SM)
From TH - 103 AT 29 FEET

GRAVEL 18 % SAND 77 %
SILT & CLAY 5 % LIQUID LIMIT %
PLASTICITY INDEX %

SUB4 DEVELOPMENT
SOLACE APARTMENT COMPLEX
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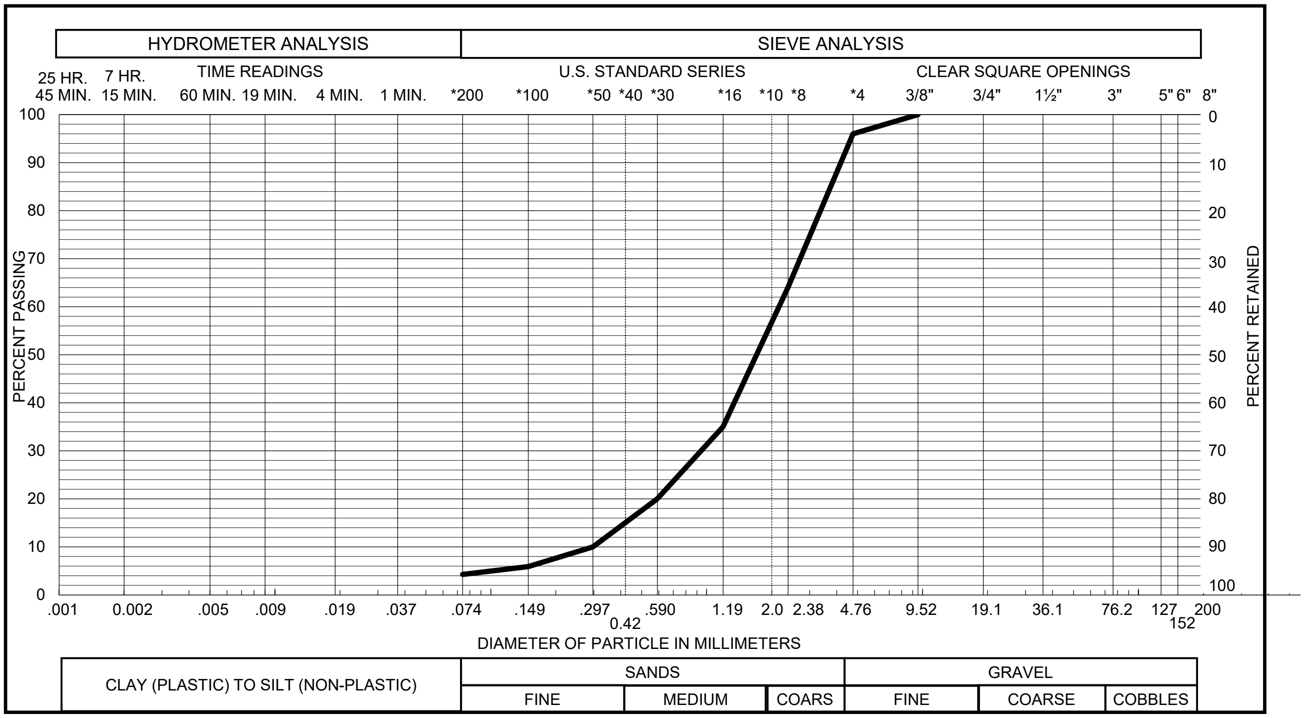
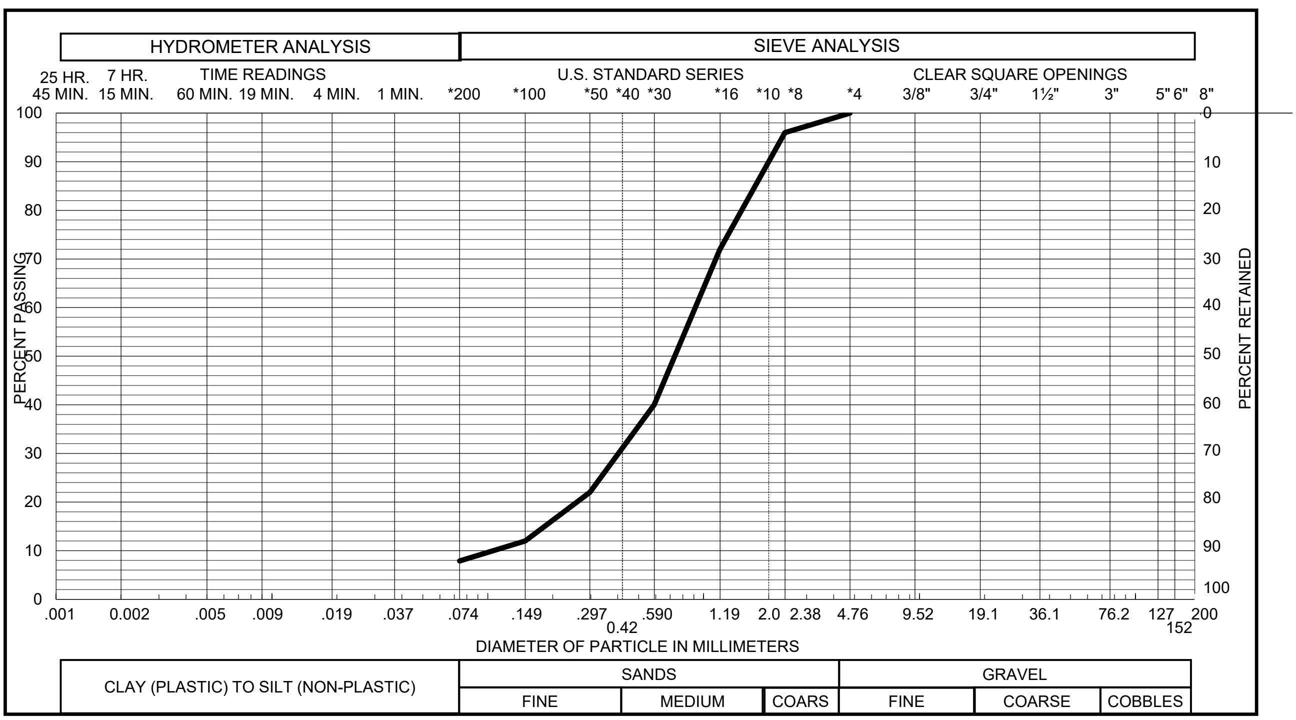
Gradation Test Results

FIG. B-3



Sample of SAND (SW)
From TH - 105 AT 24 FEET

GRAVEL 4 % SAND 92 %
SILT & CLAY 4 % LIQUID LIMIT %
PLASTICITY INDEX %



Sample of SAND, SLIGHTLY SILTY (SP-SM)
From TH - 107 AT 19 FEET

GRAVEL 0 % SAND 92 %
SILT & CLAY 8 % LIQUID LIMIT %
PLASTICITY INDEX %

SUB4 DEVELOPMENT
SOLACE APARTMENT COMPLEX
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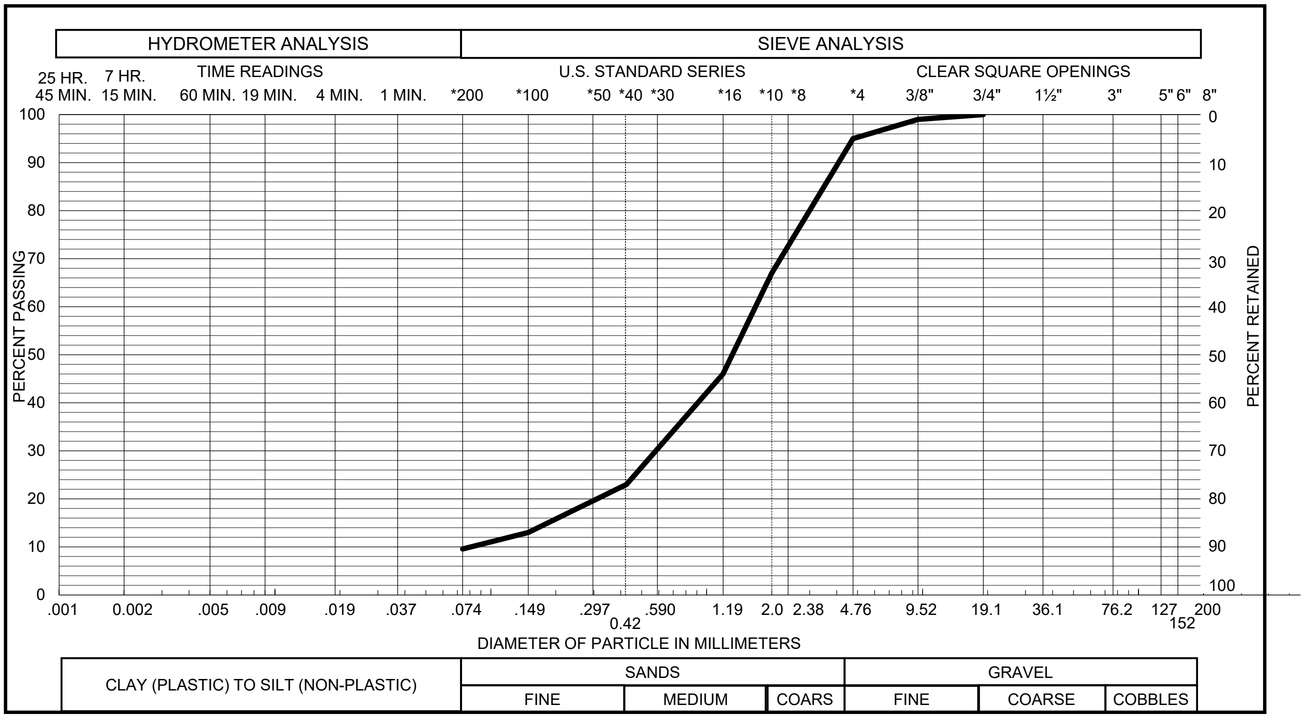
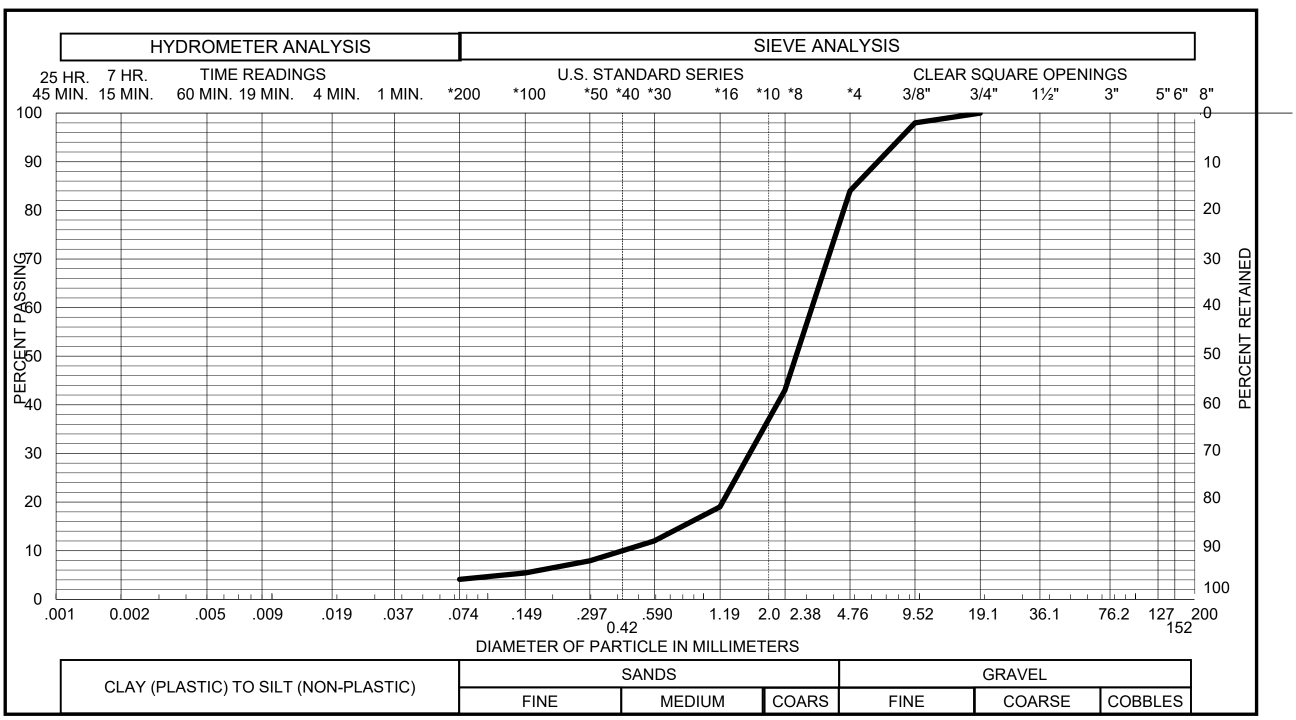
Gradation Test Results

FIG. B-4



Sample of SAND, SLIGHTLY SILTY (SP-SM)
From TH - 108 AT 0-4 FEET

GRAVEL 5 % SAND 85 %
SILT & CLAY 10 % LIQUID LIMIT %
PLASTICITY INDEX %



Sample of SAND (SW)
From TH - 108 AT 24 FEET

GRAVEL 16 % SAND 80 %
SILT & CLAY 4 % LIQUID LIMIT %
PLASTICITY INDEX %

SUB4 DEVELOPMENT
SOLACE APARTMENT COMPLEX
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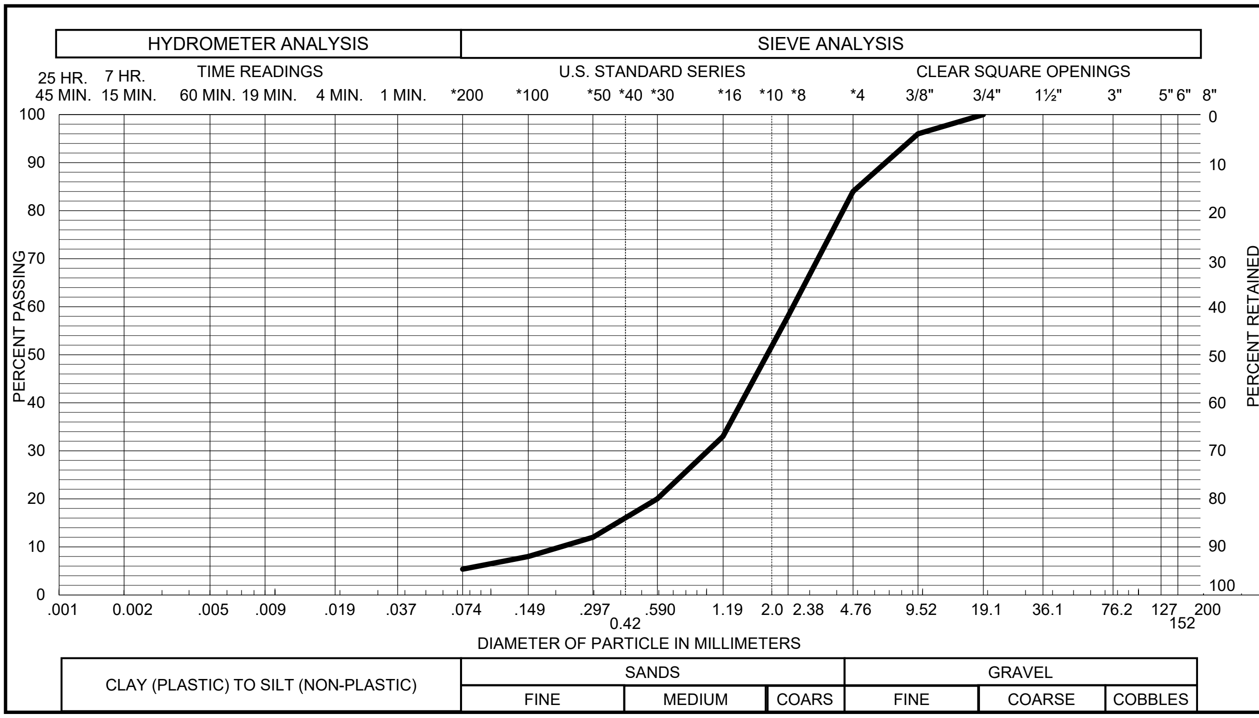
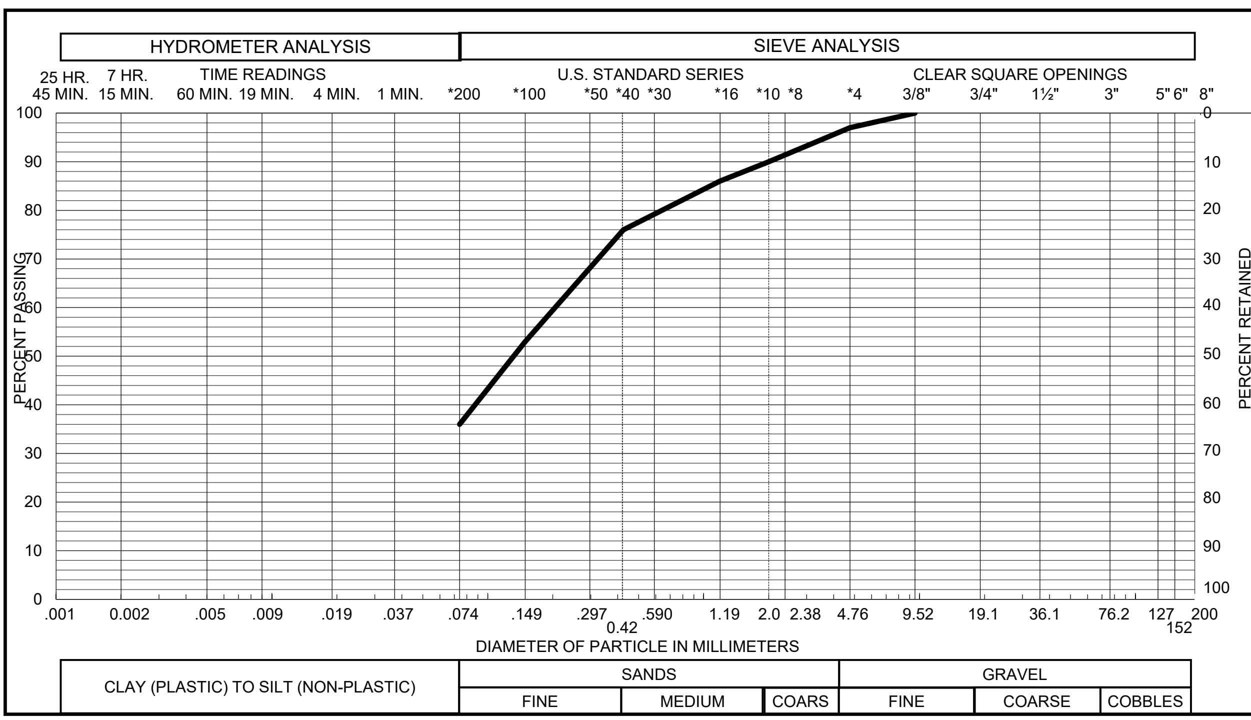
Gradation Test Results

FIG. B-5



Sample of SAND, SLIGHTLY SILTY (SP-SM)
From TH - 109 AT 24 FEET

GRAVEL 16 % SAND 79 %
SILT & CLAY 5 % LIQUID LIMIT %
PLASTICITY INDEX %



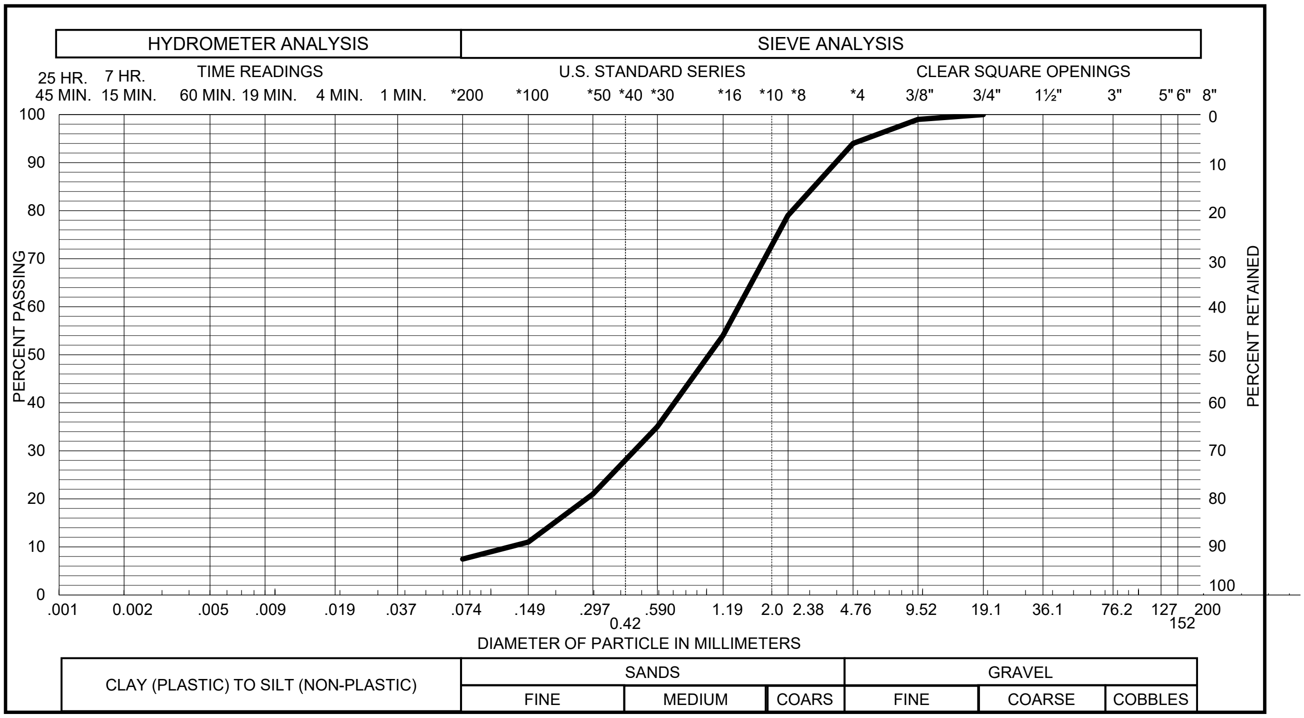
Sample of SAND, CLAYEY AND SILTY (SC-SM)
From TH - 110 AT 1-4 FEET

GRAVEL 3 % SAND 61 %
SILT & CLAY 36 % LIQUID LIMIT %
PLASTICITY INDEX %

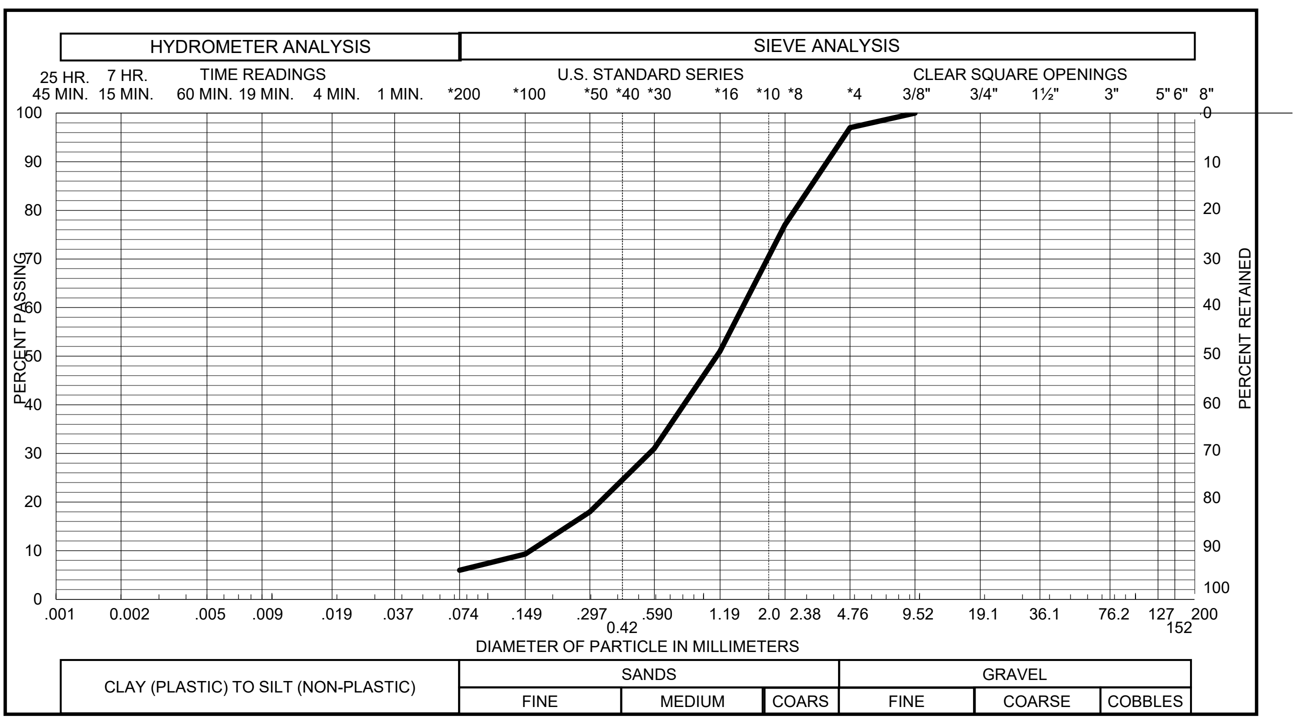
SUB4 DEVELOPMENT
SOLACE APARTMENT COMPLEX
CTL|T PROJECT NO. CS19163.001-125

Gradation Test Results

FIG. B-6



Sample of	SAND, SLIGHTLY SILTY (SP-SM)	GRAVEL 6 %	SAND 86 %
From	TH - 111 AT 4 FEET	SILT & CLAY 8 %	LIQUID LIMIT %
		PLASTICITY INDEX %	



Sample of	SAND, SLIGHTLY SILTY (SP-SM)	GRAVEL 3 %	SAND 91 %
From	TH - 113 AT 19 FEET	SILT & CLAY 6 %	LIQUID LIMIT %
		PLASTICITY INDEX %	

SUB4 DEVELOPMENT
SOLACE APARTMENT COMPLEX
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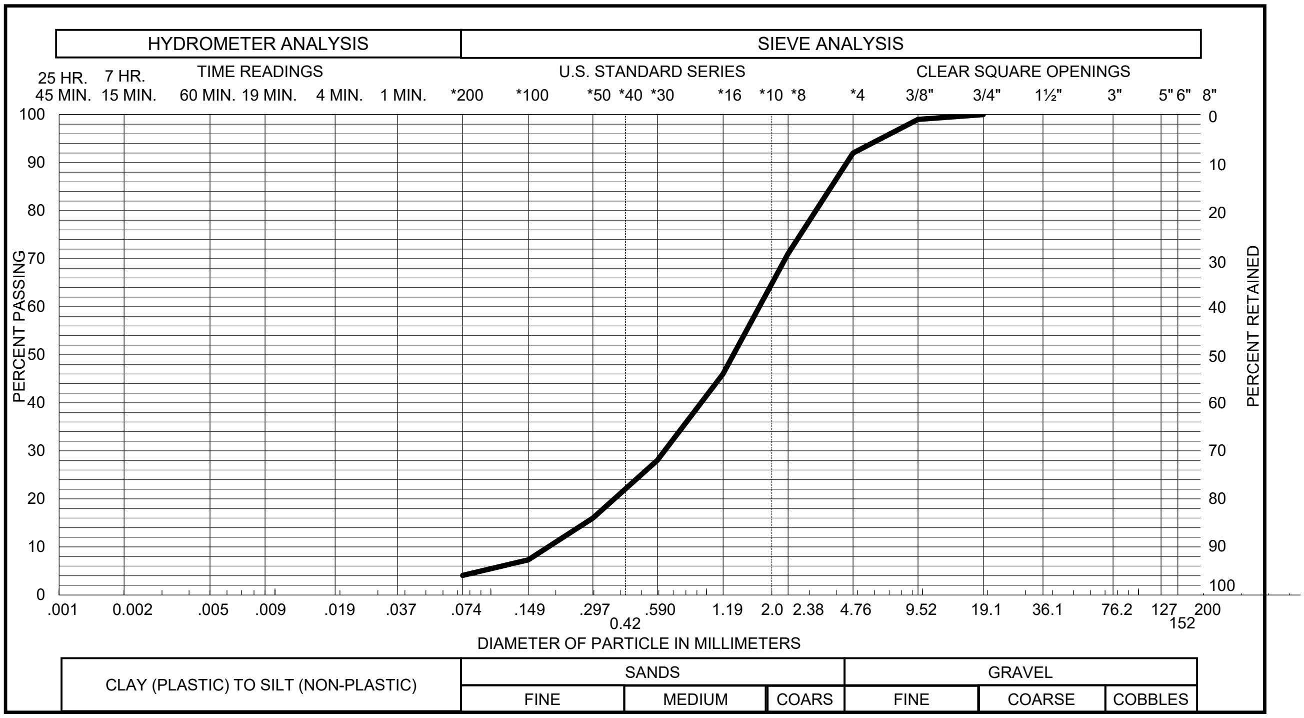
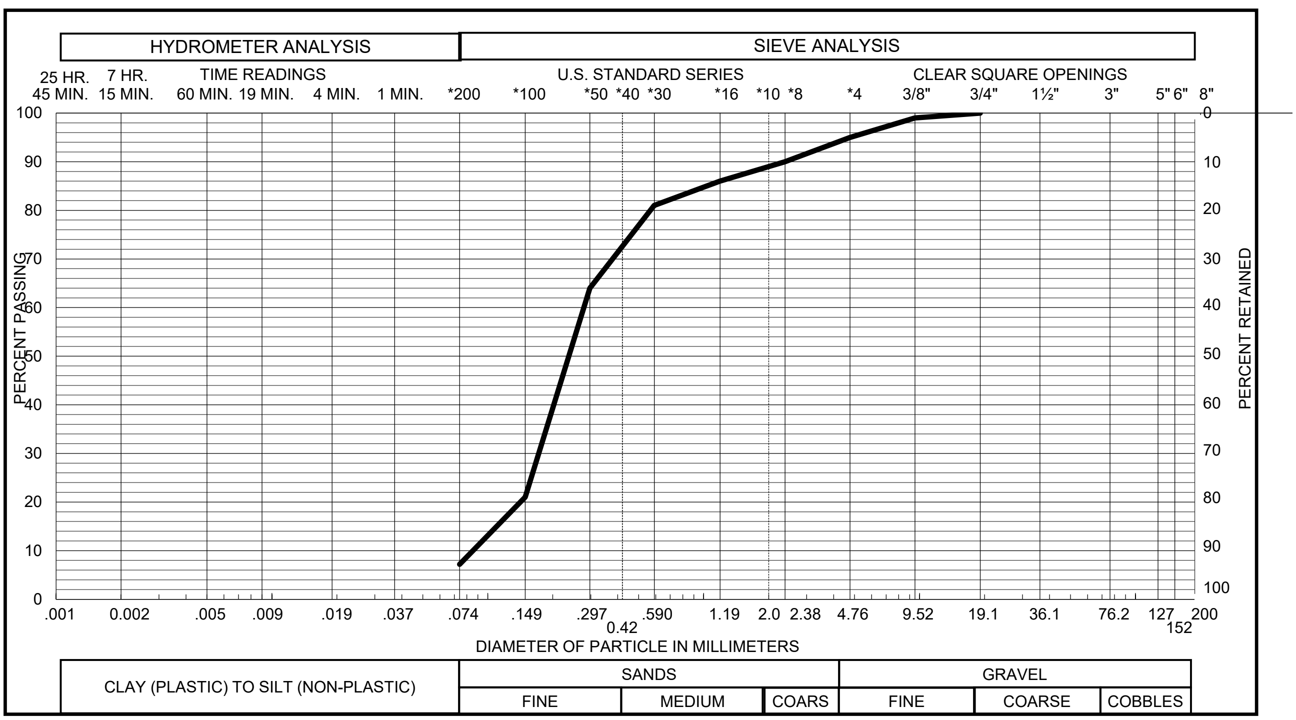
Gradation Test Results

FIG. B-7



Sample of SAND (SW)
From TH - 113 AT 24 FEET

GRAVEL 8 % SAND 88 %
SILT & CLAY 4 % LIQUID LIMIT %
PLASTICITY INDEX %



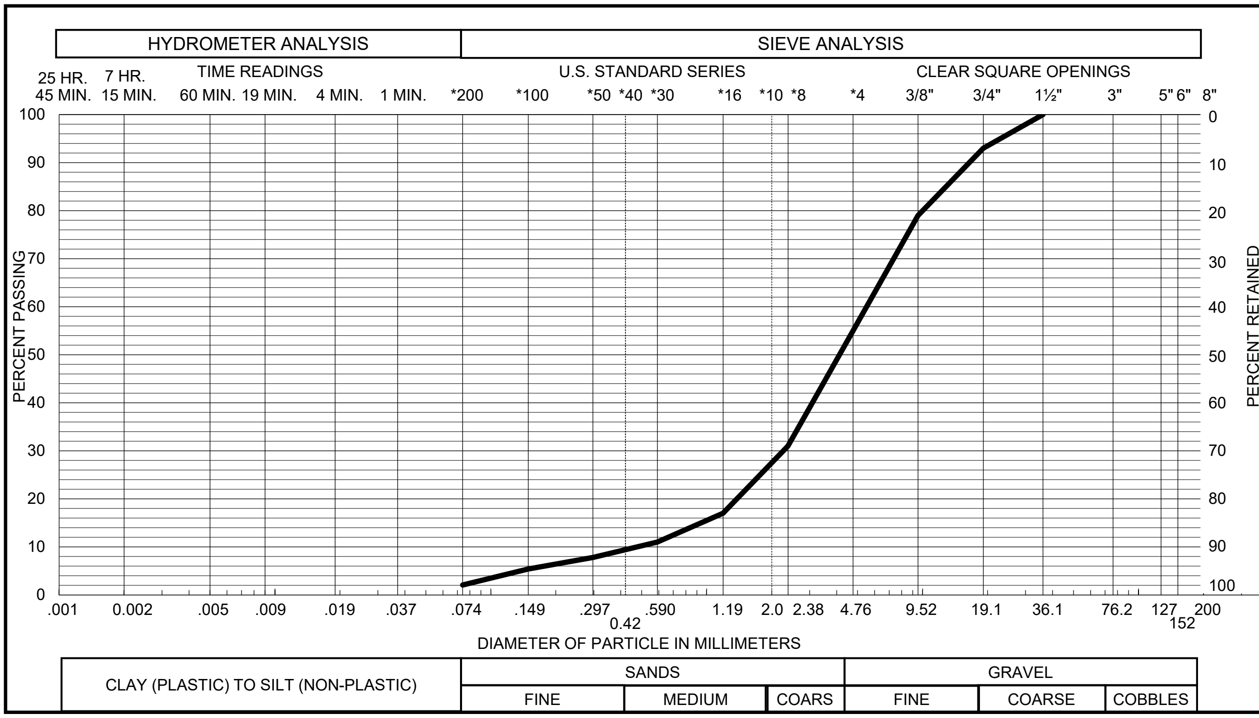
Sample of SAND, SLIGHTLY SILTY (SP-SM)
From TH - 114 AT 9 FEET

GRAVEL 5 % SAND 88 %
SILT & CLAY 7 % LIQUID LIMIT %
PLASTICITY INDEX %

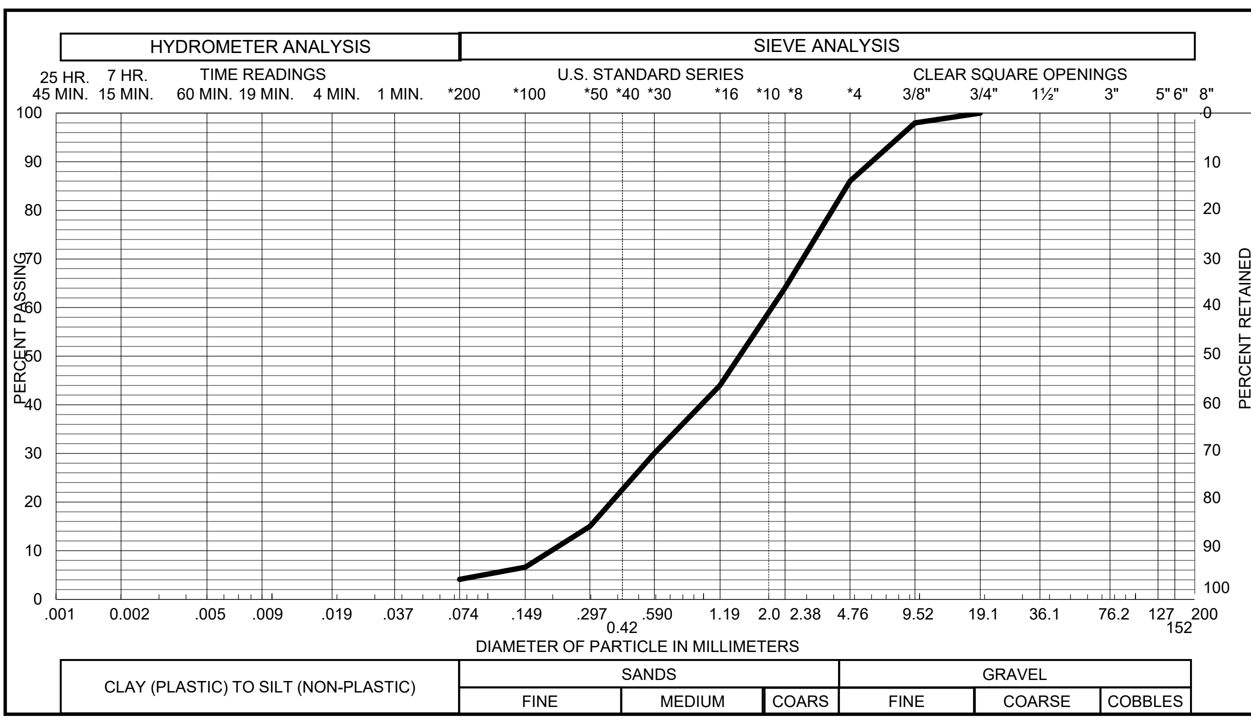
SUB4 DEVELOPMENT
SOLACE APARTMENT COMPLEX
CTL|T PROJECT NO. CS19163.001-125

Gradation Test Results

FIG. B-8



Sample of	SAND (SW)	GRAVEL	45 %	SAND	53 %
From	TH - 115 AT 4 FEET	SILT & CLAY	2 %	LIQUID LIMIT	%
		PLASTICITY INDEX			%

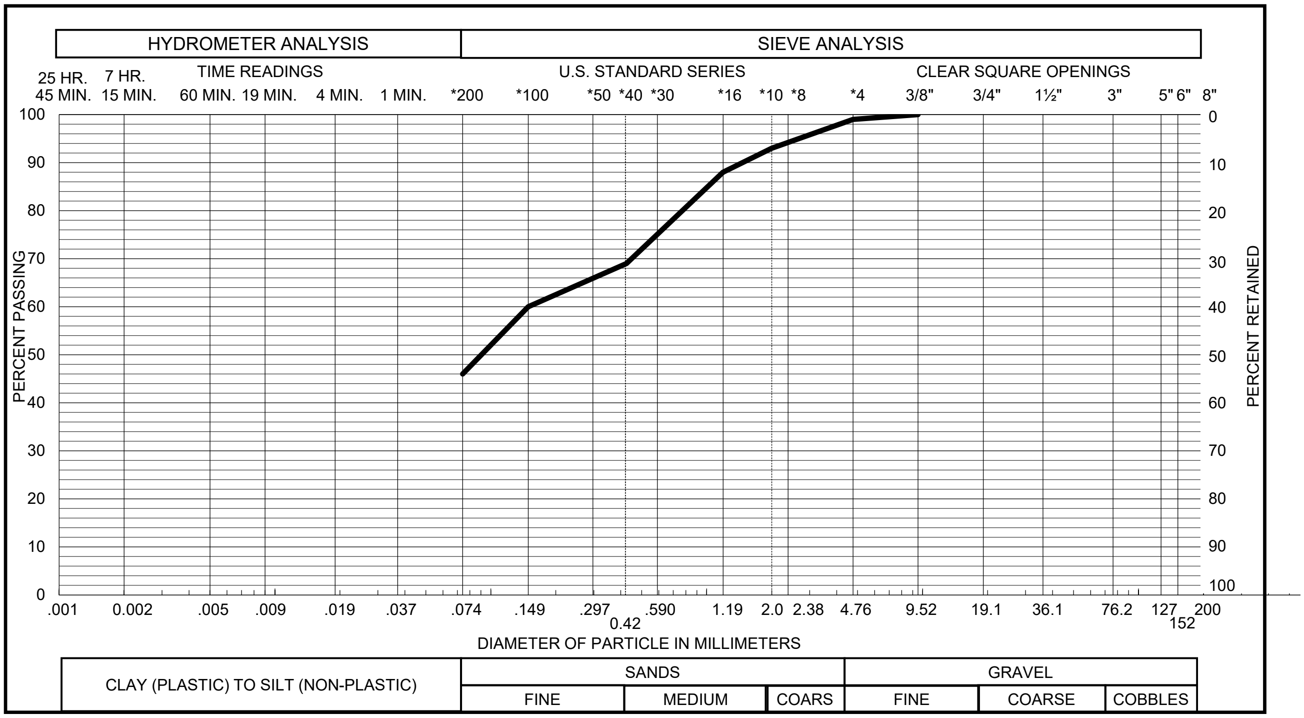


Sample of	SAND (SP)	GRAVEL	14 %	SAND	82 %
From	TH - 115 AT 14 FEET	SILT & CLAY	4 %	LIQUID LIMIT	%
		PLASTICITY INDEX			%

SUB4 DEVELOPMENT
SOLACE APARTMENT COMPLEX
CTL|T PROJECT NO. CS19163.001-125

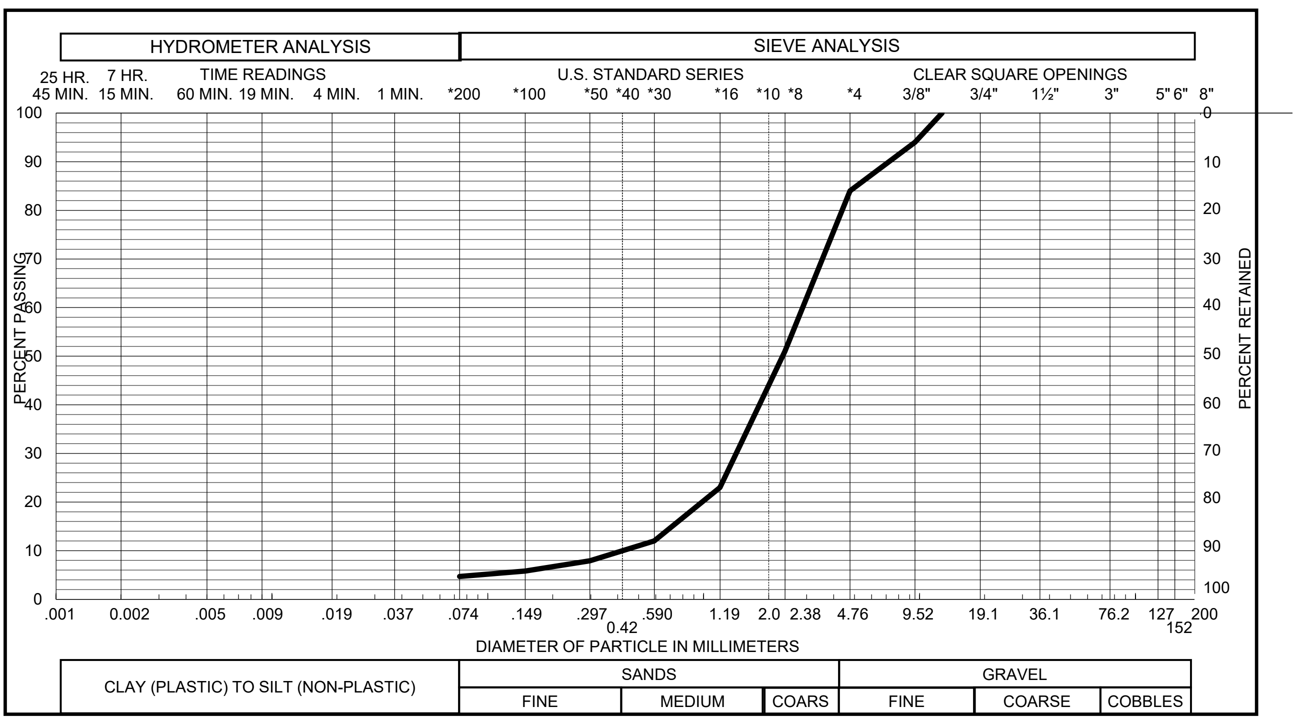
Gradation Test Results

FIG. B-9



Sample of SAND, CLAYEY AND SILTY (SC-SM)
From TH - 116 AT 0-4 FEET

GRAVEL	1 %	SAND	53 %
SILT & CLAY	46 %	LIQUID LIMIT	27 %
PLASTICITY INDEX			7 %



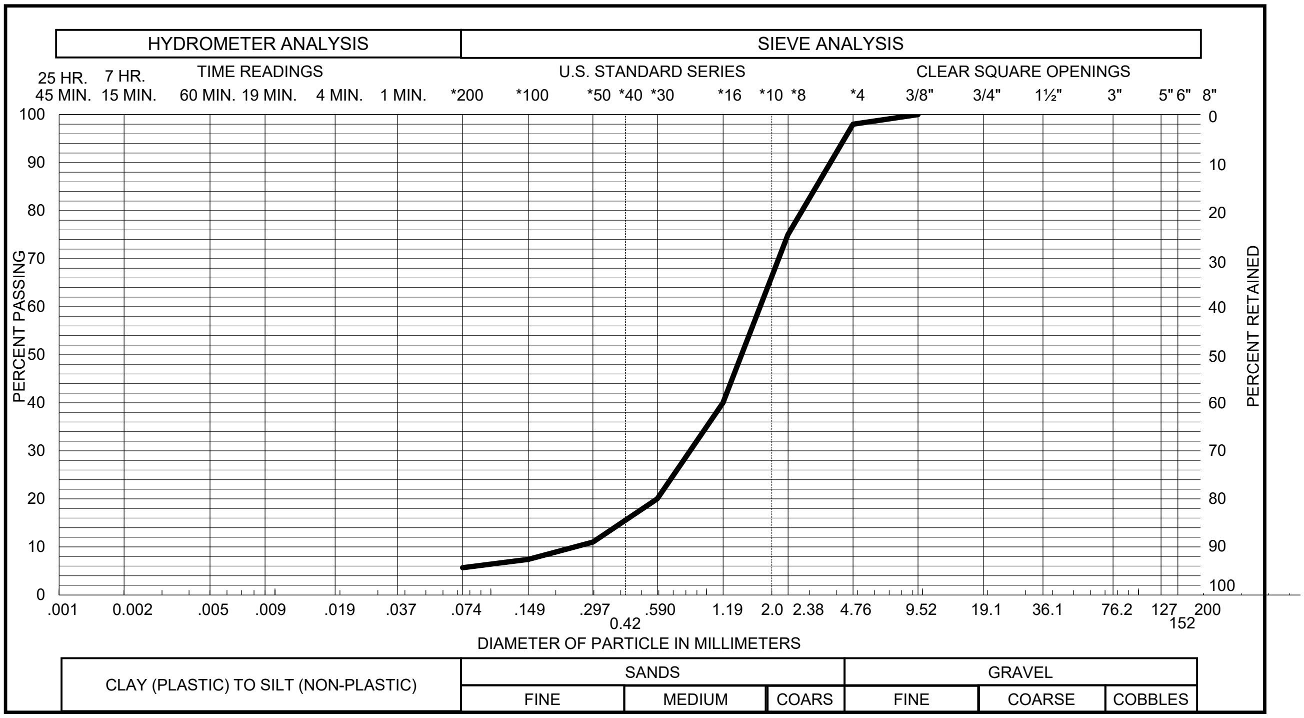
Sample of SAND, SLIGHTLY SILTY (SP-SM)
From TH - 116 AT 19 FEET

GRAVEL	16 %	SAND	79 %
SILT & CLAY	5 %	LIQUID LIMIT	%
PLASTICITY INDEX			%

SUB4 DEVELOPMENT
SOLACE APARTMENT COMPLEX
CTL|T PROJECT NO. CS19163.001-125

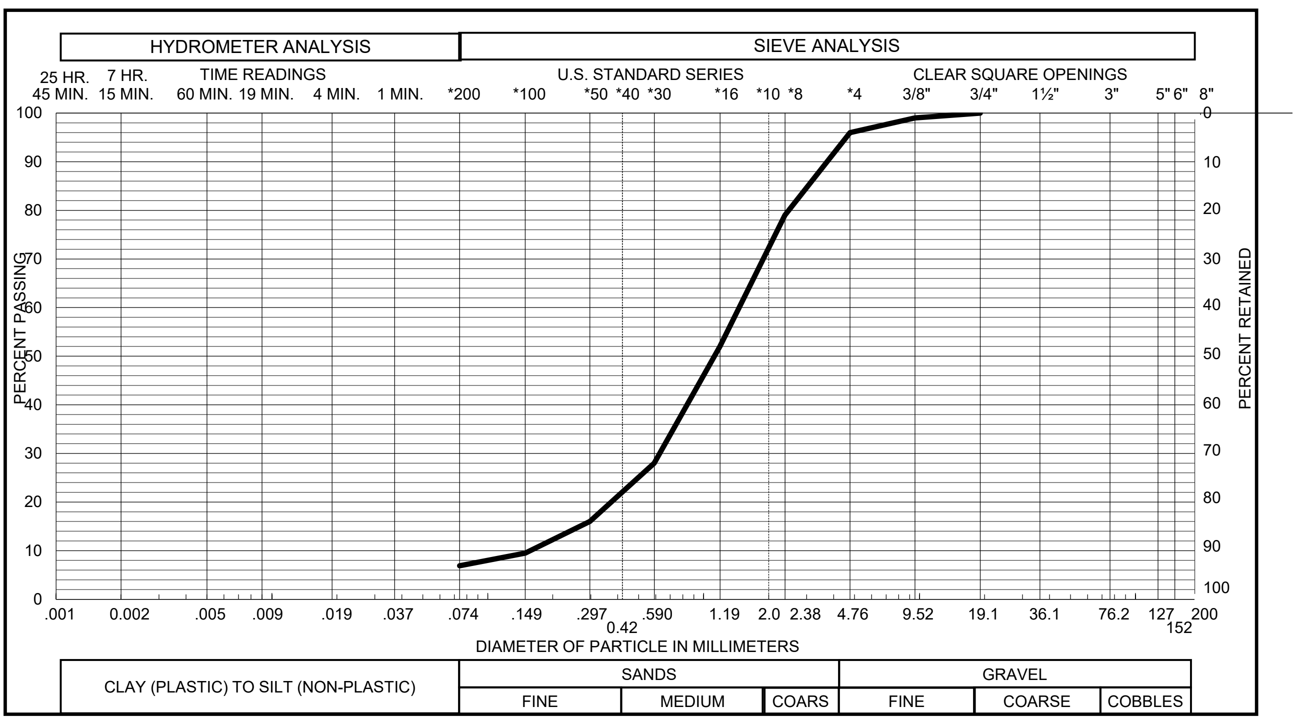
Gradation Test Results

FIG. B-10



Sample of SAND, SLIGHTLY SILTY (SP-SM)
From TH - 117 AT 24 FEET

GRAVEL 2 % SAND 92 %
SILT & CLAY 6 % LIQUID LIMIT %
PLASTICITY INDEX %



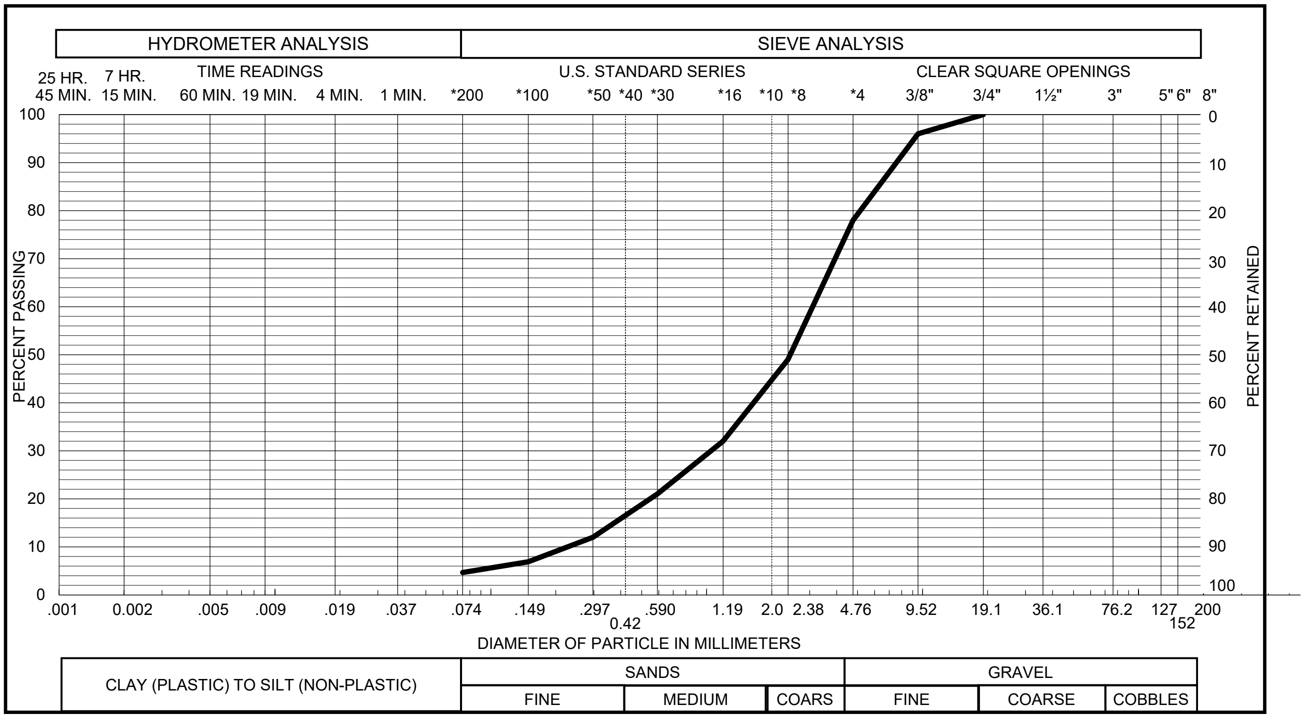
Sample of SAND, SLIGHTLY SILTY (SP-SM)
From TH - 118 AT 24 FEET

GRAVEL 4 % SAND 89 %
SILT & CLAY 7 % LIQUID LIMIT %
PLASTICITY INDEX %

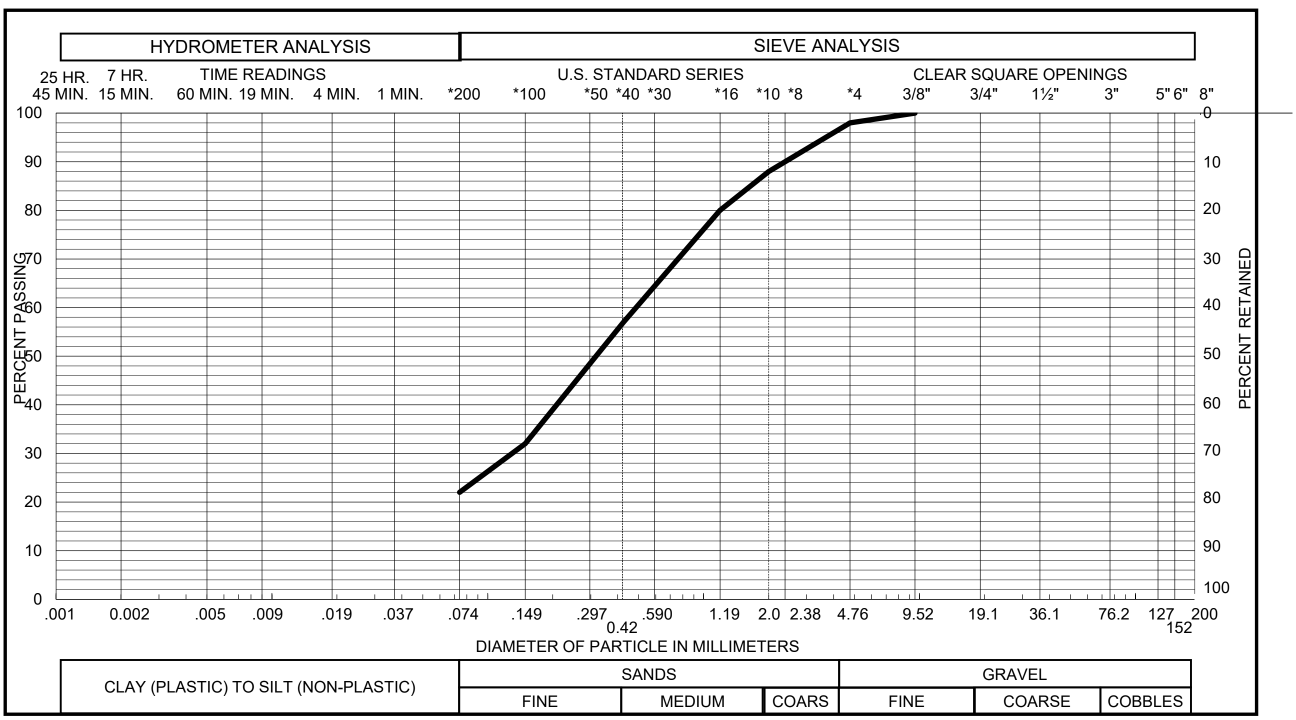
SUB4 DEVELOPMENT
SOLACE APARTMENT COMPLEX
CTL|T PROJECT NO. CS19163.001-125

Gradation Test Results

FIG. B-11



Sample of	SAND, SLIGHTLY SILTY (SP-SM)	GRAVEL	22 %	SAND	73 %
From	TH - 118 AT 29 FEET	SILT & CLAY	5 %	LIQUID LIMIT	%
		PLASTICITY INDEX	%		



Sample of	SAND, CLAYEY AND SILTY (SC-SM)	GRAVEL	2 %	SAND	76 %
From	TH - 119 AT 0-4 FEET	SILT & CLAY	22 %	LIQUID LIMIT	%
		PLASTICITY INDEX	%		

SUB4 DEVELOPMENT
SOLACE APARTMENT COMPLEX
CTL|T PROJECT NO. CS19163.001-125

Gradation Test Results

FIG. B-12

TABLE B-1

SUMMARY OF LABORATORY TESTING
CTL|T PROJECT NO. CS19163.001-125

				ATTERBERG LIMITS		SWELL TEST RESULTS*					
BORING	DEPTH (FEET)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	SWELL (%)	APPLIED PRESSURE (PSF)	SWELL PRESSURE (PSF)	PASSING NO. 200 SIEVE (%)	WATER SOLUBLE SULFATES (%)	DESCRIPTION
TH-101	0-4	2.5		21	4				34		SAND, CLAYEY AND SILTY (SC-SM)
TH-101	24	9.2	117						5		SAND, SLIGHTLY SILTY (SW-SM)
TH-102	0-4	2.9		25	6				32		SAND, CLAYEY AND SILTY (SC-SM)
TH-102	9	4.9	111						28		SAND, SLIGHTLY SILTY (SP-SM)
TH-102	19	2.1	113						4		SAND (SP)
TH-103	0-4	4.6		20	4				36		SAND, CLAYEY AND SILTY (SC-SM)
TH-103	14	15.6	108						45		SAND, VERY CLAYEY (SC)
TH-103	29	9.0	126						5		SAND, SLIGHTLY SILTY (SP-SM)
TH-104	14	6.0	97						20		SAND, SILTY (SM)
TH-104	19	3.8	112						5		SAND, SLIGHTLY SILTY (SP-SM)
TH-105	14	12.7	112	33	16	0.1	1800		36		SAND, VERY CLAYEY (SC)
TH-105	24	6.8	107						4		SAND (SW)
TH-106	4	3.4	105						41	<0.1	SAND, VERY SILTY (SM)
TH-106	14	3.7	119						7		SAND, SLIGHTLY SILTY (SP-SM)
TH-107	4	5.3	101						51		SAND, VERY SILTY (SM)
TH-107	19	5.6	117						8		SAND, SLIGHTLY SILTY (SW-SM)
TH-108	0-4	3.4		NV	NP				10		SAND, SLIGHTLY SILTY (SP-SM)
TH-108	14	21.6	101	30	11	0.2	1800		58		CLAY, VERY SANDY (CL)
TH-108	24	11.9	114						4		SAND (SW)
TH-109	4	1.7	117						9		SAND, SLIGHTLY SILTY (SP-SM)
TH-109	24	7.8	123						5		SAND, SLIGHTLY SILTY (SW-SM)
TH-110	1-4	3.9		24	6				36		SAND, CLAYEY AND SILTY (SC-SM)
TH-110	14	14.5	109	NV	NP	0.0	1800		40		SAND, VERY SILTY (SM)
TH-111	4	0.8	113						8		SAND, SLIGHTLY SILTY (SW-SM)
TH-111	14	4.9	110						36		SAND, VERY SILTY (SM)
TH-112	4	3.9	112								SAND, SILTY (SM)
TH-112	9	3.3	109						8		SAND, SLIGHTLY SILTY (SP-SM)
TH-113	4	3.0	128						24		SAND, SILTY (SM)
TH-113	19	4.6	117						6		SAND, SLIGHTLY SILTY (SW-SM)
TH-113	24	9.7	126						4		SAND (SW)
TH-114	9	2.4	99						7		SAND, SLIGHTLY SILTY (SP-SM)
TH-114	14	3.1	96						6		SAND, SLIGHTLY SILTY (SP-SM)
TH-115	4	1.2	111						2		SAND (SW)
TH-115	14	3.6	111						4		SAND (SP)
TH-116	0-4	4.5		27	7				46	<0.1	SAND, CLAYEY AND SILTY (SC-SM)
TH-116	1	5.9	99	31	12	0.3	200		50		CLAY, VERY SANDY (CL)
TH-116	19	2.9	113						5		SAND, SLIGHTLY SILTY (SW-SM)
TH-117	9	2.6	109						7		SAND, SLIGHTLY SILTY (SP-SM)
TH-117	24	10.3	129						6		SAND, SLIGHTLY SILTY (SW-SM)

* SWELL MEASURED UNDER ESTIMATED IN-SITU OVERBURDEN PRESSURE.
NEGATIVE VALUE INDICATES COMPRESSION.

TABLE B-1

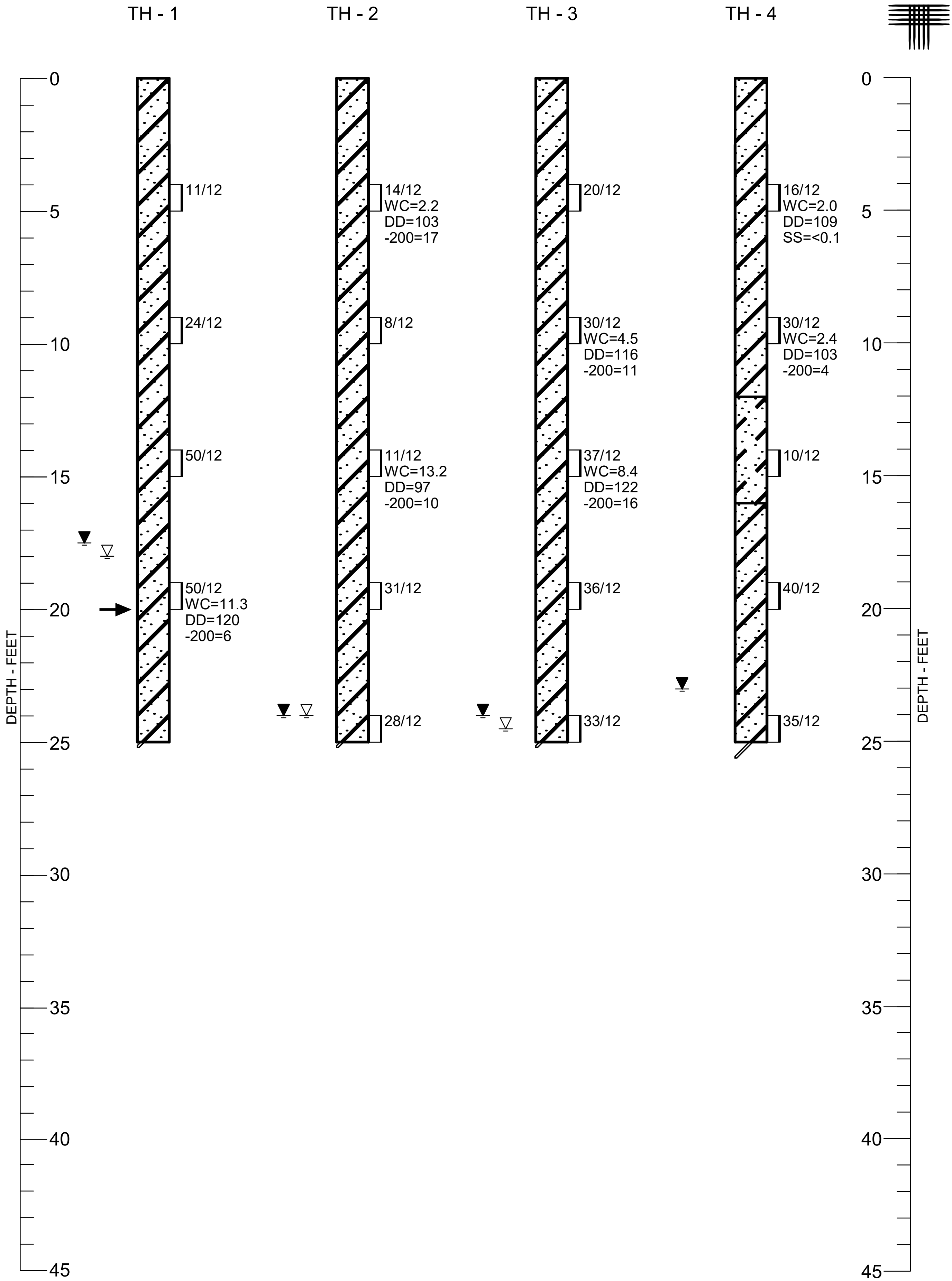
SUMMARY OF LABORATORY TESTING
CTL|T PROJECT NO. CS19163.001-125

BORING	DEPTH (FEET)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	ATTERBERG LIMITS LIQUID LIMIT (%)	ATTERBERG LIMITS PLASTICITY INDEX (%)	SWELL TEST RESULTS* SWELL (%)	SWELL TEST RESULTS* APPLIED PRESSURE (PSF)	SWELL TEST RESULTS* SWELL PRESSURE (PSF)	PASSING NO. 200 SIEVE (%)	WATER SOLUBLE SULFATES (%)	DESCRIPTION
TH-118	14	10.0	122	NV	NP	-0.3	1800		30		SAND, SILTY (SM)
TH-118	19	3.6							12		SAND, SLIGHTLY SILTY (SP-SM)
TH-118	24	5.5	112						7		SAND, SLIGHTLY SILTY (SW-SM)
TH-118	29	7.9	114						5		SAND, SLIGHTLY SILTY (SW-SM)
TH-119	0-4	2.0		20	5				22	0.07	SAND, CLAYEY AND SILTY (SC-SM)
TH-119	1	3.1	100			0.2	200		20		SAND, CLAYEY AND SILTY (SC-SM)
TH-119	9	6.4	110						14		SAND, SILTY (SM)

* SWELL MEASURED UNDER ESTIMATED IN-SITU OVERBURDEN PRESSURE.
NEGATIVE VALUE INDICATES COMPRESSION.

APPENDIX C

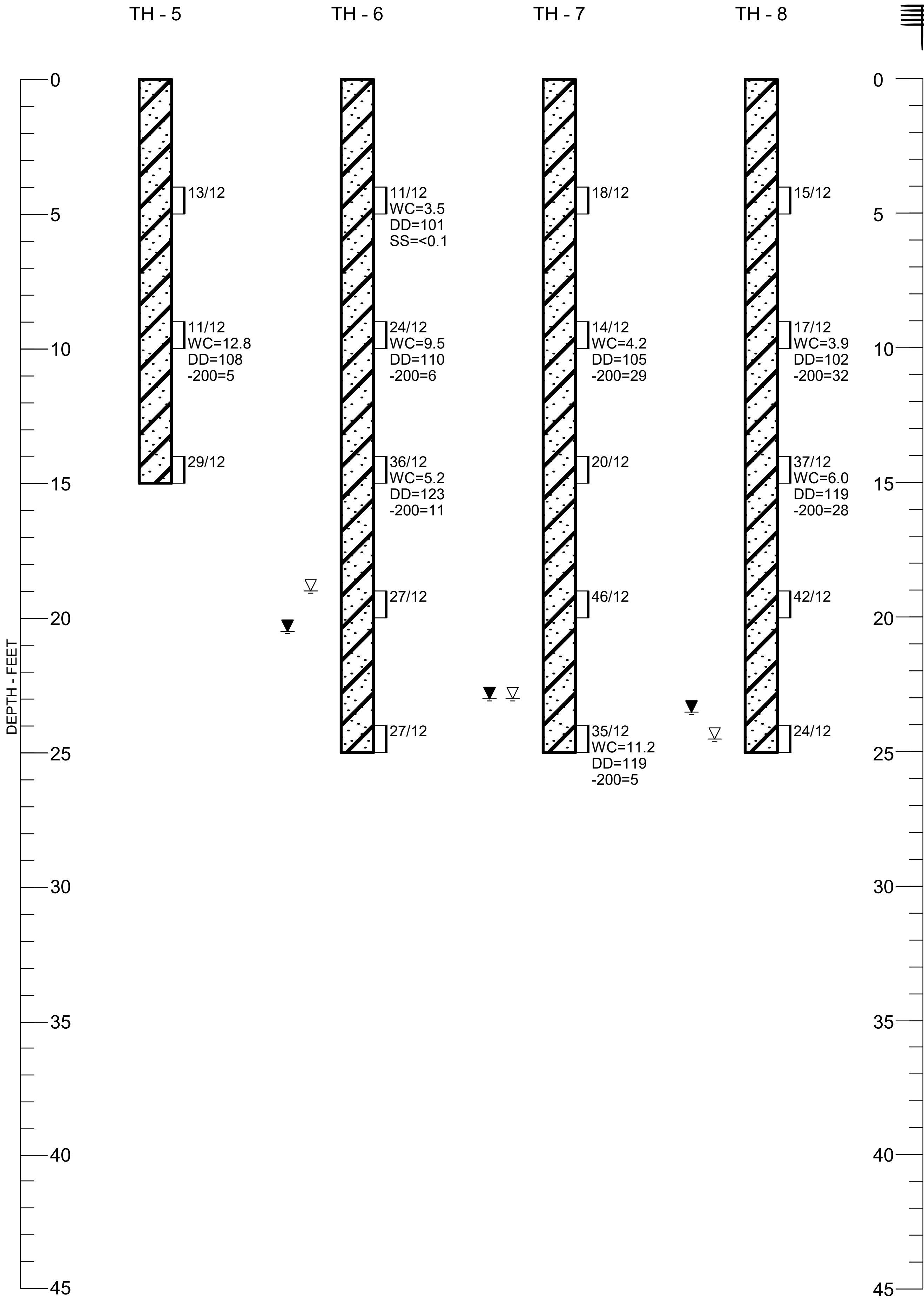
SUMMARY LOGS CTL|T PROJECT NO. CS19163.000



JACKSON DEARBORN PARTNERS
POWERS APARTMENT COMPLEX
CTL|T PROJECT NO. CS19163-105

Summary Logs of Exploratory Borings

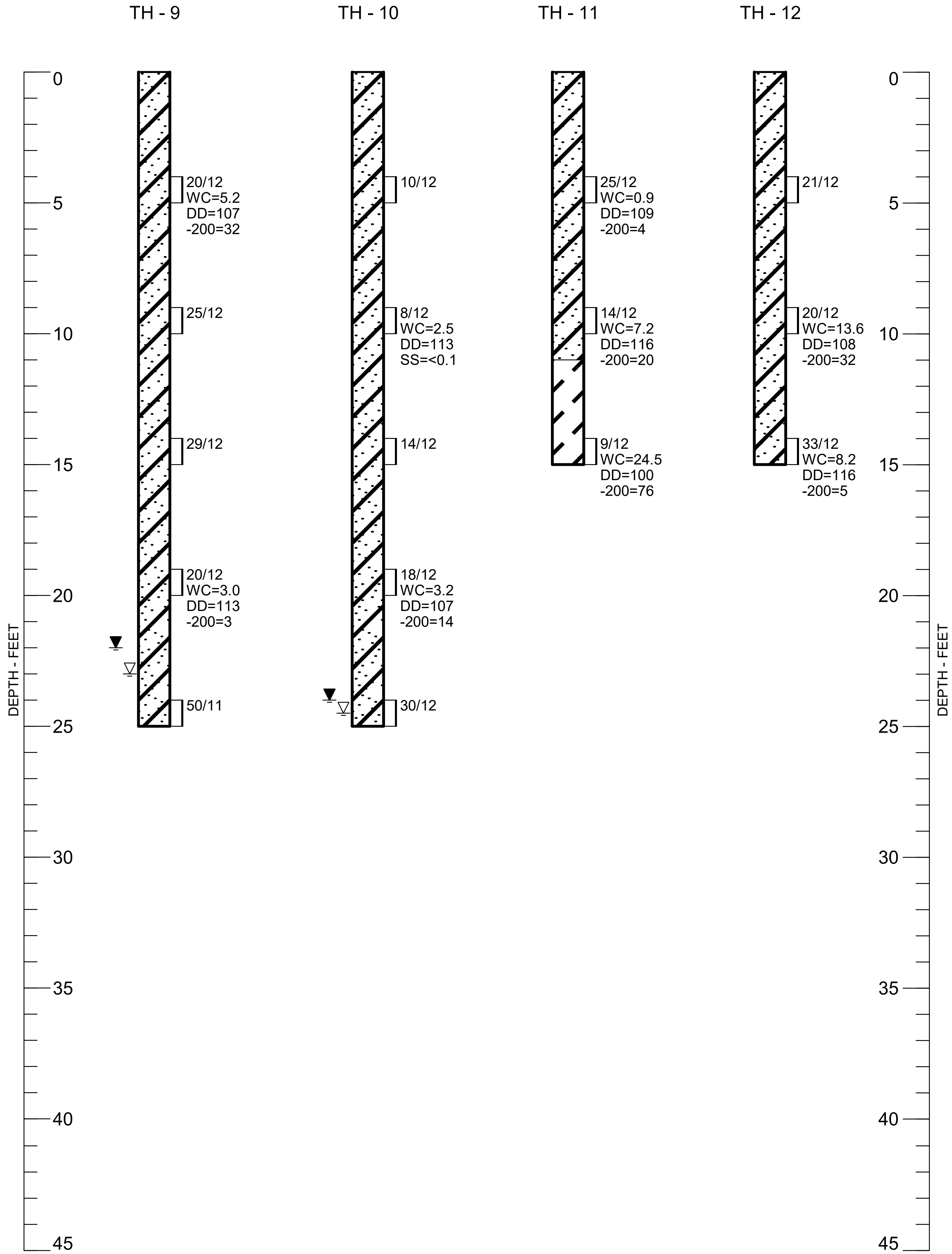
FIG. A-1



JACKSON DEARBORN PARTNERS
POWERS APARTMENT COMPLEX
CTL|T PROJECT NO. CS19163-105

Summary Logs of Exploratory Borings

FIG. A-2



NOTES:

1. THE BORINGS WERE DRILLED OCTOBER 10 AND 17, 2019 USING A 4-INCH DIAMETER, CONTINUOUS-FLIGHT AUGER AND A CME-55, TRUCK-MOUNTED DRILL RIG.
2. THESE LOGS ARE SUBJECT TO THE EXPLANATIONS, LIMITATIONS, AND CONCLUSIONS AS CONTAINED IN THIS REPORT.
3. WC - INDICATES MOISTURE CONTENT. (%)
   DD - INDICATES DRY DENSITY. (PCF)
   -200 - INDICATES PASSING NO. 200 SIEVE. (%)
   SS - INDICATES WATER-SOLUBLE SULFATE CONTENT. (%)

LEGEND:

SAND, CLEAN TO SILTY, LOOSE TO DENSE, SLIGHTLY MOIST TO WET, LIGHT TO MEDIUM BROWN, LIGHT GRAY. (SP, SP-SM, SW-SM, SM)

SAND, CLAYEY, MEDIUM DENSE, MOIST, DARK BROWN. (SC)

CLAY, SANDY, STIFF, VERY MOIST, GRAY BROWN. (CL)

DRIVE SAMPLE. THE SYMBOL 14/12 INDICATES 14 BLOWS OF A 140-POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE A 2.5-INCH O.D. SAMPLER 12 INCHES.

GROUNDWATER LEVEL MEASURED AT TIME OF DRILLING.

GROUNDWATER LEVEL MEASURED SIX DAYS AFTER DRILLING.

INDICATES DEPTH WHERE THE TEST HOLE CAVED DURING DRILLING.

JACKSON DEARBORN PARTNERS
POWERS APARTMENT COMPLEX
CTL|T PROJECT NO. CS19163-105

Summary Logs of Exploratory Borings

FIG. A-3