NIPOMO HIGH SCHOOL
NEW CLASSROOM BUILDINGS
DSA # 03-125793

PROJECT MANUAL

LMUSD PROJECT # 5102

LUCIA MAR UNIFIED SCHOOL DISTRICT
NIPOMO, CALIFORNIA

DSA V2 SUBMITTAL - APRIL 28, 2026

FINNEY ARCHITECTS
380 PACIFIC STREET
SAN LUIS OBISPO, CALIFORNIA 93401
(408) 963-5710

FINNEY ARCHITECTS
380 Pacific Street
San Luis Obispo, CA 93401
(408) 963-5710

SPECIFICATIONS
Finney Project No. 25042

DSA File No. 40-H9
DSA Application No. 03-125793
OPSC: 68759-136

NEW CLASSROOM BUILDINGS AT NIPOMO HIGH SCHOOL

LUCIA MAR UNIFIED SCHOOL DISTRICT
San Luis Obispo County, California

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
APP: 03-125793 INC:
REVIEWED FOR
SS ☑ FLS ☑ ACS ☑
DATE: 06/15/2026

LICENSED ARCHITECT
MARK C. FINNEY
NO. C-24673
REN. 9-30-27
STATE OF CALIFORNIA

Division of the State Architect
Department of General Services

Mark Finney, Architect
Finney Architects

REGISTERED PROFESSIONAL ENGINEER
METIN SERTTUNC
No. M31059
EXP. JUNE 30, 2027
MECHANICAL
STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER
KATHLEEN ALLWINE
C 77354
CIVIL
STATE OF CALIFORNIA

Metin Serttunc, PE
Cypress Engineering Group

Kathleen Allwine, PE
Ashley & Vance Engineers

REGISTERED PROFESSIONAL ENGINEER
JEFFREY M. THOMA
NO. 20823
ELECTRICAL
STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER
BRIAN T. DEAN
S 6087
STRUCTURAL
STATE OF CALIFORNIA
S&S
12/19/25

Jeff Thoma, PE
Thoma Engineering

Brian Dean, SE
T&S Structural Engineers

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ADDITIONAL ANALYSIS OF ENGINEERING GEOLOGY AND GEOTECHNICAL ENGINEERING IN RESPONSE TO CGS REVIEW COMMENTS – DATED FEBRUARY 9TH, 2026.

END OF SECTION

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SECTION 01 57 13 EROSION & SEDIMENT CONTROL

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes providing temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion and sedimentation control Drawings and requirements of authorities having jurisdiction. Temporary measures include the following:
   1. Silt fences and straw bales
   2. Sediment barriers and check dams
   3. Stabilized construction entrance
   4. Construction of temporary swales and sedimentation basins as required
   5. Seeding, sodding, and hydro mulching

B. Comply with all local, state, and federal regulations regarding erosion control including the applicable provisions of the National Pollution Discharge Elimination System (NPDES) regulations from the Federal Clean Water Act.

C. Should any provisions of this section be at variance with erosion control plan prepared by the civil engineer, the civil engineer's directive shall take precedence.

1.2 NOTICE OF INTENT

A. Contractor shall submit an EPA Notice of Intent (NOI) prior to construction.

B. Contractor shall prepare the report, coordinate with Owner, and file in accordance with regulations.

PART 2 PRODUCTS

2.1 SILT FENCE

A. Filter Fabric: Non-woven polypropylene, polyethylene or polyamide thermoplastic fibers with non-raveling edges. The fabric shall be non-biodegradable, inert to most soil chemicals, ultraviolet resistant, unaffected by moisture or other weather conditions, and permeable to water while retaining sediment. The filter fabric shall be supplied in rolls a minimum of 36-inches wide.
   1. Acceptable Products: Lundin "Silt Buster", Mirafi "Envirofence" or acceptable substitution.

B. Wire Fence Support: Welded wire fabric 2 x 4 - W1.0 x W1.0.

C. Fence Posts: Painted or galvanized steel Tee or Y-posts with anchor plates, not less than 5-feet in length with a minimum weight of 1.3 pounds per foot. Hangers shall be adequate to secure fence and fabric to posts. Posts and anchor plates shall conform to ASTM A-702. 2.2

2.2 STRAW BALES

A. Standard rectangular straw bales bound by baling wire (NO TWINE).

2.3 SEDIMENT TRAPS

A. Standard manufacture designed to fit the intended inlet.

2.4 STABILIZED CONSTRUCTION ENTRANCE

A. Aggregate: Graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D 448 and TEX 401- A coarse-aggregate; with 0 percent being retained by a 5-inch sieve and 100 percent being retained by a 3-inch sieve.

2.5 GRASS

A. Materials and seeding and sodding shall conform to applicable Division 32 section.

2.6 FERTILIZER

A. Use commercial grade fertilizers to insure germination and growth. Analysis by weight shall be 16-4-8 or 15-5-10 for Nitrogen, Phosphoric Acid and Potash.

2.7 WATER

A. Use clean potable water for maintaining the grass.

PART 3 EXECUTION

3.1 GENERAL A. KEEP DISTURBED AREAS TO A MINIMUM REQUIRED TO ADEQUATELY PERFORM THE WORK. AT ALL TIMES, MAINTAIN THE SITE IN SUCH A MANNER THAT MINIMIZES EROSION OF THE SITE. THE EXECUTION OF WORK UNDER THIS SECTION SHALL BE IN CONFORMANCE WITH THE NPDES RULINGS AND THE SITE STORM WATER POLLUTION PREVENTION PLAN.

3.2 SILT FENCES

A. Silt fence shall be a minimum of 24-inches high. Posts shall be embedded a minimum of 12-inches in the ground, placed a maximum of 8-feet apart and set on a slight angle toward the anticipated runoff source.
   1. When directed by the Engineer or designated representative, posts shall be set at specified intervals to support concentrated loads.

B. Securely attach filter fabric to posts and wire support fence, with the bottom 12-inches of filter fabric buried in a trench a minimum of 6-inches deep and 6-inches wide to prevent sediment from passing under the fence.
   1. When silt fence is constructed on impervious material, a 12-inch flap of fabric shall be extended upstream from the bottom of the silt fence and weighted to limit particulate loss.
   2. No horizontal joints will be allowed in the filter fabric.
   3. Vertical joints shall be overlapped a minimum of 12-inches with the ends sewn or otherwise securely tied.

C. Silt fence shall be maintained for the duration of the project, and repaired, replaced, and/or

relocated when necessary or as directed by the Engineer or designated representative. Accumulated silt shall be removed when it reaches a depth of 6-inches

3.3 EROSION CONTROL BARRIERS

A. Provide erosion control barriers at intervals along swales and ditches as shown on the Drawings or as necessary to meet the requirements of the Storm Water Pollution Prevention Plan.

B. Barriers: Silt fence or straw bales placed as indicated on the Drawings. C. Maintain barriers in good working condition and replace when damaged.\

3.4 STABILIZED CONSTRUCTION ENTRANCE

A. Remove brush, stumps, obstructions, and other objectionable material and dispose of in a manner that will not interfere with the excavation, grading, and construction of the entrance as indicated on the Drawings.
   1. Stabilized construction entrance shall not drain onto the public right-of-way and shall not allow surface water runoff to exit the construction site.
   2. When necessary, vehicle wheels shall be cleaned to remove sediment prior to entrance onto public right-of-way. When vehicle washing is required, it shall be done on an area stabilized with crushed stone, which drains into an approved sediment trap or sediment basin.
   3. Sediment shall be prevented from entering any storm drain, ditch or watercourse through use of sand bags, gravel, boards, silt fence or other methods approved by the Engineer or designated representative.

B. The entrance shall be maintained in a condition that will prevent tracking or disposition of sediment onto public right-of-way. Provide periodic top dressing with additional stone as conditions demand, as well as the repair and/or cleanout of any measures used to trap sediment. Sediment that is spilled, dropped, washed, or tracked onto public right-of-way shall be removed immediately.

3.5 TEMPORARY AND PERMANENT SWALES

A. Description:
   1. Provide temporary and permanent drainage swales as required to carry drainage away from the work area to an approved outfall point.
   2. Unless otherwise shown on the drawings, swales shall be earthen "V" shaped channels graded to a sufficient depth and slope to carry the anticipated runoff, but at least 2-feet deep with a slope of 0.1 percent.
   3. Swales not designated to remain in place at the completion of the contract shall be cleaned of any muck, debris and other unsuitable material and filled with approved fill before final grading operations begin.
   4. Swales shall have erosion control barriers as required.
   5. All permanent swales shall be sodded to a minimum width of 10-feet on either side of the centerline of the swale.

B. Maintenance:
   1. During the course of construction maintain temporary swales constructed for this contract so as to allow proper drainage from the construction area. Before Contractor leaves the site at the end of construction, place temporary swales to remain in good working condition.

2. Work with other contractors at the site in maintaining existing swales and ditches.
3. Where necessary for access to the work areas install adequately sized culverts and maintain to provide the access without disturbing the site drainage.
4. Take care not to rut and damage sodded swales. Immediately repair damaged swales.
5. Keep sodded swales mowed.

3.6 DRAINAGE DITCHES

A. Immediately hydro mulch drainage ditches upon final grading.

B. Repair erosion of the banks of the drainage ditches immediately and re-stabilize.

C. Place sediment barriers at intervals along the ditch as shown on the plans or as necessary to help trap sediment on the site. Remove sediment and other debris trapped by the barriers daily.

D. Maximum Ditch Side Slopes: 3-feet horizontal to 1-foot vertical.

E. Maintenance of the ditches during construction shall include but not be limited to mowing, re-grading, sediment removal, re-hydro mulching, bank repair, and debris removal.

F. Sediment removed from the ditches may be re-spread on the site as directed by the Owner.

3.7 FILL AND CUT SLOPES

A. Fill slopes in all cases shall be no steeper than 3:1 unless specifically stated on the plans or approved by the Owner's soils engineer.

B. When cut slopes exceed 2:1 for depths over 3-feet, proper bracing and shoring per OSHA requirements shall be used and maintained.

C. For permanent slopes, cut or fill, between 2:1 and 10:1, erosion protection shall be provided with hydro mulching, sodding, seeding, or other method as approved.

3.8 SEDIMENTATION BASINS

A. Description:
1. Provide sedimentation ponds where indicated.
2. Route drainage from cleared areas through the sedimentation basin.
3. Operate and maintain the pond during construction.

B. Maintenance:
1. Maintain the pond and the outfall and sediment-retarding structure in good working condition throughout the time the pond is to be in operation.
2. When sediment and debris fill the pond to over one third (⅓) its' designed capacity, clean out the pond.
3. Stockpile, in its' own separate area, the sediment from the clearing operation, or remove from the site, as required. Make adequate drainage provisions such that drainage from the sediment stockpile drains back into the sediment pond. When approved by the Owner, sediment removed from the pond may be spread over the site.

3.9 SEEDING

A. Seed disturbed portions of the site and stockpile areas within fourteen (14) days if the phasing of the construction operations is anticipated to leave those portions of the areas unworked for twenty-one (21) days or more.

B. Maintain seeded areas until the Owner accepts the project. Maintain by watering, fertilizing, reseeding, mowing and erosion repair as may be required. Cut grass when the average height of the grass reaches 4-inches. Clippings may be mulched back into the seeded areas.

END OF SECTION 01 57 13

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SECTION 02 41 00 DEMOLITION

PART 1 GENERAL

1.1 SUMMARY

A. Removing above-grade site improvements within limits indicated

B. Disconnecting, capping or sealing, and abandoning site utilities in place.

C. Disconnecting, capping or sealing, and removing site utilities.

D. Disposing of objectionable material.

1.2 RELATED SECTIONS

A. Section 31 11 00 – Clearing and Grubbing

B. Section 31 23 00 – Excavation and Fill

1.3 DEFINITIONS

A. ANSI: American National Standards Institute

B. OR-OSHA: Oregon Occupational Safety and Health Administration

1.4 SUBMITTALS

A. Follow Submittal procedure outlined in General Conditions

1.5 PROJECT CONDITIONS

A. Except for materials indicated to be stockpiled or to remain the Owner's property, cleared materials are the Contractor's property. Remove cleared materials from site and dispose of in lawful manner.

B. Salvable Improvements: Carefully remove items indicated to be salvaged and store where indicated on plans or where designated by the Owner. Avoid damaging materials designated for salvage.

C. Unidentified Materials: If unidentified materials are discovered, including hazardous materials that will require additional removal other than is required by the Contract Documents, immediately report the discovery to the Owner. If necessary, the Owner will arrange for any testing or analysis of the discovered materials and will provide instructions regarding the removal and disposal of the unidentified materials.

PART 2 PRODUCTS

2.1 SOIL MATERIALS

A. Backfill excavations resulting from demolition operations with on-site or import materials conforming to structural backfill defined in Section 31 23 00 Excavation and Fill.

PART 3 EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points during construction.

B. Protect existing site improvements to remain during construction.

3.2 RESTORATION

A. Restore damaged improvements to their original condition, as acceptable to the Owner.

3.3 UTILITIES

A. Locate and identify any utility infrastructure to be removed or relocated.

B. Shut off indicated utilities with utility companies or verify that utilities have been shut off.

C. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless authorized in writing by the Owner, and then only after arranging to provide temporary utility services according to requirements indicated.

D. Coordinate utility interruptions with utility company affected.

E. Do not proceed with utility interruptions without the permission of the Owner, adjacent property owners and utility companies affected. Notify Owner, adjacent property owners and utility companies affected two working days prior to utility interruptions.

F. Excavate and remove underground utilities and power poles that are indicated to be removed.

G. Securely close ends of abandoned piping with tight fitting plug or wall of concrete minimum 6-inches thick.

3.4 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.

B. Remove slabs, paving, curbs, and gutters, as indicated. Where concrete slabs, curb, gutter, and asphalt pavements are designated to be removed, remove bases and subbase to surface of underlying, undisturbed soil.

C. Unless the existing full-depth joints coincide with line of pavement demolition, neatly saw-cut to full depth the length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.

D. Remove driveways, curbs, gutters and sidewalks by saw cutting to full depth. If saw cut falls within 30-inches of a construction joint, expansions joint, score mark, or edge, remove

material to joint, mark, or edge.

3.5 BACKFILL

A. Place and compact material in excavations and depressions remaining after site clearing in conformance with Section 31 23 00 Excavation and Fill

3.6 DISPOSAL

A. Remove surplus obstructions, demolished materials, and waste materials, including trash and debris, and legally dispose of them off the Owner's property.

END OF SECTION 02 41 00

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SECTION 02 41 13 - SELECTIVE SITE DEMOLITION

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Demolition, removal, salvage and disposal of existing site features, fences, structures and materials where indicated on the drawings and as specified in this section.
B. Demolition and removal of concrete foundations, sidewalks, concrete and asphaltic paving as shown on the drawings
C. Demolition and removal of existing utilities as shown on the drawings

1.02 RELATED SECTIONS

A. Section 31 10 00 – Site Clearing

1.03 SUBMITTALS

A. Permits and Certificates.
    1. Permits and notices authorizing building demolition.
    2. Certificates of severance of utility service.
    3. Permit for transport and disposal of debris.

1.04 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division One specifications.
B. Accurately record actual locations of capped utilities and subsurface obstructions.

1.05 REGULATORY REQUIREMENTS

A. Conform to applicable State and local codes for demolition of structures, safety of adjacent structures, dust control, and disposal.
B. Obtain required permits from authorities.
C. Notify affected utility companies before starting work and comply with their requirements.
D. Do not close or obstruct roadways, sidewalks, or hydrants without written permission from Owner.
E. Conform to applicable regulatory procedures when discovering hazardous or contaminated materials and notify owner immediately.
F. Notify Owner a minimum of 48 hrs. in advance of interrupting or shutting down any utilities.

1.06 SCHEDULING

A. Schedule and submit under provisions of Division One specifications.
B. Provide detailed descriptions for demolition and removal procedures.

PART 2 – PRODUCTS

2.01 FILL MATERIALS

A. Fill Material: Use on site fill material under provisions of Division 31 section - Earthwork

PART 3 – EXECUTION

3.01 INSPECTION

A. Verify areas to be demolished are unoccupied and discontinued in use.
B. Do not commence work until conditions are acceptable to Engineer.

3.02 PREPARATION

A. Provide, erect, and maintain temporary barriers, enclosures, security fences and shoring at demolition locations in accordance with Division One and other related specifications to protect personnel.
B. Protect existing structures and utilities which are not to be demolished.
C. Provide temporary wiring and connections to maintain existing telephone, electrical, instrumentation and control systems in service during construction.
D. Protect designated trees and plants from damage.
E. Mark location of existing utilities.

3.03 GENERAL REQUIREMENTS

A. Sprinkle Work with water to minimize dust where applicable. Provide hoses and water connections for this purpose.
B. Do not use water to extent causing flooding, contaminated runoff, or icing.
C. Break concrete into sections less than 2 feet in any dimension, and remove from site
D. Repair damage to adjacent structures.
E. Remove existing exposed piping and electrical wiring and conduit to be abandoned to structural surface, cut flush, and finish to match existing surfaces.
F. Remove buried piping, wiring, and conduit to be abandoned as required for the Work. Plug the remainder flush.

3.04 DISPOSAL

A. Do not store or burn waste materials on-site.
B. Transport demolition debris to designated off-site disposal area.

3.05 SITE DEMOLITION

A. Disconnect, remove, cap and identify designated utilities within demolition area.
B. Remove asphalt paving, parkway, curb, gutter, sidewalk and other concrete as shown on plans. Remove concrete to nearest joint beyond demolition area.
C. Remove and dispose of existing site fencing as shown on the plans
D. Remove storm sewer items where shown on the drawings.
E. Backfill areas excavated caused as a result of demolition, in accordance with Section 31 20 00 - Earthwork.
F. Rough grade and compact areas affected by demolition to maintain site grades and contours as shown on drawings.
G. Remove demolished materials from site.
H. Do not burn or bury materials on site, unless otherwise directed by Owner. Leave site in clean condition.

I. Pavement striping to be removed shall be painted over with “black-out” paint, or mechanically removed, as long as it is not deeper than 1/8”, so as to not introduce visible depressions, rough areas, or markings in pavement.

3.06 ELECTRICAL DEMOLITION

A. General:
    1. Remove, relocate and extend existing installation to accommodate new construction.
B. Existing Electrical Service:
    1. Work by Contractor:
        a) Provide standby power conduit and cables for temporary use during construction. Completely remove temporary service after new permanent service is installed.

3.07 BUILDING DEMOLITION

A. Remove and dispose of all remaining portions of main building and storage buildings.
B. Refer to architectural plans for detailed building demolition information.

END OF SECTION (sfa 12-19)

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SECTION 05 51 33 – STEEL ACCESS LADDERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Fixed steel access ladders.

1.3 REFERENCES

A. OSHA 1910.27 – Fixed Ladders.

1.4 SUBMITTALS

A. Submit under provisions of the general conditions.

B. Product Data: Manufacturer's data sheets on each product.

C. Shop Drawings:

1. Detail fabrication and erection of each ladder indicated. Include plans, elevations, sections, and details of metal fabrications and their connections.

2. Provide templates for anchors and bolts specified for installation under other Sections.

3. Provide reaction loads for each hanger and bracket.

D. Qualification Data:

1. Refer to Quality Assurance provisions for submittal requirements evidencing experience, certifications and resources.

E. Selection Samples: For each finish specified, two complete sets of color chips representing manufacturer's full range of available colors.

F. Verification Samples: For each finish specified, two samples, minimum size 6 inches (150 mm) square, represent actual product color.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in producing aluminum metal ladders similar to those indicated for this Project.

1. Record of successful in-service performance.

2. Sufficient production capacity to produce required units.

3. Professional engineering competent in design and structural analysis to fabricate ladders in compliance with industry standards and local codes.

B. Installer Qualifications: Competent and experienced firm capable of selecting fasteners and installing ladders to attain designed operational and structural performance.

C. Product Qualification: Product design shall comply with OSHA 1910.27 minimum standards for ladders.

D. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.

1. Install ladder in area designated by Architect.

2. Do not proceed with remaining work until workmanship and installation are approved by Architect.

3. Rework mock-up as required to produce acceptable work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions by field measurement before fabrication.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, indicate established dimensions on shop drawing submittal and proceed with fabrication.

1.8 WARRANTY

A. Manufacturer has responsibility for an extended Corrective Period for work of this Section for a period of 5 years from date of Substantial Completion against all the conditions indicated below, and when notified in writing from Owner, manufacturer shall promptly and without inconvenience and cost to Owner correct said deficiencies.

1. Defects in materials and workmanship.

2. Deterioration of material and surface performance below minimum OSHA standards as certified by independent third party testing laboratory. Ordinary wear and tear, unusual abuse or neglect excepted.

3. Within the warranty period, the manufacturer shall, at its option, repair, replace, or refund the purchase price of defective ladder.

B. Manufacturer shall be notified immediately of defective products, and be given a reasonable opportunity to inspect the goods prior to return. Manufacturer will not assume responsibility, or compensation, for unauthorized repairs or labor. Manufacturer makes no other warranty, expressed or implied, to the merchantability, fitness for a particular purpose, design, sale, installation, or use, of the ladder; and shall not be liable for incidental or consequential damages, losses of or expenses, resulting from the use of ladder products.

1.9 EXTRA MATERIALS

A. Furnish touchup kit for each type and color of paint finish provided.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Cotterman – Bakersfield Plan. 6901 Distrit Blvd, Bakersfield, CA 93313. Toll Free Tel: (888) 653-3333. Tel: (661) 617-6033. Email: info@cotterman.com. Web: http://www.cotterman.com.

B. Substitutions: Not permitted.

C. Requests for substitutions will be considered in accordance with provisions of the general conditions.

2.2 APPLICATIONS/SCOPE

A. Fixed and Cage Ladder Design:

1. Safety cages are required on ladders over 24 feet (7315 mm)
2. Safety cages are required on all ladders in high or hazardous areas.
3. Landing platforms are required at 50 feet (15,240 mm) above the bottom of the ladder.
4. Rail and harness fall arrest system as alternate to safety cage and landing platforms shall be a permissible manufacturer’s option.
    a. Fixed Ladder Bottom Bracket:
    b. Bottom floor supported bracket.
    c. Bottom wall supported bracket.
    d. Bracket as drawn.

B. Fixed Access Ladder:

1. Series F Fixed Ladders
    a. Exact model and number of rungs to be determined based on as-built conditions.
    b. Outside width: 20 inches.
    c. Fully wall mounted, above floor.

2.3 FINISHES

A. Powder coated finish.

1. Color: to be selected by architect from manufacturer’s available standard colors.

2.4 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. First paragraph below specifies minimum yield point of 30 ksi (205 MPa); revise if higher strength is required.

C. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

2.5 FABRICATION

A. Ladder shall be one-piece welded assembly.

B. Rungs: 3/4” steel round deformed bars on 12” centers, welded all around to side rails.

1. Rungs shall withstand a 1,500 pound (454 kg) load without deformation or failure.

C. Channel Side Rails: 1/4“ x 2” x 2” steel angle, continuous.

D. Stand off wall mounting brackets shall be 60” o.c., 7” from wall, fabricated from 1/4” steel bar. Fully welded to side rails and with holes for bolting to wall.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Coordinate anchorages. Furnish setting drawings, templates, and anchorage structural loads for fastener resistance.

B. Do not begin installation until supporting structure is complete and ladder installation will not interfere with supporting structure work.

C. If supporting structure is the responsibility of another installer, notify Architect of unsatisfactory supporting work before proceeding.

3.2 INSTALLATION

A. Install in accordance with project drawings, manufacturer's instructions, and in proper relationship with adjacent construction.

3.3 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 05 52 00 – METAL RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Steel pipe and tube railings.

1.3 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Provide exterior railings that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

C. Structural Performance: Provide railing and handrail assemblies which, when installed, comply with the following minimum requirements for structural performance, unless otherwise indicated.

1. Handrail and Toprails: Capable of withstanding the following loads applied as indicated.

a. Uniform load of 50 lbs. per lineal ft. applied simultaneously in both vertical and horizontal directions.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Manufacturer's product lines of mechanically connected railings.
2. Grout, anchoring cement, and paint products.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Samples for Initial Selection: For products involving selection of color, texture, or design**,** including mechanical finishes on stainless steel.

D. Samples for Verification: For each type of exposed finish required.

1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
2. Fittings and brackets.
3. Assembled Sample of railing system, made from full-size components, including top rail, post, handrail, and infill. Sample need not be full height.

a. Show method of finishing, connecting members at intersections.

E. Mill Certificates: Signed by manufacturers of stainless-steel products certifying that products furnished comply with requirements.

F. Welding certificates.

G. Qualification Data: For professional engineer.

H. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

1.5 QUALITY ASSURANCE

A. Comply with State Chapter 17A, Title 24, Vol.2, 2016 C.B.C.

B. Source Limitations: Obtain each type of railing through one source from a single manufacturer.

C. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Provide allowance for trimming and fitting at site.

1.7 COORDINATION AND SCHEDULING

A. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

B. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Steel Pipe and Tube Railings:

a. Sharpe Products.
b. Wagner, R & B, Inc.; a division of the Wagner Companies.

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.

2.3 STEEL AND IRON

A. Tubing: ASTM A 500 (cold formed) or ASTM A 513, Type 5 (mandrel drawn).

B. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

C. Plates, Shapes, and Bars: ASTM A 36/A 36M.

D. Castings: Either gray or malleable iron, unless otherwise indicated.

1. Gray Iron: ASTM A 48/A 48M, Class 30, unless another class is indicated or required by structural loads.
2. Malleable Iron: ASTM A 47/A 47M.

E. Expanded Metal: ASTM F 1267, Type [**I (expanded)**] [**II (expanded and flattened)**], Class 1 (uncoated).

1. Style Designation: [**3/4 number 13**] [**1-1/2 number 10**].

2.4 FASTENERS

A. General: Provide the following:

1. Steel Railings: Plated steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

C. Fasteners for Interconnecting Railing Components:

1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.
2. Provide tamper-resistant or square or hex socket flat-head machine screws for exposed fasteners, unless otherwise indicated.

D. Anchors: Provide cast-in-place or torque-controlled expansion anchors, fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

2.5 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

1. For aluminum railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

B. Shop Primers: Provide primers that comply with Division 9 Section "High-Performance Coatings."

C. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.

1. Use primer with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Shop Primer for Galvanized Steel: Zinc-dust, zinc-oxide primer formulated for priming zinc-coated steel and for compatibility with finish paint systems indicated, and complying with SSPC standards.

E. Galvanizing Repair Paint: High-zinc-dust-content paint for re-galvanizing welds in steel, complying with SSPC standards.

F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

G. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.

1. Water-Resistant Product: At exterior locations and where indicated provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.6 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings with welded connections, unless otherwise indicated.

H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.
4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

I. Welded Connections for Aluminum Pipe: Fabricate railings to interconnect members with concealed internal welds that eliminate surface grinding, using manufacturer's standard system of sleeve and socket fittings.

J. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

K. Form changes in direction as follows:

1. By flush bends or by inserting prefabricated flush-elbow fittings.

L. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

M. Close exposed ends of railing members with prefabricated end fittings.

N. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

O. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work, unless otherwise indicated.

1. At brackets and fittings fastened to plaster or gypsum board partitions, provide fillers made from crush-resistant material, or other means to transfer wall loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

P. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

Q. For railing posts set in concrete, provide steel sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with steel plate forming bottom closure.

R. For removable railing posts, fabricate slip-fit sockets from steel tube or pipe whose ID is sized for a close fit with posts; limit movement of post without lateral load, measured at top, to not more than one-fortieth of post height. Provide socket covers designed and fabricated to resist being dislodged.

1. Provide chain with eye, snap hook, and staple across gaps formed by removable railing sections at locations indicated. Fabricate from same metal as railings.

2.7 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other

components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.8 STEEL AND IRON FINISHES

A. Galvanized Railings:

1. Hot-dip galvanize indicated steel and iron railings, including hardware, after all fabrication (no field welding permitted).
2. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.
3. Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.

B. Fill vent and drain holes that will be exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

C. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

D. For nongalvanized steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors to be embedded in exterior concrete or masonry.

E. Preparation for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic-phosphate process.

F. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed railings:

1. Exterior Railings (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Interior Railings (SSPC Zone 1A): SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."

G. Apply shop primer to prepared surfaces of railings, unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

1. Do not apply primer to galvanized surfaces.
2. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

C. Corrosion Protection: Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

D. Adjust railings before anchoring to ensure matching alignment at abutting joints.

E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

A. Nonwelded Connections: Use mechanical joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.

B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in Part 2 "Fabrication" Article whether welding is performed in the shop or in the field.

C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to 1 side, and locate joint within 6 inches of post.

3.4 ANCHORING POSTS

A. Use steel pipe sleeves preset and anchored into concrete for installing posts. Alternatively, holes may be cored into existing concrete, avoiding existing reinforcement. After posts have been inserted into holes, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Leave anchorage joint exposed; wipe off surplus anchoring material; and leave 1/8-inch buildup, sloped away from post.

C. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:

1. For aluminum pipe railings, attach posts using fittings designed and engineered for this purpose.
2. For stainless-steel pipe railings, weld flanges to post and bolt to supporting surfaces.
3. For steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.

D. Install removable railing sections, where indicated, in slip-fit metal sockets cast in concrete.

3.5 ANCHORING RAILING ENDS

A. Anchor railing ends to concrete and masonry with round flanges connected to railing ends and anchored to wall construction with anchors and bolts.

B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends or connected to railing ends using nonwelded connections.

3.6 ATTACHING HANDRAILS TO WALLS

A. Attach handrails to wall with wall brackets. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface.

1. Use type of bracket with predrilled hole for exposed bolt anchorage.

B. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

C. Secure wall brackets to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger.
2. For wood stud partitions, use hanger or lag bolts set into wood backing between studs. Coordinate with carpentry work to locate backing members.

3. For steel-framed gypsum board and/or plaster partitions, fasten brackets directly to concealed steel reinforcements using self-tapping screws of size and type required to support structural loads.

3.7 ADJUSTING AND CLEANING

A. Clean aluminum and stainless steel by washing thoroughly with clean water and soap and rinsing with clean water.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 painting Sections.

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.8 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 05 52 00

SECTION 06 20 00 - FINISH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Exterior standing and running trim.
2. Exterior plywood soffits.
3. Interior standing and running trim.
4. Interior plywood and board paneling.

B. Related Sections include the following:

1. Division 6 Section "Rough Carpentry" for furring, blocking, and other carpentry work not exposed to view and for framing exposed to view.
2. Division 8 Section “Door Hardware” for Builders Hardware.
3. Division 8 Section “ Wood Doors”.
4. Division 9 Section "Painting" for priming and back-priming of finish carpentry.

1.3 DEFINITIONS

A. Inspection agencies, and the abbreviations used to reference them, include the following:

1. ANSI - American National Standards Institute
2. ASTM - American Society for Testing and Materials
3. AWI – American Woodwork Institute
4. NHLA - National Hardwood Lumber Association.
5. RIS - Redwood Inspection Service.
6. WCLIB - West Coast Lumber Inspection Bureau.
7. WI - Woodwork Institute “Manual of Millwork”.
8. WWPA - Western Wood Products Association.

1.4 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Include construction details, material descriptions, dimensions of individual components and profiles, textures, and colors.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.

Indicate type of preservative used, net amount of preservative retained, and chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.

2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.
3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

B. Samples for Verification:

1. For each species and cut of lumber and panel products with non-factory-applied finish, with 1/2 of exposed surface finished, 50 sq. in. for lumber and 8 by 10 inches for panels.
2. For each finish system and color of lumber and panel products with factory-applied finish, 50 sq. in. for lumber and 8 by 10 inches for panels.

C. Research/Evaluation Reports: Showing that fire-retardant-treated wood complies with building code in effect for Project.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer.

B. Fire-Test-Response Characteristics: Where fire-retardant materials are indicated, provide materials with specified fire-test-response characteristics as determined by Underwriters Laboratory, Inc., or other testing and inspection agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency on surfaces of materials that will be concealed from view after installation.

C. Treated Wood Materials: Submit chemical treatment manufacturer’s instructions for handling, storage, installation and finishing treated materials. For each type specified, include certification by treating plant stating chemical solutions used, submersion period and conformance with specified standards.

D. Factory-mark each piece of lumber and plywood with type, grade, mill and grading agency identification; except omit marking from surfaces to receive transparent finish, and submit mill certificate that material has been inspected and graded in accordance with requirements if it cannot be marked on a concealed surface.

E. Pre-installation Meeting: Meet at project site prior to delivery of finish carpentry materials and review coordination and environmental controls required for proper installation and ambient conditioning in areas to receive work. Include in the meeting the Contractor, Architect and other Owner Representatives (if any), Installers of finish carpentry, wet work including plastering, other finishes, painting, mechanical work and electrical work, and firms and persons responsible for continued operation (whether temporary or permanent) of HVAC system as required to maintain temperature and humidity conditions. Proceed with finish carpentry on interior only when everyone concerned agrees that required ambient conditions can be properly maintained.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect materials against weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels. Provide for air circulation within and around stacks and under temporary coverings.

B. Deliver interior finish carpentry only when environmental conditions meet requirements specified for installation areas. If finish carpentry must be stored in other than installation areas, store only where environmental conditions meet requirements specified for installation areas.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install interior finish carpentry until building is enclosed and weatherproof, wet work in space is completed and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit work to be performed according to manufacturer's written instructions and warranty requirements and at least one coat of specified finish to be applied without exposure to rain, snow, or dampness.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Plywood Siding:

a. Champion International Corp.
b. Georgia-Pacific Corp.
c. Louisiana-Pacific Corporation.
d. Pacific Wood Laminates, Inc.
e. Simpson Timber Co.

2. Hardwood Veneer Plywood Paneling:

a. Champion International Corp.
b. Georgia-Pacific Corp.
c. Weyerhaeuser Company.

2.2 MATERIALS, GENERAL

A. Lumber: DOC PS 20 and applicable grading rules of inspection agencies certified by the American Lumber Standards' Committee Board of Review.

1. Factory mark each piece of lumber with grade stamp of inspection agency indicating grade, species, moisture content at time of surfacing, and mill.
2. For exposed lumber, mark grade stamp on end or back of each piece**,** or omit grade stamp and provide certificates of grade compliance issued by inspection agency.

B. Softwood Plywood: DOC PS 1/ANSI A199.1.

C. Hardwood Plywood: HPVA HP-1.

D. Hardboard: AHA A135.4

E. Medium-Density Fiberboard: ANSI A208.2, Grade MD-Exterior Glue.

F. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.

2.3 WOOD-PRESERVATIVE-TREATED MATERIALS (Trt-Wd)

A. Water-Repellent Preservative Treatment by Non-pressure Process: AWPA N1.

1. Preservative Chemicals: 3-iodo-2-propynyl butyl carbamate (IPBC)**,** combined with an insecticide containing chloropyrifos.
2. Use chemical formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants in solution to distinguish treated material from untreated material.
3. Application: Exterior trim and wood siding.

2.4 FIRE-RETARDANT-TREATED MATERIALS (F Trt-Wd)

A. General: Where fire-retardant-treated lumber and plywood are indicated, use materials impregnated with fire-retardant chemicals by a pressure process or other means acceptable to authorities having jurisdiction to produce products with the following fire-test-response characteristics:

1. Flame-spread index of not greater than 25 when tested according to ASTM E 84.

B. For exposed items indicated to receive transparent finish, do not use chemical formulations that contain colorants or that bleed through or otherwise adversely affect finishes.

C. Exterior-Type Fire-Retardant Treatment: Organic-resin-based formulation that shows no increase in flame spread of treated material after being weathered according to ASTM D 2898, Method A.

D. Interior, Low-Hygroscopic-Type, Fire-Retardant Treatment: Formulation that results in treated material with an apparent moisture content of not more than 28 percent when tested according to ASTM D 3201 at 92 percent relative humidity.

E. Mill lumber before treatment and implement special procedures during treatment and drying processes that prevent lumber and plywood from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.

F. Kiln-dry material after treatment to levels required for untreated material. Do not use material that does not comply with requirements for untreated material or is warped or discolored.

2.5 EXTERIOR STANDING AND RUNNING TRIM

A. Lumber Trim for Semitransparent-Stained or Clear-Finished Applications: Kiln-dried lumber with saw-textured face and of the following species and grade:

1. Clear All Heart redwood where indicated; RIS.
2. Grade B & B Btr. - 1 & 2 Western red cedar where indicated; WCLIB, or WWPA.

B. Lumber Trim for Painted Applications: Kiln-dried, finger-jointed or solid lumber with surfaced smooth face and of the following species and grade:

1. Clear redwood; RIS.
2. Grade B & B Btr. - 1 & 2 Western red cedar; WCLIB, or WWPA.

C. Moldings: Made to patterns included in WMMPA WM 7. Wood moldings made from kiln-dried stock and graded under WMMPA WM 4.

1. Moldings for Semitransparent Finish (Stained Finish): N-grade redwood, western red cedar, or sugar pine as indicated.
2. Moldings for Opaque Finish (Painted): P-grade redwood, western red cedar, or sugar pine.
3. Patterns as indicated.

D. MDO Trim: Exterior Grade B-B, MDO plywood.

2.6 INTERIOR STANDING AND RUNNING TRIM

A. Softwood Lumber Trim for Transparent Finish (Stain or Clear Finish): Kiln-dried finished lumber (S4S) of the following species and grades:

1. Grade - Clear All Heart Redwood where indicated; Para 103 RIS.
2. Clear Maple where indicated; WCLIB, or WWPA.
3. Manufactured to sizes and patterns (profiles) shown.

B. Lumber Trim for Opaque Finish (Painted): Finished lumber (S4S), either finger-jointed or solid lumber, of one of the following species and grades:

1. Grade D Select (Quality) Idaho white, lodgepole, ponderosa, or sugar pine; WWPA.
2. Grade D Select white woods; WWPA.
3. Grade A Finish alder, aspen, basswood, cottonwood, gum, magnolia, soft maple, sycamore, tupelo, or yellow poplar; NHLA.

C. Moldings: Made to patterns included in WMMPA WM 7. Wood moldings made from kiln-dried stock and graded under WMMPA WM 4.

1. Moldings for Transparent Finish (Stain or Clear Finish): N-grade Idaho white, lodgepole, ponderosa, or sugar pine, western red cedar, douglas fir, or yellow poplar].

a. Provide material selected for compatible grain and color.

2. Moldings for Opaque Finish (Painted): P-grade Idaho white, lodgepole, ponderosa, or sugar pine, or yellow poplar.
3. Manufactured to sizes and patterns (profiles) shown.

2.7 PANELING

A. Hardwood Veneer Plywood Paneling: Manufacturer's stock hardwood plywood panels complying with applicable requirements in HPVA HP-1.

1. Face Veneer Species: Plain-sliced red oak.
2. Backing Veneer Species: Any hardwood compatible with face species.
3. Construction: Veneer core.
4. Thickness: 7/16 inch.
5. Panel Size: As indicated on the drawings.
6. Glue Bond: Type II (interior).
7. Face Pattern: As selected by Architect form manufacturer's standard patterns.
8. Finish: As selected by Architect from manufacturer's full range.

2.8 MISCELLANEOUS MATERIALS

A. Fasteners for Exterior Finish Carpentry: Provide nails or screws of the following materials, in sufficient length to penetrate minimum of 1-1/2 inches into substrate, unless otherwise recommended by manufacturer:

1. Hot-dip galvanized steel.
2. Pre-finished aluminum in color to match stain, where face fastening of material to receive stain is unavoidable.

B. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.

1. Where finish carpentry materials are exposed in areas of high humidity, provide fasteners and anchorages with hot-dip galvanized coating complying with ASTM A 153/A 153M.

C. Paneling Adhesives: Comply with paneling manufacturer's written recommendations for adhesives.

D. Flashing: Comply with requirements in Division 7 Section "Sheet Metal Flashing and Trim" for flashing materials installed in finish carpentry.

1. Horizontal Joint Flashing for Siding: Preformed galvanized steel Z-shaped flashing.

E. Sealants: Comply with requirements in Division 7 Section "Joint Sealants" for materials required for sealing siding work.

2.9 FABRICATION

A. Wood Moisture Content: Comply with requirements of specified inspection agencies and with manufacturer's written recommendations for moisture content of finish carpentry at relative humidity conditions existing during time of fabrication and in installation areas.

B. Back out or kerf backs of the following members, except members with ends exposed in finished work:

1. Exterior standing and running trim wider than 5 inches.
2. Interior standing and running trim, except shoe and crown molds.
3. Wood board paneling.

C. Ease edges of lumber less than 1 inch in nominal thickness to 1/16-inch radius and edges of lumber 1 inch or more in nominal thickness to 1/8-inch radius.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Pre-installation Meeting: Meet at project site prior to delivery of finish carpentry materials and review coordination and environmental controls required for proper installation and ambient conditioning in areas to receive work. Include in meeting the Contractor, Architect and other Owner Representatives (if any), Installers of finish carpentry, wet work including plastering, other finishes, painting, mechanical work and electrical work, and firms and persons responsible for continued operation (whether temporary or permanent) of HVAC system as required to maintain temperature and humidity conditions. Proceed with finish carpentry on interior only when everyone concerned agrees that required ambient conditions can be properly maintained.

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

B. Before installing finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours**,** unless longer conditioning is recommended by manufacturer.

C. Painted Lumber: Prime lumber for exterior applications to be painted, including both faces and edges. Cut to required lengths and prime ends. Comply with requirements in Division 9 Section "Painting."

3.3 INSTALLATION, GENERAL

A. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, or too small to fabricate with proper jointing arrangements.

1. Do not use manufactured units with defective surfaces, sizes, or patterns.

B. Install finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.

1. Scribe and cut finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
2. Countersink fasteners, fill surface flush, and sand where face fastening is unavoidable.
3. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
4. Coordinate finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate finish carpentry.

3.4 STANDING AND RUNNING TRIM INSTALLATION

A. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches long, except where necessary. Stagger joints in adjacent and related standing and running trim. Cope at returns and miter at corners to produce tight-fitting joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints. Plane backs of casings to provide uniform thickness across joints, where necessary for alignment.

1. Match color and grain pattern across joints.
2. Install trim after gypsum board joint finishing operations are completed.
3. Drill pilot holes in hardwood before fastening to prevent splitting. Fasten to prevent movement or warping. Countersink fastener heads on exposed carpentry work and fill holes.
4. Fit exterior joints to exclude water. Apply flat grain lumber with bark side exposed to weather.

3.5 PANELING INSTALLATION

A. Plywood Paneling: Select and arrange panels on each wall to minimize noticeable variations in grain character and color between adjacent panels. Leave 1/4-inch gap to be covered with trim at top, bottom, and openings. Install with uniform tight joints between panels.

1. Attach panels to supports with manufacturer's recommended panel adhesive and fasteners. Space fasteners as recommended by panel manufacturer.
2. Conceal fasteners to greatest practical extent.
3. Arrange panels with grooves and joints over supports. Fasten to supports with nails of type and at spacing recommended by panel manufacturer. Use fasteners with prefinished heads matching groove color.

3.6 ADJUSTING

A. Replace finish carpentry that is damaged or does not comply with requirements. Finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing. Adjust joinery for uniform appearance.

3.7 CLEANING

A. Clean finish carpentry on exposed and semi-exposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

3.8 PROTECTION

A. Installer of finish carpentry work shall advise Contractor of final protection and maintained conditions necessary to ensure that the work will be without damage or deterioration at time of acceptance.

END OF SECTION 06 20 00 (3/06)

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SECTION 07 13 26 - SELF-ADHERING SHEET WATERPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Special Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Rubberized-asphalt sheet waterproofing.
2. Asphalt polyethylene sheet waterproofing at openings.

B. Related Sections include the following:

1. Division 7 Section "Joint Sealants" for joint-sealant materials and installation.

1.3 PERFORMANCE REQUIREMENTS

A. Provide waterproofing that prevents the passage of water.

1.4 SUBMITTALS

A. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of waterproofing.

B. Shop Drawings: Show locations and extent of waterproofing. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

C. Samples: For the following products:

1. 12-by-12-inch square of waterproofing and flashing sheet.
2. 4-by-4-inch square of drainage panel.

D. Installer Certificates: Signed by manufacturers certifying that installers comply with requirements.

E. Product Test Reports: From a qualified independent testing agency indicating and interpreting test results of waterproofing for compliance with requirements, based on comprehensive testing of current waterproofing formulations.

F. Sample Warranty: Copy of special waterproofing manufacturer's and Installer's warranty stating obligations, remedies, limitations, and exclusions before starting waterproofing. (See Special Project Warrantee requirements below)

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer, with a minimum of 3 years of experience installing like projects, who is authorized, approved, or licensed by waterproofing manufacturer to install manufacturer's products.

B. Source Limitations: Obtain waterproofing materials**,** protection course, and molded-sheet drainage panels through one source from a single manufacturer.

C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review requirements for waterproofing, including surface preparation specified under other Sections, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver liquid materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by waterproofing manufacturer.

C. Remove and replace liquid materials that cannot be applied within their stated shelf life.

D. Store rolls according to manufacturer's written instructions.

E. Protect stored materials from direct sunlight.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate and until opening and penetration work has been completed.

1. Do not apply waterproofing in snow, rain, fog, or mist.

B. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.8 WARRANTY

A. Special Project Warrantee: Provide written warranty, signed by Contractor, Installer and Manufacturer of primary waterproofing materials, agreeing to replace/repair defective

materials and workmanship, including significant leakage of water, abnormal aging or deterioration of materials, and other failures of sheet waterproofing to perform as required within warranty period. During warranty period, repairs and replacements required because of acts of God and other events beyond Contractor's/ Installer's/Manufacturer's control (and which exceed performance requirements) shall be completed by Contractor/Installer and paid for by Owner at prevailing rates.

1. Warranty period is 10 years after date of substantial completion. *(Project Close-out Item)*

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the following products:

1. Rubberized-Asphalt Sheet Waterproofing:

   a. Carlisle Corporation, Carlisle Coatings & Waterproofing Div.; CCW Mira DRI 860.
   b. W. R. Grace & Co.; Bituthene.
   c. W. R. Meadows, Inc.; Mel-Rol.
   d. Pecora Corporation; Duramem 700-SM.
   e. Tamko Roofing Products, Inc.; TW-60.
   f. Or preapproved equal.

2. Asphalt Polyethylene Sheet Waterproofing, at openings:

   a. W. R. Grace & Co.; Vycor V40.
   b. Or preapproved equal.

2.2 RUBBERIZED-ASPHALT SHEET WATERPROOFING

A. Rubberized-Asphalt Sheet: 60-mil- thick, self-adhering sheet consisting of 56 mils of rubberized asphalt laminated to a 4-mil- thick, polyethylene film with release liner on adhesive side and formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction.

1. Physical Properties: As follows, measured per standard test methods referenced:

   a. Tensile Strength: 250 psi minimum; ASTM D 412, Die C, modified.
   b. Ultimate Elongation: 300 percent minimum; ASTM D 412, Die C, modified.
   c. Low-Temperature Flexibility: Pass at minus 20 deg F; ASTM D 1970.
   d. Crack Cycling: Unaffected after 100 cycles of 1/8-inch movement; ASTM C 836.
   e. Puncture Resistance: 40 lbf minimum; ASTM E 154.
   f. Hydrostatic-Head Resistance: 150 feet minimum; ASTM D 5385.
   g. Water Absorption: 0.15 percent weight-gain maximum after 48-hour immersion at 70 deg F; ASTM D 570.
   h. Vapor Permeance: 0.05 perms; ASTM E 96, Water Method.

B. Rubberized-Asphalt Sheet, at openings: 40-mil- thick, self-adhering sheet consisting of rubberized-asphalt membrane with cross-laminated polyethylene, with the following physical properties measured per standard test methods referenced:

1. Pliability: No cracks when bent 180 degrees over a 1-inch mandrel at minus 25 deg F; ASTM D 146.
2. Hydrostatic-Head Resistance: 150 feet minimum.
3. Vapor Permeance: 0.05 perms; ASTM E 96, Water Method.

2.3 AUXILIARY MATERIALS

A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.

1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.

B. Primer: Liquid waterborne or solvent-borne primer recommended for substrate by manufacturer of sheet waterproofing material.

C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by manufacturer of sheet waterproofing material.

D. Sheet Strips: Self-adhering, rubberized-asphalt composite sheet strips of same material and thickness as sheet waterproofing.

E. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, trowel grade or low viscosity.

F. Substrate Patching Membrane: Low-viscosity, two-component, asphalt-modified coating.

G. Mastic, Adhesives, and Tape: Liquid mastic and adhesives, and adhesive tapes recommended by waterproofing manufacturer.

1. Detail Tape: Two-sided, pressure-sensitive, self-adhering reinforced tape, 4-1/2 inches wide, with a tack-free protective adhesive coating on one side and release film on self-adhering side.
2. Detail Strips: 62.5-mil- thick, felt-reinforced self-adhesive strip, 9 inches wide, with release film on adhesive side.

H. Metal Termination Bars: Aluminum bars, approximately 1 by 1/8 inch thick, predrilled at 9-inch centers.

I. Protection Course: Where shown, provide type recommended by waterproofing sheet-material manufacturer, unless another type is indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.

1. Verify that concrete has cured and aged for minimum time period recommended by waterproofing manufacturer.
2. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
3. Verify that compacted subgrade is dry, smooth, and sound; ready to receive HDPE sheet.
4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.

B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.

E. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.

1. Install sheet strips and center over treated construction and contraction joints and cracks exceeding a width of 1/16 inch or 1/8 inch for heavy-duty deck paving waterproofing.

F. Bridge and cover isolation joints, expansion joints and discontinuous deck-to-wall and deck-to-deck joints with overlapping sheet strips.

1. Invert and loosely lay first sheet strip over center of joint. Firmly adhere second sheet strip to first and overlap to substrate.

G. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.

1. Install membrane strips centered over vertical inside corners. Install 3/4-inch fillets of liquid membrane on horizontal inside corners and as follows:

a. At footing-to-wall intersections, extend liquid membrane each direction from corner or install membrane strip centered over corner.
b. At plaza deck-to-wall intersections, extend liquid membrane or sheet strips onto deck waterproofing and to finished height of sheet flashing.

H. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to ASTM D 6135.

3.3 RUBBERIZED-ASPHALT SHEET APPLICATION

A. Install self-adhering sheets according to waterproofing manufacturer's written instructions and recommendations in ASTM D 6135.

B. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.

C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch- minimum lap widths and end laps. Overlap and seal seams and stagger end laps to ensure watertight installation.

1. When ambient and substrate temperatures range between 25 and 40 deg F, install self-adhering, rubberized-asphalt sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F.

D. Horizontal Application: Apply sheets from low point to high point of decks to ensure that side laps shed water.

E. Apply continuous sheets over sheet strips bridging substrate cracks, construction, and contraction joints.

F. Seal exposed edges of sheets at terminations not concealed by metal counterflashings or ending in reglets with mastic or sealant.

G. Install sheet waterproofing and auxiliary materials to tie into adjacent waterproofing where applicable.

H. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheets extending 6 inches beyond repaired areas in all directions.

I. Correct deficiencies in or remove sheet waterproofing that does not comply with requirements, repair substrates, reapply waterproofing, and repair sheet flashings.

3.4 PROTECTION COURSE INSTALLATION

A. Install protection course with butted joints over waterproofing membrane before starting subsequent construction operations.

1. Molded-sheet drainage panels may be used in place of a separate protection course to vertical applications when approved by waterproofing manufacturer.

3.5 FIELD QUALITY CONTROL

A. Flood Testing: Flood test each deck area for leaks, according to recommendations in ASTM D 5957, after completing waterproofing but before overlying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.

1. Flood to an average depth of 2-1/2 inches with a minimum depth of 1 inch and not exceeding a depth of 4 inches. Maintain 2 inches of clearance from top of sheet flashings.
2. Flood each area for 48 hours.
3. After flood testing, repair leaks, repeat flood tests, and make further repairs until waterproofing installation is watertight.

B. Owner will engage an independent testing agency to observe flood testing and examine underside of decks and terminations for evidence of leaks during flood testing.

3.6 PROTECTION AND CLEANING

A. Do not permit foot or vehicular traffic on unprotected membrane.

B. Protect waterproofing from damage and wear during remainder of construction period.

C. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 13 26 (3/06)

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SECTION 07 21 00 - THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Blanket type thermal building insulation.
   2. Blanket type sound attenuation insulation.

B. Related Sections include the following:
   1. Division 6 Section "Rough Carpentry".
   2. Division 9 Sections "Gypsum Board Assemblies" and "Gypsum Board Shaft-Wall Assemblies" for installation in metal-framed assemblies of insulation specified by reference to this Section.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for insulation products.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of building insulation through one source.

B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

   1. Surface-Burning Characteristics: ASTM E 84.
   2. Fire-Resistance Ratings: ASTM E 119.
   3. Combustion Characteristics: ASTM E 136.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Glass-Fiber Insulation:

a. CertainTeed Corporation
b. Johns Manville Corp.
c. Owens Corning

2. Mineral Wool Insulation:

a. Rockwool
b. Owens Corning
c. Johns Manville Corp.

3. Rigid Insulation

a. Owens Corning
b. Johns Manville Corp.
c. CertainTeed

4. Closed-cell Spray Foam Insulation
a. Walltite by BASF
b. Johns Manville
c. SealTite Pro by Carlisle Spray Foam Insulation

2.2 INSULATING MATERIALS

A. General: Provide insulating materials that comply with requirements and with referenced standards.

1. Preformed Units: Sizes to fit applications indicated; selected from manufacturer's standard thicknesses, widths, and lengths.

B. R-Values:
a. 2x8 Exterior Walls: R-25 insulation.
b. 2x6 Exterior Walls: R-19 insulation.
c. 2x6 Interior Walls: R-19 insulation.
d. Roof framing: R-38 insulation, without Class 1 vapor retarder on the ceiling side of the unvented enclosed roof framing assembly.

2.3 GLASS-FIBER BLANKET INSULATION

A. Mineral-Fiber Blanket Insulation: Unfaced: ASTM C665, Type I; passing ASTM E136 for combustion characteristics.
   1. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
   2. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
   3. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

B. Mineral-Fiber Blanket Insulation: Polypropylene-Scrim-Kraft Faced: ASTM C665, Type II (nonreflective faced), Class A (faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier).
   1. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

C. Mineral-Fiber Blanket Insulation: Kraft Faced: ASTM C665, Type II (nonreflective faced), Class C (faced surface not rated for flame propagation); Category 1 (membrane is a vapor barrier).
   1. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

D. Line Wire: Standard gauge as required to support blanket/batt insulation.

2.4 MINERAL-WOOL BLANKET INSULATION

A. Mineral-Wool Blanket Insulation

   1. Mineral-Wool Blanket Insulation, Unfaced: ASTM C665, Type I (blankets without membrane facing); consisting of fibers; passing ASTM E136 for combustion characteristics.
   2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
   3. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
   4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

2.5 POLYISOCYANURATE FOAM-PLASTIC BOARD INSULATION

A. Polyisocyanurate Board Insulation, Foil Faced: ASTM C1289, foil faced, Type I, Class 1

   1. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
   2. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

B. Polyisocyanurate Board Insulation, Glass-Fiber-Mat Faced: ASTM C1289, glass-fiber-mat faced, Type II, Class 2.

1. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
2. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

2.6 INSULATION FASTENERS

A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.
   1. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
   2. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation.

B. Adhesively Attached, Angle-Shaped, Spindle-Type Anchors: Angle welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.
   1. Angle: Formed from 0.030-inch- thick, perforated, galvanized carbon-steel sheet with each leg 2 inches square.
   2. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation.

C. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick galvanized-steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches square or in diameter.
   1. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:
      a. Ceiling plenums.
      b. Attic spaces.

D. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates without damaging insulation, fasteners, or substrates.

2.7 CLOSED-CELL SPRAY POLYURETHANE FOAM INSULATION

Closed-Cell Spray Polyurethane Foam: ASTM C1029, Type II, minimum density of 1.5 lb/cu. ft. and minimum aged R-value at 1-inch thickness of 6.2 deg F x h x sq. ft./Btu at 75 deg F.

1. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

   a. Flame-Spread Index: 25 or less.
   b. Smoke-Developed Index: 450 or less.

2. Fire Propagation Characteristics: Passes NFPA 285 and NFPA 276 testing as part of an approved assembly.

3. Accessories:

a. Primer: Material recommended by insulation manufacturer where required for adhesion of insulation to substrates.

4. Thermal Barrier: Material barrier intended to prevent flam-source access to foam and delay temperature-rise of foam during a fire event.
   a. Gypsum Wallboard: 0.5 inch minimum thickness
   b. Thermal Barrier Coating: Fire-protective intumescent coating formulated for application over polyurethane foam plastics, compatible with insulation, and passes NFPA 275 testing as part of an approved assembly.
   c. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
      1) Flame-Spread Index: 25 or less.
      2) Smoke-Developed Index: 50 or less.
   d. Topcoat: 8 to 12 mil thick, water-based latex-based paint or heavy-duty protective coating recommended in writing by intumescent thermal barrier manufacturer as compatible with substrate materials.

5. Ignition Barrier: Material providing a 15-minute minimum fire-ignition barrier.

6. Mineral-Fiber Insulation: 1.5-inch minimum thickness.
7. Wood Structural Panel, Particleboard or Hardboard: 0.25-inch minimum thickness.
8. Gypsum Wallboard: 0.325-inch minimum thickness.
9. Corrosion-Resistant Steel: 0.016-inch base metal thickness.
10. Cellulose Insulation: 1.5-inch minimum thickness, self-supported spray-applied; for attic spaces only.
11. Ignition Barrier Coating: Fire-protective coating formulated for application over polyurethane foam plastics, compatible with insulation, and in compliance with ICC-ES AC377, Appendix X.

12. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

    a. Flame-Spread Index: 25 or less.
    b. Smoke-Developed Index: 50 or less.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for Sections in which substrates and related work are specified and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of substances harmful to insulations or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

3.3 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and application indicated. If printed instructions are not available or do not apply to project conditions, consult manufacturer's technical representative for specific recommendations before proceeding with insulation installation.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice and snow.

C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

1. Stuff loose glass fiber insulation into miscellaneous voids and cavity spaces as indicated. Compact to approximately 40% of normal maximum volume (to density of approximately 2.5 lbs. per cu. ft.)

D. Water-Piping Coordination: If water piping is located on inside of insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.

E. Apply single layer of insulation to produce thickness indicated, unless multiple layers are otherwise shown or required to make up total thickness.

F. Prior to installing gypsum board, install sound attenuation blankets as indicated, unless readily installed after gypsum board has been installed.

3.4 INSTALLATION OF GENERAL BUILDING INSULATION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions to envelope the entire area to be conditioned, including small pockets or holes that might allow a heat transfer between the room and conditioned space and the exterior. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Set vapor-retarder-faced units with vapor retarder to warm side of construction, unless otherwise indicated. Vapor barrier shall be free of gaps, openings, etc., which would allow passage of vapor from unprotected to protected spaces or volumes. Do not obstruct ventilation spaces, except for firestopping. Vapor retarder shall be continuous without gaps, rips or tears and shall be fastened to face of studs or joists.

C. Set reflective foil-faced units with approximately ¾" air space in front of foil face, when installed in substantial contact with unexposed surface of the ceiling, wall or floor finishes.

D. Install mineral-fiber blankets in cavities formed by framing members according to the following requirements:

1. Use blanket widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
2. Place blankets in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping stapling flanges to flanges of metal studs.

E. If insulation units are located in an unsupported ceiling area, provide line wire to support insulation units from dropping out from between supports. Space line wire at 16 " on center maximum.

F. If insulation units are to be installed at the upper portion of the joists or rafters to eliminate the void between the roof deck and the conditioned cavity, use 5/8" staples and 18 gauge galvanized sag-wires.

G. Contractors Option: Use Simpson "IS" insulation supports between joists and rafters. Comply with manufacturer's recommendation for installation requirements.

H. For wood-framed construction, install mineral-fiber blankets according to ASTM C 1320 and as follows:

1. With faced blankets having stapling flanges, secure insulation by inset, stapling flanges to sides of framing members.
2. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to produce airtight installation after concealing finish material is in place.

3.5 INSTALLATION OF SPRAY FOAM INSULATION

A. Preparation:

1. Verify that substrates are clean, dry, and free of substances that are harmful to insulation.
2. Priming: Prime substrates where recommended by insulation manufacturer. Apply primer to comply with insulation manufacturer's written instructions. Confine primers to areas to be insulated; do not allow spillage or migration onto adjoining surfaces.

B. Installation:

1. Comply with insulation manufacturer's written instructions applicable to products and applications.
2. Spray insulation to envelop entire area to be insulated and fill voids.
3. Apply in multiple passes to not exceed maximum thicknesses recommended by manufacturer. Do not spray into rising foam.
4. Framed Construction: Install into cavities formed by framing members to achieve thickness indicated on Drawings.
5. Cavity Walls: Install into cavities to [thickness indicated on Drawings] [fully fill void].
6. Miscellaneous Voids: Apply according to manufacturer's written instructions.
7. Install thermal barrier material.

8. Do not cover insulation prior to any required spray foam insulation inspections.
9. Apply barrier coatings in accordance with manufacturer's written instructions and to comply with requirements for listing and labeling for fire-propagation characteristics and surface-burning characteristics specified.
    a. Use equipment and techniques best suited for substrate and type of material applied as recommended by coating manufacturer.
    b. Apply coatings to prepared surfaces as soon as practical after preparation and before subsequent surface soiling or deterioration.
    c. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Produce sharp lines and color breaks.

3.6 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07 21 00

SECTION 07 25 00 – WEATHER-RESISTIVE BARRIERS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Special Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Weather barrier membrane
2. Seam Tape
3. Flashing
4. Fasteners

B. Related Sections include the following:

1. Division 7 Section "Joint Sealants" for joint-sealant materials and installation.

1.3 REFERENCES

A. ASTM International

1. ASTM C920; Standard Specification for Elastomeric Joint Sealants
2. ASTM C1193; Standard Guide for Use of Joint Sealants
3. ASTM D882; Test Method for Tensile Properties of Thin Plastic Sheeting
4. ASTM D1117; Standard Guide for Evaluating Non-woven Fabrics
5. ASTM E84; Test Method for Surface Burning Characteristics of Building Materials
6. ASTM E96; Test Method for Water Vapor Transmission of Materials
7. ASTM E1677; Specification for Air Retarder Material or System for Framed Building Walls
8. ASTM E2178; Test Method for Air Permeance of Building Materials
9. ASTM E2357; Standard Test Method for Determining Air Leakage of Air Barrier Assemblies

B. AATCC – American Association of Textile Chemists and Colorists

1. Test Method 127 Water Resistance: Hydrostatic Pressure Test

C. TAPPI

1. Test Method T-410; Grams of Paper and Paperboard (Weight per Unit Area)

2. Test Method T-460; Air Resistance (Gurley Hill Method)

1.4 SUBMITTALS

A. Refer to Section 01 33 00 Submittal Procedures

B. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of waterproofing.

C. Samples: Weather Barrier Membrane, minimum 8-1/2 inches by 11 inch.

D. Quality Assurance Submittals

1. Design Data, Test Reports: Provide manufacturer test reports indicating product compliance with indicated requirements.

2. Manufacturer Instructions: Provide manufacturer’s written installation instructions. Copy of special waterproofing manufacturer's and Installer's warranty stating obligations, remedies, limitations, and exclusions before starting waterproofing. (See Special Project Warrantee requirements below)

3. Manufacturer’s Field Service Reports: Provide site reports from authorized field service representative, indicating observation of weather barrier assembly installation.

E. Closeout Submittals

1. Refer to Closeout Submittals Section 01 77 00

2. Weather Barrier Warranty: Manufacturer’s executed warranty form with authorized signatures and endorsements indicating date of Substantial Completion.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer, with a minimum of 3 years of experience installing like projects, who is authorized, approved, or licensed by waterproofing manufacturer to install manufacturer's products.

1. Installation shall be in accordance with weather barrier manufacturer’s installation guidelines and recommendations.

2. Source Limitations: Provide commercial weather barrier and accessory materials produced by single manufacturer.

B. Mock-up

1. Install mock-up using approved weather barrier assembly including fasteners, flashing, tape and related accessories per manufacturer's current printed instructions and recommendations.
   a. Mock-up size: [10 feet by 10 feet] [insert size].
   b. Mock-up Substrate: Match wall assembly construction, including window opening.
   c. Mock-up may [not] remain as part of the work.

2. Contact manufacturer's designated representative prior to weather barrier assembly installation, to perform required mock-up visual inspection and analysis as required for warranty.

C. Pre-installation Meeting

1. Refer to Division 1 Section "Project Management and Coordination."

2. Hold a pre-installation conference, two weeks prior to start of weather barrier installation. Attendees shall include Contractor, Architect, Engineer, Installer, Owner's Representative, and Weather Barrier Manufacturer's Designated Representative.

3. Review all related project requirements and submittals, status of substrate work and preparation, areas of potential conflict and interface, availability of weather barrier assembly materials and components, installer's training requirements, equipment, facilities and scaffolding, and coordinate methods, procedures and sequencing requirements for full and proper installation, integration and protection.

1.6 DELIVERY, STORAGE AND HANDLING

A. Refer to Product Requirements Section

B. Deliver weather barrier materials and components in manufacturer's original, unopened, undamaged containers with identification labels intact.

C. Store weather barrier materials as recommended by weather barrier manufacturer.

1.7 SCHEDULING

A. Review requirements for sequencing of installation of weather barrier assembly with installation of windows, doors, louvers and flashings to provide a weather-tight barrier assembly.

B. Schedule installation of weather barrier materials and exterior cladding within nine months of weather barrier assembly installation.

1.8 WARRANTY

A. Refer to Warranties Section

B. Special Warranty

1. Warranty period is 10 years after date of substantial completion. *(Project Close-out Item)*

2. Pre-installation meetings and jobsite observations by weather barrier manufacturer for warranty are required.

3. Warranty Areas: [Describe specific areas of work protected and areas of work excluded as required by project conditions].

PART 2 – PRODUCTS

2.1 MANUFACTURER

A. Air Barrier and auxiliary materials shall comply with the following system requirements:

1. Obtain air barrier and auxiliary materials as a single-source from the Air Barrier Manufacturer to ensure total system compatibility and integrity.

2. Air leakage:

a. ASTM E2357: Pass

b. CAN/ULC-S742-11: Classification A1

c. CAN/ULC S741-08

3. Water resistance:

a. AATCC TM127: Pass

b. ASTM E331: Pass

4. Nail Sealability:

a. AAMA 711-13, ASTM D1970: Pass

B. Acceptable Manufacturers:

1. Henry® Company
999 N. Sepulveda Blvd. Suite 800
El Segundo, CA 90245
(800) 486-1278
www.henry.com

2.2 MATERIALS

A. Primary Sheet-Applied, Vapor Permeable Water Resistive Air Barrier (Basis of Design):

1. Self-adhered vapor permeable, water resistive air barrier consisting of a reinforced, modified polyolefin tri-laminate film surface and patented permeable adhesive technology with split-back poly-release film; having the following typical physical properties:

a. Basis of design: Henry® Blueskin® VP160 Self-Adhered Water Resistive Air Barrier
b. Color: Blue
c. Thickness: 23 mils (0.58 mm)
d. Water Vapor Permeance (ASTM E96): 29 perms
e. Air Leakage of Air Barrier Assemblies (ASTM E2357): Pass
f. Air Permeance (ASTM E2178): Pass
g. Nail Sealability (ASTM D1970): Pass
h. Dry Tensile Strength (ASTM D882):
1) 41 lbf /182N MD
2) 29 lbf /129N CD
i. Surface Burning Characteristics (ASTM E84):
1) Flame Spread: Class A
2) Smoke Development: Class A
j. Low Application Temperature: 20 degrees F (-7 degrees C)

B. Assembly Auxiliary Materials:
1. Adhesives/Primers:
a. Low VOC adhesive:
1) Synthetic rubber based quick setting adhesive with low VOC content; having the following typical physical properties:
a) Basis of design: Henry® Blueskin® LVC Adhesive
b) Color: Blue
c) Maximum VOC: <240 g/L
d) Drying time (initial set): 30 minutes
e) Low Application Temperature: 10 degrees F (-12 degrees C)
2) Polymer emulsion water based quick setting adhesive with low VOC content; having the following typical physical properties:
a) Basis of design: Henry® Aquatac™ Primer
b) Color: Aqua
c) Maximum VOC: 50 g/L
d) Drying time (initial set): 30 minutes
e) Low Application Temperature: 25 degrees F (-4 degrees C)

2.3 ACCESSORIES

A. Seam Tape: 3 inch wide, DuPont™ Tyvek® Tape for commercial applications.

B. Fasteners:

1. Tyvek® Wrap Caps, as distributed by DuPont: #4 nails with large 1-inch plastic cap fasteners, or 1-inch plastic cap staples with leg length sufficient to achieve a minimum penetration of 5/8-inch into the wood stud.

C. Sealants

1. Provide sealants that comply with ASTM C920, elastomeric polymer sealant to maintain watertight conditions.

2. Products:

    a. DuPont™ Commercial Sealant
    b. Sealants recommended by the weather barrier manufacturer.

D. Adhesives:

1. Provide adhesive recommended by weather barrier manufacturer.

2. Products:

    a. SIA 655
    b. Adhesives recommend by the weather barrier manufacturer.

E. Primers:

1. Provide flashing manufacturer recommended primer to assist in adhesion between substrate and flashing.

2. Products:

    a. SIA 655
    b. Primers recommended by the flashing manufacturer

F. Flashing

1. DuPont™ FlexWrap™, as distributed by DuPont: flexible membrane flashing materials for window openings and penetrations.

2. DuPont™ FlexWrap™ NF, as distributed by DuPont: flexible membrane flashing materials for window openings and penetrations.

3. Preformed Inside and Outside Corners and End Dams as distributed by DuPont: Preformed three-dimensional shapes to complete the flashing system used in conjunction with DuPont™ Thru-Wall Flashing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify substrate and surface conditions are in accordance with weather barrier manufacturer recommended tolerances prior to installation of weather barrier and accessories.

3.2 INSTALLATION – WEATHER BARRIER

A. Install weather barrier over exterior face of exterior wall substrate in accordance with manufacturer recommendations.

B. Install weather barrier prior to installation of windows and doors.

C. Start weather barrier installation at a building corner, leaving 6-12 inches of weather barrier extended beyond corner to overlap.

D. Install weather barrier in a horizontal manner starting at the lower portion of the wall surface with subsequent layers installed in a shingling manner to overlap lower layers. Maintain weather barrier plumb and level.

E. Sill Plate Interface: Extend lower edge of weather barrier over sill plate interface 3-6 inches. Secure to foundation with elastomeric sealant as recommended by weather barrier manufacturer.

F. Window and Door Openings: Extend weather barrier completely over openings.

G. Overlap weather barrier

1. Exterior corners: minimum 12 inches.

2. Seams: minimum 6 inches.

H. Weather Barrier Attachment:

1. Attach weather barrier to studs through exterior sheathing. Secure using weather barrier manufacturer recommended fasteners, space 12 -18 inches vertically on center along stud line, and 24 inch on center, maximum horizontally.

3.3 SEAMING

A. Seal seams of weather barrier with seam tape at all vertical and horizontal overlapping seams.

B. Seal any tears or cuts as recommended by weather barrier manufacturer.

3.4 OPENING PREPARATION

A. Flush cut weather barrier at edge of sheathing around full perimeter of opening.

B. Cut a head flap at 45-degree angle in the weather barrier at window head to expose 8 inches of sheathing. Temporarily secure weather barrier flap away from sheathing with tape.

3.5 THRU-WALL FLASHING INSTALLATION

A. Apply primer per manufacturer’s written instructions.

B. Install preformed corners and end dams bedded in sealant in appropriate locations along wall.

C. Starting at a corner, remove release sheet and apply membrane to primed surfaces in lengths of 8 to 10 feet.

D. Extend membrane through wall and leave ¼ inch minimum exposed to form drip edge.

E. Roll flashing into place. Ensure continuous and direct contact with substrate.

F. Lap ends and overlap preformed corners 4 inches minimum. Seal all laps with sealant.

G. Trim exterior edge of membrane 1-inch and secure metal drip edge per manufacturer's written instructions.

H. Apply sealant bead at each termination.

3.6 THRU-WALL FLASHING / WEATHER BARRIER INTERFACE AT BASE OF WALL

A. Overlap thru-wall flashing with weather barrier by 6-inches.

B. Mechanically fasten bottom of weather barrier through top of thru-wall flashing.

C. Seal vertical and horizontal seams with tape or sealing membrane.

3.7 FIELD QUALITY CONTROL

A. Notify manufacturer's designated representative to obtain [required] periodic observations of weather barrier assembly installation.

3.8 PROTECTION

A. Protect installed weather barrier from damage.

END OF SECTION 07 25 00

SECTION 07 26 15 CONCRETE MOISTURE-VAPOR CONTROL SYSTEM

PART 1- GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Special Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes:

1. Multi-component epoxy- or modified synthetic polymer-based (non-silicate) moisture-vapor emission and alkalinity control system for interior concrete slabs to receive finish flooring materials.
2. Preparation of concrete slab prior to application of moisture-vapor emission control system.
3. Installation of cementitious overlay after application of moisture-control emission system and successful post-installation moisture testing.
4. Testing for concrete moisture-vapor emission and alkalinity levels.
    a. Pre-installation.
    b. Post-installation.

B. Related Sections include:

1. Section 03 30 05 "Underslab Vapor Barrier" for vapor barrier sheet membrane occurring below concrete slabs on grade.
2. Section 09 65 16 "Resilient Flooring" for linoleum flooring installed over concrete slabs with moisture-vapor control system.

1.3 REFERENCES

A. ASTM International (American Society for Testing and Materials):

1. ASTM C 109: Test Method for Compressive Strength of Hydraulic Cement Mortars.
2. ASTM D 1308: Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes.
3. ASTM D 4541: Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
4. ASTM E 84: Test Method for Surface Burning Characteristics of Building Materials.
5. ASTM E 96: Test Methods for Water Vapor Transmission of Materials.
6. ASTM F 710: Practice for Preparing Concrete Floors to Receive Resilient

Flooring.

7. ASTM F 2170: Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

B. Code of Federal Regulations (CFR):

1. 40 CFR, Part 59, Subpart D: National Volatile Organic Compound Emission Standards.

1.4 DEFINITIONS

A. VOC: Volatile organic compounds.

1.5 COORDINATION

A. Coordinate sequencing of installation of concrete moisture-vapor control system such that the length of time that system is left exposed prior to subsequent installation of finish flooring material is minimized. Protect system as specified in Part 3 “Protection” Article.

1.6 PREINSTALLATION MEETING

A. Pre-installation Conference: Conduct conference at Project site to review pertinent issues related to installation of concrete moisture-vapor control system.

1. Attendees: Installer and representatives of moisture-vapor emission control system manufacturer, and other manufacturers and installers affected by installation of moisture-vapor control system.

2 Agenda: Review methods and procedures, and outstanding issues related to moisture-vapor control system including, but not limited to, the following:

a. Condition of substrate and preparatory work.

b. Project conditions.

c. Requirements for protecting work, including restriction of traffic during installation period.

d. Manufacturer’s installation instructions and warranty requirements.

e. Coordination with other work.

f. Protection of adjacent work.

3. Document proceedings including corrective measures and actions required, and furnish copy of record to each participant.

1.7 ACTION SUBMITTALS

A. Product Data: Manufacturer’s technical data for concrete moisture-vapor control system, including cementitious overlay.

B. Moisture-Vapor Emission and Alkalinity Testing: Submit procedure and reporting format for moisture-vapor emission and alkalinity tests.

1.8 INFORMATIONAL SUBMITTALS

A. Installer's Qualification Data: Manufacturer's certification of Installer as approved installer of concrete moisture-vapor control system.
   1. Provide five project references.

B. Product Test Reports: From a qualified independent testing agency indicating concrete moisture-vapor control system compliance with specified performance requirements.

C. Product Certifications: Certificates signed by manufacturer certifying materials comply with specified performance characteristics and physical requirements.

D. Moisture-Vapor Emission and Alkalinity Test Reports: Submit test reports with results of testing for moisture-vapor emission and alkalinity levels in concrete slabs, as specified in Part 3 "Moisture Testing Procedures" Article.
   1. Pre-installation testing.
   2. Post-installation field quality control testing.

E. Qualification Data: For testing agency.

F. Sample Warranties: For special warranties.

1.9 QUALITY ASSURANCE

A. Source Limitations: Obtain components and accessories of concrete moisture-vapor control system through one source from same manufacturer as concrete moisture-vapor control system, or as approved in writing by concrete moisture-vapor control system manufacturer.

B. Manufacturer Qualifications: Company with minimum of 5 years experience in manufacturing non-silicate epoxy or modified polymer-based concrete moisture-vapor emission and alkalinity control products, with a record of successful in-service performance, and capable of providing field service representation during construction.

C. Installer Qualifications: Authorized representative trained and approved in writing by manufacturer of concrete moisture-vapor control system.

D. Testing Agency: Independent third-party agency with minimum of 5 years of demonstrated experience and capability to perform specified concrete moisture-vapor emission and alkalinity tests.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in manufacturer's original, unopened, undamaged containers with identification labels intact.

B. Store materials in a dry, secure area protected from exposure to harmful weather conditions and at temperature levels as recommended by manufacturer.

1.11 FIELD CONDITIONS

A. Moisture Testing: Conduct pre-installation and post-installation concrete moisture and alkalinity testing within temperature and relative humidity conditions as specified in Part 3 “Concrete Moisture and Alkalinity Testing” Article.

B. At new concrete slabs, do not install concrete moisture-vapor control system until pre-installation concrete moisture and alkalinity test results have been reviewed, and concrete slab has cured and is in acceptable condition as determined by manufacturer of concrete moisture-vapor control system.

C. Environmental Limitations: Comply with concrete moisture-vapor control system manufacturer’s written instructions for substrate temperature, ambient temperature, humidity, ventilation, and other conditions affecting system installation.

D. Close spaces to traffic during application of concrete moisture-vapor control system during application, and for not less than 24 hours afterwards, unless manufacturer recommends longer period.

1.12 WARRANTY

A. Special Warranty: Written non-prorated warranty as provided by manufacturer against failure of finish flooring system due to concrete moisture-vapor emission, alkalinity, and concrete adhesion failure. Warranty to include replacement of finish flooring material, flooring adhesive, concrete moisture-vapor control system, and all associated labor costs. Cracks and other issues relating to installation of concrete substrate are not justification for exclusion of coverage.

1. Warranty Period: 10 years. Coverage includes the following:
    a. Manufacturing defects.
    b. Installation defects.
        i) Signed by manufacturer-approved applicator.
    c. Concrete moisture and alkalinity damage to floor coverings.
    d. Failure to meet specified performance requirements.
2. Warranty shall not exclude the following:
    a. Cracks and other issues relating to installation of concrete substrate.
    b. Upper limits for moisture-vapor levels as recorded by pre-installation testing.
    c. Condensation or dew point issues.
    d. Salts in concrete.
    e. Pinholes in moisture-vapor control system.
    f. Future removal and reinstallation of finish flooring.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Moisture-Vapor Emission Levels: Provide system capable of producing the following results in concrete slab:

1. Reduce moisture level to a 75 percent maximum relative humidity, as verified by relative humidity testing using in situ probes in conformance with ASTM F 2170.
2. Alkalinity level of not less than 7 and not more than 9 pH, as verified by testing per ASTM F 710.

2.2 CONCRETE MOISTURE-VAPOR CONTROL SYSTEM

A. Concrete Moisture-Vapor Control System: Multi-component, ultra-low-viscosity non-silicate epoxy or modified polymer-based liquid penetrant designed for penetrating concrete substrates to mechanically restrict water-vapor emission passage and alkalinity levels; capable of meeting specified performance requirements and filling concrete voids, cracks, and pinholes.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Advanced Moisture Control, Inc.; Vapor-Guard DC.
   b. DiamondStone, LLC; Diamond-VRS.
   c. Floor Seal Technology; MES 100.
   d. Koster American Corporation; VAP 12000.
   e. Synthetics International; Synthetic 30.
   f. Equal product in accordance with Division 1 requirements for product substitutions.
2. VOC Content: Provide concrete moisture-vapor system that complies with local regulatory limits for VOC content when calculated according to 40 CFR, Part 59, Subpart D (EPA Method 24).
3. Microbial Resistance: Formulation shall be resistant to to the growth of mold, mildew, and micro-organisms.
4. Environmental Properties: Non-oil-based, non-corrosive, non-marine pollutant. Shall not contain harmful fumes or vapors when in a wet mixed or unmixed state.
5. Physical Properties:
   a. Concrete Adhesion: 350 psi minimum, or concrete cohesive failure when tested according to ASTM D 4541.
   b. Water Vapor Transmission: Minimum 92 percent reduction when tested according to ASTM E 96.
   c. Chemical Resistance: No effect when exposed to14 pH alkali solution when tested according to ASTM D 1308 for acids/alkali.
6. Acrylic, latex, sodium, lithium, potassium silicate formulations, and other single-

component products are not acceptable.

2.3 ACCESSORY MATERIALS

A. Cementitious Overlay and Patching: Portland cement-based, polymer-modified, self-leveling product that can be applied in minimum uniform thicknesses of 1/8 inch and approved in writing by manufacturer of moisture-vapor control system.

1. Product: Subject to compliance with requirements, provide one of the following:
   a. Ardex; K-15 Self-Leveling Underlayment Concrete.
   b. RAECO Specialty Cements, LLC; SLU.
   c. Equal product in accordance with Division 1 requirements for product substitutions.
2. Cement Binder: ASTM C 150, Portland cement, or hydraulic or blended hydraulic cement as defined by ASTM C 219.
3. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109.
4. Underlayment Additive: Resilient-emulsion product of underlayment manufacturer formulated for use with underlayment when applied to substrate and conditions indicated.

PART 3 - EXECUTION

3.1 CONCRETE MOISTURE AND ALKALINITY TESTING

A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform moisture testing as specified in this Article.

B. Testing Conditions: Do not conduct moisture testing until final building environmental conditions have been achieved. Maintain temperature between 65 and 85 deg F, and relative humidity between 40 percent and 60 percent for not less than 72 hours prior to, and throughout duration of testing.

C. Prepare concrete slab substrates prior to testing in accordance with referenced testing standards.

1. Verify that substrates are dry and free of curing compounds, seaters, coatings, and other substances that would preclude accurate test readings.

D. Moisture-Vapor Emission Testing: Moisture testing shall be performed using relative humidity in-situ probe test method, conforming with ASTM F 2170.

1. Level of moisture to be determined and reported as relative humidity (RH).
2. After completion of testing, fill test probe holes with cementitious patching material.

E. Alkalinity Testing: Testing shall utilize a calibrated digital 1-14 wide range pH meter and conform with requirements of ASTM F 710 for test procedure. Paper and pencil type tests are not acceptable.

F. Quantity and locations of testing shall meet the following criteria, except that post-installation field quality control testing need not be performed on those areas that show moisture levels of less than 75 percent relative humidity, and a pH level of 7 to 9, in pre-installation moisture testing.

1. Minimum of three tests for first 1,000 square feet.
2. Minimum of one test for each additional 1,000 square feet.
3. At slabs on grade, include at least one test within 3 feet of each exterior wall.

G. Test reports shall include the following information:

1. Name and address of structure.
2. Description of testing instruments and methods. Include statement of justification for type of test instruments used; include copy of ASTM F 2170 and ASTM F 710 testing protocols.
3. Date and time of measurements.
4. Name, title, and affiliation of individual performing measurements.
5. Floor plan with location of each test location clearly marked. Include the following information.
    a. Moisture Tests:
        i) Locations and depths of probe holes within the structure.
        ii) Relative humidity in each probe hole, to the nearest percent relative humidity.
        iii) Temperature in each probe hole to the nearest degree F.
        iv) Ambient air temperature, to the nearest degree F, and relative humidity to the nearest percent above each probe hole.
        v) Make, model, and last calibration date of instrument used to make measurements.
    b. Alkalinity Tests:
        i) Location of each test.
        ii) pH level of each test.
6. Any observations that might affect the interpretation of individual measurements such as standing water on the slab, wet coring operations, weather, or ventilating system operations.

3.2 EXAMINATION

A. Pre-installation Concrete Moisture and Alkalinity Testing: Conduct pre-installation concrete moisture and alkalinity testing of existing concrete slabs as specified in “Concrete Moisture and Alkalinity Testing” Article, on all interior concrete slab areas to receive finish flooring.

1. Allow new concrete to cure for a minimum of 14 days.
2. After reviewing results of pre-installation concrete moisture and alkalinity testing of concrete slab areas to receive finish flooring, meet with Architect and Construction Manager to determine areas to receive moisture-vapor control

system.

3. Those slab areas that show moisture levels of less than 75 percent relative humidity, and a pH level of 7 to 9 need not be treated with concrete moisture-vapor control system, and may be deducted from scope of work by way of Change Order, if so directed by Construction Manager.

B. Examine concrete substrates, with Installer present, for compliance with requirements for installation of concrete moisture-vapor and alkalinity control system. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 PREPARATION

A. Mask and protect adjacent surfaces from the effects of dust and splashing of materials associated with preparation and installation of concrete moisture-vapor control system.

B. Surface Preparation: Scarify existing concrete slab surfaces to receive system treatment by shot blasting and as recommended in writing by manufacturer of moisture-control system. Acid etching is not allowed.

1. Newly poured slabs do not require scarification. Allow minimum cure time prior to application of concrete moisture-vapor control system as required by manufacturer.

C. Crack and Joint Preparation: Mechanically open, vacuum, and seal all cracks and joints with moisture-control system component material, and then fill with 100 percent portland cement-based patching compound, as recommended in writing by manufacturer of concrete moisture-vapor control system.

D. If necessary, place dehumidifiers in locations and for time period as required to achieve ambient humidity conditions in conformance with manufacturer's written recommendations.

3.4 CONCRETE MOISTURE-VAPOR CONTROL SYSTEM APPLICATION

A. Apply concrete moisture-vapor control system in accordance with manufacturer's written instructions. Saturate concrete surfaces, cracks, and joints.

1. Apply penetrants and coatings by squeegee and roller application to saturate concrete surfaces.

2. Conform with manufacturer's requirements for coverage rates and number of applications as needed to meet specified performance requirements.

B. After application and curing of moisture-vapor control material, and post-installation concrete moisture and alkalinity testing with satisfactory results is complete, install cementitious overlay at those areas to receive resilient finish flooring materials. Install in accordance with manufacturer's written instructions, to minimum thickness of 1/16 inch and as otherwise required to provide a smooth and continuous substrate suitable to receive finish flooring materials without the use of special adhesives or patching compounds.

1. Refer to "Field Quality Control" Article for post-installation concrete moisture and alkalinity testing requirements to be fulfilled prior to installation of

cementitious overlay.

3.5 FIELD QUALITY CONTROL

A. Conduct post-installation moisture and alkalinity testing for concrete moisture-vapor emissions and alkalinity in presence of concrete moisture-vapor control system manufacturer's representative and as specified in “Concrete Moisture and Alkalinity Testing” Article, at those areas receiving concrete moisture-vapor control system, prior to installation of cementitious overlay. Verify the following results:

1. Moisture level of 75 percent relative humidity or less.
2. Alkalinity level of 7 to 9 pH.

B. If test results do not meet specified performance requirements, apply additional concrete moisture-vapor emission control material, or take other corrective action as recommended by manufacturer of concrete moisture-vapor control system to meet requirements.

1. Additional concrete moisture and alkalinity testing, at Contractor’s expense, to be performed to determine compliance of replaced or additional work with specified requirements.

3.6 PROTECTION

A. Protect concrete moisture-vapor control system, and cementitious overlay from damage and surface moisture during time prior to installation of finish flooring materials.

END OF SECTION 07 26 15

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SECTION 07 26 16 BELOW GRADE VAPOR BARRIER

PART 1 - GENERAL

1.1 SUMMARY

A. Products supplied under this section:

1. Vapor barrier and installation accessories for installation under concrete slabs.

B. Related sections:

1. Section 03 30 00 Cast-in-Place Concrete
2. Section 07 26 00 Vapor Retarders

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM E1745-17 Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.
2. ASTM E1643-11 Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.

B. Technical Reference - American Concrete Institute (ACI):

1. ACI 302.2R-06 Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.
2. ACI 302.1R-15 Guide to Concrete Floor and Slab Construction.

1.3 SUBMITTALS

A. Quality control/assurance:

1. Summary of test results per paragraph 9.3 of ASTM E1745.
2. Manufacturer’s samples and literature.
3. Manufacturer’s installation instructions for placement, seaming, penetration prevention and repair, and perimeter seal per ASTM E1643.
4. All mandatory ASTM E1745 testing must be performed on a single production roll per ASTM E1745 Section 8.1.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Vapor barrier shall have all of the following qualities:

1. Maintain permeance of less than 0.01 Perms [grains/(ft^2 · hr · inHg)] as tested in accordance with mandatory conditioning tests per ASTM E1745 Section 7.1 (7.1.1-7.1.5).
2. Other performance criteria:

    a. Strength: ASTM E1745 Class A.
    b. Thickness: 15 mils minimum
3. Provide third party documentation that all testing was performed on a single production roll per ASTM E1745 Section 8.1

B. Vapor barrier products:

1. Basis of Design: Stego Wrap Vapor Barrier (15-mil) by Stego Industries LLC., (877) 464-7834 www.stegoindustries.com.
2. Or preapproved equal.

2.2 ACCESSORIES

A. Seams:

1. Stego Tape by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.

B. Sealing Penetrations of Vapor barrier:

1. Stego Mastic by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.
2. Stego Tape by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.

C. Perimeter/edge seal:

1. Stego Crete Claw by Stego Industries LLC, (877) 464-7834

    a. Stego Term Bar by Stego Industries LLC, (877) 464-7834

3. StegoTack Tape (double-sided sealant tape) by Stego Industries LLC, (877) 464-7834

D. Penetration Prevention:

1. Beast Foot by Stego Industries LLC, (877) 464-7834

E. Vapor Barrier-Safe Screed System

1. Beast Screed by Stego Industries, LLC, (877) 464-7834

PART 3 – EXECUTION

3.1 PREPARATION

A. Ensure that subsoil is approved by Architect or Geotechnical Engineer.

1. Level and compact base material.

3.2 INSTALLATION

A. Install vapor barrier in accordance ASTM E1643.

1. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete placement and face laps away from the expected direction of the placement whenever possible.

2. Extend vapor barrier to the perimeter of the slab. If practicable, terminate it at the top of the slab, otherwise (a) at a point acceptable to the structural engineer or (b) where obstructed by impediments, such as dowels, waterstops, or any other site condition requiring early termination of the vapor barrier. At the point of termination, seal vapor barrier to the foundation wall, grade beam or slab itself.

    a. Seal vapor barrier to the entire slab perimeter using Stego Crete Claw, per manufacturer's instructions.

    OR

    b. Seal vapor barrier to the entire perimeter wall or footing/grade beam with double sided StegoTack Tape, or both Stego Term Bar and StegoTack Tape, per manufacturer's instructions. Ensure the concrete is clean and dry prior to adhering tape.

3. Overlap joints 6 inches and seal with manufacturer's seam tape.
4. Apply seam tape/Crete Claw to a clean and dry vapor barrier.
5. Seal all penetrations (including pipes) per manufacturer's instructions.
6. For interior forming applications, avoid the use of non-permanent stakes driven through vapor barrier. Use blunt-end and/or threaded nail stakes (screed pad posts) and insert them into Beast Foot. Ensure Beast Foot's peel-and-stick adhesive base is fully adhered to the vapor barrier
7. If non-permanent stakes must be driven through vapor retarder, repair as recommended by vapor retarder manufacturer.
8. Use reinforcing bar supports with base sections that eliminate or minimize the potential for puncture of the vapor barrier.
9. Repair damaged areas with vapor barrier material of similar (or better) permeance, puncture and tensile.
10. For vapor barrier-safe concrete screeding applications, install Beast Screed (vapor barrier-safe screed system) per manufacturer's instructions prior to placing concrete.

END OF SECTION

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SECTION 07 31 13 - ASPHALT SHINGLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Asphalt shingles.
2. Sheet underlayment.

B. Related Sections include the following:

1. Division 6 Section "Rough Carpentry" for roof deck wood structural panels.
2. Division 7 Section "Sheet Metal Flashing and Trim" for metal roof penetration flashings and counter-flashings not part of this Section.
3. Division 7 Section "Roof Accessories".

1.3 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

1.4 SUBMITTALS

A. Product Data: Technical product data, installation instructions, and recommendations from shingle manufacturer, including data that materials comply with requirements.

B. Samples for Initial Selection: Two samples for each type of asphalt shingle, ridge and hip cap shingles indicated.

1. Include similar Samples of trim and accessories involving color selection.

C. Samples for Verification: For the following products, of sizes indicated, to verify color selected.

1. Asphalt Shingle: Full-size asphalt shingle strip.
2. Ridge and Hip Cap Shingles: Full-size ridge and hip cap asphalt shingle.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for asphalt shingles.

E. Research/Evaluation Reports: For asphalt shingles.

F. Maintenance Data: For asphalt shingles to include in maintenance manuals.

G. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain ridge and hip cap shingles felt underlayment through one source from a single asphalt shingle manufacturer.

B. Fire-Test-Response Characteristics: Provide asphalt shingle and related roofing materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

1. Exterior Fire-Test Exposure: Class A; ASTM E 108 or UL 790, for application and roof slopes indicated.

C. Pre-installation Conference: Conduct conference at Project, with Architect, Contractor, Owners Representative and others affected by this work, prior to commencement of application.

D. Comply with CBC 2022 for Roofs.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store roofing materials in a dry, well-ventilated, weathertight location according to asphalt shingle manufacturer's written instructions. Store underlayment rolls on end on pallets or other raised surfaces. Do not double-stack rolls.

1. Handle, store, and place roofing materials in a manner to avoid significant or permanent damage to roof deck or structural supporting members.

B. Protect unused underlayment from weather, sunlight, and moisture when left overnight or when roofing work is not in progress.

1.7 PROJECT CONDITIONS

A. Substrate: Proceed with shingle work only after substrate construction and penetrations have been completed.

B. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit asphalt shingle roofing to be performed according to manufacturer's written instructions and warranty requirements.

1. Install sheet underlayment within the range of ambient and substrate temperatures recommended by manufacturer.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace asphalt shingles that fail in materials within specified warranty period. Materials failures include manufacturing defects and failure of asphalt shingles to self-seal after a reasonable time.

1. Material Warranty Period: 25 years from date of Substantial Completion, prorated, with first 3 years non-prorated. *(Project Close-Out Item)*

2. Wind-Speed Warranty Period: Asphalt shingles will resist blow-off or damage caused by wind speeds up to 60 mph for 5 years from date of Substantial Completion. *(Project Close-Out Item)*

B. Special Project Warranty: Roofing Installer's warranty, signed by roofing Installer, covering Work of this Section, in which roofing Installer agrees to repair or replace components of asphalt shingle roofing that fail in materials or workmanship within the following warranty period:

1. Warranty Period: Two years from date of Substantial Completion. *(Project Close-Out Item)*

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Asphalt Shingles: 2% of each type, in unbroken bundles. Obtain written verification of delivery from Owner. *(Project Close-Out Item)*

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.

B. Products: Subject to compliance with requirements, provide one of the products specified.

2.2 GLASS-FIBER-REINFORCED ASPHALT SHINGLES

A. 3-Dimensional Laminated-Strip Shingle, UL Class “A”: Mineral-surfaced, self-sealing, laminated, multi-ply overlay construction, glass-fiber based strip shingle complying with ASTM D 3018, Type 1, and with ASTM D 3462.

1. Products: Subject to compliance with requirements, provide on of the following:

a. CertainTeed Corporation, “Landmark Pro”

b. Or approved equal.

2. Color and Blends: “Weathered Wood”, to match existing shingled roofs on site. Or as selected by Architect from manufacturer's full range depending on availability.

B. Hip and Ridge Shingles: Manufacturer's standard units to match asphalt shingles or Site-fabricated units cut from asphalt shingle strips. Trim each side of lapped portion of unit to taper approximately 1 inch.

2.3 UNDERLAYMENT MATERIALS

A. Felts: ASTM D226, D4869, or D6757, Type I, asphalt-saturated organic felts, No. 15, nonperforated, 36 inch wide, approximate weight of 18/lbs/square.

B. Composite underlayment: CertainTeed WinterGuard Waterproofing Shingle Underlayment or approved equivalent meeting ASTM D1970.

2.4 ACCESSORIES

A. Asphalt Roofing Cement: Fibrated asphalt cement complying with ASTM D 4586, designed for trowel applications, asbestos free.

B. Roofing Nails: Hot-dip galvanized steel wire shingle nails, minimum 12 gage, barbed shank, sharp-pointed, with a minimum 3/8-inch- diameter flat head and of sufficient length to penetrate 3/4 inch into solid wood decking or to penetrate through to plywood sheathing.

1. Where nails are in contact with metal flashing, use nails made from same metal as flashing.

C. Felt Underlayment Nails: Hot-dip galvanized steel wire with low profile capped heads or disc caps, 1-inch minimum diameter.

2.5 METAL FLASHING AND TRIM

A. Sheet Metal Flashing and Trim: Comply with requirements in Division 7 Section "Sheet Metal Flashing and Trim."

1. Metal Drip Edge Sheet Metal: Minimum 26 gage, hot dipped galvanized sheet metal. Brake formed as indicated on drawings. Furnish in 8 foot to 10 foot lengths.
2. Metal Flashing: Minimum 26 gage, hot dipped galvanized sheet metal. Job cut to sizes and configurations required.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. Examine roof sheathing to verify that sheathing joints are supported by framing and blocking or metal clips and that installation is within flatness tolerances.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored; and that provision has been made for flashings and penetrations through asphalt shingles.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

A. Option 1: On low slopes (2” to 4” per foot), one layer of WinterGuard Waterproofing Shingle Underlayment, lapped 19” over entire roof.

B. Option 2: Double-Layer Felt Underlayment: Install double layers of felt underlayment on roof deck perpendicular to roof slope in parallel courses. Install an 18-inch- wide starter course at eaves and completely cover with full-width second course. Install succeeding courses lapping previous courses 19 inches in shingle fashion. Lap ends a minimum of 6 inches. Stagger end laps between succeeding courses at least 72 inches. Fasten with roofing nails in compliance with CBC 2019.

3.3 METAL FLASHING INSTALLATION

A. General: Install metal flashings and other sheet metal to comply with requirements in Division 7 Section "Sheet Metal Flashing and Trim" and in compliance with details and CBC 2013:

B. Rake Drip Edges: Install rake drip edge flashings over underlayment and fasten to roof deck.

C. Eave Drip Edges: Install eave drip edge flashings below underlayment and fasten to roof sheathing.

D. Pipe Flashings: Form flashing around pipe penetrations and asphalt shingles. Fasten and seal to asphalt shingles as recommended by manufacturer.

3.4 ASPHALT SHINGLE INSTALLATION

A. Install asphalt shingles according to manufacturer's written instructions, and CBC 2013.

B. Install starter strip along lowest roof edge, consisting of an asphalt shingle strip with tabs removed with self-sealing strip face up at roof edge.

1. Extend asphalt shingles 1/2 inch over fascia at eaves and rakes.
2. Install starter strip along rake edge.

C. Install first and remaining courses of asphalt shingles stair-stepping diagonally across roof deck with manufacturer's recommended offset pattern at succeeding courses, maintaining uniform exposure.

D. Fasten asphalt shingle strips in pattern and with number of fasteners per shingle recommended by manufacturer's written instructions and CBC 2013.

E. Open Valleys: Cut and fit asphalt shingles at open valleys, trimming upper concealed corners of shingle strips. Maintain uniform width of exposed open valley from highest to lowest point.

1. Set valley edge of asphalt shingles in a 3-inch- wide bed of asphalt roofing cement.
2. Do not nail asphalt shingles to metal open valley flashings.

F. Ridge and Hip Cap Shingles: Maintain same exposure of cap shingles as roofing shingle exposure. Lap cap shingles at ridges to shed water away from direction of prevailing winds. Fasten with roofing nails of sufficient length to penetrate sheathing.

3.5 ROOFING INSTALLER'S WARRANTY

A. WHEREAS (**Insert name**) of (**Insert address**), herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:

1. Owner: (**Insert name of Owner.**)
2. Address: (**Insert address.**)
3. Building Name/Type: (**Insert information.**)
4. Address: (**Insert address.**)
5. Area of Work: (**Insert information.**)
6. Acceptance Date: (**Insert date.**)
7. Warranty Period: (**Insert time.**)
8. Expiration Date: (**Insert date.**)

B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions

1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:

a. lightning;

b. peak gust wind speed exceeding 80 mph;

c. fire;
d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
f. vapor condensation on bottom of roofing; and

g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.

2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
5. During Warranty Period, if original use of roof is changed, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this (**Insert day**) day of (**Insert month**), (**Insert year**).

1. Authorized Signature: (**Insert signature.**)
2. Name: (**Insert name.**)
3. Title: (**Insert title.**)

(Project Close-Out Item)

END OF SECTION 07 31 13

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SECTION 07 60 00 - FLASHING AND SHEET METAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Special Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following sheet metal flashing and trim:
1. Manufactured reglets.
2. Formed roof drainage system.
3. Formed low-slope roof flashing and trim.
4. Formed steep-slope roof flashing and trim.
5. Formed wall flashing and trim.
6. Formed equipment support flashing.

B. Related Sections include the following:
1. Division 6 Section "Rough Carpentry" for wood nailers, curbs, and blocking.
2. Division 7 Section “Asphalt Shingles” for installing sheet metal flashing and trim integral with roofing.
3. Division 7 Section “Membrane Roofing” for installing sheet metal flashing and trim integral with roofing membrane.
4. Division 7 Section "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
5. Division 7 Section "Joint Sealants" for field-applied sheet metal flashing and trim sealants.

1.3 PERFORMANCE REQUIREMENTS

A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

C. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show layouts of sheet metal flashing and trim, including plans and elevations. Distinguish between shop- and field-assembled work. Include the following:

1. Identify material, thickness, weight, and finish for each item and location in Project.
2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
3. Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining work.
4. Details of expansion-joint covers, including showing direction of expansion and contraction.

C. Samples for Initial Selection: For each type of sheet metal flashing and trim indicated with factory-applied color finishes.

1. Include similar Samples of trim and accessories involving color selection.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Sheet Metal Flashing: Two - 12 inches long. Include fasteners, cleats, clips**,** closures, and other attachments.
2. Trim: Two - 12 inches long. Include fasteners and other exposed accessories.
3. Accessories: Full-size Sample.

1.5 QUALITY ASSURANCE

A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

B. Coordinate work of this Section with interfacing and adjoining work for proper sequencing of each installation. Ensure best possible weather resistance and durability of work and protection of materials and finishes.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.

B. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

1.7 COORDINATION

A. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products specified.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 SHEET METALS

A. Aluminum Sheet: ASTM B 209, Alloy 3003, 3004, 3105, or 5005, Temper suitable for forming and structural performance required, but not less than H14, finished as follows:

1. Mill Finish: Standard two-sides bright.
2. Factory Prime Coating: Where painting after installation is indicated, provide pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat; with a minimum dry film thickness of 0.2 mil.
3. Siliconized-Polyester Coating: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil for primer and 0.8 mil for topcoat.

    a. Color: As selected by Architect from manufacturer's full range.

4. High-Performance Organic Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

    a. Fluoropolymer 2-Coat System: Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605.

        1) Color: As selected by Architect from manufacturer's full range.

5. Anodized Finish: Apply the following coil-anodized finish:
    a. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
    b. Class I, Color Anodic Finish: AA-M12C22A44 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating:

Architectural Class I, electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.

B. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.

1. Finish: No. 2D (dull, cold rolled).

C. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality**,** mill phosphatized for field painting.

2.3 UNDERLAYMENT MATERIALS

A. Polyethylene Sheet: 6-mil- thick polyethylene sheet complying with ASTM D 4397.

B. Felts: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.

C. Slip Sheet: Rosin-sized paper, minimum 3 lb/100 sq. ft..

2.4 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.

1. Exposed Fasteners: Heads matching color of sheet metal by means of plastic caps or factory-applied coating.
2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex washer head.
3. Blind Fasteners: High-strength aluminum or stainless-steel rivets.
4. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

C. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.

D. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane, polysulfide or silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

E. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.

F. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

G. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

H. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

I. Building Paper Flashing: 6 inch wide by 15 pound Kraft paper flashing.

J. Elastic Sheet Flashing/Membrane: Non-reinforced flexible, black elastic sheet flashing of 50 to 65 mils thickness and complying with the following:

1. Shore Hardness - (ASTM D 2240) 50 to 70.
2. Tensile Strength - (ASTM D 412) 1200psi.
3. Tear Resistance - (ASTM D 624, Die C) 20 lbs. per linear inch.
4. Ultimate Elongation - (ASTM D 412) 250 percent.
5. Low Temperature Brittleness - (ASTM D 746) minus 30 deg. F.
6. Resistance to Ozone Aging – (ASTM D 1149) no cracks for 10 percent elongation sample 100 hours in 50 pphm (50.5mPa) Ozine at 104 deg. F.
7. Resistance to heat Aging – (ASTM D 573) maximum hardness increase of 15 points, elongation reduction of 40 percent and tensile strength reduction of 30 percent, for 70 hours at 212 deg.F.
8. Acceptable Products:

a. Neoprene synthetic rubber sheet.
b. EPDM synthetic rubber sheet.

K. Reglets: Metal or plastic units of type and profile indicated, compatible with flashing indicated, non-corrosive.

L. Metal Accessories: Provide sheet metal clips, straps, anchoring devices and similar devices and similar accessory units as required for installation of work, matching or compatible with material being installed, non-corrosive, size and gauge required for performance.

2.5 MANUFACTURED SHEET METAL FLASHING AND TRIM

A. Reglets: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory-mitered and -welded corners and junctions.

2.6 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.

B. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.

C. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.

1. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.

D. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.

E. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.

F. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.

G. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual" and FMG Loss Prevention Data Sheet 1-49 for application but not less than thickness of metal being secured.

2.7 ROOF DRAINAGE SHEET METAL FABRICATIONS

A. Hanging Gutters: Fabricate to cross section indicated, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch- long sections. Furnish flat-stock gutter spacers and gutter brackets fabricated from same metal as gutters, of size recommended by SMACNA but not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, gutter bead reinforcing bars, and gutter accessories from same metal as gutters.

1. Material: As indicated.
2. Gutter Style: As detailed.
3. Expansion Joints: As indicated or detailed.
4. Accessories: Wire ball downspout strainer.
5. Material Thickness: Refer to SMACNA “Architectural Sheet Metal Manual.” For minimum material thickness.

B. Downspouts: Fabricate round or rectangular, as indicated, downspouts complete with mitered elbows. Furnish with metal hangers, from same material as downspouts, and anchors.

1. Material and thickness: As indicated.
2. Manufactured Hanger Style: As indicated.
3. Fabricate downspouts from the following material:

2.8 STEEP-SLOPE ROOF SHEET METAL FABRICATIONS

A. Apron, Step, Cricket, and Backer Flashing: Fabricate from material and thickness as indicated.

B. Valley Flashing: Fabricate from material and thickness as indicated.

C. Drip Edges: Fabricate from material and thickness as indicated.

D. Eave, Rake, Ridge, and Hip Flashing: Fabricate from material and thickness as indicated.

E. Base Flashing: Fabricate from material and thickness as indicated.

F. Counterflashing: Fabricate from material and thickness as indicated.

G. Flashing Receivers: Fabricate from material and thickness as indicated.

H. Roof-Penetration Flashing: Fabricate from material and thickness as indicated.

2.9 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from material and thickness as indicated.

2.10 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.

1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Torch cutting of sheet metal flashing and trim is not permitted.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.

1. Coat side of sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene underlayment.
3. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.

C. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.

D. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and elastomeric sealant.

E. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

1. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.

F. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.

G. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.

1. Galvanized or Prepainted, Metallic-Coated Steel: Use stainless-steel fasteners.
2. Aluminum: Use aluminum or stainless-steel fasteners.
3. Stainless Steel: Use stainless-steel fasteners.

H. Seal joints with elastomeric sealant as required for watertight construction.

1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F, set joint members for 50 percent movement either way. Adjust setting proportionately for

installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.

2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

I. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to be soldered to a width of 1-1/2 inches except where pretinned surface would show in finished Work.

1. Do not solder prepainted, metallic-coated steel and aluminum sheet.
2. Stainless-Steel Soldering: Pretin edges of uncoated sheets to be soldered using solder recommended for stainless steel and phosphoric acid flux. Promptly wash off acid flux residue from metal after soldering.
3. Do not use open-flame torches for soldering. Heat surfaces to receive solder and flow solder into joints. Fill joints completely. Completely remove flux and spatter from exposed surfaces.

J. Aluminum Flashing: Rivet or weld joints in uncoated aluminum where necessary for strength.

3.3 ROOF DRAINAGE SYSTEM INSTALLATION

A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.

B. Hanging Gutters: Join sections with riveted and soldered joints or with lapped joints sealed with elastomeric sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchored gutter brackets or straps spaced not more than 36 inches apart. Provide end closures and seal watertight with sealant. Slope to downspouts.

C. Downspouts: Join sections with 1-1/2-inch telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.

1. Connect downspouts to underground drainage system, unless otherwise indicated.

D. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated. Lap joints a minimum of 4 inches in direction of water flow.

3.4 ROOF FLASHING INSTALLATION

A. General: Install sheet metal roof flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight.

B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.

1. Interlock bottom edge of roof edge flashing with continuous cleats anchored to substrate at 24-inch centers, unless otherwise indicated.

C. Copings: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.

1. Interlock exterior bottom edge of coping with continuous cleats anchored to substrate at 24-inch centers, unless otherwise indicated.
2. Anchor interior leg of coping with screw fasteners and washers at 24-inch centers, unless otherwise indicated.

D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.

E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints a minimum of 4 inches and bed with elastomeric sealant.

1. Secure in a waterproof manner by means of snap-in installation and sealant or lead wedges and sealant, unless otherwise indicated.

F. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Install flashing as follows:

1. Turn lead flashing down inside vent piping, being careful not to block vent piping with flashing.
2. Seal with elastomeric sealant and clamp flashing to pipes penetrating roof except for lead flashing on vent piping.

3.5 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Reglets: Installation of reglets as indicated and shown on the drawings.

C. Openings Flashing in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 6 inches beyond wall openings or as indicated on the drawings.

3.6 MISCELLANEOUS FLASHING INSTALLATION

A. Overhead-Piping Safety Pans: Suspend pans from pipe and install drain line to plumbing waste or drain line.

B. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

C. Elastic Flashing: Install Elastic Flashing in accordance with manufacturer's recommendations. Where required, provide for movement at joints by forming loops or bellows in width of flashing. Locate cover or filler strips at joints to facilitate complete drainage of water from flashing. Seam adjacent flashing sheets with adhesive, seal and anchor edges in accordance with manufacturer's recommendations.

3.7 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 60 00

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SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes joint sealants for which the type and form is indicated on the drawings.

1. Exterior joints in vertical surfaces and horizontal nontraffic surfaces:

2. Exterior joints in horizontal traffic surfaces:

3. Interior joints in vertical surfaces and horizontal nontraffic surfaces:

4. Interior joints in horizontal traffic surfaces:

B. Related Sections include the following:
1. Division 9 Section "Gypsum Board Assemblies" for sealing perimeter joints of gypsum board partitions to reduce sound transmission.
2. Division 9 Section "Ceramic Tile" for sealing tile joints.

1.3 PERFORMANCE REQUIREMENTS

A. Provide joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

1.4 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Samples for Verification: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.

E. SWRI Validation Certificate: For each elastomeric sealant specified to be validated by SWRI's Sealant Validation Program.

F. Qualification Data: For Installer and testing agency.

G. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

H. Product Test Reports: Based on comprehensive testing of product formulations performed by a qualified testing agency, indicating that sealants comply with requirements.

I. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

C. Product Testing: Obtain test results for "Product Test Reports" Paragraph in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period preceding the Notice to Proceed with the Work.

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated, as documented according to ASTM E 548.
2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.
3. Test elastomeric joint sealants according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.
4. Test other joint sealants for compliance with requirements indicated by referencing standard specifications and test methods.

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.6 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.

3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 WARRANTY *(Project Close-Out Item)*

A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two (2) years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two (2) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.3 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

C. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

D. Single-Component Mildew-Resistant Acid-Curing Silicone Sealant:

1. Products:

   a. Dow Corning Corporation; 786 Mildew Resistant.
   b. GE Silicones; Sanitary SCS1700.
   c. Tremco; Tremsil 200.
   d. Pecora Corporation; 863 Silicone

2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 25.
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: G, A, and, as applicable to joint substrates indicated, O.

E. Multicomponent Pourable Urethane Sealant:

1. Products:

   a. Meadows, W. R., Inc.; POURTHANE.
   b. Pacific Polymers, Inc.; Elasto-Thane 227 High Shore Type I (Self Leveling).
   c. Pacific Polymers, Inc.; Elasto-Thane 227 Type I (Self Leveling).
   d. Pecora Corporation; Urexpan NR-200.
   e. Tremco; THC-901.
   f. Tremco; THC-900.
   g. Tremco; Vulkem 245.

2. Type and Grade: M (multicomponent) and P (pourable).
3. Class: 25.
4. Use Related to Exposure: T (traffic).
5. Uses Related to Joint Substrates: M, A, and, as applicable to joint substrates indicated, O.

F. Single-Component Nonsag Urethane Sealant:

1. Products:

   a. Bostik Findley; Chem-Calk 900.
   b. Bostik Findley; Chem-Calk 915.
   c. Bostik Findley; Chem-Calk 916 Textured.
   d. Bostik Findley; Chem-Calk 2639.
   e. Pecora Corporation; Dynatrol I-XL.
   f. Tremco; DyMonic.
   g. Tremco; Vulkem 921.

2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 25.
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.

2.4 LATEX JOINT SEALANTS

A. Latex Sealant: Comply with ASTM C 834, Type OP, Grade NF.

B. Products:

1. Bostik Findley; Chem-Calk 600.
2. Pecora Corporation; AC-20+.
3. Sonneborn, Division of ChemRex Inc.; Sonolac.
4. Tremco; Tremflex 834.

2.5 ACOUSTICAL JOINT SEALANTS

A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and the following:

1. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
2. Flame-spread and smoke-developed indexes of less than 25 per ASTM E 84.
3. Products:

a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
b. United States Gypsum Co.; SHEETROCK Acoustical Sealant.

B. Acoustical Sealant for Concealed Joints: Manufacturer's standard, nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission.

1. Products:

a. Pecora Corporation; BA-98.
b. Tremco; Tremco Acoustical Sealant.

2.6 FIRE RESISTANT JOINT SEALERS

A. General: Provide manufacturer’s standard sealant and accessory materials with fire-resistance rating indicated which are identical to those of assemblies whose fire endurance has been determined by testing per ASRM E 814 by Underwriters Laboratory, Inc. or other testing and inspecting agency acceptable to authorities having jurisdiction.

B. Foamed in Place Fire Stopping Sealant: Two part, foamed-in-place, silicone sealant formulated for use as part of a through-penetration fire-stop system for filling openings around cables, conduit, pipes and similar penetrations through walls and floors.

1. Products:

a. Dow Corning Corporation; Dow Corning Fire Stop Foam.

b. Hilti, Inc. CP620 Fire Foam.
c. Specified Technologies, Inc.; SSS100.

C. One Part Fire Stopping Sealant: One part elastomeric sealant formulated for use as a part of a through penetration fire stop system for sealing openings around cables, conduit, pipes and similar penetrations through walls and floors.

1. Products:

a. Dow Corning Corporation; Dow Corning Fire Stop Sealant.
b. Electrical Products Division/3M Corporation; 3M Fire Barrier Caulk CP25WB+.
c. Hilti, Inc. FS-One high performance intumescent firestop sealant.

2.7 JOINT FILLERS FOR CONCRETE PAVING

A. General: Provide joint fillers of thickness and widths indicated.

1. Self-Expanding Cork Joint Filler: Preformed strips complying with ASTM D1752 for Type III.
2. Sponge Rubber Joint Filler: Preformed strips complying with ASTM D1752 for Type I.

2.8

2.8 JOINT-SEALANT BACKING

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), Type O (open-cell material), B (bicellular material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F. Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and to otherwise contribute to optimum sealant performance.

D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.9 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

    a. Concrete.
    b. Masonry.
    c. Unglazed surfaces of ceramic tile.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

    a. Metal.
    b. Glass.
    c. Porcelain enamel.
    d. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience.

Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Acoustical Sealant Application Standard: Comply with recommendations in ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.

D. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

E. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

F. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

G. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
4. Provide flush joint configuration where indicated per Figure 5B in ASTM C 1193.

5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 5C in ASTM C 1193.

    a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

H. Installation of Preformed Tapes: Install according to manufacturer's written instructions.

I. Installation of Preformed Silicone-Sealant System: Comply with the following requirements:

1. Apply masking tape to each side of joint, outside of area to be covered by sealant system.
2. Apply silicone sealant to each side of joint to produce a bead of size complying with preformed silicone-sealant system manufacturer's written instructions and covering a bonding area of not less than 3/8 inch. Hold edge of sealant bead 1/4 inch inside masking tape.
3. Within 10 minutes of sealant application, press silicone extrusion into sealant to wet extrusion and substrate. Use a roller to apply consistent pressure and ensure uniform contact between sealant and both extrusion and substrate.
4. Complete installation of sealant system in horizontal joints before installing in vertical joints. Lap vertical joints over horizontal joints. At ends of joints, cut silicone extrusion with a razor knife.

J. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping, taking care not to pull or stretch material, producing seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures where expansion of sealant requires acceleration to produce seal, apply heat to sealant in compliance with sealant manufacturer's written instructions.

K. Installation of Fire Stopping Sealant: Install sealant, including forming, packing and other accessory materials to fill openings around mechanical and electrical services penetrating floors and walls to provide fire-stops with fire resistance ratings indicated for floor or wall assembly in which penetration occurs.

3.4 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 07 92 00

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SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Work under this section comprises of furnishing hollow metal doors and frames, including transom frames, sidelight and window frames with provision for glazed, paneled or louvered openings, fire labeled and non-labeled, as scheduled.

1. Flush Steel Doors.
2. Steel frames.
3. Hollow Metal Framing Systems.

B. Related Sections: Related documents, drawings and general provisions of contract, including General and Supplementary Conditions and Division 1 specification sections apply to this section. The latest published edition of each reference applies.

1. Section 06 10 00 - Rough Carpentry
2. Section 08 14 00 - Wood Doors
3. Section 08 71 00 - Door Hardware
4. Section 08 80 00 - Glazing

C. References: The intent of this document is that all hollow metal and its application will comply or exceed the standards identified below. The latest published edition of each reference applies.

1. ANSI - American National Standards Institute - ansi.org
2. NFPA - National Fire Protection Association

a. NFPA 80 - Standard for Fire Doors and Other Opening Protectives
b. NFPA 101 – Life Safety Code
c. NFPA 105 – Standard Smoke Door Assemblies and Other Opening Protectives
d. NFPA 252 - Standard Method of Fire Tests of Door Assemblies.

3. DHI - Door and Hardware Institute – Door Security + Safety Professionals

a. Installation Guide for Doors and Hardware.
b. Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames.
c. Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames.

4. SDI - Steel Door Institute

a. SDI-105 – Recommended Erection Instructions for Steel Frames
b. SDI-107 – Hardware on Steel Doors (Reinforcement - Application)
c. SDI-111 - Recommended Details for Standard Steel Doors, Frames, Accessories, and Related Components
d. SDI-117 - Manufacturing Tolerances Standard Steel Doors and Frames
e. SDI-118 – Basic Fire Door Requirements
f. SDI A250.3 Test Procedure and Acceptance Criteria for Factory Applied Finish Coatings for Steel Doors and Frames
g. SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, and Frame Anchors
h. SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel

Doors and Frames
i. SDI A250.8 - SDI-100 Specifications for Standard Steel Doors and Frames
j. SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames
k. SDI A250.11 - Recommended Erection Instructions for Steel Frames
l. SDI A250.13 Testing and Rating of Severe Windstorm Resistant Components for Swinging Door Assemblies

5. BHMA - Builders Hardware Manufacturers Association
   a. BHMA A156.115 - Hardware Preparations in Standard Steel Doors and Frames.
   b. BHMA A156.7 - Hinge Template Dimensions.
6. ASTM - American Society for Testing Materials
   a. ASTM A568/A568M-19a Standard Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements
   b. ASTM A879/A879M-12(2017) Standard Specification for Steel Sheet, Zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface
   c. ASTM A653/A653M-19a Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
   d. ASTM A924/A924M-19 Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
   e. ASTM A1008/A1008M-18 Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
7. ICC - International Code Counsel
   a. ICC A117.1 – Accessible and Usable Building and Facilities.
   b. ICC 500 Standard for the Design and Construction of Storm Shelters
8. UL - Building Materials Directory; Underwriters Laboratories Inc.
   a. UL 10B - Standard for Neutral Pressure Fire Tests of Door Assemblies
   b. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies
   c. UL 1784 – Air Leakage Test of Door Assemblies
   d. UL 752 – Standard for Bullet-Resisting Equipment
9. NAAMM/HMMA – National Association of Architectural Metal Manufacturers/Hollow Metal Manufacturers Association
   a. NAAMM/HMMA 840 – Guide Specification for Receipt, Storage, and Installation of Hollow Metal Doors and Frames.
10. WH - Certification Listings; Warnock Hersey International Inc.
11. Federal Emergency Management Agency (FEMA) 361 Guidelines, ICC500 - 2014
12. Miami - Dade County test protocols PA 201, PA 202 and PA 203.
13. Florida Building Code test protocols TAS 201, TAS 202 and TAS 203.
14. Texas Department of Insurance TDI - Complies with TAS 201, TAS 202 and TAS 203, Large Missile Impact.

1.2 SUBSTITUTIONS:

A. All substitution requests must be submitted within the procedures and time frame as outlined in Division 1, General Requirements. Approval of products is at the discretion of the architect and their consultant

1.3 SUBMITTALS

A. Submittals to comply with provisions of Division 01, Submittal Procedures.
B. Product Data: Manufacturer's standard details and catalog data indicating compliance with referenced standards and manufacturer's installation instructions.
C. Shop Drawings: Provide a schedule of doors and frames using same reference numbers for details and door openings as those on the contract documents. Shop drawings should include the following information to ensure doors and frames are properly prepared and coordinated to receive hardware.

1. Elevations of each door and frame type.
2. Details for door core.
3. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
4. Locations of cutouts for glass and louvers.
5. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
6. Mounting locations for hardware.
7. Thickness of reinforcement/preparations for hardware.
8. Details of anchorages, joints, field splices, and connections.
9. Details of accessories.
10. Details of moldings, removable stops, and glazing.
11. Fire ratings.
12. Finish.

D. Samples: 12 by 12 inches (304 mm by 304 mm) cut away sample door with provisions for lockset, hinge and corner section of frame welded and prepped for specified hardware. Sample should be furnished with submittals for Owner approval. After approval return sample to door/frame supplier as confirmation of approved construction.
E. Closeout Submittals to comply with Division 1, Closeout Submittals procedures.
F. Furnish copies of manufacturer’s warranty information and maintenance instructions.

1.4 QUALITY ASSURANCE

A. Hollow Metal Distributor is to be a direct account of the manufacturer of the products furnished. In addition, that distributor must have in their regular employment an Architectural Hardware Consultant (AHC), Certified Door Consultant (CDC), an Architectural Openings Consultant (AOC), a Door & Hardware Consultant (DHC) or equivalent door and hardware industry experience who will be available to consult with the Architect and Contractor regarding any matters affecting the door and frame opening.
B. Manufacturer Qualifications: Certified Member of the Steel Door Institute in good standing.
C. Installer: Minimum five years documented experience installing products specified this Section.
D. Certificates:

1. Manufacturer's certification that products comply with referenced standards.
2. Hollow Metal Manufacturer must provide documentation that they are an SDI Certified Manufacturer.

E. Fire Rated Doors and Frames: Underwriters' Laboratories, Intertek Testing Services/Warnock Hersey, and Factory Mutual labeled fire doors and frames:

1. Provide labeled fire doors and frames in accordance with Underwriters Laboratories standard UL10C Positive Pressure Fire Tests of Door Assemblies.
2. Construct and install doors and frames to comply with current issue of NFPA 80.
3. Manufacture Underwriters' Laboratories labeled doors and frames in strict compliance to UL procedures, and provide the degree of fire protection, heat transmission and panic loading capability indicated by the opening class.

4. Manufacture Intertek Testing Services /Warnock Hersey labeled doors and frames in strict compliance to ITS/WH procedures and provide the degree of fire protection capability indicated by the opening class.
5. Manufacture Factory Mutual labeled doors and frames in strict compliance to FM procedures, and provide the degree of fire protection, heat transmission and panic loading capability indicated by the opening class.
6. Affix a physical label or approved marking to each fire door and/or fire door frame, at an authorized facility as evidence of compliance with procedures of the labeling agency.
7. Conform to applicable codes for fire ratings. It is the intent of this specification that doors, frames, hardware and their application comply or exceed the standards for labeled openings. In case of conflict between types required for fire protection, furnish type required by NFPA and UL.
8. Provide Temperature Rise Fire Door Assemblies in exit enclosures and exit passageway with maximum transmitted temperature end point rating of not more than 250 degrees F (121 degrees C) above ambient at the end of 30 minutes of the standard fire test exposure.
9. For openings required to be fire rated exceeding limitations of labeled assemblies, submit manufacturer's certification that each door and frame assembly has been constructed to conform to design, materials and construction equivalent to requirements for labeled construction.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping

1. The use of non-vented plastic or canvas shelters that can create a humidity chamber shall be avoided to prevent rust or damage.
2. Provide cardboard wrapped or crated product to provide protection during transit and job site storage
3. Should wrappers become wet, remove immediately

B. Delivery and Site Acceptance

1. The supplier shall deliver all materials to the project site; direct factory shipments are not allowed unless agreed upon beforehand. Supplier shall coordinate delivery times and schedules with the contractor.
2. Deliver doors cardboard wrapped or crated to provide protection during transit and job site storage. Provide additional protection to prevent damage to any factory-finished doors. Mark all doors and frames with architects opening numbers as shown on the contract documents and shop drawings on the center hinge preparation location.
3. Upon delivery, check in doors and frames jointly with supplier. Inspect doors and frames upon delivery for damage, correct quantities or shortages. Minor damages may be repaired provided refinished items are equal in all respects to new work and acceptable to the architect. Otherwise, remove and replace damaged goods as directed. Note shortages and replace immediately.

C. Storage and Protection

1. Handle, store and protect products in accordance with the manufacturers printed instructions, ANSI/SDI A250.8 – Specifications for Standard Steel Doors and Frames, A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames, or ANSI/SDI A250.3 - Test Procedure and Acceptance Criteria for Factory Applied Finish Coatings for Steel Doors and Frames and NAAMM/HMMA 840 – Guide Specification for Receipt, Storage, and Installation of Hollow Metal Doors and Frames.
2. Store all materials in a dry area. All hollow metal material shall be stored so that it does not come in contact with water or moisture. Protect units from adverse weather elements.
3. Place units on 4 inch (102 mm) high wood sills to prevent rust and damage.

4. Store doors vertically under a properly vented cover, five units maximum in a stack with a ¼" space between doors to permit air circulation.
5. Store frames in an upright position with heads uppermost under cover.
6. Store assembled frames five units maximum in a stack with 2-inch (51 mm) space between frames to permit air circulation.

1.6 COORDINATION

A. Coordinate Work with other directly affected sections involving manufacture or fabrication of internal cutouts and reinforcement for door hardware, electric devices and recessed items.
B. Coordinate Work with frame opening construction, door and hardware installation.
C. Sequence installation to accommodate required door hardware.
D. Verify field dimensions for factory assembled frames prior to fabrication.

1.7 WARRANTY

A. Comply with Division 01 Closeout Submittals
B. All doors and frames shall be warranted in writing by the manufacturer against defects in materials and workmanship for a period of one (1) year commencing on the date of manufacture.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design - Metal Products Inc. (MPI), Corbin, KY (606) 523-0461 (Web: www.metalproductsinc.com

1. Exterior Doors: Polyurethane Doors, Tech 302
2. Acceptable Alternate:

a. 707 Series (QMAX) by Curries Assa Abloy
b. Legion by Ceco Door Assa Abloy

B. Provide all steel doors and frames from a single SDI certified manufacturer.

2.2 General:

A. Physical performance: Units shall comply with the 1 million cycles swing test requirement per ANSI A250.4 - Level A.
B. Finishing:

1. Raw, no primer
2. Prime Gray to meet SDI A250.10
3. Standard Color (on Galv doors and frames only) to meet SDI A250.3

2.3 DOORS

A. General: Construct exterior/interior doors to the following designs and gauges:

1. Exterior Doors: Doors shall be made of commercial quality, level, cold rolled steel conforming to ASTM Designation A1008 and free of scale, pitting, or other surface defects. Face sheets shall be not less than 16 gauge.

a. Door Thickness: 1-3/4 inches.
b. Core: Rigid Pre-formed Closed Cell Polyisocyanurate Board
c. Thermal Value: U-factor = 0.38 (Minimum U-factor = 0.50)

2. Interior Doors - Cold-rolled steel, ASTM A 1008/A 1008M:

   a. Door gauge:16 gauge
   b. Door Thickness: 1-3/4 inches
   c. Core: Rigid pre-formed closed cell polyisocyanurate (polyurethane) board, 2 lb. density average, Conforming to ASTM D2856. Core U-factor = 0.100, R-value – 10.0.
   d. Face sheets: 16 ga.
   e. U-factor: 0.38

2.4 DOOR FRAMES

A. General: Construct exterior/interior metal door frames to the following designs and gauges;

1. Exterior Frames: Zinc-Iron Alloy-Coated galvannealed steel (A40) (A60) or Zinc-Coated Galvanized steel (G90) that conforms to ASTM A 653/A653M:

   a. Thickness:
      1) 16 gauge.

2. Interior Frames in stud wall construction: cold rolled steel, ASTM A 1008/A 1008M.

   a. Thickness:
      1) 16 gauge.

3. Interior KD Drywall Frames (Slip-On construction): cold rolled steel, ASTM A 1008/A 1008M.

   a. Thickness:
      1) 16 gauge.

B. Steel Frames:

1. Basis of Design: Standard 3 Side Frames, Tech 201 by MPI (Metal Products Inc.)
2. Profile:

   a. Face:
      1) 2 Inches face dimension and types and throat dimensions indicated on the Door Schedule.

   b. Stops:
      1) Standard 5/8-inch-high stops
      2) Kerf style stops: 5/8-inch-high stops w/ 1/8-inch kerf slot positioned in the side of the stop.
      3) Thermal break w/ kerf stops: 5/8 inch-high stops. Steel used to make the stop on the frame will connect to the steel on the rabbet through a material that allows for a thermal break. A kerf slot for gasketing to be built into the thermal break.

3. Provide reinforcements and accessories for specified hardware per SDI 250.6.
4. Anchors: Locate adjustable anchors in each jamb 6 inches from the top of the door opening to hold frame in rigid alignment.

   a. Exposed fastener type; recessed hole at base of jamb for countersunk fastener installation.
   b. Snap in base anchors
   c. Strap anchors welded to frame

5. Fire Rating: Supply frame units bearing Labels for fire ratings indicated in Door Schedule for the locations indicated.

C. Steel Frames for Drywall:

1. Profile:

a. Face:
   1) 2 Inches face dimension and types and throat dimensions indicated on the Door Schedule.
   2) Custom special face dimension and types and throat dimensions indicated on the Door Schedule.

b. Stops:
   1) Standard 5/8-inch-high stops
   2) Kerf style stops: 5/8-inch-high stops w/ 1/8-inch kerf slot positioned in the side of the stop.

2. Provide reinforcements and accessories for specified hardware per SDI 250.6.
3. Anchors: Locate adjustable anchors in each jamb 6 inches from the top of the door opening to hold frame in rigid alignment.

   a. Exposed fastener type; recessed hole at base of jamb for countersunk fastener installation.
   b. Snap in base anchors
   c. Strap anchors welded to frame

4. Fire Rating: Supply frame units bearing Labels for fire ratings indicated in Door Schedule for the locations indicated.

2.5 HOLLOW METAL FRAMING SYSTEMS

A. Hollow Metal Framing Systems:

1. Components: Construct architectural stick frame assemblies of standard frame components, fabricated as specified.

   a. Exterior Frame Material: Zinc-Iron Alloy-Coated galvannealed steel (A40) (A60) or Zinc-Coated Galvanized steel (G90) that conforms to ASTM A 653/A653M, 14 gauge galvannealed steel.
   b. Interior Frames in Masonry: Zinc-Iron Alloy-Coated galvannealed steel (A40) (A60) or Zinc-Coated Galvanized steel (G90) that conforms to ASTM A 653/A653M, 16 gauge galvannealed steel.
   c. Interior Frames in stud wall construction: 16 gauge cold rolled steel, ASTM A 1008/A 1008M steel.
   d. Include galvannealed components and internal reinforcements with galvannealed frames.

2. Frame component requirements:

   a. Prepare required sticks at door openings and frame assemblies for hardware as specified in Section 087100.
   b. Fabricate frame assemblies from three basic components:
      1) Open Sections (perimeter members) identical in configuration to standard frames.
      2) Closed sections (intermediate members) with identical jamb depth, face dimensions, and stops as open sections.
      3) Sill sections: To be flush with both faces of adjacent vertical members. Cut individual components to length and notched to assure square joints and corners.
   c. Externally welded face joints at meeting mullions or between mullions and other frame members on the face surfaces only. Grind and finish face joints smooth.
   d. Fabricate frame assemblies for shipment to the jobsite completely welded.
      1) Field joints permissible only when the size of the total assembly exceeds

shipping limitations.
2) Fabricate oversized frames in sections designated for splicing in the field.

e. Pierced and dimpled glazing beads for use with manufacturers' standard fasteners.
f. Provide necessary anchors for jambs, heads, and sills of assemblies.
g. Verify field dimensions as required. Do not begin fabrication until these dimensions have been verified and approved.

3. Accessories:

a. Glazing Bead: Formed steel sheet; screw-attached.
b. Steel Panels:
1) 1/2-inch – 1 inch thick and manufactured from 18 gauge or 16 gauge thick non-galvannealed or galvannealed steel faces with a polystyrene core.
2) 1-3/4 inches thick and manufactured from 18 gauge or 16 gauge thick non-galvannealed or galvannealed steel faces with a steel stiffened core for fire rated openings.

4. Fire Rating: Provide factory assembled welded units bearing Labels for fire ratings indicated on the Drawings.

2.6 ACCESSORIES

A. Anchors: Manufacturer's standard framing anchors, specified in manufacturer's printed installation instructions for project conditions.
B. Astragals for pairs of doors: Manufacturer's standard for labeled and non-labeled openings.
C. Plaster Guards: Same material as door frame, minimum 24 gauge (0.5 mm) minimum; provide for all strike boxes. Plaster guards not mandatory on interior after set frames.
D. Silencers: Resilient rubber, Inserted type, three per strike jamb for single openings. Stick-on silencers shall not be permitted except on hollow metal framing systems.
E. Glazing: Specified in Section 088000.

2.7 FABRICATION

A. Steel Frames:

1. Fabricate steel door and frame units to be rigid, neat in appearance, and free from defects, warp, or buckle. Where practical, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at Project site. Comply with ANSI/SDI 100 requirements.

a. Clearances shall comply with the requirements of NFPA 80.

2. Three-piece knock-down frames: Head and jamb intersecting corners die-cut, mitered at 45 degrees, with locking tabs for rigid connection when assembled.
3. Factory-welded frames: Head and jamb intersecting corners mitered at 45 degrees, with back welded joints ground smooth.

a. Continuous face weld the joint between the head and jamb faces along their length either internally or externally. Grind, prime paint, and finish smooth face joints with no visible face seams.
b. Externally weld, grind, prime paint, and finish smooth face joints at meeting mullions or between mullions and other frame members per a current copy of ANSI/SDI A250.8.

4. Provide temporary steel spreaders (welded to the jambs at each rabbet of door openings) on welded frames during shipment. Remove temporary steel spreaders prior to installation of the frame.

B. Tolerances shall comply with SDI-117 "Manufacturing Tolerances for Standard Steel Doors and

Frames."

C. Fabricate concealed stiffeners, reinforcement, edge channels, louvers, and moldings from either cold-rolled or hot-rolled steel sheet.
D. Unless otherwise indicated, provide exposed fasteners with countersunk flat or oval heads for exposed screws and bolts.
E. Reinforce doors and frames to receive surface-applied hardware per SDI A250.6. Drilling and tapping for surface-applied hardware shall be done at Project site. Provide internal reinforcements for all doors to receive door closers and exit devices where scheduled.
F. Locate hardware as indicated on Shop Drawings or, if not indicated, per the Door and Hardware Institute's (DHI) "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."

2.8 FINISHES

A. Chemical Treatment: Treat steel surfaces to promote paint adhesion.
B. Exposed door and frame surfaces to be cleaned and treated then coated with rust inhibitive primer. Water-based primer and color paint finishes to be free of Hazardous Air Pollutants (HAPS) and Volatile Organic Compounds (VOCs). Paint to comply with ANSI A250.3 and A250.10.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that project conditions are acceptable before beginning installation of frames.
    1. Verify that completed openings to receive knock-down wrap-around frames are of correct size and thickness.
    2. Verify that completed concrete or masonry openings to receive butt type frames are of correct size.
B. Do not begin installation until conditions have been properly prepared.
C. Correct unacceptable conditions before proceeding with installation.

3.2 INSTALLATION

A. Install doors and frames in accordance with manufacturer's printed installation instructions and with Steel Door Institute's recommended erection instructions for steel frames SDI A250.11 and NAAMM/HMMA 840.
B. DHI – Door and Hardware Institute – Door Security + Safety Professionals – Installation Guide for Doors and Hardware
C. Fire Doors and Frames: Install in accordance with SDI A 250.11 and NFPA 80.
    1. To ensure compliance with Positive Pressure criteria as required by UBC7-2, UL10C, NFPA5000 and all applicable Local, State and National Code Jurisdictions, all Doors and Frames should be checked for accurate installation per Manufacturers installation instructions to provide proper fire and Smoke Gasketing as tested and listed.
    2. Fit hollow-metal doors accurately in frames, within clearances specified in SDI A 250.11 and SDI 100. Install fire rated doors with clearances specified in NFPA 80.
D. Comply with provisions of SDI-105, “Recommended Erection Instructions for Steel Door Frames,” unless otherwise indicated. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set.
    1. Except for frames located in existing concrete, masonry, or gypsum board assembly construction, place frames before constructing enclosing walls and ceilings.
    2. Drywall series frames are designed for installation in interior applications after construction of

wood or metal stud and drywall applications. Drywall series frames are provided with adjustable jamb lock anchors for secure installation. Install frames per manufacturers' installation instructions. Adjust anchors and secure sill and baseboard anchors as provided.

E. Remove temporary steel spreaders prior to installation of frames.

F. Set frames accurately in position; plumb, align and brace until permanent anchors are set. After wall construction is complete, remove temporary wood spreaders.

1. Field splice only at approved locations indicated on the shop drawings.
2. Weld, grind, and finish as required to conceal evidence of splicing on exposed faces.

G. Glaze and seal exterior transom, sidelight and window frames in accordance with HMMA-820 TN03.

H. Apply hardware in accordance with hardware manufacturers' instructions and Section 087100 of these Specifications. Install hardware with only factory-provided fasteners. Install silencers. Adjust door installation to provide 1/8" at head and 1/8" at strike and hinge jamb with door undercut to meet fire ratings and floor conditions to achieve maximum operational effectiveness and appearance.

3.3 FIELD QUALITY CONTROL

A. Fire-Rated Door Assembly Testing:

1. Upon completion of the installation, test each fire door assembly to confirm proper operation of its closing device and verify that it meets all criteria of a fire door assembly per NFPA 80.
2. Perform inspections by individuals with documented knowledge and understanding of the operation components of the type of door being tested per NFPA 80 and NFPA 101.
3. Provide a written record to the Owner with copies available to the Authorities Having Jurisdiction (AHJ).
4. Record shall list the fire door assembly and include the door number with an itemized list of hardware set components for each door opening and location in the facility.

3.4 ADJUST AND CLEAN

A. Adjust doors for proper operation, free from binding or other defects.
B. Clean and restore soiled surfaces. Remove scraps and debris and leave site in a clean condition.
C. Prime Coat Touch-Up: Immediately after erection, sand smooth rusted or damaged areas of prime coat, and apply touch-up of compatible air-drying primer.
D. Properly clean and apply paint to doors and frames in accordance with HMMA-840 TN01 and ANSI A250.8 appendix B along with Manufactures recommended surface preparation for painting.

3.5 PROTECTION

A. Protect installed products and finished surfaces from damage during construction.

END OF SECTION

SECTION 08 14 16 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1. Interior Solid-core doors with wood-veneer and medium-density overlay**,** faces.
2. Louvers for flush wood doors.

B. Related Sections include the following:

1. Division 8 Section " Custom Steel Doors and Frames" for HM frames.

1.2 SUBMITTALS

A. Product Data: For each type of door. Include details of core and edge construction**,** louvers, and trim for openings.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.

1. Indicate dimensions and locations of mortises and holes for hardware.
2. Indicate dimensions and locations of cutouts.
3. Indicate requirements for veneer matching.
4. Indicate fire ratings for fire doors.
5. Identify each door to correspond to Door Schedule shown on drawings.

C. Samples for Verification:
1. Corner sections of doors, approximately 8 by 10 inches, with door faces and edgings representing typical range of color and grain for each species of veneer and solid lumber required.
2. Louver blade and frame sections, 6 inches long, for each material and finish specified.

D. W.I. Certificates: Furnish a W.I. Certificate of Compliance prior to delivery of doors certifying that doors fully meet all the requirements of the W.I. grade or grades specified herein.

E. References: NWWDA I.S.6-A and W.I. Section 12 – Doors, Premium Grade.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer.

B. Quality Standard: Comply with WI's "Manual of Millwork."

1. Provide WI-Certified Compliance Certificate indicating that doors comply with requirements of grades specified.

2. Provide WI-Certified Compliance Certificate for installation.

C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL10C and NFPA 252.

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.4 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in plastic bags or cardboard cartons.

C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until building is enclosed, wet work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form, signed by manufacturer, Installer, and Contractor, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship, have warped (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section, or show telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.

1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
2. Warranty shall be in effect during the following period of time from date of Substantial Completion:

a. Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flush Wood Doors:
a. DoorMerica Products (basis of design)

b. Algoma Hardwoods Inc.
c. Haley Brothers, Inc.
d. Vancouver Door Company, Inc.
e. Weyerhauser Company

2. Metal Louvers for Doors:

a. Air Louvers, Inc.
b. Anemostat Door Products.

2.2 DOOR CONSTRUCTION, GENERAL

A. Doors for Transparent Finish:

1. Grade: Premium, with Grade AA faces.
2. Species and Cut: Maple or Birch, plain sliced.
3. Match between Veneer Leaves: Slip match.
4. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
5. Room Match: Provide door faces of compatible color and grain within each separate room or area of building.
6. Transom Match: Continuous match.
7. Stiles: Same species as faces.

B. Doors for Opaque Finish:

1. Grade: Premium.
2. Faces for Interior Doors: Medium-density overlay.
3. Apply medium-density overlay to standard thickness, closed-grain, hardwood face veneers.

2.3 SOLID-CORE DOORS

A. Particleboard Cores: Comply with the following requirements:

1. Particleboard: ANSI A208.1, Grade LD-2.
2. Provide doors with either glued-block or structural composite lumber cores instead of particleboard cores at locations where exit devices are indicated.

B. Interior Veneer-Faced Doors:

1. Core: Particleboard.
2. Construction: Five or seven plies with stiles and rails bonded to core, then entire unit abrasive planed before veneering.

C. Fire-Rated Doors:

1. Construction: Construction and core specified above for type of face indicated or manufacturer's standard mineral-core construction as needed to provide fire rating indicated.

2. Blocking: For mineral-core doors, provide composite blocking with improved screw-holding capability approved for use in doors of fire ratings indicated as needed to eliminate through-bolting hardware.
3. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile matching face veneer, and laminated backing at hinge stiles for improved screw-holding capability and split resistance.

4. Pairs: Provide fire-rated pairs with fire-retardant stiles matching face veneer that are labeled and listed for kinds of applications indicated without formed-steel edges and astragals.

2.4 LOUVERS

A. Metal Louvers:

1. Blade Type: Vision-proof, inverted V or Vision-proof, inverted Y.
2. Metal and Finish: Galvanized steel, 0.0396 inch thick, hot-dip zinc coated and factory primed for paint finish.

2.5 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels, unless otherwise indicated:

1. Comply with clearance requirements of referenced quality standard for fitting. Comply with requirements in NFPA 80 for fire-rated doors.

2. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.
3. Metal Astragals: Premachine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

B. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of door(s) required.

1. Louvers: Factory install louvers in prepared openings.

2.6 SHOP PRIMING

A. Doors for Opaque Finish: Shop prime faces and edges of doors, including cutouts, with one coat of wood primer specified in Division 9 Section "Painting."

B. Doors for Transparent Finish: Shop seal faces and edge of doors, including cutouts, with stain (if required), other required pretreatments, and first coat of finish as specified in Division 9 Section "Painting."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames before hanging doors.

1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Division 8 Section "Door Hardware."

B. Manufacturer's Written Instructions: Install doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.

1. Install fire-rated doors in corresponding fire-rated frames according to UL10C and NFPA 252.

C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal cut surfaces after fitting and machining.

1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold.

a. Comply with UL10C and NFPA 252 for fire-rated doors.

2. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
3. Bevel fire-rated doors 1/8 inch in 2 inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.

D. Field-Finished Doors: Refer to the following for finishing requirements:

1. Division 9 Section "Painting."

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08 14 16

SECTION 08 31 00 - ACCESS DOORS AND PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawing and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Wall access doors and frames.
2. Fire-rated wall access doors and frames.
3. Ceiling access doors and frames.
4. Fire-rated ceiling access doors and frames.

B. Related Sections include the following:
1. Division 8 Section "Door Hardware" for mortise or rim cylinder locks and master keying.

1.3 SUBMITTALS

A. Product Data: For each type of door and frame indicated. Include construction details relative to materials, individual components and profiles, finishes, and fire ratings (if required) for access doors and frames.

B. Shop Drawings: Show fabrication and installation details of customized doors and frames. Include plans, elevations, sections, details, and attachments to other Work.

C. Schedule: Provide complete door and frame schedule, including types, general locations, sizes, construction details, latching or locking provisions, and other data pertinent to installation.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain doors and frames through one source from a single manufacturer.

B. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics per the following test method and that are labeled and listed by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. NFPA 252 or UL 10B for vertical access doors.
2. ASTM E 119 or UBC Standard 7.1 or UL 263 for horizontal access doors and frames.

C. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

1.5 COORDINATION

A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed equipment, and indicate on schedule specified in "Submittals" Article.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Access Doors:
   a. Bilco, Inc. (Floor Access)
   b. Cesco Products. (Ceiling & Wall Access)
   c. Dur-red Products. (Floor Access)
   d. J. L. Industries, Inc. (Ceiling & Wall Access)
   e. Karp Associates, Inc. (Ceiling & Wall Access)
   f. Larsen's Manufacturing Company. (Ceiling & Wall Access)

2.2 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Hot-Rolled Steel Sheets: ASTM A 569/A 569M, Commercial Steel (CS), Type B; free of scale, pitting, and surface defects; pickled and oiled; with minimum thickness indicated representing specified nominal thickness according to ASTM A 568/A 568M.

C. Cold-Rolled Steel Sheets: ASTM A 366/A 366M, Commercial Steel (CS), or ASTM A 620/A 620M, Drawing Steel (DS), Type B; stretcher-leveled standard of flatness; with minimum thickness indicated representing specified nominal thickness according to ASTM A 568/A 568M. Electrolytic zinc-coated steel sheet, complying with ASTM A 591/A 591M, Class C coating, may be substituted at fabricator's option.

D. Electrolytic Zinc-Coated Steel Sheet: ASTM A 591/A 591M, Commercial Steel (CS), with Class C coating and phosphate treatment to prepare surface for painting; with minimum thickness indicated representing specified nominal thickness according to ASTM A 568/A 568M for uncoated base metal.

E. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B, with A60 zinc-iron-alloy (galvannealed) coating or G60 mill-phosphatized zinc coating; stretcher-leveled standard of flatness; with minimum thickness indicated representing specified thickness according to ASTM A 924/A 924M.

F. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304; with minimum sheet thickness indicated representing specified thickness according to ASTM A 480/A 480M.

G. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.

H. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

I. Rolled-Stainless-Steel Floor Plate: ASTM A 793.

J. Drywall Beads: Edge trim formed from 0.0299-inch zinc-coated steel sheet formed to receive joint compound and in size to suit thickness.

K. Plaster Bead: Casing bead formed from 0.0299-inch zinc-coated steel sheet with flange formed out of expanded metal lath and in size to suit thickness of plaster.

2.3 PAINT

A. Shop Primers: Provide primers that comply with Division 9 Section "Painting."

B. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements in FS TT-P-664; selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

C. Shop Primer for Metallic-Coated Steel: Organic zinc-rich primer complying with SSPC-Paint 20 and compatible with topcoat.

D. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

2.4 ACCESS DOORS AND FRAMES

A. Flush, Insulated, Fire-Rated Access Doors and Frames with Exposed Trim: Fabricated from stainless-steel sheet.

1. Locations: Ceramic-tile, wall and ceiling surfaces.
2. Fire-Resistance Rating: Three-fourths or One hour, see plans.
3. Temperature Rise Rating: 250 deg F at the end of 30 minutes.
4. Door: Flush panel with a core of mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 0.036 inch.
5. Frame: Minimum 0.060-inch thick sheet metal with 1-inch wide, surface-mounted trim.
6. Hinges: Continuous piano hinge.
7. Automatic Closer: Spring type.
8. Lock: Key-operated cylinder lock with interior release.

B. Flush Access Doors and Frames with Exposed Trim: Fabricated from stainless-steel sheet.

1. Locations: Ceramic-tile, wall and ceiling surfaces.
2. Door: Minimum 0.060-inch thick sheet metal, set flush with exposed face flange of frame.
3. Frame: Minimum 0.060-inch thick sheet metal with 1-inch wide, surface-mounted trim.
4. Hinges: Continuous piano hinge.
5. Latch: Screwdriver operated cam latch.
6. Lock: Key-operated cylinder lock w/ full size interchangeable core.

2.5 FABRICATION

A. General: Provide access door assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Steel Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.

1. Exposed Flanges: Nominal 1 to 1-1/2 inches wide around perimeter of frame.

2. For trimless frames with drywall bead for installation in gypsum board assembly and gypsum veneer plaster, provide edge trim for gypsum board securely attached to perimeter of frames.
3. For trimless frames with plaster bead for full-bed plaster applications, provide zinc-coated expanded metal lath and exposed casing bead welded to perimeter of frames.
4. Provide mounting holes in frames to attach frames to metal or wood framing in plaster and drywall construction and to attach masonry anchors in masonry construction. Furnish adjustable metal masonry anchors.

D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling.

1. For recessed doors with plaster infill, provide self-furring expanded metal lath attached to door panel.

E. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

1. For cylinder lock, furnish two keys per lock and key all locks alike.
2. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.
3. For doors with latches released by and locks operated by mortise cylinders, prepare access doors for cylinders specified in Division 8 Section "Door Hardware."

F. Extruded Aluminum: After fabrication, apply manufacturer's standard protective coating on aluminum that will come in contact with concrete.

2.6 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

2.7 STAINLESS-STEEL FINISHES

A. Remove tool and die marks and stretch lines or blend into finish.

B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

C. Bright, Directional Polish: No. 4 finish.

1. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 PREPARATION

A. Advise installers of other work about specific requirements relating to access door and floor door installation, including sizes of openings to receive access door and frame, as well as locations of supports, inserts, and anchoring devices.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.

C. Install access doors with trimless frames flush with adjacent finish surfaces or recessed to receive finish material.

3.3 ADJUSTING AND CLEANING

A. Adjust doors and hardware after installation for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 08 31 00

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SECTION 08 51 13 - ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following types of aluminum-framed windows:

1. All exterior Architectural Performance Class (AW) windows furnished and installed as shown on drawings, specified in this section and designated in AAMA/WDMA/CSA 101/I.S.2/A440-2011 North American Fenestration Standard (NAFS-2011).
2. All labor, materials, tools, equipment and services needed to furnish and install AW Class windows.
3. Components furnished with installed windows.
4. Installation accessories furnished and installed.

B. Related Sections include the following:

1. Division 8 Section "Glazing" for glazing requirements for aluminum windows, including those specified to be factory glazed.

1.3 DEFINITIONS

A. AW: Architectural.

B. C: Commercial.

C. HC: Heavy Commercial.

D. Performance grade number, included as part of the AAMA/NWWDA product designation code, is actual design pressure in pounds force per square foot used to determine structural test pressure and water test pressure.

E. Structural test pressure, for uniform load structural test, is equivalent to 150 percent of design pressure.

F. Minimum test size is smallest size permitted for performance class (gateway test size). Products must be tested at minimum test size or at a size larger than minimum test size to comply with requirements for performance class.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide aluminum windows capable of complying with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified and that are of test size indicated below:

1. Size: As indicated on Drawings.

B. AAMA/NWWDA Performance Requirements: Provide aluminum windows of the performance class and grade indicated that comply with AAMA/NWWDA 101/I.S.2.

1. Performance Class: HC/AW 50 (minimum for all windows)
2. Performance Grade: Minimum for performance class indicated.

3. Exception to AAMA/NWWDA 101/I.S.2: In addition to requirements for performance class and performance grade, design glass framing system to limit lateral deflections of glass edges to less than 1/175 of glass-edge length or 3/4 inch, whichever is less, at design pressure based on the following:

a. Testing performed according to AAMA/NWWDA 101/I.S.2, Uniform Load Deflection Test.

4. Deflection: Design glass framing system to limit lateral deflections of glass edges to less than 1/175 of glass-edge length or 3/4 inch, whichever is less, at design pressure based on structural computations.
5. Basic Wind Speed: As indicated in miles per hour at 33 feet above grade. Determine wind loads and resulting design pressures applicable to Project according to the following, based on mean roof heights above grade as indicated on Drawings:

6. Design Pressure: 25 lbf/sq. ft.

C. Air Infiltration: Maximum rate not more than indicated when tested according to AAMA/NWWDA 101/I.S.2, Air Infiltration Test.

1. Maximum Rate: 0.3 cfm/sq. ft. of area at an inward test pressure of 1.57 lbf/sq. ft..

D. Water Resistance: No water leakage as defined in AAMA/NWWDA referenced test methods at a water test pressure equaling that indicated, when tested according to AAMA/NWWDA 101/I.S.2, Water Resistance Test.

1. Test Pressure: 15 percent of positive design pressure, but not less than 2.86 lbf/sq. ft. or more than 12 lbf/sq. ft..

E. Thermal Movements: Provide aluminum windows, including anchorage, that accommodate thermal movements of units resulting from the following maximum change (range) in ambient and surface temperatures without buckling, distortion, opening of joints, failure of joint sealants, damaging loads and stresses on glazing and connections, and other detrimental effects. Base engineering calculation on actual surface temperatures of materials due to solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F material surfaces.

F. Awning and Projected Windows: Comply with AAMA/NWWDA 101/I.S.2 for the following tests:

1. Sash Torsion Test.

2. Torsion Test.
3. Horizontal Concentrated Load Test on Latch Rail.
4. Vertical Concentrated Load Test on Latch Rail.
5. Torsion Load Test on Intermediate Frame Rails.
6. Vertical Concentrated Load Test on Intermediate Frame Rails.

7. Balance Arm Load Test.

1.5 SUBMITTALS

A. Product Data: Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions for each type of aluminum window indicated.

B. Shop Drawings: Include plans, ¼" scale wall elevations, typical unit elevations at ¾" scale, full size detail sections of every typical composite member, details, hardware, attachments to other Work, operational clearances. Include glazing details.

C. Samples for Verification: For aluminum window components required, prepared on Samples of size indicated below.

1. Main Framing Member: 12-inch- long, full-size sections of extrusions with factory-applied color finish.
2. Hardware: Full-size units with factory-applied finish.
3. Weather Stripping: 12-inch- long sections.
4. Architect reserves the right to require additional samples that show fabrication techniques, workmanship, and design of hardware and accessories.

D. Qualification Data: For Installer.

E. Product Test Reports: Based on evaluation of comprehensive tests performed within the last four years by a qualified testing agency, for each type, grade, and size of aluminum window. Test results based on use of down-sized test units will not be accepted.

F. Maintenance Data: For operable window sash, operating hardware, weather stripping, window system operators and finishes to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project.

B. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

C. Source Limitations: Obtain aluminum windows through one source from a single manufacturer.

D. Product Options: Drawings indicate size, profiles, and dimensional requirements of aluminum windows and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

E. Fenestration Standard: Comply with AAMA/NWWDA 101/I.S.2, "Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors," for minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

1. Provide AAMA-certified aluminum windows with an attached label.

F. Glazing Publications: Comply with published recommendations of glass manufacturers and GANA's "Glazing Manual" unless more stringent requirements are indicated.

G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify aluminum window openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1.8 WARRANTY *(Project Close-Out Item)*

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:

1. Failure to meet performance requirements.
2. Structural failures including excessive deflection.
3. Water leakage, air infiltration, or condensation.
4. Faulty operation of movable sash and hardware.
5. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
6. Insulting glass failure.

B. Warranty Period: Three years from date of Substantial Completion.

C. Warranty Period for Metal Finishes: 10 years from date of Substantial Completion.

D. Warranty Period for Glass: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. All Window Types, Unless Otherwise Noted:
   a. Wausau Corporation
      1) Model: 2250i Invent Retro XLT Window, Fixed, Awning, and Hopper with extended thermal separation.
      2) Glazing: dual
      3) Finish: Anodized clear
      4) Operator (at accessible windows): Standard Roto-Operator – 5 lb. maximum operating force.
      5) Latch (at accessible windows): Linear operation latch - 5 lb. maximum operating force.
   b. Or approved equal

2.2 MATERIALS, GENERAL

A. Aluminum Extrusions: Alloy and temper recommended by aluminum window manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi ultimate tensile strength, not less than 16,000-psi minimum yield strength, and not less than 0.062-inch thickness at any location for the main frame and sash members.

B. Fasteners: Aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by manufacturer to be noncorrosive and compatible with aluminum window members, trim, hardware, anchors, and other components. Cadmium-plated steel fasteners are not permitted.

1. Reinforcement: Where fasteners screw-anchor into aluminum less than 0.125 inch thick, reinforce interior with aluminum or nonmagnetic stainless steel to receive screw threads, or provide standard, noncorrosive, pressed-in, splined grommet nuts.

2. Exposed Fasteners: Unless unavoidable for applying hardware, do not use exposed fasteners. For application of hardware, use fasteners that match finish of member or hardware being fastened, as appropriate.

C. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated. Cadmium-plated steel anchors, clips, and accessories are not permitted.

D. Reinforcing Members: Aluminum, nonmagnetic stainless steel, nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient

strength to withstand design pressure indicated. Cadmium-plated steel reinforcing members are not permitted.

E. Compression-Type Weather Stripping: Provide compressible weather stripping designed for permanently resilient sealing under bumper or wiper action, and completely concealed when aluminum window is closed.

1. Weather-Stripping Material: Dense elastomeric gaskets complying with ASTM C 864.

F. Sliding-Type Weather Stripping: Provide woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric. Comply with AAMA 701/702.

1. Weather Seals: Provide weather stripping with integral barrier fin or fins of semirigid, polypropylene sheet or polypropylene-coated material.

G. Replaceable Weather Seals: Comply with AAMA 701/702.

H. Sealant: For sealants required within fabricated windows, provide window manufacturer's standard, permanently elastic, nonshrinking, and nonmigrating type recommended by sealant manufacturer for joint size and movement.

2.3 GLAZING

A. Glass and Glazing Materials: Refer to Division 8 Section "Glazing" for glass units and glazing requirements applicable to glazed aluminum window units.

B. Glass: Clear, insulating-glass units complying with Division 8 Section "Glazing."

C. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal. Manufacturer's standard factory-glazing system as indicated in Division 8 Section "Glazing."

D. Dual-Action Windows: Provide pivoting unit for double glazing, constructed of one sheet of glass in a removable sash for access to interior of unit, installed with airtight gaskets.

2.4 HARDWARE

A. General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with aluminum; designed to smoothly operate, tightly close, and securely lock aluminum windows and sized to accommodate sash or ventilator weight and dimensions. Cadmium-plated hardware is not permitted. Do not use aluminum in frictional contact with other metals. Where exposed, provide extruded, cast, or wrought aluminum or nonmagnetic stainless steel.

B. Counterbalancing Mechanism: Comply with AAMA 902.

C. Sill Cap/Track: Extruded-aluminum with natural anodized finish track of thickness, dimensions, and profile indicated; designed to comply with performance requirements indicated and to drain to the exterior.

D. Locks and Latches: Designed to allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only.

E. Roller Assemblies: Low-friction design.

F. Push-Bar Operators: Provide telescoping-type, push-bar operator designed to open and close ventilators with fixed screens.

G. Gear-Type Rotary Operators: Comply with AAMA 901 when tested according to ASTM E 405, Method A.

1. Operation Function: All ventilators move simultaneously and securely close at both jambs without using additional manually controlled locking devices.

H. Four- or Six-Bar Friction Hinges: Comply with AAMA 904.

1. Locking mechanism and handles for manual operation.
2. Friction Shoes: Provide friction shoes of nylon or other nonabrasive, nonstaining, noncorrosive, durable material.

I. Limit Devices: Provide limit devices designed to restrict sash or ventilator opening.

1. Safety Devices: Limit clear opening to 6 inches for ventilation; with custodial key release.

J. Pole Operators: Tubular-shaped anodized aluminum; with rubber-capped lower end and standard push-pull hook at top to match hardware design; of sufficient length to operate window without reaching more than 60 inches above floor; 1 pole operator and pole hanger per room that has operable windows more than 72 inches above floor.

K. Projected Windows: Provide the following operating hardware:

1. Window-Operating System at accessible project-out windows: Caldwell “Omni Drive” operator, designed to unlatch, open, and close operable sash with one movement, capable of operation with a closed fist.
2. Hinges: Concealed four- or six-bar friction hinges located on each jamb near top rail; two per ventilator.
3. Lock: Combination lever handle and cam-action lock with concealed pawl and keeper; one (two if units over 42 inches wide or high) per ventilator.
4. Lock: Key-operated custodial lock with removable handle.
5. Limit Device: Concealed friction adjustor, adjustable stay bar or support arms with adjustable, limited, hold-open limit device; located on jamb of each ventilator.

2.5 FABRICATION

A. General: Fabricate aluminum windows, in sizes indicated, that comply with requirements and that meet or exceed AAMA/NWWDA 101/I.S.2 performance requirements for the following window type and performance class. Include a complete system for assembling components and anchoring windows.

1. All Window Types: HC and AW (HC/AW 50 Minimum).

B. Fabricate aluminum windows that are reglazable without dismantling sash or ventilator framing.

C. Weather Stripping: Provide full-perimeter weather stripping for each operable sash and ventilator.

1. Horizontal-Sliding Windows: Provide operable sash with a double row of sliding weather stripping in horizontal rails and single- or double-row weather stripping in meeting or jamb stiles, as required to meet specified performance requirements. Provide compression-type weather stripping at perimeter of each movable panel where sliding-type weather stripping is not appropriate.

D. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.

E. Provide water-shed members above side-hinged ventilators and similar lines of natural water penetration.

F. Mullions: Provide mullions and cover plates as shown, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design loads of window units.

G. Subframes: Provide subframes with anchors for window units as shown, of profile and dimensions indicated but not less than 0.062-inch- thick extruded aluminum. Miter or cope corners, and weld and dress smooth with concealed mechanical joint fasteners. Finish to match window units. Provide subframes capable of withstanding design loads of window units.

H. Factory-Glazed Fabrication: Glaze aluminum windows in the factory where practical and possible for applications indicated. Comply with requirements in Division 8 Section "Glazing" and with AAMA/NWWDA 101/I.S.2.

I. Glazing Stops: Provide snap-on glazing stops coordinated with Division 8 Section "Glazing" and glazing system indicated. Provide glazing stops to match sash and ventilator frames.

2.6 FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

C. Clear Anodized Finish: AA-MA 611-98 Class I (Minimum thickness of 0.7 mils), etched, medium matte colored anodic coating natural aluminum coating.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances; rough opening dimensions; levelness of sill plate; coordination with wall flashings, vapor retarders, and other built-in components; operational clearances and other conditions affecting performance of work.

1. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
2. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components; Drawings; and Shop Drawings.

B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.

C. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction. All jambs and mullions shall have self adhered weather resistive barrier applied over wood prior to installation of window. All manufacturer’s leg extenders or other accessories shall be applied over window sealant/tape, then exterior wood/aluminum trim shall be installed.

D. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.

E. Metal Protection: Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials by complying with requirements specified in "Dissimilar Materials" Paragraph in Appendix B in AAMA/NWWDA 101/I.S.2.

3.3 FIELD QUALITY CONTROL

A. Remove and replace windows where inspection results indicate that they do not comply with specified requirements.

3.4 ADJUSTING

A. Adjust operating sashes and ventilators, screens, hardware, operators, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.

3.5 PROTECTION AND CLEANING

A. Protect window surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor window surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written recommendations.

B. Clean aluminum surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

C. Clean factory-glazed glass immediately after installing windows. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels and clean surfaces.

D. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION 08 51 13

SECTION 08 71 00 – DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Mechanical door hardware for:

a. Swinging doors.

B. Exclusions: Unless specifically listed in hardware sets, hardware is not specified in this section for:

1. Windows
2. Cabinets (casework), including locks in cabinets
3. Signage
4. Toilet accessories
5. Overhead doors
6. Installation.
7. Rough hardware.
8. Conduit, junction boxes & wiring.
9. Folding partitions, except cylinders where detailed.
10. Sliding aluminum doors, except cylinders where detailed.
11. Access doors and panels, except cylinders where detailed.

C. Related Sections:

1. Division 01 Section “Alternates” for alternates affecting this section.
2. Division 07 Section “Joint Sealants” for sealant requirements applicable to threshold installation specified in this section.
3. Division 26 sections for connections to electrical power system and for low-voltage wiring.

1.3 REFERENCES

A. UL - Underwriters Laboratories

1. UL 10B - Fire Test of Door Assemblies
2. UL 10C - Positive Pressure Test of Fire Door Assemblies
3. UL 1784 - Air Leakage Tests of Door Assemblies
4. UL 305 - Panic Hardware

B. ANSI - American National Standards Institute

1. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties

C. California Code of Regulations

1. Title 24: California Building Standards Code

1.4 SUBMITTALS

A. General:

1. Submit in accordance with Conditions of Contract and Division 01 requirements.

B. Action Submittals:

1. Product Data: Product data including manufacturers' technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Samples for Verification: If requested by Architect, submit production sample or sample installations of each type of exposed hardware unit in finish indicated, and tagged with full description for coordination with schedule.

    a. Samples will be returned to supplier in like-new condition. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.

3. Door Hardware Schedule: Submit schedule with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule as published by the Door and Hardware Institute. Indicate complete designations of each item required for each door or opening, include:

    a. Door Index; include door number, heading number, and Architects hardware set number.
    b. Opening Lock Function Spreadsheet: List locking device and function for each opening.
    c. Type, style, function, size, and finish of each hardware item.
    d. Name and manufacturer of each item.
    e. Fastenings and other pertinent information.
    f. Location of each hardware set cross-referenced to indications on Drawings.
    g. Explanation of all abbreviations, symbols, and codes contained in schedule.
    h. Mounting locations for hardware.
    i. Door and frame sizes and materials.
    j. Name and phone number for local manufacturer's representative for each product.

4. Key Schedule:

    a. Initiate and conduct meeting(s) with Owner representatives and hardware supplier to determine system keyway(s), keybow styles, structure, stamping, degree of physical security and degree of geographic exclusivity. Furnish Owner's written approval of the system; do not order keys or cylinders without written confirmation of actual requirements from the Owner.
    b. After Keying Conference, provide keying schedule listing levels of keying as well as explanation of key system's function, key symbols used and door numbers controlled.

c. Use ANSI/BHMA A156.28 “Recommended Practices for Keying Systems” as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
d. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
e. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
f. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion.
   1) Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.

5. Templates: After final approval of hardware schedule, provide templates for doors, frames and other work specified to be factory prepared for door hardware installation.

C. Informational Submittals:

1. Qualification Data: For Supplier and Installer.
2. Product Certificates for electrified door hardware, signed by manufacturer:

   a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.

3. Warranty: Special warranty specified in this Section.

D. Closeout Submittals:

1. Operations and Maintenance Data : Provide in accordance with Division 01 and include:

   a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
   b. Catalog pages for each product.
   c. Name, address, and phone number of local representative for each manufacturer.
   d. Final approved hardware schedule, edited to reflect conditions as-installed.
   e. Final keying schedule
   f. Copy of warranties including appropriate reference numbers for manufacturers to identify project.

1.5 QUALITY ASSURANCE

A. Product Substitutions: Comply with product requirements stated in Division 01 and as specified herein.

1. Where specific manufacturer’s product is named and accompanied by “No Substitute,” including make or model number or other designation, provide product specified. (Note: Certain products have been selected for their unique characteristics and particular project suitability.)

   a. Where no additional products or manufacturers are listed in product category, requirements for “No Substitute” govern product selection.

2. Where products indicate “acceptable manufacturers” or “acceptable manufacturers and products”, provide product from specified manufacturers, subject to compliance with specified requirements and “Single Source Responsibility” requirements stated herein.

B. Supplier Qualifications and Responsibilities: Recognized architectural hardware supplier with record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project.

1. Scheduling Responsibility: Preparation of door hardware and keying schedules.

C. Installer Qualifications: Qualified tradesmen, skilled in application of commercial grade hardware with record of successful in-service performance for installing door hardware similar in quantity, type, and quality to that indicated for this Project.

D. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.

E. Fire-Rated Door Openings: Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and are identical to products tested by Underwriters Laboratories, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.

F. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.

1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at tested pressure differential of 0.3-inch wg (75 Pa) of water.

G. Means of Egress Doors: Latches do not require more than 5 lbs (67 N) to release latch. Locks do not require use of key, tool, or special knowledge for operation.

H. Accessibility Requirements: For door hardware on doors in an accessible route, comply with governing accessibility regulations cited in “REFERENCES” article, herein.

1. Provide operating devices that do not require tight grasping, pinching, or twisting of wrist and that operate with force of not more than 5 lbs (22.2 N).
2. Maximum opening-force requirements:

   a. Interior, Non-Fire-Rated Hinged Doors: 5 lbs (22.2 N) applied perpendicular to door.
   b. Sliding or Folding Doors: 5 lbs (22.2 N) applied parallel to door at latch.
   c. Fire Doors: The minimum opening force allowable by the appropriate administrative authority, not to exceed 15 lbs (66.7N).

3. Bevel raised thresholds with slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high.
4. Adjust closer so that the time required to move the door from the 90 degree position to 12 degrees from the latch is 5 seconds minimum.

I. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Inspect and discuss preparatory work performed by other trades.
3. Review sequence of operation for each type of electrified door hardware.

4. Review required testing, inspecting, and certifying procedures.

J. Coordination Conferences:

1. Installation Coordination Conference: Prior to hardware installation, schedule and hold meeting to review questions or concerns related to proper installation and adjustment of door hardware.

a. Attendees: Door hardware supplier, door hardware installer, Contractor.
b. After meeting, provide letter of compliance to Architect, indicating when meeting was held and who was in attendance.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

1. Deliver each article of hardware in manufacturer’s original packaging.

C. Project Conditions:

1. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
2. Provide secure lock-up for door hardware delivered to Project, but not yet installed. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.

D. Protection and Damage:

1. Promptly replace products damaged during shipping.
2. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work.
3. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.

E. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

1.7 COORDINATION

A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

D. Direct shipments not permitted, unless approved by Contractor.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Years from date of Substantial Completion, for durations indicated.

a. Closers:
1) Mechanical: 30 years.

b. Exit Devices:
1) Mechanical: 3 years.

c. Locksets:
1) Mechanical: 3 years.

d. Continuous Hinges: 10 years
e. Key Blanks: Lifetime

2. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.

1.9 MAINTENANCE

A. Maintenance Tools:

1. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

1.10 REGULATORY REQUIREMENTS**:**

A. Locate latching hardware between 34 inches to 44 inches above the finished floor, per 2022 California Building Code, Section 11B-404.2.7.

1. Panic hardware: locate between 36 inches to 44 inches above the finished floor.

B. Handles, pull, latches, locks, other operable parts**:**

1. Readily openable from egress side with one hand and without tight grasping, tight pinching, or twisting of the wrist to operate. 2022 California Building Code Section 11B-309.4.
2. Force required to activate the operable parts: 5.0 pounds maximum, per 2022 California Building Code Section 11B-309.4.

C. Adjust doors to open with not more than 5.0-pounds pressure to open at exterior doors and 5.0-pounds at interior doors. As allowed per 2022 California Building Code Section 11B-404.2.9, local authority may increase the allowable pressure for fire doors to achieve positive latching, but not to exceed 15-pounds.

1. Exception: exterior doors' pressure-to-open may be increased to 8.5-pounds if: at a single location, and one of a bank of eight leafs or fraction of eight, and one leaf of this bank is fitted with a low- or high-energy operator.

D. Adjust door closer sweep periods so that from an open position of 90 degrees, the door will take at least 5 seconds to move to a point 12 degrees from the latch, measured to the landing side of the door, per 2022 California Building Code Section 11B-404.2.8.

E. Smooth surfaces at bottom 10 inches of push sides of doors, facilitating push-open with wheelchair footrests, per 2022 California Building Code Section 11B-404.2.10.

1. Applied kickplates and armor plates: bevel the left and right edges; free of sharp or abrasive edges.
2. Tempered glass doors without stiles: bottom rail may be less than 10 inches if top leading edge is tapered 60 degrees minimum.

F. Door opening clear width no less than 32 inches, measured from face of frame stop, or edge of inactive leaf of pair of doors, to door face with door opened to 90 degrees. Hardware projection not a factor in clear width if located above 30 inches and below 80 inches, and the hardware projects no more than 4 inches. 2022 California Building Code Section 11B-404.2.3.

1. Exception: In alterations, a projection of 5/8 inch (15.9 mm) maximum into the required clear width shall be permitted for the latch side stop.
2. Door closers and overhead stops: not less than 78 inches above the finished floor or ground, per 2022 California Building Code 11B-307.4.

G. Thresholds**:** floor or landing no more than 0.50 inches below the top of the threshold of the doorway, per 2022 California Building Code Section 11B-404.2.5. Vertical rise no more than 0.25 inches, change in level between 0.25 inches and 0.50 inches**:** beveled to slope no greater than 1**:**2 (50 percent slope). 2022 California Building Code Section 11B-303.2 & ~.3.

H. Floor stops**:** Do not locate in path of travel. Locate no more than 4 inches from walls, per DSA Policy #99-08 (Access).

I. Pairs of doors with independently-activated hardware both leafs**:** limit swing of right-hand or right-hand-reverse leaf to 90 degrees to protect persons reading wall-mounted tactile signage, per 2022 California Building Code Section 11B-703.4.2.

J. Door and door hardware encroachment: Doors, when fully open, shall not reduce the required width by more than 7 inches. Doors in any position shall not reduce the required width by more than one-half. 2022 California Building Code, Section 1005.7.1.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Where “No Substitute” is noted, submittals and substitution requests for other products will not be considered.

B. Approval of manufacturers and/or products other than those listed as “Scheduled Manufacturer” or “Acceptable Manufacturer” in the individual article for the product category shall be in accordance with QUALITY ASSURANCE article, herein.

C. Approval of products from manufacturers indicated in “Acceptable Manufacturers” is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer’s product.

D. Hand of Door: Drawings show direction of slide, swing, or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement as shown.

E. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

2.2 MATERIALS

A. Fasteners

1. Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation.
2. Furnish screws for installation with each hardware item. Finish exposed (exposed under any condition) screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
3. Provide concealed fasteners for hardware units exposed when door is closed except when no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless thru-bolts are required to fasten hardware securely. Review door specification and advise Architect if thru-bolts are required.
4. Install hardware with fasteners provided by hardware manufacturer.

B. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.

1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

2.3 HINGES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Ives 5BB series
2. Acceptable Manufacturers and Products: Hager BB series, McKinney TA/T4A series, Stanley FBB Series

B. Requirements:

1. Provide five-knuckle ball bearing hinges conforming to ANSI/BHMA A156.1.
2. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:

   a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches (114 mm) high
   b. Interior: Standard weight, steel, 4-1/2 inches (114 mm) high

3. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:

   a. Exterior: Heavy weight, bronze/stainless steel, 5 inches (127 mm) high
   b. Interior: Heavy weight, steel, 5 inches (127 mm) high

4. 2 inches or thicker doors:

   a. Exterior: Heavy weight, bronze or stainless steel, 5 inches (127 mm) high
   b. Interior: Heavy weight, steel, 5 inches (127 mm) high

5. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
6. Where new hinges are specified for existing doors or existing frames, provide new hinges of identical size to hinge preparation present in existing door or existing frame.
7. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:

    a. Steel Hinges: Steel pins
    b. Non-Ferrous Hinges: Stainless steel pins
    c. Out-Swinging Exterior Doors: Non-removable pins
    d. Out-Swinging Interior Lockable Doors: Non-removable pins
    e. Interior Non-lockable Doors: Non-rising pins

8. Width of hinges: 4-1/2 inches (114 mm) at 1-3/4 inch (44 mm) thick doors, and 5 inches (127 mm) at 2 inches (51 mm) or thicker doors. Adjust hinge width as required for door, frame, and wall conditions to allow proper degree of opening.
9. Doors 36 inches (914 mm) wide or less furnish hinges 4-1/2 inches (114 mm) high; doors greater than 36 inches (914 mm) wide furnish hinges 5 inches (127 mm) high, heavy weight or standard weight as specified.
10. Provide hinges with electrified options as scheduled in the hardware sets. Provide with sufficient number and wire gage to accommodate electric function of specified hardware. Locate electric hinge at second hinge from bottom or nearest to electrified locking component.
11. Provide mortar guard for each electrified hinge specified.
12. Provide spring hinges where specified. Provide two spring hinges and one bearing hinge per door leaf for doors 90 inches (2286 mm) or less in height. Provide one additional bearing hinge for each 30 inches (762 mm) of additional door height.

2.4 CYLINDRICAL LOCKS – GRADE 1

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Schlage ND Series
2. Acceptable Manufacturers and Products: No substitutions.

B. Requirements:

1. Provide cylindrical locks conforming to the following standards and requirements:

    a. ANSI/BHMA A156.2 Series 4000, Grade 1.
    b. UL 10C for 4’-0” x 10’-0” 3-hour fire door.

2. Cylinders: Refer to “KEYING” article, herein.
3. Provide cylindrical locksets exceeding the ANSI/BHMA A156.2 Grade 1 performance standards for strength, security, and durability in the categories below:

    a. Abusive Locked Lever Torque Test – minimum 3,100 inch-pounds without gaining access
    b. Cycle life - tested to minimum 10 million cycles per ANSI/BHMA A156.2 Cycle Test with no visible lever sag or use of performance aids such as set screws or spacers.

4. Provide locks with standard 2-3/4 inches (70 mm) backset, unless noted otherwise, with 1/2 inch latch throw. Provide proper latch throw for UL listing at pairs.
5. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.

6. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
7. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
8. Provide electrified options as scheduled in the hardware sets.
9. Lever Trim: Solid cast levers without plastic inserts, and wrought roses on both sides.

    a. Lever Design: As scheduled.

2.5 EXIT DEVICES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Von Duprin 99 series
2. Acceptable Manufacturers and Products: No substitutions

B. Requirements:

1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1, and UL listed for Panic Exit or Fire Exit Hardware. Cylinders: Refer to “KEYING” article, herein.
2. Provide touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
3. Touchpad: Extend minimum of one half of door width. Match exit device finish, stainless steel for US26, US26D, US28, US32, and US32D finishes; and for all other finishes, provide compatible finish to exit device. No plastic inserts are allowed in touchpads.
4. Provide exit devices with dead-latching feature for security and for future addition of alarm kits and/or other electrified requirements.
5. Provide flush end caps for exit devices.
6. Provide exit devices with manufacturer’s approved strikes.
7. Provide exit devices cut to door width and height. Install exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
8. Mount mechanism case flush on face of doors, or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
9. Removable Mullions: 2 inches (51 mm) x 3 inches (76 mm) steel tube. Where scheduled as keyed removable mullion, provide type that can be removed by use of a keyed cylinder, which is self-locking when re-installed.
10. Where lever handles are specified as outside trim for exit devices, provide heavy-duty lever trims with forged or cast escutcheon plates. Provide vandal-resistant levers that will travel to 90-degree down position when more than 35 pounds of torque are applied, and which can easily be re-set.

    a. Lever Style: Match lever style of locksets.

11. Accessibility: Maximum 5lbs force to retract latch bolt per CBC Chapter 11B.

    a. “AX” feature: touchpad directly retracts the latchbolt with 5 lb or less of force. Provide testing lab certification confirming that the mechanical device is independent third-party tested to meet this 5 lb requirement.

12. Provide UL labeled fire exit hardware for fire rated openings.
13. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.

2.6 CYLINDERS

A. Manufacturers:

1. Scheduled Manufacturer: Schlage
2. Acceptable Manufacturers: No substitutions

B. Requirements:

1. Provide permanent, interchangeable core cylinders/cores to match Owner's existing key system, compliant with ANSI/BHMA A156.5; latest revision, Section 12, Grade 1; permanent cylinders; cylinder face finished to match lockset, manufacturer's series as indicated. Refer to "KEYING" article, herein.
2. Replaceable Construction Cores.

a. Provide temporary construction cores replaceable by permanent cores, furnished in accordance with the following requirements.
   1) 3 construction control keys
   2) 12 construction change (day) keys.

b. Owner or Owner's Representative will replace temporary construction cores with permanent cores.

2.7 KEYING

A. Provide a factory registered keying system, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.

B. Provide cylinders/cores keyed into Owner's existing factory registered keying system, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.

C. Requirements:

1. Provide permanent cylinders/cores keyed by the manufacturer or Owner according to the following key system.

a. Master Keying system as directed by the Owner.
b. Schlage "E" keyway (Verify).
c. Permanent cores to be "111111" BITTED.

2. Forward bitting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements shall be cause for replacement of cylinders/cores involved at no additional cost to Owner.
3. Provide keys with the following features:

a. Material: Nickel silver; minimum thickness of .107-inch (2.3mm)

4. Identification:

a. Mark permanent cylinders/cores and keys with applicable blind code per DHI publication "Keying Systems and Nomenclature" for identification. Blind code marks shall not include actual key cuts.
b. Identification stamping provisions must be approved by the Architect and Owner.

c. Stamp cylinders/cores and keys with Owner's unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with "DO NOT DUPLICATE".
d. Failure to comply with stamping requirements shall be cause for replacement of keys involved at no additional cost to Owner.
e. Forward permanent cylinders/cores to Owner, separately from keys, by means as directed by Owner.

5. Quantity: Furnish in the following quantities.

a. Change (Day) Keys: 3 per cylinder/core.
b. Permanent Control Keys: 3.
c. Master Keys: 6.

2.8 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: LCN 4040XP series.
2. Acceptable Manufacturers and Products: No substitutions.

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
3. Cylinder Body: 1-1/2-inch (38 mm) diameter piston with 5/8-inch (16 mm) diameter double heat-treated pinion journal. QR code with a direct link to maintenance instructions.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards. Provide snap-on cover clip, with plastic covers, that secures cover to spring tube.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck. Provide graphically labelled instructions on the closer body adjacent to each adjustment valve. Provide positive stop on reg valve that prevents reg screw from being backed out.
7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.9 PROTECTION PLATES

A. Manufacturers:

1. Scheduled Manufacturer: Trimco
2. Acceptable Manufacturers: Ives

B. Requirements:

1. Provide kick plates, mop plates, and armor plates minimum of 0.050 inch (1 mm) thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
2. Sizes of plates:

   a. Kick Plates: 12 inches (254 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs
   b. Mop Plates: 4 inches (102 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs

2.10 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

A. Manufacturers:

1. Scheduled Manufacturers: Glynn-Johnson
2. Acceptable Manufacturers: Rixson, Sargent

B. Requirements:

1. Provide heavy duty concealed mounted overhead stop or holder as specified for exterior and interior vestibule single acting doors.
2. Provide heavy duty concealed mounted overhead stop or holder as specified for double acting doors.
3. Provide heavy or medium duty and concealed or surface mounted overhead stop or holder for interior doors as specified. Provide medium duty surface mounted overhead stop for interior doors and at any door that swings more than 140 degrees before striking wall, open against equipment, casework, sidelights, and where conditions do not allow wall stop or floor stop presents tripping hazard.
4. Where overhead holders are specified provide friction type at doors without closer and positive type at doors with closer.

2.11 DOOR STOPS AND HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer: Trimco
2. Acceptable Manufacturers: Ives

B. Provide door stops at each door leaf:

1. Provide wall stops wherever possible. Provide convex type where mortise type locks are used and concave type where cylindrical type locks are used.
2. Where a wall stop cannot be used, provide universal floor stops for low or high rise options.
3. Where wall or floor stop cannot be used, provide medium duty surface mounted overhead stop.

2.12 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

A. Manufacturers:

1. Scheduled Manufacturer: Zero International
2. Acceptable Manufacturers: National Guard, Pemko

B. Requirements:

1. Provide thresholds, weather-stripping (including door sweeps, seals, and astragals) and gasketing systems (including smoke, sound, and light) as specified and per architectural details. Match finish of other items.
2. Size of thresholds:

   a. Saddle Thresholds: 1/2 inch (13 mm) high by jamb width by door width
   b. Bumper Seal Thresholds: 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width

3. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.

2.13 SILENCERS

A. Manufacturers:

1. Scheduled Manufacturer: Trimco
2. Acceptable Manufacturers: Ives

B. Requirements:

1. Provide "push-in" type silencers for hollow metal or wood frames.
2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
3. Omit where gasketing is specified.

2.14 FINISHES

A. Finish: BHMA 626/652 (US26D); except:

1. Hinges at Exterior Doors: BHMA 630 (US32D)
2. Protection Plates: BHMA 630 (US32D)
3. Overhead Stops and Holders: BHMA 630 (US32D)
4. Door Closers: Powder Coat to Match
5. Wall Stops: BHMA 630 (US32D)
6. Weatherstripping: Clear Anodized Aluminum
7. Thresholds: Mill Finish Aluminum

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.

B. Wood Doors: DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Custom Steel Doors and Frames: HMMA 831.
3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.

C. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.

D. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.

E. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

F. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.

G. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

H. Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. Replace construction cores with permanent cores as indicated in keying section.

I. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

J. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Closers shall not be visible in corridors, lobbies and other public spaces unless approved by Architect.

K. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

L. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.

M. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

N. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

O. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

B. Occupancy Adjustment: Approximately three months after date of Substantial Completion, Installer shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.5 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.6 DEMONSTRATION

A. Provide training for Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Division 01 Section "Demonstration and Training."

3.7 DOOR HARDWARE SCHEDULE

A. Locksets, exit devices, and other hardware items are referenced in the following hardware sets for series, type and function. Refer to the above-specifications for special features, options, cylinders/keying, and other requirements.

B. Do not order material until submittal has been reviewed, stamped, and signed by Architect's door hardware consultant.

C. Hardware Sets:

HW SET: 01 - CLASSROOMS

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW SH 4.5 X 4.5 NRP	630	IVE
1	EA	PANIC HARDWARE	PA-AX-99-NL-OP-110MD-499F	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	ANTI-VANDAL TRIM	1097HA	630	TRM
1	EA	SURFACE CLOSER	4040XP EDA ST-1944 SPEC	689	LCN
1	EA	KICK PLATE	K0050 12" X 2" LDW B4E CS	630	TRM
1	EA	FLOOR STOP/HOLDER	1261/1263/1265/1267 (AS REQ'D) x 1268 ANCHOR	626	TRM
1	EA	RAIN DRIP	142AA (OMIT @ OVERHANG)	AA	ZER
1	SET	DOOR SEAL	429AA-S	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER

INSTALL SEAL BEFORE CLOSER & STRIKE.

HW SET: 02 – ELECTRICAL ROOM, MECHANICAL / CUSTODIAL

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW SH 4.5 X 4.5 NRP	630	IVE
1	EA	VANDL STOREROOM LOCK	ND96TD RHO	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH ST-1595 SPEC	689	LCN
1	EA	KICK PLATE	K0050 12" X 2" LDW B4E CS	630	TRM
1	EA	RAIN DRIP	142AA (OMIT @ OVERHANG)	AA	ZER
1	SET	DOOR SEAL	429AA-S	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER

INSTALL SEAL BEFORE CLOSER.

HW SET: 03 – STAFF RESTROOMS

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	STAFF RESTRM PRIVACY	ND85PD RHO	626	SCH
1	EA	CUT KEY	35-251 EMERGENCY KEY	468	SCH
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ	689	LCN
1	EA	KICK PLATE	K0050 12" X 2" LDW B4E CS	630	TRM
1	EA	MOP PLATE	KM050 4" X 1" LDW B4E CS	630	TRM
1	EA	WALL STOP	1270CV	626	TRM
1	EA	RAIN DRIP	142AA (OMIT @ OVERHANG)	AA	ZER
1	SET	DOOR SEAL	328AA-S (HEAD & JAMBS)	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER

HW SET: 04 – ROOM 9 STORAGE

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	ND70TD RHO	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	KICK PLATE	K0050 12" X 2" LDW B4E CS	630	TRM
1	SET	DOOR SEAL	328AA-S (HEAD & JAMBS)	AA	ZER

HW SET: 05 – HVAC CLOSETS IN CLASSROOMS

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	VANDL STOREROOM LOCK	ND96TD RHO	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	OH STOP & HOLDER	90H	630	GLY
1	EA	KICK PLATE	K0050 12" X 2" LDW B4E CS	630	TRM
1	SET	DOOR SEAL	328AA-S (HEAD & JAMBS)	AA	ZER

End of Section

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SECTION 08 81 00 – GLASS GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:

1. Windows.

B. Related Sections include the following:

1. Division 8 Section "Windows."

2. Division 8 Section “Hollow Metal Doors”.

1.3 DEFINITIONS

A. Manufacturers of Glass Products: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.

D. Deterioration of Coated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.

E. Deterioration of Insulating Glass: Failure of hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or

gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:

1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300. according to the following requirements.

C. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.5 SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Samples: For the following products, in the form of 12-inch- square Samples for glass.

1. Each color of tinted float glass.
2. Coated vision glass.
3. Insulating glass for each designation indicated.
4. For each color (except black) of exposed glazing sealant indicated.

C. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.

1. For solar-control low-e-coated glass, provide documentation demonstrating that manufacturer of coated glass is certified by coating manufacturer.

D. Qualification Data: For installers.

E. Preconstruction Adhesion and Compatibility Test Report: From glazing sealant manufacturer indicating glazing sealants were tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.

F. Product Test Reports: For each of the following types of glazing products:

1. Tinted float glass.
2. Coated float glass.
3. Insulating glass.
4. Glazing sealants.
5. Glazing gaskets.

G. Warranties: Special warranties specified in this Section.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under the National Glass Association Glazier Certification Program as Level 2 (Senior Glaziers) or Level 3 (Master Glaziers).

B. Source Limitations for Glazing Accessories: Obtain glazing accessories through one source from a single manufacturer for each product and installation method indicated.

C. Glass Product Testing: Obtain glass test results for product test reports in "Submittals" Article from a qualified testing agency based on testing glass products.

1. Glass Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

D. Elastomeric Glazing Sealant Product Testing: Obtain sealant test results for product test reports in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period.

1. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated, as documented according to ASTM E 548.
2. Test elastomeric glazing sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.

E. Safety Glazing Products:

1. Comply with testing requirements in CPSC 16 CFR Part 1201.
2. Identify each pane of safety glazing with a manufacturer’s designation specifying who applied the designation, the manufacturer or installer, and the safety glazing standard with which it complies per 2022 CBC Section 2406.3. Designation shall be acid etched, sand blasted, ceramic fired, laser etched, embossed, or of a type that once applied, cannot be removed without being destroyed.

F. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the following testing and inspecting agency:

1. Insulating Glass Certification Council.
2. Associated Laboratories, Inc.

G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1.9 WARRANTY (Project Close-Out Item)

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form, made out to Owner and signed by coated-glass manufacturer agreeing to replace coated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form, made out to Owner and signed by insulating-glass manufacturer agreeing to replace insulating-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Products: Subject to compliance with requirements, provide one of the products specified, or preapproved equal.
2. Manufacturers: One of the following for each glass type:

1) Viracon, Inc.
2) Vitro Architectural Glass
3) Andersen Windows (for total unit performance).

2.2 GLASS PRODUCTS

A. Annealed Float Glass: ASTM C 1036, Type I (transparent flat glass), Quality-Q3; of class indicated.

1. Ultra-Clear (Low-Iron) Float Glass: Class I (clear); with a minimum 91 percent visible light transmission and a minimum solar heat gain coefficient of 0.87.

B. Heat-Treated Float Glass: ASTM C 1048; Type I (transparent flat glass); Quality-Q3; of class, kind, and condition indicated.

1. Provide Kind HS (heat-strengthened) float glass in place of annealed float glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.
2. For uncoated glass, comply with requirements for Condition A.
3. For coated vision glass, comply with requirements for Condition C (other uncoated glass).
4. Provide Kind FT (fully tempered) float glass in place of annealed or Kind HS (heat-strengthened) float glass where safety glass is indicated.

C. Insulating-Glass Units, General: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with ASTM E 774 for Class CBA units and with requirements specified in this Article and in Part 2 "Insulating-Glass Units" Article.

1. Provide Kind FT (fully tempered) glass lites where safety glass is indicated.
2. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated for insulating-glass units are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.
3. Sealing System: Dual seal, with primary and secondary sealants as follows:

    a. Manufacturer's standard sealants.
    b. Polyisobutylene and polysulfide.
    c. Polyisobutylene and silicone.
    d. Polyisobutylene and hot-melt butyl.

4. Spacer Specifications: Manufacturer's standard spacer material and construction complying with the following requirements:

    a. Spacer Material: Aluminum with mill or clear anodic finish or Galvanized steel.
    b. Spacer bar to be bronze color where visible.
    c. Desiccant: Molecular sieve or silica gel, or blend of both.
    d. Corner Construction: Manufacturer's standard corner construction.

2.3 GLASS AND GLAZING TYPES

A. Type A: 1 inch Insulated Glass with 1/2 inch air space – Low E
Design requirements: Overall U-factor 0.3, Overall SHGC 0.2, Overall VT 0.5

1. Exterior Sheet: 1/4 inch
2. Interior sheet: 1/4 inch

B. Type B: 1 inch Tempered Insulated Glass with 1/2 inch air space – Low E (Safety Glazing – see Quality Assurance section for identification requirements)
Design requirement: Overall U-factor 0.3, Overall SHGC 0.2, Overall VT 0.5

1. Exterior Sheet: 1/4 inch tempered
2. Interior sheet: 1/4 inch tempered

2.4 GLAZING SEALANTS

A. General: Provide products of type indicated, complying with the following requirements:

1. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. One Part Silicone-Rubber Glazing Sealant (SR-GS): Elastomeric silicone sealant complying with FS TT-S-001543, Class A, non-sag. Provide acid type recommended by manufacturer where only nonporous bond surfaces are contacted; provide non acid type recommended by manufacturer where one or more porous bond surfaces are contacted.

C. One Part Polysulfide Glazing Sealant (1Ps-GS): Polysulfide elastomeric sealant complying with FS TT-S-00230, Class A, Type II; Compounded specifically for exterior exposed glazing.

D. One Part Acrylic Glazing Sealant (1Ac-GS): Thermo-plastic acrylic terpolymer, complying with FS TT-S-00230, Class B, Type II: solids of 95% acrylic.

E. Preformed Butyl Rubber Glazing Sealant (PBuR-GS): Compound of polymerized butyl rubber and inert fillers, with or without polyisobutylene modification, solvent-based, 95% solids, formed and coiled on release paler; tack free in 24 hours, paintable, nonstaining; plain, preshimmed or reinforced as required for proper installation and setting of glass.

F. Glazing Sealants for Fire-Resistive Glazing Products: Identical to products used in test assemblies to obtain fire-protection rating.

2.5 GLAZING GASKETS

A. Vinyl Foam Glazing Tape (VF-GT): Closed cell, flexible, self-adhesive, non-extruding, polyvinyl chloride foam tape; recommended by manufacturer for exterior, exposed, watertight installation of glass, with only nominal pressure in the glazing channel; comply with ASTM D 1667.

2.6 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

G. Perimeter Insulation for Fire-Resistive Glazing: Identical to product used in test assembly to obtain fire-resistance rating.

2.7 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with outdoor and indoor faces.

C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing glazing, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep system.
3. Minimum required face or edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches as follows:

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until just before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant, where indicated.

G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 SEALANT GLAZING

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.6 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 08 81 00

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SECTION 08 91 00 - LOUVERS AND VENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Fixed, extruded-aluminum louvers.
2. Fixed, formed-metal louvers.

B. Related Sections include the following:

1. Division 7 Section "Joint Sealants" for sealants installed in perimeter joints between louver frames and adjoining construction.
2. Division 8 Section "Custom Steel Doors and Frames" for louvers in hollow-metal doors and frames.
3. Division 8 Section "Flush Wood Doors" for louvers in wood doors.
4. Division 9 Section "Painting (Professional Line Products)" for field painting louvers.
5. Division 23 Section "HVAC Instrumentation and Controls" for electric, electronic, and pneumatic control of adjustable metal louvers.
6. Division 23 Sections for louvers that are a part of mechanical equipment.
7. Division 26 Sections for electrical power connections for motor-operated adjustable metal louvers.

1.3 DEFINITIONS

A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.

B. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Provide louvers capable of withstanding the effects of earthquake motions determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."

B. Thermal Movements: Provide louvers that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other

detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

C. Air-Performance, Water-Penetration, Air-Leakage, and Wind-Driven Rain Ratings: Provide louvers complying with performance requirements indicated, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals and installation instruction for required products, including finishes.

B. Shop Drawings: For louvers and accessories. Submit shop drawings for fabrication and erection of louver units and accessories. Include plans, elevations, sections, details, and attachments to other Work. Show blade profiles, angles, and spacing. Indicate material finishes, fasteners, joinery and other information to determine compliance with specification requirements.

C. Samples for Verification: For each type of metal finish required.

D. Finish Samples: Submit 6” square samples of each required finish. Prepare samples on metal of the same gage and alloy to be used in the work. Where normal color and texture variations are to be expected, include 2 ore more units in each sample showing limits of such variation.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain all louvers and vents through one source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

B. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures except otherwise indicated

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify louver openings by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Louvers:

a. Airline Products Co.
b. Airolite Company (The).
c. Greenheck.
d. H.H. Robertson Co.
e. Ruskin Company; Tomkins PLC.

2.2 MATERIALS

A. Aluminum Extrusions: ASTM B 221, alloy 6063-T5 or T-52.

B. Aluminum Sheet: ASTM B 209, alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.

C. Aluminum Castings: ASTM B 26/B 26M, alloy 319.

D. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 zinc coating, mill phosphatized.

E. Fasteners: Of same basic metal and alloy as fastened metal, unless otherwise indicated. Do not use metals that are incompatible with joined materials. Fasteners for exterior applications may be hot-dip galvanized, stainless steel or aluminum.

1. Use types and sizes, gauges and lengths, to suit unit installation conditions.
2. Use Phillips flat-head screws for exposed fasteners, unless otherwise indicated.

F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.3 FABRICATION, GENERAL

A. Coordinate field measurements and shop drawings with fabrications and assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Vertical Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates.

1. Continuous Vertical Assemblies: Fabricate units without interrupting blade-spacing pattern unless horizontal mullions are indicated.

C. Maintain equal louver blade spacing to produce uniform appearance.

D. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

1. Frame Type: Exterior flange, unless otherwise indicated.

E. Include supports, anchorages, and accessories required for complete assembly.

F. Provide vertical mullions of type and at spacings indicated, but not more than recommended by manufacturer, or 72 inches o.c., whichever is less.

1. Exposed Mullions: Where indicated, provide units with exposed mullions of same width and depth as louver frame. Where length of louver exceeds fabrication and handling limitations, provide interlocking split mullions designed to permit expansion and contraction.
2. Exterior Corners: Prefabricated corner units with mitered blades with concealed close-fitting splices and with semirecessed mullions at corners, unless otherwise indicated.

G. Where indicated, provide subsills made of same material as louvers or extended sills for recessed louvers.

H. Join frame members to each other and to fixed louver blades with fillet welds, threaded fasteners, or both, as standard with louver manufacturer, concealed from view, unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.4 FIXED, EXTRUDED-ALUMINUM LOUVERS

A. Horizontal, Drainable-Blade Louver (FEAL-1):

1. Louver Depth: Size and depth as indicated.
2. Frame and Blade Nominal Thickness: As required to comply with structural performance requirements, but not less than 0.080 inch for blades and 0.080 inch for frames.
3. Mullion Type: Exposed.
4. Performance Requirements:

a. Free Area: Not less than 8.0 sq. ft. for 48-inch- wide by 48-inch- high louver.
b. Point of Beginning Water Penetration: Not less than 950 fpm.
c. Air Performance: Not more than 0.15-inch wg static pressure drop at 950-fpm free-area velocity.

5. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.5 FIXED, FORMED-METAL LOUVERS

A. Horizontal, Drainable-Blade Louver (FFML-1):

1. Louver Depth: 4 inches, unless otherwise indicated.

2. Frame and Blade Material and Nominal Thickness: Galvanized steel sheet, of thickness required to comply with structural performance requirements, but not less than 0.0635 inch, unless otherwise indicated.
3. Louver Blade Angle: 30 degrees.
4. Formed Metal Blades: No. 666
5. Mullion Type: Exposed.
6. Performance Requirements:

    a. Free Area: Not less than 8.0 sq. ft. for 48-inch- wide by 48-inch- high louver.
    b. Point of Beginning Water Penetration: Not less than 960 fpm.
    c. Air Performance: Not more than 0.15-inch wg static pressure drop at 960-fpm free-area velocity.

7. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.6 LOUVER SCREENS

A. General: Provide removable screen at each exterior louver.

1. Screen Location for Fixed Louvers: Interior face.
2. Screen Location for Adjustable Louvers: Interior face, unless otherwise indicated.
3. Screening Type: Bird screening where indicated; insect screening where indicated.

B. Secure screens to louver frames with stainless-steel machine screws, spaced a maximum of 6 inches from each corner and at 12 inches o.c.

C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.

1. Metal: Same kind and form of metal as indicated for louver to which screens are attached. Reinforce extruded-aluminum screen frames at corners with clips.
2. Finish: Same finish as louver frames to which louver screens are attached.
3. Type: Rewirable frames with a driven spline or insert for securing screen mesh.

D. Louver Screening for Aluminum Louvers:

1. Bird Screening (where shown): Aluminum, 1/2-inch- square mesh, 0.063-inch wire.
2. Insect Screening (where shown): Aluminum, 18-by-16 mesh, 0.012-inch wire.

E. Louver Screening for Galvanized Steel Louvers:

1. Bird Screening: Galvanized steel, 1/2-inch- square mesh, 0.041-inch wire.
2. Insect Screening: Galvanized steel, 18-by-14 mesh, 0.011-inch wire.

2.7 BLANK-OFF PANELS

A. Uninsulated, Blank-off Panels:

1. Aluminum sheet for aluminum louvers, not less than 0.050-inch nominal thickness, unless otherwise indicated.
2. Galvanized steel sheet for galvanized steel louvers, not less than 0.052-inch nominal thickness, unless otherwise indicated.

3. Panel Finish: Same finish applied to louvers, unless otherwise indicated.
4. Attach blank-off panels to back of louver frames with stainless-steel, sheet metal screws.

2.8 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish louvers after assembly.

2.9 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with system established by the Aluminum Association for designating aluminum finishes.

B. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

C. Class I, Color Anodic Finish: AA-M12C22A42/A44 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.
1. Color: As selected by Architect from the full range of industry colors and color densities.

D. Conversion-Coated and Factory-Primed Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below).

1. Organic Coating: Air-dried primer of not less than 2-mil dry film thickness.

E. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Apply baked enamel complying with paint manufacturer's written instructions for cleaning, conversion coating, and painting.

1. Organic Coating: Thermosetting, modified-acrylic enamel primer/topcoat system complying with AAMA 2603, except with a minimum dry film thickness of 1.5 mils, medium gloss.
2. Color: As selected by Architect from manufacturer's full range.

F. High-Performance Organic-Coating Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Fluoropolymer Two-Coat Coating System: Manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605.

2.10 GALVANIZED STEEL SHEET FINISHES

A. Surface Preparation: Clean surfaces of dirt, grease, and other contaminants. Clean welds, mechanical connections, and abraded areas and repair galvanizing according to ASTM A 780. Apply a conversion coating suited to the organic coating to be applied over it.

B. Factory Priming for Field-Painted Finish: Where field painting after installation is indicated, apply an air-dried primer immediately after cleaning and pretreating.

C. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil for topcoat. Comply with paint manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

D. Powder-Coated Finish: Prepare, treat, and coat galvanized metal louvers to comply with resin manufacturer's written instructions and as follows:

1. Prepare louvers by thoroughly removing grease, dirt, oil, flux, and other foreign matter.
2. Treat prepared louvers with zinc-phosphate pretreatment, rinse, and seal surfaces.
3. Apply thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 1.5 mils.
4. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

A. Locate and place louvers and vents level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Form closely fitted joints with exposed connections accurately located and secured. Provide reveals and openings for sealants and joint fillers, as indicated.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

F. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.

G. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Division 7 Section "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

A. Test operation of adjustable louvers and adjust as needed to produce fully functioning units that comply with requirements.

B. Clean exposed surfaces of louvers and vents that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.

C. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

D. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 08 91 00 (3/06)

SECTION 09 21 16 - GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Interior gypsum wallboard.
2. Vinyl tackboard wall paneling.

B. Related Sections include the following:

1. Division 5 Section "Steel Studs and Joists" for load-bearing and non-load-bearing steel framing.
2. Division 6 Section "Rough Carpentry" for wood framing and furring**,** and gypsum sheathing applied over wood framing.
3. Division 7 Section "Thermal Insulation" for insulation and vapor retarders installed in gypsum board assemblies.
4. Division 9 Section "Gypsum Board Shaft-Wall Assemblies" for framing, gypsum panels, and other components of shaft wall assemblies.
5. Division 9 Section "Ceramic Tile" for cementitious backer units installed as substrates for ceramic tile.

1.3 DEFINITIONS

A. Gypsum Board Terminology: Refer to ASTM C 11 for definitions of terms for gypsum board assemblies not defined in this Section or in other referenced standards.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

1.5 QUALITY ASSURANCE

A. Single Source: Obtain gypsum board products from a single manufacturer, or from manufacturer’s recommended by the prime manufacturer of gypsum board.

B. Fire-Test-Response Characteristics: For gypsum board assemblies with fire-resistance ratings, provide materials and construction identical to those tested in assembly indicated

according to ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance-Rated Assemblies: Indicated by design designations from UL's "Fire Resistance Directory." and GA-600, "Fire Resistance Design Manual".

C. Sound Transmission Characteristics: For gypsum board assemblies with STC ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by a qualified independent testing agency.

1. STC-Rated Assemblies: Indicated by design designations from GA-600, "Fire Resistance Design Manual."

D. Gypsum Board Terminology Standard: GA-505.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Stack gypsum panels flat to prevent sagging.

C. Handle gypsum board to prevent damage to edges, ends and surfaces. Protect metal corner beads and trims from being bent or damaged.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

1. Cold Weather Protection: When ambient outdoor temperatures are below 55 degrees F, maintain continuous, uniform, comfortable building working temperatures of not less than 55 degrees F for a minimum of 48 hours prior to, during and following application of gypsum board and joint treatment or bonding of adhesives.

2. Ventilation: Ventilate building spaces as required to remove water in excess of that required for drying of joint treatment material immediately after its application. Avoid drafts during dry, hot weather to prevent too rapid drying.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products of the following:

1. Gypsum Board and Related Products:

a. American Gypsum Co.
b. Domtar Gypsum
c. Flintkote Products, Genstar Building Materials Co.
d. G-P Gypsum Corp.
e. Gold Bond Building Products Div., National Gypsum Company.
f. United States Gypsum Co.
g. Pabco

2. Direct Suspension Systems:

a. Chicago Metallic Corp.
b. Donn Corporation
c. United States Gypsum Co.

2.2 INTERIOR GYPSUM WALLBOARD

A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.

B. Gypsum Wallboard: ASTM C 36.

1. Regular Type:

a. Thickness: 5/8 inch, unless otherwise indicated.
b. Long Edges: Tapered.
c. Location: As indicated.

2. Type X:

a. Thickness: 5/8 inch, unless otherwise indicated.
b. Long Edges: Tapered.
c. Location: Where required for fire-resistance-rated assembly.

C. Gypsum Backing Wallboard for Multi-Layer Application: ASTM C 442.

1. Core: 5/8 inch, regular type and 5/8 inch, Type X for rated assemblies.
2. Long Edges: Manufacturer's standard.
3. Location: As indicated.

D. Proprietary Abuse-Resistant Gypsum Wallboard: ASTM C 36, manufactured to produce greater resistance to surface indentation and through-penetration than standard gypsum panels.

1. Products: Subject to compliance with requirements, provide one of the following:

a. National Gypsum Company; Gold Bond Hi-Abuse Wallboard.
b. United States Gypsum Co.; SHEETROCK Brand Abuse-Resistant Gypsum Panels.

2. Core: 5/8 inch, regular type and 5/8 inch, Type X for fire rated assemblies.

E. Moisture and Mold Resistant Gypsum Backing Board: ASTM C 1396.

1. Core: 5/8 inch, regular type and 5/8 inch, Type X for fire rated assemblies.

2.3 BACKING PANELS

A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.

B. Fiberboard Tack Base (for vinyl wall covering specified elsewhere): Fed. Spec. LLL-1-535.

1. Products:

a. United States Gypsum Corp.

2. Thickness: ½ inch thick. Primed and ironed.
3. Flame Spread: 25
4. Smoke Developed: 10
5. ASTM E84: Meets or exceeds (Class A).

C. Prefinished Vinyl Covered Tackboard Wall Paneling: ASTM E-84-87.

1. Products:
   a. Lamvin, Inc. 760. 806.6400
   b. Chatfield Clark. 909.823.4297

2. Thickness: ½ inch by 48 inches by full height
3. Flame Spread: Class II – 75 or less.
4. Trims: “L” angle, “H” bead, “J” bead and etc., as manufactured by panel manufacturer.

2.4 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
2. Shapes:

   a. Cornerbead: Use at outside corners, unless otherwise indicated.
   b. LC-Bead: J-shaped; exposed long flange receives joint compound; use at exposed panel edges.
   c. L-Bead: L-shaped; exposed long leg receives joint compound; use where indicated.
   d. U-Bead: J-shaped; exposed short flange does not receive joint compound; use where indicated.
   e. Expansion (Control) Joint: Use where indicated.
   f. Curved-Edge Cornerbead: With notched or flexible flanges; use at curved openings.

B. Exterior Trim: ASTM C 1047.

1. Material: Hot-dip galvanized steel sheet or rolled zinc.
2. Shapes:

a. Cornerbead: Use at outside corners.
b. LC-Bead: J-shaped; exposed long flange receives joint compound; use at exposed panel edges.
c. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening. Use where indicated.

C. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Fry Reglet Corp.
b. Gordon, Inc.
c. MM Systems Corporation.
d. Pittcon Industries.

2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, alloy 6063-T5.
3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified, unless otherwise indicated.

D. High Impact Corner Guards:

1. Koroseal Wall Protection Systems., G100 High Impact Corner Guard (2”x2” 90 degrees), .080 thickness extruded from chemical and stain resistant PVC with the addition of impact modifiers, embossed texture.
2. Corner guards to be 48 inches high unless otherwise indicated.
3. Color selection by Architect from manufacturer’s full range of colors.
4. Top and bottom caps of injection molded thermoplastic. Color to match corner guards.
5. Corner Guards shall have continuous aluminum retainer.

2.5 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475.

B. Joint Tape:

1. Interior Gypsum Wallboard: Paper.
2. Exterior Gypsum Soffit Board: Paper.
3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
4. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use setting-type, sandable topping compound.

5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.

D. Joint Compound for Exterior Applications:

1. Exterior Gypsum Soffit Board: Use setting-type taping and setting-type, sandable topping compounds.
2. Glass-Mat Gypsum Sheathing Board: As recommended by manufacturer.

E. Joint Compound for Tile Backing Panels:

1. Water-Resistant Gypsum Backing Board: Use setting-type taping and setting-type, sandable topping compounds.
2. Glass-Mat, Water-Resistant Backing Panel: As recommended by manufacturer.
3. Cementitious Backer Units: As recommended by manufacturer.

2.6 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

C. Gypsum Board Nails and Screws: Comply with ASTM C-840.

D. Isolation Strip at Exterior Walls:

1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

E. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

F. Thermal Insulation: As specified in Division 7 Section "Building Insulation."

G. Polyethylene Vapor Retarder: As specified in Division 7 Section "Building Insulation."

H. Gypsum Board Nails and Screws: ASTM C-840

I. Resilient Channels: USG RC-1.

J. Concealed Acoustical Sealant: Non-drying, non-hardening, non-skinning, non-staining, non-bleeding, gunnable sealant for concealed applications per ASTM C 919.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Suspended Ceilings: Coordinate installation of ceiling suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive ceiling hangers at spacing required to support ceilings and that hangers will develop their full strength.

1. Furnish concrete inserts and other devises indicated to other trades for installation in advance of time needed for coordination and construction.

3.3 INSTALLING STEEL FRAMING, GENERAL

A. Installation Standards: ASTM C 754, and ASTM C 840 requirements that apply to framing installation.

B. Install supplementary framing, blocking, and bracing at terminations in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. Comply with details indicated and with gypsum board manufacturer's written recommendations or, if none available, with United States Gypsum's "Gypsum Construction Handbook."

C. Isolate steel framing from building structure at locations indicated to prevent transfer of loading imposed by structural movement.

1. Isolate ceiling assemblies where they abut or are penetrated by building structure.
2. Isolate partition framing and wall furring where it abuts structure, except at floor. Install slip-type joints at head of assemblies that avoid axial loading of assembly and laterally support assembly.

a. Use deep-leg deflection track where indicated.
b. Use proprietary deflection track where indicated.
c. Use proprietary firestop track where indicated.

D. Do not bridge building control and expansion joints with steel framing or furring members. Frame both sides of joints independently.

3.4 INSTALLING STEEL SUSPENDED CEILING AND SOFFIT FRAMING

A. Suspend ceiling hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with the location of hangers required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
3. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail.
4. Secure rod, flat and angle hangers to structure, including intermediate framing members, by attaching to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
5. Do not support ceilings directly from permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
6. Do not attach hangers to steel deck tabs.
7. Do not attach hangers to steel roof deck. Attach hangers to structural members.
8. Do not connect or suspend steel framing from ducts, pipes, or conduit.

B. Installation Tolerances: Install steel framing components for suspended ceilings so members for panel attachment are level to within 1/8 inch in 12 feet measured lengthwise on each member and transversely between parallel members.

C. Sway-brace suspended steel framing with hangers used for support.

D. For exterior soffits, install cross bracing and framing to resist wind uplift.

E. Screw furring to wood framing.

F. Wire-tie or clip furring channels to supports, as required to comply with requirements for assemblies indicated.

G. Install suspended steel framing components in sizes and spacings indicated, but not less than that required by the referenced steel framing and installation standards.

1. Hangers: 48 inches o.c.
2. Carrying Channels (Main Runners): 48 inches o.c.
3. Furring Channels (Furring Members): 16 inches o.c.

H. Grid Suspension System: Attach perimeter wall track or angle where grid suspension system meets vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

3.5 APPLYING AND FINISHING PANELS, GENERAL

A. Gypsum Board Application and Finishing Standards: ASTM C 840 and GA-216. Comply with 2010 CBC Section 2508.

B. Install sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.

C. Install ceiling board panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

D. Install gypsum panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

E. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

F. Attach gypsum panels to steel studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

G. Attach gypsum panels to framing provided at openings and cutouts.

H. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members using resilient channels, or provide control joints to counteract wood shrinkage.

I. Form control and expansion joints with space between edges of adjoining gypsum panels.

J. Cover both faces of steel stud partition framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect open concrete coffers, concrete joists, and other structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by coffers, joists, and other structural members; allow 1/4- to 3/8-inch-wide joints to install sealant.

K. Isolate perimeter of non-load-bearing gypsum board partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations, and trim edges with U-bead edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

L. Floating Construction: Where feasible, including where recommended in writing by manufacturer, install gypsum panels over wood framing, with floating internal corner construction.

M. STC-Rated Assemblies: Seal construction at perimeters, behind control and expansion joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through gypsum board assemblies, including sealing partitions above acoustical ceilings.

N. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's written recommendations.

1. Space screws a maximum of 12 inches o.c. for vertical applications.

O. Space fasteners in panels that are tile substrates a maximum of 8 inches o.c.

3.6 PANEL APPLICATION METHODS

A. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to the greatest extent possible and at right angles to framing, unless otherwise indicated.
2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

    a. Stagger abutting end joints not less than one framing member in alternate courses of board.
    b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.

3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.

B. Multilayer Application on Partitions/Walls: Apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.

1. Z-Furring Members: Apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.

C. Single-Layer Fastening Methods: Apply gypsum panels to supports with steel drill screws.

D. Multilayer Fastening Methods: Fasten base layers and face layers separately to supports with screws.

E. Tile Backing Panels:

1. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.

2. Areas Not Subject to Wetting: Install standard gypsum wallboard panels to produce a flat surface except at other locations indicated to receive water-resistant panels.
3. Where tile backing panels abut other types of panels in the same plane, shim surfaces to produce a uniform plane across panel surfaces.

F. Fiberboard Tack Base: Install over gypsum backing board with adhesive with either nails or screws as required, with approximately 1/8 inch space at joints. Where installed over concrete or masonry substrate, nail with concrete nails to hold for adhesive.

3.7 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints at locations indicated on Drawings. If not shown, install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

3.8 FINISHING GYPSUM BOARD ASSEMBLIES

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below, according to ASTM C 840, for locations indicated

1. Level 1: Embed tape at joints in ceiling plenum areas, concealed areas, and where indicated**,** unless a higher level of finish is required for fire-resistance-rated assemblies and sound-rated assemblies.
2. Level 2: Embed tape and apply separate first coat of joint compound to tape, fasteners, and trim flanges where indicated.
3. Level 3: Embed tape and apply separate first and fill coats of joint compound to tape, fasteners, and trim flanges where indicated.
4. Level 4: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges at panel surfaces that will be exposed to view, unless otherwise indicated.
5. Level 5: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges, and apply skim coat of joint compound over entire surface where indicated.

3.9 APPLYING TEXTURE FINISHES

A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.

Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture matching Architect approved mockup and free of starved spots or other evidence of thin application or of application patterns.

1. Spray Knock-Down Texture shall be applied to all gypsum board surfaces to be painted. Provide (3) different textured samples for review and approval by Architect on a 2'x2' gypsum board.

B. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture finish manufacturer's written recommendations.

3.10 FIELD QUALITY CONTROL

A. Above-Ceiling Observation: Before Contractor installs gypsum board ceilings, Architect will conduct an above-ceiling observation and report deficiencies in the Work observed. Do not proceed with installation of gypsum board to ceiling support framing until deficiencies have been corrected.

1. Notify Architect seven days in advance of date and time when Project, or part of Project, will be ready for above-ceiling observation.
2. Before notifying Architect, complete the following in areas to receive gypsum board ceilings:

   a. Installation of 80 percent of lighting fixtures, powered for operation.
   b. Installation, insulation, and leak and pressure testing of water piping systems.
   c. Installation of air-duct systems.
   d. Installation of air devices.
   e. Installation of mechanical system control-air tubing.
   f. Installation of ceiling support framing.

3.11 PROTECTION

A. Provide final protection and maintain conditions, in a manner suitable to Installer, which ensures gypsum drywall work being without damage or deterioration at time of substantial completion.

END OF SECTION 09 21 16 (9-2-08/jm)

SECTION 09 24 00 - PORTLAND CEMENT PLASTER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Nonstructural steel framing and furring.

2. Exterior portland cement plasterwork (stucco) on metal lath plaster bases.

B. Related Sections include the following:

1. Division 5 Section "Steel Studs and Joists" for structural, load-bearing (transverse and axial) steel studs and joists that support lath and portland cement plaster.
2. Division 6 Section "Rough Carpentry" for wood framing and furring**,** sheathing, and water-resistant barriers included in portland cement plaster assemblies.
3. Division 7 Section “Thermal Insulation" for thermal insulations and vapor retarders included in portland cement plaster assemblies.
4. Division 7 Section "Joint Sealants" for acoustical sealants and sealants installed with exterior portland cement plaster (stucco).

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Initial Selection: For each type of factory-prepared finish coat indicated.

C. Samples for Verification: For each type of colored and textured finish coat indicated; 12 by 12 inches, and prepared on rigid backing.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For portland cement plaster assemblies with fire-resistance ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

B. Mockups: Before plastering, prepare mockups of at least 4 feet by 4 feet area by full thickness to demonstrate final aesthetic effects and set quality standards for materials and execution.

1. Install mockups for each type of finish indicated and with materials, including lath and support systems, indicated for final work.
2. For interior plasterwork, simulate finished lighting conditions for review of mockups.
3. Obtain Architect's acceptance of panel's visual quality before commencement of work.
4. Retain panel(s) during construction as a standard for judging completed work.
5. Remove panel(s) at completion and acceptance of work.

C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

D. Standards: Plastering shall be done in accordance with these specifications; the "Reference Specifications" of the California Lathing and Plastering Contractor's Association, Inc. (latest edition); The Metal Lath manufacturer's Association specifications, and Title 24, 2022 CBC, Chapter 25.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

1.6 PROJECT CONDITIONS

A. Comply with ASTM C 926 requirements.

B. Exterior Plasterwork:

1. Apply and cure plaster to prevent plaster drying out during curing period. Use procedures required by climatic conditions, including moist curing, providing coverings, and providing barriers to deflect sunlight and wind.
2. Apply plaster when ambient temperature is greater than 40 deg F.
3. Protect plaster coats from freezing for not less than 48 hours after set of plaster coat has occurred.

C. Factory-Prepared Finishes: Comply with manufacturer's written recommendations for environmental conditions for applying finishes.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Products: Subject to compliance with requirements, provide one of the products specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 NONSTRUCTURAL STEEL FRAMING MEMBERS, GENERAL

A. Manufacturers:

1. Chicago Metallic Corporation
2. Gold Bond Building Products Div., National Gypsum Co.
3. Milcor Division; Inryco, Inc.
4. United States Gypsum Co.
5. Western Metal Lath & Steel Framing Systems.

B. Components, General: Comply with ASTM C 1063. For steel sheet components not included in ASTM C 1063, comply with ASTM C 645 requirements for metal, unless otherwise indicated.

C. Cold-Rolled Channels: Base metal thickness of 0.0538 inch with ASTM A 653/A 653M, G60, hot-dip galvanized zinc coating.

D. Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, not less than 0.0475-inch diameter, unless otherwise indicated.

2.3 METAL LATH

A. Expanded-Metal Lath: ASTM C 847 with ASTM A 653/A 653M, G60, hot-dip galvanized zinc coating.

1. Manufacturers:

a. California Expanded Metal Products Company (CEMCO).
b. Gold Bond Building Products Div., National Gypsum Co.
c. Milcor Division; Inryco, Inc.
d. United States Gypsum Co..
e. Western Metal Lath & Steel Framing Systems.

2. Diamond-Mesh Lath: Self-furring.

a. Weight: 3.4 lb/sq. yd.

3. 3/8-Inch Rib Lath:

a. Weight: 3.4 lb/sq. yd.

B. Wire-Fabric Lath:

1. Manufacturers:

a. Davis Wire Corporation.
b. Jaenson Wire Company.
c. Keystone Steel & Wire.

2. Woven-Wire Lath: ASTM C 1032; self-furring, with stiffener wire backing.

a. 17 gage. x 1-1/2 inch galvanized.

C. Paper Backing: FS UU-B-790, Type I Grade D, Style 2 vapor-permeable paper. Two layers, 30 minute and in accordance with 2010 CBC Section 2510.6.

2.4 ACCESSORIES

A. General: Comply with ASTM C 1063 and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.

B. Zinc and Zinc-Coated (Galvanized) Accessories:

1. Manufacturers:
   a. California Expanded Metal Products Company (CEMCO).
   b. Fry Regelet Corporation
   c. Gold Bond Building Products Div., National Gypsum Co.
   d. Keene Corporation
   e. Milcor Division; Inryco, inc.
   f. United States Gypsum Co.
   g. Western Metal Lath & Steel Framing Systems.

2. Foundation Weep Screed: Western No. 7 or No. 36. Fabricated from hot-dip galvanized steel sheet, ASTM A 653/A 653M, G60 zinc coating.

3. Cornerite: Fabricated from metal lath with ASTM A 653/A 653M, G60, hot-dip galvanized zinc coating.

4. External-Corner Reinforcement: Fabricated from metal lath with ASTM A 653/A 653M, G60, hot-dip galvanized zinc coating.

5. Cornerbeads: Western No. 1A. Fabricated from zinc or zinc-coated (galvanized) steel.

   a. Small nose cornerbead with expanded flanges; use unless otherwise indicated.
   b. Small nose cornerbead with perforated flanges; use on curved corners.
   c. Small nose cornerbead with expanded flanges reinforced by perforated stiffening rib; use on columns and for finishing masonry corners.
   d. Allow full encasement of plaster.

6. Casing Beads: Western No. 66. Fabricated from zinc-coated (galvanized) steel; square-edged style; with expanded flanges.
7. Control Joints: Keene XJ15-3. Fabricated from zinc-coated (galvanized) steel; one-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.
8. Expansion Joints: Fabricated from zinc-coated (galvanized) steel; folded pair of unperforated screeds in M-shaped configuration; with expanded flanges.
9. Two-Piece Expansion Joints: Western No. 40. Fabricated from zinc-coated (galvanized) steel; formed to produce slip-joint and square-edged reveal that is adjustable from 1/4-to-5/8-inch wide; with perforated flanges.
10. Soffit vent screeds: As indicated

2.5 MISCELLANEOUS MATERIALS

A. Water for Mixing: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.

B. Fiber for Base Coat: Alkaline-resistant glass or polypropylene fibers, 1/2 inch long, free of contaminants, manufactured for use in portland cement plaster.

1. Products:

a. Dur-O-Fiber AR Glass; Dur-O-Wall
b. Harbourite; Fibermesh, Inc.

C. Bonding Compound: ASTM C 932.

D. Steel Drill Screws: Galvanized, for metal-to-metal fastening, ASTM C 1002 or ASTM C 954, as required by thickness of metal being fastened; with wafer head that is suitable for application; in lengths required to achieve penetration through joined materials of not fewer than ¼ inch.

E. Fasteners for Attaching Metal Lath to Substrates: Complying with ASTM C 1063.

1. Nails: Galvanized furring nails, No. 12 gauge 3/8 inch head with 3/8 inch wad spacers for lath attachment. Minimum 1-1/4 inch penetration into structure.
2. Ring Shank Hook Staples: No. 9 W & M gauge, ½ inch wide x 1-1/2" inches long "J" staple for soffit application only.
3. Earthquake Staples: No. 16 gauge, galvanized, round or flattened wire, with chisel or divergent points, ¾ inch crown and 1-1/4 inch legs for soffit application only.

F. Wire Ties: 16 gage galvanized.

G. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing), produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

H. Isolation Strip at Exterior Walls:

1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), unperforated.

2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

I. Window and/or Door Flashing, provide either of the following:
1. Kraft paper flashing conforming to F.S. UU-B-790A, Style 4, Grade A,B,C; 6 inch minimum width in the vertical wall plane.
2. Self-adhered rubberize asphaltic membrane i.e. Vicor by Grace Manufacturing, 6 inch minimum width in the vertical wall plane.

2.6 PLASTER MATERIALS Retain second option in first paragraph below if sulfate resistance is required.

A. Portland Cement: ASTM C 150, Type I or III.

1. Color for Base Coats: Gray.

B. Masonry Cement: ASTM C 91, Type N.

1. Color for Base Coats: Gray.

C. Lime: ASTM C 206, Type S; or ASTM C 207, Type S.

D. Sand Aggregate: ASTM C 897.

1. Color for Job-Mixed Finish Coats: In color matching Architect's sample.

E. Ready-Mixed Integral Color Finish-Coat Plaster: Mill-mixed portland cement, aggregates, coloring agents, and proprietary ingredients.

1. Products:

a. LaHabra Stucco.
b. King Stucco Inc.
c. Superior Stucco Products
d. Western Stucco Products Inc.

2. Color: As selected by Architect from manufacturer's full range.

F. Additives: “PRF”, Gibco Industries.

2.7 PLASTER MIXES

A. General: Comply with ASTM C 926 for applications indicated.

1. Fiber Content: Add fiber to base-coat mixes after ingredients have mixed at least two minutes. Comply with fiber manufacturer's written instructions for fiber quantities in mixes, but do not exceed 2 lb of fiber/cu. ft. of cementitious materials. Reduce aggregate quantities accordingly to maintain workability.

B. Base-Coat Mixes for Use over Metal Lath: Scratch and brown coats for three-coat plasterwork as follows:

1. Portland Cement Mixes:

a. Scratch Coat (3/8”): For cementitious material, mix 1 part portland cement, 3 oz. PRF (per 94 lbs Portland cement). Use 4 parts sand per part of cementitious material (sum of separate volumes of each component material).
b. Brown Coat (3/8”): For cementitious material, mix 1 part portland cement, 3 oz. PRF (per 94 lbs. Portland cement). Use 5 parts sand per part of cementitious material (sum of separate volumes of each component material).

C. Factory-Prepared Finish-Coat Mixes (1/8”): For ready-mixed finish-coat plasters, comply with manufacturer's written instructions. Add water only.

1. Finish coat shall be textured as noted on the Drawings or as selected by Architect.

D. Mixing: Mechanically mix cementitious and aggregate material for plasters to comply with applicable referenced application standard and with recommendations of plaster manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect adjacent work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.

B. Prepare solid-plaster bases that are smooth or that do not have the suction capability required to bond with plaster according to ASTM C 926.

3.3 INSTALLATION, GENERAL

A. Fire-Resistance-Rated Assemblies: Install components according to requirements for design designations from listing organization and publication indicated on Drawings.

B. Sound Attenuation Blankets: Where required, install blankets before installing lath unless blankets are readily installed after lath has been installed on one side.

C. Acoustical Sealant: Where required and indicated, seal joints between edges of plasterwork and abutting construction with acoustical sealant.

D. Sealant: Seal around all window frames and transition to provide a “water tight” exterior finish.

3.4 INSTALLING NONSTRUCTURAL STEEL FRAMING, GENERAL

A. General: Comply with requirements in ASTM C 1063 for applications indicated.

1. Comply with ASTM C 754 for installation of items not addressed in ASTM C 1063.

B. Install supplementary framing, blocking, and bracing at terminations in plaster assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

C. Isolate steel framing from building structure to prevent transfer of loading imposed by structural movement.

1. Isolate ceiling assemblies where they abut or are penetrated by building structure.

2. Isolate partition framing and wall furring where it abuts structure, except at floor. At head of assemblies, install slip-type joints that avoid axial loading and that support assembly laterally.

D. Do not bridge building control and expansion joints with steel framing or furring members. Frame both sides of joints independently.

E. Soffits: Unless otherwise detailed on Drawings, install furred or suspended soffits to comply with requirements for ceiling installation; install framed soffits to comply with requirements for partition installation.

3.5 INSTALLING METAL LATH

A. General: Install expanded metal lath or stucco netting where plaster base is required. Provide appropriate type, configuration and weight of material selected from materials indicated which comply with referenced lathing installation standards.

1. Comply with the requirements of ML/SFA “Specificationfor METAL Lathing and Furring” applicable to each installation condition indicated.

B. Ceramic Tile Setting Beds:

1. Use diamond mesh lath, 3.4 lbs. per square yard, paper backed. Maximum variation in the backing surface shall not exceed 1/8” in 8 feet form the required plane.

C. Exterior Sheathed Wall Surfaces; Steel Stud Construction: Install 2 layers 60 minute, Grade D paper, shingle style over sheathing with 3 inch edge laps and 6 inch end laps. Over building paper install self furring stucco netting. Provide wadding for sheet metal screw attachment to maintain ¼ inch minimum spacing of netting from backing surface. Self furring stucco netting shall be installed to maintain ¼ inch spacing of netting from backing surface in all conditions.

3.6 INSTALLING ACCESSORIES

A. Install according to ASTM C 1063 and at locations indicated on Drawings.

B. Reinforcement for External Corners:

1. Install lath-type external-corner reinforcement at exterior locations.
2. Install cornerbead at interior locations.

C. Control Joints: Install control joints at locations indicated on Drawings, or if not indicated in specific locations complying with following criteria and approved by Architect for visual effect as follows:

1. As required to delineate plasterwork into areas (panels) of the following maximum sizes:

   a. Vertical Surfaces: 144 sq. ft..
   b. Horizontal and other Nonvertical Surfaces: 100 sq. ft..

2. At distances between control joints of not greater than 18 feet o.c.
3. As required to delineate plasterwork into areas (panels) with length-to-width ratios of not greater than 2-1/2:1. 10 feet maximum in both vertical and horizontal dimensions.
4. Where control joints occur in surface of construction directly behind plaster.
5. Where plasterwork areas change dimensions, to delineate rectangular-shaped areas (panels) and to relieve the stress that occurs at the corner formed by the dimension change.
6. Attach control joints to stucco mesh by wire tying at 24 inches on center.

D. Drip Screeds: Install drip screed a minimum of 4 inches above grade, unless otherwise shown.

E. Soffit Vent Screeds: Install soffit vent screed where shown sufficient to vent all concealed attics, joist spaces, etc.

F. Window Flashing: Install window flashing material at window head, jambs and sill. Lap adjacent flashing material 6 inches minimum.

3.7 PLASTER APPLICATION

A. General: Comply with ASTM C 926.

1. Do not deviate more than plus or minus 1/8 inch in 10 feet from a true plane in finished plaster surfaces, as measured by a 10-foot straightedge placed on surface.
2. Grout hollow-metal frames, bases, and similar work occurring in plastered areas, with base-coat plaster material, before lathing where necessary. Except where full grouting is indicated or required for fire-resistance rating, grout at least 6 inches at each jamb anchor.
3. Finish plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground, unless otherwise indicated. Where casing bead does not terminate plaster at metal frame, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.
4. Provide plaster surfaces that are ready to receive field-applied finishes indicated.

B. Curing: Moisture cure Portland cement plaster base and finish coats to comply with ASTM C 926, including between coats and curing required by 2007 CBC, Table 2512.6.

C. Bonding Compound: Apply on unit masonry and concrete plaster bases.

D. Plaster Finish Coats: Apply to provide finish and texture to match Architect's sample.

E. Sand smooth-troweled finishes lightly to remove trowel marks and arises.

F. Apply fog coat over patches and adjacent areas where there is a transition in surface plane.

H. Caulk or seal around all window frames and transitions to provide a “water tight” ext. finish.

3.8 CUTTING AND PATCHING

A. Cut, patch, replace, and repair plaster as necessary to accommodate other work and to restore cracks, dents, and imperfections. Repair or replace work to eliminate blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.

3.9 CLEANING AND PROTECTION

A. Remove temporary protection and enclosure of other work. Promptly remove plaster from doorframes, windows, and other surfaces not indicated to be plastered. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering.

END OF SECTION 09 24 00 (3/06)

SECTION 09 30 13 - CERAMIC TILING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Glazed ceramic wall tile.
2. Mosaic porcelain floor tile.
3. Waterproof membrane for thin-set tile installations.

B. Related Sections include the following:

1. Division 1 Section "Selective Demolition" for removing existing finishes.

2. Division 7 Section "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.

1.3 DEFINITIONS

A. Module Size: Actual tile size (minor facial dimension as measured per ASTM C 499) plus joint width indicated.

B. Facial Dimension: Nominal tile size as defined in ANSI A137.1.

1.4 PERFORMANCE REQUIREMENTS

A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:

1. Level Surfaces: Minimum 0.6.

B. Ceramic tile flooring shall be stable, firm, and slip resistant, per CBC Section 11B-302.1.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Initial Selection: For each type of tile and grout indicated. Include Samples of accessories involving color selection.

C. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer. *(Project Close-Out Item)*

D. Product Certificates: For each type of product, signed by product manufacturer.

E. Qualification Data: For Installer.

F. Material Test Reports: For each tile-setting and -grouting product.

1.6 QUALITY ASSURANCE

A. Source Limitations for Tile: Obtain all tile of same type and color or finish from one source or producer.

1. Obtain tile from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section through one source from a single manufacturer for each product:

1. Joint sealants.

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement in ANSI A137.1 for labeling sealed tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained, and contamination avoided.

D. Store liquid latexes and emulsion adhesives in unopened containers and protected from freezing.

E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.9 EXTRA MATERIALS *(Project Close-Out Item)*

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed, for each type, composition, color, pattern, and size indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:

1. Products: Subject to compliance with requirements, provide one of the products specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.

1. For facial dimensions of tile, comply with requirements relating to tile sizes specified in Part 1 "Definitions" Article.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI standards referenced in "Setting and Grouting Materials" Article.

C. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:

1. As selected by Architect from manufacturer's full range.

D. Factory Blending: For tile exhibiting color variations within ranges selected during Sample submittals, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

E. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer, unless otherwise indicated.

1. Where tile is indicated for installation in wet areas, do not use back- or edge-mounted tile assemblies.

F. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.3 TILE PRODUCTS

A. Manufacturers:
1. Daltile; Div. of Dal-Tile International Inc.
2. American Olean; Div. of Dal-Tile International Corp.
3. Or approved equal.

B. Glazed Wall Tile at Restrooms: Flat tile as follows:

1. Module Size: 4x4 inches.
2. Thickness: 5/16 inch.
3. Face: Plain with cushion edges.

4. Price Group: Color selection shall be made from price range of Price Groups 1 and 2.
5. Colors:
   a. Field : 0100 “White”, Glossy
   b. Accent 1: 0169 “Waterfall” Glossy
   c. Cove Base: “Suede Gray”, glossy.
6. Grout color: Custom Building Products
   a. Wall – Field: #544 Rolling Fog
   b. Wall – Base: #19 Pewter

7. Insert special-purpose tile requirements here if required.

8. Glazed Wall Tile Trim Units: Matching characteristics of adjoining flat tile and coordinated with sizes and coursing of adjoining flat tile where applicable. Provide shapes as follows, selected from manufacturer's standard shapes:

   a. Base for Portland Cement Mortar Installations: Coved, module size 4-1/4 by 4-1/4 inches.
   b. Wainscot Cap for Portland Cement Mortar Installations: Bullnose cap, module size 4-1/4 by 4-1/4 inches.
   c. Wainscot Cap for Flush Conditions: Regular flat tile for conditions where tile wainscot is shown flush with wall surface above.
   d. External Corners for Portland Cement Mortar Installations: Bullnose shape with radius of at least 3/4 inch unless otherwise indicated.
   e. Internal Corners: Field-butted square corners except with coved base and cap angle pieces designed to fit with stretcher shapes.
   f. Sizes for Trim Shapes: As indicated, coordinated with sizes and coursing of adjoining flat tile, where applicable.

C. Factory-Mounted Mosaic Porcelain Tile (Unglazed)

1. Manufacturers:
   a. Daltile
      1) Keystones Groups 1 and 2
2. Face Size: 2” x 2”.
3. Thickness: 1/4 inch.
4. Face: Plain with cushion edges.
5. Dynamic Coefficient of Friction: Not less than 0.42.
6. Tile Color and Pattern: “Suede Grey Speckle”
7. Grout Color: Custom Building Products #19 Pewter.
8. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile]. Provide shapes as follows, selected from manufacturer's standard shapes:

   a. Base Cap: Surface bullnose, module size, same as adjoining flat tile.
   b. External Corners: Surface bullnose, module size same as adjoining flat tile.
   c. Internal Corners: Field-butted square corners.

2.4 WATERPROOFING AND CRACK-SUPPRESSION MEMBRANES FOR THIN-SET TILE INSTALLATIONS

A. General: Manufacturer's standard product that complies with ANSI A118.10, selected from the following.

B. Liquid-Applied Elastomeric Waterproofing Membrane.

1. Products:
   a. Custom Building Products – RedGard Waterproofing and Crack Prevention Membrane.
   b. Or approved equal.

2.5 SETTING AND GROUTING MATERIALS

A. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.02.

1. Cleavage Membrane: Asphalt felt, ASTM D226/D226M, Type I (No. 15); or polyethylene sheeting, ASTM D4397, 4.0 mils thick.
2. Reinforcing Wire Fabric: Galvanized, self-furring welded-wire lath, 1-1/2 by 1-1/2 inches by 17 guage diameter; comply with ASTM A185/A185M and ASTM A82/A82M, except for minimum wire size.

3. Latex Additive: Manufacturer's standard water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement and aggregate mortar bed.

B. Standard Dry-Set Mortar (Thinset): ANSI A118.1.
1. Manufacturers:
   a. Bostik.
   b. Custom Building Products.

c. LATICRETE International Inc.
d. MAPEI Corporation.

2. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.1.

C. Modified Dry-Set Mortar (Thinset): ANSI A118.4.

1. Manufacturers:
   a. Bostik.
   b. Custom Building Products.
   c. LATICRETE International Inc.
   d. MAPEI Corporation.
2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
3. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.

2.6 GROUT MATERIALS

A. Standard Cement Grout: ANSI A118.6.

1. Manufacturers: Custom Building products or approved equal.
2. Unsanded grout mixture for joints 1/8 inch and narrower.
3. Sanded grout mixture for joints more than 1/8 inch wide.

B. High-Performance Tile Grout: ANSI A118.7.

1. Manufacturers: Custom Building products or approved equal.

2. Polymer Type: Either ethylene vinyl acetate, in dry, redispersible form, prepackaged with other dry ingredients, or acrylic resin or styrene-butadiene rubber in liquid-latex form for addition to prepackaged dry-grout mix.
3. Unsanded grout mixture for joints 1/8 inch and narrower.
4. Sanded grout mixture for joints more than 1/8 inch wide.

C. Water-Cleanable Epoxy Grout: ANSI A118.3

1. Manufacturers: Custom Building products or approved equal.

2.7 MISCELLANEOUS MATERIALS

A. Temporary Protective Coating: Product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.

1. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.

B. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

C. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints that does not change color or appearance of grout.

1. Products:
   a. Bostik; CeramaSeal Grout Sealer.
   b. Custom Building Products; Grout and Tile Sealer.
   c. MAPEI Corporation; KER 004, Keraseal Penetrating Sealer for Unglazed Grout and Tile.

2.8 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
   a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
   b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproof membrane by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot (1:50) toward drains.

C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 INSTALLATION OF CLEAVAGE MEMBRANE AND LATH

A. Membrane shall be lapped 6” vertically and 2” horizontally, and continuous behind expansion joints, if occurs.

B. Lath shall be lapped a minimum of 2 inches at sides and end where sheets are joined. Wire must be stopped at expansion joints.

1. Separate application of membrane and lath is recommended. Pan head type non-corrosive fasteners shall be used and be of sufficient length to penetrate into studs.

3.4 INSTALLATION OF PORTLAND CEMENT PLASTER BACKING

A. Plaster scratch coat and leveling coat

1. Shall be mixed of one part Portland cement, ½ part hydrated lime and four parts dry sand or five parts damp sand by volume: (ANSI A 108.1A-2008).
2. Cure minimum of 24 hours before applying brown coat.

B. Brown coat (mortar bed mix)

1. Shall be mixed one part Portland cement, ½ part hydrated lime and five parts damp sand (ANSI A 108.1A2.1.1 2008). Cure time shall be 14 days or more. Clime conditions may require longer periods to reduce moisture content of plaster assembly.
2. Brown coat shall be within ½ inch in 10 feet of the required plane, with a wood float finish, with no abrupt offsets in the finish greater than 1/16 inch in 12 inches.

3.5 INSTALLATION OF CERAMIC TILE

A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in

TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

E. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.

F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

G. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:

1. Porcelain Mosaic Tile: 1/8 inch.
2. Glazed Wall Tile: 1/16 inch.

H. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

I. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.

J. Floor Sealer: Apply floor sealer to grout joints according to floor-sealer manufacturer's written instructions. As soon as floor sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.6 INSTALLATION OF WATERPROOF MEMBRANES

A. Install waterproof membrane to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.

B. Allow waterproof membrane to cure and verify by testing that it is watertight before installing tile or setting materials over it.

3.7 INSTALLATION OF CRACK ISOLATION MEMBRANES

A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.

B. Allow crack isolation membrane to cure before installing tile or setting materials over it.

3.8 ADJUSTING AND CLEANING

A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.

B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove grout residue from tile as soon as possible.
2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.9 PROTECTION

A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.10 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

A. Interior Floor Installations, Concrete Subfloor:

1. TCNA F112 and ANSI A108.1C: Cement mortar bed (thickset) bonded to concrete.

a. Ceramic Tile Type: Unglazed mosaic porcelain tile
b. Bond Coat for Cured-Bed Method: Standard dry-set, Modified dry-set, Medium-bed, modified dry-set, or Improved modified dry-set mortar.
c. Grout: High-performance unsanded Epoxy grout.

B. Interior Wall Installations, Masonry or Concrete:

1. TCNA W231/W241 and ANSI A108.1B Cement mortar bed (thickset).

a. Ceramic Tile Type: Glazed wall tile.
b. Bond Coat for Wet-Set Method: Standard dry-set, Modified dry-set, or Improved modified dry-set mortar.
c. Bond Coat for Cured-Bed Method: Standard dry-set, Modified dry-set, or Improved modified dry-set mortar.
d. Grout: High-performance unsanded grout.

END OF SECTION 093013

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SECTION 09 51 13 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes acoustical panels and exposed suspension systems for ceilings.

B. Related Sections include the following:

1. Division 9 Section "Gypsum Board Assemblies" for suspended gypsum board ceilings.
2. Division 9 Section "Acoustical Metal Ceilings."

C. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete at ceilings.

1.3 DEFINITIONS

A. LR: Light Reflectance coefficient.

B. NRC: Noise Reduction Coefficient.

C. STC: Sound Transmission Coefficient

D. CAC: Ceiling Attenuation Class

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Initial Selection: For components with factory-applied color finishes.

C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.

1. Acoustical Panel: Set of 6-inch- square Samples of each type, color, pattern, and texture.
2. Exposed Suspension System Members, Moldings, and Trim: Set of 12-inch- long Samples of each type, finish, and color.

D. Qualification Data: For testing agency.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each acoustical panel ceiling.

F. Research/Evaluation Reports: For each acoustical panel ceiling and components and anchor type.

G. Maintenance Data: Include manufacturer's recommendations for cleaning and refinishing acoustical units, including precautions against materials and methods which may be detrimental to finishes and acoustical performances. Resubmit at closeout.

1.5 QUALITY ASSURANCE

A. Comply with 2022 CBC Section 2506.2.1 and DSA IR 25-2.13.

B. Acoustical Testing Agency Qualifications: An independent testing laboratory, or an NVLAP-accredited laboratory, with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548. NVLAP-accredited laboratories must document accreditation, based on a "Certificate of Accreditation" and a "Scope of Accreditation" listing the test methods specified.

C. Source Limitations:

1. Acoustical Ceiling Panel: Obtain each type through one source from a single manufacturer.
2. Suspension System: Obtain each type through one source from a single manufacturer.

D. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:

1. Fire-Resistance Characteristics: Where indicated, provide acoustical panel ceilings identical to those of assemblies tested for fire resistance per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

a. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
b. Identify materials with appropriate markings of applicable testing and inspecting agency.

2. Surface-Burning Characteristics: Provide acoustical panels with the following surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:

a. Flame Spread: 25 or less.
b. Smoke-Developed Index: 50 or less.

E. Seismic Standard: Provide acoustical panel ceilings designed and installed to withstand the effects of earthquake motions according to the 2022 CBC.

F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

1.8 COORDINATION

A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Panels: Full-size panels equal to 2.0 percent of quantity installed.
2. Suspension System Components: Quantity of each exposed component equal to 2.0 percent of quantity installed.
3. Hold-Down Clips: Equal to 2.0 percent of amount installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
1. Products: Subject to compliance with requirements, provide one of the products specified.
2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 ACOUSTICAL PANELS, GENERAL

A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.

1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface per ASTM E 795.

B. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.

C. Panel-Based Antimicrobial Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial solution that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria.

2.3 WATER-FELTED, MINERAL-BASE ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING - APC-A

A. Products: Armstrong World Industries, School Zone Fine Fissured #1811

B. Color: White.

C. LR: Not less than 0.82.

D. NRC: Not less than 0.70.

E. CAC: 35 - 40.

F. Flame Spread: 0-25.

G. Edge Detail: Square.

H. Thickness: 3/4 inch.

I. Size: 24 by 48 inches.

J. Antimicrobial Treatment: BioBlock Mold/Mildew Protection.

2.4 WATER-FELTED, MINERAL-BASE ACOUSTICAL PANELS WITH MEMBRANE-FACED OVERLAY FOR ACOUSTICAL PANEL CEILING - APC-B

A. Products:

1. Armstrong World Industries, Inc, Clean Room FL #1716

B. Color: White.

C. LR: Not less than 0.74.

D. NRC: .55.

E. CAC: .35.

F. Flame Spread: 0-25.

G. Edge Detail: Square Lay-in

H. Thickness: 3/4 inch.

I. Size: 24 by 48 inches.

J. Antimicrobial Treatment: Mold and Mildew Protection, Soil-resistant polyester film.

2.5 SUSPENDED ACOUSTICAL PANELS UNITS- APC-C

A. Products:

1. Armstrong World Industries, Inc, Optima Capz #3933 and #3931

B. Texture Color: Fine, White.

C. LR: Not less than 0.88.

D. NRC: 0.90

E. Flame Spread: ASTM E1264, Class A

F. Edge Detail: Square

G. Thickness: 7/8 inch.

H. Size: 48 by 96 inches and 24 by 96 inches

I. Accessories:

1. QSUTC: Galvanized steel, attachment clip to fasten grid to structure.

2. ARBRKT: Galvanized steel, adjustable hanger bracket to fasten grid to structure.

3. ARSTUD: Galvanized steel, with (1/4-20 threads x 1 inch long) used to secure panel to grid.

4. ARCAP/5487: Aluminum, screws through the panel on the 1/4-20 stud and have 1-1/4 inch diameter face to align and support the panel. Available in white, silver, or black.

5. ARPLUG: Galvanized steel, locks the cross tee tabs on outside rows of mains. Only works with Armstrong® ceilings XL® cross tee end details.

2.6 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.

B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated, or if not otherwise indicated, as selected by Architect from manufacturer's full range of standard colors.

C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated.

D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Zinc-Coated Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- diameter wire.

E. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

F. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical panels in-place.

G. Hold-Down Clips: Where indicated, provide manufacturer's standard hold-down clips spaced 24 inches o.c. on all cross tees.

H. Impact Clips: Where indicated, provide manufacturer's standard impact-clip system designed to absorb impact forces against acoustical panels.

2.7 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING APC-A, B, and C

A. Products:

1. Chicago Metallic Corporation; Series: 1200, Heavy Duty

a. Main Runner: 211-01
b. Cross Runner: 1228-01 (1226 for 2 x 2 Grid)

2. Donn Corporation; Series: DX, Heavy Duty

a. Main Runner: DX24
b. Cross runner: DX216, DX316, DX416

3. Armstrong World Industries; Series: 7300, Heavy Duty

a. Main Runner: 7300 (Non-fire-resistence), HD 8201 (Fire-resistance-rated)

b. Cross Runner: XL-7328, XL-7342 (Non-fire-resistance), XL 8200 series (Fire-resistance-rated).

2.8 METAL EDGE MOLDINGS AND TRIM

A. Manufacturers:

1. Armstrong World Industries, Inc.
2. Chicago Metallic Corporation.
3. Donn Corporation

B. Sheet-Metal or Plastic Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that fit acoustical panel edge details and suspension systems indicated; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.

2.9 ACOUSTICAL SEALANT

A. Products:

1. Acoustical Sealant for Exposed and Concealed Joints:

a. Pecora Corp; AC-20 FTR Acoustical and Insulation Sealant.
b. United States Gypsum Co.; SHEETROCK Acoustical Sealant.

2. Acoustical Sealant for Concealed Joints:

a. OSI Sealants, Inc.; Pro-Series SC-170 Rubber Base Sound Sealant.
b. OSI Sealants, Inc.; Pro-Series SC-175 Rubber Base Sound Sealant.
c. Pecora Corp.; BA-98.
d. Tremco, Inc.; Tremco Acoustical Sealant.

B. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

C. Acoustical Sealant for Concealed Joints: Manufacturer's standard nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements

for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION, GENERAL

A. General: Install acoustical panel ceilings to comply with UBC Standard 25-2 and seismic requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of four tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, post-installed mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
6. Do not attach hangers to steel deck tabs.
7. Do not attach hangers to steel roof deck. Attach hangers to structural members.
8. Space hangers not more than 48 inches o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 6 inches from ends of each member.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches O.C. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
3. Unless unavoidable, do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

1. Arrange directionally patterned acoustical panels as follows:

   a. Install panels with pattern running in one direction.

2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
3. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
4. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions, unless otherwise indicated.
5. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.4 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 51 13 (FA – 4/2026)

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SECTION 09 65 13 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Special Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Wall base.

B. Related Sections include the following:

1. Division 9 Section “Carpeting”

1.3 SUBMITTALS

A. Product Data: 2 copies of manufacturers technical data and installation instructions for each type of product indicated.

B. Samples for Initial Selection: Actual sections for each type of product indicated, from manufactures full range of colors and patterns available.

C. Samples for Verification: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches long, of each resilient product color, texture, and pattern required.

D. Maintenance Data: Provide 2 copies each for each type of resilient products used to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide resilient stair accessories with a critical radiant flux classification of Class I, not less than 0.45 W/sq. cm, as determined by testing identical products per ASTM E 648 by a testing and inspecting agency acceptable to authorities having jurisdiction.

B. Wherever possible, provide required resilient wall base and accessories produced by a single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 65 deg F or more than 90 deg F .

1.6 PROJECT CONDITIONS

A. Maintain temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After post-installation period, maintain temperatures within range recommended by manufacturer, but not less than 65 deg F or more than 95 deg F.

C. Install resilient products after other finishing operations, including painting, have been completed.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

2.2 COLORS AND PATTERNS

A. Flexco “078 Umber”.

2.3 RESILIENT WALL BASE

A. Wall Base: ASTM F 1861.

1. Flexco “Wallflowers TS Rubber Base” (Basis of Design).

2. Armstrong World Industries, Inc.
3. Burke Mercer Flooring Product
4. Johnsonite
5. Roppe Corporation

B. Type (Material Requirement): Complying with FS SS-W-40; Type I rubber.

C. Group (Manufacturing Method): Type I with matching end stops and factory interior and exterior corner units, and as follows:

D. Style: Cove (with top-set toe) at all locations.

E. Minimum Thickness: 0.125 inch.

F. Height: 4 inches unless indicated otherwise.

G. Lengths: Coils in manufacturer's standard length.

H. Outside Corners: Pre-molded.

I. Inside Corners**:** Pre-molded.

J. Surface: Smooth.

2.4 RESILIENT MOLDING ACCESSORY

A. Description: Cap for cove carpet. Cap for cove resilient sheet floor covering. Carpet bar for tackless installations. Carpet edge for glue-down applications. Nosing for carpet. Nosing for resilient floor covering. Reducer strip for resilient floor covering. Joiner for tile and carpet, etc. Provide applicable molding to create flush transitions and finished edges.

1. Burke Mercer Flooring Products
2. Johnsonite
3. Roppe Corporation

B. Material: Rubber.

C. Profile and Dimensions: By Manufacturer.

2.5 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic cement based formulation provided or approved by resilient product manufacturers for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

C. Concrete Slab Primer: Non-staining type as recommended by flooring manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of resilient products.

B. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

C. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.

D. Apply concrete slab primer, if required and recommended by flooring manufacturer, prior to application of adhesive. Apply in compliance with manufacturer’s directions.

E. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

1. Do not install resilient products until they are the same temperature as the space where they are to be installed.

F. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 RESILIENT WALL BASE INSTALLATION

A. Apply wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

B. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

C. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

D. Do not stretch wall base during installation.

E. On masonry surfaces or other similar irregular substrates, fill voids along top edge of wall base with manufacturer's recommended adhesive filler material.

F. Pre-molded Corners: Install pre-molded corners before installing straight pieces.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor coverings that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Perform the following operations immediately after completing resilient product installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

    a. Do not wash surfaces until after time period recommended by manufacturer.

B. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.

1. Apply protective floor polish to stair accessory surfaces that are free from soil, visible adhesive, and surface blemishes if recommended in writing by manufacturer.

    a. Use commercially available product acceptable to manufacturer.
    b. Coordinate selection of floor polish with Owner's maintenance service.

2. Cover stair accessory products with un-dyed, untreated building paper until Substantial Completion.
3. Do not move heavy and sharp objects directly over stair accessories. Place plywood or hardboard panels over surfaces and under objects while they are being moved. Slide or roll objects over panels without moving panels.

3.6 PROJECT CLOSE OUT

A. See individual headings in this section for exact requirements.

END OF SECTION 09 65 13

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SECTION 09 68 13 – TILE CARPETING

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes
1. Modular Carpet Tile
2. Modular Walk-off Mat Tile

B. Related Sections, as applicable:
1. Section 09 65 16 Resilient Base and Accessories
2. Section 09 65 19 Resilient Tile Flooring
3. Section 09 65 16 Resilient Sheet Flooring

1.02 SUBMITTALS

A. Shop Drawing showing columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required as well as direction of carpet pile and pattern, location of edge moldings and edge bindings shall be submitted to the Architect for approval prior to installation.

B. Floor schedule using same room designations indicated on drawings.

C. Product Data: Provide data on specified products, describing physical and performance characteristics, sizes, patterns, colors available, and method of installation.

D. Verification Samples: Submit samples illustrating color and pattern for each carpet material specified.

E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

F. Maintenance Data: Include maintenance procedures, recommendations for maintenance materials and equipment, and suggested schedule for cleaning.

G. Manufacturer's Product Warranty.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications
1. Company specializing in manufacturing specified carpet with minimum 10 years documented experience.

2. Upon request, manufacturer to provide representative to assist in project start-up and to inspect installation while in process and upon completion. Representative will notify designated contact if any installation instructions are not followed.

3. Single Source Responsibility: Obtain each type of product from one source and by a single manufacturer.

B. Installer Qualifications
   1. Flooring contractor must be certified by the manufacturer prior to bid.

   2. Flooring contractor to be a specialty contractor normally engaged in this type of work and shall have prior experience in the installation of these types of materials.

   3. Flooring contractor possessing Contract for the product installation shall not sub-contract the labor without written approval of the Project Manager.

   4. Flooring contractor will be responsible for proper product installation, including floor testing and preparation as specified by the manufacturer and JOB CONDITIONS herein.

   5. Flooring contractor to provide Owner a written installation warranty that guarantees the completed installation to be free from defects in materials and workmanship for a period of one year after job completion.

1.04 DELIVERY, STORAGE, & HANDLING

A. Deliver materials to the site in manufacturer's original packaging listing manufacturer's name, product name, identification number, and related information.

B. Store in a dry location, between 60 degrees F and 80 degrees F and a relative humidity below 65%. Protect from damage and soiling. Store in pallet form as supplied by Manufacturer. Do not stack pallets.

C. Make stored materials available for inspection by the Owner's representative.

D. Store materials in area of installation for minimum period of 48 hours prior to installation.

1.05 PROJECT CONDITIONS

A. Sub-floor preparation is to include all required work to prepare the existing floor for installation of the product as specified in this document and Manufacturer's installation instructions.

B. The maximum amount of moisture evacuation from the floor is 5.0 pounds per 1,000 square feet in 24 hours. The acceptable pH level of the substrate is between 7.0 and 9.0. Flooring contractor is responsible for floor testing.

C. All material used in sub-floor preparation and repair shall be recommended by the carpet manufacturer and shall be chemically and physically compatible with the carpet system being bid.

D. Maintain minimum 65 degrees F ambient temperature and 65% Relative Humidity for 72 hours prior to, during, and 48 hours after installation.

E. Do not install flooring until space is enclosed and weatherproof, wet-work in space is completed and nominally dry, work above ceilings is complete, and ambient temperature and humidity conditions are and will be continuously maintained at values near those indicated for final occupancy.

1.06 EXTRA MATERIALS

A. Provide additional 5% of product for "attic stock."

PART 2 - PRODUCTS

2.01 PRODUCT WARRANTY

A. Warranty to be sole source responsibility of the Manufacturer. Second source warranties and warranties that involve parties other than the carpet manufacturer are unacceptable.

B. If the product fails to perform as warranted when properly installed and maintained, the affected area will be repaired or replaced at the discretion of the Manufacturer.

C. Chair pads are not required, but are recommended for optimum textural performance. Absent the use of chair pads, more intensive maintenance will be required for areas in direct contact with chair caster traffic, and some degree of appearance change is to be expected.

D. Warranty shall be for a specifically defined period of fifteen years. "Lifetime" warranties are not acceptable.

E. The fifteen-year warranty shall specifically warrant against:
    1. Excessive Surface Wear: More than 15% loss of pile fiber weight
    2. Excessive Static Electricity: More than 3.0 kV per AATCC 134
    3. Resiliency Loss of the Backing: More than 10% loss of backing resiliency
    4. Delamination
    5. Edge Ravel
    6. Zippering

F. Tuft Bind warranty in lieu of edge ravel and zippering is not acceptable.

2.02 FIBER

A. For carpet tile: Nylon Fiber: Dynex SD Bulked Continuous Filament (BCF) Nylon in a loop pile construction.

B. For walk-off tile: Nylon Finer: TDX® Nylon in a loop pile construction.

C. Fiber to contain carbon-core filament for permanent static control. Topical treatments are not acceptable.

D. Durable stain inhibitor should be applied to the fiber during product manufacturing to resist fiber staining and soiling.
    1. Initial: Minimum 400 ppm Fluorine per CRI TM-102
    2. After two hot water extractions per AATCC 171: Minimum 260 ppm Fluorine per CRI TM-102

2.03 BACKING CHARACTERISTICS

A. Primary Backing: Synthetic Non-Woven.

B. Secondary Backing:
    1. Density (ASTM D-1667): Min. 65 lbs/cu ft +/- 5%
    2. Standard Size: 24" x 24"
    3. Fiberglass Reinforced
    4. Face yarn fully fused to secondary backing system that will not delaminate.

5. Delamination: No delamination per ASTM D3936
6. Product must not contain pesticides (US EPA Registered Antimicrobials). Installation adhesives are exempt from this section.

2.04 PRODUCT SPECIFICATIONS

A. Carpet Tile, Manufactured by: Mannington Commercial, Inc.

1. Modular Carpet Tiles, 24” x 24”
2. Style: Dispatch
3. Collection: Exchange 2
4. Color: Haptics (13143)
5. Construction: Textured Patterned Loop
6. Gauge: 5/64
7. Stitch Rate: 9.67 units / inch
8. Density: 9,108
9. Pile Thickness: 0.083 inch.
10. Total Thickness, Average: 0.180 inch
11. Dye Method: Solution
12. Static Coefficient of Friction: ASTM C-1028; Passes ADA requirements.
13. Static Propensity: AATCC 134: 3.0 kV or less
14. Flooring Radiant Panel: ASTM E-648 or NFPA 253: Class 1
15. Acoustic Requirements: Noise Reduction Coefficient (NRC): 0.10 Minimum
16. Secondary Backing Density: Min. 65 lbs/cu ft +/- 5%

B. Walk – Off Carpet, Manufactured by: Shaw Contract, Inc.

1. Modular Walk-Off Mat Tiles, 24” x 24”
2. Style: Welcome II
3. Collection: Steppin’ Out
4. Color: “Charcoal”
5. Construction: Needlebond hobnail
6. Gauge: 1/10
7. Stitch Rate: 9.0 pile units/inch
8. Total Thickness, Average: 0.250 inch
9. Fiber System: PET Polyester
10. Dye Method: Solution Dyed
11. Static Propensity: AATCC 134: 1.1 kV
12. Flooring Radiant Panel: ASTM E-648: Class 1

B. Substitutes/Alternates

Subject to compliance with all requirements, “or equal” must match the selected colors, have similar aesthetic appearance and tuft density, factory-applied “dry” adhesive. Substitution sample and submittals must be submitted for written approval of quality and color at least ten days prior to bid to be considered. Sample of proposed substitute must be inclusive of both the face and proposed backing (color-only sample not acceptable).

2.05 ACCESSORIES

A. Materials recommended by Manufacturer for patching, leveling, priming, etc.

B. Base, Carpet Edge, and Transition Strips: As specified in applicable sections.

PART 3 EXECUTION

3.01 EXAMINATION / PREPARATION

A. Prepare sub-floor to comply with criteria established in Manufacturer's installation instructions. Use only preparation materials that are acceptable to the Manufacturer.

B. Remove all deleterious substances from substrate(s) that would interfere with or be harmful to the installation.

C. Remove sub-floor ridges and bumps. Fill cracks, joints, holes, and other defects.

D. Verify that sub-floor is smooth and flat within specified tolerances and ready to receive carpet.

E. Verify that substrate surface is dust-free and free of substances that would impair bonding of product to the floor.

F. Verify that concrete surfaces are ready for installation by conducting moisture and pH testing. Results must be within limits recommended by Manufacturer.

G. There will be no exceptions to the provisions stated in the Manufacturer's installation instructions.

3.02 INSTALLATION - GENERAL

A. Install product in accordance with Manufacturer's installation instructions.

B. Product as installed to be securely attached to the floor in compliance with CBC 11B-302.2.

C. Where demountable partitions or other items are indicated for installation on top of finished carpet tile floor, install carpet tile before installation of these items.

D. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings.

E. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

F. Roll with appropriate roller for complete contact of product with adhesive to sub-floor.

G. Trim carpet neatly at walls and around interruptions. Completed product is to be smooth and free of bubbles, puckers, and other defects.

3.03 PROTECTION & CLEANING

A. Remove excess adhesive and/or other from floor and wall surfaces without damage.

B. All rubbish, wrappings, debris, trimmings, etc. to be removed from site and disposed of properly.

C. Clean and vacuum surfaces using a beater brush/bar commercial vacuum.

D. After each area is installed, protect from soiling and damage by other trades.

END OF SECTION 09 68 13

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SECTION 09 72 16 – VINYL COATED PRE-WRAPPED PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Shop-fabricated, vinyl-wrapped wall panels at Library.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include data on physical characteristics, durability, fade resistance, and flame-resistance characteristics.

B. Samples for Initial Selection: For each type of wall covering indicated.

C. Samples for Verification: Full width by 36-inch- long section of wall covering from dye lot to be used for each type of wall covering indicated for each color, texture, and pattern required.

D. Schedule: For wall coverings. Use same designations indicated on Drawings.

E. Maintenance Data: Two copies of wall coverings to include in maintenance manuals. Resubmit at project close-out. *(Project Close-Out Item)*

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide fabric-wrapped wall panels meeting the following as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Surface-Burning Characteristics: As determine by testing per ASTM E 84.

2. Fire Growth Contribution: Meeting acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 286.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not install wall coverings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and

ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Lighting: Do not install wall covering until a lighting level of not less than 15 fc or a permanent level of lighting is provided on the surfaces to receive wall covering.

C. Wall coverings are to be installed prior to the installation of any visual display boards and casework referenced in Divisions 10 and 12.

PART 2 - PRODUCTS

2.1 PEFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: Panels shall comply with "Surface-Burning Characteristics" or "Fire Growth Contribution" Subparagraph below, or both, as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
1. Surface-Burning Characteristics: Comply with ASTM E 84 or UL 273; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   a. Flame-Spread Index: 25 or less.
   b. Smoke-Developed Index: 450 or less.
2. Fire Growth Contribution: Comply with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 286.

2.2 SHOP FABRICATED VINYL-WRAPPED PANELS:

A. General: Provide rolls and sheets of each type of wall covering, or preapproved equal, from the same run number or dye lot.

B. Pre-Wrapped Vinyl Wall Covering Boards:
1. Products:
   a. Koroseal Wallcoverings, West, Inc.
   b. Chatfield-Clarke Company, Inc.

2. Vinyl Wall-Covering Standards: Provide mildew-resistant products complying with the following:
   a. FS CCC-W-408 and CCFFA-W-101 for Type I, Class A.

3. Backing Material: Mineral-Fiber Board: Maximum flame-spread and smoke-developed indexes of 25 and 10, respectively; minimum density of 13 lb/cu. ft. (208 kg/cu. m).

4. Vinyl Colors, Textures and Patterns: **Group 1, 15 oz: "Beige"**

5. Pre-wrapped board sizes: 48" wide x 96" h, and 120" h as required.

2.3 ACCESSORIES

A. Use “Korogard” Color Matched or Complimentary Accessory Moldings, wrapped in fabric to match wall panels: Manufacturer's standard. J-Molding: Plastic #82. Divider Bar: Plastic #87/88. Inside Corner: Plastic #83. Outside Corner “F” molding: Plastic #85.

1. Color: Shall match wall panels.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for levelness, wall plumbness, maximum moisture content, and other conditions affecting performance of work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances that could impair pre-wrapped board installation, including mold, mildew, oil, grease, incompatible primers, dirt, and dust.

C. Prepare substrates to achieve a smooth, dry, clean, structurally sound surface free of flaking, unsound coatings, cracks, and defects.

1. Moisture Content: Maximum of 5 percent on new plaster, concrete, and concrete masonry units when tested with an electronic moisture meter.
2. Plaster: Allow new plaster to cure. Neutralize areas of high alkalinity.
3. Metals: If not factory primed, clean and apply metal primer.
4. Gypsum Board: Prime with primer recommended by wall-covering manufacturer.
5. Painted Surfaces: Treat areas susceptible to pigment bleeding.

D. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

E. Acclimatize wall-covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

3.3 INSTALLATION

A. General: Comply with wall-covering manufacturers' written installation instructions applicable to products and applications indicated, except where more stringent requirements apply.

B. Install pre-wrapped boards with no gaps or overlaps.

C. Install over gypsum backing board with adhesive with either nails or screws as required, with approximately 1/8 inch space at joints. Where installed over concrete or masonry substrate, nail with concrete nails to hold for adhesive.

3.4 CLEANING

A. Use cleaning methods recommended in writing by wall-covering manufacturer.

B. Replace pre-wrapped boards that cannot be cleaned.

C. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

END OF SECTION 09 72 16

SECTION 09 77 50 – FIBERGLASS REINFORCED WALL PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work specified in this section.
B. Section 10 26 00 – Impact Resistant Wall Protection.

1.2 DESCRIPTION OF WORK:

A. Extent of Fiberglass Reinforced (FRP) wall panels required are indicated on drawings and in schedules.
B. Mounting hardware, adhesives, accessories and trims.

1.3 QUALITY ASSURANCE:

A. Manufacturer: Obtain panels from a single manufacturer to ensure uniformity in quality of appearance and construction, unless otherwise indicated.

1.4 SUBMITTALS:

A. Shop Drawings: Submit product literature for approval and verification of panel sizes and anchorage method and location of panels.
B. Samples: submit full range of color samples for each type of panel system. Colors shall be selected from manufactures standard color selection. Colors to be selected by Architect.

1.5 RODUCT DELIVERY, STORAGE AND HANDLING:

A. Packaging of panels is the responsibility of the supplier. Secure panels on site in a weather proof location. At time of delivery inspect product for any defects, proper sizes and colors to match submittals. Return damaged or incorrect product and deliver correct and damaged free products in a timely manner.

1.6 PROJECT/SITE CONDITIONS:

A. Environmental Requirements:
1. Installation shall not begin until building is enclosed, permanent heating and cooling equipment is in operation and residual moisture from plaster, concrete or terrazzo work has dissipated.
2. Install panels between 60 degrees F - 75 degrees F (15 - 24 degrees C) and relative humidity below 55%, ideally at the same conditions as the room's normal operating temperatures after building is occupied.

3. Provide ventilation to disperse fumes during application of adhesive as recommended by adhesive manufacturer.

4. Do not install wall system until normal lighting conditions exist. Normal lighting conditions are described as those in place when the project is finished.

B. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

1. Wall, ceilings, floors and openings must be level, plumb, straight, in-line and square

1.7 WARRANTY

A. Project Warranty: Refer to Conditions of the Contract for project warranty provisions.
B. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.
C. Warranty Period: 5 years commencing on Date of Substantial Completion. Warranty extends to products assembled / installed and used in the manner intended and does not cover damage or failure caused by: misuse, abuse or accidents, exposure to extreme temperature, improper installation, improper maintenance and exposure to water or excessive humidity or excessive moisture.

PART 2 - PRODUCTS

2.2 ACCEPTABLE MANUFACTURERS:

A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:

1. NUDO Products Inc.
2. Crane Composites
3. Citadel

2.3 MATERIALS AND COMPONENTS:

A. Wall panels shall be .09" thick Class A rated. Surface texture of material and color to be selected by Architect. Provide as large as size possible to accommodate the installation as shown or noted on plans.
1. Texture: Smooth.
2. Color: White

B. Flame spread index 25, smoke developed index 335, USDA and FDA approved for food processing plants.

C. Aluminum moldings are to be installed at all joints and edges of FRP panels per manufacturer's instructions. Use "L" angle, "H" bead, and "J" bead, etc., as manufactured by panel manufacturer.

D. Stainless Steel Corner Guards are to be installed at all wall corners. Type 304 (NSF Standard 51). 3-1/2"x3-1/2"x96", 1/8" radius, 90 degree angle. No. 4 Sating Finish.

E. Provide adhesive and silicone sealant for installation.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Install wall panels using adhesive and sealant as recommended by manufacturer and accepted by all agencies to be compatible with other existing surfaces. Contractor shall prepare existing and new surfaces as necessary for a proper, complete and acceptable installation approved by the manufacturer.

B. Install moldings and panels true and straight. Inspect substrate material prior to installation and notify Architect if unacceptable to receive FRP panels. Have corrections made to substrate before proceeding. Installation of panels to substrate without notifying of any problems is an acceptance of the material and any problems with the panel installation shall be corrected at no expense to owner.

C. Install panels per manufactures recommendation over existing or new surfaces. Replace damaged panels due to shipping or installation neglect prior to final inspection.

3.2 ADJUST AND CLEAN:

A. Protection and Completed Work: Advise Contractor of proper procedures required for protection of installed wall panels from damage or deterioration until acceptance of work.

3.3 PROJECT CLOSE-OUT:

A. See individual headings in this section for exact requirements.

END OF SECTION 09 77 50

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SECTION 09 91 00 – PAINTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Surface preparation and field painting of exposed interior items and surfaces, including mechanical and electrical equipment that do not have a factory-applied finish.

B. Surface preparation and field painting of exposed exterior items and surfaces.

1.2 REFERENCES

A. ASTM International (ASTM): ASTM D 16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications.

B. Steel Structures Painting Council (SSPC) SP6 - Commercial Blast Cleaning Procedures.

C. Steel Structures Painting Council (SSPC) SP10 - Near White Blast Cleaning Procedure.

1.3 DEFINITIONS

A. General: Standard coating terms defined within Masters Painters Institute (MPI) manual.
   1. Gloss level 1 - Flat with a gloss range below 5 when measured at a 60-degree meter and 10 when measured at an 85-degree meter.
   2. Gloss level 2 - Low Sheen with a gloss range of 5 to 10 when measured at a 60 degree meter and 10 to 35 when measured at an 85 degree meter.
   3. Gloss level 3 - Eggshell with a gloss range between 10 and 15 when measured at a 60-degree meter and 10 to 35 when measured at an 85-degree meter.
   4. Gloss level 4 - Satin with a gloss range between 25 to 35 when measured with a 60 degree meter.
   5. Gloss level 5 - Semi-Gloss with a gloss range between 50 and 55 when measured at a 60 degree meter.
   6. Gloss level 6 - Gloss with a gloss range more than 70 when measured at a 60 degree meter.

1.4 SUBMITTALS

A. Submit under provisions of Division 01.

B. [Product Data]: Manufacturer's data sheets on each product to be used, including:
   1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
   2. Preparation instructions and recommendations.
   3. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.
   4. Do not include safety data sheets (MSDS) in submittal.

C. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

D. Verification Samples: For each finish product specified, two samples, minimum size 6

inches (150 mm) square, representing actual product, color, and patterns.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.

C. Paint exposed surfaces. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Architect will select from standard colors and finishes available.

D. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

E. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
   1. Finish areas designated by Architect.
   2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
   3. Refinish mock-up area as required to produce acceptable work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label:

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain storage containers in a clean condition, free of foreign materials and residue.

C. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

D. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 deg F (10 and 32 deg C), unless manufacturers instructions specifically state's.

E. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95 deg F (7 and 35 deg C).

F. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.
   1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

1.7 EXTRA MATERIALS

A. Furnish extra paint materials from the same production run as the materials applied and in

the quantities described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to Owner.

B. Quantity: Furnish Owner with an additional three percent, but not less than 1 gal (3.8 l) or 1 case, as appropriate, of each material and color applied.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Sherwin-Williams Paints,
102 Cross Street Suite 130, San Luis Obispo, CA 93401
(805) 596-0273
Area Representative: Mike Lechuga Michael.d.lechuga@sherwin.com

B. Requests for substitutions will be considered in accordance with provisions of Division 01.

2.2 PAINT MATERIALS - GENERAL

A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. VOC Classification: Provide materials, including primers, undercoats, and finish-coat materials, that meet local air quality management district regulations.

C. Color: Refer to Finish Schedule and Paint Schedule in drawings for paint colors.

D. Application Rate: Coating thickness for primer, intermediate, barrier and finish coats shall be measured as Dry Film Thickness (DFT) and comply with manufacturer's published recommendations.

2.3 SURFACE REPAIR / STABILIZATION MATERIALS

A. Hardener / Resin for all exposed exterior end grain, wood that is damaged, slightly decayed, softened, weathered, or in preparation for any epoxy filler:

1. Quick drying, Solvent-borne resin hardener, such as Minwax High Performance Wood Hardener, System 3 End Rot, Abatron Liquid Wood, Smith’s Clean penetrating epoxy sealer, or approved equal.

B. Filler for defects in wood.

1. 2-part Epoxy filler such as Minwax High Performance Wood Filler, System 3 Wood Putty, Abatron Wood Filler, or approved equal.

C. Filler defects for metal.

1. 2-part Epoxy filler for Metal such as Evercoat “Rage” or approved equal.

D. Metal Etch / Rust converter for prepping bare steel, rusty, or zinc coated surfaces:

2. Phosporic Acid metal etch and prep such as Skyco OSPHO Metal Treatment or approved equal.

2.4 EXTERIOR METAL

A. Ferrous Metal:

1. Primer: B66W01310 Pro industrial Procryl Primer
2. First Coat: B66W01151 Pro Industrial DTM Acrylic Semi Gloss
3. Second Coat: B66W01151 Pro Industrial DTM Acrylic Semi Gloss

B. Galvanized Metal, Aluminum and Copper:
1. Primer: B66W01310 Pro industrial Procryl Primer
2. First Coat: B66W01151 Pro Industrial DTM Acrylic Semi Gloss
3. Second Coat: B66W01151 Pro Industrial DTM Acrylic Semi Gloss

2.5 EXTERIOR WOOD

A. Non-Staining Wood and Hardboard:
1. Primer: B42W08141 Exterior Latex Wood Primer
2. First Coat: A12W00151 A-100 Exterior Low-Sheen Latex
3. Second Coat: A12W00151 A-100 Exterior Low-Sheen Latex

B. Wood Trim: Doors, Windows, and Shutters:
1. Primer: B42W08141 Exterior Latex Wood Primer
2. First Coat: A12W00151 A-100 Exterior Semi-Gloss Latex
3. Second Coat: A12W00151 A-100 Exterior Semi-Gloss Latex

2.6 EXTERIOR MASONRY, CONCRETE AND STUCCO

A. Concrete, Stucco, and Brick (Painted Finish):
1. Primer: LX02W0050 LXN Primer WH
2. First Coat: A12W00151 A-100 Exterior Low Sheen Latex
3. Second Coat: A12W00151 A-100 Exterior Low Sheen Latex

B. Cement-Fiber Board (Painted Finish):
1. Primer: LX02W0050 LXN Primer WH
2. First Coat: A12W00151 A-100 Exterior Low Sheen Latex
3. Second Coat: A12W00151 A-100 Exterior Low Sheen Latex

2.7 INTERIOR GYPSUM WALLBOARD

A. Smooth Wall Finishes:
1. Primer: B28W08020 – PVA Primer Interior Primer
2. First Coat: B31W02651 – ProMar 200 Zero VOC Interior Latex Low Sheen
3. Second Coat: B31W02651 – ProMar 200 Zero VOC Interior Latex Low Sheen

2.8 INTERIOR PLASTER, CONCRETE, MASONRY

A. Painted Finish on Plaster and Concrete:
1. Primer: B51W00620 – Prep Rite Pro Block interior/Exterior Latex Primer/Sealer
2. First Coat: B31W02651 – ProMar 200 Zero VOC Interior Latex Semi-Gloss
3. Second Coat: B31W02651 – ProMar 200 Zero VOC Interior Latex Semi-Gloss

2.9 INTERIOR WOOD, HARDBOARD (PAINTED)

A. Wood and Hardboard (Painted Finish):
1. Primer: B51W00620 – Prep Rite Pro Block interior/Exterior Latex Primer/Sealer
2. First Coat: B31W02651 – ProMar 200 Zero VOC Interior Latex Semi-Gloss
3. Second Coat: B31W02651 – ProMar 200 Zero VOC Interior Latex Semi-Gloss

2.10 INTERIOR WOOD (FINISHED)

A. Wood and Hardboard (Stained or Finish):
1. Primer: None
2. First Coat: Minwax Indoor/Outdoor Helmsman Spar Urethane, Satin
3. Second Coat: Minwax Indoor/Outdoor Helmsman Spar Urethane, Satin

2.11 INTERIOR METAL

A. Ferrous Metal:
1. Primer: B66W01151 Pro Industrial DTM Acrylic Semi Gloss
2. First Coat: B66W01151 Pro Industrial DTM Acrylic Semi Gloss
3. Second Coat: B66W01151 Pro Industrial DTM Acrylic Semi Gloss

B. Galvanized Metal and Aluminum:
1. Primer: B66W01310 Pro industrial Procryl Primer
2. First Coat: B66W01151 Pro Industrial DTM Acrylic Semi Gloss
3. Second Coat: B66W01151 Pro Industrial DTM Acrylic Semi Gloss

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
1. Notify Architect about anticipated problems when using the materials specified over substrates primed by others.
2. If a potential incompatibility of primers applied by others exists, obtain the following from the primer Applicator before proceeding:
a. Confirmation of primer's suitability for expected service conditions.
b. Confirmation of primer's ability to be top coated with materials specified.

3.2 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.
1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning.
1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.

1. Provide barrier coats over incompatible primers or remove and reprime.
2. Provide barrier coats over incompatible primers or remove primers and reprime substrate.
3. Cementitious Substrates: Prepare concrete, brick, concrete masonry block, and cement plaster surfaces to be coated. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods to prepare surfaces.
   a. Use abrasive blast-cleaning methods if recommended by coating manufacturer.
   b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not coat surfaces if moisture content exceeds that permitted in manufacturer's written instructions.
4. Wood Substrates: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Smoothly sand surfaces exposed to view and dust off.
   a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer, before applying primer.
   b. Immediately on delivery, prime edges, ends, faces, undersides, and backsides of wood to be coated.
   c. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
   d. Determine moisture content of surfaces by performing a moisture test. Do not coat if moisture content exceeds 15 percent.
5. Ferrous-Metal Substrates: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC recommendations.
   a. Blast-clean steel surfaces as recommended by coating manufacturer and according to SSPC-SP 10.
   b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
   c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire brush, solvent clean, and touch up with same primer as the shop coat.
6. Nonferrous-Metal Substrates: Clean nonferrous and galvanized surfaces according to manufacturer's written instructions for the type of service, metal substrate, and application required.
   a. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

D. Material Preparation: Carefully mix and prepare coating materials according to manufacturer's written instructions.
   1. Maintain containers used in mixing and applying coatings in a clean condition, free of foreign materials and residue.
   2. Stir materials before applying to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into the material. Remove film and, if necessary, strain coating material before using.
   3. Use only the type of thinners approved by manufacturer and only within recommended limits.
   4. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.3 APPLICATION

A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.

B. Number of Coats: A minimum of one (1) prime coat and two (2) finish coats shall be required for all paints and surfaces.

C. General: Apply high-performance coatings according to manufacturer's written instructions.
   1. Use applicators and techniques best suited for the material being applied.
   2. Do not apply high-performance coatings over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to forming a durable coating film.
   3. Coating surface treatments, and finishes are indicated in the coating system descriptions.
   4. Provide finish coats compatible with primers used.
   5. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, grilles, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.

D. Application Procedures: Apply coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
   1. The number of coats and film thickness required is the same regardless of application method.
   2. Completed Work: Match approved Samples for color, texture, and coverage. Remove, refinish, or recoat work that does not comply with specified requirements.

3.4 FIELD QUALITY CONTROL

A. Owner reserves the right to invoke the following test procedure at any time and as often as Owner deems necessary during the period when paint is being applied:
   1. Owner will engage a qualified independent testing agency to sample paint material being used. Samples of material delivered to Project will be taken, identified, sealed, and certified in the presence of Contractor.
   2. Owner may direct Contractor to stop painting if test results show material being used does not comply with specified requirements. Contractor shall remove non-complying paint from Project site, pay for testing, and repaint surfaces previously coated with the non-complying paint. If necessary, Contractor may be required to remove non-complying paint from previously painted surfaces if, on repainting with specified paint, the two coatings are incompatible.

3.5 CLEANING

A. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

3.6 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.

B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.

C. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces.

END OF SECTION 09 91 00

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SECTION 10 11 00 - VISUAL DISPLAY SURFACES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
1. Markerboards.

B. Related Sections include the following:

1. Division 6 Section “Rough Carpentry” for wood blocking.

1.3 DEFINITIONS

A. Visual Display Boards: Markerboards.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Show location of panel joints, anchors, reinforcement, accessories, layout and installation details.
2. Include sections of typical trim members.

C. Samples for Initial Selection: For each type of visual display surface indicated and as follows:

1. Actual sections of porcelain-enamel face sheet.
2. Samples of accessories involving color selection.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for surface-burning characteristics of vinyl and polyester fabrics.

E. Qualification Data: For Installer.

F. Certification:Submit manufacturer’s certification that materials comply with the specified requirements.
(Project Close-Out Item)

G. Maintenance Data: 2 copies each of visual display surfaces to include in maintenance manuals. *(Project Close-Out Item)*

H. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of visual display surface through one source from a single manufacturer.

1. Manufacturer must have five (5) years minimum experience under one manufacturer's name.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-built visual display boards, including factory-applied trim where indicated, completely assembled in one piece without joints, where possible. If dimensions exceed maximum manufactured panel size, provide two or more pieces of equal length as acceptable to Architect. When overall dimensions require delivery in separate units, prefit components at the factory, disassemble for delivery, and make final joints at the site.

B. Store visual display units vertically with packing materials between each unit.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings.

B. Sequence: Sequence of installation requires all wall coverings referenced in Division 9 to be in place prior to installation of any casework visual display Surfaces.

1.8 WARRANTY *(Project Close-Out Item)*

A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer's standard form in which manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Surfaces lose original writing and erasing qualities.
b. Surfaces become slick or shiny.
c. Surfaces exhibit crazing, cracking, or flaking.

2. Warranty Period: 50 years from date of Substantial Completion.

3. Replacement is limited to material replacement only; labor for removal and reinstallation is not included.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Product: Subject to compliance with requirements, provide product specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 MATERIALS, GENERAL

A. Porcelain-Enamel Face Sheet: Porcelain-enamel-clad, ASTM A 463/A 463M, Type 1, stretcher-leveled aluminized steel, with 0.0236-inch uncoated thickness; with 2 coat porcelain-enamel coating, ground coat and color cover coat, fused to steel at approximately 1500 deg F. Concealed face with a 1 coat process consisting of a ground coat.

1. Gloss Finish: Low gloss; dry-erase markers wipe clean with dry cloth or standard eraser. Suitable for use as projection screen.

B. Particleboard: ANSI A208.1, Grade 1-M-1.

C. Extruded Aluminum: ASTM B 221, Alloy 6063.

2.3 MARKERBOARD ASSEMBLIES

A. Porcelain-Enamel Markerboard Assembly: Balanced, high-pressure, factory-laminated markerboard assembly of 3-ply construction consisting of backing sheet, core material, and 0.024-inch- thick, porcelain-enamel face sheet with low-gloss finish.

1. Manufacturers:
   a. Best-Rite Manufacturing.
   b. Claridge Products & Equipment, Inc..
   c. Polyvision
   d. Platinum Visual Systems, ABC School Equipment.
2. Particleboard Core: 1/2 inch thick; with 0.015-inch- thick, aluminum sheet backing.
3. Laminating Adhesive: Manufacturer's standard moisture-resistant thermoplastic type.
4. Subject to compliance, manufacturer shall be Nelson Adams 500 Series, or equal.

B. Sizes: 4’-0” by 8’-0” (or as shown on the Drawings).

2.4 MARKERBOARD ACCESSORIES

A. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch- thick, extruded aluminum; of size and shape indicated.

1. Factory-Applied Trim: Manufacturer's standard box style trim, to eliminate grounds.

B. Chalktray: Manufacturer's standard, continuous.

1. Box Type: Extruded aluminum with slanted front, grooved tray, and cast-aluminum end closures.

C. Map Rail: Provide the following accessories:

1. Display Rail: Continuous and integral with map rail; fabricated from cork approximately 1 to 2 inches wide.
2. End Stops: Located at each end of map rail.
3. Paper Holder: Extruded aluminum; designed to hold paper by clamping action.
4. Flag holder: Cast aluminum.

2.5 FABRICATION

A. Porcelain-Enamel Visual Display Assemblies: Laminate porcelain-enamel face sheet and backing sheet to core material under heat and pressure with manufacturer's standard flexible, waterproof adhesive.

B. Aluminum Frames and Trim: Fabricate units straight and of single lengths, keeping joints to a minimum. Miter corners to neat, hairline closure.

1. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display units at manufacturer's factory before shipment.

2.6 ALUMINUM FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

D. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance.

B. Examine roughing-in for electrical power systems to verify actual locations of connections before installation of motor-operated, sliding visual display units.

C. Examine walls and partitions for proper backing for visual display surfaces.

D. Examine walls and partitions for suitable framing depth where sliding visual display units will be installed.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove dirt, scaling paint, projections, and depressions that will affect smooth, finished surfaces of visual display boards.

3.3 INSTALLATION, GENERAL

A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

3.4 INSTALLATION OF FACTORY-FABRICATED VISUAL DISPLAY UNITS

A. Visual Display Boards: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display boards with fasteners at not more than 16 inches o.c. Secure both top and bottom of boards to wood backing in walls.

1. Field-Applied Aluminum Trim: Attach trim over edges of visual display boards and conceal grounds and clips. Attach trim to boards with fasteners at not more than 24 inches o.c.

a. Attach chalktrays to boards with fasteners at not more than 12 inches o.c.

3.5 CLEANING AND PROTECTION

A. Clean visual display surfaces according to manufacturer's written instructions. Attach one cleaning label to visual display surface in each room.

B. Touch up factory-applied finishes to restore damaged or soiled areas.

C. Cover and protect visual display surfaces after installation and cleaning.

END OF SECTION 10 11 00

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SECTION 10 14 00 - SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Panel signs.
2. Signage accessories.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of sign.

B. Shop Drawings: Include plans, elevations, and large-scale sections of typical members and other components. Show mounting methods, grounds, mounting heights, layout, spacing, reinforcement, accessories, and installation details.

1. Provide message list for each sign, including large-scale details of wording, lettering, artwork, and braille layout.
2. Wiring Diagrams: For signs with illuminated characters.

C. Samples for Initial Selection: For each type of sign material indicated that involves color selection.

D. Samples for Verification: For each type of sign, include the following Samples to verify color selected:

1. Panel Signs: Full-size Samples of each type of sign required.
2. Dimensional Characters: Full-size Samples of each type of dimensional character (letter and number) required. Show character style, material, finish, and method of attachment.
3. Casting: Show representative texture, character style, spacing, finish, and method of attachment.
4. Approved samples will not be returned for installation into Project.

E. Qualification Data: For Installer.

F. Maintenance Data: For signage cleaning and maintenance requirements to include in maintenance manuals. *(Project Close-Out Item)*

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by signage manufacturer.

B. Source Limitations: Obtain each sign type through one source from a single manufacturer.

C. Regulatory Requirements: Comply with the Americans with Disabilities Act (ADA); CAC, Title 24, 2019 CBC Chapters 10 & 11B and with code provisions as adopted by authorities having jurisdiction.

1. Interior Code Signage: Provide signage as required by accessibility regulations and requirements of authorities having jurisdiction. These include, but are not limited to, the following:

a. Illuminated Exit Signs: Refer to Division 26.
b. Signs for Accessible Spaces.

1.5 PROJECT CONDITIONS

A. Field Measurements: Where sizes of signs are determined by dimensions of surfaces on which they are installed, verify dimensions by field measurement before fabrication and indicate measurements on Shop Drawings.

1.6 COORDINATION

A. For signs supported by or anchored to permanent construction, advise installers of anchorage devices about specific requirements for placement of anchorage devices and similar items to be used for attaching signs.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PANEL SIGNS

A. General: Provide panel signs that comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.

1. Produce smooth panel sign surfaces constructed to remain flat under installed conditions within tolerance of plus or minus 1/32 inch measured diagonally.

B. Manufacturers:

1. Garnet Sign Studio (San Francisco, CA)
2. Classic Signs & Awards (Concord, CA)
3. Designer Sign Systems (San Jose, CA)

C. Plastic Laminate: Provide high-pressure laminate engraving stock with face and core plies in contrasting colors as selected by Architect from manufacturer's full range.

D. Aluminum Sheet and Plate: ASTM B 209 (ASTM B 209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of 5005-H15.

E. Laminated Panels: Permanently laminate face panels to backing sheets of material; use manufacturer's standard process.

F. Graphic Content and Style: Provide sign copy that complies with requirements indicated on Drawings for size, style, spacing, content, mounting height and location, material, finishes, and colors of signage.

G. Tactile and Braille Copy: Manufacturer's standard process for producing copy complying with ADA Accessibility Guidelines and ICC/ANSI A117.1. Text shall be accompanied by California Contracted Grade 2 braille. Produce precisely formed characters with domed cut edges free from burrs and cut marks.

1. Panel Material: Opaque acrylic sheet.
2. Raised-Copy Thickness: Not less than 1/32 inch.
3. Dots shall be 0.100 inch on center in each cell with 0.300 inch space between cells, domed or rounded raised, 0.059 inch to 0.063 inch in diameter.

H. Engraved Copy: Machine engrave letters, numbers, symbols, and other graphic devices into panel sign on face indicated to produce precisely formed copy, incised to uniform depth.

1. Engraved Plastic Laminate: Engrave through exposed face ply of plastic-laminate sheet to expose contrasting core ply. Sign inserts shall be routed form Rowmark “Ultramattes” reverse engravable laminate acrylic plastic, colors to be selected from Rowmark’s standard color chart. Letters, numbers and symbols shall be either laser cut or machine profile cut from Rowmark “ADA Alternative Appliqué” material and applied to the surface using 3M 467MP Hi Performance Adhesive Sheeting.

2.3 PANEL SIGN TYPES

A. Room Signs & Identification Signage:

1. Material: Plastic laminate.
2. Copy: Tactile and braille.
3. Character Style: Univers 55.
4. Text: As indicated.
5. Message: Fixed.
6. Sizes:

a. Sign: Room name: 4 inch by 10 inch unless legend requires a longer sign.
b. Character: Minimum 1-inch high characters. Centered on background and centered on aluminum frame.

7. Colors:
   a. Character: As selected by Architect from manufacturer's full range.
   b. Background: As selected by Architect from manufacturer's full range.

B. Assisted Listening Device Sign:

1. Material: Plastic laminate.
2. Perimeter: none
3. Copy: Engraved.
4. Character Style: Univers 55.
5. Text: As indicated on the Drawings.
6. Message: Fixed.
7. Sizes:

   a. Sign: Comply with Section 11B-703.5, 2019 C.B.C.
   b. Character: Comply with Section 11B-703.5, 2019 C.B.C.

8. Colors:

   a. Character: White
   b. Background: As selected by Architect from manufacturer's full range

C. Toilet Room Signs:

1. Material: Cast-acrylic sheet, ¼ inch thick.
2. Perimeter: Unframed at door and wall mounted signs.
3. Copy: Raised. (Grade 2 Braille, California contracted)
4. Character Style: Univers 55.
5. Text: According to requirements in the ADA or of authorities having jurisdiction, whichever are more stringent.
6. Message: Fixed.
7. Sizes:

   a. Sign:
      1) "Boys" – Equilateral triangle, 12 inches on a side. Door mounted.
      2) "Girls" – Circle, 12 inches diameter. Door mounted.
      3) "Unisex" - Equilateral triangle superimposed over a 12-inch circle. Door mounted.
   b. Character: Minimum 1-inch high characters. Grade 2 Braille at accessible facilities.

8. Colors:
   a. Character: Contrasting color to door as selected by Architect.
   b. Background: Contrasting color to door as selected by Architect.

2.4 ACCESSORIES

A. Vinyl Film: Provide opaque nonreflective (interior) and reflective (exterior) vinyl film, 0.0035-inch minimum thickness, with pressure-sensitive adhesive backing suitable for both exterior and interior applications.

B. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

2.5 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Verify that items**,** including anchor inserts, and electrical power provided under other sections of Work are sized and located to accommodate signs.

C. Examine supporting members to ensure that surfaces are at elevations indicated or required to comply with authorities having jurisdiction and are free from dirt and other deleterious matter.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Locate signs and accessories where indicated, using mounting methods of types described and in compliance with manufacturer's written instructions unless otherwise indicated.

1. Install signs level, plumb, and at heights indicated, with sign surfaces free from distortion and other defects in appearance.

2. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches of sign without encountering protruding objects or standing within swing of door.

B. Wall-Mounted Panel Signs: Attach panel signs to wall surfaces using methods indicated below:
1. Shim Plates: Provide 1/8-inch- thick shims as required for level mounting, concealed aluminum shim plates with predrilled and countersunk holes, at locations indicated, and where other mounting methods are not practicable. Attach plate with fasteners and anchors suitable for secure attachment to substrate. Attach panel signs to plate using method specified above.

2. Non-Exposed Mechanical Fasteners: Use nonremovable mechanical fasteners placed through predrilled holes in aluminum frames. Attach signs with fasteners and anchors suitable for secure attachment to substrate as recommended in writing by sign manufacturer.

3. Where panel signs are scheduled or indicated to be mounted on glass, provide matching plate on opposite side of glass to conceal mounting materials.

3.3 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.

END OF SECTION 10 14 00

SECTION 10 21 00 - TOILET COMPARTMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Solid plastic toilet compartments including the following: Hiny Hiders by Scranton Products
   1. Floor mounted overhead-braced toilet compartments.
   2. Floor-to-ceiling toilet compartments.
   3. Ceiling hung toilet compartments.
   4. Privacy screens.

1.2 REFERENCES

A. National Fire Protection Association (NFPA) 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.

B. ASTM A 666 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

C. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

D. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

B. Shop Drawings: Provide layout drawings and installation details with location and type of hardware required.

C. Verification Samples: For each finish product specified, provide owner and architect a sample representing actual product, color, and patterns.

1.4 QUALITY ASSURANCE

A. Materials: Doors, panels and pilasters, constructed from high density polyethylene (HDPE) resins. Partitions to be fabricated from polymer resins compounded under high pressure, forming a single component which is waterproof, nonabsorbent and has a self-lubricating surface that resists marks from pens, pencils, markers and other writing instruments.

B. Performance Requirements:
   1. Fire Resistance: Partition materials shall comply with the following requirements, when tested in accordance with ASTM E 84:

a. Class A flame spread/smoke developed rating.
b. Class B flame spread/smoke developed rating.

2. Material Fire Ratings:
   a. National Fire Protection Association (NFPA) 286: Pass.
   b. International Code Council (ICC): Class B.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

1.6 PROJECT CONDITIONS

A. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.7 WARRANTY

A. Manufacturer guarantees its plastic against breakage, corrosion, and delamination under normal conditions for 25 years from the date of receipt by the customer. If materials are found to be defective during that period for reasons listed above, the materials will be replaced free of charge.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Scranton Products, which is located at: 801 E. Corey St.; Scranton, PA 18505; Toll Free Tel: 800-445-5148; Fax: 855-376-6161; Email:request info (info@scrantonproducts.com); Web:www.scrantonproducts.com

B. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.2 MATERIAL

A. Plastic Panels: High density polyethylene (HDPE) suitable for exposed applications, waterproof, non-absorbent, and graffiti-resistant textured surface.

B. Zinc Aluminum Magnesium and Copper Alloy (Zamac): ASTM B 86.

C. Stainless Steel Castings: ASTM A167, Type 304.

D. Aluminum: ASTM 6463-T5 alloy.

2.3 SOLID PLASTIC TOILET COMPARTMENTS

A. Basis of Design: Hiny Hiders Toilet Partitions as manufactured by and supplied by Scranton Products.
   1. Style: Floor mounted overhead-braced toilet compartments.

B. Panel Color: Traditional Series.
   1. Glacier Grey - Orange Peel.

C. Pilaster Shoes: 3 inches (76 mm) high type 304, 20 gauge stainless steel. Secured to pilasters with a stainless-steel tamper resistant Torx head sex bolt.

D. Headrail: Heavy-duty extruded 6463-T5 alloy aluminum with anti-grip design. Finish to be clear anodized. Fastened to headrail brackets with stainless steel tamper resistant Torx head sex bolt, and fastened at the top of the pilaster with stainless steel tamper resistant Torx head screws.
   1. Headrail Brackets: 20 gauge stainless steel with satin finish. Secured to the wall with stainless steel tamper resistant Torx head screws.

E. Wall Brackets:
   1. Aluminum Brackets: Heavy-duty aluminum 6463-T5 alloy.
   2. Brackets are fastened to pilasters with stainless steel tamper resistant Torx head screws and fastened to the panels with stainless steel tamper resistant Torx head sex bolts.

F. Door Hardware:
   1. Continuous Piano Hinge
   2. Stainless Steel Paddle Latch and Housing: Heavy-duty stainless steel type 304. Bright finish.
   3. Doors supplied with one coat hook/bumper and door pull made of chrome plated Zamak.
   4. Equip outswing handicapped doors with second door pull and door stop.

2.4 SOLID PLASTIC PRIVACY SCREENS

A. Provide plastic privacy screens in urinal and entry toilet room applications as indicated or scheduled.

B. Panels, and pilasters, if required, 1 inch (25 mm) thick with edges rounded to a radius. Screens to be mounted at 14 inches (356 mm) above the finished floor. Color as selected by Architect from manufacturer's full line of current colors.

C. Screen Type: Wall mounted.
   1. Urinal Screens: 18 inches (457 mm) wide by 55 inches (1397 mm) high.

PART 3 EXECUTION

3.1 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Examine areas to receive toilet partitions, screens, and shower compartments for correct height and spacing of anchorage/blocking and plumbing fixtures that affect installation of partitions. Report discrepancies to the architect.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install partitions rigid, straight, plumb, and level manor, with plastic laid out as shown on shop drawings.

C. Clearance at vertical edges of doors shall be uniform top to bottom and shall not exceed 3/8

inch (9.5 mm).

D. No evidence of cutting, drilling, and/or patching shall be visible on the finished work.

E. Finished surfaces shall be cleaned after installation and be left free of imperfections.

3.3 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 10 28 00 - TOILET ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Toilet and bath accessories.
2. Underlavatory guards.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions and thicknesses, dimensions, profiles, fastening and mounting methods, specified options, and finishes for each type of accessory specified.

B. Samples: For each accessory item to verify design, operation, and finish requirements.

C. Setting Drawings: For cutouts required in other work; include templates, substrate preparation instructions, and directions for preparing cutouts and installing anchoring devices.

D. Maintenance Data: For accessories to include in maintenance manuals specified in Division 1. Provide lists of replacement parts and service recommendations. *(Project Close-Out Item)*

E. Design Calculations: Computations demonstrating design and/or test data to Architect for review and/or submittal to the Division of the State Architect. Design calculations shall be proposed and signed by a registered professional engineer to comply with the requirements of the 2019 C.B.C., Section 11B-609.8 regarding structural strength of grab bars, fasteners and mounting devices to be secured to the toilet partitions.

1.4 QUALITY ASSURANCE

A. Source Limitations: Provide products of same manufacturer for each type of accessory unit and for units exposed to view in same areas, unless otherwise approved by Architect.

B. Product Options: Accessory requirements, including those for materials, finishes, dimensions, capacities, and performance, are established by specific products indicated in the Toilet and Bath Accessory Schedule.

1. Products of other manufacturers listed in Part 2 with equal characteristics, as judged solely by Architect, may be provided.
2. Do not modify aesthetic effects, as judged solely by Architect, except with Architect's approval. Where modifications are proposed, submit comprehensive explanatory data to Architect for review.

1.5 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by disabled persons, proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.6 WARRANTY *(Project Close-Out Item)*

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

1. Manufacturer’s written 1 year warranty against defects in materials and workmanship on all accessories.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide accessories by one of the following:

1. Toilet and Bath Accessories:

a. American Specialties, Inc.

2. Underlavatory Guards:

a. Brocar Products, Inc.
b. Truebro, Inc.

B. Products: Subject to compliance with requirements, provide one of the products indicated for each designation in the Toilet and Bath Accessories.

2.2 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, with No. 4 finish (satin), in 0.0312-inch minimum nominal thickness, unless otherwise indicated.

B. Brass: ASTM B 19, leaded and unleaded flat products; ASTM B 16, rods, shapes, forgings, and flat products with finished edges; ASTM B 30, castings.

C. Sheet Steel: ASTM A 366/A 366M, cold rolled, commercial quality, 0.0359-inch minimum nominal thickness; surface preparation and metal pretreatment as required for applied finish.

D. Galvanized Steel Sheet: ASTM A 653/A 653M, G60.

E. Chromium Plating: ASTM B 456, Service Condition Number SC 2 (moderate service), nickel plus chromium electrodeposited on base metal.

F. Baked-Enamel Finish: Factory-applied, gloss-white, baked-acrylic-enamel coating.

G. Mirror Glass: ASTM C 1036, Type I, Class 1, Quality q2, nominal 6.0 mm thick, with silvering, electroplated copper coating, and protective organic coating complying with FS DD-M-411.

H. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

I. Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of galvanized steel when concealed.

2.3 FABRICATION

A. General: One, maximum 1-1/2-inch- diameter, unobtrusive stamped manufacturer logo, as approved by Architect, is permitted on exposed face of accessories. On interior surface not exposed to view or back surface of each accessory, provide printed, waterproof label or stamped nameplate indicating manufacturer's name and product model number.

B. Surface-Mounted Toilet Accessories: Unless otherwise indicated, fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with continuous stainless-steel hinge. Provide concealed anchorage where possible.

C. Recessed Toilet Accessories: Unless otherwise indicated, fabricate units of all-welded construction, without mitered corners. Hang doors and access panels with full-length, stainless-steel hinge. Provide anchorage that is fully concealed when unit is closed.

D. Framed Glass-Mirror Units: Fabricate frames for glass-mirror units to accommodate glass edge protection material. Provide mirror backing and support system that permits rigid, tamper-resistant glass installation and prevents moisture accumulation.

1. Provide galvanized steel backing sheet, not less than 0.034 inch and full mirror size, with nonabsorptive filler material. Corrugated cardboard is not an acceptable filler material.

E. Mirror-Unit Hangers: Provide mirror-unit mounting system that permits rigid, tamper- and theft-resistant installation, as follows:

1. One-piece, galvanized steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.

2. Heavy-duty wall brackets of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.

F. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Secure mirrors to walls in concealed, tamper-resistant manner with special hangers, toggle bolts, or screws. Set units level, plumb, and square at locations indicated, according to manufacturer's written instructions for substrate indicated.

C. Install grab bars to withstand a downward load of at least 250 lbf, when tested according to method in ASTM F 446.

D. Toilet Tissue Dispensers: Supplied by District and installed by Contractor. 3 inch maximum profile from wall surface in accessible stalls, typical.

E. Paper Towel Dispensers: Supplied by District and installed by Contractor.

F. Soap Dispensers: Supplied by District and installed by Contractor.

G. Seat-Cover Dispenser: Supplied by District and installed by Contractor.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation and verify that mechanisms function properly. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

3.3 TOILET AND BATH ACCESSORIES

A. Paper Towel Dispenser: O.F.C.I.

B. Toilet Tissue Dispenser: O.F.C.I.

C. Soap Dispenser: O.F.C.I.

D. Grab Bar: Where this designation is indicated, provide stainless-steel grab bar complying with the following:

1. Products: ASI 3800
2. Stainless-Steel Nominal Thickness: Minimum 0.05 inch.
3. Mounting: Concealed with manufacturer's standard flanges and anchors.
4. Gripping Surfaces: Manufacturer's standard slip-resistant texture.
5. Outside Diameter: 1-1/4 inches for medium-duty applications.
6. Clearance: 1-1/2 inches from wall to inside face of bar.

E. Sanitary Napkin Disposal Unit: Where this designation is indicated, provide stainless-steel sanitary napkin disposal unit complying with the following:

1. Products: ASI 20852
2. Surface Mounted Type: With seamless exposed walls; self-closing top cover; locking bottom panel with stainless-steel, continuous hinge; and removable, reusable receptacle.

F. Seat-Cover Dispenser:
1. Products: ASI 0477-SM
2. Surface-Mounted Type: Stainless-steel unit with concealed opening at bottom for filling; minimum 250-seat-cover capacity.

G. Mirror Unit: Where this designation is indicated, provide mirror unit complying with the following:

1. Products: ASI 0600-A, size 18x30
2. Stainless-Steel, Channel-Framed Mirror: Fabricate frame from stainless-steel channels in manufacturer's standard satin or bright finish with square corners mitered to hairline joints and mechanically interlocked.

H. Underlavatory Guard: Where this designation is indicated, provide underlavatory guard complying with the following:

1. Products: Provide one of the following:
2. Insulating Piping Coverings: White, antimicrobial, molded-vinyl covering for supply and drain piping assemblies intended for use at accessible lavatories to prevent direct contact with and burns from piping. Provide components as required for applications indicated with flip tops at valves that allow service access without removing coverings.

I. Coat Hook / Bag Hook:
1. Products: ASI 7345-S or equal.
2. Surface mounted type. Extends 2” from wall.

END OF SECTION 10 28 13

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SECTION 10 44 00 - FIRE-PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following**:**

1. Portable fire extinguishers.
2. Fire-protection cabinets for the following:

    a. Portable fire extinguishers.

3. Mounting brackets for fire extinguishers.

B. Related Sections include the following:

1. Division 7 Section "Through-Penetration Firestop Systems" for firestopping sealants at fire-rated cabinets.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire-protection cabinets.

1. Fire Extinguishers: Include rating and classification.
2. Fire-Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.

B. Maintenance Data: For fire extinguishers and fire-protection cabinets to include in maintenance manuals. *(Project Close-Out Item)*

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain fire extinguishers and fire-protection cabinets through one source from a single manufacturer.

B. Code Compliance: Fabricate and label fire extinguishers to comply with CCR Title 19, Div. 1 Public Safety, Section 596 and NFPA 10.

C. Fire Extinguishers: UL Listed and labeled for type, rating, and classification.

D. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements of ASTM E 814 for fire-resistance rating of walls where they are installed.

1.5 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

1.6 WARRANTY *(Project Close-Out Item)*

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of portable fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure of hydrostatic test according to NFPA 10.
b. Faulty operation of valves or release levers.

2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.

B. Break Glass: Clear float glass, ASTM C 1036, Type I, Class 1, Quality q3, 3 mm thick, single strength.

2.3 PORTABLE FIRE EXTINGUISHERS

A. Manufacturers:

1. JL Industries, Inc.
2. Larsen's Manufacturing Company.

B. General: Provide fire extinguishers of type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.

1. Valves: Manufacturer's standard.
2. Handles and Levers: Manufacturer's standard.
3. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B and bar coding for documenting fire extinguisher location, inspections, maintenance, and recharging.

C. Regular Dry-Chemical Type in Steel Container 40-B:C, 10-lb nominal capacity, with sodium bicarbonate-based dry chemical in enameled-steel container. (At Kitchens.)

D. Multipurpose Dry-Chemical Type in Steel Container 2-A:10-B:C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

2.4 FIRE-PROTECTION CABINET

A. Manufacturers:

1. JL Industries, Inc.
2. Larsen's Manufacturing Company.

B. Cabinet Type: Suitable for fire extinguisher.

C. Cabinet Construction: Non-rated, (1-hour fire rated, 2-hour fire rated, where indicated on the Drawings).

D. Cabinet Material: Enameled-steel sheet.

E. Semirecessed Cabinet: Cabinet box partially recessed in walls of shallow depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).

1. Square-Edge Trim: 1-1/4- to 1-1/2-inch backbend depth.

F. Surface-Mounted Cabinet (where indicated): Cabinet box fully exposed and mounted directly on wall; with no trim.

G. Cabinet Trim Material: Steel sheet.

H. Door Material: Steel sheet.

I. Door Style: Center glass panel with frame.

J. Door Glazing: Clear float glass, 1/8 inch thick.

K. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

1. Provide projecting lever handle with cam-action latch or projecting door pull and friction latch.

2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.
3. Door Hardware to be accessible per 1125B.4.
4. Provide locking cabinet, selected from manufacturers standard products.

L. Accessories:

1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."

1) Location: Applied to location indicated on Drawings.
2) Application Process: Silk-screened.
3) Lettering Color: Red.
4) Orientation: Horizontal, unless otherwise indicated.

M. Finishes:

1. Manufacturer's standard baked-enamel paint for the following:

a. Exterior of cabinet , door, and trim, except for those surfaces indicated to receive another finish.
b. Interior of cabinet and door.

2.5 MOUNTING BRACKETS

A. Manufacturers:
1. JL Industries, Inc.
2. Larsen's Manufacturing Company.

B. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish. Location where designated on the drawings

1. Color: Black.

C. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.

a. Orientation: Vertical.

D. Backboard:¾ inch MDO plywood with eased edges and anchored to wall, is to be provided under this Section. Board to be of sufficient size to accommodate extinguisher and lettering. Board to be field painted under Division 9 “Painting”.

2.6 FABRICATION

A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

1. Weld joints and grind smooth.
2. Construct fire-rated cabinets with double walls fabricated from 0.0428-inch- thick, cold-rolled steel sheet lined with minimum 5/8-inch- thick, fire-barrier material.

a. Provide factory-drilled mounting holes.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.

1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
2. Miter and weld perimeter door frames.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.7 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire-protection cabinets after assembly.

D. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where semi-recessed cabinets will be installed.

B. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged units.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for semi-recessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. General: Install fire-protection specialties in locations and at mounting heights indicated or, if not indicated, at heights indicated on the Drawings. Comply with applicable regulation of governing authorities.

B. Fire-Protection Cabinets: Fasten fire-protection cabinets to structure, square and plumb.

1. Provide inside latch and lock for break-glass panels.
2. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.

C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

D. Identification: Apply at locations indicated.

E. Where exact location of surface-mounted cabinets and bracket-mounted fire extinguishers is not indicated, locate as directed by Architect.

F. Fire Extinguishers shall not be mounted higher than 5 feet from floor level to the top of the fire extinguisher per Title 19, Section 596.4. Mount at +48” A.F.F. maximum to handle. Provide release for disabled access 5 lbf maximum operation.

3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire-protection specialties are installed, unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet manufacturer.

E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 10 44 00

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SECTION 12 35 13 – PLASTIC LAMINATE CASEWORK

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Plastic laminate casework
   2. Hardware typically furnished by the casework manufacturer
   3. Shelving
   4. Structural supports incorporated into wood casework

B. Excluding:
   1. Metal support brackets and fittings that are part of the building structure
   2. Plumbing, electrical fixtures, and telephone equipment

C. Related sections:
   1. Division 6 – “Rough carpentry” for wood blocking or grounds inside finished walls or above finished ceilings.

1.02 REFERENCES

A. The *North American Architectural Woodwork Standards (NAAWS),* latest edition. Jointly published by Woodwork Institute and the Architectural Woodwork Manufacturers Association of Canada.

1.03 SUBMITTALS

A. Shop drawings:
   1. Submit shop drawings in conformance with the requirements of the *North American Architectural Woodwork Standards*.
   2. Furnish a Woodwork Institute Certified Compliance Label on the first page of the shop drawings.
   3. Submit two copies, one of which will be returned with reviewed notations. Make corrections noted (if any), and distribute required copies prior to the start of work.

B. Samples:
   1. Submit four finished samples of each species and cut of wood to be used. Lumber samples to be minimum 6 inches by 18 inches, and sheet product samples to be minimum 12 inches square. Samples shall represent the range of color and grain expected to be provided.
   2. Submit a sample in the specified finish of each hardware item that will be visible at exposed surfaces when the job is complete.

1.04 QUALITY ASSURANCE

A. Work shall be in accordance with the Grade or Grades specified of the *North American Architectural Woodwork Standards*.

B. Certified Compliance

1. Before delivery to the job site, provide a Woodwork Institute Certified Compliance Certificate indicating the millwork products being supplied and Certifying that these products fully meet the requirements of the *NAAWS* Grade or Grades specified.
2. Provide a Woodwork Institute Certified Compliance Label on each elevation of casework.
3. At completion of installation provide a Woodwork Institute Certified Compliance Certificate indicating the products installed, and certifying that the installation of these products fully meets the requirements of the *NAAWS* Grade or Grades specified.
4. All fees charged by the Woodwork Institute for its Certified Compliance program are the responsibility of the millwork manufacturer and/or installer and shall be included in their bid.

C. Qualification:
1. Firm (woodwork manufacturer) with no less than five years of production experience similar to a specific project, whose qualifications indicate the ability to comply with the requirements of this section.

D. Single source responsibility: A single manufacturer shall provide and install the work of described in this section.

1.05 DELIVERY STORAGE AND HANDLING

A. Deliver materials only when the project is ready for installation and the general contractor has provided a clean storage area.
1. Delivery of architectural millwork shall be made only when the area of operation is enclosed, all plaster and concrete work is dry and the area broom clean.
2. Maintain indoor temperature and humidity within the range recommended by the *North American Architectural Woodwork Standards* for the location of the project.

1.06 SCHEDULING

A. Coordinate fabrication, delivery, and installation with the general contractor and other applicable trades.

PART 2 – PRODUCTS

2.01 COMPONENTS

A. Lumber: In accordance with the *North American Architectural Woodwork Standards* Grade specified for the product being fabricated. Moisture Content: 6% to 12% for boards up to 2-inch (50.8 mm) nominal thickness, and shall not exceed 19% for thicker pieces.

B. Core: MDF meeting the requirements of *North American Architectural Woodwork Standards*.
1. Made with no added urea formaldehyde.
2. Water-resistant core, where required: MDF meeting the requirements of ANSI A 208.2 Grade 155 MR-50.

C. Veneer core plywood: A non-telegraphing hardwood manufactured with exterior glue.

D. Plastic laminate: Meeting the requirements of the *North American Architectural Woodwork Standards* for its use.
1. Manufacturers:
    a. Wilsonart – “High Wear Laminate”
    b. Nevamar Corp. – “Hi-Wear Laminate”

E. Edgeband: PVC or ABS matching the color and pattern of the exposed laminate.
F. Adhesives: Type II, water-resistant
G. Hardware:
   1. Finish: US28 and /or US32D.
   2. Pulls: 4-inch U shaped handles for drawers and hinged doors.
   3. Drawer guides: Full extension.
      a. Meeting the requirements of *NAAWS* for the type and size of drawer.
      b. File drawers: Full extension. Minimum 100-pound capacity except 150-pound capacity for lateral files.
   4. Hinges: Five-knuckle Grade 1 hinges, with hospital tips, Rockford Process or Equal.
   5. Door catches: HD Type
   6. Shelf supports: Steel with pins for ¼ inch drilled holes with earth quake pins to hold shelves against lateral movement, Hettich, Sekura # 6, or approved equal.
   7. Locks:
      a. Door locks: 5 pin tumbler, model #500DR.
      b. Drawer locks: 5 pin tumbler, model #600DW.
      c. Keying: Each room keyed alike.
   8. Elbow catches: HD type, all inactive doors.

2.02 FABRICATION
A. Grade: *NAAWS* Custom Grade.
B. Exposed exterior surfaces: High-pressure decorative laminate.
   1. Color and pattern – Vertical surfaces: **Wilsonart – Huntington Maple #7929-38**
   2. Color and pattern – Countertop: **Wilsonart – Natural Tigris #4669-60.**
C. Exposed interior surfaces: High-pressure laminate matching exposed surfaces.
D. Semi-exposed surfaces: Low-pressure melamine overlay.
   1. Color: **White.**
E. Cabinet construction type: Frameless.
F. Door Interface Style: Flush overlay.
G. Edgeband: PVC or ABS, matching the color and pattern of the exposed laminate.
   1. Edgeband at doors and drawer fronts: 3mm PVC or ABS.
H. Drawers:
   1. Sides: Seven-ply hardwood plywood with no internal voids.
   2. Bottoms: Hardwood plywood of the same species and cut as the drawer sides. Bottoms shall be fully housed into drawer sides, backs, and subfronts, and securely glued.
   3. Joinery: Dowels

PART 3 – EXECUTION

3.01 EXAMINATION
A. Verify the adequacy and proper location of any required backing or support framing.
B. Verify that mechanical, electrical, plumbing, and other building components affecting work in this section are in place and ready.

3.02 INSTALLATION

A. Install all work in conformance with the *North American Architectural Woodwork Standards*, latest edition.
    1. Installation shall conform to the *NAAWS* grade of the items being installed.
B. All work shall be secured in place, square, plumb, and level.
C. All work abutting other building components shall be properly scribed.
D. Mechanical fasteners used at exposed and semi-exposed surfaces, excluding installation attachment screws and those securing cabinets end to end, shall be countersunk.
E. Equipment cutouts shown on plans shall be cut by the installer.
F. Operable parts for all accessible casework shall comply with CBC Section 11B-309.

3.03 ADJUSTING AND TOUCH UP

A. Before completing installation, the installer shall adjust all moving and operating parts to function smoothly and correctly.
B. All nicks, chips, and scratches in the finish shall be filled and retouched. Damaged items that cannot be repaired shall be replaced.

3.04 CLEANUP

A. Upon completion of installation, the installer shall clean all installed items of pencil and ink marks and broom clean the area of operation, depositing debris in containers provided by the general contractor.

END OF SECTION

SECTION 22 00 00

PLUMBING GENERAL REQUIREMENTS

PART 1 – GENERAL

1.1 CONDITIONS AND REQUIREMENTS

A. Refer to the General Conditions, Supplementary Conditions, and Division 01 General Requirements.

1.2 SCOPE OF WORK

A. Provide all labor, apparatus, and materials that are required to provide a complete installation as indicated on the drawings and in the specifications, including that reasonably inferred for proper execution of this Division.

B. Consult all other Sections to determine the extent of this work specified elsewhere.

C. Coordinate all utility requirements for equipment furnished under this Division. Rough-in required systems and make final connections.

1.3 REGULATIONS AND STANDARDS

A. Install all work to meet or exceed requirements prescribed by governmental bodies having jurisdiction and in accordance with all federal, state, and local codes and ordinances, and all OSHA requirements. These codes include, but are not limited to the latest applicable edition of the following:

1. California Building Code
2. California Electrical Code
3. California Plumbing Code
4. California Mechanical Code
5. California Energy Code
6. California Green Buildings Standard
7. California Fire Code
8. National Fire Protection Association

1.4 QUALITY ASSURANCE

A. Comply with current governing codes, ordinance and regulations of the Authority Having Jurisdiction and the regulations and requirements of the Owner’s insurance underwriter.

B. Where requirements differ between drawings, specifications, codes and standards, apply the more stringent.

C. Should any change in drawings or specifications be required to comply with governing regulations, notify the Architect prior to submitting bid.

D. After contract is awarded, if minor changes or additions are required by the aforementioned authorities, even though such work is not shown on drawings or overtly covered in the specifications, they shall be included at the Contractor's expense.

E. Execute work in strict accordance with the best practices of the trades in a thorough, substantial, skillful and well-executed manner by competent workers. Provide a competent, experienced full-time Superintendent who is authorized to make decisions on behalf of the Contractor.

F. The Architect or Architect's Representative may conduct unannounced field reviews of any work completed or in progress. A report will be issued for all items that are found to be inconsistent with the contract documents. All items in the report shall be addressed in writing by the Contractor within two (2) weeks.

1.5 SAFETY

A. Contractors must conduct a weekly safety meeting with their employees and maintain documentation of attendance and topics of discussion. Contractor shall comply with all OSHA regulations. Contractor is required to obtain and pay for insurance required to cover all activities withing Contractor's scope of work.

1.6 PERMITS, FEES, AND UTILITIES

A. Secure and pay for all permits, licenses, inspections, and fees required.

B. Coordinate with other Sections and schedule sequence of accomplishing the work in such a manner as not to interrupt existing services and utilities at a time that will inconvenience the Owner. Provide Owner a minimum 48 hour notice when utilities will be interrupted.

1.7 PAINTING

A. Paint all exposed piping and supports.

B. See Division 09 for painting.

1.8 COORDINATION

A. Coordinate with work performed by other Sections in order to ensure adequate space and proper location of all necessary work on this project whether or not work is under this Section. Coordination shall be done prior to order or manufacture of any systems or components.

B. At a minimum, coordinate location of each piece of equipment, requirements for access panels, space required for supports, power requirements for each piece of equipment, and control requirements for each piece of equipment.

C. Coordination meetings shall happen within the first two weeks of construction start. Coordination meeting minutes shall be submitted to the Architect for review.

D. Prepare complete set of construction coordination shop drawings indicating equipment actually purchased and exact routing of all piping and ductwork. Requirement for coordination shop drawings shall not be construed as authorization for contractor to make unauthorized changes to Contract Documents. Prior to final acceptance, contractor shall submit the coordination shop drawings as part of the record drawings.

E. Wherever the work is of sufficient complexity, prepare additional detail drawings to scale to coordinate the work with the work of other trades. At completion, include a set of these drawings with the record drawings.

F. Install the work in cooperation with other trades. Before installation, make proper provisions to avoid interferences.

G. Pipes which pitch have right-of-way over those which do not pitch. For example, condensate drains and waste normally have right-of-way.

H. No additional costs will be considered for work which has to be relocated due to conflicts with other trades or for additional equipment/parts that need to be installed due to a lack of coordination prior to, or during, construction.

PART 2 – PRODUCTS

2.1 EQUIPMENT AND MATERIALS

A. Provide products and materials that are new, clean, free of defects, damage and corrosion. Inspect all materials and remove defective materials from the site.

B. Provide materials and equipment bearing the label of, or listed by, the Underwriter's Laboratories (UL), unless the material or equipment is of a type for which label or listing service is not provided.

C. Furnish all materials and equipment of the same type by the same manufacturer.

2.2 ALTERNATE EQUIPMENT AND MATERIALS

A. No substitute materials or equipment may be installed without the written approval of the Architect.

B. Contract documents are based on materials specified and equipment manufacturers indicated. Acceptance of alternative equipment manufacturers does not relieve Contractor of the responsibility to provide equipment and materials which meet the quality and performance stated or implied in the contract documents.

C. All submittals for substitution must include comparison to show equal with scheduled equipment. Submit proposals to supply alternate materials or equipment, in writing, with sufficient lead time for review prior to the date equipment must be ordered to maintain project schedule.

D. No increase in the contract price will be considered to accommodate the use of alternative equipment, including revisions required by other trades.

2.3 SUBMITTALS

A. Submit shop drawings, manufacturer's data, samples and test reports as specified.

B. The review of submittals is for general compliance with the design concept and contract documents. Comments or absence of comments does not relieve the Contractor/Vendor/Manufacturer from compliance with the contract documents. The Contractor remains solely responsible for details and accuracy, for confirming and correlating all quantities and dimensions, for selecting fabrication processes, for techniques of construction, for performing the work in a safe manner, and for coordinating the work with that of other trades.

C. No part of the work shall be ordered, procured, or installed until that work has been submitted, reviewed, and returned without comment.

D. Items indicated in submittal comments shall be provided and installed by contractor.

E. The Engineer and/or Architect shall review the submitted documents for general conformance with the design concept of the project. The review does not relieve the Contractor of the responsibility of deviations from the requirements stated in the contract documents.

F. The Engineer's and/or Architect's review shall not be construed as a completed detailed check of the work submitted, nor shall it relieve the Manufacturer or Contractor of responsibility for errors or omissions of any sort or from the necessity of furnishing any work required by the contract documents.

G. Submittals are not reviewed for quantities, dimensions, weights, fabrication processes, construction methods, coordination with work of other trades, construction safety practices, service clearance, location of control and electrical panels, and other layout constraints. These items shall remain the sole responsibility of the Contractor.

H. A minimum period of ten (10) working days will be required in the Engineer's office each time a submittal is sent for review. Contractor shall prioritize submittal reviews where multiple submittals are sent for review. This time period must be considered by the Contractor in the scheduling of the work.

I. Submittals will be returned to indicate appropriate action taken as follows:

1. No Exceptions Taken.
2. Make Corrections Noted. No Resubmittal Required.
3. Revise and Resubmit.
4. Rejected.
5. Not Reviewed.

J. Use electronic form acceptable to Architect for electronic submittals, containing the following information:

1. Project name.
2. Date.
3. Name and address of Architect and Engineer.
4. Name of Owner.

5. Name, address and contact information of Contractor.
6. Names and contact information of sub-contractor, manufacturer, and supplier.
7. Name of entity that prepared submittal.
8. Category and type of submittal.
9. Specification Section number and title.
10. Drawing number and detail references, as appropriate.
11. Transmittal number, numbered consecutively, and revision number clearly identified.
12. Each item submitted labeled or identified the same as on the drawings.

K. Identify each sheet of submittal pages (using arrows, underlining or circling) to show applicable sizes, types, model numbers, ratings, capacities and options actually being proposed. Cross out non-applicable information.

L. Organize submittals to keep all related items together; break submittal into sections and provide appropriate identifying tags on submittal pages to indicate item being submitted.

M. Provide a bookmark for each submittal section. Include a table of contents at beginning of submittal.

N. Submit all items related to specification section in single submittal file. Partial submittals will be deemed incomplete and not reviewed.

O. Inadequate or incomplete submittals will not be reviewed and will be returned to the Contractor for resubmittal.

P. Place orders for all equipment in time to prevent any delay in construction schedule or completion of project. No additional costs will be considered for any special handling charges or expedited processing required for materials or equipment not ordered in time.

2.4 REQUEST FOR INFORMATION

A. While every effort has been made to coordinate the locations of equipment covered under other sections or divisions of these specifications, it is the responsibility of the Contractor to coordinate the exact requirements governed by actual job conditions. Check all information and report any discrepancies before submitting bid or fabricating work.

B. Report discrepancies in time to avoid unnecessary work, and make changes as directed by the Architect.

C. Do not make changes or additions that are subject to additional compensation without written authorization, based upon an agreed price. Any changes made without the above-mentioned authorization shall be at Contractor's own risk and expense.

D. Follow manufacturer’s instructions where they cover points not specifically indicated. However, if they are in conflicts with these drawings and specifications, obtain clarifications from the Architect before starting work.

E. All requests for information shall be accompanied with Contractor’s proposed solution.

PART 3 – EXECUTION

3.1 EXAMINATION OF SITE

A. The Contract Documents do not make representations regarding the character or the extent of the subsoils, water levels, existing structural, mechanical, plumbing, and electrical installations, above or below grade, or other sub-surface conditions which may be encountered during the work.

B. Evaluate existing conditions that may affect methods or cost of performing the work, based on examination of the site or other information. Failure to examine the Drawings or other information does not relieve the Contractor of responsibility for satisfactory completion of the work.

3.2 DRAWINGS

A. Drawings show general arrangement and location of piping and equipment. Drawings are diagrammatic and intended to show approximate location and routing. Dimensions on drawings shall take precedence over scaled dimensions on drawings. Allow for supports, expansion, and pitch of piping. Field verify all dimensions.

B. The exact locations of equipment and piping shall be ascertained from the Architect or the Owner's representative in the field. The Architect reserves the right to make minor changes in the location of piping and equipment up to the time of installation without additional cost.

C. Furnish and install any incidental work not shown or specified which can reasonably be inferred as part of the work and necessary to provide a complete and workable system. This includes any wiring of sensors, switches, etc.

D. Execute any work or apparatus shown on the Drawings and not specifically mentioned in the Specifications, or vice versa. Omission from Drawings or Specifications of any minor details of construction, installation, materials, or essential specialties does not relieve Contractor from furnishing complete workable system.

3.3 RECORD DRAWINGS

A. Contractor shall maintain a complete set of documents on site that are marked up during the construction process indicating all changes that have been made. Record drawings shall be maintained up to date throughout construction. Indicate clearly all work installed differently from that shown.

B. Upon completion of work, certify all record drawings with a stamp including the date and name of Contractor. Submit one (1) complete, bookmarked, set of electronic record drawings to the Architect for final review.

C. Record drawings must include the following as a minimum:

1. Actual equipment locations.
2. Revisions or substitutions to equipment schedules.
3. Pipe size and routing.
4. Dimensional changes to drawings.

5. Revisions to details shown on drawings.
6. Changes made by RFIs, Addenda, or Change Orders.
7. Locations of access panels and shut-off valves.
8. Locations and depths of underground utilities.

3.4 PROTECTION OF BUILDING

A. Protect new and existing building structures and adjacent finished surfaces during construction. Patch, repair, and refinish existing work damaged by work under this Division to match adjacent undisturbed areas.

3.5 DELIVERY, DRAYAGE AND HAULING

A. Include all drayage, hauling, hoisting, shoring and placement in the building of equipment specified and be responsible for the timely delivery of equipment to the project as required by the construction schedule.

B. Provide proper protection and storage of all items and tools required.

C. If equipment is not delivered or installed at the project site in a timely manner as required by the construction schedule, the Contractor shall be responsible for disassembly, re-assembly, manufacturer's supervision, shoring, general construction modification, delays, overtime costs, etc. at no additional cost to the Owner.

3.6 EQUIPMENT AND MATERIAL PROTECTION

A. Protect the work, equipment, and material of other trades from damage by work or workers of this trade, and correct damage caused without additional cost to the Owner.

B. The Contractor shall be responsible for all work, materials, and equipment until finally inspected, tested, and accepted. Protect work against theft, injury, or damage. Carefully store material and equipment received on site that is not immediately installed.

C. Cover open ends of work with temporary covers or plugs during construction to prevent entry of dust, dirt, water or other obstructing material. Cover and protect equipment and materials from damage due to water, humidity, paint, spray-on fireproofing, construction debris, etc. Store equipment subject to moisture damage, such as insulation or electrical components in dry, heated spaces.

D. Provide adequate means for fully protecting finished parts of the materials and equipment against damage from whatever cause during the process of the work until final acceptance.

E. Do not install damaged items. Take immediate steps to obtain replacement or repair. Replace all wet or damp insulation or acoustic lining.

F. Do not operate water systems until piping has been cleaned, disinfected and start-up strainers are in place.

3.7 QUALITY OF WORK

A. The quality of work shall be of a standard generally accepted in the respective trade. Use only experienced, competent, and properly equipped workers. Replace work falling below this standard as directed by the Architect.

B. Systems shall be worked into a complete and integrated arrangement with like elements arranged neatly with adequate head room and passageway free from obstructions.

3.8 FURRING AND PIPE SPACES

A. Spaces provided in the design of the building shall be utilized and the work shall be kept within the furring lines established on the Drawings.

B. Ensure necessary clearances on trim plates at exposed penetrations of walls and floors. If sufficient room is not available above suspended ceiling or vertical shafts obtain clarification from Architect before work is started.

3.9 CUTTING AND PATCHING

A. Do not cut, channel or drill unfinished masonry, tile, etc. unless written permission is obtained from the Architect. Perform this work in a manner acceptable to the Architect. Cutting of structural members or footings is prohibited without the prior written consent of the Structural Engineer.

B. Where cutting, channeling or drilling of floors, walls, partitions, ceilings, or other surfaces is necessary from the proper installation, support or anchorage of piping or equipment, lay out the work carefully in advance. Repair any damage to the building, piping, equipment or finishes using skilled tradesmen for all required work.

C. All core drilling, bolt anchor insertion, or cutting of existing structural concrete shall be approved prior to execution of any construction. At all structural concrete to be drilled, cut or bolt anchors inserted, the contractor shall find and mark all reinforcing in both faces located by means of x-ray, pach-ometer, or prof-ometer. Submit sketch showing location of rebar and proposed cuts, cores, or bolt anchor locations for approval.

D. Provide slots, chases, openings and recesses through floors, walls, ceilings and roofs as required. Where these openings are not provided, provide cutting and patching to accommodate penetrations.

E. Provide sleeves for all piping passing through new floors, walls, partitions, and any other building construction, of adequate diameter to allow minimum of 1” clearance all around between sleeve and piping. When piping is insulated, insulation shall pass continuously through sleeve with 1” clearance between insulation and sleeve or hole in existing construction.

3.10 ACCESS

A. Indicating equipment or specialties requiring reading, adjusting, inspection, repairing, removal, or replacement shall be conveniently and accessibly located with reference to finished building.

B. No controls, or equipment shall be placed in a location that will be inaccessible after the system is complete. Access panels or doors shall be provided where required whether shown on Drawings or not.

C. Access panels shall be 24” x 24” unless otherwise directed, style as selected by the Architect. Panels shall have the same acoustic barrier or rating as the construction in which panel is installed.

D. Doors shall be Milcor, Newman or equal, with concealed hinges, screwdriver locks, prime coated with rust inhibitive paint, finish painted in field to match adjacent surface. Provide key locks where required by Architect/Owner. All access doors shall be keyed the same. Doors in walls of toilet rooms shall be stainless steel.

E. Continuously check installation manuals for clearance and accessibility of equipment. No allowance of any kind will be made for negligence on part of Contractor to foresee means of installing equipment in proper position.

3.11 SEISMIC RESTRAINTS

A. All equipment, piping, and materials shall be fastened and securely anchored to building structure as required by the Drawings, Specifications, OSHPD Preapproval of Manufacturer’s Certification OPM-0295-13 and OPM-0052-13, and the California Building Code.

B. Piping shall be braced as follows:

1. Brace all gas piping that is 1” nominal diameter and larger.
2. Brace all piping located in mechanical equipment rooms that is 1 1/4” nominal diameter and larger.
3. Brace all piping that is 2 1/2" nominal diameter and larger.
4. Transverse bracings at 40’-0” on center maximum (minimum of one brace per direction of run).
5. Longitudinal bracings at 80’-0” on center maximum (minimum of one brace per direction of run).
6. Transverse bracing shall be 20’-0” on center maximum and longitudinal bracing at 40’-0” on center maximum for gas piping and piping in mechanical rooms.
7. Transverse bracing for one pipe section may also act as longitudinal bracing for the pipe section connected perpendicular to it, if the bracing is installed within 24” of the elbow or tee and is connected to the largest pipe.
8. Do not use branch lines to brace main lines.
9. Provide flexibility in joints where pipes pass through building seismic or expansion joints or where rigidly supported pipes connect to equipment with vibration isolators.
10. At vertical pipe risers, support the weight of the riser at a point or points above the center of gravity of the riser wherever possible. Provide lateral guides at the top and bottom of the riser and at intermediate points not to exceed 30’-0” on center.
11. No bracing is required if the top of single pipe is suspended 12” or less from the connection point at the supporting structural member.

3.12 MANUFACTURER'S DIRECTIONS

A. Materials and equipment shall be installed in accordance with manufacturer's application and recommendations, requirements, and instructions, and in accordance with Contract Documents.

B. Conflicts between manufacturer's instructions and Contract Documents shall be brought to the Architect's attention for resolution prior to installation.

C. Where requirements indicated in Contract Documents exceed manufacturer's requirements, Contract Documents shall govern.

3.13 ELECTRICAL EQUIPMENT AND ELECTRICAL ROOM PRECAUTIONS

A. Do not install piping, equipment, plumbing, or any piping systems not included as part of the electrical work in the following rooms: switchgear, transformer, generator, elevator equipment, telephone, fire command, security, dimmer or electrical equipment rooms.

B. Do not install piping or equipment within the code required service space for switchboards, disconnects, panelboards, dimmers, control panels, VFDs, individual motor controllers, electronics, etc.

3.14 CATHODIC PROTECTION

A. Install dielectric unions at points in piping where dissimilar metal pipes are connected together.

3.15 PIPING AND EQUIPMENT IDENTIFICATION

A. Furnish and install engraved nameplates with 1/4" minimum lettering at panel mounted control devices, manual control stations, power disconnects, and pieces of equipment. Nameplates shall be white lettering on black background. For outdoor locations, provide brass engraved nameplates or plastic rated for outdoor use.

B. Each piping system installed under this work shall be identified and the direction of flow indicated. Markings shall be applied after all painting, priming, and cleaning of the piping and insulation is completed. Labels shall be black lettering on colored backgrounds. Lettering shall be easily readable from the floor and background colors easily discernible. Furnish labels in every room and every 20' of pipe length.

C. Tag all valves with 2" diameter brass tags noting the valve number and contents in the pipe. At the completion of the project, provide Owner with a valve listing for all valves installed in the project. Valve listing shall note valve tag number, contents in the pipe and the areas (room numbers, etc.) that are impacted by valve.

3.16 GUARANTEE

A. The Contractor shall guarantee the quality of all work and the quality of the equipment and materials in accordance with the provisions of the General Conditions and Special Conditions. Should any defects occur during this period, the Contractor shall promptly repair or replace defective items as directed by the Architect, without cost to the Owner.

B. Contractor shall be responsible for damage to any part of premises during guaranteed period caused by leaks or breaks in work furnished and/or installed under this Section.

3.17 TESTING

A. Test all equipment, piping, and systems as called for in the Specifications. Notify Architect and inspection authorities prior to testing so that they may be witnessed. Protect all personnel and equipment during testing.

3.18 OPENINGS

A. Locating and sizing of all openings for piping through walls, roof, etc. shall be done under this Division. Framing of openings shall be done by the respective trades in whose work the opening is made.

3.19 CLEAN-UP

A. During the course of work under this Division, all rubbish, debris, surplus materials, tools, etc. resulting from this work shall be removed from work area and shall be disposed of off-site at the end of each working day. The Owner's premises shall be left clean, and in a condition acceptable to the Architect.

B. Clean all work installed under this Contract to satisfaction of Owner.

3.20 PUNCH LIST

A. Respond to Architect's punch list in writing within 10 days of receipt. Include action plan and an estimated timeline for completion.

B. Submit photographs of completed items.

3.21 OPERATING INSTRUCTIONS AND OPERATOR TRAINING

A. Provide the services of factory-trained specialists to supervise the operation of all equipment and train the Owner's operating and maintenance personnel.

B. Instruct the Owner's operating personnel in the basis of design, the available documentation, the proper starting sequences, operation, shut-down, minor adjustments, troubleshooting, recommended spare parts, and regular maintenance procedures.

C. Submit training agenda, schedule and list of representatives to the Owner for review ten (10) days prior to training. Confirm attendance at training by sign-in sheet. At a minimum, the training agenda shall cover all items required to be provided in the operating and maintenance manuals.

3.22 OPERATING AND MAINTENANCE MANUALS

A. Provide operating instructions and maintenance manuals for all equipment and material furnished under this Division.

B. Provide the following equipment and maintenance information where applicable:

1. Systems and Equipment Controls – describe sequence of operation and diagram controls as required.

2. Identifying equipment manufacturer, product name, and model number.
3. Locations.
4. Wiring Diagrams.
5. Manufacturer's recommended operating and maintenance instructions, with all non-applicable information deleted.
6. Assembly and disassembly instructions.
7. Startup procedures.
8. Routine and normal operating instructions.
9. Normal and emergency shutdown instructions.
10. Troubleshooting diagnostic instructions.
11. Parts list and recommended spare parts including name and address of source of supply.

C. Contractor must start compiling above data immediately upon approval of submittals for equipment and materials.

D. Submit one (1) electronic copy of operating and maintenance manuals, indexed and bookmarked, for review by Architect/Engineer.

E. Submit three (3) complete sets of bound hard copies of operating and maintenance manuals, and one (1) electronic copy to Owner within thirty (30) days of issuance of final occupancy permit.

END OF SECTION

SECTION 22 05 00

PLUMBING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 01, and Division 22 Sections apply to this Section.

1.2 SCOPE OF WORK

A. Provide labor, materials, equipment, and services to furnish and install complete plumbing and piping systems which shall include, but not limited to fixtures, equipment, piping, valves, and supports.

1.3 SUBMITTALS

A. Submit for review, within fifteen (15) days after signing Contract, the required number of copies of a complete list of materials proposed for use. This list includes:

1. Plumbing fixtures and trim.
2. Water Heaters.
3. Piping and fittings.
4. Insulation.
5. Pipe hangers and supports.
6. Valves.
7. Drains and cleanouts.
8. Trap primers and water hammer arrestors.
9. Coordination Drawings: plans and details, drawn to scale, on which piping is shown and coordinated with other installations, using input from installers of the items involved.

B. No substitute materials or equipment shall be installed without the written approval of the Architect.

C. No increase in the contract price will be considered to accommodate the use of alternative equipment, including revisions required by other trades.

D. Submit test reports on all systems tested. Tests required by Authorities Having Jurisdiction over the work shall be submitted on appropriate forms to the satisfaction of such authorities.

1.4 QUALITY ASSURANCE

A. Steel support welding qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, “Structural Welding Code – Steel.”

B. Pipe welding qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. Each length of pipe, fitting, trap, fixture, or device used in any piping system shall be stamped or indelibly marked with type, weight, quality, and manufacturer's name or mark.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Pipes shall be shipped so as not to bend, dent, or otherwise damage the pipe during transport. Contractor shall take all necessary precautions to prevent damage to pipe and fittings during delivery and unloading. Any pipe found to have been damaged due to improper handling shall be removed from the jobsite at Contractor's expense.

B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

C. Store and handle pipes and tubes having factory-applies protective coatings to avoid damaging coating, and to protect from direct sunlight.

D. Protect stored PE pipes and valves from direct sunlight.

PART 2 – PRODUCTS

2.1 PLUMBING FIXTURES, TRIM AND ACCESSORIES

A. See Schedules on Drawings for plumbing fixtures. Furnish and install all fixtures in accordance with Drawings, manufacturer's recommendations, and all applicable codes.

B. Fixture locations and heights as shown on Architectural Drawings.

C. Comply with applicable provisions and recommendations of CALGreen for water conservation measures.

D. Provide fixtures complete with all trim and materials, fittings, supports, fastening devices, faucets, valves, traps, and appurtenances required.

E. Lavatories and sinks shall be provided with required number of holes by faucet only, unless otherwise specified or required.

F. Install fixtures level, plumb and set at right angles to wall, floor, or both unless otherwise indicated.

G. Make connections between fixtures and waste pipe gastight and watertight with neoprene type gaskets or bowl wax.

H. Where fittings, trim, and accessories are exposed or semi-exposed, provide chrome plated 17 gauge seamless brass.

I. Where fixture supplies and drains penetrate walls, provide chrome plated brass escutcheons with setscrews.

J. Vitreous china: unmarked, true, clear, smooth and bright. Color shall be white unless otherwise indicated.

K. Porcelain lined ware: constructed of smooth, sound iron castings, properly finished, and provided with first quality, high temperature enamel.

2.2 ELECTRIC WATER HEATERS

A. Refer to schedule on Drawings for capacities, recovery rates and electrical characteristics.

B. Acceptable manufacturers: A.O. Smith, Bradford White, or approved equal.

C. Heater shall be ETL or UL listed and shall bear the UL or ETL label.

D. Heater shall meet the energy efficiency requirements of California Title 24.

E. Internal surfaces exposed to water shall be glasslined with an alkaline borosilicate composition fused to steel at 1600°F.

F. Heating elements shall be medium watt density. Each heating element shall be controlled by an individually mounted thermostat and high temperature cutoff switch.

G. Heater shall be provided with anodic protection.

H. Insulation: Factory installed foam insulation with heat loss not to exceed ASHRAE Standard 90.1 and California Title 24. With steel cover with factory backed enamel finish.

I. Provide a minimum two (2) year manufacturer’s commercial installation warranty for the entire unit.

J. Water heater shall be seismically braced in accordance with California Plumbing Code.

2.3 WATER PIPING AND FITTING MATERIALS

A. All water piping shall comply with NSF/ANSI Standard 372 for low lead requirements.

B. Above Grade: ASTM B88, Type L copper tubing, hard temper with wrought copper fittings.

C. Below Grade: ASTM B88, Type K copper tubing, hard temper with wrought copper fittings.

D. Joints: 1/2" to 1-1/2” pipe sizes soldered using ASTM B32, lead-free alloys. Include water-flushable flux according to ASTM B813. 100 percent lead free, 95 percent tin and 5 percent antimony composition, silver bearing solders unless otherwise indicated.

E. Joints: 2” and larger pipe sizes brazed using AWS A5.8/A5.8M, AWS BCuP Series copper-phosphorous alloys.

F. Water Hammer Arrestors: Provide at quick closing valves such as flush valves, etc. Certified under Plumbing and Drainage Institute Standard WH201 and by ASSE Standard 1010.

G. Select and size water hammer arrestors in accordance with Plumbing and Drainage Institute Standard WH201. Install above ceilings or behind wall access door at each plumbing fixture, or where plumbing fixtures are installed in groups, at each group of fixtures.

H. Insulation: Insulate outdoor piping with 1” Glass Fiber Insulation and 0.016 aluminum jacket.

2.4 HOT WATER PIPING INSULATION

A. Acceptable manufacturers: Johns Manville, Owens Corning, Knauf.

B. Glass Fiber: Conforming to ASTM C547, rigid molded, non-combustible.

1. Installed thermal conductivity: 0.23 btu-inch per hour-ft^2-°F at 75°F.
2. 1” thickness.
3. Owens-Corning SSLII with ASJ max or other equal.

C. All insulated piping installed indoors in exposed locations shall be protected with PVC jacketing.

D. All insulated piping installed outdoors shall be protected with 0.016 inch thick aluminum jacketing.

E. All insulation shall in accordance with the California Energy Code.

2.5 WATER PIPING VALVES

A. All valves shall be the product of a single manufacturer. Milwaukee, NIBCO, Stockham, Crane, or approved equal. 125 PSIG steam service rated and 300 PSIG air and water rated. All valves shall be low lead type per NSF/ANSI Standard 372.

B. Provide valves with screwed or flanged ends as required by the piping system in which they are installed.

C. Shut-off valves 2 inches and smaller: Ball Valve. Bronze body, two piece, full port, extended handle that allows operation of valve without disturbing the insulation.

D. Shut-off valves 2 1/2 inches and larger: Gate Valve. Iron body, resilient wedge, outside screw and yoke.

E. Check valves: Bronze body, swing check, screwed. Provide non-slam check on pumped equipment or quick closing fixtures.

F. Relief valves: Bronze body, spring and diaphragm combination pressure and temperature relief valves with test lever and automatically resetting type thermostatic element. Tested under ANSI Z21.22 and rated relief capacities greater than water heater’s input rating.

2.6 WASTE AND VENT PIPING AND FITTING MATERIALS

A. Above Grade Waste and Vent: Hubless cast iron soil pipe and fittings, service weight per ASTM A888 and Cast-Iron Soil Pipe Institute Standard (CISPI) 301. Couplings conforming to ASTM and CISPI 310; stainless steel covered neoprene gasket sleeve and stainless steel clamps.

B. Below Grade Waste and Vent: ABS Schedule 40 per ASTM D2661 D2680 or PVC Schedule 40 per ASTM D17885 D2665 with solvent weld socket fittings.

C. Above Grade Vent alternate: ABS Schedule 40 per ASTM D2661 D2680 or PVC Schedule 40 per ASTM D1785 D2665 with solvent weld socket fittings may be used for above grade vent.

D. Traps: Provide traps at all fixtures connected to waste systems, except for fixtures having integral traps. Type of trap(s) shall be approved by local codes and be of same material as piping system. Exposed traps for fixtures shall be chrome plated 17 gauge brass.

E. Trap Primers: Pressure drop activated brass trap seal primer with view holes and removable filter screen and requires no adjustments or air pre-charge. Select appropriate model for number of drains being served. Precision Plumbing Products, MIFAB, or approved equal.

F. Drains: Size of drain outlets shall be same as connecting pipe and as indicated on Drawings. Provide trap primer connections on all drains. Drain outlet as required for connection to piping.

G. Temperature and Pressure Relief Drain: Material shall be rated at not less than the operating temperature of the system and approved for such use or shall comply with ASME A 112.4.1.

H. Cleanouts: Install cleanouts of same diameter as pipe (4 inch maximum) where indicated or required by code. Cleanouts shall be installed at all points of change in direction and in horizontal waste lines over 50 feet inside building and 100 feet outside building. Locate minimum 18 inches away from building construction to allow sufficient space for rodding.

1. Provide cleanouts in waste drop from each sink and urinal. Provide one wrench for each size and type of cleanout used.
2. Floor Cleanouts: ZURN Z1400 series, or approved equal. Nickel-bronze, round top, with vandal proof screws.
3. Wall Cleanouts: ZURN Z1446 series, or approved equal with stainless steel cover and vandal proof screws.
4. Unfinished Areas: Zurn Z1440, or approved equal. Cast iron cleanout.
5. Grass or Planting Area: Zurn Z1449, or approved equal. Locate in concrete box and cover.

I. In ground cleanouts outside building shall be back-to-back tee/wye pair.

2.7 CONDENSATE DRAIN PIPING

A. Condensate drain piping shall be type DWV copper with wrought copper fittings. Condensate drain piping may also be Type L or M copper pipe with wrought copper fittings.

B. Condensate drain piping inside building shall be insulated with 1” thick closed cell elastomeric foam insulation. Armaflex, Aeroflex, or approved equal.

2.8 UNIONS AND FLANGES

A. Install Watts, Epco, Nibco, or equal, dielectric unions or flanges at points of connection between copper or brass piping or material and steel or cast iron pipe or material except in drain, waste, or vent piping. Dielectric unions installed in potable water systems shall conform to lead free requirements.

B. Install unions in piping 2” and smaller and flanges in piping 2 1/2" and larger at each connection to all equipment, tanks, and automatic valves.

C. Locate unions for easy removal of equipment, tank, or valve.

2.9 PIPE HANGERS AND SUPPORTS

A. Provide adequate supports, hangers, guides, thrusters, etc. as necessary to allow for proper movement of the piping at the building seismic joints and at the thermal expansion loops and flexible connectors, taking into account the pipe size, flex connection type, required seismic movement and system operating temperature and pressure.

B. Acceptable manufacturers: B-line, Tolco, Superstrut, Unistrut, or approved equal.

C. All copper pipe shall be isolated from steel hangers and supports using factory Vibra-Cushion strip or plastic coated hangers. Field wrapping of pipe with tape is not acceptable.

D. Plumbers tape or sheetmetal straps shall not be used for hanging or supporting of pipes.

E. Support horizontal piping in accordance with the following schedule:

Pipe Size (inches)	Maximum Hanger Spacing (feet)						Hanger Rod Diameter (inches)		
	Steel	Cast Iron	Copper	Plastic			Steel / Cast Iron	Copper	Plastic
				CPVC	PVC	PP			
Up to 1	7	-	5	3.5	3	2.75	3/8	3/8	3/8
1 1/4	9	-	6	3.5	3	2.75	3/8	3/8	3/8
1 1/2 & 2	9	5	8	3.5	3.5	2.75	3/8	3/8	3/8
2 1/2	12	5	8	3.5	3.5	3.5	1/2	1/2	1/2
3	12	5	10	3.5	3.5	3.5	1/2	1/2	1/2
3 1/2	-	5	10	-	-	-	5/8	1/2	-
4	12	5	10	4	4	4	5/8	5/8	5/8
5	12	5	10	4	4	4	5/8	5/8	5/8
6	12	5	10	4	4	4	3/4	3/4	3/4
8 to 12	12	5	10	4	4	4	7/8	3/4	7/8

F. Provide hangers at each change in direction and both sides of valves 4-inch and larger. Place a hanger within 12 inches of each horizontal elbow, valve, strainer, or similar piping specialty item.

G. Support Steel piping on the roof in accordance with the following schedule:

Nominal Pipe Size (inches)	Spacing of Supports (feet)
1/2	6
3/4 or 1	8
1 1/4 or larger	10
1 1/4 or larger (Vertical)	Every floor level

For pipes on roof other than steel pipe, match support spacing from previous Hanger table above.

PART 3 – EXECUTION

3.1 PREPARATION

A. Close equipment shutoff valves before turning off natural gas to premises or piping section.

B. Inspect natural gas piping according to NFPA 54 to determine that natural gas utilization devices are turned off in piping section affected.

3.2 PIPE SIZES TO EQUIPMENT

A. Pipe sizes indicated, including required valving, shall be carried full size to equipment served. Any change of size to match equipment connection shall be made within 1’-0” of equipment.

3.3 PIPING GENERAL INSTALLATION

A. Thoroughly clean all pipe and maintain in clean condition during construction temporarily capping or plugging ends of pipe when not being worked on.

B. Cut pipes accurately to measurements established at the site and work into place without springing or undue forcing and out of the way of openings, ductwork, and equipment; ream ends of screwed pipes and tubing to original bore before connecting together.

C. Protect all piping located over switchboards, electrical machinery, or equipment against condensation. Insulate piping and install sheetmetal pan underneath piping running above electrical equipment and panels.

D. Where changes in pipe size occur, use only reducing fittings.

E. Provide screwed unions or flanges in locations required for disconnecting and connecting of all equipment.

F. Pipe runs in masonry and concrete floors shall be sleeved for protection.

G. Chase or sleeve all lines rising in footings and where running concealed through walls.

H. Caulk space between pipes and sleeves in exterior walls and in concrete slabs with graphite packing and waterproof plastic compound; caulk with Dow Corning #3 6548 Silicone RTV Foam per manufacturer's recommendations at fire walls.

I. Place escutcheons, stamped with #16 gauge steel and chromium plated, on pipes passing through sleeves in walls, floors or ceiling where exposed to view within a finished area. Grout in all other lines.

J. Support piping where necessary at sufficiently close intervals (and 24" from each fitting and change of direction) to keep it in alignment and to prevent sagging.

K. Anchor vertical risers with hooks, brackets, or clamps to make rigid.

L. All changes of direction of piping shall be made with fittings. Do not bend pipe.

M. Flash roof vent piping through roof with 24 gauge or heavier galvanized flashing. Make watertight with black fibrous mastic. Extend flashing into roofing felt 12” from pipes.

N. Insulate cold water piping outdoors for freeze protection.

3.4 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints:

1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
2. Cut threads full and clean using sharp dies.
3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Welded Joints:

1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
2. Bevel plain ends of steel pipe.
3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

E. Brazed Joints:

1. Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

F. Flanged Joints:

1. Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.

G. Flared Joints:

1. Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.

3.5 WASTE, VENT AND CONDENSATE DRAIN PIPING INSTALLATION

A. Lay piping in straight lines at a minimum slope of 2 percent in direction of flow of drainage system, unless otherwise noted on the Drawings.

B. Keep stopper in mouth of pipe when pipe when pipe laying is not in process.

C. Make changes in direction with long sweep or bends. Do not change direction of flow more than 90 degrees.

D. Reducing size of drainage piping in direction of flow is prohibited.

E. Make connections of branches to mains with “Y” fittings and 1/8 or 1/16 bends.

F. Install traps and fresh air inlets where required by code regulations.

G. Install traps with offset drain where required to meet ADA clearances.

H. Install trap primers discharge piping appropriate for trap primers installed. Coordinate discharge piping routing and method of connection to inlet side of floor drain and ensure discharge piping has positive drainage towards connection point floor drain. Slope piping at 1/8” per foot.

I. Install cleanouts at ends of horizontal runs in excess of 5’-0” and every 100’-0” of horizontal run.

J. Makeup cleanout plugs with graphite and oil to facilitate easy removal.

K. Extend vents through roof. Vents may be combined in accordance with California Plumbing Code. Arrange piping passing through roofs to be a minimum of 12 inches from walls or other obstructions so as to permit proper flashing.

L. Do not terminate vent outlet less than ten (10) feet from air intakes.

M. Deliver to the owner at completion of work two (2) suitable wrenches for each type of cleanout installed.

N. Take necessary precautions to protect cleanouts during course of construction.

O. Contractor to inquire from Owner the time to make tie-in to existing systems.

3.6 WATER PIPING INSTALLATION

A. Extend piping for hot and cold water, including mains, risers, and supplies to fixtures and indicated equipment. Carry headers for groups of fixtures full size throughout their length.

B. All domestic water piping shall be arranged to drain to low points and to provide for air elimination at high points.

C. All ferrous to non-ferrous pipe connections shall be made with accepted dielectric pipe or flange union isolating joints to prevent any electrolytic action between dissimilar metals.

D. Insulate all domestic hot and hot water return piping and fittings.

E. Make changes in pipe sizes with reducing tees or reducer fittings.

F. Install a shut off valve at domestic water line to each fixture group so that each group can be shut off without shutting down the other parts of the system.

G. Provide shut off valves for all plumbing equipment, fixtures, and fixture trim which do not have supply stop or integral isolation valves included.

H. Arrange and orientate valves, trap primers, water hammer arrestors, etc. in manner accessible for maintenance and/or removal.

I. No water piping will be permitted below slab on grade unless shown on Drawings.

J. Contractor to inquire from Owner the time to make tie-in to existing systems.

3.7 HANGER AND SUPPORT INSTALLATION

A. Support exposed piping tight to wall with support channels and pipe clamps. All pipe clamps shall include rubber cushion.

B. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure. Comply with OSHPD Preapproval of Manufacturer's Certification OPM-0295-13 and OPM-0052-13, and the California Building Code.

C. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

D. Install lateral bracing with pipe hangers and supports to prevent swaying.

E. Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

F. Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 are not exceeded.

G. Adjust hangers to distribute loads equally on attachments.

H. Trim excess length of continuous-thread hanger and support rods to 1 1/2 inches.

3.8 EXCAVATION AND BACKFILL

A. Provide excavation for the work of this Division. Excavate all material encountered, to the depths indicated on the Drawings or as required. Remove excavated materials not required or suitable for backfill from the site. Provide grading as may be necessary to prevent surface water from flowing into trenches or other excavations. Remove any water that accumulates. Provide sheeting and shoring as may be necessary for the protection of the work and for the safety of personnel.

A. Provide trenches of widths necessary for the proper execution of the work. Grade bottom of the trenches accurately to provide uniform bearing and supp ort the work on undisturbed soil at every point along its entire length.

B. Bedding shall be on minimum 6" deep layer of sand placed on leveled trench bottom. Sand removed to necessary depth for piping bells and couplings to maintain contact of pipe on sand for entire length. All other piping laid on smooth level trench bottom to maintain contact for entire length.

C. All backfill shall be bank run sand and/or gravel to 6" above piping up to slab on interior piping below slabs. All backfill placed in layers not exceeding 8" deep and compacted to 95% maximum density at optimum moisture content per AASHTO Standards.

D. Following backfilling, grade all trenches to level of surrounding subgrade. All excess soil shall be located per Owner's instructions.

E. Do not backfill trenches until all required tests have been performed and the installation observed by the Architect.

F. After backfilling, remove all surplus earth resulting from this work from the premises and dispose off site.

3.9 PAINTING

A. Paint exposed, exterior metal piping, valves, service regulators, earthquake valves, and piping specialties except components with factory-applied paint or protective coating.

B. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

C. Refer to Division 09 for additional painting requirements.

3.10 TESTING, ADJUSTING, AND CLEANING

A. Provide testing of all installed gas, domestic water, drainage and vent systems during progress of work. Such tests shall be done in the presence of the Owner's representative, and all Authorities Having Jurisdiction. The inspection authority having jurisdiction and the Engineer shall be notified a minimum of 48 hours prior to performance of all tests so that they may be witnessed.

B. Provide the Architect with certified copies of the test results in written format. At a minimum include the date of the test, witnesses present, sections tested, length of tests, starting and final pressures.

C. Contractor shall provide all apparatus, temporary work, or any other requirements necessary for such tests. Take all due precautions to prevent damage to the building or its contents that may be incurred by such tests as the Contractor will be required to repair and make good, at own expense, any damage caused.

D. Any defects or deficiencies discovered as result of tests shall be immediately repaired and tests shall be repeated until all test requirements are fully met. No caulking of pipe joints to remedy leaks shall be permitted.

E. Waste and Condensate Drain Piping: All waste and condensate drain systems shall be tested hydraulically by filling to the highest vent point with water. Piping may be tested in sections. Each section of drainage piping tested shall have all openings tightly closed with screw plugs, or equal device, and stand without loss of level for a period of 4 hours when filled with water which produces at least a 10-foot head at the highest point of the section tested.

F. Water Piping: All water piping shall be tested to 100 psig with potable water and held for 8 hours without drop in pressure before it is covered and concealed. Equipment and personnel shall be protected from this test pressure. After fixtures are connected, test system for 2 hours at 75 psig or prevailing water pressure, whichever is higher.

G. Adjust and regulate all faucets, valves, water heating equipment, etc. and turn over to the Owner in perfect working order.

H. Upon completion of work, clean all equipment and piping installed under this Section.

3.11 DISINFECTION

A. Upon completion of all tests and necessary replacements, all domestic water piping shall be disinfected. Chlorination shall be accomplished by personnel in direct employ of a firm licensed to do this type of work. After work has been accomplished, provide the Owner and Architect with a statement from the laboratory indicating the water is suitable for human consumption.

B. Prior to testing, flush piping with clean water until clean water free of silt or grit is observed for at least one minute.

C. Comply with local requirements where local code requirements are more stringent. Provide necessary labor, equipment, material, and test kits for chlorine application and tests. Make all arrangements with jurisdictional water authority for witnessing chlorination tests and tests of proper disinfection.

D. Sterilize all parts of building water system with water solution containing 50 ppm of available chlorine for at least a 24 hour contact period. After contact period, flush all parts of system with clear water until system tests at no more than 0.2 ppm residual chlorine.

E. Flush thoroughly and submit bacteriological samples to a certified laboratory which shall certify in writing that the water is suitable for drinking.

3.12 TRAINING AND O&MS

A. Refer to Section 22 00 00 Plumbing General Requirements and Division 01 for Training requirements, Operating and Maintenance Manuals, and other Closeout procedures.

END OF SECTION

SECTION 23 00 00

MECHANICAL GENERAL REQUIREMENTS

PART 1 – GENERAL

1.1 CONDITIONS AND REQUIREMENTS

A. Refer to the General Conditions, Supplementary Conditions, and Division 01 General Requirements.

1.2 SCOPE OF WORK

A. Provide all labor, apparatus, and materials that are required to provide a complete installation as indicated on the drawings and in the specifications, including that reasonably inferred for proper execution of this Division.

B. Consult all other Sections to determine the extent of this work specified elsewhere.

C. Coordinate all utility requirements for equipment furnished under this Division. Rough-in required systems and make final connections.

1.3 REGULATIONS AND STANDARDS

A. Install all work to meet or exceed requirements prescribed by governmental bodies having jurisdiction and in accordance with all federal, state, and local codes and ordinances, and all OSHA requirements. These codes include, but are not limited to the latest applicable edition of the following:

1. California Building Code
2. California Electrical Code
3. California Plumbing Code
4. California Mechanical Code
5. California Energy Code
6. California Green Buildings Standard
7. California Fire Code
8. National Fire Protection Association

1.4 QUALITY ASSURANCE

A. Comply with current governing codes, ordinance and regulations of the Authority Having Jurisdiction and the regulations and requirements of the Owner’s insurance underwriter.

B. Where requirements differ between drawings, specifications, codes and standards, apply the more stringent.

C. Should any change in drawings or specifications be required to comply with governing regulations, notify the Architect prior to submitting bid.

D. After contract is awarded, if minor changes or additions are required by the aforementioned authorities, even though such work is not shown on drawings or overtly covered in the specifications, they shall be included at the Contractor's expense.

E. Execute work in strict accordance with the best practices of the trades in a thorough, substantial, skillful and well-executed manner by competent workers. Provide a competent, experienced full-time Superintendent who is authorized to make decisions on behalf of the Contractor.

F. The Architect or Architect's Representative may conduct unannounced field reviews of any work completed or in progress. A report will be issued for all items that are found to be inconsistent with the contract documents. All items in the report shall be addressed in writing by the Contractor within two (2) weeks.

1.5 SAFETY

A. Contractors must conduct a weekly safety meeting with their employees and maintain documentation of attendance and topics of discussion. Contractor shall comply with all OSHA regulations. Contractor is required to obtain and pay for insurance required to cover all activities withing Contractor's scope of work.

1.6 PERMITS, FEES, AND UTILITIES

A. Secure and pay for all permits, licenses, inspections, and fees required.

B. Coordinate with other Sections and schedule sequence of accomplishing the work in such a manner as not to interrupt existing services and utilities at a time that will inconvenience the Owner. Provide Owner a minimum 48 hour notice when utilities will be interrupted.

1.7 PAINTING

A. See Division 09 for painting.

1.8 COORDINATION

A. Coordinate with work performed by other Sections in order to ensure adequate space and proper location of all necessary work on this project whether or not work is under this Section. Coordination shall be done prior to order or manufacture of any systems or components.

B. At a minimum, coordinate location of each piece of equipment, requirements for access panels, space required for supports, power requirements for each piece of equipment, and control requirements for each piece of equipment.

C. Coordination meetings shall happen within the first two weeks of construction start. Coordination meeting minutes shall be submitted to the Architect for review.

D. Prepare complete set of construction coordination shop drawings indicating equipment actually purchased and exact routing of all piping and ductwork. Requirement for coordination shop drawings shall not be construed as authorization for contractor to make unauthorized changes to Contract Documents. Prior to final acceptance, contractor shall submit the coordination shop drawings as part of the record drawings.

E. Wherever the work is of sufficient complexity, prepare additional detail drawings to scale to coordinate the work with the work of other trades. At completion, include a set of these drawings with the record drawings.

F. Install the work in cooperation with other trades. Before installation, make proper provisions to avoid interferences.

G. No additional costs will be considered for work which has to be relocated due to conflicts with other trades or for additional equipment/parts that need to installed due to a lack of coordination prior to, or during, construction.

PART 2 – PRODUCTS

2.1 EQUIPMENT AND MATERIALS

B. Provide products and materials that are new, clean, free of defects, damage and corrosion. Inspect all materials and remove defective materials from the site.

C. Provide materials and equipment bearing the label of, or listed by, the Underwriter's Laboratories (UL), unless the material or equipment is of a type for which label or listing service is not provided.

D. Furnish all materials and equipment of the same type by the same manufacturer.

E. Statically and dynamically balance rotating equipment for minimum vibration and lowest operating noise level.

2.2 ALTERNATE EQUIPMENT AND MATERIALS

A. No substitute materials or equipment may be installed without the written approval of the Architect.

B. Contract documents are based on materials specified and equipment manufacturers indicated. Acceptance of alternative equipment manufacturers does not relieve Contractor of the responsibility to provide equipment and materials which meet the quality and performance stated or implied in the contract documents.

C. All submittals for substitution must include comparison to show equal with scheduled equipment. Submit proposals to supply alternate materials or equipment, in writing, with sufficient lead time for review prior to the date equipment must be ordered to maintain project schedule.

D. No increase in the contract price will be considered to accommodate the use of alternative equipment, including revisions required by other trades.

2.3 SUBMITTALS

A. Submit shop drawings, manufacturer's data, samples and test reports as specified.

B. The review of submittals is for general compliance with the design concept and contract documents. Comments or absence of comments does not relieve the Contractor/Vendor/Manufacturer from compliance with the contract documents. The Contractor remains solely responsible for details and accuracy, for confirming and correlating all quantities and dimensions, for selecting fabrication processes, for techniques of construction, for performing the work in a safe manner, and for coordinating the work with that of other trades.

C. No part of the work shall be ordered, procured, or installed until that work has been submitted, reviewed, and returned without comment.

D. Items indicated in submittal comments shall be provided and installed by contractor.

E. The Engineer and/or Architect shall review the submitted documents for general conformance with the design concept of the project. The review does not relieve the Contractor of the responsibility of deviations from the requirements stated in the contract documents.

F. The Engineer's and/or Architect's review shall not be construed as a completed detailed check of the work submitted, nor shall it relieve the Manufacturer or Contractor of responsibility for errors or omissions of any sort or from the necessity of furnishing any work required by the contract documents.

G. Submittals are not reviewed for quantities, dimensions, weights, fabrication processes, construction methods, coordination with work of other trades, construction safety practices, service clearance, location of control and electrical panels, and other layout constraints. These items shall remain the sole responsibility of the Contractor.

H. A minimum period of ten (10) working days will be required in the Engineer's office each time a submittal is sent for review. Contractor shall prioritize submittal reviews where multiple submittals are sent for review. This time period must be considered by the Contractor in the scheduling of the work.

I. Submittals will be returned to indicate appropriate action taken as follows:

1. No Exceptions Taken.
2. Make Corrections Noted. No Resubmittal Required.
3. Revise and Resubmit.
4. Rejected.
5. Not Reviewed.

J. Use electronic form acceptable to Architect for electronic submittals, containing the following information:

1. Project name.
2. Date.
3. Name and address of Architect and Engineer.
4. Name of Owner.

5. Name, address and contact information of Contractor.
6. Names and contact information of sub-contractor, manufacturer, and supplier.
7. Name of entity that prepared submittal.
8. Category and type of submittal.
9. Specification Section number and title.
10. Drawing number and detail references, as appropriate.
11. Transmittal number, numbered consecutively and revision number clearly identified.
12. Each item submitted labeled or identified the same as on the drawings.

K. Identify each sheet of submittal pages (using arrows, underlining or circling) to show applicable sizes, types, model numbers, ratings, capacities and options actually being proposed. Cross out non-applicable information.

L. Organize submittals to keep all related items together; break submittal into sections and provide appropriate identifying tags on submittal pages to indicate item being submitted.

M. Provide a bookmark for each submittal section. Include a table of contents at beginning of submittal.

N. Submit all items related to specification section in single submittal file. Partial submittals will be deemed incomplete and not reviewed.

O. Inadequate or incomplete submittals will not be reviewed and will be returned to the Contractor for resubmittal.

P. Place orders for all equipment in time to prevent any delay in construction schedule or completion of project. No additional costs will be considered for any special handling charges or expedited processing required for materials or equipment not ordered in time.

2.4 REQUEST FOR INFORMATION

A. While every effort has been made to coordinate the locations of equipment covered under other sections or divisions of these specifications, it is the responsibility of the Contractor to coordinate the exact requirements governed by actual job conditions. Check all information and report any discrepancies before submitting bid or fabricating work.

B. Report discrepancies in time to avoid unnecessary work, and make changes as directed by the Architect.

C. Do not make changes or additions that are subject to additional compensation without written authorization, based upon an agreed price. Any changes made without the above-mentioned authorization shall be at Contractor's own risk and expense.

D. Follow manufacturer’s instructions where they cover points not specifically indicated. However, if they are in conflicts with these drawings and specifications, obtain clarifications from the Architect before starting work.

E. All requests for information shall be accompanied with Contractor’s proposed solution.

PART 3 – EXECUTION

3.1 EXAMINATION OF SITE

A. The Contract Documents do not make representations regarding the character or the extent of the subsoils, water levels, existing structural, mechanical, plumbing, and electrical installations, above or below grade, or other sub-surface conditions which may be encountered during the work.

B. Evaluate existing conditions that may affect methods or cost of performing the work, based on examination of the site or other information. Failure to examine the Drawings or other information does not relieve the Contractor of responsibility for satisfactory completion of the work.

3.2 DRAWINGS

A. Drawings show general arrangement and location of ductwork, piping, and equipment. Drawings are diagrammatic and intended to show approximate location and routing. Dimensions on drawings shall take precedence over scaled dimensions on drawings. Allow for supports, expansion, and pitch of ducts and piping. Field verify all dimensions.

B. The exact locations of equipment, ducts, piping, and registers shall be ascertained from the Architect or the Owner's representative in the field. The Architect reserves the right to make minor changes in the location of ducts, registers, piping, and equipment up to the time of installation without additional cost.

C. Furnish and install any incidental work not shown or specified which can reasonably be inferred as part of the work and necessary to provide a complete and workable system. This includes any wiring of sensors, switches, etc.

D. Execute any work or apparatus shown on the Drawings and not specifically mentioned in the Specifications, or vice versa. Omission from Drawings or Specifications of any minor details of construction, installation, materials, or essential specialties does not relieve Contractor from furnishing complete workable system.

3.3 RECORD DRAWINGS

A. Contractor shall maintain a complete set of documents on site that are marked up during the construction process indicating all changes that have been made. Record drawings shall be maintained up to date throughout construction. Indicate clearly all work installed differently from that shown.

B. Upon completion of work, certify all record drawings with a stamp including the date and name of Contractor. Submit one (1) complete, bookmarked, set of electronic record drawings to the Architect for final review.

C. Record drawings must include the following as a minimum:

1. Actual equipment locations.
2. Revisions or substitutions to equipment schedules.
3. Duct/pipe size and routing.
4. Dimensional changes to drawings.

5. Revisions to details shown on drawings.
6. Changes made by RFIs, Addenda, or Change Orders.
7. Locations of access panels and shut-off valves.
8. Locations and depths of underground utilities.
9. Controls sequence of operations.

3.4 PROTECTION OF BUILDING

A. Protect new and existing building structures and adjacent finished surfaces during construction. Patch, repair, and refinish existing work damaged by work under this Division to match adjacent undisturbed areas.

3.5 DELIVERY, DRAYAGE AND HAULING

A. Include all drayage, hauling, hoisting, shoring and placement in the building of equipment specified and be responsible for the timely delivery of equipment to the project as required by the construction schedule.

B. Provide proper protection and storage of all items and tools required.

C. If equipment is not delivered or installed at the project site in a timely manner as required by the construction schedule, the Contractor shall be responsible for disassembly, re-assembly, manufacturer's supervision, shoring, general construction modification, delays, overtime costs, etc. at no additional cost to the Owner.

3.6 EQUIPMENT AND MATERIAL PROTECTION

A. Protect the work, equipment, and material of other trades from damage by work or workers of this trade, and correct damage caused without additional cost to the Owner.

B. The Contractor shall be responsible for all work, materials, and equipment until finally inspected, tested, and accepted. Protect work against theft, injury, or damage. Carefully store material and equipment received on site that is not immediately installed.

C. Cover open ends of work with temporary covers or plugs during construction to prevent entry of dust, dirt, water or other obstructing material. Cover and protect equipment and materials from damage due to water, humidity, paint, spray-on fireproofing, construction debris, etc. Store equipment subject to moisture damage, such as insulation or electrical components in dry, heated spaces.

D. Provide adequate means for fully protecting finished parts of the materials and equipment against damage from whatever cause during the process of the work until final acceptance.

E. Do not install damaged items. Take immediate steps to obtain replacement or repair. Replace all wet or damp insulation or acoustic lining.

3.7 QUALITY OF WORK

A. The quality of work shall be of a standard generally accepted in the respective trade. Use only experienced, competent, and properly equipped workers. Replace work falling below this standard as directed by the Architect.

B. Systems shall be worked into a complete and integrated arrangement with like elements arranged neatly with adequate head room and passageway free from obstructions.

3.8 CUTTING AND PATCHING

A. Do not cut, channel or drill unfinished masonry, tile, etc. unless written permission is obtained from the Architect. Perform this work in a manner acceptable to the Architect. Cutting of structural members or footings is prohibited without the prior written consent of the Structural Engineer.

B. Where cutting, channeling or drilling of floors, walls, partitions, ceilings, or other surfaces is necessary from the proper installation, support or anchorage of ductwork, piping, or equipment, lay out the work carefully in advance. Repair any damage to the building, piping, equipment or finishes using skilled tradesmen for all required work.

C. All core drilling, bolt anchor insertion, or cutting of existing structural concrete shall be approved prior to execution of any construction. At all structural concrete to be drilled, cut or bolt anchors inserted, the contractor shall find and mark all reinforcing in both faces located by means of x-ray, pach-ometer, or prof-ometer. Submit sketch showing location of rebar and proposed cuts, cores, or bolt anchor locations for approval.

D. Provide slots, chases, openings and recesses through floors, walls, ceilings and roofs as required. Where these openings are not provided, provide cutting and patching to accommodate penetrations.

E. Provide sleeves for all ductwork and piping passing through new floors, walls, partitions, and any other building construction, of adequate diameter to allow minimum of 1” clearance all around between sleeve and ductwork or piping. When ductwork or piping is insulated, insulation shall pass continuously through sleeve with 1” clearance between insulation and sleeve or hole in existing construction.

3.9 ACCESS

A. Damper operators, filters, and indicating equipment or specialties requiring reading, adjusting, inspection, repairing, removal, or replacement shall be conveniently and accessibly located with reference to finished building.

B. No dampers, controls, or equipment shall be placed in a location that will be inaccessible after the system is complete. Access panels or doors shall be provided where required whether shown on Drawings or not.

C. Access panels shall be 24” x 24” unless otherwise directed, style as selected by the Architect. Panels shall have the same acoustic barrier or rating as the construction in which panel is installed.

D. Doors shall be Milcor, Newman or equal, with concealed hinges, screwdriver locks, prime coated with rust inhibitive paint, finish painted in field to match adjacent surface. Provide key locks where required by Architect/Owner. All access doors shall be keyed the same. Doors in walls of toilet rooms shall be stainless steel.

E. Continuously check installation manuals for clearance and accessibility of equipment. No allowance of any kind will be made for negligence on part of Contractor to foresee means of installing equipment in proper position.

3.10 SEISMIC RESTRAINTS

A. All equipment, ductwork, piping, and materials shall be fastened and securely anchored to building structure as required by the Drawings, Specifications, OSHPD Preapproval of Manufacturer's Certification OPM-0295-13 and OPM-0052-13, and the California Building Code.

3.11 MANUFACTURER'S DIRECTIONS

A. Materials and equipment shall be installed in accordance with manufacturer's application and recommendations, requirements, and instructions, and in accordance with Contract Documents.

B. Conflicts between manufacturer's instructions and Contract Documents shall be brought to the Architect's attention for resolution prior to installation.

C. Where requirements indicated in Contract Documents exceed manufacturer's requirements, Contract Documents shall govern.

3.12 BELT DRIVES

A. Belt drives for fans and equipment shall consist of "V" belts and sheaves.

B. Drives that require not more than two belts shall be provided with variable pitch, driving sheaves to provide some speed adjustment above and below the normal required operating speed; the adjustments to be as near equal as practicable.

C. Belts shall be furnished in matching sets.

D. Fan drives for blower-type fans shall be selected for the proper fan speeds required for the air volumes specified or shown on the Drawings at the static pressures indicated. The static pressures indicated show estimated conditions, which may vary under actual operating conditions. Should it be necessary to adjust the fan speeds to obtain the proper air volume, the Contractor shall make the necessary changes to the drives without additional cost the Owner.

3.13 ELECTRICAL MOTORS FOR HVAC EQUIPMENT

A. Provide electric motors for driving the mechanical equipment. Motors shall be of proper power, construction and speed to suit the specified equipment.

B. Motors and motor control equipment shall conform to NEMA standards and shall be UL listed.

C. Coordinate the NEMA type of each motor with the torque and inertia load of the equipment served, and the in-rush current characteristics of the motor with the motor starter selection, so that all items furnished constitute a complete motor control and protection package. Motor shall not operate in the 15% service factor range.

D. Motors located in ducted air streams or subject to outside air elements shall be totally enclosed fan cooled; others shall be open drip-proof design.

E. Motors used with variable frequency drives shall be designed specifically for use on AC inverter power and adjustable speed applications.

F. Each motor shall be factory-wired to a junction box mounted on the motor or on the driven piece of equipment to facilitate single point of field power connection under Division 26.

G. Motors 1/2 HP and smaller shall be rated 120 VAC – single phase – 60 hertz and shall be provided with integral thermal overload protection, unless otherwise indicated.

H. Motors 3/4 HP and larger shall be rated for 208 VAC or 460 VAC – 3 phase – 60 hertz, unless otherwise indicated.

3.14 COORDINATION WITH ELECTRICAL CONTRACTOR

A. Coordinate with the Electrical Contractor on furnishing and installing of controls, motors, starters, etc. Provide copies of submittal and installation data to Electrical Contractor for all items requiring electrical connection.

B. Furnish and install all line voltage and low-voltage temperature control wiring in the Mechanical work, including all interlock wiring between motor starter coils, interlock relays, and temperature control equipment. Conduit for temperature control wiring shall be responsibility of Mechanical Contractor and shall be of type specified in Division 26.

C. Electrical Contractor shall furnish disconnect switches, motor starters, conduit and wiring for line voltage power to the equipment. See Division 26 and Drawings.

3.15 ELECTRICAL EQUIPMENT AND ELECTRICAL ROOM PRECAUTIONS

A. Do not install piping, equipment, or ductwork, plumbing, or any piping systems not included as part of the electrical work in the following rooms: switchgear, transformer, generator, elevator equipment, telephone, fire command, security, dimmer or electrical equipment rooms.

B. Do not install piping, equipment, or ductwork within the code required service space for switchboards, disconnects, panelboards, dimmers, control panels, VFDs, individual motor controllers, electronics, etc.

3.16 LUBRICATION

A. Provide means for lubricating all bearings and other machine parts. If a part requiring lubrication is concealed or inaccessible, extend a metallic lubrication tube with suitable fitting to an accessible location and identify it with permanent laminated plastic nameplates. Identify this location in the maintenance manual.

B. After installation, properly lubricate all parts requiring lubrication and keep them adequately lubricated with a lubricant recommended by the equipment manufacturer until Owner acceptance.

3.17 EQUIPMENT GUARDS

A. Provide easily (without tools) removable expanded metal guards for all hot surfaces, belts, couplings, exposed fan inlets and outlets, and other moving parts or machinery. Provide access openings for greasing, oiling, adjusting, etc. All guards shall comply with OSHA requirements and applicable codes.

3.18 CATHODIC PROTECTION

A. Install dielectric unions at points in piping where dissimilar metal pipes are connected together.

3.19 PIPING AND EQUIPMENT IDENTIFICATION

A. Furnish and install engraved nameplates with 1/4” minimum lettering at panel mounted control devices, manual control stations, power disconnects, motor starters, and pieces of equipment. Nameplates shall be white lettering on black background. For outdoor locations, provide brass engraved nameplates or plastic rated for outdoor use.

B. Label each thermostat and switch with equipment connected to the thermostat or switch with black lettering on white background.

C. Each piping system installed under this work shall be identified and the direction of flow indicated. Markings shall be applied after all painting, priming, and cleaning of the piping and insulation is completed. Labels shall be black lettering on colored backgrounds. Lettering shall be easily readable from the floor and background colors easily discernible. Furnish labels in every room and every 20’ of pipe length.

D. Tag all valves with 2” diameter brass tags noting the valve number and contents in the pipe. At the completion of the project, provide Owner with a valve listing for all valves installed in the project. Valve listing shall note valve tag number, contents in the pipe and the areas (room numbers, etc.) that are impacted by valve.

3.20 GUARANTEE

A. The Contractor shall guarantee the quality of all work and the quality of the equipment and materials in accordance with the provisions of the General Conditions and Special Conditions. Should any defects occur during this period, the Contractor shall promptly repair or replace defective items as directed by the Architect, without cost to the Owner.

B. Contractor shall be responsible for damage to any part of premises during guaranteed period caused by leaks or breaks in work furnished and/or installed under this Section.

3.21 TESTING

A. Test all ductwork, equipment, piping, and systems as called for in the Specifications. Notify Architect and inspection authorities prior to testing so that they may be witnessed. Protect all personnel and equipment during testing.

3.22 OPENINGS

A. Locating and sizing of all openings for ductwork and piping through walls, roof, etc. shall be done under this Division. Framing of openings shall be done by the respective trades in whose work the opening is made.

3.23 CLEAN-UP

A. During the course of work under this Division, all rubbish, debris, surplus materials, tools, etc. resulting from this work shall be removed from work area and shall be disposed of off-site at the end of each working day. The Owner's premises shall be left clean and in a condition acceptable to the Architect.

B. Clean all work installed under this Contract to satisfaction of Owner.

C. Remove debris and trash from ductwork, fan units, and all air handling equipment. Vacuum clean fan housing, coils, and ducts in vicinity of openings before grilles and registers are installed. Replace construction filters with new filters prior to project completion.

3.24 PUNCH LIST

A. Respond to Architect's punch list in writing within 10 days of receipt. Include action plan and an estimated timeline for completion.

B. Submit photographs of completed items.

3.25 ACCEPTANCE TESTING

A. Equipment and systems requiring acceptance testing certification for Code Compliance shall have Certificate of Acceptance completed and submitted to enforcement agency. See Drawings for equipment and systems requiring acceptance certification. Tests shall be performed by Certified Mechanical Acceptance Test Technician. Contractor shall be responsible for procuring the required test forms from the California Energy Commission website.

B. The acceptance testing procedures must be repeated, and deficiencies must be corrected by the contractor until the construction/installation of the specified systems conform and pass the required acceptance criteria.

3.26 OPERATING INSTRUCTIONS AND OPERATOR TRAINING

A. Provide the services of factory-trained specialists to supervise the operation of all equipment and train the Owner's operating and maintenance personnel.

B. Instruct the Owner's operating personnel in the basis of design, the available documentation, the proper starting sequences, operation, shut-down, minor adjustments, troubleshooting, recommended spare parts, and regular maintenance procedures.

C. Submit training agenda, schedule and list of representatives to the Owner for review ten (10) days prior to training. Confirm attendance at training by sign-in sheet. At a minimum, the training agenda shall cover all items required to be provided in the operating and maintenance manuals.

3.27 OPERATING AND MAINTENANCE MANUALS

A. Provide operating instructions and maintenance manuals for all equipment and material furnished under this Division.

B. Provide the following equipment and maintenance information where applicable:

1. Systems and Equipment Controls – describe sequence of operation and diagram controls as required.
2. Identifying equipment manufacturer, product name, and model number.
3. Locations.
4. Wiring Diagrams.
5. Lubrication Charts.
6. Manufacturer's recommended operating and maintenance instructions, with all non-applicable information deleted.
7. Assembly and disassembly instructions.
8. Startup procedures.
9. Routine and normal operating instructions.
10. Normal and emergency shutdown instructions.
11. Troubleshooting diagnostic instructions.
12. Parts list and recommended spare parts including name and address of source of supply.

C. Contractor must start compiling above data immediately upon approval of submittals for equipment and materials.

D. Submit one (1) electronic copy of operating and maintenance manuals, indexed and bookmarked, for review by Architect/Engineer.

E. Submit three (3) complete sets of bound hard copies of operating and maintenance manuals, and one (1) electronic copy to Owner within thirty (30) days of issuance of final occupancy permit.

END OF SECTION

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SECTION 23 05 00

HEATING, VENTILATING, AIR CONDITIONING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 01, and Division 23 Sections apply to this Section.

1.2 SCOPE OF WORK

A. Provide labor, materials, equipment, and services to furnish and install complete mechanical systems which shall include, but not limited to equipment, ductwork, piping, accessories, insulation, and supports.

1.3 SUBMITTALS

A. Submit for review, within fifteen (15) days after signing Contract, the required number of copies of a complete list of materials proposed for use. This list includes:

1. Split Systems.
2. Fans.
3. Roof Hoods and Caps.
4. Ductwork.
5. Duct Insulation and Lining.
6. Dampers and Duct Accessories.
7. Filters.
8. Diffusers, Registers, and Grilles.
9. Louvers.
10. Refrigerant Piping.
11. Mechanical Supports.
12. Controls.
13. Coordination Drawings: plans and details, drawn to scale, on which equipment and duct routing is shown and coordinated with other installations, using input from installers of the items involved.

B. No substitute materials or equipment shall be installed without the written approval of the Architect.

C. No increase in the contract price will be considered to accommodate the use of alternative equipment, including revisions required by other trades.

D. Submit test reports on all systems tested. Tests required by Authorities Having Jurisdiction over the work shall be submitted on appropriate forms to the satisfaction of such authorities.

PART 2 – PRODUCTS

2.1 HVAC EQUIPMENT

A. See Schedules on Drawings for equipment data. Furnish and install all equipment in accordance with Drawings, manufacturer's recommendations, and all applicable codes.

2.2 FILTERS

A. Filters shall be 2"-thick of size and number required for equipment and selected for 300 FPM velocity.

B. Filters shall be throwaway type, Class 2 UL listed.

C. Filters shall be minimum MERV 13 based on ASHRAE Standard 52.2 test method.

2.3 ROOF HOODS AND CAPS

A. Roof hoods shall be of size, type, and capacity noted on Drawings.

B. Roof caps for exhaust shall be of size required for duct dimensions noted on Drawings.

C. Roof hood and cap housing shall be constructed of heavy gauge galvanized steel and shall be fully weatherproof and painted with name. Cap and hood shall be reinforced to prevent oil canning and deflecting in high winds. Roof caps and hoods shall be complete with bird screen and roof curb. Distance of hood from roof shall be 18" unless otherwise noted on Drawings.

2.4 DUCTWORK

A. Comply with latest edition of SMACNA HVAC Duct Construction Standards, Metal and Flexible for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated. Comply with NFPA 90A when ducts traverse through smoke zones.

B. Comply with UL 181 and California Energy Code Section 120.4 requirements for air distribution ducts and plenums.

C. Ducts shall be minimum 24 gauge thickness. Ducts shall be constructed for 2500 FPM maximum velocity and static pressure classes as follows:

1. Supply Ducts: +3 inch w.g.
2. Return Ducts: - 2 inch w.g.
3. Exhaust Ducts: -2 inch w.g.

D. Longitudinal seams: Groove and Pittsburgh lock seams and slip joints shall be used.

E. Duct Connections: Ductmate industries "Ductmate 35" and "Ductmate 45". Ductmate "Spiralmate" for round duct. Ductmate "Ovalmate" for oval duct.

F. Duct sealing shall be DP 1010 water based duct sealant or other equal and SMACNA approved foil-backed pressure sensitive tape or other equal.

G. Flexible ducts shall be UL 181 and Class I air duct in compliance with SMACNA HVAC Duct Construction Standards, Metal and Flexible, and NFPA 90A and 90B.

H. Flexible ducts shall be two-ply vinyl film supported by helically wound spring-steel wire, R4.2 fiberglass insulation, exterior reinforced laminated vapor barrier film. Duct shall be rated for +2 inch w.g., -1 inch w.g., 4000 FPM maximum velocity, and -10°F to +160°F. Flame Spread less than 25, Smoke Developed less than 50.

2.5 DUCT INSULATION AND LINING

A. All duct insulation and lining shall comply with California Energy Code Section 120.4 requirements for air distribution ducts and plenums.

B. Insulation shall conform to NFPA 90A and 90B, and UL 181, Class I. Insulation shall have Flame Spread not over 25 and Smoke Developed of not over 50.

C. Wherever external duct insulation is specified and internal acoustic treatment of equivalent insulating effect is also required by the Drawings or Specification for the same location, the external insulation may be omitted.

D. Acceptable Manufacturers: Johns Manville, Owens Corning or approved equal.

E. Acoustic Duct Liner: 1” thick, R4.2 in directly conditioned space and 2” thick, R8.0 in unconditioned space or outdoors. Owens Corning Quiet R, or approved equal.

F. Duct Insulation: 3” thick, R8.3 in unconditioned space and 1 1/2” thick, R4.2 for indirectly conditioned space. Owens Corning SoftR Ductwrap FRK, or approved equal.

G. Duct Insulation Outdoor: 2” thick rigid board fiberglass, R8.7 with 0.016 inch thick sheet Aluminum jacket.

2.6 REGISTERS, DIFFUSERS AND GRILLES

A. Acceptable manufacturers: Titus, Krueger.

B. Registers, diffusers, and grilles shall be as indicated on Drawings. Drawings and schedules indicate specific requirements of air inlets and air outlets. Other manufacturers’ products with equal quality, appearance, finish, and performance characteristics may be considered.

C. Registers shall have adjustable air pattern for setting in field to match field conditions. Redirect air pattern when required.

D. Refer to Architectural Drawings and Specifications for reflected ceiling plans, elevations, wall and ceiling type and construction. Coordinate frame and border types to accommodate the wall or ceiling specified or shown on the Architectural Drawings.

E. Registers, diffusers, and grilles in fire-rated ceilings or walls shall be all-steel construction.

2.7 DAMPERS AND DUCT ACCESSORIES

A. Acceptable manufacturers:

1. Dampers: Ruskin, Air Balance Inc, Pottorff, or approved equal.

2. Acutuators: Belimo, Honweywell, or approved equal.
3. Turning vanes: Ductmate industries, Duro Dyne, or approved equal.
4. Flexible connectors: Duro Dyne, Ventafabrics, or approved equal.
5. Duct access doors: Ductmate industries, Ward industries, or approved equal.
6. Backdraft dampers: Ruskin, Greenheck, Air Balance Inc, or approved equal.
7. Fire dampers: C&S Air products, or approved equal.

B. Provide volume dampers as specified or shown on the Drawings for proper balancing and distribution of air. Provide single blade dampers in ducts 24 inches in width or less, or 12 inches in height or less. Provide multiple blade, opposed blade design, dampers for all other duct sizes. Coordinate with the balancing contractor and provide additional dampers required for proper air balance.

C. Dampers shall be galvanized steel construction and shall be minimum 2 gauges thicker than duct gauge. Damper shall be pivoted to turn easily, provided with operating handles and locking devices mounted on the outside of the duct in an accessible location. Dampers shall be reinforced for rigidity.

D. Control dampers for outside air and return air shall be low-leakage with blade edge seals and jamb seals. Damper shall be AMCA licensed as a Class 1A damper.

E. Damper actuators for control dampers shall be modulating, 24V power supply, 0-10V DC control input, weatherproof construction.

F. Turning vanes shall comply with SMACNA HVAC Duct Construction Standards, Metal and Flexible for vanes and vane runners. Vane runners shall automatically align vanes.

G. Manufactured Turning Vanes: Fabricate 1 1/2” wide, double vane, curved blades of galvanized steel construction set to 3/4" o.c. Support with bars perpendicular to blades set 2” o.c. and set into vane runners suitable for duct mounting.

H. Flexible duct connectors shall be flame retardant fabrics, coatings, and adhesives complying with UL 181, Class I. Where exposed to weather, fabric shall be double coated with weatherproof, synthetic rubber resistant to UV rays.

I. Duct access doors shall be airtight and suitable for duct pressure class, constructed of galvanized steel with insulation fill as integral part of appropriate thickness. Include cam latches, sash locks, and hinges such that doors can easily be opened without tools. Seal around frame with neoprene or foam rubber.

J. Backdraft dampers shall be multi blade, parallel action gravity balanced, or adjustable counter-balance weighted dampers. Dampers shall have center pivoted blades of maximum 6” width, with sealed edges, assembled in rattle free manner with 90-degree stop. Provide with adjustment device to permit setting for varying differential static pressure.

K. Fire dampers shall be UL listed and conforming to NFPA 90A. Dampers shall be factory installed in sleeves. Dampers shall be arranged to close automatically upon operation of listed fusible link.

2.8 REFRIGERANT PIPING

A. Refrigerant line kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed. Factory insulated lines with flared fittings at both ends. Mueller Streamline Co., JMF Company, or approved equal.

B. Refrigerant pipe insulation shall be flexible closed cell elastomeric foam complying with ASTM C534 with UV retardant, and resistant to mold and mildew.

C. Both suction and liquid lines shall be insulated outdoors and in exposed indoor locations. Concealed Indoor liquid lines may omit insulation for cooling only units.

D. Outdoor piping shall have insulation covered with .016 inch thick aluminum jacket.

E. Indoor exposed piping shall have insulation covered with smooth PVC jacketing, painted per Architect's directions.

F. Refrigerant pipe insulation shall meet requirements of California Energy Code Section 120.3.

2.9 HANGERS AND SUPPORTS

A. Subject to compliance with requirements, provide products by one of the following manufacturers or other approved equal:

1. B-Line.
2. Mason West.
3. Unistrut.
4. Power Strut.
5. Hilti.

B. Qualify welding processes and operators according to ASME Boiler and Pressure Vessel Code. Comply with AWS D1.1 procedures for field welding.

C. Duct attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

2.10 SLEEVES

A. Construct sleeves for pipes passing through walls, floors, partitions, hung or furred ceilings, etc. of minimum 18 gage galvanized steel, flanges on each side of wall, partition, hung or furred ceiling, etc.

B. Provide standard weight galvanized steel pipe sleeves with welded anchor flanges at foundation walls and reinforced concrete or masonry walls.

C. Provide 20 gage galvanized sheet metal sleeves for round ductwork passing through masonry or concrete construction. Rectangular ductwork shall be provided with framed openings through floor and wall construction.

D. Install escutcheons at exposed piping through floors, ceilings, walls and partitions in finished areas, within cabinets and millwork, and piping through all fire-rated separations.

2.11 CONTROLS

A. Furnish and install programmable thermostats where indicated. Coordinate exact locations with Architect.

B. If indicated on Drawings, provide thermostats by specified manufacturer.

C. Thermostats shall comply with latest edition of California Energy Code for demand responsive capabilities and occupancy monitoring if required.

D. Mount thermostats 48 inches above finished floor.

E. Control wiring shall be installed per manufacturer's instructions and wiring diagrams. Wiring in walls and exposed spaces, including mechanical rooms, shall be in conduit and in accordance with Division 26. Wiring concealed above ceiling shall be plenum rated cable complying with NFPA 70.

F. Provide and install heavy duty lockable thermostat cover for assembly areas, gymnasiums, and any other public areas required by Owner.

2.12 PAINTING

A. See Division 09 for painting.

B. Prime and paint diffuser boot and duct interiors where visible through grilles with a matte black finish.

C. Prime and paint exposed ductwork, supports, and registers where required by the Architect.

D. Prime and paint louver or grille interiors where required by the Architect.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for installation clearances, tolerances and other conditions affecting performance of work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EQUIPMENT INSTALLATION

A. Equipment shall be installed level, on curbs or supports as required and/or indicated on Drawings and in accordance with manufacturer's instructions and recommendations.

B. Equipment shall be installed in locations shown and as complete assemblies with adequate service clearances for access and maintenance as required by codes and equipment installation manuals.

3.3 DUCTWORK INSTALLATION

A. All ductwork gauges, joints, reinforcing, and other details shall be in accordance with latest edition of SMACNA manuals unless otherwise specified.

B. Duct dimensions are net, inside, clear dimensions. For internally lined ducts, add lining thickness to determine metal duct dimensions.

C. Provide minimum 24-gauge sheet metal construction for ducts. Construct ducts with NFPA 90A gauges when traversing smoke zones.

D. Construct ducts of galvanized sheet metal, except where otherwise indicated or specified.

E. Construct all ductwork to dimensions indicated, straight and smooth on the inside with neatly finished joints lapped in direction of travel.

F. Construct all ductwork to avoid sharp duct edges. Edges shall be sufficiently rounded and where not possible, sharp edges shall be covered with edge protectors.

G. Fabricate changes in direction, both horizontal and vertical, to permit easy airflow.

H. At exposed duct penetrations of walls, floors and ceilings, provide sheet metal angle type escutcheons fastened to the duct only.

I. Duct Openings: Provide openings where required to accommodate thermometers, smoke detectors, controllers, wiring, conduit, tubing, etc. insert through air-tight rubber grommets.

J. Provide pitot tube openings where required for testing of systems. Include threaded metal cap, spring loaded cap or threaded plug to eliminate any air leakage. Coordinate locations of openings with balancing contractor.

K. Install ductwork to clear all obstructions, preserve headroom, and keep openings clear. Install exposed ducts as high as possible. Coordinate with other trades to maintain minimum 7’-6” clearance above finished floor, unless otherwise indicated.

L. Install ducts unless otherwise indicated, vertically or horizontally and parallel and perpendicular to building lines; avoid diagonal runs.

M. Coordinate layout with suspended ceiling, lighting layouts, and similar finished work.

N. Install dampers in branch duct for all air inlets and outlets at accessible location. Dampers shall be capable of adjustments and of being locked into position.

O. Use radius elbows in rectangular ductwork unless otherwise indicated. Centerline radius shall be a minimum 150 percent of duct width. Where space does not permit duct radius, install square elbow with turning vanes.

P. Ends of ducts shall turn over 3/4” for airtight connections between ducts and grilles. The ducts and grilles shall have separate sets of screws. Register frames and ends of ducts shall be properly placed before finishing is begun.

Q. All ducts shall be supported per SMACNA HVAC Duct Construction Standards. Supports and seismic bracing shall be in accordance with OSHPD Preapproval of Manufacturer’s Certification OPM-0295-13 and OPM-0052-13, and the California Building Code.

R. Ducts exposed to weather shall be completely waterproof with outdoor vapor barrier mastic over tape at all joints and seams. Slope entire top of duct down towards sides and coordinate duct slope with roof slope. Arrange standing seam, joints, and flanges to prevent accumulation, ponding or pooling of water.

S. Seal joints and seams of ductwork airtight to SMACNA seal classifications.

T. Protect all ductwork and interiors of ducts shall be clean and free from foreign materials until building is enclosed.

U. All ductwork and sealing shall comply with California Energy Code Section 120.4 requirements for Air Distribution System Ducts and Plenums.

3.4 DUCT SEALING

A. Duct systems shall be sealed to a leakage rate not to exceed 6 percent of the nominal air handler air flow rate.

B. Ductwork for constant volume systems that have more than 25 percent of the total duct surface area located outdoors or in unconditioned space shall have the duct leakage confirmed through HERS field verification and diagnostic testing.

C. New duct systems not subject to testing shall meet duct leakage requirements of CMC 603.9.2.

3.5 FLEXIBLE DUCTWORK INSTALLATION

A. Flexible ductwork shall be installed with no runs of more than 5’-0” in length and shall be used only at register connections.

B. Flexible duct shall be installed in fully extended condition, free of sags and kinks, using only minimum length required to make connection. Bends greater than 90° are not allowed.

C. Flexible duct shall be full size of branch. Any change in size to match terminal connection shall be made at terminal. Connect to duct collars, terminal unit connections and air inlets and outlets per manufacturer’s instructions.

D. All connections shall be sealed with high pressure duct sealer and secured with 3/8” nylon straps around inside liner of flexible duct.

E. Flexible ducts shall be supported at or near mid-length with 2” wide, 28 gauge steel hanger collar attached to the structure with an approved duct hanger. Installation shall minimize sharp radius turns or offsets.

3.6 DUCT INSULATION AND LINING INSTALLATION

A. Concealed ductwork shall be insulated with fiberglass ductwrap.

B. Provide acoustic lining where indicated on Drawings.

C. All supply and return ductwork shall be insulated, or acoustically lined on the inside when ductwork is exposed.

D. Exhaust duct need not be insulated. Outside air duct indoors need not be insulated. Outside air duct installed outdoors shall be insulated.

3.7 DUCT ACCESSORIES INSTALLATION

A. Flexible connections shall be installed on inlet and outlet duct connections of fans, air conditioning units, furnaces, and all other HVAC equipment. Fabric shall be of weight and strength for service required, properly fitted to render connection airtight. Fabric of sufficient width to provide minimum 4” between connected items.

B. Install backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated. Install backdraft dampers at roof hoods or louvers connected to ductwork.

C. Install duct access doors to allow for inspecting, adjusting, and maintaining accessories and terminal units. Access doors shall be large enough for maintenance.

3.8 FILTER INSTALLATION

A. Filter boxes shall have hinged access panels and shall allow tool-less entry.

B. Filter boxes shall be installed such that they are easily accessible and allow unimpeded removal and installation of filters without interference with other obstacles.

C. Filter boxes shall accommodate 2” thick filter installation.

D. Filter boxes shall be installed with air tight seals and the access door shall fully close with a seal to prevent infiltration of air.

3.9 REGISTERS, DIFFUSERS, AND GRILLES INSTALLATION

A. Locations indicated on the Architectural Drawings shall take precedence. For lay-in ceiling panels, locate in the center of the panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

B. Install with airtight connection to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

C. After installation of diffusers, registers, and grilles, inspect exposed finish. Clean exposed surfaces to remove burrs, dirt, and smudges. Replace diffusers, registers, and grilles that have damaged finishes.

D. Install diffusers, registers, and grilles level and plumb, according to manufacturer’s written instructions.

E. All visible interior surfaces of registers, diffusers, and grilles shall be painted flat black.

F. All visible exterior surfaces of registers, diffusers, and grilles shall be factory off-white finish as standard. Where required by Architect, provide in a color as selected by Architect or provide prime-painted for field painting.

3.10 REFRIGERANT PIPING INSTALLATION

A. Refrigerant pipe installation shall comply with latest editions of ASHRAE 15 and ASME B31.5.

B. Install piping in accordance with manufacturer’s instructions and good practices.

C. Install piping adjacent to unit to allow access to unit for service and maintenance.

D. Where required, provide or install additional refrigerant charge per equipment manufacturer's requirements. After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

E. Install piping as short and direct as possible, with a minimum number of joints and fittings.

F. Support exposed piping tight to wall with strut channels and pipe clamps. Support concealed pipe on hanging pipe supports, provide bracing where required.

G. Support roof piping at sufficient intervals to prevent pipe sag.

H. Route piping in orderly manner, parallel to building structure, and maintain gradient. Group piping whenever practical at common elevations and locations. Install piping to conserve space and avoid interference with use of space.

I. Install piping in straight lines and use 45 degree of 90 degree bends for changes in direction.

J. Slope piping one percent in direction of oil return. Provide suction traps at base of suction risers where required.

K. Piping shall be cut accurately to measurements established at job site and worked into place without springing or forcing, allowing for proper head room.

L. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

M. Install sleeves for piping and tubing penetrations of walls, ceilings, and floors. Install escutcheons for piping and tubing penetrations of walls, ceilings, and floors.

N. Install insulation without any gaps or cracks and use contact adhesive recommended by manufacturer at joints and connections.

O. When the thickness of insulation is reduced, for example at support hangers, reinforce the reduced thickness with additional insulation.

P. Seal longitudinal seams and end joints of insulation with manufacturer's recommended adhesive to eliminate openings in insulation. Installation to maintain a continuous vapor barrier.

Q. Where metal jackets are indicated for insulation, install with 2 inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless steel bands 12 inches on center at end joints.

R. Use insulated pipe clamps and insulated pipe supports to provide continuous insulation throughout. No section of bare pipe shall come in contact with other metals.

S. Brazed joints: Construct joints according to AWS C3.4M/C3.4.

1. Provide brazing for refrigerant piping system using AWS A5.8/A5.8M, Bag-1 with 15 percent silver, 80 percent copper and 5 percent phosphorous.

2. Clean surfaces to be jointed of oil, grease, rusts, and oxides.

3. Any joints showing evidence of overheating, cracking, poor penetration, or other defects of fit-up or workmanship shall be replaced as directed by the Architect at the contractor's expense.

3.11 LOUVERS INSTALLATION

A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Maintain equal louver blade spacing to produce uniform appearance.

C. Comply with SMACNA's Architectural Sheet Metal Manual for fabrication, construction details, and installation procedures.

D. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.

E. Use concealed anchorages where possible.

F. Form closely fitted joints with exposed connections accurately located and secured.

G. Protect unpainted galvanized and nonferrous metal surfaces that will be in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

H. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses where watertight louver joints are required.

3.12 HANGERS AND SUPPORTS INSTALLATION

A. All equipment, plenums, registers, ductwork, and piping shall be securely anchored to building structure and seismically braced as required by the Drawings and Specifications. Comply with OSHPD Preapproval of Manufacturer's Certification OPM-0295-13 and OPM-0052-13, and the California Building Code.

B. Comply with SMACNA HVAC Duct Construction Standards – Metal and Flexible for hanger rod or sheet metal strap sizes and spacing for duct supports.

C. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

D. Install lateral bracing with pipe hangers and supports to prevent swaying.

E. Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

F. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

G. Install hangers and supports to provide indicated pipe slopes.

H. Adjust hangers to distribute loads equally on attachments.

I. Trim excess length of continuous-thread hanger and support rods to 1 1/2 inches.

J. Perform all welding in accordance with standards of the American Welding Society. Clean surfaces of loose scale, rust, paint or other foreign matter and properly align before welding. Use wire brush on welds after welding.

3.13 TESTING

A. Comply with more stringent of system manufacturer's requirements and requirement indicated herein.

B. Provide the Architect with certified copies of the test results in written format. At a minimum include the date of the test, witnesses present, sections tested, length of tests, starting and final pressures.

C. After completion of refrigerant piping installation, pressurize piping systems to a test pressure of not less than 600 psig using dry nitrogen.

a. Test field piping to 600 psig pressure in increments of 200 psig.

b. Test pressure for low side of the system shall be maximum low side allowable pressure.

c. Test pressure for high side of the system shall be maximum high side allowable pressure.

d. If the high side of the system cannot be isolated from the low side of the system, the entire system shall be pressure tested to the low side maximum allowable pressure.

D. Successful testing shall maintain the test pressure for a continuous and uninterrupted period of 24 hours.

E. After completion of pressure testing evacuate piping systems using a vacuum pump with a check valve. Maintain test pressure per manufacturer's requirements for a continuous and uninterrupted period of one (1) hour.

F. Prepare and submit test reports to the Architect for project record.

G. Charge the refrigerant piping system following system manufacturer's written instructions. Total refrigerant charge shall be recorded and permanently displayed at the system's outdoor unit.

3.14 ADJUSTING

A. Adjust equipment and components to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust initial temperature setpoints. Adjust initial airflow settings and discharge airflow patterns.

C. Set field adjustable switches and circuit breaker trip ranges according to manufacturer's written instructions.

3.15 FIELD QUALITY CONTROL

A. Engage a factory authorized service representative to inspect field assembled components and equipment installation, including piping and electrical connections. Provide a written report of inspection to the Architect.

B. Engage a factory authorized service representative to perform startup service. Complete installation and startup checks according to manufacturer's written instructions. Provide completed startup sheets for each piece of equipment to the Architect.

3.16 TRAINING AND O&MS

A. Refer to Section 23 00 00 Mechanical General Requirements and Division 01 for Training requirements, Operating and Maintenance Manuals, and other Closeout procedures.

END OF SECTION

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SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 01, Division 22, and Division 23 Specification Sections, apply to this Section.

1.2 WORK INCLUDED

A. Test and balance air distribution systems.

1.3 QUALITY ASSURANCE

A. Work shall be performed by independent testing agency certified by AABC or NEBB. Work shall be performed by qualified technicians and trained personnel, using instruments certified accurate to its limits.

B. Use standard forms from AABC's National Standards for Testing, Adjusting and Balancing or NEBB's Procedural Standards for Testing, Adjusting and Balancing.

C. Calibrate instruments at least every twelve months or more frequently if required by the instrument manufacturer.

1.4 COORDINATION

A. Coordinate efforts of HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist with testing, adjusting, and balancing activities.

B. Check for and report defects or deficiencies that may affect balancing.

C. Mechanical Contractor shall advise Balancing Contractor of changes made to the system during construction.

D. Mechanical Contractor shall install test holes or wells complete with removable and replaceable plugs or caps, dampers as specified on Drawings and where required by Balancing Contractor to obtain final system balance.

E. Mechanical Contractor shall make any changes in the pulleys, belts, and dampers, or the addition of dampers for the correct balance as recommended by Balancing Contractor at no additional cost to the Owner.

F. Controls Contractor shall cooperate with and work with the Balancing Contractor when setting damper linkages, minimum outside air dampers, and other air volume devices, and shall be available for readjusting of dampers, devices or controls.

1.5 SUBMITTALS

A. Within 30 days of Contractor's Notice to Proceed, submit the following documents:

1. TAB agency and team member qualifications.
2. Strategies and procedures plan.
3. Sample report forms intended for use on this project.
4. Instrument calibration reports.

B. Submit final, completed balance report prior to request for final mechanical observation of the project.

PART 2 – PRODUCTS

2.1 INSTRUMENTS

A. Utilize test instruments and equipment of type, precision, and capacity as recommended in the AABC or NEBB standards.

B. Instruments for testing and balancing of air and hydronic systems shall have been calibrated within a period of 6 months and verified for accuracy prior to start of work.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Prior to construction, examine the Contract Documents to become familiar with the project requirements and to discover conditions in the systems' designs that may preclude proper testing, adjusting and balancing of systems and equipment.

B. Examine system and equipment installations to verify that balancing devices are properly installed and accessible for effective balancing.

C. Recommend adjustments and/or corrections to mechanical equipment and hydronic and air distribution systems that are necessary for proper balancing of systems.

3.2 GENERAL PROCEDURE

A. Perform testing and balancing procedures on each system according to procedures contained in AABC or NEBB standards.

B. Testing and balancing shall not begin until system has been completed and is in full working order.

C. Cut insulation, ducts, pipes, and equipment cabinets for installation or test probes to the minimum extent necessary for balancing procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this project.

D. Permanently mark settings on valves, splitters, dampers, and other adjustment devices.

E. Balance to a maximum measured flow deviation from specified values of plus or minus 10 percent at terminal devices and outlets, and plus or minus 5 percent at equipment.

F. At final inspection, recheck random selections of data recorded in report to verify balance has not been disrupted.

3.3 AIR SYSTEMS PROCEDURE

A. Execute air systems balancing for each air system in accordance with AABC or NEBB standards and as described herein.

B. Conduct tests with supply, return and exhaust systems operating and doors and windows closed or in their normal operating condition.

C. Construction filters shall be removed before testing and balancing. Tests shall be done with final filters installed. Allowances shall be made for air filter resistance at time of tests. The main air supplies shall be set with filter resistance midway between clean and dirty filters.

D. Test and adjust fan or blower speed to design requirements.

E. Test and record motor full load amps. Record each installed motor manufacturer and motor efficiency.

F. Traverse main supply air ducts, using a pitot tube and manometer.

G. Submit data in support of fan deliveries by the following methods:

1. By summation of the air quantity readings at inlets or outlets.
2. By duct traverse of main ducts.

H. Test and record required and measured system static pressures, filter differential, coil differential and fan total static pressure.

I. Test and adjust systems for design recirculated airflow rates.

J. Test and adjust system for outside airflow rates. Measure and adjust outside airflow rates for all fan speeds.

K. Test and record entering and leaving air temperatures in both heating and cooling modes.

L. Inspect and confirm all fire dampers are open, all smoke dampers and fire/smoke dampers are in the correct positions, all duct access doors are closed and fire damper fusible links are accessible.

M. Adjust zones to proper design supply, return, and exhaust flow rates.

N. Test and adjust each air inlet and air outlet and transfer duct to within 10 percent of design requirements.

O. Adjust diffusers, grilles and registers to minimize drafts, dumping, and to prevent short circuiting between supply and return outlets.

P. Vary total system airflow rates by adjustment of fan speeds. Vary branch air quantities by damper regulation.

Q. Record installed fan drive assemblies; fans sheaves, motor sheaves, belts and motors.

R. The final balanced condition of each area shall include testing and adjusting of pressure conditions. Test and record building pressurization levels in variable volume systems throughout full range of fan delivery rates, under both heating and cooling conditions. For multi-story buildings, test pressure conditions at ground, intermediate and upper levels. Front doors, stair and vestibule doors, exits and elevator shafts shall be checked for airflow so that leakage does not cause excessive or abnormal pressure conditions. Document abnormal building leakage conditions noted.

S. Complete balancing to achieve positive building pressure unless otherwise instructed. A positive pressure relative to outside of 0.02 inch wg minimum and 0.05 inch wg maximum shall be achieved, measure with negligible outside wind velocity.

3.4 ACCEPTANCE

A. Mechanical systems shall not be considered ready for final inspection until balancing results acceptable to the Architect are obtained.

B. If it is found that specified airflows cannot be achieved on portions of the system, the actual conditions shall be reported to the Architect for consideration of corrective action.

3.5 BALANCE REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

B. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB firm and specialist.
3. Project name.
4. Project location.
5. Architect’s name and address.
6. Engineer’s name and address.
7. Contractor’s name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Summary of contents including the following:

a. Design versus final performance.

b. Notable characteristics of systems.

c. Description of system operation sequence if it varies from the Contract Documents.

C. Report shall be indexed as follows:

1. Air

a. Summary.

b. Procedure.

c. Instrumentation.

d. Drawings.

e. Equipment Summary.

f. Fan Sheets.

g. Fan Curves.

h. Fan Profile Data.

i. Static Data.

j. Traverse Data and Schedule.

k. Terminal Unit Summary.

l. Outlet Data Summary and Schematics (per system).

m. Supply Temperature Data.

n. Building Pressurization Data.

END OF SECTION

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SECTION 26 05 00 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section Includes:
1. Materials and equipment shall be furnished and installed in support of electrical work described in these plans and specifications as required for a complete and fully functional system.
2. Complete fire alarm and annunciation system as shown and/or required by the (local jurisdiction having authority, California State Fire Marshal) including monitoring equipment and wiring for central station connection.
3. Lighting systems, both interior and exterior as shown on the plans and as specified herein, including controls, occupancy sensors, lumen sensors, photocell controls, lamps, dimmers, racks, dimming ballasts/drivers, supports, fasteners, straps, and miscellaneous mounting hardware and support structures for such equipment.
4. Site work as shown and/or required.
5. Duct banks and raceways for all power and communications systems as shown and/or required. Duct banks shall include all trenching, racking, conduit, concrete, backfill, boxes, pads, substructures required for a fully developed and useable pathway for cables, conductors, as shown on site, etc.
6. HVAC and plumbing electrical: Conduit, conductors and terminations for all line voltage power, line voltage controls and fusible and/or non-fusible safety disconnect switches for HVAC equipment, including but not limited to air conditioners, furnaces, fans, heat pumps, system pumps, condensing units, etc. Provide protective equipment unless otherwise noted, including protective devices.
7. Plumbing Electrical: Conduit, conductors and terminations for plumbing equipment with power requirements including necessary fusible and/or non-fusible safety disconnect devices. Provide motor starters where required unless provided by mechanical specification.
8. Power and Lighting Distribution: Furnish and install power and lighting distribution systems including but not limited to panels, feeders, transformers, branch circuits, devices, fixtures, disconnect switches, contactors, controls, etc. for a complete working system.
9. Data systems infrastructure including all boxes, raceways, dedicated branch circuits, sleeves and penetrations, etc. as described and as shown in plans, risers, specifications, EIA/TIA standards and/or required for a complete and operating system.
10. Lighting acceptance testing, documentation and completion of required forms as specified in Section 26 56 70, LIGHTING ACCEPTANCE TESTING.
11. Allocation of time to adequately train the Owner on the use and operation of all systems installed within the facility or on the property. Minimum two week advance notice shall be coordinated with the Owner and his representatives. Training shall be as outlined in individual system specifications identified to follow.

B. Related Sections Under Other Divisions:
   1. Mechanical Wiring: Control circuit wiring, energy management controls and interlocks for mechanical equipment shall be installed by Mechanical Contractor.
   2. Painting of electrical equipment where exposed and required by the Architect to be painted as described elsewhere in the specification.
   3. Irrigation System: Provide all line voltage (50 volts or above) connections to irrigation system equipment, time clocks and or powered satellite controls. Coordinate locations of this work with the Landscape Contractor.
   4. HVAC Control Raceway: Raceways, boxes, and control wiring for thermostats, temperature sensors and control components specified within the mechanical specifications, shall be furnished and installed as required by Division 25 and installed in accordance with the minimum wiring methods allowed for branch circuit wiring in Division 26 (the DDC systems/EMS systems and components are installed in accordance with Division 25).

1.3 SYSTEM DESCRIPTION

A. The electrical plans indicate the general layout and arrangement; the architectural drawings and field conditions shall determine exact locations. Field verify all conditions and modify as required to satisfy design requirements as well as code minimums. Maintain all required working clearances as described in CEC Article 110 as well as other applicable articles.

B. Discrepancies shall be brought immediately to the attention of the Architect for clarification. The Architect shall approve any changes. Prior to rough-in, refer to architectural plans that shall take precedence over electrical plans with respect to locations.

1.4 SUBMITTALS AND SHOP DRAWINGS

A. Before construction, submit in (accordance with the General Conditions of this Specification) a complete list of all materials proposed to be furnished and installed under this section. Any material procured without review and approval of the engineer and/or owner’s representative, will solely be at the contractor’s risk.

B. Manufacturers' specifications, catalog cuts and shop drawings as required to demonstrate compliance with the specifications. Identify specific intended use for each component where submittal may be ambiguous. Submit entire bound submittal at one time; partial submittals will not be accepted. At a minimum, submittals will be required for the following:
   1. Site work equipment including ducts, conduits, fittings, concrete manholes, concrete and fiberglass pull, manhole, boxes, vaults, trench racks, accessories, etc.
   2. Distribution equipment including distribution/branch panels breakers, grounding, transient voltage surge suppressors, etc.
   3. Electrical equipment including disconnects, fuses, raceways, straps and racks, fittings, conductors, boxes, gutters, devices, plates, etc.
   4. Lighting equipment including fixtures, ballasts/drivers, lamps, mounting accessories, color charts (where required), etc.
   5. Lighting control equipment including low voltage switching system, dimmer switchbank / accessories, occupancy sensing equipment, time clocks, contactors, photocells, lumen sensors, etc.
   6. Constructability review letter/comments for lighting acceptance testing as required by Section 26 56 70, LIGHTING ACCEPTANCE TESTING.
   7. Complete system component submittals and shop drawings for:

a. Sound Systems with assisted listening devices as required to meet ADA.
b. Fire Alarm System
c. Communication Systems including but not limited to: cable, fiber, terminations, cable management, patch panels, equipment racks, specified active electronics (where called for), cabinets, jacks, plates, cable labeling, testing procedure.

8. Conduit including all fittings, etc.
9. Wiring and cable, terminations, etc.
10. Fire rating penetration materials, details, etc.

C. The intent of these specifications is to establish a standard of quality for materials and equipment. Therefore, some items are identified by manufacturer or trade name designation. Substitutions shall be subject to the Architect's approval. Samples of the proposed and substitute materials may be required for inspection prior to approval. Costs, if any, for evaluation of substitutions shall be the Contractor's responsibility. The decision of the Architect shall be final. Where the substitution will affect other trades, coordinate all changes with those trades concerned and pay any additional costs incurred by them as a result of this substitution. Approval of substitutions shall not relieve the Contractor from providing an operational system in accordance with all applicable codes and ordinances.

D. SUPPORTING DEVICES
1. Provide all details of suspension and support for ceiling hung equipment.
2. Where walls, floor, slabs or supplementary steel work are used for seismic restraint locations, details of acceptable attachment methods for ducts, conduit and pipe must be included and approved before the submittals must include spacing, static loads and seismic loads at all attachment and support points.
3. Provide seismic details of seismic restraints and anchors; including number, size and locations for each piece of equipment.

1.5 DELIVERY, STORAGE AND HANDLING

A. Storage of equipment for the job is the responsibility of the Electrical Contractor and shall be scheduled for delivery to the site, as the equipment is required. Damage to the equipment delivered to the site or in transport to the job shall be the responsibility of the Electrical Contractor.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials shall be new and bear the label of or be listed by a nationally recognized testing laboratory. The quality and suitability of all materials shall conform to the standards and practices of this trade.

B. Supplied materials shall be of a current manufactured product line. Discontinued products are not acceptable. Where products are identified on the contract documents by part number, supply the current product model or series which meets the specification and intended use of the specified component.

2.2 SUPPORTING DEVICES

A. Hangers: Kindorf B-905-2A Channel, H-119-D washer, C105 strap, 3/8” rod with ceiling flange.

B. Concrete Inserts: Kindorf D-255, cast in concrete for support fasteners for loads up to 800 lbs.

C. Pipe Straps: Two-hole galvanized or malleable iron.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Professionalism and appearance of installations shall be in accordance with accepted practices of this trade. Installation methods shall conform to manufacturers' specifications and recommendations. The Contractor shall man the job with qualified journeymen and helpers in this trade for the duration of the job. It is the Contractor's responsibility to communicate with and keep the job superintendent appraised of changes or clarifications, etc.

B. Employment of any person on any job in the capacity of an electrician is not permitted unless such person has qualified for and holds a valid Journeyman Electrician Pocket Card or General Journeyman Electrician Certificate issued by the State of California Division of Apprenticeship Standards except, Contractor may employ electrical helpers or apprentices on any job of electrical construction, new or existing, when the work of such helpers or apprentices is performed under the direct and constant personal supervision of a journeyman electrician holding a valid Pocket Card accepted by the State of California Division of Apprenticeship Standards.
   1. Each Pocket Card carrying journeyman electrician will be permitted to be responsible for the quality of workmanship for a maximum of one helper or apprentice during any same time period, provided the nature of work is such that good supervision can be maintained and the quality of workmanship is the best, as expected by Owner and implied by the latest edition of the National Electrical Code.
   2. Before each journeyman electrician commences work, deliver to Owner at the project site, a photocopy of the journeyman’s valid Pocket Card.

C. Materials shall be installed in accordance with the manufacturers' specification and recommendations. They must conform to the approval AHJ adopted codes and standards, but not less than the 2022 CEC and all applicable codes and standards, including but not necessarily limited to California Code of Regulations Title 24, NFPA, National Electrical Manufacturers Association, ANSI, CBC, and any other adopted ordinances of applicable agencies having jurisdiction. Refer to general conditions of specifications.

D. Electrical Contractor shall lay work out in advance in order to avoid unnecessary cutting, chasing, and drilling of floors, walls, ceilings and other surfaces. Work of this nature shall be carefully done so as not to damage work already performed by other trades. Any damage which results must be properly repaired at no extra cost to the Owner. Such alterations shall not depreciate the integrity of the structure. Approval for cuts or penetrations in structural members shall be by the Architect.

E. Supporting Devices:
   1. Verify mounting height of all luminaires or items prior to installation when heights are not detailed.

2. Install vertical support members for equipment and luminaires, straight and parallel to building walls. Provide independent supports to structural member for electrical luminaires, materials, or equipment installed in or on ceiling, walls or in void spaces or over furred or suspended ceilings.
3. Do not use other trade's fastening devices as supporting means for electrical equipment, materials or luminaires. Do not use supports or fastening devices to support other than one particular item.
4. Support conduits within 18" of outlets, boxes, panels, cabinets and deflections. Maximum distance between supports not to exceed 8' spacing.
5. Securely suspend all junction boxes, pull boxes or other conduit terminating housings located above suspended ceiling from the floor above or roof structure to prevent sagging and swaying.
6. Provide seismic bracing per UBC requirements for this building location.
7. Supporting Devices: Safety factor of 4 required for every fastening device or support for electrical equipment installed. Support to withstand four times weight of equipment it supports. Bracing to comply with seismic design category "SDC" per Structural Engineer.

F. Coordinate work with other trades as required to eliminate any delays during construction. Coordinate changes with other prime contractors to avoid construction conflicts.

G. Engineer's Field Observation: Site visits during construction for field observations and reports will be conducted by electrical engineer when directed by the Architect. A list of items that need to be addressed will be submitted to the Architect for forwarding to the Contractor. A written response to all items shall be submitted for Owner's review once complete. When Electrical Engineering representative performs a field observation, the Electrical Contractor shall be present and available to remove equipment covers as needed.

H. Drawings of Record: Provide a full and accurate set of field record drawings marked up in a neat and understandable manner submitted to the Owner Representative, Construction Manager, or Architect upon completion of the work and prior to issuance of a certificate of completion. The drawings shall dimension all electrical facilities including but not limited to underground conduit, vaults, boxes as well as conduit routing scaled to within 12" of actual field conditions and shall be kept up to date on a daily basis reflecting changes or deviations. Electrical facilities shall be accurately drawn on the plan to scale. Refer to the general conditions of these specifications for additional requirements. Record drawings shall be required to identify both horizontal and vertical dimensions to visible and fixed points such as concrete, asphalt, buildings, sidewalks, etc.

I. Identification: Provide engraved laminated plastic nameplates for all switchboards, panelboards, fire alarm terminal cabinets, telephone and cable television backboards, main devices, control panels, time clocks, contactors and safety disconnect switches accurately identifying each device. Labels shall be attached to the equipment by means of screws or rivets. Self-adhering labels will not be acceptable. Refer to Section 26 05 53, IDENTIFICATION OF ELECTRICAL SYSTEMS.

J. Safety: The Electrical Contractor is responsible to maintain equipment in a safe and responsible manner. Keep dead front equipment in place while equipment is energized. Conduct construction operations in a safe manner for employees as well as other work persons or anyone visiting the job site. Provide barriers, trench plates, flags, tape, etc. The Contractor shall hold all parties harmless of negligent safety practices that may cause injury to others on or near the job site.

K. Guarantees: Equipment and labor shall be guaranteed and warranted free of defects, unless otherwise stated to be more restrictive, for a period of one year from the date of final acceptance by the Owner. A written warranty shall be presented to the Architect at the time of completion prior to final acceptance. Equipment deemed to be damaged, broken or failed should be repaired or replaced at no additional cost to the Owner. Materials or system requiring longer than a one-year warranty as described herein shall be separately warranted in separate letters of guarantee stating the duration of warranty.

L. Operating and Installation Manuals: Provide two copies each of manuals, operating and installation instructions for equipment indicated in submittal packages. Instruct the Owner's representative as to the operation and location of equipment necessary to allow them to operate the facility upon final acceptance. This instruction period shall be prearranged with the Owner's representative prior to occupancy of the facility and the weeks prior to training scheduled.

M. Lighting Acceptance Testing: Provide two copies of lighting acceptance testing results and equipment operating manuals as specified in Section 26 56 70, LIGHTING ACCEPTANCE TESTING. Instruct the Owner on operation of control systems.

END OF SECTION 26 05 00

SECTION 26 05 01 - SELECTIVE ELECTRICAL DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section Includes:
   1. Electrical demolition.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work shall be as specified in individual sections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor to walk job to observe existing conditions and account for variance as needed.

B. Verify field measurements and circuiting arrangements as shown on drawings.

C. Verify that abandoned wiring and equipment serve only abandoned facilities.

D. Demolition Drawings are based on limited field observation and existing record documents. Report discrepancies to Owner/Architect before disturbing existing installation.

3.2 PREPARATION

A. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.

B. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, observe provisions of NFPA 70E and CALOSHA, use personnel experienced in such operations.

3.3 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Demolish and extend existing electrical work under provisions of this section.

B. Remove, relocate, and extend existing installations to accommodate new construction.

C. Allow the owner first right to retain ownership of salvaged materials, otherwise the Electrical Contractor is responsible for its removal from the site and proper disposal or recycling.

D. Remove abandoned wiring to source of supply. Existing abandoned conductors removed over #12 AWG shall be salvaged back to the District Maintenance Yard located at 222 Stanley Ave, Arroyo Grande, CA.

E. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

F. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets which are not removed.

G. Disconnect and remove abandoned panelboards and distribution equipment.

H. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

I. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.

J. Discarded electrical components and lamps containing hazardous waste (i.e., mercury in fluorescent lamps) shall be disposed of as required by the State Laws and Local Ordinances regarding hazardous materials.

K. Repair adjacent construction and finishes damaged during demolition and extension work.

L. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

3.4 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment which remain or are to be reused.

B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

C. Luminaires: Cleaning light fixtures. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace LED drivers, light fixtures, ballasts and broken electrical parts as required for any inoperative fixtures. Provide new lamps for all fixtures that are to remain.

3.5 INSTALLATION

A. Install relocated materials and equipment as shown and/or as required.

END OF SECTION 26 05 01

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SECTION 26 05 19 - LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Wires and cables.
   2. Connectors.
   3. Lugs and pads.

1.3 SYSTEM DESCRIPTION

A. Provide wires, cables, connectors, lugs, strain reliefs, racking insulators for a complete and operational electrical system.

1.4 SUBMITTALS

A. Submit in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.

B. Provide product data for the following equipment:
   1. Wires.
   2. Cables.
   3. Connectors.
   4. Lugs.
   5. Splice Kits.
   6. Strain Relief Fittings.
   7. Cable Racking and Insulators.

C. Provide the insulation cable testing report in the project closeout documentation, refer to Closeout Requirements in the General Conditions portion of this specification.

1.5 REGULATORY REQUIREMENTS

A. Conform to requirements of the CEC, latest adopted version with amendments by local Authority Having Jurisdiction (AHJ).

B. Furnish products listed by UL or other testing firm acceptable to AHJ.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Wires and Cables: General Cable, Okonite, Southwire, or approved equal.

B. Connectors: Burndy, Ilsco, Thomas & Betts, or approved equal.

C. Wire connectors shall be minimum 75 degree centigrade rated and properly sized for the number of conductors being connected, terminated, spliced etc. All above grade connectors shall be solderless lug or plastic wire nut type, screw on, pressure cable type (wire nut or spring nut type), 600 volt, 105 degree C, with skirt to cover all portions of stripped wires. Connector shall be U.L. rated for number and size of conductors being joined together as a splice.

D. Splices:
1. Branch Circuit Splices: Ideal, Scotch-Lock, 3M, or approved.
2. Feeder Splices: Compression barrel splice with two layers Scotch 23 and four layers of Scotch 33+ as vapor barrier.
3. Screw Terminal Lugs.
4. Kearney Split Bolt.

2.2 WIRES AND CABLES FOR LINE VOLTAGE SYSTEM AND CONTROLS. WIRE AND CABLE SHALL BE:

A. Copper, 600 volt rated throughout. Conductors 14AWG to 10AWG, solid or stranded. Conductors 8AWG and larger, stranded.

B. Phase color to be consistent at all feeder terminations; A-B-C, top to bottom, left to right, front to back. Phasing tape shall be permitted on sizes #6 and larger.

C. Color Code Conductors as Follows:

PHASE	**208 VOLT**	**480 VOLT**
A	Black	Brown
B.	Red	Orange
C.	Blue	Yellow
Neutral	White	Gray
Ground	Green	Green

D. All conductors shall be copper unless otherwise noted. Minimum size for individual conductors shall be #12 AWG unless otherwise noted. Sizes #8 AWG and larger shall be stranded conductor. Individual conductors shall be insulated with type, XHHW, THW, THHN/THWN 600-volt insulation unless otherwise noted. Control, signal, communication conductors shall be as dictated by the vendor of that equipment or as specified here-in. Proper insulation type shall be used for the proper environmental application (i.e., waterproof, wet location, plenum, temperature rated). If a condition exists where the application is uncertain, contact the Engineer for direction. Contractor is responsible to follow specific cabling requirements described in other sections of this specification relative to various communications and controls systems as well as the respective riser diagrams shown on plans. If a discrepancy occurs, communicate such discrepancy to the Architect and Engineer immediately for resolution.

E. Insulation types THWN, THHN or XHHW. Minimum insulation rating of 90C for branch circuits.

F. Refer to signal and communications specification sections for cable requirements.

2.3 CONNECTORS

A. Copper Pads: Drilled and tapped for multiple conductor terminals.

B. Lugs: Indent/compression type for use with stranded branch circuit or control conductors.

C. Solid Conductor Branch Circuits: Spring connectors, wire nuts, for conductors 18 through 8AWG.

2.4 LUGS AND PADS

A. Ampacity: Cross-sectional area of pad for multiple conductor terminations to match ampere rating of panelboard bus or equipment line terminals.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation: Conductors shall not be installed until after conduit systems are permanently in place. Use an approved non hardening type wire pulling lubricant if lubricant is to be used. Maintain all conduits and wire pulls free from foreign material. If due to field conditions, more than a total of 300 degrees of bend are required; a pull box shall be furnished and installed for ease of installation. Said pull boxes must be sized and rated for the appropriate application and must remain easily accessible upon completion of the project (approval of the location shall be obtained from the Architect prior to installation). Show these pullboxes on the field record drawings. Conductors installed in underground raceways on site shall be duct sealed and taped where they exit the raceway to prevent the entrance of foreign material and moisture after the conductors are installed. Proper drainage shall be provided for underground pull and splice boxes.

B. Insulation: Use proper insulation types where temperature and environment are a factor.

C. Splices at or below grade level shall be made with wet location rated and approved mechanical connectors and shall be encapsulated in epoxy or plastic molded poured kits. The connections must be assured to be watertight. Splices at or below grade shall always be avoided and minimized. Prior approval is required for feeder splices below grade. Submit proposed materials and exhibit showing location of intended splices for Engineer’s review and approval prior to commencing with the work.

D. Labeling: All conductors in panels, switchboards, terminal cabinets, vaults, pull boxes, and junction boxes shall be labeled with tape number markers indicating circuit number and identifying system. All labeling shall be permanent. In manholes and vaults, provide embossed brass tags identifying system serviced and function. See Section 26 05 53 IDENTIFICATION OF ELECTRICAL SYSTEMS.

E. All conductors, wiring, cable where installed below floor, slab or underground shall be considered wet locations, and shall be rated accordingly. Non waterproof cabling is not allowed in any below grade or wet application.

F. Cable and conductors routed through pull boxes and vaults shall be properly supported on porcelain or equal insulators mounted on steel rack inserts. Bend radius of cable or conductor shall not be less than six times the overall cable diameter.

G. Wires and Cables:
1. Conductor Installation:
   a. Install conductors in raceways having adequate, code size cross-sectional area for wires indicated.
   b. Install conductors with care to avoid damage to insulation.
   c. Do not apply greater tension on conductors than recommended by manufacturer during installation.
   d. Use of pulling compounds is permitted. Clean residue from exposed conductors and raceway entrances after conductor installation.
2. Conductor Size and Quantity:
   a. Install no conductors smaller than 12AWG unless otherwise shown.
   b. Provide all required conductors for a fully operable system.
3. Provide dedicated neutrals (one neutral conductor for each phase conductor) in the following single phase circuits:
   a. Lighting and power branch circuits.
   b. Dimmer controlled circuits.
   c. Isolated ground circuits.
   d. Ground fault and arc fault protected circuits where a GFI and arc fault breakers are used in panelboards.
   e. Other electronic equipment which produces a high level of harmonic distortion including but not limited to computers, printers, plotters, copy machines, fax machines, where indicated.
4. Conductors in Cabinets:
   a. Cable and train all wires in panels and cabinets for power and control neatly and uniformly. Use plastic ties in panels and cabinets.
   b. Tie and bundle feeder conductors in wireways of panelboards.
   c. Hold conductors away from sharp metal edges.
   d. Connectors: Retighten mechanical type lugs and connectors for conductors to equipment prior to Notice of Completion.

3.2 FIELD QUALITY CONTROL

A. Tests:
1. Test conductor insulation on feeders of 400 amp and greater for conformity with 1000 volt megohmmeter. Use Insulated Cable Engineers Association testing procedures. Minimum insulation resistance acceptable is 1 megohm for systems 600 volts and below.

2. Test Report: Prepare a typed tabular report indicating the testing instrument, the feeder tested, amperage rating of the feeder, insulation type, voltage, the approximate length of the feeder, conduit type, and the measured resistance of the megohmmeter test. Submit report with operating and maintenance manual.

END OF SECTION 26 05 19

SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section Includes:
   1. Grounding and bonding requirements of electrical installations for personnel safety and to provide a low impedance path for possible ground fault currents as described in CEC Article 250.
   2. “Grounding electrode system” refers to all electrodes required by CEC, as well as including made, supplementary, lightning protection system and telecommunications system grounding electrodes.
   3. The terms “connect” and “bond” are used interchangeably in this specification and have the same meaning.

B. Related Work:
   1. Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
   2. Section 26 05 19, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.

1.3 SUBMITTALS

A. Submit in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.

PART 2 - PRODUCTS

2.1 GROUNDING AND BONDING CONDUCTORS

A. Equipment grounding conductors shall be UL 83 insulated stranded copper, except that sizes No. 10 AWG and smaller shall be solid copper. Insulation color shall be continuous green for all equipment grounding conductors, except that wire sizes No. 4 AWG and larger shall be permitted to be identified per CEC.

B. Bonding conductors shall be ASTM B8 bare stranded copper, except that sizes smaller than No. 2 AWG shall be ASTM B1 solid bare copper wire.

C. Conductor sizes shall not be less than what is shown on the drawings and not less than required by the CEC, whichever is greater.

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2.2 GROUND RODS

A. Copperclad steel, 5/8" diameter by 10’ long, conforming to UL 467 unless otherwise noted on drawings and details.

B. Quantity of rods shall be as required to obtain the specified ground resistance or additional rods shall be driven to obtain specified resistance or less.

2.3 SPLICES AND TERMINATION COMPONENTS

A. Components shall meet or exceed UL 467 and be clearly marked with the manufacturer, catalog number, and permitted conductor size(s).

PART 3 - EXECUTION

3.1 GENERAL

A. Ground in accordance with the CEC, as shown on drawings, and as hereinafter specified.

B. System Grounding:
1. Secondary service neutrals: Ground at the supply side of the secondary disconnecting means and at the related transformers.
2. Separately derived systems (transformers downstream from the service entrance): Ground the secondary neutral.

C. Equipment Grounding: Metallic structures (including ductwork and building steel), enclosures, fire sprinklers, plumbing piping, raceways, junction boxes, outlet boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits shall be bonded and grounded.

3.2 INACCESSIBLE GROUNDING CONNECTIONS

A. Make grounding connections which are buried or otherwise normally inaccessible (except connections for which periodic testing access is required) by exothermic weld.

3.3 SECONDARY EQUIPMENT AND CIRCUITS

A. Main Bonding Jumper: Bond the secondary service neutral to the ground bus in the service equipment.

B. Metallic Piping, Building Steel, and Supplemental Electrode(s):
1. Provide a grounding electrode conductor sized per CEC between the service equipment ground bus and all metallic water and gas pipe systems, building steel, and supplemental or made electrodes. Jumper insulating joints in the metallic piping. All connections to electrodes shall be made with fittings that conform to UL 467.
2. Provide a supplemental ground electrode and bond to the grounding electrode system.

C. Service Disconnect: Provide a ground bar bolted to the enclosure with lugs for connecting the various grounding conductors.

D. Switchgear, Switchboards, Unit Substations, and Motor Control Centers:
   1. Connect the various feeder equipment grounding conductors to the ground bus in the enclosure with suitable pressure connectors.
   2. For service entrance equipment, connect the grounding electrode conductor to the ground bus.
   3. Connect metallic conduits, which terminate without mechanical connection to the housing, by grounding bushings and grounding conductor to the equipment ground bus.

E. Transformers:
   1. Exterior: Exterior transformers supplying interior service equipment shall have the neutral grounded at the transformer secondary. Provide a grounding electrode at the transformer.
   2. Separately derived systems (transformers downstream from service equipment): Ground the secondary neutral at the transformer. Provide a grounding electrode conductor from the transformer to nearest component of the grounding electrode system and the ground bar at the service equipment.

F. Conduit Systems:
   1. Ground all metallic conduit systems. All metallic conduit systems shall contain an equipment grounding conductor sized per CEC.
   2. Non metallic conduit systems shall contain an equipment grounding conductor.
   3. Metal conduit containing only a grounding conductor, and which is provided for mechanical protection of the conductor, shall be bonded to that conductor at the entrance and exit from the conduit.

G. Feeders and Branch Circuits: Install equipment grounding conductors with all feeders, power and lighting branch circuits.

H. Boxes, Cabinets, Enclosures, and Panelboards:
   1. Bond the equipment grounding conductor to each pullbox, junction box, outlet box, device box, cabinets, and other enclosures through which the conductor passes.
   2. Provide lugs in each box and enclosure for equipment grounding conductor termination.
   3. Provide ground bars in panelboards, bolted to the housing, with sufficient lugs to terminate the equipment grounding conductors.

I. Motors and Starters: Provide lugs in motor terminal box and starter housing or motor control center compartment to terminate equipment grounding conductors.

J. Receptacles shall not be grounded through their mounting screws. Ground with a jumper from the receptacle green ground terminal to the device box ground screw and the branch circuit equipment grounding conductor.

K. Ground lighting fixtures to the equipment grounding conductor of the wiring system when the green ground is provided; otherwise, ground the fixtures through the conduit systems. Fixtures connected with flexible conduit shall have a green ground wire included with the power wires from the fixture through the flexible conduit to the first outlet box.

L. Fixed electrical appliances and equipment shall be provided with a ground lug for termination of the equipment grounding conductor.

3.4 CONDUCTIVE PIPING

A. Bond all conductive piping systems, interior and exterior, to the building to the grounding electrode system. Bonding connections shall be made as close as practical to the equipment ground bus.

3.5 TELECOMMUNICATIONS SYSTEM

A. Bond telecommunications system grounding equipment to the electrical grounding electrode system. Refer to Section 27 13 00, INTERCOMMUNICATIONS SYSTEMS.

3.6 GROUND RESISTANCE

A. Grounding system resistance to ground shall not exceed 25 ohms. Make necessary modifications or additions to the grounding electrode system for compliance without additional cost to the Owner. Final tests shall assure that this requirement is met and test results shall be submitted to the Owner with final close out documents.

B. Resistance of the grounding electrode system shall be measured using a four-terminal fall-of-potential method as defined in IEEE Standard 81. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

C. Below-grade connections shall be visually inspected by the IOR prior to backfilling. The Contractor shall notify the IOR 24 hours before the connections are ready for inspection.

D. Furnish a copy of tests to Owner at completion of project.

3.7 GROUND ROD INSTALLATION

A. Drive each rod vertically in the earth, not less than 8’ in depth.

B. Where permanently concealed ground connections are required, make the connections by the exothermic process to form solid metal joints. Make accessible ground connections with mechanical pressure type ground connectors.

C. Where rock prevents the driving of vertical ground rods, install angled ground rods or grounding electrodes in horizontal trenches to achieve the specified resistance.

3.8 GROUNDING FOR RF/EMI CONTROL

A. Install bonding jumpers to bond all conduit, sleeves and equipment for low voltage signaling and data communications circuits. Bonding jumpers shall consist of 4” wide copper strip or two No. 10 copper conductors spaced minimum 4” apart. Use No. 6 copper where exposed and subject to damage.

B. Comply with the following when shielded cable is used for communication circuits.
   1. Shields shall be continuous throughout each circuit.
   2. Connect shield drain wires together at each circuit connection point and insulate from ground. Do not ground the shield.
   3. Do not connect shields from different circuits together.
   4. Shield shall be connected at one end only. Connect shield to signal reference at the origin of the circuit. Consult with equipment manufacturer to determine signal reference.

END OF SECTION 26 05 26

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SECTION 26 05 33 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Conduit and fittings.
2. Outlet boxes.
3. Weatherproof outlet boxes.
4. Junction and pull boxes.
5. Cabinets, termination cabinets.
6. Gutters.
7. Concrete boxes and vaults.
8. Fiberglass or composite boxes and vaults.

B. Related Work:
1. Installation of all wire, cable, conductor, boxes/gutters, pull ropes, fiber optic cable raceway, conduit, innerduct, cable sleeve and duct as described on the plans and/or as specified here-in. This scope shall include pathways to be installed underground on site, underslab, above grade, both concealed and exposed, overhead concealed and exposed as appropriately applied. Raceways/boxes shall be installed in accordance with their intended and allowed uses and as specified here-in whichever is more restrictive. Size and capacity of all raceway/boxes shall be as specified here-in or as depicted on the drawings, but shall not be less than that required by code. Larger raceway sizes may be specified than code would permit. The specifications shall govern.
2. Listed products for termination, coupling, extending, benching supports of raceways shall be used.
3. Raceways/boxes described by this section shall include, but not be limited to: power for site utilities and lighting, site and building communications, controls, fire alarm, data system, energy management systems, power distribution, lighting, lighting controls, voice communications, intercom, HVAC and other building low voltage/communications systems controls as may be required.
4. Protection of and cleanliness of pathways and raceways must be assured during the construction process in order to eliminate the possibility of debris entering the conduit, duct, pathway resulting in decreased wire capacity and potential damage to installed conductors and cables.
5. Pathways are shown in a diagrammatic way and are generally accurate as to routing, however, it is the Contractor’s responsibility as a means and methods process to coordinate with all other trades that require space within a building. The Contractor shall obtain approval for installation of raceways routing through structural footings, retaining walls, columns, beams, purlins, grade beams, etc.
6. It is the Contractor’s responsibility to ensure that all raceway and boxes systems penetrate fire assemblies and sound rated assemblies in an approved manner using the appropriate and listed products for the purpose.

7. Trenching and backfilling for all underground conduit systems installed by the Electrical Contractor shall be the responsibility of the Contractor. Conduits shall have minimum cover requirement of 24” below finish grade. More stringent depth requirements may be imposed by the local agency and shall be adhered to, and / or this specification or as detailed on the plans. Joint trenching may be utilized where practicable and where permitted by this specification. Concrete, native material and sand shall be used as backfill material and shall be compacted in accordance with and coordinated with the grading and site preparation requirements. Conduits shall rest in a minimum of 4” bed of sand prior to backfill and compaction. Locations of existing underground (UG) utility systems shall be determined by calling Underground Service Alert (USA) at least 48 hours prior to any excavation.
8. Minimum conduit size shall be 3/4" except if plan shows or code requires larger size. Exception: Use minimum 1" for underslab and below grade applications outside of building exterior walls.
9. All electrical, control, communications systems shall be installed in metallic conduit system. This shall include but not be limited to all systems described in Section B.3 above, except for voice and data systems which shall be installed as described on these plans and as specified here-in but shall not be less than the recommendations of EIA/TIA standards.
10. All line voltage wiring within the building shall be installed in metallic conduit.
11. All conduit, concrete pads, underground concrete or fiberglass substructures shall be furnished and installed with the approved materials and type for the application. Provide proper traffic control during construction as well as barriers and protection of all excavations and trenching.
12. Empty or future conduits shall be properly plugged with plastic caps or inserts with a 3/8” polyethylene pull rope. Plastic or "duct" tape will not be acceptable.
13. Exterior installations: After conductors are installed, seal conduit ends to prevent entrance of foreign material using pliable duct seal, caps or waterproof expanding foam.
14. All low voltage systems including intercom, fire alarm, public address, etc. shall be in dedicated conduit systems. Voice / Data and Direct Digital Control (DDC) systems for HVAC cabling shall be routed as specified in Section 27 1300, INTERCOMMUNICATIONS SYSTEMS and as recommended by EIA/TIA standards. It shall be the contractor’s responsibility to provide raceway down walls to outlet boxes and to provide sleeves across inaccessible ceiling spaces.
15. Underground conduits entering building shall have the open end of conduit within building above the elevation of the conduit outside the building such that water cannot enter building through conduit. If such a condition exists, a pull box outside of building footprint shall be installed in conduit route before conduit enters building whereby top of pull box is below finish floor of building and moisture may exit box before entering building.
16. No single conduit run of any type shall exceed 300 degrees of radius bend from termination box to termination box.
17. Separate Raceway System: Provide a separate dedicated raceway system for each system installed, do not combine different systems into a raceway or cable tray system, unless otherwise noted or allowed.
18. Spare, Future Conduits: Conduits labeled conduit only, spare, or for future use, shall be provided with a pullrope, capped at each end, labeled as spare with destination marked, and turned over to the Owner in an unused state. Contractor shall not utilize these conduits for the installation of cabling or conductors as part of this scope of work. Contractor to verify and install at no additional cost to the Owner, additional conduits as required for the installation of the systems being installed.
19. Outlet System: Provide electrical boxes and fittings as required for a complete installation. Including but not limited to outlet boxes, junction boxes, pull boxes, bushings, locknuts, covers and all other necessary components.

20. Code Compliance: Comply with CEC as applicable to construction and installation of electrical boxes and fittings and size boxes according to CEC 312, 314 and 366 except as noted otherwise.
21. Outlets to be flush mounted: Maintain integrity of insulation and vapor barrier. Unless otherwise noted, flush mount all outlet boxes.
22. Provide putty pads of proper type around outlet boxes and/or as detailed on plan to meet sound transmission restrictions and fire ratings of walls.

1.3 SUBMITTALS

A. Provide Shop Drawings and Product Data for the Following Equipment:
1. Conduit and fittings.
2. Outlet boxes.
3. Weatherproof outlet boxes.
4. Junction and pull boxes.
5. Cabinets, termination cabinets.
6. Gutters.
7. Concrete boxes and vaults.
8. Fiberglass or composite boxes and vaults.
9. Raceways

1.4 REGULATORY REQUIREMENTS

A. Conform to requirements of the CEC, latest adopted version with amendments by local AHJs.

B. Furnish products listed by UL or other independent and nationally recognized testing firm.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Heavy wall Rigid Non-Metallic Conduit, shall be PVC schedule 40 manufactured in accordance with NEMA Standard TC-2, UL-651 and WC 1094A specifications.

B. Extra heavy wall non-metallic conduit, shall be PVC schedule 80 manufactured in accordance with NEMA Standard TC-2, UL-651 and WC 1094A specifications.

C. Galvanized Rigid Steel (GRS) conduit shall be hot dipped galvanized, zinc coated and shall comply with Underwriters Laboratories UL-6, ANSI Specification C-80.1 and Federal Specification WW-C-581E.

D. Electrical Metallic Tubing (EMT) shall be zinc coated, with a protective coating applied to the inside surface and shall comply with Underwriter Laboratories UL-797 ANSI Specification C-80.3 and Federal Specification WW-C-563A.

E. Flexible Metal Conduit (FMC) shall be continuous wound reduced wall galvanized steel produced to UL standards. Aluminum Flexible Metal Conduit will NOT be allowed.

F. Liquid tight flexible metal conduit shall have a thermoplastic cover over a galvanized steel core containing an integral copper ground in sizes to 1 1/4" and shall be in compliance with UL standards and CEC Article 350. Aluminum Liquid Tight Flexible Metal Conduit will NOT be allowed.

G. Wire basket tray shall be 12” wide with 4” side rails unless otherwise noted. It shall be U.L. listed and use listed connectors, elbows, tees, etc. and be cut and installed using listed equipment. Material shall be zinc electroplated steel.

H. Manufacturers:
1. Outlet Boxes: Bowers, Raco, Steel City or equal.
2. Weatherproof Outlet Boxes: Bell, Red Dot, [Carlon] or equal.
3. Junction and Pull Boxes: Circle AW, Hoffman, Wireguard or equal.
4. Box Extension Adapter: Bell, Red Dot, [Carlon] or equal.
5. Conduit Fittings: O-Z Gedney, Thomas & Betts, or equal.
6. Vaults: Christy, Brooks, Utility Vault or equal.
7. Heavy wall rigid non-metallic conduit, Carlon, Certainteed, R&G Sloane or equal.
8. Extra heavy wall non-metallic conduit, Carlon, Certainteed, R&G Sloane or equal.
9. Galvanized Rigid Steel (GRS) conduit shall be hot dipped galvanized, zinc coated and shall comply with Underwriters Laboratories UL-6, ANSI Specification C-80.1 and Federal Specification WW-C-581E.
10. Electrical Metallic Tubing (EMT) shall be zinc coated, with a protective coating applied to the inside surface and shall comply with Underwriter Laboratories UL-797 ANSI Specification C-80.3 and Federal Specification WW-C-563A.
11. Flexible Metal Conduit (FMC), Alflex, American Flexible Conduit or equal.
12. Liquid tight flexible metal conduit, Anacanda (type UA), Electri-flex Liquatite or equal.
13. Wire basket tray, B-line, GS Metals, Cablofil or equal.
14. Exterior In-Grade Boxes for Non-Utility Company, Precast concrete or polymer concrete, Utility Vault and Christy.

2.2 OUTLET BOXES

A. NEMA 1 gutter, junction and pull boxes shall be fabricated from code gage steel finished in grey enamel with screw cover fronts and concentric knockouts in all sides.

B. NEMA 3R gutter, junction and pull boxes shall be fabricated from code gage galvanized steel with screw cover fronts and concentric knockouts in the bottom only. Any penetrations to the side, top or back shall be weatherproofed in an approved manner such as “MYERS” gasketed type hub.

C. Steel outlet boxes and plaster rings shall be galvanized rigid assemblies, either one piece pressed or factory welded construction containing the size and number of knockouts required. Steel outlet boxes shall be manufactured, sized and installed in accordance with CEC Article 314. Device Outlet: Installation of one or two devices at common location, minimum 4” square, minimum 1 1/2" deep. Single or 2 gang flush device plaster ring. Raco Series 681 and 686 or equal. HDMI boxes shall be 4-11/16” square and all data/communications outlets boxes shall be true 5” square (RANDL Industries or approved equal).

D. Luminaire Outlet: minimum 4” square with correct plaster ring depth, minimum 1 1/2” deep with 3/8” luminaire stud if required. Provide proper depth plaster ring on bracket outlets and on ceiling outlets.

E. Multiple Devices: Three or more devices at common location. Install 1 piece gang boxes with 1 piece device plastering. Install one device per gang unless otherwise allowed.

F. Construction: Provide galvanized steel interior outlet wiring boxes, of the type, shape and size, including depth of box, to suit each respective location and installation; constructed with stamped knockouts in back and sides, and with threaded holes with screws for securing box covers or wiring devices. Boxes shall be properly secured to the structure such that they are flush with the finish surface. Boxes shall be made structurally secure by means of the proper fastening devices.

G. Accessories: Provide outlet box accessories as required for each installation, including mounting brackets, wallboard hangers, extension rings, plaster rings, luminaire studs, cable clamps and metal straps for supporting outlet boxes, compatible with outlet boxes being used and meeting requirements of individual wiring situations.

2.3 WEATHERPROOF OUTLET BOXES

A. Construction: Provide corrosion-resistant cast iron, with zinc finish, weatherproof outlet wiring boxes, of the type, shape and size, including depth of box, with threaded conduit ends, cast metal face plate with spring-hinged waterproof cap suitably configured for each application, including face plate gasket, blank plugs and corrosion proof fasteners. Weatherproof boxes to be constructed to have smooth sides, zinc, galvanized finish.

B. Surface mounted die cast aluminum device boxes shall be provided with screw holes to accommodate cast device covers.

C. Cover plates on outlet boxes mounted flush in the wall shall be gasketed to the wall in a watertight manner. Weatherproof boxes in wet locations as described in CEC 406.8 (B) shall be provided with a “while-in-use” cover. When on-grade, unit to be Midwest #U010010GRP or #U012010GRP or approved equivalent. When on roof, red dot ‘CK’ Series of aluminum die-cast construction, NEMA 3R, with lacquer finish, or approved equivalent.

2.4 JUNCTION AND PULL BOXES

A. Construction: Provide galvanized sheet steel junction and pull boxes, with screw-on covers; of the type shape and size, to suit each respective location and installation; with welded seams and equipped with steel nuts, bolts, screws and washers.

B. Location:
1. Install junction boxes above accessible ceilings for drops into walls for receptacle outlets from overhead.
2. Install junction boxes and pull boxes as required to facilitate the installation of conductors and limiting the accumulated angular sum of bends between boxes, cabinets and appliances to 300 degrees.
3. Locations: Junction boxes shall be located only where necessary and only in equipment rooms, closets, and accessible attic and underfloor spaces. A horizontal distance of 24” shall separate outlet boxes on opposite sides of occupancy separation walls, fire-rated walls or partitions.
4. Labeling: Junction box covers shall be marked with indelible ink indicated the circuit numbers passing through the box.

2.5 BOX EXTENSION ADAPTER

A. Construction: Cast iron with gasket.

B. Location: Install over flush wall outlet boxes to permit flexible raceway extension from flush outlet to fixed or movable equipment.

2.6 CONDUIT FITTINGS

A. Requirements: Provide corrosion-resistant punched-steel box knockout closures, conduit locknuts and plastic conduit bushings of the type and size to suit each respective use and installation.

B. A bushing shall be required at all conduit terminations into distribution equipment, service equipment and pull boxes/vaults.

C. Steel boxes may allow for field knock-out modifications, but shall in all other ways conform to code requirements.

2.7 EXTERIOR IN-GRADE BOXES FOR NON-UTILITY COMPANY USE SHALL BE:

A. Precast concrete or polymer concrete type with full bottoms and draining into gravel drywell. Open bottom splice/pull boxes smaller than 24” x 36” shall be open bottom, with minimum 12” of gravel below for drainage, only if a vault is not already specified on the plans.

B. Flushmount in hardscape and 1” above grade in softscape.

C. Provided with correct traffic type lid, i.e., full vehicular, intermediate incidental vehicular or pedestrian-rated as applicable stamped with “ELECTRIC”, “LIGHTING”, COMMUNICATIONS”, etc. cover identification as shown on the drawings or as applicable. All boxes or vaults located in streets, driveways, sidewalks wider than 8’, and turf areas where mowing takes place shall be traffic rated.

D. Provided with brass hold-down bolts in cover.

E. Provided with necessary box extensions to gain proper depth.

F. Seal all conduit in underground boxes with duct seal after conductors have been installed. All conduit penetrations into underground boxes, enclosures and pad mounted equipment shall be provided with bell ends.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Conduit systems listed below are for use in installations where they are permitted to be used by CEC and/or other occupancy restrictions. The below installation methods do not intend to suggest that these materials be installed in conflict with any applicable code. Special attention

to applications shall be made in building types such as Educational, Health Care, wet location, hazardous locations, assembly occupancy and multi-story, but not limited to these. Requirements which are more restrictive than the CEC may be called for by the drawings and / or these specifications. These requirements must be adhered to. The Electrical Contractor shall be responsible to use the proper conduit system for the application. Exposed conduit is not allowed below ceilings or above slab of floor, without the permission and approval of the Architect. All conduits shall be concealed except in electrical and telecommunication rooms or where shown to be surface mounted. Exposed conduit (where allowed) shall be run square and plumb with building lines in an approved manner. Strap conduits to blocks with proper sized conduit straps. Spacing of support shall be a minimum as provided for in the CEC. All exposed conduit mounted below 8’ above finished grade shall be strapped at a minimum of 5’ spacing.

B. Non-Metallic Rigid Conduit shall be used in concrete slabs, below concrete slabs on grade, or underground outside of a building slab or foundation. Maintain minimum depth requirements and cover with appropriate fill material. Minimum 4” of bedding and cover of backfill material 1/4" size grain and smaller maximum. Conduit shall be heavy wall Schedule 40 or 80, rigid PVC only. Rigid utility P&C duct shall not be used in any application. Properly sized grounding conductors shall be installed per CEC article 250, in all non-metallic conduit branch circuit and feeder runs. PVC conduit shall be formed or field bent only with the use of properly approved bending tools such as to not decrease the internal bore of the conduit. All conduits shall be cut square and reamed of burrs. Approved and compatible glue shall be used on all PVC fittings to attain watertight joints. All non-metallic conduit runs over 150’ in length and over 1 1/4" trade size conduit shall utilize galvanized rigid steel elbows.

C. Galvanized Rigid Steel (GRS) conduit shall be used where exposed less than 8’–0” above finished grade to 18” below finished grade and where subject to physical damage. Conduits shall be cut square and reamed to remove burrs and sharp edges. Strap conduit below 8’ above grade at 5’ intervals. Unless otherwise noted, threadless setscrew and threadless weathertight fittings may be used in lieu of threaded fittings. All threaded ends entering a junction box of any type shall require one locknut on the inside and one on the outside of the enclosure and be provided with a plastic bushing or grounding bushing where necessary for proper grounding. Where exposed to moisture, a watertight hub or other approved method shall be required. All conduits shall be stubbed up straight and uniform into junction boxes, panels, cabinets, etc., and shall be (GRS) properly supported and strapped. All GRS conduit located below grade, shall be tape wrapped. Exposed threads on GRS shall be coated with a cold galvanized paint.

D. Electrical Metallic Tubing (EMT) shall be used as allowed by code and as permitted by this specification. It shall not be in contact with soil or the concrete slab on the ground floor of any structure. Connectors and couplings shall be diecast non-insulated set screw type where installed in indoor dry locations not subject to moisture. Where the potential for moisture is present, compression type weathertight fittings are required. One hole conduit straps are permitted from 1/2" to 1” and two hole conduit straps are required for size 1 1/4” and larger. EMT shall not be allowed in areas subject to severe physical damage. Install copper ground wire sized per CEC 250-122 in all EMT conduits.

E. Flexible conduit may be used where concealed in building construction or above dropped ceilings, but shall meet the following criteria: No individual circuit path from distribution panel to last device shall exceed a cumulative length of 20’ of flexible conduit from start to end. Flexible conduit shall not exceed a total directional change of 270 bending degrees in any one run between conduit terminations. Squeeze type or Jake type steel flex fittings of a grounding type are required. Flexible conduit must be supported in accordance with CEC. Where exposed to the weather, moisture, or spray down flexible conduit shall be of the liquidtight type. Fittings

shall be manufactured for use with liquidtight flexible conduit. All motor connections shall be made with liquidtight flex. Flexible conduit may not be used where exposed except for last 2' of equipment connection and unless otherwise noted or approved. A copper ground wire sized per CEC 250-122 shall be installed in all flexible conduit runs. Flexible conduit may not be used exposed. Weatherproof liquid tight conduit shall not be used at roof level for equipment connections with lengths exceeding 24" nor shall it be used to circumvent a rigid conduit system in a horizontal direction. Steel flexible metal conduit shall be limited to areas where conduit must be fished in inaccessible spaces or for interior appliance applications when accessible or exposed.

F. Underground conduits and transition to above grade/slab shall be as follows:
   1. PVC elbows allowed if top of elbow is minimum 18" BFG or below top of slab, otherwise GRS elbows are required.
   2. GRS elbows are required if conduit run is 150' or greater.
   3. GRS risers are required from elbow below grade to equipment (device, outlet, panel, cabinet, etc.) above grade.
   4. GRS elbows/risers to be PVC coated or 10 MIL taped wrapped (1/2" lapped) to 3" above finish grade or top of slab.

G. Conduit Supports: Conduit runs may be supported by one-hole and two-hole straps or supports as manufactured by Unistrut, Minerallac, Caddy or equals. All strut ends shall be deburred and coated with a cold galvanized paint. Supports may be fastened by means of anchors, shields, beam clamps, toggle bolts, or other approved methods appropriate for the application and size of conduit. Pipe nailers (J-hooks) are not allowed. Conduit support methods are subject to review by the engineer and authority having jurisdiction for adequacy. Installations deemed inadequate shall be corrected by the contractor at no cost to the Owner.

H. Bends and offsets shall be made with approved tools for the type of conduit being utilized. Bends shall be made without kinking or destroying the smooth bore of the conduit. Parallel conduits shall be run straight and true with bends uniform and symmetrical. Minimum radii shall be per CEC 344-24.

I. Conduit Stub-outs below grade shall be capped with plastic cap, and identified by placing a pull box marked with correctly identified utility such as "Elec", "Tel", etc. Dimension for exact location on field record drawings. Provide lids for proper field application (i.e. traffic, incidental, pedestrian).

J. Conduit Seals: Where below grade conduits enter structure through slab or retaining wall of building or basement, seal the inside of each conduit as follows:
   1. Provide damming material around conductors 3" into conduit.
   2. Fill 3" of conduit with 3M #2123 sealing compound.
   3. Wrap conductors where they exit the conduit with 3M #2229 "Scotch Seal" mastic tape. Lap tape to approximate diameter of the raceway and wrap outside of conduit opening with (minimum) one turn.
   4. Use conduit sealing bushings type CSB (O-Z/Gedney) or equal.
   5. Empty conduits shall be sealed with standard non-hardening duct seal compound and then capped to prevent entrance of moisture and gases and to meet fire resistance requirements.
   6. Provide cable drip loop minimum 12" high.

K. Marker tape: Place 6" wide mylar/aluminum traceable marker tape at 12" below finish grade along and above buried conduits. Label tape "CAUTION: ELECTRICAL LINES BELOW" or similar wording. Color code marker tape as follows:

1. Electrical Power – RED
2. Communications - ORANGE

L. Conduits for high voltage (12kv) systems shall be separated from all other conduits by a minimum of 12". All power system conduits shall be separated from low voltage systems by a minimum of 12" when running parallel to each other and no less than 6" when running perpendicular to each other at conduit crossings.

M. Electrical and communications systems raceways routed underground shall not occupy the same trench as plumbing utilities such as sewer, water, storm drain, gas or other wet or dry gaseous utility system. A minimum of 12" of undisturbed earth is required. Where utilities must cross in closer proximity to each other due to physical constraints, 6" minimum crossing distances are allowed, however 18" on all sides of a utility crossing must be concrete encased.

N. Duct bank defined here-in shall be four or more conduits in a common trench, conduit spacers and saddles shall be required in all trenches where more than two conduits over 2" in diameter travel in the same trench. Proper spacing between systems as outlined above shall be required and spacers shall be located each 5' (maximum) along trench route from point to point.

O. Conduits, routed below footings, slabs, grade beams, columns, and other structural elements shall be installed in strict compliance with structural details and criteria shown on structural plans. Clearances below structural elements and sleeves through structural elements must be carefully planned to avoid conflict and must be approved by the structural engineer if conflict arises.

P. All conduit or raceways passing through fire rated walls, floors, or ceilings shall be installed with a listed penetration method which protects the opening to the same rating as the assembly and is non hardening.

Q. Expansion Joints
1. Conduits 3" and larger, that are secured to the building structure on opposite sides of a building expansion joint, require expansion and deflection couplings. Install the couplings in accordance with the manufacturer's recommendations.
2. Provide conduits smaller than 3" with junction boxes on both sides of the expansion joint. Connect conduits to junction boxes with sufficient slack of flexible conduit to produce 5" vertical drop midway between the end. All conduit shall have a copper green grounding bonding conductor installed.

R. Seismic Joints
1. At seismic joints, provide conduits rigidly secured to the building structure on opposite sides of a building expansion joint with junction boxes or approved fittings, on both sides of the joint. Connect conduits to junction boxes with sufficient slack flexible conduit such that these slack conduits are 1 1/2 times the distance between conduit ends. Flexible conduit shall have a copper green ground bonding jumper installed.

S. Wire basket tray shall be used in all concealed spaces (above ceiling spaces, under buildings in access tunnels, below raised floors, etc.) unless otherwise noted. Wire basket tray installations shall conform to the requirements of CEC Article 318. The contractor shall provide all mounting hardware, connectors and bracing as required and as recommended by the manufacturer for a complete system installation. All cutting of wire basket tray shall be per the manufacturer's recommendation using tools designed for that purpose. Cable loading shall not exceed the listing of the system and its support.

T. Location: Locate boxes and conduit bodies so as to ensure accessibility of electrical wiring.

U. Anchoring: Secure boxes rigidly to the substrate upon which they are being mounted, or solidly embed boxes in concrete or masonry.

V. Special Application: Provide weatherproof outlets for locations exposed to weather or moisture.

W. Knockout Closures: Provide knockout closures to cap unused knockout holes where blanks have been removed.

X. Mount outlet boxes, unless otherwise required by ADA, or noted on drawings, the following distances above the finished floor:
1. Receptacles, Telephone, TV & Data outlets. (measured to bottom of outlet box): +15".
2. Outlet above counter (measured to top of outlet box): +46".
3. Control (light) Switches. (measured to top of outlet box): +48".
4. Fire Alarm Manual Pull Stations, T-stats. (measured to top of outlet box): +48".
5. Fire Alarm Visuals: the lower of +80" to bottom of lens, or 6" below ceiling.
6. Other Outlets: As indicated in other sections of specifications or as detailed on drawings.

Y. Coordinate all electrical device locations with the architectural floor plan and interior and exterior elevations to prevent mounting devices within elements that they may conflict such as cabinetry, mirrors, planters, etc.

Z. Size outlet and junction boxes to minimum wire fill space requirements. Upsize box as required to allow ease of wire installation and device installation.

AA. Outlet and junction boxes in fire rated walls shall be gauged and spaced so as not to exceed the maximum penetration allowed by the assembly without compromising the fire rating. If a conflict arises relative to a specific condition, the contractor shall follow the requirements of the fire authority and ask for guidance from the design team. At no time should a larger box be installed prior to resolution of conflict.

END OF SECTION 26 05 33

SECTION 26 05 53 - IDENTIFICATION OF ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section Includes:
   1. Nameplates and warning signs where specified herein and as shown on contract documents including the following:
      a. Nameplates and warning signs permanently installed on all electrical equipment and devices including, but not limited to, the following items:
         1) Enclosures for switchboards, panels, pullboxes, cabinets, motors.
         2) Enclosures for all separately enclosed devices including, but not limited to, disconnect switches, circuit breakers, contactors, time switches, control stations and relays, fire alarm panels and lighting control panel.
         3) Wall switches not within sight of outlet controlled.
         4) Special systems such as, but not limited to fire alarm and signal systems. Identification shall be at each equipment rack, terminal cabinet, control panel, annunciator and pullbox.
         5) Devices mounted within and part of equipment including circuit breakers, switches, control devices, control transformers, relays, indication devices and instruments.
   2. Conductor and Cable Identification.

B. Related Work:
   1. Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
   2. Section 26 05 19, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.
   3. Section 26 24 16, PANELBOARDS.
   4. Section 26 28 16, ENCLOSED SWITCHES AND CIRCUIT BREAKERS.

1.3 SUBMITTALS

A. Submit in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABEL DESIGNATIONS

A. Equipment labels indicating equipment designations both emergency and normal. Designation data per drawings or to be supplied with shop drawings approval.

B. Panelboard labels showing panel designation, voltage, phase and source.

C. In accordance with CEC 110.16, provide arc flash protection warning labels on all switchboards, panelboards, distribution panels, transformers, safety switches, transfer equipment, etc. Labels shall be per ANSI Z535.4 guidelines.

2.2 MATERIALS

A. For Labels: Three layer laminated plastic or micarta with engraved white letters over black background.

B. For Emergency Equipment: Use engraved white letters over red background.

C. For Warning Signs: Minimum 18 gauge steel with red lettering on white porcelain enamel finish.

D. Arc flash labels shall be provided as required by CEC Article 70E.

E. Conductor tape number markers: TayMac MX4280 Series non-fading permanent adhesive.

PART 3 - EXECUTION

3.1 MOUNTING

A. Equipment labels shall be mounted by self-tapping, threaded screws and bolts, or by rivets. Adhesive types are not acceptable unless specifically noted in this section.

B. Conductor tape markers shall be consistently placed for ready conductor identification.

3.2 HEIGHTS ON LABELS

A. Panelboards, Switchboards and Special Systems Enclosures: 1/4" identify equipment designation; 1/8” identify voltage rating and source.

B. Individual Circuit Breakers, Switches, and Motor Starters in Panelboards, Switchboards, and Motor Control Centers: 3/16” identify circuit and load served, including location of equipment.

C. Enclosed Circuit Breakers, Enclosed Switches, and Motor Starters: 3/16” identify load served.

3.3 WARNING SIGNS

A. Warning signs shall be permanently mounted with cadmium plated steel screws or nickel-plated brass bolts.

B. Warning signs to read "DANGER - HIGH VOLTAGE", with letters 1 1/2" high, 3/16” stroke minimum.

C. Provide warning sign on all doors or immediately next to door for equipment rooms, enclosures or closets containing equipment energized above 150 volts to ground as per CEC, and/or as directed by the Architect. For interior finish spaces and interior doors, signage shall be coordinated and approved with the Architect in advance of installation.

END OF SECTION 26 05 53

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SECTION 26 09 23 - OCCUPANCY SENSORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Related Work:
1. Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
2. Section 26 05 33, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS.
3. Section 26 05 19, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.
4. Section 26 27 26, WIRING DEVICES.
5. Section 26 56 70, LIGHTING ACCEPTANCE TESTING.

1.2 SYSTEM DESCRIPTION

A. The occupancy sensors shall sense the presence of human activity within the desired space and enable or disable the on/off manual lighting control function provided by local switches.

B. Upon detection of human activity by the detector, initiate a time delay to maintain the lights on for a preset period of time. Field adjustable time delay setting from 30 seconds to 15 minutes.

C. Sensors shall have factory set PIR sensing sensitivity for maximum sensitivity. Provide time delay at 10 minutes.

D. Install system in accordance with manufacturer's recommendations and instructions.

E. All line voltage sensors, control units, and relays UL listed

1.3 SUBMITTALS

A. Submit in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.

B. Provide, on reproducible architectural floor plan, a layout of sensors indicating their sensing distribution.

C. Provide wiring diagrams indicating low voltage and line voltage wiring requirements.

PART 2 - PRODUCTS

2.1 PASSIVE INFRARED SENSORS - GENERAL

A. The passive infrared sensors shall detect presence, in the floor area being controlled, by detecting changes in the Infrared energy. Detect small movements, i.e., when a person is writing while seated at a desk.

B. Provide a temperature compensated dual element sensor and a multi element fresnel lens.

C. The sensor shall utilize DIP switch adjustments for "on" mode operation, time delay, and sensitivity.

D. Provide a daylight filter which ensures that the sensor is insensitive to short-wavelength infrared waves, i.e., those emitted by the sun.

E. The sensors not to protrude more than 1 1/2" from the wall or ceiling and should blend in aesthetically.

F. Conceal adjustments and mounting hardware under a removable cover to prevent tampering with adjustments and hardware.

G. Low Voltage Sensors:
1. Sensor shall provide complete coverage of the controlled area.
2. Sensors shall operate on 24VDC power.
3. Sensors shall operate remote power switch packs.
4. Sensors can be wired in parallel to allow coverage of large areas.
5. Manufacturers: The Watt Stopper CI Series, or approved.

H. Wall Switch Sensors:
1. 300 sq. ft. area coverage, with a field of view of 180 degrees.
2. Completely self-contained sensor system that fits into a standard single gang box. Internal transformer power supply, a latching dry contact relay switching mechanism compatible with electronic ballasts, compact fluorescent, and inductive loads. Triac and other harmonic generating devices are not allowed.
3. Rated to switch loads from 0 to 800 watt incandescent or fluorescent 120 volt and 0 to 1000 watts for 277 volt.
4. Provide adjustable daylight feature that holds lighting "off" when a desired footcandle level is present.
5. Provide integral off override switch with no leakage current to the load or ground.
6. Provide hard 1mm poly IR2 lens, soft lens is not acceptable.
7. Manufacturers: The Watt Stopper PW Series, or approved.
8. Dual Relay: Watt Stopper PW-200, or approved.

2.2 ULTRASONIC OCCUPANCY SENSORS

A. The occupancy sensors capable of detecting presence, in the controlled floor area by detecting Doppler shifts in transmitted ultrasound.

B. Occupancy sensors are precision crystal controlled and shall not interfere with each other when two or more are placed in the same area. Provide ultrasonic circuit with solid state crystal controlled with advanced signal processing.

C. Furnish each sensor with a convenient shunt provision enabling an individual to bypass the sensor in the event of failure. This bypass provision pin or device shall remain in the sensor and be visible from the floor as a constant reminder that the automatic function has been bypassed.

D. Ceiling mounted with maximum protrusion of 1.5” and blend in aesthetically with the ceiling.

E. Provide multi-directional transmitter and ultrasonic receivers that are temperature and humidity resistant.

F. Sensors can be wired in parallel to allow coverage of large areas.

G. Sensitivity adjustment shall range from off at "0" to maximum at "10."

H. Sensors shall operate on 24VDC power.

I. UL listed power pack consisting of a transformer and contact closure relay in one package. Provide a transformer that is capable of operating up to three occupancy sensors.

J. Manufacturers: The Watt Stopper Ultrasonic/UW Series, or approved.

2.3 DUAL TECHNOLOGY SENSORS

A. Utilize same technologies as passive infrared and ultrasonic.

B. Upon a person entering a space, motion from both technologies must be sensed before lighting will be turned on. After this has occurred, detection by either technology will hold lighting on for the set time period. Sensor shall have a retrigger time delay where only one motion is necessary to turn on the lights within 5 seconds after turning off.

C. Manufacturers: The Watt Stopper DT Series, or approved.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install occupancy sensors as directed by manufacturer's instructions. Complete all electrical connections to all control circuits, occupancy sensors, power supply pack and low voltage wiring.

B. Verify with manufacturer's representative that the sensors are laid out in compliance to manufacturer’s published sensing distribution. Provide additional sensors for complete coverage of the space being sensed.

3.2 QUALITY CONTROL

A. Use manufacturer's published testing and adjusting procedures to adjust sensors time delay, daylight sensitivity, and passive infrared sensitivity to satisfaction of the Owner.

END OF SECTION 26 09 23

SECTION 26 09 43 - NETWORK LIGHTING CONTROLS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Distributed Digital Lighting Control System: System includes
   1. Digital Lighting and Plug Load Controls

1.2 RELATED SECTIONS

A. 26 51 00 - INTERIOR LIGHTING

1.3 REFERENCES

A. NFPA 70 - National Electrical Code; National Fire Protection Association.

B. NEMA - National Electrical Manufacturers Association

C. FCC emission standards

D. UL - Underwriters Laboratories, Inc. Listings

E. UL 2043 - Standard for Fire Test for Heat and Visible Smoke Release for Discrete Products Installed in Air-Handling Spaces.

F. UL 20 - General Use Switches, Plug Load Controls

1.4 DESIGN / PERFORMANCE REQUIREMENTS

A. Digital Lighting Management System shall accommodate the square-footage coverage requirements for each area controlled, utilizing room controllers, digital occupancy sensors, switches, daylighting sensors and accessories that suit the required lighting and electrical system parameters.

B. System shall conform to requirements of NFPA 70.

C. System shall comply with FCC emission standards specified in part 15, sub-part J for commercial and residential application.

D. System shall be listed under UL sections 916 and/or 508.

1.5 SUBMITTALS

A. Submit in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Catalog sheets and specifications.
   2. Ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
   3. Storage and handling requirements and recommendations.
   4. Installation instructions.

C. Shop Drawings: Wiring diagrams for the various components of the System specified including:
   1. Composite wiring and/or schematic diagram of each control circuit as proposed to be installed.
   2. Show location of all devices, including at minimum sensors, load controllers, and switches/dimmers for each area on reflected ceiling plans.
   3. Provide room/area details including products and sequence of operation for each room or area. Illustrate typical acceptable room/area connection topologies.
   4. Network riser diagram including floor and building level details. Include network cable specification. Illustrate points of connection to integrated systems. Coordinate integration with mechanical and/or other trades.

D. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

E. Closeout Submittals:
   1. Project Record Documents: Record actual installed locations and settings for lighting control devices.
   2. Operation and Maintenance Manual:
      a. Include approved Shop Drawings and Product Data.
      b. Include Sequence of Operation, identifying operation for each room or space.
      c. Include manufacturer's maintenance information.
      d. Operation and Maintenance Data: Include detailed information on device programming and setup.
      e. Include startup and test reports.

F. Title 24 Acceptance Testing Documentation: Submit Certification of Acceptance and associated documentation for lighting control acceptance testing performed in accordance with CAL TITLE 24 P6, as specified in Part 3 of this specification under "COMMISSIONING".

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing of centralized and distributed lighting control systems with a minimum of 10 years documented experience.

B. Installer Qualifications: Company certified by the manufacturer and specializing in installation of networked lighting control products with minimum three years documented experience.

C. System Components: Demonstrate that individual components have undergone quality control and testing prior to shipping.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

1.8 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Do not install equipment until following conditions can be maintained in spaces to receive equipment:
   1. Ambient temperature: 32 to 104 degrees F (0 to 40 degrees C).
   2. Relative humidity: Maximum 90 percent, non-condensing.

1.9 WARRANTY

A. Products Warranty: Manufacturer shall provide a 5 year limited warranty on products within this installation, except where otherwise noted, and consisting of a one for one device replacement.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. This specification is based on products from Watt Stopper/Legrand, Santa Clara, CA. Any other system wishing to be considered must submit descriptive information 10 days prior to bid. Prior approval does not guarantee final approval by the electrical engineer. The contractor shall be completely responsible for providing a system meeting this specification in its entirety. All deviations from this specification must be listed and individually signed off by the consultant.

2.2 DISTRIBUTED DIGITAL LIGHTING CONTROL SYSTEM

A. System General: Provide a WattStopper, Provide Digital Lighting Management System (DLM) complete with all necessary enclosures, wiring, and system components to ensure a complete and properly functioning system as indicated on the Drawings and specified herein. If a conflict is identified, between the Drawing and this Specification, contact the Architect for clarification prior to proceeding.
   1. Space Control Requirements: Provide occupancy/vacancy sensors with Manual- or Partial-ON functionality as indicated in all spaces except toilet rooms, storerooms, library stacks, or other applications where hands-free operation is desirable and Automatic-ON occupancy sensors are more appropriate. Provide Manual-ON occupancy/vacancy sensors for any enclosed office, conference room, meeting room, open plan system and training room. For spaces with multiple occupants, or where line-of-sight may be obscured, provide ceiling- or corner-mounted sensors and Manual-ON switches.
   2. Task Lighting / Plug Loads: Provide automatic shut off of non essential plug loads and task lighting in spaces as required by the applicable energy code. Provide Automatic-ON of plug loads whenever spaces are occupied. For spaces with multiple occupants a single shut off consistent with the overhead lighting may be used for the area.
   3. Daylit Areas: Provide daylight-responsive automatic control in all spaces (conditioned or unconditioned) where daylight contribution is available as defined by relevant local building energy code:
      a. All luminaires within code-defined daylight zones shall be controlled separately from luminaires outside of daylit zones.
      b. Daytime setpoints for total ambient illumination (combined daylight and electric light) levels that initiate dimming shall be programmed in compliance with relevant local building energy codes.
      c. Multiple-level switched daylight harvesting controls may be utilized for areas marked on drawings.
      d. Provide smooth and continuous daylight dimming for areas marked on drawings. Daylighting control system may be designed to turn off electric lighting when daylight is at or above required lighting levels, only if system functions to turn lamps back on at dimmed level, rather than turning full-on prior to dimming.
   4. Conference, meeting, training, auditoriums, and multipurpose rooms shall have controls that allow for independent control of each local control zone. Rooms larger than 300 square feet shall instead have at least four preset lighting scenes unless otherwise

specified. Occupancy / vacancy sensors shall be provided to turn off all lighting in the space. Spaces with up to four moveable walls shall include controls that can be reconfigured when the room is partitioned.

B. Equipment Required: Lighting Control and Automation system as defined under this section covers the following equipment.
   1. Digital Lighting Management (DLM) local network: Free topology, plug-in wiring system (Cat 5e) for power and data to room devices.
   2. Digital Room Controllers: Self-configuring, digitally addressable one, two or three relay plenum-rated controllers for on/off control. Selected models include 0-10 volt or line voltage forward phase control dimming outputs and integral current monitoring capabilities.
   3. Digital Plug Load Controllers: Self-configuring, digitally addressable, single relay, plenum-rated application-specific controllers. Selected models include integral current monitoring capabilities.
   4. Digital Occupancy Sensors: Self-configuring, digitally addressable, calibrated occupancy sensors with LCD display and two-way active infrared (IR) communications.
   5. Digital Switches: Self-configuring, digitally addressable pushbutton on/off, dimming, and scene switches with two-way active infrared (IR) communications.
   6. Handheld remotes for personal control: On/Off, dimming and scene remotes for control using infrared (IR) communications. Remote may be configured in the field to control selected loads or scenes without special tools.
   7. Digital Daylighting Sensors: Single-zone closed loop, multi-zone open loop and single-zone dual-loop daylighting sensors with two-way active infrared (IR) communications for daylight harvesting using switching, bi-level, tri-level or dimming control.
   8. Configuration Tools: Handheld remote for room configuration and relay panel programming provides two way infrared (IR) communications to digital devices and allows complete configuration and reconfiguration of the device / room from up to 30 feet away.
   9. Digital Lighting Management (DLM) segment network: Linear topology, BACnet MS/TP network (1.5 twisted pair, shielded) to connect multiple DLM local networks for centralized control.
   10. Emergency Lighting Control Unit (ELCU) – allows a standard lighting control device to control emergency lighting in conjunction with normal lighting in any area within a building

C. Local Network LMRJ-Series: DLM local network is a free topology lighting control physical connection and communication protocol designed to control a small area of a building.
   1. Features of the DLM local network include:
      a. Plug n' Go automatic configuration and binding of occupancy sensors, switches and lighting loads to the most energy-efficient sequence of operation based upon the device attached.
      b. Simple replacement of any device in the local DLM network with a standard off the shelf unit without requiring significant commissioning, configuration or setup.
      c. Push n' Learn configuration to change the automatic configuration, including binding and load parameters without tools, using only the buttons on the digital devices in the local network.
      d. Two-way infrared communications for control by handheld remotes, and configuration by a handheld tool including adjusting load parameters, sensor configuration and binding, within a line of sight of up to 30 feet from a sensor, wall switch or IR receiver.
   2. Digital room devices connect to the local network using pre-terminated Cat 5e cables with

RJ-45 connectors, which provide both data and power to room devices. Systems that utilize RJ-45 patch cords but do not provide serial communication data from individual end devices are not acceptable.

3. If manufacturer's pre-terminated Cat5e cables are not used for the installation each cable must be individually tested and observed by authorized service representative following installation.

2.3 DIGITAL LOAD CONTROLLERS (ROOM, PLUG LOAD AND FIXTURE CONTROLLERS)

A. Digital Load Controllers: Digital controllers for lighting zones, fixtures and/or plug loads automatically bind room loads to the connected control devices in the space without commissioning or the use of any tools. Provide controllers to match the room lighting and plug load control requirements. Controllers are simple to install, and do not have dip switches/potentiometers, or require special configuration for standard Plug n' Go applications. Control units include the following features

1. Automatic room configuration to the most energy-efficient sequence of operation based upon the devices in the room.
2. Simple replacement using the default automatic configuration capabilities, a room controller may be replaced with an off-the-shelf device.
3. Multiple room controllers connected together in a local network must automatically arbitrate with each other, without requiring any configuration or setup, so that individual load numbers are assigned starting with load 1 to a maximum of 64, assigned based on each controller's device ID's from highest to lowest.
4. Device Status LEDs to indicate:
    a. Data transmission
    b. Device has power
    c. Status for each load
    d. Configuration status
5. Quick installation features including:
    a. Standard junction box mounting
    b. Quick low voltage connections using standard RJ-45 patch cable
6. Based on individual configuration, each load shall be capable of the following behavior on power up following the loss of normal power:
    a. Turn on to 100 percent
    b. Turn off
    c. Turn on to last level
7. Each load be configurable to operate in the following sequences based on occupancy:
    a. Auto-on/Auto-off (Follow on and off)
    b. Manual-on/Auto-off (Follow off only)
8. Polarity of each load output shall be reversible, via digital configuration, so that on is off and off is on.
9. BACnet object information shall be available for the following objects:
    a. Load status
    b. Schedule state, normal or after-hours
    c. Demand Response enable and disable
    d. Room occupancy status
    e. Total room lighting and plug loads watts
    f. Electrical current
    g. Total watts per controller
    h. Total room watts/sq ft.
    i. Force on/off all loads
10. UL 2043 plenum rated

11. Manual override and LED indication for each load
12. Zero cross circuitry for each load
13. All digital parameter data programmed into an individual room controller or plug load controller shall be retained in non-volatile FLASH memory within the controller itself. Memory shall have an expected life of no less than 10 years.
14. Dimming Room Controllers shall share the following features:
    a. Each load shall have an independently configurable preset on level for Normal Hours and After Hours events to allow different dimmed levels to be established at the start of both Normal Hours and After Hours events.
    b. Fade rates for dimming loads shall be specific to bound switch buttons, and the load shall maintain a default value for any bound buttons that do not specify a unique value.
    c. The following dimming attributes may be changed or selected using a wireless configuration tool:
        1) Establish preset level for each load from 0-100 percent
        2) Set high and low trim for each load
        3) Initiate lamp burn in for each load of either 0, 12 or 100 hours
    d. Override button for each load provides the following functions:
        1) Press and release for on/off control
        2) Press and hold for dimming control
    e. Each dimming output channel shall have an independently configurable minimum and maximum calibration trim level to set the dimming range to match the true dynamic range of the connected ballast or driver. LED level indicators on bound dimming switches shall utilize this new maximum and minimum trim.
    f. Each dimming output channel shall have an independently configurable minimum and maximum trim level to set the dynamic range of the output within the new 0-100 percent dimming range defined by the minimum and maximum calibration trim.
    g. Calibration and trim levels must be set per output channel. Devices that set calibration or trim levels per controller (as opposed to per load) are not acceptable.
    h. All configuration shall be digital. Devices that set calibration or trim levels per output channel via trim pots or dip-switches are not acceptable.

B. On/Off Room Controllers shall include:
1. Dual voltage (120/277 VAC, 60 Hz) capable rated for 20A total load
2. One or two relay configuration
3. Simple 150 mA switching power supply (Only 4 100 series devices on a Cat 5e local network)
4. Three RJ-45 DLM local network ports with integral strain relief and dust cover
5. WattStopper product numbers: LMRC-101, LMRC-102

C. On/Off/0-10V Dimming KO Mount Room Controllers shall include:
1. Dual voltage (120/277 VAC, 60 Hz) capable rated for 10A total load
2. Optional real time current and voltage monitoring (with - M Monitoring option).
3. One or two relays configurations
4. Smart 150 mA switching power supply
5. Two RJ-45 DLM local network ports. Provide molded strain relief ring
6. One dimming output per relay
    a. 0-10V Dimming - Where indicated, one 0-10 volt analog output per relay for control of compatible ballasts and LED drivers. The 0-10 volt output shall automatically open upon loss of power to the Room Controller to assure full light output from the controlled lighting

7. Units capable of providing both Class 1 or Class 2 wiring for the 0-10V output
8. WattStopper product numbers: LMRC-111, LMRC-111-M, LMRC-112, or LMRC-112-M.

D. On/Off/0-10V Dimming Enhanced Room Controllers shall include:
1. Dual voltage (120/277 VAC, 60 Hz) capable or 347 VAC, 60 Hz. 120/277 volt models rated for 20A total load; 347 volt models rated for 15A total load
2. Built in real time current monitoring
3. One, two or three relays configurations
4. Smart 250 mA switching power supply
5. Four RJ-45 DLM local network ports. Provide integral strain relief
6. One dimming output per relay
    a. 0-10V Dimming - Where indicated, one 0-10 volt analog output per relay for control of compatible ballasts and LED drivers. The 0-10 volt output shall automatically open upon loss of power to the Room Controller to assure full light output from the controlled lighting (LMRC-110 series and 210 series).
7. WattStopper product numbers: LMRC-211, LRMC-212, LRMC-213.

E. On/Off/ Forward Phase Dimming Room Controllers shall include:
1. Dual voltage (120/277 VAC, 60 Hz) rated for 20A total load, with forward phase dimmed loads derating to 16A for some load types
2. Built in real time current monitoring
3. One or two relays configurations
4. Smart 250 mA switching power supply
5. Four RJ-45 DLM local network ports. Provide integral strain relief
6. One dimming output per relay
    a. Line Voltage, Forward Phase Dimming - Where indicated, one forward phase control line voltage dimming output per relay for control of compatible two-wire or three-wire ballasts, LED drivers, MLV, forward phase compatible ELV, neon/cold cathode and incandescent loads. (LMRC-220 series)
7. WattStopper product numbers: LMRC-221, LMRC-222

F. Plug Load Controllers shall include:
1. 120 VAC, 60 Hz rated for 20A total load. Controller carries application-specific UL 20 rating for receptacle control.
2. One relay configuration with additional connection for unswitched load
3. Configurable additive time delay to extend plug load time delay beyond occupancy sensor time delay (e.g. a 10 minute additive delay in a space with a 20 minute occupancy sensor delay ensures that plug loads turn off 30 minutes after the space is vacated).
4. Factory default operation is Auto-on/Auto-off, based on occupancy
5. Real time current monitoring of both switched and un-switched load (LMPL-201 only)
6. Switching power supply
    a. Simple 150mA - Only 4 100 series devices on a Cat 5e local network (LMPL-101)
    b. Smart 250mA (LMPL-201)
7. RJ-45 DLM local network ports
    a. Three RJ-45 ports (LMPL-101)
    b. Four RJ-45 ports (LMPL-201)
8. Provide a wireless transmitter that can be connected to any Cat 5e network of the lighting controls that will communicate the room's occupancy state to receptacles mounted in the area with integral relays. Binding of the transmitter to the receptacles shall be accomplished by pressing a test button on the transmitter, and then a test button on the receptacle.

9. WattStopper product numbers:
    a. Plug Load Controllers: LMPL-101, LMPL-201.
    b. Wireless Transceiver and Receptacle: WRC-TX-LM, WRC-15-1/2, WRC-20-1/2

2.4 DIGITAL WALL OR CEILING MOUNTED OCCUPANCY SENSOR

A. Digital Occupancy Sensors shall provide graphic LCD display for digital calibration and electronic documentation. Features include the following:
1. Digital calibration and pushbutton configuration for the following variables:
    a. Sensitivity, 0-100 percent in 10 percent increments
    b. Time delay, 1-30 minutes in 1 minute increments
    c. Test mode, Five second time delay
    d. Detection technology, PIR, Ultrasonic or Dual Technology activation and/or re-activation.
    e. Walk-through mode
2. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.
3. Programmable control functionality including:
    a. Each sensor may be programmed to control specific loads within a local network.
    b. Sensor shall be capable of activating one of 16 user-definable lighting scenes.
    c. Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically within a configurable period of time (default 10 seconds) after turning off.
    d. On dual technology sensors, independently configurable trigger modes are available for both Normal (NH) and After Hours (AH) time periods. The retrigger mode can be programmed to use the following technologies:
    e. Ultrasonic and Passive Infrared
    f. Ultrasonic or Passive Infrared
    g. Ultrasonic only
    h. Passive Infrared only
    i. Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal (NH) and After Hour (AH) time periods.
4. One or two RJ-45 port(s) for connection to DLM local network.
5. Two-way infrared (IR) transceiver to allow remote programming through handheld commissioning tool and control by remote personal controls.
6. Device Status LEDs, which may be disabled for selected applications, including:
    a. PIR detection
    b. Ultrasonic detection
    c. Configuration mode
    d. Load binding
7. Assignment of occupancy sensor to a specific load within the room without wiring or special tools.
8. Manual override of controlled loads.
9. All digital parameter data programmed into an individual occupancy sensor shall be retained in non-volatile FLASH memory within the sensor itself. Memory shall have an expected life of no less than 10 years.

2.5 DIGITAL WALL SWITCH OCCUPANCY SENSORS

A. Digital Occupancy Sensors shall provide scrolling LCD display for digital calibration and electronic documentation. Features include the following:
1. Digital calibration and pushbutton configuration for the following variables:
    a. Sensitivity: 0-100 percent in 10 percent increments

b. Time delay: 1-30 minutes in 1 minute increments
c. Test mode: Five second time delay
d. Detection technology: PIR, Dual Technology activation and/or re-activation.
e. Walk-through mode
f. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.

2. Programmable control functionality including:
   a. Each sensor may be programmed to control specific loads within a local network.
   b. Sensor shall be capable of activating one of 16 user-definable lighting scenes.
   c. Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically during the configurable period of time (default 10 seconds) after turning off.
   d. On dual technology sensors, independently configurable trigger modes are available for both Normal (NH) and After Hours (AH) time periods. The retrigger mode can be programmed to use the following technologies:
      1) Ultrasonic and Passive Infrared
      2) Ultrasonic or Passive Infrared
      3) Ultrasonic only
      4) Passive Infrared only
3. Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal (NH) and After Hour (AH) time periods.
4. Two RJ-45 ports for connection to DLM local network.
5. Two-way infrared (IR) transceiver to allow remote programming through handheld configuration tool and control by remote personal controls.
6. Device Status LEDs including
   a. PIR detection
   b. Ultrasonic detection
   c. Configuration mode
   d. Load binding
7. Assignment of any occupancy sensor to a specific load within the room without wiring or special tools.
8. Assignment of local buttons to specific loads within the room without wiring or special tools
9. Manual override of controlled loads
10. All digital parameter data programmed into an individual wall switch sensor shall be retained in non-volatile FLASH memory within the wall switch sensor itself. Memory shall have an expected life of no less than 10 years.

B. Units shall not have any dip switches or potentiometers for field settings.

C. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required.

D. Two-button wall switch occupancy sensors, when connected to a single relay dimming room or fixture controller, shall operate in the following sequence as a factory default:
1. Left button
   a. Press and release - Turn load on
   b. Press and hold - Raise dimming load
2. Right button
   a. Press and release - Turn load off
   b. Press and hold - Lower dimming load

E. Low voltage momentary pushbuttons shall include the following features:
   1. Load/Scene Status LED on each switch button with the following characteristics:
      a. Bi-level LED
      b. Dim locator level indicates power to switch
      c. Bright status level indicates that load or scene is active
   2. The following button attributes may be changed or selected using a wireless configuration tool:
      a. Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).
      b. Individual button function may be configured to Toggle, On only or Off only.
      c. Individual scenes may be locked to prevent unauthorized change.
      d. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.
      e. Ramp rate may be adjusted for each dimmer switch.
      f. Switch buttons may be bound to any load on any load controller or relay panel and are not load type dependent; each button may be bound to multiple loads.
      g. WattStopper part numbers: LMPW, LMDW. Available in white, light almond, ivory, grey, red and black; compatible with wall plates with decorator opening.

2.6 DIGITAL WALL SWITCHES

A. Low voltage momentary pushbutton switches in 1, 2, 3, 4, 5 and 8 button configuration. Wall switches shall include the following features:
   1. Two-way infrared (IR) transceiver for use with personal and configuration remote controls.
   2. Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.
   3. Configuration LED on each switch that blinks to indicate data transmission.
   4. Load/Scene Status LED on each switch button with the following characteristics:
      a. Bi-level LED
      b. Dim locator level indicates power to switch
      c. Bright status level indicates that load or scene is active
      d. Dimming switches shall include seven bi-level LEDs to indicate load levels using 14 steps.
   5. Programmable control functionality including:
      a. Button priority may be configured to any BACnet priority level, from 1-16, corresponding to networked operation allowing local actions to utilize life safety priority
      b. Scene patterns may be saved to any button other than dimming rockers. Once set, buttons may be digitally locked to prevent overwriting of the preset levels.
   6. All digital parameter data programmed into an individual wall switch shall be retained in non-volatile FLASH memory within the wall switch itself. Memory shall have an expected life of no less than 10 years.

B. Two RJ-45 ports for connection to DLM local network.

C. Multiple digital wall switches may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration shall be required to achieve multi-way switching.

D. Load and Scene button function may be reconfigured for individual buttons from Load to Scene, and vice versa.
   1. Individual button function may be configured to Toggle, On only or Off only.

2. Individual scenes may be locked to prevent unauthorized change.
3. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.
4. Ramp rate may be adjusted for each dimmer switch.
5. Switch buttons may be bound to any load on any load controller or relay panel and are not load type dependent; each button may be bound to multiple loads.
6. WattStopper product numbers: LMSW-101, LMSW-102, LMSW-103, LMSW-104, LMSW-105, LMSW-108, LMDM-101. Available in white, light almond, ivory, grey, red and black; compatible with wall plates with decorator opening.

2.7 DLM HANDHELD USER INTERFACE REMOTES

A. Battery-operated handheld devices in 1, 2 and 5 button configurations for remote switching or dimming control. Remote controls shall include the following features:
1. Two-way infrared (IR) transceiver for line of sight communication with DLM local network within up to 30 feet.
2. LED on each button confirms button press.
3. Load buttons may be bound to any load on a load controller or relay panel and are not load type dependent; each button may be bound to multiple loads.
4. Inactivity timeout to save battery life.

B. Provide with a wall mount holster and mounting hardware for each remote.

C. WattStopper part numbers: LMRH-101, LMRH-102, LMRH-105.

2.8 DIGITAL DAYLIGHTING SENSORS

A. Digital daylighting sensors shall work with load controllers and relay panels to provide automatic switching, bi-level, or tri-level or dimming daylight harvesting capabilities for any load type connected to the controller or panel. Daylighting sensors shall be interchangeable without the need for rewiring.
1. Closed loop sensors measure the ambient light in the space and control a single lighting zone.
2. Open loop sensors measure incoming daylight in the space, and are capable of controlling up to three lighting zones.
3. Dual loop sensors measure both ambient and incoming daylight in the space to insure that proper light levels are maintained as changes to reflective materials are made in a single zone

B. Digital daylighting sensors shall include the following features:
1. Sensor's internal photodiode shall only measure lightwaves within the visible spectrum. The photodiode's spectral response curve shall closely match the entire photopic curve. Photodiode shall not measure energy in either the ultraviolet or infrared spectrums. Photocell shall have a sensitivity of less than 5 percent for any wavelengths less than 400 nanometers or greater than 700 nanometers.
2. Sensor light level range shall be from 1-6,553 foot-candles (fc).
3. Capability of ON/OFF, bi-level or tri-level switching, or dimming, for each controlled zone, depending on the selection of load controller(s) and load binding to controller(s).
4. For switching daylight harvesting, the photosensor shall provide a field-selectable deadband, or a separation, between the "ON Setpoint" and the "OFF Setpoint" that will prevent the lights from cycling excessively after they turn off.
5. For dimming daylight harvesting, the photosensor shall provide the option, when the daylight contribution is sufficient, of turning lights off or dimming lights to a field-

selectable minimum level.

6. Photosensors shall have a digital, independently configurable fade rate for both increasing and decreasing light level in units of percent per second.
7. Photosensors shall provide adjustable cut-off time. Cut-off time is defined by the number of selected minutes the load is at the minimum output before the load turns off. Selectable range between 0-240 minutes including option to never cut-off.
8. Optional wall switch override shall allow occupants to reduce lighting level to increase energy savings or, if permitted by system administrator, raise lighting levels for a selectable period of time or cycle of occupancy.
9. Integral infrared (IR) transceiver for configuration and/or commissioning with a handheld configuration tool, to transmit detected light level to wireless configuration tool, and for communication with personal remote controls.
10. Configuration LED status light on device that blinks to indicate data transmission.
11. Status LED indicates test mode, override mode and load binding.
12. Recessed switch on device to turn controlled load(s) ON and OFF.
13. BACnet object information shall be available for the following daylighting sensor objects, based on the specific photocell's settings:
    a. Light level
    b. Day and night setpoints
    c. Off time delay
    d. On and off setpoints
    e. Up to three zone setpoints
    f. Operating mode - on/off, bi-level, tri-level or dimming
14. One RJ-45 port for connection to DLM local network.
15. A choice of accessories to accommodate multiple mounting methods and building materials. Photosensors may be mounted on a ceiling tile, skylight light well, suspended lighting fixture or backbox. Standard tube photosensors accommodate mounting materials from 0-0.62 inch thick (LMLS-400, LMLS-500). Extended tube photosensors accommodate mounting materials from 0.62 to 1.25 inches thick (LMLS-400-L, LMLS-500-L). Mounting brackets are compatible with J boxes (LMLS-MB1) and wall mounting (LMLS-MB2). LMLS-600 photosensor to be mounted on included bracket below skylight well.
16. Any load or group of loads in the room can be assigned to a daylighting zone
17. Each load within a daylighting zone can be individually enabled or disabled for discrete control (load independence).
18. All digital parameter data programmed into a photosensor shall be retained in non-volatile FLASH memory within the photosensor itself. Memory shall have an expected life of no less than 10 years.

C. Closed loop digital photosensors shall include the following additional features:
1. An internal photodiode that measures light in a 100-degree angle, cutting off the unwanted light from bright sources outside of this cone.
2. Automatic self-calibration, initiated from the photosensor, a wireless configuration tool or a PC with appropriate software.
3. Automatically establishes application-specific setpoints following self-calibration. For switching operation, an adequate deadband between the ON and OFF setpoints shall prevent the lights from cycling; for dimming operation a sliding setpoint control algorithm with separate Day and Night setpoints shall prevent abrupt ramping of loads.
4. WattStopper Product Number: LMLS-400, LMLS-400-L.

D. Open loop digital photosensors shall include the following additional features:
1. An internal photodiode that measures light in a 60-degree angle (cutting off the unwanted

light from the interior of the room).
2. Automatically establishes application-specific setpoints following manual calibration using a wireless configuration tool or a PC with appropriate software. For switching operation, an adequate deadband between the ON and OFF setpoints for each zone shall prevent the lights from cycling; for dimming operation, a proportional control algorithm shall maintain the design lighting level in each zone.
3. Each of the three discrete daylight zones can include any non overlapping group of loads in the room.
4. WattStopper Product Number: LMLS-500, LMLS-500-L.

E. Dual loop digital photosensors shall include the following additional features:
1. Close loop portion of dual loop device must have an internal photodiode that measures light in a 100 degree angle, cutting off the unwanted light from sources outside of this con
2. Open loop portion of dual loop device must have an internal photodiode that can measure light in a 60 degree angle, cutting off the unwanted light from the interior of the room.
3. Automatically establishes application-specific set-points following self-calibration. For switching operation, an adequate deadband between the ON and OFF setpoints shall prevent the lights from cycling; for dimming operation a sliding setpoint control algorithm with separate Day and Night setpoints shall prevent abrupt ramping of load.
4. Device must reference closed loop photosensor information as a base line reference. The device must be able to analyze the open loop photosensor information to determine if an adjustment in light levels is required.
5. Device must be able to automatically commission setpoints each night to provide adjustments to electrical lighting based on changes in overall lighting in the space due to changes in reflectance within the space or changes to daylight contribution based on seasonal changes.
6. Device must include extendable mounting arm to properly position sensor within a skylight well.
7. WattStopper product number LMLS-600

2.9 HANDHELD CONFIGURATION TOOLS

A. Provide a wireless configuration tool to facilitate customization of DLM local networks using two-way infrared communications, and/or PC software that connects to each local network via a USB interface.

B. Features and functionality of the wireless configuration tool shall include but not be limited to:
1. Two-way infrared (IR) communication with DLM IR-enabled devices within a range of approximately 30 feet.
2. High visibility organic LED (OLED) display, pushbutton user interface and menu-driven operation.
3. Must be able to read and modify parameters for load controllers and relay panels, occupancy sensors, wall switches, daylighting sensors, network bridges, and identify DLM devices by type and serial number.
4. Save up to eight occupancy sensor setting profiles, and apply profiles to selected sensors.
5. Temporarily adjust light level of any load(s) on the local network, and incorporate those levels in scene setting. Set room mode for testing of Normal Hours (NH) and After Hours (AH) parameter settings.
6. Adjust or fine-tune daylighting settings established during auto-configuration, and input

light level data to complete configuration of open loop daylighting controls.
7. Set room mode for testing of Normal Hours (NH) and After Hours (AH) parameter settings.
8. Verify status of building level network devices.

C. WattStopper Product Numbers: Handheld LMCT-100

2.10 EMERGENCY LIGHTING CONTROL DEVICE

A. Emergency Lighting Control Unit – A UL 924 listed device that monitors a switched circuit providing normal lighting to an area. The unit provides normal ON/OFF control of emergency lighting along with the normal lighting. Upon normal power failure the emergency lighting circuit will close, forcing the emergency lighting ON until normal power is restored. Features include:
1. 120/277 volts, 50/60 Hz, 20 amp ballast rating
2. Push to test button
3. Auxiliary contact for remote test or fire alarm system interface

B. WattStopper Product Numbers: ELCU-100, ELCU-200.

PART 3 - EXECUTION

3.1 PREPARATION

A. Do not begin installation until measurements have been verified and work areas have been properly prepared.

B. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 INSTALLATION

A. Install system in accordance with the approved system shop drawings and manufacturer's instructions.

B. Install all room/area devices using manufacturer's factory-tested Cat 5e cable with pre-terminated RJ-45 connectors.
1. If pre-terminated cable is not used for room/area wiring, each field-terminated cable shall be tested following installation and testing results submitted to the Manufacturer's Representative for approval prior to proceeding with the Work.
2. If fixtures have internal DLM Control Modules, ensure that they are also connected with Cat 5e cable.
3. Install all room to room network devices using manufacturer-supplied LM-MSTP network wire or wireless devices. Network wire substitution is not permitted and may result in loss of product warranty.
4. Low voltage wiring topology must comply with manufacturer's specifications.
5. Route network wiring as indicated on the Drawings as closely as possible. Document final wiring location, routing and topology on as built drawings.

C. All line voltage connections shall be tagged to indicate circuit and switched legs.

D. Test all devices to ensure proper communication.

E. Calibrate all sensor time delays and sensitivity to guarantee proper detection of occupants and energy savings. Adjust time delay so that controlled area remains lighted while

occupied.

F. Provide written or computer-generated documentation on the configuration of the system including room by room description including:
   1. Sensor parameters, time delays, sensitivities, and daylighting setpoints.
   2. Sequence of operation, (e.g. manual ON, Auto OFF. etc.)
   3. Load Parameters (e.g. blink warning, etc.)

G. Post start-up tuning - Adjust sensor time delays and sensitivities to meet the Owner's requirements 30 days from beneficial occupancy. Provide a detailed report to the Architect / Owner of post start-up activity.

H. Tighten all panel Class I conductors from both circuit breaker and to loads to torque ratings as marked on enclosure UL label.

I. All Class II cabling shall enter enclosures from within low-voltage wiring areas and shall remain within those areas. No Class I conductors shall enter a low-voltage area.

J. Run separate neutrals for any phase dimmed branch load circuit. Different types of dimming loads shall have separate neutral.

K. Verify all non-panel-based lighting loads to be free from short circuits prior to connection to room controllers.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Notify Architect and Manufacturer in writing a minimum of 3 weeks prior to system start-up and testing.

B. Tests and Inspections: Manufacturer's service representative shall perform the following inspections and prepare reports.
   1. Verify Class I and II wiring connections are terminated properly by validating system performance.
   2. Set IP addresses and other network settings of system front end hardware per facilities IT instructions.
   3. Verify / complete task programming for all switches, dimmers, time clocks, and sensors.
   4. Verify that the control of each space complies with the Sequence of Operation.
   5. Correct any system issues and retest.

C. Provide a report in table format with drawings, or using a software file that can be opened in the manufacturer's system software including each room or space that has lighting control installed. Indicate the following:
   1. Date of test or inspection.
   2. Loads per space, or Fixture Address identification.
   3. Quantity and Type of each device installed
   4. Reports providing each device's settings.

3.4 COMMISSIONING ASSISTANCE

A. Title 24 Acceptance Testing Service; Include additional costs for Lighting Control Manufacturer to provide a technician for one additional day while the CLCATT performs lighting control acceptance testing in accordance with CAL TITLE 24 P6 including

submission of required documentation.

3.5 DEMONSTRATION AND TRAINING

A. Before Substantial Completion, arrange and provide a one-day Owner instruction period to designated Owner personnel. Set-up, starting of the lighting control system and Owner instruction includes:
   1. Confirmation of entire system operation and communication to each device.
   2. Confirmation of operation of individual relays, switches, and sensors.
   3. Confirmation of system Programming, photocell settings, override settings, etc.
   4. Provide training to cover installation, programming, operation, and troubleshooting of the lighting control system.

3.6 PRODUCT SUPPORT AND SERVICE

A. Factory telephone support shall be available at no cost to the Owner following acceptance. Factory assistance shall consist of assistance in solving application issues pertaining to the control equipment.

END OF SECTION 26 09 43

SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section Includes:
   1. Panelboards.

B. Related Work:
   1. Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
   2. Section 26 05 33, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS.
   3. Section 26 05 19, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Cables and wiring.
   4. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

1.3 SUBMITTALS

A. Submit in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.

1.4 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

B. Underwriters Laboratories, Inc. (UL):
   1. No. 50 Enclosures for Electrical Equipment
   2. No. 67 Panelboards
   3. No. 489 Molded Case Circuit Breakers and Circuit Breaker enclosures

C. National Fire Protection Association (NFPA):
   1. No. 70-2022 California Electrical Code (CEC)

D. National Electrical Manufacturers Association (NEMA):
   1. No. PB-1 Panelboards.
   2. No. AB-3 Molded Case Circuit Breakers and Their Application.

PART 2 - PRODUCTS

2.1 PANELBOARDS

A. Panelboards shall be in accordance with UL, NEMA, NEC, CEC and as shown on the drawings. Approved manufacturers are Square D (NQ Series or I-Line). Eaton may be substituted if pre-approved by the Engineer of Record and only if Square D is not available. Siemens and General Electric will NOT be permitted.

B. Panelboards shall be standard manufactured products. All components of the panelboards shall be the product and assembly of the same manufacturer. All similar units of all panelboards to be of the same manufacturer.

C. All panelboards shall be dead front safety type. Arrange sections for easy removal without disturbing other sections.

D. All panelboards shall be completely factory assembled with molded case circuit breakers. All factory wiring shall be checked for correct tightness and visually inspected to insure that bussing and terminations have not become loose in transit to job site.

E. Panelboards shall have main breaker or main lugs, bus size, voltage, phase, top or bottom feed, and flush or surface mounting as scheduled on the drawings. Refer to single line diagram and panel schedules on drawings. Terminals shall be minimum 75 degree rated. Back fed main circuit breakers are not allowed. Main circuit breakers shall be vertically mounted.

F. Panelboards shall have the following features:
   1. Nonreduced size copper bus bars, and connection straps bolted together and rigidly supported on molded insulators. Bus bar taps for panels with single pole branches shall be arranged for sequence phasing of branch circuit devices.
   2. Full size copper neutral bar, mounted on insulated supports.
   3. Copper ground bar and isolation ground bar (where called for in panel schedule) with sufficient terminals for all grounding wires. Buses braced for the available short circuit current.
   4. All breakers and phase bus connections shall be arranged so that it will be possible to substitute a 2-pole breaker for two single pole breakers, and a 3-pole breaker for three single pole breakers, when trip is 30 amps or less and frame size is 100 amperes or less, without having to drill and tap the main bus bars at bus straps. Where used for heating and air conditioning, and refrigeration equipment, use only HACR type U.L. listed circuit breakers.
   5. Design interior so that protective devices can be replaced without removing adjacent units, main bus connectors, and without drilling or tapping.
   6. Where designated on panel schedule as "space", include all necessary bussing, device support and connections. Provide blank cover for each space.
   7. In two section panelboards, the main bus in each section shall be full size. The first section shall be furnished with subfeed lugs on the line side with cable connections to the second section. Panelboard sections with tapped bus or crossover bus are not acceptable.
   8. Series rated panelboards are not permitted.
   9. Label all panels in accordance with Section 26 05 53, IDENTIFICATION OF ELECTRICAL SYSTEMS.

10. Recessed panel space conduit: Provide (1) ¾ inch spare conduit stubbed to accessible ceiling space and/or interstitial space below floor for every (5) spaces and spares indicated on panel schedules.

G. Panelboards serving as building mains shall be “service entrance rated” and UL Listed as “service equipment”.

2.2 CABINETS AND TRIMS

A. Cabinets:
1. Provide galvanized steel cabinets to house panelboards. Cabinets for outdoor panels shall be factory primed and suitably treated with a corrosion-resisting paint finish meeting UL standard for outdoor applications.
2. All ventilated openings in panelboards and switchboards, shall be furnished with dust filters to prevent entrance of dust and debris.
3. Cabinets for panelboards may be of one piece formed steel or of formed sheet steel with end and side panels welded, riveted, or bolted as required.
4. Provide necessary hardware for "in" and "out" adjustment of panel interior.
5. Cabinets for two section panelboards shall be arranged side by side, and shall be the same height. Flush mounted cabinets should be 1 1/2" apart and coupled by conduit nipple if necessary.
6. Gutter size in panel boxes, on all sides, shall be in accordance with the CEC. Penetrations through gutter to live area of the panelboard shall incorporate approved non-metallic-grommet type of insulation to protect wire passing through.

B. Trims:
1. Fabricate trim of sheet steel consisting of frame with door attached by concealed hinges. Provide flush or surface trim as shown on the drawings.
2. Flush trims shall overlap the box by at least 3/4" all around.
3. Surface trim shall have the same width and height as the box.
4. Flush or surface trims shall not have ventilating openings.
5. Secure trims to back boxes by indicating trim clamps.
6. Provide a welded angle on rear of trim to support and align trim to cabinet.
7. Provide separate trims for each section of multiple section panelboards. Trims and doors of sections shall be of the same height.

C. Doors:
1. Provide doors with flush type latch and manufacturer's standard lock. Doors over 48 inches in height shall have a vault handle and a three-point catch, arranged to fasten door at top, bottom, and center.
2. In making switching devices accessible, doors shall not uncover any live parts.
3. Provide concealed hinges welded to the doors and trims.
4. For lighting or power contactors incorporated in panelboards, provide separate doors for the contactors.
5. Provide keyed alike system for all panelboards.
6. Provide a directory card, metal holder, and transparent cover. Permanently mount holders on inside of doors.

D. Painting:
1. Thoroughly clean and paint trims and doors at the factory with primer and manufacturer's standard finish.

2.3 MOLDED CASE CIRCUIT BREAKERS FOR PANELBOARDS

A. Breakers shall be UL listed and labeled, in accordance with the CEC, as shown on the drawings, and as specified.

B. Circuit breakers in panelboards shall be bolt on type on phase bus bar or branch circuit bar.
   1. Molded case circuit breakers for lighting and appliance branch circuit panelboards shall have minimum interrupting rating as indicated.
   2. Molded case circuit breakers shall have automatic, trip free, non-adjustable, inverse time, and instantaneous magnetic trips for 100 ampere frame or less. Magnetic trip shall be adjustable from 3 times to 10 times for breakers with 600 ampere frames and higher. Factory setting shall be HI, unless otherwise noted.

C. Breaker features shall be as follows:
   1. Integral housing of molded insulating material.
   2. Silver alloy contacts.
   3. Arc quenchers and phase barriers for each pole.
   4. Quick-make, quick-break, operating mechanisms.
   5. A trip element for each pole, thermal magnetic type with long time delay and instantaneous characteristics, a common trip bar for all poles and a single operator.
   6. Electrically and mechanically trip free.
   7. An operating handle which indicates ON, TRIPPED, and OFF positions.
      a. Line connections shall be bolted.
      b. Interrupting rating shall not be less than the maximum short circuit current available at the line terminals as indicated on the drawings. The interrupting rating shall not be less than the minimum identified requirement.
   8. An overload on one pole of a multipole breaker shall automatically cause all the poles of the breaker to open.

2.4 SEPARATELY ENCLOSED MOLDED CASE CIRCUIT BREAKERS

A. Where separately enclosed molded case circuit breakers are shown on the drawings, provide circuit breakers in accordance with the applicable requirements of those specified for panelboards.

B. Enclosures are to be of the NEMA types shown on the drawings. Where the types are not shown, they are to be the NEMA type most suitable for the environmental conditions where the breakers are being installed.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with CEC, as shown on the drawings, and as specified.

B. Locate panelboards so that the present and future conduits can be conveniently connected. Coordinate the sizes and layout of cabinets within the designated spaces. All equipment must be dimensioned in order to physically fit in the spaces provided and to comply with all code required clearances.

C. Install a typewritten schedule of circuits in each panelboard. Include the room numbers (as finally described by the Owner) and items served on the cards. Obtain final room numbers from Architect prior to creating schedule.

D. Mount the panelboard so that maximum height of the top circuit breaker above finished floor shall not exceed 78 inches.

E. For panelboards located in areas accessible to the public, paint the exposed surfaces of the trims, doors, and boxes with finishes to match surrounding surfaces after the panelboards have been installed.

F. Circuit numbers shall correspond to the approved panel schedule. Provide as-built drawings showing the actual circuit numbers being used for each device on each branch circuit if changes are required.

G. Verify depth of all flush mounted enclosures in walls to be certain wall depth will accommodate panel depth prior to installation.

H. All openings in switchgear and panelboards that are unused shall be sealed with bolts and washers. Use caulking where holes or openings cannot be sealed by way of a washer, or bolts or conduit seals.

END OF SECTION 26 24 16

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SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section Includes:
   1. Wiring devices.

1.3 SUBMITTALS

A. Submit in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.

B. Related Work:
   1. Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
   2. Section 26 05 33, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS.
   3. Section 26 05 19, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.
   4. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

PART 2 - PRODUCTS

2.1 RECEPTACLES

A. General: All receptacles shall be listed by Underwriters Laboratories, Inc.
   1. Mounting straps shall be plated steel, with break-off plaster ears and shall include a self-grounding feature (this feature does not substitute for a grounding conductor terminated on grounding strap of device). Terminal screws shall be brass, brass plated or a copper alloy metal.
   2. Receptacles shall be of a screw terminal type, “pressure type quick wire” terminations are not allowed.
   3. 15 ampere and 20 ampere, 125-volt and 250-volt non-locking receptacles shall be tamper resistant type receptacles unless the application is specifically listed as an exception to CEC 406.12.
   4. Receptacles shall be “wet rated” when used in an exterior location.

B. Duplex receptacles shall be premium specification grade single phase, 20 ampere, 120 volts, 2-pole, 3-wire, and conform to the NEMA 5-20R configuration in NEMA WD 6. The duplex type shall have bussing break-off feature for two-circuit operation. The ungrounded pole of each receptacle shall be provided with a separate terminal.

1. Bodies shall be white in color. Contractor to verify device color with Architect prior to procurement.
2. Switched duplex receptacles shall be wired so that only the top receptacle is switched. The remaining receptacle shall be unswitched.
3. Controlled receptacles; installed per requirements of 2016 BUILDING ENERGY EFFICIENCY STANDARDS / Efficiency Standards, California Code of Regulations, Title 24, Part 6. SECTION 130.5 (d) – ELECTRICAL POWER DISTRIBUTION SYSTEMS as Circuit Controls for 120-Volt Receptacles and / or Controlled Receptacles. Shall be provided with an approved means of including a permanent and durable marking identifying the controlled receptacles or circuits to differentiate them from uncontrolled receptacles or circuits. Where shown on associated floor plans, and or required by the Standards; a duplex noted to be controlled shall be 'split-wire', so the top outlet shall be switched and the bottom outlet shall be unswitched. A double duplex (fourplex) noted to be controlled: one of the duplex receptacles shall be controlled and the other duplex receptacle shall be unswitched.
4. Duplex Receptacles on Emergency Circuit: Receptacle bodies shall be red in color. Wall plates shall also be powder coat painted red finish. Cover shall be labeled with panel and circuit number.
5. Ground Fault Interrupter Duplex Receptacles: Shall be an integral unit suitable for mounting in a standard outlet box.
    a. Ground fault interrupter shall be commercial grade and consist of a differential current transformer, solid state sensing circuitry and a circuit interrupter switch. It shall be rated for operation on a 60 Hz, 120 volt, 20-ampere branch circuit. Device shall meet CEC requirements. Device shall have a minimum nominal tripping time of 1/30th of a second. Devices shall meet UL 943.

C. Receptacles; 20, 30 and 50 ampere, 250 volts: Shall be complete and match with appropriate cord grip plug. Devices shall meet UL 231.

~~D.~~ Weatherproof Receptacles: Shall consist of a listed weather resistant duplex receptacle, mounted in box with a gasketed, while in use weatherproof, cast metal cover plate and cap receptacle opening. The cap shall be permanently attached to the cover plate by a spring-hinged flap. All on-grade weatherproof receptacles to be Midwest #U010010GRP or #U012010GRP. Otherwise, all non-on-grade weatherproof receptacles permitted to be Intermatic WP10 Series, Thomas & Betts/Red Dot 2CK Series, or engineer approved equal.

2.2 SWITCHES AND DIMMERS

A. Toggle switches shall be totally enclosed tumbler type with bodies of phenolic compound. Toggle handles color to match receptacle device color unless otherwise specified.
1. Shall be single unit toggle, butt contact, quiet AC type, heavy-duty general-purpose use with an integral self grounding mounting strap with break-off plasters ears and be of a screw terminal type.
2. Shall be color coded for current rating, listed by Underwriters Laboratories, Inc., and meet the requirements of NEMA WD 1, Heavy-Duty and UL 20.
3. Ratings:
    a. 120 volt circuits: 20 amperes at 120-277 volts AC.
    b. 277 volt circuits: 20 amperes at 277 volts AC.
4. The switches shall be mounted on the strike plate side of doors.
5. Incorporate barriers between switches with multi-gang outlet boxes where required by the CEC.

6. All toggle switches shall be of the same manufacturer.

B. Coordinate lighting control device requirements with 26 09 43 Network Lighting Controls System.

2.3 WALL PLATES

A. Wall plates for switches and receptacles shall be type 302 stainless steel.

B. Standard NEMA design, so that products of different manufacturers will be interchangeable. Dimensions for openings in wall plates shall be accordance with NEMA WD1.

C. For receptacles or switches ganged together, wall plates shall be a single ganged plate.

D. Wall plates for data, telephone or other communication outlets shall be as specified in the associated specification.

E. Surface mounted boxes, NEMA1, shall be industrial grade raised galvanized steel covers. In shop areas all receptacles shall be dust proof and or waterproof where applicable.

F. Waterproof device covers shall be cast iron, 4-corner screw type, for FS and FD type mounting. Device covers shall be zinc galvanized finish. Weatherproof covers shall be lockable.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Switches installed in hazardous areas shall be explosion proof type in accordance with the CEC and as shown on the drawings.

B. Installation shall be in accordance with the CEC, NECA “Standard of Installation”, and as shown as on the drawings.

C. Ground terminal of each receptacle shall be bonded to the outlet box with an approved green bonding jumper, and also be connected to the green equipment grounding conductor.

D. General: Devices shall be of the type specified herein. All devices shall be installed with “pigtailed” leads from the outlet box. No device shall be used in the “feed through” application. Screw terminals shall be used to connect all devices to the circuit and shall be grounded by means of a ground wire where grounding terminals are provided in the device.

E. Installation: Devices and plates shall be installed in a “plumb” condition and must be flush with the finish surface of the wall where boxes are recessed.

F. Mounting heights: All control and convenience devices shall comply with California Code of Regulations Title 24 and ADA with respect to accessibility requirements. Mounting heights indicated on plans shall have precedence.

G. Install switches with the off position down.

H. Clean debris from outlet boxes.

I. Provide extension rings as required to bring outlet boxes flush with finished surface or casework.

J. Test each receptacle device for proper polarity.

K. Receptacles shall be wired and mounted in a “ground-up” configuration, such that the topmost receptacle’s ground connection is in the top-position of the finished outlet.

END OF SECTION 26 27 26

SECTION 26 28 16 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section Includes:
   1. Disconnect and safety switches where shown on the contract drawings and specified herein.

1.3 SUBMITTALS

A. Submit in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.

B. Related Work:
   1. Section 26 05 53, IDENTIFICATION OF ELECTRICAL SYSTEMS.

PART 2 - PRODUCTS

2.1 GENERAL

A. Approved Manufacturers: Square-D. Eaton may be substituted if pre-approved by the Engineer of Record.

B. Disconnect Switches: Provide with devices enabling the switch to be locked in the open or closed positions.

C. Manual Motor Switches: Tumbler type rated 3HP, 240 Volts with or without overload heaters as required to protect equipment served.

D. Externally Operable Safety Switches: To have quick-make, quick-break mechanism, capable of switching 10 times switch rating, with cover interlock to prevent opening with switch in ON position and defeat mechanism for maintenance.

E. Switches: Shall be general duty (GD) for 240 volt and below and heavy duty (HD) for 277/480 volt type unless otherwise indicated. Provide NEMA 1 enclosures for interior locations and NEMA 3R enclosures for exterior or wet locations. Provide with number of poles, ampacity, voltage and HP rating, fusible or nonfusible as indicated. Copper blades shall be visible in off position.

F. Fusible Switches: Equip them with rejection clips for UL Class R fuses. Switches having a dual rating when used with dual element fuses shall have a rating so indicated and shall be confirmed by equipment vendor being connected.

G. 600 Amperes or Less Fuses: UL Class RKI with a minimum interrupting rating of 200,000 Amperes, Bussmann "Low-Peak Type" or equal.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

A. Locations: Install switches, disconnects and safety where indicated on the Contract Drawings or as required by CEC.

B. Fastenings: Securely fasten switches to structural members or unistrut support as directed by the manufacturer. All strut end to be deburred and coated with a cold galvanized paint.

C. Label all disconnect switches in accordance with Section 26 05 53, IDENTIFICATION OF ELECTRICAL SYSTEMS.

D. Fuse: All fuses shall be as indicated on the plan or as required by the equipment. Verify fuse size with equipment manufacturer requirements, prior to installation. Use current limiting fuses as indicated on plan. Provide one spare fuse cabinet in each electrical room with one complete set of spare fuses for all sizes of main fuses, subpanel fuses, HVAC equipment fuses and fire alarm.

E. Terminals shall be minimum 75 degree rated.

END OF SECTION 26 28 16

SECTION 26 51 00 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section Includes:
   1. Interior lighting systems, including luminaires, ballasts, lamps and emergency lighting equipment.

B. Related Work:
   1. Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
   2. Section 26 05 33, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS: Conduits, fittings, and boxes for raceway systems.
   3. Section 26 05 19, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Low voltage power and lighting wiring.
   4. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
   5. Section 26 56 00, EXTERIOR LIGHTING.
   6. Section 26 56 70, LIGHTING ACCEPTANCE TESTING.

1.3 SUBMITTALS

A. Submit in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.

B. Shop Drawings:
   1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
   2. Include electrical ratings, dimensions, mounting, details, materials, terminations, wiring and connection diagrams, photometric data, drivers, luminaires, lamps and controls.

1.4 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

B. American Society for Testing and Materials (ASTM).

C. American National Standards Institute (ANSI).

D. Aluminum Association Inc. (AA).

E. Illuminating Engineering Society of North America (IESNA).

F. National Electrical Manufacturers Association (NEMA).

G. National Fire Protection Association (NFPA).

H. Underwriters Laboratories, Inc. (UL).

1.5 DEFINITIONS

A. Lighting terminology used herein is defined in IES

B. Exception: The term “driver” is used herein to cover both drivers and power supplies, where applicable.

C. Clarification: The term “LED light source(s)” is used herein per IES to cover LED package(s), module(s), and array(s).

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment shall be in accordance with CEC, UL, ANSI, and as shown on the drawings and specified.

B. Approved manufacturers: Cree, Lithonia preferred. Columbia is acceptable for troffers.

2.2 LIGHTING FIXTURES (LUMINAIRES)

A. Shall be in accordance with NFPA 70, UL 1598 and shall be as shown on drawings and as specified. All luminaires shall have been certified to the California Energy Commission by its manufacturer to comply with the efficiency standards as per California Code of Regulations Title 24, Part 6, Section 111 referencing the Appliance Efficiency Regulations in Title 20. Post certification with building permit.

B. Sheet Metal:
   1. Shall be formed to prevent warping and sagging. Housing, trim and lens frame shall be true, straight (unless intentionally curved) and parallel to each other as designed.
   2. Wireways and fittings shall be free of burrs and sharp edges and shall accommodate internal and branch circuit wiring without damage to the wiring.
   3. When installed, any exposed fixture housing surface, trim frame, door frame and lens frame shall be free of light leaks; lens doors shall close in a light tight manner.
      a. Hinged door closure frames shall operate smoothly without binding when the fixture is in the installed position, and latches shall function easily by finger action without the use of tools.

C. Ballasts (where applicable) shall be serviceable while the fixture is in its normally installed position, and shall not be mounted to removable reflectors or wireway covers.

D. Recessed fixtures shall be of the type approved for the ceiling and insulation conditions and appropriate for the installation location. Insulation must be held back from the fixture to provide manufacturers' recommended clearances for proper operation. Thermal tripping shall be the installer's responsibility to correct. Where installed in fire rated ceilings, coordinate installation of fire rated enclosures around the ceiling penetrations. Fixtures shall contain the proper through wiring capacity for that which is shown on the plans.

E. Recessed fixtures shall be provided with the appropriate trims and hardware compatible with the ceiling type shown. Plaster frames are required where plaster or gypsum board ceilings are encountered.

F. Mechanical Safety: Lighting fixture closures (lens doors, trim frame, hinged housings, etc.) shall be retained in a secure manner by captive screws, chains, captive hinges or fasteners such that they cannot be accidentally dislodged during normal operation or routine maintenance.

G. Metal Finishes:
1. The manufacturer shall apply standard finish (unless otherwise specified) over a corrosion resistant primer, after cleaning to free the metal surfaces of rust, grease, dirt and other deposits. Edges of pre-finished sheet metal exposed during forming, stamping or shearing processes shall be finished in a similar corrosion resistant manner to match the adjacent surface(s). Fixture finish shall be free of stains or evidence of rusting, blistering, or flaking.
2. Interior light reflecting finishes shall be white with not less than 85 percent reflectances, except where otherwise specified on the drawing.
3. Exterior finishes shall be as shown on the drawings.

H. Provide all lighting fixtures with a specific means for grounding metallic wireways and housings to an equipment grounding conductor.

I. Recessed fixtures shall be manufactured specifically for LED lamps with drivers integral to the fixture. Assemblies designed to retrofit fixtures are prohibited except when described in this fashion. Fixtures shall be designed for lamps as specified.

J. Provide wire lamp guard on all exposed lamp fixture/luminaires.

2.3 LED LUMINAIRE REQUIREMENTS

A. General Requirements:
1. Luminaire shall have an external label per ANSI C136.15
2. Luminaire shall have an internal label per ANSI C136.22.
3. Luminaires shall start and operate in -20°C to +40°C ambient.
4. LED light source(s) and driver(s) shall be RoHS compliant.

2.4 EMERGENCY POWER SUPPLY FOR LIGHTING FIXTURES

A. Self-contained battery-operated power supply for operating each fixture indicated on the plans for a minimum output of 90 minutes.

B. The power supply shall be installed integral to the luminaire. Provide with test switch and charge indicator installed integral to the luminaire. The test switch and charge indictor may be installed in a remote ceiling mounted flush J-box for recessed downlights which cannot accept integral components.

C. Performance: Emergency operation lumen output for fixtures shall be a minimum of 1100 lumens (or 640 lumens in downlights), unless specifically noted otherwise on the associated electrical drawings.

D. Provide access hatches (for emergency battery future access) adjacent to recessed 6-inch or less diameter downlights installed in inaccessible ceilings.

2.5 LED DRIVER

A. Driver
1. Rated case temperature shall be suitable for operation in the luminaire operating in the ambient temperatures as indicated.
2. Shall accept the voltage or voltage range indicated, and shall operate normally for input voltage fluctuations of plus or minus 10 percent. Consistent with NEMA SSL 1.
3. Shall have a minimum Power Factor (PF) of 0.90 at full input power and across specified voltage range.
4. 0-10 volt drivers only.

B. Electromagnetic interference
1. Shall have a maximum Total Harmonic Distortion (THD) of 20% at full input power and across specified voltage range.
2. Shall comply with FCC 47 CFR part 15 non-consumer RFI/EMI standards.

C. The following shall be in accordance with corresponding sections of ANSI C136.37
1. Wiring and grounding
2. All internal components shall be assembled and pre-wired using modular electrical connections.
3. Mounting provisions
4. Terminal blocks for incoming AC lines
5. Latching and hinging
6. Ingress protection

2.6 LAMPS

A. Provide lamps for all luminaires.

B. LED LIGHT SOURCE
1. Minimum Color Rendering Index (CRI): 60.
2. Correlated Color Temperature (CCT)
a. CCT shall be as listed in Table 1 below:

Table 1. Allowable CCT

Manufacturer-Rated Nominal CCT (K)	Allowable LM-79 Chromaticity Values Measured CCT (K)
2700	2580 to 2870
3000	2870 to 3220
3500	3220 to 3710
4000	3710 to 4260
4500	4260 to 4746
5000	4745 to 5311
5700	5310 to 6020
6500	6020 to 7040

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation and furnishing of lighting fixtures shall be in accordance with the CEC, manufacturer's instructions and as shown on the drawings or specified. Fixtures damaged in transit and storage prior to completion shall be replaced at Contractor’s expense.

B. Align, mount and level the lighting fixtures uniformly.

C. Avoid interference with and provide clearance for equipment. Where the indicated locations for the lighting fixtures conflict with the locations for equipment, change the locations for the lighting fixtures by the minimum distances necessary as approved by the Architect. The Architectural reflected ceiling plan will take precedence over electrical plans.

D. For suspended lighting fixtures, the mounting heights shall provide the clearances between the bottoms of the fixtures and the finished floors as shown on the drawings.

E. Lighting Fixture Supports:
1. Contractor shall provide support for all of the fixtures independent of suspended ceilings. Supports may be anchored to channels of the ceiling construction, to the structural slab or to structural members within a partition, or above a suspended ceiling.
2. Shall maintain the fixture positions after cleaning.
3. Shall support the lighting fixtures without causing the ceiling or partition to deflect.
4. Hardware for recessed fluorescent fixtures:
a. Fixtures shall be supported as detailed on drawings and as required by DSA standards.
b. Installation: Fixtures shall be securely mounted on ceilings and walls with appropriate fastening devices. "Drop-in" type T-bar fixtures shall be secured with #12 gauge safety "earthquake wires" as described by California Code of Regulations Title 24 Part 2, Chapter 47. "Earthquake clips" will be required for

fastening to the T-bar system in addition to safety wire. Surface mounted fluorescent fixtures shall be solidly screwed or clipped into framing above drywall with 4-#10 sheet metal screws into each fixture. Provide blocking for screw supports behind all surface mounted lighting fixtures weighing more than 15 lbs.

5. Surface mounted lighting fixtures:
   a. Fixtures shall be bolted against the ceiling independent of the outlet box at four points spaced near the corners of each unit. The bolts shall be minimum ¼-20 bolt, secured to structural ceiling. Non-turning studs may be attached to the building structure by 12 gauge safety hangers.
6. Fixtures mounted in open construction shall be secured directly to the building structure with approved bolting and clamping devices.
7. Single or double pendent mounted lighting fixtures:
   a. Each stem shall be supported by an approved outlet box, mounted swivel joint and canopy which holds the stem captive and provides spring load (or approved equivalent) dampening of fixture oscillations. Outlet box shall be supported vertically from the building structure and be allowed to swing to a 45 degree angle.
8. Outlet boxes for support of lighting fixtures (where permitted) shall be secured directly to the building structure with approved devices or supported vertically in a hung ceiling from the building structure with a nine gauge wire hanger, and be secured by an approved device to a main ceiling runner or cross runner to prevent any horizontal movement relative to the ceiling.

F. Furnish and install the specified lamps for all lighting fixtures as part of this project.

G. Coordinate between the electrical and ceiling trades to ascertain that approved lighting fixtures are furnished in the proper sizes and installed with the proper devices (hangers, clips, trim frames, flanges), to match the ceiling system being installed.

H. Bond lighting fixtures and metal accessories to the grounding system as specified in Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

I. At completion of project, clean all fixtures, lenses, diffusers and louvers that have accumulated dust/dirt during construction.

J. Provide unswitched leg of interior lighting branch circuit to integral emergency battery pack light fixtures, exit signs and night lights as applicable per lighting plans.

K. Wallmount fixtures in walkway areas shall not project more than 4 inches from wall when projection occurs lower than 80 inches.

END OF SECTION 26 51 00

SECTION 26 56 00 - EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, and connection of exterior luminaires, controls, and supports.

1.2 RELATED WORK

A. Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.

B. Section 26 05 33, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS: Conduits, fittings, and boxes for raceway systems.

C. Section 26 05 19, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Low voltage power and lighting wiring.

D. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

E. Section 26 51 00, INTERIOR LIGHTING.

F. Section 26 56 70, LIGHTING ACCEPTANCE TESTING.

1.3 SUBMITTALS

A. Submit in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.

B. Shop Drawings:
   1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
   2. Include electrical ratings, dimensions, mounting, details, materials, required clearances, terminations, wiring and connection diagrams, photometric data, drivers, luminaires, lamps and controls.

1.4 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

B. American Society for Testing and Materials (ASTM).

C. American Concrete Institute (ACI).

D. American National Standards Institute (ANSI).

E. Aluminum Association Inc. (AA).

F. Illuminating Engineering Society of North America (IESNA).

G. National Electrical Manufacturers Association (NEMA).

H. National Fire Protection Association (NFPA).

I. Underwriters Laboratories, Inc. (UL).

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment shall be in accordance with CEC, UL, ANSI, as shown on the drawings and as specified.

B. Approved Manufacturers:
1. LED type (wall pack): Current Lighting LNC2 series or Cree XSPW series.
2. LED type (other): Gardco/Signify, Cree, Lithonia, Hubbell, Kennall

C. Exterior Lighting Control Timeclocks:
1. In addition to lighting controls required by CEC, mechanical timeclocks shall be installed. For 7 Day use Intermatic #T7401BC (mechanical with 24-hour backup). For 24 Hour use Intermatic #T103. Install in accordance with the drawings.

2.2 LUMINAIRES

A. UL 1598 and ANSI C136.17. Luminaries shall be weatherproof, heavy duty, outdoor types designed for efficient light utilization, adequate dissipation of lamp heat.

B. Light emitting diode (LED)-based solid state lighting (SSL) products shall be factory tested in accordance to the International Engineering Society (IES) LM-79 recommendations and meet ANSI C78.377-2008 standards.

C. LED light sources shall be factory tested in accordance to IES LM-80 recommendations.

D. LED-based SSL product shall incorporate an external heat sink, integral to the luminaire.

E. Incorporate associated ballasts and drivers within the luminaire housing.

F. Lenses shall be frame-mounted heat-resistant, borosilicate glass, prismatic refractors. Attach the frame to the luminaire housing by hinges or chain.

G. Pre-wire internal components to terminal strips at the factory.

H. Bracket mounted luminaries shall have leveling provisions and clamp type adjustable slip-fitters with locking screws.

I. Materials shall be rustproof. Latches and fittings shall be non-ferrous metal.

J. LED-based SSL luminaires shall be manufactured specifically for LED lamps with drivers integral to the luminaire housing.

2.3 LAMPS

A. Luminaires shall be listed for the lamp specified on the associated electrical plans. Install the proper lamps in every luminaire installed.

B. Lamps shall be clear or coated as recommended by luminaire manufacturer to provide for maximum luminaire efficiency in fixture used.

2.4 LED-BASED SOLID STATE DRIVERS

A. Shall be listed by either U.L. or equal listing agency and comply with IEEE C.62.41-1991, Class A operation.

B. Provide a minimum power factor of 0.9.

C. Minimum operating temperature appropriate for outdoor environments.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install lighting in accordance with the CEC, as shown on the drawings, and in accordance with manufacturer’s recommendations.

3.2 GROUNDING

A. Ground noncurrent-carrying parts of equipment including metal poles, luminaries, mounting arms, brackets, and metallic enclosures as specified in Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS. Where copper grounding conductor is connected to a metal other than copper, provide specially treated or alloyed connectors suitable and listed for this purpose.

END OF SECTION 26 56 00

SECTION 26 56 70 - LIGHTING ACCEPTANCE TESTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section Includes:
   1. The Contractor shall be responsible for the Certificate of Acceptance, but coordinate with the Certified California Lighting Controls Test Technician to assure that all required documents have been filed with and approved by the enforcement agency prior to receiving a final occupancy permit. The Certificate of Acceptance will indicate that the Contractor has demonstrated acceptance requirements of the plans and specifications, that current requirements for installation certificates are met, and that currently required operating and maintenance information (as well as the Certificate of Acceptance) were provided to the building Owner.
   2. Testing, evaluation and calibration of lighting controls equipment provided, installed and connected in Division 26.
   3. Documentation of test results, completion of “Certificate of Acceptance” and “Certificate of Installation” forms and filing with the enforcement agency for approval.
   4. Specific Jobsite Conditions:
      a. Acceptance testing must be tailored for each specific design, job site, and climactic conditions. While the steps for conducting each test remain consistent, the application of the tests to a particular site may vary. The Contractor shall review the construction documents and include all required time, material, testing equipment, etc. as required to complete the requirements of this section.

B. Related Work:
   1. Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
   2. Section 26 51 00, INTERIOR LIGHTING.
   3. Section 26 56 00, EXTERIOR LIGHTING.
   4. Section 26 09 43, NETWORK LIGHTING CONTROLS
   5. Section 26 09 23, OCCUPANCY SENSORS.

1.3 REFERENCES

A. Acceptance Testing Criteria: 2022 Building Energy Efficiency Standards Non-Residential Compliance Manual.

1.4 SYSTEM DESCRIPTION

A. Performance Requirements:
   1. All material, equipment, labor and technical supervision to perform tests, calibrations and documentation specified herein.

B. Scope of Testing, Evaluation and Calibration (as applicable):
   1. Automatic (master) time switches.
   2. Occupancy sensors.
   3. Automatic daylighting controls.
   4. Photo electric sensors.
   5. Outdoor astronomical time switches.
   6. Area controls.

1.5 SUBMITTALS

A. Submit in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.

B. Test Reports:
   1. Written record of all tests and completion of forms included in this section.
   2. At completion of project, assemble a final test report. Submit report to the enforcement agency and the Owner prior to final occupancy to include:
      a. Summary of project.
      b. Description of systems and equipment tested.
      c. Visual inspection report.
      d. Description of tests.
      e. Test results.
      f. Conclusions and recommendations.
   3. Report shall be bound in booklet form, include on the Contractor's letterhead the title of the report and the systems tested.

C. Constructability Plan Review
   1. The Contractor shall review the construction drawings and specifications to understand the scope of the acceptance tests and raise critical issues that might affect the success of the acceptance tests prior to starting construction. Any constructability issues associated with the lighting system should be forwarded to the design team for review/modifications prior to equipment procurement and installation. The Contractor shall submit on company letterhead, with the lighting control equipment required by Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL, 1.4B, a letter confirming that the constructability review has been completed and their company has reviewed and is prepared to complete the lighting acceptance testing required by this section.

PART 2 - PRODUCTS

2.1 FORMS

A. Lighting Installation forms and verification procedures for lighting systems that require acceptance testing can be downloaded from the following website: https://energycodeace.com/nonresidentialforms

B. Lighting Acceptance forms are to be provided by a Certified California Lighting Controls Acceptance Test Technician. The California Energy Commission adopted changes to the California building Efficiency Standards (Title 24, Parts 1 and 6) that require lighting controls and devices to be certified as properly installed and operational, prior to issuance of occupancy permits. All Acceptance Technicians must be employed by an Acceptance Test employer that provides support as well as quality control. Certified California Lighting Controls Acceptance

Test Technicians can be found at the following website: www.calctp.org/acceptance-technicians/contractors

C. These completed forms will be the deliverable product to the enforcement agency and Owner as described in 1.4 of this section.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Tests:
1. Contractor's Responsibilities:
a. Perform all required tests required by this section.
b. Schedule testing with building Owner.
c. Provide Installation forms
d. Acceptance forms provided by California Certified Lighting Controls Technician hired by Contractor.
e. Calibration of equipment such as light meters, photo electric controls, etc.
f. Programming of time switches (interior/exterior lighting) for operations as directed by the Owner.

3.2 ADJUSTING

A. Final Settings: The Contractor shall be responsible for implementing all final settings and adjustments on controls equipment as required for a complete and operating system.

END OF SECTION 26 56 70

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SECTION 26 77 00 - ASSISTIVE LISTENING SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide assisted listening systems as described herein.

1.2 SUBMITTALS

A. Submit in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.

PART 2 - PRODUCTS

2.1 Assisted Listening Systems

A. Provide, CBC Access compliant Assisted Listening Systems as follows:
   1. The project shall have at least one complete kit of assistive listening system (ALS):
      a. One Portable system consisting of a hard suitcase-style carrying case and containing:

         1) (1) Battery operated, belt (clip) FM transmitter unit.
         2) (4) Battery operated, belt clip receivers with headphones.
         3) (4) Battery operated, heavy-duty folding headphones.
         4) (1) mini lapel microphone.
         5) (1) Omnidirectional desktop conference microphone with 36” cord.
         6) (2) 18” neck loops for use with hearing aids or cochlear implants equipped with T-coil switch.
         7) (5) AA rechargeable Batteries.
         8) (1) hearing assistance wall plaque.

      b. The portable systems shall be stored in the Nipomo High School Administration Office available for check out. Refer to Architectural specifications for signage requirements at conference rooms and assembly areas.
      c. Acceptable Products: Williams Sound “FM ADA Kit 37 RCH”
         (1) PPA T46 FM Transmitter.
         (4) PPA R37N Receivers.
         (4) HED 027 headphones.
         (1) MIC 090 mini lapel clip microphone.
         (1) MIC 149 desktop conference mic.
         (1) CHG 3502 Charger
         (5) BAT 026-2 AA rechargeable batteries.
         (1) CCS 029 System carry case.
         (2) NKL 001 neck loops.
         (1) IDP 008 ADA wall plaque.

B. The entire system shall be one manufacturer and shall carry a 2-year (minimum) warranty. The system shall be as manufactured by Williams Sound Corp. or engineer approved equal.

C. The quantity of wireless headsets on-site shall satisfy the CBC 11B-219.3 requirement of 4% of the occupancy in the largest conference room and/or assembly area. Refer to architectural sheets for occupancy loads/types.

D. In accordance with California Building Code, Assistive Listening Devices shall comply with all requirements set forth in 11B-706.
   1. Receivers required for use with an Assistive Listening System shall include a 1/8-inch (3.2mm) standard mono jack.
   2. Receivers required to be hearing-aid compatible shall interface with telecoils in hearing aids through the provision of neck loops.
   3. Assistive listening systems shall be capable of providing a sound pressure level of 110dB minimum and 118dB maximum with a dynamic range on the volume control of 50dB.
   4. The signal-to-noise ratio for internally generated noise in assistive listening systems shall be 18dB minimum.
   5. Peak clipping shall not exceed 18dB of clipping relative to the peaks of speech.

E. In accordance with California Building Code, Assistive Listening Devices shall comply with all signage requirements set forth in 11B-216.10.
   1. Each assembly area required to provide assistive listening systems (portable or fixed) shall provide signs informing patrons of the availability of the assistive listening system. The sign shall include wording that states “Assistive-Listening System Available” and shall be posted in a prominent place at or near the assembly area entrance. Assistive listening signs shall comply with California Building Code (CBC) Section 11B-703.5 and shall include the International Symbol of Access for Hearing Loss complying with CBC Section 11B-703.7.2.4.

PART 3 - EXECUTION

3.1 COMMISSIONING

A. Train Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, and servicing of the system. Provide a minimum of 2 hours training. Operators Manuals and Users Guides shall be provided at the time of this training.

B. Schedule training with Owner through the Architect, with at least seven days advance notice.

END OF SECTION 26 77 00

SECTION 27 13 00 - INTERCOMMUNICATION SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section Includes:
   1. Telecommunications Cabling at the new or remodeled buildings for the project. Backbone and horizontal cabling comprised of copper and fiber cabling, and support systems are covered under this document.
   2. The Horizontal (workstation) Cabling System shall consist of a minimum of two (2) 4-pair Unshielded Twisted Pair (UTP) Copper Cables to each work area outlet unless otherwise noted for specific locations. The cables shall be installed from the Work Area Outlet to the Telecommunications Room (TR) located on the same floor, and routed to the appropriate rack serving that area and terminated as specified in this document.
   3. All cables and related terminations, support and grounding hardware shall be furnished, installed, wired, tested, labeled, and documented by the Telecommunications contractor as detailed in this document.
   4. Product specifications, general design considerations, and installation guidelines are provided in this document. Quantities of telecommunications outlets, typical installation details, cable routing and outlet types will be provided as an attachment to this document. If the bid documents are in conflict, this specification shall take precedence. The successful vendor shall meet or exceed all requirements for the cable system described in this document.

1.3 REGULATORY REFERENCES

A. All work and materials shall conform in every detail to the rules and requirements of the National Fire Protection Association, the local Electrical Code and present manufacturing standards.

B. All materials shall be UL Listed and shall be marked as such. If UL has no published standards for a particular item, then other national independent testing standards shall apply and such items shall bear those labels. Where UL has an applicable system listing and label, the entire system shall be so labeled.

C. All modular jacks, patch cords, consolidation point, and patch cords performance shall be verified (not just tested) by a third party to be category 6 or 6A component and channel compliant, as applicable to the component being installed.

D. The cabling system described in this is derived from the recommendations made in recognized telecommunications industry standards. The following documents are incorporated by reference:
   1. ANSI/TIA/EIA - 568-C.0, Generic Telecommunications Cabling for Customer Premises
   2. ANSI/TIA/EIA - 568-C.1, Commercial Building Telecommunications Cabling Standard.

3. ANSI/TIA/EIA - 568-C.2, Balanced Twisted Pair Cabling Components, Addendum 1 –
4. ANSI/TIA/EIA - 568-C.3, Optical Fiber Cabling Components
5. ANSI/TIA/EIA – 569-A, Commercial Building Standard for Telecommunications Pathways and Spaces, February, 1998.
6. ANSI/TIA/EIA – 606-A, Administration Standard for Telecommunications Infrastructure of Commercial Buildings, February, 2002.
7. ANSI/TIA/EIA – 607-A, Commercial Building Grounding and Bonding Requirements for Telecommunications, August, 1994.
8. ANSI/ TIA/EIA – 758, Customer-Owned Outside Plant Telecommunications Cabling Standard, April 1999.
9. BICSI - TDMM, Building Industries Consulting Services International, Telecommunications Distribution Methods Manual (TDMM) – 10th Edition, 2003.
10. National Fire Protection Agency (NFPA – 70), National Electrical Code (NEC) –2022.

E. If this document and any of the documents listed above are in conflict, then the more stringent requirement shall apply. All documents listed may not be the most current releases of the documents. The Contractor has the responsibility to determine and adhere to the most recent release when developing the proposal for installation.

F. This document does not replace any code, either partially or wholly. The contractor must be aware of local codes that may impact this project.

1.4 APPROVED CONTRACTOR

A. The Telecommunications Contractor must be a Certified Installer for the products and/or system being supplied. A copy of certification documents must be submitted with the quote in order for such quote to be valid. The Telecommunications contractor is responsible for workmanship and installation practices in accordance with said certification. At least (1) for every (3) members of the copper installation and termination crew must be certified to a Technician Level of training by the product manufacturer or BICSI. At least (1) for every (5) members of the optical fiber installation and termination crew must be certified by the product manufacturer or other approved organizations in Optical Fiber installation and termination practices.

1.5 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, and supplies and performing all operations necessary to complete the installation of this structured cabling system in compliance with the specifications and drawings. The Telecommunications contractor will provide and install all of the required material to form a complete system.

B. The work shall include, but not be limited to the following:
1. Furnish and install a complete telecommunications wiring infrastructure as described on the plans and in these specifications.
2. Furnish, install, and terminate all UTP and Optical Fiber cable.
3. Furnish and install all wall plates, jacks, patch panels, and patch cords.
4. Furnish and install all required cabinets and/or racks as required and as indicated.
5. Furnish any other material required to form a complete system.
6. Perform link testing (100% of horizontal and/or backbone links) and certification of all components.

7. Furnish test results of all cabling to the owner on disk and paper format, listed by each closet, then by workstation ID.
8. Adhere and comply with all requirements of the product certification programs.
9. Provide owner training and documentation. (Testing documentation and As-built drawings).

1.6 SUBMITTALS

A. Submit in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.

B. Under the provisions of this request for proposal, prior to the start of work the telecommunications contractor shall:
1. Submit copies of the certification of the company and names of staff that will be performing the installation and termination of the installation to provide proof of compliance of this spec.
2. Submit proof from manufacturer of contractor’s good standing in manufacturer’s program.
3. Submit appropriate cut sheets and samples for all products, hardware and cabling with highlighted or otherwise denoted specific products to be used. If product cut-sheets are submitted without specific products highlighted the engineer shall return submittal immediately with “Revise and Resubmit” response.

C. Work shall not proceed without the Owner's approval of the submitted items.

D. The telecommunications contractor shall receive approval from the Owners on all substitutions of material. No substituted materials shall be installed except by written approval from the Owner.

1.7 QUALITY ASSURANCE

A. The telecommunications contractor shall staff the project with qualified personnel. All products shall be new and in good condition.

1.8 DELIVERY, STORAGE AND HANDLING

A. Delivery and receipt of products shall be at the site described in the Scope Section.

B. Cable shall be stored according to manufacturer's recommendations as a minimum. In addition, cable must be stored in a location protected from vandalism and weather. If cable is stored outside, it must be covered with opaque plastic or canvas with provision for ventilation to prevent condensation and for protection from weather. If air temperature at cable storage location will be below 40 degrees F., the cable shall be moved to a heated (50 degrees F. minimum) location. If necessary, cable shall be stored off site at the contractor's expense.

C. If the telecommunications contractor wishes to have a trailer on site for storage of materials, arrangements shall be made with the Owner.

1.9 DRAWINGS

A. It shall be understood that the electrical details and drawings provided with the specification package are diagrammatic. They are included to show the intent of the specifications and to aid the telecommunications contractor in bidding the job. The telecommunications contractor shall make allowance in the bid proposal to cover whatever work is required to comply with the intent of the plans and specifications.

B. The telecommunications contractor shall verify all dimensions at the site and be responsible for their accuracy.

C. Prior to submitting the bid, the telecommunications contractor shall call the attention of the Engineer to any materials or apparatus the telecommunications contractor believes to be inadequate and to any necessary items of work omitted.

PART 2 - PRODUCTS

2.1 EQUIVALENT PRODUCTS

A. The Owner and engineer have selected specific products that achieve the desired level of performance and preference. The project has been designed around said products. Proposed substitutions must demonstrate equivalent performance in all areas to the satisfaction of the Owner and must be submitted for review at least 10 days prior to bid. The Owner shall not be required to entertain substitutions submitted after bid.

2.2 WORK AREA OUTLETS

A. Work area cables shall each be terminated at their designated work area location in the connector types described in the subsections below. Included are modular telecommunication jacks. These connector assemblies shall snap into a faceplate.

B. The Telecommunications Outlet Assembly shall accommodate:
1. A minimum of four (4) modular jacks.
2. Each modular jack shall match in color and category performance the incoming cable plant to each jack location. (i.e. – if incoming cable plant is a BLUE, Category 6 cable, the modular jack shall match Category 6 performance and shall also be BLUE in color).
3. Additional accommodations for specific locations as noted in the plans for optical fiber and/or additional copper cables as necessary.
4. A blank filler will be installed when extra ports are not used.
5. All modular jacks shall have their circuit number on the faceplate identifier strip.
6. Multiple jacks that are identified in close proximity on the drawings (but not separated by a physical barrier) may be combined in a single assembly. The telecommunications contractor shall be responsible for determining the optimum compliant configuration based on the products proposed.
7. The same orientation and positioning of jacks and connectors shall be utilized throughout the installation. Prior to installation, the telecommunications contractor shall submit the proposed configuration for each outlet assembly for review by the Owner.
8. The modular jack shall incorporate printed label strip on the dust cap module for identifying the outlet. Printed labels shall be permanent and compliant with

ANSI/TIA/EIA–606-A standard specifications. Labels shall be printed using a printer such as a Brady hand held printer. Hand printed labels shall not be accepted.

C. Faceplates: The faceplates shall:
1. Be as appropriate to fit the modular jack used.
2. Be UL listed and CSA certified.
3. Be constructed of type 302 stainless steel (except where noted otherwise).
4. Shall match the faceplate color used for other utilities in the building or match the color of the raceway if installed in surface raceway.
5. Be compliant with the above requirements along with the following when incorporating optical fiber:
   a. Be a low profile assembly,
   b. Incorporate a mechanism for storage of cable and fiber slack needed for termination,
   c. Position the fiber optic couplings to face downward or at a downward angle to prevent contamination and,
   d. Incorporate a shroud that protects the optical couplings from impact damage.
6. Be available as single-gang or dual-gang.
7. Provide easy access for adds, moves, and changes by front removal of jack modules.
8. Possess recessed designation windows to facilitate labeling and identification.
9. Include a clear plastic cover to protect labels in the designation window.
10. Have mounting screws located under recessed designation windows.
11. Comply with ANSI/TIA/EIA-606-A work area labeling standard.
12. Allow for the UTP modules to be inverted in place for termination purposes.
13. Be manufactured by an ISO 9001 registered company.

D. Voice / Data Jacks
1. Voice/Data jacks, also known as telecommunications jacks, shall be 8-position modular jacks and shall be Category 6 or 6A performance (as matching the installed cable plant) as defined by the references in this document including ANSI/TIA/EIA-568-C.2. All pair combinations must be considered, with the worst-case measurement being the basis for compliance. Modular jack performance shall be third-party verified by a nationally recognized independent testing laboratory.
2. The modular jack shall use dual reactance modular contact array.
3. The modular jack shall be both component, link and channel compliant to category specifications in ANSI/TIA/EIA-568-C.
4. The modular jack's performance shall be third-party verified to ANSI/TIA/EIA-568-C Category 6 or Category 6A specifications (as appropriate to match the installed cable plant).
5. The modular jack shall have low emission IDC contacts.
6. The modular jack shall use standard termination practice using 110 impact tool or manufacturer approved tool using trained technician.
7. The modular jack shall be backwards compatible to Category 3, 5, 5e, and 6.
8. The modular jack shall be center tuned to category 6 or category 6A test specifications (as appropriate to match the installed cable plant).
9. Dust covers shall be used on each termination.

2.3 MODULAR PATCH PANELS

A. The Modular Patch Panels shall:
1. Meet category 6A component compliance and be verified by a third-party nationally recognized independent testing laboratory.

2. Use low emission IDC contacts.
3. Use dual reactance technology to enhance the signal-to-noise ratio.
4. Require standard termination practices using a 110 impact tool or manufacturer approved termination tool.
5. Use a single piece IDC housing designed to accept larger Category 6A conductors.
6. Support both T568B and T568A wiring.
7. Include easy to follow wiring labels.
8. Include label fields.
9. Allow for the use of icons.
10. Include full length metal rear cable management.
11. Be available in standard or high density. Installation shall prefer standard density.
12. Be backward compatible to category 3, 5, 5e, and 6.
13. Be center tuned to category 6A test specifications.
14. Design Make:
    a. Leviton 49255-H24, 24-port patch panel suitable for Category 6A applications.

2.4 RACKS

A. All racks and wire management shall be of one manufacturer or designed specifically to work together. The equipment rack shall provide vertical cable management and support for the patch cords at the front of the rack and wire management, support, and protection for the horizontal cables inside the legs of the rack. Waterfall cable management shall be provided at the top of the rack for patch cords and for horizontal cables entering the rack channels for protection and to maintain proper bend radius and cable support. Wire management shall also be mounted above each patch panel and/or piece of equipment on the rack. The rack shall include mounting brackets for cable tray ladder rack to mount to the top of the rack. Velcro cable ties shall be provided inside the rack channels to support the horizontal cable. Rack shall be black in color to match the patch panels and cable management.

B. Free-Standing Rack
    1. Free-standing rack shall:
        a. Provide the necessary strain relief, bend radius and cable routing for proper installation of high performance cross connect products, meeting all specifications of ANSI/TIA/EIA-568-C.
            1) Rear channels to securely route distribution cables.
            2) Vertical management “cage” to protect patch cords while allowing easy access for moves, adds and change with individual 1-rack unit fingers and double hinged door.
            3) Include speednuts to reduce assembly time.
        b. Have top cable trough with waterfall and built in patch/horizontal cable distribution separator.
        c. Have EIA hole pattern on front and rear.
        d. Have rack units stamped on the front, on both sides allowing numbering from top-to-bottom or bottom-to-top.
        e. Be available with a 10.5” or 16.25” channel depth.
        f. Be available with hook and loop straps for securing bulk cables inside the vertical U-channels.
        g. Assemble as 19” (483 mm) or 23” (584 mm) with no additional hardware.
        h. Be available with three styles of vertical patch cord management: interbay with latches, cable management rings, or fingerduct with covers.
        i. Provide floor and ceiling access for cable management and distribution.
        j. Provide pre-drilled base for floor attachment of rack.

k. Be available in a 7 foot version (45 rack units) or an 8 foot version (51 rack units).
l. Be available in standard color of black.
m. Be manufactured by an ISO 9001 registered company.

C. Wall Mounted Rack
1. Wall mounted rack shall be one of two types of cabinets with requirements as listed below.
2. Large – surface mounted, enclosed cabinet with tinted front glass, such that I.T. equipment is mounted parallel with finished floor. This type of rack shall be used only where the installed location is normally unoccupied by students, or as noted on plans. Large wall mounted rack shall:
   a. Provide the necessary strain relief, bend radius and cable routing for proper installation of high performance cross connect products, meeting all specifications of ANSI/TIA/EIA-568-C.
   b. Have top cable trough to route patch and distribution cables between racks.
   c. Have EIA hole pattern on front and rear.
   d. Rack height shall be specified as 36” or 4.0 ft/1.22 m (22 rack units).
   e. Be available with a 6.5” (165 mm) or 14” (356 mm) channel depth.
   f. Be available with hook and loop straps for securing cables inside the vertical U-channels.
   g. Be available with vertical cable management rings for cord routing organization and strain relief.
   h. Be available with vertical U-channels to protect and conceal distribution cables.
   i. Provide floor and ceiling access for cable management and distribution.
   j. Have wall mount braces with locator posts for easy wall mounting.
   k. Have side access points that allow for access to manage/install distribution cables in the vertical channels.
   l. Be available in standard color of black.
   m. Be available with double-hinge for easy access to rear of equipment and incoming cable plant.
   n. Be manufactured by an ISO 9001 registered company.
   o. Be installed with additional accessories as follows:
      1) Ground bus kit for equipment and enclosure bonding.
      2) Thermostatically controlled fan kit with integral filter.
   p. Approved manufacturers of large wall mounted racks are: Chatsworth Cube-IT with tinted front glass.
3. Small – surface mounted, enclosed cabinet with minimal depth from finished wall, such that I.T. equipment is mounted perpendicular with finished floor. This type of rack shall be used only where installed location is normally occupied by staff or students, or as noted on plans. Small wall mounted rack shall:
   a. Provide the necessary strain relief, bend radius and cable routing for proper installation of high performance cross connect products, meeting all specifications of ANSI/TIA/EIA-568-C.
   b. Have top cable trough to route patch and distribution cables between racks.
   c. Have EIA hole pattern on top and bottom, including door mounting, if applicable.
   d. Cabinet height shall be specified as 42”, which shall contain (5) rack units for equipment and (4) rack units for patch panel space.
   e. Be available with a 6.5” (165 mm) or 14” (356 mm) channel depth.
   f. Be available with hook and loop straps for securing cables inside the vertical U-channels.

g. Be available with cable management rings for cord routing organization and strain relief.
h. Provide floor and ceiling access for cable management and distribution.
i. Have wall mount braces with locator posts for easy wall mounting.
j. Have side access points that allow for access to manage/install distribution cables in the vertical channels.
k. Be available in standard color of black.
l. Be manufactured by an ISO 9001 registered company.
m. Be installed with additional accessories as follows:
   1) Ground bus kit for equipment and enclosure bonding.
   2) Thermostatically controlled fan kit with integral filter.
n. Approved manufacturers of small wall mounted racks are: Hubbell RE-BOX "RE4X" unless otherwise noted.

2.5 HORIZONTAL DISTRIBUTION CABLE

A. All horizontal data station cable and voice cable shall terminate on modular patch panels (copper or fiber), 110 cross-connecting blocks (copper), or patch/splice cabinets (fiber) in their respective Telecommunications Room or Equipment Room as specified on the drawings.

B. 100 OHM Category 6 UNSHIELDED TWISTED PAIR CABLE (UTP)
1. Physical Characteristics:
   a. The diameter of the insulated conductor shall be .023 in. maximum.
   b. The outer jacket of the overall cable shall be BLUE in color.
   c. Shall consist of (4) twisted pairs.
   d. Shall be suitable for the environment in which they are to be installed.
   e. The color coding of pairs shall be in accordance with T-568B:
      Pair 1 Pair 2 Pair 3 Pair 4
      W-BL; BLW-O; O W-G; G W-BR; BR
   f. The overall diameter of the cable shall be 0.230"nominal.
   g. The ultimate breaking strength measured in accordance with ASTM D 4565 shall be 400 N minimum.
   h. Cable shall withstand a bend radius of 1" at -20 degrees Celsius without jacket or insulation cracking.
   i. Cable shall be third party verified to meet ANSI/TIA/EIA-568-C.2.
2. Transmission Characteristics:
   a. DC resistance of any conductor shall not exceed 9.38 Ohms per 100m max. at 20°C. Measured in accordance with ASTM D 4566.
   b. The mutual capacitance of any pair at 1 kHz for 100m of cable shall not exceed 4.4 Nf.
   c. DC resistance unbalance between any two conductors of any pair shall not exceed 3% when measured at or corrected to 20°C in accordance with ASTM D 4566.
   d. The capacitance unbalance to ground at 1 kHz of any pair shall not exceed 330 pF per 100m.
3. Cable shall be Berk-Tek LANmark-1000 UTP or approved equal.
4. Cable installed underground/below slab in conduit shall be Berk-Tek LANmark-6 OSP (wet location) or approved equal.

C. 100 OHM Category 6A UNSHIELDED TWISTED PAIR CABLE (UTP)
1. Physical Characteristics:
   a. The diameter of the insulated conductor shall be .023 in. maximum.
   b. The outer jacket of the overall cable shall be WHITE in color.

c. Shall consist of (4) twisted pairs.
d. Shall be suitable for the environment in which they are to be installed.
e. The color coding of pairs shall be in accordance with T-568B:
Pair 1 Pair 2 Pair 3 Pair 4
W-BL; BLW-O; O W-G; G W-BR; BR
f. The overall diameter of the cable shall be 0.320" nominal.
g. The ultimate breaking strength measured in accordance with ASTM D 4565 shall be 400 N minimum.
h. Cable shall withstand a bend radius of 1.2" at -20 degrees Celsius without jacket or insulation cracking.
i. Cable shall be third party verified to meet ANSI/TIA/EIA-568-C.2.

2. Transmission Characteristics:
a. DC resistance of any conductor shall not exceed 9.38 Ohms per 100m max. at 20°C. Measured in accordance with ASTM D 4566.
b. The mutual capacitance of any pair at 1 kHz for 100m of cable shall not exceed 5.1 Nf.
c. DC resistance unbalance between any two conductors of any pair shall not exceed 3% when measured at or corrected to 20°C in accordance with ASTM D 4566.
d. The capacitance unbalance to ground at 1 kHz of any pair shall not exceed 330 pF per 100m.

3. Cable shall be Berk-Tek LANMARK RDT or approved equal.
4. Cable installed underground/below slab in conduit shall be Berk-Tek LANmark 10G OSP series category 6A (wet location) or approved equal.

2.6 FIBER OPTIC CABLE

A. MULTIMODE FIBER: Indoor/Outdoor Optical Fiber Non-Conductive Loose Tube with Laser Enhanced 50/125 Optical Fibers

1. Each Multimode Fiber shall be:
a. Graded-index optical fiber wave-guide with nominal 50/125um-core/cladding diameter, OM4 or better industry rating.
b. The fiber shall comply with the latest revision of ANSI/EIA/TIA-4920000.
c. Attenuation shall be measured in accordance with ANSI/EIA/TIA-455-46, 53 or 61.
d. Information transmission capacity shall be measured in accordance with the latest revision of ANSI/EIA/TIA-455—204.
e. The measurements shall be performed at 23 degrees C +/- 5 degrees.
f. Maximum attenuation dB/Km @ 850/1300 nm: 3.5/1.5.
g. Bandwidth 4700 MHz-km @ 850nm.
h. Bandwidth 500 MHz-km @ 1300nm.
i. Optical Fiber shall be laser optimized and guarantee Gigabit Ethernet distances of 750m/600m for 850nm and 1300nm respectively and 10 gigabit distances of min. 300m for both 850nm and 1300nm.
j. Be used for Fire Alarm applications only and shall be provided in Red jacket color.

2. Physical Characteristics:
a. Shall be suitable for use in both outdoor and indoor applications without the use of a transition at the building entrance.
b. Shall be suitable for use in risers, plenums and horizontal applications.
c. Shall have a dry water blocking system for cable core and buffer tubes.
d. Shall be available with a fiber strand count range from 6 to 72.
e. Shall have a 3.0 mm sub-unit diameter.
f. Shall have and be marked with an UL-OFNP and OFN FT6 Flame Rating.
g. Shall comply with the requirements of ICEA S-83-596 & ANSI/ICEA S-87-640.

h. Strength members shall be dielectric and may be either fiberglass or aramid yarn.
i. Suitable for underground or aboveground conduits.
j. Loose Tube fibers shall be color coded in accordance with EIA / TIA 598 with an overall dark blue jacket.
k. Shall have a ripcord for overall jacket.
l. Suitable for operation between -40° to +75° C.
m. Shall be UV resistant.
n. Shall be of an all dielectric design.
o. Shall have a maximum installation tension of 300 lbs for cables without dielectric strength member and 600 lbs for cables with dielectric strength members.

3. Design Make:
   a. Berk-Tek “Adventum” optical fiber cable with GIGAlite-10FB 50/125 micron fiber or approved equal.

B. SINGLEMODE FIBER: Indoor/Outdoor Optical Fiber Non-Conductive Plenum (OFNP) Loose Tube with Laser Enhanced 9/125 Optical Fibers

1. Each Singlemode Fiber shall be:
   a. Graded-index optical fiber wave-guide with nominal 9/125um-core/cladding diameter, OS2 or better industry rating.
   b. The fiber shall comply with the latest revision of ANSI/EIA/TIA-4920000.
   c. Attenuation shall be measured in accordance with ANSI/EIA/TIA-455-46, 53 or 61.
   d. Information transmission capacity shall be measured in accordance with the latest revision of ANSI/EIA/TIA-455—204.
   e. The measurements shall be performed at 23 degrees C +/- 5 degrees.
   f. Maximum attenuation dB/Km @ 1310/1550 nm: 0.4/0.3.
   g. Optical Fiber shall be laser optimized and guarantee Gigabit Ethernet distances of >5000m for 1310nm and 10 Gigabit Ethernet distances of >5000m for 1310nm.
   h. Used for data systems and data distribution exclusively
   i. Provided in Jacket color Black or Yellow
2. Physical Characteristics:
   a. Shall be suitable for use in both outdoor and indoor applications without the use of a transition at the building entrance.
   b. Shall be suitable for use in risers, plenums and horizontal applications.
   c. Shall have a dry water blocking system for cable core and buffer tubes.
   d. Shall be available with a fiber strand count range from 6 to 72.
   e. Shall have a 3.0 mm sub-unit diameter.
   f. Shall have and be marked with an UL-OFNP and OFN FT6 Flame Rating.
   g. Shall comply with the requirements of ICEA S-83-596 & ANSI/ICEA S-87-640.
   h. Strength members shall be dielectric and may be either fiberglass or aramid yarn.
   i. Suitable for underground or aboveground conduits.
   j. Loose Tube fibers shall be color coded in accordance with EIA / TIA 598 with an overall dark blue jacket.
   k. Shall have a ripcord for overall jacket.
   l. Suitable for operation between -40° to +75° C.
   m. Shall be UV resistant.
   n. Shall be of an all dielectric design.
   o. Shall have a maximum installation tension of 300 lbs for cables without dielectric strength member and 600 lbs for cables with dielectric strength members.
3. Design Make:
   a. Berk-Tek “Adventum” OS2 optical fiber cable (Singlemode-AB) with 9/125 micron fiber or approved equal

2.7 FIBER OPTIC CONNECTORS

A. LC Fiber Optic Connectors:
   1. Each LC fiber optical connector shall be factory terminated onto a factory cut and polished “Pig-Tail” in preparation for field termination by fusion splice only. Mechanical field terminations or gel-matched connector types will not be permitted.
   2. Each LC Fiber Connector shall:
      a. Be a pre-polished fiber connector with a fiber stub or field-polish fiber connector.
      b. Be available in single mode and multimode versions.
      c. Have a domed zirconia ferrule.
      d. Be a PC polish type connector.
      e. Accept a nominal fiber diameter of 125 micrometers.
      f. Have a typical insertion loss of 0.1 dB for multimode and 0.1 dB for single mode.
      g. Have repairable tips.
      h. Have an insertion loss change of less than 0.2 dB after 500 reconnects.
      i. Be stable over an operating range of –40C to +75 degrees C.
   3. Design Make:
      a. Leviton LC Fiber Optic Connectors on pre-terminated pig-tails or approved equal.
      b. Fiber optic pigtails shall be fusion spliced only in submitted and approved fiber optic splice trays and enclosures.

2.8 FIBER OPTIC SPLICE ENCLOSURES

A. All incoming fiber optic cable shall be fusion spliced to pre-terminated and polished “pig-tails” as noted above. This fusion splice shall be mechanically protected using a splice enclosure with modular fiber patching bulk-heads. Each fiber optic splice enclosure shall be mounted inside a physically secure cabinet, or mounted to a free-standing rack inside an IT designated area on premises. Each fiber optic splice enclosure shall:
   1. Be able to use interchangeable bulk-heads for both single-mode and multi-mode patching.
   2. Be able to hold one or more 12-strand splice trays
   3. Splice trays shall be:
      a. Capable of handling maximum of 12 fiber splices per tray, including heat-shrink.
      b. Capable of being stacked for using in multi-tray installations
   4. Contain integral strain-relief for installed fiber plant.
   5. Be installed with all un-used positions in fiber bulk-heads populated with dust-caps.
   6. Be manufactured by an ISO 9001 registered company
   7. Design Make:
      a. Installations with 12 or fewer strands shall use Corning “SPH-01P”
      b. Installations with more than 12 strands shall use Leviton OPT-X 1000i series

2.9 PATCH CORDS

A. The contractor shall provide factory terminated and tested UTP and optical fiber patch cords and equipment cords for the complete cabling system. The UTP patch cables shall meet the requirements of ANSI/TIA/EIA-568-B for patch cord testing.

B. Copper (UTP) patch cords shall:
   1. Use 8-position connector with impedance matched contacts and designed using dual reactance.

2. Be constructed of 100 ohm, 4 pair stranded conductor, unshielded twisted pair copper per the requirements of the ANSI/TIA/EIA-568-B.2 and ANSI/TIA/EIA-568-B.2–1 standard.
3. Meet TIA category 6 or 6A (corresponding to the matching cable plant) component specifications in ANSI/TIA/EIA-568-B.2-1
4. 100% factory tested to meet category 6 or 6A corresponding to the matching cable plant performance.
5. ETL or any other nationally recognized 3rd party verification
6. Be center tuned to category 6A performance specifications by using paired bi-level contact array.
7. Be capable of universal T568A or T568B wiring schemes.
8. Modular connector shall maintain the paired construction of the cable to facilitate minimum untwisting of the wires.
9. Have a performance marking indelibly labeled on the jacket (by the manufacturer).
10. Have the ability to accept color-coded labels and icons to comply with ANSI/TIA/EIA-606-A labeling specifications.
11. Have “snagless” protection for the locking tab to prevent snagging and to protect locking tab in tight locations and provide bend relief.
12. Be provided and installed in colors that match installed cable plant.
    a. Cables with Category 6 performance shall be BLUE.
    b. Cables with Category 6A performance shall be WHITE.
13. Be available in 3 foot, 5 foot, 7 foot, 9 foot, and 15 foot standard lengths.
14. Be backwards compatible to Category 3, 5 and 5e.
15. Be manufactured by an ISO 9001 registered company.

C. Optical Fiber patch cords shall:
1. Contain two (2) multi-mode or single mode optical fibers, corresponding with the matching installed cable plant.
2. Use multi-mode, graded-index fibers with a 50 micron core or use single mode fibers with a 9 micron core, corresponding with installed cable plant.
3. Be capable of transmission at both 850 nm and 1300 nm wavelengths for multi-mode and 1310 nm and 1550 nm for single-mode.
4. Include listing of actual loss of patchcord when packaged.
5. Be manufactured in standard lengths of 1 m (3.27 ft), 2 m (6.56 ft), 3 m (9.84 ft), 4 m (13.11 ft), 7 m (22.95 ft), and 10 m (32.79 ft), and special ordered in any other lengths.
6. Be manufactured by an ISO 9001 registered company.

2.10 GROUNDING AND BONDING

A. The facility shall be equipped with a Telecommunications Bonding Backbone (TBB). This backbone shall be used to ground all telecommunications cable shields, equipment, racks, cabinets, raceways, and other associated hardware that has the potential to act as a current carrying conductor. The TBB shall be installed independent of the building’s electrical and building ground and shall be designed in accordance with the recommendations contained in the ANSI/TIA/EIA-607 Telecommunications Bonding and Grounding Standard.

B. The main entrance facility/equipment room in each building shall be equipped with a telecommunications main grounding bus bar (TMGB). Each telecommunications room shall be provided with a telecommunications ground bus bar (TGB). The TMGB shall be connected to the building electrical entrance grounding facility. The intent of this system is to provide a grounding system that is equal in potential to the building electrical ground system. Therefore,

ground loop current potential is minimized between telecommunications equipment and the electrical system to which it is attached.

C. All racks, metallic backboards, cable sheaths, metallic strength members, splice cases, cable trays, ungrounded conduits, etc. entering or residing in the TR or ER shall be grounded to the respective TGB or TMGB using a minimum #6 AWG stranded copper bonding conductor and compression connectors.

D. All wires used for telecommunications grounding purposes shall be identified with a green insulation. Non-insulated wires shall be identified at each termination point with a wrap of green tape. All cables and bus bars shall be identified and labeled in accordance with the System Documentation Section of this specification.

2.11 FIRESTOP

A. A firestop system is comprised of the item or items penetrating the fire rated structure, the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure. Firestop systems comprise an effective block for fire, smoke, heat, vapor and pressurized water stream.

B. All penetrations through fire-rated building structures (walls and floors) shall be sealed with an appropriate firestop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating item i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly firestopped.

C. Firestop systems shall be UL Classified to ASTM E814 (UL 1479) and shall be approved by a qualified Professional Engineer (PE), licensed (actual or reciprocal) in the state where the work is to be performed. A drawing showing the proposed firestop system, stamped/embossed by the PE shall be provided to the Owner’s Technical Representative prior to installing the firestop system(s).

PART 3 - EXECUTION

3.1 WORK AREA OUTLETS

A. Cables shall be coiled in the in-wall or surface-mount boxes if adequate space is present to house the cable coil without exceeding the manufacturer’s bend radius. In hollow wall installations where box-eliminators are used, excess wire can be stored in the wall. No more than 12” of UTP and 12” of fiber slack shall be stored in an in-wall box, modular furniture raceway, or insulated walls. Excess slack shall be loosely coiled and stored in the ceiling above each drop location when there is not enough space present in the outlet box to store slack cable.

B. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA-568-C.0 document, manufacturer's recommendations and best industry practices.

C. Pair untwist at the termination shall not exceed 12 mm (one-half inch).

D. Bend radius of the horizontal cable shall not be less than 4 times the outside diameter of the UTP cable.

E. The cable jacket shall be maintained to within 25mm (one inch) of the termination point.

F. Data jacks, unless otherwise noted in drawings, shall be located in the bottom position(s) of each faceplate. Data jacks in horizontally oriented faceplates shall occupy the right-most position(s).

G. Voice jacks shall occupy the top position(s) on the faceplate. Voice jacks in horizontally oriented faceplates shall occupy the left-most position(s).

3.2 HORIZONTAL DISTRIBUTION CABLE INSTALLATION

A. Cable shall be installed in accordance with manufacturer's recommendations and best industry practices.

B. A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in any conduit.

C. Cable raceways shall not be filled greater than the ANSI/TIA/EIA-569-A maximum fill for the particular raceway type or 40%.

D. Cables shall be installed in continuous lengths from origin to destination (no splices) except for transition points, or consolidation points.

E. Where transition points, or consolidation points are allowed, they shall be located in accessible locations and housed in an enclosure intended and suitable for the purpose.

F. The cable's minimum bend radius and maximum pulling tension shall not be exceeded.

G. If a J-hook or trapeze system is used to support cable bundles all horizontal cables shall be supported at a maximum of 48 to 60 inch (1.2 to 1.5 meter) intervals. At no point shall cable(s) rest on acoustic ceiling grids or panels.

H. Horizontal distribution cables shall be bundled in groups of no more than 50 cables. Cable bundle quantities in excess of 50 cables may cause deformation of the bottom cables within the bundle and degrade cable performance.

I. Cable shall be installed above fire-sprinkler systems and shall not be attached to the system or any ancillary equipment or hardware. The cable system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.

J. Cables shall not be attached to ceiling grid or lighting fixture wires. Where support for horizontal cable is required, the contractor shall install appropriate carriers to support the cabling.

K. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the contractor prior to final acceptance at no cost to the Owner.

L. Cables shall be identified by a self-adhesive label in accordance with the System Documentation Section of this specification and ANSI/TIA/EIA-606-A. The cable label shall be applied to the cable behind the faceplate on a section of cable that can be accessed by removing the cover plate.

M. Unshielded twisted pair cable shall be installed so that there are no bends smaller than four times the cable outside diameter at any point in the run and at the termination field.

N. Pulling tension on 4-pair UTP cables shall not exceed 25-lbf for a four-pair UTP cable.

O. Cables installed underground or below slab shall be suitable for use in wet locations and outdoors in duct or conduit. If wet location cable is exposed in the building after exiting the wet area, it must transition to an appropriate category dry cable within 50 feet (15m) of exiting conduit.

3.3 HORIZONTAL COPPER TERMINATION AND INSTALLATION

A. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA-568-C standard, manufacturer's recommendations and best industry practices.

B. Pair untwist at the termination shall not exceed 13 mm (0.5 inch).

C. Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.

D. Cables shall be neatly bundled and dressed to their respective panels or blocks. Each panel or block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.

E. The cable jacket shall be maintained as close as possible (within 25mm – 1 inch) to the termination point.

F. Each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support ties. Cables labeled within the bundle, where the label is obscured from view shall not be acceptable.

3.4 OPTICAL FIBER TERMINATION HARDWARE

A. Fiber slack shall be neatly coiled within the fiber splice tray or enclosure. No slack loops shall be allowed external to the fiber panel.

B. Each cable shall be individually attached to the respective splice enclosure by mechanical means. The cables strength member shall be securely attached the cable strain relief bracket in the enclosure.

C. Each fiber bundle shall be stripped upon entering the splice tray and the individual fibers routed in the splice tray.

D. Each cable shall be clearly labeled at the entrance to the splice enclosure. Cables labeled within the bundle shall not be acceptable.

E. A maximum of 12 strands of fiber shall be spliced in each tray.

F. All spare strands shall be installed into spare splice trays.

G. All terminated strands shall be accounted on patch-panel labels which follow District labelling standards.

H. All un-used fiber positions in fiber termination bulk-head (also known as adapter plate) shall be populated with manufacturer provided dust caps.

3.5 BACKBONE CABLE INSTALLATION

A. Backbone cables shall be installed separately from horizontal distribution cables

B. A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in any conduit.

C. Where cables are housed in conduits, the backbone and horizontal cables shall be installed in separate conduits

D. Where backbone cables are installed in an air return plenum, riser rated cable shall be installed in metallic conduit.

E. Where backbone cables and distribution cables are installed in a cable tray or wireway, backbone cables shall be installed first and bundled separately from the horizontal distribution cables.

F. All backbone cables shall be securely fastened to the sidewall of the TR on each floor.

G. Backbone cables spanning more than three floors shall be securely attached at the top of the cable run with a wire mesh grip and on alternating floors or as required by local codes.

H. Vertical runs of cable shall be supported to messenger strand, cable ladder, or other method to provide proper support for the weight of the cable.

I. Large bundles of cables and/or heavy cables shall be attached using metal clamps and/or metal banding to support the cables.

3.6 RACKS

A. Racks shall be securely attached to the concrete floor using a minimum 3/8” hardware or as required by local codes.

B. Racks shall be placed with a minimum of 36-inch clearance from the walls on all sides of the rack. When mounted in a row, maintain a minimum of 36 inches from the wall behind and in front of the row of racks and from the wall at each end of the row.

C. All racks shall be grounded to the telecommunications ground bus bar in accordance with Section 3.8 of this document.

D. Rack mount screws not used for installing patch panels and other hardware shall be bagged and left with the rack upon completion of the installation.

E. Wall mounted termination block fields shall be mounted on 4’ x 8’ x .75” void free plywood. The plywood shall be mounted vertically 12” above the finished floor. The plywood shall be painted with two coats of white fire retardant paint.

F. Wall mounted termination block fields shall be installed with the lowest edge of the mounting frame 18” from the finished floor.

3.7 FIRESTOP SYSTEM

A. All firestop systems shall be installed in accordance with the manufacturer’s recommendations and shall be completely installed and available for inspection by the local inspection authorities prior to cable system acceptance.

3.8 GROUNDING SYSTEM

A. The TBB shall be designed and/or approved by a qualified PE, licensed in the state that the work is to be performed. The TBB shall adhere to the recommendations of the ANSI/TIA/EIA-607 standard, and shall be installed in accordance with best industry practice.

B. Installation and termination of the main bonding conductor to the building service entrance ground shall be performed by a licensed electrical contractor.

3.9 IDENTIFICATION AND LABELING

A. The contractor shall provide and install a complete labeling system for the intercommunications installation in accordance with ANSI/TIA/EIA-606A, and identified using the following methodology:
   1. FACEPLATES (Workstation Outlets): Faceplates in work areas shall be labeled consecutively starting at “1” and incrementing moving in a clockwise motion around each room. Index “1” in each room shall begin at the occupant entrance to the room and shall increment at each occurrence of a new/different faceplate in a clockwise and outermost-to-innermost pattern (spiraling inward). In this manner, labeling of wall outlets will be done first, and floor-boxes will be labeled next.
      a. The following special configuration prefixes shall be used in front of the nameplate index and port position:
         1) Wireless Access Points: shall have additional “WAP” prefix to the index assigned by method 1 above. (Example: WAP2A and WAP2B may share a 2-port biscuit)
         2) IP enabled speakers: shall have additional “SPK” prefix to the index assigned by method 1 above. (Example: SPK3A)
         3) IP enabled cameras: shall have additional “CAM” prefix to the index assigned by method 1 above. (Example: CAM1A)
      b. Labeling within each faceplate (or biscuit): Each modular jack shall be identified by a letter to index the individual port within any faceplate, starting at the letter “A”. Each port shall be indexed starting in the upper-left and incrementing right-to-left first and then top-to-bottom.
   2. RACK EQUIPMENT: Intermediate Distribution Frames (IDF) and Main Distribution Frames (MDF) shall be labeled according to their District-wide recognized room name at the time of installation. The IDF or MDF shall be labelled according to the following naming template:

a. Small telecom cabinet shall be of the format: “TIC” <ROOM NAME> (Example: TIC901B is a small IDF cabinet in room 901B).
b. Large telecom cabinet or IDF rack shall be of the format: “IDF” <ROOM NAME> (Example: “IDF1205” for a free-standing 2-post rack in room 1205)
c. MDF room equipment shall be of the format: “MDF” <ROOM NAME> (Example: “MDF-LIB01” for the main distribution frame in room LIB01)
d. During construction, a room name may not correspond to the District recognized room name, therefore Contractor shall seek approval from District IT for recognized room names prior to start of labeling.
e. If more than one rack within the IDF or MDF is installed, contractor shall seek special instructions on naming conventions.

B. The labeling system shall clearly identify all components of the system: racks, cables, panels and outlets. The labeling system shall designate the cables origin and destination within the system. Racks and patch panels shall be labeled to identify the location within the cable system infrastructure. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme. Labeling shall follow the guidelines of ANSI/TIA/EIA-606-A.

C. Outside Plant cables passing through a pull box or vault shall have a cable label that is water and mud proof.

D. All label printing will be machine generated by Ortronics LabelMo, or similar software, using indelible ink ribbons or cartridges. Self-laminating labels will be used on cable jackets, appropriately sized to the OD of the cable, and placed within view at the termination point on each end. Outlet, patch panel and wiring block labels shall be installed on, or in, the space provided on the device.

3.10 FIBER OPTIC DATA CHANNEL

A. All fiber optic strands within a fiber optic cable shall be installed so as to complete an end-to-end, full-duplex data channel, known as the cable plant. The cable plant shall only be connected at each end to active optical networking equipment/electronics via one patch cable at each end of the installed cable plant. Cable plant shall not be “cross-patched” from one fiber pair to another, even at a specified fiber bulk-head, without explicit approval from Engineer and Owner.

B. Data throughput shall only be limited by the characteristics of the cable or the capability of the active electronics equipment attached. Cable shall not be limited by channel disturbances, such as kinks, breaks, tears, lossy splices, mating optical patches, etc.

C. Where plans or specifications call for additions or modifications to an existing fiber channel, Contractor shall only complete the addition or modification using approved fiber optic cable fusion splices, in submitted and approved termination enclosures.

3.11 HORIZONTAL COPPER DATA CHANNEL

A. All 4-pair, 8-position copper data cables (Category cabling) shall be installed as a complete end-to-end, full duplex ethernet channel, known as the cable plant. The cable plant shall only be connected at each end to active networking equipment/electronics via one patch cable at each

end of the installed cable plant. Cable plant shall not be “cross-patched” from one ethernet cable to another without explicit approval from Engineer and Owner.

B. Data throughput shall only be limited by the characteristics of the cable or the capability of the active electronics equipment attached. Cable shall not be limited by channel disturbances, such as kinks, breaks, tears, additional patch cables, additional punch-downs, etc.

C. Where plans or specifications call for additions or modifications to an existing data channel, Contractor shall only complete the addition or modification using approved fiber optic cable fusion splices, in submitted and approved termination enclosures.

3.12 TESTING AND ACCEPTANCE

A. General
1. All cables and termination hardware shall be 100% tested for defects in installation and to verify cabling system performance under installed conditions according to the requirements of ANSI/TIA/EIA-568-B. All pairs of each installed cable shall be verified prior to system acceptance. Any defect in the cabling system installation including but not limited to cable, connectors, feed through couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors in all cables installed.
2. All cables shall be tested in accordance with this document, the ANSI/TIA/EIA standards, the Certification Program Information Manual provided by the product manufacturer and best industry practice. If any of these are in conflict, the Contractor shall bring any discrepancies to the attention of the project team for clarification and resolution.

B. Copper Link Testing
1. All twisted-pair copper cable links shall be tested for continuity, pair reversals, shorts, opens and performance as indicated below. Additional testing is required to verify Category performance.
2. Horizontal cabling shall be tested using a Level III test unit for category 6 and category 6A performance compliance, corresponding with the installed cable type.
3. The basic tests required are:
    a. Wire Map
    b. Length
    c. Attenuation
    d. NEXT (Near end crosstalk)
    e. Return Loss
    f. ELFEXT Loss
    g. Propagation Delay
    h. Delay skew
    i. PSNEXT (Power sum near-end crosstalk loss)
    j. PSELFEXT (Power sum equal level far-end crosstalk loss)
4. Continuity - Each pair of each installed cable shall be tested using a test unit that shows opens, shorts, polarity and pair-reversals, crossed pairs and split pairs. Shielded/screened cables shall be tested with a device that verifies shield continuity in addition to the above stated tests. The test shall be recorded as pass/fail as indicated by the test unit in accordance with the manufacturers’ recommended procedures, and referenced to the appropriate cable identification number and circuit or pair number. Any faults in the wiring shall be corrected and the cable re-tested prior to final acceptance.
5. Length - Each installed cable link shall be tested for installed length using a TDR type device. The cables shall be tested from patch panel to patch panel, block to block, patch

panel to outlet or block to outlet as appropriate. The cable length shall conform to the maximum distances set forth in the ANSI/TIA/EIA-568-C Standard. Cable lengths shall be recorded, referencing the cable identification number and circuit or pair number. For multi-pair cables, the shortest pair length shall be recorded as the length for the cable.

6. Category 6 Performance Shall meet the link requirements outlined below for a 90-meter, 4-connector permanent link.

Frequency (MHz)	Maximum Insertion Loss (dB)	Minimum NEXT (dB)	Minimum PSNEXT (dB)	Minimum ELFEXT (dB)	Minimum PSELFEXT (dB)	Minimum Return Loss (dB)
1.0	2.1	69.0	64.0	65.3	62.3	21.0
4.0	4.0	67.0	62.5	53.2	50.2	21.0
10.0	6.3	60.6	46.0	45.3	42.3	21.0
20.0	9.0	55.6	51.0	39.2	36.2	21.0
31.25	11.3	52.4	47.7	35.4	32.4	19.1
62.5	16.4	47.4	42.6	29.3	26.3	16.1
100.0	21.2	43.9	39.1	25.3	22.3	14.0
155.0	26.6	40.7	35.8	21.4	18.4	12.1
200.0	31.5	38.8	33.9	19.2	16.2	11.0
250.0	36.0	37.1	32.4	17.3	14.3	10.0

7. Category 6A performance shall meet the link requirements outlined below for a 90-meter, 4-connector permanent link.

Frequency (MHz)	Maximum Insertion Loss (dB)	Minimum NEXT (dB)	Minimum PSNEXT (dB)	Minimum ELFEXT (dB)	Minimum PSELFEXT (dB)	Minimum Return Loss (dB)
1.0	2.1	74.3	72.3	-	-	20.0
4.0	3.8	65.3	63.3	-	-	23.0
10.0	5.9	59.3	57.3	-	-	25.0
16.0	7.5	56.2	54.2	-	-	25.0
20.0	8.4	54.8	52.8	-	-	25.0
31.25	10.5	51.9	49.0	-	-	23.6
62.5	15.0	47.4	45.4	-	-	21.5
100.0	19.1	44.3	42.3	-	-	20.1
250.0	31.1	38.3	36.3	-	-	17.3
350.0	37.2	36.1	34.1	-	-	16.3
400.0	40.1	35.3	33.3	-	-	15.9
500.0	45.3	33.8	31.8	-	-	15.2

NOTE: For ELFEXT and PSELFEXT, follow TIA guidelines for Cat6A.

C. Fiber Testing

1. All fiber testing shall be performed on all fibers in the completed end-to-end system. Testing shall consist of an end-to-end power meter test performed per EIA/TIA-455-53A. The system loss measurements shall be provided at 850 and/or 1300 nanometers for multimode fibers and 1310 and/or 1550 nanometers for single mode fibers. These tests also include continuity checking of each fiber.
2. Backbone multimode fiber cabling shall be tested at both 850 nm and 1300 nm (or 1310 and 1550 nm for singlemode) in both directions.

3. Test set-up and performance shall be conducted in accordance with ANSI/EIA/TIA-526-14 Standard, Method B.
4. Where links are combined to complete a circuit between devices, the Contractor shall test each link from end to end to ensure the performance of the system. ONLY LINK TEST IS REQUIRED. The contractor can optionally install patch cords to complete the circuit and then test the entire channel. The test method shall be the same used for the test described above. The values for calculating loss shall be those defined in the ANSI/TIA/EIA Standard.
5. Attenuation testing shall be performed with an approved hand held tester from an industry recognized test equipment manufacturer.

3.13 SYSTEM INTEGRATION AND TESTING

A. Contractor shall provide to client representative, at contract notice to proceed, a list of all devices and/or locations where equipment is noted on plans as “District” or “Owner” provided. Contractor shall be responsible for coordinating the receipt and safe handling of each piece of equipment until installation is complete.

B. Equipment provided by the client shall be handled and installed by the Contractor, this may include network switches, Wireless Access Points, Power-Over-Ethernet injectors, security cameras, etc. All equipment shall be installed by the Contractor in their respective locations as shown on the plans.

C. Upon complete install of the equipment, Contractor shall provide and install appropriate patching of equipment to network infrastructure (Cat 6, Cat 6A, fiber-optic cable, etc.) as necessary to deliver a fully functional network solution.

3.14 SYSTEM DOCUMENTATION

A. Upon completion of the installation, the telecommunications contractor shall provide three (3) full documentation sets to the Engineer for approval. Documentation shall include the items detailed in the sub-sections below.

B. Documentation shall be submitted within ten (10) working days of the completion of each testing phase (e.g. subsystem, cable type, area, floor, etc.). This is inclusive of all test result and draft as-built drawings. Draft drawings may include annotations done by hand. Machine generated (final) copies of all drawings shall be submitted within 30 working days of the completion of each testing phase. At the request of the Engineer, the telecommunications contractor shall provide copies of the original test results.

C. The Engineer may request that a 10% random field re-test be conducted on the cable system, at no additional cost, to verify documented findings. Tests shall be a repeat of those defined above. If findings contradict the documentation submitted by the telecommunications contractor, additional testing can be requested to the extent determined necessary by the Engineer, including a 100% re-test. This re-test shall be at no additional cost to the Owner.

3.15 TEST RESULTS

A. Test documentation shall be provided on disk within three weeks after the completion of the project. The disk shall be clearly marked on the outside front cover with the words “Project Test

Documentation", the project name, and the date of completion (month and year). The results shall include a record of test frequencies, cable type, conductor pair and cable (or outlet) I.D., measurement direction, reference setup, and crew member name(s). The test equipment name, manufacturer, model number, serial number, software version and last calibration date will also be provided at the end of the document. Unless the manufacturer specifies a more frequent calibration cycle, an annual calibration cycle is anticipated on all test equipment used for this installation. The test document shall detail the test method used and the specific settings of the equipment during the test as well as the software version being used in the field test equipment. The test documentation shall be compatible with common, license-free computer software such as Adobe Acrobat (PDF), or with Microsoft Excel or Word.

B. The field test equipment shall meet the requirements of ANSI/TIA/EIA-568-C including applicable TSB's and amendments. The appropriate Level III tester shall be used to verify Category 6 cabling systems.

C. Printouts generated for each cable by the wire (or fiber) test instrument shall be submitted as part of the documentation package. The telecommunications contractor must furnish this information in electronic form CD-ROM). If needed, provide manufacturers software require to read the test results.

D. When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall be documented.

PART 4 - WARRANTY AND SERVICES

4.1 WARRANTY

A. The manufacturer shall provide the warranty directly to the end-user.

B. An Extended Product Warranty shall be provided which warrants functionality of all components used in the system for a minimum of 20 years from the date of registration. The Extended Product Warranty shall warrant the installed horizontal and/or backbone copper, and both the horizontal and the backbone optical fiber portions of the cabling system.

C. The Application Assurance Warranty shall cover the failure of the wiring system to support the applications that are designed for the link/channel specifications of ANSI/TIA/EIA–568-C.0. These applications include, but are not limited to, 10BASE-T, 100BASE-T, 1000BASE-T, 155Mb/sATM, and 1Gb/s ATM.

D. The contractor shall provide a warranty on the physical installation.

4.2 FINAL ACCEPTANCE AND SYSTEM CERTIFICATION

A. Completion of the installation, in-progress and final inspections, receipt of the test and as-built documentation, and successful performance of the cabling system for a two-week period will constitute acceptance of the system. Upon successful completion of the installation and subsequent inspection, the end user shall be provided with a numbered certificate, from the product manufacturer, registering the installation.

SECTION 31 00 00 EARTHWORK

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.

B. Geotechnical Engineering Report, Project No.: 300909-010, June 20, 2025, by Earth Systems Pacific, and all addenda and supplemental geotechnical reports.

1.2 SUMMARY

A. Related Sections:
1. Section 01 57 13, Erosion Control
2. Section 31 23 33, Trenching and Backfilling
3. Section 32 13 13, Site Concrete
4. Section 33 40 00, Stormwater Utilities

1.3 QUALITY ASSURANCE

A. Use only new materials and products, unless existing materials or products are specifically shown otherwise on the Drawings to be salvaged and re-used.

B. All materials, components, assemblies, workmanship and installation are to be observed by the Owner's Inspector of Record. Work not so inspected is subject to uncovering and replacement.

C. The representatives of the Owner’s testing lab will not act as supervisor of construction, nor will they direct construction operations. Neither the presence of the Owner’s testing lab representatives nor the testing by the Owner’s testing lab shall excuse the contractors or subcontractors for defects discovered in their work during or following completion of the project. Correcting of inadequate compaction or moisture content is the sole responsibility of the contractor.

D. Tests (See Part 3 for Compaction Testing).

E. Contractor shall be solely responsible for all subgrades built. Failures resulting from inadequate compaction or moisture content are the responsibility of the contractor. Contractor shall be solely responsible for any and all repairs.

1.4 SUBMITTALS

A. Manufacturer's Data: Submit list and complete descriptive data of all products proposed for use. Include manufacturer's specifications, published warranty or guarantee, installation instructions, and maintenance instructions.

1.6 REFERENCES AND STANDARDS

A. General: Site survey, included in the drawings, was prepared by Clad Consulting and is the basis for data regarding current conditions. While the survey is deemed generally accurate, there exists discrepancies and variations due to elapsed time, weather, etc. Existing dirt grades may vary 0.2 ft. from that shown.

B. Geotechnical Engineering Report was prepared by Earth Systems. Report is on file with Architect. Recommendations of the Goetechnical report were used to develop the contract plans and specifications. The Geotechnical report shall be used as a reference for the soil condition of the project site. The design information contained in the contract plans and specifications shall govern over the recommendation of the Geotechnical report.

C. Site Visitation: All bidders interfacing with existing conditions shall visit the site prior to bid to verify general conditions of improvements. Discrepancies must be reported prior to the bid for clarification.

D. ANSI/ASTM D698-e1 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).

E. ANSI/ASTM D1556-e1 - Test Method for Density of Soil in Place by the Sand-Cone Method.

F. ANSI/ASTM 698-12e2 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).

G. ANSI/ASTM D 3017-05 Test Methods for Moisture Content of Soils and Soil-Aggregate Mixture by Nuclear Methods (Shallow Depth).

H. ANSI/ASTM D 4318-10e1 Test Method for Liquid Limit, Plastic Limit, and Plasticity Limit.

I. CALTRANS Standard Specifications Section 17.

J. CAL-OSHA, Title 8, Section 1590 (e).

K. Any work within the street, highway or right-of-way shall be performed in accordance with the requirement of the governmental agencies having jurisdiction, and shall not begin until all of those governing authorities have been notified.

1.7 DELIVERY, STORAGE AND HANDLING

A. Transport, store and handle in strict accord with the local jurisdiction.

B. Make delivery to job when notified by Contractor verifying that the job is ready to receive the work of this Section and that arrangements have been made to properly store, handle and protect such materials and work.

1.8 PROJECT CONDITIONS

A. Existing civil, mechanical and electrical improvements are shown on respective site plans to the extent known. Should the Contractor encounter any deviation between actual conditions and those shown, he is to immediately notify the Architect before continuing work.

B. Excavation dewatering may be necessary. Contractor shall provide any and all tools, equipment and labor necessary for excavation dewatering no matter what the source. Dewatering shall be continuous until all site utilities are installed and backfilled.

1.9 EXISTING SITE CONDITIONS

A. Contractor shall acquaint himself with all site conditions. If unknown active utilities are encountered during work, notify Architect promptly for instructions. Failure to notify will make Contractor liable for damage to these utilities arising from Contractor's operations subsequent to discovery of such unknown active utilities.

1.10 ON SITE UTILITY VERIFICATION AND REPAIR PROCEDURES

A. Ground-breaking requirements:
   1. All underground work performed by a Contractor must be authorized by the District's Construction Manager or the Low Voltage Consultant prior to start of construction.
   2. The Contractor is to obtain and keep the original School's construction utility site plans on site during all excavation operations. Contractor can contact the District's Construction Manager, Facilities Manager, or the Low Voltage Consultant to procure the drawings.

B. Underground Utility Locating:
   1. The contractor shall hire an Underground Utility Locating Service to locate existing underground utility pathways in areas affected by the scope of work for excavation.
   2. Contractor must use an underground utility locator service with a minimum of 3 years' experience. The equipment operator must have demonstrated experience.
   3. The Underground Utility Locator Service must have the use of equipment with the ability to locate by means of inductive clamping, induction, inductive metal detection, conductive coupling, or TransOnde (Radio detection) to generate signals, passive locating (free scoping) for "hot" electric, and metal detector.
   4. The Underground Utility Locator Service must be able to locate existing utilities at a depth of at least 72".
   5. The Underground Utility Locator Service must be able to locate but are not limited to locating the following types of utility pathways:
      a. All conduit pathways containing 110 volt or greater 50-60Hz electrical wire.
      b. All conduit pathways containing an active cable TV system.
      c. All conduit pathways containing wire or conductor in which a signal can be attached and generated without damaging or triggering the existing systems.
      d. All empty conduit pathways or pipe in which a signal probe or sonde (miniature transmitter) can be inserted.
      e. All conduit pathways containing non-conductive cables or wires in which a signal probe or sonde (miniature transmitter) can be inserted.
      f. All plastic and other nonconductive water lines in which a TransOnde
      g. Radio detection) or other "transmitter" can be applied to create a low frequency pressure waive (signal) without damaging or triggering the existing systems.
      h. All copper or steel waterlines and plastic or steel gas lines
   6. All markings made by the Underground Utility Locator Service or other shall be clear and visible.
   7. The contractor shall maintain all markings made by Underground Utility Locator Service or other throughout the entire length of the project.
   8. The Underground Utility Locator Service shall provide the contractor with two sets of maps showing the location of utilities and average depth. They will be referenced to

permanent buildings. Contractor will deliver one copy to the district at no additional charge.

9. Contractor is responsible to contact Underground Service Alert (U.S.A. 800/227-2600) and receive clearance prior to any excavation operations.
10. Contractor shall inform the (District's Construction Manager) (Architect) (Owner) no later than five (5) days prior to the date scheduled for the utility locator service to be on site.

1.11 PROTECTION

A. Adequate protection measures shall be provided to protect workmen and passers-by on and off the site. Adjacent property shall be fully protected throughout the operations. Blasting will not be permitted. Prevent damage to adjoining improvements and properties both above and below grade. Restore such improvements to original condition should damage occur. Replace trees and shrubs outside building area disturbed by operations.

B. In accordance with generally accepted construction practices, the Contractor shall be solely and completely responsible for working conditions at the job site, including safety of all persons and property during performance of the work. This requirement shall apply continuously and shall not be limited to normal working hours.

C. Any construction review of the Contractor's performance conducted by the Geotechnical Engineer is not intended to include review of the adequacy of the Contractor's safety measures, in, on, or near the construction site.

D. Provide shoring, sheeting, sheet piles and or bracing to prevent caving, erosion or gullying of sides of excavation.

E. Surface Drainage: Provide for surface drainage during period of construction in manner to avoid creating nuisance to adjacent areas. The contractor shall make a reasonable effort on a daily basis to keep all excavations and the site free from water during entire progress of work, regardless of cause, source, or nature of water.

F. Adjacent streets and sidewalks shall be kept free of mud, dirt or similar nuisances resulting from earthwork operations.

G. The site and adjacent influenced areas shall be watered as required to suppress dust nuisance. Dust control measures shall be in accordance with the local jurisdiction.

1.12 SEASONAL LIMITS

A. No fill material shall be placed, spread or rolled during unfavorable weather conditions. When work is interrupted by rains, fill operations shall not be resumed until field tests indicate that moisture content and density of fill are satisfactory.

B. Excessively wet fill material shall be bladed and aerated per section 3.08, B.

1.13 TESTING

A. Geotechnical Engineer: Owner is retaining a Geotechnical Engineer to determine compliance of fill with Specifications, and to direct adjustments in fill operations. Costs of

Geotechnical Engineer will be borne by Owner; except those costs incurred for re-tests or re-inspection will be paid by Owner and back charged to Contractor.

1. If Contractor elects to process or mine onsite materials for use as Suitable Fill, Aggregate Sub Base, Aggregate Base, Rock, Crushed Rock or sand the cost of all testing of this material shall be paid for by the Contractor.
2. Testing of import fill for compliance with Department of Toxic Substance Control (DTSC) shall be paid for by the Contractor.

1.14 ARCHEOLOGICAL AND CULTURAL RESOURCES

A. A. If archeological or cultural resources are discovered during the Work, the Contractor must cease all construction operations in the vicinity of the discovery until a qualified archeologist can assess the value of these resources and make recommendations to the State Historic Preservation Officer. Archeological and cultural resources include artifacts, large amounts of bone, shell, or flaked stone, and other evidence of human activity. If the State Historic Preservation Officer or the Owner directs that work be temporarily ceased at the location of an archeological or cultural find, the Contractor must temporarily suspend work at the location.

PART 2 PRODUCTS

2.1 2.01 MATERIALS

A. Engineered Fill Materials: All fill shall be of approved local materials supplemented by imported fill if necessary. "Approved" local materials are defined as local soils tested and approved by Geotechnical Engineer free from debris, and concentrations of clay and organics; and contain rocks no larger than 3-inches in greatest dimension. The soil and rock should be thoroughly blended so that all rock is surrounded by soil. This may require mixing of the soil and rock with a dozer prior to placement and compaction. Clods, rocks, hard lumps or cobbles exceeding 3-inches in final size shall not be allowed.

B. Imported Engineered Fill Material: Imported fill may be required to complete work. All import fill material shall be tested and approved by Soils Engineer prior to transportation to the site. Proposed fill material shall comply with DTSC guidelines to include Phase 1 environmental site assessment and related tests. Refer to the October 2001 DTSC Information Advisory for clean imported fill material.

1. DTSC TESTING: Site work contractor is to coordinate testing with an analytical lab, hired by the owner, licensed by the State of California for the DTSC testing. The costs associated with the testing will be paid by the contractor.
2. DTSC testing shall include documentation as to the previous land use, location, and history. Soils shall be analyzed for all compounds of concern to ensure the imported soil is uncontaminated and acceptable. Testing shall be performed per the recommendations included in DTSC Imported Fill Advisory http://www.dtsc.ca.gov/Schools/upload/SMP FS Cleanfill-Schools.pdf). Soils shall be tested prior to import to the project site.
3. Lab shall determine geographically which tests and analysis comparison will be appropriate for the testing. (CAM 17 / Title 22); (RWQCB) Regional Water Quality Control Board; or (OEHHA) Office of Environmental Health Hazard Assessment.
4. Frequency of testing shall be conducted in accordance with DTSC's Imported Fill Advisory as follows;

Fill Material Sampling Schedule

Area of Individual Borrow Area	**Sampling Requirements**
2 Acres or less	Minimum of 4 samples
2 to 4 Acres	Minimum of 1 sample every ½ Acre
4 to 10 Acres	Minimum of 8 Samples
Greater than 10 Acres	Minimum of 8 locations with 4 subsamples per location

Volume of Borrow Area Stockpile	
Up to 1,000 Cubic Yards	1 sample per 250 cubic yards
1,000 to 5,000 Cubic Yards	4 samples for the first 1000 cubic Yards + 1 sample per each additional 500 cubic yards
Greater than 5,000 Cubic Yards	12 samples for the first 5,000 cubic yards + 1 sample per each additional 1,000 cubic yards

5. Reports/ Documentation
   a. Results of the testing analysis shall be sent to the Owner; Architect; Project Inspector, Project Civil Engineer, DTSC, and DSA. Letter shall reference DSA file and application numbers.

C. Water: Furnish all required water for construction purposes, including compaction and dust control. Water shall be potable.

D. Aggregate Base: Provide Class 2 3/4" Aggregate Base conforming to standard gradation as specified in Cal Trans Standard Specifications, Section 26,-1.02A.

E. Decomposed Granite: Decomposed Granite shall be well graded mixture of fine to 1/8" particles in size with no clods. The material shall be free of vegetation, other soils, debris and rock. The material shall be reddish-tan to tan in color.

F. Decomposed Granite Solidifier: PolyPavement or equal.

PART 3 EXECUTION

3.1 INSPECTION LAYOUT AND PREPARATION

A. Prior to installation of the work of this Section, carefully inspect and verify by field measurements that installed work of all other trades is complete to the point where this installation may properly commence

B. Layout all work, establish grades, locate existing underground utilities, set markers and stakes, setup and maintain barricades and protection facilities; all prior to beginning actual earthwork operations. Layout and staking shall be done by a licensed Land Surveyor or Professional Civil Engineer.

C. Verify that specified items may be installed in accordance with the approved design.

D. In event of discrepancy, immediately notify Owner and the Architect. Do not proceed in discrepant areas until discrepancies have been fully resolved.

3.2 PERFORMANCE

A. GENERAL:
1. General: Do all grading, excavating and cutting necessary to conform finish grade and contours as shown. All cuts shall be made to true surface of subgrade.
2. Archaeological Artifacts: Should any artifacts of possible historic interest be encountered during earthwork operations, halt all work in area of discovery and immediately contact the Architect for notification of appropriate authorities.
3. Degree of Compaction: Percentage of maximum density, hereinafter specified as degree of compaction required, means density equivalent to that percentage of maximum dry density determined by ASTM D1557 Compaction Test method, and such expressed percentage thereof will be minimum acceptable compaction for specified work.
4. Moisture Content: Moisture content shall be as noted below and as called for on the plans. Moisture content shall be maintained until subgrade is covered by surfacing materials.

3.3 DEMOLITION, DISPOSAL AND DISPOSITION OF UNDESIRABLE MAN-MADE FEATURES

A. All other obstructions, such as abandoned utility lines, septic tanks, concrete foundations, and the like shall be removed from site. Excavations resulting from these removal activities shall be cleaned of all loose materials, dish shaped, and widened as necessary to permit access for compaction equipment. Areas exposed by any required over-excavation should be scarified to a depth of 36", moisture-conditioned to (optimum) (2% above optimum) moisture content, and recompacted to at least 90% of the maximum dry density. See soils report and confer with Geotechnical engineer.

3.4 TESTING AND OBSERVATION

A. All grading and earthwork operations shall be observed by the Geotechnical Engineer or his representative, serving as the representative of the Owner.

B. Field compaction tests shall be made by the Geotechnical Engineer or his representative. If moisture content and/or compaction are not satisfactory, Contractor will be required to change equipment or procedure or both, as required to obtain specified moisture or compaction. Notify Geotechnical Engineer at least 48 hours in advance of any filling operation.

C. Earthwork shall not be performed without the notification or approval of the Geotechnical Engineer or his representative. The Contractor shall notify the Geotechnical Engineer at least two (2) working days prior to commencement of any aspect of the site earthwork.

D. If the Contractor should fail to meet the compaction or design requirements embodied in this document and on the applicable plans, he shall make the necessary readjustments until all work is deemed satisfactory, as determined by the Geotechnical Engineer or Architect/Engineer.

E. After each rain event Geotechnical Engineer shall test fill material for optimum moisture. Do not place any fill material until desired moisture is achieved.

3.5 CLEARING AND GRUBBING

A. Prior to grading, remove all debris off-site. Remove trees and brush including the root systems. Holes resulting from tree and brush removal should be prepared and backfilled in accordance with paragraphs 3.7, 3.8, 3.9, and 3.10, see below. This may require deepening and/or widening the holes to adequately remove disturbed soil and provide room for compaction equipment. Strip the surface of all organics.

3.6 CUTTING

A. Building pads that are located within a cut/fill transition area will have to be overexcavated to provide a semi-uniform fill beneath the building pad.

B. Do all cutting necessary to bring finish grade to elevations shown on Drawings.

C. When excavation through roots is necessary, cut roots by hand.

D. Carefully excavate around existing utilities to avoid unnecessary damage. The contractor shall anticipate and perform hand work near existing utilities as shown on the survey, without additional claims or cost.

3.7 STRUCTURAL EXCAVATION

A. General: Excavate to bear on firm material at contract depth shown on Structural Drawings.

B. Footings: All footing excavations shall be of sufficient width for installation of formwork, unless earth will retain its position during concreting. All portions of footings above grade must be formed.

C. Unsuitable Ground: Any errors in structural excavation, soft ground, or clay soils found when excavating shall be reported to Architect. In no case shall work be built on any such soft or clayey unsuitable surface without direction from the Architect. Restore excavations to proper elevation with engineered fill material compacted to 90% of dry density.

3.8 SUBGRADE PREPARATION

A. Grade compact and finish all subgrades within a tolerance of 0.10' of grades as indicated on Drawings and so as not to pool water. Subgrade within building pads and concrete walks shall be within 0.05' of grades indicated.

B. After clearing, grubbing and cutting, subsurface shall be plowed or scarified to a depth of at least 36", until surface is free from ruts, hummocks or other uneven features and uniform and free from large clods. Moisture condition to (optimum) (2% above optimum) moisture content and recompact to at least 92% of the maximum dry density as determined by ASTM Test Method D1557. If the existing soils are at a water content higher than specified, the contractor shall provide multiple daily aerations by ripping, blading, and/or disking to dry the soils to a moisture content where the specified degree of compaction can be achieved. After seven consecutive working days of daily aerations, and the moisture content of the soil remains higher than specified, the contractor shall notify the architect. If the existing soils have a moisture content lower than specified, the contractor shall scarify, rip, water and blade existing soil to achieve specified moisture content. The contractor shall make proper allowance in schedule and methods to complete this work.

C. Subgrade in areas to receive landscaping shall be compacted to 90%.

D. Where Contractor over-excavates building pads through error, resulting excavation shall be recompacted as engineered fill at Contractor's expense.

3.9 PLACING, SPREADING AND COMPACTING FILL MATERIAL IN BUILDING PAD AND PAVEMENT AREAS

A. Selected fill material shall be placed in layers which, when compacted, shall not exceed 6 inches in compacted thickness. Each layer shall be spread evenly and thoroughly mixed to insure uniformity in moisture content.

B. Selected fill material shall be moisture-conditioned to specified moisture content. Selected fill material shall be unfrozen. When moisture content of fill material is below that specified, add water until proper moisture content is achieved. When moisture content is above that specified, aerate by blading or other methods mentioned in 3.08 B until moisture content is satisfactory.

C. After each layer has been placed, mixed and spread evenly, it shall be thoroughly compacted to a minimum of 90% as determined by the ASTM D1557 Compaction Test. Compact each layer over its entire area until desired density has been obtained.

D. Recompaction of Fill in Trenches and Compaction of Fill Adjacent to Walls: Where trenches must be excavated, backfill with material excavated. Place in lifts that when compacted do not exceed 6”, moisture conditioned to (optimum)(2% above optimum) moisture content, and compact to a minimum of 90% relative compaction in building pad and paved areas, and to 90% relative compaction in landscape areas.

E. Jetting of fill materials will not be allowed.

3.10 FINAL SUBGRADE COMPACTION

A. Building Pads: Upper 36" of all final building pad subgrades (including future buildings) shall be uniformly compacted at specified moisture content to at least 95% of maximum dry density, as determined by ASTM D1557 Compaction Test, regardless of whether final subgrade elevation is attained by filling, excavation, or is left at existing grade. After acceptance of final compaction test, contractor shall maintain the required moisture content of subgrade until concrete flatwork is placed.
   1. Exception; in lime /cement treated areas the upper 36” shall be compacted to 95% Compaction.

B. Paved Areas: Upper 36" of all final subgrades supporting pavement sections and all other flatwork shall be brought to specified moisture content and shall be uniformly compacted to not less than 95% of maximum dry density, regardless of whether final subgrade elevation is attained by filling, excavation, or is left at existing grade. After acceptance of final compaction test, contractor shall maintain the required moisture content of subgrade until concrete flatwork is placed.

C. Gravel Fill: Do not place compacted gravel fill until after underground work and foundations are in place. Compact gravel fill with vibratory plate or similar equipment to preclude settlement.

SECTION 28 31 00 - FIRE ALARM AND DETECTION SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section Includes:
1. Provide a complete, fully addressable, power limited, fire detection and evacuation system as shown on the drawings and/or as required for a complete and operating system. The system shall be connected, tested, verified by AHJ to be acceptable and left in first class operating condition. All equipment herein specified shall be engineer-approved and California State Fire Marshal (CSFM) listed. The entire installation shall conform to the National Fire Protection Association (NFPA) Standard 72, 90A & CEC Article 760 and authorities having jurisdiction as applicable. The system specified and depicted on the plan is a complete and approved system. Substitution of system components or manufacturer will require the contractor to separately obtain approval with the CSFM at Contractor's expense and shall meet all requirements of the system as designed and pre-approved. The entire fire alarm system has been submitted and approved by the Division of the State Architect as a complete submittal. Any routing of the system wiring that is significantly different than shown on the approved drawings shall have the approval of the engineer and must be obtained prior to construction.
2. Provide all work and material as shown and / or required to provide a fully functional and adequate system as described hereon and as required by the California State Fire Marshal.
3. Supervision: The fire alarm system shall monitor the integrity of all alarm initiating and indicating appliance circuits and provide local and remote status of all connected systems. The system shall be provided with automatically charged standby batteries to maintain system operation for 24 HRS in the normal supervisory mode and 15 minutes of alarm. Batteries shall be supervised for connection to the system and low voltage threshold. The automatic battery charger shall be capable of charging fully discharged system batteries to 100% in 8 hours.
4. The system wiring and installation shall be as stated in drawings and as required by the manufacturer. All wiring shall be color coded, tagged and verified to assure that it is free from shorts and grounds and shall be rated for the appropriate environmental conditions such as well locations.
5. Testing: The completed system shall be tested in accordance with NFPA Standard 72-7-1.
6. Warranty: The equipment and wiring shall be warranted to be free from electrical and mechanical defects for a period of two (2) years commencing with final acceptance by Owner.
7. All Fire Alarm wiring shown in drawings shall be installed in conduit.
8. System Operation shall include:
   a. Separate zone signaling and device status indication for all initiating devices.

b. Audible to sound the California uniform fire alarm signal in temporal mode. Devices shall be at least 15dBA above average ambient sound level, but not less than 75dBA at 10' or more than 120dBA.
c. Visual devices shall not exceed 2 flashes per second and shall not be slower than 1 flash per second. Visual devices shall be synchronized when 3 or more devices are within the same field of view.
d. Supervision of all circuits to indicate any abnormal wiring condition.
e. One (1) N.O./N.C. integral relay for external device interface or as indicated on drawings.
f. Central station connection capable of indicating (3) distinct separate signals as being tamper, trouble and alarm with point reporting capabilities.

9. All work shall be completed as shown on the plans and or as specified within this specification and shall include the following (but is not limited to):
   a. Life safety fire alarm detection and signaling system.
   b. Furnishing and installation of equipment and devices.
   c. Conductors, connections and interconnections where specified and all in conduit system.
   d. Testing, cleaning and adjusting of completed work.
   e. Wiring diagrams, as-built drawings and three (3) sets of equipment operations and maintenance instructions for Owner.
   f. Complete maintenance for two years. Proposal for subsequent maintenance contract.
   g. All work and material for complete and operable systems as indicated or specified.
   h. Permits, inspections and fees.
   i. Identification and instruction to Owner Representative. Training shall consist of a minimum or two (2) 6-hour sessions.
10. Coordination with Section 26 05 33, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS.
11. Furnishing of special back boxes where required for installation of fire alarm devices.
12. All conductors to be installed in conduit pursuant to Specification Section 26 05 33, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS.
13. Qualifications: Contractor shall receive written approval and verified test results which shall be submitted to the owner for system from manufacturers recognized representative prior to completion and acceptance.
14. All initiating devices shall be separately addressed for individual identification at control panel.
15. As-Built Drawings: A complete set of reproducible "as-built" drawings showing installed wiring, color coding, wire tag notations exact locations of all installed equipment, specific interconnections between all equipment and internal wiring of the equipment shall be delivered to the owner upon completion of the system.
16. Maintenance Instructions: Three (3) submittals of maintenance instructions shall be provided and shall be complete, easy to read, understandable and shall provide the following information:
    a. Instructions for replacing any components of the system, including internal parts.
    b. Instructions for periodic cleaning and adjustments of equipment with a schedule of these functions.
    c. A complete list of all equipment and components with information as to the address and telephone number of both the manufacturer and local supplier of each item.
    d. User operating instructions shall be prominently displayed on a separate sheet located next to the control unit in accordance with UL Standard 864. The contractor shall warrant all equipment and wiring free from inherent mechanical and electrical defects for two years from the date of final acceptance.

1.3 SUBMITTALS

A. Submit in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.

B. The submittal shall include certification from the manufacturer verifying that the distributor is an authorized agent, who is qualified and trained by the manufacturer in the proper installation, operation and service of the system.

C. Shop Drawings:
1. A complete list of all supplied equipment including model numbers with catalog data sheets on each component and CSFM number.
2. Provide schematic layout, floor plan, drawings indicating location of all components and equipment, required size and location of conduit and outlets and type and quantity of system conductors. Include voltage drop calculations and battery calculations based on actual number of devices to be installed. Note: It shall be acceptable to provide written acknowledgement that the engineer-prepared approved fire alarm drawings will be used as project fire alarm shop drawings and no exceptions are taken.
3. Include wiring diagrams for overall system and components including control panels, annunciators, power supplies, initiating circuits, notification appliances, control devices and FATC. Address numbers shall be noted on all appliances.
4. Include physical and electrical characteristics of equipment to indicate conformance with the Specifications.
5. Describe system characteristics and function as well as device wiring diagrams.
6. Voltage drop and battery calculations for each control panel and power supply and initiating circuits.
7. System operational matrix.

D. Data Sheets: Show California State Fire Marshal Listing, U.L. listing, equipment ratings, dimensions and finishes.

E. Manufacturer's Certificate: Note whether the system meets or exceeds specified requirements.

F. Operating and Maintenance Instruction Manual:
1. Manual shall include the following tailored to this specific project:
    a. Operational description.
    b. Coded cabling plan.
    c. Two wire circuit diagrams.
    d. Wiring destination schedule.
    e. Schematic component diagrams and PC board layouts.
    f. Maintenance and alignment procedures.
    g. Voltage drop and battery calculations.

1.4 COORDINATION

A. Refer to the electrical and mechanical drawings and specifications to determine quantities and location of devices and required scope of work and coordinate work with mechanical and electrical installers. Provide function described under mechanical section Sequence of Control, for fire and/or emergency conditions. Submit conduit and pathing requirements to electrical installer.

1.5 SYSTEM DESCRIPTION

A. General: System to be listed by Underwriters Laboratories and the California State Fire Marshal, designed to meet the functional requirements of NFPA 72.

B. Features:
1. Fire control command center panel with graphic annunciator, printer (where specified) and alarm communicator transmitter (DACT) where specified and/or required.
2. Alarm/trouble point transmitters.
3. Manual alarm reporting stations (addressable).
4. Photoelectric smoke detectors (addressable).
5. NAC extender panels.
6. Heat detectors (addressable).
7. Combination speaker/visual alarm signal devices.
8. Speaker and audible devices.
9. Visual alarm signal device.
10. Exterior bell.
11. Connection to sprinkler waterflow and pressure switches (addressable).
12. Sprinkler valve supervision (addressable).
13. Provision for connection to off-site central station via leased telephone lines.
14. Control module.
15. Monitor module.
16. Sync. Module.

1.6 SYSTEM OPERATION

A. System to be the active interrogate/respond type alarm system, 24 volt DC noncoded, positive, non-interfering, successive operation, in which all devices are constantly sending status signals to the main fire control command center from remote data transmitter panels approximately every one second. A change in status to be reported twice to determine that it is a valid signal, and be automatically and permanently recorded.

B. Wiring, equipment and devices for alarm initiation, annunciation, and audible signaling to be continuously supervised for opens, shorts or grounds (trouble). Each alarm initiating device circuit to be provided with illuminated and audible annunciation of both trouble and alarm conditions. Non-illumination indicates a normal condition.

C. Any alarm or trouble condition shall sound an audible signal at the fire command center and the remote annunciator. Signal shall be silenced by a momentary contact switch which shall transfer the signal to a visual indicator. Subsequent trouble conditions shall cause the signal to resound and in turn may be silenced. Upon restoration to normal, the trouble signal silencing indicator shall extinguish automatically.

D. Activation of any automatic or manual alarm initiating device shall cause the following to occur:
1. Sound an audible alarm and illuminate the visual indicator for zone and type of alarm at the fire command center, the remote annunciator and fire alarm control panel.
2. Sound, at building of origin, the audible alarm signal over the system audible devices and activate the visual signal devices.
3. Transmit alarm signal to energy management system for shutdown of building air handler.
4. Transmit alarm signal to the central station office.

E. System shall not incorporate a time delay for any of the alarm initiating devices. All alarms shall be considered confirmed alarms.

F. Detection shall be addressable and reporting of fire conditions to be accomplished by the following basic methods:
   1. Smoke detectors.
   2. Heat detectors.
   3. Waterflow switches.
   4. Carbon Monoxide detectors.

G. Fire alarm system inputs to be further subdivided as follows, for a more defined indication of the location and nature of the fire or trouble condition:
   1. Smoke/heat detector by device and location.
   2. Waterflow or pressure switch by device and location.
   3. Sprinkler valve position indication by device and location.

H. Alarm condition shall override trouble indication. Trouble indication shall reappear after alarm reset.

I. Fire Alarm Zones shall be as indicated on drawings.

J. Printout on system printer of all alarm and trouble reports, indicating type of device, condition, time and date and alarm clearing.

K. Selective manual testing of any device point or zone in the system to determine normal, trouble or alarm status.

L. Command center shall have annunciator indicating building floor, room number and zone.

M. System shall be capable of manual operation in the event of malfunction of the central processor. Supplier shall include a statement in the system shop drawing submittal explaining the manual operating capability of the system. System shall provide redundant processor capabilities to duplicate primary processor function.

N. Operation: All components shall be interconnected in accordance with the manufacturer's instructions to provide a complete and operable system as described.

1.7 LOADS OF EQUIPMENT AND COMPONENTS

A. Follow IEEE Standard where applicable.

B. Provide fuse protection for equipment and spare fuses.

C. Design systems for operation at 120 volts, normal or emergency power as indicated, 60 Hz nominal input.

D. Operating voltage dissipated by resistors shall not exceed 25% of ratings.

E. Operating voltage of capacitors shall not exceed 80% of rated voltage.

F. Operating loads and voltages on transistors and solid-state devices shall not exceed manufacturer's recommendation for normal full load operation.

G. Use electronic components of types and rating commonly available from stock of established commercial distribution.

1.8 GUARANTEE

A. Conform to applicable provisions of the GENERAL REQUIREMENTS.

B. Service technicians and replacement components for the system shall be available locally from a service representative of the manufacturer who is able to provide evidence of technical training and authorization by the manufacturer.

C. For a period of two years from date of final acceptance, the system shall be under full guarantee for materials and labor at no cost to the Owner. The system shall be under a service contract with a technician authorized by the manufacturer. Replacement parts and labor shall be readily available during normal business hours while the service contract is in effect. A complete system inspection and test shall be performed at five months and again at eleven months after final acceptance. Tests shall include all smoke detector sensitivity settings.

D. All component failures shall be remedied to the satisfaction of the Owner.

E. A continuing service contract shall be offered at time of bid to commence at the expiration of warranty included with the system.

PART 2 - PRODUCT

2.1 MATERIALS

A. Fire Alarm Control Panel (FACP) and system shall be UL listed for power-limited application, (as described on the plans). System shall be as manufactured by Gamewell Fire Control Instruments (FCI).

B. Peripheral Devices
1. Analog Photoelectric Smoke Sensors (refer to drawings for model number).
a. Analog photoelectric sensors shall have a low profile and be capable of being set at five sensitivity settings of “LOW, LOW MEDIUM, MEDIUM, MEDIUM HIGH, and HIGH” levels.
b. Automatic and manual functional sensitivity and performance tests shall be possible without the need for generating smoke. This method shall test all sensor circuitry and a “Failed Test” indication shall display for any failed test.
c. Two LEDs providing 360-degree visibility of operating status and alarm indication shall be provided on each sensor. The LEDs shall pulse periodically indicating that the sensor is receiving power and communication is taking place. This feature shall be field programmable. Upon alarm, these LEDs shall light continuously. An alarm output shall be available for remote annunciation.
d. The system shall check the sensitivity of each sensor periodically. If a sensor alarm threshold sensitivity has changed, due to again and/or dust accumulation, the system shall automatically compensate for this change (drift compensation).

e. Each sensor shall allow for the setting of two sensitivity levels. These levels may be programmed so that when the building is occupied, a sensor will be less sensitive than when the building is unoccupied. This feature permits sensors to be more reliable and at the same time reduces/minimizes unwanted alarms. This feature shall also provide for programmable weekend days, where the sensor will remain at an unoccupied sensitivity level.
f. The sensor screen and cover assembly shall be removable for field cleaning.

2. Addressable Thermal Sensor (refer to drawings for model number):
   a. Addressable thermal sensors shall have a low-profile and operate on the combination “rate-of-rise” and “fixed temperature” principals with the fixed temperature set point at 135ºF. They shall contain dual thermistor sensing circuitry for fast response.
3. Addressable Subloop Monitor Module (refer to drawings for model number):
   a. An addressable monitor module with an initiating circuit capable of being configured Class B, Style B. The module shall contain a yellow status LED that shall flash when in a quiescent mode and light continuously when in alarm. The LED shall be field programmable not to provide quiescent status indication, if so desired.

C. Fire Alarm remote power supply, NAC panel, shall be UL listed for power-limited application. Provided with (4) four-signal circuits minimum capacity or as required to make system fully operational with an output current of 6 to 9 amps as required for proper operation.

D. System Devices and components shall be provided as specified on the fire alarm equipment legend and as shown on associated electrical drawing:

E. Fire Alarm terminal cabinet shall be Square D Class 6650. Size as shown on drawings or as required.

F. Conduit and Wire
1. Conduit
   a. Conduit shall be in accordance with The National Electrical Code (NEC), local and state requirements.
   b. Where required, all wiring shall be installed in conduit or raceway. Conduit fill shall not exceed 40 percent of interior cross sectional area where three or more cables are contained within a single conduit.
   c. Fire alarm cabling above accessible ceilings may be installed without conduit in “open-wired” fashion. Support labels with J-hooks or similar means.
   d. Cable must be separated from any open conductors of power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, per NEC Article 760-29.
   e. Wiring for 24 volt DC control, alarm notification, emergency communication and similar power-limited auxiliary functions may be run in the same conduit as initiating and signaling line circuits. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.
   f. Conduit shall not enter the fire alarm control panel, or any other remotely mounted control panel equipment or backboxes, except where conduit entry is specified by the FACP manufacturer.
   g. Conduit shall be 3/4" (19.1 mm) minimum.
2. Wire

a. Wiring shall be in accordance with local, state and national codes (e.g., NEC Article 760) and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG (1.02 mm) for Initiating Device Circuits and Signaling Line Circuits, and 14 AWG (1.63 mm) for Notification Appliance Circuits.
b. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.
c. Wire and cable not installed in conduit shall have a fire resistance rating suitable for the installation as indicated in NFPA 70 (e.g., FPLR).
d. Wiring used for the multiplex communication circuit (SLC) shall be twisted and unshielded and support a minimum wiring distance of 12,500 feet. The design of the system shall permit use of IDC and NAC wiring in the same conduit with the SLC communication circuit.
e. All field wiring shall be electrically supervised for open circuit and ground fault.
f. The fire alarm control panel shall be capable of t-tapping Class B (NFPA Style 4) Signaling Line Circuits (SLCs). Systems that do not allow or have restrictions in, for example, the amount of t-taps, length of t-taps etc., are not acceptable.

G. Substitutions
1. The fire alarm System has been designed and approved as a “complete system”. Substitute equipment will be approved when the following conditions are met:
a. A request for substitution shall be made prior to bid for the Owner’s and design team consideration and approval.
b. Submit detailed fire alarm plans, specifications and engineering calculations including but not necessarily limited to:
1) CSFM listing #’s and Manufacturer Model #’s for every system component which is to be interconnected as a part of this project.
2. Single line, riser and point to point wiring diagrams including battery and voltage drop calculations for the entire system in compliance with NFPA 72. Indicating appliance shall be calculated on the bases of the highest current rating possible at that device.
3. Indication of conductor type(s), power-limited or non-power-limited system, independent of interconnected to existing system.
4. Submit / obtain approval from the Owner for the entire system.
a. The party requesting the substitution shall be responsible for any additional cost acquired during the approval.

PART 3 - EXECUTION

3.1 GENERAL

A. Comply with all applicable paragraphs in Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL, apply as though repeated herein.

B. Install system(s) in accordance with manufacturer's instructions.

C. Include services of certified technicians to supervise installation, provide adjustments, provide final connections, system testing and system training to Owner Representative.

3.2 GROUNDING

A. All equipment to be grounded by means of green ground wire to "U" contact of duplex receptacles and bonded to ground provided under 26 05 26, GROUNDING AND BONDING OF ELECTRICAL SYSTEMS.

3.3 INSPECTION

A. Systems to meet all the requirements of the CSFM and IOR and AHJ and shall be approved thereby before installation and prior to final acceptance.

3.4 LOCATION

A. Before installation, verify exact location of control equipment and outlets. The Owner reserves the right to relocate system components within a radius of 10' at no increase in cost before rough-in work is started for the respective component.

3.5 WIRING

A. Furnish all conductors, equipment, terminal strips, etc., and labor to install a complete and operable system. All cable conductors shall be color coded and numbered for identification at all terminals. Green shall be for grounding conductor only. Use red insulation and or red jacketing on all fire alarm cable.

3.6 TESTING

A. After all equipment specified herein for each system has been installed and is in operating condition, conduct performance tests to determine if the installation and components comply with these specifications. Furnish competent personnel, all test material and approved test instruments and conduct the tests under supervision of factory personnel, in the presence of the Engineer, the building and fire inspecting agencies.
   1. The contractor’s job foreman, in the presence of a representative of the manufacturer, a representative of the owner, and the fire department shall operate every installed device to verify proper operation and correct annunciation at the control panel.
   2. At least on half of all tests shall be performed on battery standby power.
   3. Where application of heat would destroy any detector, it may be manually activated.
   4. The signaling line circuits and notification appliance circuits shall be opened in at least two (2) locations to verify the presence of supervision.
   5. When the testing has been completed to the satisfaction of the contractor representative IOR, representatives of the manufacturer and owner, a notarized letter co-signed by each attesting to the satisfactory completion of said testing shall be forwarded to the owner and the authority having jurisdiction.
   6. The contractor shall leave the fire alarm system in proper working order, and, without additional expense to the owner, shall replace any defective materials or equipment provided by him under this contract within two years from the date of final acceptance by the awarding authority.
   7. The local responding fire department must be notified prior to the final test in accordance with local requirements and when requested, participate in system testing and evaluation.

3.7 REPORT

A. Prepare written report of final test results, signed by witnessing parties. Submit to the Engineer in triplicate for final approval.

END OF SECTION 28 31 00

3.11 PLACING, SPREADING, AND COMPACTION OF LANDSCAPE BACKFILL MATERIALS

A. All landscaped areas shall receive topsoil. After subgrade under landscape area has been scarified and brought to 90% maximum dry density, top soil shall be placed evenly to depth of 2" at 90% of maximum dry density.

B. Project Inspector must verify that materials are uniformly spread to minimum depth specified.

3.12 DECOMPOSED GRANITE COMPACTION AND STABILIZATION

A. Decomposed granite paving, paths or track shall be placed uniformly to the required depth and treated with PolyPavement or approved equal. Apply PolyPavement using Application Method 1 or a mixed application method.

3.13 SLOPE CONSTRUCTION

A. Cut slopes shall be constructed to no steeper than 2:1 (horizontal:vertical). Fill slopes shall be constructed to no steeper than 2:1 (horizontal:vertical). Prior to placement of fill on an existing slope the existing slope shall be benched. The face of the fill slopes shall be compacted as the fill is placed, or the slope may be overbuilt and then cut back to the design grade. Compaction by track walking will not be allowed.

3.14 FINISH GRADING

A. At completion of project, site shall be finished graded, as indicated on Drawings. Finish grades shall be “flat graded” to grades shown on the drawing. Mounding of finish grades will not be allowed unless otherwise directed on the landscape drawings. Tolerances for finish grades in drainage swales shall be +-0.05’. Tie in new and existing finish grades. Leave all landscaped areas in finish condition for lawn seeding. Landscaped planters shall be graded uniformly from edge of planter to inlets. If sod is used for turf areas the finish grade on which it is placed shall be lowered to allow for sod thickness.

B. All landscape areas shall be left free of rock or foreign material as specified in Section 32 90 00.

C. All landscape areas shall be approved by Architect prior to any planting.

3.15 SURPLUS MATERIAL

A. Excavated material not required for grading or backfill shall be removed from site at contractor’s expense.

3.16 CLEANING

A. Remove from fill all vegetation, wood, form lumber, casual lumber, and shavings, in contact with ground; buried wood will not be permitted in any fill.

END OF SECTION 31 00 00

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SECTION 311000 - SITE CLEARING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work included: Clear and grub the site as shown on the Drawings and specified herein.
B. Related Work:
   1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

1.2 QUALITY ASSURANCE

A. A Geotechnical Engineer will be retained by the Owner to observe performance of work in connection with Site Clearing, Grading, Excavation and Fill, Utility Trenching, Subgrade and Roadbed preparation, and perform compaction tests.
B. Re-adjust work performed that does not meet technical or design requirements, but make no deviation from the contract documents without specific and written approval from the Architect.
C. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.3 PRODUCT HANDLING

A. Comply with pertinent provisions of Division 1 of these Specifications for Product Requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide materials not specifically described but required for proper completion of the work of this Section, as selected by the Contractor subject to the approval of the Architect.
B. Herbicide – Provide a dry, free-flowing, dust-free chemical compound, soluble in water, capable of inhibiting growth of vegetation, and approved for use on this work by governmental agencies having jurisdiction and the Architect.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper execution of the work. Do not proceed until unsatisfactory conditions are corrected.

3.2 PROTECTION

A. Protect existing utilities indicated or made known.
B. Protect trees and shrubs, where indicated to remain, by providing a fence around the tree or shrub a sufficient distance away and of sufficient height so trees and shrubs will not be damaged in any way as part of this work.
C. Protection of persons and property:
   1. Barricade open depressions and holes occurring as part of this work, and post warning lights on property adjacent to or within public access.
   2. Operate warning lights during hours from dusk to dawn each day and as otherwise required.
   3. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by operations under this Section.
D. Use means necessary to prevent dust from becoming a nuisance to the public, to neighbors, and to other work being performed on or near the site.
E. Maintain access to the site at all times.

3.3 CLEARING

A. Clearing and Grubbing
   1. Remove all surface rocks, debris, trash, tree stumps, roots, and other vegetation within the extent of construction as indicated by the drawings. Do not remove vegetation in other areas.
   2. Fell trees, dispose of the trees and other vegetation designated for removal, together with the downed timber, snags, brush, wood, rocks, weeds grass and rubbish. Contractor shall provide a qualified professional tree surgeon to trim individual trees designated to be left standing within the cleared areas of all dead branches and of all live branches to such heights and in such manner as are indicated on the drawings or approved by the Architect. All limbs, branches and roots damaged during construction, together with those required to be trimmed, shall be neatly cut next to the hole of the tree or main branch or root. Cuts more than 1” diameter thus made and any injury to the tree trunk or main branches shall be immediately painted with tree wound paint.
   3. Grub soils to a depth adequate to remove all deleterious material from the working area of the site.
   4. Do not leave any root greater than one inch in diameter and larger in the ground to a depth of at least 12” below the existing ground surface or subgrade or the new graded surface, whichever is lower except as specifically approved by the Engineer. Tree root remaining in the soil with an herbicide approved by the Architect.

B. Removal of Debris: Remove all debris from the site in a legal manner and leave the site in a neat and orderly condition subject to the approval of the Owner. Do not store or permit debris to accumulate on the job site.

3.4 DISPOSAL

A. General:
   1. Remove brush, grass, roots, trash, and other material from clearing operations.
   2. Dispose of away from the site in a legal manner.
   3. Do not store or permit debris to accumulate on the job site.

B. Do not burn debris at the site.

3.5 DUST CONTROL

A. At the contractor's expense, use chemical palliative or spread water as required to maintain strict control of dust generated by operation of work under this Section.

3.6 CLEAN-UP

A. Maintain cleanliness on roadways and other public area used by equipment. Contractor will be held responsible for immediate removal of all spillage on these pavings. Remove from the Project Site all rubbish, rubble, and debris found thereon and all materials and debris resulting from demolition, leaving site in a safe and clean condition.

END OF SECTION 311000

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SECTION 31 11 00 – Clearing and Grubbing

PART 1 - GENERAL

1.1 SUMMARY

A Clearing vegetation, debris, trash and other materials within limits indicated.

B Grubbing of vegetation within limits indicated.

1.2 NOT USED

1.3 NOT USED

PART 2 - PRODUCTS

1.1 NOT USED

A. Clearing vegetation, debris, trash and other materials within limits indicated.

B. Grubbing of vegetation within limits indicated.

PART 3 - EXECUTION

3.1 PREPARATION

A. Locate and clearly flag vegetation to remain or to be relocated.

3.2 RESTORATION

A. Repair or replace vegetation indicated to remain that is damaged by construction operations, as directed by the Owner.

B. Employ a qualified arborist, licensed in jurisdiction where the Project is located, to submit details of proposed repairs and to repair damage to shrubs.

3.3 CLEARING AND GRUBBING

C. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction. Removal includes digging out stumps and obstructions and grubbing roots.

D. Remove trash, debris, logs, concrete, masonry and other waste materials.

E. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.

F. Completely remove stumps, roots, obstructions, and debris extending to a depth of 18-inches below subgrade.

G. Use only hand methods for grubbing within drip line of remaining trees.

3.4 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

A. Construction Waste shall be managed in accordance with provisions of Section 01 74 19 Construction Waste Management and Disposal. Documentation shall be submitted to satisfy the requirements of that section.

END OF SECTION

SECTION 31 22 00 - GRADING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B Geotechnical Engineering Report, Project No.: 300909-010, June 20, 2025, by Earth Systems Pacific, and all addenda and supplemental geotechnical reports.

1.02 SUMMARY

A This Section includes the following:
1. Regulatory Requirements
2. Protection
3. Site Grading
4. Excavation
5. Backfilling
6. Compaction
7. Quality Control
8. Restoration

B Reference Standards:
1. ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, using 5.5 lb (2.5 Kg) Rammer and 12-inch (300 mm) Drop.
2. ASTM D1556 - Test Method for Density of Soil in Place by the Sand-Cone Method.
3. ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb (4.5 Kg) Rammer and 18-inch (450 mm) Drop.
4. ASTM D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
5. ASTM C136 - Method for Sieve Analysis of Fine and Coarse Aggregates.

1.03 SUBMITTALS

A In accordance with the requirements of Section 6705 of the Labor Code of the State of California, submit a detailed plan to the Geotechnical Engineer before excavation, showing the design of shoring, bracing, sloping, or other provisions to be made for worker protection from the hazard of caving ground during the excavation of any trench or trenches 5 feet or more in depth.

B Plan must be submitted and approved by the Owner and Geotechnical Engineer prior to start of work.

C Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

1.04 DEFINITIONS

A Utility: Any buried pipe, duct, conduit, or cable.
B Structure: Foundation, manhole, septic tank, cleanout, catch basin, vault, or culvert.
C Solid Rock: Large continuous masses of igneous, metamorphic, or sedimentary rock, which in the opinion of the Geotechnical Engineer cannot be excavated without drilling and blasting. Soil that is capable of being excavated with rippers is not considered solid rock.
D Loose Rock: Boulders and other detached stones, with a minimum volume of 1 cubic yard.

1.05 QUALITY ASSURANCE

A Perform Work in accordance with Local Public Works Department public improvement standards.
B Contractor shall assume sole and complete responsibility for locating all underground utilities and related facilities and for protection of the same during the course of construction.

PART 2 - PRODUCTS

2.01 MATERIALS

A Topsoil and Other Fill Materials: See Section 31 23 23: Fill.

PART 3 - EXECUTION

3.01 EXAMINATION

A Verify that survey benchmarks, control points, and intended elevations are as shown on drawings.
B Verify the absence of standing or ponding water.
1. Provide temporary means and methods to remove all standing or ponding water from areas prior to grading.

3.02 PROTECTION

A Barricade open excavations.
B Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
C Provide safe conditions for workers and passers-by.

3.03 PREPARATION

A Notify Underground Service Alert (800) 227-2600 in Northern California prior to excavation. Comply with their notice requirements.
B Identify required lines, levels, contours, and datum locations.
C Stake and flag locations of known utilities.
D Protect plant life, lawns, rock outcropping, and other features remaining as final landscaping.
E Protect benchmarks, existing structures, fences, and paving from excavating equipment and vehicular traffic.
F Maintain and protect utilities and structures to remain.

3.04 EXCAVATION

A Classification of Excavation:
1. All excavation with equipment commonly used in the industry is classified as common excavation (except for drilling and blasting).

B Use open cut method on all excavation unless otherwise shown on the drawings, required by permit, or approved in writing by the Engineer.

C Stockpile excavated material on site. Any material not utilized for construction purposes may be spread onsite or removed from the site as designated by the Engineer.

3.05 FINISH GRADING

A Before Finish Grading:
1. Verify building and trench backfilling have been inspected.
2. Verify subgrade has been contoured and compacted.

B Remove debris, roots, branches, stones, in excess of 1/2 inch in size. Remove soil contaminated with petroleum products.

C In areas where vehicles or equipment have compacted soil, scarify surface to depth of 3 inches.

D Fine grade topsoil to eliminate uneven areas and low spots. Maintain profiles and contour of subgrade.

E Maintain stability of topsoil during inclement weather. Replace topsoil in areas where surface water has eroded thickness below specifications.

3.06 TOLERANCES

A Top Surface of Subgrade: Plus or minus 0.10 foot (1-3/16 inches) from required elevation.

B Top Surface of Finish Grade: Plus or minus 0.04 foot (1/2 inch).

3.07 REPAIR AND RESTORATION

A Existing Facilities, Utilities, and Site Features to Remain: If damaged due to this work, repair or replace to original condition.

B Other Existing Vegetation to Remain: If damaged due to this work, replace with vegetation of equivalent species and size.

3.08 FIELD QUALITY CONTROL

A A certified soils testing laboratory may be sourced to perform baseline Modified Proctor density tests in accordance with Cal 216 or latest revision:
1. Tests may be performed at locations approved by the Geotechnical Engineer.
2. Test results from tests prior to construction will be made available to the contractor.
3. Testing is at the Owner’s expense.

B Compaction testing will be determined at the Geotechnical Engineer's discretion. See Section 31 23 23: Fill.

C If work does not meet specified requirements, remove, replace, and retest. All re-testing is at the contractor’s expense. Compaction tests shall be used as the basis for determination of acceptability of work performed under this contract.

3.09 CLEANING

A Remove unused stockpiled topsoil. Grade stockpile area to prevent standing water.
B Leave site clean and raked, ready to receive landscaping.

3.10 PROTECTION OF FINISHED WORK

A If vehicular traffic has altered finished work, reshape and re-compact.

END OF SECTION

SECTION 31 23 00 EXCAVATION AND FILL

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Section Includes
   1. Excavation and/or embankment from existing ground to subgrade, including soil sterilant, for roadways, driveways, parking areas, walks, paths, or trails and any other site improvements called for on the Plans.

B. Related Sections
   1. Section 02 41 00 – Demolition.
   2. Section 31 11 00 – Clearing and Grubbing.
   3. Section 31 23 33 – Trenching and Backfilling.

C. ASTM:
   1. D 1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.
   2. D 1586, Method for Penetration Tests and Split-Barrel Sampling of Soils.
   3. D 2487, Classification of Soils for Engineering Purposes.
   4. D 3740, Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
   5. D 4318. Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
   6. E 329, Specification for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.
   7. E 548, Guide for General Criteria Used for Evaluating Laboratory Competence.

D. California Code of Regulation Title 24, Part 2, California Building Code:
   1. Chapter 11B – Accessibility to Public Buildings.
   2. Chapter 33 – Site Work, Demolition and Construction.

E. Caltrans Standard Specifications:
   1. Section 17, Watering.
   2. Section 19, Earthwork.

F. CAL/OSHA, Title 8.

1.2 SECTION EXCLUDES

A. Earthwork related to underground utility installation, see Section 31 23 33 – Trenching and Backfilling.

1.3 DEFINITIONS

A. Borrow: Approved soil material imported from off-site for use as Structural Fill or Backfill.

B. Excavation: Removal of material encountered above subgrade elevations.
   1. Authorized Over-Excavation: Excavation below subgrade elevations or beyond indicated horizontal dimensions as shown on plans.
   2. Unauthorized Over-Excavation: Excavation below subgrade elevations or beyond

indicated horizontal dimensions. Unauthorized excavation shall be without additional compensation.

C. Structural Backfill: Soil materials used to fill excavations resulting from removal of existing below grade facilities, including trees. See Section 31 23 33 – Trenching and Backfilling.

D. Structural Fill: Soil materials used to raise existing grades.

E. Rock: Rock material in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material ¾-cubic yards or more in volume that, according to ASTM D 1586, exceeds a standard penetration resistance of 100 blows/2-inches.

F. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man made stationary features constructed above or below grade.

G. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, base or topsoil materials.

H. Unsuitable Material: Any soil material that is not suitable for a specific use on the Project.

I. Utilities: onsite underground pipes, conduits, ducts and cables.

1.4 SUBMITTALS

A. Follow submittal procedures outlined in Section 01 33 00 – Submittal Procedures.

B. Submit material certificates signed by the material producer and the Contractor, certifying that that each material item complies with, or exceeds the specified requirements.

1.5 QUALITY ASSURANCE

A. Conform all work to the appropriate portion(s) of the California Code of Regulations, Title 24 and Caltrans Standard Specifications, Sections 17 and 19.

B. Percentage of compaction specified shall be the minimum acceptable. The percentage represents the ratio of the dry density of the compacted material to the maximum dry density of the material as determined by the procedure set forth in ASTM D 1557.

C. Upon completion of the construction work, certify that all compacted fills and foundations are in place at the correct locations, and have been constructed in accordance with sound construction practice. In addition, certify that the materials used are of the types, quality and quantity required by these Technical Specifications. The Contractor shall be responsible for the stability of all fills and backfills constructed by his forces.

D. Finish soil grade tolerance at completion of grading:
   1. Building and paved areas: +0.05
   2. Other areas: ±0.10 feet.

E. The project geotechnical engineer shall be notified of the construction schedule at least one week prior to the beginning of major site construction, and notified at least 48 hours (working days) before being required to perform field observation and testing.

1.6 PROJECT CONDITIONS

A. Promptly notify the Owner of surface or subsurface conditions differing from those disclosed in the construction documents. First notify the Owner verbally to permit verification and extent of condition and then in writing. No claim for conditions differing from those anticipated in the Contract Documents will be allowed unless the Contractor has notified the Owner in writing of differing conditions prior to the Contractor starting work on affected items.

B. Protect open excavations, trenches, and the like with fences, covers and railings to maintain safe pedestrian and vehicular traffic passage.

C. Prevent erosion of freshly graded areas during construction and until such time as permanent drainage and erosion control measures have been installed.

D. Temporarily stockpile fill material in an orderly and safe manner and in a location approved by the Owner.

E. Provide dust and noise control in conformance with Division 1 General Requirements for Cleaning and Waste Management.

F. Environmental Requirements: When unfavorable weather conditions necessitate interrupting earthwork operation, areas shall be prepared by compaction of surface and grading to avoid collection of water. Provide adequate temporary drainage to prevent erosion. After interruption, compaction specified in last layer shall be re-established before resuming work.

PART 2 PART 2 PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from on-site excavations.

B. On-Site Structural Fill and Structural Backfill: Soil or soil-rock mixture from on site excavations, free from organic matter or other deleterious substances. On-site structural fill and backfill shall not contain rocks or rock fragments over 4 inches in greatest dimension and not more than 15 percent shall be over 2-1/2 inches in greatest dimension and with an organic content less than 3.0 percent by weight.

C. Imported Structural Fill and Structural Backfill: Conform to the requirements of on-site structural fill. Material shall also be a non-expansive and predominantly granular soil or soil-rock mixture with plasticity index of 15 or less in accordance with ASTM D 4318 and an R-Value of 25 or greater.

PART 3 PART 3 EXECUTION

3.1 GENERAL

A. Conform to Section 19, Earthwork, Caltrans Standard Specifications as modified by the Contract Documents.

B. Placement and compaction of material by flooding, ponding, or jetting will not be permitted.

C. The use of explosives will not be permitted.

3.2 CONTROL OF WATER AND DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding the site and surrounding area. Provide dewatering equipment necessary to drain and keep excavations and site free from water.

B. Dewater during backfilling operation so that groundwater is maintained a least one foot below level of compaction effort.

C. Obtain the Owner's approval for proposed control of water and dewatering methods.

D. Protect subgrades from softening, undermining, washout and damage by rain or water accumulation.

E. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations.

F. Maintain dewatering system in place until dewatering is no longer required.

3.3 WET WEATHER CONDITIONS

A. Do not prepare subgrade, place or compact soil materials if above optimum moisture content.

3.4 BRACING AND SHORING

A. Conform to California and Federal OSHA requirements.

B. Place and maintain such bracing and shoring as may be required to support the sides of the excavations for the proper protection of workmen; to facilitate the work; to prevent damage to the facility being constructed; and to prevent damage to adjacent structures or facilities. Remove all bracing and shoring upon completion of the work.

C. Be solely responsible for all bracing and shoring and, if requested by the Owner, submit details and calculations to the Owner. The Owner may forward the submittal to the Consulting Engineer and/or the California Division of Industrial Safety for their review. The Contractor's submittal shall include the basic design, assumed soils conditions and estimation of forces to be resisted, together with plans and specifications of the materials and methods to be used, and shall be prepared by a civil engineer or structural engineer registered in California. No excavations related to the proposed facility shall precede a response to the submittal by the Owner.

D. Be solely responsible for installing and extracting the sheathing in a manner which will not disturb the position or operation of the facility being constructed or adjacent utilities and facilities.

3.5 EXCAVATION

A. Excavate earth and rock to lines and grades shown on drawings and to the neat dimensions indicated on the Plans, required herein or as required to satisfactorily compact backfill.

B. Remove and dispose of large rocks, pieces of concrete and other obstructions encountered

during excavation.

C. Where forming is required, excavate only as much material as necessary to permit placing and removing forms.

D. Provide supports, shoring and sheet piles required to support the sides of excavations or for protection of adjacent existing improvements.

3.6 REMOVAL OF EXISTING FILLS AND UNSUITABLE MATERIAL

A. Over-excavate areas of existing fills and other unsuitable material encountered during mass grading.

B. Compensation for increased removal widths and depths that are not required will not be considered, except when such increase is necessary for protection of life and property as determined by and approved by the Owner.

3.7 GRADING

A. Uniformly grade the Project to the elevations shown on plans.

B. Finish ditches, gutters and swales to the sections, lines and grades indicated and to permit proper surface drainage.

C. Round tops and bottoms of slopes as indicated or to blend with existing contours.

3.8 SUBGRADE PREPARATION

A. Install underground utilities and service connections prior to final preparation of subgrade and placement of base materials for final surface facilities. Extend services so that final surface facilities are not disturbed when service connections are made.

B. Prepare subgrades under paved areas, curbs, gutters, walks, structures, other surface facilities and areas to receive structural fill.

C. Prepare subgrades for paved areas, curbs and gutters by plowing or scarifying surface at least 6 inches below final subgrade elevations and 5-feet beyond edge of pavement. Uniformly moisture condition to obtain optimum moisture contents. Break clods and condition surface by harrowing or dry rolling. Remove boulders, hard ribs and solid rock. Prepare earth uniform for full depth and width of subgrade.

D. Protect utilities from damage during compaction of subgrades and until placement of final pavements or other surface facilities.

3.9 PLACEMENT OF STRUCTURAL FILL

A. Place structural fill on prepared subgrade.

B. Spread structural fill material in uniform lifts not more than 8-inches in un-compacted thickness and compact.

C. Place structural fill material to suitable elevations above grade to provide for anticipated settlement and shrinkage.

D. Overbuild fill slopes to obtain required compaction. Remove excess material to lines and grades indicated.

E. Do not drop fill on structures. Do not backfill around, against or upon concrete or masonry structures until structure has attained sufficient strength to withstand loads imposed and the horizontal structural system had been installed.

F. Backfill in uniform lifts not exceeding 8 inches in uncompacted thickness. Each lift should be brought to a uniform moisture content of at lease 1 percent above optimum prior to compacting by either spraying the soil with water of it is too dry or aerating the material if it is too wet.

3.10 KEYWAYS AND BENCHES

A. Provide keyways as indicated for fill slopes steeper than 6 horizontal to 1 vertical. Extend keyway -feet minimum into competent, undisturbed soil or 3-feet minimum into competent, undisturbed rock.

B. Place subsurface drains in bottom of keyway.

C. Bench subgrade as indicated above toe of fill.

D. Place subsurface drains at benches every 20 vertical feet.

3.11 LOT FINISH GRADING

A. Blade finish lots to lines and grades indicated.

3.12 COMPACTION AND TESTING

A. Do not compact by ponding, flooding or jetting.

B. Compact soils at optimum water content. Aerate material if it is too wet. Add water to material if it is too dry. Thoroughly mix lifts before compaction to ensure uniform moisture distribution.

C. Perform compaction using rollers, pneumatic or vibratory compactors.

D. Compaction requirements:
   1. Refer to soils report by geotechnical engineer for compaction requirements: Geotechnical Engineering Report, Project No.: 300909-010, June 20, 2025, by Earth Systems Pacific, and all addenda and supplemental geotechnical reports.

3.13 DISPOSAL

A. Lawfully dispose of all unsuitable and excess or surplus material off-site at no cost to the Owner.

END OF SECTION 31 23 00

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SECTION 31 23 16 EXCAVATION

PART 1 GENERAL

1.1 SUMMARY

A. Excavation for building foundations.

B. Excavation for slabs-on-grade, paving, and landscaping.

C. Excavation for site structures.

D. REFERENCES
1. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, Chapter 18A and Appendix J.

1.2 QUALITY ASSURANCE

A. Comply with Chapters 18A and Appendix J of the CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2.

1.3 FIELD CONDITIONS

A. Verify that survey benchmark and intended elevations for the Work are as indicated.

B. Notify Architect of unexpected subsurface conditions and discontinue work in area affected until notified to resume work.

1.4 PROTECTION

A. Protect trees, shrubs, lawns, and other features remaining as portion of final landscaping.

B. Protect bench marks, fences, roads, sidewalks paving, and curbs.

C. Underpin adjacent structures, including utilities and pipe chases, which may be damaged by excavation work.

D. Protect above or below grade utilities which are to remain.

E. Barricade open excavations and post warning lights. Operate lights from dusk to dawn.

F. Protect facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

G. Repair or replace all damage.

PART 2 PRODUCTS

2.1 EQUIPMENT

A. Equipment: Capable of excavating subsoil.

PART 3 EXECUTION

3.1 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Identify known below grade utilities. Stake and flag locations.

C. Identify and flag above grade utilities.

D. Maintain and protect existing utilities remaining which pass through work area.

E. Notify utility company and pay all costs to remove and relocate utilities.

F. Upon discovery of unknown utility or concealed conditions, discontinue affected work; notify Architect.

3.2 EXCAVATION FOR STRUCTURES

A. Excavate subsoil required to accommodate building foundation, driveway areas, play areas, wells, retaining walls, and construction operations.

B. Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 foot.

C. Extend a sufficient distance from footings and foundations to permit placing and removal of formwork, installation of services, other construction, and for inspection.

D. Overexcavate all existing fill to expose undisturbed native soil. An approximate 2 to 3 feet with some deeper removals at the westernmost classroom building area.

E. Extend overexcavation a minimum distance of 5 feet horizontally beyond exterior face of building, including foundation wall and footing.

F. Hand trim excavation. Remove loose matter.

G. Do not disturb bottom of excavations intended for bearing surfaces.

H. Scarify bottom of excavation to a depth of a minimum of 12 inches, uniformly moisture-conditioned at or above optimum moisture content.

3.3 EXCAVATION FOR PAVEMENTS

A. Cut surface under pavements to comply with cross-sections, elevations, and grades as shown, to subgrade elevations required and to grade tolerances specified.

B. Overexcavate a minimum depth of 6 inches beneath all slabs-on- grade.

C. Overexcavate a minimum depth of 6 inches beneath all paving.

D. Scarify subgrade beneath slabs-on-grade to a depth of 12 inches, moisture-condition to

optimum moisture content and

E. compact as specified.

F. Scarify subgrade beneath paving to a depth of 12 inches, moisture-condition to optimum moisture content and compact as specified.

3.4 STORAGE OF EXCAVATED MATERIALS

A. Stockpile excavated materials in designated on-site area.

B. Segregate excavated materials based upon intended use.

C. Place, grade, and shape stockpile for proper drainage.

D. Locate stockpile away from edge of excavation.

E. Do not stockpile materials within drip line of trees.

3.5 STABILITY OF EXCAVATIONS

A. Comply with local codes, ordinances, and requirements of agencies having jurisdiction.

B. Machine slope banks to angle or repose or less.

C. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

D. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.

E. Provide shoring and bracing in good serviceable condition.

F. Extend shoring and bracing as excavation progresses.

G. Maintain shoring and bracing in excavations regardless of time period excavation will be open.

H. Provide permanent steel sheet piling wherever subsequent removal of piling would permit lateral movement of soil under adjacent structures. Cut off top of piling 2'-6" below finish grade and leave permanently in place.

I. Design and Calculations: Provide by licensed California engineer in accordance with requirements of the California Building Code and Safety Orders of the State of California, Division of Industrial Safety; Title 8, Division 1, Chapter 4, Subchapter 4, Article 6.

3.6 DEWATERING

A. Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.

B. Grade top perimeter of excavations to prevent surface water from draining into excavations.

C. Do not allow water to accumulate in excavations.

D. Remove water to prevent softening of foundation bottoms and soil changes detrimental to stability of subgrades.

E. Provide and maintain pumps, well points, sumps, suction and discharge lines and other components necessary to convey water away from excavations.

F. Establish and maintain temporary drainage ditches and other diversions to convey rain water and water removed from excavations to runoff areas.

G. Do not use trench excavations as temporary ditches.

3.7 DISPOSAL OF EXCESS AND WASTE MATERIAL

A. Remove excess and waste materials, including unacceptable excavated material, trash, and debris, and dispose of legally off site.

3.8 PROTECTION OF WORK

A. Protect finished work under provisions of Section 01 61 00.

B. Protect excavations by methods required to prevent cave-in or loose soil from falling into excavation.

C. Protect bottom of excavations from freezing, water saturation, and disturbance.

3.9 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 01 45 29.

B. Allow testing service to inspect, test, and approve subgrade before further construction work is performed.

3.10 GRADING TOLERANCES

A. Structures: Shape surface of areas under foundations to line, grade, and cross-section, with finish surface not more than 0.10 foot above or below required subgrade elevation.

B. Pavements: Shape surface of areas under pavement to line, grade, and cross-section, with finish surface not more than 1/2 inch above or below required subgrade elevation.
   1. Building Slab: Grade smooth and even, free of voids, to required subgrade elevation. Final grade tolerance to be within 1/2 inch when tested with a 10 foot straightedge.

END OF SECTION 31 23 16

SECTION 31 23 23 FILL

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Filling, backfilling, and compacting for building volume below grade and paving.
2. Backfilling and compacting for utilities outside the building to utility main connections.

B. Related Sections:
1. Section 31 22 00: Grading.
2. Section 31 23 16.13: Trenching.

1.3 DEFINITIONS

A. Finish Grade Elevations: Indicated on drawings.

1.4 SUBMITTALS

A. See Section 01 33 00: Submittal Procedures.

1.5 DELIVERY, STORAGE, AND HANDLING

A. When necessary, store materials on site in advance of need.

PART 2 PRODUCTS

2.1 FILL MATERIALS

A. Fill and Backfill material shall comply with the City of San Luis Obispo Standards and Specifications and the Geotechnical Report

2.2 SOURCE QUALITY CONTROL

A. See Section 01 40 00: Quality Requirements for general requirements for testing and analysis of soil material.

B. If tests indicate materials do not meet specified requirements, change material and retest.

PART 3 EXECUTION

3.1 EXAMINATION

A. Identify required lines, levels, contours, and datum locations.

B. Verify areas to be filled are not compromised with surface or ground water.

3.2 PREPARATION

A. Scarify and proof roll subgrade surface to a depth of 6 inches to identify soft spots.

B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.

C. Compact subgrade to density equal to or greater than requirements for subsequent fill material.

D. Until ready to fill, maintain excavations and prevent loose soil from falling into excavation.

3.3 TOLERANCES

A. Top Surface of General Filling: Plus or minus 1 inch from required elevations.

B. Top Surface of Filling Under Paved Areas: Plus or minus 1 inch from required elevations.

END OF SECTION 31 23 23

SECTION 31 23 33 TRENCHING AND BACKFILLING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. ASTM:
1. C 33, Specification for Concrete Aggregates.
2. C 150, Specification for Portland Cement.
3. C 260, Specification for Air-Entraining Admixtures for Concrete.
4. C 618, Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.
5. D 1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.
6. D 2321, Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.
7. D 2487, Classification of Soils for Engineering Purposes.
8. D 3740, Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
9. E 329, Specification for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.
10. E 548, Guide for General Criteria Used for Evaluating Laboratory Competence.

B. California Code of Regulation Title 24, Part 2, California Building Code:
1. Chapter 11B – Accessibility to Public Buildings.
2. Chapter 33 – Site Work, Demolition and Construction.

C. Caltrans Standard Specifications:
1. Section 19, Earthwork.
2. Section 26, Aggregate Bases.
3. Section 68, Subsurface Drains.
4. Section 88, Engineering Fabrics.

D. CAL/OSHA, Title 8.

1.2 SUMMARY

A. Section Includes
1. Excavation, bedding, and backfill for underground storm drain, sanitary sewer, and water piping and associated structures.

B. Section Excludes
1. Drainage fill material and placement around subdrains.
2. Trenching and backfill for other utilities such as underground HVAC piping, electrical conduit, telephone conduit, gas piping, cable TV conduit, etc.

C. Related Sections
1. Section 31 23 00 – Excavation and Fill.
2. Section 33 10 00 – Water Utilities.
3. Section 33 30 00 – Sanitary Sewerage Utilities.
4. Section 33 40 00 – Storm Drainage Utilities.

1.3 DEFINITIONS

A. AC: Asphalt Concrete.

B. ASTM: American Society for Testing and Materials.

C. Bedding: Material from bottom of trench to bottom of pipe.

D. CDF: Controlled Density Fill.

E. DIP: Ductile Iron Pipe.

F. Initial Backfill: Material from bottom of pipe to 12-inches above top of pipe.

G. PCC: Portland Cement Concrete.

H. RCP: Reinforced Concrete Pipe.

I. Springline of Pipe: Imaginary line on surface of pipe at a vertical distance of ½ the outside diameter measured from the top or bottom of the pipe.

J. Subsequent Backfill: Material from 12-inches above top of pipe to subgrade of surface material or subgrade of surface facility or to finish grade.

K. Trench Excavation: Removal of material encountered above subgrade elevations and within horizontal trench dimensions.
   1. Authorized Trench Over-Excavation: Excavation below trench subgrade elevations or beyond indicated horizontal trench dimensions as shown on plans.
   2. Unauthorized Trench Over-Excavation: Excavation below trench subgrade elevations or beyond indicated horizontal trench dimensions. Unauthorized excavation shall be without additional compensation.

L. Utility Structures:
   1. Storm drainage manholes, catch basins, drop inlets, curb inlets, vaults, etc.
   2. Sanitary sewer manholes, vaults, etc.
   3. Water vaults, etc.

1.4 SUBMITTALS

A. Product Data:
   1. Grading and quality characteristics showing compliance with requirements for the Work.
   2. Certify that material meets requirements of the Project.

B. Samples:
   1. If required, provide 40-pound samples of all imported trench bedding and backfill material sealed in airtight containers, tagged with source locations and suppliers of each proposed material.
   2. Provide materials from same source throughout work. Change of source requires approval of the Owner.

1.5 QUALITY ASSURANCE

A. Conform all work to the appropriate portion(s) of the Caltrans Standard Specifications, Section 19.

B. Percentage of compaction specified shall be the minimum acceptable. The percentage represents the ratio of the dry density of the compacted material to the maximum dry density of the material as determined by the procedure set forth in ASTM D 1557.

C. Conform work to the requirements of the California Building Code.

1.6 PROJECT CONDITIONS

A. Promptly notify the Owner of surface or subsurface conditions differing from those disclosed in the construction documents. First notify the Owner verbally to permit verification and extent of condition and then in writing. No claim for conditions differing from those anticipated in the Contract Documents will be allowed unless Contractor has notified the Owner in writing of differing conditions prior to contractor starting work on affected items.

B. Protect open, trenches, and utility structure excavations with fences, covers and railings to maintain safe pedestrian and vehicular traffic passage.

C. Stockpile on-site and imported backfill material temporarily in an orderly and safe manner.

D. Provide dust and noise control in conformance with Section 02000, Supplemental General Requirements for Civil Improvements. Also see Division 1 General Requirements for Cleaning and Waste Management.

PART 2 PRODUCTS

2.1 PIPE BEDDING AND INITIAL BACKFILL

A. ASTM D 2321, Class IA, IB or II.
   1. Clean and free of clay, silt or organic matter.

B. Permeable Material: Conform to Section 68-1.025 of Caltrans Standard Specifications, Class 2 permeable.

C. Class 2 Aggregate Base: Conform to Section 26 of Caltrans Standard Specifications, ¾-inch maximum. Material shall also be non-expansive and predominantly granular soil or soil-rock mixture “(percent of passing #200: 50 maximum, 5 minimum)” with plasticity index of 15 or less.

D. Sand: Conform to Section 19-3.025B of Caltrans Standard Specifications.

2.2 WARNING TAPE

A. See Section 33 10 00 – Water Utilities.

2.3 SUBSEQUENT BACKFILL

A. Conform to on-site or imported structural backfill in Section 31 23 00 – Excavation and Fill.

2.4 CONTROLLED DENSITY FILL (CDF) (IN TRENCHES)

A. Provide non-structural CDF, from bottom of trench to finish subgrade of subbase or base material, that can be excavated by hand and produce unconfined compressive 28-day strengths from 50-psi to a maximum of 150-psi. Provide aggregate no larger than 3/8-inch top size. The 3/8-inch aggregate shall not comprise more than 30% of the total aggregate content.

B. Cement: Conform to the standards as set forth in ASTM C-150, Type II Cement.

C. Fly Ash: Conform to the standards as set forth in ASTM C-618, for Class F pozzolan. Do not inhibit the entrainment of air with the fly ash.

D. Air Entraining Agent: Conform to the standards as set forth in ASTM C-260.

E. Aggregates need not meet the standards as set forth in ASTM C-33. Any aggregate, producing performances characteristics described herein will be accepted for consideration. The amount of material passing a #200 sieve shall not exceed 12% and no plastic fines shall be present.

F. Provide CDF that is a mixture of cement, Class F pozzolan, aggregate, air entraining agent and water. CDF shall be batched by a ready mixed concrete plant and delivered to the job site by means of transit mixing trucks.

G. The Contractor shall determine the actual mix proportions of the controlled density fill to meet job site conditions, minimum and maximum strengths, and unit weight. Entrained air content shall be a minimum of 4.0%. The actual entrained air content shall be established for each job with the materials and aggregates to be used to meet the placing and unit weight requirements. Entrained air content may be as high as 20% for fluidity requirements.

2.5 CONCRETE STRUCTURE BEDDING AND BACKFILL

A. Precast Structures: Same materials to the same heights as specified for pipe bedding and backfill.

B. Poured-in-Place Structures:
   1. Bedding: In general, bedding is not required, pour bases against undisturbed native earth in cut areas and against engineered fill compacted to 90% relative compaction in embankment areas.
   2. Side Backfill: On-site or imported structural fill meeting the requirements given in Section 31 23 00 – Excavation and Fill.

2.6 FILTER FABRIC

A. Filter Fabric:
   1. Filter Fabric: Section 88-1.03 of Caltrans Standard Specifications.
   2. Mirafi 140N (Mirafi Inc., Charlotte, NC) (Tel. 800-438-1855) or equal.

PART 3 EXECUTION

3.1 TRENCHING AND EXCAVATION

A. Existing PCC or AC Areas: Cut PCC or AC to full depth at a minimum distance of 12-inches beyond the edge of the trench.

B. Excavate by hand or machine. For gravity systems begin excavation at the outlet end and proceed upstream. Excavate sides of the trench parallel and equal distant from the centerline of the pipe. Hand trim excavation. Remove loose matter.

C. Excavation Depth for Bedding: Minimum of 4-inches below bottom, except that bedding is not required for nominal pipe diameters of 2-inches or less.

D. Excavation Width at Springline of Pipe:
1. Up to a nominal pipe diameter of 24-inches: Minimum of twice the outside pipe diameter.
2. Nominal pipe diameter of 30-inches through 36-inches: Minimum of the outside pipe diameter plus 2-feet.
3. Nominal pipe diameter of 42-inches through 60-inches: Minimum of the outside pipe diameter plus 3-feet.

E. Over-Excavations: Backfill trenches that have been excavated below bedding design subgrade, with approved bedding material.

F. Comply with the Owner's limitations on the amount of trench that is opened or partially opened at any one time. Do not leave trenches open overnight without the approval of the Owner.

G. Where forming is required, excavate only as much material as necessary to permit placing and removal of forms.

H. Grade bottom of trench to provide uniform thickness of bedding material and to provide uniform bearing and support for pipe along entire length. Remove stones to avoid point bearing.

3.2 CONTROL OF WATER AND DEWATERING

A. Be solely responsible for dewatering trenches and excavations and subsequent control of ground and surface water. Provide and maintain such pumps or other equipment as may be necessary to control ground water.

B. Dewater during backfilling operation so that groundwater is maintained a least one foot below level of compaction effort.

C. Reroute surface water runoff away from open trenches and excavations. Do not allow water to accumulate in trenches and excavations.

D. Maintain dewatering system in place until dewatering is no longer required.

3.3 BRACING AND SHORING

A. Conform to California and Federal OSHA requirements.

B. Place and maintain such bracing and shoring as may be required to support the sides of the excavations for the proper protection of workmen; to facilitate the work; to prevent damage to the pipes and appurtenances being constructed; and to prevent damage to adjacent structures or facilities. Remove all bracing and shoring upon completion of the work.

C. Be solely responsible for all bracing and shoring and, if requested by the Owner, submit details and calculations to the Owner. The Owner may forward the submittal to the Consulting Engineer and/or the California Division of Industrial Safety for their review. The Contractor's submittal shall include the basic design, assumed soils conditions and estimation of forces to be resisted, together with plans and specifications of the materials and methods to be used, and shall be prepared by a civil engineer or structural engineer registered in California. No excavations in trench section or around structures shall precede a response to the submittal by the Owner.

D. Be solely responsible for installing and extracting the sheathing in a manner which will not disturb the line, grade, or backfill compaction or operation of the utility being installed or adjacent utilities and facilities.

3.4 PIPE BEDDING

A. Accurately shape bedding material to the line and grade called for on the Plans. Carefully place and compact bedding material to the elevation of the bottom of the pipe in layers not exceeding 8-inches in loose thickness. Compact bedding material at optimum water content to 95% relative compaction unless specified otherwise on the. Compact by pneumatic tampers or other mechanical means. Jetting or ponding of bedding material will not be permitted.

3.5 WARNING TAPE

A. Install in accordance with Section 33 10 00 – Water Utilities.

3.6 BACKFILLING

A. Bring initial backfill up simultaneously on both sides of the pipe, so as to prevent any displacement of the pipe from its true alignment. Carefully place and compact initial backfill material to an elevation of 12-inches above the top of the pipe in layers not exceeding 8-inches in loose thickness. Compact bedding material at optimum water content to 90% relative compaction unless specified otherwise on the. Compact by pneumatic tampers or other mechanical means. Jetting or ponding of initial backfill material will not be permitted.

B. Bring subsequent backfill to subgrade or finish grade as indicated. Carefully place and compact subsequent backfill material to the proper elevation in layers not exceeding 8-inches in loose thickness. Compact bedding material at optimum water content to 90% relative compaction, unless specified otherwise on the Plans. Compact by pneumatic tampers or other mechanical means. Jetting or ponding of subsequent backfill material will not be permitted.

C. Do not use compaction equipment or methods that produce horizontal or vertical earth pressures that may cause excessive pipe displacement or damage the pipe.

3.7 CLEANUP

A. Upon completion of utility earthwork all lines, manholes catch basins, inlets, water meter boxes and other structures shall be thoroughly cleaned of dirt, rubbish, debris and obstructions of any kind to the satisfaction of the Owner.

END OF SECTION 31 23 33

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SECTION 320010 - FIELD ENGINEERING

PART 1- GENERAL

1.1 DESCRIPTION

A. Work included: Provide such field engineering services as are required for proper completion of the Work including, but not necessarily limited to:
   1. Establishing and maintaining lines and levels;
   2. Structural design of shores, forms, and similar items provided by the Contractor as part of his means and methods of construction.

B. Related work:
   1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division l of these Specifications.
   2. Additional requirements for field engineering also may be described in other Sections of these Specifications.
   3. As described in The General Conditions, the Owner will furnish survey describing the physical characteristics, legal limitations, utility locations, and legal description of the site.

1.2 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.3 SUBMITTALS

A. Comply with pertinent provisions of Division 1.

B. Upon request of the Architect, submit:
   1. Data demonstrating qualifications of persons proposed to be engaged for field engineering services.
   2. Documentation verifying accuracy of field engineering work.
   3. Certification, signed by the Contractor's retained field engineer, certifying that elevations and locations of improvements are in conformance or nonconformance with requirements of the Contract Documents.

1.4 PROCEDURES

A. In addition to procedures directed by the Contractor for proper performance of the Contractor's responsibilities:
   1. Locate and protect control points before starting work on the site.
   2. Preserve permanent reference points during progress of the Work.
   3. Do not change or relocate reference points or items of the Work without specific approval from the Architect.
   4. Promptly advise the Architect when a reference point is lost or destroyed, or requires relocation because of other changes in the Work.

a. Upon direction of the Architect, require the field engineer to replace reference stakes or markers.
b. Locate such replacements according to the original survey control.

END OF SECTION 320010

SECTION 321214 - SUBGRADE

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section includes, but is not necessarily limited to the work necessary for the preparation of the subgrade.
   1. The subgrade will be considered as those areas and surfaces of new or existing streets, alleys, driveways, parking lots, sidewalks, or other places upon which additional materials are to be placed under Contract, or which are to be constructed or prepared for the future placement thereupon of other materials in accordance with Section 312000 – EARTH MOVING, and as provided herein.

1.2 RELATED WORK DESCRIBED ELSEWHERE

A. All underground work contemplated in the area of the subgrade shall be completed and properly backfilled before subgrade work is started. This is intended to include work on the Contract, work to be performed by the School District, or by others.
B. These Specifications are to be used in conjunction with requirements in those sections of the Specifications having to do with specific types of base materials and pavements.
   1. Division 02 sections - Selective Demolition
   2. Division 31 Sections - Site Clearing, Earthwork, Grading, Excavation, Fill.
   3. Division 32 Sections - Aggregate Base, Site Concrete Paving.

PART 2 - PRODUCTS

2.1 EXCAVATION AND EMBANKMENT

A. The excavation shall include removal of materials which are encountered in excavating to the required grades, including existing pavement and curbs designated to be removed, or as required to accomplish the construction.

2.2 EQUIPMENT

A. Furnish all necessary equipment required to accomplish the excavating, shaping, grading and rolling, and compaction specified herein.

PART 3 - EXECUTION

3.1 SUBGRADE

A. Excavate and shape subgrade to line, grade, and cross section. Roll subgrade with an approved roller until the top 12 inches is compacted to 95 percent of maximum density at optimum moisture content as determined by ASTM D 1557. Remove all soft or otherwise unsuitable material disclosed by the rolling and replace with suitable material from the excavation. Fill holes, and depressions which develop under the roller, to the required grade and cross sections with material from the excavation. The finished subgrade shall be within a tolerance of plus or minus 0.10 of a foot of the grade and cross section shown, shall be smooth and free from irregularities and at the specified density. Compaction shall extend one foot beyond the edge of paving, curb, or form work.

B. The Contractor shall be responsible for the protection of existing improvements; any damage resulting from his operations shall be the Contractor’s sole responsibility.

3.2 EXCAVATION BELOW GRADE

A. Where the Geotechnical Engineer deems subgrade material to be unsatisfactory, excavation below grade will be required to such depths as necessary to remove the unsatisfactory material. Excavation below grade shall be of the same classification as that above it provided it is removed in the same operation as the normal excavation. Where the Contractor has completed the excavation and is required to remove additional, unsuitable material beyond the scope provided in these specifications, or where the additional depth requires special equipment because of unforeseen conditions, the work shall be performed and a payment for excavation below grade will be made on the basis of extra work as provided in the Contract.

B. If the excavation below grade is required because of negligence on the part of the Contractor, the necessary excavation below grade and the backfilling required to restore the surface satisfactorily shall be at the Contractor's sole expense.

C. The subgrade shall be sprinkled with water as required, and in such quantities as necessary, to obtain the specified compaction.

3.3 PROTECTION OF SUBGRADE

A. After preparing the subgrade as above specified, all unnecessary traffic shall be kept off. Should it be found necessary to haul over the prepared subgrade, the Contractor shall drag and roll the traveled way as frequently as may be necessary to remove ruts, cuts, and breaks in the surface. All cuts, ruts, and breaks in the surface of the subgrade that are not removed by the above operations shall be raked and hand-tamped. All equipment used for transporting materials over the prepared subgrade shall be equipped with pneumatic tires.

B. Continued use of sections of prepared subgrade for hauling, so as to cut up or deform it from the true cross section, will not be permitted. The Contractor shall protect the prepared subgrade from both construction and public traffic.

C. The subgrade shall be maintained in the finished condition until the first succeeding course is placed.

3.4 DRIVEWAYS

A. Excavate and shape driveways to the lines, grades, and cross sections shown, or as determined in the field by the Engineer.

END OF SECTION 321214

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SECTION 321215 - AGGREGATE BASE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: This section covers the materials and work necessary for construction of aggregate base, as specified, complete.

B. Related Sections:
   1. Section 32 12 14 Subgrade and Roadbed.
   2. Section 32 13 13 Site Concrete Paving

1.2 SUBMITTALS

A. Samples and Testing: At least thirty (30) days prior to the use thereof, the Contractor shall submit to the Geotechnical Engineer a sample of aggregate, graded as intended for use. Provide sample size as directed by the Geotechnical Engineer, not to exceed 120 lbs. This requirement shall be complied with for each aggregate and grading thereof that has not been reviewed. The Geotechnical Engineer will test the sample at no cost to the Contractor, and will determine the acceptability of the aggregate.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aggregate: The aggregate shall be free from vegetable matter and other deleterious substances. Aggregate for aggregate base shall consist of virgin material of which at least 60 percent by weight shall be crushed particles as determined by Test Method No. Calif. 205.
   1. The percentage composition by weight of aggregate base shall conform to one of the following gradings when determined by Test Method No. Calif. 202.
   2. The particle size distribution shall be in accordance with the grading specified for 3/4-inch maximum size aggregate.

Percentage Passing

Sieve Size	1-1/2" Maximum	3/4" Maximum
2-Inch	100	
1-1/2-Inch	90-100	
1-Inch		100
3/4-Inch	50-85	90-100
No. 4	25-45	35-60
No. 30	10-25	10-30
No. 200	2-9	2-9

   3. The aggregate base shall also conform to the following quality requirements:

	Test Method

Tests		No. Calif.	Requirements
Resistance (R-Value)*		301 78	Minimum
Sand Equivalent		217 30	Minimum
Durability Index	229	35	Minimum

4. The aggregate shall not be treated with lime, cement, or other chemicals before the Durability Index test is performed.
5. Material yielding a maximum dry density of less than 112 pounds per cubic foot when tested in the laboratory in accordance with ASTM "Standard Methods of Test of Moisture-Density Relations of Soils, Using 10-Pound Rammer and 18-Inch Drop", Designation D 1557, shall not be used.
6. Any rock, including red rock, meeting all the requirements of this Section will be acceptable. Such rock shall be plant processed at an approved processing plant.
7. Recycled material shall not be used.

2.2 EQUIPMENT

A. Furnish all necessary equipment required to accomplish the spreading, shaping, and compaction required.

PART 3 - EXECUTION

3.1 SUBGRADE

A. Proof roll subgrade immediately prior to commencement of spreading of aggregate base. Make necessary repairs as directed by the Geotechnical Engineer OR as described in Section 321214 – Subgrade and Roadbed.

3.2 DELIVERY AND SPREADING

A. Aggregate base material shall be delivered to the roadbed as uniform mixtures; each layer shall be spread in one operation.

B. At the time aggregate base is spread it shall have a moisture content sufficient to obtain the required compaction. Such moisture shall be uniformly distributed throughout the material.

C. The material shall be spread upon the prepared subgrade by means of vehicles equipped with approved spreading devices at a uniform quantity per linear foot, which quantity will provide the required compacted thickness within the tolerances specified.

D. Depositing and spreading shall commence at that part of the work farthest from the supply of base material and shall progress continuously without breaks, unless otherwise directed by the Geotechnical Engineer.

E. Where the required thickness is six inches or less, the base material may be spread and compacted in one layer. Where the required thickness is more than six inches, the base material shall be spread and compacted in two or more layers of approximately equal thickness, and the maximum compacted thickness of any one layer shall not exceed six inches. Each layer shall be spread and compacted in a similar manner.

F. Base material placed in areas inaccessible to the spreading equipment may be spread in one or more layers by any means that will make possible the specified compaction and surface.

G. When the subgrade for aggregate base consists of cohesionless sand, and written permission is granted by the Geotechnical Engineer, the base material may be dumped in piles upon the subgrade and spread ahead from the dumped material.

H. The base material, after spreading, shall be shaped by means of a blade grader to such thickness that after watering and compacting, the completed base will conform to the required grade and cross section within the tolerances specified.

I. Segregation of aggregate shall be avoided; the base shall be free from pockets of coarse or fine material.

3.3 COMPACTION

A. Immediately following spreading, shaping, and smoothing, the full width of the base material shall be watered as ordered by the Geotechnical Engineer, and compacted by rolling with a minimum of two pieces of self-propelled reversible equipment. Compaction shall be as follows:

1. For initial rolling use a 3-wheel steel-tired roller, weighing not less than 12 tons distributed so that the rear wheels will apply to the surface being rolled not less than 325 pounds per linear inch of rear tire width. Rolling shall commence by covering completely the outer edge of the material. Subsequent passes shall lap at least 25 percent on previously rolled material.
2. For subsequent rolling use a pneumatic-tired roller of the oscillating type, having a width of not less than four feet and equipped with tires of equal size and diameter. Wobble wheel rollers will not be permitted. The tires shall be so spaced that the entire gap between adjacent tires will be covered by the tread of the following tire. The tires shall be inflated to 90 pounds per square inch minimum.
3. To compact all areas inaccessible to the rollers, use compressed air or gas powered tampers.

B. The foregoing equipment requirements serve as a standard of adequacy.

C. Subject to the condition that the Contractor shall notify the Geotechnical Engineer at least ten (10) days in advance and shall secure approval for the use of each piece of compacting equipment other than that specified, selection thereof and obtainment of the specified compaction throughout the volume of base and the specified surface shall be solely the responsibility of the Contractor.

D. If compaction is not uniform or tests show it to be inadequate, or if the surface is unsatisfactory, the Geotechnical Engineer may require the use of other or additional equipment.

E. Should low or high spots develop during rolling operations, such spots shall be smoothed by blading with a self-propelled, pneumatic-tired motor grader having a wheelbase not less than 15 feet long and a blade not less than 10 feet long.

F. Aggregate base shall be watered after compaction. Water shall be applied at the rate and in the quantities ordered by the Geotechnical Engineer.

G. The relative compaction of aggregate base, determined by tests of the in-place, field compacted base shall be not less than 95 percent of the maximum compaction at optimum moisture content determined by ASTM Methods of Test, Designation D 1556 and Method C of Designation D 1557. The tests will be conducted and evaluated in the laboratory by the Geotechnical Engineer at no cost to the Contractor.

H. The surface of the finished aggregate base at any point shall not vary more than 0.05 foot above or below proper grade; such surface shall contain no ridges, valleys or sharp breaks.

I. Finished base that does not conform to the foregoing requirements shall be reshaped or reworked, watered, and thoroughly recompacted to conform thereto.

J. The Contractor shall not allow any completed untreated rock base to be subject to public or construction traffic, except the latter necessary to the completion of the overlying surface courses.

END OF SECTION 321215

SECTION 32 13 13 – SITE CONCRETE PAVING

Part 1. General

1.01 Related Documents

A. The Drawings and general provisions of the Contract, including General and Special Conditions and Division 1, General Requirements, Apply to the work specified in this section.

B. Parts 1,2,3,4,5,6, Title 24 of the California Code of Regulations (California Building Code) is to be considered an integral part of this section.

C. All California Prevailing Wage Laws apply to the work of this section.

1.02 Work Included

A. The following is a general description of the work included in this section. This description does not limit the scope of work shown in the drawings nor does it relieve the Contractor of any responsibility for coordination of all work of this Contract.

Item	Description
General	• Furnish and install all concrete as shown and specified. This work includes, but is not necessarily limited to concrete pavement, waterproofing, forms, reinforcing, and miscellaneous items. • Concrete paving, headers, curbs, and site work. • Concrete walk repair where existing walks are disturbed or damaged as part of the work of this project. • Incidental concrete repair for utility trenching and other sub-grade construction. • All other concrete flatwork required in conjunction with the work of this project. • Refer to Architectural drawings for masonry wall, gate footings and related concrete work.

B. Related work may be described in other sections of this Project Manual. All sections of this project manual are related. Contractor shall coordinate the work of this section with all other sections.

1.03 Submittals

A. Provide the following submittals per the requirements of Division 1.

Item	Description
Catalog Cuts	• n/a
Samples/Mockups	• Provide manufacturer's color charts. In addition, provide 2'x 2' sample on site of each concrete paving type and color as shown on plans, for color and finish.
Mix Design	• The proposed mix design, giving the brand of cement, type, gradations and source of aggregates, water/cement ratio, mix proportions, and unit weight. • Manufacturer's literature for admixtures, embedded items, liquid membrane-form curing compound and non-shrink grout. • Certification that materials are in compliance with specification requirements. • Method of transporting and placing concrete.
Shop Drawings	• n/a
Product Data	• Provide product data for each type of product and process specified in this section and incorporated into the work of other sections during fabrication, finishing, and installation.
Schedule	• Provide written delivery and installation schedule for purposes of coordination, notification and completion.

1.04 References / Standards

A. The following References and Standards are incorporated into the requirements of this Section as they apply to products, assembly, manufacturing procedures and installation. References shall be utilized in determining "Industry Standards" and other acceptable manufacture and installation methods but shall not relieve the Contractor of any other responsibilities of the Contract. Where conflicts occur between multiple listed references, the Contractor shall assume that the more restrictive standard applies and shall seek determination from the District Representative regarding applicable standard.

- Unless otherwise shown or specified, all materials and methods shall conform to the appropriate current sections of:

  1. District Standards for Public Improvements.
  2. The State of California, Department of Transportation Standard Specifications (DTSS) sections 52 and 90 except for measurement and payment requirements.
  3. Applicable ASTM Specifications as they reasonably apply to this work, except for measurement and payment requirements.
  4. American Concrete Institute (ACI), current standards.

1.05 Quality Assurance

Item	Description
Qualifications of Workers	• Provide paving subcontractor experienced in Institutional grade flatwork, accessibility requirements and pedestrian hazard management.
Product Acceptance	• Provide assurance that concrete finish will match existing where specified
Substrate Acceptance	Commencement of work implies acceptance of substrate, including: • Compaction • Base composition

1.06 Quality Control

A. The following specific procedures shall be required to demonstrate adequate levels of quality provided for project components and systems. Exclusion of any item from this list does not relieve the Contractor of any responsibilities for quality procedures covered elsewhere in the Contract Documents.

Item	Description
Tolerances	• Tolerances for sub-grade, sub-base and finished grade shall be as specified by DTSS except that Contractor shall deliver the full aggregate base and concrete thickness shown. No combination of high and low tolerances that compromise the section will be permitted.
Finish and Color	• The Contractor shall demonstrate to the satisfaction of the District and the Landscape Architect that he, or his subcontractor, possesses

	sufficient skills and experience to perform the work. Photographs and/or site visits of past work may be required to supply this information. A 2' x 2' sample of all concrete pavement types shall be poured and finished at the site for District Representative's review prior to commencing concrete pouring. Samples shall contain same thickness, material composition, finish, color and texture as specified for the project. Once the samples have been reviewed, the Contractor shall meet or exceed that quality of finish in all subsequent work. Contractor shall be responsible for removal of the samples at the completion of the work.
Weather Limitations	• Construct concrete surface course only when atmospheric temperature is above 40 degrees F., when the underlying base is dry, and when weather is not rainy.
Grade Control	• Establish and maintain the required lines and grades, including cross-slope during construction operations. All concrete shall slope to drain with no ponding of water. • District Representative to observe initial placement and finishing to determine compliance with expected finish quality and consistency. • District Representative to observe selected placement throughout project and accept or reject based on expected finish quality and consistency

1.07 Warranty

A. Provide written warranty in accordance with Division 1.

Item	Description
Warranty Form	• Contractor to provide warranty against defects in materials or workmanship. Replacement or repair of such defects shall be repaired or replaced in a timely fashion at no additional cost to the District.

Warranty Period	• 1 year
Warranty Start	• Substantial Completion

1.08 Close Out

A. Provide written warranty in accordance with Division 1.

Item	Description
Commissioning Requirements	• Refer to Division 1 for detailed Commissioning Procedures. General Commissioning Requirements. • Spot check for gradient and drainage by District Representative. • Specific review of finish consistency. • Specific review of trip hazards.

Part 2. Products

2.01 Materials

A. Forms: Shall be dimensional lumber, straight, and free and clear of any defects.

B. Reinforcing:

1. All reinforcement material: new and free from scale, rust, or coatings, which will reduce bond to concrete.
2. Unless otherwise noted, use only deformed reinforcement.
3. Reinforcing steel: Deformed billet steel bars, ASTM A615, Grade 60, except stirrups and ties #3 or smaller may be Grade 40. ASTM A706 for reinforcement to be welded.
4. Tie wire: 16 gauge or heavier, black annealed steel wire.

C. Dowels at Expansion Joints: Greenstreak Speed Dowel sleeve, with smooth steel dowel.

D. Concrete: Class 1 conforming to Section 90 of the DTSS.

1. Cement: Type II modified conforming to ASTM-C-150.
2. Aggregate: Minimum 3/8 inch, maximum 3/4 inch size.
3. Compression strength at 28 days shall be 3,000 p.s.i. minimum.
4. Provide minimum 5-1/2 sacks of cement per cu. yd., with a maximum slump of 4 inches.

E. Color Admixture: shall be “lamp black” at the rate of ½ lb. per cubic yard.

F. Expansion Joint Filler: “Fibre” joint filler manufactured by W.R. Meadows Seal Tight, 1/2” thick. Conforming to ASTM D 1757.

G. Expansion Joint Sealer: Sikaflex – 2c (two-component, self-leveling, polyurethane elastomeric sealant, with color added). Color to be selected by Architect.

H. Cleaning Agents: As required.

I. Aggregate Base: refer section 32 12 15.

J. Finish: Light Broom.

Part 3. Execution

3.01 Preparation

A. Clear area to be paved of all debris and organic material. Recompact and regrade as necessary prior to placement of concrete. Verify that the subgrade and/or aggregate base is properly compacted and at suitable grade.

B. Before beginning paving work and during construction, take all steps necessary for protection of existing improvements. As the concrete is being placed, extreme care shall be taken not to discolor or damage any adjacent improvements. If satisfactory repair cannot be made, remove and replace the section as directed.

C. Formwork and Reinforcement:

1. Assure that excavations and formwork are completed.
2. Check that reinforcement is secured in place.
3. Verify all slopes are in conformance with plans. Notify Architect if any discrepancies or slopes that exceed those as specified in drawings.
4. Verify that expansion joint material, anchors, and other embedded items are secured in position. Plastic caps shall be in place over expansion joint filler.

D. Expansion Joints:

1. General:
   a. Expansion joints shall be laid out with form boards, and dowels installed with speed dowel sleeves securely attached to form board, so they are perpendicular to joint.
   b. Rebar and dowels shall be placed appropriately at expansion joints. Rebar shall not run continuous across expansion joints.
   c. Place top of expansion joint ¾” below finished surface. After concrete has cured, remove plastic caps. Caulk joint per detail.
   d. Cardboard shall never be used for sleeves. Speed dowel sleeves, or approved equal, shall be used to ensure proper dowel alignment with forms.
2. New Expansion Joints at Existing Site Paving: Existing concrete with rough or damaged edges shall be repaired before new site concrete is placed. Color and finish shall match existing concrete.
3. New Expansion Joints within New Concrete Area:

Dowels shall be aligned perpendicular to joint. They shall be attached firmly to form with speed dowels or approved equal. Dowels placed in loose form openings or allowed to float freely during the pour will result in rejection of the entire work.

3.02 Placement

A. Finishes

1. Provide a medium broom finish for all concrete flatwork specified. Finish shall be applied uniformly and in straight, parallel lines. Sample finish shall be reviewed and accepted prior to pouring the concrete. *All walkway surfaces shall have a non-slip finish as required by code.*

B. Convey all concrete to place of final deposit by methods that will prevent separation and loss of material. Place concrete as dry as practical, consistent with specified slump, and with a maximum temperature of 80 degrees F and minimum temperature of 50 degrees F at the time of placement. Do not use retempered concrete.

C. Thoroughly consolidate and compact the concrete by suitable means during placement, completely embedding reinforcing steel, anchors, and filling of corners.

D. Tamp slabs with a jitterbug and depress course aggregates, using pushfloat to level and finish to screeds without depressions. Trowel slabs to a smooth, dense surface, and finish as noted.

E. Wet slabs shall meet all screeds and existing work accurately and shall not rise above or be below them. Carefully contour at all new or existing imbedded items so as to avoid depressions or obstructions. No bird baths!

F. Make all slabs even and uniform in appearance, sloped uniformly to provide even fall or drainage. All surfaces shall have a slip-resistant finish.

G. Cure concrete for a minimum of five (5) days before removal of forms. Use spray applied biodegradable monomolecular curing compound for slabs such as Master Builders "Confilm."

H. Water-spray all concrete for minimum of three (3) days, and keep moist at all times during daylight hours.

3.03 Clean Up

A. Upon completion of the work under this section, remove immediately all surplus materials, rubbish, and equipment associated with or used in the performance of this work.

B. Remove all plastic caps from expansion joints.

C. Install sealant at all the expansion joints.

3.04 Defective Work

A. Immediately after forms are removed, inspect concrete surfaces. If voids, rock pockets, or other imperfections exist, patch before concrete becomes thoroughly dry.

B. Patching of minor defective areas shall include the wetting of the area to be patched and the surrounding area, the pre-coating of the area to be patched with the epoxy bonding agent specified, and the patching of the area with non-shrink grout, as specified, and in accordance with the respective manufacturer's printed recommendations.

C. Architect reserves the right to reject and require replacement of defective concrete work for reasons including, but not limited to, the following:

1. Deficient grades and “bird baths”
2. Deficient edge and joint tooling
3. Inconsistent finish texture or color
4. Inconsistent joint width and depth

End of Section

SECTION 32 31 20 - ORNAMENTAL STEEL FENCING (CUSTOM)

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Ornamental perforated steel fencing panels welded into metal frame, including steel fence posts and gates.

B. Related sections:

1. Section 32 13 13 – Site Concrete: Concrete footings for support of fence posts.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM) Publications:

1. ASTM A36 - Structural Steel.

2. ASTM A121 - Zinc-Coated (Galvanized) Steel Barbed Wire.

3. ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

4. ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

5. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus.

6. ASTM D822 - Tests on Paint and Related Coatings Using Filtered Open-Flame Carbon-Arc Exposure Apparatus.

7. ASTM D1794 - Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).

8. ASTM D3363 - Test Method for Film Hardness by Pencil Test.

1.3 SUBMITTALS

A. Provide in accordance with Division 01, Submittal Procedures:

1. Product data for components and accessories.

2. Shop drawings showing layout, dimensions, spacing of components, and anchorage and installation details.

3. Sample: 8 by 10 inches minimum size sample of fence panel illustrating design, fabrication workmanship, and selected color coating.

4. Copy of warranty specified in Paragraph 1.4 for review by Architect.

5. Prepare on-site fencing mockup which shows typical footing. Mockup to be approved by Architect prior to fence installation.

1.4 WARRANTY

A. Provide in accordance with Division 01 – Contract (Project) Closeout:

1. Ten (10) year warranty for factory finish against cracking, peeling, and blistering under normal use.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Local distributor/fabricator recommended for sourcing material is Grating Pacific, Inc. 1398 Mariani Court, Tracy, CA 95376 (209-832-6363) contact Dave Scheuerlein.

B. Manufacturers of equivalent products submitted and approved in accordance with Division 01 – Product Options and Substitutions.

2.2 MATERIALS

A. Steel sheet: ASTM A653.

B. Steel tubing: ASTM A500, Grade B.

C. Grout: Non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, and water reducing and plasticizing additives.

2.3 FENCE SYSTEM

A. Type: Ornamental steel fencing system consisting of posts, top and bottom rails, and pickets.

B. Fence panels: Fabricated from square steel tube top and bottom rails with steel pickets.

1. Top and bottom perimeter rails: 14 gauge 1-1/2 inch square steel tubes.

3. Panel height: As shown on drawings.

4. Panel width: As shown on drawings.

C. Posts: square steel tubes, 14 gauge

1. Size: Per drawings.

2. Length: As shown on drawings.

3. Weld flat steel bar top caps to tubular posts.

2.4 GATES

A. Provide gates of type and size indicated on Drawings. Equip gates with hardware as indicated in gate hardware schedule and manufacturer's standard hardware as required for complete functional operation.

B. Type: Hinged swinging single and double gates.

1. Construction: Welded frame fabricated from steel tubing and solid bar with perforated steel panels to match fencing material.

2. Nominal size: As shown on drawings.

3. Hardware:

a. Hinges: Size and type per drawings.

b. Hardware: As indicated in gate hardware schedule.

2.5 ACCESSORIES

A. Fasteners: Stainless steel bolts of type, size, and spacing as recommended by fence manufacturer for specific condition. Use attachment system and fasteners to secure panels to supporting members as shown on plans.

B. For exposed locations, provide anti-intruder bolts consisting of cup head bolt and nut with clamping hexagon such that tightening shears hexagon and render bolt impossible to release.

2.6 FACTORY FINISH

A. Steel fence panels and posts shall be hot-dip galvanized to 1.25 ounces per square foot minimum zinc coating in accordance with ASTM A123. Standard size components shall receive polyester powder coating. Large gate panels shall be coated with 2-part polyurethane coating.

B. Polyester powder coating: Electrostatically applied colored polyester powder coating heat cured to chemically bond finish to metal substrate.

4. Minimum hardness measured in accordance with ASTM D3363: 2H.

5. Direct impact resistance tested in accordance with ASTM D2794: Withstand 160 inch-pounds.

6. Salt spray resistance tested in accordance with ASTM B117: No undercutting, rusting, or blistering after 500 hours in 5 percent salt spray at 95 degrees F and 95 percent relative humidity and after 1000 hours less than 5 mm undercutting.

C. Polyurethane coating: 1.0 mil dry film thickness of coating of steel test panel cured 30

minutes at 180 degree F and aged 14 days shall resist the following test conditions without failure:

1. 5 percent salt spray for 500 hours.

2. 100 percent relative humidity for 1000 hours.

3. Water immersion for 100 hours.

4. 20 double rubs with cloth saturated with either lacquer thinner, acetone, MEK, gasoline, xylene.

5. Exposure to lubricating oils, hydraulic fluids, and cutting oils.

6. 16 cycles of 24 hours at 100 percent humidity, 24 hours at 10 degrees F, and 24 hours at 77 degrees F.

7. Hardness: H to 2H.

8. Flexibility: 1/8 inch conical mandrel.

D. Color: Selected by Architect from manufacturer's standard range.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prior to fabrication, field verify required dimensions.

B. Cast concrete footings in accordance with Section 32 13 13 - Cast-in-Place Concrete as detailed on Drawings and approved shop drawings.

3.2 INSTALLATION

A. Install fencing in accordance with manufacturer's installation instructions and approved shop drawings.

B. Install fence posts plumb and level [by embedding post directly in concrete footing.] Temporarily brace fence posts with 2 by 4 wood supports until [concrete] is set.

C. Do not installed bent, bowed, or otherwise damaged panels. Remove damaged components from site and replace.

D. Gates:

1. Install gates and adjust hardware for smooth operation.

2. Provide concrete center foundation depth and drop rod retainers at center of double swinging gate openings.

3. After installation, test gate. Open and close a minimum of five times. Correct

deficiencies and adjust.

E. Touch-up damaged finish with paint supplied by manufacturer and matching original coating.

END OF SECTION 32 31 20

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SECTION 33 10 00 - WATER UTILITIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B Geotechnical Engineering Report, Project No.: 300909-010, June 20, 2025, by Earth Systems Pacific, and all addenda and supplemental geotechnical reports.

C Uniform Plumbing Code (UPC), Current Edition.

1.02 SUMMARY

A Section Includes:
1. Water-distribution piping and related components.

B Related Requirements:
1. Section 312000 Earth Moving.

1.03 DEFINITIONS

A DIP: Ductile Iron Pipe

B PVC: Polyvinyl chloride plastic pipe

1.04 ACTION SUBMITTALS

A Product Data: For each type of product indicated.

1.05 INFORMATIONAL SUBMITTALS

A Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from water system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.

B Profile Drawings: Show system piping in elevation. Draw profiles at horizontal scale of not less than 1 inch equals 50 feet and vertical scale of not less than 1 inch equals 5 feet. Indicate piping and specialty sizes and valves, meter and specialty locations, and elevations. Show types, sizes, materials, and elevations of other utilities crossing system piping.

C Field quality-control reports.

1.06 CLOSEOUT SUBMITTALS

A Operation and Maintenance Data: For water valves and specialties to include in emergency, operation, and maintenance manuals.

1.07 QUALITY ASSURANCE

A Regulatory Requirements:
1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.

3. Comply with standard of authorities for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

B Piping materials shall bear label, stamp, or other markings of specified testing agency.

1.08 DELIVERY, STORAGE, AND HANDLING

A Preparation for Transport: Prepare valves, including fire hydrants, according to the following:
1. Ensure that valves are dry and internally protected against rust and corrosion.
2. Protect valves against damage to threaded ends and flange faces.
3. Set valves in best position for handling. Set valves closed to prevent rattling.

B During Storage: Use precautions for valves, including fire hydrants, according to the following:
1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
2. Protected from weather. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

C Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

D Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

E Protect stored piping from moisture and dirt. Elevate above grade.

F Protect flanges, fittings, and specialties from moisture and dirt.

G Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.09 PROJECT CONDITIONS

A Interruption of Existing Water-Distribution Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:
1. Notify Architect, Construction Manager, and Owner no fewer than seven days in advance of proposed interruption of service.
2. Do not proceed with interruption of water-distribution service without Architect's, Construction Manager's, and Owner's written permission.
3. Coordinate utility shut down with utility Owner.

1.10 COORDINATION

A Coordinate connection to water main with utility company.

PART 2 - PRODUCTS

2.01 COPPER TUBE AND FITTINGS

A Soft Copper Tube: ASTM B88, Type K and ASTM B251 water tube, annealed temper.
1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.
2. Copper, Pressure-Seal Fittings:

a) NPS 2 and Smaller: Wrought-copper fitting with EPDM O-ring seal in each end.
b) NPS 2-1/2 to NPS 4: Bronze fitting with stainless-steel gripring and EPDM O-ring seal in each end.

B Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.

C Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

2.02 DUCTILE-IRON PIPE AND FITTINGS

A Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.
1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
2. Gaskets: AWWA C111, rubber.

C Grooved-Joint, Ductile-Iron Pipe: AWWA C151, with cut, rounded-grooved ends.
1. Grooved-End, Ductile-Iron Pipe Appurtenances:
a) Grooved-End, Ductile-Iron Fittings: ASTM A 47/A 47M, malleable-iron castings or ASTM A 536, ductile-iron castings with dimensions matching pipe.
b) Grooved-End, Ductile-Iron-Piping Couplings: AWWA C606, for ductile-iron-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.

D Flanges: ASME 16.1, Class 125, cast iron.

2.03 PVC PIPE AND FITTINGS

A PVC Pipe: PVC SCH 40, ASTM D1785
B Gasket Joints: ASTM F477
C Solvent-weld joints: ASTM D2672

2.04 JOINING MATERIALS

A Brazing Filler Metals: AWS A5.8, BCuP Series.

2.05 PIPING SPECIALTIES

A Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

B Tubular-Sleeve Pipe Couplings:
1. Description: Metal, bolted, sleeve-type, reducing or transition coupling, with center sleeve, gaskets, end rings, and bolt fasteners and with ends of same sizes as piping to be joined.
a) Standard: AWWA C219.
b) Center-Sleeve Material: Manufacturer's standard, Carbon steel, Stainless steel, Ductile iron, or Malleable iron.

c) Gasket Material: Natural or synthetic rubber.
d) Pressure Rating: 200 psig minimum.
e) Metal Component Finish: Corrosion-resistant coating or material.

C Split-Sleeve Pipe Couplings:
1. Description: Metal, bolted, split-sleeve-type, reducing or transition coupling with sealing pad and closure plates, O-ring gaskets, and bolt fasteners.
a) Standard: AWWA C219.
b) Sleeve Material: Manufacturer's standard, Carbon steel, or Stainless steel.
c) Sleeve Dimensions: Of thickness and width required to provide pressure rating.
d) Gasket Material: O-rings made of EPDM rubber, unless otherwise indicated.
e) Pressure Rating: 200 psig minimum.
f) Metal Component Finish: Corrosion-resistant coating or material.

D Flexible Connectors:
1. Nonferrous-Metal Piping: Bronze hose covered with bronze wire braid; with copper-tube, pressure-type, solder-joint ends or bronze flanged ends brazed to hose.
2. Ferrous-Metal Piping: Stainless-steel hose covered with stainless-steel wire braid; with ASME B1.20.1, threaded steel pipe nipples or ASME B16.5, steel pipe flanges welded to hose.

2.06 CATHODIC PROTECTION

A Cathodic Protection shall be per Authorities having Jurisdiction Water & Sewer Division Standards.

2.07 GATE VALVES

A AWWA, Cast-Iron Gate Valves:
1. Nonrising-Stem, Metal-Seated Gate Valves:
a) Description: Gray- or ductile-iron body and bonnet; with cast-iron or bronze double-discgate, bronze gate rings, bronze stem, and stem nut.
1) Standard: AWWA C500.
2) Minimum Pressure Rating: 200 psig.
3) End Connections: Mechanical joint.
4) Interior Coating: Complying with AWWA C550.
2. Nonrising-Stem, Resilient-Seated Gate Valves:
a) Description: Gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-irongate, resilient seats, bronze stem, and stem nut.
1) AWWA C509.
2) Minimum Pressure Rating: 200 psig.
3) End Connections: Mechanical joint.
4) Interior Coating: Complying with AWWA C550.
3. Nonrising-Stem, High-Pressure, Resilient-Seated Gate Valves:
a) Description: Ductile-iron body and bonnet; with bronze or ductile-iron gate, resilient seats, bronze stem, and stem nut.
1) Standard: AWWA C509.
2) Minimum Pressure Rating: 250 psig.
3) End Connections: Push on or mechanical joint.
4) Interior Coating: Complying with AWWA C550.
4. OS&Y, Rising-Stem, Metal-Seated Gate Valves:

a) Description: Cast- or ductile-iron body and bonnet, with cast-iron double disc, bronze disc and seat rings, and bronze stem.
1) Standard: AWWA C500.
2) Minimum Pressure Rating: 200 psig.
3) End Connections: Flanged.

5. OS&Y, Rising-Stem, Resilient-Seated Gate Valves:
a) Description: Cast- or ductile-iron body and bonnet, with bronze or gray- or ductile-irongate, resilient seats, and bronze stem.
1) AWWA C509.
2) Minimum Pressure Rating: 200 psig.
3) End Connections: Flanged.

B UL/FMG, Cast-Iron Gate Valves:
1. UL/FMG, Nonrising-Stem Gate Valves:
a) Description: Iron body and bonnet with flange for indicator post, bronze seating material, and inside screw.
1) Standards: UL 262 and FMG approved.
2) Minimum Pressure Rating: 175 psig. End Connections: Flanged.
2. OS&Y, Rising-Stem Gate Valves:
a) Description: Iron body and bonnet and bronze seating material.
1) Standards: UL 262 and FMG approved.
2) Minimum Pressure Rating: 175 psig.
3) End Connections: Flanged.

C Bronze Gate Valves:
1. OS&Y, Rising-Stem Gate Valves:
a) Description: Bronze body and bonnet and bronze stem.
1) Standards: UL 262 and FMG approved.
2) Minimum Pressure Rating: 175 psig.
3) End Connections: Threaded.
2. Nonrising-Stem Gate Valves:
a) Description: Class 125, Type 1, bronze with solid wedge, threaded ends, and malleable-iron handwheel.
1) Standard: MSS SP-80.

2.08 GATE VALVE ACCESSORIES AND SPECIALTIES

A Tapping-Sleeve Assemblies:
1. Description: Sleeve and valve compatible with drilling machine.
a) Standard: MSS SP-60.
b) Tapping Sleeve: Cast- or ductile-iron or stainless-steel, two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve.
c) Valve: AWWA, cast-iron, nonrising-stem, metal or resilient-seated gate valve with one raised face flange mating tapping-sleeve flange.

B Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel approximately 5 inches in diameter.
1. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

C Indicator Posts: UL 789, FMG-approved, vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve.

2.09 CORPORATION VALVES AND CURB VALVES

A Service-Saddle Assemblies: Comply with AWWA C800. Include saddle and valve compatible with tapping machine.
1. Service Saddle: Copper alloy with seal and AWWA C800, threaded outlet for corporation valve.
2. Corporation Valve: Bronze body and ground-key plug, with AWWA C800, threaded inlet and outlet matching service piping material.
3. Manifold: Copper fitting with two to four inlets as required, with ends matching corporation valves and outlet matching service piping material.

B Curb Valves: Comply with AWWA C800. Include bronze body, ground-key plug or ball, and wide tee head, with inlet and outlet matching service piping material.

C Service Boxes for Curb Valves: Similar to AWWA M44 requirements for cast-iron valve boxes. Include cast-iron telescoping top section of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over curb valve and with a barrel approximately 3 inches in diameter.
1. Shutoff Rods: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and slotted end matching curb valve.

2.10 FIRE HYDRANTS

A Dry-Barrel Fire Hydrants:
1. Description: Freestanding, with one NPS 4-1/2 and two NPS 2-1/2 outlets, 5-1/4-inch main valve, drain valve, and NPS 6 mechanical-joint inlet. Include interior coating according to AWWA C550. Hydrant shall have cast-iron body, compression-type valve opening against pressure and closing with pressure.
a) Standard: AWWA C502.
b) Pressure Rating: 150 psig minimum.
c) Per Authorities having Jurisdiction Water & Sewer Division Standards.

B Wet-Barrel Fire Hydrants:
1. Description: Freestanding, with one NPS 4-1/2 and two NPS 2-1/2 outlets, NPS 6 threaded or flanged inlet, and base section with NPS 6 mechanical-joint inlet. Include interior coating according to AWWA C550.
a) Standard: AWWA C503.
b) Pressure Rating: 150 psig minimum.
c) Per Authorities having Jurisdiction Water & Sewer Division Standards.

2.11 FIRE DEPARTMENT CONNECTIONS

A Fire Department Connections:
1. Description: Freestanding, with cast-bronze body, thread inlets according to NFPA 1963 and matching local fire department hose threads, and threaded bottom outlet. Include lugged caps, gaskets, and chains; lugged swivel connection and drop clapper for each hose-connection inlet; 18-inch- high brass sleeve; and round escutcheon plate.
a) Standard: UL 405.
b) Connections: Two NPS 2-1/2 inlets and one NPS 4 outlet.
c) Inlet Alignment: Inline, horizontal or Square.
d) Finish Including Sleeve: Polished bronze.
e) Escutcheon Plate Marking: "AUTO SPKR & STANDPIPE."
f) Per Authorities having Jurisdiction Water & Sewer Division Standards.

PART 3 - EXECUTION

3.01 EARTHWORK

A Excavation, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.02 UTILITY LOCATION

A Prior to any utility installation work commencing, Contractor shall call Dig Alert, at 1-(800)-422-4133, to confirm the location of existing underground utility installations.

3.03 PIPING APPLICATIONS

A General: Use pipe, fittings, and joining methods for piping systems according to the following applications.
B Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.
C Do not use flanges or unions for underground piping.
D Flanges, unions, grooved-end-pipe couplings, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.
E Underground water-service piping NPS 2 to NPS 16 shall be the following:
1. Soft copper tube, ASTM B88, Type K and B251; wrought-copper, solder-joint fittings; and brazed joints.
2. Ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed, or mechanical-joint pipe; ductile-iron, mechanical-joint fittings; and mechanical joints.
F Underground water-service piping NPS 30 shall be the following:
1. Ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed, or mechanical-joint pipe; ductile-iron, mechanical-joint fittings; and mechanical joints.

3.04 VALVE APPLICATIONS

A General Application: Use mechanical-joint-end valves for NPS 3 and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FMG, nonrising-stem gate valves for installation with indicator posts. Use corporation valves and curb valves with ends compatible with piping, for NPS 2 and smaller installation.
B Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
1. Underground Valves, NPS 3 and Larger: AWWA, cast-iron, nonrising-stem, metal or resilient-seated gate valves with valve box.
2. Underground Valves, NPS 4 and Larger, for Indicator Posts: UL/FMG, cast-iron, nonrising-stem gate valves with indicator post.
3. Use the following for valves in vaults and aboveground:
a) Gate Valves, NPS 2 and Smaller: Bronze, nonrising or rising stem.
b) Gate Valves, NPS 3 and Larger: AWWA, cast iron, OS&Y rising stem, metal seated.
c) Check Valves: AWWA C508, swing type.
4. Pressure-Reducing Valves: Use for water-service piping in vaults and aboveground to control water pressure.
5. Relief Valves: Use for water-service piping in vaults and aboveground.
a) Air-Release Valves: To release accumulated air.
b) Air/Vacuum Valves: To release or admit large volume of air during filling of piping.
c) Combination Air Valves: To release or admit air.

6. Detector Check Valves: Use for water-service piping in vaults and aboveground to detect unauthorized use of water.

3.05 PIPING INSTALLATION

A Water-Main Connection: Arrange with utility company for tap of size and in location indicated in water main.

B Water-Main Connection: Tap water main according to requirements of water utility company and of size and in location indicated.

C Make connections larger than NPS 2 with tapping machine according to the following:
1. Install tapping sleeve and tapping valve according to MSS SP-60.
2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.
5. Comply with Authorities having Jurisdiction Water & Sewer Division Standards.

D Make connections NPS 2 and smaller with drilling machine according to the following:
1. Install service-saddle assemblies and corporation valves in size, quantity, and arrangement required by utility company standards.
2. Install service-saddle assemblies on water-service pipe to be tapped. Position outlets for corporation valves.
3. Use drilling machine compatible with service-saddle assemblies and corporation valves. Drill hole in main. Remove drilling machine and connect water-service piping.
4. Install corporation valves into service-saddle assemblies.
5. Install manifold for multiple taps in water main.
6. Install curb valve in water-service piping with head pointing up and with service box.
7. Comply with Authorities having Jurisdiction Water & Sewer Division Standards.

E Comply with NFPA 24 for fire-service-main piping materials and installation.
1. Install copper tube and fittings according to CDA's "Copper Tube Handbook."

F Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.

G Bury piping with depth of cover over top at least 12 inches, with top at least 12 inches below level of maximum frost penetration if applicable (unless otherwise noted).

H Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

3.06 JOINT CONSTRUCTION

A Make pipe joints according to the following:
1. Copper-Tubing, Pressure-Sealed Joints: Use proprietary crimping tool and procedure recommended by copper, pressure-seal-fitting manufacturer.
2. Ductile-Iron Piping, Gasketed Joints for Water-Service Piping: AWWA C600 and AWWA M41.
3. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.
4. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
    a) Dielectric Fittings for NPS 2 and Smaller: Use dielectric nipples or unions.
    b) Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges, flange kits or nipples.

c) Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.07 ANCHORAGE INSTALLATION

A Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:
1. Concrete thrust blocks.
2. Locking mechanical joints.
3. Set-screw mechanical retainer glands.
4. Bolted flanged joints.
5. Heat-fused joints.
6. Pipe clamps and tie rods.

B Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:
1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
3. Steel Piping; per Authorities having Jurisdiction Water & Sewer Division Specifications and Details.

C Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.08 VALVE INSTALLATION

A AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.

B AWWA Valves Other Than Gate Valves: Comply with AWWA C600 and AWWA M44.

C UL/FMG, Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.

D UL/FMG, Valves Other Than Gate Valves: Comply with NFPA 24.

E MSS Valves: Install as component of connected piping system.

F Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.

G Pressure-Reducing Valves: Install in vault or aboveground between shutoff valves.

H Relief Valves: Comply with AWWA C512. Install aboveground with shutoff valve on inlet.

3.09 DETECTOR-CHECK VALVE INSTALLATION

A Install in vault or aboveground.

B Install for proper direction of flow. Install bypass with water meter, gate valves on each side of meter, and check valve downstream from meter.

C Support detector check valves, meters, shutoff valves, and piping on brick or concrete piers.

3.10 WATER METER INSTALLATION

A Install water meters, piping, and specialties according to utility company's written instructions.

B Water Meters: Install displacement-type water meters, NPS 2 and smaller, in meter boxes with shutoff valves on water meter inlets. Include valves on water meter outlets and valved bypass around meters unless prohibited by authorities having jurisdiction.

C Water Meters: Install compound-type water meters, NPS 3 and larger, in meter vaults. Include shutoff valves on water meter inlets and outlets and valved bypass around meters. Support meters, valves, and piping on brick or concrete piers.

3.11 BACKFLOW PREVENTER INSTALLATION

A Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.
B Do not install backflow preventers that have relief drain in vault or in other spaces subject to flooding.
C Do not install bypass piping around backflow preventers.
D Support NPS 2-1/2 and larger backflow preventers, valves, and piping near floor and on brick or concrete piers.

3.12 WATER METER BOX INSTALLATION

A Install water meter boxes in paved areas flush with surface.
B Install water meter boxes in grass or earth areas with top 2 inches above surface.

3.13 FIRE HYDRANT INSTALLATION

A General: Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints or thrust blocks, and support in upright position.
B Wet-Barrel Fire Hydrants: Install with valve below frost line. Provide for drainage.
C AWWA Fire Hydrants: Comply with AWWA M17.
D UL/FMG Fire Hydrants: Comply with NFPA 24.

3.14 FIRE DEPARTMENT CONNECTION INSTALLATION

A Install ball drip valves at each check valve for fire department connection to mains.
B Install protective pipe bollards on two sides of each fire department connection.

3.15 CONNECTIONS

A Connect water-distribution piping to existing water main. Use tapping sleeve and tapping valve or method approved by the Water & Sewer Division.

3.16 FIELD QUALITY CONTROL

A Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.
B Hydrostatic Tests: Test at not less than one-and-one-half times working pressure for two hours.
    1. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig. Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.
C Prepare reports of testing activities.

3.17 IDENTIFICATION

A Install continuous underground detectable warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Section 312000 "Earth Moving."

3.18 CLEANING

A Clean and disinfect water-distribution piping as follows:
1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
3. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:
    a) Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
    b) Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.
    c) After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
    d) Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

B Prepare reports of purging and disinfecting activities.

END OF SECTION

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SECTION 33 30 00 - SANITARY SEWERAGE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
B Geotechnical Engineering Report, Project No.: 306471-001, January 11, 2024, by Earth Systems, and all addenda and supplemental geotechnical reports.
C Uniform Plumbing Code (UPC), Current Edition.

1.02 SUMMARY

A Provide all labor, materials, and equipment as necessary to complete all work as indicated on the Drawings and specified herein.
B This Section Includes:
1. Pipe and fittings.
2. Non-pressure and pressure couplings.
3. Expansion joints and deflection fittings.
4. Backwater valves.
5. Cleanouts
6. Encasement for piping.
7. Manholes.
C Related Requirements:
1. Section 312000 Earth Moving.
2. Section 033000 Cast-in-Place Concrete
3. Section 017400 Cleaning

1.03 DEFINITIONS

A DIP: Ductile Iron Pipe
B PVC: Polyvinyl chloride plastic pipe

1.04 ACTION SUBMITTALS

A Product Data: For each type of product indicated.

1.05 INFORMATIONAL SUBMITTALS

A Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from sewer system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.
B Profile Drawings: Show system piping in elevation. Draw profiles at horizontal scale of not less than 1 inch equals 50 feet and vertical scale of not less than 1 inch equals 5 feet. Indicate manholes and piping. Show types, sizes, materials, and elevations of other utilities crossing system piping.
C Field quality-control reports.

1.06 QUALITY ASSURANCE

A Regulatory Requirements:
1. Comply with requirements of Authorities having Jurisdiction for Sewer and Wastewater, including inspection prior to and during work.

B Piping materials shall bear label, stamp, or other markings of specified testing agency.

1.07 DELIVERY, STORAGE, AND HANDLING

A Do not store plastic manholes, pipe, and fittings in direct sunlight.
B Protect pipe, pipe fittings, and seals from dirt and damage.
C Handle catch basins and stormwater inlets according to manufacturer's written rigging instructions.

1.08 PERFORMANCE REQUIREMENTS

A Pressure pipe pressure ratings: At least equal to system operating pressure, nut not less than 150 psig.

1.09 PROJECT CONDITIONS

A Site Information: Architect-Engineer shall coordinate site survey, research public utility records, and verify existing utility locations with project representatives. Locate existing structures and piping to be closed and abandoned.

B Coordinate the Interruption of Existing Sanitary Sewerage Service with Owner. Contract Documents should indicate that interruption of service to facilities occupied by Owner or others is only permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
1. Notify Owner no fewer than fourteen (14) days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without Owner's written permission.

PART 2 - PRODUCTS

2.01 PRODUCTS

A Hub-and-Spigot, Cast-Iron Soil Pipe and Fittings:
1. Pipe and Fittings: ASTM A 74, service class.
2. Gaskets: ASTM C 564, rubber.
3. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

B Ductile-Iron Pipe and Fittings:
1. Push-on-Joint Piping:
a) Pipe: AWWA C151 ANSI A21.51, cement lined with bituminous coating per AWWA C104 ANSI 21.4 thickness class 50 52 55 56 per AWWA C150 ANSI A 21.50.
b) Standard Fittings: AWWA C110, ductile or gray iron.
c) Gaskets: AWWA C111 ANSI 21.11, rubber, of shape matching pipe and fittings.
2. Mechanical-Joint Piping:
a) Pipe: AWWA C151 ANSI A21.51, with bolt holes in bell.
b) Standard Fittings: AWWA C110, ductile or gray iron, with bolt holes in bell.
c) Compact Fittings: AWWA C153, with bolt holes in bells.

d) Glands: Cast or ductile iron; with bolt holes and high-strength, cast-iron or high-strength, low-alloy steel bolts and nuts.
e) Gaskets: AWWA C111, ANSI A21.11 rubber, of shape matching pipe, fittings, and glands.

C PVC Pipe and Fittings:
1. PVC Sewer Piping, 15-inch and smaller:
a) Pipe: ASTM D3034, SDR 35 PVC sewer pipe for gasket or solvent-welded pipe with a minimum pipe stiffness of 46 tested per ASTM D2412
b) Fittings: ASTM D3034, SDR 35
c) Gaskets: ASTM F477, elastomeric seals.
d) Solvent-welded Joints: ASTM D2672
2. PVC Pressure Piping:
a) Pipe: ASTM D1785, SCH 40 PVC for gasket or solvent-weld.
b) Fittings: ASTM D1785, SCH 40 PVC
c) Gaskets: ASTM F477, elastomeric seals.
d) Solvent-welded Joints: ASTM D2672

D HDPE Pipe and Fittings:
1. HDPE Sewer Piping, 18-inch and larger:
a) Pipe: ASTM D3035, SDR 17 for gasket or heat fusion-welded pipe.
b) Fittings: ASTM D3035, SDR 17
c) Gaskets: ASTM F477, elastomeric seals.
d) Heat Fusion-welded Joints: ASTM D2620

E Non-Pressure-Type Transition Couplings:
1. Comply with ASTM C1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground non-pressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant-metal tension band and tightening mechanism on each end.
2. Sleeve Materials:
a) For Cast-Iron Soil Pipes: ASTM C564, rubber.
b) For Plastic Pipes: ASTM F477, elastomeric seal or ASTM D926, PVC.
c) For Dissimilar Pipes: ASTM D5926, PVC or other material compatible with pipe materials being joined.

F Unshielded, Flexible Couplings: Elastomeric sleeve with stainless steel corrosion-resistant-metal tension band and tightening mechanism on each end.

G Shielded, Flexible Couplings: ASTM C1460, elastomeric or rubber sleeve with full-length, corrosion-resistant stainless steel outer shield and corrosion-resistant stainless steel tension band and tightening mechanism on each end.

H Pressure-Type Pipe Couplings:
1. Metal, bolted, mechanical joint sleeve, reducing or transition coupling, for joining underground pressure piping. Include 200-psig minimum pressure rating and ends of same sizes as piping to be joined.
a) Gasket Material: Natural or synthetic rubber.
b) Metal Component Finish: Corrosion-resistant coating or material.

I Ductile-Iron Deflection Fittings: Compound coupling fitting with ball joint, flexing section, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include rating for 250-psig minimum working pressure and for up to 15 degrees of deflection.

J Backwater Valves:
1. Cast-Iron Backwater Valves: ASME A112.14.1, gray-iron body and bolted cover, with bronze seat.
2. PVC Backwater Valves: Horizontal type; with PVC body, PVC removable cover, and PVC swing check valve.

K Cleanouts:

1. Cast-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
    a) Top-Loading Classifications: Heavy Duty.
    b) Sewer Pipe Fitting and Riser to Cleanout: ASTM A74, Service class, cast-iron soil pipe and fittings.
2. PVC Cleanouts: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

L Encasement for Piping:
1. Standard: ASTM A 674 or AWWA C105.
2. Material: polyethylene film of 0.008-inch (0.20-mm) minimum thickness.
3. Form: Sheet or tube.
4. Color: Black or natural.
    a) Standard Precast Concrete Manholes: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
5. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
6. Riser Sections: Of length to provide depth indicated.
7. Top Section: Eccentric-cone type unless flat-slab-top type is required; with top of cone of size that matches grade rings.
8. Section Joint Sealant: ASTM C 443 rubber gasket.
9. Resilient Pipe Connectors: ASTM C 923 rubber boot, cast or fitted into manhole walls, for each pipe connection. Boot shall result in a water tight connection conforming to the performance requirements of ASTM C 443.
10. Steps: Cast Iron steps conforming to the performance standards of ASTM C 478. Omit steps if total depth from floor of manhole to finished grade is less than 48. Cast or anchor steps into sidewalls at 16-inch intervals inches.
11. Grade (Adjusting) Rings: Reinforced-concrete rings, with diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope. Maximum per Drawings.

M Manhole Frames and Covers: Include indented top design with lettering cast into cover, using wording equivalent to "SANITARY SEWER."
1. Material: ASTM A 48, Class 35 gray ASTM A 536, Grade 60-40-18 ductile iron unless otherwise indicated.

N Manhole-Cover Inserts: Manufactured, plastic form, of size to fit between manhole frame and cover and designed to prevent stormwater inflow. Include handle for removal and gasket for gastight sealing.
1. Type: Solid.

O External Chimney Seal: Rubber sleeves shall be extruded from a high grade rubber compound meeting the applicable requirements of ASTM C923. Sleeves shall be double or triple pleated with a minimum unexpanded vertical height of 8 inches, a minimum thickness of 3/16 inch, capable of expanding not less than 2 inches vertically when installed.
1. Screws, bolts and nuts: Stainless steel, ASTM F-593 and 594 Type 304.
2. Expansion Bands shall be16 gauge thickness, 1-3/4 inches wide and made of stainless steel meeting the requirements of ASTM A240, Type 304.

P Protective Coatings: One- or two-coat, coal-tar epoxy; 15-mil minimum thickness, unless otherwise indicated; factory or field applied to the exterior and interior surfaces.

Q Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum. Include channels and benches in manholes.

1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
2. Invert Slope: 1 percent through manhole.
3. Benches: Concrete, sloped to drain into channel.
4. Slope: 8 percent.

PART 3 - EXECUTION

3.01 EARTHWORK

A Excavation, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.02 UTILITY LOCATION

A Prior to any utility installation work commencing, Contractor shall call Dig Alert, at 1-(800)-422-4133, to confirm the location of existing underground utility installations.

3.03 INSPECTIONS

A Require inspection and report by Contractor of interior of piping to determine whether line displacement or other damage has occurred. Inspection should occur after approximately 24 inches of backfill is in place, and again at completion of Project.
1. Contractor shall submit separate report for each system inspection.
2. Defects requiring correction include the following:
   a) Alignment: Less than full diameter of inside of pipe is visible between structures.
   b) Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
   c) Damage: Crushed, broken, cracked, or otherwise damaged piping.
   d) Infiltration: Water leakage into piping.
   e) Exfiltration: Water leakage from or around piping.
3. Contractor shall replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Contractor shall reinspect and repeat procedure until results are satisfactory.

3.04 PREPARATION

A Sanitary sewer pipes:
1. Refer to Section 312000, “Earth Moving”, requirements.
2. For all rigid pipe installations, the width of the trench at the top of the pipe shall not exceed the outside pipe diameter, including bells, plus the clear width on each side of the pipe as listed in Table 33 30 00-1:

Table 33 30 00-1

Pipe Size (in)	**Maximum Clear Width (in)**
6 – 24	12
27 – 54	15
60 and over	24

3. For all non-rigid pipe installations, the minimum trench width shall be per the pipe manufacturer's recommendations, but at no time shall the width be less than that specified in ASTM D2321.
4. The length of trench or tunnel open at any one time shall conform to the limits approved by Owner. In general, not more than 100 feet of trench shall be opened in advance of the completed work.
5. Where the sewer pipes are built upon the surface of the ground, the surface shall be grubbed and cleared of all stumps, grass, muck, or other vegetable matter.
6. Pipes shall not be constructed on frozen ground.

B Manholes:
1. Refer to Section 312000, "Earth Moving" requirements.

3.05 SANITARY SEWER PIPE INSTALLATION

A Pipe shall be laid accurately to the line and grade designated on the Contract Drawings. Pipe shall be carefully centered so that when laid it will form a sewer with close fitting joints and a uniform invert.

B All pipe shall begin and end with pipe ends as normally fabricated by the manufacturers. If field cutting pipe is required, cutting shall be performed by the use of tools or equipment that will provide a neat perpendicular cut with a beveled end without structural damage to the pipe wall or damage to coatings or fillers.

C For Ductile Iron pipes:
1. Installation of ductile iron pipes shall conform to AWWA C600 unless otherwise noted on Contract Documents.
2. Remove and replace defective pieces.
3. Clear of all debris and dirt before installing and keep clean until accepted.
4. For push-on joints, clean bell of excess tar or other obstruction and wipe out before inserting next pipe spigot. Shove pipe into place until properly seated and hold securely until joint completed.
5. Temporary Plugs: When pipe laying not in progress, close open ends of pipe with temporary watertight plugs. If water in trench, do not remove plug until danger of water entering pipe passed.
6. Appurtenances: Set fittings and appurtenances as indicated on Contract Drawings.
7. Polyethylene wrapping: All buried ductile iron piping shall be polyethylene wrapped in accordance with pipe manufacturer's written instruction.

D For PVC pipes:
1. Installation of all sizes of PVC pipe shall conform to ASTM D2321 unless otherwise noted on Contract Documents.
2. Factory made fittings must be used on all house connections or other connections. Bedding material for house connections (sanitary sewer house laterals) shall be equal to that of the main sewer. Risers in deep or unstable trenches shall be embedded in Class I materials only. Brackets or anchors shall be used to hold end caps or plugs in place on sanitary sewers and house laterals for the purpose of withstanding air testing pressures. Caps or plugs shall not be chemically-welded in place.
3. Remove and replace defective pieces.
4. Clear of all debris and dirt before installing and keep clean until accepted.

E Joining pipes:
1. Before joining pipe with a coupling or bell end, all surfaces of the portions of the pipe to be joined and all surfaces of factory made jointing materials shall be clean and dry. Lubricants, primers, adhesives, solvents, bolts, etc. shall have been manufactured specifically for their intended use and shall be used as

recommended by the pipe and/or pipe joint manufacturer. The jointing materials shall be fitted and adjusted or applied in such a manner as to obtain a close fitting joint and to obtain the degree of water tightness required.

2. Where the joining of pipes of different materials is required or approved, this work shall be done utilizing special adapters and couplers manufactured specifically for this purpose. The adapters and couplers shall be installed and securely attached to both pipe barrels according to manufacturers' recommendations.
3. As soon as possible after a joint is made, sufficient backfill materials shall be placed along each side of the pipe to support the pipe in its final position.
4. Where a pipe stub or run of pipe is to be temporarily terminated for future extension, the end of the pipe shall be sealed using an approved removable plug.

F Where required by the Contract Drawings, flexible pipe shall be elongated by increasing its vertical diameter by five percent. The vertical elongation shall be maintained by horizontal wire struts that shall be left in place until the embankment is completed. The struts shall be removed as directed by Owner.

3.06 PRECAST CONCRETE MANHOLE INSTALLATION

A CONTRACTOR shall submit to Owner the following:
1. Manufacturer's name and address
2. Detailed shop drawings
3. Material specifications

B Approval will be based on complete inspection of manufacturer's plant, method of manufacture, samples of materials to be used and inspection and testing of actual units to be used.

C Excavation and backfill shall be in accordance with Section 312000, "Earth Moving".

D The manhole bottom shall have a uniform bearing on a minimum of three inches of compacted #57 stone. Unsuitable material shall be removed and replaced as specified in Section 312000, "Earth Moving".

E Adequate precautions shall be taken to prevent concrete and/or mortar from freezing. Any material incorporated in these items having a temperature of 40 degrees F or less shall not be placed until heated for a period sufficient to ensure a temperature of 50 degrees F to 80 degrees F throughout the entire mass of the material. Refer to Section 033000, "Cast-in-Place Concrete" for additional requirements.

F Standard manhole steps shall be set in the cones of precast manholes as indicated on the Contract Drawings. Where the ordinance grade is below the grade of an unimproved street, the last precast section shall be built to correspond with the ordinance grade, and the manhole casting and cover set to existing grade by use of a brick chimney and/or grade rings. The inside diameter of the precast section shall be not less than 26 inches nor more than 28 inches.

G All manholes shall be thoroughly bonded or securely connected to the barrel of the sewer, and all connections with pipes neatly made without projections or voids. Unless otherwise noted on the Contract Drawings, all pipe connected to precast concrete manholes shall be sealed by use of a resilient manhole connector meeting the requirements of ASTM C923.

H When manholes are completed, they shall be cleared of scaffolding, centering or forms and cleaned of surplus mortar or other foreign materials.

I Manholes on sanitary sewers shall be tested by CONTRACTOR. Testing shall be performed in accordance with ASTM C1244.

3.07 REPAIR/RESTORATION

A All surfaces affected by the construction work shall be permanently restored according to Section 017400, "Cleaning".
B Before Final Completion, CONTRACTOR shall clean up the Work area in accordance with Section 017400, "Cleaning".

3.08 FIELD TESTING

A General:
1. Remove all dirt, dust, oil, grease and other foreign material before initiating testing and acceptance procedures.
2. Perform leakage tests and measurements according to applicable standards.
3. Contractor shall test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
4. Contractor shall not enclose, cover, or put into service before inspection and approval.
5. Contractor shall test completed piping systems according to requirements of authorities having jurisdiction.
6. Contractor shall schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
7. Contractor shall submit separate report for each test.

B Low Pressure Air Test:
1. All sewers, manholes or other structures and appurtenances which are to be used for sanitary sewage shall at all times be water tight and not permit the infiltration of water into, or the exfiltration of sewage therefrom. All such sewers shall be subject to an air leakage test to be performed by CONTRACTOR, under the direct observation of Owner, unless otherwise noted. No request by CONTRACTOR for waiver of the test will be considered. The cost of all air-leakage testing shall be included in the unit price bid for the pipe.
2. The air test shall be performed within a reasonable time after completion of the sewer, or sections of a large portion of the sewer installation, before the Substantial Completion. CONTRACTOR shall verify that the sewers, manholes, etc. are substantially complete and reasonably clean prior to performing the test.
3. The testing procedure and criteria shall be in accordance with UNI-B-6, ASTM C828 (clay pipe – for pipe up to 42-inch diameter), C924 (concrete pipe and ductile iron pipe – for pipe sizes up to 24-inch diameter), or F1417 (plastic pipe), as applicable, and Table 33 30 00-2 which shows the minimum test time in minutes per 100 feet of pipe for each nominal pipe size for a 1.0 psi pressure drop from 3.5 to 2.5 psi. Testing procedures and criteria for PVC pipe shall be in accordance with ASTM D3212. All sanitary sewer manholes shall be tested in accordance with ASTM C1244.

Table 33 30 00-2

Nominal Pipe Size (in)	**Time, T (min/100ft)**	**Nominal Pipe Size (in)**	**Time, T (min/100ft)**
3	0.2	21	3.0
4	0.3	24	3.6
6	0.7	27	4.2
8	1.2	30	4.8
10	1.5	33	5.4
12	1.8	36	6.0
15	2.1	39	6.6
18	2.4	42	7.3

4. If the sewer fails to meet the minimum test times shown in Table 33 30 00-2, OWNER may order CONTRACTOR to expose and repair as required joints or any section in the test, backfill, and restore the surface. Such additional work shall be at CONTRACTOR's expense. Following the repairs, the sewer shall be retested until the minimum test time is equaled or exceeded.
5. In the event that the pipe fails to meet the test requirements, no payment to exceed 75 percent of the price bid for the pipe items shall be made until the sewer(s) satisfactorily passes the low pressure air test. Passing an air test or making repairs and passing an air test does not release CONTRACTOR from the responsibility of repair or replacement of sewers and appurtenances during the Warranty Period.

C Individual Joint Test:
1. For CCFRPM pipe 48-inch diameter or larger, individual joint testing shall conform with ASTM C1103.
2. For reinforced concrete pipe 27-inch diameter or larger, individual joint testing shall conform with ASTM C1103.

D Hydrostatic Tests: Contractor shall test sanitary sewerage according to requirements of authorities having jurisdiction and per Exfiltration and Infiltration Method Procedures per the Standard Specifications for Water and Sewer Construction in Illinois latest edition where no separate written standards exist.

E Force Main: Perform hydrostatic test after thrust blocks, supports, and anchors have hardened. Test at pressure not less than 1-1/2 times the maximum system operating pressure, but not less than 150 psig.

F Ductile-Iron Piping: Test according to AWWA C600, "Hydraulic Testing" Section.

G PVC Piping: Test according to AWWA M23, "Testing and Maintenance" Chapter.

H Manholes: Perform hydraulic test according to ASTM C 969.

I Leaks and loss in test pressure constitute defects that must be repaired.

J Deflection Tests:
1. All sewers constructed using non-rigid pipe materials shall be subject to a pipe deflection test, regardless of the pipe stiffness, to be performed by CONTRACTOR, under the direct supervision of OWNER. No request by CONTRACTOR for waiver of the test will be considered. The cost of performing the deflection testing shall be included in the unit price bid for the pipe.
2. The deflection test will be performed at the end of the Warranty Period before release of the retainer or bond.
3. The test shall consist of pulling a mandrel (Go/No Go) device through the sewer by hand. No mechanical pulling devices shall be used. The mandrel shall be either the full circle or 9-arm type and conform to the dimensions noted in Table 33 30 00-3. No sewer will be accepted if the pipe deflection at any point is in excess of 5 percent of its average inside diameter as noted in Table 33 30 00-3, where T-1 equals Cell Classification 12454C and T-2 equals Cell Classification 12364C.

Table 33 30 00-3

	ASTM D-3034		**ASTM D-2680**		**ASTM F-679**	
Minimal Pipe Size (in)	**Average I.D. (in)**	**5% Deflection Mandrel (in)**	**Average I.D. (in)**	**5% Deflection Mandrel (in)**	**Average I.D. (in)**	**5% Deflection Mandrel (in)**
6	5.893	5.598				
8	7.891	7.496	7.75	7.35		
10	9.864	9.371	9.75	9.25		

12	11.737	11.150	11.75	11.16		
15	14.374	13.655	14.75	14.01		
					T-1	
18					18.165	17.257
21					21.415	20.344
24					24.092	22.887
27					27.152	25.794
					T-2	
18					18.202	17.292
21					21.459	20.386
24					24.142	22.935
27					27.208	25.848

4. All portions of sewer found to exceed this limit shall be replaced or repaired by CONTRACTOR promptly in a manner satisfactory to OWNER. After a period of at least 60 days after backfilling the repaired area(s), the sewer shall again be tested for deflection. This procedure shall be repeated as necessary until the maximum pipe deflection is 5 percent or less. CONTRACTOR shall bear the total cost of all repairs or replacement, including surface restoration in accordance with Section 017400, "Cleaning".

K Closed Caption Television (CCTV) Inspection:

1. All sewers, manholes, inlets and other appurtenances shall be subject to CCTV and visual inspections, to be performed by CONTRACTOR, prior to Substantial Completion of the sewer items. No request by CONTRACTOR for waiver of the inspections will be considered.
2. The CCTV inspections shall be performed after completion of the sewer items, before the Substantial Completion and release of the retainer or bond. CONTRACTOR shall verify that the sewers and manholes are substantially complete and reasonably clean prior to performing the inspection.
3. CCTV inspections shall be performed in accordance with National Association of Sewer Service Companies (NASSCO) Pipeline Assessment Certification Program (PACP), latest edition.
4. All pipe, manholes, and appurtenances found to be defective shall be replaced or repaired by CONTRACTOR promptly in a manner satisfactory to OWNER. CONTRACTOR shall bear the total cost of all repairs or replacement, including surface restoration.
5. Passing the CCTV inspection or making repairs and passing the CCTV inspection does not release CONTRACTOR from the responsibility of repair or replacement of sewers and appurtenances during the Warranty Period.
6. Submit the following information to the City prior to Substantial Completion:
   a) Database file with inspection event and defect records in Microsoft Access (.MDB) (Granite native export database, PACP 4.2 schema-compliant database, or accepted equal)
   b) Video file: MPEG (.mpg) or Windows Media file (.wmv). One video file per pipe inspection.
   c) Inspection report: One report in Adobe Acrobat PDF format per pipe inspection. Report should include:
      1) Inspection header info (who, what, where, when)
      2) Defect log
      3) Photos of defects
   d) Defect photos: screen captures from the video (.jpg)

e) Use the “Asset IDs” provided in the plans when referencing “start manhole,” “end manhole,” and “pipe segment” in the inspection database and filenames.

3.09 FIELD PAINTING/COATINGS

A Repair any shop painting/coatings damaged during storage or installation to OWNER’s satisfaction.

3.10 ADJUSTING

A Coordinate with OWNER for any field adjustments. OWNER reserves the right to reject any field adjustments.

3.11 PROTECTION

A Protect sanitary sewers from damage throughout storage, installation, testing, and Final Completion.

3.12 REPLACEMENT

A Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

END OF SECTION

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SECTION 33 40 00 - STORMWATER UTILITIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
B Geotechnical Engineering Report, Project No.: 300909-010, June 20, 2025, by Earth Systems Pacific, and all addenda and supplemental geotechnical reports.
C Uniform Plumbing Code (UPC), Current Edition.
D ASTM INTERNATIONAL (ASTM)
1. ASTM C923/C923M (2020) Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals
2. ASTM C990 (2009; R 2019) Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
3. ASTM C990M (2009; R 2019) Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants (Metric)
4. ASTM D1751 (2018) Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
5. ASTM D2564 (2020) Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
6. ASTM D3034 (2016) Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
7. ASTM D3212 (2020) Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
8. ASTM F477 (2014; R 2021) Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
9. ASTM F679 (2016) Standard Specification for Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings
10. ASTM F794 (2021) Standard Specification for Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter
11. ASTM F1417 (2011a; E 2020) Standard Practice for Installation Acceptance of Plastic Non-pressure Sewer Lines Using Low-Pressure Air
12. ASTM F2881/F2881M (2021; E 2021) Standard Specification for 12 to 60 in. (300 to 1500 mm) Polypropylene (PP) Dual Wall Pipe and Fittings for Non-Pressure Storm Sewer Applications

1.02 SUMMARY

A Section Includes:
1. Pipe and fittings.
2. Nonpressure transition couplings.
3. Drains.
4. Encasement for piping.
B Related Requirements:
1. Section 312000 Earth Moving.

1.03 DEFINITIONS

A HDPE: High Density Polyethylene
B PE: Polyethylene
C PP: Polypropylene
D PVC: Polyvinyl Chloride Plastic
E RCP: Reinforce Concrete Sewer Pipe
F SRPE: Steel Reinforced Polyethylene

1.04 ACTION SUBMITTALS

A Product Data: For each type of product indicated.

1.05 INFORMATIONAL SUBMITTALS

A Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from storm drainage system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.
B Profile Drawings: Show system piping in elevation. Draw profiles at horizontal scale of not less than 1 inch equals 50 feet and vertical scale of not less than 1 inch equals 5 feet. Indicate manholes and piping. Show types, sizes, materials, and elevations of other utilities crossing system piping.
C Field quality-control reports.

1.06 DELIVERY, STORAGE, AND HANDLING

A Inspect materials delivered to site for damage and unload and store materials with minimal handling.
B Do not store materials directly on the ground. Keep the inside of pipes and fittings free of dirt and debris.
C Before, during, and after installation, protect plastic pipe and fittings from any environment that would result in damage or deterioration to the material.
D Keep a copy of the manufacturer's instructions available at the construction site at all times and follow these instructions unless directed otherwise by the Engineer of Record.
E Store solvents, solvent compounds, lubricants, elastomeric gaskets, and any similar materials required to install plastic pipe in accordance with the manufacturer's recommendations and discard if the storage period exceeds the recommended shelf life.
F Discard solvents in use when the recommended pot life is exceeded.
G Handle materials in a manner that ensures delivery to the trench in sound, undamaged condition. Carry pipe to the trench.

1.07 PROJECT CONDITIONS

A Interruption of Existing Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
    1. Notify Architect and Owner no fewer than five days in advance of proposed interruption of service.
    2. Do not proceed with interruption of service without Owner's written permission.

PART 2 - PRODUCTS

2.01 PVC PIPE AND FITTINGS

A PVC Storm Sewer Piping, 4-inch through 8-inch:
1. Pipe: ASTM D3034, SDR 35 PVC, pipe shall have an integrally molded bell or socket end for gasketed joint assembly.
2. Fittings: ASTM D3034, PVC with bell ends.
3. Joints: ASTM D3212
4. Gaskets: ASTM D3212

B PVC Underdrain Piping:
1. Pipe: ASTM D3034, SDR 35 PVC, pipe shall have an integrally molded bell or socket end for gasketed joint assembly.
2. Fittings: ASTM D 3034, PVC with bell ends.
3. Joints: ASTM D3212
4. Gaskets: ASTM D3212
5. Slots: Three rows of 1-inch x 0.1-inch slots at 3-inch spacing.

C HDPE Storm Sewer Piping
1. N-12 Prolink WT (Watertight) series as manufactured by advanced drainage systems, inc. (ADS) unless noted otherwise on plans. Lateral connections to mainlines shall be made using manufacturer's watertight reducing fittings. Pipe and fitting installation shall be in accordance with manufacturer's recommended procedures. Connections to concrete structures shall be constructed watertight using manufacturer's recommended materials and methods.
2. AASHTO M252 (4-10 inch)
3. AASHTO M294 (12-60 inch)
4. ASTM F2306 (12-60inch)

2.02 NONPRESSURE TRANSITION COUPLINGS

A Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

B Sleeve Materials:
1. For Plastic Pipes: ASTM F477, elastomeric seal or ASTM D 5926, PVC.
2. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

C Unshielded, Flexible Couplings:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a) Dallas Specialty & Mfg. Co.
   b) Fernco Inc.
   c) Logan Clay Pipe.
   d) Mission Rubber Company; a division of MCP Industries, Inc.
   e) NDS Inc.
   f) Plastic Oddities; a division of Diverse Corporate Technologies, Inc.
2. Description: Elastomeric sleeve with corrosion-resistant-metal tension band and tightening mechanism on each end.

2.03 DRAINS

A Ductile Iron Grates:
1. Description: ASTM A536 Grade 70-50-05 compliant square secured grate and frame with round bottom flange size to match basin outer diameter. Size as indicated.

2. Top-Loading Classification(s): Heavy Duty (H-20).

B Plastic Grates:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a) ADS.
2. Description: UV Protected, HDPE, flat grate. Frame and grate to match basin outer diameter. Size as indicated.
3. Top-Loading Classification(s): Pedestrian (H-10). ADA compliant. Heel-proof.

C Plastic Catch Basins:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a) ADS.
2. Description: ASTM D1784 cell class 12454 compliant PVC. Custom manufactured according to plan details. Provide watertight connection with specified pipe system.
3. Top-Loading Classification(s): Heavy Duty (H-20).

D Precast Concrete Catch Basins:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a) ADS.
   b) Jensen Precast.
   c) Mid State Concrete Products
   d) Oldcastle Infrastructure
2. Description: Concrete: Type II Portland cement ASTM C 150 and Federal Specifications on cement, SS-C-1960/3, Type I/II Low Alkali, minimum compressive strength 4000 PSI at 28 days. Reinforcing Bar: ASTM A-706 / A-615, Grade 40 and 60.
3. Top-Loading Classification(s): Heavy Duty (H-20)

2.04 CONCRETE

A General: Cast-in-place concrete according to ACI 318, ACI 350/350R, and the following:
1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C33, sand.
3. Coarse Aggregate: ASTM C33, crushed gravel.
4. Water: Potable.

B Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.
1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

PART 3 - EXECUTION

3.01 EARTHWORK

A Excavation, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.02 PIPING INSTALLATION

A General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout

take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

C Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

D Install gravity-flow, nonpressure drainage piping according to the following:
1. Install piping pitched down in direction of flow.
2. Install piping NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place concrete supports or anchors.
3. Install PVC profile gravity storm sewer piping according to ASTM D 2321 and ASTM F 1668.

3.03 PIPE JOINT CONSTRUCTION

A Join gravity-flow, nonpressure drainage piping according to the following:
1. Join PVC profile gravity storm sewer piping according to ASTM D 2321 for elastomeric-seal joints or ASTM F 794 for gasketed joints.
2. Join dissimilar pipe materials with nonpressure-type flexible couplings.

3.04 DRAIN INSTALLATION

A Install type of drains in locations indicated.
1. Use Medium-Duty, top-loading classification drains in earth, unpaved foot traffic, or paved foot-traffic areas.
2. Use Heavy-Duty, top-loading classification drains in vehicle-traffic service areas.

B Embed drains in 4-inch minimum concrete around bottom and sides.

C Fasten grates to drains if indicated.

D Set drain frames and covers with tops flush with pavement surface.

E Assemble trench sections with flanged joints.

F Embed trench sections in 4-inch minimum concrete around bottom and sides.

3.05 CONCRETE PLACEMENT

A Place cast-in-place concrete according to ACI 318.

3.06 CONNECTIONS

A Make connections to existing piping and underground manholes.
1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch overlap, with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
2. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.07 IDENTIFICATION

A Materials and their installation are specified in Section 312000 "Earth Moving." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.
1. Use detectable warning tape over ferrous piping.
2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.08 FIELD QUALITY CONTROL

A Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
1. Submit separate reports for each system inspection.
2. Defects requiring correction include the following:
   a) Alignment: Less than full diameter of inside of pipe is visible between structures.
   b) Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
   c) Damage: Crushed, broken, cracked, or otherwise damaged piping.
   d) Infiltration: Water leakage into piping.
   e) Exfiltration: Water leakage from or around piping.
3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.
5. Top of grate elevation shall be within 0.02’ of specified elevation on plans. Contractor shall adjust noncompliant grates at contractor’s expense.

3.09 CLEANING

A Clean interior of piping of dirt and superfluous materials. Flush with potable water.

END OF SECTION

UPDATED GEOTECHNICAL ENGINEERING AND GEOLOGIC HAZARDS REPORT NIPOMO HIGH SCHOOL NEW CLASSROOM BUILDINGS 525 NORTH THOMPSON AVENUE NIPOMO, CALIFORNIA

June 20, 2025

Prepared for

Mr. Andy Stenson
Lucia Mar Unified School District

Prepared by

Earth Systems Pacific
4378 Old Santa Fe Road
San Luis Obispo, CA 93401

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EARTH SYSTEMS
4378 Santa Fe Road | San Luis Obispo, CA 93401 | (805) 544-3276 | www.earthsystems.com

June 20, 2025

File No.: 300909-010

Mr. Andy Stenson
Lucia Mar Unified School District
222 Stanley Avenue
Arroyo Grande, CA 93420

PROJECT: NIPOMO HIGH SCHOOL
NEW CLASSROOM BUILDINGS
525 NORTH THOMPSON AVENUE
NIPOMO, CALIFORNIA

SUBJECT: Updated Geotechnical Engineering and Geologic Hazards Report

CONTRACT REF: Revised Proposal to Provide an Updated Geotechnical Engineering and Geologic Hazards Report, with an Option to Provide a Groundwater Monitoring Well Adjacent to the Existing Pool, Nipomo High School, Three New Classroom Buildings, 525 North Thompson Avenue, Nipomo, California, Doc. No. SLO-2504-030.PRP.REV, dated April 15, 2025, Revised April 16, 2025

Dear Mr. Stenson:

In accordance with your authorization of the referenced proposal, this updated geotechnical engineering and geologic hazards report has been prepared for use in the development of plans and specifications for the new classroom buildings planned at Nipomo High School in Nipomo, California. Updated geotechnical recommendations are presented herein for site preparation, grading, utility trenches, foundations, slabs-on-grade, retaining walls, drainage and maintenance, and observation and testing. This report also provides updated information regarding general geologic characteristics, existing and potential geologic hazards, and the impacts that the geologic conditions may have upon the project. An electronic copy of this report has been furnished for your use.

Due to issues with determining the exact locations of existing underground utility lines, the monitoring well installation that was authorized as part of this project per the referenced proposal has been removed from our scope of work.

We appreciate the opportunity to have provided services for this project and look forward to working with you again in the future. If there are any questions concerning this report, please do not hesitate to contact the undersigned.

Sincerely,

Earth Systems Pacific

REGISTERED PROFESSIONAL ENGINEER
Nicholas B. Zoetewey
GE 3137
Geotechnical
STATE OF CALIFORNIA

Nick Zoetewey, GE
Senior Engineer

REGISTERED GEOLOGIST
DARRIN G. HASHAM
NO. 2423
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

Darrin Hasham, CEG
Engineering Geologist

Doc. No.: 2506-043.SGR/cr

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1.0 INTRODUCTION

Per information provided by Mr. John Tischler of Finney Architects (Finney 2025), new permanent classroom buildings are planned in the approximate center of the Nipomo High School campus at 525 North Thompson Avenue in Nipomo, California, (see Figure 1 – Site Vicinity Map in Appendix A). Current plans call for three new buildings to be constructed initially; a fourth building may be constructed at a later date, adjacent to the three initial buildings. The single-story buildings will have footprints of approximately 3,800 to 5,800 square feet each. The structures will be site-built, and of conventional stud, CMU wall, wood and/or steel frame and roof construction. The buildings will be supported by conventional spread (pad) and continuous shallow foundations, with concrete slabs-on-grade. Maximum wall and column loads on the order of 2 kips per linear foot and 25 kips, respectively, have been assumed. Additional improvements will include exterior pedestrian flatwork and utilities, which will be extended underground to the existing campus utility systems. Cuts and fills on the order of 2 feet or less from the existing topography have been assumed. Structure or sitework retaining walls, and possibly cut or fill slopes, a maximum of 3 feet tall may also be constructed. No other structures or improvements, and no drainage basins or low impact development/best management practices (LID/BMP) features requiring infiltration testing, will be constructed.

It is our understanding that this project will be designed and constructed under the jurisdiction of the Division of the State Architect (DSA).

2.0 SCOPE OF SERVICES

The scope of work for this report included review of a previous Geotechnical and Geologic Hazards Report at the school prepared by this firm for the Track and Stadium Improvements project (ESP 2018, copy included in Appendix B); review of a previous Geologic Hazards Report for the Nipomo High School/Central Coast New Tech High School project (ESP 2015); a field reconnaissance by a registered geotechnical engineer; subsurface exploration; geotechnical laboratory testing of samples obtained during the subsurface exploration; geotechnical and geologic analyses of the data; and preparation of this report. The analysis and subsequent recommendations were based on project information provided by Mr. Tischler (Finney 2024).

This report and updated recommendations are intended to comply with the considerations of Sections 1803A.1 through 1803A.7, J104.3 and J104.4, as applicable, of the California Building Code (CBC) (CBSC 2022); California Geological Survey (CGS) Note 48 (2022); Interpretation of Regulations (IR) Document A-4 (DSA 2025); and common geotechnical engineering and engineering geology practice in this area under similar conditions at this time. The geotechnical

test procedures were accomplished in general conformance with the standards noted, as modified by common geotechnical engineering practice in this area under similar conditions at this time.

Updated geotechnical recommendations for site preparation, grading, utility trenches, foundations, slabs-on-grade, retaining walls, drainage and maintenance, and observation and testing are provided in this report. This report, either within or by reference, also describes the general geologic characteristics, identifies existing and potential geologic hazards, and discusses the impacts the geologic conditions may have upon the project. The results of previously completed corrosivity testing, which were subcontracted to HDR Engineering, Inc. and M. J. Schiff & Associates, Inc. are also included by reference. These items are presented to guide the development of project plans and specifications. It is our intent that this geotechnical/geologic report be used exclusively by the client to form the geotechnical/geologic basis of the design, and in the preparation of plans and specifications. Application beyond this intent is strictly at the user's risk.

This report does not address dewatering and other issues in the domain of contractors such as, but not limited to, site safety, loss of volume due to stripping of the site, shrinkage of soils during compaction, excavatability, shoring, temporary slope angles, construction means and methods, etc. Analyses of the soil for mold potential, asbestos in man-made products, lead, radioisotopes, hydrocarbons, or chemical properties (other than geotechnical corrosivity) are beyond the scope of this report. Ancillary features such as temporary access roads, and non-structural fills are not within our scope and are also not addressed.

As there may be unresolved geotechnical and/or geologic issues with respect to this project, the geotechnical engineer and engineering geologist should be retained to provide consultation as the design progresses, to review project plans as they near completion, to assist in verifying that pertinent geotechnical and geologic issues have been addressed, and to aid in conformance with the intent of this report. In the event that there are any changes in the nature, design, or location of improvements, or if any assumptions used in the preparation of this report prove to be incorrect, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed, and the conclusions of this report are verified or are modified in writing. The criteria presented in this report may be modified following a peer review or review by any jurisdiction or following a review by the geotechnical engineer and/or engineering geologist of conditions in the field during construction; modification of the recommendations must be completed in writing.

3.0 SITE SETTING

The planned building location on the existing campus has approximate coordinates and an elevation, as obtained from the Google Earth website (Google Earth 2025), of latitude 35.0487N, longitude 120.4871W, and 335 feet above mean sea level (MSL), respectively.

The building area is currently occupied by relocatable classrooms, exterior pedestrian flatwork and landscaping. Relocatable and permanent buildings generally surround the new building area. Beyond the buildings to the south and west are the competition swimming pool, AC-paved hardcourts, tennis courts, and turf playfields. Beyond the buildings to the north and east are parking areas, driveways, North Thompson Avenue and agricultural fields. The building area and the rest of the existing campus is relatively flat, with a slight slope to the south. The locations and dispositions of underground utilities in the building area are unknown.

4.0 FIELD INVESTIGATION

The subsurface exploration for the current field investigation consisted of drilling four borings in the project area on April 29, 2025, to a maximum depth of approximately 24.5 feet below the existing ground surfaces (bgs). The borings were drilled with a GTech GT-8 truck mounted drill rig, equipped with 6-inch outside diameter hollow stem auger and an automatic trip hammer for sampling. The approximate locations of the borings are shown on Figure 2 – Exploration Location Map in Appendix A. As the borings were drilled, soil samples were obtained at selected depths using a ring-lined barrel sampler (ASTM D 3550-17 with shoe similar to D 2937-17); bulk samples were obtained from the auger cuttings. The borings were backfilled per the requirements of the governing jurisdiction.

Soils encountered in the borings were categorized and logged in general accordance with the Unified Soil Classification System and ASTM D 2488-17. Copies of the boring logs and a Boring Log Legend are also included in Appendix A. In reviewing the boring logs and legend, the reader should recognize that the legend is intended as a guideline only, and there are a number of conditions that may influence the soil characteristics as observed during drilling. These include, but are not limited to, the presence of cobbles or boulders, cementation, variations in soil moisture, presence of groundwater, and other factors.

Previous explorations performed by this firm for the Stadium and Track Improvements project (ESP 2018) consisted of ten borings, which were drilled to maximum depths of 40.2 feet bgs (one boring), 20.0 feet bgs (four borings), 15.0 feet (1 boring), and 6.5 feet bgs (four borings). The logs of those borings and an Exploration Location Map are included in the full copy of the report in Appendix B.

5.0 LABORATORY ANALYSIS

Selected ring samples obtained from the current borings were tested for unit weight and moisture (ASTM D 2937-17, modified for ring liners). One bulk sample was also tested for expansion index (ASTM D 4829-21). These current geotechnical laboratory test results are presented in Appendix C.

Laboratory test results for the Stadium and Track Improvements project (ESP 2018) are also included in the full copy of the report in Appendix B.

Two soil samples were submitted to HDR Engineering, Inc., for geotechnical corrosivity testing for the Stadium and Track Improvements project (ESP 2018). in The Soil Corrosivity Study by HDR Engineering, Inc., is included in the previous report in Appendix B. Two soil samples were also submitted to M. J. Schiff & Associates, Inc. geotechnical corrosivity testing for the Geologic Hazards Report by this firm (ESP 2015) for additional improvements on the site; this geologic hazards report is contained within the Stadium and Track Improvements project report (ESP 2018) in Appendix B.

6.0 GENERAL SUBSURFACE AND GEOLOGIC PROFILE

Fill consisting of medium stiff sandy fat clay with varying percentages of gravel, medium dense well graded sand with gravel (aggregate base), and silty sand (topsoil) were found in the upper 5.0 to 6.0 feet of all four of the currently drilled borings. Below the fill was Alluvium, composed of medium stiff to very stiff sandy fat clay with varying percentages of gravel. During drilling, the soils were described as being moist.

The subsurface conditions encountered in the borings completed for the Stadium and Track Improvements project (ESP 2018) had similar subsurface conditions, i.e., Fill of varying thickness over Alluvium. At 30.5 feet in the deepest boring, stiff sandy silt identified as Older Marine Terrace Deposits were found; this formation extended to the full depth of 40.2 feet bgs.

Groundwater was not encountered in any of the borings advanced to a maximum depth of 24.5 feet for the current investigation. Several borings advanced for previous projects on the Nipomo High School campus (ESP 2015) encountered an approximately 2-foot thick layer of saturated well graded sand around 25 feet bgs (i.e., perched groundwater zones), underlain by clay to the maximum depth explored of 100.5 feet bgs.

Please refer to the boring logs in Appendix A of this report, and in the Stadium and Track Improvements report (ESP 2018) in Appendix B, for a more complete description of the subsurface conditions.

7.0 GEOLOGY

Geologic Setting

The site lies upon the Nipomo Mesa, in the Coast Ranges geomorphic province of California (CGS 2002). The northern and southern coast ranges are separated by a depression containing the San Francisco Bay. The Nipomo Mesa, in the vicinity of the site, is bounded between the Pacific Ocean to the west, Arroyo Grande Valley to the north, Santa Maria Valley to the south, and Nipomo Valley to the east (USGS 2025a). This portion of coastal central California has been described in the context of *seismotectonic domains* by Clark and others (1994). Each domain is separated by predominantly northwest-southeast trending quaternary boundary faults. The Nipomo Mesa is within the triangular shaped Santa Maria basin-San Luis Range domain, which is bounded by the offshore Hosgri fault zone to the west, the Los Osos fault system to the northeast, and the Santa Ynez fault to the south (Clark et al. 1994). Tectonically, the region is dominated by the Los Osos and San Luis Range faults (Lettis and Hall 1994).

According to the Geologic Map of the Nipomo Quadrangle by Delattre and Wiegers (2014), the project site is underlain by late Pleistocene to Holocene younger alluvium deposits (Qya) which are unconsolidated sand, silt, and clay deposited in the mouths of drainages, in this case the drainage is that of Deleissigues Creek (see Figure 3 – Regional Geologic Map in Appendix D). Our subsurface explorations performed for this site encountered unconsolidated deposits of clay, locally with gravel, and a well graded sand layer, which are consistent with the geologic units mapped and described by Delattre and Wiegers (2014).

Faulting

Faults are classified by the State of California based on the likelihood of generating ground motions and surface rupture. The classification system applies to known faults that have been compiled by numerous researchers through various methods of investigation. The State evaluates faults with documented ground rupture during the last 11,700 years and considers them for inclusion in Earthquake Fault Zones requiring investigation (Alquist-Priolo or A-P Zones) which encompass traces of *Holocene-active* faults, as defined by the State's Alquist-Priolo Earthquake Fault Zoning Act (1972). The State's guidance is intended to prohibit developments and structures for human occupancy across the trace of active faults (CGS 2018). Other active faults capable of generating strong ground motion are present in the region but are not included in A-P Zones because they do not meet the criteria of "sufficiently active and well-defined."

The site is within a seismically active area with numerous active faults; although, there are no known *Holocene-Active* faults on the site. The site is between the *Holocene-Active* Irish Hills segment of the Los Osos fault located about 19.5 miles northwest, and the Zaca Creek segment of the Los Alamos fault located about 26 miles southeast of the site, both of which are included in A-P Zones (CGS 2024). These faults, and several other faults considered capable of generating severe shaking at the site, are discussed below.

The San Andreas, Hosgri, Los Alamos, and Los Osos faults are several regional faults that have ruptured during the Holocene Epoch (~11,000 years). The San Luis Range, Oceanic-West Huasna, Casmalia, Lions Head, and Rinconada faults are also regional faults considered active and capable of large earthquakes. The most significant regional active faults that could affect development on the site are listed in Table E-1 presented in Appendix E. The inferred Wilmar Avenue fault segment of the San Luis Range fault system is the closest fault included in the current community fault model (CFM) to the site (USGS 2013). The regional faults are graphically depicted on Figure 4 – Historical Seismicity Map presented in Appendix D.

<u>San Andreas Fault</u>

The San Andreas Fault is considered the most active fault in the region; it is about 38.5 miles east of the site. The last major earthquake that occurred on this fault was the 1857 Fort Tejon earthquake (USGS 2019). The San Andreas fault is modeled as segments with some segments capable of earthquakes up to magnitude 7.5 (Cao et al. 2003). Simultaneous rupture of more than one segment may cause an earthquake of magnitude 8.0 or more (BSSC 2014).

Rinconada Fault Zone

The Rinconada fault zone lacks obvious Holocene offset and therefore does not meet the State's criteria for inclusion in an A-P zone; nonetheless, it is considered an active fault and is included as a seismic source in regional models. The Rinconada fault is a northwest-trending high angle fault that forms the boundary between two dissimilar geologic terranes modeled 17.5 miles north of the site. Northeast of the Rinconada fault is the Salinian Block, composed of crystalline plutonic and metamorphic rock overlain by a thick sequence of marine sedimentary rocks. Southwest of the Rinconada fault is the Coastal Block, composed of Franciscan mélange overlain by marine sedimentary rocks (Dibblee 1976). The Rinconada fault is estimated to be capable of a magnitude 7.5 earthquake (Cao et al. 2003).

Hosgri-San Simeon Fault System

The Hosgri-San Simeon Fault System lies offshore approximately 19 miles west of the site. A northwest-trending strike-slip fault, the San Simeon Fault extends from offshore of Ragged Point to just offshore of San Simeon Point, where it joins the northern end of the Hosgri Fault; from this point the Hosgri Fault extends to an ocean shelf 2 miles west of Point Buchon, and then trends toward the Point Sal area. The fault system is considered *Holocene-active* and is included in an A-P Zone between San Simeon Point and Arroyo de le Cruz (CDMG 1986a, 1986b). The Hosgri-San Simeon fault is estimated to be capable of a magnitude 7.54 earthquake (BSSC 2014).

Los Alamos Fault

The Los Alamos fault is a *Holocene-active* fault included in a Special Studies Zone; it is approximately 22 miles southeast of the site. It is a northwest-trending fault that is approximately 17 miles long. The southern end of the fault merges with the northern end of the West Baseline fault approximately 28 miles southeast of the site and is estimated to be capable of a magnitude 6.96 earthquake (BSSC 2014). The Los Alamos fault is poorly constrained (Guptill et. al. 1981).

Los Osos Fault

The Los Osos fault is the closest known *Holocene-active* fault to the site included in a Special Studies Zone. The Los Osos fault is divided into four segments (Lettis and Hall 1994); the most westerly segment is the Estero Bay segment lies mostly offshore. The Irish Hills segment starts in the vicinity of Los Osos and extends eastward to just past San Luis Obispo Creek. A two-mile length of the Irish Hills segment west of Laguna Lake is designated as an Earthquake Special Studies Zone located approximately 19.5 miles northeast of the site (CDMG 1990, Treiman 1989).

The other two segments of the Los Osos fault are the Lopez Reservoir segment and the Newsome Ridge segment. The closest segment of the Los Osos fault is approximately 5.3 miles north of the site and is considered capable of a magnitude 7.15 earthquake (BSSC 2014).

Oceanic-West Huasna Fault

The Oceanic-West Huasna fault is a northwest trending, northeast dipping reverse fault that separates the Santa Lucia and San Rafael Ranges to the north from a series of distinct tectonic domains stretching from Cambria to the western Transverse Ranges, referred to as the Los Osos domain (Lettis et al. 2004). The Oceanic-West Huasna fault is considered late quaternary by the State, with the latest movement estimated to have occurred during the late Quaternary period, which includes the Holocene epoch. This Fault system trends northwest-southeast for approximately 75 miles and is modeled about 4.9 miles northeast of the site. The Oceanic-West Huasna fault is considered capable of a magnitude 7.21 earthquake (BSSC 2014).

San Luis Range Fault System

The San Luis Range Fault System consists of a series of west-northwest trending faults that include the Santa Maria River, Wilmar Avenue, Oceano, San Luis Bay, and San Miguelito Faults (Lettis et al. 1994). The Wilmar Avenue fault is the closest segment to the site, modeled approximately 0.2 miles southwest (USGS 2013). The San Luis Range fault system is considered capable of a magnitude 7.49 earthquake (BSSC 2014).

Groundwater

Groundwater was not encountered in any of the borings advanced to a maximum depth of 24.5 feet for the current investigation. Several borings advanced for previous projects on the Nipomo High School campus (ESP 2015) encountered an approximately 2-foot thick layer of saturated well graded sand around 25 feet bgs (i.e., perched groundwater zones), underlain by clay to the maximum depth explored of 100.5 feet bgs.

8.0 SEISMICITY

Earthquake History

The historic seismicity in the site's region was researched using a catalog of historical California earthquakes (ANSS 2025). We compiled the epicentral distance for earthquakes within the search parameters: magnitudes greater than 5.0, within a 65-mile radius from the site, from 1800 to December 2024. The epicentral distances should be considered estimates, particularly for earthquake data prior to 1932, when modern instruments were first used to record earthquake data. The site coordinates used in this search were latitude 35.0487°N and longitude 120.4871°W.

Results of the search indicated that within the search parameters, 25 earthquakes with magnitude greater than or equal to 5.0 have occurred within 65 miles of the site. The largest magnitude earthquake that occurred during the 224-year time period was the November 4, 1927 Lompoc earthquake with a calculated magnitude of 7.1. The closest earthquake to the site occurred approximately 17.9 miles from the site on July 28, 1902, and had an estimated magnitude of 5.8. The historical earthquakes are presented in Table E-2, Historical Earthquakes in Vicinity of Project Site, M≥5.0, in Appendix E. The approximate locations of epicenters of historical earthquakes with magnitudes greater than 5.0 are depicted on Figure 4 – Historical Seismicity Map presented in Appendix D.

Historical earthquakes that resulted in damage within the region include two series of historical earthquakes on the Los Alamos fault recorded by local newspapers. In 1902, between late July and mid-December numerous earthquakes were reported that caused damage to structures and two 3,000 gallon oil tanks at the Careaga Oil Field. A landmark adobe house on the Orena Ranch was reportedly reduced to ruins, and water mains were broken in Lompoc. Many ground fissures were noted in an area approximately 15 miles long and landslides destroyed the road in Drum Canyon (Guptill et al., 1981). In January of 1915 another strong earthquake with many aftershocks was reported. These earthquakes appear to have had an epicenter at Confaglia Ranch and produced soil cracks up to 6 feet deep and a seiche at Zaca Lake (Guptill et al., 1981).

The Lompoc earthquake of 1927 is believed to have occurred on the offshore Hosgri fault (Helmberger et al. 1992). The event triggered a tsunami that was measured by tidal gauges at San Francisco and San Diego and liquefaction phenomenon, including sand boils, at several locations within and around Lompoc. Reportedly, structures were damaged in Arroyo Grande and Guadalupe (SCEDC 2020).

The San Simeon earthquake that occurred on December 22, 2003, is an example of a significant regional earthquake during recent times, the results of which are well documented. Significant reports of damage were reported from Paso Robles to Oceano. The highest recorded PGA from the San Simeon earthquake was at the hospital in Templeton and liquefaction effects were concentrated at Oceano, approximately 50 miles south of the earthquake epicenter suggesting a PGA of 0.4g or greater (EERI 2005).

Ground Motion Analyses

In accordance with CGS Note 48 (2022), the CBC (CBSC 2022) and ASCE 7-16 (2017, 2018, 2021), an assessment was made to determine the need for employing "Site-Specific Ground Motion Procedures" to calculate the seismic design parameters for the project. Based on our site evaluation and Standard Penetration Tests (SPT), the subsurface characteristics are those of Site Class D (Stiff Soil) as defined by ASCE 7-16 (2017) Table 20.3-1, Site Classification. The mapped S_1 ground motion value obtained from the Structural Engineers Association of California website (SEAOC 2025), using ASCE 7-16 (2017), was 0.396 g, which is greater than 0.2; therefore, per Section 11.4.8 of ASCE 7-16, the project requires site-specific ground motion analyses unless certain procedures are used during the structural design that comply with the exceptions allowed. To provide flexibility for the structural design professionals, we have provided "General Procedure" seismic design parameters, which are only valid if structural calculations are performed in accordance with the exception permitted by Supplement 3 of ASCE 7-16 (ASCE 2021), and "Site-Specific" seismic design parameters developed through a site-specific ground motion hazard analysis in accordance with Chapter 21 of ASCE 7-16 (2017, 2018, 2021).

The site may be subject to strong ground shaking due to potential fault movements along regional faults including the San Luis Range fault system. Engineered design and earthquake-resistant construction increase safety and allow development of seismic areas. The minimum seismic design should comply with the CBC (CBSC 2022) and ASCE 7-16 (2017, 2018, 2021) using the seismic design coefficients given in the following sections.

Seismic Design Category

Section 1613A.2.5 of the CBC (CBSC 2022) states that structures classified as Risk Category I, II, or III that are located where the mapped spectral response acceleration parameter at 1-second period, S_1, is greater than or equal to 0.75 shall be assigned to Seismic Design Category E…others shall be assigned to Seismic Design Category D. The S_1 for the site is 0.396, which is less than 0.75; therefore, the site should be assigned to Seismic Design Category D. We understand that the site falls under Risk Category II, per Table 1604A.5 of the CBC (CBSC 2022).

General Procedure Seismic Design Parameters

The General Procedure seismic parameters presented in Table 1 below consider Seismic Site Class D, and an earthquake probability of 2-percent in 50 years, equivalent to a 2,475-year return period. The general procedure seismic design parameters presented below are only valid if structural calculations are performed in accordance with the exception permitted by Supplement 3 of ASCE 7-16 (ASCE 2021).

Table 1 - General Procedure Seismic Parameters (2022 CBC)

Site Class (ASCE 7-16)	D
Occupancy (Risk) Category	III
Seismic Design Category	D
Maximum Considered Earthquake (MCE) Ground Motion	
Spectral Response Acceleration, Short Period – S_s	1.086 g
Spectral Response Acceleration at 1 sec. – S_1	0.396 g
General Procedure Site Coefficient – F_a	1.07
General Procedure Site Coefficient – F_v	1.90
Site-Modified Spectral Response Acceleration, Short Period – S_{MS}	1.157 g
Site-Modified Spectral Response Acceleration at 1 sec. – S_{M1}	0.754 g
Design Earthquake Ground Motion	
Short Period Spectral Response – S_{DS}	0.771 g
One Second Spectral Response – S_{D1}	0.503 g
Site Modified Peak Ground Acceleration - PGA_M	0.54 g
Design Response Spectrum Transition Periods (Seconds)	
T_0 = 20% of S_{D1}/S_{DS}	0.13
$T_S = S_{D1}/S_{DS}$	0.65
T_L = Mapped Long Period Transition	8

Site Specific Seismic Design Parameters

As an alternative, we have also developed Site-Specific seismic design parameters for the site. The site-specific seismic design parameters are summarized in Table 2 below, and the results of our analysis are presented in Appendix E, Tables E-3 and E-4.

A risk-targeted maximum considered earthquake (MCE_R) modeling procedure was performed in accordance with ASCE 7-16 (2017, 2018, 2021), including a Probabilistic Seismic Hazard Analysis (PSHA) using ground motion data from the United States Geologic Survey Earthquake Hazard Toolbox (USGS 2025b), based on the National Seismic Hazard Model (NSHM) Conterminous U.S. 2023, and a Deterministic Seismic Hazard Analysis (DSHA) using the Third Uniform California Earthquake Rupture Forecast (UCERF3) fault models (USGS 2013) and NGA-West2 ground motion prediction equations (PEER 2015). These analyses are based on knowledge of the regional tectonic setting, geology, and seismicity. These analyses were performed as described in ASCE 7-16 (2018) Section 21.2.1.1 (Method 1) to estimate the peak ground motion corresponding to

the uniform hazards earthquake and MCE_R which has a 2 percent probability of being exceeded in 50 years. Our site-specific ground motion hazard analysis considered the ground response anticipated resulting from a magnitude 7.49 earthquake on the San Luis Range fault (south margin, community fault model 3.2). Fault parameters used in our analyses are summarized in Table E-1, Fault Parameters, presented in Appendix E, modified in accordance with the USGS Earthquake Scenario web page (BSSC 2014).

Table 2 - Site Specific Seismic Parameters (2022 CBC/ASCE 7-16)

Seismic Design Category	D
Occupancy (Risk) Category	III
Site Class	D
Mapped and Code Based Ground Motion	
Short Period Spectral Response, S_s	1.086 g
1 second mapped Spectral Response, S_1	0.396 g
Design Earthquake Ground Motion	
Short Period Spectral Response, S_{DS}	0.844 g
1 second Spectral Response, S_{D1}	0.763 g
Peak Ground Acceleration (PGA_M)	0.503 g
MCE Spectral Response Acceleration	
Short Period Spectral Response, S_{MS}	1.266 g
1 Second Period Spectral Response, S_{M1}	1.144 g
Site Amplification Factors	
Short Period Site Coefficient, F_a	1.07
1 Second Period Site Coefficient, F_v	2.50
Vertical Site Coefficient, C_v	1.32
Risk Coefficient (Short Period), C_{Rs}	0.899
Risk Coefficient (1 Second Period), C_{R1}	0.904
Design Response Spectrum Transition Periods (Seconds)	
T_0 = 20% of S_{D1}/S_{DS}	0.181
$T_S = S_{D1}/S_{DS}$	0.904
T_L = Mapped Long Period Transition	8

9.0 GEOLOGIC HAZARDS

Surface Ground Rupture

Surface ground rupture generally occurs at sites that are traversed by, or lie very near to, an active fault. The site is not located in any State or County Earthquake Fault Zones (Bryant and Hart 2007, SLO Co 2025). The closest mapped Holocene-active (A-P Zoned) fault to the site is the Los Osos fault, located approximately 5.3 miles north of the site. The Wilmar Avenue fault strand of the San Luis Range fault system is mapped approximately 3,500 feet (0.6 miles) southwest of the site on the regional geologic map, with an un-named, inferred strand mapped approximately 800 feet southwest of the site. The San Luis Range fault system is considered active but these faults are not included in A-P Zones. A paleoseismic investigation of the Nipomo High School site was performed in May 1999, by advancing 40 cone penetrometer (CPT) soundings to evaluate the potential for an active fault to cross the site (HFA 1999). The results of the CPT soundings did not indicate the presence of offsets in the subsurface strata that could be the result of faulting. Because there are no mapped active faults on the site and the results of the paleoseismic study did not find indications of faulting the potential for surface fault rupture to occur at the site is considered to be very low.

Liquefaction and Seismically Induced Settlement

Liquefaction refers to a phenomenon that tends to occur in saturated soils (soils below the groundwater table) of low density that have grain sizes within a certain range, usually fine- to medium-grained poorly graded sands, silty sands, and silts. A sufficiently strong earthquake is also required to cause liquefaction. During liquefaction, the energy from the earthquake causes the water pressure within the pores of the soil to increase. The increase in water pressure decreases the friction between the soil grains, allowing the soil grains to move relative to one another. During this state, the soil will behave as a viscous liquid, temporarily losing its ability to support foundations and other improvements. As the pressure is released, the soils typically settle in a process called “dynamic settlement.” Dynamic settlement can cause damage to structures and other surface and subsurface improvements. Dynamic settlement may also result within unsaturated soils during a seismic event. Unsaturated loose to medium dense cohesionless soils above the groundwater table may also settle during seismic shaking.

The County’s liquefaction hazard map (SLOCO 2025) indicates that the site has a low potential for liquefaction. As previously (ESP 2015) noted, due to the predominantly fine grained, very stiff to hard nature of the soils encountered above and below the limited perched groundwater, the

medium dense and well graded nature of the sand and gravel in the perched groundwater zones, we consider the potential for liquefaction, as well as seismically-induced settlement, to occur on this site to be low to very low.

Slope Stability

The school site is in an area designated Class 0 for deep seated landslide susceptibility by the State, which is considered very low potential (Wills et al. 2011). The County has mapped the campus as low landslide risk (SLOCO 2025). The site has little vertical relief. Slope stability is not considered a hazard to the project or school occupants.

Flooding

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map No. 06079C1636G (FEMA 2012), approximately the northwestern half of the high school campus is located within a flood hazard Zone-X, characterized by areas prone to 0.2% annual chance (500-year) floods or areas of 1% annual chance (100-year) floods with an average depth of less than 1 foot or with drainage areas less than 1 square mile. The flood hazard zone for this site is presented on Figure 5, FEMA Flood Zone Map in Appendix D and includes approximately the western half of the proposed building site.

Tsunami and Seiche Potential

According to the State of California Tsunami Inundation Zone map for the County of San Luis Obispo, (California 2021), the project site does not lie within a Tsunami Inundation Zone. Furthermore, the site is located over 8 miles from the Pacific Ocean at an approximate elevation of over 300 feet above sea level; therefore, the potential for a tsunami to flood the site is considered to be nil.

A seiche is a single water wave that can be generated in a reservoir, lake, or pond as the result of barometric pressure anomalies or long-period seismic waves generated by strong earthquakes. There are no reservoirs or significant water bodies near the site, therefore a seiche is not considered a hazard to the site.

Naturally Occurring Asbestos (NOA)

Asbestos is a term used for several types of naturally-occurring fibrous minerals found in many parts of California. The most common type of asbestos is chrysotile, but other types are also found in California. When rock containing asbestos is broken or crushed, asbestos fibers may be released and become airborne. Exposure to asbestos fibers may result in health issues such as

lung cancer, mesothelioma (a rare cancer of the thin membranes lining the lungs, chest and abdominal cavity), and asbestosis (a non-cancerous lung disease which causes scarring of the lungs) (CARB 2002).

Asbestos minerals are generally limited to only a few types of rocks known to be present in the central coast area of California; these are ultra-mafic igneous rocks and their metamorphic equivalents, which include serpentinite and some types of schist. The site is underlain by older alluvial sediments which are not known to contain asbestos; therefore, the potential for naturally occurring asbestos on the site is considered very low.

Radon

Radon is a naturally-occurring, colorless, odorless gas present in certain soils and rock, which is derived from the decay of uranium atoms. The occurrence of radon correlates with the presence of specific minerals, and its concentrations in soil or rock will vary depending on the mineralogy of the surrounding bedrock, temperature, barometric pressure, moisture and other factors. Prolonged exposure to elevated levels of radon is associated with an increased risk of lung cancer. The route of exposure is via inhalation. The U.S EPA recommends remedial action if indoor radon concentrations exceed 4 picocuries per liter (pCi/L) in residential situations (Churchill 2008).

According to the Radon Potential Zone Map for Western San Luis Obispo County (Churchill 2008), the site is mapped by the State as having low potential for indoor radon. An excerpt of the State's Indoor Radon Potential Map depicting the site is presented as Figure 6, in Appendix D.

10.0 CONCLUSIONS

In our opinion, the site is suitable for the proposed buildings and associated improvements, as described in the "Introduction" Section of this report, provided the recommendations contained in the previous Stadium and Track Improvements report (ESP 2018), as modified in the following Section 11.0 Geotechnical Recommendations, are implemented. The primary geotechnical concerns are the potential for strong ground shaking, the presence of fill and the potential for settlement, and the soil's expansion and corrosive potential.

The site is in a County-designated zone of low liquefaction potential (SLOCO 2025). As previously (ESP 2015) noted, due to the predominantly fine grained, very stiff to hard nature of the soils encountered above and below the limited perched groundwater, the medium dense and well graded nature of the sand and gravel in the perched groundwater zones, we consider the potential for liquefaction, as well as seismically-induced settlement, to occur on this site to be low to very low.

Frost depth is not a concern on this site. Provided that the building areas are prepared as recommended, continuous perimeter and interior spread (pad) foundations may be used to support the proposed buildings.

Strong Ground Shaking

The site is in a region of high seismic activity, with the potential for large seismic events that could generate strong ground shaking. A seismic analysis was undertaken to provide current seismic acceleration design parameters. Our methods and the results of the seismic analysis are presented in the "Seismicity" Section of this report. Seismic acceleration parameters should be utilized in the design of the structure so that potential damage is reduced during a seismic event.

Potential for Settlement Due to Existing Fill and Potential Disturbance During Site Preparation

Fill was found in all four borings, ranging in depth from 5.0 to 6.0 feet bgs; this fill was likely placed during the original development of the school. While the fill was considered to be properly compacted and documented at the time of construction, the variable depths could create a potential for differential settlement within the new building area. Variable soil moisture and density conditions were also found in the borings. Additionally, some disturbance of the bearing soils is anticipated when the existing structures, pedestrian flatwork and utility lines are removed and/or relocated. To create more uniform bearing and settlement conditions for the planned structures, a minor program of overexcavation and recompaction of the site soils is recommended prior to construction of foundations.

Expansive Soils

Expansion index testing yielded a value of 90 for the upper soils encountered in the currently drilled borings. Previously (ESP 2018) expansion index results of 144 and 201 were recorded for the near-surface soils. Per CBC Section 1803A.5.3 (CBSC 2022), the soils are considered to be expansive. The more commonly used ASTM classification is that the soils are considered to have "high" to "very high" expansion potential. Expansive soils tend to swell with seasonal increases in moisture and shrink during the dry season as subsurface moisture decreases. The volume changes that these materials undergo in this cyclical pattern can stress and damage slabs and foundations if precautionary measures are not incorporated into the design and construction procedures. Recommendations for reducing the potential for expansive soil movement of the proposed improvements are provided.

Corrosion Potential

As indicated in the Soil Corrosivity Study by HDR Engineering, Inc. (ESP 2018), electrical resistivities of the samples tested were in the corrosive and severely corrosive categories with as received moisture contents; when saturated, the resistivities were in the severely corrosive category. Soil pH values were in the neutral category. The soluble salt contents of the soils were moderate. Nitrate concentration was high enough to be aggressive to copper. The soils were classified as severely corrosive to ferrous metals and aggressive to copper.

11.0 UPDATED GEOTECHNICAL RECOMMENDATIONS

All geotechnical recommendations contained in the previous report (ESP 2018) are considered applicable for the current project, with the following additions or modifications:

General (All Sections as Applicable):

- References to ASTM test methods should be understood to mean the latest published versions.
- All references to the 2016 CBC should be understood to mean the equivalent section in the 2022 CBC (CBSC 2022).
- All references to American Concrete Institute (ACI) Documents 318 and 302.1R should be understood to mean the latest published versions.
- All references to the Caltrans Standard Specifications should be understood to mean the 2024 version (Caltrans 2024).

Definitions Section:

- All references to the “Ticketing and Restroom Building and Press Box Areas” should be understood to mean the “Classroom Building Areas” for the purposes of this updated report.

Site Preparation Section: No Updated Recommendations

Grading Section:

- In Paragraph 1, 4 and 5, the recommended relative compaction range for the expansive on-site should be understood to mean between 87 and 92 percent of maximum dry density.
- Paragraphs 3 and 9 related to earthwork in the Track area should be disregarded for this update report.

- To the end of Paragraph 10, add the following sentence: "In accordance with the requirements of the State of California's Department of Toxic Substances Control, any soil imported to the site should be sourced from SMARA (Surface Mining and Reclamation Act) approved quarries; non-SMARA quarry material proposed for use should be tested by this firm for the presence of environmental contaminants before being imported to the site."

- Paragraph 15 regarding lime-treatment of expansive on-site soils rather than use of imported non-expansive soils should be disregarded for this update report.

- The following paragraph should be added to the end of the Grading Section for this update report: "Finished cut and fill slopes, if any, should be constructed no steeper than 3:1 (horizontal to vertical). Landscape material or other non-compacted material placed at the surface to facilitate plant growth is not considered part of the compacted slope face."

- The following paragraph should be added to the end of the Grading Section for this update report: "The architect/engineer should incorporate appropriate measures for grading operations, as needed, to mitigate the low potential for radon activity."

Utility Trenches Section:

- In Paragraph 4, the recommended relative compaction range for the expansive on-site should be understood to mean between 87 and 92 percent of maximum dry density.

- The following paragraph should be added to the end of the Utility Trenches Section for this update report: "The architect/engineer should incorporate appropriate measures for utility improvements, as needed, to mitigate the low potential for radon activity."

Foundations Section:

- Any references to and recommendations for Track Curbs in this section, including the section title, should be disregarded for this update report

- Paragraph 5 should be deleted and replaced with the following: "Allowable bearing capacities may be increased by one-third when transient loads such as wind or seismicity are included. Foundations may be designed using the seismic parameters contained in the Seismicity Section of this update report."

- The following paragraph should be added to the end of the Foundations Section for this update report: "The architect/engineer should incorporate appropriate measures for foundations, as needed, to mitigate the low potential for radon activity."

Slabs-on-Grade and Exterior Pedestrian Flatwork Section:

- Interior Slabs-on-Grade – Paragraph 1: Based on soil expansion potential only, minimum interior slab reinforcement should be No. 4 rebars at 18 inches on center each way.
- Exterior Pedestrian Flatwork - Paragraph 1: Based on soil expansion potential only, minimum interior slab reinforcement should be No. 4 rebars at 18 inches on center each way.
- Moisture Vapor Transmission – No updated recommendations.
- Slabs-on-Grade – General - The following paragraph should be added to the end of the Slabs-on-Grade - General Section for this update report: "The architect/engineer should incorporate appropriate measures for slabs-on-grade, as needed, to mitigate the low potential for radon activity."

Retaining Walls Section:

- The first sentence in Paragraph 1 of this section should be deleted and replaced with: "All retaining walls should be founded in firm fill that has been recompacted per the Grading Section of this report."
- The following paragraph should be added to the end of the Retaining Walls Section for this update report: "The architect/engineer should incorporate appropriate measures for retaining walls, as needed, to mitigate the low potential for radon activity."

AC Paths Section:

- Any references to and recommendations for the track surface in this section should be disregarded for this update report

Drainage and Maintenance Section:

- Replace Paragraph 9 with the following: "The architect/engineer should incorporate appropriate measures for drainage features, as needed, to mitigate the low potential for radon activity."

Observation and Testing Section: No Updated Recommendations

12.0 CLOSURE

Our intent was to provide this update report in a manner consistent with the level of care and skill ordinarily exercised by members of the profession currently practicing in the locality of this project under similar conditions. No representation, warranty, or guarantee is either expressed or implied. This update report is intended for the exclusive use by the client as discussed in the "Scope of Services" Section. Application beyond the stated intent is strictly at the user's risk.

This report is valid for conditions as they exist at this time for the type of project described herein. The conclusions and recommendations contained in this report could be rendered invalid, either in whole or in part, due to changes in building codes, regulations, standards of geotechnical or construction practice, changes in physical conditions, or the broadening of knowledge.

If changes with respect to the project become necessary, if items not addressed in this report are incorporated into plans, or if any of the assumptions used in the preparation of this report are not correct, this firm shall be notified for modifications to this report. Any items not specifically addressed in this report should comply with the CBC of other applicable standards, and the requirements of the governing jurisdiction.

The recommendations presented in this updated geotechnical report are based upon the geotechnical conditions encountered at the site and may be augmented by additional requirements of the client, or by additional recommendations provided by the geotechnical engineer based on peer or jurisdiction reviews, or conditions exposed at the time of construction. If Earth Systems Pacific is not retained to provide construction observation and testing services, it shall not be responsible for the interpretation of the information by others or any consequences arising therefrom.

This document, the data, conclusions, and recommendations contained herein are the property of Earth Systems Pacific. This report shall be used in its entirety, with no individual sections reproduced or used out of context. Copies may be made only by Earth Systems Pacific, the client, and the client's authorized agents for use exclusively on the subject project. Any other use is subject to federal copyright laws and the written approval of Earth Systems Pacific.

Thank you for this opportunity to have been of service. If you have any questions, please feel free to contact this office at your convenience.

End of Text.

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APPENDIX A

Figure 1 – Site Vicinity Map
Figure 2 – Exploration Location Map
Boring Log Legend
Boring Logs



BASE MAP PROVIDED BY: GOOGLE EARTH (2025)

NOT TO SCALE

Earth Systems Pacific
4378 Old Santa Fe Road, San Luis Obispo, CA 93401
www.earthsystems.com
(805) 544-3276 ● Fax (805) 544-1786

SITE VICINITY MAP

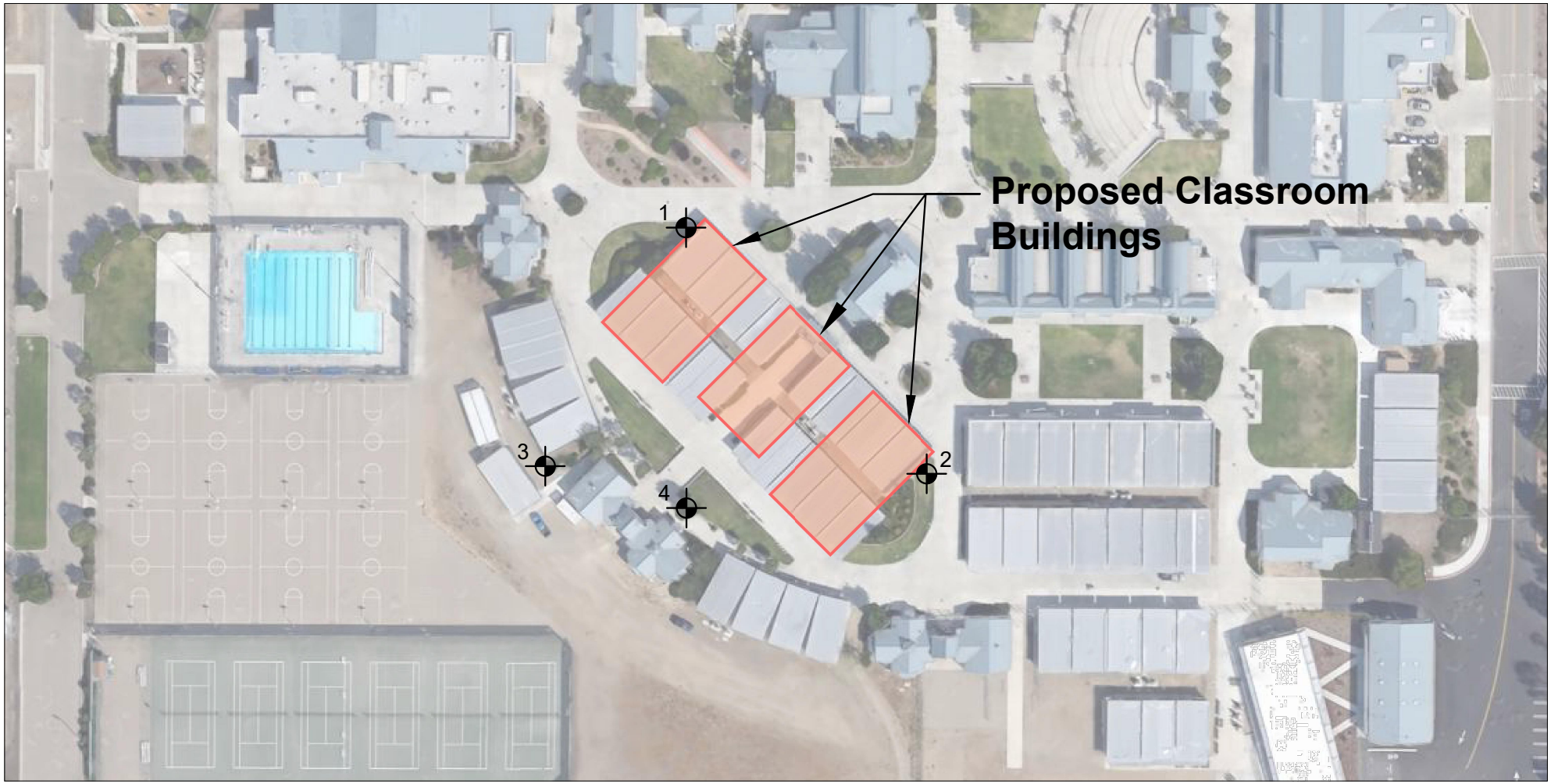
NIPOMO HIGH SCHOOL
NEW CLASSROOM BUILDINGS
525 North Thompson Avenue
Nipomo, California

Date
May 2025

Project No.
300909-010

Figure 1

300909-010 Nipomo HS New Classroom Buildings – Maps.dwg



LEGEND

4 Boring Location (Approx.)

BASE MAP PROVIDED BY: FINNEY ARCHITECTS (2025)

NOT TO SCALE

Earth Systems Pacific
4378 Old Santa Fe Road, San Luis Obispo, CA 93401
www.earthsystems.com
(805) 544-3276 • Fax (805) 544-1786

EXPLORATION LOCATION MAP

NIPOMO HIGH SCHOOL
NEW CLASSROOM BUILDINGS
525 North Thompson Avenue
Nipomo, California

Date
May 2025

Project No.
300909-010

Figure 2

300909-010 Nipomo HS New Classroom Buildings – Maps.dwg

Earth Systems Pacific

BORING LOG LEGEND

SAMPLE / SUBSURFACE WATER SYMBOLS	GRAPH. SYMBOL
CALIFORNIA MODIFIED	
STANDARD PENETRATION TEST (SPT)	
SHELBY TUBE	
BULK	
SUBSURFACE WATER DURING DRILLING	
SUBSURFACE WATER AFTER DRILLING	

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2487)

MAJOR DIVISIONS	GROUP SYMBOL	TYPICAL DESCRIPTIONS	GRAPH. SYMBOL
COARSE GRAINED SOILS (MORE THAN HALF OF MATERIAL IS LARGER THAN #200 SIEVE SIZE)	GW	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	
	GP	POORLY GRADED GRAVELS, OR GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	
	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES, NON-PLASTIC FINES	
	GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES, PLASTIC FINES	
	SW	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	
	SP	POORLY GRADED SANDS OR GRAVELLY SANDS, LITTLE OR NO FINES	
	SM	SILTY SANDS, SAND-SILT MIXTURES, NON-PLASTIC FINES	
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES, PLASTIC FINES	
FINE GRAINED SOILS (HALF OR MORE OF MATERIAL IS SMALLER THAN #200 SIEVE SIZE)	ML	INORGANIC SILTS AND VERY FINE SANDS, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY	
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS	
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY	
	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS	
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS	
	PT	PEAT AND OTHER HIGHLY ORGANIC SOILS	

OBSERVED MOISTURE CONDITION

DRY	SLIGHTLY MOIST	MOIST	VERY MOIST	WET (SATURATED)

CONSISTENCY

COARSE GRAINED SOILS			FINE GRAINED SOILS		
BLOWS/FOOT		DESCRIPTIVE TERM	BLOWS/FOOT		DESCRIPTIVE TERM
SPT	CA SAMPLER		SPT	CA SAMPLER	
0-10	0-16	LOOSE	0-2	0-3	VERY SOFT
11-30	17-50	MEDIUM DENSE	3-4	4-7	SOFT
31-50	51-83	DENSE	5-8	8-13	MEDIUM STIFF
OVER 50	OVER 83	VERY DENSE	9-15	14-25	STIFF
			16-30	26-50	VERY STIFF
			OVER 30	OVER 50	HARD

GRAIN SIZES

U.S. STANDARD SERIES SIEVE				CLEAR SQUARE SIEVE OPENING		
# 200	# 40	# 10	# 4	3/4"	3"	12"

SILT & CLAY	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		

TYPICAL BEDROCK HARDNESS

MAJOR DIVISIONS	TYPICAL DESCRIPTIONS
EXTREMELY HARD	CORE, FRAGMENT, OR EXPOSURE CANNOT BE SCRATCHED WITH KNIFE OR SHARP PICK; CAN ONLY BE CHIPPED WITH REPEATED HEAVY HAMMER BLOWS
VERY HARD	CANNOT BE SCRATCHED WITH KNIFE OR SHARP PICK; CORE OR FRAGMENT BREAKS WITH REPEATED HEAVY HAMMER BLOWS
HARD	CAN BE SCRATCHED WITH KNIFE OR SHARP PICK WITH DIFFICULTY (HEAVY PRESSURE); HEAVY HAMMER BLOW REQUIRED TO BREAK SPECIMEN
MODERATELY HARD	CAN BE GROOVED 1/16 INCH DEEP BY KNIFE OR SHARP PICK WITH MODERATE OR HEAVY PRESSURE; CORE OR FRAGMENT BREAKS WITH LIGHT HAMMER BLOW OR HEAVY MANUAL PRESSURE
SOFT	CAN BE GROOVED OR GOUGED EASILY BY KNIFE OR SHARP PICK WITH LIGHT PRESSURE, CAN BE SCRATCHED WITH FINGERNAIL; BREAKS WITH LIGHT TO MODERATE MANUAL PRESSURE
VERY SOFT	CAN BE READILY INDENTED, GROOVED OR GOUGED WITH FINGERNAIL, OR CARVED WITH KNIFE; BREAKS WITH LIGHT MANUAL PRESSURE

TYPICAL BEDROCK WEATHERING

MAJOR DIVISIONS	TYPICAL DESCRIPTIONS
UNWEATHERED	NO DISCOLORATION, NOT OXIDIZED
SLIGHTLY WEATHERED	DISCOLORATION OR OXIDATION IS LIMITED TO SURFACE OF, OR SHORT DISTANCE FROM, FRACTURES: SOME FELDSPAR CRYSTALS ARE DULL
MODERATELY WEATHERED	DISCOLORATION OR OXIDATION EXTENDS FROM FRACTURES, USUALLY THROUGHOUT; Fe-Mg MINERALS ARE "RUSTY", FELDSPAR CRYSTALS ARE "CLOUDY"
HIGHLY WEATHERED	DISCOLORATION OR OXIDATION THROUGHOUT; FELDSPAR AND Fe-Mg MINERALS ARE ALTERED TO CLAY TO SOME EXTENT, OR CHEMICAL ALTERATION PRODUCES IN SITU DISAGGREGATION
DECOMPOSED	DISCOLORATION OR OXIDATION THROUGHOUT, BUT RESISTANT MINERALS SUCH AS QUARTZ MAY BE UNALTERED; FELDSPAR AND Fe-Mg MINERALS ARE COMPLETELY ALTERED TO CLAY

drafting/masters/Boring Log Legend 062719.dwg

Earth Systems Pacific

Boring No. 1
PAGE 1 OF 1
JOB NO.: 300909-010
DATE: 4/29/2025

LOGGED BY: L. Johnson
DRILL RIG: GTech GT8 with Automatic Hammer
AUGER TYPE: 6" Hollow Stem

NIPOMO HIGH SCHOOL
NEW CLASSROOM BUILDINGS
525 North Thompson Avenue
Nipomo, California

DEPTH (feet)	USCS CLASS	SOIL DESCRIPTION	SAMPLE DATA: INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0	CH	SANDY FAT CLAY: dark brown, medium stiff, moist, medium grained sand (Fill)	0.5 - 3.0	◯			6
2			2.0 - 3.5	▬	77.0	25.9	11 12
3	CH	SANDY FAT CLAY WITH GRAVEL: dark brown, stiff, moist, medium and coarse grained sand, fine gravel					
5			5.0 - 6.5	▬	96.9	24.2	5 12 15
6	CH	SANDY FAT CLAY WITH GRAVEL: dark brown, very stiff, moist, medium and coarse grained sand, fine gravel (Alluvium)					
10			10.0 - 11.5	▬	87.4	28.8	8 15 22
15			15.0 - 16.5	▬	--	--	7 17 19
16	CH	SANDY FAT CLAY: very dark brown, very stiff, moist, fine grained sand					
20			20.0 - 21.5	▬	--	--	7 14 17
21		End of Boring @ 21.5' No subsurface water encountered					

LEGEND: ▬ Ring Sample ◯ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 2
PAGE 1 OF 1

LOGGED BY: L. Johnson
DRILL RIG: GTech GT8 with Automatic Hammer
AUGER TYPE: 6" Hollow Stem

JOB NO.: 300909-010
DATE: 4/29/2025

NIPOMO HIGH SCHOOL
NEW CLASSROOM BUILDINGS
525 North Thompson Avenue
Nipomo, California

DEPTH (feet)	USCS CLASS	SOIL DESCRIPTION	SAMPLE DATA: INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0	CH	SANDY FAT CLAY: dark brown, medium stiff, moist, medium grained sand (Fill)					
2			2.0 - 3.5	■	96.6	23.5	4 8 11
3	CH	SANDY FAT CLAY WITH GRAVEL: dark brown with dark gray mottling, medium stiff, moist, medium and coarse grained sand, fine gravel	2.5 - 5.0	○			
5			5.0 - 6.5	■	85.8	28.3	5 10 14
6	CH	SANDY FAT CLAY WITH GRAVEL: very dark gray, stiff, moist, medium and coarse grained sand, fine gravel (Alluvium)					
10			10.0 - 11.5	■	84.4	37.6	5 12 16
14		dark brown, increase in gravel content					
15			15.0 - 16.5	■	--	--	7 12 15
20			20.0 - 21.5	■	--	--	5 11 15
22	CH	SANDY FAT CLAY: tan with orange staining, very stiff, moist, fine grained sand					
23		orange with white mottling	23.0 - 24.5	■	--	--	10 16 23
25		End of Boring @ 24.5' No subsurface water encountered					

LEGEND: ■ Ring Sample ○ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 3

LOGGED BY: L. Johnson
DRILL RIG: GTech GT8 with Automatic Hammer
AUGER TYPE: 6" Hollow Stem

PAGE 1 OF 1
JOB NO.: 300909-010
DATE: 4/29/2025

NIPOMO HIGH SCHOOL
NEW CLASSROOM BUILDINGS
525 North Thompson Avenue
Nipomo, California

DEPTH (feet)	USCS CLASS	SOIL DESCRIPTION	SAMPLE DATA: INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0		16.0" AB					
2	CH	SANDY FAT CLAY WITH GRAVEL: very dark gray, medium stiff, moist, medium and coarse grained sand, fine gravel (Fill)					
5	CH	SANDY FAT CLAY WITH GRAVEL: very dark gray, stiff, moist, medium and coarse grained sand, fine gravel (Alluvium)	5.0 - 6.5	■	84.6	32.6	4 10 11
10		dark brown, very stiff	10.0 - 11.5	■	87.4	33.9	7 15 21
15			15.0 - 16.5	■	89.4	33.4	7 13 17
20		decrease in gravel content	20.0 - 21.5	■	--	--	7 12 12
23			23.0 - 24.5	■	--	--	8 15 15
25		End of Boring @ 24.5' No subsurface water encountered					

LEGEND: ■ Ring Sample ○ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 4

LOGGED BY: L. Johnson
DRILL RIG: GTech GT8 with Automatic Hammer
AUGER TYPE: 6" Hollow Stem

PAGE 1 OF 1
JOB NO.: 300909-010
DATE: 4/29/2025

NIPOMO HIGH SCHOOL
NEW CLASSROOM BUILDINGS
525 North Thompson Avenue
Nipomo, California

DEPTH (feet)	USCS CLASS	SOIL DESCRIPTION	SAMPLE DATA: INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0	SM	SILTY SAND: dark brown, loose, moist, medium grained sand, top soil					
1	SP	(Fill)	1.5 - 5.0	○			3
2	CH	POORLY GRADED SAND: light brown, loose, moist interlayered with SANDY FAT CLAY: dark brown, medium stiff, moist, layers 6 to 8 inches thick	2.0 - 3.5	■	103.7	6.9	5 6
3							
4							4
5			5.0 - 6.5	■	90.5	30.6	8 9
6	CH	SANDY FAT CLAY: very dark brown, stiff, moist, medium and coarse grained sand (Alluvium)					
7							
8							
9							4
10			10.0 - 11.5	■	84.0	37.8	8 14
11							
12							
13							
14							8
15			15.0 - 16.5	■	--	--	12 14
16	CH	SANDY FAT CLAY WITH GRAVEL: dark brown, very stiff, moist, medium and coarse grained sand, fine gravel					
17							
18							
19							6
20			20.0 - 21.5	■	--	--	12 15
21							
22		End of Boring @ 21.5'					
23		No subsurface water encountered					
24							
25							
26							

LEGEND: ■ Ring Sample ○ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

APPENDIX B

Geotechnical Engineering and Geologic Hazards Report, Nipomo High School, Stadium and Track Improvements, 525 North Thompson Avenue, Nipomo, California, by Earth Systems Pacific, Doc. No. 1805-001.SGR, dated May 3, 2018

GEOTECHNICAL ENGINEERING AND GEOLOGIC HAZARDS REPORT NIPOMO HIGH SCHOOL STADIUM AND TRACK IMPROVEMENTS 525 NORTH THOMPSON AVENUE NIPOMO, CALIFORNIA

May 3, 2018

Prepared for

Mr. Andy Stenson
Assistant Superintendent of Business
Lucia Mar Unified School District

Prepared by

Earth Systems Pacific
4378 Old Santa Fe Road
San Luis Obispo, CA 93401

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Earth Systems
4378 Old Santa Fe Road | San Luis Obispo, CA 93401 | Ph: 805.544.3276 | www.earthsystems.com

May 3, 2018

FILE NO.: 300909-002

Mr. Andy Stenson
Assistant Superintendent of Business
Lucia Mar Unified School District
222 Stanley Avenue
Arroyo Grande, CA 93420

PROJECT: NIPOMO HIGH SCHOOL
STADIUM AND TRACK IMPROVEMENTS
525 NORTH THOMPSON AVENUE
NIPOMO, CALIFORNIA

SUBJECT: Geotechnical Engineering and Geologic Hazards Report

CONTRACT REF: Purchase Order No. 182211 by Lucia Mar Unified School District, dated March 8, 2018, Referencing Earth Systems Pacific Revised Proposal to Provide a Geotechnical Engineering Investigation, Soil Corrosivity Analysis and Geologic Hazards Assessment, dated March 1, 2018

Dear Mr. Stenson:

As requested by Ms. Kathryn Hicks of RRM Design Group and in accordance with the referenced Purchase Order, this geotechnical engineering and geologic hazards report has been prepared for use in the development of plans and specifications for the Stadium and Track Improvements project planned at Nipomo High School in Nipomo, California. Preliminary geotechnical recommendations are presented herein for site preparation, grading, utility trenches, foundations and track curbs, Portland cement concrete (PCC) flatwork and slabs-on-grade, retaining walls, asphalt concrete (AC) paths, drainage and maintenance, and observation and testing. This report also describes the general geologic characteristics, identifies existing and potential geologic hazards, and discusses the impacts the geologic conditions may have upon the project. A geotechnical corrosivity study, which was subcontracted to HDR Engineering, Inc., is also included. Two bound copies and an electronic copy of this report are furnished for your use.

We appreciate the opportunity to have provided services for this project and look forward to working with you again in the future. If there are any questions concerning this report, please do not hesitate to contact the undersigned.

Sincerely,
Earth Systems Pacific

Nick Zoetewey, PE
Project Engineer

Keith P. Askew, GE
Principal Engineer

Darrin Hasham, CEG
Engineering Geologist

Copy to: LMUSD, Attn.: Ms. Cindy Naber, Mr. Bryan Hagwood and Ms. Candace Brown
RRM Design Group, Attn.: Ms. Kathryn Hicks

Doc. No.: 1805-001.SGR/pm

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1.0 INTRODUCTION

The proposed project at Nipomo High School will consist of a new ticketing and restroom building, new home bleachers and press box, new scoreboard, track resurfacing, and path of travel (POT) upgrades. The ticketing and restroom building is expected to be a single-story structure comprised of masonry construction with conventional continuous and spread foundations, and Portland cement concrete (PCC) slabs-on-grade. The home grandstand will be of modular steel and or aluminum construction, and will likely be supported by isolated spread foundations. The press box will be constructed as part of the grandstand. The track is anticipated to be improved with a synthetic running surface, over asphalt concrete (AC) and aggregate base (AB). The POT upgrades are anticipated to include AC paths and/or PCC flatwork. Structural loads were not provided; therefore, we have assumed maximum continuous loads of 2 kips per lineal foot and maximum isolated loads of 25 kips for the proposed structural improvements. The building will be served by the existing campus utility systems. Cuts and fills up to 2 feet from the existing topography have been assumed to achieve new grades. Retaining walls for sitework, or connected to or forming part of the structures, and a maximum of 3 feet tall, may also be utilized. No vehicle pavement, low impact development (LID) or other improvements are planned. It is our understanding that this project will be designed and constructed under the jurisdiction of the Division of the State Architect (DSA).

2.0 SCOPE OF SERVICES

The scope of work for this report included a field reconnaissance by a registered geotechnical engineer, subsurface exploration, laboratory testing (geotechnical and corrosivity) of samples obtained during the field investigation, geotechnical and corrosivity (subcontracted to HDR Engineering, Inc.) analyses of the data, and preparation of this report. The analysis and subsequent recommendations were based on preliminary information provided by Ms. Kathryn Hicks of RRM Design Group, which included an untitled, undated site plan that showed the approximate locations of the proposed improvements. Geologic hazards on the campus were addressed by this firm (Earth Systems Pacific 2015) for the Nipomo High School/Central Coast New Tech High School project. At this time, we are unaware of any changes to the requirements for a geologic hazards evaluation by the DSA (2015); therefore, the conclusions and recommendations of that report, which has been accepted by the California Geologic Survey (CGS) and the DSA, are still considered valid. A copy of the 2015 report is included in Appendix B for reference.

This report and preliminary geotechnical recommendations are intended to comply with the considerations of Sections 1803A.1 through 1803A.7, J104.3 and J104.4, as applicable, of the 2016 California Building Code, California Code of Regulations (CBC 2016); California Geological Survey (CGS) Note 48 (CGS 2013); Interpretation of Regulations (IR) Document A-4.13 (DSA 2016); and common geotechnical engineering and engineering geology practice in this area under similar conditions at this time. The geotechnical test procedures were accomplished in general conformance with the standards noted, as modified by common geotechnical engineering practice in this area under similar conditions at this time.

Preliminary geotechnical recommendations for site preparation, grading, utility trenches, foundations, track curbs, PCC flatwork and slabs-on-grade, retaining walls, AC paths, drainage and maintenance, and observation and testing are provided in this report. The results of corrosivity testing and analyses with mitigation recommendations are also included; this scope of work was subcontracted to HDR Engineering, Inc. The items above are presented to guide the development of project plans and specifications. It is our intent that this report be used exclusively by the client in the preparation of plans and specifications. Application beyond this intent is strictly at the user's risk.

This report does not address dewatering and other issues in the domain of contractors such as, but not limited to, site safety, loss of volume due to stripping of the site, shrinkage of soils during compaction, excavatability, shoring, temporary slope angles, construction means and methods, etc. Analyses of the soil for mold potential, asbestos in man-made products, lead, radioisotopes, hydrocarbons, or chemical properties (other than geotechnical corrosivity) are beyond the scope of this report. Ancillary features such as temporary access roads, and nonstructural fills are not within our scope and are also not addressed.

As there may be unresolved geotechnical issues with respect to this project, the geotechnical engineer should be retained to provide consultation as the design progresses, to review project plans as they near completion to assist in verifying that pertinent geotechnical issues have been addressed and to aid in conformance with the intent of this report. In the event that there are any changes in the nature, design, or location of improvements, or if any assumptions used in the preparation of this report prove to be incorrect, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and the conclusions of this report are verified or are modified in writing. The criteria presented in this report are considered preliminary until such time as any peer review or review by any jurisdiction has been completed, conditions are observed by the geotechnical engineer in the field during construction, and the recommendations have been verified as appropriate or modified in writing.

3.0 SITE SETTING

Nipomo High School is located at 525 North Thompson Avenue in Nipomo, California. The approximate coordinates and elevation of the center of the project area, as obtained from the Google Earth website (Google Earth 2018), are latitude 35.0480N, longitude 120.4897W, and 327 feet above mean sea level. The approximate site location is shown on Figure 1, Site Vicinity Map in Appendix A.

The ticketing and restroom building will be located near the eastern corner of the stadium and track area, and is currently surfaced with a material locally termed "decomposed granite" or "DG". The track is also currently surfaced with DG. The home grandstand and press box will be located at the southwestern side of the track, where the visitor bleachers are currently located. The new scoreboard will replace the existing scoreboard at approximately the same location at the western corner of the stadium and track area. The locations of the POT upgrades have not been provided; however, we anticipate the upgrades will be located near the bleachers and grandstands in areas that are currently occupied by DG, grass turf, or AB. The locations and dispositions of utility lines in the project area are generally unknown; however, it is known that some utilities exist within the improvement areas, as several borings needed to be relocated before the site investigation to not damage existing utilities.

4.0 FIELD INVESTIGATION

Ten exploratory borings were drilled in the project area on April 2 and 3, 2018 to a maximum depth of approximately 40 feet below the existing ground surface (bgs), where practical drilling refusal was met in Boring 2. The borings were drilled with a Mobile Drill Model B-53 truck mounted drill rig, equipped with 6-inch outside diameter hollow stem auger and an automatic trip hammer for sampling. The approximate locations of the borings are shown on Figure 2, Exploration Location Map in Appendix A. As the borings were drilled, soil samples were obtained using a ring-lined barrel sampler (ASTM D 3550-01/07 with shoe similar to D 2937-10). Standard penetration tests were also performed (ASTM D 1586-11) at selected depths. Bag soil samples were obtained from the auger cuttings. The borings were backfilled per the requirements of the governing jurisdiction.

Soils encountered in the borings were categorized and logged in general accordance with the Unified Soil Classification System and ASTM D 2488-09a. Copies of the boring logs and a Boring Log Legend are included in Appendix A. In reviewing the boring logs and legend, the reader should recognize that the legend is intended as a guideline only, and there are a number of conditions that may influence the soil characteristics as observed during drilling. These include, but are not limited to, the presence of cobbles or boulders, cementation, variations in soil moisture, presence of groundwater, and other factors.

5.0 LABORATORY ANALYSIS

Ring samples obtained from the borings were tested for unit weight and moisture (ASTM D 2937-10, modified for ring liners). Bag samples were tested for maximum density and optimum moisture content (ASTM D 1557-12), expansion index (ASTM D 4829-11), R-Value (ASTM D 2844/D 2844M-13), and cohesion and angle of shearing resistance by direct shear (ASTM D 3080-11, recompacted to 90 percent of maximum dry density, and modified for consolidated, undrained conditions). Select SPT samples were tested for moisture content (ASTM D 2216-10), and sieve analysis (ASTM D 422-63/07). The geotechnical laboratory test results are presented in Appendix C.

Two soil samples were submitted to HDR Engineering, Inc. for geotechnical corrosivity testing. The Corrosivity Study from HDR Engineering, Inc. is presented in Appendix D.

6.0 GENERAL SUBSURFACE AND GEOLOGIC PROFILE

Existing surface improvements and/or fill were encountered in all borings. The surface improvements in all borings except Borings 6 and 8 through 10 consisted of up to 12 inches of loose DG or AB (which were identified in the field as well graded sand with variable amounts of gravel). The surface improvements in Boring 6 consisted of approximately 12 inches of grass turf while approximately 5 feet of fill was encountered in Borings 8 through 10, which consisted of soft to stiff fat clay.

Below the surface improvements and fill, older alluvium was encountered, which generally consisted of soft to very stiff fat clay with variable amounts of sand and gravel, and extended to approximately 30.5 feet in Boring 2. The older alluvium was underlain by older marine terrace deposits, which consisted of stiff to hard sandy silt, and were encountered to the maximum depth explored and where practical drilling refusal was met at approximately 40 feet below existing grades.

Groundwater was not encountered in any of the borings. Please refer to the boring logs in Appendix A for a more complete description of the subsurface conditions encountered in the borings.

7.0 GEOLOGY, SEISMICITY AND GEOLOGIC HAZARDS

A geologic hazards report was prepared previously by this firm for the Nipomo High School/Central Coast New Tech High School project (ESP 2015). The boundaries for that study encompasses this site. That report, and several of the references noted in it, were reviewed as part of the work scope for this project. The subsurface conditions encountered in the borings for

this project were similar to the conditions encountered previously; therefore, in our opinion, the conclusions and recommendations with respect to geology, seismicity and geologic hazards presented in the report for the Nipomo High School/Central Coast New Tech High School project remain valid, with the exception that some of the seismic response parameters needed to be updated to the 2016 CBC, which are included in the table below. A copy of the Nipomo High School/Central Coast New Tech High School report is included in Appendix B.

TABLE 1: SUMMARY OF DESIGN RESPONSE ACCELERATION PARAMETERS

Mapped Spectral Response Acceleration for Site Class B		**Site Coefficients for Site Class D**		**Adjusted MCE Spectral Response Accelerations for Site Class D**		**Design Spectral Response Accelerations for Site Class D**	
Seismic Parameter	Value (g)	Site Coefficient	Value	Seismic Parameter	Value (g)	Seismic Parameter	Value (g)
S_S	1.179	F_a	1.028	S_{MS}	1.213	S_{DS}	0.808
S_1	0.444	F_v	1.556	S_{M1}	0.691	S_{D1}	0.461
Peak Mean Ground Acceleration (PGA_M) = 0.491 g							

8.0 CONCLUSIONS

In our opinion, the site is suitable, from a geotechnical engineering standpoint, for the proposed improvements, as described in the "Introduction" Section of this report, provided the recommendations contained herein are implemented in the design and construction. The primary geotechnical engineering concerns are the expansion potential and corrosive potential of the soils. Provided that the building areas are prepared as recommended in the "Grading" Section of this report, conventional continuous and spread (pad) foundations may be used to support the proposed structures.

Expansive Soils

Expansion index testing yielded results of 144 and 201 for the near-surface soils. Per CBC Section 1803A.5.3, the soils are considered to be expansive. The more commonly used ASTM classification is that the soils are considered to have "very high" expansion potential. Expansive soils tend to swell with seasonal increases in moisture and shrink during the dry season as subsurface moisture decreases. The volume changes that these materials undergo in this cyclical pattern can stress and damage slabs and foundations if precautionary measures are not incorporated into the design and construction procedures. Recommendations for reducing the potential for movement of the proposed improvements are provided in the following sections.

Corrosion Potential

As indicated in the Soil Corrosivity Study by HDR Engineering, Inc. (see Appendix D), electrical resistivities of the samples tested were in the corrosive and severely corrosive categories with as received moisture contents; when saturated, the resistivities were in the severely corrosive category. Soil pH values were in the neutral category. The soluble salt contents of the soils were moderate. Nitrate concentration was high enough to be aggressive to copper. The soils were classified as severely corrosive to ferrous metals and aggressive to copper.

9.0 PRELIMINARY GEOTECHNICAL RECOMMENDATIONS

The following recommendations are for improvements constructed as described in the "Introduction" section of this report. If locations, elevations, structural loads, etc., change, the recommendations contained herein may require modification. In developing the following recommendations, it was assumed that irrigated landscaping or flatwork that would keep the soils relatively uniform, year-round moisture will be installed for a zone of at least five feet around the perimeter of all improvements.

Two distinct types of Portland cement concrete (PCC) slabs-on-grade are discussed in the following recommendations. Interior slabs for the ticketing and restroom building are defined as "slabs-on-grade." Sidewalks that will not support vehicle traffic and housekeeping slabs (if any) below the bleachers are defined as "exterior pedestrian flatwork." Asphalt concrete (AC) paths may also be utilized for pedestrian and light maintenance vehicle access, however it is also assumed that they will not support conventional vehicle traffic.

Unless otherwise noted, the following definitions are used in the recommendations presented below. Where terms are not defined, definitions commonly used in the construction industry are intended.

- **Ticketing and Restroom Building and Press Box Areas –** The ticketing and restroom building and press box areas are defined as the areas within and extending a minimum of 5 feet beyond the perimeter of the foundations for each building. The building area includes any retaining walls, covered walkways or other improvements that are connected to the structure and that are intended to act in a manner similar to it.
- **Bleacher Foundation Area –** The foundation areas are defined as the areas within and extending a minimum of 3 feet beyond the perimeter of the continuous and/or spread foundations for the bleachers.

- **Exterior Pedestrian Flatwork and AC Path Areas –** The areas within the footprints of all exterior pedestrian flatwork, all AC paths for pedestrian use (including within the track area), and housekeeping slabs (if any), including any curb and/or gutter improvements.
- **Track Area –** The area within the footprint of the track, including the interior and exterior perimeter track curbs.
- **Sitework Retaining Wall Areas –** The areas within and extending a minimum of 3 feet beyond the foundation limits of all sitework retaining walls.
- **Grading Area –** The entire area to be graded, including the building, bleacher and press box area, exterior pedestrian flatwork and pavement areas, the track area and sitework retaining wall areas.
- **Existing Grade –** Elevations of the site that existed as of the date of this report.
- **Finish Pad Grade –** The elevation in the building area where earthwork operations are typically considered to be complete. It does not include any sand or gravel that might be placed below slabs-on-grade in association with vapor protection for the slabs.
- **Subgrade –** The elevation in exterior pedestrian flatwork and AC path areas where imported nonexpansive materials, sand, or AB are placed to support the flatwork or AC.
- **Scarified** – Plowed or ripped in two orthogonal directions to a depth of not less than 8 inches.
- **Moisture Conditioned –** Adjusting the soil moisture to optimum moisture content, or just above, prior to application of compactive effort, unless stated otherwise.
- **Compacted/Recompacted** – Soils placed in level lifts not exceeding 8 inches in loose thickness and compacted to a minimum of 90 percent of maximum dry density, unless stated otherwise, based on maximum dry density by ASTM D 1557-12 and field density by ASTM D 6938-15, or other methods acceptable to the geotechnical engineer and jurisdiction.

Site Preparation

1. The ground surface in the grading areas should be prepared for construction by removing the existing structures, flatwork, AB, DG, and all other improvements, vegetation, large roots, debris, organic topsoil, and other deleterious materials. Existing utility lines that will not remain in service should be either removed or abandoned. The appropriate method of abandonment will depend upon the type and depth of the utility. Recommendations for abandonment can be made as necessary.

2. Voids created by the removal of materials or utilities described above should be called to the attention of the geotechnical engineer. No fill should be placed unless the underlying soil has been observed by the geotechnical engineer.

Grading

1. Following site preparation, ticketing and restroom building and press box areas should be overexcavated to a level plane at least 36 inches below bottom of interior slabs. The resulting level excavated surfaces should be scarified, moisture conditioned to at least 3 percent above optimum moisture content, and compacted to 87 to 92 percent of maximum dry density.

2. To create as uniform conditions as possible for the structure, all earthwork operations should be completed throughout each building area in a uniform manner at the same time, from the bottom of the overexcavation recommended in the previous paragraph through fill placement to finish grade. Earthwork operations that complete only a portion of the building area at one time (i.e., "flip-flopping", "checkerboarding," etc.) should not be allowed.

3. Following site preparation, the track area should be overexcavated to a minimum depth of 36 inches below the proposed bottom of AC and to a lateral limit that includes all curbs. The sidewalls should be cut neat and as vertically as possible, while the excavation bottoms should be scarified, moisture conditioned to at least 3 percent above optimum moisture content, and compacted to 87 to 92 percent of maximum dry density.

4. Following site preparation, sitework retaining wall footings should be excavated to the minimum bottom of footing depth recommended in the "Retaining Walls" Section. The resulting overexcavated surfaces should then be scarified, moisture conditioned to at least 3 percent above optimum moisture content and compacted to 87 to 92 percent of maximum dry density. To reduce the potential for cracking in sitework retaining walls, construction joints should be placed in the wall and the foundation where overexcavation operations have been stepped to conform to fill depth changes. Unlike the recommended earthwork program for the building and press box areas, overexcavation and recompaction operations for sitework retaining walls can proceed in a non-uniform manner for individual wall segments.

5. Following site preparation and any excavations to grade, and prior to placement of fill, the soil in grading areas should be scarified, moisture conditioned to at least 3 percent above optimum moisture content and recompacted to 87 to 92 percent of maximum dry density.

6. Voids created by dislodging cobbles and/or debris during scarification should be backfilled and recompacted, and the dislodged materials should be removed from the work area.

7. Previously removed site soils and other similar soils may be placed as fill in the building and press box areas, exterior pedestrian flatwork and AC path areas, and track area, to a maximum depth of 36 inches below bottom of slab or AC.

8. The upper 36 inches of fill below bottom of slab elevation in the building and press box areas, and exterior pedestrian flatwork areas should be nonexpansive. Nonexpansive materials are defined as imported soils that fall in the GW, GM, GC, SP, SW, SC and SM categories per ASTM D 2487-11, and that have an expansion index of 10 or less (ASTM D 4829-11). The clean sand layer described in the "Slabs-on-Grade" section of this report (if utilized below interior slabs-on-grade or exterior pedestrian flatwork) is considered to be part of the minimum recommended thickness of nonexpansive material utilized, not in addition to it.

9. The upper 36 inches of fill below the AC for the track should also consist of nonexpansive materials, with the top 4 inches comprised of Class 2 AB per the Standard Specifications (Caltrans 2015). Prior to placement of the nonexpansive materials within curb areas, a minimum 10-mil thick moisture barrier should be placed to line the excavation sidewalls and bottom of excavation to at least 3 feet laterally into the excavation.

10. Imported nonexpansive soils (including AB) used in the building and track areas should not contain recycled materials, should have strength qualities equal to or better than the site soils, and should not exceed the geotechnical corrosivity potential of the site soils. See the Soil Corrosivity Study by HDR Engineering, Inc. in Appendix D of this report for the corrosivity parameters of the site soils. Proposed imported materials should be reviewed by the geotechnical engineer before being brought to the site, and on an intermittent basis during placement.

11. All materials used as fill should be cleaned of any debris and rocks larger than 3 inches in diameter. When fill material includes rocks, the rocks should be placed in a sufficient soil matrix to ensure that voids caused by nesting of the rocks will not occur and that the fill can be properly compacted.

12. All AB in areas to support AC paths should be compacted to a minimum of 95 percent of maximum dry density. Imported nonexpansive materials, sand or AB used to support exterior pedestrian flatwork and slabs-on-grade should be compacted to 90 percent of maximum dry density. The top 12 inches of subgrade in these areas should be compacted to 87 to 92 percent of maximum dry density.

13. If the soils are overly moist so that they become unstable, or if the minimum recommended compaction cannot be readily achieved, drying the soil so that it is nearer optimum moisture content may be necessary. Placement of gravel layers or geotextiles may also be necessary to help stabilize unstable soils. Additional overexcavation may also be recommended to correct unstable conditions or if soft or loose conditions are encountered during grading. No fill should be placed in any grading area if the underlying soil is unstable.

14. The recommended soil moisture content should be maintained throughout construction, and during the lives of the structures and all other improvements. Failure to maintain the soil moisture content can result in desiccation cracks and disturbance, which are an indication of degradation of the soil compaction. If desiccation cracks are allowed to develop, or if soils near improvements such as foundations, flatwork, etc. are otherwise disturbed, damage to those improvements may result. Soils that have cracked or are otherwise disturbed should be removed, moisture conditioned, and recompacted.

15. As a potentially cost-saving alternative to exporting highly expansive on-site soils and importing nonexpansive soils, the on-site soils may be lime treated. The lime treatment section should be at least 36 inches thick and should consist of at least 4 percent lime by weight (the actual lime content demand may also be calculated by a lime stability test [ASTM D 6276], where a pH of 12.4 or higher). The lime treatment section may be used within all improvement areas of the site (excluding landscaping areas). The top of the lime treatment section should be below any recommended pavement or slab support sections, such as the 4 inches of aggregate base recommend below AC path areas and sand below slab on grade areas. The lime should be evenly spread and thoroughly mixed

into maximum 18-inch thick layers of the on-site soils with task-specific mixing equipment (such as a Terex RS 650), with a minimum of two mixing cycles performed for each layer; a minimum mellowing period of 24 hours should occur between the first and second mixing cycle. Each treated layer should be compacted with lime treatment-specific compaction equipment (such as a Rex 3-70) to 95 percent of maximum dry density. Testing for soluble sulfates should be considered, as soils with sulfate contents above 0.3 percent by weight may require special provisions for lime treatment, such as an extended mellowing period. Care should be taken to not allow the lime treatment to extend into turf or landscaping areas, as turf and other vegetation will not survive in lime-treated soils.

Utility Trenches

1. Utility trenches adjacent to foundations should not be excavated within the zone of foundation influence, as shown in Typical Detail A in Appendix E.

2. Utilities that must pass beneath foundations should be placed with properly compacted utility trench backfill and the foundation should be designed to span the trench.

3. A select, noncorrosive, granular, easily compacted material should be used as bedding and shading immediately around utilities. The site soil may be used for trench backfill above the select material to subgrade or finish grade beyond the building area, and to within 30 inches below bottom of slab elevation in the building areas. In exterior pedestrian flatwork and AC path areas, trench backfill should match the thickness of imported nonexpansive soils, sand or AB used to support these improvements.

4. In general, trench backfill should be compacted to a minimum of 90 percent of maximum dry density for imported nonexpansive materials, and to a moisture content of at least 3 percent over optimum and compacted to 87 to 92 percent of maximum dry density for on-site expansive soils.

5. Prior to applying compactive effort, trench backfill should be moisture conditioned. Trench backfill should be placed in level lifts not exceeding 6 inches in loose thickness and compacted to the minimums recommended above.

6. Compaction of trench backfill by jetting or flooding is not recommended at this site due to the expansive site soils. However, to aid in *encasing* utility conduits, particularly

corrugated drain pipes, and multiple, closely-spaced conduits in a single trench with the bedding and shading material, jetting or flooding may be useful. Flooding or jetting should only be attempted with extreme caution, and any flooding or jetting operation should be subject to review by the geotechnical engineer.

7. Long-term settlement of properly compacted sand should be assumed to be about 0.25 to 0.5 percent of the depth of the backfill. Where trenches are backfilled with site soils, the anticipated settlement would be about twice that of sand. Improvements that are constructed over or near trenches should be designed to accommodate the potential for settlement.

8. The Soil Corrosivity Study by HDR Engineering, Inc. in Appendix D should be used by the architect/engineer in specifying appropriate corrosion protection measures for utility improvements.

9. The recommendations of this section are minimums only, and may be superseded by the architect/engineer based upon soil corrosivity or the requirements of pipe manufacturers, utility companies or the governing jurisdiction.

Foundations and Track Curbs

1. The building, press box and bleachers may be supported by continuous and spread footings bearing in firm, undisturbed native soils or firm recompacted fill, but not by both materials, as recommended in the "Grading" Section of this report.

2. Based on soil expansion potential only, minimum overall foundation depths of 39 inches below lowest adjacent grade should be maintained. Spread footings should be at least 24 inches square, and should be interconnected on at least two sides by grade beams or continuous footings with minimum dimensions of 12 inches wide and 39 inches deep.

3. Continuous footings should be reinforced in accordance with the requirements of the architect/engineer; based on soil expansion potential only, minimum continuous footing reinforcement should consist of two No. 5 rebar, one at the top and one at the bottom. Spread footings should be reinforced in accordance with the requirements of the architect/engineer.

4. Footings bearing in firm recompacted soil may be designed using maximum allowable bearing capacities of 2,000 psf for dead loads and 3,000 psf for dead plus live loads. Using these criteria, total maximum and differential settlements (including static and seismic settlements) are expected to be on the order of 1¼-inch and ¾-inch over a horizontal distance of 25 feet, respectively.

5. Allowable bearing capacities may be increased by one-third when transient loads such as wind or seismicity are included. Foundations may be designed using the site design response parameters contained in Table 1: Summary of Design Response Acceleration Parameters found in the "Geology, Seismicity and Geologic Hazards" Section of this report.

6. To calculate resistance to lateral loads, please see the values presented in the "Retaining Walls" Section of this report. Lateral capacity is based on the assumption that any backfill adjacent to foundations has been properly compacted. Passive and friction components of resistance may be combined in the analysis without reduction to either value.

7. Minimum 6-inch wide curbs should be placed around the interior, the exterior, and along the straightaways and ends of the track. The track curbs should extend to a minimum depth of 30 inches below the bottom of the AC layer. The moisture barrier should be in contact with the entire sides of all curbs facing away from the track. Based on soil expansion potential only, minimum reinforcement for the track curbs should consist of two No. 5 rebar, one at the top and one at the bottom. Joints for track curbs should be as specified by the architect/engineer.

8. Footing and track curb excavations should be observed by the geotechnical engineer prior to placement of reinforcing steel. Footing and track curb excavations should be lightly moistened and no desiccation cracks should be present prior to concrete placement.

9. The Soil Corrosivity Study by HDR Engineering, Inc. in Appendix D should be used by the architect/engineer in specifying appropriate corrosion protection measures for foundations and track curbs.

Slabs-on-Grade

Interior Slabs-On-Grade

1. Interior slabs-on-grade should have a minimum thickness of 4 inches. They should be reinforced and doweled to foundations per the specifications of the architect/engineer.

At a minimum, interior slabs should be reinforced with No. 4 rebar at 24 inches on center each way. All structural slabs should contain minimum rebar meeting the criteria of ACI 318, Section 7.6.1.1 (ACI 2014). At a minimum, foundation dowels should be lap spliced to the slab rebar. The size and spacing of the dowels should match the size and spacing of the slab rebar.

Exterior Pedestrian Flatwork and Housekeeping Slabs

1. Exterior pedestrian flatwork ("flatwork") and housekeeping slabs ("slabs") should have a minimum thickness of 4 inches. In conventional construction, it is common to use 4 to 6 inches of sand beneath flatwork and slabs. However, due to the high expansion potential of the site soils, there will be a risk of movement and damage to the flatwork and slabs if conventional measures are used. Heaving and cracking could occur. To reduce the potential for movement and damage, flatwork and slabs should be supported on at least 30 inches of nonexpansive imported soils and minimum reinforcement should consist of No. 4 rebar placed at 24 inches on-center each way.

2. If it is acceptable for the flatwork and slabs to experience movement due to expansive soils, then the thickness of the nonexpansive soil can be reduced. Under all flatwork and slabs, however, the thicker the nonexpansive layer, the better the expansive soil protection.

3. Another measure that can be taken to reduce the risk of movement of flatwork and slabs due to expansive soils is to provide thickened edges or grade beams around the perimeters of the flatwork. To reduce the potential for movement, the thickened edges or grade beams could be up to 33 inches deep. If it is acceptable for the flatwork and slabs to experience movement, then the thickened edges or grade beams can be reduced. At a minimum, any thickened edge or grade beam should be reinforced by two No. 5 rebar, one at the top and one at the bottom.

4. It is recognized that the measures discussed above for protecting flatwork and slabs from expansive soils are expensive, possibly more expensive than simply replacing flatwork that has heaved and/or cracked. Consequently, the above measures for protecting flatwork and slabs are only suggestions for consideration by the owner and/or architect/engineer. The degree to which flatwork and slabs are protected from expansive soil damage is left to the discretion of the owner and/or architect/engineer.

5. Flatwork and slabs should be constructed with frequent joints to allow articulation as the flatwork and slabs move in response to seasonal soil temperature and moisture variations. The expansive soil underlying any nonexpansive material placed below flatwork and slabs should be moisture conditioned, and no desiccation cracks should be present, prior to casting the flatwork.

6. Flatwork and slabs at doorways, and at other areas where maintaining the elevation of the flatwork and slabs is desired when mitigating expansive soil potential, should be doweled to the perimeter foundation (if applicable). The size and spacing of the dowels should match the size and spacing of the flatwork or slab rebar. In other areas, the flatwork and slabs may be doweled to the foundation or the flatwork and slabs may be allowed to "float free," at the discretion of the architect/engineer. Flatwork and slabs that are intended to float free should be separated from foundations by a felt joint or other means.

Moisture Vapor Transmission

1. Due to the current use of impermeable floor coverings, water-soluble flooring adhesives, and the speed at which buildings are now constructed, moisture vapor transmission through slabs is a much more common problem than in past years. Where moisture vapor transmitted from the underlying soil would be undesirable, slabs should be protected from subsurface moisture vapor. A number of options for vapor protection are discussed below; however, the means of vapor protection, including the type and thickness of the vapor retarder, if specified, are left to the discretion of the architect/engineer.

2. Where specified, vapor retarders should conform to ASTM Standard E 1745-11. This standard specifies properties for three performance classes; Class A, B and C. The appropriate class should be selected based on the potential for damage to the vapor retarder during placement of slab reinforcement and concrete. Unless it is determined that a permeance of 0.10 perms will not allow vapor to accumulate beneath moisture-sensitive flooring, adhesives, stored products and/or equipment, then a vapor retarder permeance of 0.010 perms is recommended, per ACI 302.1-15. Permeance of vapor retarders should remain below 0.010 perms after the conditioning tests of ASTM E 1745-11.

Note: ASTM E 1745-11 has the same permeance threshold for Class A through Class C (0.1 perms). The class that is chosen will make a difference in how resistant the vapor retarder is to punctures and tears, but it will not insure any better permeance values to protect floor coverings.

3. Several recent studies, including those of American Concrete Institute Committee 302 (ACI 2015), have concluded that excess water above the vapor retarder increases the potential for moisture damage to floor coverings and could increase the potential for mold growth or other microbial contamination. The studies also concluded that it is preferable to eliminate the typical sand layer beneath the slab and place the slab concrete in direct contact with a Class A vapor retarder, particularly during wet weather construction. However, placing the concrete directly on the vapor retarder requires special attention to using the proper vapor retarder, a very low water-cement ratio in the concrete mix, and special finishing and curing techniques.

4. Another option that may be a reasonable compromise between effectiveness and cost considerations is the use of a subslab vapor retarder protected by a sand layer. If a Class A vapor retarder is specified, the retarder can be placed directly on the nonexpansive soil. The retarder should be covered with a minimum 2 inches of *clean* sand. If a less durable vapor retarder is specified (Class B or C), a minimum of 4 inches of clean sand should be provided, and the retarder should be placed in the center of the clean sand layer. Clean sand is defined as a well or poorly graded sand (ASTM D 2487-11) of which less than 3 percent passes the No. 200 sieve.

5. Regardless of the underslab vapor retarder selected, proper installation of the retarder per ASTM E 1643-11 is critical for optimum performance. Where utilized, the vapor retarder should be placed a minimum of 1 inch above the flow line of the drainage path surrounding the structures, or 1 inch above the area drain grates if area drains are used to collect runoff around the structures. As required by ASTM E 1643-11, all seams and utility penetrations should be properly sealed. At terminating edges of the vapor retarder, the vapor retarder should be effectively sealed with accessories specifically designed to seal the material to new or existing concrete; details for edge sealing of the vapor retarder should be provided by the architect/engineer.

6. If the sand is used between the vapor retarder and the slab, it should be moistened only as necessary to promote concrete curing; saturation of the sand should be avoided, as the excess moisture would be on top of the vapor retarder, potentially resulting in vapor transmission through the slab for months or years.

7. Positive drainage away from the structure should be maintained; see the "Drainage and Maintenance" section of this report for additional discussion of this issue. If water is allowed to pond near the structure, it may seep into the ground and migrate laterally through cracks or utility penetrations in the foundation, ultimately gaining access above the vapor retarder.

Slabs-on-Grade - General

1. To reduce shrinkage cracks in all interior and exterior slabs-on-grade, the concrete aggregates should be of appropriate size and proportion, the water/cement ratio should be low, the concrete should be properly placed and finished, contraction joints should be installed, and the concrete should be properly cured. This is particularly applicable to slabs that will be cast directly upon a vapor retarder and those that will be protected from transmission of vapor by use of admixtures or surface sealers. Concrete materials, placement, and curing specifications should be at the direction of the architect/engineer; AC 302.1R-15 (ACI 2015) is suggested as a resource for the architect/engineer in preparing such specification.

2. To provide stability for curbs adjacent to exterior pedestrian flatwork, they should be set back a minimum distance equal to one-third the height of any adjacent descending slope, but not less than 5 feet from the tops of slopes. Alternately, curbs may be deepened to provide stability. The geotechnical engineer should review, on an individual basis, any situation where curbs must be deepened to meet this recommendation.

3. The Soil Corrosivity Study by HDR Engineering, Inc. in Appendix C should be used by the architect/engineer in specifying appropriate corrosion protection measures for slabs-on-grade.

Retaining Walls

1. Sitework retaining walls should be founded in firm, native undisturbed soil or firm fill that has been recompacted per the "Grading" Section of this report. If a sitework retaining wall crosses an undisturbed native soil/recompacted fill transition, or a transition

between varying fill overexcavation depths, a construction joint should be placed in the footing and wall at the transitions. Foundations for all retaining walls should have minimum overall depths of 39 inches below lowest adjacent grade.

2. Retaining wall footings should be reinforced in accordance with the requirements of the architect/engineer; based on soil expansion potential only, minimum retaining wall footing reinforcement should consist of two No. 5 rebar, one at the top and one at the bottom.

3. Retaining wall design may be based on the following parameters:

Active equivalent fluid pressure (imported sand/gravel backfill)	35 pcf
At-rest equivalent fluid pressure (imported sand/gravel backfill)	50 pcf
Passive equivalent fluid pressure	350 pcf
Maximum toe pressure	3,000 psf
Coefficient of sliding friction	0.35

4. Per 2016 CBC Table 1610A.1, the highly expansive native site soils are not suitable for re-use as backfill for retaining walls; therefore, only imported nonexpansive materials should be used as wall backfill.

5. No surcharges are taken into consideration in the values presented in the previous paragraph. The maximum toe pressure is an *allowable* value; no factors of safety, load factors or other factors have been applied to the remaining values. With the exception of the maximum toe pressure, these values will require application of appropriate factors of safety, load factors, and/or other factors as deemed appropriate by the architect/engineer.

6. If the active or at-rest pressures presented in Paragraph 3 for *imported sand or gravel backfill* are utilized for design of retaining walls, the sand or gravel should be used exclusively as backfill above a 1:1 plane extended upward from the back of the wall footing to approximately 1 foot from the top of the wall backfill. The upper foot should be backfilled with native soil, except in areas where AC paths or exterior pedestrian flatwork will abut the top of the wall. In such cases, the gravel should extend to the imported nonexpansive material, sand, AB, or other material below the improved surface,

as appropriate. If gravel backfill is utilized, the gravel should be encased in a permeable synthetic filter fabric conforming to standard specification Section 88-1.02B – Class C (Caltrans 2015).

7. The active and at-rest pressures presented in Paragraph 3 are applicable to a horizontal retained surface behind the wall. Walls having a retained surface that slopes upward from the wall should be designed for an additional equivalent fluid pressure of 1 pcf for the active case and 1.5 pcf for the at-rest case, for every degree of slope inclination.

8. It is assumed that retaining wall heights will not exceed 6 feet; therefore, per Section 1803A.5.12.1 of the 2016 CBC, dynamic seismic lateral earth pressures are not required. If retaining walls are planned that will retain more than 6 feet of backfill, the geotechnical engineer should be notified to provide dynamic seismic lateral earth pressure increments, as needed.

9. Long-term settlement of properly compacted retaining wall backfill should be assumed to be about 0.5 to 1 percent of the depth of the backfill. Improvements that are constructed near the tops of retaining walls should be designed to accommodate long-term settlement.

10. All retaining walls should be drained with perforated pipe encased in a free-draining gravel blanket. The pipe should be placed perforations downward, and should discharge in a nonerosive manner away from foundations and other improvements. The gravel blanket should have a width of approximately 1 foot and should extend upward to approximately 1 foot from the top of the wall backfill. The upper foot should be backfilled with native soil, except in areas where AC paths or exterior pedestrian flatwork will abut the top of the wall. In such cases, the gravel should extend to the imported nonexpansive material, sand, AB, or other material below the improved surface, as appropriate. To reduce infiltration of the soil into the gravel, a permeable synthetic filter fabric conforming to Standard Specifications Section 88-1.02B – Class C (Caltrans 2015), should be placed between the two materials. Manufactured synthetic drains, such as Miradrain or Enkadrain are acceptable alternatives to the use of gravel, provided that they are installed in accordance with the recommendations of the manufacturer.

11. Where weep hole drainage can be properly discharged, the perforated pipe may be omitted in lieu of weep holes on maximum 4-foot centers. A filter fabric as described above should be placed between the weep holes and the drain gravel.

12. Walls facing areas where moisture transmission through the wall would be undesirable should be *thoroughly* waterproofed in accordance with the specifications of the architect/engineer.

13. The architect/engineer should bear in mind that retaining walls by their nature are flexible structures, and that surface treatments on walls often crack. Where walls are to be plastered or otherwise have a finish applied, the flexibility should be considered in determining the suitability of the surfacing material, spacing of horizontal and vertical control joints, etc. The flexibility should also be considered where a retaining wall will abut or be connected to a rigid structure, and where the geometry of the wall is such that its flexibility will vary along its length.

14. The Soil Corrosivity Study by HDR Engineering, Inc. in Appendix D should be used by the architect/engineer in specifying appropriate corrosion protection measures for retaining walls.

AC Paths

1. Paths for pedestrian access and for supporting the synthetic track surface may be constructed of AC over AB. Design methods for AC pavement do not typically consider pedestrian loading only; the section design is typically based on local experience and anticipated life span. For this application, a minimum pavement section of 2 inches of AC over 4 inches of AB is considered appropriate. As with exterior pedestrian flatwork, this minimum thickness of AC and AB will be subject to movement due to expansive soils; therefore, we recommend the AC be supported by at least 30 inches of nonexpansive fill, which includes the AB section. The AB within the synthetic track area (and any other areas with surface coverings) should only consist of virgin AB; recycled AB should not be used.

2. It is recognized that the increased AB/nonexpansive fill thickness recommended above for protecting AC paths from expansive soils will be expensive. For areas excluding those covered by the synthetic track surface, constructing the nonexpansive fill section may possibly be more expensive than simply replacing AC paths that have heaved and/or cracked. Consequently, this measure for protecting AC paths is only a suggestion for consideration by the client and/or architect/engineer, and only for areas excluding those covered by the synthetic track surface. The degree to which AC paths are protected from expansive soil damage is left to the discretion of the owner and/ or architect/engineer.

3. Paths should be constrained by curbs, gutters, flatwork, walls, etc.; free edges to the paths should be avoided.

4. AB should conform to the requirements of Section 26 of the Standard Specifications (Caltrans 2015). AC should conform to the requirements of Section 32 of the Standard Specifications (Caltrans 2015).

5. All AB in AC path areas should be compacted to a minimum of 95 percent of maximum dry density. Subgrade and AB should be firm and unyielding when proofrolled with heavy, rubber-tired grading equipment prior to continuing construction.

6. To reduce migration of surface drainage into the subgrade, maintenance of pavement areas is critical. Any cracks that develop in pavement should be promptly sealed.

7. The local jurisdiction may have additional requirements for pavement that could take precedence over the above recommendations.

Drainage and Maintenance

1. Per Section 1804A.4 of the 2016 CBC, unpaved ground surfaces should be *finish graded* to direct surface runoff away from foundations and other improvements at a minimum 5 percent grade for a minimum distance of 10 feet. The site should be similarly sloped to drain away from foundations, and other improvements during construction. Where this is not practicable due to other improvements, etc., swales with improved surfaces, area drains, or other drainage facilities, should be used to collect and discharge runoff.

2. All eaves of the buildings should be fitted with roof gutters. Runoff from flatwork, roof gutters, downspouts, planter drains, area drains, etc. should discharge in a non-erosive manner away from foundations and other improvements in accordance with the requirements of the governing agencies. Erosion protection should be placed at all discharge points unless the discharge is to a pavement surface.

3. To reduce the potential for planter drainage gaining access to subslab areas, any raised planter boxes adjacent to foundations should be installed with drains and sealed sides and bottoms. Drains should also be provided for areas adjacent to the structures and in landscape areas that would not otherwise freely drain.

4. If soils are disturbed during construction, stabilization of soils by vegetation or other means, *during* and *following* construction, is essential to reduce erosion damage. Care should be taken to establish and maintain vegetation. The landscaping should be planned and installed to maintain the surface drainage recommended above. Surface drainage should also be maintained during construction.

5. Maintenance of drainage and other improvements is critical to the long-term stability of the site and the integrity of the structures. Site improvements should be maintained on a regular basis.

6. Finished flatwork surfaces should be sloped to freely drain toward appropriate drainage facilities. Water should not be allowed to stand or pond on or adjacent to exterior pedestrian flatwork, or other improvements as it could infiltrate into the AB and/or subgrade, causing premature deterioration of flatwork or other improvements.

7. All exterior drains, retaining wall drains, and drain outlets should be maintained to be free-flowing. Care should be taken to establish and maintain vegetation. Vegetation and erosion matting (if utilized) should be maintained or augmented as needed. Irrigation systems should be maintained so that soils around structures are maintained at a relatively uniform year-round moisture content, and are neither over-watered nor allowed to dry and desiccate.

8. To reduce the potential for disruption of drainage patterns and undermining of structures, fill areas, etc., all rodent activity should be aggressively controlled.

9. The architect/engineer should consider incorporating appropriate measures in the design of the buildings and site improvements to mitigate the moderate potential for radon.

Observation and Testing

1. It must be recognized that the recommendations contained in this report are based on a limited number of borings and rely on continuity of the subsurface conditions encountered.

2. It is assumed that the geotechnical engineer will be retained to provide consultation during the design phase, to interpret this report during construction, and to provide construction monitoring in the form of testing and observation.

3. At a minimum, the geotechnical engineer should be retained to provide:

   - Professional observation during grading, trench and retaining wall backfill, and foundation construction
   - Oversight of special inspection and compaction testing grading, trench and retaining wall backfill, and foundation construction

4. Special inspection of grading and backfill should be provided as per Section 1705A.6 and Table 1706A.6 of the CBC. The special inspector should be under the direction of the geotechnical engineer. At a minimum, the following items should be inspected and/or tested by the special inspector:

   - Stripping and clearing of all existing improvements, vegetation, and deleterious materials
   - Removal and replacement of existing fill within the building and sitework retaining wall areas to the recommended depths
   - Scarification and moisture conditioning of exterior pedestrian flatwork and AC path areas, and all other grading areas
   - Fill quality, placement, moisture conditioning and compaction
   - Utility trench backfill
   - Foundation excavations

5. A program of quality assurance should be developed prior to beginning construction. At a minimum, the program should include all geotechnical items shown on the testing and inspection schedule of the approved plans. It should also include any additional inspection items required by the engineer and/or the governing jurisdiction. These items should be discussed at a preconstruction site meeting among a representative of the owner, the geotechnical engineer, special inspector, the project inspector, the engineer, and contractors. The geotechnical engineer should be notified at least 48 hours prior to beginning grading operations.

6. Locations and frequency of compaction tests should be per the recommendation of the geotechnical engineer at the time of construction. The recommended test location and frequency may be subject to modification by the geotechnical engineer, based upon soil and moisture conditions encountered, size and type of equipment used by the contractor, the general trend of the results of compaction tests, or other factors.

10.0 CLOSURE

Our intent was to perform the investigation in a manner consistent with the level of care and skill ordinarily exercised by members of the profession currently practicing in the locality of this project under similar conditions. No representation, warranty, or guarantee is either expressed or implied. This report is intended for the exclusive use by the client as discussed in the "Scope of Services" section. Application beyond the stated intent is strictly at the user's risk.

This report is valid for conditions as they exist at this time for the type of project described herein. The conclusions and recommendations contained in this report could be rendered invalid, either in whole or in part, due to changes in building codes, regulations, standards of geotechnical or construction practice, changes in physical conditions, or the broadening of knowledge.

If changes with respect to the project become necessary, if items not addressed in this report are incorporated into plans, or if any of the assumptions used in the preparation of this report are not correct, this firm shall be notified for modifications to this report. Any items not specifically addressed in this report should comply with the CBC of other applicable standards, and the requirements of the governing jurisdiction.

The preliminary recommendations presented in this geotechnical report are based upon the geotechnical conditions encountered at the site, and may be augmented by additional requirements of the client, or by additional recommendations provided by the geotechnical engineer based on peer or jurisdiction reviews, or conditions exposed at the time of construction. If Earth Systems Pacific is *not* retained to provide construction observation and testing services, it shall not be responsible for the interpretation of the information by others or any consequences arising therefrom.

This document, the data, conclusions, and recommendations contained herein are the property of Earth Systems Pacific. This report shall be used in its entirety, with no individual sections reproduced or used out of context. Copies may be made only by Earth Systems Pacific, the client, and the client's authorized agents for use exclusively on the subject project. Any other use is subject to federal copyright laws and the written approval of Earth Systems Pacific.

Thank you for this opportunity to have been of service. If you have any questions, please feel free to contact this office at your convenience.

End of Text.

TECHNICAL REFERENCES

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APPENDIX A

Figure 1 – Site Vicinity Map
Figure 2 – Exploration Location Map
Boring Log Legend
Boring Logs



Earth Systems Pacific
4378 Old Santa Fe Road, San Luis Obispo, CA 93401
www.earthsystems.com
(805) 544-3276 • Fax (805) 544-1786

SITE VICINITY MAP

Nipomo High School Stadium and Track Improvements
525 N. Thompson Avenue
Nipomo, California

Date
May, 2018

Project No.
300909-002

Figure 1

NIPOMO HIGH SCHOOL STADIUM AND TRACK IMPROVEMENT-040918maps



LEGEND

10 Boring Location (Approx.)

NOT TO SCALE

Earth Systems Pacific
4378 Old Santa Fe Road, San Luis Obispo, CA 93401
www.earthsystems.com
(805) 544-3276 • Fax (805) 544-1786

EXPLORATION LOCATION MAP
Nipomo High School Stadium and Track Improvements
525 N. Thompson Avenue
Nipomo, California

Date
May, 2018

Project No.
300909-002

Figure 2

NIPOMO HIGH SCHOOL STADIUM AND TRACK IMPROVEMENT-040918mxps

Earth Systems Pacific

BORING LOG LEGEND

SAMPLE / SUBSURFACE WATER SYMBOLS	GRAPH. SYMBOL
CALIFORNIA MODIFIED	
STANDARD PENETRATION TEST (SPT)	
SHELBY TUBE	
BULK	
SUBSURFACE WATER DURING DRILLING	
SUBSURFACE WATER AFTER DRILLING	

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2487)

MAJOR DIVISIONS	GROUP SYMBOL	TYPICAL DESCRIPTIONS	GRAPH. SYMBOL
COARSE GRAINED SOILS (MORE THAN HALF OF MATERIAL IS LARGER THAN #200 SIEVE SIZE)	GW	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	
	GP	POORLY GRADED GRAVELS, OR GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	
	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES, NON-PLASTIC FINES	
	GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES, PLASTIC FINES	
	SW	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	
	SP	POORLY GRADED SANDS OR GRAVELLY SANDS, LITTLE OR NO FINES	
	SM	SILTY SANDS, SAND-SILT MIXTURES, NON-PLASTIC FINES	
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES, PLASTIC FINES	
FINE GRAINED SOILS (HALF OR MORE OF MATERIAL IS SMALLER THAN #200 SIEVE SIZE)	ML	INORGANIC SILTS AND VERY FINE SANDS, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY	
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS	
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY	
	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS	
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS	
	PT	PEAT AND OTHER HIGHLY ORGANIC SOILS	

OBSERVED MOISTURE CONDITION

DRY	SLIGHTLY MOIST	MOIST	VERY MOIST	WET (SATURATED)

CONSISTENCY

COARSE GRAINED SOILS			FINE GRAINED SOILS		
BLOWS/FOOT		DESCRIPTIVE TERM	BLOWS/FOOT		DESCRIPTIVE TERM
SPT	CA SAMPLER		SPT	CA SAMPLER	
0-10	0-16	LOOSE	0-2	0-3	VERY SOFT
11-30	17-50	MEDIUM DENSE	3-4	4-7	SOFT
31-50	51-83	DENSE	5-8	8-13	MEDIUM STIFF
OVER 50	OVER 83	VERY DENSE	9-15	14-25	STIFF
			16-30	26-50	VERY STIFF
			OVER 30	OVER 50	HARD

GRAIN SIZES

U.S. STANDARD SERIES SIEVE				CLEAR SQUARE SIEVE OPENING		
# 200	# 40	# 10	# 4	3/4"	3"	12"

SILT & CLAY	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		

TYPICAL BEDROCK HARDNESS

MAJOR DIVISIONS	TYPICAL DESCRIPTIONS
EXTREMELY HARD	CORE, FRAGMENT, OR EXPOSURE CANNOT BE SCRATCHED WITH KNIFE OR SHARP PICK; CAN ONLY BE CHIPPED WITH REPEATED HEAVY HAMMER BLOWS
VERY HARD	CANNOT BE SCRATCHED WITH KNIFE OR SHARP PICK; CORE OR FRAGMENT BREAKS WITH REPEATED HEAVY HAMMER BLOWS
HARD	CAN BE SCRATCHED WITH KNIFE OR SHARP PICK WITH DIFFICULTY (HEAVY PRESSURE); HEAVY HAMMER BLOW REQUIRED TO BREAK SPECIMEN
MODERATELY HARD	CAN BE GROOVED 1/16 INCH DEEP BY KNIFE OR SHARP PICK WITH MODERATE OR HEAVY PRESSURE; CORE OR FRAGMENT BREAKS WITH LIGHT HAMMER BLOW OR HEAVY MANUAL PRESSURE
SOFT	CAN BE GROOVED OR GOUGED EASILY BY KNIFE OR SHARP PICK WITH LIGHT PRESSURE, CAN BE SCRATCHED WITH FINGERNAIL; BREAKS WITH LIGHT TO MODERATE MANUAL PRESSURE
VERY SOFT	CAN BE READILY INDENTED, GROOVED OR GOUGED WITH FINGERNAIL, OR CARVED WITH KNIFE; BREAKS WITH LIGHT MANUAL PRESSURE

TYPICAL BEDROCK WEATHERING

MAJOR DIVISIONS	TYPICAL DESCRIPTIONS
FRESH	NO DISCOLORATION, NOT OXIDIZED
SLIGHTLY WEATHERED	DISCOLORATION OR OXIDATION IS LIMITED TO SURFACE OF, OR SHORT DISTANCE FROM, FRACTURES: SOME FELDSPAR CRYSTALS ARE DULL
MODERATELY WEATHERED	DISCOLORATION OR OXIDATION EXTENDS FROM FRACTURES, USUALLY THROUGHOUT; Fe-Mg MINERALS ARE "RUSTY", FELDSPAR CRYSTALS ARE "CLOUDY"
INTENSELY WEATHERED	DISCOLORATION OR OXIDATION THROUGHOUT; FELDSPAR AND Fe-Mg MINERALS ARE ALTERED TO CLAY TO SOME EXTENT, OR CHEMICAL ALTERATION PRODUCES IN SITU DISAGGREGATION
DECOMPOSED	DISCOLORATION OR OXIDATION THROUGHOUT, BUT RESISTANT MINERALS SUCH AS QUARTZ MAY BE UNALTERED; FELDSPAR AND Fe-Mg MINERALS ARE COMPLETELY ALTERED TO CLAY

drafting/masters/Boring Log Legend121714.dwg

Earth Systems Pacific

Boring No. 1
PAGE 1 OF 1
JOB NO.: 300909-002
DATE: 4/3/18

LOGGED BY: M. Navarro
DRILL RIG: Mobile B-53 with Automatic Hammer
AUGER TYPE: 6" Hollow Stem Auger

NIPOMO HIGH SCHOOL
STADIUM AND TRACK IMPROVEMENTS
525 N. Thompson Avenue
Nipomo, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA: INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0	SW		WELL GRADED SAND: brown, loose, moist (Fill)					
1				0.0 - 5.0	○			2
2	CH		FAT CLAY W/ GRAVEL: dark gray, medium stiff, very moist, trace sand (Older Alluvium)	2.0 - 3.5	■	82.3	34.3	4 5
3								
4								
5			becomes stiff	5.0 - 6.5	■	83.7	34.3	3 6 8
6								
7								
8								
9								
10				10.0 - 11.5	■	87.6	30.9	4 8 13
11								
12								
13				13.0 - 15.0	●			3 6 9
14								
15			End of Boring @ 15.0'					
16			No subsurface water encountered					
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								

LEGEND: ■ Ring Sample ○ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 2

LOGGED BY: M. Navarro
DRILL RIG: Mobile B-53 with Automatic Hammer
AUGER TYPE: 6" Hollow Stem Auger

JOB NO.: 300909-002
DATE: 4/3/18

NIPOMO HIGH SCHOOL
STADIUM AND TRACK IMPROVEMENTS
525 N. Thompson Avenue
Nipomo, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA: INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0	SW		WELL GRADED SAND: light brown, loose, slightly moist (Fill)	0.0 - 5.0	○			2
1	CH		FAT CLAY: dark gray brown, medium stiff, very moist, trace gravel (Older Alluvium)	2.0 - 3.5	▬	85.3	33.5	5 8
5			becomes stiff, very dark gray, no gravel, some sand	5.0 - 6.5	▬	90.3	28.0	2 6 9
10	CH		FAT CLAY W/ GRAVEL: dark brown, stiff, moist	10.0 - 11.5	▬	89.1	27.3	3 8 12
15				15.0 - 16.5	●			2 4 7
20				20.0 - 21.5	●			2 4 7
25				25.0 - 26.5	●			3 5 7
26	CH		SANDY FAT CLAY: brown, stiff, moist, trace gravel					

LEGEND: ▬ Ring Sample ○ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 2
PAGE 2 OF 2

LOGGED BY: M. Navarro
DRILL RIG: Mobile B-53 with Automatic Hammer
AUGER TYPE: 6" Hollow Stem Auger

JOB NO.: 300909-002
DATE: 4/3/18

NIPOMO HIGH SCHOOL
STADIUM AND TRACK IMPROVEMENTS
525 N. Thompson Avenue
Nipomo, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA: INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
27	CH		SANDY FAT CLAY: brown, stiff, very moist, trace gravel					
28			decreasing gravel content					
29								
30				30.0 - 31.5	●		32.5	3 5 8
31	ML		SANDY SILT: orange gray with black mottling, stiff, very moist, caliche veins (Older Marine Terrace Deposits)					
32								
33								
34			becomes hard					
35				35.0 - 36.5	●		48.7	14 22 18
36								
37								
38			becomes dark gray					
39								
40				40.0 - 40.2	N/R			50/2"
41			End of Boring @ 40.2' due to drilling refusal No subsurface water encountered					
42								
43								
44								
45								
46								
47								
48								
49								
50								
51								
52								
53								

LEGEND: ■ Ring Sample ○ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 3
PAGE 1 OF 1

LOGGED BY: M. Navarro
DRILL RIG: Mobile B-53 with Automatic Hammer
AUGER TYPE: 6" Hollow Stem Auger

JOB NO.: 300909-002
DATE: 4/2/18

NIPOMO HIGH SCHOOL
STADIUM AND TRACK IMPROVEMENTS
525 N. Thompson Avenue
Nipomo, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA: INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0	SW		WELL GRADED SAND: yellow brown, loose, slightly moist (Fill)	0.0 - 5.0	○			
1	CH		FAT CLAY: dark gray brown, stiff, very moist (Older Alluvium)					4
2				2.0 - 3.5	■	86.5	27.5	8
3								11
4								
5				5.0 - 6.5	■			3
6								9
7			End of Boring @ 6.5'					13
8			No subsurface water encountered					
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								

LEGEND: ■ Ring Sample ○ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 4

LOGGED BY: M. Navarro
DRILL RIG: Mobile B-53 with Automatic Hammer
AUGER TYPE: 6" Hollow Stem Auger

PAGE 1 OF 1
JOB NO.: 300909-002
DATE: 4/2/18

NIPOMO HIGH SCHOOL
STADIUM AND TRACK IMPROVEMENTS
525 N. Thompson Avenue
Nipomo, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA: INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0	SW		WELL GRADED SAND: light brown, loose, slightly moist, trace gravel (Fill)	0.0 - 5.0	○			
1	CH		FAT CLAY: dark brown, medium stiff, very moist, trace sand and gravel (Older Alluvium)	2.0 - 3.5	■			4 5 8
2								
3	CH		FAT CLAY W/ GRAVEL: brown, medium stiff, moist					
4								
5			becomes stiff	5.0 - 6.5	■			4 9 13
6								
7			End of Boring @ 6.5' No subsurface water encountered					
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								

LEGEND: ■ Ring Sample ○ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 5
PAGE 1 OF 1

LOGGED BY: M. Navarro
DRILL RIG: Mobile B-53 with Automatic Hammer
AUGER TYPE: 6" Hollow Stem Auger

JOB NO.: 300909-002
DATE: 4/2/18

NIPOMO HIGH SCHOOL
STADIUM AND TRACK IMPROVEMENTS
525 N. Thompson Avenue
Nipomo, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA: INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0	SW		WELL GRADED SAND: yellow brown, loose, moist (Fill)	0.0 - 5.0	○			
1	CH		FAT CLAY: dark gray with green mottling, stiff, very moist, some gravel (Older Alluvium)					3
2				2.0 - 3.5	▬	89.4	26.5	6
3								8
4								
5				5.0 - 6.5	▬			3
6								6
7			End of Boring @ 6.5'					8
			No subsurface water encountered					

LEGEND: ▬ Ring Sample ○ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

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Boring No. 6

LOGGED BY: M. Navarro
DRILL RIG: Mobile B-53 with Automatic Hammer
AUGER TYPE: 6" Hollow Stem Auger

PAGE 1 OF 1
JOB NO.: 300909-002
DATE: 4/2/18

NIPOMO HIGH SCHOOL
STADIUM AND TRACK IMPROVEMENTS
525 N. Thompson Avenue
Nipomo, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA: INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0			grass and topsoil					
1	CH		FAT CLAY: dark brown, stiff, moist, trace organics (Older Alluvium)	2.0 - 3.5	Ring	97.0	22.2	3, 6, 10
5			becomes very stiff, some organics	5.0 - 6.5	Ring	109.4	14.4	6, 14, 21
10			becomes dark brown, stiff, some gravel, no organics	10.0 - 11.5	Ring	98.1	20.7	5, 8, 17
14	CH		SANDY FAT CLAY: yellow orange, stiff, moist	15.0 - 16.5	SPT			4, 5, 7
17	CH		FAT CLAY: dark brown, very stiff, moist	18.5 - 20.0	SPT			3, 8, 18
20			End of Boring @ 20.0' No subsurface water encountered					

LEGEND: ■ Ring Sample ○ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

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Boring No. 7

LOGGED BY: M. Navarro
DRILL RIG: Mobile B-53 with Automatic Hammer
AUGER TYPE: 6" Hollow Stem Auger

PAGE 1 OF 1
JOB NO.: 300909-002
DATE: 4/2/18

NIPOMO HIGH SCHOOL
STADIUM AND TRACK IMPROVEMENTS
525 N. Thompson Avenue
Nipomo, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA: INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0	SW		WELL GRADED SAND: light brown, loose, slightly moist (Fill)	0.0 - 5.0	○			
1	CH		FAT CLAY: dark brown, medium stiff, moist, trace gravel (Older Alluvium)	2.0 - 3.5	■			4, 6, 7
2			becomes dark gray, stiff					
3				5.0 - 6.5	■			2, 7, 8
4			End of Boring @ 6.5'					
5			No subsurface water encountered					
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								

LEGEND: ■ Ring Sample ○ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

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Boring No. 8
PAGE 1 OF 1

LOGGED BY: M. Navarro
DRILL RIG: Mobile B-53 with Automatic Hammer
AUGER TYPE: 6" Hollow Stem Auger

JOB NO.: 300909-002
DATE: 4/2/18

NIPOMO HIGH SCHOOL
STADIUM AND TRACK IMPROVEMENTS
525 N. Thompson Avenue
Nipomo, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA: INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0	CH		FAT CLAY: dark brown, medium stiff, very moist, some sand, trace gravel (Fill)	0.0 - 5.0	○			3
2				2.0 - 3.5	▬	87.5	25.8	4 4
5	CH		FAT CLAY: dark brown, medium stiff, very moist, some sand (Older Alluvium)	5.0 - 6.5	▬	87.3	33.2	2 4 5
10			becomes stiff	10.0 - 11.5	▬	87.8	32.2	4 7 14
13	CH		FAT CLAY W/ GRAVEL: dark gray brown, stiff, moist	15.0 - 16.5	●			4 6 8
18				18.5 - 20.0	●			3 6 10
20			End of Boring @ 20.0' No subsurface water encountered					

LEGEND: ▬ Ring Sample ○ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

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Boring No. 9
PAGE 1 OF 1
JOB NO.: 300909-002
DATE: 4/3/18

LOGGED BY: M. Navarro
DRILL RIG: Mobile B-53 with Automatic Hammer
AUGER TYPE: 6" Hollow Stem Auger

NIPOMO HIGH SCHOOL
STADIUM AND TRACK IMPROVEMENTS
525 N. Thompson Avenue
Nipomo, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA: INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0	SW		WELL GRADED SAND W/ GRAVEL: light brown,					
1	CH		loose, slightly moist (Fill)	0.0 - 5.0	○			3
2			FAT CLAY: dark brown with dark gray mottling, stiff, very moist (Fill)	2.0 - 3.5	▬	91.2	29.1	6 8
3								
4								
5	CH		FAT CLAY: dark brown with dark gray mottling medium stiff, very moist (Older Alluvium)	5.0 - 6.5	▬	84.1	32.5	2 4 5
6								
7								
8								
9			becomes dark gray with green mottling, stiff					
10				10.0 - 11.5	▬	91.9	28.4	6 11 11
11								
12								
13								
14			becomes medium stiff					
15				15.0 - 16.5	●			3 6 7
16								
17								
18			becomes stiff					
19				18.5 - 20.0	●			5 7 9
20								
21			End of Boring @ 20.0'					
22			No subsurface water encountered					
23								
24								
25								
26								

LEGEND: ▬ Ring Sample ○ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 10

LOGGED BY: M. Navarro
DRILL RIG: Mobile B-53 with Automatic Hammer
AUGER TYPE: 6" Hollow Stem Auger

PAGE 1 OF 1
JOB NO.: 300909-002
DATE: 4/2/18

NIPOMO HIGH SCHOOL
STADIUM AND TRACK IMPROVEMENTS
525 N. Thompson Avenue
Nipomo, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA: INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0	CH		FAT CLAY: dark brown with dark gray mottling, soft, very moist, some sand (Fill)	0.0 - 5.0	○			2
2				2.0 - 3.5	▬	77.0	28.8	2 3
5	CH		FAT CLAY: dark gray, soft, very moist, some sand (Older Alluvium)	5.0 - 6.5	▬	85.9	34.4	2 3 4
10	CH		FAT CLAY W/ GRAVEL: dark gray, stiff, very moist	10.0 - 11.5	▬	90.0	30.3	3 7 15
14			very stiff, decreasing gravel content	15.0 - 16.5	●			4 6 11
18				18.5 - 20.0	●	92.9	30.1	4 8 15
20			End of Boring @ 20.0' No subsurface water encountered					

LEGEND: ▬ Ring Sample ○ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

APPENDIX B

Geologic Hazards Report
Nipomo High School/Central Coast New Tech High School
(ESP 2015)

GEOLOGIC HAZARDS REPORT
NIPOMO HIGH SCHOOL/CENTRAL COAST NEW TECH HIGH SCHOOL
525 NORTH THOMPSON AVENUE
NIPOMO, SAN LUIS OBISPO COUNTY, CALIFORNIA

January 15, 2015

Prepared for

Mr. Tuan Nguyen
Lucia Mar Unified School District

Prepared by

Earth Systems Pacific
4378 Old Santa Fe Road
San Luis Obispo, CA 93401

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Earth Systems Pacific

4378 Old Santa Fe Road
San Luis Obispo, CA 93401-8166

(805) 544-3276 • FAX (805) 544-1786
E-mail: esp@earthsystems.com

January 15, 2015

FILE NO.: SL-17068-GA

Lucia Mar Unified School District
Attn.: Mr. Tuan Nguyen
222 Stanley Avenue
Arroyo Grande, CA 93420

PROJECT: NIPOMO HIGH SCHOOL/CENTRAL COAST NEW TECH HIGH SCHOOL
525 NORTH THOMPSON AVENUE
NIPOMO, SAN LUIS OBISPO COUNTY, CALIFORNIA

SUBJECT: Geologic Hazards Report

CONTRACT REF: Work Order to Provide a Geologic Hazards Report, Nipomo High School/Central Coast New Tech High School, 525 North Thompson Avenue, Nipomo, San Luis Obispo County, by Earth Systems Pacific, Doc. No. 1501-016.WO, dated January 6, 2015

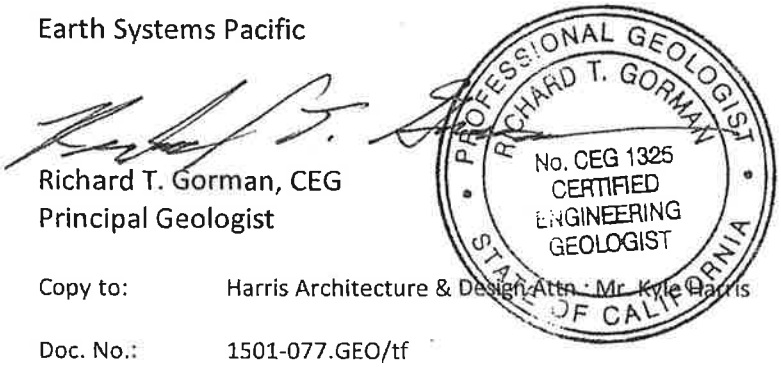
Dear Mr. Nguyen:

In accordance with your authorization of the above-referenced Work Order, this geologic hazards report has been prepared for future development within the Nipomo High School/Central Coast New Tech High School site areas in Nipomo, San Luis Obispo County, California. This report describes the general geologic characteristics, identifies existing and potential geologic hazards, and discusses the impacts that these conditions could have upon future development within the two school site areas. Two bound copies and an electronic copy of this report are being furnished for your use. As authorized, an electronic copy has been forwarded to Kyle Harris of Harris Architecture & Design.

We appreciate the opportunity to have provided services for this project and look forward to working with you again in the future. If there are any questions concerning this report, please do not hesitate to contact the undersigned.

Sincerely,

Earth Systems Pacific



Richard T. Gorman, CEG
Principal Geologist

Copy to: Harris Architecture & Design, Attn.: Mr. Kyle Harris

Doc. No.: 1501-077.GEO/tf

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APPENDIX D	M.J. Schiff & Associates Soil Corrosivity Study, June 24, 1999

1.0 INTRODUCTION

This geologic hazards report is intended for use in the preparation of plans and specifications for future development within the existing Nipomo High school/Central Coast New Tech High School site area, in Nipomo, San Luis Obispo County, California. A geologic hazards study and a separate soils engineering investigation (ESCNC, 1999a and 1999b) were prepared for the initial development of Nipomo High School at the site. At that time, the site only consisted of Nipomo High School; in recent years, an area in the northeastern corner of the site was been designated as the Central Coast New Tech High school, and various structures and improvements have been added to develop that facility. The original geologic hazards report (ESCNC 1999a) included general site geologic hazards information, subsurface field investigation and a fault investigation preformed by Holguin, Fahan & Associates, Inc. The original soils engineering investigation (ESCNC 1999b) included a subsurface field investigation, laboratory and geotechnical analysis. Since the publication of those two reports, the standards of the reviewing agencies (Division of the State Architect – DSA and California Geologic Survey – CGS) have changed, and there have been several changes in the California Building Code (CBC). Soils engineering issues for new structures added to the site have been addressed through various project-specific update reports conforming to the revised standards. However, the original geologic hazards report (ESCNC 1999a) has not been updated or amended since it was published. Our intent with this report is to address the geologic hazards according to the current standards on the entire Nipomo High School/Central Coast New Tech High School campus (hereinafter referred to as "the site"); this report is intended for use as considered acceptable by the governing jurisdiction for all new construction of school buildings and related improvements and support structures on the site.

2.0 SCOPE OF SERVICES

The scope of work for this report included a general site reconnaissance by a certified engineering geologist, review of the referenced Geologic Hazards and Soils Engineering Reports by Earth Systems Consultants Northern California (1999a and 1999b), geologic analyses of the data, and preparation of this report.

This report is intended to comply with the considerations of Sections 1803A.1 through 1803A.7 and of the 2013 California Building Code (CBSC 2013); California Geological Survey Note 48 (CGS 2013); DSA Interpretation of Regulations Document IR A-4 (DSA 2011); and common engineering geology practice in this area under similar conditions at this time.

This report does not address issues in the domain of contractors such as, but not limited to, site safety, loss of volume due to stripping of the site, shrinkage of soils during compaction, excavatability, dewatering, shoring, temporary slope angles, construction means and methods, etc. Analyses of soil engineering issues and of the soil for mold potential, man-made asbestos, lead, radioisotopes, hydrocarbons, or chemical properties are beyond the scope of this report.

3.0 SITE SETTING

The Nipomo High/Central Coast New Tech High School site is at 525 Thompson Avenue, Nipomo, San Luis Obispo County, California (see the Vicinity Map in Appendix A). The approximate coordinates and elevation at the approximate center of the site, as obtained from the Google Earth website (2014), are latitude 35.0484N and longitude 120.4865W, and 335 feet above mean sea level. The site lies southwest of Thompson Avenue and northeast of Nipomo Creek. Topographically, the site originally consisted of low, gently rolling terrain that sloped to the southwest toward Nipomo Creek. Nipomo Creek crosses the western corner of the site in a northwest-southeast direction. Initial development of the site with mass earthwork operations created an access road from Thompson Avenue and improved parking areas on the northwest side of the site, school building and exterior flatwork areas in the central and northeast portions of the site, and athletic fields and hardcourt play areas on the southwest, south and southeast sides. The overall site drainage pattern was maintained from northeast to southwest.

4.0 GENERAL SUBSURFACE AND GEOLOGIC PROFILE

The geologic hazard report for the original development of the site (ESCNC, 1999a) included a boring (designated Boring 1) drilled to characterize the upper 100 feet of geologic materials on the site. Boring 5, drilled as part of soil engineering investigation (ESCNC, 1999b), was extended to a depth of 36.5 feet. Although other borings were drilled for the soils engineering investigation (ESCNC, 1999b), these two borings were used as the basis for our evaluation of the general subsurface and geologic profile of the site. The approximate locations of Borings 1 and 5 are shown on the Boring Location Map in Appendix A. Soils encountered in the borings were categorized and logged in general accordance with the Unified Soil Classification System and ASTM D 2488-93. Copies of the logs for these two borings can also be found in Appendix A.

The borings encountered approximately 2 feet of sandy fat clay topsoil that was underlain by 22 to 28.5 feet of older alluvium. The older alluvium consisted of very stiff, moist, sandy lean clay and clayey sand with occasional gravel. At 24 in Boring 5 and 28.5 feet in Boring 1, a 2-foot

layer of medium dense, wet, well graded sand with fine gravel was encountered in the older alluvium. The older alluvium was underlain by marine terrace deposits which consisted of stiff to hard, moist, sandy lean clay to the maximum depths explored.

Based on the subsurface conditions encountered, the Site Class per 2013 CBC Table 1613A.5.2 was taken as "D", a "stiff soil profile".

Free subsurface groundwater was encountered in Boring 1 at 28.5 feet, and in Boring 5 at 24 feet. The groundwater appeared to be perched on the very stiff, sandy lean clay marine terrace deposits. The groundwater appeared to be limited to the 2-foot thick layer of medium dense, well graded sand with fine gravel.

5.0 GEOLOGY

Regional Geologic Setting

The site is situated in the Coast Range Geomorphic Province of California. This province is characterized by a system of longitudinal mountain ranges separated by valleys. The mountains generally range in elevation from 2,000 to 4,000 feet, and occasionally to 6,000 feet, above sea level. One of the mountain ranges that lies within this province is the northwest-trending San Luis Range, located approximately 2 miles northeast of the site. In the general region of the site, the San Luis Range is bounded to the southwest by the Nipomo Valley and to the northeast by the San Rafael Range. Structurally, the range is bordered on the east by the West Huasna fault, on the northeast by the Los Osos fault and on the southwest by the San Luis Range fault (Lettis and others, 1994). Tectonically, the region is dominated by northwest-trending, northeast-dipping reverse faults, which include the West Huasna, Oceano, and the San Luis Range faults.

Local Geologic Setting

Locally, the site lies within the Nipomo Valley, which consists of middle to upper Pleistocene age (1 million to 11,000 years before present) marine terrace deposits, older alluvium, and Holocene age (11,000 years before present or less) fluvial deposits. The Quaternary geologic map prepared by PG&E (1988), indicates that the study area is underlain by dune deposits, older alluvium and possibly marine terrace deposits, with dune sands present over half of the site (see the Quaternary Geologic Map in Appendix B). A Geologic Map of the Nipomo quadrangle prepared by Dibblee, Jr. (2006), however, shows the site as underlain entirely by older alluvium, i.e. no dune deposits are indicated (see the Geologic Map of Nipomo Quadrangle in Appendix B).

The original geologic hazard report (ESCNC, 1999a) indicated that no evidence of dune sand was observed during a geologic reconnaissance of the site, and no dune deposits were encountered in the borings. Based on this information, we concur with the Dibblee's Geologic Map of the Nipomo Quadrangle (2006) and interpretation of the geology units, rather than the interpretation indicated on the Quaternary Geologic Map by PG&E (1988).

We also concur with Dibblee's Geologic Map of Nipomo Quadrangle (2006) indicating that Nipomo Creek is the boundary between the older dune sands of the Nipomo Mesa to the southwest and the older alluvium of the Nipomo Valley to the northeast.

Faulting

Significant Faults

The San Andreas, Hosgri-San Simeon, and Los Osos Faults are the most significant regional *active* faults within a 65-mile radius of the site, which could affect future construction at the site. The late Pleistocene-age San Luis Range Fault (Wilmar Avenue fault segment) is apparently the closest mapped fault (regardless of activity) to the school site. Regional faults and locations of historic earthquake events are depicted on the Historical Earthquake/Fault Map in Appendix B.

San Andreas Fault

The San Andreas Fault, considered to be the most active fault in the general region, lies approximately 40 miles to the east of the site. The San Andreas Fault undergoes a major change in character between Parkfield and Cholame. North of Cholame, the fault moves more or less constantly in a process called creep, whereas the south end of the fault is locked, moving only in very large earthquakes. The last major quake on this part of the fault was the 1857 event (magnitude 7.9). In the immediate vicinity of Parkfield, there is a 20-mile segment that is locked, generating an earthquake every 20 years or so on average. Dated quakes on this segment are 1881, 1901, 1922, 1934, and 1966, and are usually in the magnitude 5.5 to 6.0 range (Bakun, 1988). A 6.0 magnitude earthquake occurred on this fault segment on September 28, 2004.

Hosgri-San Simeon Fault

The Hosgri-San Simeon Fault system lies approximately 16 miles to the west of the site. A northwest-trending strike-slip fault, the San Simeon Fault extends from offshore of Ragged Point to just offshore of San Simeon Point, where it joins the northern end of the Hosgri Fault.

From this point, the Hosgri Fault extends to an ocean shelf 2 miles west of Point Buchon, and then trends toward the Point Sal area. The fault system is considered active by the United States Geologic Survey (Jennings & Bryant, 2010), based on Hall's claims of recent offset terrace deposits along San Simeon Cove, and also by a relocation of the 1927 "Lompoc Earthquake" onto the southern end of the Hosgri Fault (Hall, 1975, 1976, 1977).

On December 22, 2003, a 6.5 magnitude earthquake occurred approximately 6 miles northeast of San Simeon, California and approximately 28 miles north of the subject site. Analysis by the USGS and the University of California at Berkeley indicated that the event had a thrust (reverse-faulting) mechanism (Goel, 2004). The earthquake occurred in the vicinity of the northern end of the Hosgri-San Simeon Fault.

Los Osos Fault

The Los Osos Fault, at its closest point to the site, is approximately 5 miles to the northeast. It consists of four distinct segments. From northwest to southeast, these are the Estero Bay, the Irish Hills, the Lopez Reservoir, and the Newsome Ridge segments. PG&E (1988) suggests that the Irish Hills segment displays the best expressed geomorphic features, displacing late Pleistocene and Holocene deposits. The Irish Hills segment starts in the vicinity of Los Osos and extends to just past San Luis Obispo Creek. A two-mile long segment west of Laguna Lake is considered to be active (Treiman, 1989) and is zoned as a State Earthquake Fault Zone under the Alquist-Priolo Act (Hart, 1997). This active segment lies about 20 miles to the northwest of the site. The Los Osos Fault comprises a northwest-trending series of high- and low-angle faults that exhibit a complex history of both strike-slip and reverse displacement. However, during late Quaternary, movement appears to have been primarily reverse displacement (PG&E, 1988).

San Luis Range Fault (Wilmar Avenue segment)

The San Luis Range fault is a northwest trending fault with an approximate length of 40 miles (Peterson and others, 1996). The fault system includes the San Luis Bay fault, the Wilmar Avenue fault, the Olsen Fault and the Santa Maria River fault.

The Wilmar Avenue fault is a northwest-trending, northeast-dipping reverse fault that separates the uplifting San Luis/Pismo structural block from the subsiding Santa Maria Valley block. Cumulative displacement of the 120,000 year old marine terrace suggests multiple faulting events during the late Pleistocene, but the recurrence interval and timing of the most recent event is uncertain. The fault has poor geomorphic expression suggesting a low rate of

activity with little or no Holocene activity. The fault may extend a total of 18 miles from approximately 3 miles offshore to the northern part of the Santa Maria Valley. Based on changes in the structural style of faulting along the strike of the Wilmar Avenue fault, Nitchman and Slemons (1994) have divided the fault into two sections: western and eastern. The western section extends from Wilmar Avenue in Pismo Beach to Price Canyon, a distance of approximately 1 mile. This section offsets 120,000-year old late Pleistocene marine terrace deposits on a sea cliff at Wilmar Avenue in Pismo Beach. Due to poor exposures and extensive urban development along the remaining projected trace of this segment of the fault, Nitchman and Slemons (1994) could not find any evidence of Holocene activity. The eastern section of the fault extends approximately 3.5 miles between Price Canyon and Arroyo Grande Creek. The fault is not exposed anywhere along this section, and is interpreted as a blind reverse fault. In this fault section Nitchman and Slemons (1994) found a 120,000-year old marine terrace that was uplifted almost 23 feet and was tilted to the southwest indicating late Pleistocene slip along the fault. Lettis and others (1994) indicated that south of Arroyo Grande Creek the trend of the fault is difficult to discern due to extensive late Pleistocene-Holocene age aeolian deposits, fluvial erosion, parallelism of the fault trend with marine strandlines, and limited land access. In the vicinity of the town of Nipomo, Lettis and others (1994) inferred the alignment of the fault based on several subtle geomorphic and geologic features, including a straight segment of Nipomo Creek (Nipomo lineament) and a probable step in the top of basement bedrock. According to the Diablo Canyon Power Plant Long Term Seismic Program (PG&E, 1988), the Wilmar Avenue fault has a late Quaternary net slip rate of 0.04 to 0.07 millimeters per year.

The Quaternary Geologic Map in Appendix B shows the Wilmar Avenue Fault segment immediately west of the southwestern property boundary. However, the Geologic Map of the Nipomo Quadrangle (Dibblee, Jr., 2006) does not show the Wilmar Avenue Fault in this location. The original geologic hazard report (ESCNC, 1999a) included a fault investigation using cone penetration soundings that was performed by Holguin, Fahan & Associates, Inc. (HFA, 1999) to determine if Wilmar Avenue Fault segment crossed the site. A copy of the results of their study, which did not find evidence of faulting on the site, is presented in Appendix C.

6.0 SEISMICITY

Earthquake History

The historic seismicity in the site's region was researched using EQSEARCH (Blake, updated December 2012) and the Boore and others (1997) method of analysis for Site Class "D", stiff soil sites (ASCE 2010) that is incorporated within that program. EQSEARCH is a computer program

that performs automated searches of a custom catalog of historical Central California earthquakes. As the program searches the catalog, it computes the epicentral distance from the selected site to each of the earthquakes within the specified search area. The epicentral distances should be considered estimates, particularly for earthquake data prior to 1932, when modern instruments were first used to record earthquake data. The parameters used for the search consisted of earthquake Richter magnitudes ranging from 5.0 to 9.0 that occurred within a 65-mile radius from the site from 1800 to December 2012. The Historical Earthquake/Fault Map presented in Appendix B graphically depicts the results of the search, including historical earthquake epicenters, their corresponding magnitudes, and faults within the general region of the project.

Results of the search indicated that within the search parameters, 42 earthquakes have occurred. The highest peak horizontal ground acceleration estimated to have occurred at the site from those historical earthquakes is 0.29g. This earthquake had a 7.5 magnitude, occurred in 1927, and was located approximately 16 miles southwest of the site. This earthquake probably occurred on the southern end of the Hosgri Fault Zone, and is known as the Lompoc earthquake. The largest magnitude earthquake that the search revealed was a 7.9 magnitude earthquake. This earthquake was located approximately 43 miles east and is known as the 1857 earthquake on the San Andreas Fault. It produced an estimated peak horizontal ground acceleration of 0.17g at the site.

Design Acceleration Parameters

In accordance with CGS Note 48 (2013), Item 16, an assessment was made to determine the need for employing "Site Specific Ground Procedures" for the Nipomo High School/Central Coast New Tech High School site area. Based on a review of the San Luis Obispo County Planning Department Permit View web site (2014), the site is not located in a Geologic Study Area, Alquist-Priolo Earthquake Fault Zone, or in a high liquefaction Hazard Zone. In addition, the S_1 ground motion value of 0.443g obtained from the United States Geological Survey Earthquake Hazards Program website (USGS 2014) using the 2010 ASCE 7 Standard Analysis Method for Site Class "D" (stiff soil), was below 0.75 (see the table below). Therefore, the project does not require a site-specific ground motion analysis.

The site is in a region of generally high seismicity and has the potential to experience strong ground shaking from earthquakes on regional or local causative faults. To characterize the seismicity at the site and to provide seismic design parameters, a General Procedure Ground Motion Analysis was performed. The deterministic ground motions are based on the 2013

California Building Code General Procedure that were obtained from the United States Geological Survey Earthquake Hazards Program website (USGS 2013) using the 2010 ASCE 7 Standard Analysis Method for Site Class "D" (stiff soil). The results of this analysis are presented in the following table.

SUMMARY OF DESIGN RESPONSE ACCELERATION PARAMETERS

Mapped Acceleration Values for Site Class "B"		2013 CBC Site Coefficients and General Procedure Adjusted MCE Spectral Response Acceleration Parameters For Site Class "D"					
Seismic Parameters	Values (g)	Site Coefficients	Values	Seismic Parameters	Values (g)	Seismic Parameters	Values (g)
S_S	1.174	F_a	1.030	S_{MS}	1.210	S_{DS}	0.807
S_1	0.443	F_v	1.557	S_{M1}	0.690	S_{D1}	0.460

Seismic Design Category

Section 1613A.5.6 of the 2013 CBC indicates that sites will be assigned to Category D unless $S_1 \geq 0.75$. The S_1 calculated for the site is 0.443g; therefore, the site would be Category D.

7.0 GEOLOGIC HAZARDS

Surface Ground Rupture

The site is not located in a State Earthquake Fault Zone and there are no mapped faults crossing the site. While the late Pleistocene-age Wilmar Avenue Fault segment of the San Luis Range fault was mapped by PG&E (1988) near the southwestern property boundary, this segment is of sufficient distance from the existing school buildings, and the anticipated locations of any new buildings, that no significant impacts to these areas are anticipated. The fault investigation performed by HFA revealed no evidence of a trace of this fault crossing, or within a 50-foot distance of, any of the school building areas, including the football field and bleacher sites, which lie along the western end of the school site. Therefore, the potential for surface ground rupture to occur within the proposed building areas (including the football field and bleacher sites) is considered to be very low.

Liquefaction

The term liquefaction refers to the liquefied condition and subsequent softening that can occur in saturated soils when they are subjected to cyclic strains, such as those generated during a seismic event. Previous studies have concluded that liquefaction within the upper 50 feet of

soil can potentially affect improvements at the ground surface. Due to the predominantly fine-grained, very stiff to hard nature of the soils encountered above and below the perched groundwater, and the medium dense, well graded nature of the sand and gravel found within the perched groundwater table, the potential for liquefaction to occur at the site is considered to be very low.

Seismically Induced Settlement

Seismically-induced settlement of sufficient magnitude to cause structural damage is normally associated with poorly consolidated, predominantly sandy soils, or variable consolidation characteristics within the building areas. Due to the predominantly fine-grained nature of the soils, the potential for seismically-induced settlement is considered to be very low.

Slope Stability

The site consists of relatively flat terrain with no significant natural or man-made slopes on or immediately adjacent to it; therefore, instability of natural slopes is not of concern.

Flooding

According to the Flood Insurance Rate Map Number 06079C1636G (November 16, 2012), published by the Federal Emergency Management Agency (FEMA), the majority of the school site is located within Flood Zone X (See the FEMA Flood Zone Map in Appendix B). These are areas that have been determined to have a 0.20 percent chance of being flooded in any given year. The southwestern school property boundary is located within a Zone A 100-year flood zone.

Naturally Occurring Asbestos

There are no naturally occurring asbestos-bearing rock formations (serpentinite or ultramafic rock) on the site. The site is underlain predominantly by older alluvium, which is not an asbestos-bearing geologic unit. Therefore, the potential for naturally occurring asbestos to occur on the site is nil.

Radon

Radon is a colorless, odorless gas present in soil and rock, which is derived from the decay of uranium. The occurrence of radon correlates with the presence of specific minerals, and its concentrations in soil or rock will vary depending on the mineralogy of the surrounding bedrock, temperature, barometric pressure, moisture and other factors.

Prolonged exposure to elevated levels of radon is associated with an increased risk of lung cancer. The United States Environmental Protection Agency (USEPA) has established a "safe" level of radon in indoor air at 4 picocuries per liter (pC/L). If radon is found above 4 pC/L, it is recommended that engineering controls be implemented to reduce radon concentrations to safe levels.

According to Special Report 208, by the California Geological Survey (Churchill 2008) radon is most commonly found in areas of San Luis Obispo County that are underlain by bedrock of the Monterey and Santa Margarita Formations. This report shows that the school site is in an area of low radon potential for San Luis Obispo County, as it is underlain by older alluvial deposits, which are typically not associated with significant radon potential.

Expansive Soils

The original soils engineering report (ESCNC 1999b) provided test results indicating that the site soils have medium to very high expansion potential. Recommendations for mitigation of the expansive soils were provided in that report, and in subsequent project-specific soils engineering update reports that have been provided for various site improvements.

Corrosive Soils

The original soils engineering report (ESCNC 1999b) provided test results and a soil corrosivity study by MJSA (1999). The study indicated that the site soils were considered moderately corrosive to corrosive with as-received moisture, and became severely corrosive when saturated. Soil pH values were slightly acidic to neutral, and the soils were classified as severely corrosive to ferrous metals and aggressive to copper. A copy of the MJSA report is included in Appendix D.

8.0 CONCLUSIONS

It is our opinion that there are no significant local or regional geologic conditions that would preclude future construction of school buildings and associated improvements at the site.

Site Geology

The site is relative flat and underlain by older alluvium.

Groundwater

Groundwater appears to be perched on the marine terrace deposits at depths of approximately 24 to 28 feet.

Slope Stability

The site is relatively flat with a gentle slope to the southwest. No significant natural or man-made slopes on or adjacent to the planned improvement areas are present; therefore, there is no potential for landsliding or slope instability to impact the site.

Seismicity

The site is located within the seismically active southern California area, and moderate to severe ground shaking can be expected during the life of the proposed structures. The largest historical mean peak horizontal acceleration estimated to have occurred at the site was 0.29g.

Surface Ground Rupture

The site is not located in any State Earthquake Fault Zones and there are no mapped faults crossing the site. The closest mapped *active* fault to the site is Hosgri Fault, approximately 16 west. The fault investigation performed by HFA (1999) revealed no evidence of the Wilmar Avenue Fault crossing, or within a 50-foot distance of, any of the school building areas, including the football field and bleacher sites, which lie along the western end of the school site. Therefore, the potential for surface fault rupture to occur at the site is considered to be very low.

Liquefaction, Seismically Induced Settlement, and Naturally Occurring Asbestos

The site is underlain predominantly fine-grained, very stiff to hard sandy lean clay older alluvium and marine terrace deposits, with a layer of groundwater perched on the terrace deposits, therefore the potentials for liquefaction, seismically induced settlement or naturally occurring asbestos at the site are very low to nil.

Flooding

The majority of the school site is located inside of Flood Zone X and the southwestern school property boundary is located within a Flood Zone A.

Radon

As the school site is underlain by older alluvium, the potential for radon gas to affect it is considered to be low.

Expansive Soils

The site soils are considered to be in the medium to very high expansion category, therefore special considerations to mitigate these effects will be need to be provided in site-specific soils engineering report updates for future construction.

Corrosive Soils

The soil corrosivity study by MJSA (1999) indicated that the site soils were considered moderately corrosive to corrosive with as-received moisture, and became severely corrosive when saturated. Soil pH values were slightly acidic to neutral, and the soils were classified as severely corrosive to ferrous metals and aggressive to copper. Mitigation recommendations are included in the study.

9.0 CLOSURE

No representation, warranty, or guarantee is either expressed or implied. This report is intended for the exclusive use by the client as discussed in the "Scope of Services" section. Application beyond the stated intent is strictly at the user's risk.

If any changes are made to increase the size of the site, or if any of the assumptions used in the preparation of this report are not correct, this firm shall be notified for modifications to this report. This firm should be retained early in the design process for future development to provide engineering geology guidance. Any items not specifically addressed in this report shall comply with the CBC and the requirements of the governing jurisdiction.

This document, the data and conclusions contained herein are the property of Earth Systems Pacific. This report shall be used in its entirety, with no individual sections reproduced or used out of context. Copies may be made only by Earth Systems Pacific, the client, and the client's authorized agents for use exclusively on the subject project. Any other use is subject to federal copyright laws and the written approval of Earth Systems Pacific.

Thank you for this opportunity to have been of service. If you have any questions, please feel free to contact this office at your convenience.

End of Text.

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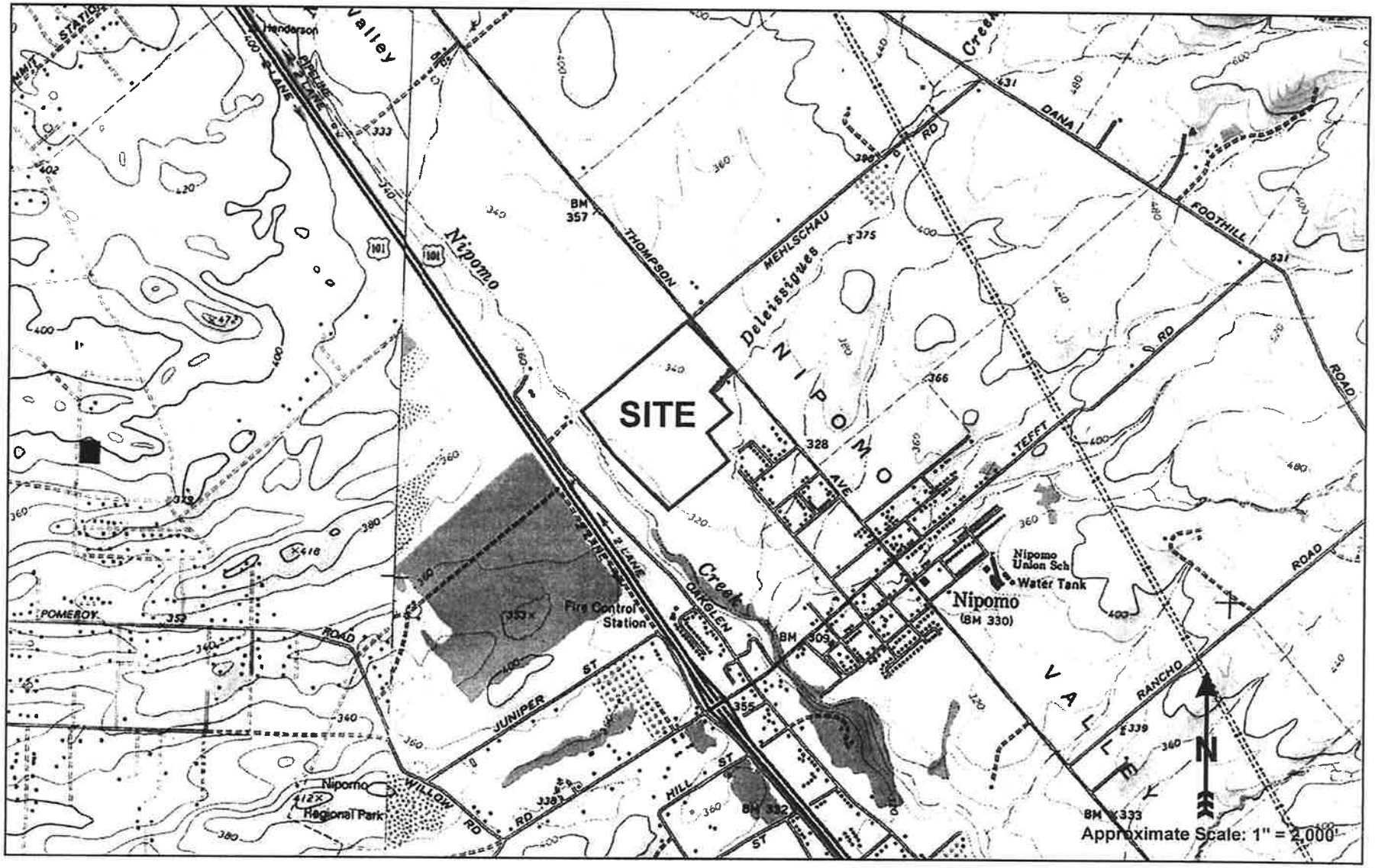
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APPENDIX A

Vicinity Map
Boring Location Map
Boring Logs



Reference: Extracted from USGS Topo Maps, Nipomo Quadrangle, 1965

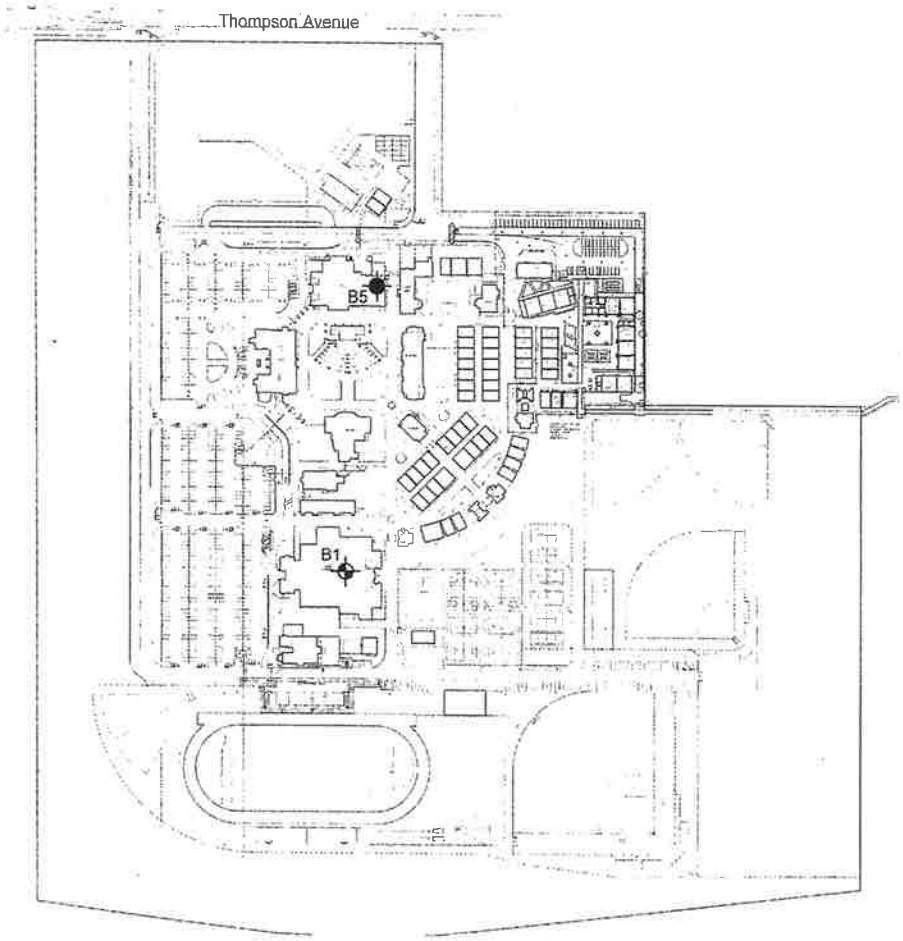
EARTH SYSTEMS PACIFIC
4378 Old Santa Fe Road, San Luis Obispo, CA 93401
www.earthsystems.com - email: esp@earthsystems.com
(805) 544-3276

VICINITY MAP

NIPOMO HIGH SCHOOL/CENTRAL COAST
NEW TECH HIGH SCHOOL
525 North Thompson Avenue
Nipomo, San Luis Obispo County, California

Date
January 2015

Project No.
SL-17068-GA



LEGEND

B1 Boring Location, Geologic Hazards Report, ESCNC, 1999 (Approx.)

B5 Boring Location, Soils Engineering Investigation, ESCNC, 1999 (Approx.)

Ref.: Site plan prepared by Harris Architecture, January 2015

NOT TO SCALE

BORING LOCATION MAP

NIPOMO HIGH SCHOOL/CENTRAL COAST NEW TECH HIGH SCHOOL

525 North Thompson Avenue
Nipomo, San Luis Obispo County, California

Earth Systems Pacific
4378 Old Santa Fe Road
San Luis Obispo, CA 93401-8116
(805) 544-3276 • FAX (805) 544-1786
E-mail: esp@earthsystems.com

January 13, 2015 RW SL-17068-GA

NIPOMO HIGH SCHOOL NEW TECH HIGH SCHOOL--011315borings.dwg

Earth Systems Consultants

Northern California

LOGGED BY: R. Gorman
DRILL RIG: C.M.E.
AUGER TYPE: 8" Hollow Stem

Boring No. 1
PAGE 1 OF 4
JOB NO.: NGG11319-01
DATE: 05/20/99

LUCIA MAR UNIFIED SCHOOL DISTRICT
HIGH SCHOOL SITE 2
Nipomo, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA: INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0	CH		SANDY FAT CLAY: soft, dark brown to black, moist, (Topsoil)					
2	CL		SANDY LEAN CLAY: very stiff, brown, very moist, occasional gravel to 1.0" diameter, (older alluvium)					
10			dark brown, 5% gravel	10.0–11.5	●			5 9 10
20			dark brown/black mottled, gravel ends	20.0–21.5	●			4 9 16

LEGEND: ■ Ring Sample ○ Grab Sample □ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

LUCIA MAR UNIFIED SCHOOL DISTRICT
HIGH SCHOOL SITE 2
Nipomo, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA: INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
25	CL		SANDY LEAN CLAY: as above					
26								
27								
28								
29	SW		WELL GRADED SAND WITH GRAVEL: medium dense, light brown, wet					
30				30.0–31.5	●			5 9 14
31	CL		SANDY LEAN CLAY: very stiff, orange/gray mottled, moist, caliche veins, (marine terrace deposits)					
32								
33								
34								
35								
36								
37								
38								
39								
40			orange brown	40.0–41.5	●			4 10 13
41								
42								
43								
44								
45								
46								
47								
48								
49								
50								

LEGEND: ■ Ring Sample ○ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling.

LOGGED BY: R. Gorman
DRILL RIG: C.M.E.
AUGER TYPE: 8" Hollow Stem

JOB NO.: NGG11319-01
DATE: 05/20/99

LUCIA MAR UNIFIED HIGH SCHOOL DISTRICT
HIGH SCHOOL SITE 2
Nipomo, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA: INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
50	CL		SANDY LEAN CLAY: hard, orange brown/dark gray mottled, moist, some cobbles	50.0–51.5	●			8 11 17
60				60.0–61.5	●			8 15 21
70				70.0–71.5	●			8 13 17

LEGEND: ▬ Ring Sample ○ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling.

Earth Systems Consultants

Northern California

LOGGED BY: R. Gorman
DRILL RIG: C.M.E.
AUGER TYPE: 8" Hollow Stem

Boring No. 1
PAGE 4 of 4
JOB NO.: NGG11319-01
DATE: 05/20/99

LUCIA MAR UNIFIED SCHOOL DISTRICT
HIGH SCHOOL SITE 2
Nipomo, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA: INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
75	CL		SANDY LEAN CLAY: as above					
80				80.0–81.5	●			8 20 39
88			dark brown to black, blocky structures					
90				90–91.5	●			24 43 50/4.0"
100			END OF BORING @ 100.5'. Subsurface water encountered between 28.5' and 30.5'.	100–101	●			27 57/3.0"

LEGEND: ▬ Ring Sample ○ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling.

Earth Systems Consultants

Northern California

LOGGED BY: D. Burns
DRILL RIG: Mobile B-53
AUGER TYPE: 8" Hollow Stem

Boring No. 5
PAGE 1 OF 2
JOB NO.: NGS11319-02
DATE: 06/03/99

LUCIA MAR UNIFIED SCHOOL DISTRICT
HIGH SCHOOL SITE 2
Thompson Avenue
Nipomo, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA: INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0	CH		SANDY FAT CLAY: stiff, black to dark brown, moist					
1			very moist, (topsoil)					
2	CL		SANDY LEAN CLAY: very stiff, brown, very moist, occasional gravel to 1.0" diameter (older alluvium)	2.0–5.0	○			10 30 20
5	SC		CLAYEY SAND WITH GRAVEL: dense, light brown, moist, gravel to 1.0" diameter	5.0–6.5	▬			
7	CL		SANDY LEAN CLAY: very stiff, light brown, very moist, occasional gravel to 0.5" diameter					21 50
10	SC		CLAYEY SAND WITH GRAVEL: dense, light brown, moist, gravel to 1.0" diameter	10.0–11.0	▬			
12	CL		SANDY LEAN CLAY: very stiff, brown, very moist, occasional gravel to 1.0" diameter					
20				20.0–21.5	●			7 11 21
24	SW		WELL GRADED SAND WITH GRAVEL: medium dense, brown, wet	25.0–26.5	●			12 9 9

LEGEND: ▬ Ring Sample ○ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling.

Earth Systems Consultants

Northern California

LOGGED BY: D. Burns
DRILL RIG: Mobile B-53
AUGER TYPE: 8" Hollow Stem

Boring No. 5
PAGE 2 OF 2
JOB NO.: NGS11319-02
DATE: 06/03/99

LUCIA MAR UNIFIED SCHOOL DISTRICT
HIGH SCHOOL SITE 2
Thompson Avenue
Nipomo, California

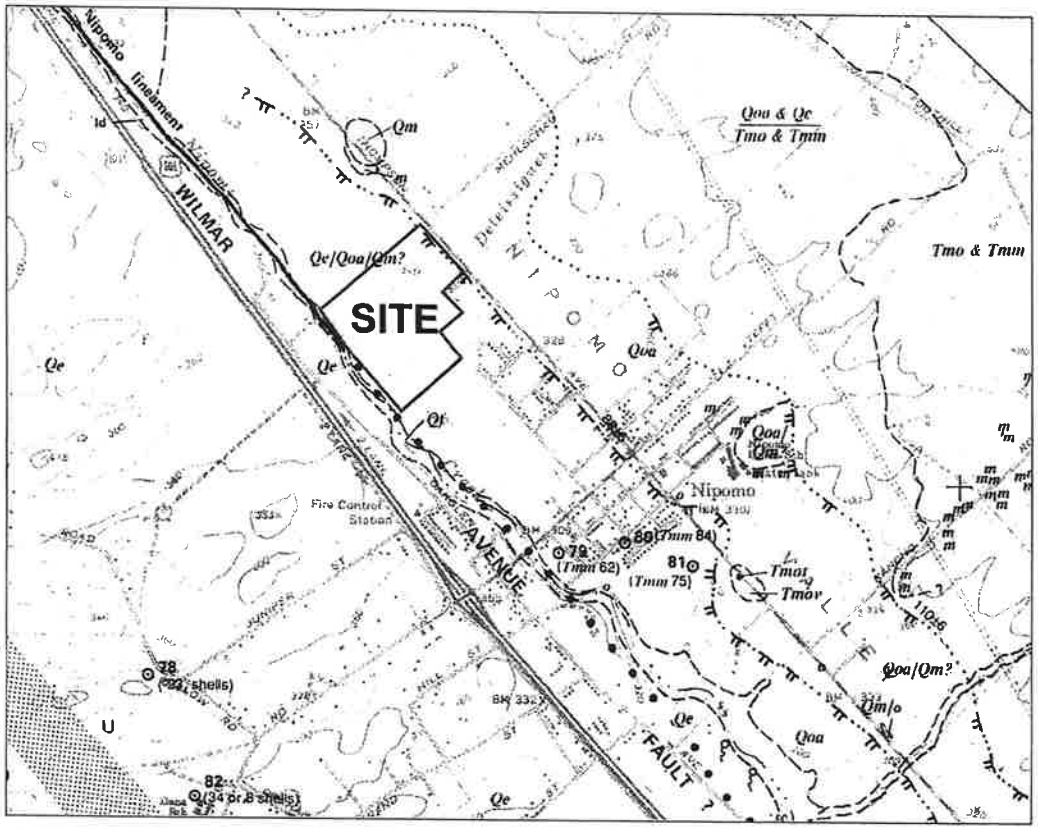
DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA: INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
25	SW		WELL GRADED SAND WITH GRAVEL: as above					
26	CL		SANDY LEAN CLAY: very stiff, light yellow brown, very moist, (terrace deposits)					
27								
28								
29								
30				30.0–31.5	●			11, 16, 15
31								
32								
33								
34								
35				35.0–36.5	●			11, 13, 18
36								
37			END OF BORING @ 36.5'. Subsurface water encountered between 24.0' and 26.0'.					
38								
39								
40								
41								
42								
43								
44								
45								
46								
47								
48								
49								
50								

LEGEND: ▬ Ring Sample ○ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

APPENDIX B

Quaternary Geologic Map
Geologic Map of Nipomo Quadrangle
Historical Earthquake/Fault Map
FEMA Flood Zone Map



Extracted from: Quaternary Geologic Map of the Southern Margin of the San Luis/Pismo Structural Block from Shell Beach to the Santa Maria Valley, South Central California, By PG&E, 1988

N

Approx. Scale: 1" = 2000'

EXPLANATION

MAP SYMBOLS

- Fault — Long dash where approximately located; short dash where location is concealed but well- constrained; dotted where concealed and inferred; queried where uncertain; U = up/D = down indicate relative sense of displacement; sawteeth on upper plate of thrust fault
- Buried monocline — Arrow showing direction and width of downwarp
- Vertical stratigraphic separation of top of bedrock unit across a fault or monocline (meters)
- Postulated subsurface step or warp in the top of bedrock identified from oil and water well data is constrained within this zone; U = up/D = down; queried where uncertain
- Buried bedrock step of uncertain origin; ball on lower side
- Aerial photograph lineament — Dashed where less distinct; possible fault, but origin is not known; ld = linear drainage, lc = tonal contrast, vl = vegetation lineament, sd = saddle, bls = break in slope
- Marine terrace strandline — Solid where well constrained; double dot-dash where buried or less well constrained; dotted where eroded; bar with single tick where uncertain or inferred; double bar indicates associated wave-cut platform stripped of marine deposits; number refers to altitude of shoreline angle in meters
- Contact — Dashed where approximately located, dotted where concealed and inferred

DESCRIPTION OF MAP UNITS

- Qb — Beach deposit — Modern beach sands, unconsolidated
- Qe — Estuarine deposit (Holocene and late Pleistocene) — Silty clay interbedded with thin layers of fine- to coarse-grained sand; locally contains peat and wood
- Qc — Colluvial deposit (Holocene and Pleistocene) — Unconsolidated, poorly sorted cobbles, pebbles, sand, silt, and clay
- Qe — Eolian deposit (Holocene and late Pleistocene) — Unconsolidated active dune sand and slightly to weakly cemented older stabilized dune sand
- Qeo — Older eolian deposit (Pleistocene) — Weakly cemented dune sand; generally buried
- Qf — Fluvial and alluvial deposits (Holocene late Pleistocene) — Undifferentiated cobbles, pebbles, sand, silt, and clay in active stream channels and floodplains and in fluvial terraces inset within the margins of the stream valleys
- Qoa — Older alluvium (middle to late Pleistocene) — Unconsolidated cobbles, pebbles, sand, silt, and clay deposited in fluvial channels and alluvial fans; poorly to moderately sorted; some discontinuous, horizontal bedding; moderately to well sorted with local cross-bedding in the vicinity of Arroyo Grande and Los Berros Creeks; weakly to strongly cemented horizons (duripans) present locally; includes colluvium on hillslopes and younger alluvium within small drainages and gullies
- Qm — Marine deposit (middle to late Pleistocene) — Unconsolidated, well- to moderately sorted, boulders, cobbles and sand; clasts are typically subrounded to rounded and consist of Franciscan Complex, Obispo, Monterey and Pismo Formation lithologies

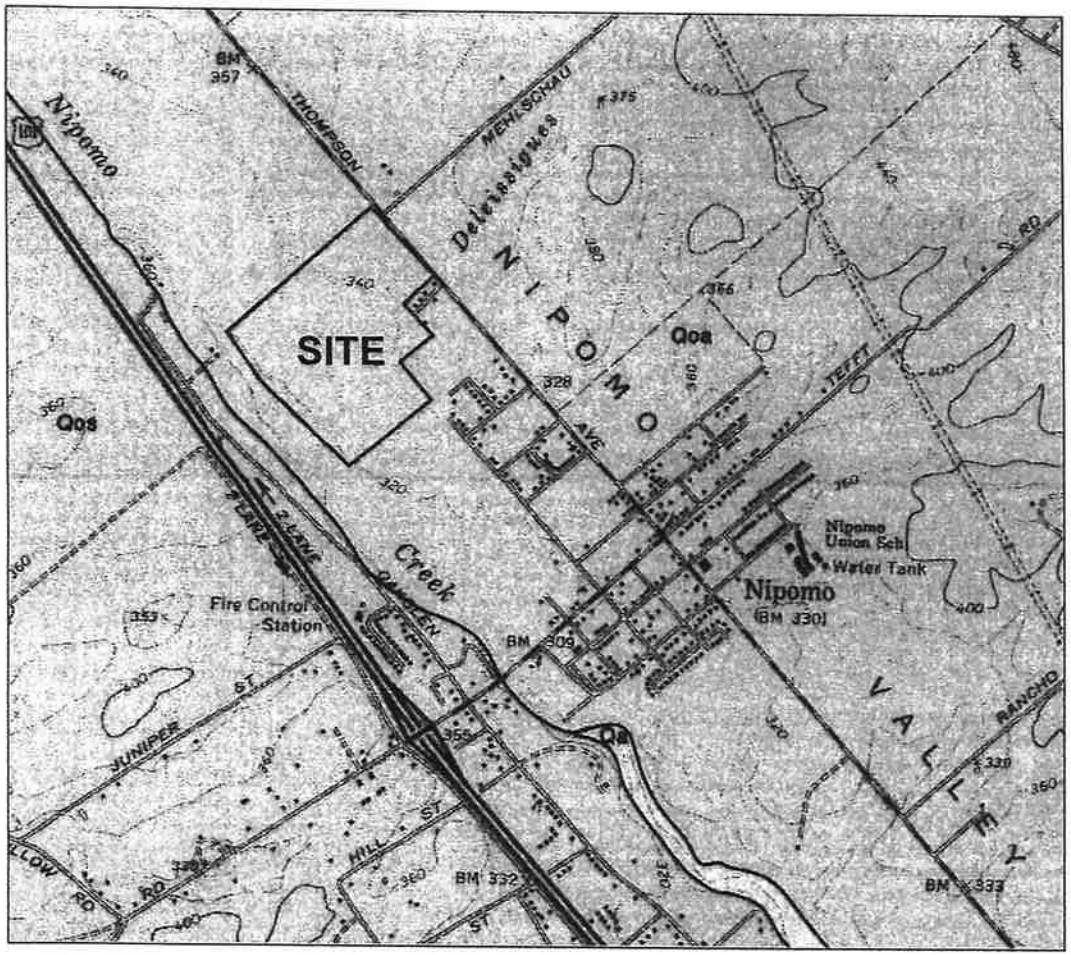
Bedrock outcrops (Note: Bedrock geology is not mapped in detail. Geologic symbols in parentheses are used in cross section, oil well descriptions, and on the map to indicate the general distribution of bedrock based on Hall and Corbato, 1967 and Hall, 1973.)

- c (Tmc) — Careaga Sandstone (late Pliocene) — Coarse-grained white arkosic to lithic arenite, and limestone (modified from Hall and Corbato, 1967)
- q (Tpq) — Squire Member of the Pismo Formation (late Pliocene) — Massive, white to green, medium- to coarse-grained sandstone; locally bituminous (modified from Hall, 1973)
- m — Foxen Mudstone (late Pliocene) — Mudstone, siltstone, and fine-grained silty sandstone (from Woolf, 1951; Woodring and Bramlette, 1950)
- pm (Tpm) — Pismo Formation (Pliocene) undifferentiated — Includes brown clay and silt, diatomaceous siltstone and sandy siltstone of the Miguelito Member and nonbituminous and bituminous arkosic or quartz sandstone of the Edna Member (modified from Hall, 1973)
- m (Tmm) — Monterey Formation (Miocene) — Siltstone, chert, dolomitic claystone or siltstone, diatomite, some tuff, and opaline or cherty shale and sandstone (modified from Hall, 1973)
- o (Tmo) — Obispo Formation (early Miocene) — Includes fine- to coarse-grained white tuff or crystalline tuff and resistant, silicified, or zeolitized tuff (modified from Hall and Corbato, 1967)
- r (Tmr) — Rincon Formation (late Oligocene) — Brown siltstone, medium-grained sandstone and claystone (modified from Hall and Corbato, 1967)
- l (Tl) — Lospe Formation (early Oligocene) — Includes conglomerate, sandstone, and tuff (from Hall, 1973)
- s (Js) — Serpentinite (Jurassic?)
- f (Kf) — Franciscan Complex (Cretaceous and Jurassic) — Includes graywacke, schist, conglomerate, metavolcanic rock, and green, white, and red chert (modified from Hall and Corbato, 1967)

EARTH SYSTEMS PACIFIC
4378 Old Santa Fe Road, San Luis Obispo, CA 93401
www.earthsystems.com - email: esp@earthsystems.com
(805) 544-3276

QUANTERNARY GEOLOGIC MAP
NIPOMO HIGH SCHOOL/CENTRAL COAST NEW TECH HIGH SCHOOL
525 North Thompson Avenue
Nipomo, San Luis Obispo County, California

Date
January 2015
Project No.
SL-17068-GA
Drafted by:
R.G.



Extracted from: Geologic Map of the Nipomo Quadrangle, San Luis Obispo County, California: by T.W. Dibblee, Jr., 2006.

EXPLANATION

Geologic Units

Qa — **Alluvium** gravel & sand (Holocene)

Qoa — **Older Alluvium** (Pleistocene)

Qos — **Older Dune Sand** (Pleistocene)

Geologic Symbols

Contact
Dashed where approximately located or inferred

High-angle fault
Dashed where approximately located or inferred; dotted where concealed

Thrust or reverse fault
Dashed where approximately located or inferred; dotted where concealed. Saw-teeth on upper plate. Dip of fault plane between 30° and 60°

Anticline
Showing axis of surface. Dashed where approximately located; dotted where concealed

Syncline
Showing axis of surface. Dashed where approximately located; dotted where concealed

Horizontal — Inclined — Vertical
Strike and dip of beds

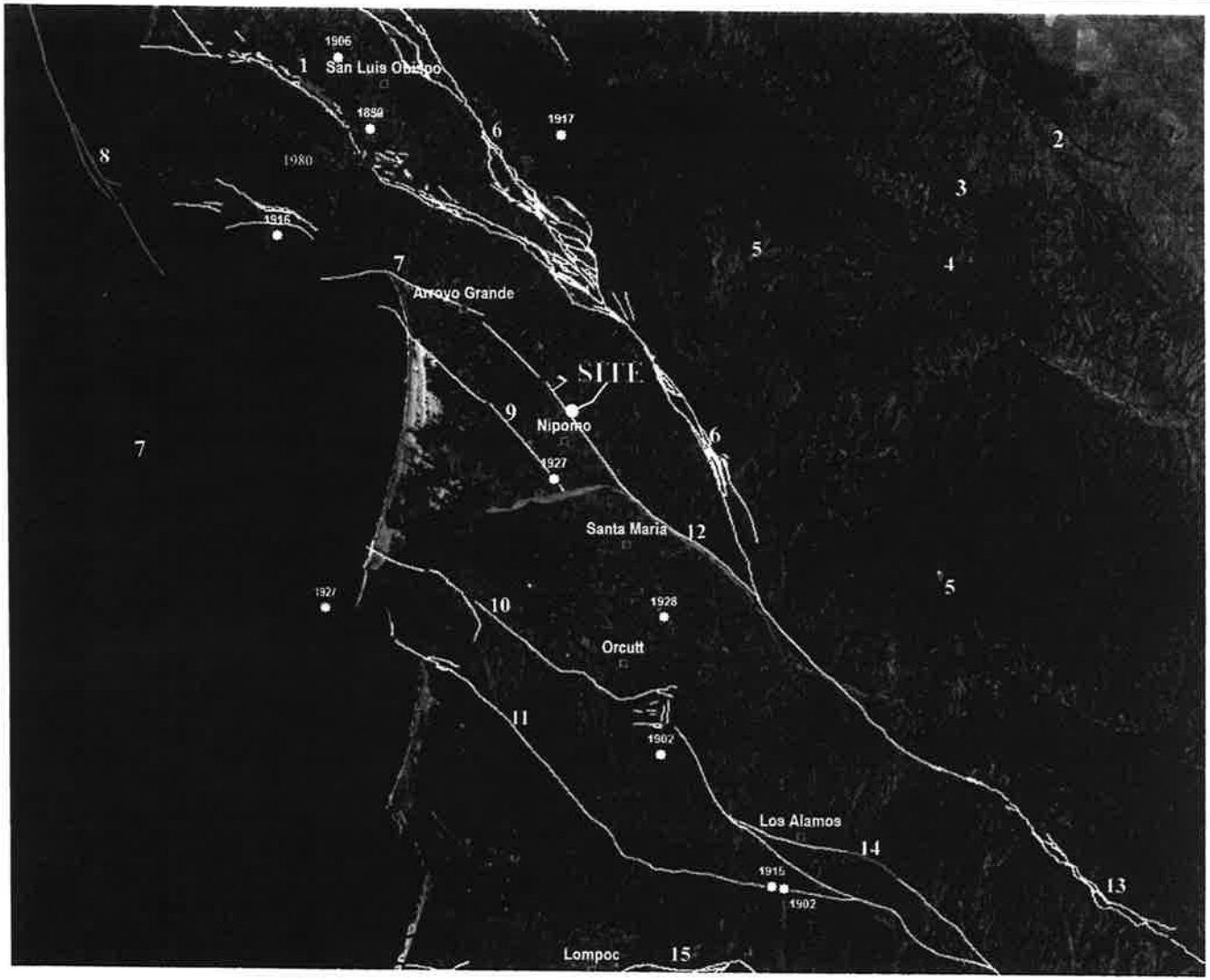
N

Approx. Scale: 1" = 1000'

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(805) 544-3276

GEOLOGIC MAP OF THE NIPOMO QUADRANGLE
NIPOMO HIGH SCHOOL/CENTRAL COAST NEW TECH HIGH SCHOOL
525 North Thompson Avenue
Nipomo, San Luis Obispo County, California

Date
January 2015
Project No.
SL-17068-GA
Drafted by:
R.G.



LEGEND

- Historic rupture (<200 years)
- Holocene fault (<10,000 years)
- Late Quaternary (<700,000 years)
- Quaternary fault (<1.6 million)

HISTORICAL EARTHQUAKE MAGNITUDE

○ 5.0 to 5.9 ● 6.0 to 6.9 ○ 7.0 to 7.9

FAULTS

1 Los Osos
2 San Juan
3 La Panza
4 South Cuyama
5 East Huasna
6 West Huasna
7 San Luis Range
8 Hosgri-San Simeon
9 Oceano
10 Orcutt Frontal (Casmalia)
11 Lions Head
12 Santa Maria River
13 Little Pine
14 Los Alamos
15 Santa Ynez River
16 Santa Ynez
17 Mission Ridge/ Arroyo Parida

Note: Not all faults are shown on map

REFERENCES

Blake, T.F., EQSEARCH, 2000, updated 2012
Jennings, C.W. & Bryant, W.A., 2010

N

(Approximate Scale: 1" = 6 miles)

EARTH SYSTEMS PACIFIC
4378 Old Santa Fe Road, San Luis Obispo, CA 93401
www.earthsystems.com - email: esp@earthsystems.com
(805) 544-3276

HISTORICAL EARTHQUAKE/ FAULT MAP
NIPOMO HIGH SCHOOL/CENTRAL COAST
NEW TECH HIGH SCHOOL
525 North Thompson Avenue
Nipomo, San Luis Obispo County, California

Date
January 2015
Project No.
SL-17068-GA
Drafted by:
R.G.



EARTH SYSTEMS PACIFIC
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(805) 544-3276

FEMA FLOOD ZONE MAP

NIPOMO HIGH SCHOOL/CENTRAL COAST
NEW TECH HIGH SCHOOL
525 North Thompson Avenue
Nipomo, San Luis Obispo County, California

Date
January 2015

Project No.
SL-17068-GA

APPENDIX C

Holguin, Fahan & Associates, Inc. Cone Penetrometer Test Report,
May 29, 1999

HOLGUIN, FAHAN & ASSOCIATES, INC.
CONE PENETROMETER TESTING AND DIRECT-PUSH SAMPLING GROUP
16570 Aston Street • Irvine, California 92606 • (949) 442-6665 • Fax (949) 724-0446

May 27, 1999

Mr. Rick Gorman
Earth Systems Consultants Northern California
4378 Santa Fe Road
San Luis Obispo, California 93401

Subject: **CONE PENETROMETER TEST SOUNDINGS AND INITIAL DETERMINATION OF THE PRESENCE OR ABSENCE OF FAULTING IN THE BUILDING AREA OF THE PROPOSED LUCIA MAR HIGH SCHOOL SITE NO. 2, NIPOMO, CALIFORNIA**

Dear Mr. Gorman:

Holguin, Fahan & Associates, Inc. (HFA) is pleased to provide Earth Systems Consultants Northern California (ESC) with this report of a subsurface investigation conducted using a cone penetrometer. These cone penetrometer test (CPT) soundings were conducted in order to make an initial determination as to the presence or absence of any fault zone passing through the building area of the proposed Lucia Mar High School Site No. 2 where construction of a high school is planned.

The proposed site is located on the southwestern corner of the intersection of Thompson Avenue and Mehlschau Road in the community of Nipomo, California (see Figure 1 - Site Location Map).

Rationale for Investigation

The Division of the State Architect has mandated that "no school building shall be constructed, rehabilitated, or relocated within 50 feet of the trace of a geologic fault along which surface rupture can reasonably be expected to occur within the life of a school building".

An active fault (or fault zone) is defined as one with movement within the last ≈11,000 years—the approximate time of formation of near-surface deposits (the upper 15 to 25 feet of the ground). Thus, the presence of an active fault can often be inferred from a relatively shallow subsurface investigation into the native soils.

Even if fault movement does not rupture the ground surface, displacements in bedrock at depth, regardless of the style of faulting at depth, generally coincide with deformed sediments in the near-surface. Significant amounts of recent offset would then indicate the presence of

an active fault zone, for instance, a sharp lateral (or vertical) discontinuity/separation in near-surface geologic units would be good evidence of an underlying fault. On the other hand, continuity of beds and lack of offsets of geologic units would suggest any folding detected is not a compressional feature between two traces of a fault.

Field Investigation

On May 20, 21, and 22, 1999, HFA advanced 40 CPT soundings at the subject site. These soundings were conducted on a 225-foot x 200-foot grid and cover an area that includes the locations of all of the proposed buildings and the bleachers next to the athletic fields at the west end of the subject site (see Figure 2 - Plot Plan and Table 1 - Coordinates and Depth to Water).

The CPT data was continually processed in the field and the logs (data and interpreted stratigraphy) evaluated on site by an experienced HFA engineer for any evidence of faulting.

Results

The field data underwent QA/QC in HFA's offices, and was then processed to obtain the final logs of CPT soundings (see Attachment 1 for the logs of CPT soundings). The final logs were used by HFA to refine the draft cross-sections and construct a 3-dimensional model of the subsurface. A series of cross-sections were then developed using the 3-dimensional model (see Figure 3 - Cross Section A-A' through Figure 8 - Cross Section F-F').

Examination of these cross-sections does not reveal any sharp lateral or vertical discontinuities within the depth of investigation. Additionally, no sudden change is evident in the dip of any of the stratigraphic units.

Since a fault zone may also form a barrier to migration of groundwater, and groundwater levels may differ from one side of the fault to the other, HFA used a water sounder to measure the depth to groundwater—in all sounding holes that stayed open after the cone penetrometer was withdrawn—and used these data to develop a profile of the groundwater table (see Figure 9 - Estimated Water Table). Although there are some dips in the groundwater level, no abrupt changes are seen. The dips are likely due to the presence of buried channels that have been filled with sediment in the recent past.

Based on the preceding, it is HFA's opinion that no displacements have disrupted the upper 15 to 25 feet of the stratified alluvial and topsoil deposits present at the subject site. This suggests that if faults are present at greater depth, they are probably inactive in the sense that their time

If you have any questions or require additional information, please contact me at 949/442-6665 or toll-free at 888/HFA-CPT1 (888/432-2781). I can also be reached via e-mail at girish_agrawal@oc.hfa.com.

Sincerely,

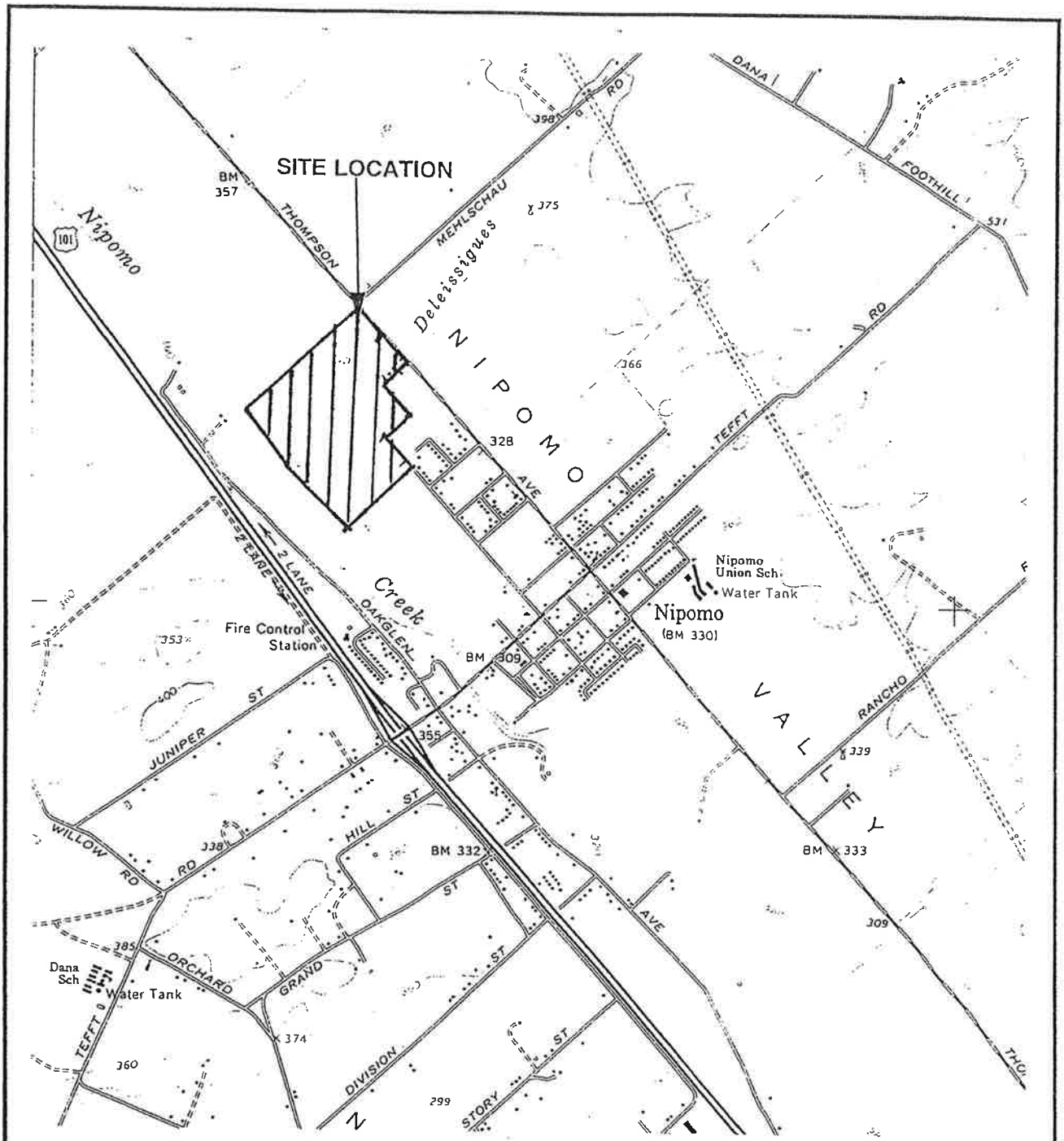
Girish Agrawal



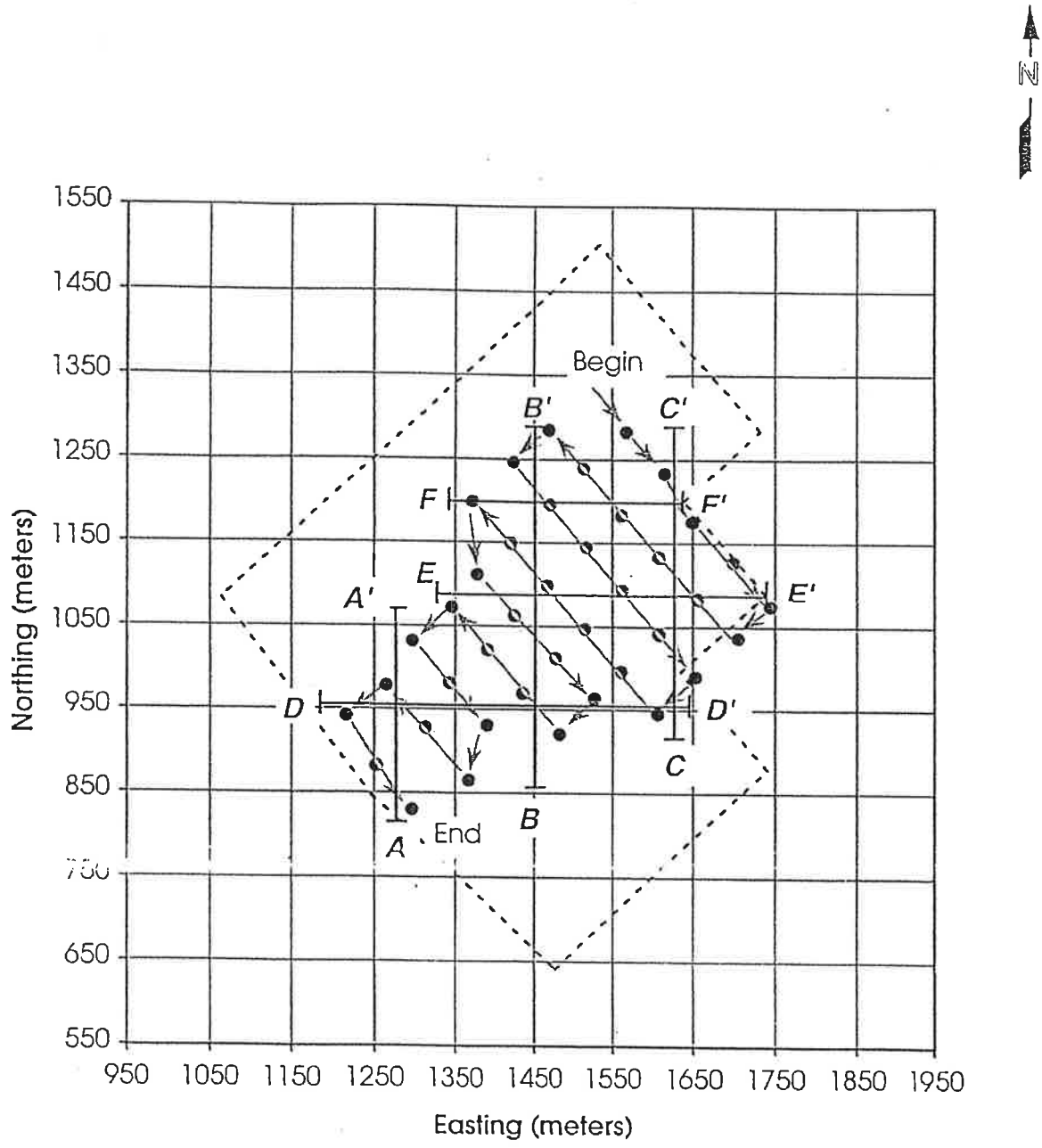
Girish Agrawal, PhD, PE
Senior Engineer/Geotechnical Services Manager
Holguin, Fahan & Associates, Inc.

GA:pi

Enclosures:
Figure 1 - Site Location Map
Figure 2 - Plot Plan
Figure 3 - Cross Section A-A'
Figure 4 - Cross Section B-B'
Figure 5 - Cross Section C-C'
Figure 6 - Cross Section D-D'
Figure 7 - Cross Section E-E'
Figure 8 - Cross Section F-F'
Figure 9 - Estimated Water Table
Table 1 - Coordinates and Depth to Water
Attachment 1 - Logs of CPT Soundings



LEGEND	EARTH SYSTEMS CONSULTANTS
0 0.5 1 MILE 0 1,000 2,000 3,000 4,000 5,000 FEET 0 0.5 1 KILOMETER USGS NIPOMO 7.5 MINUTE SERIES QUADRANGLE	PROPOSED LUCIA MAR HIGH SCHOOL SITE NO. 2 NIPOMO, CALIFORNIA FIGURE 1 - SITE LOCATION MAP
	HOLGUIN, FAHAN & ASSOCIATES, INC.



LEGEND		EARTH SYSTEMS CONSULTANTS
●	CPT SOUNDING	PROPOSED LUCIA MAR HIGH SCHOOL SITE NO. 2 NIPOMO, CALIFORNIA FIGURE 2 - PLOT PLAN
Begin → End	SEQUENCE OF CPT SOUNDINGS (CPT-01 through CPT-40)	
- - - - - - -	SITE BOUNDRY	
⊢—⊣	LINE OF CROSS SECTION	HOLGUIN, FAHAN & ASSOCIATES, INC.

REVISION DATE: MAY 24, 1999: PI

LEGEND			EARTH SYSTEMS CONSULTANTS
SOFT CLAY AND ORGANIC MATERIAL	LOCATION: 1275 EAST	SCALE	PROPOSED LUCIA MAR HIGH SCHOOL SITE NO. 2 NIPOMO, CALIFORNIA FIGURE 3 - CROSS SECTION A-A'
SILTY SAND	BEARING: 90°	HORIZONTAL 1" = 160'	
SILTY CLAY	DIP: 0°	VERTICAL 1" = 16'	
CEMENTED CLAYEY SAND/ VERY STIFF SILTY CLAY			HOLGUIN, FAHAN & ASSOCIATES, INC.

REVISION DATE: MAY 27, 1999: PI

LEGEND			EARTH SYSTEMS CONSULTANTS
SOFT CLAY AND ORGANIC MATERIAL	LOCATION: 1450 EAST	SCALE	PROPOSED LUCIA MAR HIGH SCHOOL SITE NO. 2 NIPOMO, CALIFORNIA FIGURE 4 - CROSS SECTION B-B'
SILTY SAND	BEARING: 90°	HORIZONTAL 1" = 160'	
SILTY CLAY	DIP: 0°	VERTICAL 1" = 16'	
CEMENTED CLAYEY SAND/ VERY STIFF SILTY CLAY			HOLGUIN, FAHAN & ASSOCIATES, INC.

REVISION DATE: MAY 27, 1999: PI

LEGEND			EARTH SYSTEMS CONSULTANTS
SOFT CLAY AND ORGANIC MATERIAL	LOCATION: 1625 EAST	SCALE	PROPOSED LUCIA MAR HIGH SCHOOL SITE NO. 2 NIPOMO, CALIFORNIA FIGURE 5 - CROSS SECTION C-C'
SILTY SAND	BEARING: 90°	HORIZONTAL 1" = 160'	
SILTY CLAY	DIP: 0°	VERTICAL 1" = 16'	
CEMENTED CLAYEY SAND/ VERY STIFF SILTY CLAY			HOLGUIN, FAHAN & ASSOCIATES, INC.

REVISION DATE: MAY 27, 1999: PI

LEGEND			EARTH SYSTEMS CONSULTANTS
SOFT CLAY AND ORGANIC MATERIAL	LOCATION: 960 NORTH	SCALE	PROPOSED LUCIA MAR HIGH SCHOOL SITE NO. 2 NIPOMO, CALIFORNIA FIGURE 6 - CROSS SECTION D-D'
SILTY SAND	BEARING: 0°	HORIZONTAL 1" = 160'	
SILTY CLAY	DIP: 0 °	VERTICAL 1" = 16'	
CEMENTED CLAYEY SAND/ VERY STIFF SILTY CLAY			HOLGUIN, FAHAN & ASSOCIATES, INC.

REVISION DATE: MAY 27, 1999: PI

LEGEND			EARTH SYSTEMS CONSULTANTS
SOFT CLAY AND ORGANIC MATERIAL	LOCATION: 1085 NORTH	SCALE	PROPOSED LUCIA MAR HIGH SCHOOL SITE NO. 2 NIPOMO, CALIFORNIA FIGURE 7 - CROSS SECTION E-E'
SILTY SAND	BEARING: 0°	HORIZONTAL 1" = 160'	
SILTY CLAY	DIP: 0°	VERTICAL 1" = 16'	
CEMENTED CLAYEY SAND/ VERY STIFF SILTY CLAY			HOLGUIN, FAHAN & ASSOCIATES, INC.

REVISION DATE: MAY 27, 1999: PI

LEGEND			EARTH SYSTEMS CONSULTANTS
SOFT CLAY AND ORGANIC MATERIAL	LOCATION: 1210 NORTH	SCALE	PROPOSED LUCIA MAR HIGH SCHOOL SITE NO. 2 NIPOMO, CALIFORNIA FIGURE 8 - CROSS SECTION F-F'
SILTY SAND	BEARING: 0°	HORIZONTAL 1" = 160'	
SILTY CLAY	DIP: 0°	VERTICAL 1" = 16'	
CEMENTED CLAYEY SAND/ VERY STIFF SILTY CLAY			HOLGUIN, FAHAN & ASSOCIATES, INC.

REVISION DATE: MAY 27, 1999: PI

LEGEND			EARTH SYSTEMS CONSULTANTS
ON THE TRIAD: X = EAST Y = NORTH	ELEVATION OF BASE = 85m BEARING = 55° DIP = 40°	WATER TABLE	PROPOSED LUCIA MAR HIGH SCHOOL SITE NO. 2 NIPOMO, CALIFORNIA FIGURE 9 - ESTIMATED WATER TABLE HOLGUIN, FAHAN & ASSOCIATES, INC.

REVISION DATE: MAY 27, 1999: PI

Table 1.
Coordinates and Depth to Water for CPT Soundings Conducted at the
Proposed Lucia Mar High School Site No. 2, Nipomo, California

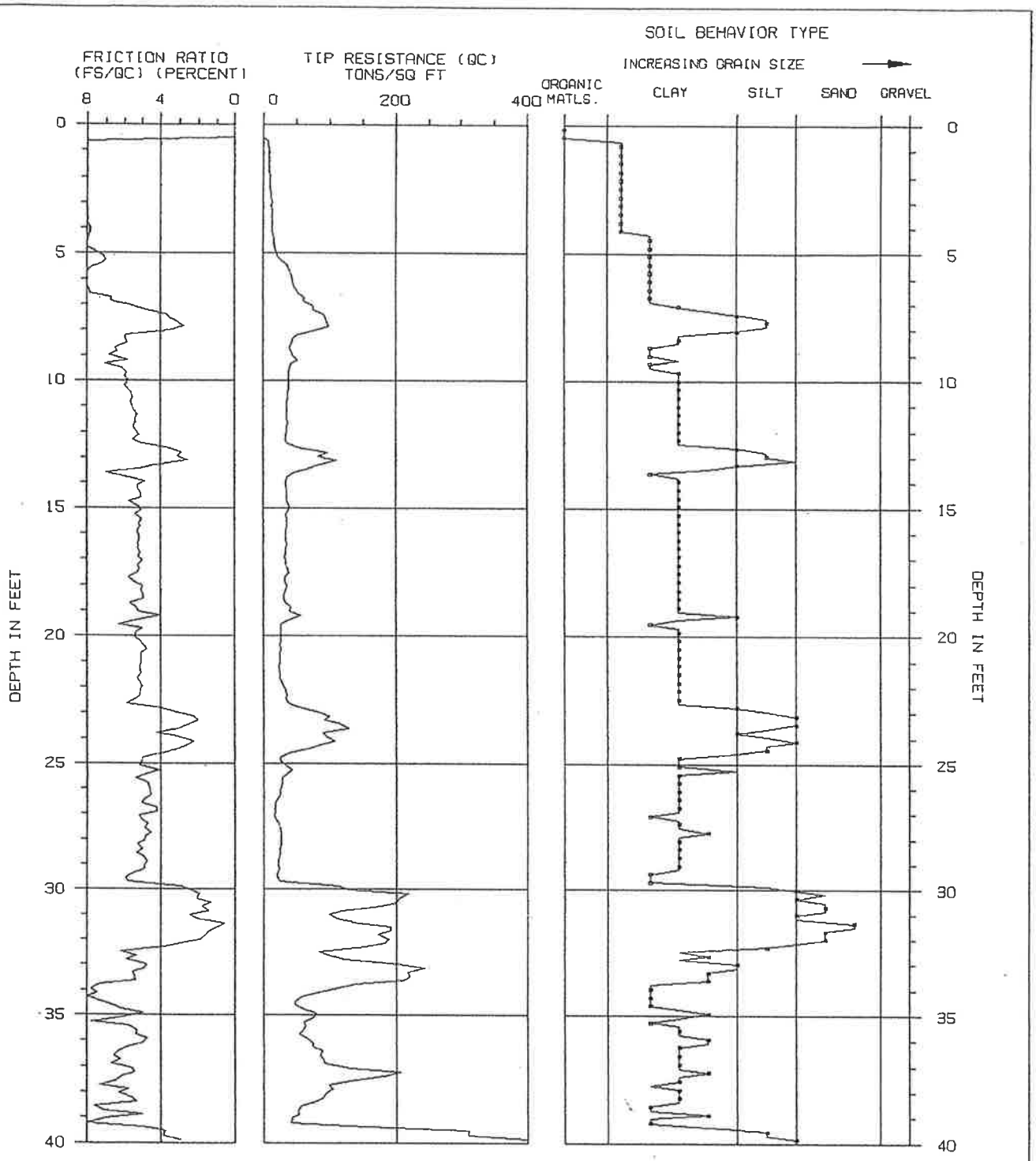
CPT No.	Northing (meters)	Easting (meters)	Ground Elevation (meters)	Measured Depth to Water (meters)	Elevation of Water Table (meters)
1	1283.26	1568.07	102.64	5.18	97.46
2	1233.66	1615.41	103.06	5.79	97.27
3	1175.53	1649.86	103.80	6.71	97.09
4	1127.20	1699.37	104.10	7.62	96.48
5	1075.49	1744.79	103.04	6.40	96.64
6	1036.79	1705.30	103.14	6.71	96.44
7	1084.01	1656.04	103.51	9.14	94.36
8	1133.42	1608.24	102.07	5.79	96.27
9	1182.72	1561.01	102.87	6.40	96.47
10	1238.97	1514.53	101.98	5.62	96.36
11	1285.21	1469.93	102.29	6.10	96.19
12	1246.07	1425.06	101.56	5.79	95.77
13	1195.57	1471.16	101.38	5.79	95.59
14	1145.30	1518.07	100.96	5.33	95.62
15	1093.30	1562.71	100.65	7.77	92.88
16	1041.63	1608.26	102.35	6.55	95.80
17	990.17	1653.25	102.55	9.30	93.26
18	945.50	1606.67	102.09	6.55	95.53
19	996.61	1561.09	100.99	5.03	95.96
20	1047.72	1515.51	99.94	11.58	88.36
21	1097.88	1467.39	100.49	5.18	95.31

Table 1.
Coordinates and Depth to Water for CPT Soundings Conducted at the
Proposed Lucia Mar High School Site No. 2, Nipomo, California

CPT No.	Northing (meters)	Easting (meters)	Ground Elevation (meters)	Measured Depth to Water (meters)	Elevation of Water Table (meters)
22	1148.70	1420.70	100.99	8.69	92.30
23	1198.19	1372.43	102.19	6.71	95.48
24	1111.38	1377.88	100.40	5.18	95.22
25	1062.42	1425.28	100.10	4.88	95.22
26	1011.73	1477.92	99.69	4.57	95.12
27	963.09	1527.63	99.58	11.58	88.00
28	920.45	1482.93	99.18	3.96	95.22
29	969.37	1435.91	99.06	3.96	95.09
30	1021.22	1390.93	99.47	4.42	95.05
31	1072.25	1346.39	99.65	7.62	92.03
32	1031.83	1296.88	99.05	3.81	95.24
33	981.03	1343.30	98.74	3.81	94.93
34	930.72	1390.75	98.58	3.66	94.92
35	865.33	1367.51	98.55	3.35	95.20
36	927.57	1313.26	98.09	3.05	95.05
37	978.11	1264.90	98.29	3.20	95.09
38	941.26	1216.99	97.37	2.44	94.94
39	882.21	1252.56	97.66	---	---
40	830.00	1296.33	97.42	---	---

ATTACHMENT 1.

LOGS OF CPT SOUNDINGS



TOP 0.5 FT IS DISTURBED SOIL

TIP RESISTANCE NOT CORRECTED FOR END AREA EFFECT

ASSUMED TOTAL UNIT WT = 120 PCF

ASSUMED DEPTH OF WATER TABLE = 21.0 FT

SOIL BEHAVIOR TYPE INTERPRETATIONS BASED ON: GUIDELINES FOR GEOTECHNICAL DESIGN USING THE CPT AND CPTU. SOIL MECHANICS SERIES #120. UNIVERSITY OF BRITISH COLUMBIA. SEPTEMBER 1989. BY P.K. ROBERTSON AND R.G. CAMPANELLA.

CONE PENETRATION TEST

SOUNDING NUMBER: CPT-01

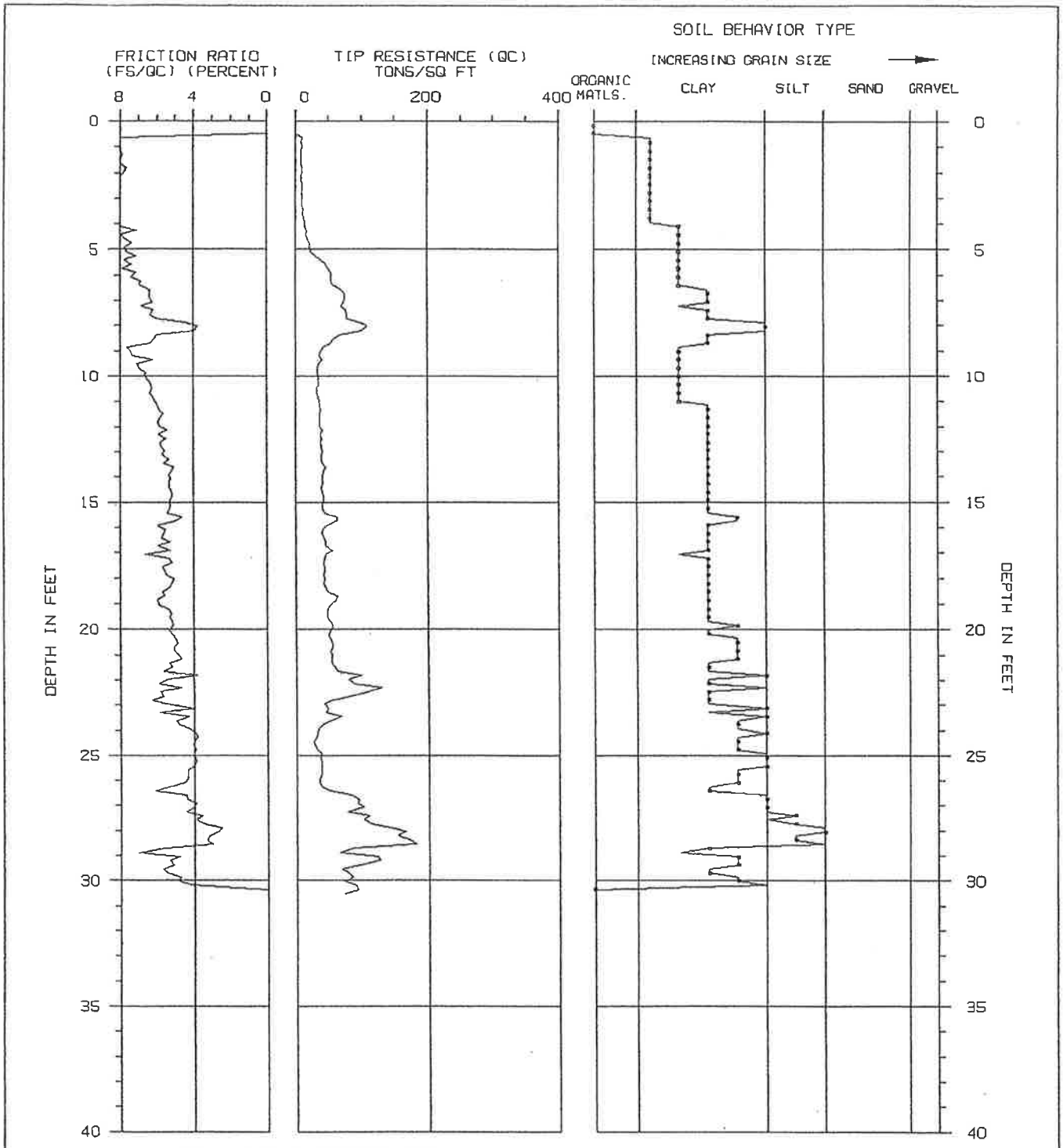
PROJECT NAME : ESC-NIPOMO H.S.

PROJECT NUMBER : 99-E775

CONE/RIG : 469\#1 JH.MR.DA

DATE/TIME: 04-20-99 07:54

HFA



TOP 0.5 FT IS DISTURBED SOIL

TIP RESISTANCE NOT CORRECTED FOR END AREA EFFECT

ASSUMED TOTAL UNIT WT = 120 PCF

ASSUMED DEPTH OF WATER TABLE = 21.0 FT

SOIL BEHAVIOR TYPE INTERPRETATIONS BASED ON: GUIDELINES FOR GEOTECHNICAL DESIGN USING THE CPT AND CPTU. SOIL MECHANICS SERIES #120. UNIVERSITY OF BRITISH COLUMBIA. SEPTEMBER 1989. BY P.K. ROBERTSON AND R.G. CAMPANELLA.

CONE PENETRATION TEST

SOUNDING NUMBER: CPT-02

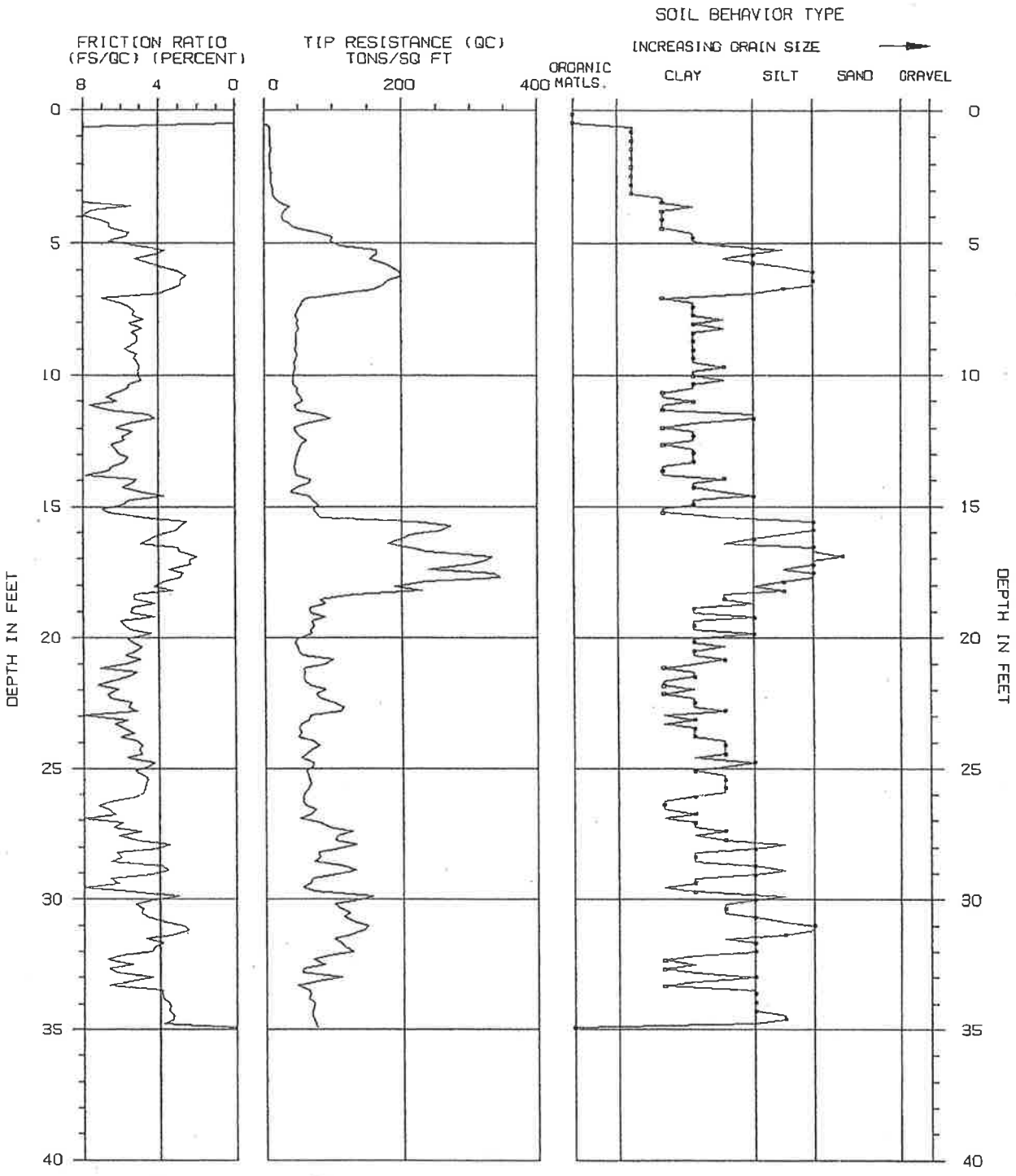
PROJECT NAME : ESC-NIPOMO H.S.

PROJECT NUMBER : 99-E775

CONE/RIG : 495\#1 JH.MR.GA

DATE/TIME: 04-20-99 08:38

HFA



TOP 0.5 FT IS DISTURBED SOIL

TIP RESISTANCE NOT CORRECTED FOR END AREA EFFECT

ASSUMED TOTAL UNIT WT = 120 PCF

ASSUMED DEPTH OF WATER TABLE = 21.0 FT

SOIL BEHAVIOR TYPE INTERPRETATIONS BASED ON: GUIDELINES FOR GEOTECHNICAL DESIGN USING THE CPT AND CPTU. SOIL MECHANICS SERIES #120. UNIVERSITY OF BRITISH COLUMBIA. SEPTEMBER 1989. BY P.K. ROBERTSON AND R.G. CAMPANELLA.

CONE PENETRATION TEST

SOUNDING NUMBER: CPT-03

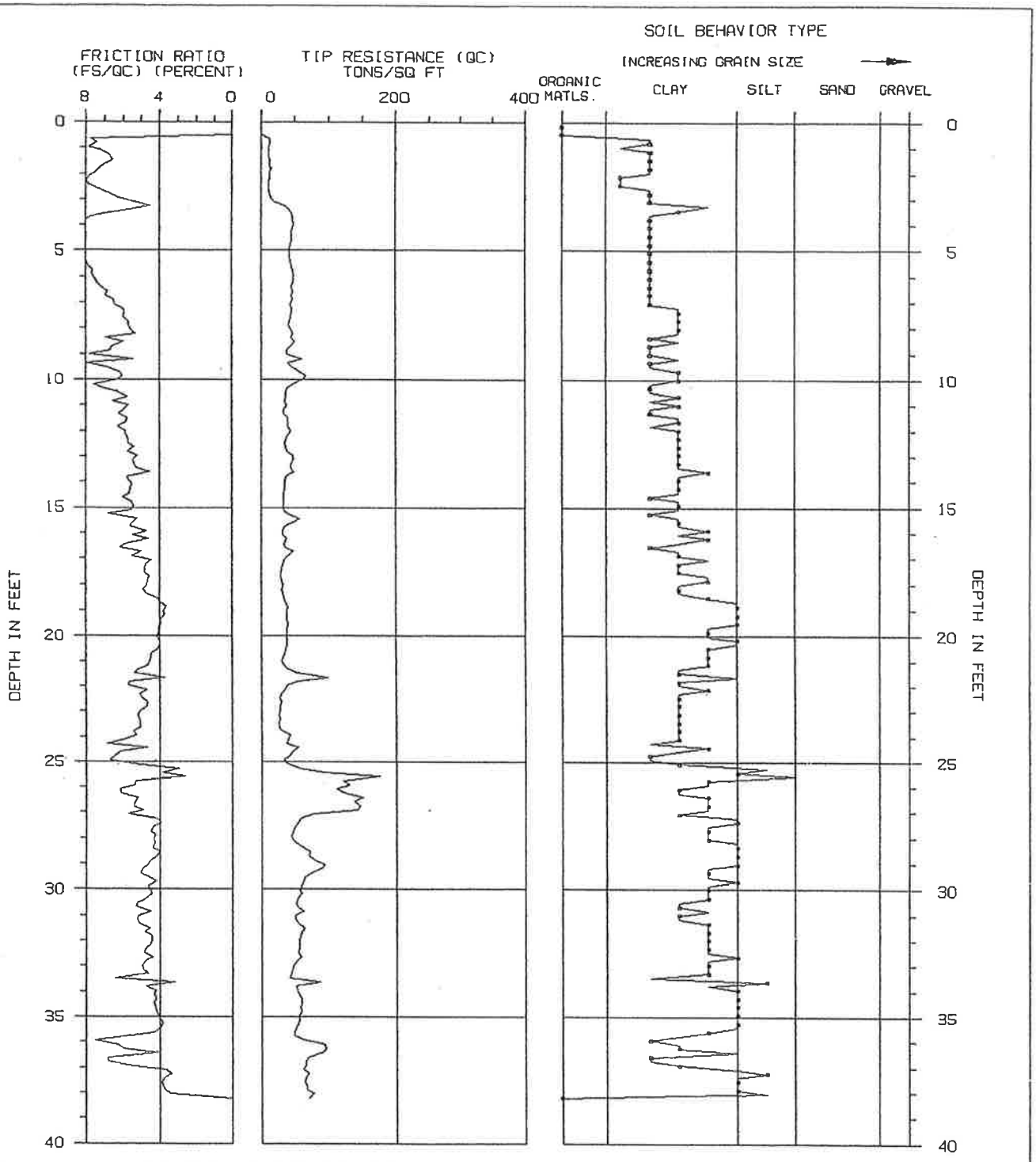
PROJECT NAME : ESC-NIPOMO H.S.

PROJECT NUMBER : 99-E775

CONE/RIG : 471\#1 JH.MR.CA

DATE/TIME: 04-20-99 09:16

HFA



TOP 0.5 FT IS DISTURBED SOIL

TIP RESISTANCE NOT CORRECTED FOR END AREA EFFECT

ASSUMED TOTAL UNIT WT = 120 PCF

ASSUMED DEPTH OF WATER TABLE = 21.0 FT

SOIL BEHAVIOR TYPE INTERPRETATIONS BASED ON: GUIDELINES FOR GEOTECHNICAL DESIGN USING THE CPT AND CPTU. SOIL MECHANICS SERIES #120. UNIVERSITY OF BRITISH COLUMBIA. SEPTEMBER 1999. BY P.K. ROBERTSON AND R.G. CAMPANELLA.

CONE PENETRATION TEST

SOUNDING NUMBER: CPT-04

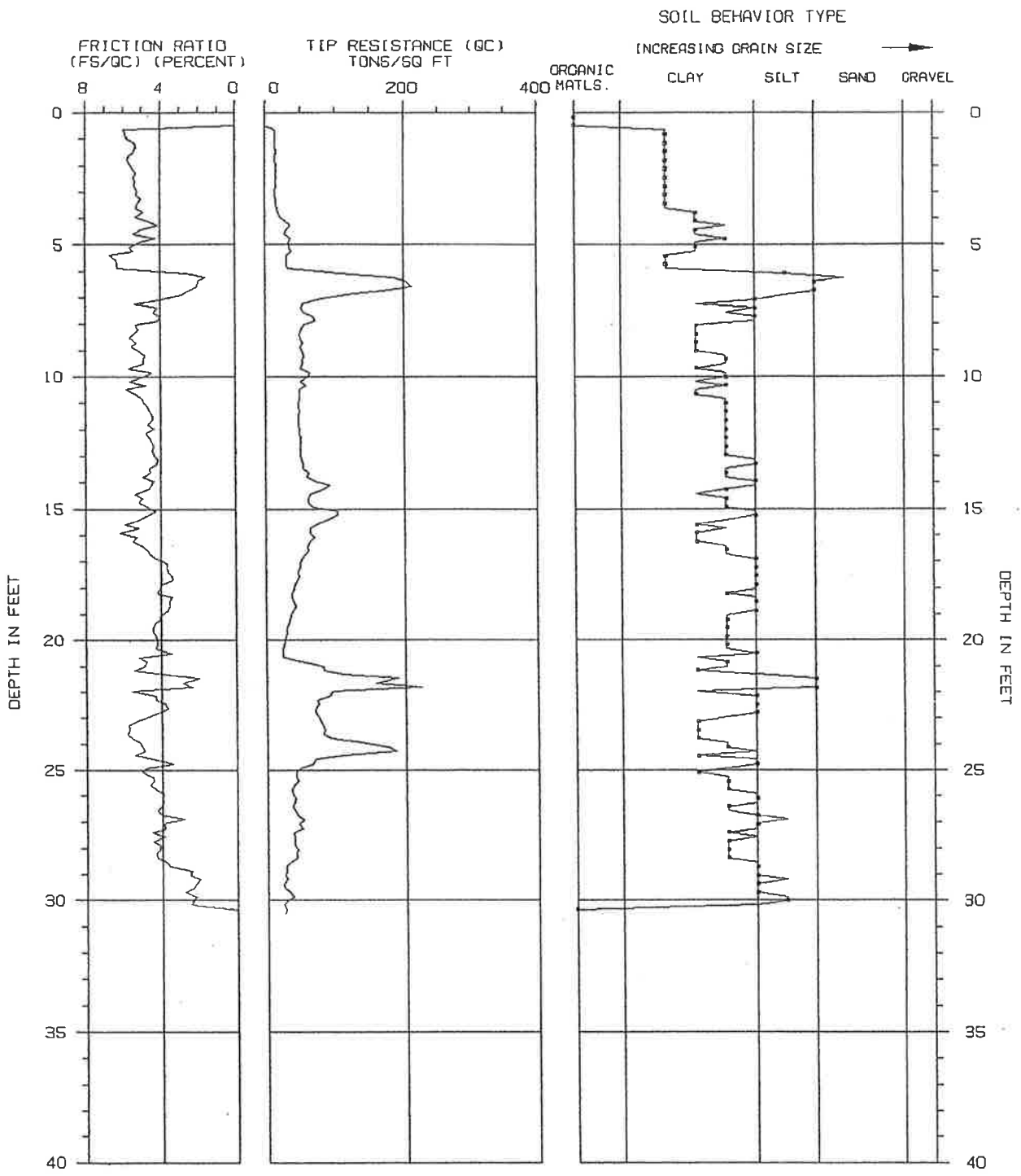
PROJECT NAME : ESC-NIPOMO H.S.

PROJECT NUMBER : 99-E775

CONE/RIG : 471\#1 JH.MR.CA

DATE/TIME: 04-20-99 09:53

HFA



TOP 0.5 FT IS DISTURBED SOIL

TIP RESISTANCE NOT CORRECTED FOR END AREA EFFECT

ASSUMED TOTAL UNIT WT = 120 PCF

ASSUMED DEPTH OF WATER TABLE = 21.0 FT

SOIL BEHAVIOR TYPE INTERPRETATIONS BASED ON: GUIDELINES FOR GEOTECHNICAL DESIGN USING THE CPT AND CPTU. SOIL MECHANICS SERIES #120. UNIVERSITY OF BRITISH COLUMBIA. SEPTEMBER 1989. BY P.K. ROBERTSON AND R.G. CAMPANELLA.

CONE PENETRATION TEST

SOUNDING NUMBER: CPT-05

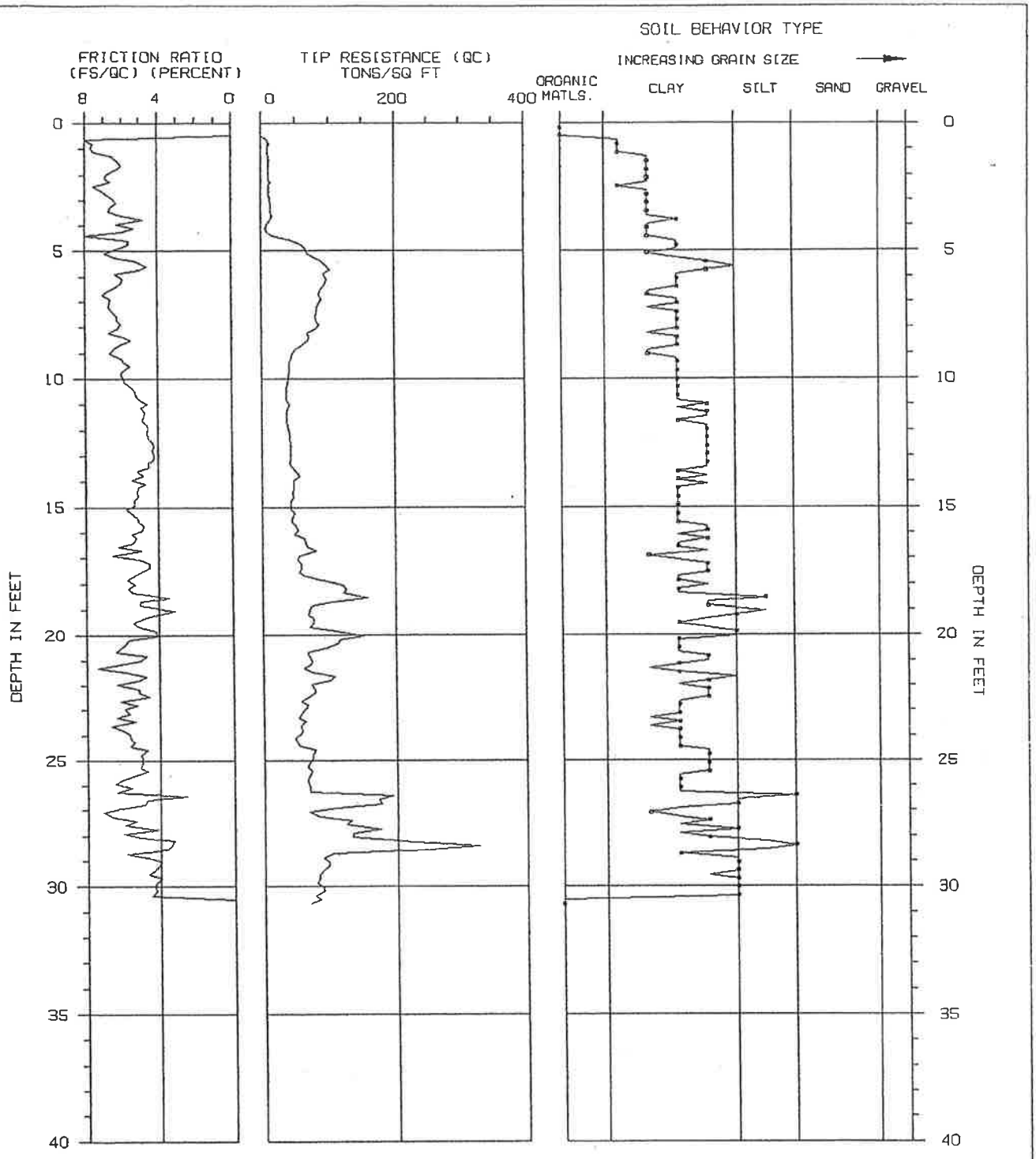
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PROJECT NUMBER : 99-E775

CONE/RIG : 471\¤1 JH.MR.GA

DATE/TIME: 04-20-99 10:24

HFA



TOP 0.5 FT IS DISTURBED SOIL

TIP RESISTANCE NOT CORRECTED FOR END AREA EFFECT

ASSUMED TOTAL UNIT WT = 120 PCF

ASSUMED DEPTH OF WATER TABLE = 21.0 FT

SOIL BEHAVIOR TYPE INTERPRETATIONS BASED ON: GUIDELINES FOR GEOTECHNICAL DESIGN USING THE CPT AND CPTU. SOIL MECHANICS SERIES #120. UNIVERSITY OF BRITISH COLUMBIA. SEPTEMBER 1989. BY P.K. ROBERTSON AND R.G. CAMPANELLA.

CONE PENETRATION TEST

SOUNDING NUMBER: CPT-06

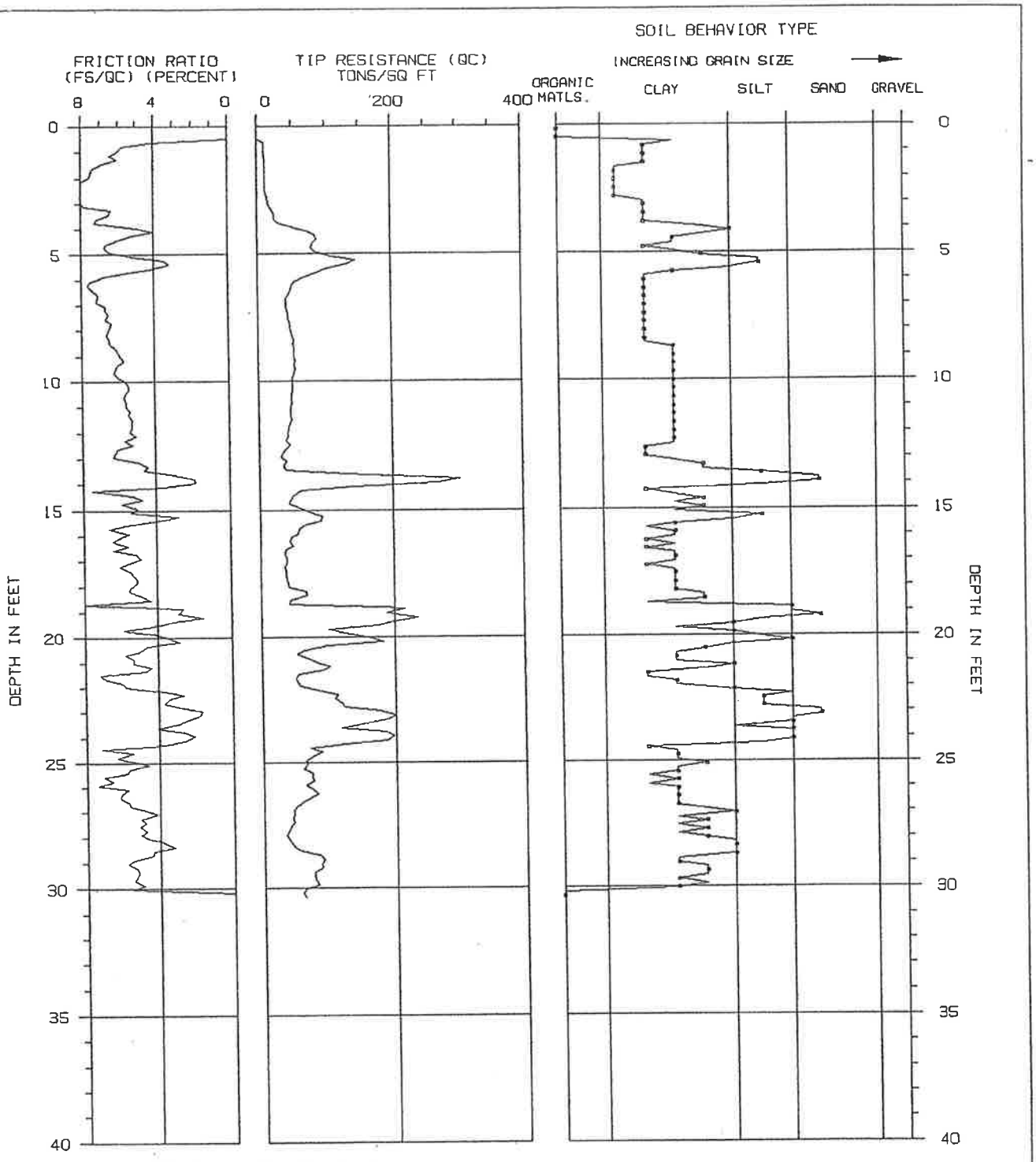
PROJECT NAME : ESC-NIPOMO H.S.

PROJECT NUMBER : 99-E775

CONE/RIG : 471\#1 JH.MR.CA

DATE/TIME: 04-20-99 10:49

HFA



TOP 0.5 FT IS DISTURBED SOIL

TIP RESISTANCE NOT CORRECTED FOR END AREA EFFECT

ASSUMED TOTAL UNIT WT = 120 PCF

ASSUMED DEPTH OF WATER TABLE = 21.0 FT

SOIL BEHAVIOR TYPE INTERPRETATIONS BASED ON: GUIDELINES FOR GEOTECHNICAL DESIGN USING THE CPT AND CPTU. SOIL MECHANICS SERIES #120. UNIVERSITY OF BRITISH COLUMBIA. SEPTEMBER 1989. BY P.K. ROBERTSON AND R.G. CAMPANELLA.

CONE PENETRATION TEST

SOUNDING NUMBER: CPT-07

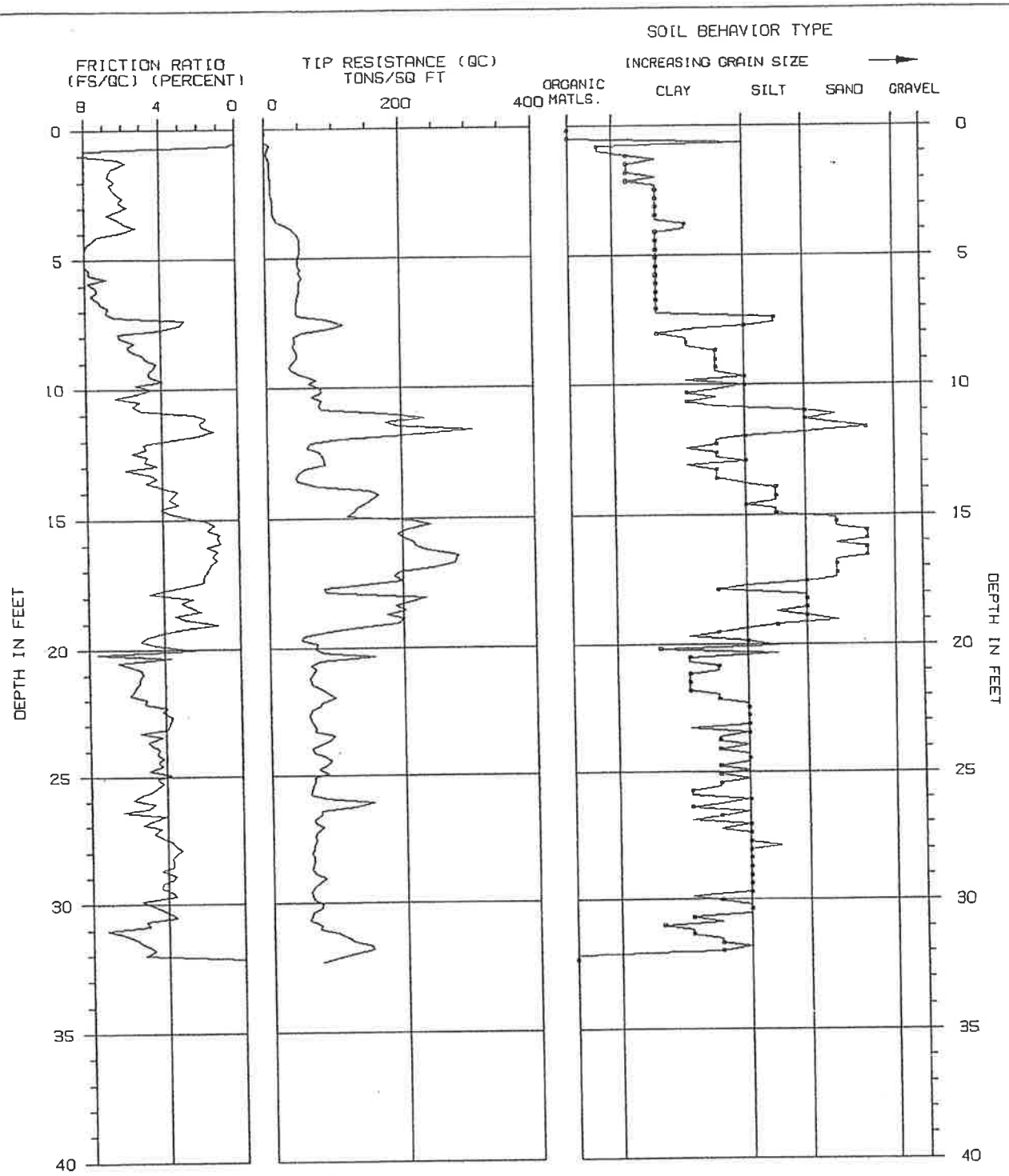
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PROJECT NUMBER : 99-E775

CONE/RIG : 471\#1 JH.MR.CA

DATE/TIME: 04-20-99 11:18

HFA



TOP 0.5 FT IS DISTURBED SOIL

TIP RESISTANCE NOT CORRECTED FOR END AREA EFFECT

ASSUMED TOTAL UNIT WT = 120 PCF

ASSUMED DEPTH OF WATER TABLE = 21.0 FT

SOIL BEHAVIOR TYPE INTERPRETATIONS BASED ON: GUIDELINES FOR GEOTECHNICAL DESIGN USING THE CPT AND CPTU. SOIL MECHANICS SERIES #120. UNIVERSITY OF BRITISH COLUMBIA. SEPTEMBER 1989. BY P.K. ROBERTSON AND R.G. CAMPANELLA.

CONE PENETRATION TEST

SOUNDING NUMBER: CPT-08

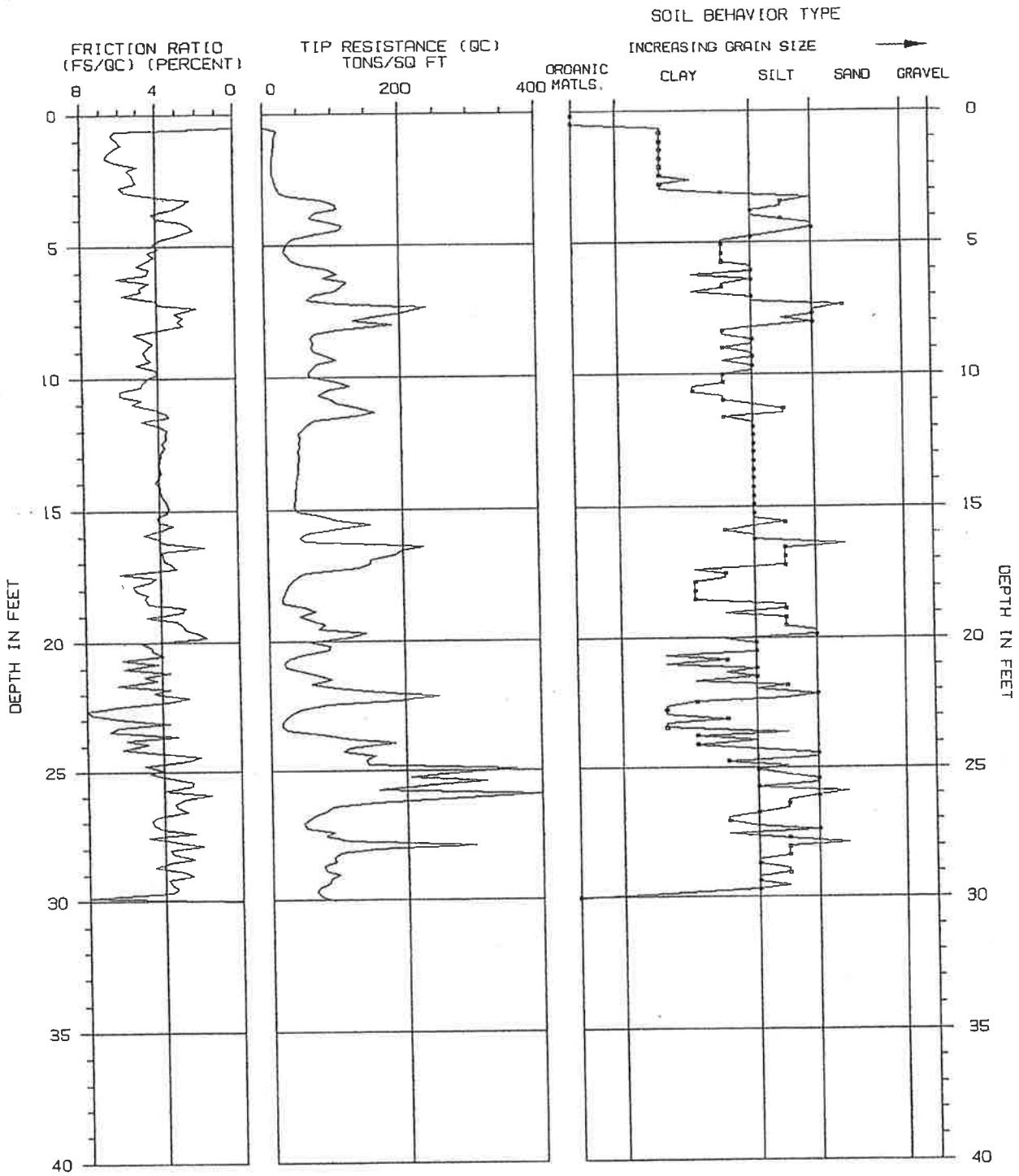
PROJECT NAME : ESC-NIPOMO H.S.

PROJECT NUMBER : 99-E775

CONE/RIG : 471\#1 JH.MR.GA

DATE/TIME: 04-20-99 12:30

HFA



TOP 0.5 FT IS DISTURBED SOIL

TIP RESISTANCE NOT CORRECTED FOR END AREA EFFECT

ASSUMED TOTAL UNIT WT = 120 PCF

ASSUMED DEPTH OF WATER TABLE = 21.0 FT

SOIL BEHAVIOR TYPE INTERPRETATIONS BASED ON: GUIDELINES FOR GEOTECHNICAL DESIGN USING THE CPT AND CPTU. SOIL MECHANICS SERIES #120. UNIVERSITY OF BRITISH COLUMBIA. SEPTEMBER 1989. BY P.K. ROBERTSON AND R.G. CAMPANELLA.

CONE PENETRATION TEST

SOUNDING NUMBER: CPT-09

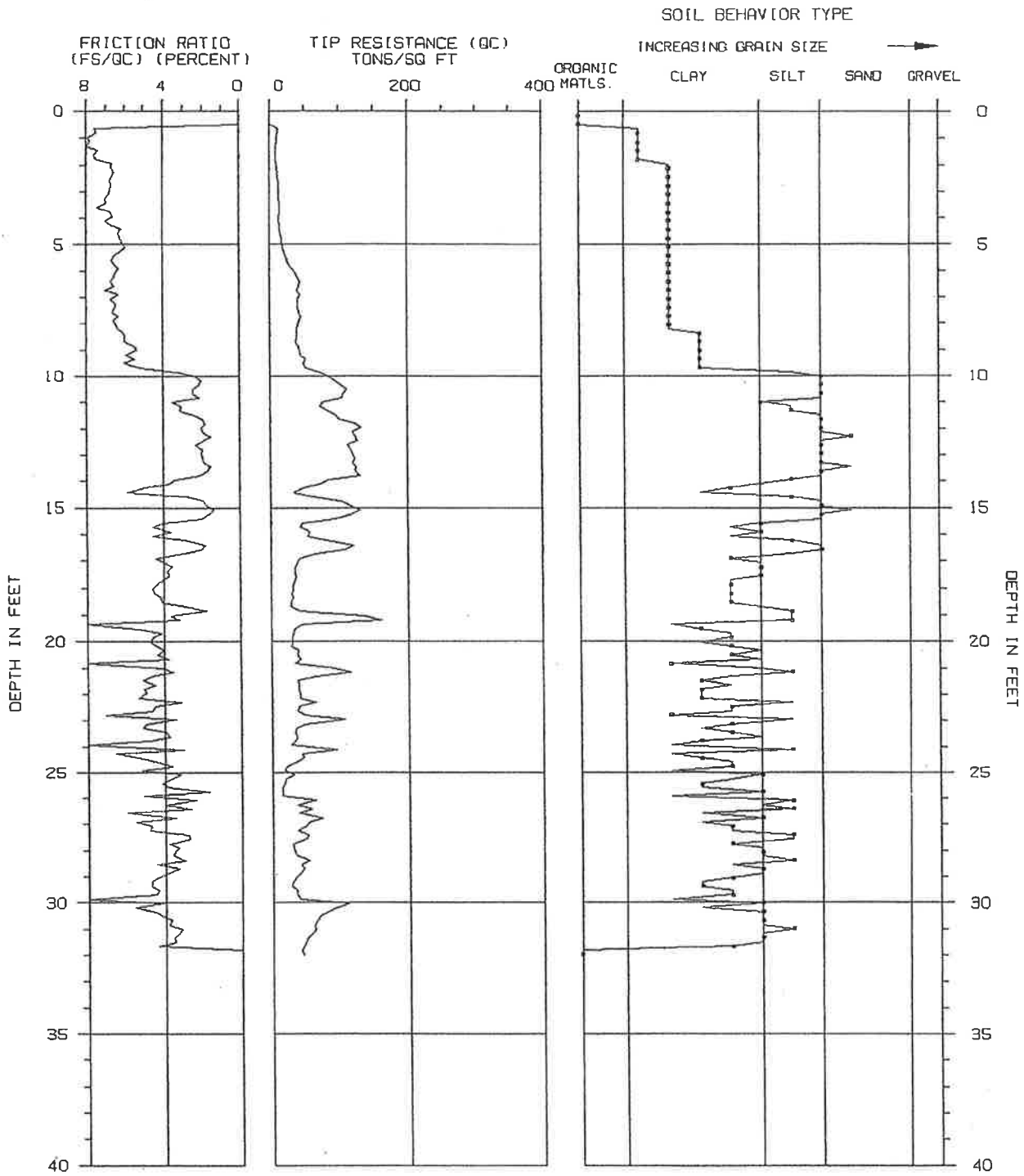
PROJECT NAME : ESC-NIPOMO H.S.

PROJECT NUMBER : 99-E775

CONE/RIG : 471\#1 JH.MR.CA

DATE/TIME: 04-20-99 12:59

HFA



TOP 0.5 FT IS DISTURBED SOIL

TIP RESISTANCE NOT CORRECTED FOR END AREA EFFECT

ASSUMED TOTAL UNIT WT = 120 PCF

ASSUMED DEPTH OF WATER TABLE = 21.0 FT

SOIL BEHAVIOR TYPE INTERPRETATIONS BASED ON: GUIDELINES FOR GEOTECHNICAL DESIGN USING THE CPT AND CPTU. SOIL MECHANICS SERIES #120. UNIVERSITY OF BRITISH COLUMBIA. SEPTEMBER 1989. BY P.K. ROBERTSON AND R.G. CAMPANELLA.

CONE PENETRATION TEST

SOUNDING NUMBER: CPT-10

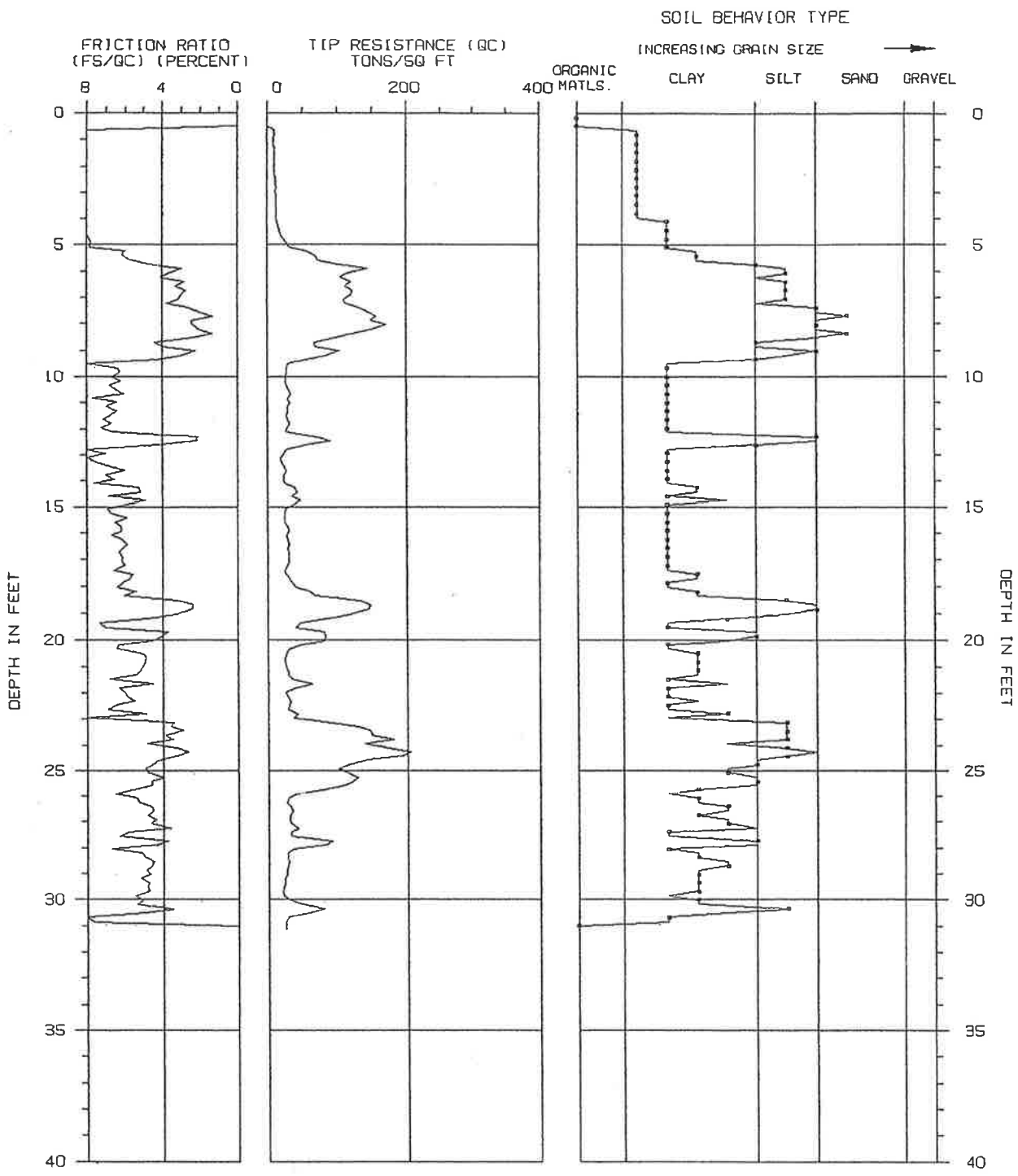
PROJECT NAME : ESC-NIPOMO H.S.

PROJECT NUMBER : 99-E775

CONE/RIG : 471\#1 JH.MR.CA

DATE/TIME: 04-20-99 13:44

HFA



TOP 0.5 FT IS DISTURBED SOIL

TIP RESISTANCE NOT CORRECTED FOR END AREA EFFECT

ASSUMED TOTAL UNIT WT = 120 PCF

ASSUMED DEPTH OF WATER TABLE = 21.0 FT

SOIL BEHAVIOR TYPE INTERPRETATIONS BASED ON: GUIDELINES FOR GEOTECHNICAL DESIGN USING THE CPT AND CPTU. SOIL MECHANICS SERIES #120. UNIVERSITY OF BRITISH COLUMBIA. SEPTEMBER 1989. BY P.K. ROBERTSON AND R.G. CAMPANELLA.

CONE PENETRATION TEST

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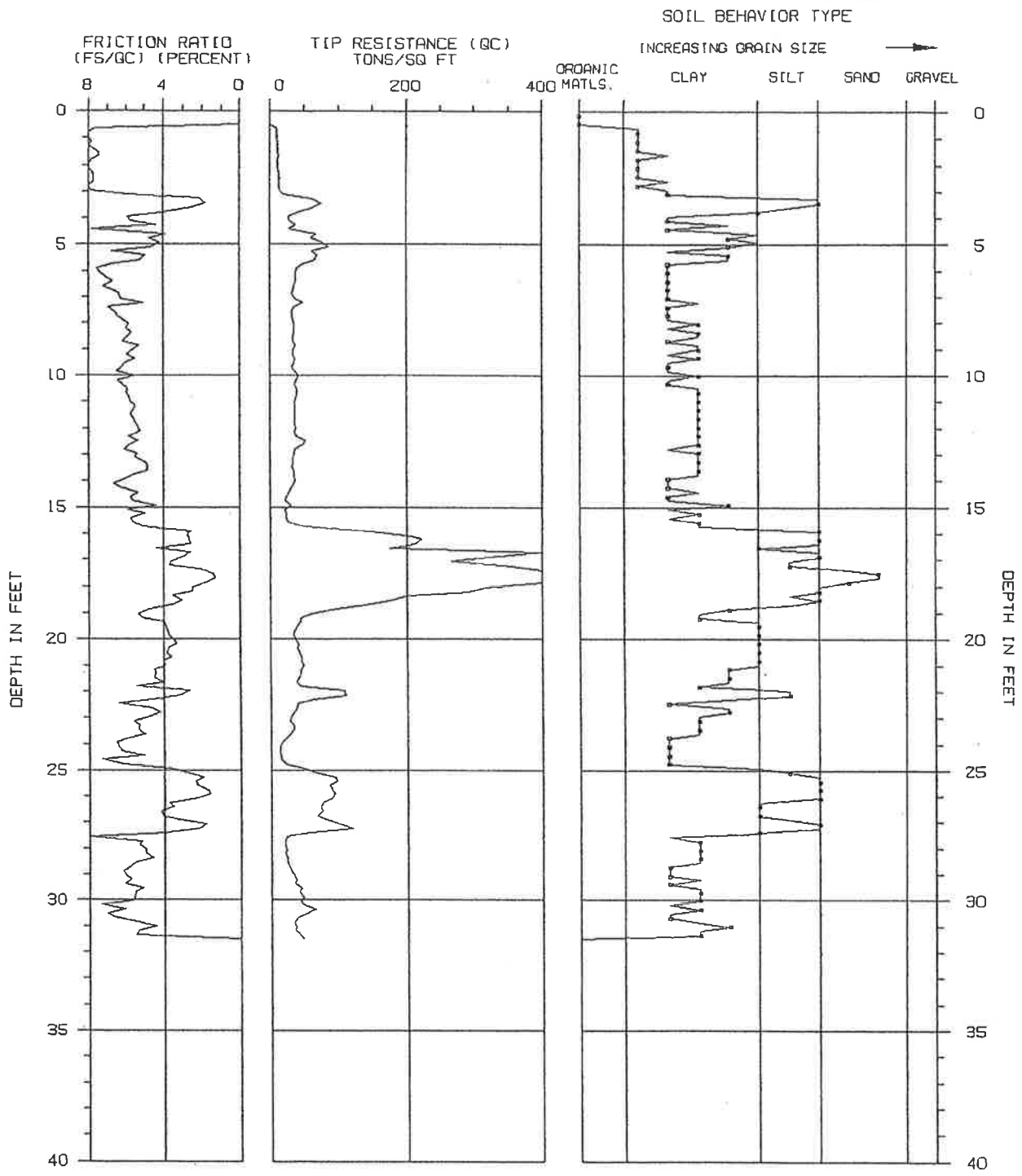
PROJECT NAME : ESC-NIPOMO H.S.

PROJECT NUMBER : 99-E775

CONE/RIG : 471\#1 JH.MR.DA

DATE/TIME: 04-20-99 14:14

HFA



TOP 0.5 FT IS DISTURBED SOIL

TIP RESISTANCE NOT CORRECTED FOR END AREA EFFECT

ASSUMED TOTAL UNIT WT = 120 PCF

ASSUMED DEPTH OF WATER TABLE = 21.0 FT

SOIL BEHAVIOR TYPE INTERPRETATIONS BASED ON: GUIDELINES FOR GEOTECHNICAL DESIGN USING THE CPT AND CPTU. SOIL MECHANICS SERIES #120, UNIVERSITY OF BRITISH COLUMBIA, SEPTEMBER 1989, BY P.K. ROBERTSON AND R.G. CAMPANELLA.

CONE PENETRATION TEST

SOUNDING NUMBER: CPT-12

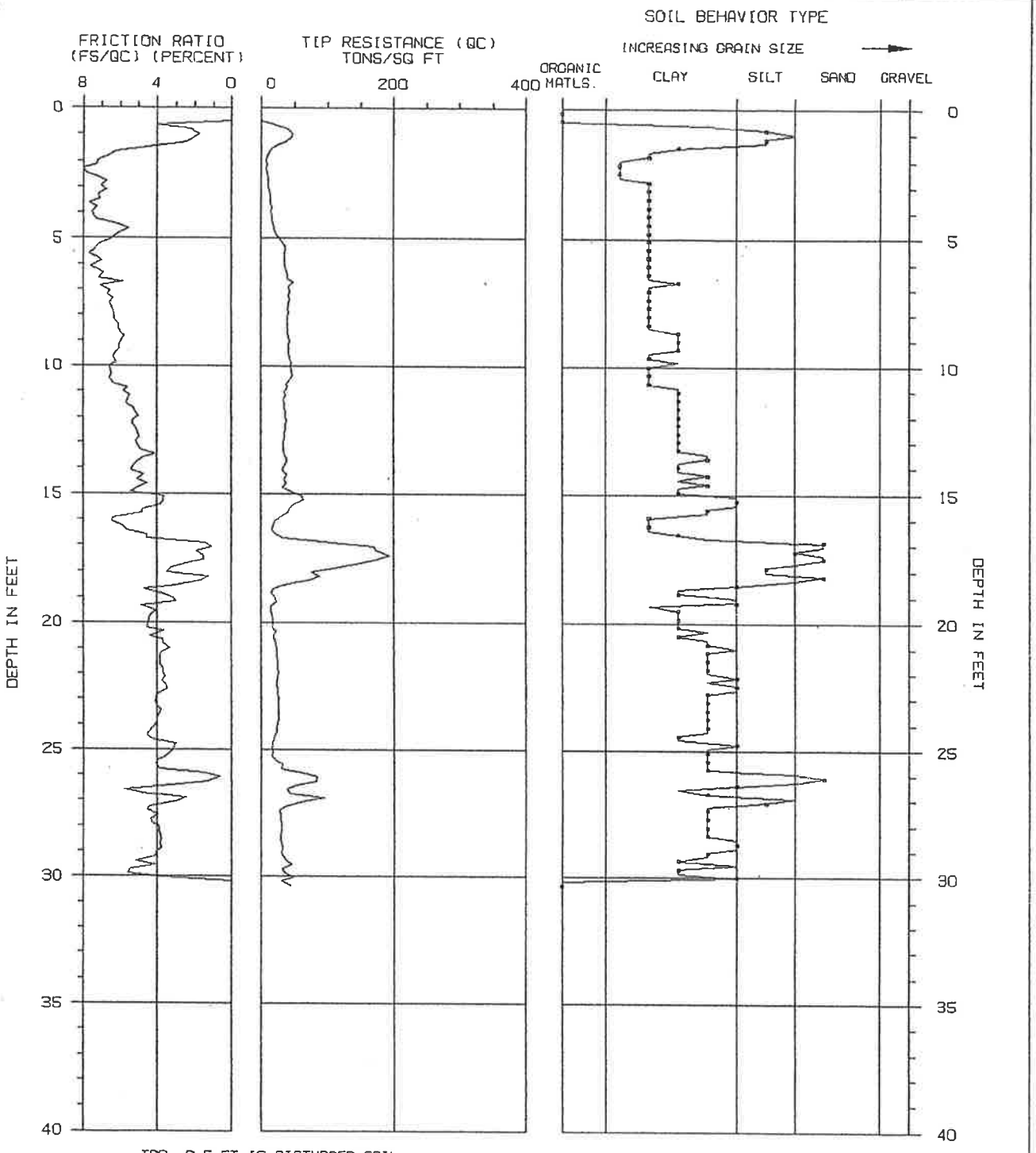
PROJECT NAME : ESC-NIPOMO H.S.

PROJECT NUMBER : 99-E775

CONE/RIG : 471\±1 JH.MR.CA

DATE/TIME: 04-20-99 14:41

HFA



TOP 0.5 FT IS DISTURBED SOIL

TIP RESISTANCE NOT CORRECTED FOR END AREA EFFECT

ASSUMED TOTAL UNIT WT = 120 PCF

ASSUMED DEPTH OF WATER TABLE = 21.0 FT

SOIL BEHAVIOR TYPE INTERPRETATIONS BASED ON: GUIDELINES FOR GEOTECHNICAL DESIGN USING THE CPT AND CPTU. SOIL MECHANICS SERIES #120. UNIVERSITY OF BRITISH COLUMBIA. SEPTEMBER 1989. BY P.K. ROBERTSON AND R.G. CAMPANELLA.

CONE PENETRATION TEST

SOUNDING NUMBER: CPT-13

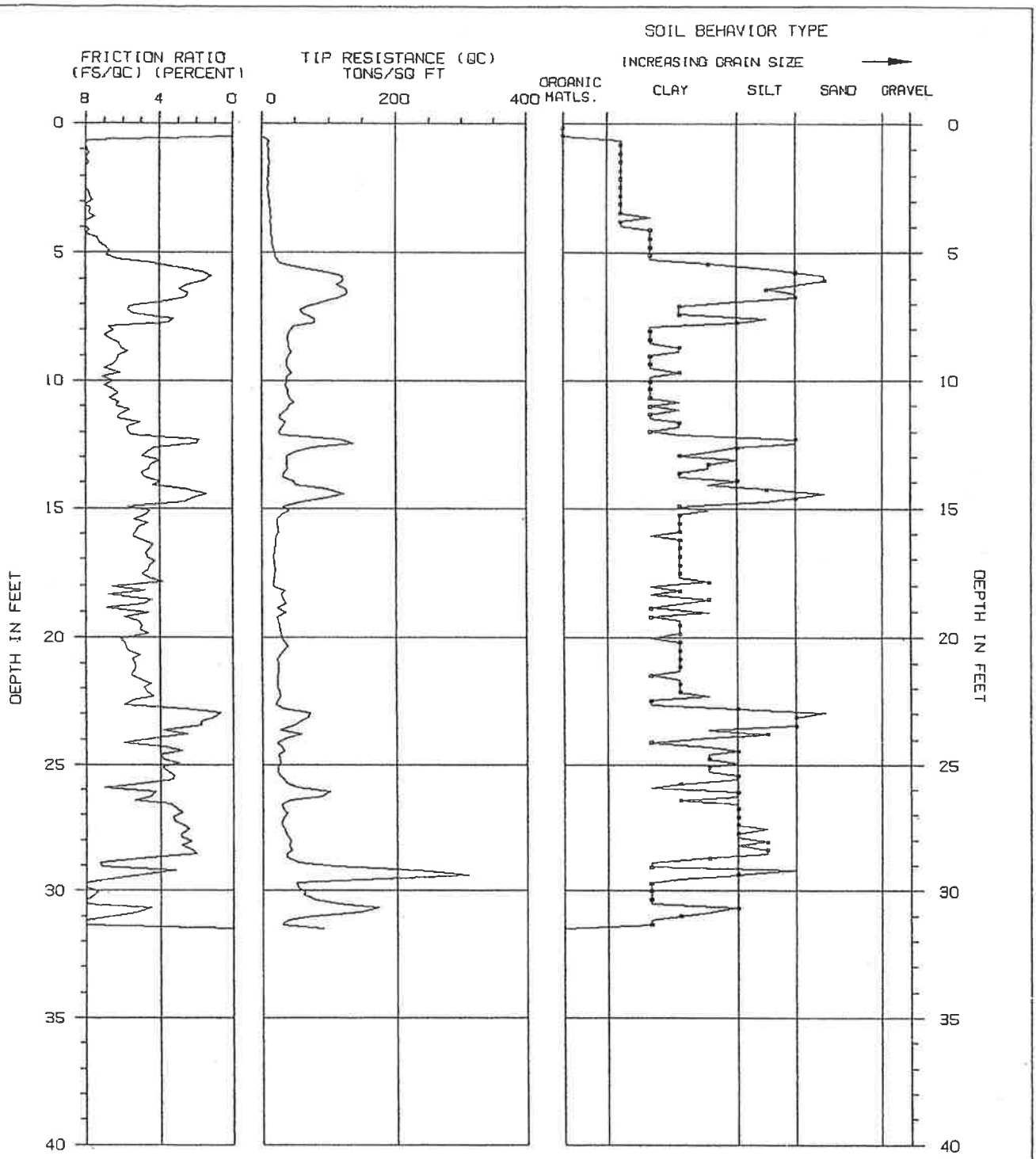
PROJECT NAME : ESC-NIPOMO H.S.

PROJECT NUMBER : 99-E775

CONE/RIG : 471\#1 JH.MR.CA

DATE/TIME: 04-20-99 15:13

HFA



TOP 0.5 FT IS DISTURBED SOIL

TIP RESISTANCE NOT CORRECTED FOR END AREA EFFECT

ASSUMED TOTAL UNIT WT = 120 PCF

ASSUMED DEPTH OF WATER TABLE = 21.0 FT

SOIL BEHAVIOR TYPE INTERPRETATIONS BASED ON: GUIDELINES FOR GEOTECHNICAL DESIGN USING THE CPT AND CPTU. SOIL MECHANICS SERIES #120. UNIVERSITY OF BRITISH COLUMBIA. SEPTEMBER 1989. BY P.K. ROBERTSON AND R.G. CAMPANELLA.

CONE PENETRATION TEST

SOUNDING NUMBER: CPT-14

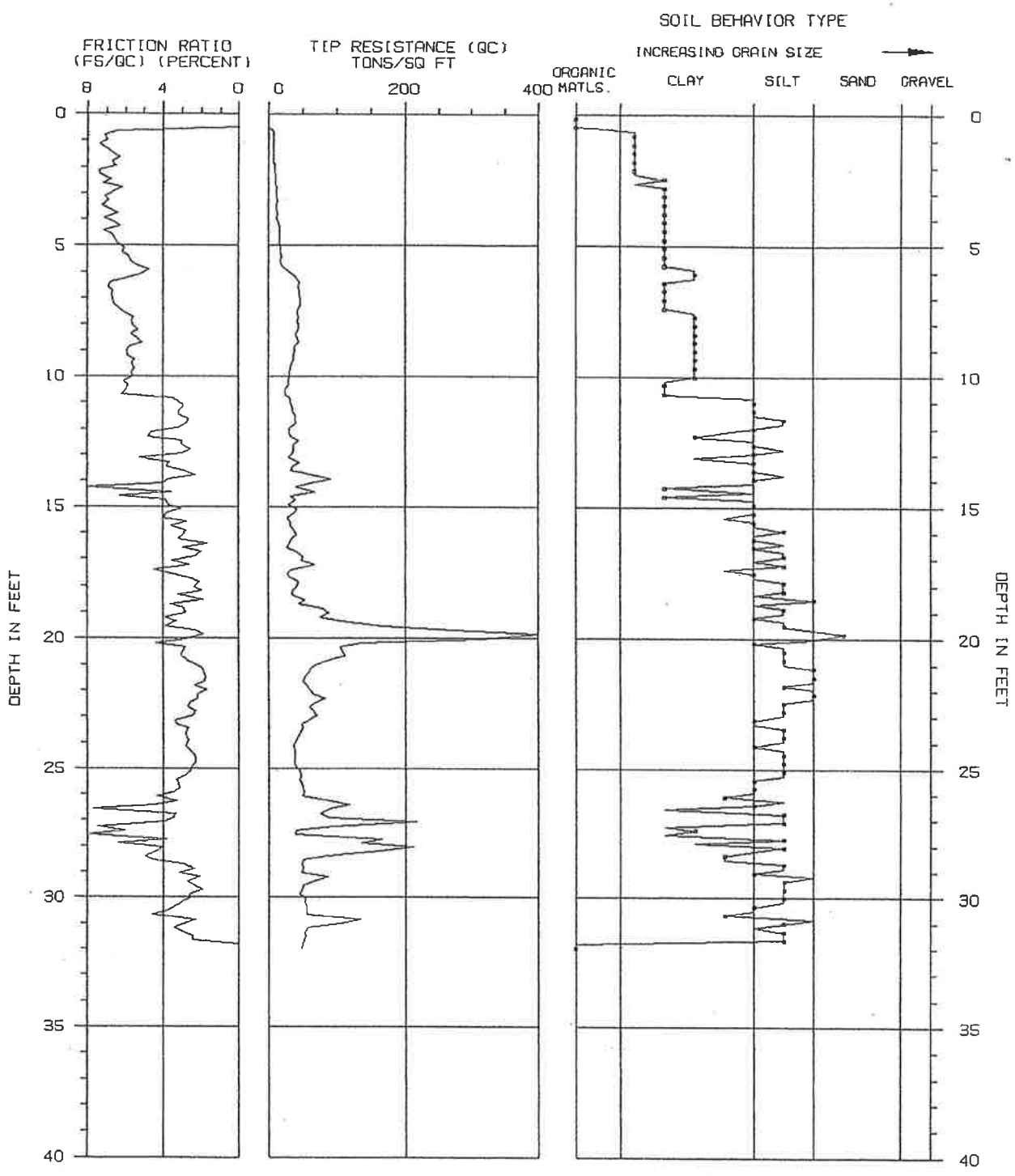
PROJECT NAME : ESC-NIPOMO H.S.

PROJECT NUMBER : 99-E775

CONE/RIG : 471\#1 JH.MR.GA

DATE/TIME: 04-20-99 15:44

HFA



TOP 0.5 FT IS DISTURBED SOIL

TIP RESISTANCE NOT CORRECTED FOR END AREA EFFECT

ASSUMED TOTAL UNIT WT = 120 PCF

ASSUMED DEPTH OF WATER TABLE = 21.0 FT

SOIL BEHAVIOR TYPE INTERPRETATIONS BASED ON: GUIDELINES FOR GEOTECHNICAL DESIGN USING THE CPT AND CPTU. SOIL MECHANICS SERIES #120. UNIVERSITY OF BRITISH COLUMBIA. SEPTEMBER 1989. BY P.K. ROBERTSON AND R.G. CAMPANELLA.

CONE PENETRATION TEST

SOUNDING NUMBER: CPT-15

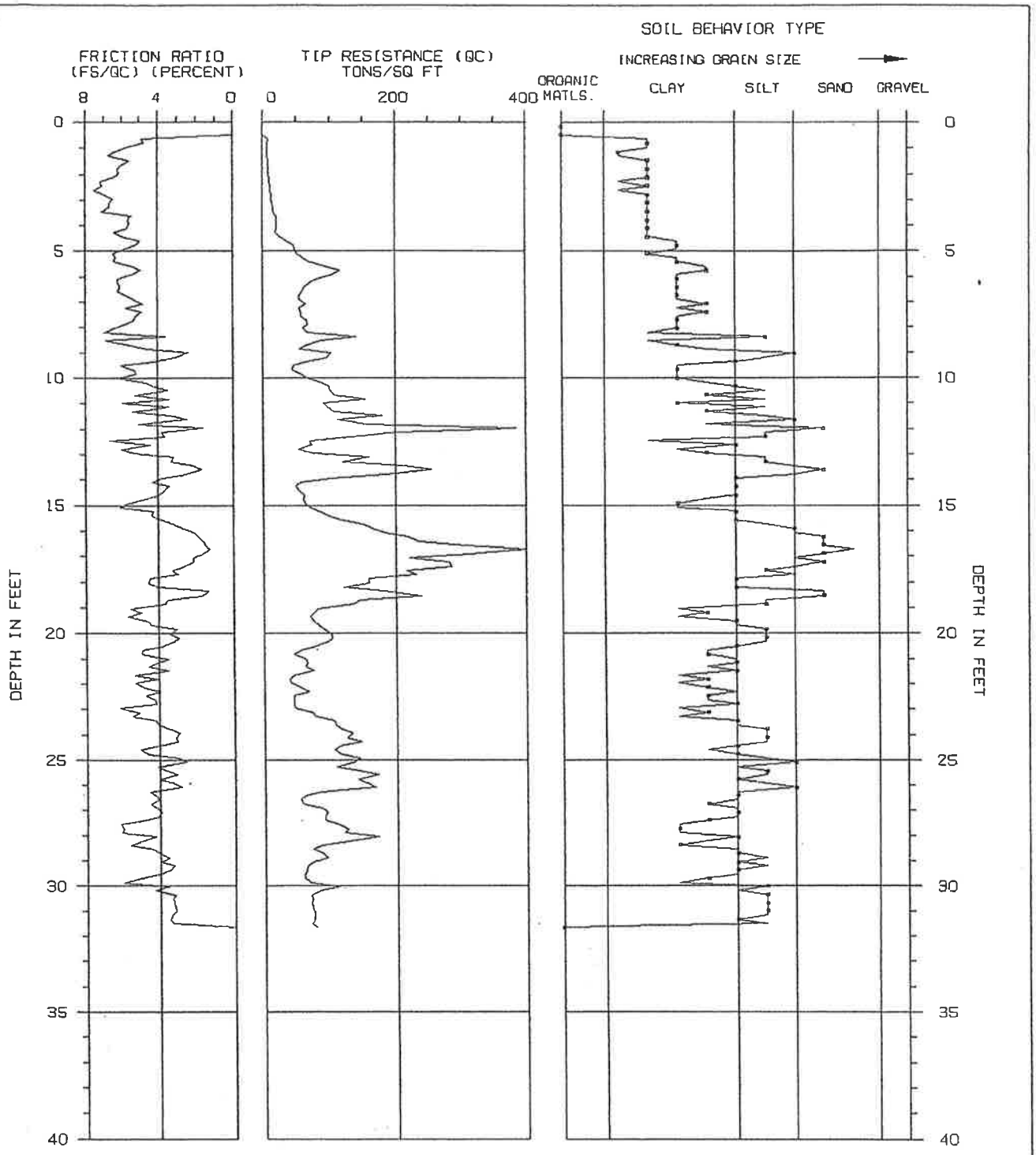
PROJECT NAME : ESC-NIPOMO H.S.

PROJECT NUMBER : 99-E775

CONE/RIG : 471\#1 JH.MR.CA

DATE/TIME: 04-21-99 05:59

HFA



TOP 0.5 FT IS DISTURBED SOIL

TIP RESISTANCE NOT CORRECTED FOR END AREA EFFECT

ASSUMED TOTAL UNIT WT = 120 PCF

ASSUMED DEPTH OF WATER TABLE = 21.0 FT

SOIL BEHAVIOR TYPE INTERPRETATIONS BASED ON: GUIDELINES FOR GEOTECHNICAL DESIGN USING THE CPT AND CPTU. SOIL MECHANICS SERIES #120. UNIVERSITY OF BRITISH COLUMBIA. SEPTEMBER 1989. BY P.K. ROBERTSON AND R.G. CAMPANELLA.

CONE PENETRATION TEST

SOUNDING NUMBER: CPT-16

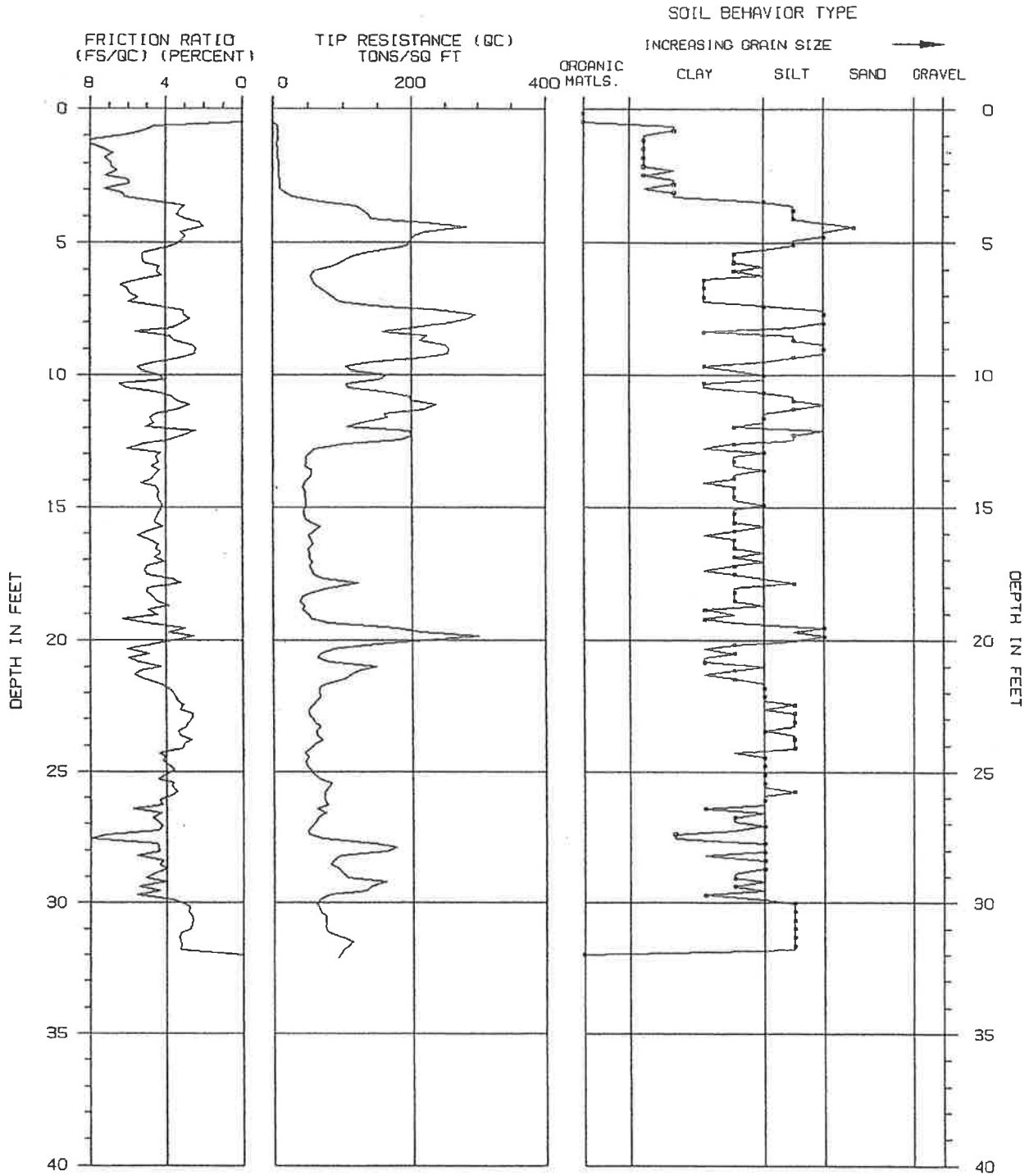
PROJECT NAME : ESC-NIPOMO H.S.

PROJECT NUMBER : 99-E775

CONE/RIG : 471\#1 JH.MR.GA

DATE/TIME: 04-21-99 06:35

HLA



TOP 0.5 FT IS DISTURBED SOIL

TIP RESISTANCE NOT CORRECTED FOR END AREA EFFECT

ASSUMED TOTAL UNIT WT = 120 PCF

ASSUMED DEPTH OF WATER TABLE = 21.0 FT

SOIL BEHAVIOR TYPE INTERPRETATIONS BASED ON: GUIDELINES FOR GEOTECHNICAL DESIGN USING THE CPT AND CPTU. SOIL MECHANICS SERIES #120. UNIVERSITY OF BRITISH COLUMBIA. SEPTEMBER 1989. BY P.K. ROBERTSON AND R.G. CAMPANELLA.

CONE PENETRATION TEST

SOUNDING NUMBER: CPT-17

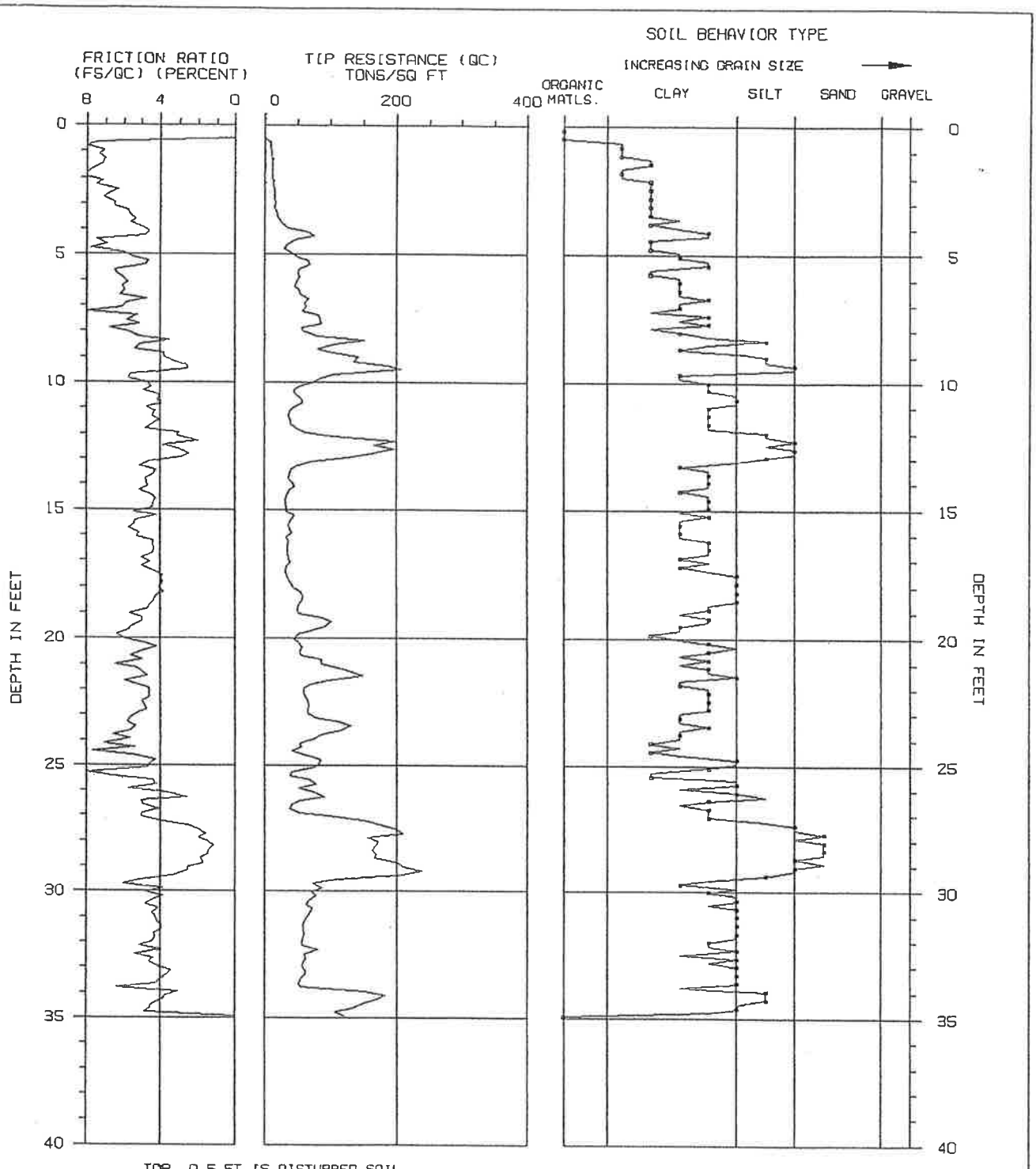
PROJECT NAME : ESC-NIPOMO H.S.

PROJECT NUMBER : 99-E775

CONE/RIG : 471\#1 JH.MR.GA

DATE/TIME: 04-21-99 07:04

HFA



TOP 0.5 FT IS DISTURBED SOIL

TIP RESISTANCE NOT CORRECTED FOR END AREA EFFECT

ASSUMED TOTAL UNIT WT = 120 PCF

ASSUMED DEPTH OF WATER TABLE = 21.0 FT

SOIL BEHAVIOR TYPE INTERPRETATIONS BASED ON: GUIDELINES FOR GEOTECHNICAL DESIGN USING THE CPT AND CPTU. SOIL MECHANICS SERIES #120. UNIVERSITY OF BRITISH COLUMBIA, SEPTEMBER 1989. BY P.K. ROBERTSON AND R.G. CAMPANELLA.

CONE PENETRATION TEST

SOUNDING NUMBER: CPT-18

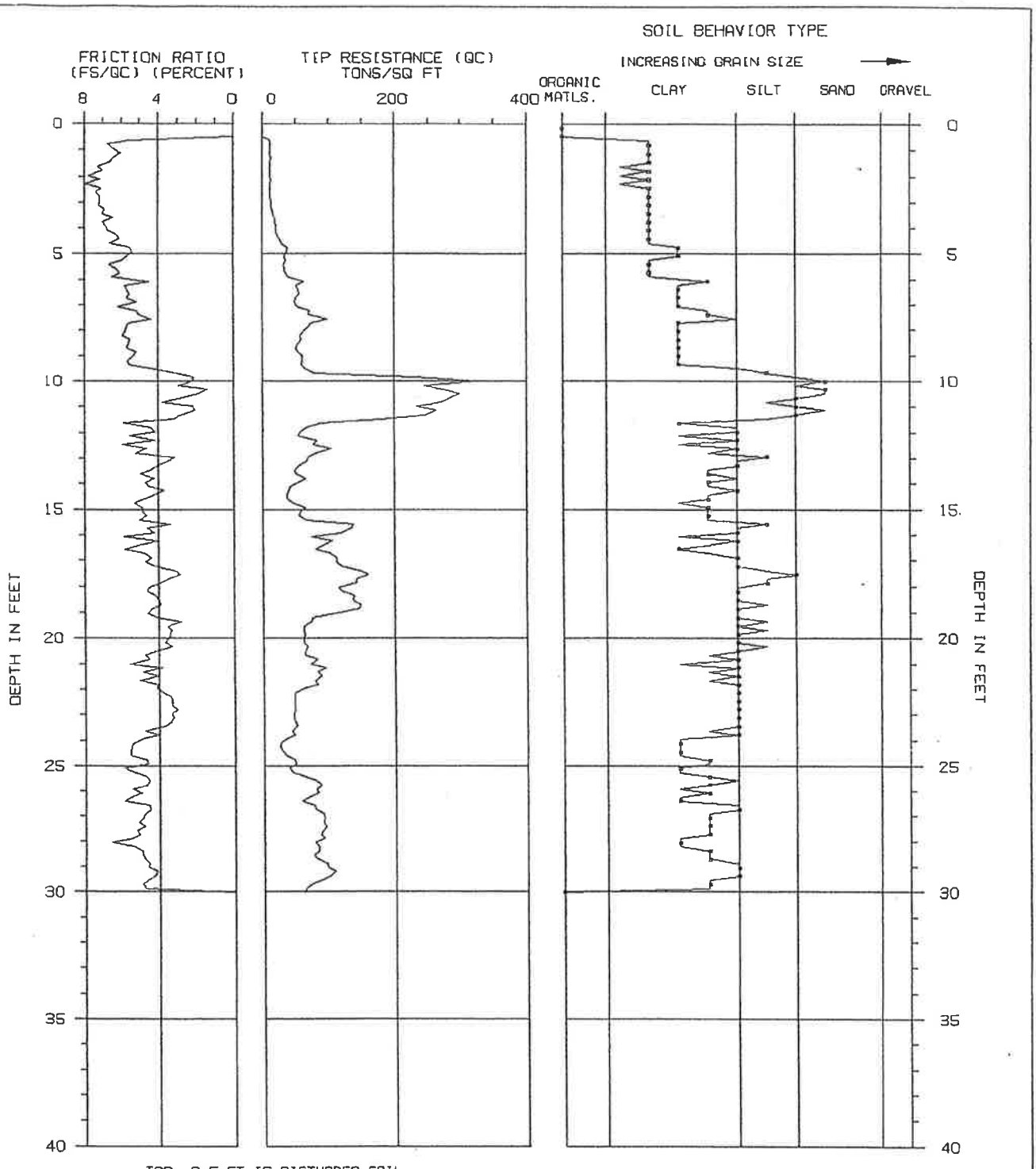
PROJECT NAME : ESC-NIPOMO H.S.

PROJECT NUMBER : 99-E775

CONE/RIG : 471\#1 JH.MR.CA

DATE/TIME: 04-21-99 07:36

HFA



TOP 0.5 FT IS DISTURBED SOIL

TIP RESISTANCE NOT CORRECTED FOR END AREA EFFECT

ASSUMED TOTAL UNIT WT = 120 PCF

ASSUMED DEPTH OF WATER TABLE = 21.0 FT

SOIL BEHAVIOR TYPE INTERPRETATIONS BASED ON: GUIDELINES FOR GEOTECHNICAL DESIGN USING THE CPT AND CPTU. SOIL MECHANICS SERIES #120. UNIVERSITY OF BRITISH COLUMBIA. SEPTEMBER 1989. BY P.K. ROBERTSON AND R.G. CAMPANELLA.

CONE PENETRATION TEST

SOUNDING NUMBER: CPT-19

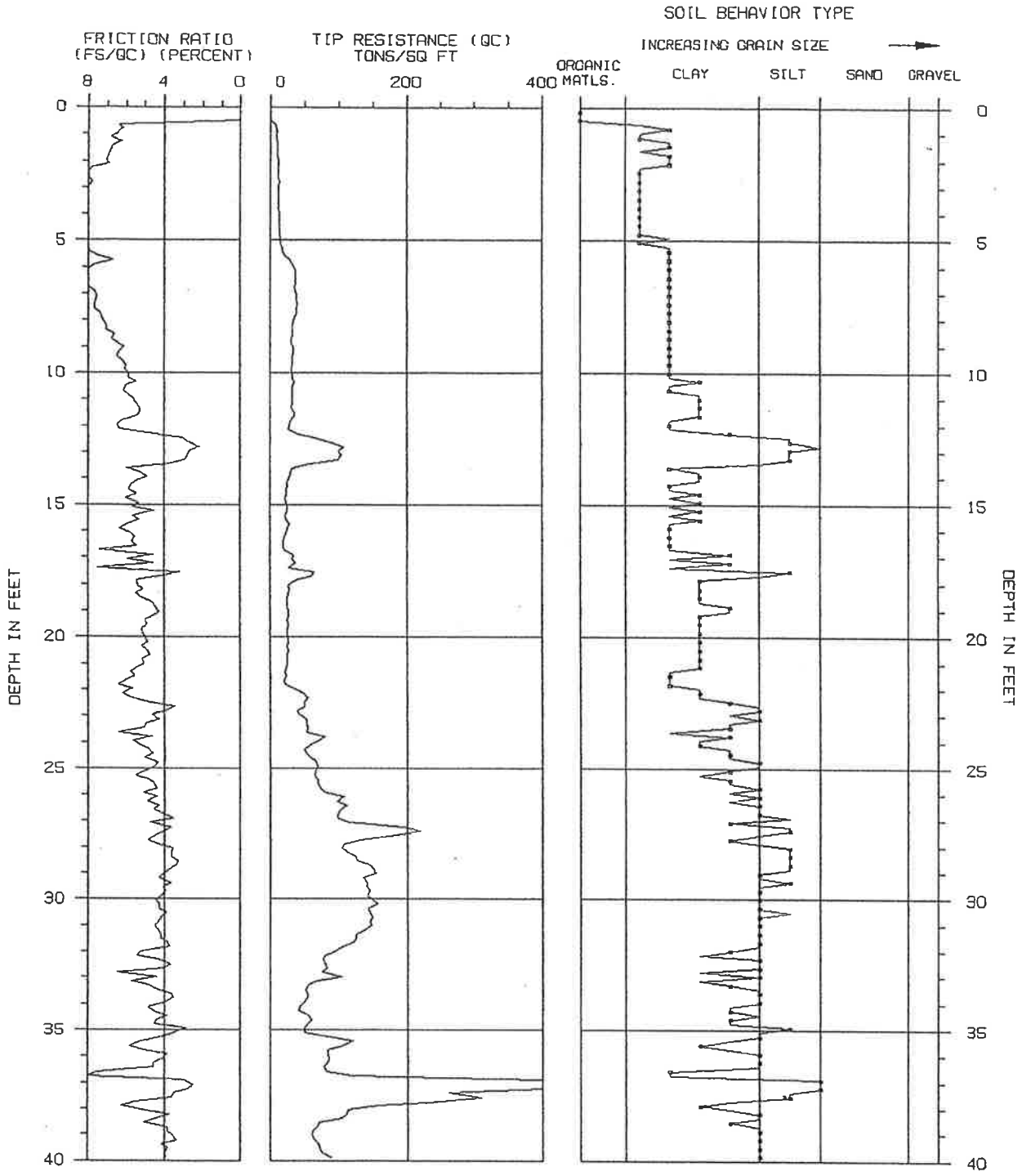
PROJECT NAME : ESC-NIPOMO H.S.

PROJECT NUMBER : 99-E775

CONE/RIG : 471\#1 JH.MR.CA

DATE/TIME: 04-21-99 08:30

HFA



TOP 0.5 FT IS DISTURBED SOIL

TIP RESISTANCE NOT CORRECTED FOR END AREA EFFECT

ASSUMED TOTAL UNIT WT = 120 PCF

ASSUMED DEPTH OF WATER TABLE = 21.0 FT

SOIL BEHAVIOR TYPE INTERPRETATIONS BASED ON: GUIDELINES FOR GEOTECHNICAL DESIGN USING THE CPT AND CPTU. SOIL MECHANICS SERIES #120. UNIVERSITY OF BRITISH COLUMBIA. SEPTEMBER 1989. BY P.K. ROBERTSON AND R.G. CAMPANELLA.

CONE PENETRATION TEST

SOUNDING NUMBER: CPT-20

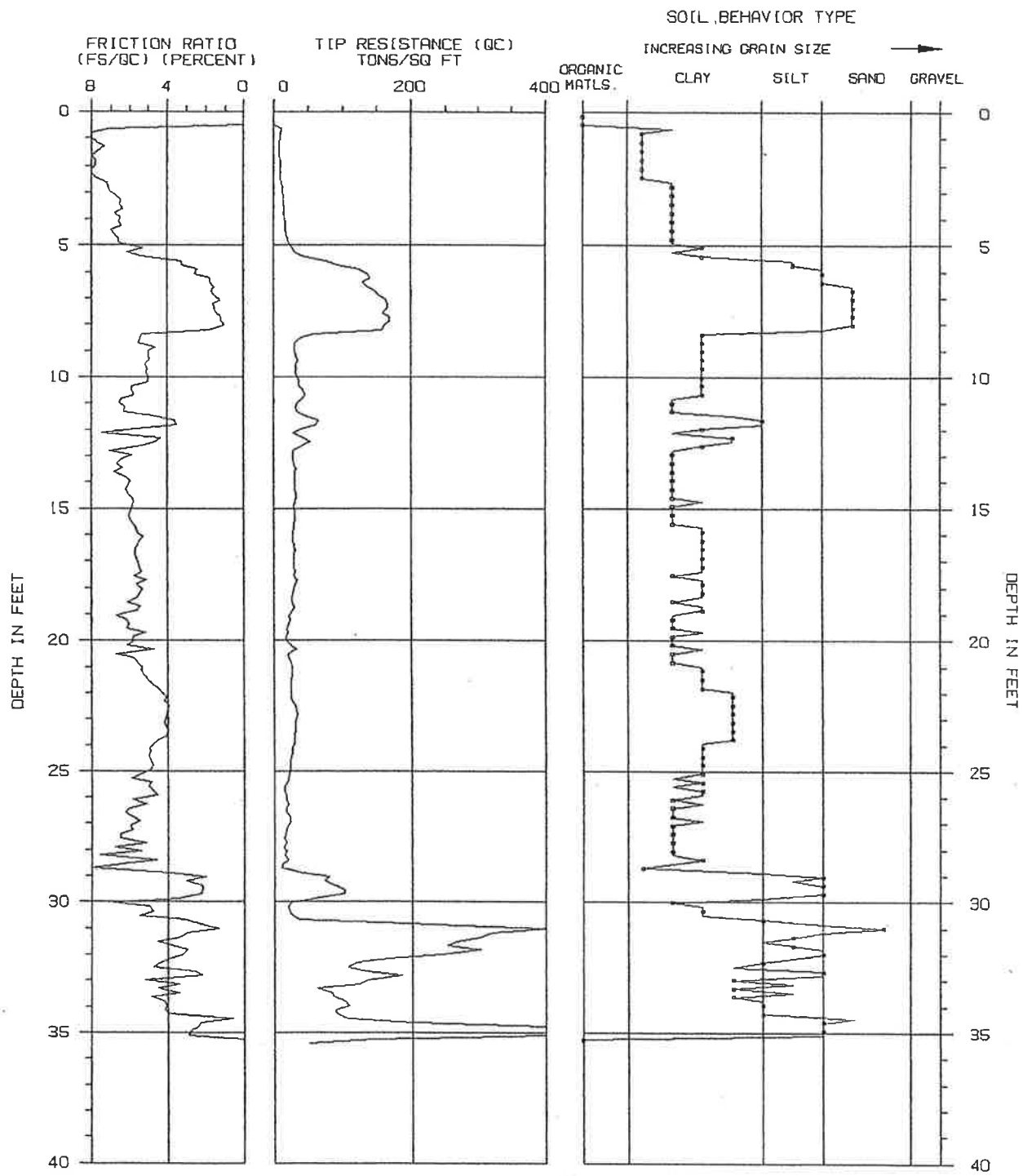
PROJECT NAME : ESC-NIPOMO H.S.

PROJECT NUMBER : 99-E775

CONE/RIG : 471\#1 JH.MR.CA

DATE/TIME: 04-21-99 08:58

HFA



TOP 0.5 FT IS DISTURBED SOIL

TIP RESISTANCE NOT CORRECTED FOR END AREA EFFECT

ASSUMED TOTAL UNIT WT = 120 PCF

ASSUMED DEPTH OF WATER TABLE = 21.0 FT

SOIL BEHAVIOR TYPE INTERPRETATIONS BASED ON: GUIDELINES FOR GEOTECHNICAL DESIGN USING THE CPT AND CPTU. SOIL MECHANICS SERIES #120. UNIVERSITY OF BRITISH COLUMBIA. SEPTEMBER 1989. BY P.K. ROBERTSON AND R.G. CAMPANELLA.

CONE PENETRATION TEST

SOUNDING NUMBER: CPT-21

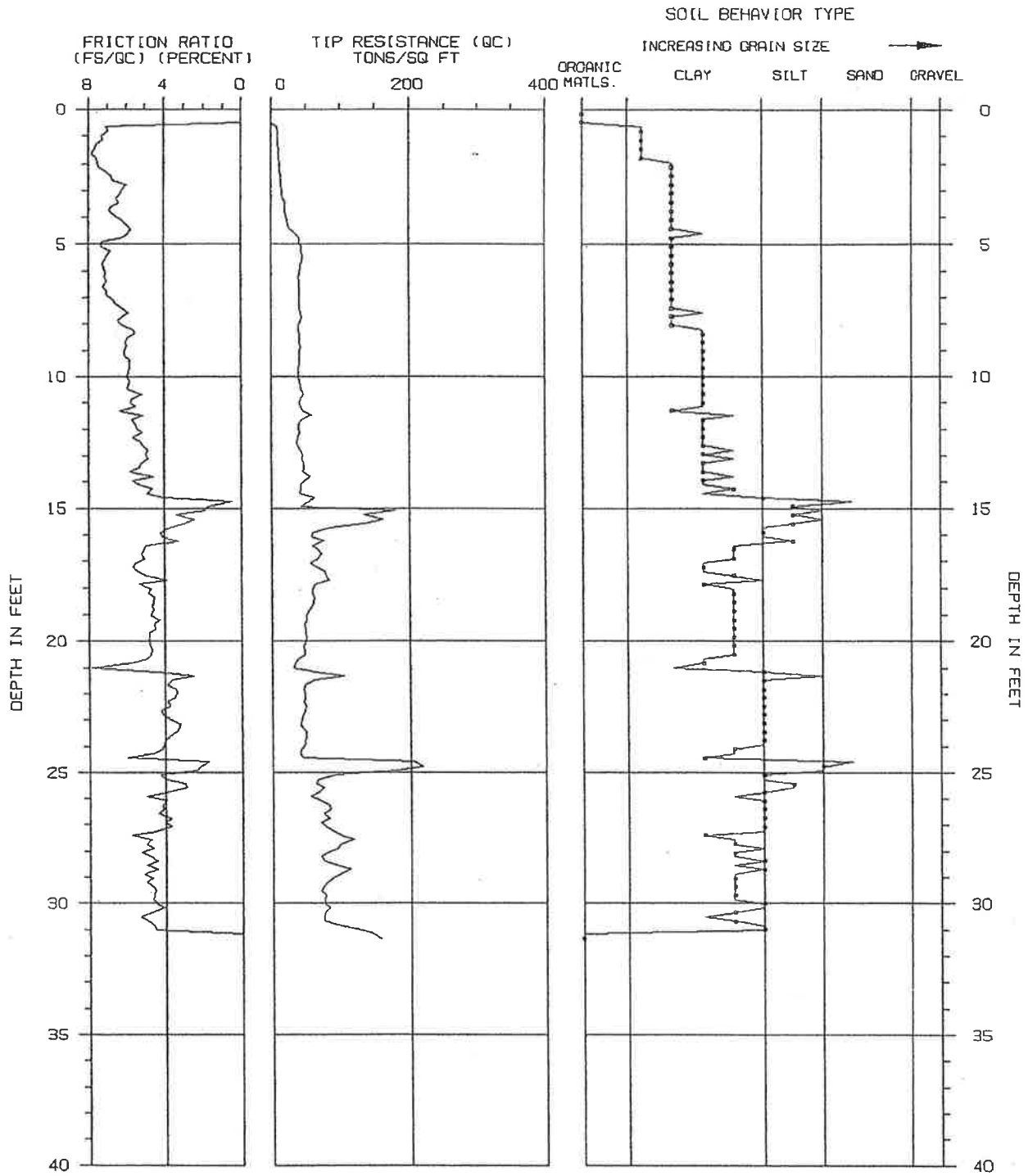
PROJECT NAME : ESC-NIPOMO H.S.

PROJECT NUMBER : 99-E775

CONE/RIG : 471\#1 JH.MR.GA

DATE/TIME: 04-21-99 09:37

HFA



TOP 0.5 FT IS DISTURBED SOIL

TIP RESISTANCE NOT CORRECTED FOR END AREA EFFECT

ASSUMED TOTAL UNIT WT = 120 PCF

ASSUMED DEPTH OF WATER TABLE = 21.0 FT

SOIL BEHAVIOR TYPE INTERPRETATIONS BASED ON: GUIDELINES FOR GEOTECHNICAL DESIGN USING THE CPT AND CPTU. SOIL MECHANICS SERIES #120. UNIVERSITY OF BRITISH COLUMBIA. SEPTEMBER 1989. BY P.K. ROBERTSON AND R.G. CAMPANELLA.

CONE PENETRATION TEST

SOUNDING NUMBER: CPT-22

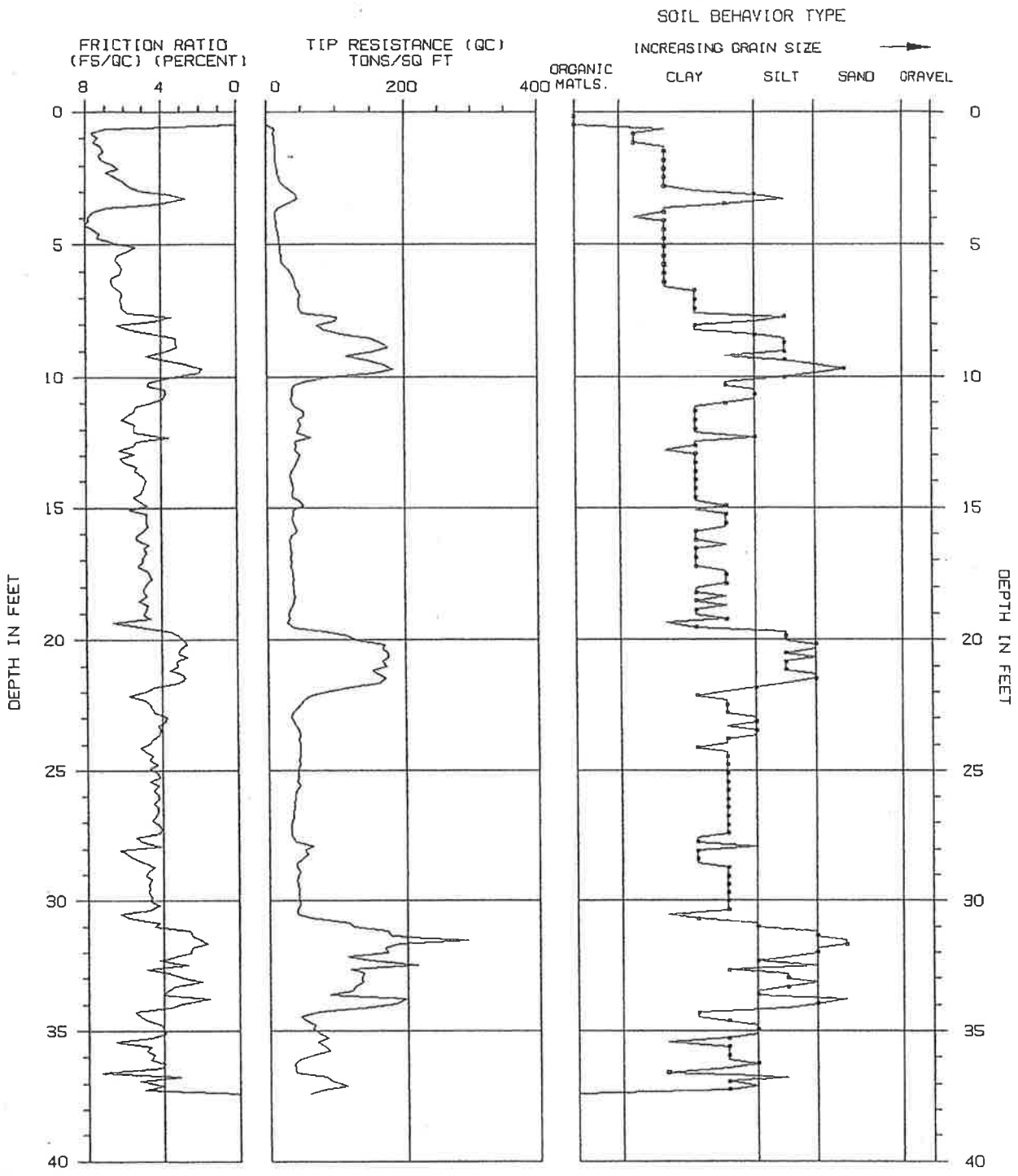
PROJECT NAME : ESC-NIPOMO H.S.

PROJECT NUMBER : 99-E775

CONE/RIG : 471\#1 JH.MR.GA

DATE/TIME: 04-21-99 12:30

HFA



TOP 0.5 FT IS DISTURBED SOIL

TIP RESISTANCE NOT CORRECTED FOR END AREA EFFECT

ASSUMED TOTAL UNIT WT = 120 PCF

ASSUMED DEPTH OF WATER TABLE = 21.0 FT

SOIL BEHAVIOR TYPE INTERPRETATIONS BASED ON: GUIDELINES FOR GEOTECHNICAL DESIGN USING THE CPT AND CPTU. SOIL MECHANICS SERIES #120. UNIVERSITY OF BRITISH COLUMBIA. SEPTEMBER 1989. BY P.K. ROBERTSON AND R.G. CAMPANELLA.

CONE PENETRATION TEST

SOUNDING NUMBER: CPT-23

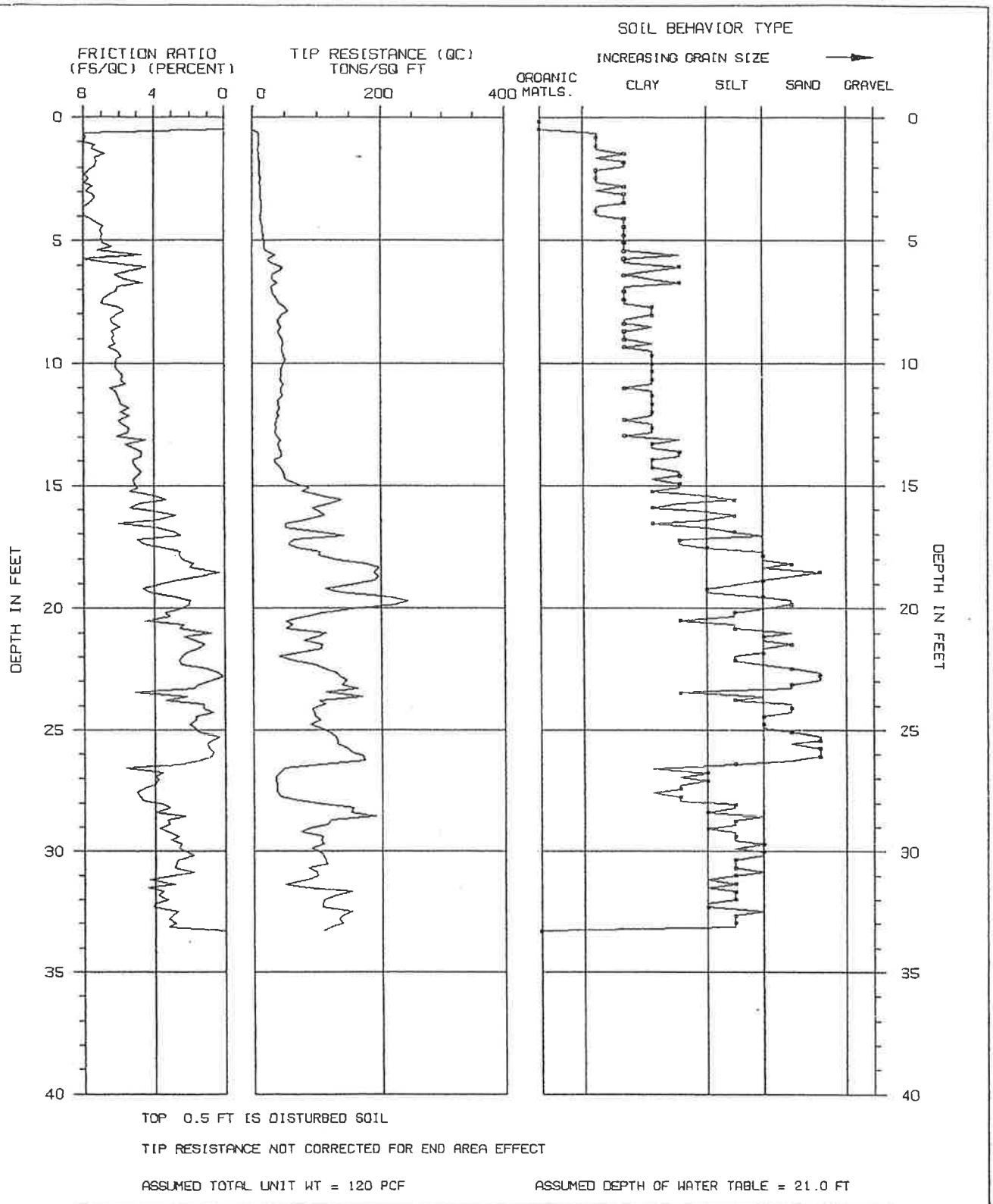
PROJECT NAME : ESC-NIPOMO H.S.

PROJECT NUMBER : 99-E775

CONE/RIG : 471\#1 JH.MR.CA

DATE/TIME: 04-21-99 12:56

HFA



TOP 0.5 FT IS DISTURBED SOIL

TIP RESISTANCE NOT CORRECTED FOR END AREA EFFECT

ASSUMED TOTAL UNIT WT = 120 PCF

ASSUMED DEPTH OF WATER TABLE = 21.0 FT

SOIL BEHAVIOR TYPE INTERPRETATIONS BASED ON: GUIDELINES FOR GEOTECHNICAL DESIGN USING THE CPT AND CPTU. SOIL MECHANICS SERIES #120. UNIVERSITY OF BRITISH COLUMBIA. SEPTEMBER 1989. BY P.K. ROBERTSON AND R.G. CAMPANELLA.

CONE PENETRATION TEST

SOUNDING NUMBER: CPT-24

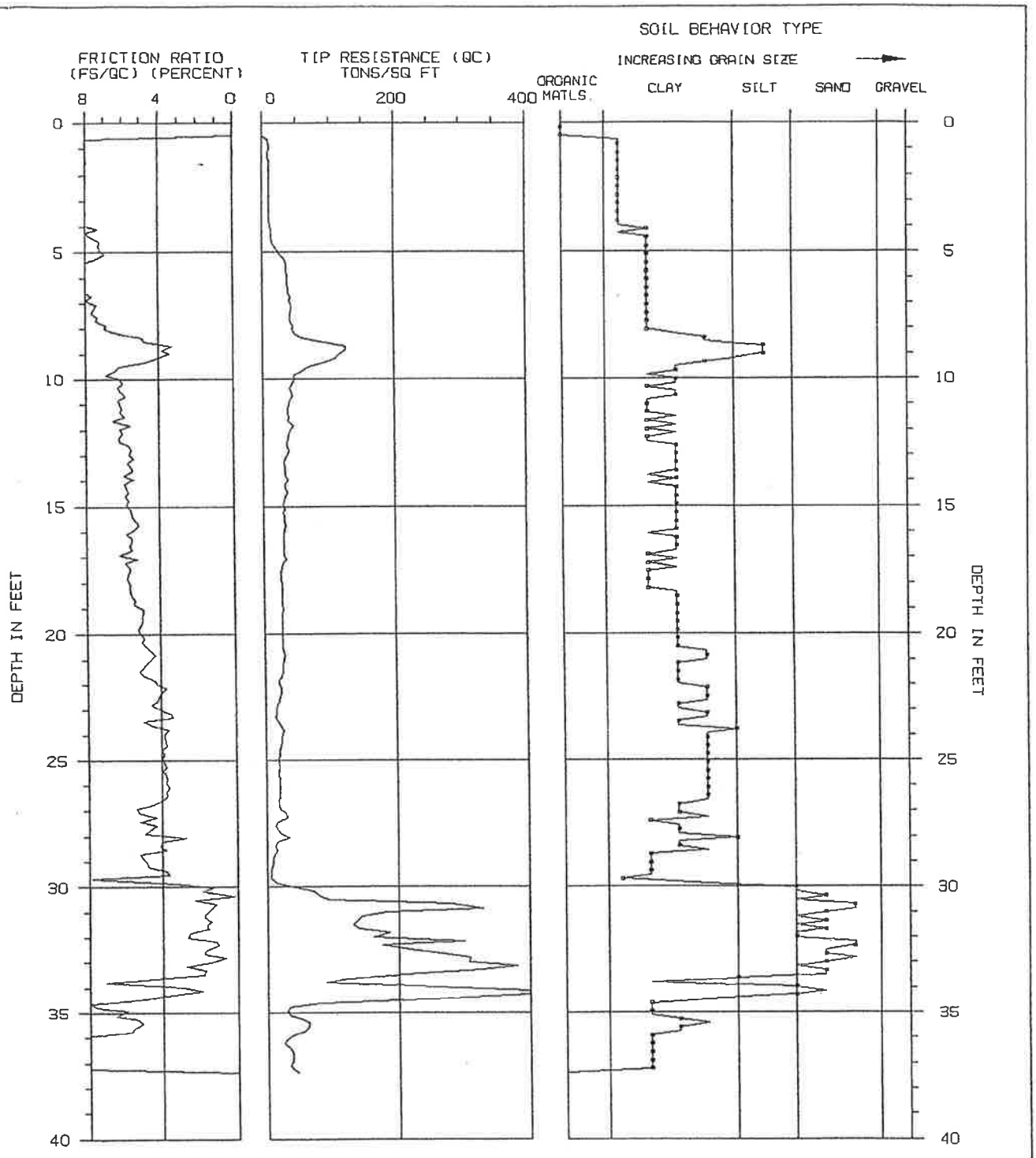
PROJECT NAME : ESC-NIPOMO H.S.

PROJECT NUMBER : 99-E775

CONE/RIG : 471\#1 JH.MR.GA

DATE/TIME: 04-21-99 14:15

HFA



TOP 0.5 FT IS DISTURBED SOIL

TIP RESISTANCE NOT CORRECTED FOR END AREA EFFECT

ASSUMED TOTAL UNIT WT = 120 PCF

ASSUMED DEPTH OF WATER TABLE = 21.0 FT

SOIL BEHAVIOR TYPE INTERPRETATIONS BASED ON: GUIDELINES FOR GEOTECHNICAL DESIGN USING THE CPT AND CPTU. SOIL MECHANICS SERIES #120. UNIVERSITY OF BRITISH COLUMBIA. SEPTEMBER 1989. BY P.K. ROBERTSON AND R.G. CAMPANELLA.

CONE PENETRATION TEST

SOUNDING NUMBER: CPT-25

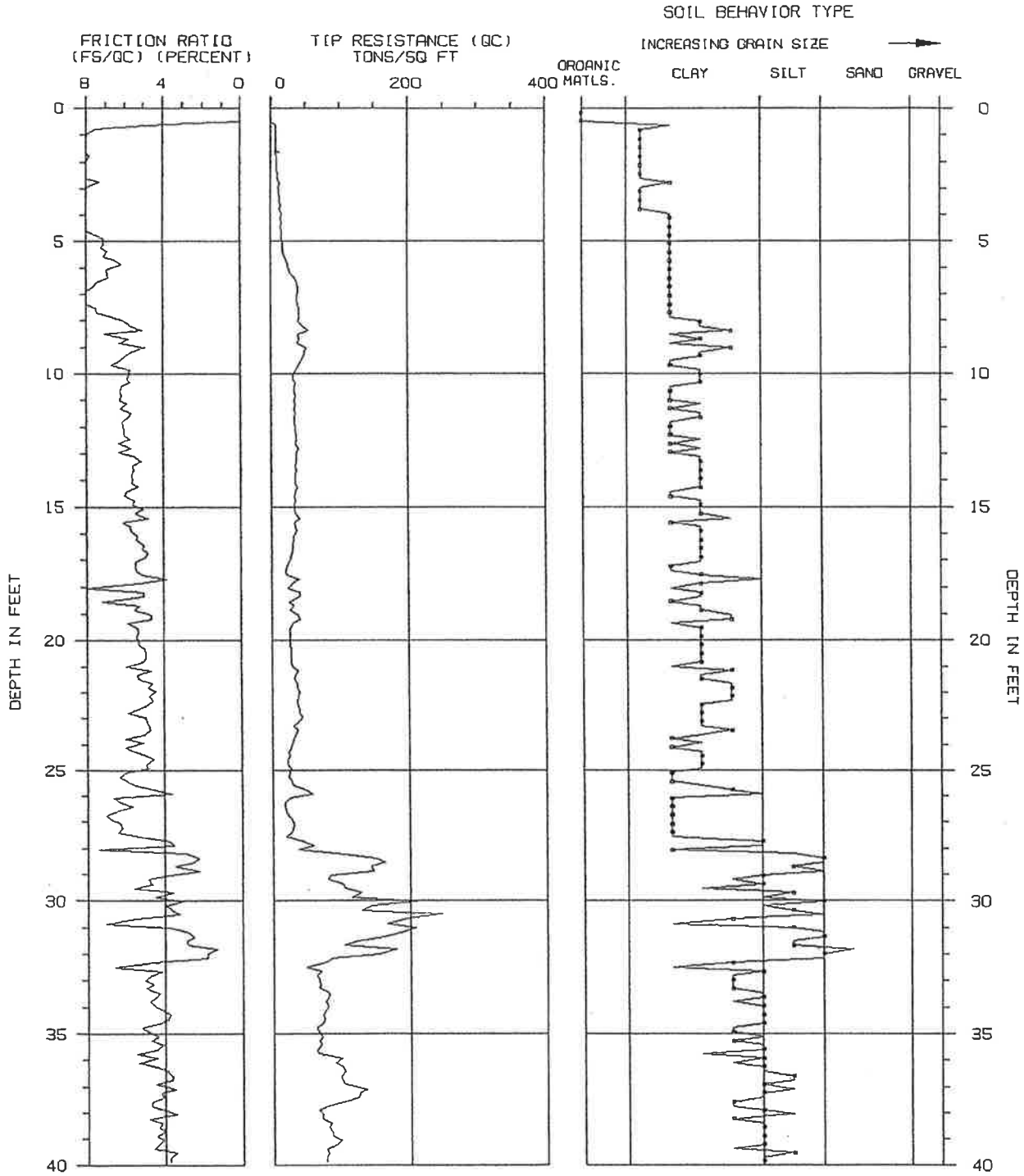
PROJECT NAME : ESC-NIPOMO H.S.

PROJECT NUMBER : 99-E775

CONE/RIG : 495\#1 JH.MR.CA

DATE/TIME: 04-21-99 14:48

HFA



TOP 0.5 FT IS DISTURBED SOIL

TIP RESISTANCE NOT CORRECTED FOR END AREA EFFECT

ASSUMED TOTAL UNIT WT = 120 PCF

ASSUMED DEPTH OF WATER TABLE = 15.0 FT

SOIL BEHAVIOR TYPE INTERPRETATIONS BASED ON: GUIDELINES FOR GEOTECHNICAL DESIGN USING THE CPT AND CPTU. SOIL MECHANICS SERIES #120. UNIVERSITY OF BRITISH COLUMBIA. SEPTEMBER 1989. BY P.K. ROBERTSON AND R.G. CAMPANELLA.

CONE PENETRATION TEST SOUNDING NUMBER: CPT-26 (1 OF 2)

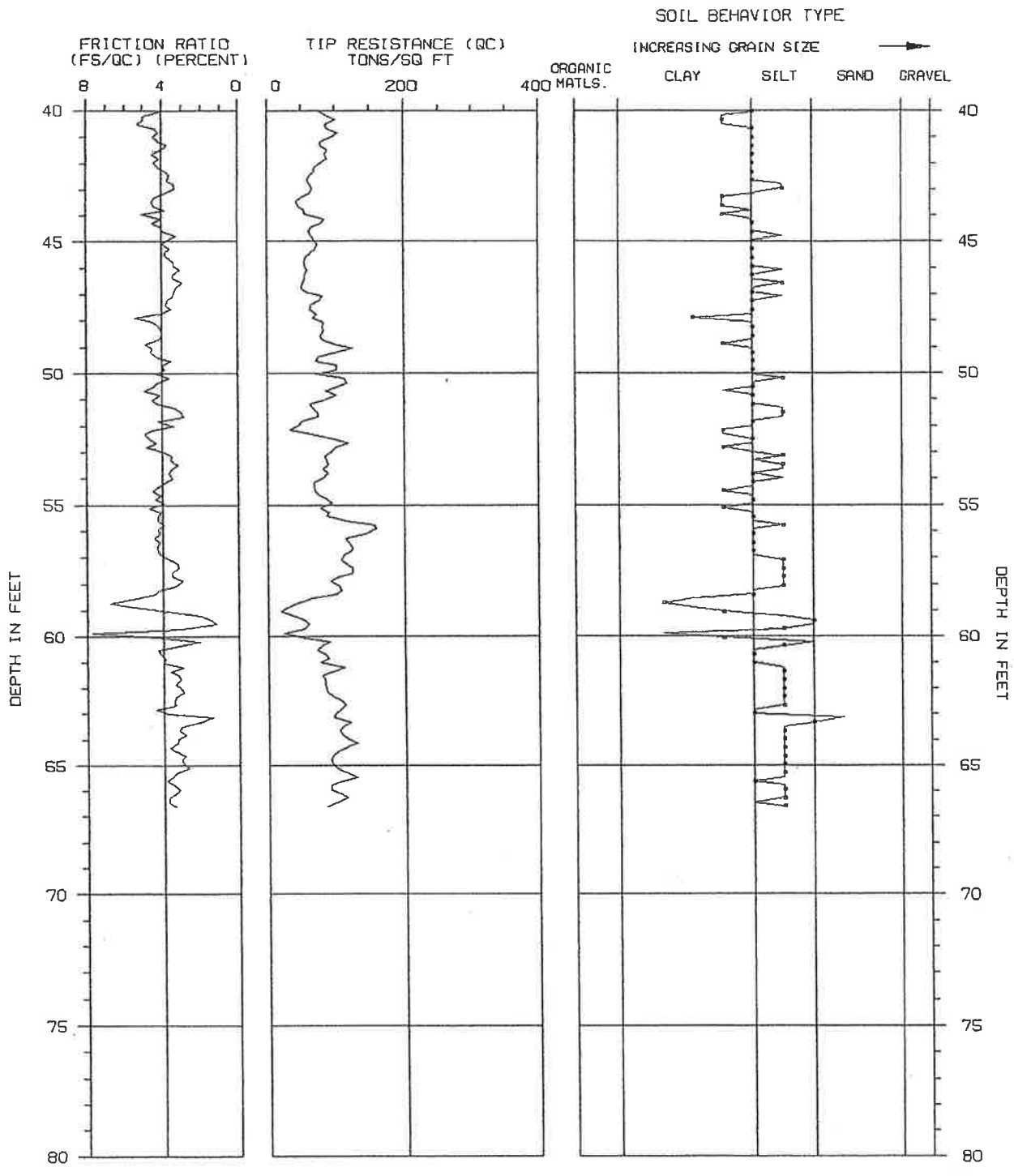
PROJECT NAME : ESC-NIPOMO H.S.

PROJECT NUMBER : 99-E775

CONE/RIG : 473\#1 JH.MR.CA

DATE/TIME: 04-22-99 11:31

HFA



TIP RESISTANCE NOT CORRECTED FOR END AREA EFFECT

ASSUMED TOTAL UNIT WT = 120 PCF

ASSUMED DEPTH OF WATER TABLE = 15.0 FT

SOIL BEHAVIOR TYPE INTERPRETATIONS BASED ON: GUIDELINES FOR GEOTECHNICAL DESIGN USING THE CPT AND CPTU. SOIL MECHANICS SERIES #120. UNIVERSITY OF BRITISH COLUMBIA. SEPTEMBER 1989. BY P.K. ROBERTSON AND R.G. CAMPANELLA.

CONE PENETRATION TEST SOUNDING NUMBER: CPT-26 (2 OF 2)

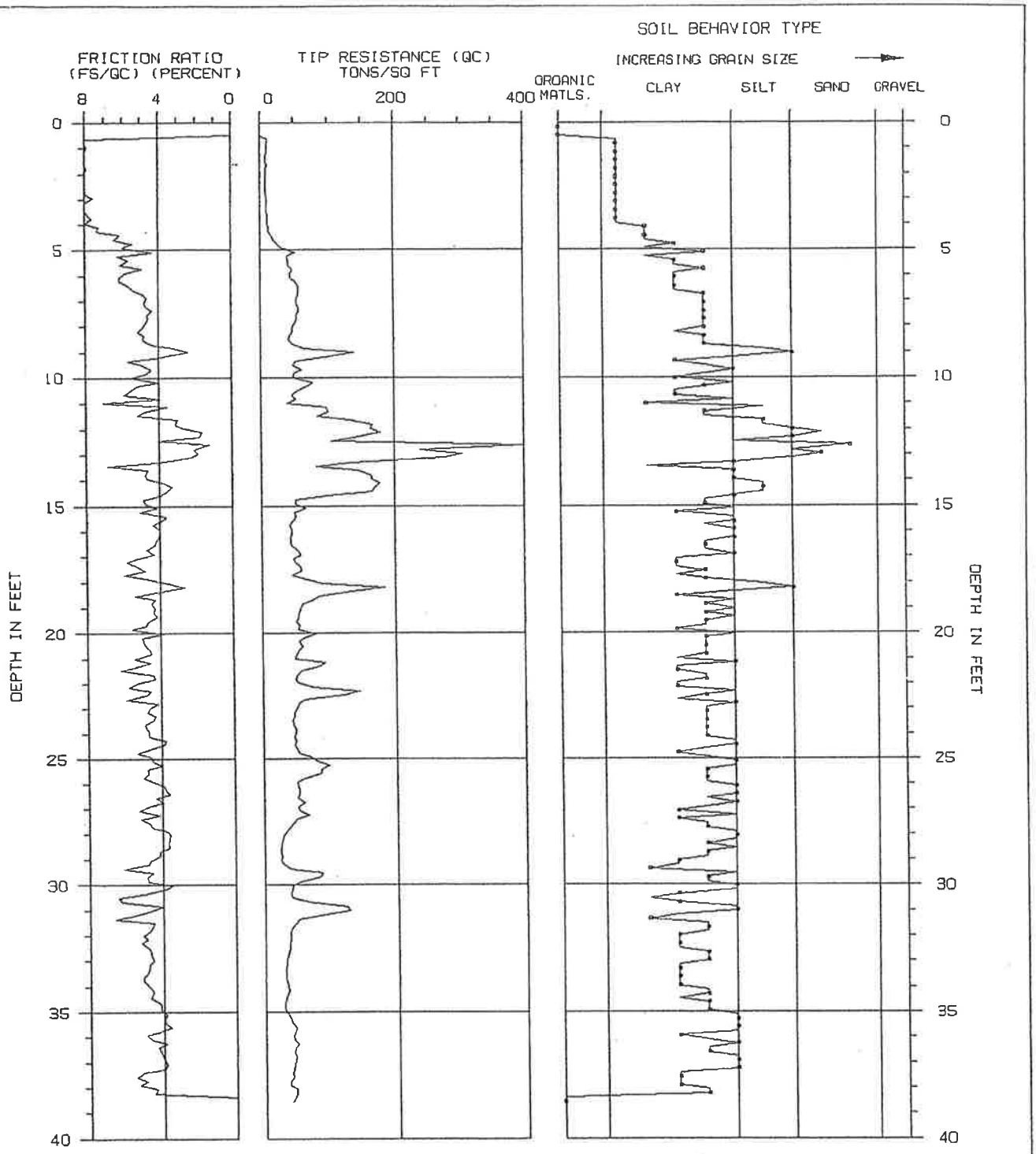
PROJECT NAME : ESC-NIPOMO H.S.

PROJECT NUMBER : 99-E775

CONE/RIG : 473\#1 JH.MR.CA

DATE/TIME: 04-22-99 11:31

HFA



TOP 0.5 FT IS DISTURBED SOIL

TIP RESISTANCE NOT CORRECTED FOR END AREA EFFECT

ASSUMED TOTAL UNIT WT = 120 PCF

ASSUMED DEPTH OF WATER TABLE = 15.0 FT

SOIL BEHAVIOR TYPE INTERPRETATIONS BASED ON: GUIDELINES FOR GEOTECHNICAL DESIGN USING THE CPT AND CPTU. SOIL MECHANICS SERIES #120. UNIVERSITY OF BRITISH COLUMBIA. SEPTEMBER 1989. BY P.K. ROBERTSON AND R.G. CAMPANELLA.

CONE PENETRATION TEST

SOUNDING NUMBER: CPT-27

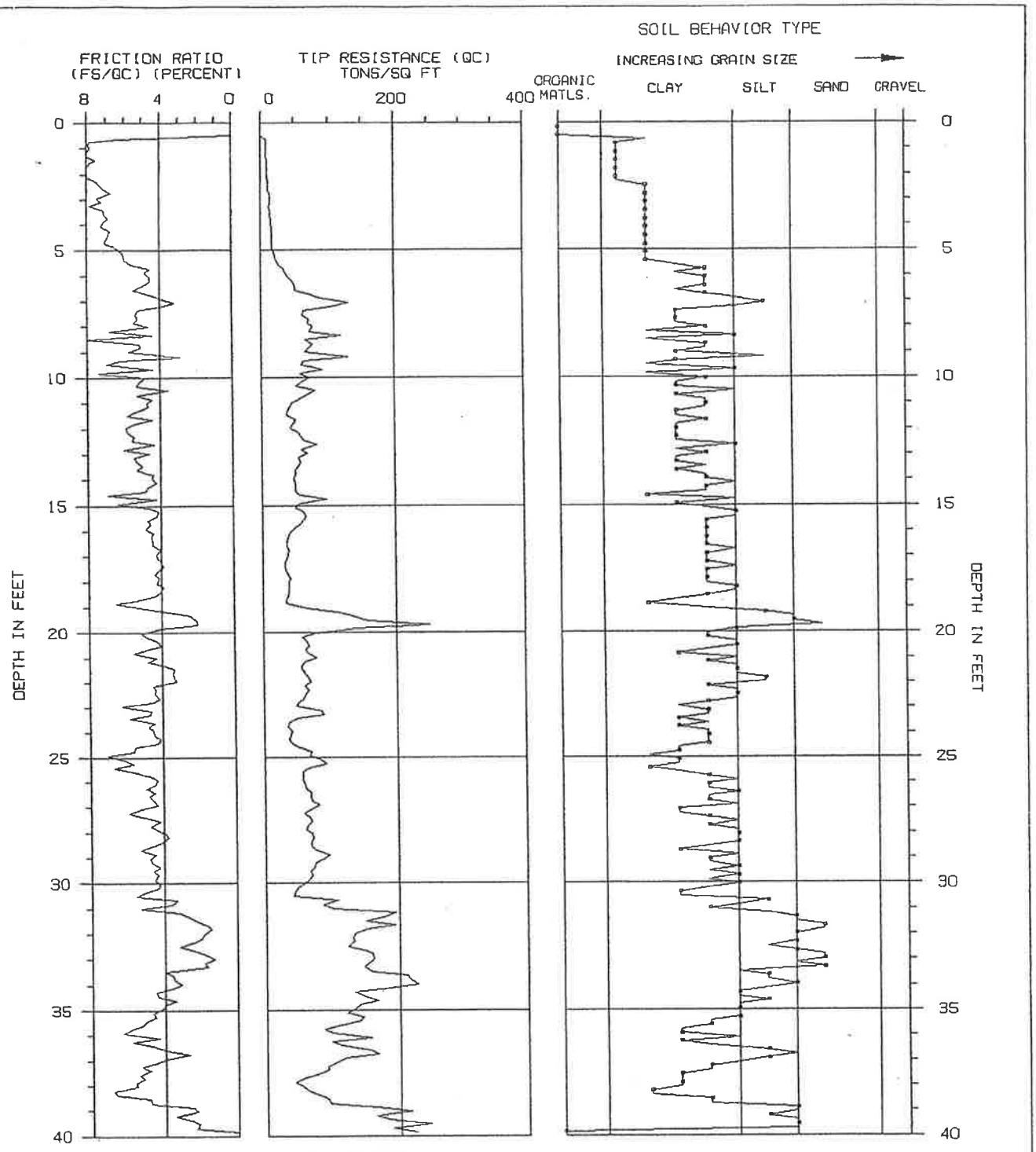
PROJECT NAME : ESC-NIPOMO H.S.

PROJECT NUMBER : 99-E775

CONE/RIG : 495\#1 JH.MR.CA

DATE/TIME: 04-21-99 15:33

HFA



TOP 0.5 FT IS DISTURBED SOIL

TIP RESISTANCE NOT CORRECTED FOR END AREA EFFECT

ASSUMED TOTAL UNIT WT = 120 PCF

ASSUMED DEPTH OF WATER TABLE = 15.0 FT

SOIL BEHAVIOR TYPE INTERPRETATIONS BASED ON: GUIDELINES FOR GEOTECHNICAL DESIGN USING THE CPT AND CPTU. SOIL MECHANICS SERIES #120. UNIVERSITY OF BRITISH COLUMBIA. SEPTEMBER 1989. BY P.K. ROBERTSON AND R.G. CAMPANELLA.

CONE PENETRATION TEST

SOUNDING NUMBER: CPT-28

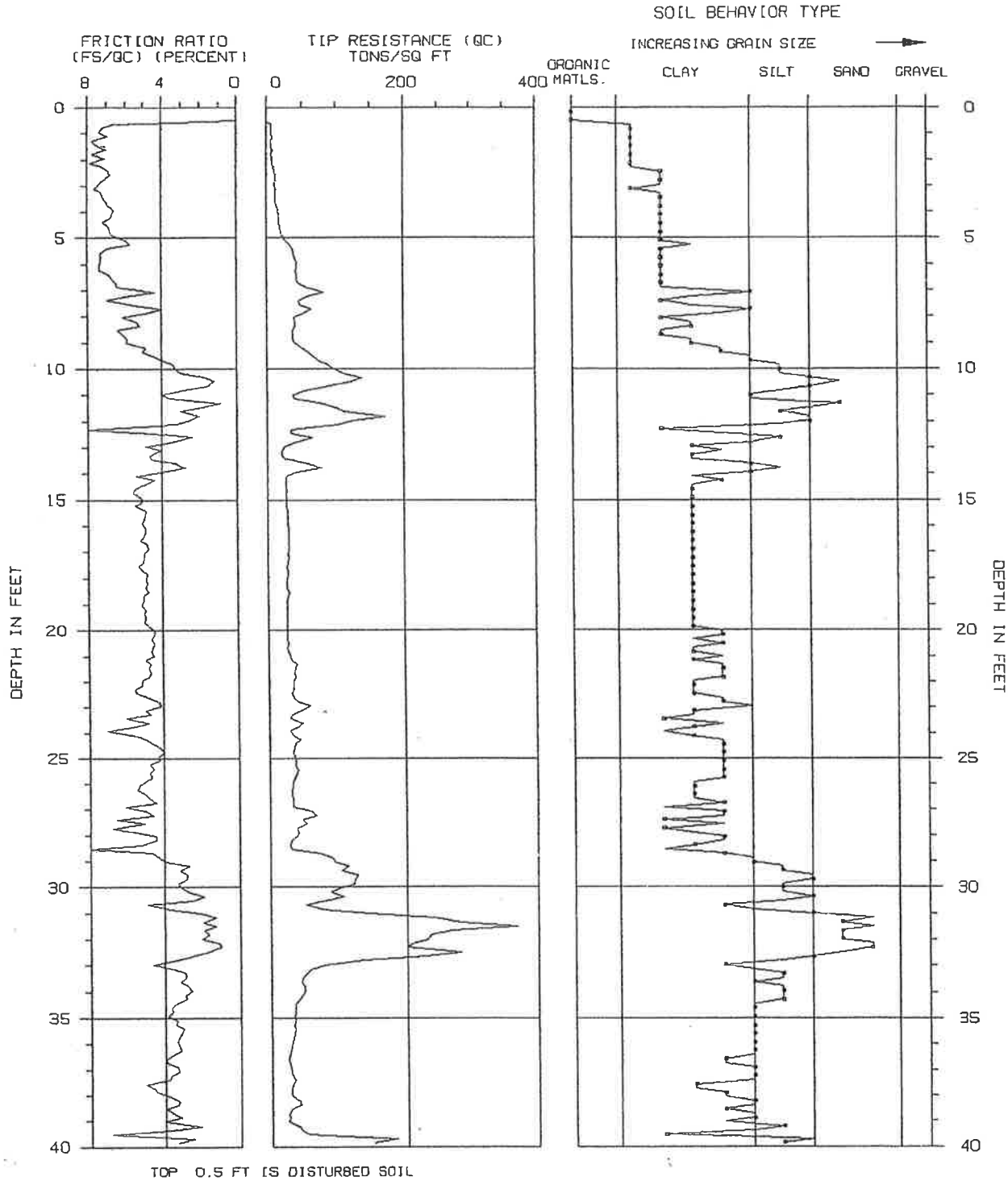
PROJECT NAME : ESC-NIPOMO H.S.

PROJECT NUMBER : 99-E775

CONE/RIG : 495\#1 JH.MR.CA

DATE/TIME: 04-21-99 16:12

HFA



TOP 0.5 FT IS DISTURBED SOIL

TIP RESISTANCE NOT CORRECTED FOR END AREA EFFECT

ASSUMED TOTAL UNIT WT = 120 PCF

ASSUMED DEPTH OF WATER TABLE = 15.0 FT

SOIL BEHAVIOR TYPE INTERPRETATIONS BASED ON: GUIDELINES FOR GEOTECHNICAL DESIGN USING THE CPT AND CPTU. SOIL MECHANICS SERIES #120. UNIVERSITY OF BRITISH COLUMBIA. SEPTEMBER 1989. BY P.K. ROBERTSON AND R.G. CAMPANELLA.

CONE PENETRATION TEST

SOUNDING NUMBER: CPT-29

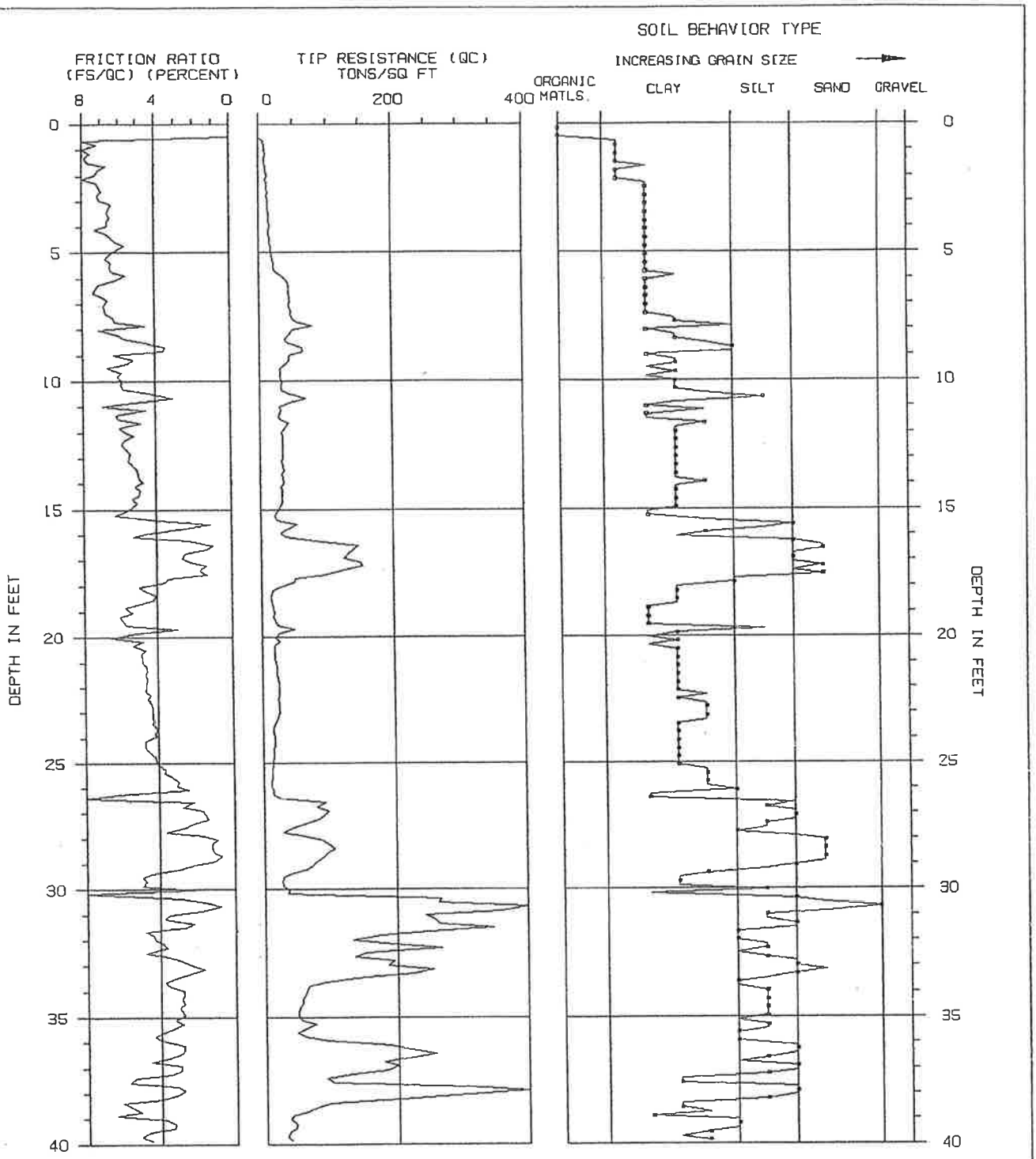
PROJECT NAME : ESC-NIPOMO H.S.

PROJECT NUMBER : 99-E775

CONE/RIG : 495\#1 JH.MR.DA

DATE/TIME: 04-22-99 06:12

HFA



TOP 0.5 FT IS DISTURBED SOIL

TIP RESISTANCE NOT CORRECTED FOR END AREA EFFECT

ASSUMED TOTAL UNIT WT = 120 PCF

ASSUMED DEPTH OF WATER TABLE = 15.0 FT

SOIL BEHAVIOR TYPE INTERPRETATIONS BASED ON: GUIDELINES FOR GEOTECHNICAL DESIGN USING THE CPT AND CPTU. SOIL MECHANICS SERIES #120. UNIVERSITY OF BRITISH COLUMBIA. SEPTEMBER 1989. BY P.K. ROBERTSON AND R.G. CAMPANELLA.

CONE PENETRATION TEST

SOUNDING NUMBER: CPT-30

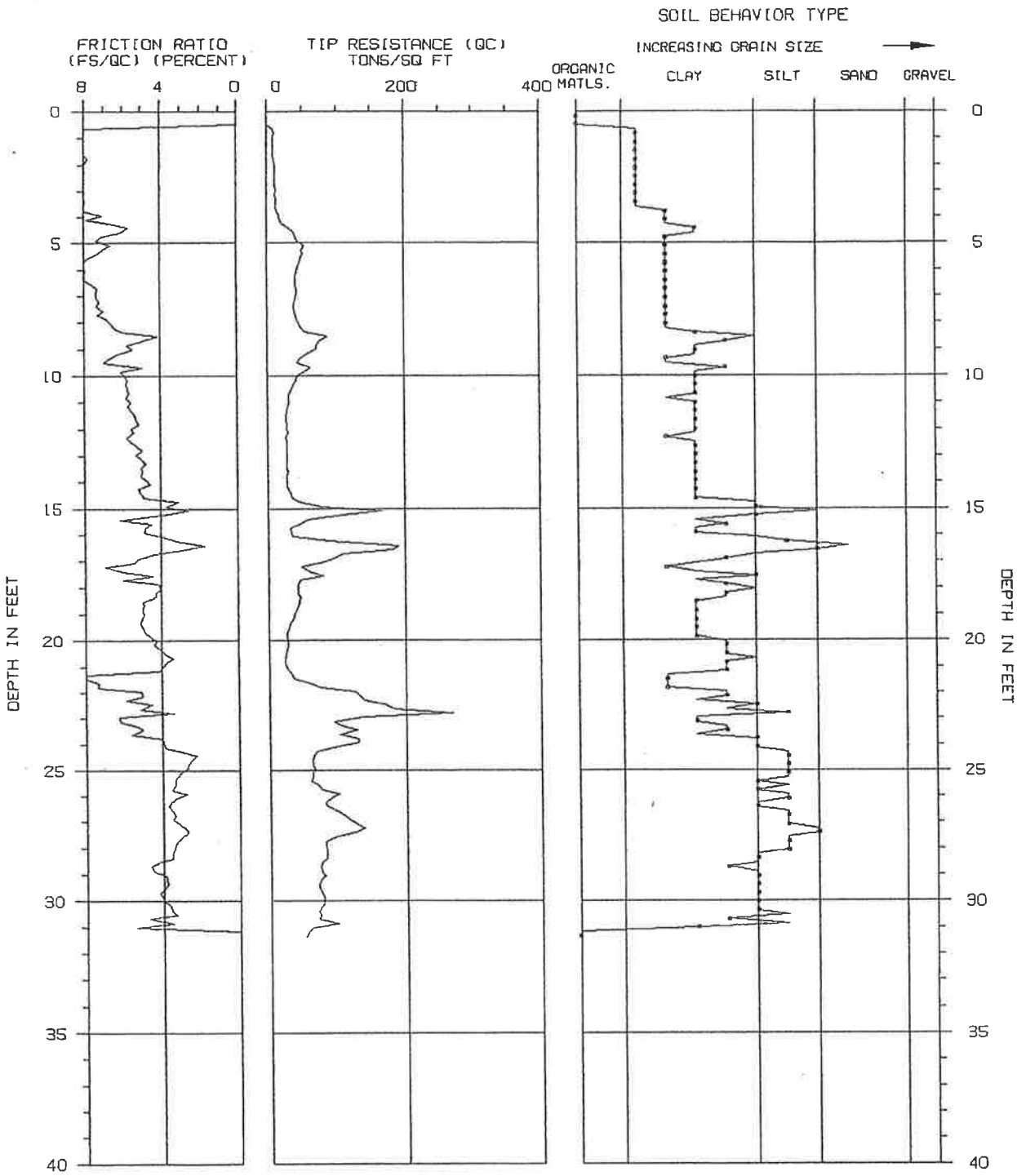
PROJECT NAME : ESC-NIPOMO H.S.

PROJECT NUMBER : 99-E775

CONE/RIG : 495\#1 JH.MR.CA

DATE/TIME: 04-22-99 06:44

HFA



TOP 0.5 FT IS DISTURBED SOIL

TIP RESISTANCE NOT CORRECTED FOR END AREA EFFECT

ASSUMED TOTAL UNIT WT = 120 PCF

ASSUMED DEPTH OF WATER TABLE = 15.0 FT

SOIL BEHAVIOR TYPE INTERPRETATIONS BASED ON: GUIDELINES FOR GEOTECHNICAL DESIGN USING THE CPT AND CPTU. SOIL MECHANICS SERIES #120. UNIVERSITY OF BRITISH COLUMBIA. SEPTEMBER 1989. BY P.K. ROBERTSON AND R.G. CAMPANELLA.

CONE PENETRATION TEST

SOUNDING NUMBER: CPT-31

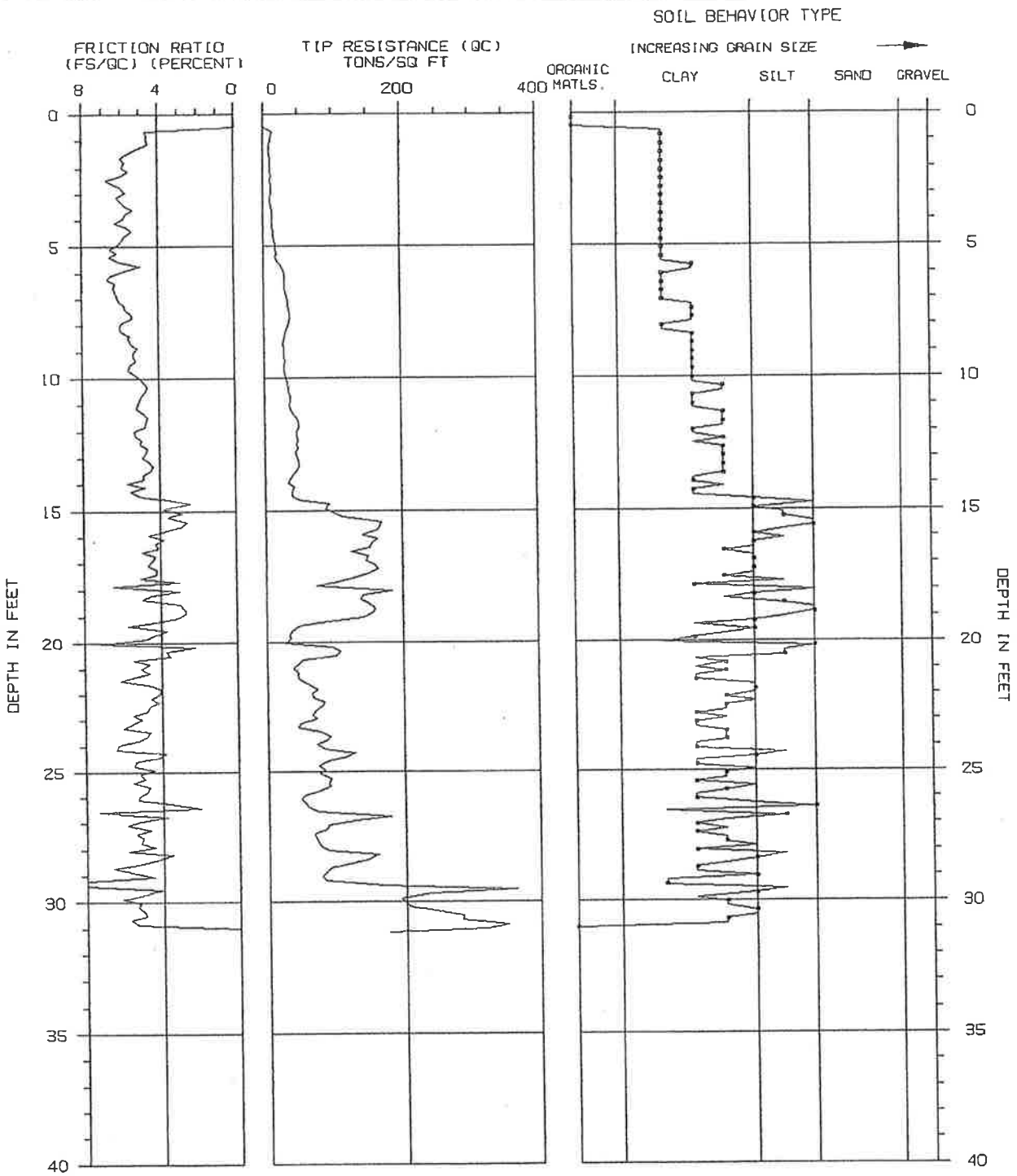
PROJECT NAME : ESC-NIPOMO H.S.

PROJECT NUMBER : 99-E775

CONE/RIG : 495\#1 JH.MR.CA

DATE/TIME: 04-22-99 07:24

HFA



TOP 0.5 FT IS DISTURBED SOIL

TIP RESISTANCE NOT CORRECTED FOR END AREA EFFECT

ASSUMED TOTAL UNIT WT = 120 PCF

ASSUMED DEPTH OF WATER TABLE = 15.0 FT

SOIL BEHAVIOR TYPE INTERPRETATIONS BASED ON: GUIDELINES FOR GEOTECHNICAL DESIGN USING THE CPT AND CPTU. SOIL MECHANICS SERIES #120. UNIVERSITY OF BRITISH COLUMBIA. SEPTEMBER 1989. BY P.K. ROBERTSON AND R.G. CAMPANELLA.

CONE PENETRATION TEST

SOUNDING NUMBER: CPT-32

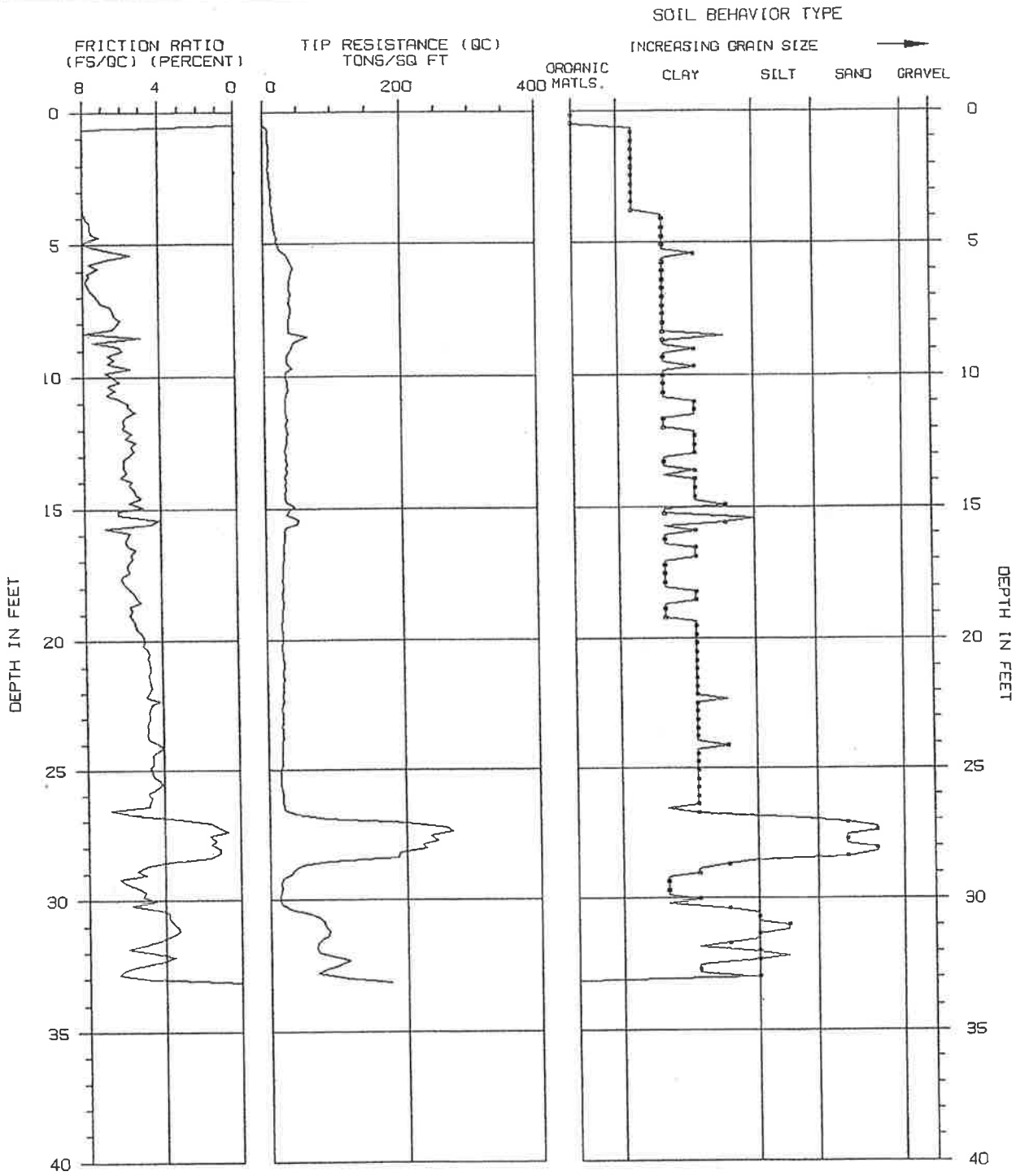
PROJECT NAME : ESC-NIPOMO H.S.

PROJECT NUMBER : 99-E775

CONE/RIG : 495\#1 JH.MR.CA

DATE/TIME: 04-22-99 07:54

HFA



TOP 0.5 FT IS DISTURBED SOIL

TIP RESISTANCE NOT CORRECTED FOR END AREA EFFECT

ASSUMED TOTAL UNIT WT = 120 PCF

ASSUMED DEPTH OF WATER TABLE = 15.0 FT

SOIL BEHAVIOR TYPE INTERPRETATIONS BASED ON: GUIDELINES FOR GEOTECHNICAL DESIGN USING THE CPT AND CPTU. SOIL MECHANICS SERIES #120. UNIVERSITY OF BRITISH COLUMBIA. SEPTEMBER 1989. BY P.K. ROBERTSON AND R.G. CAMPANELLA.

CONE PENETRATION TEST

SOUNDING NUMBER: CPT-33

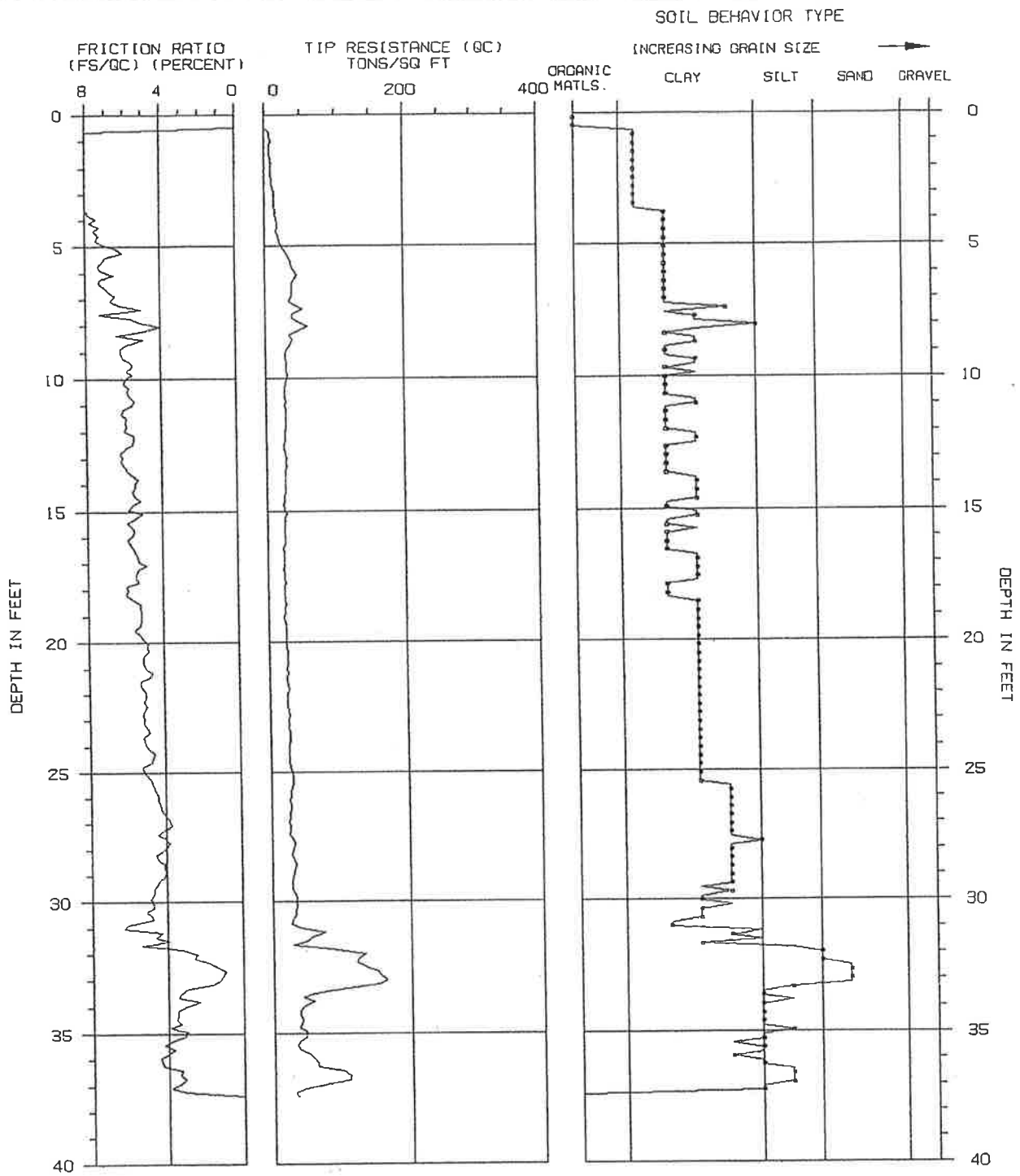
PROJECT NAME : ESC-NIPOMO H.S.

PROJECT NUMBER : 99-E775

CONE/RIG : 495\#1 JH.MR.CA

DATE/TIME: 04-22-99 08:24

HFA



TOP 0.5 FT IS DISTURBED SOIL

TIP RESISTANCE NOT CORRECTED FOR END AREA EFFECT

ASSUMED TOTAL UNIT WT = 120 PCF

ASSUMED DEPTH OF WATER TABLE = 15.0 FT

SOIL BEHAVIOR TYPE INTERPRETATIONS BASED ON: GUIDELINES FOR GEOTECHNICAL DESIGN USING THE CPT AND CPTU. SOIL MECHANICS SERIES #120. UNIVERSITY OF BRITISH COLUMBIA. SEPTEMBER 1989. BY P.K. ROBERTSON AND R.G. CAMPANELLA.

CONE PENETRATION TEST

SOUNDING NUMBER: CPT-34

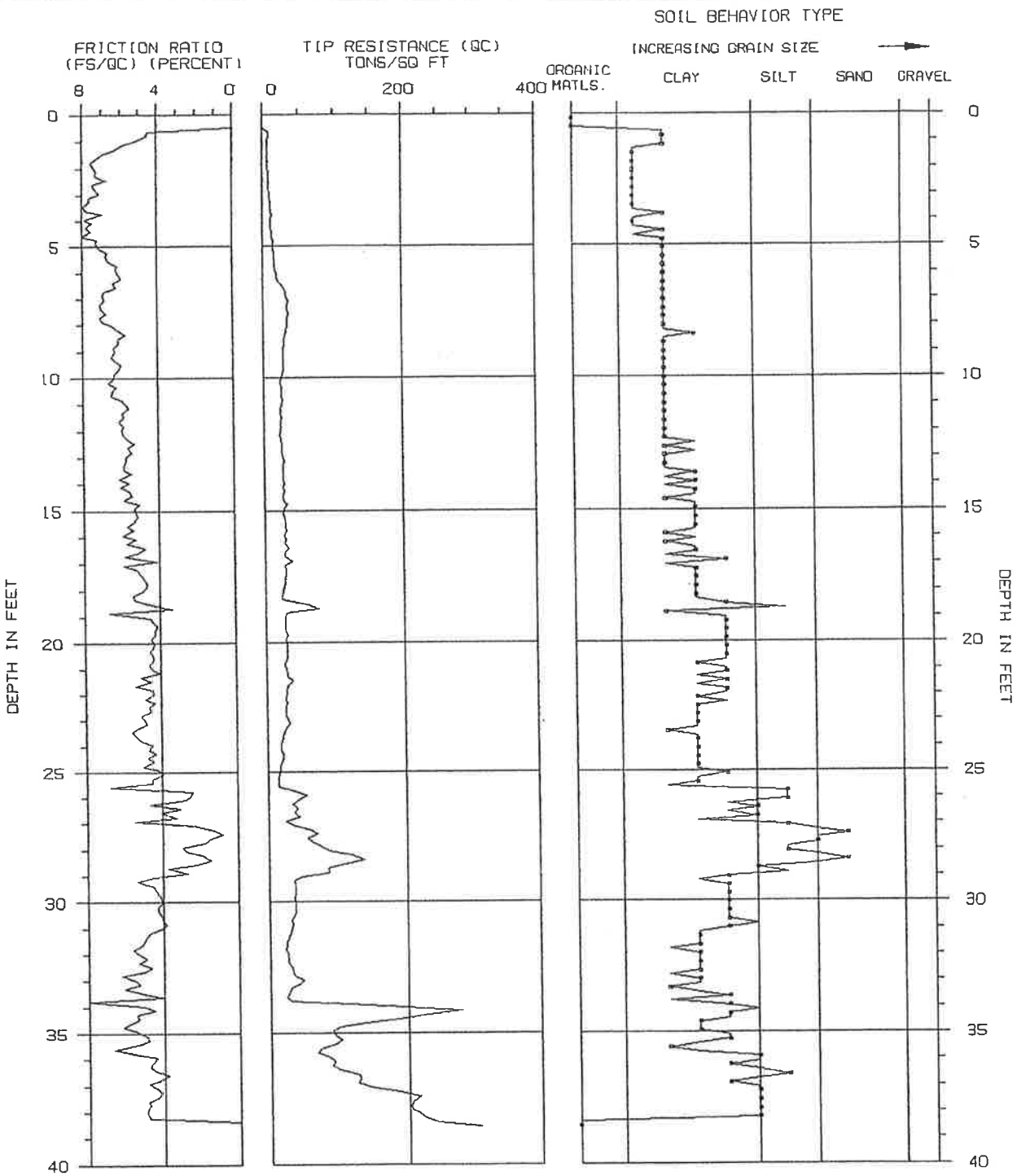
PROJECT NAME : ESC-NIPOMO H.S.

PROJECT NUMBER : 99-E775

CONE/RIG : 495\#1 JH.MR.CA

DATE/TIME: 04-22-99 09:16

HFA



TOP 0.5 FT IS DISTURBED SOIL

TIP RESISTANCE NOT CORRECTED FOR END AREA EFFECT

ASSUMED TOTAL UNIT WT = 120 PCF

ASSUMED DEPTH OF WATER TABLE = 15.0 FT

SOIL BEHAVIOR TYPE INTERPRETATIONS BASED ON: GUIDELINES FOR GEOTECHNICAL DESIGN USING THE CPT AND CPTU. SOIL MECHANICS SERIES #120. UNIVERSITY OF BRITISH COLUMBIA. SEPTEMBER 1989. BY P.K. ROBERTSON AND R.G. CAMPANELLA.

CONE PENETRATION TEST

SOUNDING NUMBER: CPT-35

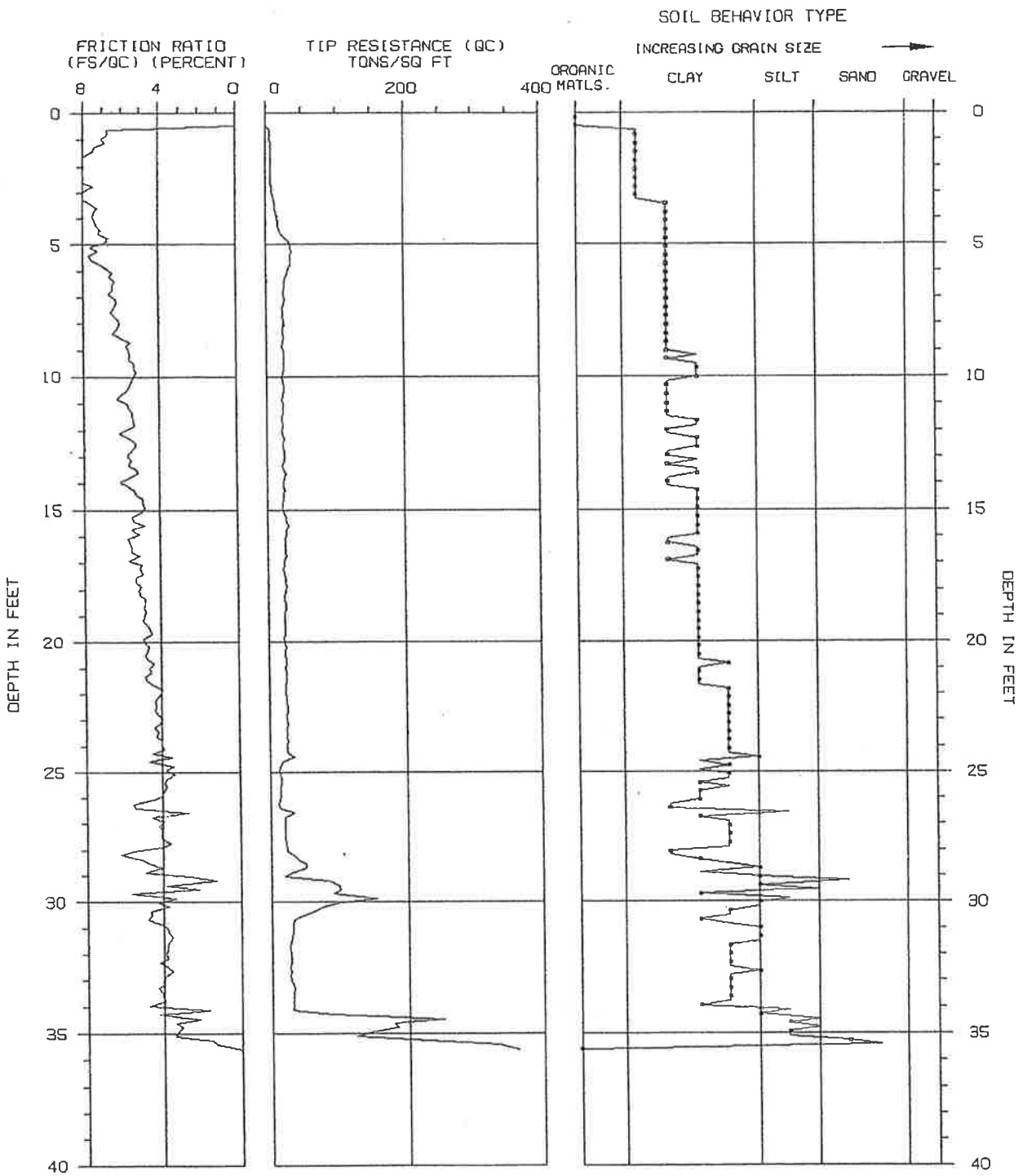
PROJECT NAME : ESC-NIPOMO H.S.

PROJECT NUMBER : 99-E775

CONE/RIG : 495\#1 JH.MR.GA

DATE/TIME: 04-22-99 10:34

HFA



TOP 0.5 FT IS DISTURBED SOIL

TIP RESISTANCE NOT CORRECTED FOR END AREA EFFECT

ASSUMED TOTAL UNIT WT = 120 PCF

ASSUMED DEPTH OF WATER TABLE = 15.0 FT

SOIL BEHAVIOR TYPE INTERPRETATIONS BASED ON: GUIDELINES FOR GEOTECHNICAL DESIGN USING THE CPT AND CPTU. SOIL MECHANICS SERIES #120. UNIVERSITY OF BRITISH COLUMBIA, SEPTEMBER 1989. BY P.K. ROBERTSON AND R.G. CAMPANELLA.

CONE PENETRATION TEST

SOUNDING NUMBER: CPT-36

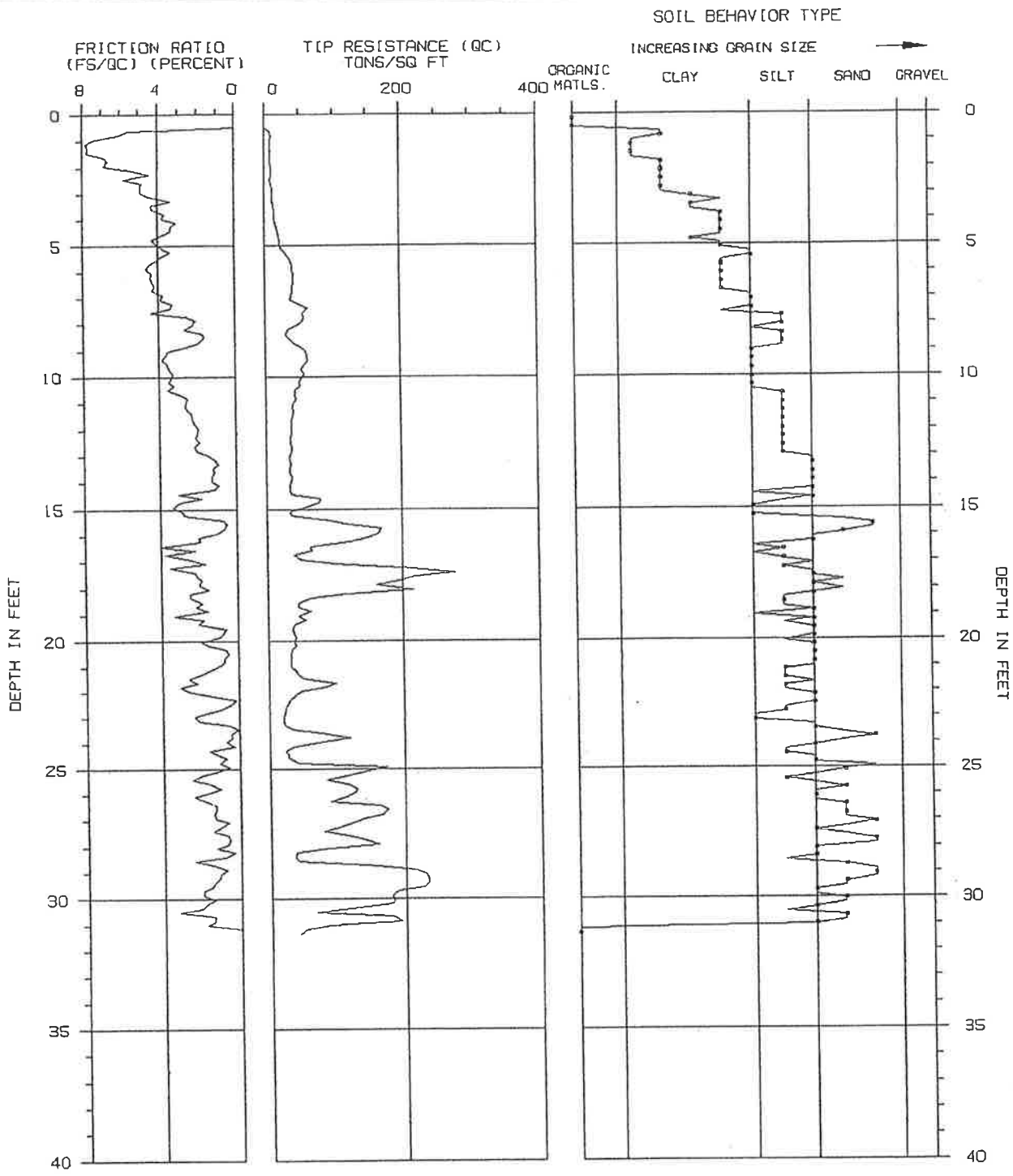
PROJECT NAME : ESC-NIPOMO H.S.

PROJECT NUMBER : 99-E775

CONE/RIG : 473\#1 JH.MR.CA

DATE/TIME: 04-22-99 13:49

HFA



TOP 0.5 FT IS DISTURBED SOIL

TIP RESISTANCE NOT CORRECTED FOR END AREA EFFECT

ASSUMED TOTAL UNIT WT = 120 PCF

ASSUMED DEPTH OF WATER TABLE = 15.0 FT

SOIL BEHAVIOR TYPE INTERPRETATIONS BASED ON: GUIDELINES FOR GEOTECHNICAL DESIGN USING THE CPT AND CPTU. SOIL MECHANICS SERIES #120. UNIVERSITY OF BRITISH COLUMBIA. SEPTEMBER 1989. BY P.K. ROBERTSON AND R.G. CAMPANELLA.

CONE PENETRATION TEST

SOUNDING NUMBER: CPT-37

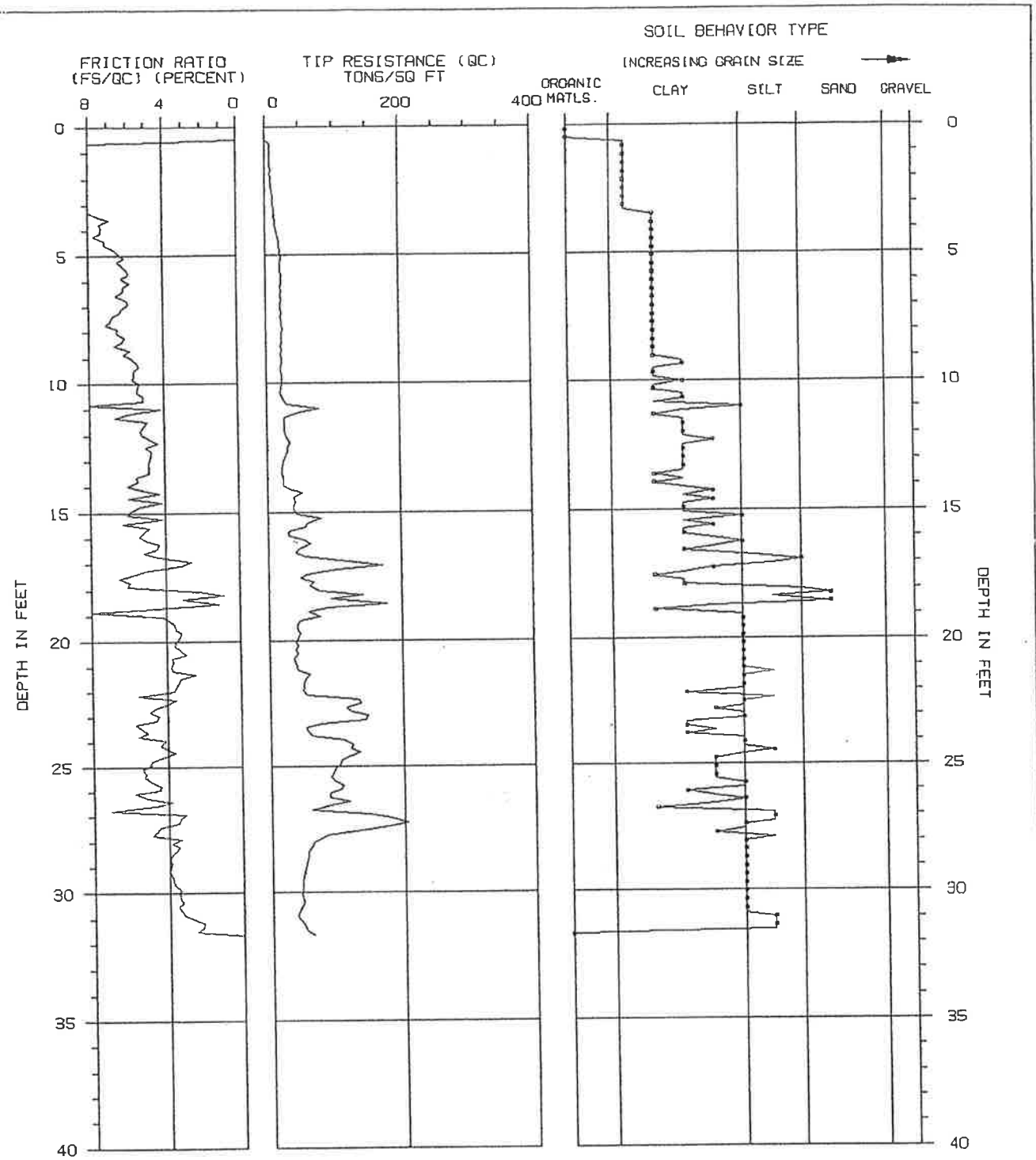
PROJECT NAME : ESC-NIPOMO H.S.

PROJECT NUMBER : 99-E775

CONE/RIG : 473\#1 JH.MR.CA

DATE/TIME: 04-22-99 14:25

HFA



TOP 0.5 FT IS DISTURBED SOIL

TIP RESISTANCE NOT CORRECTED FOR END AREA EFFECT

ASSUMED TOTAL UNIT WT = 120 PCF

ASSUMED DEPTH OF WATER TABLE = 15.0 FT

SOIL BEHAVIOR TYPE INTERPRETATIONS BASED ON: GUIDELINES FOR GEOTECHNICAL DESIGN USING THE CPT AND CPTU. SOIL MECHANICS SERIES #120. UNIVERSITY OF BRITISH COLUMBIA, SEPTEMBER 1989. BY P.K. ROBERTSON AND R.G. CAMPANELLA.

CONE PENETRATION TEST

SOUNDING NUMBER: CPT-38

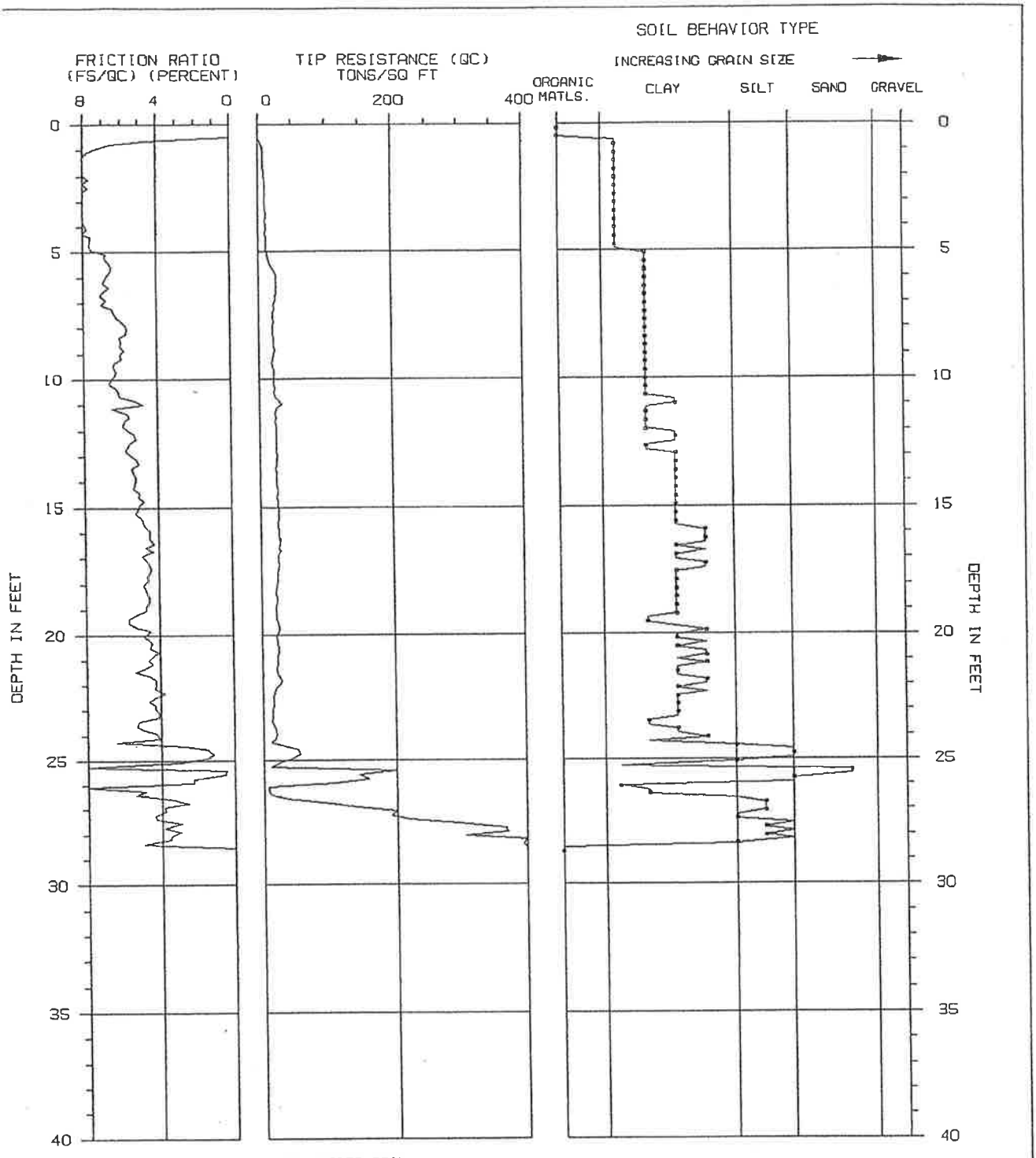
PROJECT NAME : ESC-NIPOMO H.S.

PROJECT NUMBER : 99-E775

CONE/RIG : 473\#1 JH.MR.CA

DATE/TIME: 04-22-99 15:08

HFA



TOP 0.5 FT IS DISTURBED SOIL

TIP RESISTANCE NOT CORRECTED FOR END AREA EFFECT

ASSUMED TOTAL UNIT WT = 120 PCF

ASSUMED DEPTH OF WATER TABLE = 15.0 FT

SOIL BEHAVIOR TYPE INTERPRETATIONS BASED ON: GUIDELINES FOR GEOTECHNICAL DESIGN USING THE CPT AND CPTU. SOIL MECHANICS SERIES #120. UNIVERSITY OF BRITISH COLUMBIA. SEPTEMBER 1989. BY P.K. ROBERTSON AND R.G. CAMPANELLA.

CONE PENETRATION TEST

SOUNDING NUMBER: CPT-39

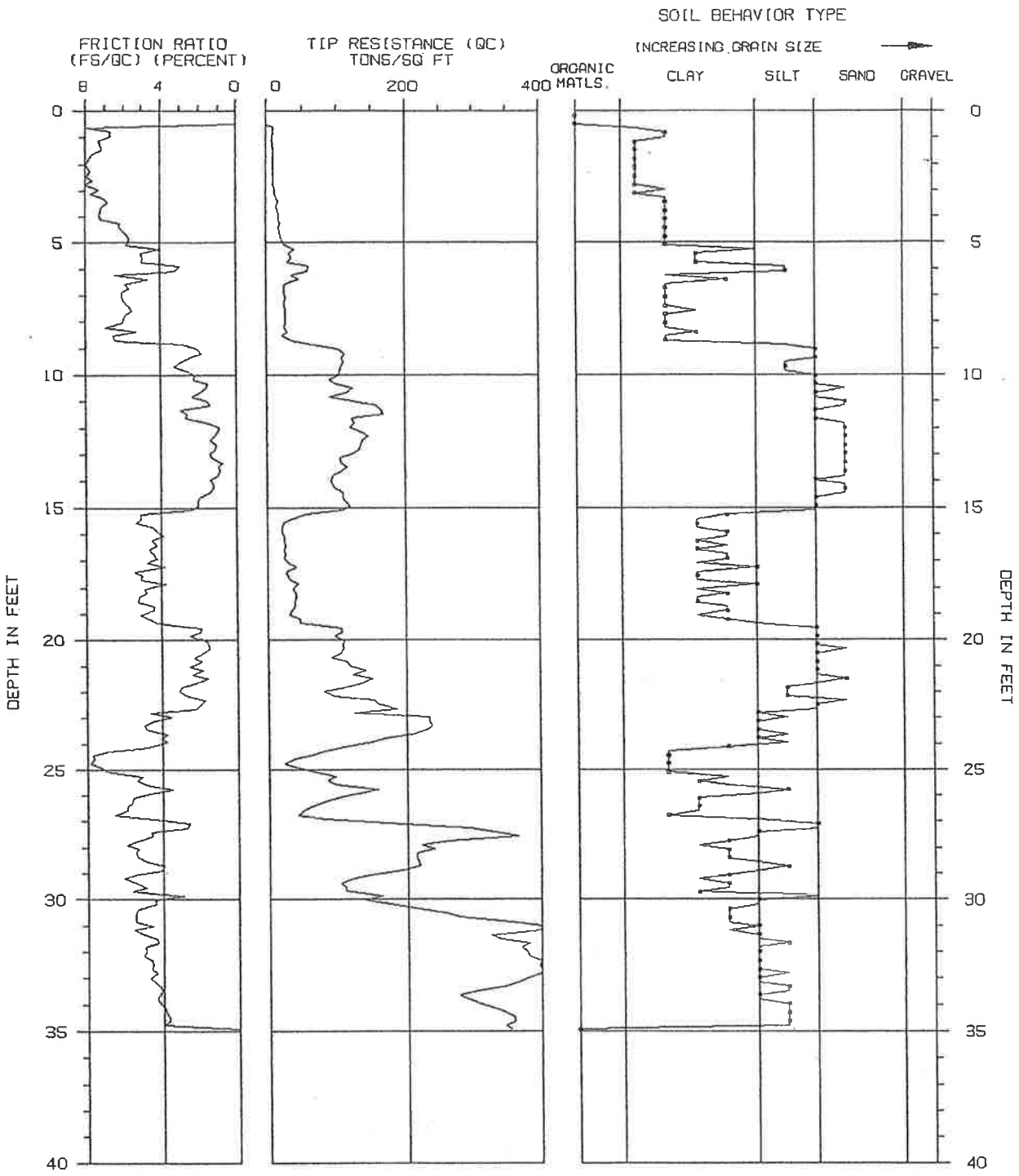
PROJECT NAME : ESC-NIPOMO H.S.

PROJECT NUMBER : 99-E775

CONE/RIG : 473\#1 JH.MR.CA

DATE/TIME: 04-22-99 15:43

HFA



TOP 0.5 FT IS DISTURBED SOIL

TIP RESISTANCE NOT CORRECTED FOR END AREA EFFECT

ASSUMED TOTAL UNIT WT = 120 PCF

ASSUMED DEPTH OF WATER TABLE = 15.0 FT

SOIL BEHAVIOR TYPE INTERPRETATIONS BASED ON: GUIDELINES FOR GEOTECHNICAL DESIGN USING THE CPT AND CPTU. SOIL MECHANICS SERIES #120. UNIVERSITY OF BRITISH COLUMBIA. SEPTEMBER 1989. BY P.K. ROBERTSON AND R.G. CAMPANELLA.

CONE PENETRATION TEST

SOUNDING NUMBER: CPT-40

PROJECT NAME : ESC-NIPOMO H.S.

PROJECT NUMBER : 99-E775

CONE/RIG : 473\#1 JH.MR.GA

DATE/TIME: 04-22-99 16:33

HFA

APPENDIX D

M.J. Schiff & Associates Soil Corrosivity Study,
June 24, 1999

M.J. SCHIFF & ASSOCIATES, INC.

Consulting Corrosion Engineers - Since 1959
1308 Monte Vista Avenue, Suite 6
Upland, CA 91786

Phone: (909)931-1360 / Fax: (909)931-1361
E-mail: mjsa@mjs-a.com
http://www.mjs-a.com

June 24, 1999

EARTH SYSTEMS CONSULTANTS
4378 Santa Fe Road
San Luis Obispo, California 93401

Attention: Mr. Dennis Shallenberger, G.E.

Re: Soil Corrosivity Study
Lucia Mar High School, Site 2
Nipomo, California
Your #NGS11319-02, MJS&A #99235-01

INTRODUCTION

Laboratory tests have been completed on two soil samples you sent for the referenced high school project on Thompson Road. The purpose of these tests was to determine if the soils may have deleterious effects on underground utilities and concrete structures. We assume that the samples provided are representative of the most corrosive soils at the site.

The scope of this study is limited to a determination of soil corrosivity and general corrosion control recommendations for materials likely to be used for construction. If the architects and/or engineers desire more specific information, designs, specifications, or review of design, we will be happy to work with them as a separate phase of this project.

TEST PROCEDURES

The electrical resistivity of each sample was measured in a soil box per ASTM G57 in its as-received condition and again after saturation with distilled water. Resistivities are at about their lowest value when the soil is saturated. The pH of the saturated samples was measured. A 5:1 water:soil extract from each sample was chemically analyzed for the chemicals commonly found in soils and for ammonium and nitrate. Test results are shown on Table 1.

SOIL CORROSIVITY

A major factor in determining soil corrosivity is electrical resistivity. The electrical resistivity of a soil is a measure of its resistance to the flow of electrical current. Corrosion of buried metal is an electrochemical process in which the amount of metal loss due to corrosion is directly proportional to the flow of electrical current (DC) from the metal into the soil. Corrosion currents, following Ohm's Law, are inversely proportional to soil resistivity. Lower electrical resistivities result from higher moisture and chemical contents and indicate corrosive soil.

A correlation between electrical resistivity and corrosivity toward ferrous metals is:

Soil Resistivity in ohm-centimeters			Corrosivity Category
over		10,000	mildly corrosive
2,000	to	10,000	moderately corrosive
1,000	to	2,000	corrosive
below		1,000	severely corrosive

Other soil characteristics that may influence corrosivity towards metals are pH, chemical content, soil types, aeration, anaerobic conditions, and site drainage.

Electrical resistivities were in moderately corrosive and corrosive categories with as-received moisture. When saturated, the resistivities dropped into the severely corrosive category. The resistivity of the sample from boring 10 dropped considerably with added moisture because the sample was dry as-received.

Soil pH values were 6.1 and 6.9. This range is slightly acidic to neutral and does not particularly increase soil corrosivity.

The soluble salt content of the samples was low and moderate. No concentration was high enough to be of particular concern.

Ammonium and nitrate were detected. The levels of ammonium were high enough to be aggressive to copper.

Tests were not made for sulfide and negative oxidation-reduction (redox) potential because they would not exist in these dry, brown, or aerated samples.

This soil is classified as severely corrosive to ferrous metals and aggressive to copper.

CORROSION CONTROL

The life of buried materials depends on thickness, strength, loads, construction details, soil moisture, etc., in addition to soil corrosivity, and is, therefore, difficult to predict. Of more practical value are corrosion control methods that will increase the life of materials that would be subject to significant corrosion.

Steel Pipe

Abrasive blast underground steel utilities and apply a high quality dielectric coating such as polyurethane, extruded polyethylene, a tape coating system, hot applied coal tar enamel, or fusion bonded epoxy.

Bond underground steel pipe with rubber gasketed, mechanical, grooved end, or other nonconductive type joints for electrical continuity. Electrical continuity is necessary for corrosion monitoring and cathodic protection.

Electrically insulate each buried steel pipeline from dissimilar metals, cement-mortar coated and concrete encased steel, and above ground steel pipe to prevent dissimilar metal corrosion cells and to facilitate the application of cathodic protection.

Apply cathodic protection to steel piping as per NACE International RP-0169-96.

As an alternative to dielectric coating and cathodic protection, apply a 3/4 inch cement mortar coating or encase in cement-slurry or concrete 3 inches thick, using any type of cement.

Iron Pipe

Encase ductile iron water piping in 8 mil thick low-density polyethylene or 4 mil thick high-density, cross-laminated polyethylene plastic tubes or wraps per AWWA Standard C105 or coat with a polyurethane intended for underground use. Bond all nonconductive type joints for electrical continuity. Electrically insulate underground iron pipe from dissimilar metals and from above ground iron pipe with insulated joints.

Encase cast iron drain lines in 8 mil thick low-density polyethylene or 4 mil thick high-density, cross-laminated polyethylene plastic tubes or wraps per AWWA Standard C105. Electrically insulate underground iron pipe from dissimilar metals and from above ground iron pipe with insulated joints.

Copper Tube

Copper tubing can be protected by applying cathodic protection or preventing soil contact. Soil contact may be prevented by placing the tubing above ground or inside a plastic pipe. The amount of cathodic protection current needed can be minimized by coating the tubing.

Plastic and Vitrified Clay Pipe

No special precautions are required for plastic and vitrified clay piping placed underground from a corrosion viewpoint. Protect any iron valves and fittings with a double polyethylene wrap per AWWA C105 or as described below for bare steel appurtenances.

All Pipe

On all pipe, coat bare steel appurtenances such as bolts, joint harnesses, or flexible couplings with a coal tar or elastomer based mastic, coal tar epoxy, moldable sealant, wax tape, or equivalent after assembly.

Where metallic pipelines penetrate concrete structures such as building floors or walls, use plastic sleeves, rubber seals, or other dielectric material to prevent pipe contact with the concrete and reinforcing steel.

Concrete

Any type of cement may be used for concrete structures and pipe because the sulfate concentration is negligible, 0 to 0.1 percent, per 1997 Uniform Building Code (UBC) Table 19-A-4 and American Concrete Institute (ACI-318) Table 4.3.1.

Standard concrete cover over reinforcing steel may be used for concrete structures and pipe in contact with these soils. Use 2 inches minimum cover over embedded steel at the edges of concrete slabs and footings above grade as well as below.

Please call if you have any questions.

Respectfully Submitted,
M.J. SCHIFF & ASSOCIATES, INC.

Robert A. Pannell

Robert A. Pannell

Reviewed by,

Paul R. Smith

Paul R. Smith, P.E.

Enc: Table 1

..\99235-01\scs-cu



M. J. Schiff & Associates, Inc.
Consulting Corrosion Engineers - Since 1959
1308 Monte Vista Avenue, Suite 6
Upland, CA 91786-8224
Phone: 909/931-1360

Table 1 - Laboratory Tests on Soil Samples

Lucia Mar High School, Site 2, Nipomo, CA
Your #NGS 11319-02, MJS&A #99235-01
23-Jun-99

Sample ID			B-10 @ 0-2' Fat clay (CH)	B-14 @ 10-12' clayey sand (SC)
Resistivity		**Units**		
as-received		ohm-cm	5,650	1,400
saturated		ohm-cm	540	845
pH			6.1	6.9
Electrical Conductivity		mS/cm	0.15	0.29
Chemical Analyses				
Cations				
calcium	Ca^{2+}	mg/kg	60	72
magnesium	Mg^{2+}	mg/kg	24	29
sodium	Na^{1+}	mg/kg	ND	147
Anions				
carbonate	CO_3^{2-}	mg/kg	ND	ND
bicarbonate	HCO_3^{1-}	mg/kg	284	503
chloride	Cl^{1-}	mg/kg	ND	74
sulfate	SO_4^{2-}	mg/kg	ND	99
Other Tests				
ammonium	NH_4^{1+}	mg/kg	12.6	9.5
nitrate	NO_3^{1-}	mg/kg	2.2	7.1
sulfide	S^{2-}	qual	na	na
Redox		mv	na	na

Electrical conductivity in millisiemens/cm and chemical analysis were made on a 1:5 soil-to-water extract.
mg/kg = milligrams per kilogram (parts per million) of dry soil.
Redox = oxidation-reduction potential in millivolts
ND = not detected
na = not analyzed

APPENDIX C

Geotechnical Laboratory Test Results

Nipomo High School
Stadium and Track Improvements

300909-002

BULK DENSITY TEST RESULTS

ASTM D 2937-17 (modified for ring liners)

April 11, 2018

BORING NO.	DEPTH feet	MOISTURE CONTENT, %	WET DENSITY, pcf	DRY DENSITY, pcf
1	3.0 - 3.5	34.3	110.6	82.3
1	6.0 - 6.5	34.3	112.4	83.7
1	11.0 - 11.5	30.9	114.6	87.6
2	3.0 - 3.5	33.5	113.9	85.3
2	6.0 - 6.5	28.0	115.5	90.3
2	11.0 - 11.5	27.3	113.4	89.1
2	30.0 - 30.5	32.5	---	---
2	35.0 - 35.5	48.7	---	---
3	3.0 - 3.5	27.5	110.3	86.5
5	3.0 - 3.5	26.5	113.1	89.4
6	3.0 - 3.5	22.2	118.5	97.0
6	6.0 - 6.5	14.4	125.2	109.4
6	11.0 - 11.5	20.7	118.4	98.1
8	3.0 - 3.5	25.8	110.1	87.5
8	6.0 - 6.5	33.2	116.3	87.3
8	11.0 - 11.5	32.2	116.1	87.8
9	3.0 - 3.5	29.1	117.7	91.2
9	6.0 - 6.5	32.5	111.5	84.1
9	11.0 - 11.5	28.4	118.0	91.9
10	3.0 - 3.5	28.8	99.2	77.0
10	6.0 - 6.5	34.4	115.5	85.9
10	11.0 - 11.5	30.3	117.3	90.0
10	18.5 - 19.0	30.1	120.9	92.9

EXPANSION INDEX TEST RESULTS

ASTM D 4829-11

BORING NO.	DEPTH feet	EXPANSION INDEX
1	0.0 - 5.0	201
8	0.0 - 5.0	144

Nipomo High School
Stadium and Track Improvements

300909-002

MOISTURE-DENSITY COMPACTION TEST

ASTM D 1557-12 (Modified)

PROCEDURE USED: A

PREPARATION METHOD: Moist

RAMMER TYPE: Mechanical

SPECIFIC GRAVITY: 2.70 (assumed)

April 11, 2018

Boring #1 @ 0.0 - 5.0'

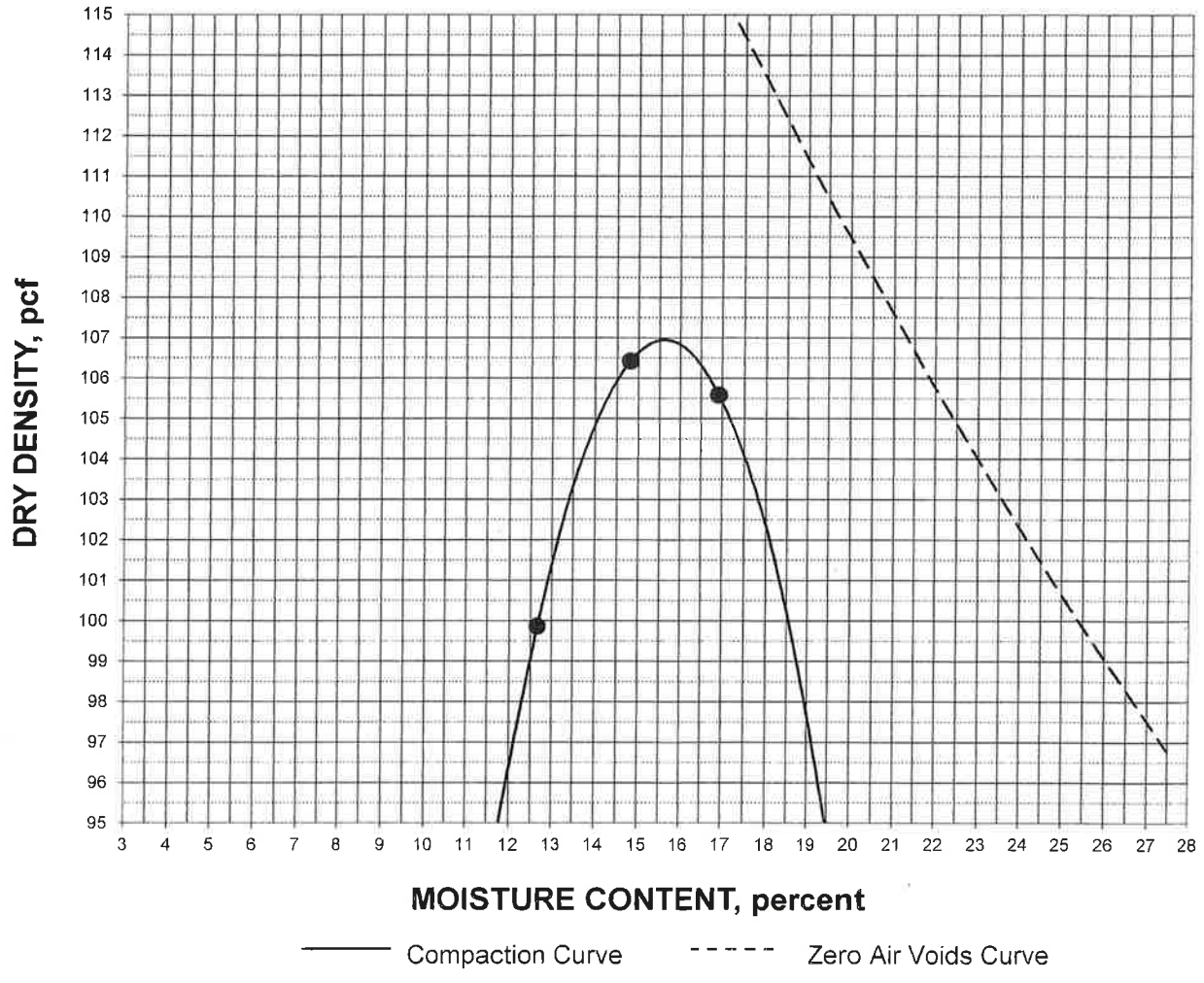
Dark Gray Fat Clay (CH)

SIEVE DATA:

Sieve Size	% Retained (Cummulative)
3/4"	0
3/8"	0
#4	0

MAXIMUM DRY DENSITY: 107.0 pcf

OPTIMUM MOISTURE: 15.6%



Nipomo High School
Stadium and Track Improvements

300909-002

MOISTURE-DENSITY COMPACTION TEST

ASTM D 1557-12 (Modified)

PROCEDURE USED: A

PREPARATION METHOD: Moist

RAMMER TYPE: Mechanical

SPECIFIC GRAVITY: 2.70 (assumed)

April 11, 2018

Boring #8 @ 0.0 - 5.0'

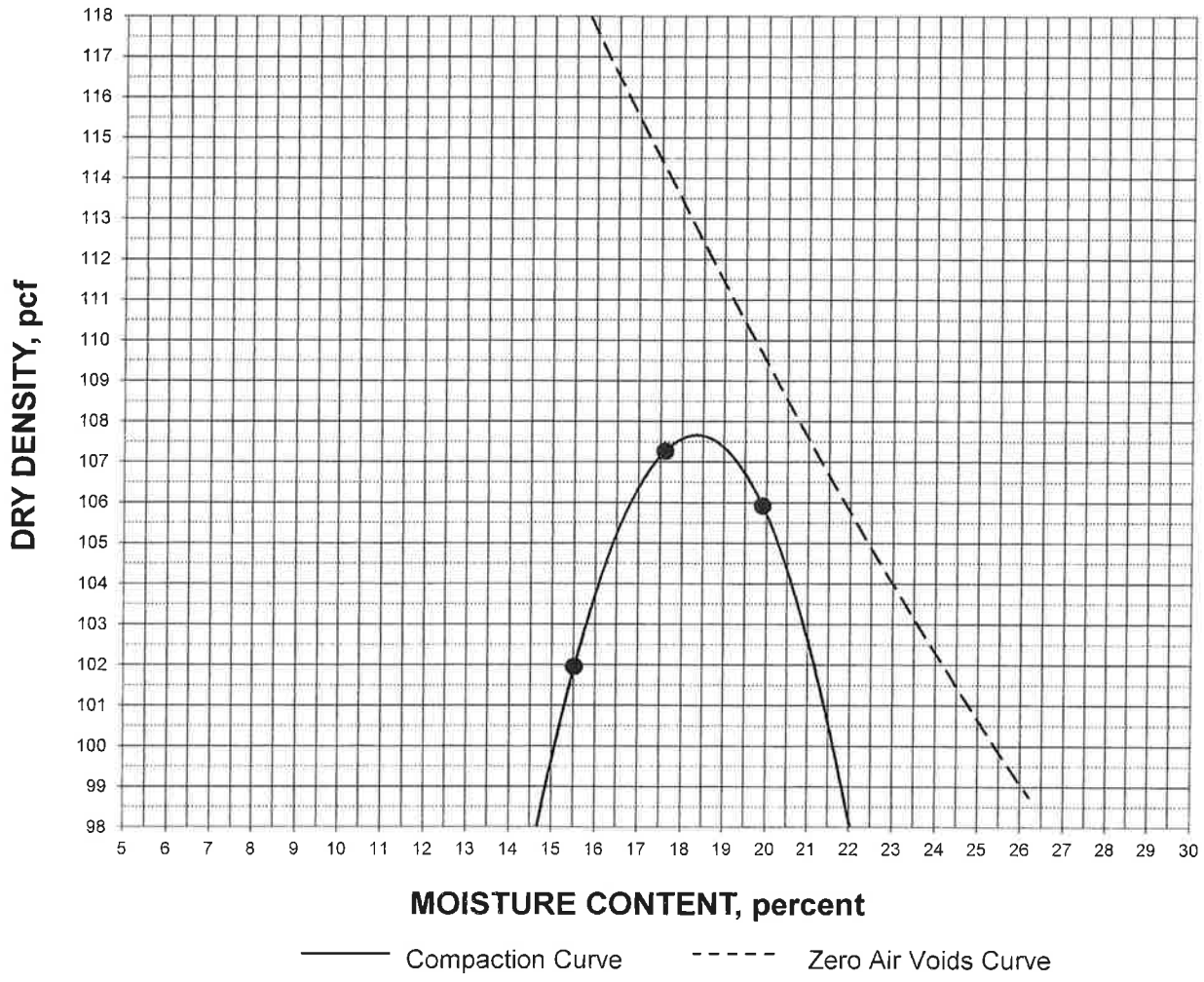
Dark Brown Fat Clay (CH)

SIEVE DATA:

Sieve Size	% Retained (Cummulative)
3/4"	0
3/8"	0
#4	0

MAXIMUM DRY DENSITY: 107.7 pcf

OPTIMUM MOISTURE: 18.3%



Nipomo High School
Stadium and Track Improvements

300909-002

DIRECT SHEAR

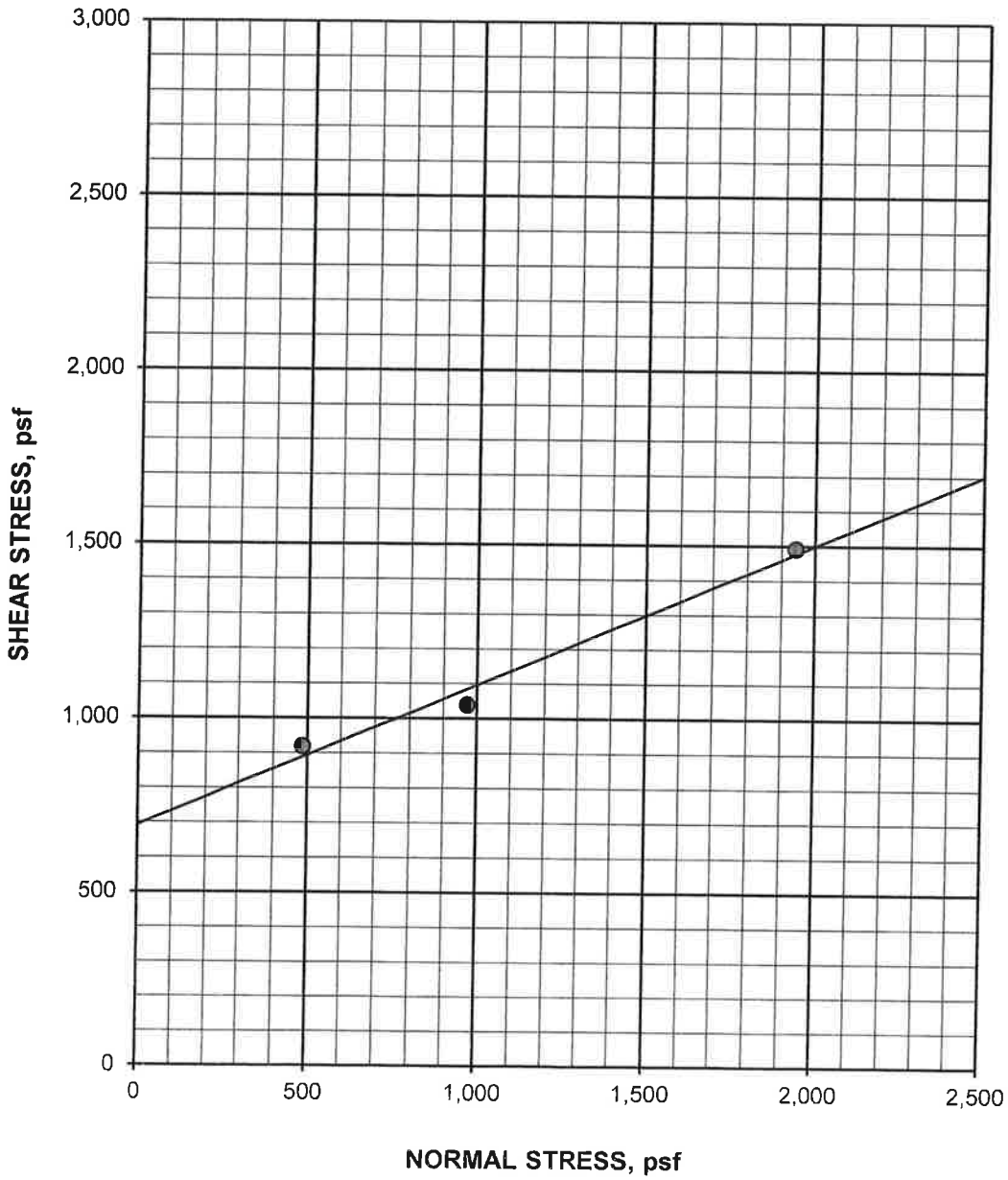
ASTM D 3080/D3080M-11 (modified for consolidated, undrained conditions)

April 11, 2018

Boring #1 @ 0.0 - 5.0'
Fat Clay (CH)
Compacted to 90% RC, saturated

INITIAL DRY DENSITY: 96.2 pcf
INITIAL MOISTURE CONTENT: 15.6 %
PEAK SHEAR ANGLE (Ø): 22°
COHESION (C): 693 psf

SHEAR vs. NORMAL STRESS



Nipomo High School
Stadium and Track Improvements

300909-002

DIRECT SHEAR continued

ASTM D 3080/D3080M-11 (modified for consolidated, undrained conditions)

Boring #1 @ 0.0 - 5.0'

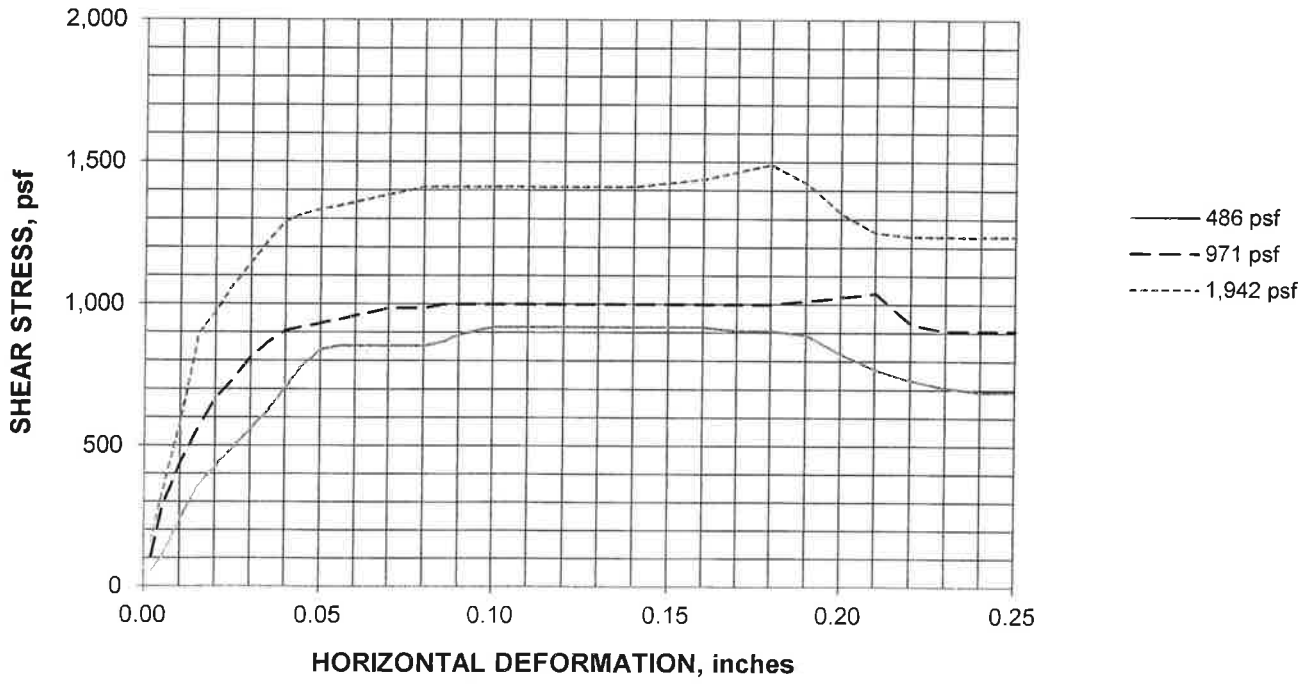
April 11, 2018

Fat Clay (CH)

Compacted to 90% RC, saturated

SPECIFIC GRAVITY: 2.70 (assumed)

SAMPLE NO.:	1	2	3	AVERAGE
INITIAL				
WATER CONTENT, %	15.6	15.6	15.6	15.6
DRY DENSITY, pcf	96.2	96.2	96.2	96.2
SATURATION, %	56.0	56.0	56.0	56.0
VOID RATIO	0.752	0.752	0.752	0.752
DIAMETER, inches	2.410	2.410	2.410	
HEIGHT, inches	1.00	1.00	1.00	
AT TEST				
WATER CONTENT, %	38.4	38.8	36.1	
DRY DENSITY, pcf	98.0	99.8	102.3	
SATURATION, %	100.0	100.0	100.0	
VOID RATIO	0.719	0.687	0.647	
HEIGHT, inches	0.98	0.96	0.94	



Nipomo High School
Stadium and Track Improvements

300909-002

DIRECT SHEAR

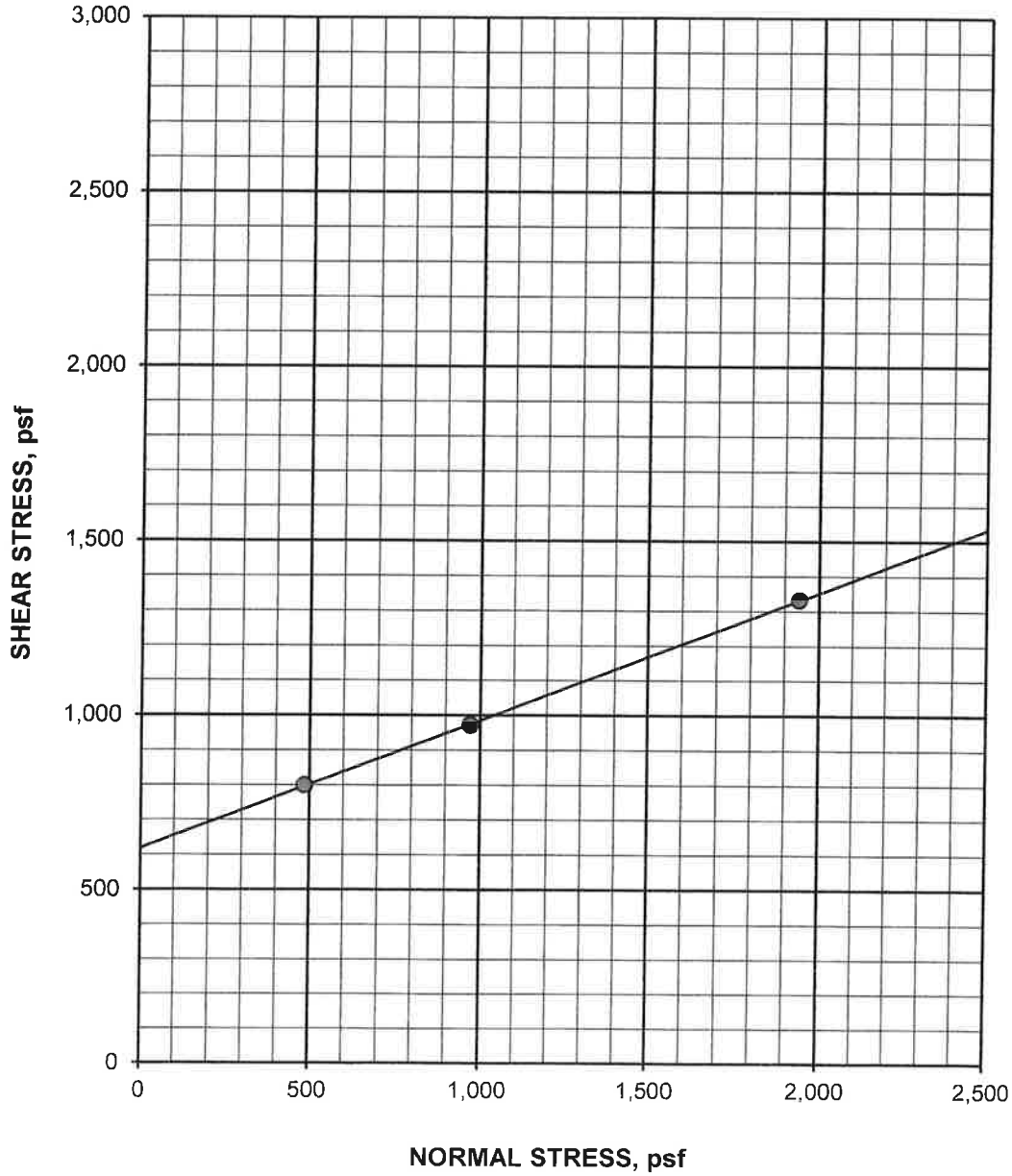
ASTM D 3080/D3080M-11 (modified for consolidated, undrained conditions)

April 11, 2018

Boring #8 @ 0.0 - 5.0'
Fat Clay (CH)
Compacted to 90% RC, saturated

INITIAL DRY DENSITY: 94.8 pcf
INITIAL MOISTURE CONTENT: 18.3 %
PEAK SHEAR ANGLE (Ø): 20°
COHESION (C): 619 psf

SHEAR vs. NORMAL STRESS



Nipomo High School
Stadium and Track Improvements

300909-002

DIRECT SHEAR continued

ASTM D 3080/D3080M-11 (modified for consolidated, undrained conditions)

Boring #8 @ 0.0 - 5.0'

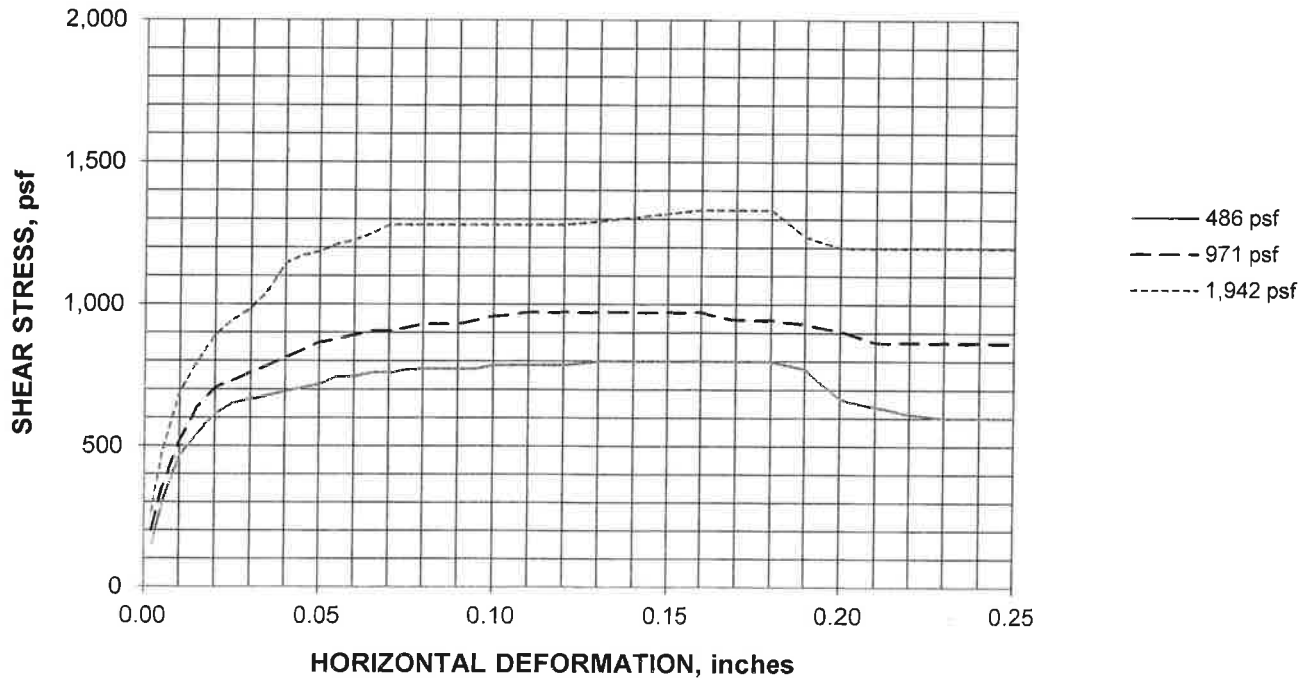
April 11, 2018

Fat Clay (CH)

Compacted to 90% RC, saturated

SPECIFIC GRAVITY: 2.70 (assumed)

SAMPLE NO.:	1	2	3	AVERAGE
INITIAL				
WATER CONTENT, %	18.3	18.3	18.3	18.3
DRY DENSITY, pcf	94.8	94.9	94.7	94.8
SATURATION, %	63.6	63.7	63.4	63.5
VOID RATIO	0.777	0.776	0.780	0.778
DIAMETER, inches	2.410	2.410	2.410	
HEIGHT, inches	1.00	1.00	1.00	
AT TEST				
WATER CONTENT, %	41.3	42.2	43.2	
DRY DENSITY, pcf	96.5	99.7	103.6	
SATURATION, %	100.0	100.0	100.0	
VOID RATIO	0.745	0.691	0.627	
HEIGHT, inches	0.98	0.95	0.91	



Nipomo High School
Stadium and Track Improvements

300909-002

RESISTANCE '*R* ' VALUE AND EXPANSION PRESSURE

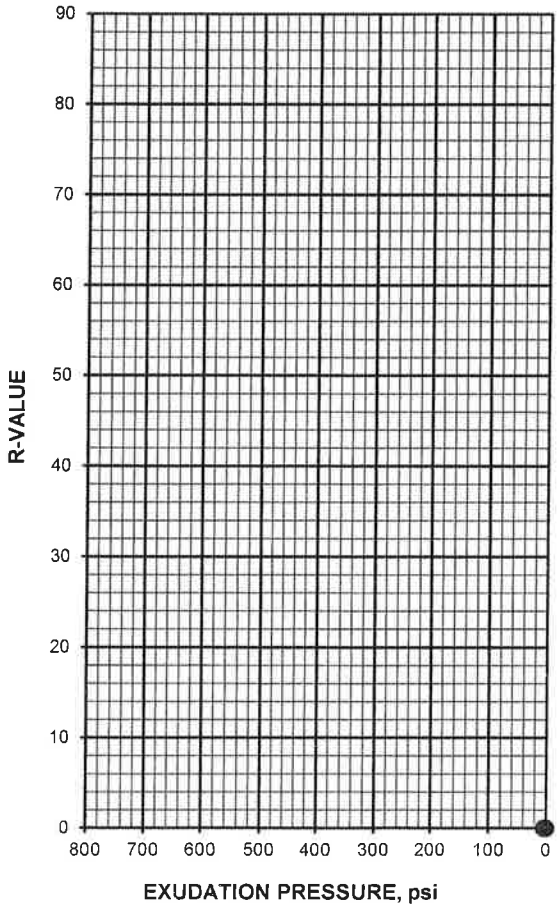
ASTM D 2844/D2844M-13

April 11, 2018

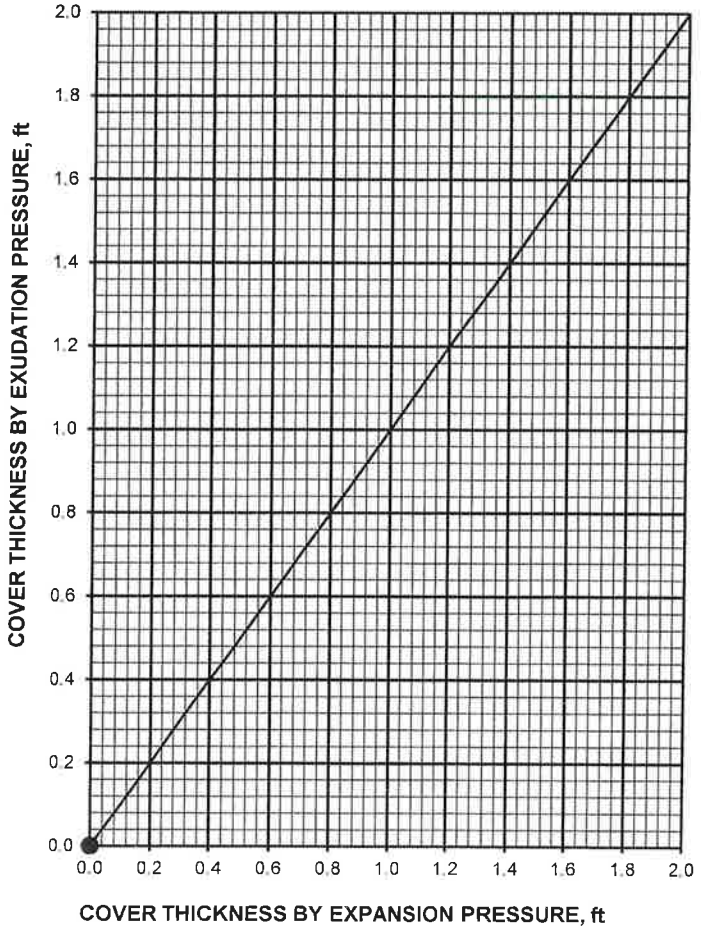
Boring #3 @ 0.0 - 5.0'
Dark Gray Brown Fat Clay (CH)

Dry Density @ 300 psi Exudation Pressure: N/A
%Moisture @ 300 psi Exudation Pressure: N/A
R-Value - Exudation Pressure: N/A
R-Value - Expansion Pressure: N/A
R-Value @ Equilibrium: Less than 5
(sample extruded from mold during testing)

EXUDATION PRESSURE CHART



EXPANSION PRESSURE CHART



Nipomo High School
Stadium and Track Improvements

300909-002

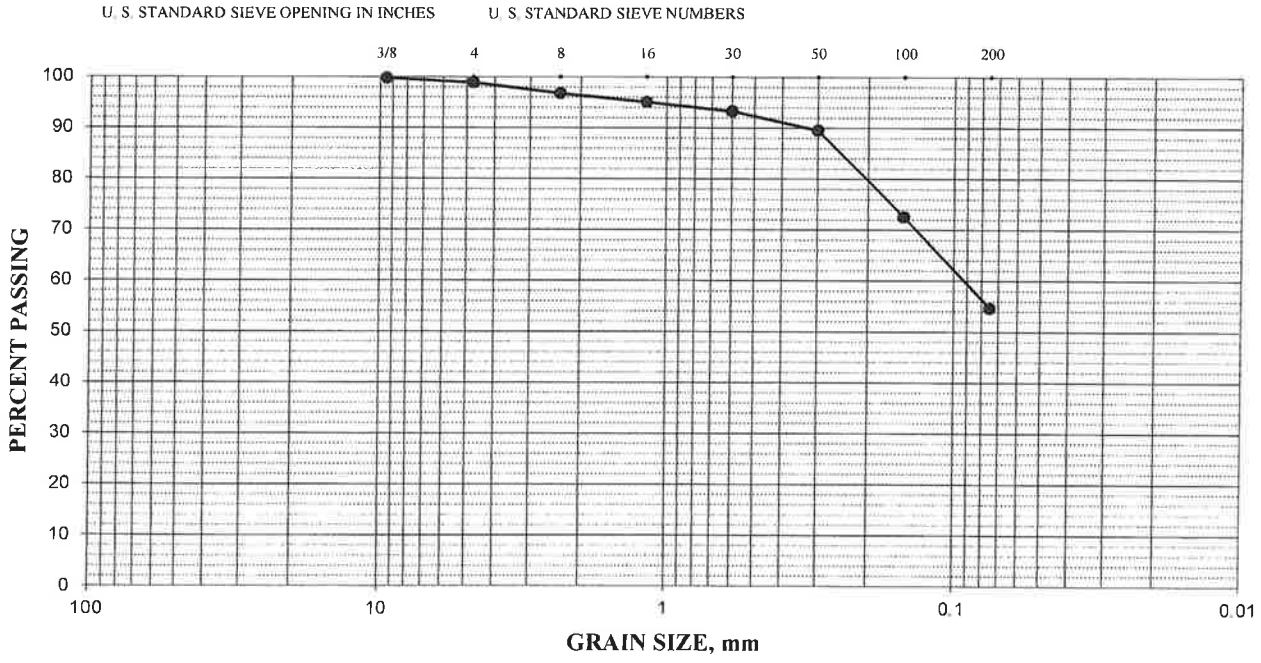
PARTICLE SIZE ANALYSIS

ASTM D 422-63/07; D 1140-17

Boring #2 @ 30.0 - 30.5'
Sandy Silt (ML)

April 11, 2018

Sieve size	% Retained	% Passing
3/8" (9.5-mm)	0	100
#4 (4.75-mm)	1	99
#8 (2.36-mm)	3	97
#16 (1.18-mm)	5	95
#30 (600-µm)	7	93
#50 (300-µm)	10	90
#100 (150-µm)	27	73
#200 (75-µm)	45	55



APPENDIX D

Soil Corrosivity Study by HDR Engineering, Inc.

Tuesday, April 24, 2018 via email: nzoetewey@earthysystems.com

EARTH SYSTEMS PACIFIC
4378 Old Santa Fe Road
San Luis Obispo, CA 93401

Attention: Mr. Nick Zoetewey, PE

Re: Soil Corrosivity Study
Nipomo HS Stadium and Track Improvements
Nipomo, California
HDR #18-0245SCS, ESP #300909-002

Introduction

Laboratory tests have been completed on two soil samples provided for the referenced project. The purpose of these tests was to determine if the soils might have deleterious effects on underground utility piping and concrete structures. HDR Engineering, Inc. (HDR) assumes that the samples provided are representative of the most corrosive soils at the site.

The proposed project consists of a new restroom/ticketing building, home bleachers and press box, track, scoreboard, and travel path upgrades. The site is located at 525 N. Thompson Avenue in Nipomo, California, and the water table is reportedly greater than 25 feet deep.

The scope of this study is limited to a determination of soil corrosivity and general corrosion control recommendations for materials likely to be used for construction. HDR's recommendations do not constitute, and are not meant as a substitute for, design documents for the purpose of construction. If the architects and/or engineers desire more specific information, designs, specifications, or review of design, HDR will be happy to work with them as a separate phase of this project.

Laboratory Soil Corrosivity Tests

The electrical resistivity of each sample was measured in a soil box per ASTM G187 in its as-received condition and again after saturation with distilled water. Resistivities are at about their lowest value when the soil is saturated. The pH of the saturated samples was measured per CTM 643. A 5:1 water:soil extract from each sample was chemically analyzed for the major soluble salts commonly found in soil per ASTM D4327, ASTM D6919, and Standard Method 2320-B[1]. Laboratory test results are shown in the attached Table 1.

Soil Corrosivity

A major factor in determining soil corrosivity is electrical resistivity. The electrical resistivity of a soil is a measure of its resistance to the flow of electrical current. Corrosion of buried metal is an electrochemical process in which the amount of metal loss due to corrosion is directly proportional to the flow of electrical current (DC) from the metal into the soil. Corrosion currents, following Ohm's Law, are inversely proportional to soil resistivity. Lower electrical resistivities result from higher moisture and soluble salt contents and indicate corrosive soil.

A correlation between electrical resistivity and corrosivity toward ferrous metals is:[2]

Soil Resistivity in ohm-centimeters	Corrosivity Category
Greater than 10,000	Mildly Corrosive
2,001 to 10,000	Moderately Corrosive
1,001 to 2,000	Corrosive
0 to 1,000	Severely Corrosive

[1] *American Public Health Association (APHA). 2012. Standard Methods of Water and Wastewater. 22nd ed. American Public Health Association, American Water Works Association, Water Environment Federation publication. APHA, Washington D.C.*

[2] *Romanoff, Melvin. Underground Corrosion, NBS Circular 579. Reprinted by NACE. Houston, TX, 1989, pp. 166–167.*

Other soil characteristics that may influence corrosivity towards metals are pH, soluble salt content, soil types, aeration, anaerobic conditions, and site drainage.

Electrical resistivities were in the corrosive and severely corrosive categories with as-received moisture. When saturated, both resistivities were in the severely corrosive category. The as-received resistivities were at or near their saturated values.

Soil pH values were 7.0 and 7.1. This range is neutral and does not particularly increase soil corrosivity.[3]

The soluble salt content of the samples was moderate. The nitrate concentration was high enough to be aggressive to copper.

Tests were not made for sulfide and oxidation-reduction (redox) potential because these samples did not exhibit characteristics typically associated with anaerobic conditions.

This soil is classified as severely corrosive to ferrous metals and aggressive to copper.

Corrosion Control Recommendations

The life of buried materials depends on thickness, strength, loads, construction details, soil moisture, etc., in addition to soil corrosivity, and is, therefore, difficult to predict. Of more practical value are corrosion control methods that will increase the life of materials that would be subject to significant corrosion.

The following recommendations are based on the soil conditions discussed in the Soil Corrosivity section above. Unless otherwise indicated, these recommendations apply to the entire site or alignment.

---

[3] *Romanoff, Melvin. Underground Corrosion, NBS Circular 579. Reprinted by NACE. Houston, TX, 1989, p. 8.*

Steel Pipe

1. Underground steel pipe with rubber gasketed, mechanical, grooved end, or other nonconductive type joints should be bonded for electrical continuity. Electrical continuity is necessary for corrosion monitoring and cathodic protection.

2. Install corrosion monitoring test stations to facilitate corrosion monitoring and the application of cathodic protection:

    a. At each end of the pipeline.

    b. At each end of all casings.

    c. Other locations as necessary so the interval between test stations does not exceed 1,200 feet.

3. To prevent dissimilar metal corrosion cells and to facilitate the application of cathodic protection, electrically isolate each buried steel pipeline per NACE SP0286 from:

    a. Dissimilar metals.

    b. Dissimilarly coated piping (cement-mortar vs. dielectric).

    c. Above ground steel pipe.

    d. All existing piping.

4. Choose one of the following corrosion control options:

    OPTION 1

    a. Apply a suitable dielectric coating intended for underground use such as:

        i. Polyurethane per AWWA C222 *or*

        ii. Extruded polyethylene per AWWA C215 *or*

        iii. A tape coating system per AWWA C214 *or*

        iv. Hot applied coal tar enamel per AWWA C203 *or*

        v. Fusion bonded epoxy per AWWA C213.

b. Apply cathodic protection to steel piping as per NACE SP0169.

OPTION 2

a. As an alternative to dielectric coating and cathodic protection, apply a ¾-inch cement mortar coating per AWWA C205 or encase in concrete 3 inches thick, using any type of ASTM C150 cement. Joint bonds, test stations, and insulated joints are still recommended for this alternative.

NOTE: Some steel piping systems, such as for oil, gas, and high-pressure piping systems, have special corrosion and cathodic protection requirements that must be evaluated for each specific application.

Ductile Iron Pipe

1. To prevent dissimilar metal corrosion cells and to facilitate the application of cathodic protection, electrically insulate underground iron pipe from dissimilar metals and from above ground iron pipe with insulating joints per NACE SP0286.

2. Bond all nonconductive type joints for electrical continuity. Electrical continuity is necessary for corrosion monitoring and cathodic protection.

3. Install corrosion monitoring test stations to facilitate corrosion monitoring and the application of cathodic protection:

    a. At each end of the pipeline.

    b. At each end of any casings.

    c. Other locations as necessary so the interval between test stations does not exceed 1,200 feet.

4. Choose one of the following corrosion control options:

    OPTION 1

    a. Apply a suitable coating intended for underground use such as:

        i. Polyethylene encasement per AWWA C105; *or*

        ii. Epoxy coating; *or*

iii. Polyurethane; *or*

iv. Wax tape.

NOTE: The thin factory-applied asphaltic coating applied to ductile iron pipe for transportation and aesthetic purposes does not constitute a corrosion control coating.

b. Apply cathodic protection to cast and ductile iron piping as per NACE SP0169.

OPTION 2

a. As an alternative to the coating systems described in Option 1 and cathodic protection, concrete encase all buried portions of metallic piping so that there is a minimum of 3 inches of concrete cover provided over and around surfaces of pipe, fittings, and valves using any type of ASTM C150 cement.

NOTE: Some iron piping systems, such as for fire water piping, have special corrosion and cathodic protection requirements that must be evaluated for each specific application.

Cast Iron Soil Pipe

1. Protect cast iron soil pipe with either a double wrap 4-mil or single wrap 8-mil polyethylene encasement per AWWA C105.
2. It is not necessary to bond the pipe joints or apply cathodic protection.
3. Provide 6 inches of clean sand backfill all around the pipe.

Clean Sand Backfill

1. HDR recommends the following parameters for clean sand backfill:
    a. Minimum saturated resistivity of no less than 3,000 ohm-cm; *and*
    b. pH between 6.0 and 8.0.
2. All backfill testing should be performed by a corrosion engineering laboratory.

Copper Tubing

1. Electrically insulate underground copper pipe from dissimilar metals and from above ground copper pipe with insulating devices per NACE SP0286.

2. Electrically insulate cold water piping from hot water piping systems.

3. Protect buried copper tubing by one of the following measures:

    a. Prevention of soil contact. Soil contact may be prevented by placing the tubing above ground or encasing the tubing using PVC pipe with solvent-welded joints.

    b. Installation of a factory-coated copper pipe with a minimum 25-mil thickness such as Kamco's Aqua Shield™, Mueller's Streamline Protec™, or equal. The coating must be continuous with no cuts or defects.



    c. Installation of 12-mil polyethylene pipe wrapping tape with butyl rubber mastic over a suitable primer. Protect wrapped copper tubing by applying cathodic protection per NACE SP0169.

Plastic and Vitrified Clay Pipe

1. No special corrosion control measures are required for plastic and vitrified clay piping placed underground.

2. Protect all metallic fittings and valves with wax tape per AWWA C217, or with epoxy and appropriately sized cathodic protection per NACE SP0169.

All Pipe

1. On all pipes, appurtenances, and fittings not protected by cathodic protection, coat bare metal such as valves, bolts, flange joints, joint harnesses, and flexible couplings with wax tape per AWWA C217 after assembly.

2. Where metallic pipelines penetrate concrete structures such as building floors, vault walls, and thrust blocks use plastic sleeves, rubber seals, or other dielectric material to prevent pipe contact with the concrete and reinforcing steel.

Concrete Structures and Pipe

1. From a corrosion standpoint, any type of ASTM C150 cement may be used for concrete structures and pipe because the sulfate concentration is negligible, from 0 to 0.10 percent.[4,5,6]

2. Standard concrete cover over reinforcing steel may be used for concrete structures and pipe in contact with these soils due to the low chloride concentrations[7] found onsite. Limit the water-soluble chloride ion content in the concrete mix design to less than 0.3 percent by weight of cement.

---

[4] *2015 International Building Code (IBC) which refers to American Concrete Institute (ACI) 318-14 Table 19.3.2.1*

[5] *2015 International Residential Code (IRC) which refers to American Concrete Institute (ACI) 318-14 Table 19.3.2.1*

[6] *2016 California Building Code (CBC) which refers to American Concrete Institute (ACI) 318-14 Table 19.3.2.1*

[7] *Design Manual 303: Concrete Cylinder Pipe. Ameron. p.65*

Closure

The analysis and recommendations presented in this report are based upon data obtained from the laboratory samples. This report does not reflect variations that may occur across the site or due to the modifying effects of construction. If variations appear, HDR should be notified immediately so that further evaluation and supplemental recommendations can be provided.

HDR's services have been performed with the usual thoroughness and competence of the engineering profession. No other warranty or representation, either expressed or implied, is included or intended.

Please call if you have any questions.

Respectfully Submitted,
HDR Engineering, Inc.



James Keegan



4/24/2018

Greg Frost, PE

Enc: Table 1

Table 1 - Laboratory Tests on Soil Samples

Earth Systems Pacific
Nipomo HS stadium and track improvements
Your #300909-002, HDR Lab #18-0245SCS
12-Apr-18

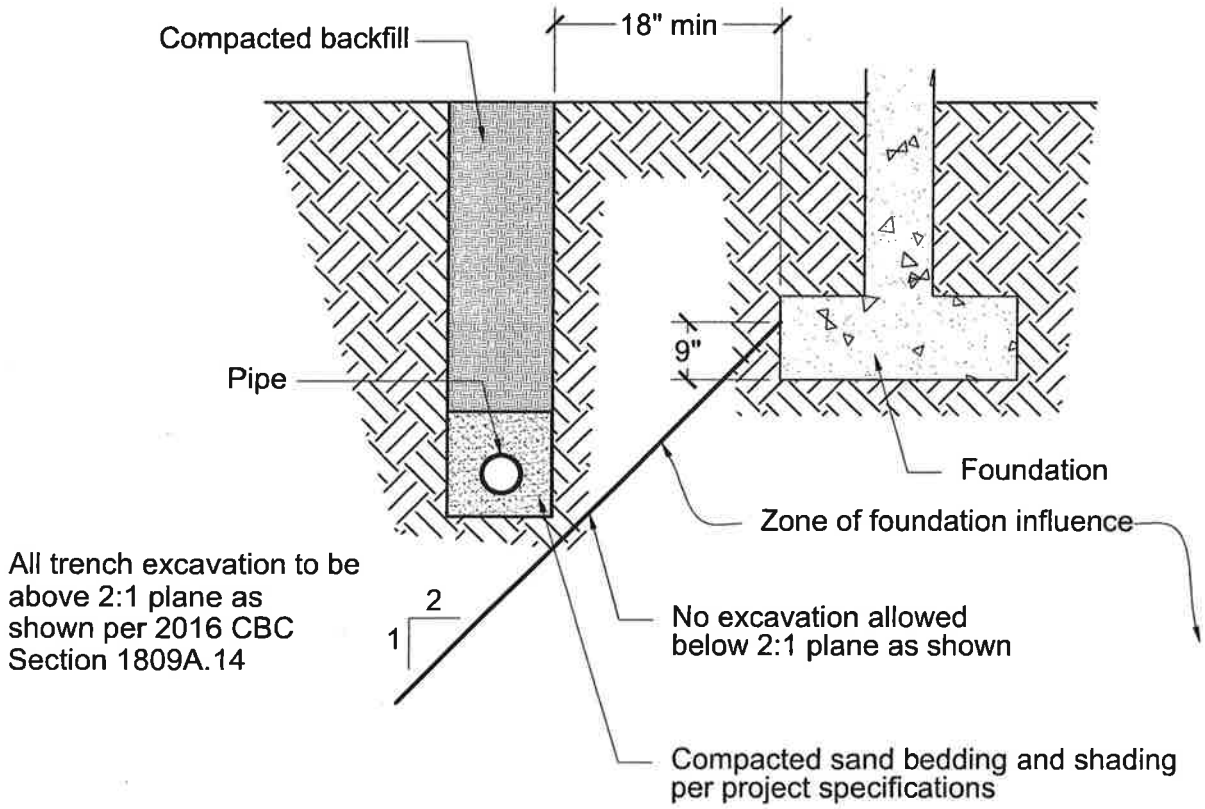
Sample ID			Bulk Sample 1/2 @ 0-5'	Bulk Sample 8/9/10 @ 0-5'
Resistivity		**Units**		
as-received		ohm-cm	1,120	680
saturated		ohm-cm	680	600
pH			7.0	7.1
Electrical Conductivity		mS/cm	0.31	0.27
Chemical Analyses				
Cations				
calcium	Ca^{2+}	mg/kg	55	58
magnesium	Mg^{2+}	mg/kg	28	30
sodium	Na^{1+}	mg/kg	235	217
potassium	K^{1+}	mg/kg	4.4	7.5
Anions				
carbonate	CO_3^{2-}	mg/kg	ND	ND
bicarbonate	HCO_3^{1-}	mg/kg	537	470
fluoride	F^{1-}	mg/kg	6.3	5.6
chloride	Cl^{1-}	mg/kg	61	25
sulfate	SO_4^{2-}	mg/kg	137	162
phosphate	PO_4^{3-}	mg/kg	ND	ND
Other Tests				
ammonium	NH_4^{1+}	mg/kg	ND	ND
nitrate	NO_3^{1-}	mg/kg	6.8	132
sulfide	S^{2-}	qual	na	na
Redox		mV	na	na

Resistivity per ASTM G187, Cations per ASTM D6919, Anions per ASTM D4327, and Alkalinity per APHA 2320-B.
Electrical conductivity in millisiemens/cm and chemical analyses were made on a 1:5 soil-to-water extract.
mg/kg = milligrams per kilogram (parts per million) of dry soil.
Redox = oxidation-reduction potential in millivolts
ND = not detected
na = not analyzed

APPENDIX E

Typical Detail A: Pipe Placed Parallel to Foundations

TYPICAL DETAIL A
PIPE PLACED PARALLEL TO FOUNDATIONS*



SCHEMATIC ONLY
NOT TO SCALE

Earth Systems Pacific

4378 Old Santa Fe Road
San Luis Obispo, CA 93401-8116
(805) 544-3276 • FAX (805) 544-1786
E-mail: esp@earthsystems.com

APPENDIX C

Laboratory Test Results

Nipomo High School
New Classroom Buildings

300909-010

BULK DENSITY TEST RESULTS

ASTM D 2937-17 (modified for ring liners)

May 5, 2025

BORING NO.	DEPTH feet	MOISTURE CONTENT, %	WET DENSITY, pcf	DRY DENSITY, pcf
1	3.0 - 3.5	25.9	96.9	77.0
1	6.0 - 6.5	24.2	120.4	96.9
1	11.0 - 11.5	28.8	112.5	87.4
2	3.0 - 3.5	23.5	119.3	96.6
2	6.0 - 6.5	28.3	110.1	85.8
2	11.0 - 11.5	37.6	116.2	84.4
3	3.0 - 3.5	32.6	112.2	84.6
3	6.0 - 6.5	33.9	117.1	87.4
3	11.0 - 11.5	33.4	119.3	89.4
4	3.0 - 3.5	6.9	110.8	103.7
4	6.0 - 6.5	30.6	118.1	90.5
4	11.0 - 11.5	37.8	115.7	84.0

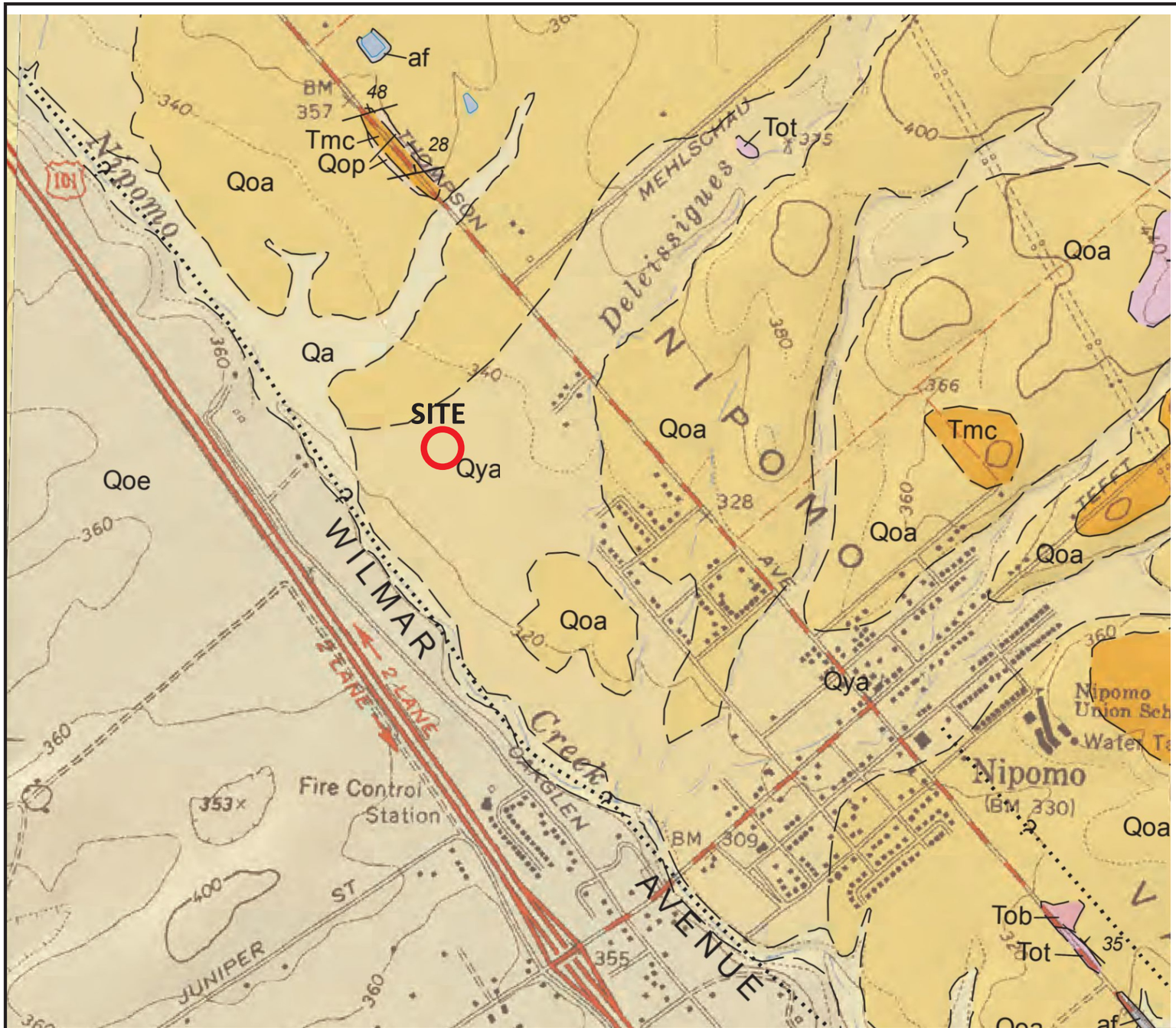
EXPANSION INDEX TEST RESULTS

ASTM D 4829-21

BORING NO.	DEPTH feet	EXPANSION INDEX
1	0.5 - 3.0	90

APPENDIX D

Figure 3 – Regional Geologic Map
Figure 4 – Historical Seismicity Map
Figure 5 – FEMA Flood Zone Map
Figure 6 – Indoor Radon Potential Map



DESCRIPTION OF MAP UNITS

SURFICIAL DEPOSITS

af — **Artificial fill (historic) –** Mapped locally, primarily underlying highway embankments and small livestock dams.

Qa — **Alluvial flood-plain deposits (late Holocene) –** Active and recently active stream channel and flood-plain deposits consisting of unconsolidated sand, silt, and clay.

Qf — **Alluvial fan deposits (Holocene) –** Unconsolidated gravel, sand, silt and clay-bearing alluvium deposited along the sides of valleys and on floodplains at the mouths of steep drainages.

Qc — **Colluvium (late Holocene) –** Unsorted sand, silt, clay and gravel depositec by gravity and slope wash processes. Mapped locally on moderate to steep slopes where it obscures underlying bedrock.

Qls — **Landslide deposits (Holocene to late Pleistocene) –** Highly fragmented to largely coherent landslide deposits; queried where existence uncertain.

Qya — **Young alluvial deposits, undivided (Holocene to late Pleistocene) –** Unconsolidated sand, silt, and clay-bearing alluvium deposited at the mouths of steep drainages. Surfaces are slightly dissected and display weak soil development.

Qof — **Old alluvial fan deposits (late Pleistocene) –** Gravel, sand, and silt deposited at the mouths of steep drainages; moderately consolidated and dissected.

Qoe — **Old eolian deposits (late Pleistocene) –** Extensive dune deposit underlying the Nipomo Mesa. Well sorted red to brown wind-blown sand with weak to moderate soil development. Surfaces are dissected and dune morphology is generally obscured.

Qoa — **Older alluvium (late to middle Pleistocene) –** Fluvial deposits of poorly sorted sand, silt and gravel preserved above active flood plains, fans, and channels. Clasts predominantly of Monterey and Obispo Formation lithologies, and occasional Franciscan Complex lithologies. Some discontinuous subhorizontal bedding. These deposits are moderately consolidated, and moderately to highly dissected, with weakly to moderately developed pedogenic soils and cemented horizons (duripans) present locally.

Monterey Formation (upper to middle Miocene) – Includes the following map units within the study area:

Tmc — **Siliceous shale –** White weathering, well-bedded siliceous siltstone and shale. Locally porcelaneous, opaline or cherty. Thin bedded and commonly laminated. Contains some fine sandstone and diatomaceous siltstone. Generally brittle, platy, closely fractured, and in some areas brecciated and secondarily silicified. In outcrop, bedding is commonly contorted by tight chevron folds.

Tmb — **Dolomitic siltstone –** Basal unit consisting of tan to yellowish-white, blocky to thin-bedded, dolomitic siltstone with thin cherty layers (Hall and Corbato, 1967; Dibblee, 2006).

Obispo Formation (lower Miocene) – Includes the following units within the study area:

Tob — **Mafic volcanic rocks –** Mostly black to dark brown, fine grained interlayered lavas consisting of basalt with some andesite. Composed of plagioclase with mafic minerals, including olivine; locally vesicular; massive to vaguely bedded. Generally deeply-weathered and incoherent except in quarries and fresh road cuts. Includes abundant diabase dikes and sills. Interlayered with rhyolitic tuffs.

Tot — **Tuff –** White to light brown rhyolitic tuff and tuff breccia, with unsorted rhyolitic fragments in a coherent rhyolitic matrix. Medium to coarse-grained; massive to vaguely bedded. Includes some waterlain beds with subrounded clasts. Interlayed with mafic volcanic rocks.

N

Source: Delattre, Marc P., and Mark O. Wiegers, 2014, Preliminary Geologic Map of the Nipomo 7.5 minute Quadrangle, original scale 1:24,000, shown at 1:12,000

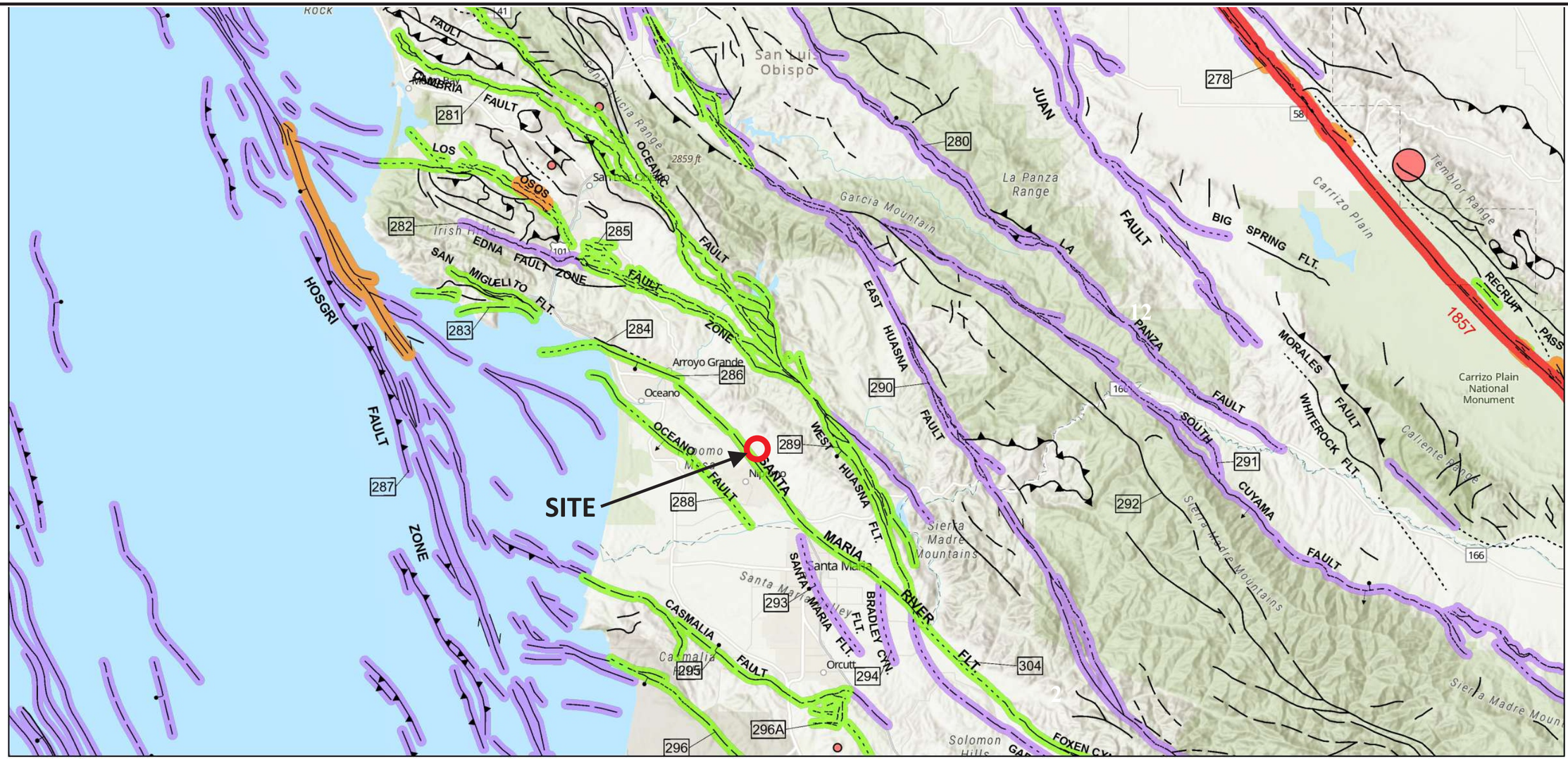
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(805) 544-3276 Fax - (805) 544-1786
www.earthsystems.com - email: esp@earthsystems.com

Regional Geologic Map
Nipomo High School
New Classroom Buildings
525 North Thompson Avenue
Nipomo, California

Figure 3

Date
June 2025

Project No.
300909-010



6/19/2025

1:447,392

0 4.25 8.5 17 mi

0 5 10 20 km

Structural Discontinuity (Local)
- structural discontinuity

Pre-Quaternary Faults
- <all other values>
- fault, certain
- fault, approx. located
- fault, concealed
- thrust fault, certain
- thrust fault, approx. located
- thrust fault, approx. located, queried
- fault, certain (ball and bar)
- fault, approx. located (ball and bar)
- fault, concealed (ball and bar)

Quaternary Faults
- fault, certain
- fault, approx. located
- fault, approx. located, queried
- fault, inferred, queried
- fault, concealed
- fault, concealed, queried
- thrust fault, certain
- thrust fault, approx. located
- thrust fault, concealed
- dextral fault, certain
- dextral fault, approx. located
- dextral fault, concealed
- sinistral fault, certain
- sinistral fault, approx. located
- sinistral fault, concealed
- thrust fault, certain (2)
- thrust fault, approx. located (2)
- thrust fault, concealed (2)
- fault, certain (ball and bar)
- fault, approx. located (ball and bar)
- fault, concealed (ball and bar)
- dextral fault, certain (ball and bar)
- fault, concealed, queried (ball and bar)
- fault, concealed, queried (ball and bar, 2)
- fault,certain (dip)
- fault, approx. located (dip)
- fault, concealed (dip)
- reverse fault, certain
- reverse fault, approx. located
- reverse fault, concealed

Fault Classification
- Historic
- Holocene
- Late Quaternary
- Quaternary

Epicenters
- < 6.0
- 7.0 +

World_Hillshade

California Geological Survey, C.W. Jennings, W.A. Bryant, Esri, CGIAR, USGS, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, (c) OpenStreetMap contributors, and the GIS User Community

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Historical Seismicity Map

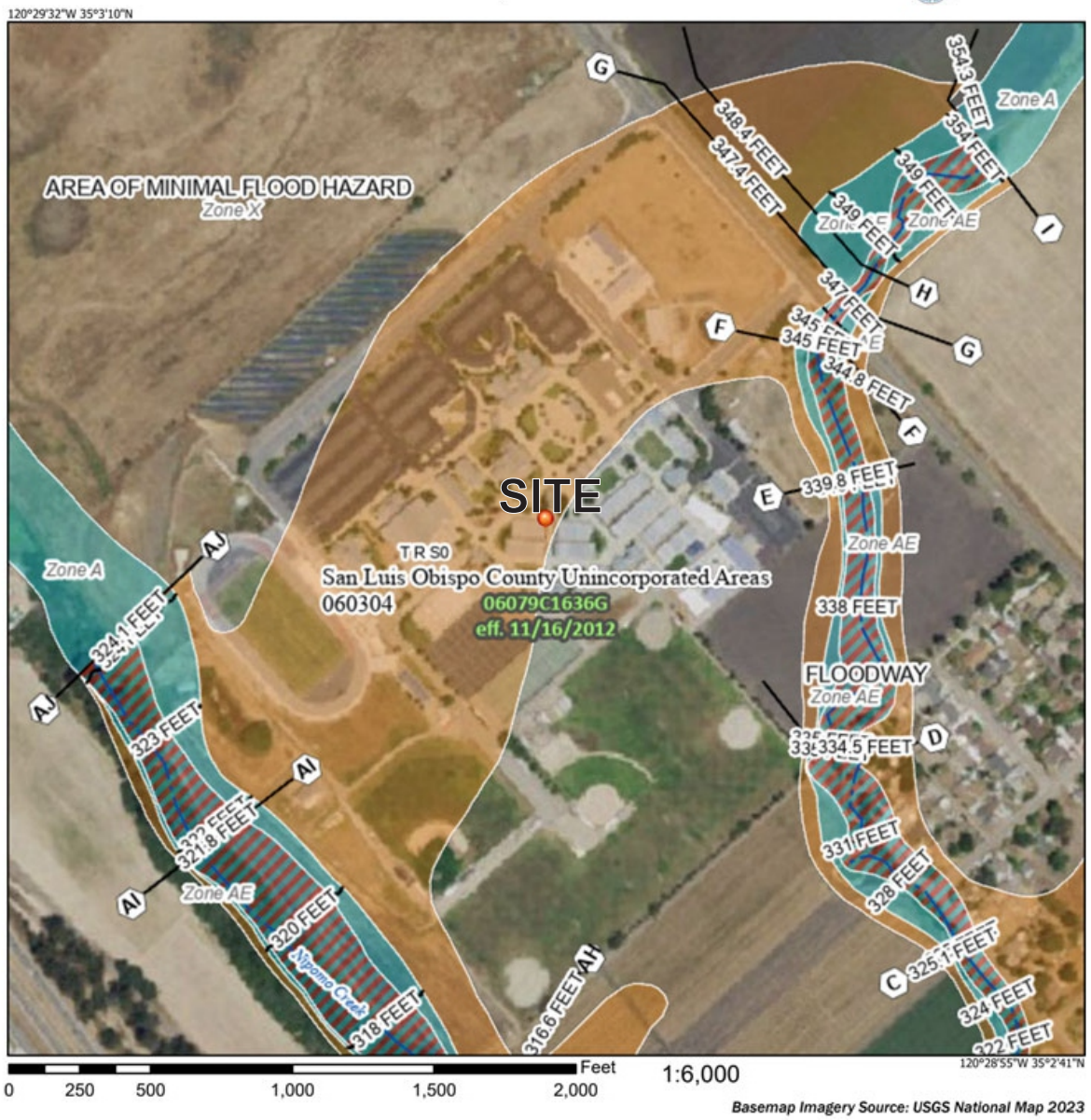
Nipomo High School
New Classroom Buildings
525 North Thompson Avenue
Nipomo, California

Figure 4

Date
June 2025

Project No.
300909-010

National Flood Hazard Layer FIRMette



Basemap Imagery Source: USGS National Map 2023

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN — Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 — Cross Sections with 1% Annual Chance
- 17.5 — Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

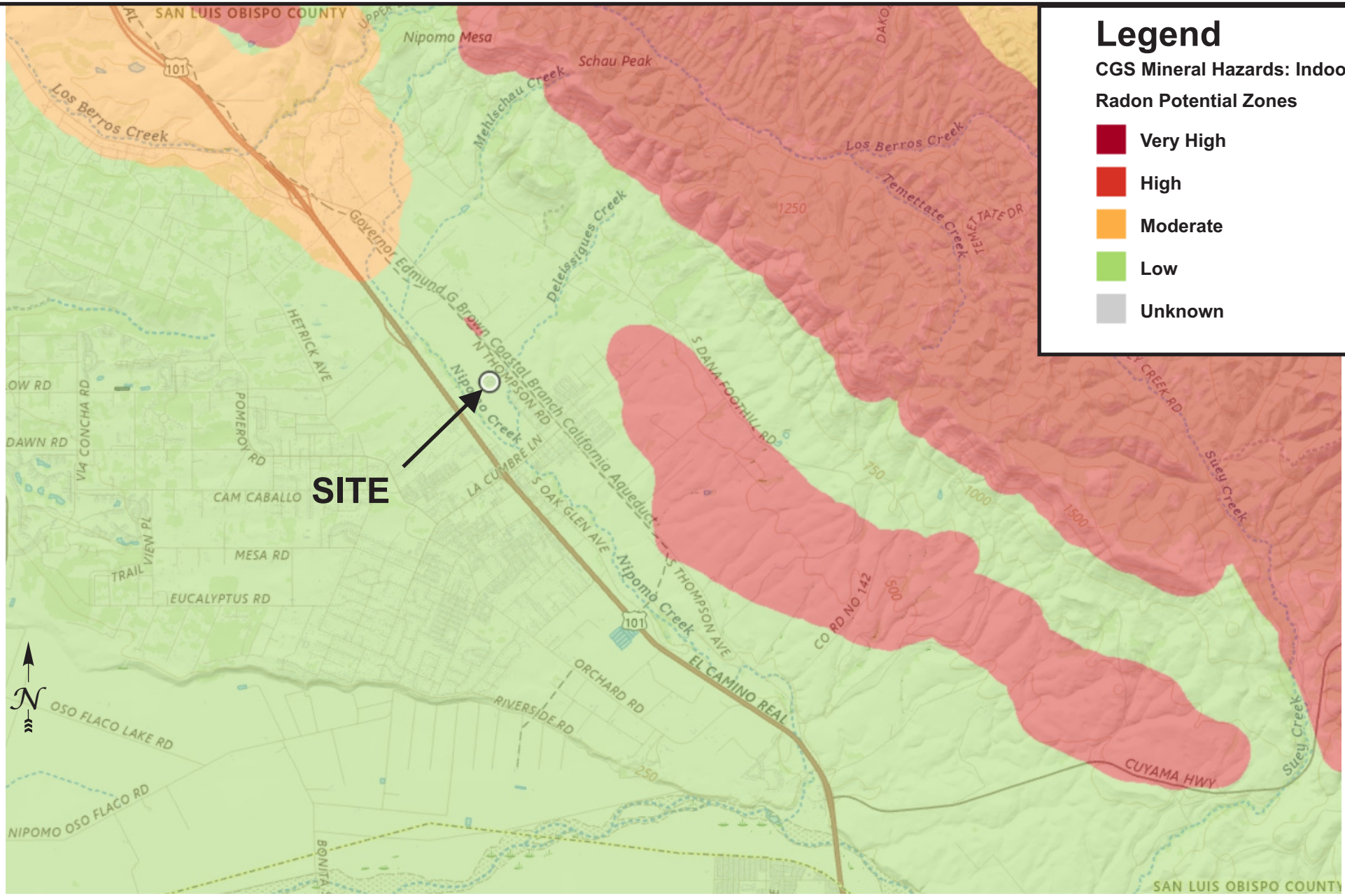
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FEMA FLOOD ZONE MAP
Nipomo High School
New Classroom Buildings
525 North Thompson Avenue
Nipomo, California

FIGURE 5

Date
June 2025

Project No.
300909-010



After Churchill, Ronald K., 2008, Radon Potential in San Luis Obispo County, California Geological Survey Special Report 208, not to scale.

EARTH SYSTEMS PACIFIC
4378 Old Santa Fe Road, San Luis Obispo, CA 93401
www.earthsystems.com - email: esp@earthsystems.com
(805) 544-3276

RADON POTENTIAL MAP

Nipomo High School
New Classroom Buildings
525 North Thompson Avenue
Nipomo, California

FIGURE 6

Date
June 2025

Project No.
300909-010

APPENDIX E

Site Specific Ground Motion Analysis – Tables E-1 through E-4

Table E-1
Fault Parameters

Fault Section Name	Distance (miles)	Distance (km)	Upper Seis. Depth (km)	Lower Seis. Depth (km)	Avg Dip Angle (deg.)	Avg Dip Direction (deg.)	Avg Rake (deg.)	Trace Length (km)	Fault Type	**Mean Mag**	Mean Return Interval (years)	Slip Rate (mm/yr)
San Luis Range 2011 CFM, FM3.1	0.2	0.3	0.0	12.0	52	na	na	79	B'	**7.2**		
San Luis Range (So Margin) FM3.2	0.4	0.6	0.0	12.0	45	37	90	115	B	**7.1**		0.2
San Luis Range - Oceano 2011 CFM, FM3.1	2.9	4.6	0.0	12.0	45	na	na	21	B'	**6.6**		
Oceanic-West Huasna FM3.1, 3.2	4.9	7.9	0.0	7.0	58	49	na	122	B'	**7.1**		
Los Osos 2011 CFM FM3.1, 3.2	5.3	8.5	0.0	12.0	45	208	90	58	B	**6.9**		0.5
Casmalia 2011 CFM	10.7	17.2	0.0	12.0	75	na	na	48	B'	**6.9**		
East Huasna 2011 CFM FM3.1, 3.2	11.3	18.2	0.0	15.0	90	na	na	74	B'	**7.2**		
San Luis Range - Pecho FM3.1, 3.2	11.4	18.4	0.0	12.0	90	na	na	26	B'	**6.6**		
Lions Head 2011 CFM FM3.1, 3.2	14.6	23.5	0.0	12.0	75	29	90	65	B	**6.7**		0.02
San Luis Bay 2011 CFM FM3.2	15.4	24.7	0.0	10.0	90	na	na	16	B'	**6.3**		
Shoreline FM3.1, 3.2	15.5	25.0	0.0	12.0	90	na	na	23	B'	**6.5**		
South Cuyama FM3.1, 3.2	15.9	25.6	0.0	13.9	33	210	na	83	B'	**7.5**		
Rinconada 2011 CFM FM3.1, 3.2	17.5	28.1	0.0	8.5	82	233	180	123	B	**7.5**		1
Hosgri FM3.1, 3.2	18.7	30.1	0.0	6.8	80	59	180	171	B	**7.3**		2.5
Hosgri (Extension) FM3.1, 3.2	19.8	31.9	0.0	7.5	80	79	na	29	B'	**6.4**		
La Panza FM3.1, 3.2	19.9	32.0	0.0	13.9	51	45	na	72	B'	**7.3**		
Los Alamos 2011 CFM FM3.1, 3.2	21.9	35.2	0.0	12.0	30	na	na	27	B'	**6.9**		
San Juan FM3.1, 3.2	27.0	43.5	0.0	13.0	90	243	180	82	B	**7.1**		1
Santa Ynez River FM3.1, 3.2	28.0	45.0	0.0	12.0	70	na	na	73	B'	**7.1**		
Morales (West) FM3.1, 3.2	33.0	53.1	0.0	8.6	32	49	na	28	B'	**6.8**		
Los Alamos extension FM3.1, 3.2	36.2	58.2	0.0	12.0	30	na	na	22	B'	**6.8**		
Santa Ynez (West) FM3.1, 3.2	37.0	59.6	0.0	9.2	70	182	0	80	B	**6.9**		2
San Andreas (Cholame) rev FM3.1, 3.2	38.5	62.0	0.0	12.0	90	51	180	63	A	**6.8**	89	3.5
San Andreas (Carrizo) rev FM3.1, 3.2	39.6	63.7	0.0	15.1	90	224	180	59	A	**6.8**	89	3.5
Ozena FM3.1, 3.2	45.6	73.4	0.0	13.9	33	na	na	41	B'	**7.2**		
Morales (East) FM3.1, 3.2	46.2	74.4	0.0	8.6	32	14	na	18	B'	**6.6**		
Red Mountain FM3.1, 3.2	48.1	77.4	0.0	14.1	56	2	90	101	B	**7.4**		2
San Andreas (Parkfield) FM3.1, 3.2	49.7	80.0	0.0	10.2	90	50	180	36	A	**6.4**	13	20
Mission Ridge-Arroyo Parida-Santa Ana FM3.1, 3.	54.3	87.3	0.0	7.6	70	176	90	69	B	**6.8**		0.4
North Channel FM3.2	55.2	88.8	1.1	4.5	26	10	90	51	B	**6.7**		1
Big Pine (West) FM3.1, 3.2	55.4	89.2	0.0	11.0	50	2	na	18	B'	**6.5**		
Pitas Point (Upper) FM3.2	55.8	89.8	1.4	10.0	42	15	90	35	B	**6.8**		1
Lost Hills FM3.1, 3.2	57.3	92.3	4.2	12.0	29	233	na	33	B'	**6.8**		
Pitas Point (Lower, West), FM 3.1	58.6	94.4	1.5	8.8	13	3	90	35	B	**7.2**		2.5
Oak Ridge (Offshore), west extension FM3.2	58.7	94.4	0.0	3.1	67	195	na	28	B'	**6.1**		
Channel Islands Western Deep Ramp FM3.1, 3.2	59.2	95.2	4.8	12.5	21	204	90	62	B'	**7.3**		
Santa Ynez (East) FM3.1, 3.2	61.4	98.8	0.0	13.3	70	172	0	68	B	**7.2**		2
San Andreas (Big Bend) FM3.1, 3.2	61.8	99.4	0.0	15.1	90	198	180	50	A	**6.8**	89	3.5
Pine Mtn FM3.1, 3.2	65.6	105.6	0.0	16.3	45	5	na	62	B'	**7.3**		
San Andreas (Creeping Section) FM3.1, 3.2	66.0	106.2	0.0	12.0	90	227	180	121	A	**6.8**	89	9

Reference: USGS OFR 2013-1165 (CGS SP 228)

Based on Site Coordinates of 35.0487 Latitude, -120.4871 Longitude

Mean Magnitude for Type A Faults based on 0.1 weight for unsegmented section, 0.9 weight for segmented model (weighted by probability of each scenario with section listed as given on Table 3 of Appendix G in OFR 2008-1437). Mean magnitude is average of Ellworths-B and Hanks & Bakun moment area relationship.

Site Coordinates: 35.0487 N 120.4871 W

Table E-2

Historical Earthquakes in Vicinity of Project Site, M >= 5.0

Day	Year	Epicenter Latitude (Degrees)	Epicenter Longitude (Degrees)	Distance from Site (mi)	Magnitude M_W
7/28	1902	34.80	120.40	17.9	**5.8**
9/5	1922	35.30	120.70	21.1	**5.5**
99/99	1830	35.35	120.65	22.7	**6.0**
7/31	1902	34.70	120.30	26.3	**5.8**
1/12	*1915	34.60	120.20	35.0	**5.7**
11/4	*1927	34.60	120.90	38.8	**7.1**
4/27	1908	35.60	120.20	41.4	**5.5**
5/30	1877	35.70	120.30	46.2	**5.5**
1/1	1821	34.55	119.85	49.9	**6.3**
3/10	1922	35.75	120.25	50.2	**6.3**
8/18	1922	35.75	120.25	50.2	**5.7**
12/7	1906	35.50	121.20	50.9	**5.7**
6/8	1934	35.79	120.29	52.4	**6.0**
9/28	2004	35.82	120.37	53.7	**6.0**
6/28	1966	35.81	120.27	54.0	**6.0**
4/7	1885	35.00	119.50	55.9	**5.5**
2/1	1853	35.70	121.10	56.7	**5.5**
12/22	2003	35.70	121.10	56.7	**6.6**
5/31	1854	34.45	119.70	60.9	**6.0**
11/16	1956	35.95	120.47	62.2	**5.0**
9/29	2004	35.95	120.50	62.2	**5.1**
3/25	1806	34.40	119.70	63.3	**5.5**
11/5	1969	34.65	121.50	63.7	**5.5**
2/14	1987	35.96	120.70	64.1	**5.2**
6/29	1925	34.30	119.80	64.8	**6.8**

From full earthquake catalog in USGS OFR 2008-1437h as updated with current events through 2024 (ANSS 2025). For events with an asterisk, alternate solutions are given in the OFR. Ordered By Closest Event. Maximum 40 Closest Events

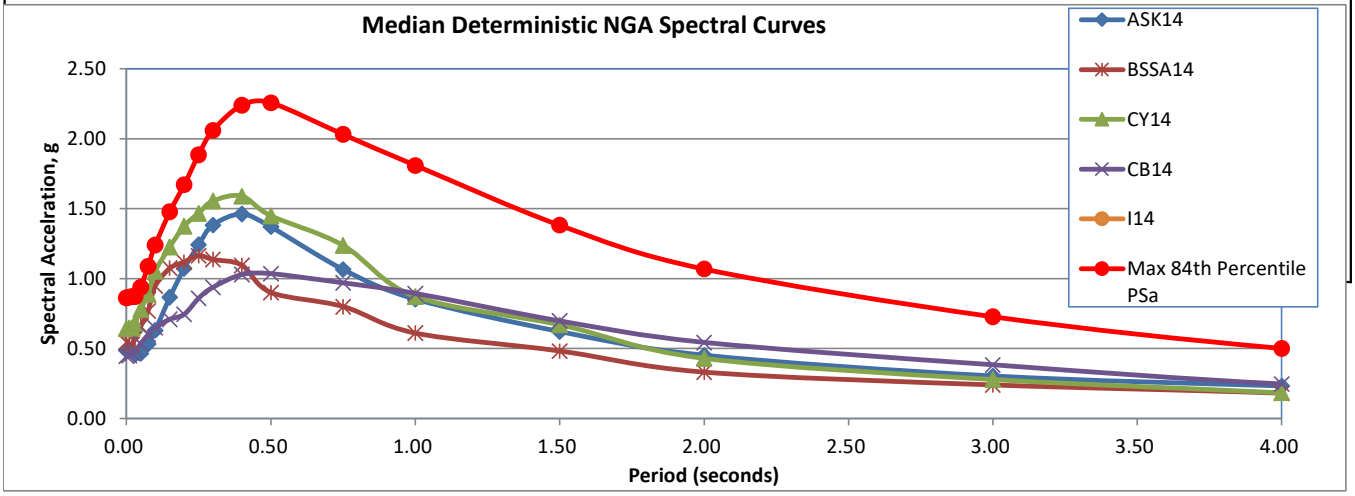
35.0487 -120.4871 Lat/Long

Table E-3 - Deterministic Spectral Response Values
Deterministic NGA Response Spectra for Largest Median Earthquake Ground Motion

Average of NGA: Abrahamson - Silva - Kamai (2014), Boore - Stewart - Seyhan - Atkinson (2013), Campbell-Bozorgnia (2013), Chiou - Youngs (2014), and Idriss (2013)

Mean Spectra Response from Attentuation Relationships

Input Variables	ASK14		BSSA14	CB14	CY14	I14	Average			
	Period (sec)	Median PSa (g)	Median PSa (g)	Median PSa (g)	Median PSa (g)	Median PSa (g)	Period (sec)	Mean PSa (g)	Max 84th Percentile PSa (g)	Max Rotated Determ. PSa
	Weight:	**0.25**	**0.25**	**0.25**	**0.25**	**0.00**				
M 7.49	**0.00**	0.49	0.54	0.45	0.64	-	**0.00**	0.528	0.862	**0.948**
	0.01	0.49	0.55	0.45	0.64	-	**0.01**	0.531	0.868	**0.955**
R_{RUP} 0.20	**0.02**	0.48	0.53	0.46	0.65	-	**0.02**	0.531	0.872	**0.960**
	0.03	0.46	0.53	0.49	0.65	-	**0.03**	0.530	0.872	**0.959**
R_{JB} 0.00	**0.05**	0.46	0.57	0.53	0.68	-	**0.05**	0.563	0.938	**1.032**
	0.075	0.53	0.66	0.60	0.78	-	**0.075**	0.643	1.088	**1.197**
V_{S30} 260	**0.10**	0.63	0.77	0.65	0.89	-	**0.10**	0.734	1.240	**1.364**
	0.15	0.87	0.95	0.71	1.05	-	**0.15**	0.893	1.477	**1.625**
F_{RV} 0	**0.20**	1.07	1.07	0.74	1.23	-	**0.20**	1.030	1.671	**1.838**
	0.25	1.24	1.12	0.86	1.38	-	**0.25**	1.148	1.886	**2.163**
F_{NM} 0	**0.30**	1.38	1.16	0.94	1.47	-	**0.30**	1.238	2.060	**2.384**
	0.40	1.46	1.14	1.03	1.55	-	**0.40**	1.296	2.240	**2.638**
W 17.00	**0.50**	1.37	1.09	1.03	1.59	-	**0.50**	1.272	2.257	**2.703**
	0.75	1.07	0.90	0.97	1.45	-	**0.75**	1.096	2.032	**2.537**
Z_{TOR} 0.00	**1.00**	0.85	0.80	0.89	1.24	-	**1.00**	0.946	1.809	**2.351**
	1.50	0.62	0.61	0.70	0.87	-	**1.50**	0.700	1.382	**1.831**
Z_{BOT} 12.00	**2.00**	0.45	0.48	0.54	0.67	-	**2.00**	0.537	1.069	**1.443**
	3.00	0.30	0.33	0.38	0.43	-	**3.00**	0.361	0.727	**1.018**
dip 45	**4.00**	0.23	0.24	0.25	0.28	-	**4.00**	0.249	0.500	**0.726**
	5.00	0.18	0.18	0.17	0.18	-	**5.00**	0.178	0.359	**0.538**
	7.50	0.10	0.09	0.07	0.08	-	**7.50**	0.085	0.169	**0.254**
	10.00	0.06	0.05	0.04	0.04	-	**10.00**	0.049	0.096	**0.143**



35.0487 -120.4871 Lat/Long

Table E-4 - Site Specific Spectral Response Values
Probabilistic and Deterministic Response Spectra for MCE compared to Code Spectra
for 5% Viscous Damping Ratio

Natural Period T (seconds)	GeoMean Probab. 2% in 50 year MCE Spectrum (1) 2475-year (ASCE 21.2.1)	Rotated Probab. 2% in 50 year MCEr Spectrum (2) 2475-year (ASCE 21.2.1.1)	Rotated 84th Percentile Determ. MCE Spectrum (3) (ASCE 21.2.2)	Determ. Lower Limit MCE Spectrum (4) (3) * 1.00=Scaling (ASCE 21.2.2)	Determ. MCE Spectrum (5) Max (3),(4) (ASCE 21.2.2)	Site Specific MCE_R, Ground Response (SaM) (6) Min (2),(5) (ASCE 21.2.3)	Site Specific MCE Spectrum Comparator (6b) Max (6),1.5*(8) (ASCE 21.2.3)	2022 CBC MCE Spectrum (7)	Site Specific Design Spectrum (Sa) (8) (ASCE 21.3)	2022 CBC Design Spectrum (9) 2/3*(7)
0.00	0.503	0.497	0.948	0.948	0.948	0.497	0.497	0.463	0.331	0.309
0.05	0.688	0.680	1.032	1.032	1.032	0.680	0.680	0.666	0.453	0.444
0.10	0.873	0.863	1.364	1.364	1.364	0.863	0.863	0.869	0.576	0.579
0.15	1.072	1.060	1.625	1.625	1.625	1.060	1.060	1.072	0.706	0.714
0.20	1.212	1.199	1.838	1.838	1.838	1.199	1.199	1.157	0.799	0.771
0.30	1.351	1.406	2.384	2.384	2.384	1.406	1.406	1.157	0.937	0.771
0.40	1.321	1.400	2.638	2.638	2.638	1.400	1.400	1.157	0.934	0.771
0.50	1.298	1.400	2.703	2.703	2.703	1.400	1.400	1.157	0.934	0.771
0.75	1.017	1.147	2.537	2.537	2.537	1.147	1.147	1.157	0.765	0.771
1.00	0.819	0.962	2.351	2.351	2.351	0.962	0.962	0.990	0.641	0.660
1.50	0.608	0.728	1.831	1.831	1.831	0.728	0.728	0.660	0.485	0.440
2.00	0.458	0.559	1.443	1.443	1.443	0.559	0.559	0.495	0.373	0.330
3.00	0.291	0.368	1.018	1.018	1.018	0.368	0.368	0.330	0.246	0.220
4.00	0.218	0.286	0.726	0.726	0.726	0.286	0.286	0.248	0.191	0.165
5.00	0.167	0.226	0.538	0.538	0.538	0.226	0.226	0.198	0.151	0.132
8.00	0.096	0.131	0.301	0.301	0.301	0.131	0.131	0.124	0.087	0.083
10.00	0.068	0.092	0.143	0.143	0.143	0.092	0.092	0.079	0.061	0.053
			0.080							

C_{RS}:	0.899	
C_{R1}:	0.904	
Site Specific To:	0.181	$= 0.2*S_{D1}/S_{DS}$
Site Specific Ts:	0.904	$= S_{D1}/S_{DS}$

The value of Fa used in Column (3) is defined within ASCE 21.2.2 Supplement 1. This Fa value only applies within Column (3).

Site Coefficients		
F_{PGA}	1.12	
F_a	1.07	
F_v	2.50	

Probabilistic spectrum from 2018 USGS Ground Motion Mapping Program adjusted for site conditions and scaled to represent maximum response in a horizontal plane, in accordance with ASCE 7-16 Section 21.2

Mapped MCE Acceleration Values		
PGA	0.479	g
S_S	1.086	g
S_1	0.396	g

Risk Coefficients have been applied to Column (2); If Method 1 was utilized the Risk Coefficients, CRS and CR1 are presented above, if Method 2 was utilized the Risk Coefficients were obtained from the USGS Risk Targeted Ground Motion Calculator (https://earthquake.usgs.gov/designmaps/rtgm).

Seismic Site Class	**D**
Risk Category	**III**

Reference: ASCE 7-16, Chapters 21.2, 21.3, 21.4, 21.5, 11.4, and 11.8

Calculation Utilized ASCE7-16, Section 21.2.1.1 - Method 1

Site-Specific Design Acceleration Values		
PGA_M	**0.503**	**g**
S_{DS}	**0.844**	**g**
S_{D1}	**0.763**	**g**

Short-Period Seismic Design Category:	1-Second Period Seismic Design Category:
D	D

Vertical Coefficient (C_V)
1.32

Deterministic Fault Parameters			
San Luis Range (So Margin) FN		R_{JB} (km)	0.0
Magnitude	7.49	R_{RUP} (km)	0.2
Distance (km)	0.3	Z_{TOR} (km)	0.0
Width (km)	17	Z_{BOT} (km)	12.0
Dip (Deg.)	45	V_{S30} (m/s)	260

Site-Specific MCE_R, 5% damped, Spectral Response Acceleration Parameter		
S_{MS}	**1.266**	**g**
S_{M1}	**1.144**	**g**

1 g = 980.6 cm/sec^2 =32.2 ft/sec^2

PSV (ft/sec) = $32.2(S_a)T/(2p)$

Key: Probab. = Probabilistic, Determ. = Deterministic, MCE = Maximum Considered Earthquake

EARTH SYSTEMS
4378 Santa Fe Road | San Luis Obispo, CA 93401 | (805) 544-3276 | www.earthsystems.com

February 9, 2026

File No.: 300909-010

CGS Application number:
03-CGS7109

Mr. Andy Stenson
Lucia Mar Unified School District
222 Stanley Avenue
Arroyo Grande, CA 93420

PROJECT: NIPOMO HIGH SCHOOL
NEW CLASROOM BUILDINGS
525 NORTH THOMPSON AVENUE
NIPOMO, CALIFORNIA
CGS APPLICATION NO. 03-CGS7109

SUBJECT: Additional Analysis of Engineering Geology and Geotechnical Engineering in Response to CGS Review Comments

Dear Mr. Stenson:

Per your authorization, we have prepared this letter in response to review comments provided by California Geological Survey (CGS 2025) where additional engineering geologic and geotechnical engineering information was requested to supplement our recent report:

- Updated Geotechnical Engineering and Geologic Hazards Report, Nipomo High School, New Classroom Buildings, 525 North Thompson Avenue, Nipomo, California (ESP 2025)

This report made references to and utilized information from the following previous reports by our firm and others:

- Geotechnical Engineering and Geologic Hazards Report, Nipomo High School, Stadium and Track Improvements, 525 North Thompson Avenue, Nipomo, California (ESP 2018)
- Geotechnical Engineering and Geologic Hazards Report, Nipomo High School / Central Coast New Tech High School, 525 North Thompson Avenue, Nipomo, California (ESP 2015)
- Cone Penetrometer Test Soundings and Initial Determination of the Presence or Absence of Faulting in the Building Area of the Proposed Lucia Mar High School Site No. 2, Nipomo, California (HFA 1999)

CGS has requested that additional information be provided, as noted in the following summary list; complete details are provided in their review letter (CGS 2025).

The analysis, conclusions, and recommendations provided herein are an addendum to our Updated Geotechnical Engineering and Geologic Hazards Report (ESP 2025). All other items reviewed by CGS and not included in the following summary list were noted (CGS 2025) to have been adequately addressed.

CGS Comment #7 - Subsurface Geology: *"Additional Information is Requested. The consultants note that the site is underlain by late Pleistocene to Holocene young alluvial deposits. Based on field exploration that consisted of four hollow-stem auger borings …The consultants have not properly considered the complete data set that is available in Reports 1 through 4 (ESP 2025, ESP 2018, ESP 2015 and HFA 1999) and may have mis-characterized subsurface conditions as a result. They are requested to perform a more complete characterization of subsurface conditions, and to also consider that shallower groundwater conditions might be justified by the provided data set."*

Response: To provide a more complete characterization of the subsurface conditions, an additional boring was drilled in the project area on January 6, 2026, to a maximum depth of approximately 51.5 feet below the existing ground surface (bgs). This boring was designated as Boring 5, continuing the sequence begun with the project's updated report (ESP 2025). The boring was drilled with a GTech GT-8 truck mounted drill rig, equipped with 6-inch outside diameter hollow stem auger and an automatic trip hammer for sampling. As the boring was drilled, soil samples were obtained continuously using a ring-lined barrel sampler (ASTM D 3550-17 with shoe similar to D 2937-17) and a Standard Penetrometer (SPT) (ASTM D 1586-18). A bulk sample was also obtained from the auger cuttings in the upper 5 feet of the boring. Following sampling, the boring was backfilled in accordance with the requirements of the governing jurisdiction. The approximate locations of all five borings completed for this project are shown on the attached Figure 2 – *Revised* Exploration Location Map.

Soils encountered in Boring 5 were categorized and logged in general accordance with the Unified Soil Classification System and ASTM D 2488-17. A copy of the boring log and a Boring Log Legend are also attached. In reviewing the boring log and legend, the reader should recognize that the legend is intended as a guideline only, and there are a number of conditions that may influence the soil characteristics as observed during drilling. These include, but are not limited to, the presence of cobbles or boulders, cementation, variations in soil moisture, presence of groundwater, and other factors. It should also be noted that the descriptions of bedrock must span a much wider range of density and strength characteristics than soil and are relative to other *bedrock* strata. For example, bedrock may be described as "soft," yet it will be considerably harder than almost any type of soil. Conversely, a clay soil may be described as "hard," however it will not be nearly as hard as the "very soft" tuff bedrock encountered on this site. Consequently, the logger must exercise judgement in interpreting the subsurface characteristics, possibly resulting in soil and bedrock descriptions that vary somewhat from the legend.

Selected ring samples obtained from Boring 5 were tested for unit weight (density) and moisture content (ASTM D 2937-17, modified for ring liners and ASTM D 2216-19). One ring sample and two SPT samples were tested for percent passing the No. 200 Sieve (ASTM D 422-63; D1140-17). Two ring samples were also tested for plasticity index (ASTM D 4318-17). The results of these tests are attached; the density and moisture content results are also included on the attached log of Boring 5.

The upper 4 feet of soils in Boring 5 were fill, consisting of loose clayey sand and medium stiff sandy fat clay. A trace of coarse sand and fine gravel were found in the fat clay below 2.5 feet bgs. Underlying the fill was stiff to very stiff sandy fat clay alluvium. Traces of fine gravel and sand were found at varying depths. From 30.0 to 34.0 feet bgs, the alluvium was interlayered medium dense clayey sand with a trace of gravel, very stiff sandy lean clay with a trace of coarse sand and fine gravel, and dense clayey sand with gravel. Below the alluvium, from 34.0 feet to the boring termination depth of 51.5 feet bgs, bedrock (very soft, decomposed Tuff) of the Obispo Formation was found. During drilling, the soils were described as being moist to very moist. No free subsurface water was encountered to the maximum depth explored of 51.5 feet bgs. Please see Figure 9 – Representative Material Photos for images of the soil and bedrock encountered within Boring 5.

In our opinion, the subsurface conditions of fill over alluvium found in Boring 5 are similar to those encountered in the previously drilled Borings 1 through 4 (ESP 2025), with the added detail of bedrock at 34.0 feet bgs. Borings for a previous investigation that encountered thin saturated soil layers were interpreted (ESP 2015) to be perched zones, rather than a true groundwater table. The current Boring 5 did not encounter any groundwater, reinforcing our previous opinion (ESP 2015).

CGS Comment #8 – Geologic Cross Sections: *"Additional information is requested. As noted in Item #7 (Comment #7) herein, subsurface conditions have not been properly defined by the consultants where buildings are proposed. In addition, Cross Section E-E of Report 4 (HFA 1999) extends across the footprints…Once subsurface geologic conditions have been reassessed by the consultants, they are requested to provide at least two geologic cross sections through the proposed building locations which correlate subsurface soils between all relevant exploration locations from Reports 1 through 4 (ESP 2025, ESP 2018, ESP 2015 and HFA 1999), Per Item 8 of CGS Note 48 (2022)…"*

Response: Attached Figures 7 and 8 (continuing the sequence from ESP 2025) are Cross Sections A-A' and B-B', respectively, through the building area, using the information previously developed (ESP 2025, ESP 2018, ESP 2015 and HFA 1999) as applicable, and the currently drilled boring. The Cross Section locations are indicated on the attached Figure 2 – *Revised* Exploration Location Map. Both cross sections extend for approximately 1,000 feet to incorporate data from several of the proximal CPT soundings.

Cross Section A-A' was oriented in an approximate northeast to southwest orientation to be more or less perpendicular to the local Wilmar Avenue fault of the San Luis Range fault system which has been mapped by Delattre and Wiegers (2014) approximately 920 feet southwest of the project site, as requested by CGS. Although the total length of Cross Section A-A' is approximately 1,000 feet, the section extends for approximately 350 feet southwest of the project area and

there are no indications of faulting indicated in the data, and therefore the fault is not depicted in the cross section. Cross Section B-B' was oriented in an approximate northwest to southeast orientation to be more or less perpendicular to Cross Section A-A'.

The original and additional data support a subsurface comprised primarily of clayey alluvial soils with thin discontinuous lenses, possibly channel deposits, of sandier soils, locally with subrounded to rounded gravel. This model is also supported by the presence of these lenticular deposits being more strongly represented across more than one boring and/or sounding in Cross Section A-A', which is oriented more or less parallel to the local creeks and drainages that trend in a southwest direction off the Temettate Ridge to the northeast. In Cross Section B-B' the sandier lenses tend to be constrained to being observed in single borings supporting the cross-channel orientation of Cross Section B-B'.

CGS Comment #20 – Seismic Settlement Calculations: *"Additional information is requested. As noted in Item 7 and 8, herein (Comment #7 and #8), the consultants have not properly characterized subsurface conditions at the locations where the buildings are proposed, and that coarser grained soil layers may be present in the subsurface below the bottom of their borings drilled for this study which could be susceptible to liquefaction and seismic settlement… CGS requests the consultants review their combined data set to a depth of 50 feet to screen for potentially liquefiable sandy/silty layers. If such sediments are present, the consultants are requested to perform a liquefaction triggering analysis and to provide copies of their calculations for CGS review.*

Response: Boring 5 completed for this response (log attached) encountered medium stiff to very stiff sandy fat clays from 4 feet bgs to 30.0 feet bgs. Two layers of clayey sand and clayey sand with gravel (each approximately 1 foot thick), in a medium dense to dense condition and with a fines content of approximately 34 percent (i.e. gravel and sand within a clayey matrix), and separated by a 2-foot-thick layer of very stiff sandy lean clay, were found below the sandy fat clay, and above bedrock. The fill found in the upper 4 feet of the site is to be overexcavated and recompacted as previously recommended (ESP 2025).

Given these soil and bedrock conditions, and the lack of groundwater in the boring, we are still of the opinion that the potential for liquefaction, as well as seismically induced settlement, to occur on this site is low to very low.

Closure

Unless superseded within, the recommendations and limitations of the Updated Geotechnical Engineering and Geologic Hazards Report (ESP 2025) remain valid and should be followed during design and construction. If there are any questions concerning this letter, please do not hesitate to contact the undersigned.

Sincerely,

Earth Systems Pacific

Nick Zoetewey, GE
Senior Engineer

Darrin Hasham, CEG
Engineering Geologist

Attachments: References
Figure 2 – *Revised* Exploration Location Map
Boring Log Legend
Boring 5 Log
Laboratory Test Results (5 pages)
Figure 7 – Cross Section A-A'
Figure 8 – Cross Section B-B'
Figure 9 – Representative Material Photos

Doc. No. 2602-014.LTR/cr

REFERENCES

California Geological Survey (CGS). November 25, 2025. *Engineering Geology and Seismology Review for Nipomo High School – Three New Classroom Buildings, 525 North Thompson Avenue, Nipomo, CA.* CGS Application No. 03-CGS7109.

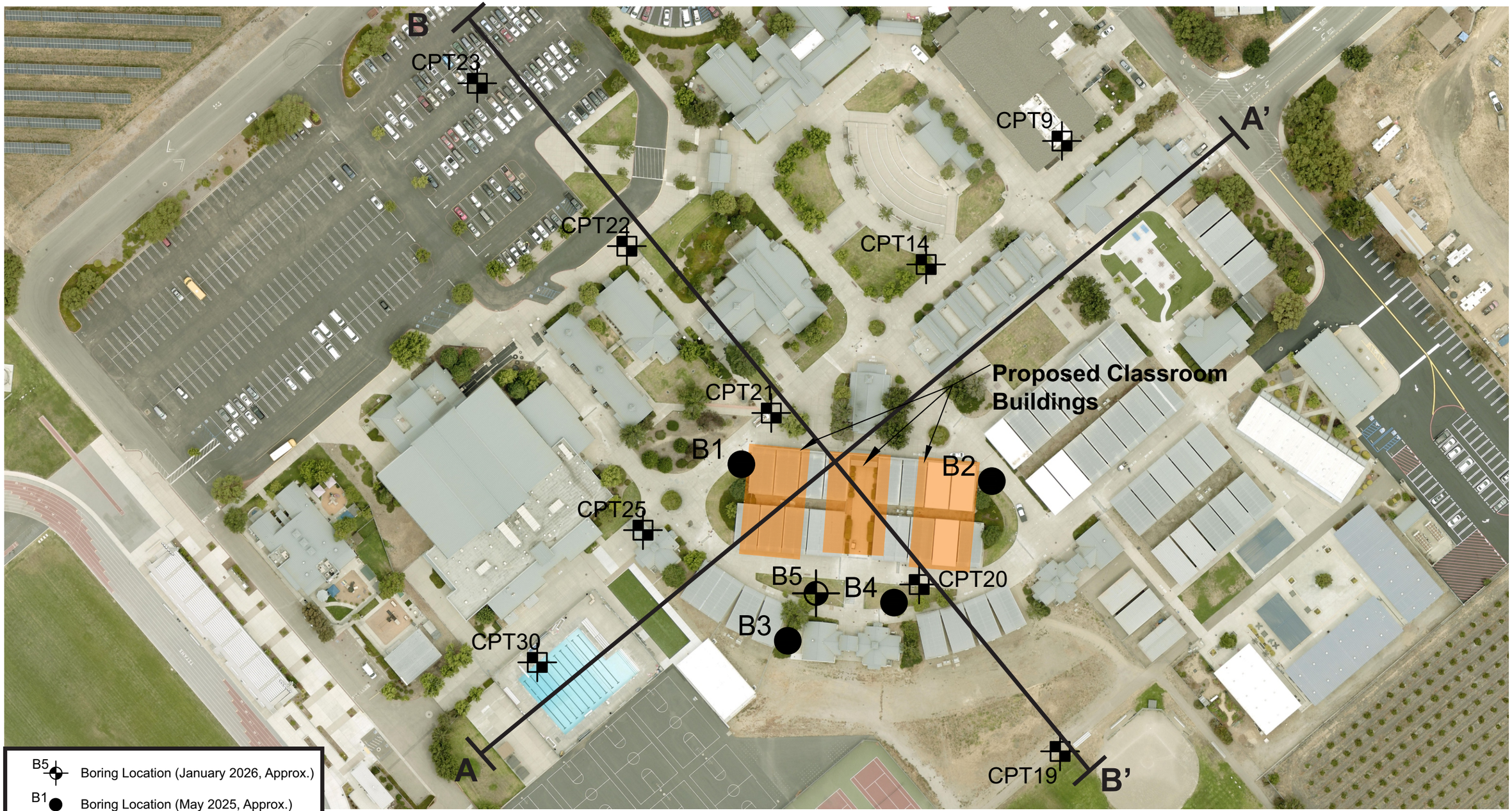
CGS (California Geological Survey). 2022. *Checklist for Review of Engineering Geology and Seismology Reports for California Public Schools, Hospitals, and Essential Services Buildings.* Note 48.

ESP (Earth Systems Pacific). June 20, 2025. *Updated Geotechnical Engineering and Geologic Hazards Report, Nipomo High School, New Classroom Buildings, 525 North Thompson Avenue, Nipomo, California.* Doc. No. 2506-043.SGR. File No. 300909-010.

ESP (Earth Systems Pacific). May 3, 2018. *Geotechnical Engineering and Geologic Hazards Report, Nipomo High School, Stadium and Track Improvements, 525 North Thompson Avenue, Nipomo, California.* Doc. No. 1805-001.SGR. File No. 300909-002.

ESP (Earth Systems Pacific). January 15, 2015. *Geotechnical Engineering and Geologic Hazards Report, Nipomo High School / Central Coast New Tech High School, 525 North Thompson Avenue, Nipomo, California.* Doc. No. 1501-077.GEO. File No. SL-17068-GA.

HFA (Holguin, Fahan & Associates, Inc.). May 27, 1999. *Cone Penetrometer Test Soundings and Initial Determination of the Presence or Absence of Faulting in the Building Area of the Proposed Lucia Mar High School Site No. 2, Nipomo, California.* Project No. 99-E775.



EARTH SYSTEMS PACIFIC
4378 Old Santa Fe Road, San Luis Obispo, CA 93401
www.earthsystems.com - email: esp@earthsystems.com
(805) 544-3276

***REVISED* EXPLORATION LOCATION MAP**

Nipomo High School
New Classroom Buildings
525 North Thompson Avenue
Nipomo, California

Figure 2

Date
January 2026

Project No.
300909-010

Earth Systems Pacific

BORING LOG LEGEND

SAMPLE / SUBSURFACE WATER SYMBOLS	GRAPH. SYMBOL
CALIFORNIA MODIFIED	
STANDARD PENETRATION TEST (SPT)	
SHELBY TUBE	
BULK	
SUBSURFACE WATER DURING DRILLING	
SUBSURFACE WATER AFTER DRILLING	

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2487)

MAJOR DIVISIONS	GROUP SYMBOL	TYPICAL DESCRIPTIONS	GRAPH. SYMBOL
COARSE GRAINED SOILS (MORE THAN HALF OF MATERIAL IS LARGER THAN #200 SIEVE SIZE)	GW	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	
	GP	POORLY GRADED GRAVELS, OR GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	
	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES, NON-PLASTIC FINES	
	GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES, PLASTIC FINES	
	SW	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	
	SP	POORLY GRADED SANDS OR GRAVELLY SANDS, LITTLE OR NO FINES	
	SM	SILTY SANDS, SAND-SILT MIXTURES, NON-PLASTIC FINES	
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES, PLASTIC FINES	
FINE GRAINED SOILS (HALF OR MORE OF MATERIAL IS SMALLER THAN #200 SIEVE SIZE)	ML	INORGANIC SILTS AND VERY FINE SANDS, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY	
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS	
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY	
	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS	
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS	
	PT	PEAT AND OTHER HIGHLY ORGANIC SOILS	

OBSERVED MOISTURE CONDITION

DRY	SLIGHTLY MOIST	MOIST	VERY MOIST	WET (SATURATED)

CONSISTENCY

COARSE GRAINED SOILS			FINE GRAINED SOILS		
BLOWS/FOOT		DESCRIPTIVE TERM	BLOWS/FOOT		DESCRIPTIVE TERM
SPT	CA SAMPLER		SPT	CA SAMPLER	
0-10	0-16	LOOSE	0-2	0-3	VERY SOFT
11-30	17-50	MEDIUM DENSE	3-4	4-7	SOFT
31-50	51-83	DENSE	5-8	8-13	MEDIUM STIFF
OVER 50	OVER 83	VERY DENSE	9-15	14-25	STIFF
			16-30	26-50	VERY STIFF
			OVER 30	OVER 50	HARD

GRAIN SIZES

U.S. STANDARD SERIES SIEVE				CLEAR SQUARE SIEVE OPENING		
# 200	# 40	# 10	# 4	3/4"	3"	12"

SILT & CLAY	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		

TYPICAL BEDROCK HARDNESS

MAJOR DIVISIONS	TYPICAL DESCRIPTIONS
EXTREMELY HARD	CORE, FRAGMENT, OR EXPOSURE CANNOT BE SCRATCHED WITH KNIFE OR SHARP PICK; CAN ONLY BE CHIPPED WITH REPEATED HEAVY HAMMER BLOWS
VERY HARD	CANNOT BE SCRATCHED WITH KNIFE OR SHARP PICK; CORE OR FRAGMENT BREAKS WITH REPEATED HEAVY HAMMER BLOWS
HARD	CAN BE SCRATCHED WITH KNIFE OR SHARP PICK WITH DIFFICULTY (HEAVY PRESSURE); HEAVY HAMMER BLOW REQUIRED TO BREAK SPECIMEN
MODERATELY HARD	CAN BE GROOVED 1/16 INCH DEEP BY KNIFE OR SHARP PICK WITH MODERATE OR HEAVY PRESSURE; CORE OR FRAGMENT BREAKS WITH LIGHT HAMMER BLOW OR HEAVY MANUAL PRESSURE
SOFT	CAN BE GROOVED OR GOUGED EASILY BY KNIFE OR SHARP PICK WITH LIGHT PRESSURE, CAN BE SCRATCHED WITH FINGERNAIL; BREAKS WITH LIGHT TO MODERATE MANUAL PRESSURE
VERY SOFT	CAN BE READILY INDENTED, GROOVED OR GOUGED WITH FINGERNAIL, OR CARVED WITH KNIFE; BREAKS WITH LIGHT MANUAL PRESSURE

TYPICAL BEDROCK WEATHERING

MAJOR DIVISIONS	TYPICAL DESCRIPTIONS
UNWEATHERED	NO DISCOLORATION, NOT OXIDIZED
SLIGHTLY WEATHERED	DISCOLORATION OR OXIDATION IS LIMITED TO SURFACE OF, OR SHORT DISTANCE FROM, FRACTURES: SOME FELDSPAR CRYSTALS ARE DULL
MODERATELY WEATHERED	DISCOLORATION OR OXIDATION EXTENDS FROM FRACTURES, USUALLY THROUGHOUT; Fe-Mg MINERALS ARE "RUSTY", FELDSPAR CRYSTALS ARE "CLOUDY"
HIGHLY WEATHERED	DISCOLORATION OR OXIDATION THROUGHOUT; FELDSPAR AND Fe-Mg MINERALS ARE ALTERED TO CLAY TO SOME EXTENT, OR CHEMICAL ALTERATION PRODUCES IN SITU DISAGGREGATION
DECOMPOSED	DISCOLORATION OR OXIDATION THROUGHOUT, BUT RESISTANT MINERALS SUCH AS QUARTZ MAY BE UNALTERED; FELDSPAR AND Fe-Mg MINERALS ARE COMPLETELY ALTERED TO CLAY

drafting/masters/Boring Log Legend 062719.dwg

Earth Systems Pacific

Boring No. 5

LOGGED BY: S. Limberg
DRILL RIG: GTech GT 8 with Automatic Hammer
AUGER TYPE: 6" Hollow Stem

JOB NO.: 300909-010
DATE: 01/06/2026

NIPOMO HIGH SCHOOL
NEW CLASSROOM BUILDINGS
525 North Thompson Avenue
Nipomo, California

DEPTH (feet)	USCS CLASS	SOIL DESCRIPTION	SAMPLE DATA: INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0	SC	CLAYEY SAND: brown, loose, moist (Fill)					
1			0.0 - 5.0	○			2 3 5
2	CH	SANDY FAT CLAY: mottled dark brown and black, medium stiff, very moist	2.0 - 3.5	●			1 2 4
3		trace coarse sand and fine gravel	3.5 - 5.0	●			4 8 11
4	CH	SANDY FAT CLAY: black, stiff, very moist, trace angular fine gravel (Alluvium)	5.0 - 6.5	■	87.3	32.3	2 5 6
5			6.5 - 8.0	●			2 4 6
6			8.0 - 9.5	●			5 12 15
7			9.5 - 11.0	■	80.3	37.8	3 6 9
8			11.0 - 12.5	●			4 7 10
9			12.5 - 14.0	●			8 14 16
10		dark brown, very stiff	14.0 - 15.5	■	88.6	32.6	4 7 10
11		stiff	15.5 - 17.0	●			5 6 9
12		very stiff	17.0 - 18.5	●			7 12 16
13			18.5 - 20.0	■	85.3	35.5	4 6 8
14			20.0 - 21.5	●			4 5 9
15		trace angular coarse sand	21.5 - 23.0	●			5 11 14
16			23.0 - 24.5	■	84.9	37.8	5 7 10
17			24.5 - 26.0	●			4 7 8
18		~1" lens of rounded gravels	26.0 - 27.5	●			
19		mottled reddish brown and dark reddish brown, very stiff, oxidation haloes, trace fine gravel					
20		stiff					
21							
22		trace subrounded fine gravel					
23							
24							
25		dark greyish brown, very stiff					
26		dark yellowish brown, increase in sand content, stiff					

LEGEND: ■ Ring Sample ○ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 5
PAGE 2 OF 2
JOB NO.: 300909-010
DATE: 01/06/2026

LOGGED BY: S. Limberg
DRILL RIG: GTech GT 8 with Automatic Hammer
AUGER TYPE: 6" Hollow Stem

NIPOMO HIGH SCHOOL
NEW CLASSROOM BUILDINGS
525 North Thompson Avenue
Nipomo, California

SOIL DESCRIPTION

DEPTH (feet)	USCS CLASS	SOIL DESCRIPTION	INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
27	CH	SANDY FAT CLAY: same as above					
28		brown, very stiff, increase in sand content, medium to coarse sand with trace fine and coarse gravel	27.5 - 29.0	■	88.8	32.1	8 12 27
29		very dusky red, decrease in sand content	29.0 - 30.5	●			9 11 12
30	SC	CLAYEY SAND: brown, medium dense, very moist, medium to coarse sand with trace gravel	30.5 - 32.0	●			8 8 7
31	CL	SANDY LEAN CLAY: dark brown, very stiff, very moist, trace angular coarse sand and fine gravel	32.0 - 33.5	■	86.9	31.5	9 13 19
32	SC	CLAYEY SAND WITH GRAVEL: brown, dense, very moist, medium to coarse sand with fine and coarse angular gravel	33.5 - 34.3	●			21 50/3.5"
33		TUFF: mottled reddish yellow, white, strong brown, and olive yellow, very soft, decomposed, very moist (Obispo Formation)	35.0 - 36.5	●			17 16 22
34			36.5 - 36.8	■			50/4"
35			38.0 - 38.8	●			8 50/3"
36			39.5 - 41.0	●			8 13 16
37			41.0 - 42.5	■	71.5	48.6	13 12 28
38			42.5 - 44.0	●			8 12 15
39			44.0 - 45.5	●			6 9 10
40			45.5 - 46.4	■			11 50/5"
41			47.0 - 47.2	●	NO RETURN		50/2"
42			48.5 - 48.8	●			50/4"
43			50.0 - 51.5	■	79.2	48.3	15 26 32
44		End of Boring @ 51.5'					
45		No subsurface water encountered					
46							
47							
48							
49							
50							
51							
52							
53							

LEGEND: ■ Ring Sample ○ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Nipomo High School
New Classroom Buildings

300909-010

BULK DENSITY TEST RESULTS

ASTM D 2937-17 (modified for ring liners)

January 15, 2026

BORING NO.	DEPTH feet	MOISTURE CONTENT, %	WET DENSITY, pcf	DRY DENSITY, pcf
5	6.0 - 6.5	32.3	115.6	87.3
5	10.5 - 11.0	37.8	110.6	80.3
5	15.0 - 15.5	32.6	117.5	88.6
5	19.5 - 20.0	35.5	115.6	85.3
5	24.0 - 24.5	37.8	116.9	84.9
5	28.5 - 29.0	32.1	117.4	88.8
5	33.0 - 33.5	31.5	114.3	86.9
5	42.0 - 42.5	48.6	106.2	71.5
5	51.0 - 51.5	48.3	117.5	79.2

Nipomo High School
New Classroom Buildings

300909-010

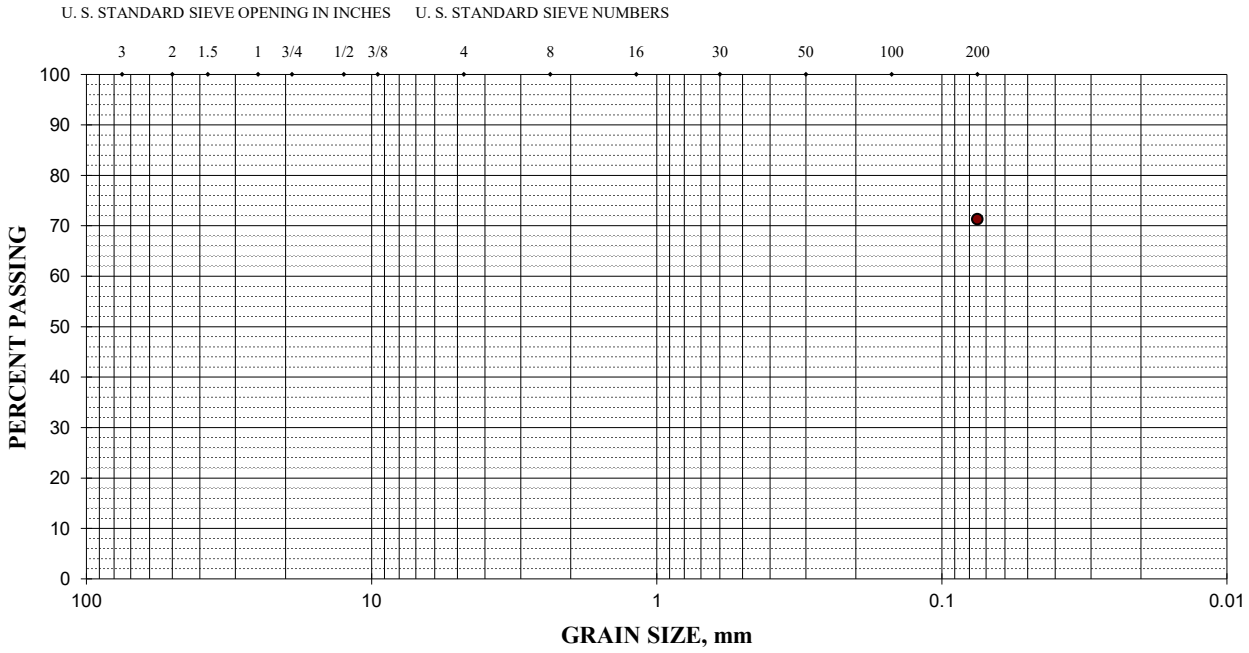
PARTICLE SIZE ANALYSIS

ASTM D 422-63/07; D 1140-17

Boring #5 @ 25.5 - 26.0'
Sandy Fat Clay (CH)

January 15, 2026

Sieve size	% Retained	% Passing
#200 (75-µm)	29	71



Nipomo High School
New Classroom Buildings

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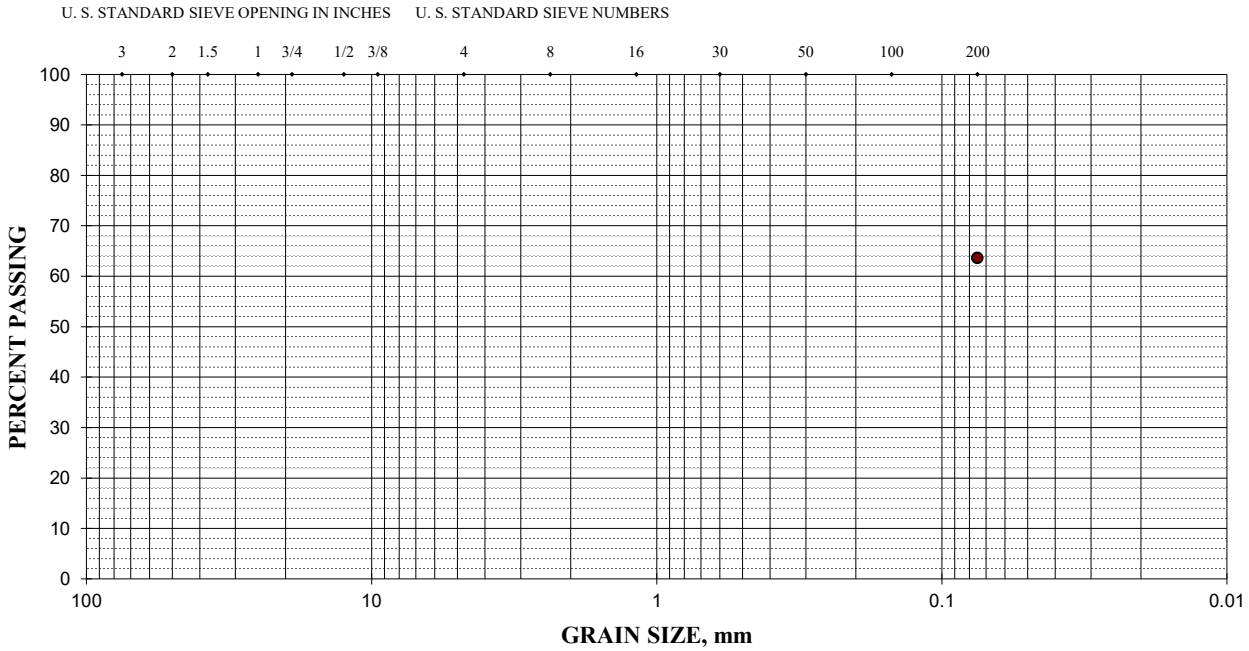
PARTICLE SIZE ANALYSIS

ASTM D 422-63/07; D 1140-17

Boring #5 @ 28.5 - 29.2'
Sandy Fat Clay (CH)

January 15, 2026

Sieve size	% Retained	% Passing
#200 (75-µm)	36	64



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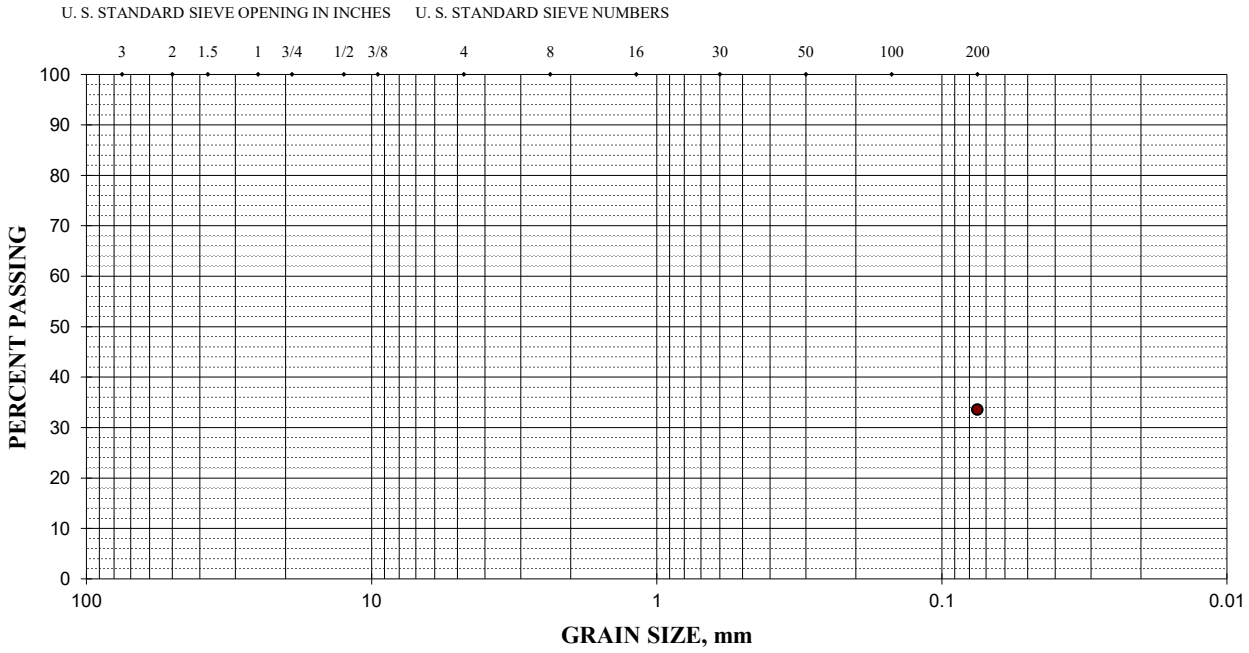
PARTICLE SIZE ANALYSIS

ASTM D 422-63/07; D 1140-17

Boring #5 @ 30.0 - 31.3'
Clayey Sand (SC)

January 15, 2026

Sieve size	% Retained	% Passing
#200 (75-µm)	66	34



New Classroom Buildings
New Classroom Buildings

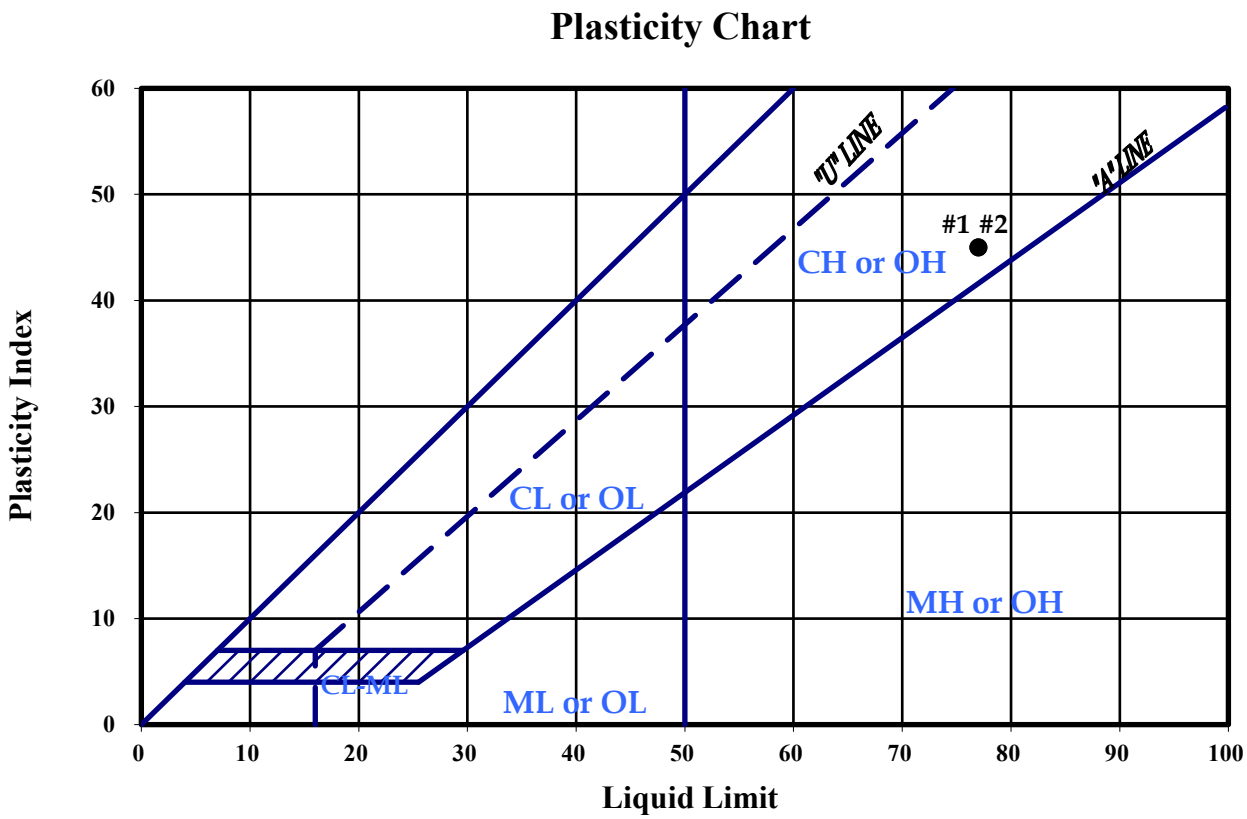
300909-010

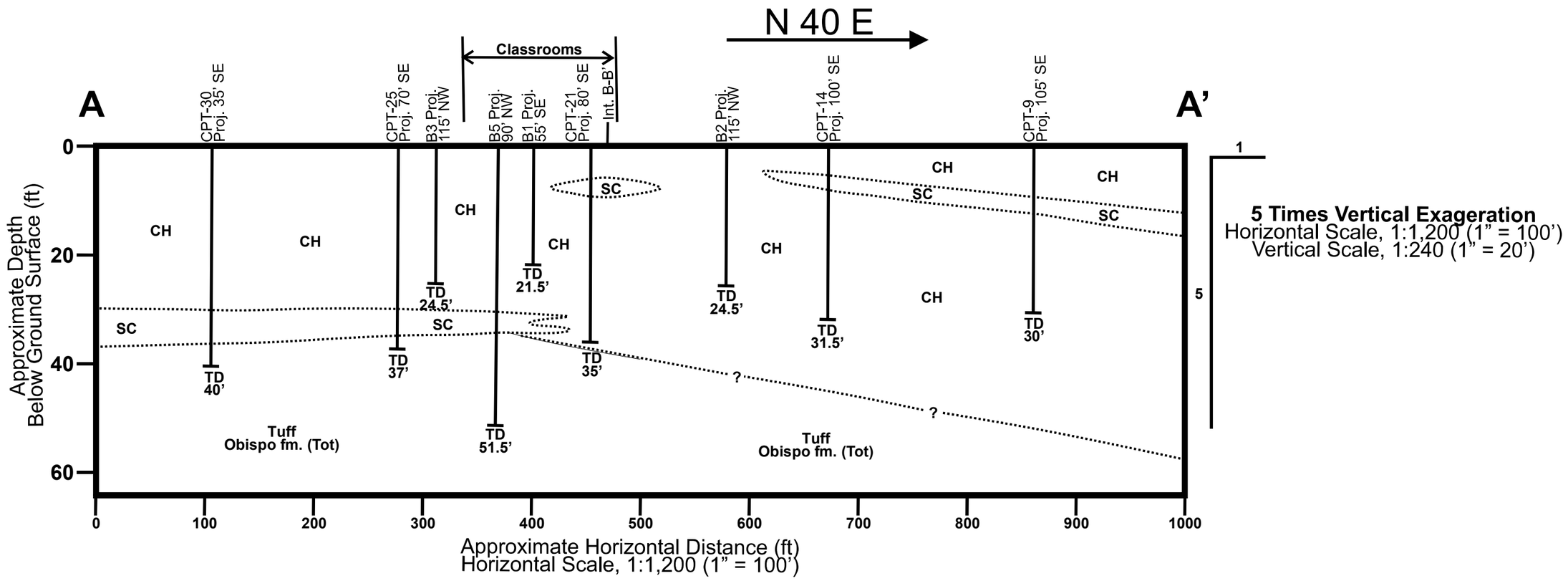
PLASTICITY INDEX

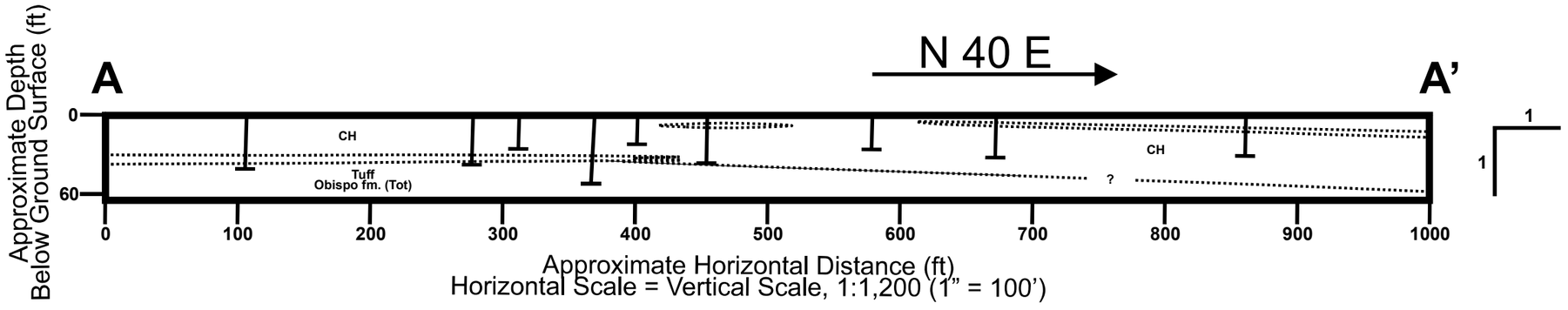
ASTM D 4318-17

January 15, 2026

Test No.:	1	2	3	4	5
Boring No.:	5	5			
Sample Depth:	6.0 - 6.5'	19.5 - 20.0'			
Liquid Limit:	77	77			
Plastic Limit:	32	32			
Plasticity Index:	45	45			







EARTH SYSTEMS PACIFIC
4378 Old Santa Fe Road, San Luis Obispo, CA 93401
www.earthsystems.com - email: esp@earthsystems.com
(805) 544-3276

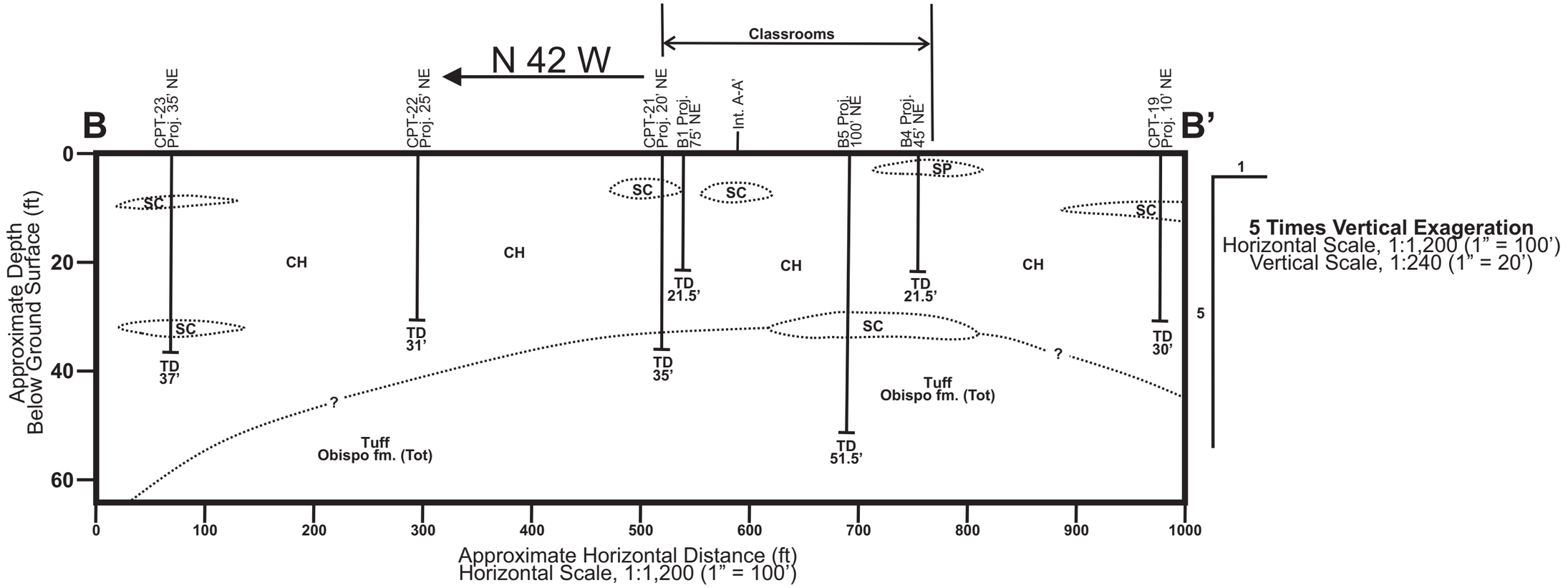
CROSS-SECTION A - A'

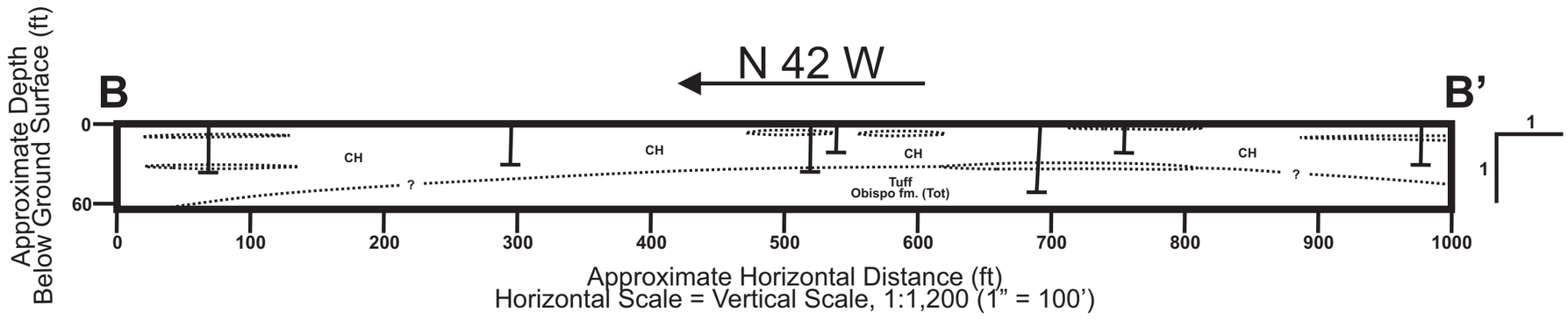
Nipomo High School
New Classroom Buildings
525 North Thompson Avenue
Nipomo, California

Figure 7

Date
January 2026

Project No.
300909-010





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CROSS-SECTION B - B'

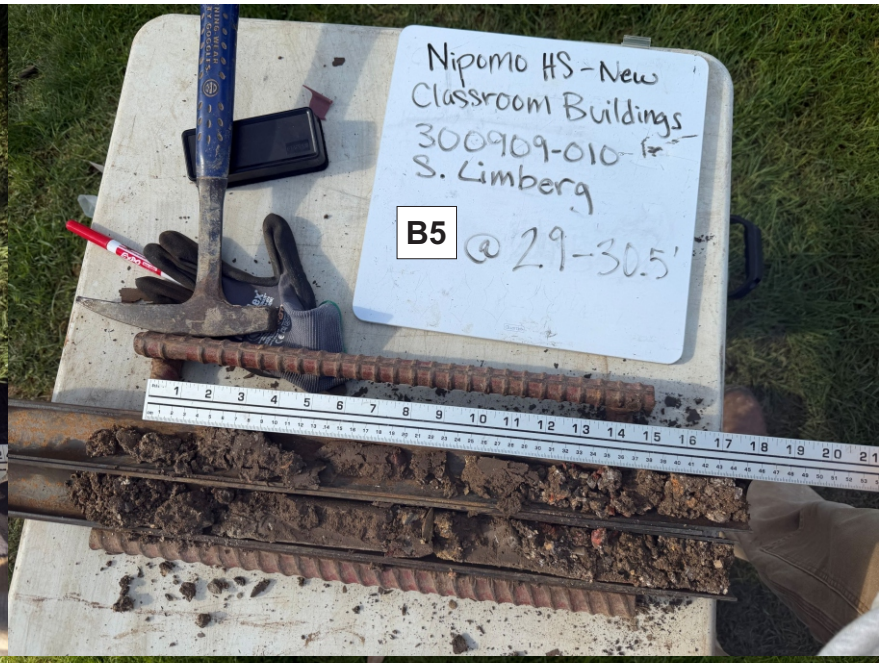
Nipomo High School
New Classroom Buildings
525 North Thompson Avenue
Nipomo, California

Figure 8

Date
January 2026

Project No.
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REPRESENTATIVE MATERIAL PHOTOS

Nipomo High School
New Classroom Buildings
525 North Thompson Avenue
Nipomo, California

FIGURE 9

Date
February 2026

Project No.
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