Project Manual

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(1) Permanent Modular TK Classroom Building @ Douglas K Fletcher ES

for:

Bakersfield City School District

Project #	Set #
2307	

ordiz melby architects
a professional corporation

INDEX OF DOCUMENTS
SECTION 01 11 00

END OF INDEX 00 01 10

SELECTIVE SITE DEMOLITION
SECTION 02 41 13

PART 1 GENERAL

1.01 SUMMARY

A. Inclusions:
   1. Provisions set forth in Divisions 0 and 1
   2. Site Demolition
      a. Removal of all trees, buildings, and structures to cleat site.
   3. Back filling and site restoration.
   4. Protection of trees and other landscape material not slated for removal.
   5. Disposal of rubbish and debris offsite.
   6. Asbestos abatement.
   7. Coordination of salvage material with Owner.
   8. Reuse and recycling.
   9. Barricades, signs, protective structures, and devices.
   10. Clean-up

B. Related Sections:
   1. Section 01 74 00 Construction Waste Management and Disposal
   2. Section 31 10 00 Site Clearing
   3. Section 31 22 00 Earthwork

C. Work by Owner:
   1. Items noted “NIC” (Not in Contract) including, but not limited to, asbestos and contaminated soil abatement, will be provided by separate Contractor.
      a. Asbestos Abatement:
         1) All asbestos abatement will be performed prior to the start of demolition of this Section.
            a) Asbestos abatement will be performed by separate Contractor and will be performed as indicated.
      b. Contaminated Soil Abatement:
         1) Contaminated soil abatement will be performed by a separate Contractor. Coordinate demolition work with contaminated Soil Abatement Contractor.

1.02 SUBMITTALS

A. Record Drawings:
   1. Keep a record of the location and size of all capped pipes and/or conduit.
   2. Submit record drawings per General Conditions.

1.03 QUALITY ASSURANCE

A. Regulatory Compliance:
   1. Work shall comply with applicable provisions of local and State safety and health ordinances.
      a. Prior to the start of any demolition, the County of Kern Environmental Health Services Department and Basic Compliance Engineering shall be given 48-hour notice by the Contractor.
   2. Take out and maintain required permits, approvals, and licenses necessary to legally complete this work.
   3. Ensure that subcontractors are properly licensed and have the required permits to perform their work.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine the demolition site to determine the extent of the work included in this Contract.

B. Accept the premises in the condition as found on the first day of work under this Contract.

3.02 PREPARATION

A. Notify utility companies concerning cut-off or restoration of service, or of relocation or modification of any such service that the work of this contract may require.

B. Protect and maintain in operation utility or sewer line that is required to remain operative during the period of this contract.

3.03 INSTALLATION OR APPLICATION

A. Furnish and maintain temporary construction, scaffolding, ladders, runways, hoists, etc.

B. Maintain a clean and safe work area, and all other affected premises.

C. If hazardous materials are encountered during demolition operations, comply with applicable regulations, laws, and ordinances concerning handling and protection against exposure or environmental pollution.
   1. Notify Architect immediately upon encountering hazardous materials.

3.04 PROTECTION OR ADJUSTMENTS

A. Enclose area of work with fence barricades.

B. The work area shall be kept securely locked at all times work is in progress.

C. Post signs and warning devices are necessary to exclude all persons, except those directly connected with the work from work areas.

D. Protect adjacent buildings, shrubs, trees, and lawns from damage.

E. Do not interfere with use of adjacent buildings or safe ingress or egress.

F. Use of explosives will not be permitted.

3.05 CLEANING OR REPAIR

A. Debris resulting from the work of this Section shall be removed and hauled away from the site.
   1. Debris and rubbish shall not be allowed to accumulate on the site.

B. All material generated by this work shall be disposed of properly outside the project limits, in accordance with all applicable regulations, laws and ordinances.
   1. Sprinkle loose material while being stored, handled, or loaded.

C. Do not burn rubbish at the site.

3.06 CONDITION OF FINISHED WORK

A. Trees and shrubs, where indicated, shall be removed along with their roots, stumps, etc.

B. Protections, tools, materials, plant apparatus, and rubbish or debris shall be removed.

C. Existing areas to remain, public or private property, that may have been damaged, made dirty, or otherwise disorderly as a result of his work shall be restored to good order.

3.07 SALVAGE

A. The Owner reserves the right to retain ownership of any equipment or fixtures removed from the property.
   1. Removed equipment and fixtures shall be stored neatly in an area designated by the Owner for a period of 48 hours.
      a. Place in neat piles or stacks.

   2. Items that are not claimed by the Owner within the 48-hour time period shall be removed from the site and properly disposed of.
   3. Improvements or materials removed from the building shall not be transferred by sale, gift, or in any manner whatsoever to the public.
      a. Sale or disposal to duly licensed contractors or materialmen is permitted.
      b. Contractor shall assume all responsibilities arising out of such operation.

B. Items indicated to be removed, but of salvageable value to the Contractor, may be removed from structure as work progresses.
   1. Transport salvaged items from site as they are removed. Storage of removed items onsite will not be permitted.
   2. Items or materials removed from the building shall not be transferred by sale, gift, or in any manner whatsoever to the public.
      a. Sale or disposal to duly licensed contractors or materialmen is permitted.
      b. Contractor shall assume all responsibilities arising out of such operation.

3.08 RECYCLING AND REUSE

A. Construction Waste Management Plan (Refer to Section 01 74 00 “Construction Waste Management and Disposal”):
   1. Where the local jurisdiction does not have a construction and demolition waste management ordinance that is more stringent, submit a construction waste management plan that:
      a. Identifies the construction waste materials to be diverted from disposal by efficient usage, recycling, reuse on the project or salvage for future use or sale.
      b. Determines if construction waste materials will be sorted on-site (source separate) or bulk mixed (single stream).
      c. Determines if construction waste materials will be sorted on-site (source separate) or bulk mixed (single stream).
      d. Determines if construction waste materials will be sorted on-site (source separate) or bulk mixed (single stream).
      e. Construction Waste Management Plan:

B. Where the local jurisdiction does have a construction and demolition waste management ordinance that is more stringent, submit a construction waste management plan that:
   1. Utilize a Waste Management Company that can provide verifiable documentation that the percentage of construction waste material diverted from the landfill complies with this section.
      a. 65% of construction waste shall be recycled or salvaged and diverted from the landfills per 2022 California Green Building Code, Title 24, Part 11, Section 5.408.

END OF SECTION 02 41 13

CONCRETE FORMING
SECTION 03 11 00

PART 1 GENERAL

1.01 SUMMARY

A. Inclusions:
   1. Provisions set forth in Divisions 0 and 1
   2. Formwork for cast-in place concrete, including shoring, bracing and anchorage.
   3. Openings for other work
   4. Form accessories.
   5. Form stripping.
   6. Clean up.

B. Related Sections:
   1. Section 03 21 00 Reinforcing Steel
   2. Section 03 31 00 Structural Concrete Work

1.02 REFERENCES

A. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute International.

B. ACI 318 - Building Code Requirements for Reinforced Concrete and Commentary; American Concrete Institute International.

C. ACI 347R - Guide to Formwork for Concrete; American Concrete Institute International.

D. PS 1 - Construction and Industrial Plywood; National Institute of Standards and Technology (Department of Commerce).

1.03 DESIGN REQUIREMENTS

A. The contractor is responsible for the design, engineer and construct formwork, shoring, reshoring, and bracing to conform to design and code requirements; resultant concrete to conform to required shape, line, and dimension. Engineering design work to be completed by a professional engineer licensed in the state in which the project is located.

B. Design and fabricate forms to support all applied loads until concrete is cured, and for easy removal without damage to concrete. Design work to be completed by a professional engineer licensed in the state in which the project is located.

1.04 SUBMITTALS

A. Refer to Section 01 30 00 “Administrative Requirements” for submittal procedures.
B. Product Data: Provide data on void form materials and installation requirements.
C. Shop Drawings: Indicate pertinent dimensions, materials, bracing, and arrangement of joints and ties. Shop drawings to be reviewed by the professional engineer responsible for the design of the formwork and submitted to the Contractor for record.
D. Openings and Blockouts: Shop drawings shall indicate the exact size and locations of only the slab edges of all openings, blockouts, sleeves and penetrations in structural elements only for review.

1.05 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 347R, ACI 301, and ACI 318.
B. Design formwork under direct supervision of a Professional Engineer experienced in design of concrete formwork and licensed in the state in which the project is located.

1.06 REGULATORY REQUIREMENTS

A. Conform to applicable code for design, fabrication, erection, and removal of formwork.

1.07 AIR QUALITY REQUIREMENTS

A. Comply with the requirements of Section 01 41 00 “Regulatory Requirements” as they are applicable to the work of this section, and as though they are repeated verbatim herein.

1.08 DELIVERY, STORAGE, AND PROTECTION

A. Deliver form materials and installation instructions in manufacturer's packaging.
B. Store forms off ground in ventilated and protected manner to prevent deterioration from moisture or damage.

PART 2 PRODUCTS

2.01 WOOD FORM MATERIALS

A. Form Materials: At the discretion of the Contractor to achieve design requirements and specified finishes.
B. Softwood Plywood: PS 1, B-B High Density Concrete Form Overlay, Class I.
C. Plywood: Douglas Fir species; solid one side grade; sound undamaged sheets with clean, true edges.
D. Lumber: Douglas Fir species; structural grade; with grade stamp clearly visible.

2.02 PREFABRICATED FORMS

A. Preformed Steel Forms: Minimum 16 gage well matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to structural tolerances and appearance of finished surfaces.

B. Glass Fiber Fabric Reinforced Plastic Forms: Matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to structural tolerances and appearance of finished concrete surfaces.
C. Pan Type: Steel, glass fiber, removable of size and profile required.
D. Tubular Column Type: Round, spirally wound laminated fiber wood, or glass fiber material, surface treated with release agent, of sizes required.
E. Void Forms: Moisture resistant treated paper faces, biodegradable, structurally sufficient to support weight of wet concrete mix until initial set.

2.03 FORMWORK ACCESSORIES

A. Form Ties: Removable or snap-off type, galvanized metal, fixed or adjustable length, cone type, with waterproofing washer, 1 inch back break dimension, free of defects that could leave holes larger than 1 inch in concrete surface.
B. Form Release Agent: Colorless material that will not stain concrete, absorb moisture, impair natural bonding of concrete finish coatings, or affect color characteristics of concrete finish coatings.
C. Corners: Chamfered, wood strip type; maximum possible lengths.
D. Dovetail Anchor Slot: Galvanized steel, minimum 14 gage thick, foam filled, release tape sealed slots, anchors for securing concrete formwork.
E. Flashing Reglets: Galvanized steel, 16 gage thick, longest possible lengths, with alignment splines for joints, foam filled, release tape sealed slots, anchors for securing to concrete formwork.
F. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.
G. Waterstops: Polyethylene, minimum 2,000 psi tensile strength, minimum 50 degrees F to plus 175 degrees F working temperature range, six inch (6”) wide, maximum possible lengths, ribbed profile, preformed corner sections, heat welded jointing.
    1. Greenstreak PVC Waterstops as manufactured by Sitka Corporation.
H. Waterstops: Preformed mineral colloid strips, 3/8 inch thick, moisture expanding.

PART 3 EXECUTION

3.01 EXAMINATION

A. Contractor shall verify lines, levels, and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.02 EARTH FORMS

A. Earth forms may be permitted only where specifically allowed in the Geotechnical report.
B. Hand trim sides and bottom of earth forms. Remove loose soil prior to placing concrete.
C. Where earth forms are used, increase the sizes of structural elements shown in the drawings by a minimum of three inches.

3.03 ERECTION – FORMWORK

A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.
B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.
C. Coordinate placement of joint devices with erection of concrete formwork and placement of form accessories.
D. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping.
E. Align joints and make watertight. Keep form joints to a minimum.
F. Obtain approval before framing openings in structural members that are not indicated on drawings.
G. Provide filler and chamfer strips on external corners of beams, joists, columns, and walls where shown on architectural drawings.
H. Install void forms in accordance with manufacturer's recommendations. Protect forms from moisture or crushing.
I. Coordinate this section with other sections of work that require attachment of components to formwork.

3.04 APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.
B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.
C. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.05 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings where required for items to be embedded in or passing through concrete work.
B. Locate and set in place items that will be cast directly into concrete.
C. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.
D. Install accessories in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.
E. Install waterstops in accordance with manufacturer's instructions, so they are continuous without displacing reinforcement. Heat seal joints so they are watertight.
F. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

G. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

3.06 FORM CLEANING

A. Clean forms as erection proceeds, to remove foreign matter within forms.
B. Clean formed cavities of debris prior to placing concrete.
   1. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.
   2. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

3.07 FORMWORK TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 301.
B. Construct and align formwork for elevator hoistway in accordance with ASME A17.1.
C. Camber slabs and beams in accordance with structural drawings requirements.

3.08 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 45 23 “Tests and Inspections”.
B. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and to verify that supports, fastenings, wedges, ties, and items are secure.

3.09 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads as determined by the engineer responsible for the formwork design.
B. Remove formwork and reshore structural members as directed by the engineer responsible for the formwork design to permit successive construction.
C. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.
D. Store removed forms to prevent damage to form materials or to fresh concrete. Discard damaged forms.
E. Remove formwork in such a sequence as to achieve similar concrete surface coloration.

END OF SECTION 03 11 00

REINFORCING STEEL
SECTION 03 21 00

PART 1 GENERAL

1.01 SUMMARY

A. Inclusions:
   1. Reinforcing steel for cast-in-place concrete and concrete masonry units.
   2. Supports and accessories for steel reinforcement.

B. Related Sections
   1. Section 03 11 00: Concrete Forming.
   2. Section 03 31 00: Structural Concrete Work.

1.02 REFERENCES

A. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute International.

B. ACI 318 - Building Code Requirements for Reinforced Concrete and Commentary; American Concrete Institute International.

C. ASTM A 82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

D. ASTM A 184/A 184M - Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement.

E. ASTM A 185 - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.

F. ASTM A 497/A 497M - Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete.

G. ASTM A 615/A 615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

H. ASTM A 704/A 704M - Standard Specification for Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement.

I. ASTM A 706/A 706M - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.

J. ASTM A 996/A 996M - Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement.

K. AWS D1.4 - Structural Welding Code - Reinforcing Steel; American Welding Society.

L. CRSI (DA4) - Manual of Standard Practice; Concrete Reinforcing Steel Institute.

M. CRSI (P1) - Placing Reinforcing Bars; Concrete Reinforcing Steel Institute.

1.03 SUBMITTALS

A. Shop Drawings: Only when deviations are made from the contract documents, submit shop drawings under provision of Section 01 31 00 “Project Management and Coordination” with deviations clearly identified.
   1. Indicate sizes, spacings, locations and quantities of reinforcing steel, wire fabric, bending and cutting schedules, splicing, stirrup spacing, supporting and spacing devices.

B. Manufacturer's Certificate: Certify that reinforcing steel and accessories supplied for this project meet or exceed specified requirements.

C. Reports: Submit certified copies of mill test report of reinforcement materials analysis, indicate physical and chemical analysis.

D. Welders Certificates: Submit certifications for welders employed on the project, verifying AWS qualifications with the previous 12 months.

1.04 QUALITY ASSURANCE

A. Perform work of this section in accordance with CRSI (DA4), CRSI (P1), ACI 301, and ACI SP-66.

1.05 AIR QUALITY REQUIREMENTS

A. Comply with the requirements of Section 01 41 00 “Regulatory Requirements” as they are applicable to the work of this section, and as though they are repeated verbatim herein.

PART 2 PRODUCTS

2.01 REINFORCEMENT

A. Reinforcing Steel: ASTM A 615/A 615M Grade 60.
   1. Deformed billet-steel bars.
   2. Unfinished.

B. Reinforcing Steel: ASTM A 706/A 706M, deformed low-alloy steel bars.
   1. Deformed billet-steel bars.
   2. Unfinished.

C. Steel Welded Wire Reinforcement: ASTM A185/A 185M, plain type.
   1. Welded Wire Mat Reinforcing: mesh size and gage as indicated on drawings.

D. Steel Welded Wire Reinforcement: ASTM A 497, deformed type.
   1. Flat Sheets.
   2. Mesh Size and Wire Gage: As indicated on drawings.

E. Reinforcement Accessories:
   1. Tie Wire: Annealed, minimum 16 gage acceptable patented system.
   2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement, including load bearing pad on bottom to prevent vapor barrier puncture.
   3. Provide stainless steel, plastic, or plastic coated steel components for placement within 1½" of weathering surfaces.

2.02 FABRICATION

A. Fabricate concrete reinforcing in accordance with CRSI (DA4) - Manual of Standard Practice.

B. Welding of reinforcement is permitted only with the specific approval of Structural Engineer. Perform welding in accordance with AWS D1.4.

C. Obtain approval from the architect for additional reinforcing splices not indicated on drawings.

PART 3 EXECUTION

3.01 PLACEMENT

A. Comply with requirements of ACI 301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.

B. Install welded wire reinforcement in maximum possible lengths, and offset end laps in both directions. Splice laps with tie wire.
   1. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with concrete placement.
   2. Do not displace or damage vapor barrier.
   3. Accommodate placement of formed openings.
   4. Bond and ground reinforcement to requirements of Section 26 05 26 "Grounding and Bonding for Electrical Systems".

3.02 FIELD QUALITY CONTROL

A. An independent testing agency, as specified in Section 01 45 23 “Tests and Inspections”, will inspect installed reinforcement for conformance to contract documents before concrete placement.

END OF SECTION 03 21 00

STRUCTURAL CONCRETE WORK
SECTION 03 31 00

PART 1 GENERAL

1.01 SUMMARY:

A. Inclusions:
   1. Provisions set forth in Divisions 0 and1
   2. Structural concrete and slabs for buildings and structures
   3. Footings for exterior concrete block walls
   4. Under slab drainage and gravel beds
   5. Under slab perforated vent piping
   6. Under slab geotextile fabric where detailed
   7. Placing of bolts, anchors, frames, inserts, etc.
   8. Protection and patching of concrete
   9. Concrete pits and slabs for plumbing, electrical, heating and ventilation inside of buildings or structures.
   10. Submittal preparation and concrete mix designs
   11. Superplasticizers and admixtures
   12. Control and expansion joints
   13. Clean-up.

B. Related Sections:
   1. Section 03 11 00: Concrete Forming
   2. Section 03 21 00: Steel Reinforcing.
   3. Section 07 26 00: Under-slab Vapor Barrier.
   4. Section 07 92 00: Joint Sealants.
   5. Section 32 13 13: Site Concrete.

1.02 REFERENCES

A. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; American Concrete Institute International.

B. ACI 211.2 - Standard Practice for Selecting Proportions for Structural Lightweight Concrete; American Concrete Institute International

C. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute International.

D. ACI 302.1R - Guide for Concrete Floor and Slab Construction; American Concrete Institute International.

E. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; American Concrete Institute International.

F. ACI 305R - Hot Weather Concreting; American Concrete Institute International.

G. ACI 306R - Cold Weather Concreting; American Concrete Institute International.

H. ACI 308R - Guide to Curing Concrete; American Concrete Institute International.

I. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; American Concrete Institute International.

J. ASTM C 33 - Standard Specification for Concrete Aggregates.

K. ASTM C 39/C 39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

L. ASTM C 94/C 94M - Standard Specification for Ready-Mixed Concrete.

M. ASTM C 143/C 143M - Standard Test Method for Slump of Hydraulic-Cement Concrete.

N. ASTM C 150 - Standard Specification for Portland Cement.

O. ASTM C 173/C 173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.

P. ASTM C 260 - Standard Specification for Air-Entraining Admixtures for Concrete.

Q. ASTM C 309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

R. ASTM C 330 – Standard Specification for Lightweight Aggregates for Structural Concrete.

S. ASTM C 494/C 494M - Standard Specification for Chemical Admixtures for Concrete.

T. ASTM C 618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.

U. ASTM C 685/C 685M – Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing.

V. ASTM C 881/C 881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.

W. ASTM C 1059 - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete.

X. ASTM C 1107/C 1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).

Y. ASTM E 1155 - Standard Test Method for Determining F(F) Floor Flatness and F(L) Floor Levelness Numbers.

Z. ASTM E 1155M - Standard Test Method for Determining F(F) Floor Flatness and F(L) Floor Levelness Numbers [Metric].

1.03 DEFINITIONS

A. Severe Exposure: Concrete which is in contact with moisture or deicing salts, such as pavements, sidewalks, parking garage floors, etc.

B. Moderate Exposure: Concrete which is occasionally exposed to moisture, such as exterior walls, beams, girders, and slabs not in contact with soil, etc.

1.04 SUBMITTALS

A. General: Submit in accordance with Section 01 31 00 “Project Management and Coordination”.

B. Shop Drawings: Submit drawings locating slab-on-grade construction joints, control joints, and isolation joints.

C. Product Data: Submit product data for proprietary products.

D. Samples:
   1. Provide 12 inch by 18 inch concrete sample of smooth rubbed [grout cleaned] [cork float] finishes showing final texture to be expected.

E. Mix Designs:
   1. Submit proposed concrete mix designs for each class or use at least 30 days prior to required delivery.
   2. Mixes shall be prepared by a professional engineer licensed in the state in which the project is located.
   3. Specifically indicate where each class of concrete is to be used.
   4. Indicate individual and combined aggregate gradations and aggregate source and characteristics.

F. Test Reports: Submit aggregate and concrete mix test reports from independent testing laboratory as required by Section 01 45 23 “Tests and Inspections”.

1.05 QUALITY ASSURANCE

A. Certifications:
   1. Submit material certification for admixtures and aggregates, certifying their

compliance with specifications.
2. Submit certified mill test reports for each lot of cement.

B. Perform work of this section in accordance with ACI 301 and ACI 318.

C. Acquire cement from same source and aggregate from same source for entire project.

D. Follow recommendations of ACI 305R for concreting during hot weather.

E. Follow recommendations of ACI 306R for concreting during cold weather.

1.06 PRE-INSTALLATION CONFERENCE

A. Conduct pre-installation conference in accordance with Section 01 31 00 “Project Management and Coordination”.

1.07 DELIVERY, STORAGE, AND HANDLING

A. General: Comply with requirements of Section 01 60 00 “Product Requirements”.

B. Deliver packaged products to site in manufacturer's sealed and labeled containers; inspect to verify compliance with specified requirements.

C. Label containers to indicate manufacturer's name, product name, date of manufacture, and instructions for use.

D. Store liquid materials in tightly covered containers in well ventilated area at ambient temperatures recommended by manufacturer. Store dry materials on raised platforms and cover to prevent moisture damage. Maintain containers in clean condition, free of foreign materials and residue with labels in legible condition.

E. Take precautionary measures to prevent fire hazards and spontaneous combustion.

1.08 AIR QUALITY REQUIREMENTS

A. Comply with the requirements of Section 01 41 00 “Regulatory Requirements” as they are applicable to the work of this section, and as though they are repeated verbatim therein.

PART 2 PRODUCTS

2.01 FORMWORK

A. Comply with the requirements of Section 03 11 00 “Concrete Forming”.

2.02 REINFORCEMENT

A. Comply with the requirements of Section 03 21 00 “Steel Reinforcing”.

2.03 CONCRETE MATERIALS

A. Portland Cement:
   1. ASTM C150, Type as indicated in the structural drawings.
   2. Air-entraining portland cement, as defined by ASTM C150, is prohibited.
   3. [Do not use Type III cement in lightweight structural concrete.]

B. Aggregate:
   1. Coarse Aggregate:
      a. ASTM C33 for normal weight aggregate.
      b. ASTM C330 for lightweight aggregate.
   2. Fine Aggregate: ASTM C33.
   3. Exposed Aggregate: To match Architect's sample.

C. Water: Clean, fresh and potable.

D. Admixtures:
   1. Calcium chloride, thiocyanates, or admixtures containing more than 0.05 percent chloride ions are not permitted unless approved by Architect.
   2. Air Entraining: ASTM C260.
   3. Water-reducing: ASTM C494, Type A.
   4. High Range Water-reducing (Superplasticizer): ASTM C494, Type F or Type G.
   5. Water-reducing, Non-corrosive, Non-chloride Accelerator:
      a. ASTM C494, Type E.
      b. Submit long term non-corrosive test data from independent testing laboratory using accelerated test method such as electrical potential measure.
   6. Water-reducing, Retarding: ASTM C494, Type D.
   7. Chemical Corrosion Inhibitor:
      a. Calcium nitrite in liquid form.
      b. Acceptable Product: DCI by Grace Construction Products, Cambridge, MA.

E. Synthetic Fibers:
   1. Monofilament or fibrillated polypropylene fibers.
   2. Acceptable Products:
      a. Fiberstrand, Euclid Chemical Company, Cleveland, OH.
      b. Fibermesh, Fibermesh, Chattanooga, TN.
      c. Forta CR, Forta Corporation, Grove City, PA.

F. Bonding Admixture:
   1. Acrylic or styrene butadiene, non-remulsifiable.
   2. Acceptable Products:

a. Flex-Con or SBR Latex, Euclid Chemical Company, Cleveland, OH.
b. Everbond, L&M Construction Chemicals, Inc., Omaha, NE.
c. Acryl Set, Master Builders, Cleveland, OH.
d. Intralok, W. R. Meadows, Inc., Elgin IL.

G. Bonding Grout:
1. Mix consisting of portland cement, part fine sand passing No. 30 mesh sieve, bonding admixture, and water in proportions as recommended by bonding admixture manufacturer.
2. Minimum 1:1 cement to sand ratio.
3. Mix to achieve consistency of thick cream.

H. Membrane Vapor Barrier:
1. Comply with the requirements of Section 07 26 00 “Under Slab Vapor Barrier”.

2.04 CONCRETE MATERIALS

A. Sheet Curing Materials: ASTM C171; white opaque polyethylene film, white polyethylene coated burlap sheeting, or regular waterproof paper.

B. Dissipating Resin Curing Compounds:
1. ASTM C309, Type 1 [1-D] clear or translucent [with fugitive dye] [Type 2 white pigmented at exterior locations], Class B, free of natural or petroleum waxes. Class A not acceptable.
2. Liquid, membrane forming, 100 percent resin based allowing maximum moisture loss in 72 hours of 0.11 lb/sq. ft.
3. Compatible with subsequent coatings and toppings.
4. Acceptable Products:
a. Kurex, Chem-Masters Corporation, Madison, OH.
b. Kurez DR, Euclid Chemical Company, Cleveland, OH.
c. L&M Cure DR, L&M Construction Chemicals, Inc., Omaha, NE.
d. 3100 Clear, W. R. Meadows, Inc., Elgin, IL.
e. ABCO 1309 Resin Cure, Nox-Crete Chemicals, Omaha, NE.
f. Kurez VOX, Euclid Chemical Co., Cleveland, OH.
g. L&M Cure R, L&M Construction Chemicals, Inc,. Omaha, NE
h. 1100 Clear, W.R. Meadows, Elgin, IL.

C. Acrylic Curing/Sealing Compounds:
1. ASTM C1315, Type I [I-D] clear or translucent [with fugitive dye] [Type II white pigmented at exterior locations], Class A [B] [C], free of natural or petroleum waxes.
2. Liquid, membrane forming, minimum 30 percent [12 percent] [22 percent] acrylic resin solids, allowing maximum moisture loss in 72 hours of 0.08 lb/sq. ft.
3. Compatible with subsequent coatings and toppings.
4. Acceptable Products:

a. Super Rez-Seal (31 percent) [Rez-Seal (14 percent)] [Eucocure (18 percent)], Euclid Chemical Company, Cleveland, OH.
b. Dress & Seal 30 [18] [Dress & Seal], L&M Construction Chemicals, Inc., Omaha, NE.
c. Tiah (30 percent) [CS-309 (12 percent)], W. R. Meadows, Inc., Elgin, IL.
d. ABCO Cure & Seal 830 (30 percent) [309 (12 percent)] [800 (22 percent)], Nox-Crete Chemicals, Omaha, NE.
e. Cure & Seal 31 percent [14 percent] [18 percent], Symons Corporation, Des Plaines, IL.

D. Water Based Acrylic Curing/Sealing Compounds:
1. ASTM C1315, Type I, Class A [B] [C], VOC compliant, free of natural or petroleum waxes. Dries clear with high [medium] gloss sheen.
2. Liquid, membrane forming, minimum 30 percent [20 percent] acrylic resin solids, allowing maximum moisture loss in 72 hours of 0.08 lb/sq. ft.
3. Acceptable Products:
a. Super Diamond Clear VOX, Euclid Chemical Company, Cleveland, OH.
b. Dress & Seal WB 30, L&M Construction Chemicals, Inc., Omaha, NE.
c. VOCOMP 30, W. R. Meadows, Inc., Elgin, IL.

E. Chemical Curing Compounds:
1. Penetrating liquid, non-film forming, solution of sodium, potassium and meta silicate compounds.
2. Compatible with subsequent coatings and toppings.
3. Acceptable Products:
a. L&M Cure, L&M Construction Chemicals, Inc., Omaha, NE.
b. Eucosil, Euclid Chemical Company, Cleveland, OH.
c. Sonosil, Sonneborn Building Products, Shakopee, MN.
d. Dust-Gard, W. R. Meadows, Inc., Elgin, IL.

2.05 ACCESSORIES

A. Crusher Run Fines fill under slabs shall conform to ASTM C33 for fine aggregate #10.

B. Crushed Rock fill under slabs shall be 3/4" x #4 coarse aggregates.

C. Construction joint waterstops shall be a 75% sodium bentonite and 25% butyl composite.
1. Volclay #RX-102, 3/4" x 3/8" or equal. Use Volclay Setseal adhesive. All penetrations and slab to footing joints shall receive waterstop treatment.

D. Membrane Vapor Barrier:
1. Refer to Section 07 26 “Under-Slab Vapor Barrier” for the vapor barrier membrane.

2.06 PATCHING AND REPAIR MATERIALS

A. Epoxy Adhesive:
   1. 100 percent solids, two component material suitable for use on dry or damp surfaces, conforming to ASTM C881.
   2. Acceptable Products and Manufacturers:
      a. Concresive Liquid LPL, Master Builders, Inc., Cleveland, OH.
      b. Sikadur Hi-Mod 32, Sika Corporation, Lyndhurst, NJ.
      c. Euco 452 or 620 System, Euclid Chemical Company, Cleveland, OH.

B. Patching Compound:
   1. Polymer modified cementitious mortar.
   2. Acceptable Products and Manufacturers:
      a. Thin Coat, Concrete Coat, or Verticoat, Euclid Chemical Company, Cleveland, OH.
      b. Duratop, L&M Construction Chemicals, Inc., Omaha, NE.
      c. Sikatop 121, 122, or 123, Sika Corporation, Lyndhurst, NJ.

C. Patching Mortar:
   1. Comprised of same materials and approximately same proportions as used for surrounding concrete, except with coarse aggregate omitted.
   2. Consisting of not more than 1 part cement to 2-1/2 parts sand.
   3. Substitute white portland cement for portion of gray portland cement to match color of surrounding exposed concrete.
   4. Limit mixing water to no more than necessary for handling and placing. Maximum water/cement ratio of 0.50.

D. Bonding Agent:
   1. Acrylic, ASTM C1059, Type II, Non redispersable.
   2. Acceptable Products and Manufacturers:
      a. Everbond, L&M Construction Chemicals, Inc., Omaha, NE.
      b. Daraweld-C, Grace Construction Products, Cambridge, MA.
      c. Intralok, W. R. Meadows, Inc., Elgin IL.

E. Evaporation Retardants:
      a. Acceptable Products and Manufacturers:
         1) Eucofilm, Euclid Chemical Co., Cleveland, OH.
         2) E-Con, L&M Construction Chemicals, Inc., Omaha, NE.
         3) Confilm, Master Builders, Inc., Cleveland, OH.

2.07 CONCRETE MIXES

A. Mix Design:
   1. Submit design mixes for each type and class of concrete based on laboratory trial batch method or field experience methods described in ACI-318, Chapter 5.
   2. If trial batch method is used, employ an independent testing agency acceptable to

Architect for preparing and reporting proposed mix designs. Mix designs are to be prepared by a professional engineer licensed in the state in which the project is located.

3. Contractor employed testing agency shall not be same firm as Owner employed testing agency.
4. Use concrete of approved mix designs only.
5. The proportioning of ingredients shall provide a concrete readily worked into forms and around reinforcement under conditions of placement to be employed, without segregation or excessive bleeding.
6. Do not place concrete until design mix for that class and type of concrete is reviewed by Architect.
7. Indicate locations in structure where each mix design is to be used.
8. Identify each mix design with code number which will be used on batch tickets.

B. Design Compressive Strengths: As indicated on Structural Drawings.
   1. Normal Weight Concrete:
      a. Compressive strength, when tested in accordance with ASTM C 39/C 39M, strength at 7 days shall be at least 60% of the minimum required 28 day strength unless noted otherwise on drawings.
      b. Maximum slump 4 inches +/- 1".
   2. Lightweight Weight Concrete:
      a. Compressive strength, when tested in accordance with ASTM C 39/C 39M, strength at 7 days shall be at least 60% of the minimum required 28 day strength unless noted otherwise on drawings.
      b. Maximum slump 4 inches +/- 1".
      c. The air dry unit weight shall be determined by ASTM C567, except that the drying time shall be 90 days.

C. Maximum Size of Coarse Aggregate:
   1. 1/5 narrowest dimension between form sides.
   2. 1/3 depth of slabs.
   3. 3/4 of minimum clear distance between reinforcing bars, wires, or bundles of bars.
   4. 1 inch maximum for normal weight concrete or 3/4 inch maximum for light weight concrete.

D. Concrete Slump at Point of Discharge:
   1. Ramps and Sloping Surfaces: Not more than 3 inches.
   2. Reinforced Foundations: Not less than 1 inch and not more than 4 inches.
   3. Concrete Containing Superplasticizer: Not more than 9 inches after addition of superplasticizer. Slump before addition of superplasticizer: 2 to 3 inches.
   4. Other Concrete: Not less than 1 inch and not more than 4 inches.
   5. Allowable tolerances of up to 1 inch above maximum indicated provided average of 10 most recent batches tested is less than maximum.

E. Minimum Cement Content: Not less than 470 pounds of total cementitious material

per cubic yard of concrete. Not more than 25% flyash or pozzolan cement substitute and not less than 385 pounds of cement per cubic yard of concrete.

F. Water-Cement Ratios for Concrete (by weight):
   1. Maximum permissible water cement ratio: 0.50 unless noted otherwise on drawings.

G. Admixtures:
   1. Only use admixtures which have been tested and approved in mix designs.
   2. Air entraining Admixture:
      a. Use in concrete exposed to freezing and thawing at any time during construction or in completed structure.
      b. Use in concrete placed at ambient temperatures below 40 degrees F.
      c. Tolerance on air content as delivered: Plus or minus 1-1/2 percent.
   3. Conform to air content requirements indicated on Drawings.

H. Maximum water-soluble chloride ion concentrations in hardened concrete at ages from 28 to 42 days contributed from all ingredients, expressed as percent by weight of cement as follows:
   1. Concrete over galvanized deck: 0.06 percent.
   2. Concrete exposed to chloride in service: 0.15 percent.
   3. Other concrete: 1.00 percent.

I. Shrinkage Tests:

   1. Prior to placing any concrete for walls or horizontal surfaces, a trial batch of each mix design of structural concrete shall be prepared using the aggregates, cement and admixture (if any) proposed for the project. From each trial batch at least 3 specimens for determining drying shrinkage shall be prepared. The drying shrinkage specimens shall be a 4" x 4" x 11" prisms fabricated, cured, dried, and measured in accordance with the requirements of Tentative Method of Test for Length Change of Cement Mortar and Concrete, ASTM C157. The measurements shall be made and reported separately for 7 and 28 days of drying after 7 days of moist curing. The effective gage length of the specimens shall be 10", and except for the foundation concrete, the average drying shrinkage at 35 days shall not exceed .054%.
   2. Previous Test: Ready-mixed concrete manufacturer may furnish certified test reports from approved Testing Laboratory as proof of meeting shrinkage requirements, provided aggregate used and concrete covered by such test report conform to mix design approved for use on this project. Method used, use an independent testing facility acceptable to Architect for preparing and reporting proposed mix designs.

J. Use accelerating admixtures in cold weather only when approved by Architect/Structural Engineer. Use of admixtures will not relax cold weather placement requirements.

2.08 MIXING

A. Ready-Mix Concrete:
   1. Comply with ASTM C 94/C 94M.
   2. Before using trucks for batching, mixing, and transporting concrete, thoroughly clean trucks and equipment of materials capable of contaminating concrete.
   3. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C94 is required.
   4. When the air temperature is between 85 degrees F and 90 degrees F, reduce mixing and delivery time from 90 minutes to 75 minutes, and when air temperature is above 90 degrees F, reduce mixing and delivery time to 60 minutes.
   5. Do not add water to ready-mix concrete at Project site except when slump is below specified limits and total water does not exceed the design water-cement ratio; inject added water into mixer and mix thoroughly before discharging.

B. Provide certificate signed by authorized official of supplier with each load of concrete stating following:
   1. Time truck left plant.
   2. Mix of concrete, identify with code number of mix design.
   3. Amount of water and cement in mix.
   4. Amount and type of admixtures.
   5. Amount of water added at project site.
   6. Time truck is unloaded at project site.

C. Truck mixers without batch tickets will be rejected.

D. Retain certificates at Project site. Submit to Architect for review upon request.

2.09 PRODUCTION

A. Ready Mixed Concrete
   1. Except as otherwise provided in these specifications, ready mixed concrete shall be batched, mixed, and transported in accordance with ASTM C94 “Specification for Ready Mixed Concrete.”

B. Lightweight Concrete
   1. Lightweight concrete shall be batched and mixed as recommended by the concrete supplier to achieve accurate volume and the necessary quality.
   2. Aggregate storage conditions, batching, and mixing procedures shall prevent premature slump loss of the concrete during delivery and discharge.

C. Mixing Water Control
   1. Concrete which arrives at the jobsite with slump below that specified for placement may be adjusted by the addition of water to increase slump,

provided the maximum slump is not exceeded and the maximum water content of the design mix is not exceeded. Following any such water addition, the concrete shall be mixed at mixing speed for at least 30 revolutions of the drum.

2. After adjustment is made to the proper slump, the concrete shall be discharged as long as it retains its placeability without the further addition of water.
3. Concrete shall be placed within one and one half hours after mixer is charged in average conditions. Time shall be reduced to one hour during hot weather concreting.

2.10 SOURCE QUALITY CONTROL

A. Testing will be performed under the provisions of Section 01 45 23 “Tests and Inspections”, except as otherwise specified.

B. Independent Testing Laboratory, approved by Architect and employed by Contractor, is responsible for:
   1. Testing aggregate as follows at start of work and whenever change in aggregate source occurs:
      a. Gradation and fineness modulus: ASTM C136.
      b. Specific gravity: ASTM C127 for coarse aggregate, ASTM C128 for fine aggregate.
      c. Organic impurities: ASTM C40.
      d. Effect of organic impurities on strength: ASTM C87 for effect of organic impurities on strength.
      e. Potential reactivity of aggregate: ASTM C295, petrographic examination.
      f. Soundness: ASTM C88.
      g. Reports of tests conducted on aggregates from the same source within the past 12 months will be acceptable.
   2. Testing concrete mixes as follows at start of work and whenever change in materials source occurs:
      a. Prepare mix designs, test concrete strength, and report results if trial batch method is used to establish design mix proportions. Mix design shall be reviewed, approved, sealed and stamped by a Licensed Professional Engineer in the state where the project is located.

C. Independent Testing Laboratory, employed by Owner, is responsible for observing and evaluating the following at batch plant at start of Work and at other times as requested by the Architect:
   1. Condition of batching equipment.
   2. Conformance with design mix proportions.
   3. Storage of materials.
   4. Mixing equipment.
   5. Mixing and transporting equipment.
   6. Other testing to verify compliance if requested by Architect.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine conditions and proceed with Work in accordance with Section 01 73 00.

B. Verify forms, reinforcement, anchors, plates, joint materials, vapor retarder and other items to be cast into concrete are accurately placed and held securely.

C. Verify forms are free of debris and water.

D. Verify excavations are free of loose material and water.

3.02 TESTING

A. Concrete materials and operations shall be tested and inspected for compliance with the specifications and requirements.

3.03 TESTING AGENCY

A. The testing agency shall be designated by the owner. Ample time shall be allowed for preliminary tests as required prior to concreting operations.

B. All testing agency personnel shall meet the requirements of ASTM E329, “Recommended Practice of Inspecting and Testing Agencies for Concrete and Steel in Construction.”

C. All testing agency personnel shall have the knowledge and ability to perform the necessary tests equivalent to the minimum guideline for Certification of Concrete Field Testing Technicians, Grade 1 in accordance with ACI CP-2.

3.04 DUTIES AND SERVICES

A. The duties and responsibilities of the testing agency and the contractor and services to be performed by each are as designated in ACI 301, Chapter 16, “Specifications for Structural Concrete for Buildings.”

3.05 EVALUATION AND ACCEPTANCE

A. Test results of standard cylinders, molded, cured, and tested according to ASTM C31 and C39 should be evaluated separately for each concrete mix according to ACI 214, “Recommended Practice for Evaluation of Concrete Compression Test Results of Field Concrete.”

B. The criteria for acceptance of concrete shall be as detailed in ACI 318, Chapter 5, Section 5.6, “Evaluation and Acceptance of Concrete” or as per ASTM C94, Section 17 “Strength” and Section 18 “Failure to Meet Strength Requirements.”

C. As referenced in ASTM C94 – Section 4.4, “When the strength of concrete is used as a basis for acceptance, the manufacturer shall be entitled to copies of all test reports.”

3.06 PREPARATION

A. Construction Joints:
   1. Clean previously placed concrete of laitance.
   2. Clean reinforcement and accessories of mortar from previous concrete placement operations.
   3. Apply bonding agent in accordance with manufacturer's recommendations.
   4. Moisten surface of previously placed concrete.

3.07 PLACEMENT

A. Place concrete according to ACI 301 and 304R, except as modified and supplemented on Drawings or in this Section.

B. Notify Architect and Owner's testing laboratory minimum of 48 hours prior to commencement of placing operations.

C. Cold Weather Concreting:
   1. Comply with requirements of ACI 306.1.
   2. Do not place concrete when ambient air temperature is expected to fall below 40 degrees F within 24 hours, except with prior written approval of Architect.
   3. Remove frost, ice, and snow from formwork, reinforcing, and accessories prior to placing concrete.
   4. Do not place concrete foundations, footings or slabs on frozen ground.
   5. Limit concrete temperature at time of discharge to 55 degrees F for sections less than 12 inches in any dimension and to 50 degrees F for other sections.

D. Hot Weather Concreting:
   1. Comply with requirements of ACI 305R when ambient air temperature exceeds 75 degrees F.
   2. Use water-reducing, retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions to extend setting time to limits specified as approved by Architect.
   3. Cool aggregates, cool mixing water, substitute ice for part of mixing water, or take other measures to limit concrete temperature at time of discharge to 90 degrees F.
   4. Cover reinforcing steel and steel forms with water soaked burlap or use fog spray to limit temperature of steel to 120 degrees F immediately prior to concrete placement.
   5. Use evaporation retardant between finishing passes.

E. At time of placement, provide concrete temperature between 50 degrees F and

90 degrees F.

F. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.

G. Repair underslab vapor retarder damaged during placement of concrete reinforcing. Repair with vapor retarder material; lap over damaged areas minimum 6 inches and seal watertight.

H. Separate slabs on grade from vertical surfaces with joint filler.

I. Place joint filler in floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

J. Extend joint filler from bottom of slab to within 1/2 inch of finished slab surface. Conform to Section 07 92 00 “Joint Sealants” for finish joint sealer requirements.

K. Install joint devices in accordance with manufacturer's instructions.

L. Install construction joint devices in coordination with floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

M. Install joint device anchors for expansion joint assemblies specified in Section 07 95 16 “Expansion Joint Cover Assemblies”. Maintain correct position to allow joint cover to be flush with floor and wall finish.

N. Apply sealants in joint devices in accordance with Section 07 92 00 “Joint Sealants”.

O. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

P. Place concrete continuously between predetermined expansion, control, and construction joints.

Q. Do not interrupt successive placement; do not permit cold joints to occur.

R. Place floor slabs in pattern indicated.

S. Saw cut joints within 12 hours after placing.

T. Screed floors level, maintaining surface flatness of maximum 1/4 inch in 10 ft.

U. Screed floors level, maintaining the minimum F(F) Floor Flatness and F(L) Floor Levelness values specified when measured in accordance with ASTM E 1155/ASTM E 1155M.

V. Maintain surfaces receiving concrete at approximately same temperature as concrete being placed.

W. Maintain surface of hardened concrete below 100 degrees F.

X. Convey concrete from mixer to place of deposit by method that will prevent segregation or loss of material, and that will not require addition of water to produce desired slump at point of placement. Do not use supported reinforcing as runway base for concrete conveying equipment.

Y. Depositing:
1. Deposit concrete as nearly as practicable to its final location.
2. Place concrete continuously between construction joints.
3. Deposit concrete in layers not exceeding 24 inches in depth.
4. Avoid inclined layers.
5. Place each layer while preceding layer is still plastic.
6. Do not allow free fall of concrete to exceed 4 feet. Do not allow free fall of concrete containing high-range water reducing admixture to exceed 10 feet.
7. Drop concrete in vertical direction, not at incline.
8. Place beams, girders, haunches, brackets, column capitals, and drop panels monolithic with slab system unless otherwise indicated.
9. Do not cast beams, girders, and slabs supported on columns and walls until concrete in supporting element is no longer plastic, minimum of 2 hours.
10. If forms and reinforcing above level of concrete already in place become coated with accumulations of hardened or partially hardened concrete, remove accumulations before proceeding.
11. Place concrete without displacing reinforcing and accessories.

Z. Consolidation:
1. Vibrate concrete to eliminate formation of surface air voids, honeycombs and sand streaks.
2. Use mechanical, internal vibrators with proper frequency, rpm, and spud size. Select spud for size and spacing of reinforcement and clearance to formwork. Supplement vibration by hand-spading, rodding, or tamping.
3. Insert and withdraw vibrator vertically at spacing not to exceed 1-1/2 times radius of action of vibrator, maximum of 24 inch centers.
4. Insert vibrators into placed layer and at least 6 inches into preceding layer.
5. Do not allow vibrator to touch form face or embedded items.
6. Do not use mechanical vibration for slabs less than 4 inches thick. Use hand spading and tamping in these locations.

AA. Placing Concrete Slabs:
1. Deposit and consolidate concrete slabs in continuous operation, in single layer, within limits of construction joints, until placing of panel or section is completed.
2. Bring slab surfaces to correct level with straightedge and strike-off.
3. Use bull floats, highway straight edges, or darbies to produce smooth surface,

free of humps or hollows before bleed water appears on surface.
4. Do not disturb slab surfaces prior to beginning finishing operations.

BB. Non-Structural Concrete Topping:
1. Placement on same day:
   a. Place and consolidate base slab.
   b. Screed to elevation to allow for topping slab thickness.
   c. After bleed water has disappeared and surface will support worker's weight without indentation, place topping mixture, compact, float and finish.
2. Placement after one day:
   a. Place and consolidate base slab.
   b. Brush partially set surface with wire broom to remove laitance and scratch surface.
   c. Wet cure base slab at least three days.
   d. Immediately, prior to placing topping, clean base slab and dampen surface.
   e. Scrub bonding grout into base slab surface or apply bonding agent in accordance with manufacturer’s recommendations].
   f. Rewettable bonding agent may be used only in areas not subject to wet conditions.
   g. Place topping slab before grout has set or dried, compact, float and finish.

CC. Curbs and Equipment Pads:
1. Form curbs and equipment pads in areas indicated.
2. Placement on same day:
   a. Place and consolidate base slab.
   b. Screed to elevation to allow for curb/pad thickness.
   c. After bleed water has disappeared and surface will support worker's weight without indentation, place curb/pad concrete mixture, compact, and float.
3. Placement after one day:
   a. Place and consolidate base slab.
   b. Brush partially set surface with wire broom to remove laitance and scratch surface.
   c. Wet cure base slab at least three days.
   d. Immediately, prior to placing curb/pad concrete, clean base slab and dampen surface.
   e. Scrub bonding grout into base slab surface, or apply bonding agent in accordance with manufacturer’s recommendations.
   f. Place curb/pad concrete before grout has set or dried, compact and float.
4. Finish interior curbs and pads by stripping forms while concrete is still green and steel trowel surfaces to hard, dense finish with corners, intersections and terminations slightly rounded.

3.08 DEPOSITING

A. Concrete shall be continuously deposited. When continuous placement is not possible, construction joints shall be located as approved by the Architect.

Concrete shall be deposited as close to its final point of placement as possible.

B. Concrete shall be consolidated by vibration, spading, rodding or forking. Work concrete around reinforcements, embedded items and into corners. Eliminate all air or rock pockets and other causes of honeycombing, pitting or planes of weakness.

C. Internal vibration shall have a minimum frequency with amplitude to consolidate the concrete effectively. See ACI 309, "Recommended Practice for Consolidation of Concrete."
   1. Vibrators shall be operated by experienced and competent workmen.
   2. Use of vibrators to transport concrete shall not be allowed.
   3. Vibrators shall be vertically inserted every 18 inches for 5 to 15 seconds and then withdrawn.

3.09 FINISHING

A. General: Provide finishes at specified locations, unless indicated otherwise.

B. Finishing Formed Surfaces:
   1. Rough Form Finish:
      a. Leave surfaces with texture imparted by forms, except patch tie holes and defects.
      b. Remove fins and other projections exceeding 1/4 inch in height.
      c. Locations: Concrete surfaces not exposed to view.
   2. Smooth Form Finish:
      a. Provide smooth, hard, uniform surface with minimum number of seams.
      b. Repair and patch defective areas, fill tie holes, remove fins and other projections completely. Leave tie holes unfilled where indicated on Drawings.
      c. Locations: Exposed concrete surfaces or concrete surfaces designated to receive coatings applied directly to concrete, such as waterproofing, dampproofing, plaster, painting, and other similar applied finishes.
   3. Smooth Rubbed Finish:
      a. Provide smooth rubbed finish to newly hardened concrete, which has already received smooth form finish, not later than one day after form removal.
      b. Moisten concrete surfaces and rub with carborundum brick or other abrasive device until uniform color and texture is produced.
      c. Do not use cement grout other than cement paste drawn from concrete by rubbing process.
   4. Grout Cleaned Finish:
      a. Provide grout cleaned finish to smooth form finished concrete which are complete and accessible.
      b. Blend one part portland cement with 1-1/2 parts fine sand and mix with 1:1 ratio of bonding admixture and water to achieve consistency of thick paint.

Match color of surrounding concrete.

c. Wet surface of concrete sufficiently to prevent absorption of water from grout and apply grout uniformly with brushes or spray.
d. Immediately after applying grout, scrub surface vigorously with cork float or stone to coat surface and fill air bubbles and holes.
e. While grout is still plastic, remove excess grout by working surface with rubber float, sack or other means.
f. After surface becomes white from drying, rub vigorously with clean burlap.
g. Keep surface damp for minimum 36 hours after final rubbing.

5. Cork Float Finish:
   a. Remove forms at early stage, not later than 3 days after placement of concrete form control joints as indicated on Drawings.
   b. Provide cork float finish to concrete which has already received smooth form finish.
      1. Mix one part portland cement and one part fine sand with sufficient water to produce stiff mortar.
      2. Dampen wall surface.
      3. Apply mortar with firm rubber float or trowel, filling voids.
      4. Compress mortar into voids using slow-speed grinder or stone.
      5. If mortar surface dries too rapidly to permit proper compacting and finishing, apply small amount of water with fog sprayer.
      6. Produce final texture with cork float using swirling motion.

C. Finishes for Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces, strike-off smooth and finish with texture matching adjacent formed surfaces.

D. Slab Finishes:
   1. Floor flatness/levelness tolerances:
      a. F_F defines maximum floor curvature allowed over 24 inches. Computed on basis of successive 12 inch elevation differentials, F_F is commonly referred to as "flatness F-Number."
         $F_F = \frac{4.57}{\text{Maximum difference in elevation, in inches, between successive 12-inch elevation differences.}}$
      b. F_L defines relative conformity of floor surface to horizontal plane as measured over 10 feet distance. F_L is commonly referred to as "levelness F-Number."
         $F_L = \frac{12.5}{\text{Maximum difference in elevation, in inches, between two points separated by 120 inches.}}$
      c. Measure floors in accordance with ASTM E1155.
      d. Ensure slabs achieve specified overall tolerances. Minimum local tolerance (1/2 bay or as designated by Architect) is 2/3 of specified tolerance unless noted otherwise.
   2. Scratch Finish:

a. Level to F_F15/F_L13 tolerance with minimum local tolerance of F_F13/F_L10 roughen surface with stiff brushes or rakes before final set.
b. Locations: Slabs to receive thick set mortar beds, concrete floor topping, portland cement terrazzo and other similar bonded cementitious finish flooring materials over 1 inch in thickness.

3. Float Finish:
   a. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating.
   b. Begin floating when surface water has disappeared and when concrete has stiffened sufficiently to permit operation of power-driven floats.
   c. Cut down high spots and fill low spots.
   d. Immediately after leveling, re-float surface to uniform, sandy texture and a F_F20/F_L17 tolerance.
   e. Locations: Surfaces requiring trowel finish, broom finish, slab surfaces covered with insulation, slabs scheduled to receive adhered roofing membrane, waterproofing membrane, exposed aggregate finish and sand bed terrazzo.
4. Trowel Finish:
   a. After float finish, follow by power troweling and then hand troweling.
   b. Begin final troweling when surface produces ringing sound as trowel is moved over surface.
   c. Finish surface free of trowel marks, uniform in texture and appearance, and to F_F25/F_L20 elevated slab tolerance.
   d. Grind surface smooth to remove defects which may telegraph through applied finish.
   e. Locations: Slabs left exposed to view, slabs covered with resilient flooring, carpet, paint and other similar applied finish.
5. Fine Broom Finish:
   a. After trowel finish, while surface is still plastic, draw soft fiber bristle broom uniformly over surface to create fine-grained but smooth texture to match Architect's sample.
   b. Locations: Interior slabs covered with thin set tile, stairs, and ramps.
6. Heavy Broom Finish:
   a. After float finish, while surface is still plastic, draw fiber bristle broom uniformly over surface to provide texture perpendicular to main traffic or at right angles to floor slope to match Architect's sample.
   b. Locations: Garage floors, sidewalks, ramps, exterior steps, landings, and platforms.

E. Construction and Control Joints in Slab-on-grade:
1. Construction joints to coincide with planned control joint pattern.
2. Provide joints in at column lines and as indicated on Drawings.
3. Tooling Control Joints and Construction Joints:
   a. Slabs Exposed to View: Tool joints after finishing slab.
   b. Concealed Slabs:
      1) Provide joints immediately after final finishing.

2) Use dry-cut sawing system (Soft-Cut) to depth of 1 inch unless noted otherwise; without dislodging aggregates by sawing. Complete sawing no later than two hours after finishing at each control joint location.

3.10 CURIING

A. General:
   1. Comply with ACI-308, except as modified or supplemented.
   2. Start immediately after placing and finishing concrete.
   3. Protect from premature drying, temperature extremes, temperature variations, rain, flowing water, and mechanical injury.
   4. Cure continuously, without allowing it to dry, for minimum period required for hydration of cement and hardening of concrete.
   5. Maintain temperature of concrete above 50 degrees F for curing period.
   6. Minimum Length of Curing Period:
      a. High Early Strength Concrete: 3 days.
      b. Other Concrete: 7 days.

B. Acceptable Curing Methods:
   1. Concrete to receive Waterproofing, Dampproofing, or Membrane Roofing: Moist curing, moisture-retaining sheet covering, or chemical curing compounds.
   2. Concrete to receive Hardeners or Sealers: Moist curing, moisture-retaining sheet covering, dissipating resin compounds, or chemical curing compounds; acceptable to manufacturer of hardener or sealer.
   3. Concrete to receive Cement Setting Beds, Bonded Toppings: Moist curing, moisture-retaining sheet covering, or chemical curing compounds.
   4. Concrete to receive Adhered Finishes: Moist curing, moisture-retaining sheet covering, acrylic curing/sealing compounds, dissipating resin compounds, or chemical curing compounds; acceptable to manufacturer of applied finish.
   5. Cast-in-place Parking Structure Slabs: Moist curing, or dissipating resin compounds.
   6. Concrete exposed to Direct Sun when Ambient Temperature Exceeds 75 degrees F: Where permitted, use white pigmented liquid compounds.
   7. Other Concrete: Moist curing, moisture-retaining sheet covering, liquid membrane-forming compounds, or chemical curing compounds.

C. Acceptable Curing Procedures:
   1. Moist Curing Unformed Surfaces:
      a. Ponding: Maintain 100 percent coverage of water continuously.
      b. Fog Spraying or Sprinkling: Maintain continuously moist with nozzles or sprayers.
      c. Fabric Mats: Cover surfaces with wet burlap or other absorptive material which will not discolor concrete; keep continuously wet.
      d. Sand: Minimum 2 inch thick layer, kept continuously saturated with water, free from deleterious materials which would stain concrete.

2. Sheet Curing Unformed Surfaces:
   a. Wet surface of concrete with fine spray of water prior to applying sheet.
   b. Immediately cover surface with polyethylene sheeting, waterproof paper, or burlap-polyethylene sheet.
   c. Lap edges of sheeting minimum of 12 inches.
   d. Repair damaged sheet.
   e. Ballast sheet to prevent movement and blow-off.
3. Liquid Membrane-forming Compound Curing of Unformed Surfaces:
   a. Apply in accordance with manufacturer's recommendations.
   b. Protect surfaces from foot and vehicular traffic.
   c. Curing compounds used must be compatible with adhesives used in setting carpet, resilient tile or sheeting flooring, and other similar finishes.
4. Curing Formed Surfaces:
   a. Keep forms continuously moist.
   b. Loosen forms for vertical surfaces to allow curing water to run between concrete and forms.
   c. If forms are removed prior to end of curing period, continue curing with any of methods described for unformed surfaces.
5. Curing surfaces which are moist cured for first 24 hours may be cured by other acceptable methods for remaining curing period provided they are not allowed to become dry.

3.11 FIELD QUALITY CONTROL

A. Field testing will be performed under the provisions of Section 01 45 23 “Tests and Inspections”.

B. Independent testing laboratory, employed by Owner, is responsible for:
   1. Sampling Fresh Concrete: ASTM C172, sample at point of discharge from mixer and additionally at point of discharge from end of pipe for concrete conveyed by pumping methods; if water is added at Project site, obtain another sample for testing.
   2. Concrete Temperature: Test each time slump and air content are tested and each time set of compressive strength test specimens is made.
   3. Slump: ASTM C143; one test from first truck at point of discharge each day, one test each time set of compressive strength test specimens is made, and when change in consistency occurs.
   4. Air Content of Plastic Mix:
      a. For Normal Weight, Air Entrained Concrete: ASTM C231, pressure method or ASTM C173, volumetric method.
      b. For Lightweight, Air Entrained Concrete: ASTM C173, volumetric method.
      c. Make one test each time a set of compressive strength test specimens is made.
   5. Compressive Strength Tests:
      a. Make and cure test specimens in accordance with ASTM C31, from concrete sampled at point of discharge from mixer and additionally at point

of discharge from end of pipe for concrete conveyed by pumping methods.
   b. Make one set of 4 test cylinder specimens for every 100 cubic yards, or for every 5000 square feet of slabs and walls, or fraction thereof, of each class of concrete, with at least one set for each class each day.
   c. Test cylinders in accordance with ASTM C39, 2 at 7 days for information, and 2 at 28 days for acceptance.
   d. When frequency of testing will provide less than five strength tests for a given class of concrete, conduct testing from at least 5 randomly selected batches, or from each batch if fewer than 5 are used.
6. Environmental Conditions:
   a. When ambient air temperature falls below 40 degrees F, record maximum and minimum air temperature in each 24 hour period; record air temperature inside protective enclosure; record minimum temperature of surface of hardened concrete.
   b. When ambient air temperature rises above 85 degrees F, record maximum and minimum air temperature in each 24 hour period; record minimum relative humidity; record maximum wind velocity, and record maximum temperature of surface of hardened concrete.
7. Observe conveying, placement and consolidation of concrete for conformance to Specifications.
8. Observe condition of formed surfaces upon removal of formwork prior to repair of surface defects and observe repair of surface defects.
9. Observe curing procedures for conformance with Specifications, record dates of concrete placement, start of preliminary curing, start of final curing, end of curing period.
10. Observe Preparations for Placement of Concrete:
    a. Inspect handling, conveying, and placing equipment, inspect vibrating and compacting equipment.
    b. Inspect preparation of construction, expansion, and isolation joints.
11. Observe preparations for protection from hot weather, cold weather, sun, and rain and preparations for curing.
12. Observations of Concrete Mixing:
    a. Monitor and record amount of water added at Project site.
    b. Observe minimum and maximum mixing times.
13. Other Inspections:
    a. Grouting under base plates.
    b. Grouting anchor bolts and reinforcing steel in hardened concrete.
14. Test for Water Soluble Chloride Ion Content in Hardened Concrete:
    a. Test in accordance with procedure described in FHWA Report No. FHWA RD-77-85.
    b. Make one test for each set of compressive strength test specimens.
    c. Test may be waived by Architect upon written request from Contractor after review of concrete design mix has been made.
15. Verify slab flatness and levelness within 24 hours of placement for each slab finish at slab-on-grade and framed slabs in accordance with ASTM E1155.

Perform minimum of 2 tests for each slab and finish; one at initial pour and second randomly chosen by testing laboratory.

C. Evaluation and Acceptance of Concrete:
   1. Strength Test: Defined as average strength of two 28 day cylinder tests from each set of cylinders.
   2. Acceptance Criteria Based on Strength Tests: Strength level of individual class of concrete is considered satisfactory if both:
      a. Average of three consecutive strength test results equal or exceed required design compressive strength, and
      b. No individual strength test result falls below required design compressive strength by more than 500 psi.
   3. Acceptance Criteria Based on Field Tests:
      a. Core Tests: Where strength tests indicate concrete of deficient strength, obtain and test cores in accordance with ASTM C42, ACI 318 and ACI-301, at locations directed by Architect.
      b. Strength level of concrete in area represented by core test is considered adequate if complies with the requirements of ACI 318.
      c. Fill core holes with low slump concrete or patching mortar used to repair surface defects.
   4. Revise concrete mix proportions, curing procedures and protection as necessary to provide concrete conforming to Specifications.

D. Acceptance of Structure:
   1. Acceptance of structure for dimensional tolerances, appearance, and strength will be based on ACI-301, Chapter 18.
   2. Remove and replace concrete which does not meet acceptance criteria.

3.12 PATCHING AND REPAIRING DEFECTIVE CONCRETE

A. General:
   1. Rewettable bonding agent may be used only in areas not subject to wet conditions.
   2. Patching compound may only be used for concrete not exposed to view.

B. Repairing Formed Surfaces:
   1. Surface Defects Requiring Repair:
      a. Color and texture irregularities.
      b. Honeycomb, air bubbles, rock pockets, and spalls.
      c. Fins, burrs and other surface projections.
      d. Cracks.
      e. Stains and other discolorations that cannot be removed by cleaning.
   2. Patch defective areas and tie holes immediately after removal of forms.
   3. Cut out honeycomb, rock pockets, and voids over 1/4 inch down to solid concrete but not less than 1 inch depth.
   4. Make edges of cuts perpendicular to concrete surface.

5. Clean and dampen area including 6 inches of surrounding surface with water.
6. Apply bonding grout by brushing into surface, after surface water has evaporated.
7. Place patching mortar or patching compound before grout has set or dried.
8. Compact patching material in place and strike off slightly higher than surrounding surface.
9. Finish after minimum of one hour to match surrounding surface.
10. Flush out form tie holes, fill with patching mortar, patching compound, or precast cement cone plugs secured in place with bonding compound.
11. Cure repair areas by same methods as surrounding concrete or keep continuously damp for 7 days.

C. Repairing Unformed Surfaces:
   1. Surface Defects Requiring Repair:
      a. Fine crazing cracks.
      b. Cracks larger than 0.012 inch wide or cracks which penetrate to reinforcing.
      c. Cracks penetrating completely through non-reinforced sections.
      d. Spalling, popouts, honeycomb, and rock pockets.
      e. High and low areas in slabs.
   2. Correct high areas in hardened concrete by grinding after concrete has cured at least 14 days.
   3. Correct high and low areas during, or immediately after, completion of initial floating operations by cutting high areas and by placing fresh concrete in low areas.
   4. Repair defective areas, except isolated random cracks and single holes not exceeding 1 inch diameter, by cutting out and replacing with patching mortar or patching compound.
      a. Remove defective areas to sound concrete with clean, square cuts.
      b. Dampen concrete surfaces in contact with patching material and apply bonding grout by brushing into surface, after surface water has disappeared.
      c. Place patching mortar or patching compound before grout has set or dried.
      d. Compact and finish to blend with adjacent finished concrete.
      e. Cure in same manner as adjacent concrete.
   5. Repair isolated random cracks and single holes not over 1 inch diameter with patching mortar.
      a. Groove top of cracks and cut out holes to sound concrete and clean area.
      b. Dampen cleaned surfaces and apply bonding grout by brushing into surface, after surface water has disappeared.
      c. Place patching material before bonding grout is set or dry.
      d. Compact in place and finish to match adjacent concrete.
      e. Keep patched area continuously moist for not less than 72 hours.

D. Structural Repairs: Contractor shall propose materials, methods, and procedures to the Architect for review and approval prior to proceeding with structural repairs.

3.13 PROTECTION

A. Protect finished work in accordance with Section 01 70 00 “Execution and Closeout Requirements”.

B. Protect concrete from construction traffic, weather, or mechanical damage for 14 days after placing.

C. Provide raised runways for traffic areas.

D. Protect concrete from staining.

END OF SECTION 03 31 00

PIPE AND TUBE RAILINGS
SECTION 05 52 13

PART 1 GENERAL

1.01 SUMMARY

A. Inclusions:
   1. Provisions set forth in Divisions 0 and 1.
   2. Pipe handrails and guardrails.
   3. Hot dip galvanizing, exterior railings.
   4. Shop priming, interior railings.
   5. Cast handrail wall brackets.
   6. Submittal preparation.
   7. Clean up.

B. Related Sections:
   1. Section 03 21 00 Reinforcing Steel
   2. Section 03 31 00 Structural Concrete Work
   3. Section 09 91 13 Exterior Painting
   4. Section 32 13 13 Site Concrete

1.02 SUBMITTALS

A. See Section 01 30 00 “Administrative Requirements” for submittal procedures.

B. Shop Drawings or Layout Drawings:
   1. Submit shop drawings indicating materials, layout, and attachment of railings to Architect for review and approval prior to starting work.

1.03 QUALITY ASSURANCE

A. Qualifications:
   1. Workmen shall be skilled in this type of steel fabrication and erection.
   2. Welders shall be qualified by tests prescribed in the "Standards Qualification Procedure" of the AWS.

PART 2 PRODUCTS

2.01 MATERIALS

A. Pipe rails shall be Schedule 40 standard steel pipe.
   1. Size per drawings.
   2. Hot Dip Galvanize after fabrication per ASTM A123, Grade 75.
      a. Interior pipe rails shall not be galvanized.

3. Shop priming shall meet Fed Spec TT-P-86, Type II; Sherwin Williams Procryl Metal Primer or equal.
   a. Exterior pipe shall be primed and painted.
4. Galvanized finish repair:
   a. Repair compound: ASTM D520, Type III high purity grad zinc dust. 24 lbs. lbs./gallon minimum weight per gallon.
      1) 52% by volume minimum solids content.
      2) 94% by weight in dry film minimum metallic zinc content.
      3) Galvilite Galvanizing Repair, ZRC Worldwide (800) 831-3275.

B. Cast Handrail Wall Brackets:
1. Malleable Iron:
   a. Quality Standard: Style P-3 by R&B Wagner, Inc.
2. Hot Dip Galvanize after fabrication per ASTM A-123, Grade 75.
3. Shop priming shall meet Fed Spec TT-P-86, Type II; Sherwin-Williams Procryl Metal Primer or equal.
4. When installed on wall to receive exterior cement plaster finish, install plaster filler.
   a. Quality Standard: Style PF-3 by R&B Wagner, Inc.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify all required backing and blocking prior to enclosing framing.

B. Verify framing or surfaces are acceptable prior to installing finish materials.

C. Verify all dimensions, including grade elevations.

D. Verify detail of existing field conditions.
1. Coordinate adjustments for existing conditions with Architect prior to performing work.

3.02 FABRICATION

A. Layout:
1. Fabrication shall be of welded construction in the largest assemblies feasible to fit into the hot dip tanks. Minimize number of field welds after the hot dip process.
   a. Re-entrant corners shall be shaped to a notch-free radius of at least one-half inch (1/2").

B. Railings and Handrails:
1. Handrails for stairs and ramps shall be 1-1/4” to 1-1/2” diameter (1-1/2” nominal) and mounted 1-1/2” clear from side walls. CBC Section 11B-505.7 (cross section) and 11B-505.5 (clearance).

2. All welded joints and surfaces shall be ground smooth, no sharp or abrasive corners, edges, or surfaces. Wall surfaces adjacent to handrail shall be smooth. CBC Section 11B-505.8 (surfaces).

C. Welding:
   1. Welding shall be done by the electric shielded arc process.
   2. Conform to the requirements of the latest edition of the AISC “Specification for the Design, Fabrication and Erection of Structural Steel Buildings”.
   3. Conform to Section 3 and 4 of the AWS “Structural Welding Code D1.1”.
   4. Electrodes shall be E-70 AWS.

D. Cutting:
   1. Gas cutting shall be done by machine wherever possible.

E. Bolted Connections:
   1. Bolt holes shall be one-sixteenth inch (1/16") larger than the nominal diameter of the bolt.
      a. Holes may be punched if the thickness of the material is less than the nominal diameter plus one-eighth inch (1/8").
      b. Holes shall be drilled or sub-punched and reamed if the thickness of the material is greater than the nominal diameter plus one-eighth inch (1/8").

F. Painting:
   1. Shop Coating for Interior Hand and Guard Rails:
      a. Cleaning shall conform to the Steel Structures Painting Council Surface Preparation Specifications as follows:
         1) Solvent cleaning: SSPC - SP1.
         2) Power tool cleaning: SSPC - SP3.
         3) Commercial blast cleaning: SSPC - SP6.
      b. Apply one coat of shop primer per the manufacturer's recommendations.
   2. Galvanizing for Exterior Hand and Guard Rails:
      a. Galvanizing shall be performed by the hot-dip process after fabrication.
      b. Galvanize in the largest practical sections.
      c. Galvanizing shall conform to ASTM A123.
         1) Where specified for small structural steel or cast steel articles galvanizing shall be performed after fabrication in accordance with ASTM A153.
         2) Repair all damaged galvanized material with approved/specified repair material. Manufacturer's requirements for prep and application shall be strictly followed.

3.03 INSTALLATION OR APPLICATION

A. Connections:
   1. Bolts shall be zinc-plated machine bolts, unless otherwise noted.
   2. Field welding shall meet all fabrication requirements listed above.
      a. Grind off zinc plating at point of connections prior to welding where required.
      b. After welding, all joints shall be ground smooth, degreased, and touch up galvanized with a 100% zinc compound.
   3. Cast Handrail Brackets:
      a. Attached to structure with lag bolts as detailed on Drawings.
         1) Use lag-screw expansions shields when attaching brackets to concrete.

3.04 QUALITY CONTROL

A. Tolerances:
   1. Tolerances shall be as set forth in the latest edition of the AISC “Specification for the Design, Fabrication and Erection of Structural Steel Buildings”.
   2. Handrails shall be set true-to-line and parallel to the slope of the walk or tops of nosing within 1/4” of dimensions indicated on the plans.

3.05 CLEANING OR REPAIR

A. Clean and straighten material before fabrication.
   1. Remove scale and rust.

B. Correct deformations resulting from fabrication processes.
   1. Heat shrinkage of low alloy structural steels will be permitted.

3.06 CONDITION OF FINISHED WORK

A. Handrails shall have returns to within 1/2” of the adjacent wall or closed returns to supporting pipes.

B. Handrails shall have welded end closures.

C. Edges shall be ground smooth and free of sharp edges.

D. Pipe splicing and butt joints shall be welded using beveled end welds.
   1. Grind smooth top to totally conceal weld.

E. No sandpaper marks, hammer marks or blemishes will be allowed.

END OF SECTION 05 52 13

DAMPPROOFING AND WATERPROOFING
SECTION 07 12 00

PART 1 GENERAL

1.01 SUMMARY

A. Inclusions:
   1. Provisions set forth in Divisions 0 and 1.
   2. Planter dampproofing of all planters, unless otherwise noted.
   3. Below-grade wall waterproofing of concrete or concrete masonry.
   4. Submittal preparation.
   5. Clean up.

B. Related Sections:
   1. Section 03 31 00: Structural Concrete Work
   2. Section 07 92 00: Joint Sealants
   3. Section 31 22 00: Earthwork
   4. Section 32 13 13: Site Concrete

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM)
   1. ASTM D146 – Standard Test methods for Sampling and Testing Bitumen-Saturated Felts and Fabrics Used in Roofing and Waterproofing.
   2. ASTM D412 – Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomer- Tension.
   3. ASTM D570 – Standard Test Method for Water Absorption of Plastics.
   4. ASTM D903 – Standard Test Method for Peel or Stripping Strength of Adhesive Bonds.
   5. ASTM D1876 – Standard Test Method for Peel Resistance of Adhesives (T-Peel Test).
   6. ASTM E96 (Method B) – Standard Test Methods for Water Vapor Transmission of Materials.
   7. ASTM E154 – Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.

1.03 SUBMITTALS

A. See Section 01 30 00 “Administrative Requirements”: for submittal process.

B. Product or Material Data:
   1. Submit copies of manufacturer's products specifications to Architect for review prior to starting installation.
   2. Submit copies of manufacturer's latest written installation or application recommendations.

C. Close-Out Submittals:
   1. Furnish the Architect a certificate from the applicator certifying the work was performed in accordance with these specifications and the manufacturer's recommendations.
      a. Indicate the number of coats and the rate of coverage of each coat.

1.04 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Use an experienced installer and adequate number of skilled personnel who are thoroughly trained and experienced in the application of fluid applied waterproofing membranes.

B. Obtain waterproofing materials from a single manufacturer regularly engaged in manufacturing the product.

C. Provide products which comply with all state and local regulations controlling use of volatile organic compounds (VOCs).

D. Warranty:
   1. Furnish a five-year guarantee covering the waterproofing and dampproofing work of the project.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Store materials in a clean dry area in accordance with manufacturer's instructions.

C. Store adhesives and primers at temperatures of 40 degrees F and above to facilitate handling.

D. Store membrane cartons on pallets.

E. Do not store at temperatures above 90 degrees F (32 degrees C) for extended periods.

F. Keep away from sparks and flames.

G. Completely cover when stored outside. Protect from rain.

H. Protect materials during handling and application to prevent damage or contamination.

I. Avoid use of products which contain tars, solvents, pitches, polysulfide polymers, or PVC materials that may come into contact with waterproofing membrane system.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Product not intended for uses subject to abuse or permanent exposure to the elements.

B. Protect rolls from direct sunlight until ready for use.

C. Do not apply standard membrane when air or surface temperatures are below 40 degrees F (4 degrees C).

D. Do not apply to frozen concrete.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
   1. W. R. Meadows Co.
   2. Tremco Commercial Sealants and Waterproofing
   3. Or approved equal. See Section 01 60 00 “Product Requirements: for substitution requirements.

B. Basis of Design:
   1. MEL-ROL Waterproofing System by W.R. Meadows.

2.02 MATERIALS

A. Rolled, Self-Adhering Sheet Waterproofing Membrane: Polymeric waterproofing membrane protected by release paper on polyethylene carrier film with exposed polymeric membrane strips on both sides protected by pull-off release strips.

B. Below-Grade Waterproofing Membrane (Non-Drained System):
   1. Primary membrane: 56 mil polymeric waterproofing membrane on a heavy duty 4 mil cross laminated polyethylene carrier film.
   2. Protective cover of 1/8" thick HDPE sheet - color black or brown.
   3. Use terminator bars with power driven fasteners and polyurethane mastic at top.

C. Below-Grade Waterproofing Membrane (Drained System):
   1. Primary membrane: 56 mil polymeric waterproofing membrane on a heavy duty 4 mil cross laminated polyethylene carrier film.
   2. Drainboard - AVM 6000 dimple board with heavy duty geotextile fabric or approved equal.
   3. Use terminator bars with power driven fasteners and polyurethane mastic at top of waterproofing membrane.

2.03 ACCESSORIES

A. Surface Conditioner: MEL-PRIME

B. Flashing and Fillets: MEL-ROL LIQUID MEMBRANE

C. Termination Selant: POINTING MASTIC

D. Termination Bar: TERMINATION BAR

E. Corner and Detailing Tape: DETAIL STRIP

F. Waterproofing Protection Course: PC-2 PROTECTION COURSE
   1. 15 mil thick

G. Rolled Matrix Drainage System: MEL-DRAIN Rolled Matrix Drainage System.

PART 3 EXECUTION

3.01 EXAMINATION

4. Examine surfaces to receive self-adhering membrane. Notify Architect if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected. Commencement of the Work shall construe Contractor acceptance of conditions.

5. Apply self-adhering sheet waterproofing to cured concrete surfaces a minimum of three (3) days after removal of forms.

3.02 SURFACE PREPARATION

A. Protect adjacent surfaces not designated to receive waterproofing.

B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions.

C. Do not apply waterproofing to surfaces unacceptable to manufacturer.

D. Concrete surfaces must be clean, smooth and free of standing water.

E. Patch all holes and voids and smooth out any surface misalignments.

F. Apply only enough adhesive to surfaces that will be covered with self-adhering membrane within one working day. Apply adhesive in accordance in accordance with manufacturer's recommended coverage rates.

G. Apply fillet beads of termination sealant at inside corners. Upon curing of sealant, install corner tape on all inside and outside corners, including footings. Ensure a minimum of 3” inches coverage of membrane onto each adjacent plane.

H. Joint Reinforcement:
   1. For statice cracks and cold joints a minimum of 1/16” but not greater than 1/8”, apply detailing membrane 9“wide strip of self-adhering detail tape centered over the joint.
   2. For expansion joints up to 1”, apply a backer rod larger than joint width into the gap and cover with self-adhering detailed tape. Ensure not less than 3” of membrane are applied substrates on both sides of the gap.

I. Pipe Penetrations:
   1. Finger flash pipe penetrations with a minimum 6” wide detailing tape by applying 3” fingers onto surrounding substrate and 3” of tape onto pipe circumference, with 2” minimum overlap. Seal all edges of flashing with termination sealant. Seal all terminations with termination sealant.

J. Seal all terminations and exposed membrane edges with termination sealant.

3.03 APPLICATION

A. Primary Membrane Application:
   1. Apply waterproofing membrane system in accordance with manufacturer's instructions.
   2. Remove release backing paper, then position the membrane at the lowest point. Ensure the proper overlap is maintained for all side and end laps.
   3. Pull balance of release paper off, then press into place to ensure full contact and elimination of all wrinkles.
   4. Stagger end laps and overlap all seams at least 2-1/2”.
   5. Terminate the top leading edge of membrane with termination bar and termination sealant as required.
   6. Seal all terminations and non-factory edges with termination sealant.
   7. Inspect membrane before covering and repair as necessary. Cover tears and inadequate overlaps with membrane, extending 6” affected areas. Seal all sides of patches and repair areas with termination sealant.
   8. Use only equipment specifically recommended or approved by the manufacturer.

B. Non-Drained system: HDPE shall be fully adhered to waterproofing membrane peel and stick membrane. Immediately apply HDPE to membrane to avoid surface contamination from dust and dirt.

C. Drained System: Apply drainboard against waterproof membrane with stainless steel shot pins and plastic washers per manufacturer's requirements.
   1. Install 12" of course gravel around drainage pipe with a layer of geotextile fabric over gavel.
   2. Foundation drain pipe shall be connected into the storm drain system and shall slope at 1% minimum.

D. Backfill with sand for a minimum thickness of 6" from the membrane.

E. Compact remainder of backfill as required per Section 31 22 00 “Earthwork”.

3.04 CONDITION OF FINISHED WORK

A. Uniformly applied coatings with straight true-to-line terminations of products and are free of fins, ridges, or voids.

B. Troweled applications shall be of uniform finish free of fins, ridges, and voids.

C. Caulking in secondary expansion joints, or construction joints is in good condition and free of voids.

3.05 PROTECTION

A. Protect membrane immediately after application with application of rigid insulation or drainage panel or asphaltic sheet.

B. Backfill immediately using care to avoid damaging waterproofing membrane system.

END OF SECTION 07 12 00

UNDER-SLAB VAPOR BARRIER
SECTION 07 26 00

PART 1 GENERAL

1.01 SUMMARY

A. Inclusions:
   1. Vapor barrier and installation accessories for installation under concrete slabs.
   2. Submittal Preparation.
   3. Clean-up.

B. Related sections:
   1. Section 03 31 00 Structural Concrete Work

1.02 REFERENCES

A. ASTM International:
   1. ASTM E1643-18a: Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
   2. ASTM E1745-17: Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.

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

1.03 SUBMITTALS

A. See Section 01 30 00 “Administrative Requirement” for submittal procedures.

B. Product Data: Manufacturer’s data sheets on each product to be used, including:
   1. Preparation instruction and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation instructions for placement, seaming, penetration prevention and repair, and perimeter seal per ASTM E1643.

1.04 QUALITY ASSURANCE

A. Certifications:
   1. Submit material certification for admixtures and aggregates, certifying their compliance with specifications.
   2. Submit certified mill test reports for lot of cement.
   3. Provide third party documentation that all testing was performed on a single production roll per ASTM E1745 Section 8.1

B. Contact vapor barrier manufacturer to schedule a pre-construction meeting and to coordinate a review, in-person or digital, of the vapor barrier installation.

C. Vapor barrier manufacturers must warrant in writing (a) compliance with the designated ASTM E1745 classification, and (b) no manufacturing defects in the product for at least ten (10) years.

D. Manufacturers verify in writing 20 years in the industry with no reported product failures.

1.05 PRE-INSTALLATION CONFERENCE

A. Conduct pre-installation conference in accordance with Section 01 30 00 “Administrative Requirements”.
   1. Contact membrane vapor barrier manufacturer to participate in pre-installation conference and coordinate a review, in-person or digital, of the vapor barrier installation prior to concrete placement.

PART 2 PRODUCTS

2.01 MATERIALS

A. General:
   1. Basis of Design: Stego Wrap Vapor Barrier by Stego Industries LLC., (877) 464-7834 www.stegoindustries.com.

B. Manufacturers/Vapor barrier products:
   1. Stego Industries LLC., Stego Wrap Vapor Barrier
   2. W.R. Meadows, Perminator
   3. Fortifiber, Moistop Ultra
   4. Or approved equal.

C. Vapor barrier shall have the following minimum requirements:
   1. Maximum Permeance: Maintain permeance of less than 0.01 Perms grains/($ft^2 \cdot hr \cdot inHg$) as tested in accordance with mandatory conditioning tests per ASTM E1745 Section 7.1 (7.1.1-7.1.5).
   2. Water Vapor Barrier: ASTM E1745, Class A.
   3. Thickness: 15 mils minimum (ACI 302.1R-15)
   4. All testing shall be performed on a single production roll per ASTM E1745 Section 8.1.

2.02 ACCESSORIES

A. All accessoires used must be from the same manufacturer of the vapor barrier material to ensure a cohesive, compatible system.
   1. Seams:
      a. Stego Tape by Stego Industries
      b. Or approved equal.
   2. Sealing Penetrations of Vapor barrier:
      a. Stego Mastic by Stego Industries
      b. Stego Tape by Stego Industries
      c. Or approved equal.

3. Perimeter/terminated edge seal:
   a. Stego Crete Claw (textured tape) by Stego Industries
   b. Stego Term Bar by Stego Industries
   c. StegoTack Tape (double-sided sealant tape) by Stego Industries
   d. One-sided seaming tape is not a recommended method of sealing at the terminated edge.
   e. Or approved equal.
4. Penetration Prevention:
   a. Beast Foot by Stego Industries
   b. Or approved equal.

PART 3 EXECUTION

3.01 PREPARATION

A. Under-slab Vapor Barrier
   1. Ensure that subsoil is approved by Architect or Geotechnical Engineer.
   2. Level and compact base material.
   3. Install vapor barrier in accordance ASTM E1643.

B. Contact vapor barrier manufacturer to schedule a pre-construction meeting and to coordinate a review, in-person or digital, of the vapor barrier installation.

3.02 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, water stops, 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 manufacturer's textured tape with a surface that creates a mechanical seal to freshly placed concrete, per manufacturer's instructions. OR
      b. Seal vapor barrier to the entire perimeter wall or footing/grade beam with manufacturer's double-sided tape, or both termination bar and double-sided 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/textured tape/double-sided tape to a clean and dry vapor barrier.
   5. Seal all penetrations (including pipes) per manufacturer's instructions.
   6. Avoid the use of stakes driven through vapor barrier by utilizing screed and forming systems that will not puncture the vapor barrier.
   7. Use reinforcing bar supports with base sections that eliminate or minimize the potential for puncture of the vapor barrier.

8. Repair damaged areas with vapor barrier material of similar (or better) permeance, puncture and tensile.
9. Utilize vapor barrier sealing accessories from the same manufacturer as the vapor barrier membrane.

END OF SECTION 07 26 00

JOINT SEALANTS
SECTION 07 92 00

PART 1 GENERAL

1.01 SUMMARY

A. Inclusions:
   1. Provisions set forth in Divisions 0 and 1.
   2. Building-related joint sealants.
   3. Joint primer and filler.
   4. Interior joint sealant required to prevent passage of moisture into wall assemblies or behind fixtures and built-in furnishings.
   5. Surface preparation.
   6. Application and curing.
   7. Submittal preparation.
   8. Clean up.

B. Related Sections:
   1. Section 09 91 13 Exterior Painting

1.02 REFERENCES

A. ASTM International (ASTM):
   1. ASTM C510 - Standard Test Method for Staining and Color Change of Single- or Multicomponent Joint Sealants.
   2. ASTM C639 - Standard Test Method for Rheological (Flow) Properties of Elastomeric Sealants.
   3. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer.
   4. ASTM C679 - Standard Test Method for Tack-Free Time of Elastomeric Sealants.
   5. ASTM C719 - Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle).
   6. ASTM C793 - Standard Test Method for Effects of Laboratory Accelerated Weathering on Elastomeric Joint Sealants.
   7. ASTM C794 - Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants.
   8. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
   9. ASTM C1382 - Standard Test Method for Determining Tensile Adhesion Properties of Sealants When Used in Exterior Insulation and Finish Systems (EIFS) Joints.
   10. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension.

11. ASTM D2240 - Standard Test Method for Rubber Property - Durometer Hardness.

B. California Department of Public Health
   1. Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers.

C. NSF International (NSF)
   1. Standard 51 - Food Equipment Materials.

D. Sealant, Waterproofing, and Restoration Institute (SWRI).
   1. SWRI Validation Program.

E. U.S. Environmental Protection Agency (EPA)
   1. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings.

F. U.S. Food and Drug Administration (FDA)
   1. 21 CFR 177.2600 - Title 21 Part 177 Indirect Food Additives: Polymers.

G. US Green Building Council (USGBC)
   1. Leadership in Energy and Environmental Design (LEED) Green Building Rating System.

1.03 SUBMITTALS

A. Product or Material Data:
   1. Manufacturer's Data:
      a. Submit a complete material listing of items proposed to be installed under this Section.
      b. Submit data to demonstrate that all materials meet or exceed the specified requirements.
      c. Submit product specifications, installation instructions, and manufacturer's recommendations for the materials that will be installed.

B. Samples: Two (2) representative units of each type, size, pattern, and color.
C. Shop Drawings: Include details of materials construction and finish. Include relationship with adjacent construction.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with a minimum of five (5) years documented experience.

B. Installer Qualifications: Company specializing in performing Work of this section with minimum of two (2) years documented experience.

C. Source Limitations: Provide each type of product from a single manufacturing source to ensure uniformity.

1.05 PRE-INSTALLATION CONFERENCE

A. Convene a conference approximately two (2) weeks before scheduled commencement of the Work. Attendees shall include Architect, Contractor or Construction Manager and trades involved. Agenda shall include schedule, responsibilities, critical path items and approvals.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the jobsite in original, unopened containers with labels intact.

B. Store only under conditions recommended by the manufacturers.

C. Remove and dispose of material that has exceeded the shelf life recommended by its manufacturer.

1.07 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 recommended limits.

1.08 WARRANTY

A. Performance Requirements:
   1. The completed system shall form a positive barrier against passage of moisture into interior wall assemblies or behind fixtures and from exterior to interior building areas.

B. Provide a written guarantee to maintain sealant/caulking in a watertight condition for a minimum period of 2 years.

PART 2 PRODUCTS

2.01 MATERIALS

A. General Purpose Building Sealant (window and door frames, plumbing fixtures, wet areas) (non-paintable):
   1. Silicone sealant meeting ASTM C920, Type S, Grade NS, Class 25, and Fed Spec. TT-S-001543:
      a. Sonneborn Sonolastic Omniplus.
      b. GE Silicones Construction 1200.
      c. Dow-Corning 790.
      d. Or approved equal.

B. General Purpose Building Sealant (paintable):
   1. Latex sealant meeting ASTM C920, Type S, Grade NS, Class 25, and Fed Spec. TT-S-001543:
      a. DAP Dynaflex 230.
      b. Or approved equal.
   2. Silyl-terminated polyether sealant meeting ASTM C920, Type S, Grade NS, Class 25, and Fed Spec. TT-S-001543:
      a. Sonneborn 150.
      b. Or approved equal.

C. Colors for each sealant shall be selected by the Architect from manufacturer's standard color range.

D. Primers shall be non-staining and specifically recommended for the type of installation by their manufacturer.

E. Backup materials shall be non-absorbent and non-staining, closed cell, and specifically recommended for the type of installation by their manufacturer.

F. Bond prevention materials shall be recommended by the manufacturer for the sealant products used.

G. Materials, not specifically described, but necessary to complete this work, shall be first quality.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine the areas and conditions under which work of this Section will be performed.

B. Correct conditions detrimental to the proper completion of the work.

C. Do not proceed until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Thoroughly clean surface.

B. Sandblast or wire brush treated surfaces, if required, to obtain a clean, smooth surface.

C. Insert approved backup material in the joint cavity to the depth required.

D. Surfaces shall be wiped clean and dry prior to application to insure proper adhesion.

E. Where the possibility of joint filler staining adjacent areas or materials exists, mask joints prior to application.

F. Do not remove masking tape before joints have been tooled, and initial cure of joint filler has taken place.

G. Work stained due to failure of proper masking precautions will not be accepted.

3.03 INSTALLATION OR APPLICATION

A. Installation of Backup Material:
   1. Compress the backup material 25% to 50%.
   2. Avoid lengthwise stretching of the material.
   3. Do not twist or braid backup stock.

B. Priming:
   1. Apply the primer in strict compliance with the manufacturer's recommendations.

C. Bond Breaker Installation:
   1. Install a bond breaker where recommended by the manufacturer of the sealant.

D. Installation of Sealants:
   1. Comply with manufacturer's recommended width-to-height ratios.
   2. Apply sealant under pressure to completely fill joints.
   3. Completely mask joints where the appearance of sealant on adjacent surfaces would be objectionable.
   4. Install the sealant in conformance with the manufacturer's recommendations.
   5. Tool all joints to the profile shown, or as directed by Architect.
   6. Joints shall be left smooth, uniform, and free of voids or air bubbles.

3.04 PROTECTION OR ADJUSTMENTS

A. Protect the work and materials of all other trades.

3.05 CLEANING OR REPAIR

A. Remove masking tape immediately after joints have been tooled and initial cure of joint filler has taken place.

B. Clean adjacent surfaces.

C. Use solvent or cleaning agent as recommended by the sealant manufacturer.

END OF SECTION 07 92 00

EXTERIOR PAINTING
SECTION 09 91 13

PART 1 GENERAL

1.01 SUMMARY

A. Inclusions:
   1. Provisions set forth in Divisions 0 and 1.
   2. Surface Preparation:
      a. Sanding, scraping, putty work, and cleaning of work to be painted.
      b. Washing, priming, and backpriming of sheet metal work.
   3. Painting, staining, and clear finishing, except factory finished materials:
      a. Exterior surfaces.
      b. Woodwork, metal work, and trim.
      c. Mechanical and electrical equipment and piping.
         1) Electrical items to be painted include conduit, fittings cabinets, panels, enclosures, junction and pull boxes, hangers, and other associated electrical items which are in "public spaces" and are therefore visible to the building occupants.
         2) Mechanical items to be painted shall include, but not be limited to:
            a) Exposed piping, vessels, ductwork. Color coding of piping per the mechanical specifications.
      d. Other normally painted surfaces.
      e. If the color of finish is not specifically listed on the Color Schedule, the Architect shall select from standard colors and finishes available.
      f. Existing work shall be painted where specified.
   4. Backpriming of wood and metal work.
   5. Sealing of masonry or concrete surfaces.
   6. Painting and special coatings on exposed concrete block surfaces.
   7. Electrostatic painting of ornamental metal, handrails, fences, gates, and guardrails..
   8. Spray painting of roof and smoke hatches, roof accessories.
   9. Touch-up painting.
   10. Labor, materials, tools, and equipment.
   11. Preparation of submittals.
   12. Clean up.

B. Related Sections:
   1. Section 09 24 00: Exterior Portland Cement Plaster
   2. Section 09 91 23: Interior Painting

1.02 REFERENCES

A. American National Standards Institute (ANSI)

1. Performance Standards.

B. ASTM International (ASTM)
   1. ASTM D16 – Standard Terminology for Paint, Related Coatings, Materials and Applications.
   2. ASTM D523 – Standard Test Method for Specular Gloss.

C. California Building Code (CBC)
   1. CBC 2022 Edition,

D. California Green Building Standards Code (CGBSC)
   1. CGBSC 2022 Edition, Title 24, Part 11.

E. San Joaquin Valley Air Pollution Control District (SJVAPCD).

F. Surface Preparation Standards and Specifications (SSPC)
   1. SSPC (PM1) – Steel Structure Painting Manual, Vol. 1, Good Painting Practice.
   2. SSPC (PM2) – Steel Structures Painting Manual, Vol. 2 Systems and Specifications.

1.03 DEFINITIONS

A. Blocking: Tow painted surfaces sticking together such as a painted door sticking to a painted jamb.

B. DFT: Dry Film Thickness of the coating.

C. DTM: Paint that is applied Direct to Metal.

D. Enamel: Acrylic (water) or alkyd (oil) base paint which dries leaving and eggshell, pearl, satin, semi-gloss or high-gloss enamel finish,

E. Gloss/Sheen Levels:
   1. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
   2. Gloss Level 2: Not more than 10 units at 60 degrees and 35 units at 85 degrees, according to ASTM D 523.
   3. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
   4. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
   5. Gloss Level 5: 35 to 70 units at 60 degrees according to ASTM D 523.
   6. Gloss Level 6: 70 to 85 units at 60 degrees according to ASTM D 523.
   7. Gloss Level 7: More than 85 units at 60 degrees according to ASTM D 523.

F. Mildew Resistant: Certified products are specially formulated with microbicidal additives that resist mold, mildew and algae growth on the paint film and inhibit growth of bacterial odors.

G. PDCA: Painting & Decorating Contractors of America www.pdca.org.

H. RAVOC: Reactivity adjusted VOC 'Reactivity means the ability of a VOC to promote ozone formation.

I. SSPC: SSPC Surface Preparation Standards and Specifications www.sspc.org.

J. VOC: Volatile Organic Compounds found in primers, paints, sealers and stains.

1.04 SUBMITTALS

A. See Section 01 30 00 "Administrative Requirements" for submittal procedures.

B. Product or Material Data:
   1. Submit product description and test data for all proposed products or materials for review and acceptance by Architect prior to start of work.
   2. Submit preparation, priming, and application instructions for each material proposed for use over job specific substrates.
   3. Substitutions shall show a line-by-line-item review between the substituted product and the specified product for comparison and the specified Dunn-Edwards or Glidden Professional product in the paint schedule. The comparison shall include:
      a. % Titanium Dioxide
      b. % Solids by Weight
      c. Type of vehicle
      d. Solvent type
      e. VOC content - Also list allowance per the Calif. Green Building Code
      f. Finish
      g. MPI rating
      h. Scrub test results
   4. It will be the discretion of the Architect to accept proposed substitutions.

C. Samples or Mockups:
   1. Submit a complete set of color selection samples of proposed materials for color selection by Architect prior to ordering materials.
   2. Submit 8"x10" minimum size brush-out color samples of colors selected for use by the Architect.

1.05 QUALITY ASSURANCE

A. Performance Requirements:
   1. Complete coverage, void of blemishes.
B. Regulatory Compliance:
   1. Materials must meet the standard set by the State of California for environmental protection and hazardous material content.
   2. 2022 CBC Chapter 8 “Interior Finishes”, Section 803 “Wall and Ceiling Finishes”:
      a. Finish of interior materials shall meet minimum Fire Classification (non-sprinklered spaces):
         1) Interior exit stairways, ramps and exit passages:
            a) Class ‘A’ (flame spread index 0-25; smoke developed 0-450).
         2) Corridors and enclosure for exit access stairways and ramps:
            a) Class A (flame spread index 0-25; smoke developed 0-450).
         3) Rooms and enclosed spaces:
            a) Class B (flame spread index 26-75; smoke developed 0-450).
   3. 2022 California Green Building Standards Code (CGBSC).

C. Single Source Responsibility:
   1. Provide primers and undercoat products from the same manufacturer as the finish coats.
   2. Review other sections in which primers are provided to ensure compatibility of the total coating systems for various substrates. On request, furnish information on characteristics or finish materials to ensure use of compatible primers.

D. Manufacturer Qualifications: Company specializing in manufacturing the products specified with a minimum of ten (10) years of documented experience.

E. Applicator Qualifications: Company specializing in performing the type of work specified with a minimum of five (5) years of documented experience and approved by manufacturer.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Contractor shall ensure that temperatures, relative humidity, and other environmental conditions for material storage, handling, and installation are maintained within the manufacturer's suggested limits.
   1. Apply water-based paints only when the temperature of surfaces to be painted and air temperatures is between 50- and 90-degrees F.
   2. Apply solvent-based paints only when the temperature of the surfaces to be painted and the air temperature is between 45- and 95-degrees F.

3. Do not apply paints in snow, fog, rain, or misty conditions when the relative humidity exceeds 85% or when temperatures are less than 5 degrees above the dew point, or to damp or wet surfaces.

B. Provide adequate lighting for proper installation of materials.

C. Provide adequate ventilation for proper installation of materials.

D. Paints, primers, and thinners shall not contain any organic compounds or metals prohibited for use in these products in California.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Handling, storage, and application of the materials covered under this Section of the specifications shall be performed in accordance with the manufacturer's latest written recommendations.

B. Materials shall be delivered to the site in original unopened containers showing the brand name and product identification number, date of manufacture, color name and number, and VOC content.

C. Rejected materials shall be immediately removed from the site.

D. Take precautions to minimize the potential for accumulation of paint fumes and the potential for fire.

1.08 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer’s recommended procedures for producing best results, including testing of substrates, moisture in substrates and humidity and temperature limitations.

C. Do not apply exterior paint and finishes during rain or snow or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

D. Minimum Application Temperature for Latex Paints: 50° F for exterior unless required otherwise by manufacturer’s instructions.

E. Provide lighting level of 80 foot-candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable manufacturers.
   1. Benjamin Moore; Montvale, NJ.
   2. Dunn Edwards; City of Commerce, CA.
   3. PPG Paints, Pittsburgh, PA
   4. Sherwin Williams; Cleveland, OH.

2.02 MATERIALS

A. Paints and Finishes: Ready mixed, unless required to be a field-catalyzed paint.
   1. Provide paints and finishes of a soft past consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties and capable of drying or curing free of streaks or sags.

B. Use only the highest quality products from the manufacturer's product line.
   1. Do not reduce, thin or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer’s product instructions.

C. All coats shall be the products of the same manufacturer.

D. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.

E. Colorants: The use of colorants containing hazardous chemicals, such as ethylene glycol, is prohibited.

F. Flammability: Comply with applicable code for surface burning characteristics.

G. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by the Architect from the manufacturer’s full line.

H. Colors: Refer to “Color Schedule”.

2.03 ACCESSORY MATERIALS

A. Accessory materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Inspect all surfaces to receive paint.

B. Application of paint indicates an acceptance of the underlying surface.
   1. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
   2. Concrete: 12 percent
   3. Masonry (Clay and CMU): 12 percent
   4. Wood: 15 percent
   5. Portland Cement Plaster: 12 percent

C. Portland Cement Plaster Substrates: Verify that plaster is fully cured, including pH testing to determined that alkalinity is within limits established by the manufacturer.

D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

E. Proceed with coating application only after unsatisfactory conditions have been corrected.
   1. Application of coating indicates acceptance of surfaces and conditions.

3.02 PREPARATION

A. General:
   1. Remove hardware and hardware access, plates, machined surfaces, light fixtures, and similar items in places that are not to be painted or provide surface-applied protection prior to surface preparation and painting. Remove these items if necessary for complete painting of the items and adjacent surfaces. Coordinate removal of items with the appropriate trade and Construction Manager. Clean surfaces before applying paint or surface treatments. Remove oils and grease from surfaces prior to final cleaning of surfaces.
      a. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
   2. Schedule cleaning and painting so that dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces. Items shall be reinstalled in the same manner that they were removed.
      a. Remove incompatible primers and re-prime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

B. Concrete, Masonry, and Stucco:
   1. Prepare concrete, masonry, and stucco surfaces to be painted by removing efflorescence, caulk, dust, dirt, grease, oils, and other forms of release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
      a. Use abrasive blast cleaning methods if recommended by the paint manufacturer.
      b. Determine alkalinity and moisture content of surfaces by performing appropriate test. Pay special attention to concrete masonry unit mortar joints and patch concrete surfaces with Ardex or other approved patching compounds. If surfaces are sufficiently alkaline to cause blistering and burning of finished paint, correct the condition before application per manufacturer's recommendation. Do not paint surfaces where moisture content of surfaces exceeds that permitted in the manufacturer's printed directions.
      c. Clean concrete floors to receive paint or coatings with a 5% muriatic acid. Flush the floor with water to remove the acid, neutralize with ammonia, then water rinse and allow drying before painting.

C. Metal:
   1. Remove oil grease, mill scale, rust, corrosive materials, and other soluble contaminants using solvents, or cleaning compounds in conjunction with wiping, dipping, steam cleaning, or degreasing.
   2. Wash and etch galvanized material.
   3. Touch up any abrasions or chips in mill finish prior to application of finish, assuring compatibility of touch-up and patching material with subsequent paint system to be applied.
   4. Follow the Structural Steel Painting Council (SSPC) recommendations.
   5. Prime the surfaces immediately after preparation.
   6. For aluminum substrates, remove loose surface oxidation.

D. Wood (Painted):
   1. Ensure that moisture content of wood is within required limits, 15% maximum.
   2. Scrape and sand material to remove dirt, oil, sap, or other materials which will affect the finish coat.
   3. Remove any mill glaze by sanding. Wetting of surface and letting dry for 2-3 days, then sanding may be required if heavily glazed.
   4. Prime and backprime all material.

3.03 SEQUENCING AND SCHEDULING

A. Sequence work to avoid potential damage from other trades.

3.04 INSTALLATION OR APPLICATION

A. Performance Requirements:
   1. Complete coverage, void of blemishes.

B. Apply paint per Section 3.09 “PAINT SCHEDULE” at the end of this spec section.

C. Application shall be in accordance with the manufacturer's latest written recommendations.

D. Mixing and Thinning: Unless otherwise recommended by the manufacturer, paints may be thinned immediately prior to application with an approved manufacturer's thinner and used only within recommended limits of the printed directions when necessary to suit conditions of surface temperature, weather, and application methods. The use of thinner shall not relieve the Contractor from obtaining complete hiding, film thickness, or required gloss. Paints of different manufacturers shall not be mixed.

E. Additional Requirements:
   1. Each coat shall be tinted in a slightly different shade.
   2. Paint areas visible through grills, screens, or registers flat black.
   3. Door tops, bottoms, and edges shall receive the same finish as door faces.

F. Exposed plumbing, and plumbing fixtures not factory finished, shall be painted as specified for metal work.

G. Shop-primed structural steel to be painted shall receive an additional field-applied primer coat per the schedule below. The shop coating shall be considered as a protective coat to inhibit rust during storage and erection. Prior to re-priming, clean all surfaces per SSPC SC-1 with non-petroleum based solvent cleaner.

H. Block fillers: Provide block fill as scheduled to conform to the following per PDCA Standard P 12-05:
   1. Level 3 – Premium fill: One or multiple coats of high-performance block filler manufactured to be applied at a high dry film build. Block filler shall be back rolled to eliminate voids and reduce the majority of the masonry profile depth.

I. Paint may be sprayed when approved by Architect. Non-metal surface (when allowed to be sprayed) must be properly back brushed or rolled.
   1. Doors and hollow metal frames shall be spray painted.
   2. Wrought iron fences, gates, and handrails not called out as hot-dipped galvanized, shall be spray painted with an electrostatic paint process

J. Surfaces not exposed to view shall be painted the same as the first coat of finish specified.

K. Finish tops, bottoms, edges, and ends of wood doors as specified for woodwork.

L. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication and Electronic Safety and Security Work:
   1. Paint the following work where exposed to view:
      a. Equipment, including panelboards and switchgear.
      b. Uninsulated metal piping.
      c. Uninsulated plastic piping.
      d. Pipe hangers and supports.
      e. Metal conduits.
      f. Plastic conduits.
      g. Tanks that do not have factory-applied final finishes.
      h. Other items as directed by Architect.

M. Surfaces for Which Painting is Prohibited:
   1. Sprinkler heads.
   2. Electrical cover and switch plates.
   3. Heat, smoke, and carbon dioxide sensors or similar equipment.
   4. Escutcheon plates.
   5. Painting shall not obscure manufacturer's labels, UL, FM, or other code-required labels, identifying color banding, nameplates, or other identification features.
   6. Factory-finished items, unless specifically listed to receive a different finish.
   7. Glass, brass, or chrome-plated portions of fire protection system control valves, hydrants, and fire department connections

3.05 QUALITY CONTROL

A. Tolerances:
   1. No holidays, sags, runs, crawls, brush marks, or other blemishes.
   2. All primers and finish coats shall be applied at manufacturers recommended spread rates to produce manufacturer's recommended dry film thickness per coat.

B. Field Inspection:
   1. Project Inspector
   2. Construction Manager
   3. Architect of Record

C. Dry Film Thickness Testing: Owner may engage the service of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
   1. Contractor shall touch up and restore painted surfaces damaged by testing.
   2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer’s written recommendations, Contractor shall pay for testing

and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.06 CLEANING OR REPAIR

A. Keep premises clean during the progress of the work.

B. Painting shall not occur during dusty conditions.

C. Thoroughly clean-up work and adjacent areas upon completion of the work.
   1. Sweep areas clean.
   2. Remove tools, excess materials, and debris from site.
   3. Remove spilled or spattered paint.

D. Touch up all scratched or damaged paint.

E. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing and refinishing, as approved by Architect and leave in an undamaged condition.

3.07 CONDITION OF FINISHED WORK

A. Complete coverage.

B. Sharp, true lines and edges.

3.08 EXTRA STOCK

A. Contractor shall provide extra stock of 5% of each type of paint/coating and color used in new unopened 1-quart containers.

3.09 PAINT SCHEDULE (Based on Dunn-Edwards Paints)

A. Concrete:
   1. Painted surfaces – Eggshell Finish:
      a. 1st Coat (Primer):
         1) Primer, alkali resistant, water-based interior/exterior.
            a) Benjamin Moore, Ultra Spec Masonry Primer 609
            b) Dunn-Edwards, EFF-Stop Select ESSL00.
            c) Sherwin Williams, Loxon Primer A24W8300
            d) PPG Paints, Perma-Crete Interior/Exterior Alkai Resistant Primer, 4-603XI
      b. 2nd Coat:
         1) Exterior 100% Acrylic Eggshell
            a) Benjamin Moore, Ultra Spec Ext Low Lustre N455
            b) Dunn-Edwards, Spartashield SSHL30 (Gloss Level 3)

c) Sherwin Williams, A-100 Satin, A82-100 Series
d) PPG Paints, Speedhide Exterior House and Trim Satin-Acrylic Latex, 6-2045XI Series.

c. 3nd Coat:
1) Exterior 100% Acrylic Eggshell
a) Benjamin Moore, Ultra Spec Ext Low Lustre N455
b) Dunn-Edwards, Spartashield SSHL30 (Gloss Level 3)
c) Sherwin Williams, A-100 Satin, A82-100 Series
d) PPG Paints, Speedhide Exterior House and Trim Satin-Acrylic Latex, 6-2045XI Series.

2. Painted surfaces – Semi-Gloss Finish:
a. 1st Coat (Primer):
1) Primer, alkali resistant, waterbased, interior/exterior.
a) Benjamin Moore, Ultra Spec Masonry Primer 609
b) Dunn-Edwards, EFF-Stop Select ESSL00.
c) Sherwin Williams, Loxon Primer A24W8300
d) PPG Paints, Perma-Crete Interior/Exterior Resistant Primer, 4-603XI.
b. 2nd Coat:
1) Exterior 100% Acrylic Semi-Gloss
a) Benjamin Moore, Ultra Spec Ext Satin N448
b) Dunn-Edwards, Spartashield SSHL50 (Gloss Level 5)
c) Sherwin Williams, A-100 Gloss
d) PPG Paints, Speedhide Exterior House and Trim Semi-Gloss Acrylic Latex, 6-900XI Series.
c. 3nd Coat:
1) Exterior 100% Acrylic Semi-Gloss
a) Benjamin Moore, Ultra Spec Ext Satin N448
b) Dunn-Edwards, Spartashield SSHL50 (Gloss Level 5)
c) Sherwin Williams, A-100 Gloss
d) PPG Paints, Speedhide Exterior House and Trim Semi-Gloss Acrylic Latex, 6-900XI Series.

B. Metal Work:
1. Ferrous Metal (structural steel and uncoated ferrous metals):
a. 1st Coat (Shop Primer):
1) Red Oxide Alkyd Primer by Section 05 12 00, “Structural Steel Framing” or Section 05 74 00, “Ornamental Metal Work”.
b. 1st Coat (Primer):
1) Rust Preventative Primer
a) Benjamin Moore, Acrylic Metal Primer HP04
b) Dunn-Edwards, Bloc-Rust Premium BRP00
c) Sherwin Williams, Procryl Primer

d) PPG Paints, Pitt-Tech Plus EP Interior/Exterior Acrylic DTM Primer, 90-1912 Series.

c. 2nd Coat:
   1) Exterior 100% Acrylic Semi-Gloss
      a) Benjamin Moore, Acrylic DTM S/G HP29
      b) Dunn-Edwards Aristoshield50 ASHL50 (Gloss Level 5)
      c) Sherwin Williams, PI WB Alkyd Urethane B53
      d) PPG Paints, Pitt-Tech Plus EP Interior/Exterior Acrylic Semi-Gloss DTM Industrial Enamel, 90-1610 Series.

d. 3rd Coat:
   1) Exterior 100% Acrylic Semi-Gloss
      a) Benjamin Moore, Acrylic DTM S/G HP29
      b) Dunn-Edwards, Aristoshield50 ASHL50 (Gloss Level 5)
      c) Sherwin Williams, PI WB Alkyd Urethane B53
      d) PPG Paints, Pitt-Tech Plus EP Interior/Exterior Acrylic Semi-Gloss DTM Industrial Enamel, 90-1610 Series.

Note: When exposed structural steel posts are connected to ornamental metal panels, the painted finish shall be per ornamental metal as listed below.

2. Ferrous Metal (Ornamental Metal, Fences, Gates, Exterior Ramps and Handrails not scheduled to be hot dipped galvanized):
   a. 1st Coat (Shop Primer):
      1) Red Oxide Alkyd Primer by Section 05 12 00, “Structural Steel Framing” or Section 05 74 00, “Ornamental Metal Work”.
   b. 1st Coat (Primer):
      1) Rust Preventative Primer
         a) Benjamin Moore, Acrylic Metal Primer HP04
         b) Dunn-Edwards, Bloc-Rust Premium BRP00
         c) Sherwin Williams, Procryl Primer
         d) PPG Paints, Pitt-Tech Plus EP Interior/Exterior Acrylic DTM Primer, 90-1912 Series.
   c. 2nd Coat:
      1) Exterior 100% Acrylic Semi-Gloss
         a) Benjamin Moore, Corotech Acrylic DTM S/G HP29
         b) Dunn-Edwards Aristoshield50 ASHL50 (Gloss Level 5)
         c) Sherwin Williams, PI WB Alkyd Urethane B53
         d) PPG Paints, Pitt-Tech Plus EP Interior/Exterior Acrylic Semi-Gloss DTM Industrial Enamel, 90-1610 Series.
   d. 3rd Coat:
      1) Exterior 100% Acrylic Semi-Gloss
         a) Benjamin Moore, Ultra Spec Ext Gloss N448
         b) Dunn-Edwards, Aristoshield50 ASHL50 (Gloss Level 5)
         c) Sherwin Williams, PI WB Alkyd Urethane B53
         d) PPG Paints, Pitt-Tech Plus EP Interior/Exterior Acrylic Semi-Gloss DTM Industrial Enamel, 90-1610 Series.

3. Non-Ferrous Metals (galvanized)
    a. 1st Coat (Primer):
        1) Galvanized Metal Primer
            a) Benjamin Moore, Acrylic Metal Primer HP04
            b) Dunn-Edwards, Ultrashield Galvanized Metal Primer ULGM00
            c) Sherwin Williams, DTM Wash Primer B71Y1
            d) PPG Paints, Pitt-Tech Plus EP Interior/Exterior Acrylic DTM Primer, 90-1912 Series.
    b. 2nd Coat:
        1) Exterior 100% Acrylic Semi-Gloss
            a) Benjamin Moore, Acrylic DTM S/G HP29
            b) Dunn-Edwards, Aristoshield50 ASHL50 (Gloss Level 5)
            c) Sherwin Moore, PI WB Alkyd Urethane 53
            d) PPG Paints, Pitt-Tech Plus EP Interior/Exterior Acrylic Semi-Gloss DTM Industrial Enamel, 90-1610 Series.
    c. 3rd Coat:
        1) Exterior 100% Acrylic Semi-Gloss
            a) Benjamin Moore, Acrylic DTM S/G HP29
            b) Dunn-Edwards, Aristoshield50 ASHL50 (Gloss Level 5)
            c) Sherwin Williams, PI WB Alkyd Urethane 53
            d) PPG Paints, Pitt-Tech Plus EP Interior/Exterior Acrylic Semi-Gloss DTM Industrial Enamel, 90-1610 Series.
4. Non-Ferrous Metals (Aluminum and Brass):
    a. 1st Coat (Primer):
        1) Galvanized Metal Primer
            a) Benjamin Moore, Acrylic Metal Primer HP04
            b) Dunn-Edwards, Ultrashield Galvanized Metal Primer ULGM00
            c) Sherwin Williams, DTM Wash Primer B7141
            d) PPG Paints, Pitt-Tech Plus EP Interior/Exterior Acrylic DTM Primer, 90-1912 Series.
    b. 2nd Coat:
        1) Exterior 100% Acrylic Semi-Gloss
            a) Benjamin Moore, Acrylic DTM S/G HP29
            b) Dunn-Edwards, Aristoshield50 ASHL50 (Gloss Level 5)
            c) Sherwin Williams, PI WB Alkyd Urethane 53
            d) PPG Paints, Pitt-Tech Plus EP Interior/Exterior Acrylic Semi-Gloss DTM Industrial Enamel, 90-1610 Series.
    c. 3rd Coat:
        1) Exterior 100% Acrylic Semi-Gloss
            a) Benjamin Moore, Acrylic DTM S/G HP29
            b) Dunn-Edwards, Aristoshield50 ASHL50 (Gloss Level 5).
            c) Sherwin Williams, PI WB Alkyd Urethane 53
            d) PPG Paints, Pitt-Tech Plus EP Interior/Exterior Acrylic Semi-Gloss DTM Industrial Enamel, 90-1610 Series.

5. Metal Trim and Hollow Metal Doors and Frames (Acrylic DTM Option):
   a. 1st Coat (Shop Primed):
      1) Galvanized per Section 08 11 00, “Hollow Metal Doors and Frames”.
   b. 2nd Coat (Shop Primed):
      1) Galvanize etching per Section 08 11 00, “Hollow Metal Doors and Frames”.
   c. 3rd Coat (Primer):
      1) Acrylic Metal Primer
         a) Benjamin Moore, Acrylic Metal Primer HP04
         b) Carboline, Galoseal WB Primer by Section 08 11 00, “Hollow Metal Doors and Frames”.
         c) Sherwin Williams, Procryl Primer
         d) PPG Paints, Pitt-Tech Plus EP Interior/Exterior Acrylic Semi-Gloss DTM Industrial Enamel, 90-1610 Series.

      When "Shop Primed", do not omit field applied primer prior to first coat;
         a) Benjamin Moore, Acrylic Metal Primer HP04
         b) Carboline Galoseal WB.
         c) Devoe 4020PF
         d) Onsite solvent cleaning per SSPC-SP 1 requirements.
   d. 4th Coat:
      1) DTM Acrylic Enamel Semi-Gloss
         a) Benjamin Moore, Acrylic DTM S/G HP29
         b) Carboline Carbocrylic #3359 MC
         c) Devoe, Devflex 4216L S/G
         d) PPG Paints, Pitt-Tech Plus EP Interior/Exterior Acrylic Semi-Gloss DTM Industrial Enamel, 90-1610 Series.

6. Mechanical Equipment:
    a. Duct Work and Miscellaneous Equipment:
        1) As per Ferrous or Non-Ferrous metal listed above, as applicable.

B. Wood:
1. Painted Eggshell Finish:
    a. 1st Coat (Primer):
        1) Exterior Acrylic Primer
            a) Benjamin Moore, Fresh Start 046
            b) Dunn-Edwards, EZ-Prime Premium EZPR00
            c) Sherwin Williams, Exterior Latex Wood Primer B42W804
            d) PPG Paints, Sela Grip Gripper Interior/Exterior 100 Percent Acrylic Latex Primer, 17-921X1 Series.
    b. 1st Coat:
        1) Smooth/Rough Sawn Wood and Siding,
            a) Benjamin Moore, Fresh Start 046
            b) Dunn Edwards, EZ-Prime Premium EZPR00
            c) Sherwin Williams, Exterior Latex Wood Primer B42W804
            d) PPG Paints, Sela Grip Gripper Interior/Exterior 100 Percent Acrylic Latex Primer, 17-921X1 Series.
        2) Synthetic Wood and Siding:
            a) Benjamin Moore, Fresh Start 046
            b) Dunn-Edwards, Ultra-Grip Premium UGPR00
            c) Sherwin Williams, PrepRite ProBlock B51Series
            d) PPG Paints, Sela Grip Gripper Interior/Exterior 100 Percent Acrylic Latex Primer, 17-921X1 Series.
    c. 2nd Coat
        1) Exterior 100% Acrylic Eggshell
            a) Benjamin Moore, Ultra Spec Ext Low Lustre N455
            b) Dunn-Edwards, Spartashield SSHL30 (Gloss Level 3)
            c) Sherwin Williams, A-100 Satin A82
            d) PPG Paints, Speedhide Exterior House and Trim Satin-Acrylic Latex, 6-2045XI Series.
    d. 3rd Coat:
        1) Exterior 100% Acrylic Eggshell
            a) Benjamin Moore, Ultra Spec Ext Low Lustre N455
            b) Dunn-Edwards, Spartashield SSHL30 (Gloss Level 3)
            c) Sherwin Williams, A-100 Satin A82
            d) PPG Paints, Speedhide Exterior House and Trim Satin-Acrylic Latex, 6-2045XI Series.

2. Painted Semi-Gloss Finish:
   a. 1st Coat (Primer):
      1) Exterior Acrylic Primer
         a) Benjamin Moore, Fresh Start 046
         b) Dunn-Edwards, EZ-Prime Premium EZPR00
         c) Sherwin Williams, Exterior Latex Wood Primer, B42W8041
         d) PPG Paints, Sela Grip Gripper Interior/Exterior 100 Percent Acrylic Latex Primer, 17-921X1 Series.
   b. 1st Coat:
      1) Smooth/Rough Sawn Wood and Siding,
         a) Benjamin Moore, Fresh Start 046
         b) Dunn-Edwards, EZ-Prime Premium EZPR00
         c) Sherwin Williams, Exterior Latex Wood Primer, B42W8041
         d) PPG Paints, Sela Grip Gripper Interior/Exterior 100 Percent Acrylic Latex Primer, 17-921X1 Series.
      2) Synthetic Wood and Siding:
         a) Benjamin Moore, Fresh Start 046
         b) Dunn-Edwards, Ultra-Grip Premium UGPR00
         c) Sherwin Williams, Exterior Latex Wood Primer, B42W8041
         d) PPG Paints, Sela Grip Gripper Interior/Exterior 100 Percent Acrylic Latex Primer, 17-921X1 Series.
   c. 2nd Coat
      1) Exterior 100% Acrylic Semi-Gloss
         a) Benjamin Moore, Ultra Spec Ext Satin N448
         b) Dunn-Edwards, Spartashield SSHL30 (Gloss Level 5)
         c) Sherwin Williams, A-100 Gloss
         d) PPG Paints, Speedhide Exterior House and Trim Semi-Gloss Acrylic Latex Paint, 6-900XI Series.
   d. 3rd Coat:
      1) Exterior 100% Acrylic Semi-Gloss
         a) Benjamin Moore, Ultra Spec Ext Satin N448
         b) Dunn-Edwards, Spartashield SSHL30 (Gloss Level 5)
         c) Sherwin Williams, A-100 Gloss
         d) PPG Paints, Speedhide Exterior House and Trim Semi-Gloss Acrylic Latex Paint, 6-900XI Series.
3. Painted Gloss Finish:
   a. 1st Coat (Primer):
      1) Exterior Acrylic Primer
         a) Benjamin Moore, Fresh Start 046
         b) Dunn-Edwards, EZ-Prime Premium EZPR00
         c) Sherwin Williams, Exterior Latex Wood Primer
         d) PPG Paints, Sela Grip Gripper Interior/Exterior 100 Percent Acrylic Latex Primer, 17-921X1 Series.

b. 1st Coat:
   1) Smooth/Rough Sawn Wood and Siding,
      a) Benjamin Moore, Fresh Start 046
      b) Dunn-Edwards. EZ-Prime Premium EZPROO
      c) Sherwin Williams, Exterior Latex Wood Primer, B42W8041
      d) PPG Paints, Sela Grip Gripper Interior/Exterior 100 Percent Acrylic Latex Primer, 17-921X1 Series.
   2) Synthetic Wood and Siding:
      a) Benjamin Moore, Fresh Start 046
      b) Dunn Edwards, Ultra-Grip Premium UGPR00
      c) Sherwin Williams, Exterior Latex Wood Primer, B42W8041
      d) PPG Paints, Sela Grip Gripper Interior/Exterior 100 Percent Acrylic Latex Primer, 17-921X1 Series.
c. 2nd Coat
   1) Exterior 100% Acrylic Gloss
      a) Benjamin Moore, Ultra Spec Ext Gloss N449
      b) Dunn-Edwards, Spartashield SSHL60 (Gloss Level 6)
      c) Sherwin Williams, Solo 100% Acrylic Gloss A77 Series
      d) PPG Paints, Speedhide Interior/Exterior High Gloss Acrylic Paint, 6-8534 Series.
d. 3rd Coat:
   1) Exterior 100% Acrylic Gloss
      a) Benjamin Moore, Ultra Spec Ext Gloss N449
      b) Dunn-Edwards, Spartashield SSHL60 (Gloss Level 6)
      c) Sherwin Williams, Solo 100% Acrylic Gloss A77 Series
      d) PPG Paints, Speedhide Interior/Exterior High Gloss Acrylic Paint, 6-8534 Series.

4. Stained Finish:
   a. 1st Coat:
      1) Alkyd exterior wiping oil stain
         a) Old Masters, Wiping Stain (one coat only)
         b) Dunn-Edwards, Cabot Semi-Solid Acrylic Stain
         c) Valspar, Stainseal (V-QYB)
         d) PPG Paints, Deft Dethane Polyurethane Interior/Exterior Oil-Based 275g/L; DFT26/123/21.
   b. 2nd Coat:
      1) Water-based interior wiping oil stain
         a) Old Masters Wiping Stain
         b) Dunn-Edwards, Cabot Semi-Solid Acrylic Stain
         c) Valspar, Stainseal (V-QYB)
         d) PPG Paints, Clear Deft Polyurethane Interior/Exterior Water-Based Acrylic DFT259/258/257.

c. 3rd Coat:
1) Alkyd interior wiping oil stain
a) Old Masters Wiping Stain
b) Dunn-Edwards, Cabot Semi-Solid Acrylic Stain
c) Valspar, Stainseal (V-QYB)
d) PPG Paints, Deft Dethane Polyurethane Interior/Exterior Oil-Based 275g/L; DFT26/123/21.

C. Portland Cement Plaster:
1. Painted Eggshell Finish:
a. 1st Coat (Primer):
1) Epoxy-fortified acrylic primer/sealer for interior and exterior
a) Benjamin Moore, Ultra Spec Masonry Primer N609
b) Dunn-Edwards, Eff-Stop Select ESSL00
c) Sherwin Williams, Loxon Primer A24W8300
d) PPG Paints, Perma-Crete Interior/Exterior Alkai Resistant Primer, 4-603XI.
b. 2nd Coat:
1) Exterior 100% Acrylic Flat
a) Benjamin Moore, Ultra Spec Ext Flat N447
b) Dunn-Edwards, Spartashield SSHL10 (Gloss Level 1)
c) Sherwin Williams, A-100 Flat A6 Series
d) PPG Paints, Speedhide Exterior House Paint Flat Latex, 6-610XI Series.
c. 3rd Coat:
1) Exterior 100% Acrylic Flat
a) Benjamin Moore, Ultra Spec Ext Flat N447
b) Dunn-Edwards, Spartashield SSHL10 (Gloss Level 1)
c) Sherwin Williams, A-100 Flat A6 Series
d) PPG Paints, Speedhide Exterior House Paint Flat Latex, 6-610XI Series.
2. Painted Elastomeric Finish:
a. 1st Coat (Primer):
1) Epoxy-fortified acrylic primer/sealer for interior and exterior
a) Benjamin Moore, Ultra Spec Masonry Primer 609
b) Dunn-Edwards, Eff-Stop Select ESSL00
c) Sherwin Williams, Loxon Primer A24W8300
d) PPG Paints, Perma-Crete Interior/Exterior Alkai Resistant Primer, 4-603XI.
b. 2nd Coat:
1) Durable elastomeric wall coating
a) Benjamin Moore, Ultra Spec Elastomeric 359, 360
b) Dunn-Edwards, Enduralastic 5 (achieve 11-13 DFT)
c) Sherwin Williams, Conlex Sherlastic Elastomeric CF16 Series

d) PPG Paints, Perma-Crete Pitt-Flex Elastomeric Coating, 4-110XI Series.

D. Addition Work:
   1. Existing Work:
      a. Metal:
         1) Three (3) coats as specified above.
      b. Non-Metal:
         1) Fill holes and cracks and apply 2 final coats as specified above.
            a) Touch up primer on larger patch areas (>2 sq.in.)

E. Equipment Color Codes (unless noted otherwise in the mechanical and plumbing specifications). Color coding of equipment and piping shall follow OSHA and ANSI, and ASME A13 standards.
   1. Chilled Water Systems: Piping, pumps, chillers, air separators and expansion tanks - Dark Blue.
   2. Steam and Condensate: Piping, flash tanks, condensate pumps – Yellow
   3. Heating Hot Water: Piping, pumps, air separator, heat exchanger, and expansion tanks - Orange.
   4. Compressed Air Systems - Gray
   5. Fire Protection System: Piping, valves, alarms, and drains - Safety Red
   6. Natural Gas - Yellow
   7. Domestic Cold Water - Dark Green
   8. Domestic Hot Water - Light Green
   9. Basic OSHA Guide Principles:
      a. Red indicates (1) danger, (2) stop or (3) presence of fire Protect equipment.
      b. Orange marks the dangerous parts of machines or energized equipment which may cut, crush, shock or injure employees. Orange emphasizes these hazards when the guards or enclosures around them are open.
      c. Yellow warns of physical hazards and means caution. A striped or checkered pattern of yellow and black may be used to help attract attention.
      d. Blue denotes caution and its use is restricted to marking out-of-service equipment which should not be used.
      e. Green indicates either the location of safety equipment such as fire aid materials or conveys safety information.
      f. Purple used for radiation hazards. It may contain a combination of purple and yellow.
      g. Black & White or a combination of the two are used to designate traffic and housekeeping markings. Stripes, checkers or other variations are often used.

END OF SECTION 09 91 13

SIGNAGE
SECTION 10 14 00

PART 1 GENERAL

1.01 SUMMARY

A. Inclusions:
   1. Provisions set forth in Divisions 0 and 1.
   2. Signage.
      a. Room identification and directional signs.
      b. Toilet room identification signs.
      c. Painted door signs.
      d. Exterior building identification signs.
      e. Dedication plaques.
   3. Accessories and associated hardware.
   4. Submittal preparation.
   5. Clean up.

B. Related Sections:
   1. Section 09 24 00 Exterior Lathing and Plastering
   2. Section 09 91 13 Exterior Painting

1.02 REFERENCES

A. American National Standards Institute (ANSI)
   1. ANSI 117.1 – For Building and Facilities.

B. ASTM International (ASTM)
   1. ASTM D256 – Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.
   2. ASTM D542 – Standard Test method for Index of Refraction of Transparent Organic Plastics.
   3. ASTM D570 – Standard Test Method for Water Absorption of Plastics.
   4. ASTM D638 – Standard Test Method for Tensile Properties of Plastics.
   5. ASTM D695 – Standard Test Method for Compressive Properties of Rigid Plastics.
   6. ASTM D696 – Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30 degrees C and 30 degrees C with a Vitreous Silica Dilatometer.
   7. ASTM D732 – Standard Test Method for Shear Strength of Plastics by Punch Tool.
   8. ASTM D785 – Standard Test Method for Rockwell Hardness of Plastics and Electrical Insulating Materials.

9. ASTM D790 – Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
10. ASTM D792 – Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
11. ASTM D1003 – Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics.
12. ASTM D1929 – Standard Test Method for Determining Ignition Temperature of Plastics.
13. ASTM D2843 – Standard Test Method for Density of Smoke from the Burning or Decomposition of Plastics.
14. ASTM D3418 – Standard Test Method for Transition Temperatures and Enthalpies of Fusion and Crystallization of Polymers by Differential Scanning Calorimetry.
15. ASTM D3763 – Standard Test Method for High-Speed Puncture Properties of Plastics Using Load and Displacement Sensors.
16. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
17. ASTM E2072 – Standard Specification for Photoluminescent (Phosphorescent) Safety Marketing.
18. ASTM E2073 – Standard Test Method for Photopic Luminance of Photo Luminescent (Phosphorescent) Markings.

C. Underwriters Laboratories (UL):
1. UL 94 – Tests for Flammability of Plastic Materials for Parts in Devices and Appliances.
2. UL 723 – Standard for Test for Surface Burning Characteristics of Building Materials.

1.03 SUBMITTALS

A. See Section 01 30 00 “Administrative Requirements” for submittal procedures.

B. Product Data: Manufacturer’s data sheets on each product specified including:
1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

C. Samples or Mockups:
1. Submit one (1) sample of the manufacturer's complete color range to the Architect for color selection purposes prior to ordering material.

D. Shop Drawings or Layout Drawings:
1. Submit copies of shop drawings to the Architect for review prior to beginning fabrication.

1.04 QUALITY ASSURANCE

A. Regulatory Compliance:
   1. All signage shall conform to 2022 CBC, Section 11B-703.
      a. Inspection: Tactile signs shall be field inspected for compliance after installation in accordance with 2022 CBC, Section 11-B.1.1.2.

B. Manufacturer's Qualifications: Minimum two (2) years documented experience in manufacturing products specified.

C. Installer's Qualifications: Minimum of two (2) years documented experience installing products specified.

D. Single Source: Provide each type of specified products as produced by a single manufacturer, including necessary mounting accessories.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in unopened factory packaging.

B. Inspect materials at delivery to verify there are no defects or damage.

C. Store products in manufacturer's original packaging until ready for installation in climate-controlled location away from direct sunlight.

D. Store and dispose of solvent-based materials and materials used with solvent-based materials in accordance with requirements of local authorities having jurisdiction.

1.06 PROJECT CONDITIONS

A. Install products in an interior climate-controlled environment.

B. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside the manufacturer's absolute limits.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Plastic Room ID, Directional and Restroom Signage:
   1. Mohawk Sign Systems; Schenectady, NY.
   2. Allenite Industries; Greensboro, NC
   3. Or approved equal.

B. Individual Cast Metal Letters:
   1. American Sign Letters; Sebastain, FL
   2. Mathews Architectural Products, Pittsburgh, PA.
   3. Or approved equal.

C. Bronze Plaques:
   1. Nelson-Harkins, Chicago, IL.
   2. Mathews Architectural Products, Pittsburgh, PA.
   3. Or approved equal.

2.02 MATERIALS

A. Plastic Room Identification and Directional Signage:
   1. Signs shall be sand- carved 1/8” thick phenolic ES plastic laminate.
      a. The background shall be light suede finish.
         1) Color as selected by Architect; Color shall be contrasting (70% minimum) to the adjacent surfaces.
      b. Characters shall have glossy smooth finish.
         1) Color as selected by Architect; color shall be contrasting (70% minimum) to the sign background color.
   2. Signage shall conform to California Code of Regulations, Title 24, Part 2, 2022 CBC Section 11B-703.
      a. Characters shall be raised 1/32" minimum and shall be Sans Serif upper case characters or simple Serif type accompanied by Grade 2 Braille (see part b below).
         1) Character size: Raised characters shall be a minimum 5/8" and a maximum of 2 inches high.
         2) Finish and contrast: Characters and their background shall have a non-glare finish. Characters shall contrast with their background with either light characters on a dark background or dark characters on a light background. (CBC 11B-703.5.1).
         3) Proportions: Characters shall be selected from fonts where the width of the upper-case "O" is between 60% and 110% of the height of the upper-case letter "T". (CBC 11B-703.5.4). Minimum character heights shall be per CBC Table 11B-703.5.5. Character stroke thickness shall be 10% minimum and 20 % maximum of the height of the character (CBC Section 11B-703.5.7). See details on drawings for heights on room identification signs.
         4) Text shall also be written in California Grade No. 2 Braille per CBC Sections 703.3 & 703.4, and Table 703.3.1 and Figure 11B-703.3.1.
         5) Pictograms shall comply with CBC Section 11B-703.6.
   3. Painted Door Signs:
      a. Description:
         1) General:

a) Location: Upper corner at hinged side, exterior face of door as you approach to enter room.
b) Material: enamel paint, refer to Section 09 91 13 “Exterior Painting”.
c) Size: size (6) inches high for room numbers and three (3) inches high for letters. Refer to character proportions in paragraph 2.02A.2.a(3).
d) Text Font: Helvetica medium
e) Color: As selected by the Architect

B. Restroom Door Signage:
1. Identification symbols on doorways to sanitary facilities shall be as follows:
a. Men/Boys sanitary facilities to be identified by an equilateral triangle 1/4 inch thick with edges 12 inches long and a vertex pointing upward, centered on the door between 58" and 60" A.F.F., and the color is to be distinctly different form the color and contrast of the door. (CBC Section 11B-703.7.2.6.1)
b. Women/Girls sanitary facilities to be identified by a circle 1/4 inch thick, 12 inches in diameter, centered on the door between 58" and 60" A.F.F. and the color is to be distinctly different from the color and contrast of the door (CBC Section 11B-703.7.2.6.2).
c. Unisex sanitary facilities to be identified by a circle 1/4 inch thick 12 inches in diameter with a 1/4-inch-thick triangle superimposed on the circle and within the 12-inch diameter.
1) Color of triangle to contrast with circle, and the circle shall contrast with color of the door. (CBC Section 11B-703.7.2.6.3)
2. Signs shall be 1/4" thick solid acrylic plastic base with 1/8" thick characters chemically welded to base.
3. Mechanically attach signage with tamper-resistant sex bolts.
4. The verbal description to be placed directly below the pictogram.
5. The minimum outside dimension of the pictogram to be 6 inches in height.

C. Building Identification Signs:
1. Material:
a. Cast aluminum.
2. Letter style:
a. Letter style shall be selected by Architect from the manufacturer’s standard styles.
3. Letter height:
a. Letter height shall be as indicated on Drawings.
4. Finish:
a. Baked enamel factory applied. Color to be selected by the Architect.
5. Mounting:
a. Stand-off stud-type mounting. Refer to drawings for detail.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify all required backing and blocking prior to enclosing framing.

B. Start of work shall be considered as acceptance of existing conditions.

3.02 INSTALLATION OR APPLICATION

A. Install signage per Drawings.
   1. Anchorage of signs shall be set in full bed of clear silicone adhesive with tamper resistant wood screws into solid blocking, or concrete screws into block/bricks.
   2. Where signs are mounted on windows; signs shall be set in a full bed of clear silicone adhesive.

B. Installation of room identification signage shall comply with accessibility guidelines per CBC Chapter 11B.
   1. Room identification signs shall be installed at + 60" height to the bottom of the top line of text and centered 9" from the strike of door, unless noted otherwise. Reference CBC Sec. 11B-703.4.1.

3.03 SCHEDULES

A. Room Identification and Miscellaneous Signs:
   1. Refer to Signage Schedule on Drawings.

B. Individual Letters:
   1. Refer to Signage Schedule on Drawings.

END OF SECTION 10 14 00

SECTION 22 05 00

COMMON WORK RESULTS FOR PLUMBING

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. This Section provides the basic plumbing requirements that apply to the Work of Division 22.

B. Related Requirements:

1. Division 01: General Requirements.

2. Division 22: Plumbing

3. Division 26: Electrical.

1.02 REGULATORY REQUIREMENTS

A. Current federal Safe Drinking Water Act (SDWA) regulations require the furnishing of lead-free pipe, solder, and flux in the installation or repair of plumbing in non-residential facilities connected to public drinking water systems. Under this regulation, solders and flux are considered lead-free when they contain 0.2 percent lead or less. Under California regulations pipes and pipe fittings are considered lead-free when they contain 0.25 percent lead or less as defined in California Assembly Bill 1953 (AB 1953). No pipe, pipe fittings, or any other fitting or fixture intended to convey or dispense water for human consumption by drinking or cooking is allowed in the domestic plumbing system, if they do not meet the low lead definition of AB 1953. Weighted average lead content of the wetted surface area of pipes, fittings and fixtures may not exceed 0.25 percent.

1. Provide lead-free water pipe, solder, and flux materials that meet the standards as outlined by the federal SDWA regulations and California AB 1953 if installed in drinking water system.

2. Collect pipe, solder, and flux material samples as required by the Project Inspector. Test samples shall be delivered to an Owner designated testing laboratory for testing of lead content.

a. Test samples for lead content by the atomic absorption spectrophotometry method.

3. Materials found not conforming to SDWA and California AB 1953 regulations shall be deemed defective Work and shall be replaced with lead-free materials.

4. Comprehensive testing of the remaining materials for their lead content shall be performed as required by the Project INSPECTOR.

A. Materials, fabrication, equipment, and installation shall comply with industry standards and code requirements. Where manufacturer's recommendations exceed industry

standards, the manufacturer's recommendation shall establish the minimum standard. As a minimum, standards from the following organizations shall apply:

1. ANSI - American National Standards Institute.
2. ASME - American Society of Mechanical Engineers.
    a. ASME Boiler and Pressure Vessel Code.
    b. ASME B31 - Standards for Pressure Piping.
3. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers.
4. ASTM - American Society for Testing and Materials.
    a. ASTM A53 Specification for Welded and Seamless Pipe.
5. AWWA - American Water Works Association.
6. CSA - Canadian Standards Association.
7. FM Global - Factory Mutual Global
8. IAPMO - International Association of Plumbing and Mechanical Officials.
9. NFPA - National Fire Protection Association.
10. OSHA - Occupational Safety and Health Administration.
11. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association.
12. UL - Underwriters Laboratories Inc.
13. Intertek (ETL Certification).

B. Materials, fabrication, equipment, and installation shall comply with federal, state, and local codes including, but not limited to, the following:

1. CBC, California Building Code, and CMC, California Plumbing Code.
    a. Latest edition as adopted by the City of Los Angeles, the County of Los Angeles, and the State of California including amendments effective on the Effective Date of the Contract.
2. California Code of Regulations, Title 8, Industrial Relations, Division 1, Chapter 4, Division of Industrial Safety.

3OSHA - Occupational Safety and Health Administration.

4. CDPH - California Department of Public Health.
5. SCAQMD - South Coast Air Quality Management District.

C. Specifications or Drawings shall not be construed to permit deviation from the requirements of governing codes unless approval has been obtained from legally constituted authorities having jurisdiction, and the Architect. The Contract Documents may contain more stringent requirements than those legally required.

D. Permits and Fees: Refer to the General and Supplementary Conditions.

1.03 SUBMITTALS

A. Provide submittals in accordance with Section 01 3300: Submittal Procedures and with specific requirements of Division 22 sections, as applicable.

B. The above information shall become the basis for inspecting and testing materials and actual installation procedures performed in the Work.

C. Shop Drawings: Submit one additional copy when control diagrams having line voltage connections are indicated. Shop Drawings shall be specifically prepared for the Work of this Project. Drawings prepared in accordance with requirements of Section 01 3113: Project Coordination and Section 01 3300 may be provided by the Architect to serve as a background for the Shop Drawings. Shop Drawings shall comply with the requirements of Section 01 3113 and Section 01 3300 and shall indicate at a minimum:

1. Complete system layout of equipment, components, plumbing fixtures, piping, indicating service clearances, and pipe sizes, fitting types and sizes and pipe elevations, distances of pipes and equipment from building reference points and hanger support locations. The above items shall be coordinated on the shop drawings according to the requirements of Section 01 3113.

2. Schedule and description of equipment, piping and fittings.

1.04 PROJECT RECORD DOCUMENTS

A. Comply with provisions of Section 01 7700: Contract Closeout.

B. Project Record Drawings:

1. Provide a complete set of plumbing and fire protection drawings in AutoCAD and, if available, BIM, complete with external reference drawings, fonts, blocks and plotter pen color/line thickness settings on CD-ROM. Also submit one set of full size reproducible plots on vellum and 3 sets of prints.

2. Before Contract Completion, deliver corrected and completed prints to the OAR. Delivery of project record documents to the OAR does not relinquish responsibility of furnishing required information omitted from project record documents.

C. Operation and Maintenance Manuals:

1. Submit two copies of operation and maintenance manuals in required form and content. If no revisions are required, furnish one additional copy. If revisions are required, one copy shall be returned with instructions for changes; perform such changes and return three copies of manuals. Manuals shall be bound in accordance to Section 01 7700. Deliver manuals to the OAR. Submit an electronic copy of the entire manual in PDF file format.

2. Contents of Manual:

a. Title sheet with Project name, including names, addresses and telephone number of Contractor, installer, and related equipment suppliers.

b. Manufacturer's operating instructions including, but not limited to, the following:

   1) Identification of components and controls.

   2) Trouble shooting checklist and guidelines.

   3) Recommendations for optimum performance.

   4) Warnings and safety precautions on improper or hazardous operational procedures or conditions

c. Manufacturer's product data and parts and maintenance booklet for each item of equipment furnished under Division 22 that includes the following as a minimum:

   1) Manufacturer's model, identification and serial numbers.

   2) Exploded view of assembly drawings identifying each component or part with the relevant part number.

   3) Directory of manufacturer's representatives, service contractors and part distributors.

   4) Maintenance and trouble-shooting instructions, including schedule for preventive maintenance, periodic inspection and cleaning criteria.

d. Project Record Drawings: Complete set of plumbing, fire protection and control system drawings in 50 percent reduced print format shall be furnished with the manual. Submit the above record drawings on CD-ROM in AutoCAD and, if available, BIM, complete with external reference drawings, fonts, blocks, and plotter pen color/line thickness settings.

e. Testing, Adjusting, and Balancing reports: Submit as specified in Section 23 0593.

f. South Coast Air Quality Management District (SCAQMD) permits to install and operate boilers, water heaters and other fuel burning equipment and third-party source test reports as required by SCAQMD to allow start-up and operation of equipment.

g. Los Angeles County industrial waste permits.

h. Valve directory complete with location, function, size, and model of each valve with reference to the project record drawings.

i. Equipment and component identification chart complete with location, function, size, and model of each equipment or component with reference to the project record drawings.

1.05 COORDINATION

A. Contract Documents indicate extent and general arrangement of Work under Division 22. Contractor shall coordinate work in accordance with Section 01 3113 requirements and make adjustments as required to provide maximum headroom, a neat arrangement to keep passageways and openings clear to provide accessibility and provisions for maintenance, and to meet code requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Storage: Deliver materials to Project site in their original unopened containers with labels intact and legible at time of delivery. Store in strict accordance with manufacturer's recommendations.

B. Do not store plastic pipe or materials in direct sunlight.

1.07 PRELIMINARY OPERATION

A. OAR may require any portion of plumbing Work to be operated before Substantial Completion. Such operation shall be in addition to regular tests, demonstrations and instructions required under the Contract Documents, and shall be performed as required.

B. Notify the INSPECTOR at least 24 hours in advance of lighting or re-lighting pilots.

1.08 TRAINING OF OWNER PERSONNEL

A. Training of Owner's personnel shall include:

1. A minimum of 4 hours of on-site overview of the overall Plumbing System.

2. Refer to Division 22 sections for specific training on each of the components of the Plumbing System.

B. Contract shall include the cost of training Owner operation and maintenance personnel in operating, adjusting, maintenance, trouble-shooting, and Project site repair of each component, equipment, or system provided under this Contract.

C. Operational and maintenance training shall be conducted on the Project site, unless indicated otherwise.

D. Upon completion of Owner training, a completion certificate indicating the nature of the training and a description of the systems, complete with equipment and component lists shall be issued to each trainee. The certificate should be issued in duplicate with one copy retained by OAR.

E. An attendance sheet with the names and signatures of all participants attending the training shall be submitted to the OAR and kept as part of the project documents.

1.09 GUARANTEES AND DAMAGE RESPONSIBILITY

A. Sound of water flowing in piping shall not be transmitted to building structure. Operation of mechanical system shall not produce operational sounds that can be heard outside of rooms enclosing apparatus or equipment.

PART 2 – PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Unless otherwise specified, materials and equipment shall be new, in good and clean condition. Equipment, materials, and components shall be of the make; type and model number noted on Drawings or specified. Pieces of equipment of the same type shall be by the same manufacturer.

B. Whenever an item is listed by a single proprietary name, with or without model number and type, it shall be for purpose of design only, to indicate characteristics and quality desired. Proprietary designation listed on Drawings, or listed first in Specifications, is used as a basis for design to establish a standard for quality and performance and space requirements.

C. Equipment and materials indicated or required to be installed outdoors shall be of the type that is designed, manufactured, listed or approved by authorities having jurisdiction for outdoor installation by being resistant to the adverse effects of weather. The additional protective measures against outdoor weather required by the manufacturers' installation instructions and prevalent practice shall be provided.

D. For substitution of materials or products, refer to the General Conditions.

PART 3 – EXECUTION

3.01 SERVICE INTERRUPTIONS, OFF-SITE, GAS AND WATER

A. Schedule Work so there shall be no service interruptions of existing systems or systems during normal hours of operation of affected systems and facilities.

B. When service interruptions are mandatory, arrange in advance with the OAR as to time and date of such interruptions.

C. Systems, which are interrupted, shall be returned back into operation in such manner that they will function as originally intended.

3.02 CUTTING, NOTCHING, AND BACKING

A. Conform to California Building Code, Title 24, Part 2, for notches and bored holes in wood and for pipes and sleeves embedded in concrete and for cuts in steel, as detailed on structural Drawings.

B. Where pipes pass through, or are located within one inch of any construction element, install a resilient pad, ½ inch thick minimum, to prevent contact.

C. Furnish provisions for recesses, chases, and accesses and provide blocking and backing for proper reception and installation of plumbing Work.

3.03 LOCATION OF PIPING AND EQUIPMENT

A. Location of piping, apparatus and equipment indicated on the Drawings is approximate and shall be altered to avoid obstructions, preserve headroom, and provide free and clear openings and passageways.

B. Trenches parallel to footings shall not be closer than 18 inches to the face of footings and shall not be below a plane having a downward slope of 2 horizontal to one vertical, from a line 9 inches above bottom of footing.

C. Pipe in tunnels shall be installed close to one side of tunnel to provide maximum space for passage. Pipe shall not be installed through crawl hole unless otherwise specified or detailed on Drawings.

D. Place equipment in locations and spaces indicated, disassemble and/or reassemble equipment as required by Project conditions.

3.04 TESTS AND TESTING

A. Tests shall be as required under the applicable sections of Division 22, including this Section.

B. Additional tests may be required in the case of products, materials, and equipment if:

1. Submitted items are altered, changed, or cannot be determined as exactly conforming to the Contract Documents.

2. Performance testing and results may also be required on certain items which are as specified, including fan, and pump performance.

C. Piping Tests:

1. Perform tests required to demonstrate that operation of plumbing systems and their parts are in accordance with Specifications covering each item or system, and furnish materials, instruments and equipment necessary to conduct such tests. Tests shall be performed in presence of the Inspector, and representatives of any governmental agency having jurisdiction. Work shall not be concealed or covered until required results are provided.

2. If required tests are not performed, Owner may provide in accordance with the Contract Documents.

3. Pressure gauges furnished in testing shall comply with CPC. Air shall be bled from lines requiring hydrostatic or water tests.

4. Systems shall be pressure-tested in accordance with pipe testing schedule below. Pipe test shall indicate no loss in pressure after a minimum duration of 4 hours at test pressures indicated. Where local codes require higher test pressures than specified herein for fire sprinkler systems, local codes shall govern.

5. Fuel gas lines shall be first tested with piping exposed, before backfilling trenches or lathing; second with piping in finished arrangement, backfilled and paved where required, and walls finished.

6. Piping systems may be tested as a unit or in sections, but entire system shall successfully meet requirements specified herein, before final testing by the Inspector.

7. Repair of damage to pipes and their appurtenances or to any other structures resulting from or caused by these tests, shall be provided.

D. Pipe Testing Schedule:

System Tested	**Test Pressure (psig)**	**Test With:**
Durham system, glass or plastic acid waste, vent and roof drain (except pipes running under a slab or underground)	Fill with water to top of highest vent; allow to stand two hours, or longer, as required by Inspector. Minimum head required for any joint shall be 10 feet in building.	Water
Cast-iron soil, waste and interior downspout, condensate drain from air conditioning equipment	10 feet of water, vertically	
Storm water disposal lines	Running water test	Water
Vacuum pump or condensate pump discharge and condensate return piping	150	Water
Domestic water piping	200	Water
Standpipes, wet or dry	300	Water
Fire sprinkler piping	200	Water
Gas piping(steel threaded or plastic)	60 (both tests)	Air
Gas piping (steel welded)	100 (both tests)	Air
Gas welding station	1-1/2 Working pressure 100 min.	Dry nitrogen
Compressed air piping	175	Air

E. Equipment Performance Assurance Tests:

1. Before operating any equipment or systems, a thorough check shall be performed to determine that systems have been flushed and cleaned as required and that equipment has been properly installed, aligned, lubricated, and serviced. Factory instructions shall be checked to verify installations have been completed and

recommended lubricants have been installed in bearings, gearboxes, crankcases, and similar equipment. Particular care shall be furnished in lubricating bearings to avoid damage by over-lubrication and blowing out seals. Equipment shall also be checked for damage that may have occurred during shipment, after delivery, or during installation. Damaged equipment, products, and materials shall be replaced or repaired as required.

2. Upon completion of the above, adjust the system settings to within normal operating conditions to prevent the system from being damaged upon start-up.

3. Run-test the equipment after start-up for five consecutive days. Tests shall include operation of all equipment and systems for a period of not less than two 8 hour periods at 90 percent of the full specified capacities.

4. Equipment Start-up Reports: For each equipment or system on which start-up is performed, submit 8 copies of start-up report for review by the Architect.

   a. The start-up report shall include the manufacturer's standard start-up form completed and signed by the start-up technician.

5. Provide, maintain, and pay costs for equipment, instruments, and operating personnel as required for specified tests.

6. Provide electric energy and fuel required for tests.

7. Final adjustment to equipment or systems shall meet specified performance requirements.

8. Equipment, systems, or Work deemed defective during testing shall be replaced or corrected as required. Test until satisfactory results are provided.

F. Specific Coordinated Plan for Test and Balance:

1. Provide a narrative of the operational intent that clearly describes the function and sequence of operation of each component, equipment, or system installed. Instruct designated Owner personnel in the operation of the installed systems.

2. Prior to final test and balance, plumbing equipment and systems shall be operated and tested as indicated in Article 3.04.F above to demonstrate satisfactory overall operation of the installed systems.

3. Welding performed as part of this Division may be subject to radiographic inspections at random in accordance with requirements specified in Section 22 0513: Basic Plumbing Materials and Methods.

3.05 NOISE AND VIBRATION REDUCTION

A. Correct noise or vibration caused by plumbing systems. Provide all necessary adjustments to specified and installed equipment and accessories to reduce noise to the lowest possible level

B. Correct noise or vibration problems caused by failure to install work in accordance with Contract Documents. Include all labor and materials required as a result of such failure.

Pay for re-testing of corrected noise or vibration problems by the project acoustical consultant including travel, lodging, test equipment expenses, etc.

3.06 PROTECTION, CARE AND CLEANING

A. In addition to storage criteria of the General Conditions, and provisions under Section 01 5000: Construction Facilities and Temporary Controls, the following shall be provided:

1. Provide for the safety and good condition of materials and equipment until Substantial Completion. Protect materials and equipment from damage.

2. Protect installed Work.

3. Replacements: In case of damage, immediately provide repairs and/or replacements as required.

4. Protect covering for bearings, open connections to tanks, pumps, compressors and similar equipment.

5. Interior of piping shall be maintained free of dirt, grit, dust, and other foreign materials.

6. Fixtures, piping, finished brass or bronze, and equipment shall have grease, adhesive, labels, and foreign materials removed. Chromium, nickel plate, polished bronze or brass Work shall be polished. Glass shall be cleaned inside and out.

7. Before initial start-up and again before Substantial Completion, piping shall be drained and flushed to completely remove grease and foreign matter. Pressure regulating assemblies, traps, strainers, boilers, flush valves, and similar items shall be thoroughly cleaned. Tag system with an information tag listing responsible party and date of element, before initial start-up and again before Substantial Completion. Compressed air, oil, and gas piping shall be blown out with oil-free compressed air or inert gas.

END OF SECTION 22 05 00

SECTION 22 05 13

BASIC PLUMBING MATERIALS AND METHODS

NOTE: Condensate drains from HVAC equipment shall not be connected to any portion of Science Classroom acid waste drainage system.

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. This Section prescribes basic materials and methods generally common to the Work of Division 22.

B. Related Requirements:

1. Division 01: General Requirements.

2. Division 22: Plumbing.

3. Division 26: Electrical.

5. Division 32: Exterior Improvements

7. Division 33: Utilities

1.02 SUBMITTALS

A. Provide in accordance with Division 01 and specific requirements of each section of Division 22.

B. Types of welding rods to be used.

1.03 QUALITY ASSURANCE

A. Standards: Comply with applicable national, state, and local codes and standards: ASTM, ASME, and ANSI. Federal Specifications, AWWA, SISPI, NFPA, FM, UL, CPC (California Plumbing Code), CMC (California Plumbing Code), CSA.

B. Conform to provisions of Section 22 0500: Common Work Results for Plumbing.

C. Manufacturer of plumbing products must be third-party certified to ANSI/NSF Standard 61, Section 9 certification, and ANSI/NSF 372 to demonstrate compliance with the federal requirements for lead contribution to drinking water, the Safe Drinking Water Act SDWA, and the California Health and Safety Code Section 116875.

D. Qualifications of Manufacturer: Products used in the Work of this Section shall be produced by manufacturers regularly engaged in manufacture of similar items and with a history of successful production as reviewed by the Architect.

1.04 COORDINATION

A. Coordinate related Work in accordance with provisions of Division 01.

PART 2 – PRODUCTS

2.01 GENERAL

A. Provide the following products if they are indicated in the Contract Documents or if they are required for the proper installation, function or operation of equipment, systems or components indicated in the Contract Document.

B. Provide the following products as a complete assembly with required accessories for a complete and functioning entity in compliance with governing codes and applicable standards as specified in manufacturer's instructions or as required.

1. Omission of minor details in the Contract Documents does not waive and/or otherwise relinquish compliance with the above requirements.

2.02 MANUFACTURERS AND MATERIALS

A. Ball Valves: 2-inch and smaller:

BV-1: Class 150, 600 psi, Bronze, CWP two piece construction with reinforced TFE seats, full port, adjustable packing gland, (no threaded stem designs allowed), threaded or solder ends.

NIBCO T-685-66-LF/S-685-66-LF, Hammond UP8303A/UP8513, Milwaukee UPBA400S/ UPBA450S or equal.

BV-2: Class 150, 600 psi, Stainless Steel, CWP two piece construction with reinforced TFE seats, full port, adjustable packing gland, (no threaded stem designs allowed), threaded or solder ends.

NIBCO T-585-S6-R-66-LL, Milwaukee BA260 or equal.

Ball Valves in Insulated Piping: Use extended operating handle of non-thermal conducive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation and memory stops that are fully adjustable after insulation is applied. NIBCO Nib-Seal Handle.

B. Butterfly Valves:

NOTE: Butterfly Valves in a domestic plumbing system intended to convey water for human consumption shall comply with Quality Assurance, article 1.03 of this Section.

BFV-1 Centerline Series A, 200 psi CWP tight shut-off.

1. Body: Lug type ductile iron. Suitable for bi-directional dead-end service at rated pressure without use of downstream flange.

2. Disc: Bronze, or aluminum bronze.

3. Stem: One or two-piece, 400 series stainless steel.

4. Seat and O-Rings: EPDM.

5. Upper and Lower Stem Bearings: Copper alloy or non-metallic material.

6. Operators: Valves 6 inches and smaller, with lever handle. Valves 8 inches and larger, with manual gear operator and disc position indicator.

7. Manufacturers:

a) Valves 2.5 to 6-inch: Milwaukee ML 233E, Hammond 6411-03, or equal.

b) Valves 8-inch and larger: Milwaukee ML 333E, Hammond 6411-03, NIBCO LD 2000, or equal.

C. Check Valves:

NOTE: Check valves in a domestic plumbing system intended to convey water for human consumption shall comply with Quality Assurance, article 1.03 of this Section.

1. Bronze, 2-inch and smaller:

CHV-1: 200 psi, CWP horizontal swing, Y pattern, renewable seat and disc, threaded ends.

NIBCO T-413-Y-LF, Milwaukee UP-509, Hammond UP-904 or equal.

NOTE: Application: Use on domestic hot and cold water systems.

CHV-2: 200 psi, CWP, bronze body, horizontal swing, Y pattern, renewable seat and disc, solder ends.

Nibco S-413-Y-LF, Hammond Up-943 or equal.

APPLICATION: Use on domestic hot and cold water systems.

CHV-3: Class 125, 200 psi, swing check, bronze body, Teflon disc, soldered ends.

Stockham B-310TY, Crane 1340, NIBCO S-413-Y, Milwaukee 1509-T, Hammond IB-912 or equal.

APPLICATION: Provide on junior fire sprinkler systems less than 3 fire sprinkler heads.

2. Cast Iron 2 1/2-inch and larger:

CHV-4: Class 125, 200 psi, CWP, IBBM, renewable seat and disc, bolted cap, threaded ends:

Crane 372, Stockham G-927, NIBCO T-918-B, or equal.

APPLICATION: Provide on multiple heating hot and chilled water pump systems, multiple steam boiler return lines from steam trap.

CHV-5: Special low-pressure check valve for installation in gas lines.

Circle Seal Products Co.
119B-xPP; 0-15 psi; #1:1/8 inch IPS; #2:1/4 inch IPS #3:3/8 inch IPS.

APPLICATION: For low pressure gas in chemistry laboratory systems.

D. Earthquake Valve:

EQV-1: Mechanically triggered by seismic movement, complying with state of California seismic response specifications, UL listed and certified by D.S.A. Size and pressure as required or indicated on Drawings. (Minimum 1/4 psi, maximum 10 psi. Earthquake valve shall shut off gas automatically during an earthquake to prevent an explosion or fire. Valve shall be Koso California seismic valve, or equal.

1. Not sensitive to vibrations caused by passing trucks or accidental bumping.

2. Sensitive to wide amplitude G's only. Preset at factory for the correct G-rating.

3. Positive sealing from minus 10 degrees F. to 150 degrees F.

4. Visual open-close indicator.

5. Manual reset.

6. Plumb line for mounting.

7. Tripping mechanism has non-creeping rolling latch.

8. Install valve per manufacturer's recommendations only.

APPLICATION: Automatic shut-off for gas systems during earthquake at gas.

D. Expansion Tank:

ET-1: Pressurized, vertical, steel expansion tank for potable water systems with FDA approved, replaceable, heavy duty, butyl rubber blend diaphragm, polypropylene lined dome, 1/2 inch, 3/4 inch, 1 inch or 1 ½-inch NPT system connection, 1/2 inch or 3/4 inch drain, 0.302 inch-32 standard automobile tire valve type charging connection, lifting rings and a floor mounting skirt for vertical installation. The tank must be constructed in accordance with Section VII of the ASME Boiler and Pressure Vessel Code and stamped for 125 psi working pressure. The tank must be also rated for a continuous working temperature of 240 degrees F. Provide weather and rust resistant coating.

Bell and Gossett, Wheatley, Taco, Amtrol or equal.

APPLICATION: For potable water use such as domestic hot water system. Provide at each domestic hot water heater or system.

E. Flow Control Valve – Manual:

FC-1: Flow control valves: Bell and Gossett Series CB circuit setter balancing valve, line size, with integral pointer (to register degree of valve opening), differential pressure meter connections with built-in check valves and lockable memory stops. Armstrong ARMflo circuit-balancing valves, series CBV, or equal.

APPLICATION: Balancing and controlling of domestic hot water system flow for different branch circuits.

F. Gate Valves:

NOTE: Gate valves in a domestic plumbing system intended to convey water for human consumption shall comply with Quality Assurance, article 1.03.

1. Bronze, 2-inch and smaller:

GV-1: Class 125, 200 psi, CWP, bronze body and bonnet, non-rising stem, inside screw, screw-in bonnet, solid disc, threaded ends:

NIBCO T-113-LF, Milwaukee UP105-P2, Hammond UP645 or equal.

APPLICATION: Use on Domestic Hot and Cold Water systems.

GV-2: Same as GV-1, except solder ends:

NIBCO S-113-LF, Milwaukee UP115, Hammond UP647, or equal.

APPLICATION: Same as GV-1. Provide in yard box, to each group of fixtures behind access panels, where valves are located near ceiling and beams.

2. Bronze, 2-1/2-inch and larger:

GV-3: Class 125 250 psi CWP iron body, flanged ends, bolted bonnet with wheel handle, resilient wedge, non-rising stem.

APPLICATION: For use in walls for Domestic Cold Water system.

NIBCO F-619-RW or equal.

GV-4: Class 125, 250 psi CWP iron body, flanged ends, bolted bonnet with 2-inch operating nut, resilient wedge, non-rising stem, fusion bonded epoxy coated.

APPLICATION: For use below grade for Domestic Cold Water system.

NIBCO F-619-RW-SON or equal.

GV-5: Class 250, 250 psi, CWP, O S and Y, IBBM, resilient seat gate valve, flanged ends. Watts 408-OSYRW or equal.

APPLICATION: For Fire Protection System.

GV-6: Class 125, 200 psi CWP, bronze body and bonnet non-rising stem, inside screw, screw-in bonnet, solid disc, threaded ends:

Hammond IB645, Crane 1701, Milwaukee 105, American 3F, NIBCO T-113, or equal. APPLICATION: Shut-off and isolation of equipment and device for Natural Gas System.

G. Globe Valves:

1. Bronze, 2-inch and smaller:

NOTE: Globe valves in a domestic plumbing system intended to convey water for human consumption shall comply with Quality Assurance of Article 1.03.

GLV-1: Class 125, 200 psi, CWP, screw-in bonnet, Teflon disc, threaded ends:

Milwaukee UP502-P2, Hammond UP440-P2 or equal.

GLV-2: Class 125, 200 psi, CWP, screw in bonnet, Teflon disc, soldered ends.

Hammond UP418, Milwaukee UP1502 or equal.

NOTE: Use on domestic hot and cold water systems.

H. Heater Vent Pipe:

1. Schedule Number:

HVP-1 Shall be UL approved for service specified. Concealed heater vent pipe, including pipe in or through attic spaces, shall be Los Angeles City approved double wall metal vent pipe. For recessed wall heaters, furnish B.W. type. All others may be Type B, or B.W. Clearances must comply with Los Angeles City code and conditions of UL listing.

American Metal Products Co., Inc., Simpson Dura-Vent, AmeriVent, Hart & Cooley Mfg. Co., Metalbestos, or equal.

NOTE: Component parts of a vent assembly, including vent cap, shall be companion items of same manufacturer. Each item shall be UL-approved and listed.

I. Liquid Level Gage:

LLG-1 Refrigerant type, carbon steel with stainless steel trim or all forged steel construction, back-seating standard design. Upper and lower valve furnished with ball

check valves; 1/2 inch diameter glass on center. Four 3/16 inch diameter gage glass guard rods or slotted steel guard.

Peneberthy, Henry, Conbraco, or equal.

J. Piping and fittings:

NOTE: Pipes and fittings in a domestic plumbing system intended to convey water for human consumption shall comply with Quality Assurance Article 1.03.

1. Piping shall be continuously and permanently marked with manufacturer's name, type of material, size, pressure rating, and the applicable ASTM, ANSI, UL, or NSF listing. On plastic pipe, date of extrusion must also be marked.

2. Underground non-ferrous pressure pipes shall be installed with proper color tracer wires. Refer to color code provisions in Section 22 0553: Plumbing Identification.

P-1: Cast iron: Hubless, service weight, ASTM A888, CISPI 301, conforming to CISPI 310 and installed in accordance to IAPMO IS 6.
Manufacturer: American Foundry, Tyler, AB & I, or equal.

PF-1a: Cast iron, soil or waste no-hub coupling with neoprene gaskets, stainless steel corrugated shields and stainless steel clamps. 2 bands for size 1 ½-inch thru 4-inch, IAPMO, ASTM C 564 and CISPI 310.
Manufacturer: American Foundry, Tyler, AB & I, or equal.

PF-1b: Cast iron, soil or waste, Heavy-duty no-hub coupling with neoprene gaskets, stainless steel corrugated shields and stainless steel clamps. 4 bands for size 5-inch thru 10-inch. IAPMO, ASTM C564 and CISPI 310.
Manufacturer: American Foundry, Tyler, AB & I, or equal.

NOTE: Provide with P-1 as required by the Engineer due to site specific conditions.

PF-1c: Same as PF-1a with Heavy Duty Husky SD 4000 Coupling and stainless steel clamps. IAPMO, ASTM C564 and CISPI 310.

NOTE: Provide with P-1 at sewage ejector or sump pump discharge.

P-2: Galvanized steel, Schedule 40, ASTM A53.
Manufacturer: US Steel or equal.

PF-2: Malleable iron, Class 150, threaded, galvanized, beaded, ANSI B 16.3.

Manufacturer: Stockham, Stanley Flagg, Grinnell, or equal.

P-3: Copper drainage tube, inside structure and above grade. Type DWV hard temper, ASTM B 306.
Manufacturer: Mueller, Anaconda, Cerro Brass, Cambridge-Lee, Halstead, or equal.

NOTE: Use of Copper tubing type DWV is prohibited for Condensate Drainage.

PF-3: Cast brass drainage fittings ASA B 16.23, ASTM B 42.
Manufacturer: Mueller Brass, Nibco, Stanley Flagg, Lee Brass, or equal.

P-4: Copper water tube, Type L hard, ASTM B88. (For above ground use only.)
Manufacturer: Mueller, Cambridge-Lee, Halstead, or equal.

NOTE: Use of Copper tubing type DWV is prohibited for Condensate Drainage.

PF-4a: Copper Press-Connect pressure fittings, comply with ASME B16.51 "Copper Alloy Press-Connect Pressure Fittings", with Ethylene Propylene Diene Monomer, EPDM O-Ring Seal in each end. Fittings with the sizes of 2-1/2" and larger shall have cross-section Grab Rings and separation rings.
Manufacturer: Viega, Mueller Industries, Apollo, or equal.

NOTE: Provide with P-4 or P-5 pipe.

PF-4b: Wrought copper - solder type ANSI B 16.22.
Manufacturer: Mueller Brass, Nibco, Lee Brass, or equal.

NOTE: Provide with P-4 or P-5 pipe, solder, and flux shall be lead=free. Flux shall be an approved water-soluble material.

PF-4c: Grooved end type– ASTM B75 or B152 and ANSI B16.22 wrought copper, bronze sand casting per ASTM B584-87 copper alloy CDA 836 per ANSIbB16.18. Couplings shall be CTS style 606 supplied with angle pattern bolt pads for rigidity, coated with copper coated alkyd enamel. Gaskets shall be pre-lubricated Flush seal type.
Manufacturer: Victaulic, or equal.

NOTE: For domestic hot and cold water 2-1/2 inch and larger copper applications. Provide with piping schedule number P-4.

P-5: Copper water tube, Type K hard, ASTM B88.
Manufacturer: Mueller, Cerro Brass, Cambridge-Lee, Halstead or equal.

P-6: Type 316L Stainless steel chemical waste pipe, marked with manufacturer's identification and fittings. Manufacturer's representative shall instruct installers and certify them for joint installation. Piping system shall be provided with a five-year manufacturer's material warranty.
Manufacturer: Blucher-Josam, Viega, or equal.

NOTE: Use for Underground installations of corrosive waste piping. For Compressed Air Distribution use specify with compressed air rated O-ring.

PF-6a: Type 316L Stainless Steel Mechanical joints. Stainless steel joint for chemical waste piping systems including drain or bottle traps.
Manufacturer: Blucher-Josam, or equal.

NOTE: Furnish when used with matching pipe only. Provide with piping schedule P-6.

PF-6b: Type 316L Stainless Steel Press Fittings. For chemical waste piping systems including drain, vent or bottle traps, provide with EPDM seals. For compressed air piping systems, provide with HNBR seals. Manufacturer's representative shall instruct installers and certify them for joint installation.
Manufacturer: Viega, or equal.

NOTE: Furnish when used with matching pipe only. Provide with piping schedule P-6.

P-7: Black steel pipe, Schedule 40, ASTM A53, Type E, ERW.
Manufacturer: US Steel, or equal.

PF-7a: Malleable iron, Class 125, ANSI B 16.3, threaded or welded Schedule 40 black steel for 2-inches and below and welded for 2 ½-inch and above.
Manufacturer: Stockham, or equal.

PF-7b: Grooved end type– ASTM A395 and A536 ductile iron; ASTM A234 WPB forged steel; fabricated from ASTM A53 carbon steel. Couplings shall be supplied with angle-pattern bolt pads for rigidity, except in locations where flexibility is desired. Gaskets shall be pre- lubricated.
Manufacturer: Victaulic, Galvanized or painted, or equal.

PF-7c: MegaPressG, ASME B31, Carbon Steel, – For aboveground piping 2-inches and below. Provide fittings with Hydrogenated Nitrile Butadiene Rubber, HNBR Sealing Element.
Manufacturer: Viega, or equal.

PF-7d: Malleable Iron, class 125, ANSI B 16.3, threaded schedule 80 black steel.
Manufacturer: Stockham, or equal.

P-8: Red seamless brass 85-5-5-5, iron pipe size (IPS), threaded pipe, ASTM B43.
Manufacturer: Mueller, Cerro Brass, Cambridge-Lee, Halstead, or equal.

PF-8: Bronze and brass, 250 psi, threaded, ASA B16.17 and F S WW-P-460.
Manufacturer: Mueller Brass, Lee Brass, or equal.

P-9: PVC, thick wall, cast-iron OD sized, UL, and NSF listed, comply with AWWA C900, and ASTM D1784 Cell Class 12454B, with tracer wire.
Manufacturer: Blue Brute, or equal.

NOTE: APPLICATION: Domestic water, irrigation and main fire line below ground only (4 inches and over).

PF-9: Ductile Iron conforming to AWWA C110, and AWWA C153, with bell and spigot gasket joints conforming to AWWA C111/A21.11.
Manufacturer: EBAA Iron Sales Inc. Megalug 2000PV, or equal.

P-10: CPVC (Chlorinated polyvinyl Chloride) schedule 40 pipe, conforming to ASTM D1784, and UL723 (ASTM E84).
Manufacturer: Spears, Corzan, Charlotte, or equal.

PF-10: CPVC (Chlorinated Polyvinyl Chloride) schedule 40 fittings, conforming to ASTM D1784, and UL723 (ASTM E84). The joints shall be of solvent cement type conforming to ASTM F493. Installer shall be certified by the manufacturer for this type of joint installation. Drains, bottle traps and similar devices shall be the same material and gauge as the pipe with mechanical joints.
Manufacturer: Spears, Corzan, Charlotte, or equal.

P-11: PVDF (Polyvinylidene Fluoride) schedule 40 chemical waste pipe, conforming to ASTM F1673, ASTM D3222 and complying with UL723 (ASTM E84). The joints shall be no-hub mechanical Joints or Socket Fusion. Installer shall be certified by manufacturer for joint installation.
Manufacturer: Orion, or equal.

NOTE: Use for above ground installations where the corrosive waste piping passes through air plenums as defined by California Mechanical Code (CMC).

PF-11a: PVDF (Polyvinylidene Fluoride), schedule 40, No-hub coupling. Each coupling shall have 300 series stainless steel outer band and 5/16 inch bolts, nuts and washers plated to meet a 100-hour salt spray test per ASTM B117. Drains, bottle traps and similar devices shall be the same material and gauge as the pipe with mechanical joints. Installer shall be certified by the manufacturer for this type of joint installation.
Manufacturer: Orion, or equal.

PF-11b: PVDF (Polyvinylidene Fluoride), schedule 40 coupling. Joined using the socket fusion system conforming to ASTM 2657. Drains, bottle traps and similar devices shall be the same material and gauge as the pipe with mechanical joints. Installer shall be certified by the manufacturer for this kind of joint installation.
Manufacturer: Orion, or equal.

P-12: FRPP (Flame Retardant Polypropylene) schedule 40 chemical waste pipe, conforming to ASTM F1412 and ASTM D4101. The joints shall be no-hub mechanical joints or Socket Fusion type. Installer shall be certified by the manufacturer for joint installation.
Manufacturer: Orion, or equal.

NOTE: Use for above ground installations where the corrosive waste piping is required to be fire rated.

PF-12a: FRPP (Flame Retardant Polypropylene), schedule 40, No-hub coupling. Each coupling shall have 300 series stainless steel outer band and 5/16 inch bolts, nuts and washers plated to meet a 100-hour salt spray test per ASTM B117. Drains, bottle traps and similar devices shall be the same material and gauge as the pipe with mechanical joints. Installer shall be certified by the manufacturer for this type of joint installation.
Manufacturer: Orion, or equal.

PF-12b: FRPP (Flame Retardant Polypropylene), schedule 40 coupling. Joined using the socket fusion system conforming to ASTM 2657. Drains, bottle traps and similar devices shall be the same material and gauge as the pipe with mechanical joints. Installer shall be certified by the manufacturer for this kind of joint installation.
Manufacturer: Orion, or equal.

P-13: Polyethylene plastic pipe, ASTM D 2513, Standard Dimension Ratio 11 rated at 80 psi working pressure and 73° Fahrenheit for 3 inches and smaller, SDR 11.5 rated at 76 psi and 73° Fahrenheit for 4 inches and above, butt or socket type fittings, joined by heat fusion, orange or yellow color. Installer shall be certified by the manufacturer for this kind of joint installation.
Manufacturer: CPCHEM (Chevron Phillips Chemical Company LP) PE 2406, or equal.

NOTE: Use for above ground installations where the corrosive waste piping is required to be fire rated.

PF-13a: Polyethylene plastic fittings, ASTM D 3261 and D 2683, Standard Dimension Ratio 11 rated at 80 psi working pressure and 73° Fahrenheit for 3 inches and smaller, SDR 11.5 rated at 76 psi at 73° Fahrenheit for 4 inches and above, butt or socket type fittings, joined by heat fusion, Installer shall be certified by manufacturer for joint installation. Color orange or yellow.
Manufacturer: CPCHEM, (Chevron Phillips Chemical Company LP), or equal.

PF-13b: Polyethylene transition risers, for PF-13a above, Transition fitting must have a minimum vertical height of 36 inches from the horizontal connection which will allow for a 6-inch steel riser above ground. Polyethylene transition risers shall be anodeless.
Manufacturer: Central Plastics Company, or equal.

NOTE: APPLICATION: installed in a gas piping system for the purpose of providing a transition from horizontal below ground (polyethylene) to a vertical above ground (steel). Transition must be made on the horizontal side of the gas piping system and meet ASTM standards for Polyethylene plastic pipe and fittings.

P-14: PVC, schedule 40, extruded from 100 percent virgin Polyvinyl Chloride (PVC) compound, meeting requirements of class 1254-13 of ASTM D1784. (Use for irrigation systems after the control valves only.)
Manufacturer: Spears, Charlotte, or equal.

PF-14 Plastic fittings, schedule 40 molded from PVC type I compound, conforming to the requirements of specification ASTM D2466.
Manufacturer: Spears, Charlotte, Harvel Plastics Inc., or equal.

P-15: Purple pipe, PVC, schedule 40 for reclaimed or recycled water (below ground only for non-potable irrigation systems), type 1, grade 1, PVC-1120, Cell Class 12454 B.
Manufacturer: Charlotte, or equal.

PF-15: Purple Plastic fittings, schedule 40 molded from PVC type I compound, conforming to the requirements of specification ASTM D2466. Refer to section 32 8426 "Reclaimed Water Irrigation".
Manufacturer: Charlotte, or equal.

K. Pipe and Fitting Requirements Schedule: Unless otherwise specified or indicated on Drawings, pipe and fittings shall be installed in accordance with the following table:

TABLE I
PIPE AND FITTING SCHEDULE

Use	Limits	Pipe	Fittings
Compressed air	All sizes	P-6	PF-6
Condensate drains and drains From HVAC Equipment	All sizes	P-4 or P-6 *Roof penetration & above shall be P-6 only	PF-4b or 6b *Roof penetration & above shall be P-6 only
Domestic Cold Water, underground	Within 5' from building, All sizes	P-5	PF-4a or 4b
Domestic Cold Water, underground	Site distribution only, 4" and over	P-9, Refer to 33 1100	PF-9, Refer to 33 1100
Domestic Hot and Cold water, aboveground	Interior only	P-4	PF-4a or 4b
Downspouts, Interior Storm Drainage	Within 5' from building, All sizes	P-1	PF-1a or 1b
Exposed Downspouts, Interior Storm Drainage	Existing Buildings and aboveground only	P-2	PF-2
Fire Mains (Fire Hydrants), Underground	Site distribution only, 4" and over	P-9, Refer to 33 1100	PF-9, Refer to 33 1100
Fire Suppression System, Interior	All sizes	P7, Refer to 21 1313	PF-7d, Refer to 21 1313
Irrigation, After Backflow Preventer	All sizes	P14, Refer to 32 8413	PF-14, Refer to 32 8413
Irrigation, Meter to Backflow Preventer	Up to 4"	P-5, Refer to 33 1100	PF-4a or 4b, Refer to 33 1100
Irrigation, Meter to Backflow Preventer	4" and over	P-9, Refer to 33 1100	PF-9, Refer to 33 1100
Irrigation, Reclaimed Water or Recycled Water	All sizes	P15, Refer to 32 8426	PF-15, Refer to 32 8426
Natural Gas, Exterior	Underground, site only	P-13	PF-13a and 13b

Use	Limits	Pipe	Fittings
Natural Gas, Interior, aboveground	All sizes	P-7	PF-7a, 7b or P-7c
Vents-ACID,	All sizes	P-6, 10, 11, or 12 *Roof penetration & above shall be P-6 only	PF-6a. 10, 11a, 11b, 12a, 12b *Roof penetration & above: PF-6a only
Waste - ACID - Aboveground - Passing through Air Plenum	All sizes	P-11	PF-11a or 11b
Waste - ACID - Aboveground - Fire-Rated	All sizes	P-12	PF-12a or 12b
Waste - ACID - Aboveground	All sizes	P-10	PF-10
Waste - ACID - Underground	All sizes	P-6	PF-6a or P-6b
Waste - FORCED	All sizes	P-1	PF-1c
Waste and Vent - Indirect	All sizes	P-3	PF-3
Waste and Vent – Sanitary/ Grease	All sizes	P-1	PF-1a or 1b
Waste and Vent – Sanitary/ Grease	Underground, site only	P-1, Refer to 33 3000	PF-1a or 1b, Refer to 33 3000

L. Pipe Isolators:

PLA-1 Absorption pad shall be not less than ½ inch thick, unloaded. Pad shall completely encompass pipe.

NOTE: APPLICATION: For copper piping.

Holdrite, LSP, Stoneman, Potter-Roemer, Trisolator, PR-Isolator, or equal.

NOTE: PLA-2 plastic cushion to form an insulating liner and eliminate metal to metal contact when securing copper tubes and pipes in air condition and refrigeration insulation preventing galvanic erosion. (Acoustical type for sound absorption.)

Hydra-Zorb Cushion Clamps, Acousto-Clamp, or equal.

M. Pressure Gage: Aluminum or steel case, minimum 4 ¼-inch dial; pressure type or combination vacuum-pressure type, with provisions for field calibration. Dial indicator to indicate pressure in psi with accuracy to within plus or minus 0.5 percent of maximum dial reading. Furnish gages with restriction screw, size 60, to eliminate vibration impulses. Black case and ring, bourdon tube of seamless copper alloy with brass tip

and socket. Three way gage cock, constructed of brass with stuffing box, 1/2 inch couplings, with fixed or movable cap nut to shut off pressure gage.

PG-1 Pressure type, black drawn steel case, 4-1/2-inch glass dial, range approximately twice line pressure.

Marsh Keckley, Trerice, Weksler, Weiss, or equal.

N. Plug Valves:

PV-1 2 inches and smaller: Rockwell No.114, lubricated plug type, 200-pound., water operating gauge pressure iron body and plug, regular pattern, threaded, with indicating arc; by Walworth, Homestead, WKM, or equal.

NOTE: APPLICATION: Isolation and on-off application for gas system.

PV-2. 2 ½-inch and larger: Rockwell No.115 and No.165 lubricated plug type, 200 pound water operating gauge. Iron body and plug, regular pattern, flanged, with indicating arc. Walworth, Homestead, WKM, or equal.

NOTE: APPLICATION: Same as PV-1.

O. Safety Relief Valves:

SRV-1: Combination temperature and pressure relief type. CSA approved. Set to open at 125 psi pressure.

Watts: 40L, Cash-Acme: NCLX-1, or equal.

NOTE: APPLICATION: Hot Water System.

SRV-2: Same as SRV-1, except provide on storage type water heater with anode in dip tube.

Watts: 100XL, Cash-Acme: NCLX-1, or equal.

NOTE: APPLICATION: Same as SRV-1.

SRV-3 Spring type, ASME and NB stamped and certified with manual lifting device for air or gas.

Bailey, Cash-Acme, Watts, Keckley or equal.

NOTE: APPLICATION: Gas system and compressed air system.

P. Strainers:

STR-1 Description: Wye type with monel or stainless steel strainer cylinder (manufacturer's standard mesh), and gasketed machine strainer cap. Where indicated on Drawings, provide with valved (globe valve) blowout piping, same size as blowout plug.

1. 2-inch and smaller:
   C.M. Bailey No.100-A, 250 lb., cast iron body, threaded, Keckley: Style B, Spirax Sarco Y-type, or equal.

2. 2 ½-inch and larger:
   C.M. Bailey No.100-A, 125 lb., cast iron body, flanged, or Victaulic style 732, 300 psi, ductile iron body, grooved, fusion bonded epoxy coated.

   C.M.Bailey, Armstrong, Muessco, Keckley 'A', or equal.

   NOTE: APPLICATION: Oil and gas systems.

STR-2 Y pattern cast iron bodies, 125 psi, monel screen. Open area at least twice the cross-sectional area of IPS pipe in which strainer is installed and may be woven wire or perforated type. Screwed ends for sizes up to 2 inches, flanged ends fusion bonded epoxy coated for 2 ½-inch and larger perforations, in accordance with the following:

1. Steam service - 40 square mesh.

2. Other services - 16 square mesh.

Bailey No.100, Armstrong, RP&C, Keckley or equal.

APPLICATION: Same as STR-1.

STR-3 Flanged, bucket type, semi-steel body, 125 psi, stainless steel screen with 1/8 inch diameter perforations, all sizes.

Bailey No.1, Zurn 150 Series, RP&C, Keckley GFV or equal.

APPLICATION: Domestic cold and hot water system. Mount above grade for water service).

STR-4 Grooved, T-pattern, ductile iron body, 300 psi, stainless steel frame and mesh basket, grooved ends.

APPLICATION: Domestic hot and cold water system except for high pressure system.

Q. Vent Caps:

VC-1 Vandal-proof hood type, for plumbing vent lines.

Stoneman Engineering and Mfg., Semco 1550

APPLICATION: Sanitary drainage system.

R. Vacuum Valves:

VV-1 Vacuum valves; for vacuum serve, 125 psig working pressure, cast iron body, spring loaded lubricated plug type.

General Controls, Honeywell, Valmatic, or equal.

APPLICATION: Domestic hot and cold water system.

S. Protective Coating for Underground Steel Piping Applied to Underground Automotive:

NOTE: Working hoist piping only.

1. Black steel or galvanized steel piping indicated for below grade installation, shall be protected as specified prior to delivery to the Project site:

   a. Sandblast black steel pipe to a gray finish. Sandblast galvanized steel pipe lightly only.

   b. Install one coat of cut back asphalt to galvanized pipe immediately after sandblasting. Pre-heat black pipe to 180 degrees F. immediately before coating.

   c. Install one coat of high-temperature (melting point of 240 degrees F. minimum) Grade B asphalt enamel.

   d. Install one wrapping of 20 mils thick glass, fiber mat, Owens-Corning Coromat or L.O.F. Blueflag with 1/4 inch overwrap. Glass fiber shall be dry at time of installation.

   e. Install a second coat of asphalt enamel as specified above. Glass fiber mat shall be centered in the asphalt enamel.

f. Install an overwrap of Kraft ripple paper.

2. Total thickness of pipe wrapping shall be not less than 1/8 inch. Entire coating operation shall be accomplished by mechanical means in a continuous operation. Hand installation of protective coating is not permitted.

3. Each piece of wrapped pipe shall be legibly identified at no greater than 5 feet intervals by fabrication company. Each material submittal shall include the name of the fabrication company. Maintain one reviewed Sample on the Project Site.

4. Acceptable manufacturers of wrapping are: Hunt, Mobile, Conway or equal.

5. Fittings (including couplings), unprotected pipe adjacent to fittings, and damaged pipe protection shall be wrapped at Project site as follows:

   a. Fittings and pipe to be wrapped shall be thoroughly cleaned of material foreign to pipe manufacturer.

   b. Install one coat of Plicoflex No. 105 or Protecto Wrap No. 1170 adhesive primer to metal.

   c. Wrap pipe and fittings with a minimum thickness of 3/32 inch of Plicoflex No. 310 pipe line butyl molding tape, or Protecto Wrap No. 200 molding tape. Install 3 layers, each layer overlapping next approximately 2/3 width of tape, without stretching. Tape and primer shall be of the same manufacturer.

   d. Wrap vinyl tape, 10 mil thickness, over molding tape with 1 inch minimum overlap.

      J.M. Trantex, 3M Scotchwrap or equal.

5. Pipe and fittings specified to be wrapped shall be tested with a holiday detector, after pipe has been installed in trench and before backfilling, in presence of the Project Inspector. Furnish a Tinkler and Raser model E-P holiday detector, or similar equipment for this test. Work, which is deemed defective, shall be repaired or replaced. The Project Inspector may test for damaged pipe wrapping after backfilling.

6. Instead of wrapping underground steel pipe as specified above, pipe may be machine-wrapped before delivery to the Project site as follows:

   a. Pipe shall be cleaned of moisture, oil, grease, scale, and other foreign material by cleaning with non-oily solvent and wire brushing. Remove metal burrs and projections.

b. Install one coat of Plicoflex No.105 adhesive primer to cleaned pipe. If thinning is required, furnish only non-oily thinners as recommended by tape manufacturer.

c. Wrap coated pipe with Plicoflex No.340-25 tape (15 mil butyl and 10 mil vinyl laminate) Tape shall be installed by machine wrapping at approved plant only. Maintain tension (minimum of 5 pounds per inch of width) on tape over entire diameter of pipe. Tape shall be permanently identified and visible on vinyl side.

d. Fittings, unprotected pipe, and damaged pipe protection shall be wrapped as indicated above.

T. Flanges: Flanges shall be furnished and installed at each flanged connection of each type of equipment, tanks, and valves. Faces of flanges being connected shall be furnished alike. Connection of a raised face flange to a flat-faced flange is not permitted. Flanges shall conform to following schedules:

TYPE OF PIPE	FLANGE
Screwed black or galvanized grooved steel pipelines.	125-pound black cast iron screwed flange, flat faced or grooved flange adapters, Victaulic Style 741, Tyco-Grinnell Fig. 71, Gruvlok Fig. 7401, or equal.
Welded or grooved steel pipe, except high pressure steam lines.	150-pound black forged steel welding flanges, 1/16 inch raised face ASTM A 105, Grade II or grooved flange adapters, Victaulic Style 741, Tyco-Grinnell Fig. 71, Gruvlok Fig. 7401, or equal.
Copper and brass pipe or tubing.	150 pound cast bronze, flat-faced flange with solder end or grooved flange adapters, Victaulic Style 641, Tyco-Grinnell Fig. 61, Gruvlok Fig. 6084, or equal.

1. Gasket material for flanged connections shall be full faced or ring type to suit facing on flanges and shall be furnished in accordance with following schedule

SERVICE	TYPE
Cold water	1/16-inch-thick neoprene

Grooved end flange adapters supplied with pressure responsive elastomeric Gaskets supplied with grooved flange adapters shall be pre-lubricated by the manufacturer. Grade of gasket to suit intended service.

U. Unions:

1. Unions shall be furnished and installed in accordance with the following requirements (unless flanges are furnished):

a. At each threaded or soldered connection to equipment and tanks, except in Freon or fuel gas, piping systems, whether indicated or not.
b. Immediately downstream of any threaded connection to each manually operated threaded valve or cock, and each threaded check valve, yard box or access box except those in Freon piping systems, whether indicated or not.
c. At each threaded connection to threaded automatic valves (except those in Freon piping systems) such as reducing valves and temperature control valves, whether indicated or not.
d. If grooved piping is used, couplings shall serve as unions. Additional unions are not required

2. Unions shall be located so that piping can be easily disconnected for removal of equipment, tank, or valve.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions under which Work of this Section shall be performed. Correct conditions detrimental to proper and timely completion of Work. Do not proceed until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Provide all materials and equipment for the Work. Furnish and install necessary apparatus, parts, materials, and accessories.

B. Pipe Installation:

1. Install piping parallel to wall and provide an orderly grouping of proper materials and execution.

2. Piping shall clear obstructions, preserve headroom, provide openings and passageways clear, whether indicated or not. Verify the Work of other Divisions to avoid interference.

3. If obstructions or the Work of other Divisions prevent installation of piping or equipment as indicated by the Drawings, perform minor deviations as required by the Architect.

4. Install piping after excavation or cutting has been performed. Piping shall not be permanently enclosed, furred in, or covered before required inspection and testing is performed.

5. Exposed polished or enameled connections from fixtures or equipment shall be installed with no resulting tool marks or threads at fittings. Residue or exposed pipe compound shall be removed from exterior of pipe.

6. Piping shall be concealed in chases, partitions, walls, and between floors, unless otherwise directed or specifically noted on Drawings. When penetrating wood studs, joists, and other wood members, provide such members with reinforcement steel straps of Continental Steel & Tube Co., ULINE, Independent Metal Strap, or equal.

7. Reduce fitting where any change in pipe size occurs. Bushings shall not be furnished unless specifically reviewed by the Architect, or indicated on Drawings.

8. Piping subject to expansion or contraction shall be anchored in a manner, which permits strains to be evenly distributed. Swing joints or expansion loops shall be installed. Seismic restraints shall be installed so as not to interfere with expansion and contraction of piping. Seismic loops required at all building separations.

9. Immediately after lines have been installed, openings shall be capped or plugged to prevent entrance of foreign materials. Caps shall be left in place until removal is necessary for completion of installation.

10. Couplings shall not be installed except where required pipe runs between other fittings are longer than standard length of type of pipe being installed and except where their installation is specifically reviewed by the Architect.

11. Water piping shall be installed generally level, free of traps, unnecessary offset, arranged to conform to building requirements, clear of ducts, flues, conduits, and other Work. Piping shall be arranged with valves installed to provide for complete drainage and control of system. Piping shall not be installed which causes an objectionable noise from flow of water therein under normal conditions. Refer to Section 23 0500: Common Work Results for Plumbing.

12. Water lines may be installed in same trench with sewer lines, provided bottom of water line is 12 inches minimum above top and to the side of sewer line.

13. Changes in pipe sizes shall be furnished with eccentric reducers, flat on top. Offsets to clear obstruction shall not be installed so as to produce air pockets.

C. Pipe Sleeves and Plates:

1. Provide pipe sleeves of Schedule 40 black steel pipe or Schedule 40 PVC plastic pipe in concrete or masonry walls, footings, and concrete floors below grade. Provide adjustable submerged deck type sleeves at locations where pipes pass

through concrete floors, except concrete slab floors on grade, and at locations where soil pipe for floor type water closets passes through concrete floors.

NOTE: For fire rated wall penetrations follow the uniform building code.

2. Sleeves shall provide ½ inch clearance around pipes, except plastic pipe shall have 1 inch clearance. Caps of deck type sleeves shall be removed just prior to installation of pipe. Area around sleeves shall be smooth and without high or low spots. Sleeves in walls shall not extend beyond exposed surface of wall. Sleeves in concrete floors and walls shall be securely fastened to forms to prevent movement while concrete is being placed.

3. Piping installed on a roof shall clear the roof surface by 10 inches minimum, with or without insulation. Bottom of individual fittings may infringe on 10 inches clear space but not groups of fittings or fittings located within 27 inches of each other.

4. Stiles shall be provided to facilitate crossing of piping when parallel piping runs are laterally greater than 12 inches out-to-out, or any pipe is higher than 18 inches, and more than 40 feet long or runs between two or more major pieces of equipment or housings greater than 20 feet apart. Stiles shall be not less than 20 inches wide with a minimum tread depth of 10 inches. Where stiles are required, they shall be located so greatest obstructed distance is 30 feet.

5. Where pipes pass through waterproofed walls, floors, or floors on grade, sealant with Link-Seal Modular Seals, or equal, between pipe and sleeve to provide a waterproof joint. Where earth is in contact with pipe on both sides of a wall or foundation, the waterproof joint is not required. Commercial rubber compression units may be furnished instead of sealed sleeves if reviewed by the Architect.

6. A swing joint, or other required device, shall be furnished and installed in hot water lines with 10 feet of sealant or compression joint to allow for expansion.

7. Provide polished, chrome-plated flanges when plumbing pipes pass through walls at plumbing fixtures, etcetera as specified in Section 22 4000 Plumbing. Provide polished steel, chromium-plated split floor and ceiling plates at locations where pipes pass through walls, floors, ceilings, and partitions in finished portion that neatly conceals pipe insert.

8. Pipe sleeves shall be provided where pipes intersect footings or foundation walls and sleeve clearances shall provide for footing settlement, but not less than one inch all around pipe.

D. Welding of Pipe and Qualifications of Welder:

1. Joints above grade or accessible conduit or tunnels in steel piping may be either welded or screwed unless specifically indicated otherwise on Drawings or specified. Joints in below grade steel piping, whether in insulation or not, shall not be welded, unless otherwise indicated.

2. Welded joints in pipe shall be continuous around pipe and shall comply with ASME B31: Code for Pressure Piping, unless otherwise specified.

3. Each pipe weld shall be stamped with welder's identification mark. Welding shall be performed by welders possessing a valid certificate of qualification for welding carbon steel welding pipe in horizontal position (2G) and horizontal fixed position (5G) in accordance with the requirements of Section IX of the ASME Boiler and Pressure Vessel Code, by an Owner-recognized, DSA approved testing laboratory.

4. Before any welder performs welding on the Work, furnish the INSPECTOR with a copy of welder's valid qualification papers and obtain verification. Welder qualification is not valid unless it has been issued while welder was performing work for current employer, and has performed type of work described by qualification in the preceding 3 months.

   NOTE: Reference: ASME Boiler and Pressure Vessel Code, Section VIII, UW-29 Tests of Welders and Welding Operators.

5. Welding performed under these Specifications is subject to special tests and inspections including rigid Ultra Sonic Testing (UT) and radiographic inspection at random, in accordance with Technique for Radiographic Examination of Welded Joints by an Owner recognized, DSA approved testing laboratory.

   NOTE: ASME Boiler and Pressure Vessel Code, Section VIII, UW-51 Radiographic Examination of Welded Joints.

E. Unacceptable Welds and Repairs to Welding:

1. Welds containing any of the following types of imperfections shall be deemed defective Work:

   a. Cracks of any type.

   b. Zones of incomplete (in excess of 1/32 inch) fusion or penetration.

   c. Elongated slab inclusions longer than 1/4 inch.

d. Groups of slag inclusions in welds having an aggregate length greater than thickness of parent metal in a length 12 times the thickness of the parent metal.

e. Undercuts greater than 1/32 inch.

f. Overlaps, abrupt ridges or valleys.

2. When a defective weld is detected by examination as outlined above, two additional welds shall be radiographed at locations selected by the Project Inspector. If the two selected welds demonstrate compliant welding, then the two tested welds shall be deemed to be in compliance. Welding revealed by radiographs to be defective Work shall be removed, repaired, and tested by radiograph.

3. If either of the two selected welds demonstrates welding deemed to be defective Work, all welding in that portion of the Work shall be deemed defective Work and either: all welds shall be cutout, prepare new ends for welding and weld to comply with this Specification, or radiograph all welds, removing and repairing only such welding deemed to be defective Work.

4. Repair welding shall be performed in a manner in full compliance with ASME B31. The welded joints or repairs shall be spot examined with UT or radiographic tests in accordance with foregoing requirements.

   NOTE: Reference ASME Boiler and Pressure Vessel Code, Section VIII, UW-52

5. Owner shall cause to be performed additional random UT and radiographic examinations of welds. Owner shall be responsible for the costs of any UT and radiographic examinations found to be in compliance with specified requirements.

6. Installer shall be responsible for the costs of UT and radiographic re-examinations of welds deemed defective Work and not in compliance with this Specification, and shall repair or replace said welds in accordance with specified requirements.

F. Welding Rods: Submit a written list of materials and proposed type of welding rods.

G. Backing Rings: Backing rings may be submitted for installation provided the Product Data is submitted with the material list.

H. Qualification Tests for Low-pressure Welding:

1. Tests shall be performed on 3-inch standard weight pipe ASTM A53, Grade A, and shall be welded by acetylene and electric arc. Each sample shall consist of 2 pieces, each 10 inches long, with 30-degree bevel at point weld.

2. Two 20-inch samples shall be performed in the 2G and two 20-inch samples in the 5G positions, with positions defined in Section IX, ASME Boiler and Pressure Vessel Code. Welds shall have the reinforcement ground or machined flush to the surface of the pipe before testing. Samples shall be tested as full section tensile.

3. Weld shall develop a load of 90 percent of 50,000 psi, i.e., 45,000 psi or shall develop a fracture in parent metal.

4. Each qualified welder shall carry an identification card listing welder's name, date of test, and type of welding tests passed; signed by the welder and the laboratory.

5. A valid certificate of qualification issued in compliance with requirements of the ASME Boiler Pressure Vessel Code Section IX shall qualify a welder for issuance of a certificate for low-pressure pipe welding.

I. Certificates of Qualification for Welding of Unfired Pressure Vessels:

1. Certificates of qualification shall be issued by a laboratory recognized by the Owner in compliance with the requirements of the ASME Boiler Pressure Vessel Code Section IX. Qualifications shall be for both acetylene and arc welding of Schedule 40 ASTM A53, Type B ,steel welded or seamless pipe in the Horizontal Position (2G) and the Horizontal Fixed Position (5G) as defined by said code.

2. Certificate described above is not valid unless it has been issued while welder was working for his current employer, and unless welder has performed type of work described by certificate in the preceding three months. Requirements for possession of a valid certificate shall not be waived for welders fabricating unfired pressure vessels when the Specifications require compliance with ASME code or when welding pipe carries working pressures greater than 75 psi and temperatures greater than 250 degrees F.

J. Pipe Joints and Connections:

1. Pipe and tubing shall be cut per IAPMO Installation Standards. Pipe shall have rough edges or burrs removed so that a smooth and unobstructed flow shall be provided.

2. Hot tapping of gas lines is strictly prohibited.

2. Threaded Pipe: Joints in piping shall be installed according to the following service schedule:

   a. Soap Piping: Litharge and glycerine, or Expando, Gasoila, or equal.

   b. Plastic Piping: Teflon pipe joint compound tape.

   c. Oxygen Piping: Wash treads with S.P., rinse, blow-dry and apply litharge and glycerine.

   d. Cleanout Plugs: No compound shall be used. After inspection and test, plugs shall be removed, cleaned, greased, and replaced.

   b. Other services furnish sealant, suitable and as reviewed by the Architect.

3. Threads on pipe shall be cut with sharp, clean, unblemished dies and shall conform to ANSI/ASME B2.1 for tapered pipe threads.

4. Joint compounds shall be smoothly placed on male thread and not in fittings. Threaded joints shall be installed tight with tongs or wrenches and sealant of any kind is not permitted. Failed joints shall be replaced with new materials. Installation of thread cement or sealant to repair a leaking joint is not permitted.

5. Sharp-toothed Stillson, or similar wrenches, is not permitted for the installation of brass pipe or other piping with similar finished surfaces.

K. Copper Tubing and Brass Pipe with Threadless Fittings:

1. Silver brazed joints shall be used for attaching fittings to non-ferrous metallic refrigerant piping.

2. Non-pressure gravity fed condensate lines may be soldered with 95/5 solder.

3. Silver brazing alloy, Class BCUP-5. Surfaces to be joined shall be free of oil, grease, and oxides. Socket of fitting and end of pipe shall be thoroughly cleaned with emery cloth and wiped to remove oxides. After cleaning and before assembly or heating, flux shall be installed to each joint surface and spread evenly. Heat shall be applied in accordance with instructions in the Copper Tube Handbook issued by Copper Development Associates. Joints constructed of rough bronze fittings shall be provided as recommended by manufacturer.

4. Do not overheat piping and fittings when installing silver brazing.

5. Joints in non-ferrous piping for services not covered above shall be installed with solder composed of 95/5 tin/antimony, ASTM B32, Grade 5A. Surfaces to be jointed shall be free of oil, grease, and oxides. Sockets of fitting and end of

pipe shall be cleaned with emery cloth to remove oxides. Solder flux shall be sparingly installed and solder added until joint is completely filled. Do not overheat. Excess solder, while plastic, shall be removed with a small brush in order to provide an uninterrupted fillet completely around joint. Random inspection of joints shall be conducted by Project Inspector to ensure joints are lead-free.

6. Grooved end joints for copper piping shall be assembled in accordance with the latest manufacturer recommendations. Pipe ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove for proper gasket sealing. Grooving tools shall be as manufactured by Victaulic, RIDGID, MAG Tool, or equal.

7. Pressed fittings for copper or copper alloy pipe or tubing shall have an elastomeric O-ring that forms the joint. The pipe or tubing shall be fully inserted into the fitting, and the pipe or tubing marked at the shoulder of the fitting. Pipe or tubing shall be cut square, mechanically cleaned and reamed prior to joining to remove all burrs (interior and exterior) and restore full inside diameter and a smooth, chamfered exterior surface. The fitting alignment shall be checked against the mark on the pipe or tubing to ensure the pipe or tubing is inserted into the fitting. The joint shall be pressed using the tool recommended by the manufacturer.

L. Ring-Type Pipe: Joints shall be installed in accordance with manufacturer's instructions with grooved couplings, fittings and rubber rings. Couplings and pipe shall be compatible and of the same manufacturer. Rings shall be accurately located and installed by grooves in coupling. Pipe shall be installed with zero deflection unless otherwise specified. Pressure pipe shall be furnished with thrust blocks at each offset point.

M. Welded Pipe Joints:

1. Joints in welded steel pipelines shall be installed by oxyacetylene or electric arc process. Welding shall be continuous around pipe and provided as specified.

2. Butt welds shall be of the single V-type, with ends of pipe and fittings beveled approximately 37 ½ degrees. Piping shall be aligned before welding is started with the alignment maintained during welding.

3. Welds for flanges and socket fittings shall be of the fillet type with a throat dimension not less than pipe wall thickness.

N. Grooved End Pipe Joints: Grooved end joints for carbon steel piping shall be assembled in accordance with the latest manufacturer recommendations. Pipe ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to grove

for proper gasket sealing. Grooving tools shall be as manufactured by Victaulic, RIDGID, MAG Tool, or equal.

O. Joints shall be Vic-Press 304TM, or equal, made with Victaulic Series 'PFT' tools and the appropriate sized jaw. Pipe shall be certified for use with Vic-Press 304TM system, and shall be square cut, properly deburred and cleaned, and marked at the required location to insure full insertion into the fittings and/or couplings.

P. Polyethylene (Plastic) Pipe:

1. Joints shall be installed by the heat fusion method, in accordance with manufacturer's recommendations and IAPMO installation standard IS 12, for natural gas.

2. Pipe Riser at Meter, Regulator and Building Wall: Prefabricated, anodeless type, utilizing a grade level transition between underground polyethylene pipe and gas supply steel pipe of riser outlet, R. W. Lyall Co., or equal. Below grade to above grade transition shall be installed in a welded, epoxy coated, steel casing.

3. Connections to Existing Pipe Line or Branch:

a. Steel-to-plastic (PE): Provide manufacturer's prefabricated standard transition fitting, transition from epoxy-coated steel pipe to plastic, R. W. Lyall Co., or equal.

b. Plastic-to-plastic, PVC to PE: Provide manufacturer's prefabricated standard transition fitting, transition from PVC to epoxy-coated steel pipe to PE; R.W. Lyall Co., or equal..

c. Plastic-to-plastic, PE to PE: Provide manufacturer's standard fused tapping tee assembly with shut-off feature.

4. Provide PE reinforcing sleeves where PE pipe is fused to multi-saddles, service punch tee, reducing tees, transition fittings and anodeless risers.

Q. Valves: Valves shall conform to the following:

1. Piping systems shall be furnished with valves at points indicated on Drawings and specified, arranged to provide complete regulating control of piping system throughout building and the Project site.

2. Valves shall be installed in a neat grouping, so that parts are easily accessible and maintained.

3. Valves shall be full size of line in which they are installed, unless otherwise indicated on Drawings or otherwise specified, and shall be one of types specified.

4. Provide chain operators on valves 2-inch and larger located 7 feet or more above the servicing floor level.

5. Valves for similar service shall be of one manufacturer.

6. Except where otherwise specified, valves shall be Belimo, Victaulic, Stockham, Crane, Jenkins, Milwaukee, Hammond, American, NIBCO, Hoffman, or equal.

7. Ball valves below grade in yard boxes shall have stainless steel handles.

8. Hose bibs in dense garden areas shall be ¾ inch in size with one hose bib in the lunch pavilion 1 inch in size. Other hose bibs shall be ¾ inch lock shield type. Bibs shall be furnished with vacuum breaker protection.

9. Safety valves and pressure relief valves shall have stamp of approval as required by ASME and shall be provided with annual test lever. Where a hot water storage tank is heated by means of a coil, pressure relief valve shall have a steam BTU discharge rating of the coil. Discharge pipe from safety or pressure relief valves shall be not less than one pipe size larger than inlet pipe size of valve. Discharge pipe shall terminate as indicated and shall be free of traps. In addition to locations specified, pressure relief valves shall be installed in the following locations:

    a. On discharge side of each pressure-reducing valve.

    b. On each water heater connected to a hot water storage tank and other pressure vessels.

    c. On cold water line to each water heater or hot water storage tank when there is a check valve, backflow prevention valve or similar device between water heater or hot water storage tank and meter or relief valve at the pressure reducing valve assembly.

    d. On discharge side of each air compressor.

    e. On each air receiver connected to an air compressor.

10. Temperature relief valves and combination temperature and pressure relief valves shall be as specified and furnished as set forth in this Section. Discharge pipe from relief valves shall be not less than discharge area of valve or valves it connects, based on discharge area of valves, and shall terminate as indicated and free of any traps. Valves shall be installed at following locations:

11. A combination temperature and pressure relief valve or combination of valves on each heating hot water storage tank. Temperature sending element shall extend into water inside tank.

12. Manual air vent valve assemblies shall be installed at each high point of hot water space heating and chilled water piping systems. Valves shall discharge through 1/4 inch diameter copper tubing and drain to nearest floor sink. Automatic type air vent valve shall only be installed where specifically indicated. Radiator, convectors, and finned pipe convectors shall be fitted with packless radiator valves, angle or straight pattern. Each convector or radiator installed as part of a space hot water heating system shall be furnished with a manual-type air vent valve.

R. Strainers: Strainers shall be installed on each water main (except for fire line) downstream of the meter, above grade, when a pressure regulator assembly is not installed. Main strainer shall be of Y-flange or groove type. On closed loop chilled and heating hot water systems pump systems, a strainer shall be installed at each pump inlet and upstream of each flow control valve assembly. The control valve assembly may include a modulating temperature control valve and a flow-limiting valve, manufactured by Griswold, AutoFlow, Flow Control Industries, Inc., or equal.

S. Hangers and Supports:

1. Piping shall be securely fastened to building structure by approved iron hangers, supports, guides, anchors, and sway braces to maintain pipe alignment to prevent sagging and to prevent noise or excessive strain on piping due to uncontrolled or seismic movement under operating conditions. Hangers and supports shall conform to Manufacturer's Standardization Society Specification SP-69. Hangers shall be relocated as required to correct unsatisfactory conditions that may become evident when system is placed into operation. Appliances, heat exchangers, storage tanks, and similar equipment shall be securely fastened to structure in accordance with seismic requirements. Outdoor metal hangers and supports shall be hot-dipped galvanized steel, unless otherwise specified.

2. Hose faucets, compressed air outlets, and similar items at ends of pipe branches shall be rigidly fastened to building construction near point of connection.

3. Piping shall not be supported by wire, rope, wood, plumbers' tape, or other non-recognized devices.

4. Hangers and supports shall be designed to support weight of pipe, fittings, weight of fluid and weight of pipe insulation, and shall have a minimum factor of safety of five, based on ultimate tensile strength of material installed.

5. Burning or welding of any structural member under load is not permitted. Field welding not specified on Drawings or reviewed Shop Drawings is not permitted without review by Architect and DSA.

6. Burning holes in beam flanges or other structural members is not permitted without review by the Architect and DSA.

7. Pipe hangers on piping covered with low temperature insulation shall be installed on outside of insulation and not in contact with pipe unless otherwise detailed on Drawings. Insulation shall be protected by 18 gage galvanized steel shield, with a minimum length of 10 inches, installed completely around pipe covering between covering and hanger. Installing hangers directly on pipe and butting adjoining sections of insulation against hanger is permitted provided void and hanger rod are properly insulated and sealed so that no sweating occurs at hangers.

8. Hanger rods shall be fastened to structural steel members with suitable beam clamps. Clamps shall be Tolco, Carpenter & Patterson, Fee and Mason, or equal, as follows:

    a. Tolco I beam, Fig.62 for maximum 1000 pounds.

    b. Tolco I or WF beam, Fig. 329, for maximum of 1290 pounds.

9. Hanger rods shall be fastened to concrete inserts in concrete slabs or beams. Inserts shall be Tolco, Carpenter & Patterson, Fee and Mason, or equal, as follows:

    a. Tolco Fig.310 for maximum of 600 pounds.

    b. Tolco Fig. 309 for maximum of 1140 pounds.

10. For fastening to wood ceilings, beams, or joists, furnish Grinnell Fig. 128R, Grinnell Fig. 153, Tolco 78, or equal pipe hanger flange fastened with drive screws. Under wood floors, 3/8 inch hanger rods shall be hung from 2-inch by 2-inch by 1/4 inch angle clips 3 inches long, with 2, staggered 10d nails, clinched over joist.

11. Hanger rod sizes for copper, iron, or steel pipe: 3/8 inch for pipe sizes ½ inch through 2-inch, ½ inch for pipe sizes 3-inch, 4-inch and 5-inch, 5/8 inch for pipe size 6-inch, and ¾ inch for 8-inch and 10-inch pipe.

12. Turnbuckles, if furnished, shall provide a load carrying capacity equal to that of the pipe hanger with which they are being installed.

13. Pipe hangers shall be of same size, or nearest larger manufactured size available, as pipe or tubing on which they are being installed.

14. Hangers, clamps, and guides furnished for support of non-metallic pipe shall be padded with 1/8 inch thick rubber, neoprene, or soft resilient cloth.

15. Where special pipe-supporting requirements in the Specifications conflict with any standard requirements specified herein, the Specification requirements shall govern.

16. Vertical Piping:

    a. Vertical pipe risers shall be securely supported with riser clamps of recognized type. Risers in reinforced concrete buildings shall be furnished with extension clamps fastened to pipe above each concrete floor slab with extended arms of clamp to rest on slab. Clamps shall be provided with lead or Teflon liners when installed on copper tubing. Clamps shall be plastic-coated when installed on non-ferrous pipe or tubing.

    b. Copper tubing in sizes 1 ½-inches and larger and steel pipelines passing up through building shall be supported at each floor of building or every 15 feet whichever is less.

    c. Copper tubing sizes 1 ¼-inches and smaller shall be supported at not intervals not more than 6 feet on center. Special provisions shall be installed for vertical lines subject to expansion and contraction caused by operating temperature differences.

    d. Vertical cast iron pipelines shall be supported from each floor and at its base. Malleable iron or steel pipe clamps with minimum thickness of 1/4 inch shall be furnished and fastened around pipe for support.

17. Horizontal Piping:

    a. Roof Mounted Piping: Pressure and non-pressure piping shall be supported from channels, stands, clamps, trapezes, rollers, or structures mounted on 100% rubber, UV resistant rooftop supports with reflective strips, Dura-Block, or equal. Roller type supports shall be provided below and above pipe to prevent its dislodgement. Bottom of pipes shall clear the roof surface by 10 inches.

    b. Insulated steam and space heating hot water insulated condensate lines, insulated domestic hot water supply and return piping shall be supported with Tolco Figure 4, B-Line Figure B3140, Grinnell Figure 212, or equal, steel hangers with welded eye rods to permit hinge movement at

point of attachment of hangers. Hinge movement at point of support shall be provided by welded eye linked rods Tolco Figure 101L, B-Line Figure B3211X, Grinnell Figure 278, or equal.

c. Domestic cold water piping, water supply and return piping, condenser water piping, insulated refrigerant piping gas piping, compressed air piping, cast iron soil piping, galvanized steel vents, waste and downspout piping and glass to be supported with Tolco Figure 1, B-Line Figure B3100, Grinnell Figure 260, or equal, hangers with rods, turnbuckles and inserts suitable for above hangers.

d. Maximum hanger and support spacing shall conform to CPC schedule for horizontal piping installed above grade.

18. A hanger or support shall be installed close to the point of change in direction of a pipe run, in either a horizontal or vertical plane.

19. When practicable, supports and hangers for cast iron soil pipe shall be installed as close as possible to joints and when hangers or supports are not located within one foot of a branch line fitting, an additional hanger or support shall be installed at fitting.

20. In systems where grooved piping is used, couplings shall be provided with angle pattern bolt pads to comply with support and hanging requirements of ANSI/ASME B31.1, ANSI/ASME B31.9, and NFPA Pamphlet 13.

T. Flashings:

1. Each pipe, duct, or gas-fired equipment vent passing through roof shall be installed with waterproof flashing.

2. Flashing or flanges on pipes, vents, and ducts passing through a tile or slate roof shall be constructed of sheet lead. Flashing for pipes and heater vents passing through a roof shall be 4 pound soft sheet lead. Flashing and flanges for ducts and heater vents passing through exterior walls shall be 22 gage sheet metal. Install caps on top of heater pipes. Flanges and flashing shall be installed waterproof at point of connection with pipe or duct. No soldered joints on roof flashings will be allowed. No Stoneman lead roof flashings will be allowed.3.

Lead flashing and flanges shall be constructed of 4 pound sheet lead with burned joints. Flange of lead flashing or lead flange on a duct shall extend out onto roof a minimum of 12 inches from pipe or duct. Lead flashing shall extend up the pipe or duct not less than 8 inches.

4. Sheet metal flashing shall be constructed of 24 gage galvanized sheet steel. Flanges on these flashings shall extend out onto roof a minimum of 10 inches from pipe or duct. Flanges on ducts through exterior walls shall extend out from duct a minimum of 2 ½ inches. Flanges on gas-fired equipment single-wall vents shall be of ventilated type. Type B gas vents through a roof shall be furnished with non-ventilated flashing as per NFPA Pamphlet 211.

5. Cast iron, steel, brass, and copper pipe, which terminates less than 18 inches above roof, shall be furnished with a combination counter-flashing and vandal-proof hood for protection against water, birds and foreign matter. Cast iron, steel, brass and copper pipe, which does not terminate within 18 inches of roof, shall be furnished with a counter-flashing sleeve. Pipe, which terminates more than 18 inches above roof, shall be furnished with protection against entrance of water, birds, and foreign matter.

6. Counter-flashing and combination counter-flashing sleeves and vandal-proof hoods shall be cast iron, vandal-proof, threaded, sealed or approved gas-heated sleeve type. Counter-flashing sleeves on each of these items shall extend down over flashing a minimum of ¾ inch.

7. Flashing and flanges on ducts shall be installed waterproof at point of connection to the duct by riveting and soldering. Storm collars shall be securely screwed and installed waterproof around appliance vent pipe immediately above flashing.

8. Vent piping above roof shall be furnished with a combination counter-flashing sleeve and vandal-proof hood.

U. Equipment Installation: Install roof or floor mounted equipment on level platforms, housekeeping pads or curbs and provide sound, vibration and seismic control measures per Section 23 05 48 even if not indicated on Drawings.

END OF SECTION 22 05 13

SECTION 22 05 53

PLUMBING IDENTIFICATION

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes: Marking and identification on mechanical piping systems, ducts, controls, valves, and apparatus.

B. Related Requirements:

1. Division 01: General Requirements

2. Division 22: Plumbing

1.02 SUBMITTALS

A. Submit in accordance with Division 01 and Section 22 05 00: Common Work Results for Plumbing.

B. Submit product data and installation instructions for each item specified.

C. Submit Samples of materials.

1.03 QUALITY ASSURANCE

A. Comply with provisions of:

1. Section 22 05 00: Common Work Results for Plumbing.

2. ANSI/ASME A13.1: Scheme for the Identification of Piping Systems.

3. APWA: Uniform Color Code.

4. IAPMO: Uniform Plumbing Code (UPC)

PART 2 – PRODUCTS

2.01 MATERIALS

A. General: Piping systems, controls, valves, apparatus, etc., except those that are installed in inaccessible locations in partitions, walls, and floors, shall be permanently identified.

2.02 VALVES

A. Furnish prepared chart or diagram for each piping system, indicating by identifying letter or model number of each valve in the system, its location, and function.

B. Install charts in aluminum frame with clear glass front and secure on wall where designated by the Project Inspector.

C. Bind copies of each chart in operating instructions manual.

D. Provide each valve with a brass, aluminum, or plastic disc, not less than 1-1/4 inches diameter bearing engraved numbers corresponding to those indicated on chart. Fasten discs to valve with No. 14 brass wire.

E. Provide an additional tag for safety valves and other valves that could be hazardous to safety and health of occupants. Distinguish these tags from regular valve tags by color (such as yellow with black letters, and marked "Danger"); submit Sample tag to the Architect for review.

2.03 INSTRUMENTS AND CONTROLS

A. Identify panel-mounted instruments and controls with engraved bakelite nameplates permanently affixed to panel boards.

B. Identify alarm indicating devices and alarm reset devices by nameplates.

C. Identify automatic valves, flow switches, and pressure switches, with embossed aluminum or plastic tape affixed to controller, indicating service and setting.

2.04 EQUIPMENT

A. Identify each major piece of equipment with engraved bakelite nameplates permanently affixed to the equipment, indicating the room numbers it services, Equipment identification designation shall be the same to its designation indicated on the “As-Built Drawings”. Room numbers in the nameplates shall correspond to the final room numbers.

2.05 ABOVE GRADE PIPE IDENTIFICATION

A. Identify pipes by means of colored labels with directional flow arrows and identification of the pipe content, in conformance to ANSI/ASME A13.1 or the UPC.

B. Materials: Precoiled acrylic plastic with clear polyester coating, all-temperature, self-adhering, as manufactured by Brady, Brimar Industries, Seton, Stranco, Inc., or equal.

C. Size:

Outside Diameter of Pipe or Insulation (in inches)	Length of Color Field (in inches)	Size of Letter (in inches)
¾ to 1 ¼	8	½
1 ½ to 2	8	¾
2 ½ to 6	12	1 ¼
8 to 10	24	2 ½
over 10	32	3 ½

D. Locations:

1. On accessible piping, whether insulated or not (including mechanical rooms, attic and ceiling spaces); except that labels shall be omitted from piping where contained material is obvious due to its connection to fixtures (such as faucets, water closets, etcetera.).

2. Near each valve and branch connection in such accessible piping.

3. At each pipe passage through wall or floor.

4. At not more than 20 feet spacing on straight pipe run between bands required in 2 and 3 above.

5. At each change in direction.

E. Application: Install on clean surfaces free of dust, grease, oil, or any material that will prevent proper adhesion. Replace non-adhering or curling labels with new labels.

F. Color Schedule:

Content of Pipe	Legend	Background Color	Lettering Color
Domestic cold water	Domestic. C.W.	Green	White
Non-potable cold water	Caution: Non-potable Water Do Not Drink (1)(2)	Purple	Black
Domestic hot-water 140ºF	Domestic H.W. 140ºF	Blue	Black
Sanitary waste	San waste	Green	White
Sanitary vent	San vent	Green	White

Storm drain or downspout	Storm drain	Green	White
Indirect drain	Ind drain	Green	White
Sump pump discharge	Pump discharge	Green	White
Fire sprinkler supply	Fire Sprinkler supply	Red	White
Fire sprinkler drain	Sprinkler drain	Red	White
Fuel oil	Diesel oil	Yellow	Black
Gas	Gas	Yellow	White
Reclaimed Water	Caution: Reclaimed Water Do Not Drink (1)(3)	Purple	Black

H. Notes on Schedule:

1. Note (1) indicates 2 ¼ inch by 1 inch yellow label with ½ inch letters reading UNSAFE WATER at one end of primary label.

   Note (2) words should read "CAUTION: NONPOTABLE WATER DO NOT DRINK." with international *do not drink* symbol.

   Note (3) words should read "CAUTION: RECLAIMED WATER DO NOT DRINK." with international *do not drink* symbol.

2.06 UNDERGROUND PIPE

A. Detectable Marking Tape:

1. Provide and install detectable marking tape along buried piping. Tape shall be specifically manufactured for marking and locating underground utilities with electronic equipment. Tape shall be acid and alkali resistant, and manufactured with integral wires or foil backing, encased with protective cladding. Tape shall be a minimum of two inches in width.

2. Manufacturer: Reef Industries, Inc., Advantage Brands, Inc., Northtown Company, Mutual Industries, Inc., or equal.

3. Detectable marking tape shall be color-coded per APWA Color Code:

   a. Yellow: Oil and gas.

   b. Blue: Water, irrigation and slurry lines.

   c. Green: Sewer and drain lines.

B. Tracer Wire:

1. Solid copper wire type THWN, 12 AWG gauge, with heat and moisture resistant insulation.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Correct detrimental conditions prior to commencing the Work of this Section. Install markers and identification tags as specified with materials and installation procedures recommended by manufacturer.

B. Place tracer wire on top of non-metal utility lines allowing some slack. Do not wrap tracer wire around pipe. Fasten tracer wire in place at approximately 10 feet on centers with non-metal ties.

C. Install underground detectable pipe marking tape continuously buried 8 to 10 inches above the buried utility pipe. Wrap tape on pipe risers up to a height of 12 inches above grade.

3.02 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION 22 05 53

SECTION 22 10 00

PLUMBING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Labor, materials, tools, and equipment to install plumbing systems as indicated.

B. Related Sections:

1. Division 01 - General Requirements.

2. Section 07 92 00: Joint Sealants.

3. Division 22

4. Division 33

1.02 SUBMITTALS

A. Provide in accordance with Division 01 and Section 22 05 00: Common Work Results for Plumbing.

B. Provide necessary documentation to Owner for processing rebates for water efficient fixtures.

1.03 QUALITY ASSURANCE

A. Unless otherwise noted, the California Plumbing Code is hereby made part of this section.

B. Conform to provisions of Section 22 05 00: Common Work Results for Plumbing.

C. Manufacturer of plumbing products must be third-party certified to ANSI/NSF Standard 61, Section 9 certification, and ANSI/NSF 372 to demonstrate compliance with the federal requirements for lead contribution to drinking water, the Safe Drinking Water Act SDWA, and the California Health and Safety Code Section 116875.

1.04 PRODUCT HANDLING

A. Conform to provisions of Section 22 05 13: Basic Plumbing Materials and Methods.

PART 2 - PRODUCTS

2.01 PIPING SYSTEMS

A. Materials: Refer to Section 22 05 13: Basic Plumbing Materials and Methods.

2.02 FIXTURES AND DRAINS

NOTE: Fixture schedule on drawings shall use the same designations for fixtures as this specification. Coordinate the two documents closely.

A. General: Fixtures specified shall be furnished complete with trim and fittings. Cast iron plumbing fixtures shall be acid resistant enamel, and identified by casting letters "AR" or words "acid-resistant" into metal. Fixtures shall be white unless otherwise specified. Cast iron fixtures shall be white enamel inside and on back, rim and apron, with exposed unfinished surfaces painted white. Fixtures of same general classifications shall be of same make.

B. Finished Brass:

1. Unless otherwise specified, finished brass of a similar type shall be of same manufacturer and model throughout buildings.

2. Finished and exposed brass equipment, except floor, shower and urinal drains shall be chromium-plated and polished. Floor, shower and urinal drains, unless otherwise specified, shall be nickel-bronze metal.

C. Traps, Trap Arms and Tailpieces:

1. Fixture traps shall be all cast brass, chromium-plated and polished. **(No tubular traps).** Exceptions as follows:

   a. Traps that are an integral part of a fixture.

   b. Traps concealed in floors, walls and furring.

   c. Traps standard for service sinks and Industrial Shop equipment.

   d. Laboratory traps and tailpieces shall be as specified in section 22 05 13 “Basic Plumbing Materials and Methods”

2. Concealed traps and 17 gage tailpieces may be rough brass finish, except as otherwise specified. Laboratory traps and tailpieces shall be as specified in Section 22 05 13: Basic Plumbing Materials and Methods. Furnish

chromium-plated and polished cast brass wall flanges with setscrews and chromium-plated and polished brass casing on discharge side of each trap.

3. Tailpieces shall be not lighter than 17 gage, brass, chromium-plated, and polished. Furnish and install chromium brass plated wall flanges with set screws and chromium-plated 20 gage brass casing on discharge side of each chrome-plated all cast trap.

D. Faucet and Shower Valve Handles: Faucet and shower valve handles shall be solid brass, chromium-plated and polished, and fastened to their stems by Allen type hollow head stainless steel set screws through the side of the handle extending into the stem. Handles with sharp edges or projections shall not be furnished. At accessible fixtures: handles shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. The force required to activate handles shall be 5 pounds maximum.

E. Fixture Supplies:

1. Supplies for water heaters shall be unplated rigid copper water tube with threaded adaptors for connections to valves and other threaded connections. All other supplies shall be chromium-plated brass with hospital threads or shall be furnished with fittings and valves, which completely cover threads.

2. Exposed supplies for showers shall be chromium-plated brass pipe up to header with hospital threads or shall be furnished with fittings and valves, which completely cover threads.

3. Supplies to water closet tanks, lavatories, and drinking fountains shall be furnished with a NSF 372/61 threaded brass nipple. Exposed unfinished piping shall be sleeved with chrome plated brass or copper cover casing and have an appropriate escutcheon for a clean finished appearance. Angle/straight valve stops shall be female 1/2 IPS (inlet) by 3/8 compression (outlet). Fixture supplies shall be polished chrome-plated, solid supply bulbed end risers with size compatible supply nut connection to fixture and 3/8 O.D. compression nut and ferrule connection to angle stop outlet. Stainless steel flexible braided connectors with re-enforced PVC inner hose are not allowed.

4. Hot and cold water fitting supply outlet piping serving water closets, urinals, lavatories, drinking fountains, sinks, faucets, hose bibs, and sillcocks shall be iron pipe size (IPS) brass nipple, and piped in such a manner that through wall water supply outlet piping be removable, size appropriate, and lead free. The use of copper, copper MIP sweat adapters or similar fittings, in lieu of brass nipples is not allowed. The IPS brass nipple shall be directly connected to the fixture as follows:

a. Control stops for water closet and urinal flush valves.

b. Angle stop for lavatories, sinks and drinking fountains.

c. Shank/arm adapters for wall mounted sink faucets.

d. Iron pipe size (IPS) brass nipple connection for hose bibs, sillcocks, and other plumbing related fixture and/or plumbing fitting water supply outlets.

5. Water supply pipe that penetrates a finished surface, wall, countertop or part of a cabinet shall be appropriately sized polished chromium-plated cover casing and wall flange/escutcheon fitting tight to the brass through wall nipple and securely affixed to the finished wall surface.

6. Water supplies of plumbing fixtures shall be protected against back-siphonage in event of a vacuum in piping system. Toilet and urinal flush valves shall be furnished with recognized atmospheric vacuum breakers, installed a minimum of 6 inches above fixture.

7. Discharge outlets of supply faucets for lavatories and sinks shall clear top of overflow rim by at least one inch.

2.03 ACCESS PLATES (To cleanouts, valves, water hammer arrestors and hose faucets)

A. Schedule Numbers:

AP-1: Square, unless otherwise noted, steel, prime coated; frame, 18 gage minimum. Door shall be 16 gage minimum with concealed hinge or be removable, with vandal-proof lock operated by Allen wrench.

(Specify for painted and stucco walls.)

SMITH	ZURN	ELMDOR	MILKOR	WATTS	MIFAB	JOSAM
Fig 4760 AK	Z-1462-VP	DW-AKL	MOR DW AK1	CO-300-S-6	UA-A	58650-VP OR EQUAL

AP-2: Round type, stainless steel, vandal-proof, 5/16 inch No. 18 or 1/4 inch No. 20 flat-head machine screw into cleanout plug. Plate shall be prime coated minimum 18 gage steel or polished chrome-plated brass, 18-8 No. 302 stainless steel, or polished nickel bronze.
(To be specified for painted walls, screwed into cleanout plug.)

SMITH	ZURN	JOSAM	WADE	WATTS	MIFAB	OR EQUAL
4710U	Z-1469-VP	58600	8480R	CO-480-RD-6	C1400-RD-6	

AP-3: Square, polished face chrome-plated bronze, aluminum alloy or brass chrome-plated brass frame with 14 gage polished 18-8 No. 302 stainless steel or brass chrome-plated secured cover with vandal-proof screws.
(To be specified for tile walls.)

SMITH	ZURN	WADE	WATTS	MIFAB	JOSAM	OR EQUAL
4735U	Z-1460-VP	58630	CO-300-S-6	C1400-S-3-6	58640-VP	

AP-4: Square, floor type, cast nickel-bronze aluminum alloy or brass, with Carborundum or Scoriated, secured top.

(To be specified for floor access to solid interceptor in Science Room, Ceramic Room, and Agriculture Room.)

SMITH	ZURN	JOSAM	WATTS	MIFAB	OR EQUAL
4910U	Z-1461-VP	58630	CO-300-S-6	C1300-S-6	

2.04 BACKFLOW PREVENTION ASSEMBLIES

A. Schedule Numbers:

BPV-1: Pressure vacuum breakers ½ inch to 2 inches, Los Angeles City approved.

(To be specified for irrigation lines to protect the potable water systems)

WILKINS	WATTS	FEBCO	OR EQUAL
720A	800M4QT	765	

BPV-2: Non-pressure type, atmospheric vacuum breaker, Los Angeles City approved.
(To be specified for "Point-of-Use" conditions.)

WATTS	WILKINS	OR EQUAL
LF288A	35XL	

BPV-3: Reduced pressure or pressure differential type, Los Angeles City approved and in compliance with DWP Rule 16-D for meter protection. Sizes ½ inch to 6-inch.

(To be specified where potential health hazard exists and at main meter. Group component devices into a dual (parallel) configuration to avoid service interruptions during testing and servicing of devices. Devices shall be designed and installed in an above ground compact, low profile and serviceable valve station)

WILKINS	WATTS	FEBCO	OR EQUAL
375 and 975 XL (for uninterrupted service)	LF009-QT; LF909-NRS	LF860	

BPV-4: Double check valve assembly for water protection. Sizes 2 ½-inch to 6-inch.

(Specify with non-toxic systems or where no potential health hazards exists. Devices shall be designed and installed in an above ground compact, low profile and serviceable valve station)

FEBCO	WILKINS	WATTS	OR EQUAL
LF870V	350	LF709	

BPV-5: Double check valve assembly. Sizes ¾ inch to 2-inch.

(To be specified with non-toxic systems or where no potential health hazard exists.)

WILKINS	WATTS	FEBCO	OR EQUAL
950XL	LF007	LF850	

BPV-6: Pressure vacuum breakers with 3/4 inch hose bib. Install 6 feet above finished floor.

WILKINS	WATTS	FEBCO	OR EQUAL
420XL	LF008PCQT	LF765	

2.05 BACKWATER SEWER VALVE ASSEMBLY

A. Schedule Numbers:

BSV-1: Cast iron with access cover, Los Angeles City approved type, with line size gate valve upstream and downstream.

SMITH	ZURN	WATTS	MIFAB	JOSAM	OR EQUAL
7022-S	Z-1090	BV-200	BV-1000	67500	

2.06 CLEANOUT ASSEMBLIES

A. Cleanout plug shall be line size.

B. Schedule Numbers:

CO-1: Iron body cleanout tee full line size up to 4 inches and round access plate, plugs shall be brass, countersunk with tapped boss for 5/16 inch No. 18 or ¼ inch No. 20 screws. **(Specify for finished walls at base of waste stack, above urinal and service sink.)** AB&I and TYLER may be used as iron body cleanouts. Trim and accessories shall be Smith or Zurn or equal.

SMITH	ZURN	WATTS	MIFAB	JOSAM	OR EQUAL
4532-U	Z-1446-BP	CO-460-RD-34B	C1460-RD-6	58600-CO	

CO-2: Iron body with approved UPC plug, top and adjustable sleeve, cut-off ferrule, polished scoriated brass nickel bronze secured cover. AB&I and TYLER may be used as iron body cleanouts. Trim and accessories shall be Smith or Zurn or equal **(To be specified for finished floors inside buildings, in covered areas, and in concrete paving.)**

Square:

SMITH	ZURN	WATTS	MIFAB	JOSAM	OR EQUAL
4053L-U-NB	ZN-1400-T	CO-200-S	C1220-S-1-6	55000-1-SQ	

Round:

SMITH	ZURN	WATTS	MIFAB	JOSAM	OR EQUAL
4033-L-U-NB	ZN-1400	CO-200-R	C1220-1-6	55000-1	

CO-3: Secured cover, extra heavy-duty, adjustable sleeve, cut-off ferule, UPC. Brass approved type plug, scoriated tractor type cover.

(To be specified for areas outside building on concrete paving.)

SMITH	ZURN	WATTS	MIFAB	JOSAM	OR EQUAL
4233-U	ZN-1400-HD	CO-200-RX-4	C1220-4-6	55000-22	

CO-4: Tapped soil tee with brass plug, full line size.

(Specify for above grade, outside building at base of exposed downspout.)

SMITH	ZURN	WATTS	MIFAB	JOSAM	OR EQUAL
4512	Z-1445-BP	CO-460-34A	C1460	58910	

CO-5: Raised threaded head brass plug.

(To be specified for yard box YB-3.)

ZURN	WAATS	SMITH	JOSAM	OR EQUAL
Z-1470-A	CO-590	4285	58540-20	

2.07 CIRCULATING PUMPS, HOT WATER HEATING SYSTEM

A. Schedule Numbers:

CPH-1: Centrifugal, single stage, close coupled with adjustable cast iron base, bronze enclosed impeller, lead-free mechanical shaft seal suitable for water temperature range from 20 degrees to 300 degrees F. Screwed or flanged connections. GPM and TDH capacities as indicated.

BELL & GOSSETT	WEIMAN	PACIFIC	TACO	OR EQUAL

CPH-2: In-line mounted. Close coupled, centrifugal type with an all bronze water chamber, bronze sleeve bearings, bronze impellers, water tight shaft seal suitable for water temperature range from 20-300 degrees F. Forged steel shaft. It must be provided with bracket support to damper vibrations. GPM and TDH capacities as indicated.

BELL & GOSSETT All Bronze	GRUNDFOS UPS15-55SFC	TACO	OR EQUAL

2.08 DRINKING FOUNTAINS

A. Also see Electric Water Coolers, below.

B. Drinking Fountains shall be provided with brass free waterways and lead mitigating water filtering systems (DFWF), ANSI-NSF 53 certified, to remove Lead and other contaminants having detrimental health effects.

C. Schedule Numbers:

DFWF-1: In-line head and Cartridge assembly for drinking fountains, with ANSI/NSF 61, ANSI/NSF 372, CSA-B483.1-07, and ANSI/NSF 53 listed 1/4 Turn Cartridge with 0.5 Micron sediment/Carbon pre-filter.

FILTER	MODEL	
AQUA PURE	3MFF100	OR EQUAL

2.09 DRUM TRAPS

A. Schedule Numbers:

DT-1: Extra heavy cast iron, bolted top.

SMITH	ZURN	WATTS	MIFAB	JOSAM	OR EQUAL
8714	ZA1180	SI-742-X	MI-SOLID-S	61030	

DT-2: Aluminum solid interceptor, furnish for on-floor installation.

SMITH	ZURN	WATTS	MIFAB	JOSAM	OR EQUAL
8710-AA	Z-1180	SI-742	MI-SOLID-S-AL	61030-26	

2.10 DIELECTRIC UNIONS

A. Schedule Numbers:

1. Dielectric style Unions using ferrous and no-ferrous metals are prohibited. Dielectric flanges are admitted for use – see DU-2.

DU-1: Lead Free Brass union with 6-inch Lead Free Brass nipple.

DU-2: Lead Free Brass union or Lead Free Brass flanged fittings are to be used in between pipes made of dissimilar metals to prevent accelerated corrosion and deterioration in the piping systems due to galvanic and stray current.

WATTS	WILKINS	ZURN	NIBCO	OR EQUAL
LF3100M3			733-LF	

2.11 EMERGENCY EYE WASH / EMERGENCY SHOWER

(Emergency eye wash/emergency shower equipment must meet OSHA safety order requirements)

A. Schedule Numbers:

EEW-1: Access compliant combination emergency shower and fold-away eyewash mounted in a flush mounted recessed stainless steel cabinet with concealed piping: Eyewash: eye/face wash in a stainless steel door/water tray assembly folds up flush into stainless cabinet. Shower: access compliant shower activation by pull lever handle mounted 42 to 45 inches above the finished floor, located inside of stainless steel cabinet, supplying an exposed 20 gpm flow regulated stainless steel shower head, mounted between 82 and 96 inches above finished floor. Unit is access compliant when eye/face wash spray outlet is mounted at a height of 36 inches above finished floor. Provide 30 inches wide by 48 inches deep clear floor space for access compliance.

(**To be specified in Middle School and High School Science Lab Classrooms.**)

HAWS	GUARDIAN	ACORN SAFETY	BRADLEY	OR EQUAL
8356WCC	GBF2150-FC20	S2260-BF-PAN-RA	S19345JXB	

NOTE: Recessed model of combined emergency eyewash/emergency shower, number EEW-1 shall be used. At locations where recessing the unit is impractical, surface mounted, number EEW-1A, may be selected. Edit this specification accordingly.

EEW-2: Access compliant combination emergency shower and fold-away eyewash mounted in a wall-surface mounted stainless steel cabinet. Eyewash: Eye/face wash in a stainless steel door/water tray assembly folds up flush into stainless steel cabinet. Shower: access compliant shower activation by pull lever handle mounted 42 to 45 inches above the finished floor, located inside of stainless steel cabinet, supplying an exposed 20 gpm flow regulated stainless steel shower head, mounted between 82 and 96 inches above finished floor. Unit is access compliant when eye/face wash spray outlet is mounted at a height of 36 inches above finished floor. Provide 30 inches wide by 48 inches inch deep clear floor space for access compliance.

(To be specified in Middle School and High School Lab Classrooms where recessed cabinet cannot be used.)

HAWS	GUARDIAN	ACORN SAFETY	OR EQUAL

8356WCSM	GBF2173	S2460-PAN-RA	

EEW-3: Access compliant deck mounted eye/face wash, chrome plated brass flow regulated fold-down Eye/face wash assembly mounted on the back-ledge of the sink, water is automatically activated when the assembly is pulled forward and down over the sink. The floor space for the approach, the sink size, the counter height, and under-counter knee clearance must be adjusted to meet accessibility requirements; the Eye/face wash spray heads should not exceed 36 inches above the finished floor.

(To be specified only at Science Prep Rooms immediately accessible to a lab that has a deluge shower. At Prep Rooms not immediately accessible to a lab with a deluge shower, specify an emergency shower/eyewash combination unit instead.)

HAWS	GUARDIAN	ACORN SAFETY	BRADLEY	OR EQUAL
7610	GBF1779	S0860-RH	S19274JDB	

EEW-4 Floor mounted combination emergency shower and eyewash shower: maximum output flow controlled to 20 gpm, chrome plated bronze stay-open shower control valve with stainless steel valve stem and stainless steel lever and pull rod. 1 ¼-inch galvanized pipe and fittings, with alternate 1 ¼-inch inlets and 9-inch diameter floor flange. Eye/Face Wash: Stainless steel eyewash bowl, pressure regulating flow controlled Eye/face wash with auto-open protective cover, chrome plated bronze stay-open eyewash valve with stainless steel ball and valve stem, protected by an easily serviceable in-line 50 by 50 mesh chrome plated brass strainer, large stainless steel push paddle for hand operation.

(To be specified in Pool Chlorination Rooms, Maintenance, Mechanical, or Janitorial spaces where chemicals and injurious irritants are stored or routinely used; access compliant.)

HAWS	GUARDIAN	ACORN SAFETY	BRADLEY	OR EQUAL
8309WC	GBF1909	S1340-BF	S19314AA2AEDA00	

2.12 ELECTRIC WATER COOLERS

A. Water Coolers shall be provided with brass free waterways and lead mitigating water filtering systems (DFWF).

B. Schedule Numbers:

DFWF-1: In-line head and Cartridge assembly, for single bubbler electric water coolers, with ANSI/NSF 61, ANSI/NSF 372, and CSA-B483.1-07 components, and with ANSI/NSF 53 listed 1/4 Turn Cartridge with 0.5 Micron sediment/Carbon pre-filter.

(REPLACEMENT CARTRIDGE ONLY) (To be specified for Single Bubbler applications).

FILTER	ELKAY	
CUNO	FM DWS 1500	OR EQUAL

DFWF-2: In-line head and Cartridge assembly, for multi-bubbler electric water coolers with ANSI/NSF 61, ANSI/NSF 372, and CSA-B483.1-07 components, and with ANSI/NSF 53 listed 1/4 Turn Cartridge with 0.5 Micron sediment/Carbon pre-filter. **(REPLACEMENT CARTRIDGE ONLY) (To be specified for Multi- Bubbler applications).**

FILTER	MODEL	OR EQUAL
AQUA PURE	3MFF100	

EWC-1: Wall-mounted electric chiller type UL listed for access compliant with minimum capacity of 8.0 GPH certified to comply with Air Conditioning and Refrigeration Institute (ARI) Standard 1010/73. Fountain with brass free waterways shall be furnished with stainless steel apron and cabinet push bar operated bubbler, automatic stream regulator, brass P-trap, and hermetically sealed, air-cooled condensing unit with 115 volt, single phase 1/5 HP motor with thermal overload protection (Hubbell No. 5264 or equal). Provide with approved 3-wire grounding cord and connector. Complete water cooler must have been tested and certified to ANSI/NSF 61 and NSI/NSF 372 lead free.

HALSEY TAYLOR	ELKAY	MURDOCK	OR EQUAL
HAC8SS-NF	VRC8WSK	A171408F	

EWC-2: ADA electric water cooler, same mechanical specification as EWC-1. Complete water cooler must have been tested and certified lead free to ANSI/NSF 61 and NSI/NSF 372 lead free.

HALSEY TAYLOR	ELKAY	MURDOCK	OR EQUAL
HAC8SS-NF	VRC8S	A171408F	

2.13 FAUCETS

A. Access compliant faucets: Force to activate controls shall be no greater than 5 pounds. Self-closing metering, where specified, to remain open 10 seconds minimum when activated. Handles shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist.

B. Schedule Numbers:

F-1: Wall mounted ¾ inch hose-thread spout faucet with vacuum breaker with integral service stops and top wall brace, adjustable eccentric union inlet connections, rough chrome.

(To be specified for service sink and can wash.)

CHICAGO	AMERICAN STANDARD	ZURN	OR EQUAL
897-RCF	8344.112-RC	Z843MI-RC	

F-2: Wall mounted stainless steel 8 inch spread faucet with lever handles and 8 inch swing spout with brass free waterways. **(To be specified for Faculty Dining Room, Nurses Station, Culinary sinks and food preparation sinks.)**

FISHER	OR STAINLESS STEEL EQUAL
53112	

F-3: NOT USED

F-4: Wall mounted stainless steel single water inlet fitting with 8 inch swing spout with brass free waterways. Furnish with lever handles and water conservation type aerator.

(**To be specified for use at pot sinks, over range tops and Photo Finishing Rooms.)**

FISHER			OR STAINLESS STEEL EQUAL
67628			

F-5: Wall mounted single water inlet with a double jointed swing spout, heat resistant handle control valve, stainless steel.

(To be specified for pot sinks and over range tops – Engineer / Designer to specify the type and length of spout.)

FISHER	OR STAINLESS STEEL EQUAL
54119 OR 54836	

F-8: Wall mounted, cast brass, hot and cold faucet with adjustable Centers and with 5 ½-inch gooseneck spout.

(To be specified for use in Graphic Arts Room.)

CHICAGO	ZURN	T&S BRASS	OR EQUAL
445-218173AB	Z841C1-5F	B-0290-LN WITH 059X 6 INCH SPOUT	

F-10: Single deck mounted hot and cold faucet, rough-plated brass with vacuum breaker top brace, with hose end. Provide with copper tubing connectors.

(To be specified for Science Room Demonstration Table and Science Prep Rooms in laboratory classrooms.)

T&S	CHICAGO	ZURN	OR EQUAL
BL-5700-09	50-E35ABCP	Z826U1-6M-MY	

F-14: 4-inch center set lavatory faucet self-closing metering, to remain open 10 seconds minimum when activated., Cold water inlets, adjustable time cycle and chrome plated finish. Provide with copper tubing connectors. To be used with 4-inch center set Lavatory Sink.

(To be specified for student restrooms).

CHICAGO	ZURN	OR EQUAL
3400-ABCP	Z86100-XL-CP4	

F-15: 4-inch center set lavatory faucet self-closing metering, to remain open 10 seconds minimum when activated., Hot & cold water inlets, adjustable time cycle and chrome plated finish. Provide with copper tubing connectors. To be used with 4-inch center set Lavatory Sink.

(To be specified for student restrooms).

CHICAGO		OR EQUAL
3600-E2805AB		

F-16: Deck mounted, single lever handle, cold water inlet fitting, with rigid swinging goose neck spout and aerator.

(To be specified for Art Classrooms, Shop and Industrial Craft Rooms, Ceramic, Science Rooms, Elementary Classrooms, Kindergarten Classrooms, and Special Education, Classrooms, Teacher Workroom and Outdoor Sinks).

CHICAGO	ZURN	T&S	OR EQUAL
350-E35ABCP	Z825B1-XL-15F	B-0305	

F-17: Vertical wall mounted fitting with lever handles, rigid gooseneck spout and spray outlet. **(To be specified for all 3-foot wash sinks with vertical outlets for Art classroom, Shop and Industrial Craft rooms and Ceramic classrooms.)**

CHICAGO		OR EQUAL
225-261ABCP		

F-20: Wall mounted, hot and cold faucet, chrome plated, with lever handles and 9 or 9 ½-inches goose-neck spout.
(To be specified for use in Administration Offices, Conference Rooms, Teacher Workrooms, and Library.)

CHICAGO	ZURN		OR EQUAL
445-L9E35ABCP	Z842J1-XL-5F		

F-21: Deck mounted, hot and cold faucet with lever handles, rigid swinging goose-neck spout and aerator.
(To be specified for use in Art Classrooms, Shop and Industrial Craft Rooms, Ceramic, Science Rooms, Elementary Classrooms, Kindergarten Classrooms, and Special Education, Classrooms, Teacher Workroom and Outdoor Sinks).

CHICAGO	ZURN	T&S BRASS	OR EQUAL
50-E35ABCP	Z826B1-XL	B-0300-VR	

2.14 FLOOR DRAINS

A. Schedule Numbers:

FD-1: Cast iron body, no hub with seepage pan and flat, round nickel bronze strainers not less than 5-inch diameter for 2-inch outlet bodies, 7-inch for 3-inch outlet bodies and 8-inch for 4-inch outlet bodies, with maximum of ½ inch square holes or slots not larger than ¼ inch by 1 ¼-inch.

(To be specified for use in locations other than tile floors.)

SMITH	ZURN	WATTS	TECH SPEC.	JOSAM	OR EQUAL
2005Y-A	ZN-415-B	FD-100-A	N702W5375R	30000-A	

FD-2: Same as specified for FD-1, except with square tops.

(To be specified for use in tile floors.)

SMITH	ZURN	WATTS	TECH SPEC.	JOSAM	OR EQUAL
2005Y-B	ZN-415-S	FD-100-M	N702W5375S	30000-S	

FD-3: Area type, with 8-inch diameter minimum cast iron top grates (no hub). Drain shall be vandal-proofed by securing grate to body with stainless steel Allen flat-head screws.

SMITH	ZURN	WATTS	MIFAB	JOSAM	OR EQUAL
2110-Y-U	Z-550-VP	FD-320-Y-6	F1320-4-6	32100-VP-Z	

FD-4: Pavilion type with cast iron hinged top, with removable sediment bucket. Drain shall be vandal-proofed by securing grate to body with stainless steel Allen flat head screws. No hub; 4-inch drain in lunch area in lieu of clarifier.

SMITH	ZURN	WATTS	MIFAB	JOSAM	OR EQUAL
2230-Y-H-U	Z-610-H-NH-UP Z-541-NH-VP-H	FD-340-Y-SET-9-6	F1340-TFB-4-6	37810-14-VP-Z	

FD-6: For indirect waste. Cast iron body, with vandal-proof nickel-bronze top and funnel. No hub.

SMITH	ZURN	WATTS	MIFAB	JOSAM	OR EQUAL
3510-F11-NB5	ZN-415-E	FD-100-EF-1	F1100-C-EF-1	30000-E2-VP	

FD-8: Area drain, cast iron body, round pedestrian grate set in square frame.

SMITH	ZURN	WATTS	MIFAB	JOSAM	OR EQUAL
1470Y-U-NB	ZN-158-VP	RD-200-CP-L-1	F1100-C-S8-1-6	23730-VP	

FD-9: Planter drain, cast iron body, secured bronze dome with stainless steel mesh screen.

SMITH	ZURN	WATTS	MIFAB	JOSAM	OR EQUAL
2646Y	ZRB-352 with Z-1040 adaptor	FD-860	F1810-6	39600	

FD-10: Trash Drain Wash down Area Drain: Waste water diversion valve drain acts as an area drain for sanitary and rain drainage. When the hose Bibb is activated, the drain automatically diverts run offs to sanitary drain. Unit shall be approved by Los Angeles Testing Laboratory.

FOX Waste Water Diversion Valve System:	OR EQUAL
DD 600	

2.15 FLEXIBLE HOSES

A. Schedule Numbers:

FLH-1: Braided stainless steel metal hose (for gas use). US Flex, Metraflex, Nelson Dunn or equal.

FLH-2: Braided bronze metal hose (for non-pressure condensate connection use). US Flex, Metraflex, Nelson Dunn or equal.

2.16 FLUSH VALVE ASSEMBLY

A. Valves shall be furnished so that flush remains constant and will not require any adjustment.

1. Each flush valve shall be provided with a loose key, square shank, lock shield angle service stop connected to flush valve with a union connection.

2. Provide l7 gage pressed brass escutcheons for wall and fixture. Escutcheons shall be fastened to not turn or rattle.

3. Each flush valve shall be furnished with a vacuum breaker providing one inch opening to atmosphere, which will not leak under any degree of back pressure and will not restrict rate of flow more than 10% at 10 PSI, and will operate noiselessly.

4. Tailpiece shall not be lighter than 17 gage and shall be part of flush valve assembly.

5. Exposed metal parts of flush valve assembly shall be nickel or chromium-plated on a brass or copper base.

6. Refer to 2.02.E for fixture supplies.

7. Controls for water closet flush valves shall be mounted on the wide side of toilet areas.

B. Schedule Numbers:

FLV-1: Automatic Flush Valve for Water Closets: Battery-powered, sensor-operated, 17 gage chrome-plated brass or heavier with cover and with metal cover manual override button. Shall deliver 1.28 gallon of water at each operation.

SLOAN	ZURN	OR EQUAL
Royal 111 SMO-1.28	ZER6000AV-HET-CPM	

FLV-1a: Manual Flush Valve for Water Closet: Shall deliver 1.28 gallon of water at each operation.

SLOAN	ZURN	OR EQUAL
Royal 111-1.28 XL	Z6000AV-HET	

FLV-2: Automatic Flush Valve for Urinals: Battery-powered, sensor-operated, automatic flush valve. Flush valve at 1/8 gallons per flush with manual override feature.

SLOAN	ZURN	OR EQUAL
Royal 186 SMO-0.125-DBP-OR	ZER6003AV-ULF-CPM	

FLV-2a: Manual Flush Valve for Urinals: shall deliver 1/8 gallon of water per flush.

SLOAN	ZURN	OR EQUAL
Royal 186-0.125 XL	Z6003AV-ULF	

2.17 FLOOR SINKS

A. Schedule Numbers:

FS-1: Round, cast iron, acid-resistant enamel body with bottom aluminum dome strainer, less grate.

(To be specified for use in Multi-Purpose Buildings and Cafeteria Buildings.)

SMITH	ZURN	WATTS	MIFAB	JOSAM	OR EQUAL
3400Y-10	Z-1950-1	FS-760-22	FS1760-22	49580A	

FS-2: 6 inches to 8 inches deep, square cast iron acid-resistant enamel, bottom aluminum dome strainer with nickel bronze rim and grate top.

(To be specified for use in Multi-Purpose Buildings, High School Cafeteria and Mechanical Equipment Rooms.)

SMITH	ZURN	WATTS	MIFAB	JOSAM	OR EQUAL
3140Y 3150Y	Z-1901 ZN-1900	FS-740-1 or FS-730-1	FS1720-1, FS1730-1	49320A-NB, 49340A-NB	

FS-3: Round, cast iron body with dome bottom strainer, under deck clamp and 2-inch high water dam; no hub type.

(To be specified for outdoor use near cooling tower, near rooftop HVAC unit, chillers, Mechanical Equipment Rooms.)

SMITH	ZURN	WATTS	MIFAB	JOSAM	OR EQUAL
3980Y-C	Z-108-NH	RD-400-F	R1200-RS-U	25500-1	

FS-4: Square, cast iron, acid-resistant enamel body with bottom aluminum dome strainer, less grate.

(To be specified for Mechanical Equipment Rooms, Janitor's room & Storage.)

SMITH	ZURN	WATTS	MIFAB	JOSAM	OR EQUAL
320-12	FD2375-NH3			49320A	

2.18 HOSE BIBBS

A. Schedule Numbers:

HB-1: For plaster or stucco wall, furnished with box and stop, exposed trim chrome-plated, with or without door and with vacuum breaker.

(To be specified for use outside at 75 feet spacing around exterior building walls & mechanical well walls.)

ACORN	WOODFORD	PRIER	OR EQUAL
8141, 8151	68	C-633NFC	

HB-2: For brick, CMU and poured in place concrete walls, furnished with box and stop, exposed trim chrome-plated, with or without door and with vacuum breaker.

(To be specified for use in swimming pool area, outside eating and 75 feet spacing around exterior building wall.)

ACORN	WOODFORD	PRIER	OR EQUAL
8141, 8104, 8151	B75	C-633NFC	

HB-3: ASTM B 62 bronze body, rubber composition disc or renewable seat, straight nose with brass die cast or enamel iron hand wheel and with vacuum breaker.

(To be specified for use for Lath House.)

ACORN	ZURN	WOODFORD	PRIER	OR EQUAL
8131-RBVB	Z-1343-VB	Y24	C-155	

HB-4: Same as HB-3 except furnish loose key stop and lockshield.

(To be specified for use at animal wash-down areas.)

ACORN	ZURN	WOODFORD	PRIER	OR EQUAL
8131-LK-RBVB	Z-1343-VB-LK	Y24 WITH LOOSE TEE KEY	C-155	

HB-5: Same as HB-3 except furnish with bent nose.
(To be specified for use at roof top AC Unit. Mechanical Equipment Room, Boiler Rooms, etc.)

ACORN	ZURN	CHAMPION	PRIER	OR EQUAL
8126-LK-RBVB	Z-1343-VB-LK	B-401 LK	C-255NP	

HB-6: Same as HB-4 except furnish with bent nose and loose key handle.

(To be specified for use in exterior Agricultural Plot.)

ACORN	ZURN	CHAMPION	PRIER	OR EQUAL
8126-LK-RBVB	Z-1343-VB-LK	B-401LK	C-255NP	

HB-7: Renewable seat, rough chrome finish, bronze body, flanged 3/4 inch I.P.S. with Female thread inlet, loose key, and vacuum breaker.

ACORN	CHICAGO	WOODFORD	PRIER	OR EQUAL
8121-CR	No. 387-E-27	No. 24P-CH-TK	C-255CP	

HB-8: Recessed hose box furnished with wall flange and built-in drip lip. Box shall be one piece construction; door shall have a recessed cam lock. Door shall remain up and out of the way when in fully opened position. Valve shall be replaceable loose key wheel handle and screwdriver stop. Install within 2 feet above finished floor. Provide vacuum breaker.

(To be specified for use in Toilet Rooms.)

ACORN	WOODFORD	PRIER	OR EQUAL
Hose box 8104 or 8151	B75	C-634BX1	

2.19 LAVATORIES

A. Access compliant faucets for Lavatories: Force to activate controls shall be no greater than 5 pounds. Self closing metering, when specified, to remain open 10 seconds minimum when activated.

B. Cast Iron Lavatories shall be acid resistant enamel, and shall conform to Commercial Standards CS 77.63. Unites furnished in conjunction with strainer installation or faucet installation shall be brass. Exposed brass nuts shall be chrome plated.

C. Exposed trim shall be free from sharp edges or points. Fixture shall be furnished with other listed manufacturer specified trim. Instead of solid supply pipe, polished chrome-plated risers, 3/8 inch outside diameter with ferrule stop end and metal nosepiece may be furnished.

D. Insulate cold water, hot water and drain lines under all access compliant lavatories with approved type insulation.

PLUMBEREX	LAV-GUARD	OR EQUAL

Schedule Numbers:

L-1: 20-inch by 18-inch cast iron, acid-resistant enamel punched with three holes, 4-inch on center and supplied with tempered or cold water only. Unit shall be furnished with cast iron hangers. Stops shall be loose key, square shank, lock shield type.

(To be specified for use in Student Toilet Rooms, Typing, Math, and Industrial Art Rooms.)

	COMMERCIAL ENAMEL	KOHLER	BRASS CRAFT	CHICAGO	ZURN OR EQUAL

Bowl	551 (3 holes)	K-2005			Z5844-CB
Faucet (See Section 2.13)	F-14	F-14	F-14	F-14	F-14
Drain				327 XCP	Z8743
Supply			HSTR 1720 A-CB-C	1017	ZH-8822-CE-LK

Note: Provide cast iron hangers for sinks.

L-2: Same as L-1, 20-inch by 18-inch cast iron, acid resistant enamel punched with three holes, 4 inches on center and supplied with tempered cold water only. Unit shall be furnished with cast iron hangers. Stops shall be loose key, square shank and lock shield type.

(To be specified for access compliant, student restrooms).

	COMMERCIAL ENAMEL	ZURN	KOHLER	OR EQUAL
Bowl	553 (3 holes)	Z5844	K-2005	
Faucet (See Section 2.13)	F-15	F-15	F-15	
Drain	Chicago 1-1/4-inch grid drain 327- XCP	Chicago 1-1/4-inch grid drain 327- XCP	Chicago 1-1/4-inch grid drain 327- XCP	OR EQUAL

L-4: 20-inch by 18-inch cast iron, acid resistant enamel lavatory with 4-inch center set combination push button metered faucet, supplied with hot and cold water complete with cast iron hangers. **(To be specified for access compliant installations at faculty restrooms)**.

	COMMERCIAL ENAMEL	ZURN	KOHLER	OR EQUAL
Bowl	553 (3 holes)	Z5844	K-2867	
Faucet (See Section 2.13)	F-15	F-15	F-15	
Drain	Chicago 1 ¼-inch grid drain 327-XCP	Chicago 1 ¼-inch grid drain 327-XCP	Chicago 1-1/4-inch grid drain 327- XCP	OR EQUAL

2.20 LABORATORY GAS VALVES

A. Laboratory Gas valves shall be protected by access-compliant and serviceable electronically-operated gas solenoid valve. This valve shall be remotely operated by a recess-mounted controller with an emergency push button. Controller shall be located as close as possible to the teacher's work station with a 48" maximum mounting height for access compliance.

B. Laboratory countertop and tabletop gas valves shall have integral check valves.

C. Schedule Numbers:

LGV-1: Controller with an emergency push button, LED, and key switch in conjunction with a 24-volt, normally-closed solenoid valve.

MANUFACTURER	American Gas Safety, AGS	ISIMET	OR EQUAL
CONTROLER	Merlin 1000Si, 24 VAC, Recessed Mount	LA SERIES, Model: LA1211-R	OR EQUAL
SOLENOID	Normally Closed, Merlin Valve, 24VAC, 1/2" through 2"	Normally Closed, S-300 Series, 1/2" through 1-1/4"	

LGV-2: Ground key stop, heavy chrome-plated, nickel and copper composition, double turret at 90 degree angle 3/8 inch international pipe size deck type, with lever handle and vandal-proof plastic index button.

(To be specified for use in Middle School Science Room countertop tables.)

CHICAGO	T & S	WATER SAVER	ZURN	OR EQUAL
980-909-957-3KAGV	BL-4200-02	YR2900-132AWSA	Z88200-Z-8001B-CS	

LGV-3: Laboratory gas valve, same as LGV-2, except single turret.

(To be specified for use in Middle School Science Room demonstration table.)

CHICAGO	T & S	WATER SAVER	ZURN	OR EQUAL
980-909-957-3KAGV	BL-4200-1	YR2900-131-WSA	Z88200-Z-8001B-CS	

LGV-5: Ground key stop, heavy chrome-plated, nickel and copper composition, single turret, wall-mounted, 3/8 inch international pipe size with lever handle and vandal-proof plastic index button.

(To be specified for use in Middle School Science Work Rooms.)

CHICAGO	T & S	WATER SAVER	ZURN	OR EQUAL
980-909-957-3KAGV	BL-4250-01	L2900-158	Z-88600-Z8001B	

2.21 PIPE HANGERS

A. Refer to Section 22 0513: Basic Plumbing Materials and Methods.

B. Schedule Numbers:

1. PH-1: Complete with clamps, inserts, etc.

SUPERSTRUT	UNISTRUT	TOLCO	B-LINE	OR EQUAL

2.22 P-TRAPS

A. Schedule Numbers:

PT-1: Cast brass complete, chrome-plated.

KEENEY	AB&A		OR EQUAL
305CPBNDF	107		

2.23 PRESSURE REGULATING VALVE ASSEMBLIES

A. Schedule Numbers:

PRV-1: Furnish for sizes ½-inch to 2-inch water service, all bronze body, stainless steel seat, bronze strainer, calibrated springs, and corrosion resistant, adjustable control.

WILKINS	WATTS	OR EQUAL
500XL- YSBR-HLR	LF223S-B-HP	

PRV-2: Furnish for sizes 2 ½-inch and larger: Automatic (pressure) control valve-pilot controlled and diaphragm actuated pressure control valve, straight or angle pattern, flanged inlet and outlet connection, fusion bonded epoxy coated inside and out with stainless steel cover, stainless steel pilot, stainless steel bolts and nuts, and stainless steel flexible tubing in a compact configuration, vandal resistant bolt-on pilot controller, ¼ ball valve on all pilot control lines, and stainless steel internal parts.

WATTS	CLA-VAL	OR EQUAL
LFM115	90-01	

PRV-3: Furnish for sizes 1 ½-inch and larger; air service, Japanned steel, spring loaded, brass forging body, nylon reinforced neoprene diaphragm, inlet pressure up to 250 pounds, reduced pressure 5 pounds to 60 pounds.

MEIDAN- MASON	SCHRADE	MASTER PNEUMATIC	OR EQUAL
71 ½-inch	3464, ½ inch 3466, 3/4-inch	VANGUARD R200	

PRV-4: Furnish for gas service, spring-loaded model, Buna N rubber composition or leather valve seat disc and diaphragm, inlet pressure 125 pound maximum.

REPLANCE	FISHER	SENSUS	OR EQUAL
1813C	S-100. 166-1, S-201, 166-2	121	

2.24 ROOF DRAINS

A. Schedule Numbers:

RD-1: Low profile dura-coat cast iron body dome strainer type.

SMITH	ZURN	WATTS	MIFAB	JOSAM	OR EQUAL
1010Y-ERC-CID	Z-100-ERC-M	RD-300-F-D-K40	R1200-EU-M	21500-22	

RD-1A:

SMITH	ZURN	WATTS	MIFAB	JOSAM	OR EQUAL
1010Y-R-C-CID	Z100-89-RC-M	RD-300-D-K40	R1200-M-B-U	21500-17-22	

RD-2: Cast iron body with standpipe. (Specify for use as overflow.)

SMITH	ZURN	WATTS	MIFAB	JOSAM	OR EQUAL
1080Y-ERC-CID	Z-100-89-ERC-M	RD-300-R-F-B-D-M	R1200-R-EU-M	21500-3-16-22	

RD-2A:

SMITH	ZURN	WATTS	MIFAB	JOSAM	OR EQUAL
1080Y-R-C-CID	Z100-89-RC-M	RD-300-R-B-D-M	R1200-R-M-B-U	21500-3-17-22	

Shower Valve, Hose and Spray	ZURN Z7100 Valve Z7000 Hand-Shower	POWERS 450-7054 E700	SYMMONS S-96-500-4-141-H321	OR EQUAL

SA-4: Shower control valve requirements for Hose and Spray:

a. Vacuum breaker: Exposed or concealed piping.

Exposed piping	Concealed Piping	T&S BRASS	OR EQUAL
CHCAGO 892-GABCP	ZURN Z-80000-EVB	B-0929-A	

b. Wall spout: Wall spout with ½ inch female i.p.s. flange inlet and ½ inch male i.p.s. Outlet, chrome-plated.

CHICAGO	ZURN	T&S BRASS	OR EQUAL
892-ABCP	80000-SE	B-0968	

c. Hose and Bar: 5-foot long reinforced white vinyl hose with 24-inch adjustable bar with hand shower slide bracket, chrome plated.

d. Hand shower: Insulated handle with central lever stop valve, bent nozzle tube; rubber bound hose spray adapted for ½-inches hose connection.

SYMMONS	BRADLEY	ZURN	OR EQUAL
H 321	B 24	Z 7000-HW	

e. Diverter Valve: Transfer flow between showerhead and hand held shower.

ACRON	BRADLEY	SYMMONS	OR EQUAL
DV	DV	4-458	

f. Tempering Valve: The temperature range between 100 and 150 degrees Fahrenheit shall be background in red or red line enclosed. Valve shall be complete with fail safe feature, square shank loose key stops, checks and strainers on both hot and cold water inlets and shut-off valve on outlet to protect from scalding.

POWERS	LEONARD	LAWLER	OR EQUAL
Single Valve Hi-Lo			

2.25 SERVICE SINKS and TRIM

A. Schedule Numbers:

SS-2: Cast Iron corner service sink, conforming to Commercial Standard CS 77.63 for acid-resistant enamel, 28-inch by 28-inch, coated wire rim guard, 2-inch flat strainer and rough-plated double faucet with top brace mounted above sink back, furnished with vacuum breaker and hose end.

(To be specified for use in Custodial Rooms.)

	CECO	American Standard	KOHLER	CHICAGO	ZURN OR EQUAL
Sink	871		K-6710		Z5850-D3

Faucet	F-1 (See Section 2.13 – Faucets)	F-1	F-1	F-1	F-1
Rim Guard	B-872		K-8940		RG
Strainer	B-71-2		K-9142		D-3

2.26 SINKS and TRIM

For classrooms, offices and dining room sinks.

A. Access compliant faucets for sinks: Force to activate controls shall be no greater than 5 pounds. where specified self closing metering to remain open 10 seconds minimum when activated.

B. Cast iron sinks shall be acid resistant enamel, and shall conform to Commercial Standards CS 77.63. Units furnished in conjunction with strainer installation or faucet installation shall be brass. Exposed brass nuts shall be chrome-plated. Refer to the Fixture Supplies paragraph of this section.

C. Exposed trim shall be free from sharp edges or points. Fixture shall be furnished with other listed manufacturer specified trim. Instead of solid supply pipe, polished chrome-plated risers, 3/8-inches outside diameter with ferrule stop end and metal nosepiece may be furnished.

D. For access compliant sinks: Insulate cold water, hot water and drain pipes under sinks with district approved type insulation.

PLUMEREX	LAV GUARD	OR EQUAL

E. Schedule Numbers:

ST-1: Stainless steel, 31-inch by 19-inch **(Designer to select and specify the size)** or as indicated on drawings, with flat rim and corner outlet. Single compartment, with flat strainer, cold deck mounted faucet.

(To be specified for use in Administration Offices, Conference Rooms, Teacher Workrooms, Faculty Lounge, Library and Kiln Room.)

	KOHLER	JUST MAN.	CECO	HAWS	OR EQUAL
Sink		CRA-ADA-1931-A-GR	720C, 720G, 720I		

Faucet	F-16	F-16	F-16	F-16	
Strainer		J-35-SSF			

ST-2: Stainless steel, 31-inch by 19-inch **(Designer to select and specify the size)** or as indicated on drawings, with flat rim and corner outlet. Single compartment, with flat strainer, hot and cold deck mounted faucet.

(To be specified for use in Administration Offices, Conference Rooms, Teacher Workrooms, Faculty Lounge, Library and Kiln Room.)

	KOHLER	JUST MAN.	CECO	HAWS	OR EQUAL
Sink		CRA-ADA-1931-A-GR	720C, 720G, 720I		
Faucet	F-21	F-21	F-21	F-21	
Strainer		J-35-SSF			

ST-3: Epoxy resin, 24-inch by 18-inch or 25-inch by 15-inch **(Designer to select and specify the size)** or as indicated on drawings, with flat rim and corner outlet. Single compartment, with flat strainer, cold deck mounted faucet.

(To be specified for use in Classroom, Art Classroom and Science Classroom.)

	KOHLER	DURCON	CECO	HAWS	OR EQUAL
Sink		D52,A56			
Faucet	F-16	F-16	F-16	F-16	
Strainer					

ST-4: Epoxy resin, 25-inch by 15-inch **(Designer to select and specify the size)** or as indicated on drawings, with flat rim and corner outlet. Single compartment, with flat strainer, Hot & cold deck mounted faucet.

(To be specified for use in Classroom, Art Classroom and Science Classroom.)

	KOHLER	DURCON	CECO	HAWS	OR EQUAL
Sink		A56			
Faucet	F-10	F-10	F-10	F-10	
Strainer					

2.27 SEWAGE EJECTORS

A. Schedule Numbers:

SE-1: Duplex, (unless otherwise indicated) screen-less sewage ejector with two pumps and motors mounted on cover-plate and cover-plate shall be gas tight; furnished with automatic alternator, high water alarm, micro switch liquid level controller starters, fused disconnect switches and factory wired. Sump pit concrete is as specified in a related section.

WEIL PUMP CO.	PACIFIC PUMP CO.	Mc COOK PUMP CO.	HYDROMATIC PUMP	OR EQUAL

2. Motors: Drip-proof with electrical characteristics as scheduled on Drawings.

3. Controls: Weil Model 8230, or equal, mercury float switches, UL listed, two switches for high water alarms with cover mounting brackets. Control panels shall be NEMA 1, UL listed, and each contain following:

   a. Two cross-the-line magnetic starters.

   b. Two fusible disconnect switches.

   c. Two HOA switches.

   d. Two running lights.

   e. One 480/220 volt control circuit transformer.

   f. One high water alarm relay.

   g. One alternator.

   h. One NEMA 1, 4-inch diameter alarm bell for mounting on control panel.

4. Basin Covers: Heavy steel covers, sizes as scheduled on drawings. Covers shall be duplex type with openings for pumps, manholes, and vent openings. Parts shall be gas-tight.

SUMP PUMP

A. Schedule Numbers:

SP-1: Duplex, centrifugal open type impeller and motor mounted cover plated, furnished complete with high water alarm, automatic alternator, float switch, enamel control panel, with starters, disconnect switches, pilot lights, factory wired, sump pit shall be concrete **(or fiberglass)** as specified in a related section.

WEIL PUMP CO.	PACIFIC PUMPING CO	Mc COOK PUMP CO.	HYDROMATIC PUMP	OR EQUAL
1600 Series				

2.28 STOP VALVES

A. Stops shall be loose key type, ½-inches IPS inlet and outlet chrome-plated brass casting, except as noted.

B. Schedule Numbers:

STV-1: Angle:

CHICAGO,	BRASSCRAFT	NIBCO	OR EQUAL
442-LKABCP		77	

STV-2: Partition:

CHICAGO	T& S BRASS	OR EQUAL
1771-ABCP	B-1028	

STV-3: Straight Type, with Loose Key:

CHICAGO	BRASSCRAFT	T&S BRASS	OR EQUAL
45-LKABCP (1/2 inch)		B-O418	

2.29 THERMOSTATIC MIXING VALVE ASSEMBLIES (TMVA)

A. General: Valve bodies shall be cast brass or bronze valve assembly provided with holding bracket and shall be installed on wall bracket. Valve shall be rough brass or bronze satin sprayed finish unless otherwise noted. Assembly shall include a 3 5/8-inch diameter dial thermometer, color-coded with white face and black letters. The temperature range between 100 degrees F. and l50 degrees F. shall be background in red or red line enclosed. Valve complete with fail safe feature, square shank loose key stops, checks and strainers on both hot and cold-water inlets and shutoff valve on outlet. Valves shall be sized on a 45 psig (maximum) pressure drop at the following flow rates:

TMVA-1: 5 to 15 GPM.

TMVA-2: 25 GPM.

TMVA-3: 40 GPM.

TMVA-4: 60 GPM.

TMVA-5: 80 GPM.

TMVA-6: 100 GPM.

TMVA-7: 125 GPM.

TMVA-8: 200 GPM.

B. Manufacturers:

POWERS	T & S	LEONARD	BRADLEY	WATTS	OR EQUAL
Type 430 Series Single Valve Hi-Lo (1430 series)	Ultra-Safe	Type TM	Navigator Series High/Low	LFMMV	

2.30 TRAP PRIMERS

A. Schedule Numbers:

ATP-1: Automatic, multi-trap primer, cast bronze with access panel. Pressure drop of three p.s.i. shall activate trap seal primers. Manufactured by MIFAB, or equal. (Installed in accessible location.)

PRECISION PLUMBING	OR EQUAL
PR-500	

2.31 URINALS

NOTES:

1. Use of non-water urinals requires District approval.

2. Provide water distribution and fixture supply piping sized to accommodate potential future conversions of non-water urinals to standard flush urinals. The

supply shall be stubbed out of wall with a chrome brass flange and a chrome brass I.P.S. cap. For new construction projects only.

A. Schedule Numbers:

U-1: Non-water urinal. Wall-hung vitreous china with replaceable trap cartridge or integral liquid seal trap, provided with a biodegradable liquid seal in compliance with the California Building Code and maintains a sanitary and odor-free environment. Furnish complete with hanger brackets, fasteners, gaskets and drain line connections.

WATERLESS	ZURN	FALCON/ SLOAN	KOHLER*	ZERO FLUSH	OR EQUAL
YUKON 2101	Z5795	F1000/ WES-100	K-4919	ZF101	

* Not for kindergarten application

1. Fixtures shall comply with the following requirements:

   a. Current versions of ASME A112.19.19, standard for Vitreous China Non-Water Urinals and/or IAPMO IGC 161.

   b. Shall meet performance, testing, and labeling requirements for American National Standards Institute (ANSI).

   c. Non-water urinals shall hold a current certificate of listing with IAPMO, and shall bear the C/IAPMO triangular certification and shall be manufactured in compliance with current IAPMO IGC 161.

2. Trap shall permit the uninhibited flow of waste through the Urinal to the sanitary drainage system.

3. Manufacturers must have a current Los Angeles Unified School District Office of Environmental Health and Safety MSDS approval prior to submittal. The following chemical compounds are currently approved:

   a. Falcon Waterfree Sealant.

   b. Waterless Co. Blue Seal Liquid.

   c. Zurn Aqua Green Sealant.

   d. Kohler Waterless Urinal Sealing Liquid.

   e. Zero Flush Odor Barrier Liquid.

4. Urinals shall at time of school opening be serviced by replacing with an entirely new cartridge and liquid sealant, for units with removable cartridges. All urinals with built in traps shall be rinsed out and liquid sealant replaced.

5. Provide the following replacement quantity based on manufacturer's annual maintenance requirements for each urinal fixture installed:

   a. Falcon Waterfree, four cartridges with liquid trap sealant.

   b. Waterless Co., four cartridges and 78 ounces of liquid trap sealant.

   c. Zurn Waterless, 36 ounces of liquid trap sealant.

   d. Zero Flush, two drain inserts and 24 ounces of liquid trap sealant.

   e. Kohler Waterless, 78 ounces of liquid trap sealant.

6. Training shall consist of two hours of manufacturer certified training for all site-based operations personnel prior to school occupancy. Certificates shall be issued for all personnel who attend the original training session. The plant manager shall be certified as a trainer by the manufacturer. Provide two video tape copies of the original training session.

7. Provide a manufactured supplied "non-water urinal" descriptive placard at each urinal. Mounting heights shall be 48-inch for standard urinals and 42-inch for access compliant urinals.

8. Provide chrome brass flange and chrome brass I.P.S. cap to each urinal water supply line.

9. Provide accessible clean-out above each urinal.

U-2: Same as U-1 with fixture roughed-in at access compliant height.

U-3: Low flush urinal, 1/8 gallon. Wall-hung vitreous china, furnish complete with hanger brackets, fasteners, gaskets and ¾-inch top spud.

A. Bowl:

KOHLER	SLOAN	ZURN	OR EQUAL
K-5452-ET	SU-1009-STG	Z5755-U	

B. Auto-flush valve (battery): FLV-2

C. Manual-flush valve: FLV-2a

U-4: Same as U-3 with fixture roughed-in at access compliant height.

2.32 WATER CLOSETS

A. General: Water closets shall be vitreous china with Polyvinyl chloride bolt caps. Fixtures with auto-flush valves shall be provided with manual override button.

B. Schedule Numbers:

WC-1: Wall hung, 15 to 17 inches height to top of seat for secondary school students and adult use, with flush valve at 1.28 gallons per flush and open front fire retardant white seats.

(To be specified for non-accessible use for Secondary School students and adults use)

a. Bowl:

AMERICAN STANDARD	KOHLER	SLOAN	ZURN	OR EQUAL
3451.001	K-4325	ST-2009	Z5655-BWL1	

b. Manual-flush valve: FLV-1a

c. Seat: White, ring thickness including bumpers shall be one inch.

OLSONITE	BEMIS	CENTOCO	OR EQUAL
10SSCTFR	1955CT	AMFR500STSCCSS	

2.33 WATER TEMPERATURE CONTROLLERS

A. Schedule Numbers:

WTC-1: Remote bulb type, plain steel case, baked enamel finish, glass fronted cover, mercury to mercury switch. 80 degrees F. to 240 degrees F. range of not more than 10 degrees F. differential.

MERCOID	HONEYWELL	JOHNSON CONTROLS	OR EQUAL
DA-4-35	T675A1540	A19 SERIES	

WTC-2: Immersion type, black hard steel case, separate well type, outside adjustment, temperature range 40 degrees to 180 degrees F. range of not more than 10 degrees F. differential.

HONEYWELL	PENN	JOHNSON CONTROLS	OR EQUAL

T-6031D 1007	A19ABC-11	A19 SERIES	

2.34 WATER HEATERS / Domestic / Boilers

A. Gas fired water heaters shall meet the Flammable Vapors Ignition Resistance requirements (FVIR).

B. Gas and electric water heaters must meet NAECA energy efficiency requirements. Exceptions: Table top and point of use models (electric) less than 20 gallons. In capacity and gas models over 75,000 BTUH.

C. Water heaters from 75,000 BTU/hr to Boilers 2,000,000 BTU/hr shall comply with rule 1146.2 “Emission of Nitrogen from large water heaters and small boilers”. Natural gas fired water heaters with heat input rates less than 75,000 Btu/hr shall comply with rule 1121.

D. Schedule Numbers:

WH-1: Storage type water heaters shall be provided with a five year unconditional guarantee on tank heater and working parts. Complete guarantee for each heater shall be delivered to the Owner.

a. Heater shall be furnished complete with baked enamel jacket, double density insulation, heating device, energy saver thermostat, drain valve is to be a ball valve with a plug in one end, and appurtenances necessary for satisfactory operation. Proper label of approval and manufacturer name, model number, size in gallons, and rated capacity shall be permanently secured to jacket.

b. Heater shall be furnished with a combination pressure temperature relief valve, installed in water heater tank.

c. Heaters, gas and electric, shall be certified by the California Energy Commission.

d. Floor-mounted heaters shall be on legs that are part of heater. Each heater shall be securely strapped to structure (with 2 straps per code).

e. Electric water heaters shall be UL tested, approved and listed. Heaters shall be furnished complete with baked enamel jacket, glass fiber insulation, heating element, double break snap acting thermostat, drain valve and appurtenances required for operation. Electric heaters shall be factory wired

ready for connection to electrical source. Install a gate valve on inlet side and union on both inlet and outlet sides of heaters and combination pressure-temperature relief valve on discharge side. Flexible water piping connectors shall not be used.

f. Water heaters shall be of sizes indicated on Drawings and shall be furnished with equipment necessary to provide a complete and satisfactory piece of equipment.

g. Submit a complete list of boiler controls and appurtenances with wiring diagram, giving manufacturer's name, model number and, when applicable, size of each piece of equipment or appurtenance to be installed.

h. Pilot lines, gas valves, relays and their wiring shall be located outside boiler jacket to protect them from ambient temperature within. Flame safeguard relay shall be mounted on a control panel attached to wall at location indicated or as directed. All other controls and manual operators shall be so located as to be readily accessible when the boiler is in the installed position.

i. Wiring of water pump control circuit and line voltage supply to control panel is part of the Work of Division 23. All other wiring in connection with boilers is a part of the Work of this section. Wiring between boiler and wall-mounted control panel shall be installed 7 feet or more above floor level.

j. Gas-fired, storage type, size indicated on Drawings, with draft diverter and energy cut-off devices. Gas supply connections supplying less than 100,000 BTUs shall be with UL listed corrugated flexible appliance connector, and comply with ANSI Z21.24/CSA 6.10, Connectors for Gas Appliances. Connections supplying 100,000 BTUs and over shall be solid pipe. Heater shall be seismically secured with an approved restraint. HOLDRITE QS-50, QS-120.

Model No. as indicated on drawings or equal by:

AMERICAN	BOCK	RHEEM	A.O. SMITH	BRADFORD WHITE	OR EQUAL
			BTH-300A		

WH-2: Commercial, high recovery, greater than 80 percent thermal efficiency.

WH-3 Water Heater, Package Water Tube, Gas-Fired Type:

a. Complete packaged unit furnished with heater, burner, pre-cast firebox, insulation, steel jacket enamel both sides, trim and control factory wired. This gas-fired water tube heater shall be constructed in accordance with the ASME

Code for 125 psi working pressure and bear appropriate seal. Heater shall be AGA approved and stamped for natural gas at 80 percent efficiency.

b. Heater shall be of inclined or straight tube design for high velocity water flow with not greater than one inch outside diameter hard drawn copper tubes of minimum 13 gage thickness. Heater head plates shall be removable, to provide full access to boiler tubes.

c. Complete heater shall be fire tested at the factory under design load conditions with results certified by an approved testing agency satisfactory to the AOR.

d. Heater shall be complete with accessories and appurtenances including AGA approved draft diverter, safety, relief valve or valves SRV-4 lever handle gas cock on main gas line FGV-8, gas pressure regulator PRV-4 set for 4-inch water column, automatic 24 volt gas valve FGV-1, a lever handle gas cock FGV-8 and pressure regulator PRV-4 set for 4-inch water column on pilot line; safety pilot assembly BTPA-1 or BTPA-2 (heaters over 150,000 BTU per hour), operating temperature controller OTC-1; high limit temperature controller HTC-1; control transformer Cont-1; 2 thermometers T-1. Refer to Section 23 5000: Heat Generation Equipment, for above accessories.

LAARS	AJAX	RAYPACK	A.O. SMITH	LOCHINVAR OR EQUAL

WH-4: Electrical, storage type, size as indicated on Drawings. Tank shall be constructed of galvanized copper-bearing steel and shall be tested at 300 lb. hydraulic pressure. Heater shall be factory wired ready for connection to electrical source. Snap acting thermostat shall be double pole type. Heater label shall be labeled UL approval and electric input rating. Heater shall be seismically secured and shall not be floor-mounted.

RUUD	A.O. SMITH	AMERICAN	OR EQUAL
EGSP	ELJF – 6S	LDCE31-06U	
	DEL-6	LDCE31-12U	

WH-5: Tank-less instantaneous electric water heaters: Comply with UL 499 for tank-less electric (water heater) heating appliance. Comply with ANSI/NSF 372. Provide a five-year limited leak warranty, covering one year of replacement parts. Electric tank-less water heater shall have a maximum operating pressure of 150 PSI. Heater shall be furnished complete with a UL rated cover with manufacturer name and model number permanently secured to the unit. Heating element shall be a replaceable

cartridge insert. Unit must turn on at a minimum flow of 0.25 gpm. Provide isolation valves before and after water heater. Provide external or internal thermostatic mixing valve. Provide separate electrical power circuit breaker.

Eemax	OR EQUAL

2.35 WATER HAMMER ARRESTORS

WHA-1: Lead Free Water Hammer Arrestor provided for Headers for Lavatories, Wash Sinks, Wash Fountains, Kitchen Sinks, Service Sinks, Urinals and Water Closets. For sizing purposes size according to manufacturer's recommendations.

SIOUX CHIEF	PPP	JR SMITH	WATTS	JOSAM	OR EQUAL
655 and 656 SERIES	SC SERIES	5005 TO 5050 SERIES	Series LF05 and LF15M2	75000	

2.36 WATER TANKS, HOT – UNFIRED

A. Schedule Numbers:

WT-1 Unfired Hot Water Storage Tanks: All welded 1/2 inch thick hot rolled carbon steel plate construction conforming to requirements of ASME Code for Unfired Pressure Vessels (Section VIII of ASME Boiler and Pressure Vessel Code). Tank designed for a working pressure of 125 psig and temperature of 150 degrees F.; tested and coded stamped. Connections shall be 3,000 psi welded extra heavy couplings. Flanged coupling may be furnished on 3 inches or larger connections.

ACE BUEHLER	RAYPAK	A.O. SMITH	OR EQUAL
	LOCHINVAR	BRADFORD/WHITE	

WT-2 Steam-Heated Hot Water Storage Tanks: Same as WT-1, but with addition of heating elements. Heating elements of seamless drawn copper tubing (3/4 inch outside diameter or 1 ¼-inch outside diameter).

ACE BUEHLER	RAYPAK	A.O. SMITH	OR EQUAL

WT-1L: Same as WT-1, but thickness as required by ASME Code for size specified; furnished with not less than 5/8 inch silicon material lining. Lining shall extend into openings so no ferrous metal remains uncovered. Lining shall be guaranteed in writing for a period of 5 years.

WT-2L: Same as WT-2, except lining same as for WT-1L.

2.37 YARD BOXES

A. Schedule Numbers:

YB-2: Same as YB-1, marked "WATER" **(For use over water valves)**.

BROOKS No. 36-HFL Assembly with cast iron hinged locking cover	OR EQUAL

YB-3: Same as YB-1, marked "SEWER"

BROOKS No. 36-HFL Assembly with cast iron hinged locking cover	OR EQUAL

2.38 FIXTURE CONNECTIONS

Fixture	Copper, Cold (Inches)	Copper, Hot (Inches)	Trap and Connections (Inches)	Soil/ Waste (Inches)	Vent (Inches)
WC Flush Valve	1	N/A	4	4	2
Lavatories	1/2	1/2	1-1/2 by 1-1/4	2	1-1/2
Service Sink	1/2	1/2	2	2	1-1/2
Kitchen Sink	1/2	1/2	1-1/2 by 1-1/2	2	1-1/2
Classroom Sink	3/8	3/8	1-1/2 by 1-1/2	2	1-1/2
Wash Sink	3/4	1/2	1-1/2 by 1-1/2	2	1-1/2
Multiple Drinking Fountains	3/8	N/A	1-1/2 by 1-1/2	2	1-1/2
Single Drinking Fountains	3/8	N/A	1-1/2	2	1-1/2
Individual Showers	1/2	1/2	2	2	2
Standard Urinals, Wall-Hung Flush Valve:	3/4	N/A	N/A	2	1-1/2
Access Compliant Urinals, Wall-Hung Flush Valve:	1	N/A	N/A	2	1-1/2
Sillcocks	3/4 minimum	N/A	N/A	N/A	N/A

A. Branches to individual fixtures shall be of the following sizes (Inches) unless larger sizes are indicated on Drawings:

B. Water headers serving water closets shall be copper water tube, with following size throughout length:

1. 1-1/2 inches for 2 flush valves.

2. 2 inches for 3 to 9 flush valves.

C. Water headers serving urinals shall be of following size throughout length:

1. 1” for 1 or 2 flush valves.

2. 1-1/4” for 3 flush valves.

3. 1-1/2” for 4 to 8 flush valves.

D. Water headers serving showers shall be same as listed above for urinals.

E. Water headers serving lavatories shall be of following size throughout length:

1. 1/2 inch for 2 lavatories.

2. 3/4 inch for 3 and 4 lavatories.

3. One inch for 5 and 6 lavatories.

F. Refer to 2.02.E for fixture supplies.

2.39 HEIGHT OF FIXTURES

A. Heights for standard fixtures.

Fixture	Adult and High School (Inches)	Secondary (Inches)	Elementary (Inches)	Kindergarten and Younger (Inches)
Toilets, height to top of seat	15 to 17	15 to 17	15	11 to 12
Lavatories, sink top height	32	32	30	25
Drinking Fountains, bubbler height.	38 to 43	40	32	30
Wash Sinks	30	30	28	24
Urinals, lip height	24	21	18	N/A
Shower Heads Male (Student and Instructor) From tip of shower head to finish floor.	72	60		
Shower Heads Female (Student and Instructor) From tip of shower head to finish floor.	72	60		
Shower valves	48	48		

C. Heights for access compliant fixtures.

Fixture	Adult Ages 12 and Over (Inches)	Elementary Ages 6 to 11 (Inches)	Kindergarten and Younger Ages 3 to 5 (Inches)
Toilets, center line from wall	17 to18	15	12
Toilets, height to top of seat	17 to 19	15	11 to 12
Lavatories, sink top height	34 maximum	29 maximum	24 maximum
Lavatories, sink knee clearance	27 minimum	24 minimum	19 minimum
Urinals, lip height	17 maximum	15 maximum	13 minimum
Urinals, flush handle height	44 maximum	37 maximum	32 maximum
Drinking fountains, bubbler height.	36 maximum	32 maximum	30 maximum
Drinking fountains, knee clearance	27 minimum	24 minimum	22 minimum
Wash Sink	Per Drawings		
Shower Valves	Per CBC		
Shower Seat	Per CBC	Per CBC	Per CBC
Shower Head (adjustable) Bar	Per CBC		

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions under which Work of this section will be performed. Correct conditions detrimental to proper and timely completion of Work. Do not proceed until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General:

1. Unless otherwise specified, plumbing fixtures, equipment and appliances that require connections to plumbing line shall be connected. This shall include fixtures specified or indicated as furnished by others, furnished by Owner, or specified in other related sections. Install supplies, stops, valves, traps, wall flanges, or pipe casing for connection of this equipment.

2. Install equipment as indicated on reviewed and accepted Shop Drawings.

3. Avoid interference with Work of other trades. Do not deviate from Drawings without review of the Architect.

B. Examination: Check each piece of equipment in system for defects verifying that parts are properly furnished and installed.

C. For piping Work, refer to Section 22 0513: Basic Plumbing Materials and Methods.

D. Plumbing Fixture and Equipment Installation:

1. Unless otherwise indicated, fixtures shall be installed with 5/16 inch brass bolts or screws of sufficient length to securely fasten fixture to backing, wall, or closet ring.

2. Fixtures installed against concrete or masonry walls shall have their hangers fastened with 5/16 inch brass bolts, Philip Shield type anchors, or 2 unit cinch anchors. Wood or plastic plugs are not permitted.

3. Fixtures installed against wood or metal stud walls shall have their hangers fastened to metal backing plates with 5/16 inch brass bolts screwed into plate. Fixture hangers for urinals shall be fastened centered vertically on metal backing plate with three 5/16 brass bolts each for small individual hangers and six, for larger one piece hangers. Lavatories shall be hung with not less than four 5/16 inch brass bolts or not less than five 1/4 inch brass bolts. Each sink hanger shall be hung with not less than four 5/16 inch brass bolt or not less than five 1/4 inch brass bolts.

4. Pan type drinking fountains shall be hung with 5/16 inch cadmium plated bolts with a bolt in each bolt opening in hanger. Hangers for pan type drinking fountains shall provide 2 inches (plus or minus 1/4 inch) between pan and wall. Spaces due to irregularities between fixtures and tile walls shall be neatly filled with white cement or silicone filler.

5. Backing for hanging of plumbing fixtures and equipment shall be installed in supporting wall at time rough piping is installed. Backing for stud walls shall be steel plate 1/4 inch thick, not less than 4 inches wide. Backing for urinals shall be ¼-inches thick by 6-inch wide steel plate. Steel plate shall be attached to stud at each end of plate and to each stud it crosses. Plate shall be attached to metal studs by bolting with two ¼ inch U-bolts per stud with bolts through plate and around stud flange or by welding with a 1/8 inch fillet weld full width of stud flange, top and bottom of plate. At wood studs, plate shall be carefully recessed flush with face of stud and attached to each stud with 2 No. 14 flat-head wood screws, 2 inches in length into pre-drilled 1/8 inch holes. Backing for stud walls supporting wall-hung closets shall be as detailed.

6. Rough-in for fixtures, equipment and appliances shall be as indicated on Drawings and as specified, including those items indicated as furnished by others, furnished by Owner, or future capacity. When connections to equipment from capped or plugged lines are required, caps or plugs shall be removed at time equipment is set and stops or valves installed and connections provided as specified.

7. Piping materials for trap arms shall be Brass, Cast Iron or DWV copper

8. Piping shall be stubbed out to exact location of fixtures and stubs shall be installed symmetrical with fixtures. Hot and cold water supplies for center set faucets on lavatories shall be installed on 8-inch centers, unless otherwise specified or required.

9. Kitchen equipment requiring backflow protection with hot and cold water connections shall be installed with approved backflow prevention assemblies; BPV-3 and drain into floor sink with air gap.

E. Cleanouts in Drain, Waste, Vent and Sewer Lines:

1. Cleanouts shall be installed at locations stated in the California Plumbing Code and accessible at following locations:

a. At locations above first floor as stated on construction documents and 5 feet outside of the building.

b Install an accessible main line upper terminal cleanout in all restrooms above water closet over flow. (Install above upper

terminal water closet where there are more than one water closet in a restroom).

c. Above faucets of each sink with brass plug.

d Above service sink with brass plug.

e. At each Drinking Fountain with brass plug.

f. At each urinal and locate above urinal with brass plug.

g. Above overflow level of pot sinks with brass plug.

h. In vertical line at base of each downspout connected to an underground storm drain system extend cleanout to exterior of building.

i. At upper end of a horizontal vent line when any part of horizontal line is below overflow level of fixture it serves.

j. Not to exceed 100-foot intervals in sewer and waste lines exterior of building.

k. At property line connection.

l. Where indicated on Drawings.

2. Cleanouts shall be extended to grade as follows:

a. Not to exceed 100-foot intervals in straight runs of pipe outside buildings.

b. At horizontal changes of direction in aggregate greater than 135 degrees (underground).

c. At property lines.

d. Where cleanouts occur under concrete.

e. Where marked for future connections.

3. Cleanouts in building shall be extended to floor level or above floor level or above floor level in walls or furring when cleanouts are not accessible or where clearance is less than 18 inches.

4. Cleanouts in finished areas in building shall be concealed except that cleanouts above service sinks in janitor's rooms or closet, and cleanouts above service sinks or in exposed piping in boiler or heater equipment rooms, may be exposed. Cleanouts for urinals shall be installed above urinal and shall terminate behind an access plate.

5. Cleanouts in floors of covered areas and those extended to grade in concrete areas shall be floor level type with extensions body brass plugs and detachable nickel-bronze or aluminum alloy scoriated.

6. Concealed cleanouts in vertical lines shall be service weight soil cleanout tees with brass plugs and round cover plates unless otherwise specified or indicated. A snug fitting sleeve of galvanized sheet metal shall be placed around hub of tee and shall extend to flush with finished soil, or cleanout shall be extended to finished wall.

7. Cleanouts extended from below floor to a wall or furring or on horizontal lines above floor that terminate at a wall or furring shall be iron body type with brass plugs and round cover plates.

8. Cover plates over cleanouts in painted walls shall be steel, bonderized and prime coated. Cover plates cover cleanouts in tile walls shall be chromium-plated brass or nickel bronze. Plates shall be attached to cleanout plugs with 5/16 inch No. 18 or 1/4 inch No. 20 stainless steel vandal-proof type screws. Plates shall be one inch larger in diameter than fitting opening.

9. Cleanouts at bases of downspouts shall be tapped soil tees with brass plugs as hereinafter specified, full size of line.

10. Cleanouts extended to grade in exterior sewer lines other than floors or concrete areas shall be a cleanout assembly with secured top, extra heavy-duty, adjustable sleeve, cut-off ferrule, countersunk threaded brass plug and scoriated tractor type cover.

11. Other cleanouts shall be iron body type.

12. Cleanout extensions shall be no-hub cast iron soil pipe. Exterior cleanouts, those in concrete excepted, shall terminate in a 14-inch by 6-inch thick concrete block with cleanout assembly and top of block flush with finish grade.

13. Fittings in lines utilized as cleanouts shall be approved soil fittings including no-hub pipe. Tees and crosses in vent headers excepted.

14. Pipe joint compound shall not be installed on cleanout plug. After lines are tested and approved, each cleanout plug shall be removed, greased, and replaced.

3.03 EXCAVATION, TRENCHING AND BACKFILLING

A. Perform trenching, excavation, and backfilling required for Work of this section as specified herein and in Section 31 2323: Excavating, Backfilling, and Compacting for Utilities.

3.04 SERVICE CONNECTIONS

A. Determine exact location of required water, drain, and sewer connections and provide proper connections.

B. Potable water lines shall be purged completely before connecting to sources of water for the Project. Determine quality of water supply before connection.

3.05 WATER HAMMER ARRESTORS

A. Install water hammer arrestors indicated on Drawings and in following locations (only non-ferrous arrestors may be installed in copper water system):

1. Water lines to lavatory headers, water closet and urinal headers, service sinks, kitchen sinks, wash fountains, drinking fountains, laboratories with medical type faucets and on wash sinks having three or more stations and all other quick closing fixture such as clothes washers, as close to fixture as possible.

2. Between last two fixtures when three or more fixtures, other than those listed in Number 1 above, are served by a common header.

B. When possible, arrestor shall be installed in wall or furring. When arrestor is installed in wall or furring, furnish an access plate large enough to permit removal of arrestor. Access plate shall be a minimum of 2 inches larger in each direction than the arrestor.

C. Fixture water lines shall be provided with mechanical water arrestor hammer dampening devices. Air chambers are not approved.

3.06 CONDENSATE DRAINS - FROM AIR CONDITIONING UNITS

A. Connect drain piping from drain pan of air conditioning unit to condensate disposal location indicated. When coil or unit housing is shock or vibration isolated, connection shall be furnished through a flexible connector not less than 10 inches

long. Drain line shall pitch to flow out at not less than one inch in 8 feet. Drain line shall not be reduced smaller than unit outlet connection.

B. Condensate drain piping installed within building whether in air conditioned space or not shall be insulated. Refer to Section 22 0700: Plumbing Insulation, for type of material required.

C. Condensate Trap:

1. A condensate trap shall be installed for each air conditioning coil. Trap shall be assembled from 2 brass unions: one between A/C unit and inlet of trap, and one at outlet of trap that connects to main drain.

2. Trap configuration shall be per manufacturer's recommendations based on total unit casting static pressure (simulated plugged filter condition), but not less than 3 inch water seal.

3. Running trap design is not permitted.

4. Secondary drain shall not be trapped.

D. Condensate trap shall be checked at equipment operational tests for proper water drainage flow from air conditioning unit. Cooling condensate pan shall be filled with water, filters covered with plastic (plugged filter simulated), unit panels replaced, and unit motor running at design condition. Pan shall drain without hesitation to bottom of inlet connection. Tests are made prior to installation of ceiling.

E. Secondary Overflow Drain:

1. Drain pan installed underneath air conditioning units in concealed ceiling space or units that incorporate dam fitting shall be furnished with secondary drain piped to outside planter area with outflow location clearly visible.

2 If outside building location is not available or feasible, secondary drains shall be piped to a classroom sink, if sink is not available pipe to a room corner away from cabinets, computers, desks, door ways/entrances or stairs.

3 Secondary vertical pipe that penetrates through suspended ceiling shall be furnished with a coupling or threaded adapter so ceiling tile can be removed without damage.

3.07 MAKE-UP WATER SYSTEMS

A. Provide and connect make-up water systems for equipment in other sections.

3.08 GAS SERVICE

A. Above Grade Service: Pipe shall be steel, hammered, free of dirt and scale, and blown out with oil-free air or nitrogen to a clean, dry condition. Piping shall not be installed in or through a ventilation duct or plenum.

B. Underground Service, Gas approved (yellow) Polyethylene Plastic Pipe: Refer to Section 22 0513: "Basic Plumbing Materials and Methods".

1. Pipes shall be joined with polyethylene fitting and joined together by thermal fusion in accordance with procedures recommended by Polyethylene plastic pipe and fitting manufacturer.

2. Plastic pipe shall be installed not less than 30 inches below grade.

3. Underground Warning Tape shall be installed 12 inches above buried gas piping. Warning tape shall be yellow with caution statement as follows: "CAUTION – BURIED GAS LINE BELOW".

4. Plastic pipe shall not be installed in or under a building or structure. Pipe shall be installed under bituminous surfacing or compacted soil area, free from large stones. Pipe may be installed under sidewalks or driveways, as long as no joint occurs. Pipe installed under paved covered areas wider than 40 feet shall be installed in ventilated conduits extending 2 feet past paving.

5. Pipe shall be installed on a 6 inches deep sand bed. After required pressure-leak test, pipe shall be covered with sand not less than 6 inches thick.

6. Piping shall not support weight of valves, metal fittings or other items. Pipe shall be installed strain free.

7. Plastic pipe fittings shall not be stored or left exposed to sunlight. Pipe in open trenches shall be shielded. A sand envelope of 6 inches minimum shall be placed around pipe, with exception of joints, until inspection by IOR is completed. Protection for pipe shall be provided when necessary to leave pipe exposed overnight.

8. Installer of piping is required to have training and to have attained a certification. Non-trained/Non-certified installer must contact the manufacturer or manufacturer's representative to provide on-site fusion training and certification, prior to work commencement

9. Polyethylene plastic pipe shall connect to a steel epoxy coated anodeless type riser to minimum of 6 inches above grade, when exiting the underground installation and transitioning to steel pipe connection.

10. Where a steel pipe riser passes into a structure or building, a double swing or double-offset joint shall be furnished. Pipe shall pass into structure 6-inches above grade and through a sleeve with a minimum one inch clearance. An isolation valve is required before pipe entering the building.

3.09 CLEANING - PLUMBING PIPING SYSTEMS AND FIXTURES

A. Plumbing lines and fixtures shall be flushed to remove dirt and foreign material until water runs clear and no foreign substance or odor is present. Strainers and screens on faucets shall be removed during this cleaning operation.

B. After satisfactory cleaning of strainer and screen replacements has been witnessed by the Project Inspector, post and maintain signs stating: "CAUTION - Water at this construction project has not yet been certified for human consumption." Signs shall be furnished with letters at least 1/2 inch in height, and shall be conspicuously posted at entrances to the Project site. Signs shall be paneled, black and yellow, in conformance with OSHA Section 1910.1455.

3.10 DISINFECTING DOMESTIC WATER PIPING SYSTEMS

A. Newly installed or replaced piping and/or fixtures dispensing potable water, and any additional piping and/or equipment impacting the integrity of this system shall be disinfected and undergo an approved bacteriological analysis before water system is allowed for public use.

B. Disinfection shall commence upon complete installation of all related domestic water systems including fixtures, valves, faucets, water heating systems, etc.

C. Work shall be performed by Technicians Certified by the American Water Works Association (AWWA) and/or the State of California Department Health Services, Grade II Water Treatment Operator Certification or higher issued by the Department of Health Services (DHS) for the State of California. Comply with Title 22, Code of Regulations Division 4, Chapter 13, and Article 2 Operator Certification Grades.

D. Method:

1. A Physical Separation of minimum 6” or Reduced Pressure Backflow assembly shall be installed to protect from cross contamination of the local water purveyor’s meter service supply when at any time there is any type of water connection with the piping to be disinfected (Chlorinated) and the water meter service supply.

2. Install a Chlorination Port including a T fitting and a shut off valve to the proximity of the point of connection at the new piping system.

3. System is to be flushed to remove any materials that may have entered the system.

4. Using a chemical feed metering pump and a chlorine tank, the chlorine solution is injected into the water system.

E. Disinfection and De-chlorination procedure (24 or 3 Hour Contact Time):

1. 24-hour Test Method:

a. Prior to disinfection, post signs on all water outlets of the system to be disinfected. Sign or tags shall read, "Water System Being Chlorinated- "Danger Do Not Drink Water" or similar warning.

b. Piping system shall then be adequately flushed with water to remove any particles and eliminate air pockets.

c. Using the continuous feed method, sodium hypochlorite conforming to ANSI/ AWWA B300 will be injected into the water system at a minimum of 50 PPM. A water flow meter provided by the water treatment technician will be used to determine the rate of injection and a chlorine test kit, Hach or equivalent, will be used to monitor the residual.

d. Chlorine residual test will be taken at all appropriate points and outlets to verify 50 PPM residual levels.

e. The chlorinated system shall be shut down for any use and the chlorinated water shall remain in the water system for retention of 24 hours.

f. After 24 hours, chlorine residual levels will again be tested at various points throughout the system to insure a minimum of 25 PPM residual. If the system has not met the minimum of a 25 PPM residual, the above disinfection process shall be repeated.

g. After satisfactory completion of the residual testing, flush out system until Hach or equivalent test reveal the water outlets have a free chlorine residual concentration less than 0.5 PPM. The procedure shall be in accordance with the AWWA standard C651-05.

h. The OAR may allow temporary use of the water system for construction purposes pending results of the bacteriological test analysis. Sign or Tags shall be left on all outlets stating water system

is not safe for consumption until laboratory results are complete and meet these specifications.

2. 3 Hour Test Method:

a. If the water systems must be turned on for use as soon as possible, a 3 hours chlorine contact time to allow for disinfection is permitted with the OAR's approval.

b. Prior to disinfection, post signs on all water outlets of the system to be disinfected. Sign or tags shall read, "Water System Being Chlorinated- "Danger Do Not Drink Water" or similar warning.

c. Piping system shall be then adequately flushed with water to remove any particles and eliminate air pockets. Using the continuous feed method, sodium hypochlorite conforming to ANSI/ AWWA B300 will be injected into the water system at a minimum of 200 PPM. A water flow meter provided by the water treatment technician will be used to determine the rate of injection and a chlorine test kit, Hach or equivalent, will be used to monitor the residual.

d. Chlorine residual test will be taken at all appropriate points and outlets to verify 200 PPM levels. The chlorinated system shall be shut down for any use and the chlorinated water shall remain in the water system for retention of 3 hours.

e. After satisfactory completion of a 3 hour disinfection period, flush out system until Hach or equivalent test reveal the water outlets have a free chlorine residual concentration less than 0.5 PPM. The procedure shall be in accordance with the AWWA standard C651-05.

f. The Owner Representative may allow temporary use of the water system for construction purposes pending results of the bacteriological test analysis. Sign or Tags shall be left on all outlets stating water system is not safe for consumption until laboratory results are complete and meet these specifications.

F. Bacteriological Test:

1. After final flushing and satisfactory results from the residual free chlorine concentration test, Bacteriological test samples shall be collected. The intent of the following is to provide insurance for an accurate representation to a complete Bacteriological test of the water system. At least two samples shall be taken from each floor of each building.

2. Bacteriological test samples shall be delivered to a State of California Department of Health Services Certified Laboratory to perform qualitative and quantitative bacterial analyses on the water samples for the presence of any Total Coliform bacteria and Plate Count. This count must be less than 500 cfu/mL.

3. The procedure shall be repeated if it shown by bacteriological examination made by an approved agency that the level of Disinfection does not meet these specifications.

4. After satisfactory results for the bacteriological test are provided to the Oa, the physical barrier or temporary reduce pressure back flow devise shall be removed, and the new piping shall be connected to the point of connection. All the connecting piping and fittings shall be disinfected prior to installation. Chlorination Port shall be capped water tight. Warning sign or tags shall be removed.

G. Drinking Fountain and Bottle Filler Lead Test: After installation of Drinking Fountain or Bottle Filler, and successful Bacteriological Test, shut off domestic water supply line feeding the fixture, and inform Owner Representative. Owner Representative will hire a service to conduct lead detection test and mitigate as necessary. Do not remove related construction warning sign and tags.

3.11 VALVES ON PLUMBING SYSTEM

A. Furnish and install gates, ball, globes, angles, and check valves on plumbing Work at following locations whether indicated on drawings or not.

B. Hot and cold valves shall be:

1. Lead free complying with AB1953.

2. Above the ground copper water system, 2-inch and larger, may utilize Victaulic butterfly valves and fittings for their connections. A 2-inch or larger Victaulic valve may be in a wall if an adequately sized access panel is provided for maintenance or removal.

C. Valves shall be accessible and installed within an access panel approximately 3 feet above floor and no more than 7 feet above floor, or in a marked yard box to prevent tampering.

1. Immediately after each water meter, in addition to any valve furnished by utility company, there shall be an accessible valve on the inlet side for a

strainer assembly, dual backflow device assembly and/or possibly a dual pressure reducing valve assembly.

2. A gate or ball valve on each water supply before it enters building. Valves shall be accessible from outside building and shall be installed in a marked yard box, unless otherwise indicated on drawings. Ball valves 2 ½-inch size or larger shall omit gate valve handle and furnish 2-inch square operating nut.

3. At multi story buildings, provide an isolation-valve or multiple valves for both hot and cold water in access panel to isolate and control each floor level.

4. For classrooms, shops, offices and boiler or mechanical room, install a gate or ball valve to control hot and cold water lines to each group of fixtures, a group of fixtures shall be considered to be 2 or more fixtures in the same room. When practical, valves shall be installed on the same wall as group of fixtures. Valves shall control only fixtures in rooms in which they are installed.

5. For restrooms, a gate or ball valve shall be installed in each restroom to isolate the hot and cold water supply into a restroom regardless of the number of fixtures. These valves shall control and be accessible only from within the restroom in which fixtures are installed. Valves shall be installed on the same wall as the group of fixtures it serves. Valves shall control only fixtures in restroom in which they are installed. Back to back restrooms shall be isolated separately and individually.

6. Install a gate or ball valve on each building branch line, which serves two or more fixtures, when these fixtures are not provided with a group isolation valve as specified above. These valves shall be located approximately 3 feet but not more than 7 feet above finish floor.

7. Install a gate, ball valve or partition stop for a drinking fountain or a group of drinking fountains.

8. Install a gate, ball valve or partition stop for hot and cold water supply to plumbing fixtures with no accessible supply stops, such as wall mounted faucets.

9. Install a gate, ball valve or partition stop for stops adjacent to, and controlling water flow to each sill cock and hose bib except as follows:

    a. A sill cock immediately below an exterior drinking fountain may be controlled by the same gate, ball valve or partition stop as drinking fountain.

b. Valves or stops will not be required for individual hose bibs when these hose bibs are on a branch line serving only hose bibs and branch line is furnished with a shut-off valve.

10. Install a lose key angle stop, on each exposed fixture supply, and for each flush valve unless otherwise specified,

11. Install gate or ball valve at each location where a water line is connected to a piece of equipment other than items mentioned above.

12. Install a check valve on each hot water return line where it connects to a hot water storage tank or a water heater.

13. Handles, hand wheels (including dishwasher fill valve handles) and operating nuts shall be furnished of steel, brass, or cast iron and shall be removable. Unless specified to be loose key type, handles shall be securely fastened to their stems. On exposed outdoor valves, omit operating handles and provide operating nuts.

14. Provide a handle or a key for each five, or fraction thereof, loose key valves, bibs, or stops and deliver them to the project OAR.

3.12 VALVES - GAS SERVICE

A. A gas readily accessible shut-off stop shall be installed on each gas line entering a building immediately prior to the point it enters the building. Unless otherwise specified or indicated, shut-off valves for lines entering a permanent structure, buildings or portable buildings, shall be installed in a vertical riser above grade.

1. Gas shut off valve for portable buildings – In addition to the gas readily accessible shut-off stop specified above, a dedicated Gas shut off valve shall be provided in a marked Yard Box, for each portable building to facilitate relocation/removal of building without the need to shut off gas to entire school.

B. Gas Shut off valve within a building – A gas shut off valve with handles shall be accessible and serviceable within an access panel. Install valve minimum 3 feet above floor but less than 7 feet above floor.

C. In addition to locations specified, gas shut off valve shall be installed at following locations:

1. Install a lubricated plug gas shut off valve on any line connected to gas main or header at master assembly.

2. Install a lubricated plug gas shut off valve before entering any building or structure.

3. Install a gas valve on each outlet, in addition to any gas stop furnished with equipment.

4. Service to laboratory gas cocks shall be furnished with a special precision check valve, located downstream from gas stop servicing room outlet at each laboratory cock. Unless otherwise specified, 1/8-inches bore shall be provided for each outlet cock.

5. Install a gas shut-off valve on each gas line serving 2 or more gas outlets in same room. Service stop shall be installed not more than 7 feet above floor, and shall be in the room it serves.

6. Install a gas shut-off valve on inlet side of each gas pressure regulating valve.

7. Gas shut-off valves to be furnished with equipment.

8. Install gas shut-off valve at not more than 1,000 foot intervals on each gas main.

9. At multi-story buildings, provide gas-shut off valve(s) to isolate and control each floor or level. Install valves in a concealed manner in walls with access panels.

10. Gas shut-off valves in classrooms and locations subject to tampering shall be protected while remaining accessible.

D. When a gas-shut off valve adjacent to gas-fired equipment is indicated in Contract Documents it shall be furnished and installed as part of Work of this section.

E. When electrical wall switches with emergency push button are specified for controlling gas outlets at Laboratory Classrooms, provide main shut-off gas valve with normally closed electric solenoid valve within an accessible access panel.

3.13 ELECTROLYSIS PREVENTION

A. Brass nipples, 6 inches, with recognized brass unions; flanges shall be furnished and installed at locations described herein. Flanges shall be installed with complete insulating component consisting of gasket bolt sleeves and bolt washers. Dielectric insulators shall be installed at following locations:

1. Where special applications indicated on Drawings require an insulation flange or brass union, with 6-inch brass nipple to be installed in a condensate

line, or steam line, flange insulation shall be of a high temperature type, suitable for continuous operation at temperatures up to 220 degrees F. for condensate and 400 degrees F. for steam.

2. Where steel or cast iron in ground connects to copper or brass piping above ground, transition from steel or cast iron pipe to copper or brass pipe shall be provided in an accessible location.

3. Underground dielectric connections shall be furnished in accessible yard boxes.

4. Above ground dielectric connections shall be exposed; or if in finished rooms shall be located in accessible access boxes.

3.14 UNDERGROUND PIPE MARKERS

A. Pipe markers shall be furnished according to Section 22 0553: "Plumbing Identification"

B. Under ground Caution Tape shall be placed 12 to 18 inches above the utility line. The Caution Tape shall be a designated color and marked with the appropriate name for the specific type of utility pipe as follows:

1. Yellow – with the words: CAUTION GAS LINE BELOW

2. Blue – with the words: CAUTION WATER LINE BELOW

3.15 HOT WATER CIRCULATING PUMPS

A. Floor-mounted pumps shall be provided with a 4-inch high concrete base with ½ inch reinforcing bars at 12-inch centers each way and doweled into concrete floor.

B. Piping shall be supported from building structure so as to prevent any strain on pump casing.

C. In-line pumps, unless otherwise specified, shall be centrifugal type with non-overloading characteristics and shall not overload motor above its horsepower rating under operating conditions with ratings based on continuous operation.

D. Centrifugal water pumps shall be rated according to Hydraulic Institute Test Code for Centrifugal Pumps. Pumps shall be furnished with bronze water chamber, bronze impeller and mechanical seal. Rotating parts shall be statically and dynamically balanced.

E. Flanged connections shall be provided on pumps with discharge connections larger than 2 inches. Smaller sizes may be threaded connections.

F. Hot water circulating pump shall be arranged so that pump can be automatically turned off when hot water system is not in operation.

3.16 WATER TEMPERATURE CONTROLLERS

A. Furnish and install a water temperature controller in hot water line adjacent to, and for control of, circulating pumps on hot water return lines when said pump is indicated on Drawings or herein specified. Bulb of temperature controller shall be installed so as to be directly in path of flowing water and so as not to obstruct flow of water.

B. Furnish and install a water temperature controller in hot water storage tanks for control of circulating pump on hot water circulating line when said pump is indicated on Drawings or specified herein.

3.17 DEPTH OF SEWER LINES

A. Minimum depth of below grade sewer lines shall be 24 inches to centerline of pipe. Sewer lines shall slope ¼ inch per foot minimum, unless otherwise indicated. Minimum depth at Owner property line shall be 6 feet, unless otherwise required.

3.18 BACKFLOW PREVENTION DEVICES

A. Backflow Devices: Installation of backflow devices shall be tested and certified by Los Angeles County backflow device tester before Substantial Completion. Tests shall be performed in presence of Project Inspector. Test reports shall be turned over to Project Inspector for mailing to proper agency.

3.19 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose off Project site.

3.20 PROTECTION

A. Protect Work of this section until Substantial Completion.

END OF SECTION 22 10 00

SECTION 26 05 00

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies the basic requirements for electrical installations and includes requirements common to more than one section of Division 26. It expands and supplements the requirements specified in sections of Division 01.

B. Related Requirements:

1. Division 01 - General Requirements.

2. Section 09 91 13 – Exterior Painting.

3. Division 27 – Communications.

4. Division 28 - Electronic Safety and Security.

C. Applicable Standards

1. ASTM D 709 (2007) – Laminated Thermosetting materials.

2. ANSI/NEMA FB-1 (2010) – Standard for Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable.

3. ANSI/NEMA 250 (2008) – Enclosure for Electrical Equipment (1000 Volts Maximum).

4. California Electrical Code (CEC).

5. IEEE C57.12.28 (2005) – Standard for Pad-Mounted equipment (Enclosure Integrity).

6. UL 1 (2005) – Standard for Flexible Metal Conduit.

7. UL 1242 (2007) – Standard for Electrical Intermediate Metal Conduit.

8. UL 506 (2017~~08~~) – Specialty Transformers.

9. UL 6 (2010) – Electrical Rigid Metal Conduit-Steel.

10. UL 797 (2007) – Electrical Metallic Tubing-Steel.

11. UL 870 (201608) – Standard for Wireways, Auxiliary Gutters, and Associated Fittings

1.02 BASIC ELECTRICAL REQUIREMENTS

A. Quality Assurance:

1. Workers possessing the skills and experience obtained in performing work of similar scope and complexity shall perform the Work of this Division.

2. Refer to other sections of the Specifications for other qualification requirements.

B. Drawings and Specifications Coordination:

1. For purposes of clearness and legibility, Drawings are essentially diagrammatic and the size and location of equipment is indicated to scale whenever possible. Verify conditions, dimensions, indicated equipment sizes, and manufacturer's data and information as necessary to install the Work of this Division. Coordinate location and layout with other Work.

2. Verify final locations for rough-ins with field measurements and with the requirements of the equipment to be connected.

3. Drawings indicate required size and points of termination of conduits, number and size of conductors, and diagrammatic routing of conduit. Install conduits with minimum number of bends to conform to structure, avoid obstructions, preserve headroom, keep openings and passageways clear, and comply with applicable code requirements.

4. Routing of conduits may be changed provided that the length of any conduit run is not increased more than 10 percent of length indicated on the Drawings.

5. Outlet locations shall be coordinated with architectural elements prior to start of construction. Locations indicated on the Drawings may be distorted for clarity.

6. Coordinate electrical equipment and materials installation with building components and the Work of other trades

7. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.

8. Coordinate connection of electrical systems with existing underground utilities and services.

C. Terminology:

1. Signal Systems: Applies to clock, bell, fire alarm, annunciator, sound, public address, buzzer, telephone, television, inter-communication, elevator access controls, lighting control systems and security systems.

2. Low Voltage: Applies to signal systems operating at 120 volts and less, and power systems operating at less than 600 volts. Medium voltage: Applies to power systems operating at more than 600 volts.

3. UL: Underwriter's Laboratories Inc, Nationally Recognized Testing Laboratory (NRTL), or equal.

D. Regulations: Work shall comply with the requirements of authorities having jurisdiction and the California Electrical and Building Codes. Material shall conform to regulations of the National Board of Fire Underwriters for electrical wiring and apparatus. Materials shall be new and listed by UL, or another NRTL.

E. Structural Considerations for Conduit Routing:

1. Where conduits pass through or interfere with any structural member, or where notching, boring or cutting of the structure is necessary, or where special openings are required through walls, floors, footings, or other buildings elements, conform to CBC, Part 2, Title 24, Section 1906.3 for conduits and pipes embedded in concrete and Sections 2308.9.10 and 2308.9.11 for notches and bored holes in wood; for steel, as detailed on the structural steel Shop Drawings.

2. Where a concrete encasement for underground conduit abuts a foundation wall or underground structure which the conduits enter, encasement shall rest on a haunch integral with wall or structure, or shall extend down to footing projection, if any, or shall be doweled into structure unless otherwise indicated. Underground structures shall include maintenance holes; pull boxes, vaults, and buildings.

3. Holes required for conduit entrances into speaker poles, floodlight poles or other poles, shall be drilled with the conduit nipple or coupling welded to poles. Welds shall be provided by the electric arc process and shall be continuous around nipple or coupling.

F. Electrically Operated Equipment and Appliances:

1. Furnished Equipment and Appliances:

a. Work shall include furnishing and installing wiring enclosures for, and the complete connection of electrically operated equipment and appliances and electrical control devices which are specified to be furnished and installed

in this or other sections of the Specifications, wiring enclosures shall be concealed except where exposed Work is indicated on the Drawings.

b. Connections shall be provided as necessary to install equipment ready for use. Equipment shall be tested for proper operation and, if motorized, for proper rotation. If outlets are of incorrect electrical characteristics or any specified equipment fails to operate properly, repair and/or replace the outlet and/or equipment.

2. Equipment and Appliances Furnished by Others:

a. Equipment and appliances indicated on Drawings as "not in contract" (NIC), "furnished by others," or "furnished by the Owner," will be delivered to the Project site. Required electrical connections shall be performed for such equipment and appliances. Motorized equipment will be furnished factory-wired to a control panel or junction box unless otherwise indicated. Appliances will be furnished equipped with portable cord and cap. Provide disconnect switches where required.

b. Connections to equipment furnished under this Division shall be part of the Work of this section. Work shall include internal wiring, installation, connection and adjustment of bolted drive motors in which the motor is supplied as a separate unit, and connections only for equipment furnished with factory installed internal wiring, except as further limited by Drawings and this Specification. Work shall include furnishing and installing suitable outlets, disconnecting devices, starters, push-button stations, selector switches, conduit, junction boxes, and wiring necessary for a complete electrical installation. Work shall also include furnishing and installing conduit and boxes for HVAC control systems, furnished under Division 23. Devices and equipment furnished shall be of same type used elsewhere on the Work or as specified.

c. Electrical equipment furnished under other sections, for installation and connection under Work of this section, will be delivered to the Project site ready for installation.

d. Mechanical equipment furnished under other sections, and requiring electrical connection under this section, will be set in place as part of the Work of the section furnishing such equipment unless noted otherwise.

e. Suitability and condition of equipment furnished under other sections shall be determined in advance of installation. Immediate notice of damage, unsuitability, or lack of parts shall be given to the entity providing such equipment.

G. Protection of Materials:

1. Protect materials and equipment from damage and provide adequate and proper storage facilities during progress of the Work. Damaged materials and/or equipment shall be replaced.

H. Cleaning:

1. Exposed parts of Work shall be left in a neat, clean, usable condition. Finished painted surfaces shall be unblemished and metal surfaces shall be polished.

2. Thoroughly clean parts of apparatus and equipment. Exposed parts to be painted shall be thoroughly cleaned of cement, plaster, and other materials. Remove grease and oil spots with solvent. Such surfaces shall be wiped and corners and cracks scraped out. Exposed rough metal shall be smooth, free of sharp edges, carefully steel brushed to remove rust and other spots, and left in proper condition to receive finish painting.

3. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

I. WARRANTIES

1. Provide one year warranty on all material and labor performed, unless noted otherwise in specific sections.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS

A. Advise the Inspector before starting the Work of this Division.

B. Exposed conduits shall be painted to match the surfaces adjacent to installation.

C. Salvaged materials removed from buildings shall be removed from the Project site as required by the OAR.

D. Trenches outside of barricade limits shall be backfilled and paved within 24 hours after being inspected by the Inspector. Provide traffic plates during the time that trenches are open in traffic areas and in areas accessible to students and staff.

E. Where existing structural walls are cored for new conduit runs, separation between cored holes shall be three inches edge to edge from new or existing holes, unless otherwise required by the Architect. All coring to be laid out and reviewed by Architect prior to drilling. Contractor to verify location of structural steel, rebar, stress cabling or similar prior to lay out.

F. Electrical equipment shall be braced and anchored for CBC Seismic Design requirements, or as otherwise indicated on the Drawings.

3.02 DELIVERY STORAGE AND HANDLING

A. Deliver products to project site with proper identification, which shall include names, model numbers, types, grades, compliance labels, and similar information needed for District identification; all products and materials shall be adequately packaged and protected to prevent damage during shipment, storage, and handling.

B. Coordinate deliveries of electrical materials and equipment to minimize construction site congestion.

3.03 CUTTING AND PATCHING

A. Cutting and patching of electrical equipment, components, and materials shall include the removal and legal disposal of selected materials, components, and equipment.

B. Do not endanger or damage installed Work through procedures and processes of cutting and patching.

C. Repair or restore other work, or surfaces damaged as a result of the work performed under this contract.

3.04 CLEANUP

A. Remove rubbish, debris and waste materials and legally dispose off the Project site.

B. Remove equipment and implements of service, and leave entire work area neat and clean, to the satisfaction of the Owner Authorized Representative.

3.05 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION 26 05 00

SECTION 26 05 13

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Boxes, enclosures, keys and locks.

2. Receptacles and switches.

3. Identifications and signs.

B. Related Requirements:

1. Division 01 - General Requirements.

2. Division 26 – Electrical.

3. Division 27 – Communications.

4. Division 28 - Electronic Safety and Security.

PART 2 - PRODUCTS

2.01 BOXES, ENCLOSURES, KEYS AND LOCKS

A. Outlet Boxes and Fittings:

1. Outlet boxes installed in concealed Work shall be galvanized steel, pressed, or welded type, with knockouts.

2. In exposed Work, where conduit runs change direction or size, outlet boxes and conduit fittings shall be cast metal with threaded hubs cast integral with box or fitting.

3. Fittings shall be cast metal and non-corrosive. Ferrous metal fittings shall be cadmium-plated or zinc galvanized. Castings shall be true to pattern, smooth, straight, with even edges and corners, of uniform thickness of metal, and shall be free of cracks, gas holes, flaws, excessive shrinkage, and burnt-out sand.

4. Covers for fittings shall be galvanized steel or non-corrosive aluminum and shall be designed for particular fitting installed.

5. Light fixture outlets shall be 4-inch octagon, 4-inch square, 2 1/8-inch deep or larger, depending upon number of conductors or conduits therein. Plaster rings shall be furnished with round opening with two ears drilled 2 23/32 inches center to center.

6. For local device outlets provide 4-inch square 2 1/8-inch deep, boxes for single gang, 5-inch square boxes for two-gang, and special solid gang boxes with gang plaster ring for more than two switches.

7. For TV outlets, and horns and strobes provide manufacturer's supplied back box as needed. For television outlets, provide 4-gang deep boxes and 4-gang plaster rings.

8. Plaster rings shall be provided on flush-mounted outlet boxes except where otherwise indicated or specified. Plaster rings shall be same depth as finished surface. Install approved ring extension to obtain depth to finish surface.

9. In existing plywood wall or drywall construction, and where flexible steel conduit is fished into walls, single-gang and 2-gang outlets for wiring devices may be sectional steel boxes with plaster ears. Boxes shall be fastened to plywood with flat-head screws in each plaster ear screw hole. Boxes fastened to gypsum board shall be Raco, Appleton, Cooper, Bowers, or equal.

10. Factory made knockout seals shall be installed to seal box knockouts, which are not intact.

11. Where flexible conduit is extended from flush outlet boxes, provide and install weatherproof universal box extension adapters.

B. Junction and Pull boxes:

1. Junction and pull boxes, in addition to those indicated, shall only be used in compliance with codes, recognized standards, and Contract Documents.

2. Interior and non-weatherproof boxes shall be constructed of blue or galvanized steel with ample laps, spot welded, and shall be rigid under torsion and deflecting forces. Boxes shall be furnished with auxiliary angle iron framing where necessary to ensure rigidity.

3. Covers shall be fastened to box with a sufficient number of machine screws to ensure continuous contact all around. Flush type boxes shall be drilled and tapped for cover screws if boxes are not installed plumb. Surfaces of pull and junction boxes and covers shall be labeled in black marker ink designating system, panelboard and circuit designation contained in box. In exposed Work, designation shall be installed on inside of pullbox or junction box cover.

4. Weatherproof NEMA 3R pull and junction boxes shall conform to foregoing for interior boxes with following modifications:

a. Cover of flush mounting boxes shall be furnished with a weather-tight gasket cemented to, and trimmed even with, cover all around.

b. Surface or semi-flush mounting pull and junction boxes shall be UL, or another Nationally Recognized Testing Laboratory (NRTL) listed as rain-tight and shall be furnished complete with threaded conduit hubs.

c. Exposed portions of boxes shall be galvanized and finished with one prime coat and one coat of baked-on gray enamel, unless already furnished with factory baked-on finish.

5. Junction and pull boxes shall be rigidly fastened to structure and shall not depend on conduits for support.

6. Underground Concrete Pull Boxes:

a. Pre-cast concrete pull boxes. Concrete pull boxes shall be traffic type, reinforced for H-20 wheel loading, pre-cast concrete. Pull boxes with inside dimensions of 2 feet by 3 feet by 3 feet deep shall consist of a base section, top ring, and cover. Base section shall be furnished with 2 knockouts measuring 10 inch by 10 inch in each 3 feet side, and one 20 inch by 20 inch knockout in each 2-foot side. Pull boxes with inside dimension 4 feet by 4 feet by 4 feet deep shall consist of a base section, midsection, topping, and cover. Base section shall be furnished with 2 knockouts measuring 8-inch by 16-inch on each of two opposite sides, and one 20-inch by 20-inch knockout on each of other two opposite sides. Pull boxes shall be furnished with a minimum of 6-inch diameter sump knockout and one inch diameter ground rod knockout. In pull boxes, furnish and install cable racks on walls. Racks shall be furnished with 3 porcelain cable holders on vertical steel mounting bars. Pull boxes shall be furnished with 3/4 inch diameter pull irons. Covers shall be traffic-type consisting of steel safety plate bolted to frame. Covers shall be marked as electrical, power, or signal as required. Pull boxes shall be as manufactured by Oldcastle Precast, Jensen Precast, Kistner, Western Precast, or equal.

b. Provide end bells in duct entrances. Terminate each metal conduit with insulated bushing provided with a grounding terminal.

c. Install pulling irons on opposite walls and below horizontal centerlines of ducts and bricked-up openings, and in bottom. Install pulling irons with each end hooked around a reinforcing bar.

d. Remove floor drain knockout and provide a depth of 24 inches of crushed rock below box extending a minimum of 12 inches beyond on all sides.

e. Permanently and effectively ground metal equipment cases, cable racks, and similar items in pull boxes to site grounding electrode system. Provide grounding conductor in compliance with CEC Article 250.

f. Provide 6-inch deep sand base under pull boxes.

g. Identify power and signal cables by tagging in manholes and pull boxes. Tie securely to cables with nylon cord.

h. Top of steel plate shall provide a minimum coefficient of static friction of 0.5 for either wet or dry locations, when tested for any shoe sole material. Test shall comply with ASTM D 1047 or F 489 or F 609 standards. Submit manufacturer's test results for Architect's review as part of materials and equipment submittals.

i. The use of underground extension boxes shall be limited to not more than 1 times the original depth of pull box.

7. Underground utility boxes shall be reinforced concrete with non-setting shoulders to prevent settlement following installation. Boxes shall be furnished with cast iron cover with finger hole, size as indicated on Drawings. Utility boxes shall be as manufactured by Oldcastle,Jensen, Kistner, Western Precast, or equal.

8. Manholes, vaults, and pull boxes required by a utility company, and installed as part of this Contract, shall meet requirements of servicing utility company.

C. Floor Outlets:

1. Provided floor outlets, except for extension outlets, shall be Harvey Hubbell Inc. B-2503, Thomas & Betts 640 series, Legrand Omnibox, or equal, adjustable, cast iron, watertight floor boxes with flush brass floor plates, and shall be set to finish flush with finish floor covering, whether it be carpeted, wood, resilient floor covering, or other finish materials. Floor boxes shall be used in office, classrooms, and in library areas only.

2. Telephones above floor outlets, where not subjected to water, shall be provided with Harvey Hubbell Inc. SC-3098 pedestals with SC309T plates, Legrand 525 series, Thomas & Betts FPT-400 Series, or equal. Refer to other Division 26 sections. Floor boxes shall be used in office, classrooms and in Library areas only.

3. Plugs above floor outlets where not subjected to water shall be provided with Legrand 525 series, Thomas & Betts FPT-400 Series, Harvey Hubbell Inc. SC-3098, or equal, pedestal and with SS309D, or equal, device plates. Refer to other Division 26 sections. Floor boxes shall be used in office, classrooms, and library areas only.

4. Plugs above floor outlets where subjected to water shall be provided with a Harvey Hubbell Inc. SA-6685 or equal, single-gang outlet box, or SA-6687 or equal, 2-gang outlet box. Provide required cover plate. Refer to other Division 26 sections. Floor outlets shall be used in Cafeteria, Cafeteria serving areas, or any areas where floors are subjected to water.

5. Furnished extension floor outlets shall be cast iron floor boxes with cast iron covers and 1/2 inch offset entries for above-floor conduit extensions; Harvey Hubbell F3186, or equal. Boxes shall be designed to permit access to wiring without disturbing above-floor extensions and shall be set flush with finish floor.

6. Furnished above floor service fittings for surge suppression receptacles shall be Hubbell SC3098 with cover plates SS309DS, Legrand 525 series, Thomas & Betts FPT-400 Series, or equal.

7. Furnished above floor service fittings for data outlets shall be Hubbell SC3098 with required cover plates, Legrand 525 Series, Thomas & Betts FPT-400 Series, or equal. Refer to other Division 26 sections.

D. Floor Pockets:

1. Three-Gang: Furnished three-gang floor lighting pockets shall be flush floor type, with cast iron floor plate and hinged cast iron door notched for cables. Three-gang floor pockets shall be owner approved Legrand or Hubbell Recessed Floor Boxes, C.W. Cole TLS-353-6, or equal, for wood floors and C.W. Cole TLS-353-6-C, or equal, for concrete slabs. Each floor pocket shall be provided with three 20 amp, 3 wire, 125 volt receptacles with matching caps.

2. Single Gang:

a. Receptacle floor pockets shall be single gang, flush floor type, with cast iron floor plate, hinged cast iron door notched for cable and cast iron box; C.W. Cole TLA-362-1-FE, or Owner approved Legrand or Hubbell recessed floor box or equal. Provide each pocket with a standard, single grounding type receptacle unless otherwise indicated. Provide C.W. Cole TLS-362-1, or equal, in wood floors.

b. Microphone or projector floor pockets shall be single gang flush floor type with cast iron floor plate, hinged cast iron door, notched for cable and cast iron box, or owner approved Legrand or Hubbell recessed floor box, C.W. Cole TLA-362-3-FE, C.W. Cole TLS-362-3,in wood floors, or equal.

E. Keys and Locks:

1. Provide two keys with furnished door locks, including cabinet door locks and switchboard locks, two keys for lock switches on switchboards or control panels, and two keys with interlocks or other furnished lock switches. Deliver keys to OAR.

2. Locks shall be keyed to Corbin No. 60 keys for access to operate equipment and Corbin 70 keys for service access. Special keys and locks shall only be provided where specified.

2.02 RECEPTACLES AND SWITCHES

A. Receptacles:

1. Duplex receptacles shall be heavy-duty specification grade, grounding type. Terminal screws shall be back and side wired with internal screw pressure plates. Mounting strap shall feature heavy-duty brass construction. Receptacle back body shall be PVC. Receptacle face shall be ivory, impact resistant nylon. Receptacles shall have triple wipe brass power contacts.

NEMA #	Pass & Seymour	Hubbell	Leviton
(20 amps) NEMA 5-20	PS5362-I	HBL5362-I	5362-I
(15 amps) NEMA 5-15	PS5262-I	HBL5262-I	5262-I

2. Duplex receptacles on circuits supplied by panel boards with integral surge suppression shall be Pass & Seymour model number PS5262BL (blue), Hubbell DRUBTVSS15, Leviton 5262-SBU, 15 amps, 120 volts, or equal.

3. Single receptacles shall be heavy-duty specification grade, grounding type. Terminal screws shall be back and side wire with internal screw pressure plates. Mounting strap shall feature heavy-duty brass construction. Receptacle back body shall be thermoplastic. Receptacle face shall be ivory, impact resistant nylon. Receptacles shall have triple wipe brass power contacts. For circuits consisting of one single receptacle only, ampere rating of receptacle shall be same as circuit breaker or fuse.

NEMA #	Pass & Seymour	Hubbell	Leviton
(20 amps) NEMA 5-20R	5361-I	HBL5361-I	5361-I
(15 amps) NEMA 5-15R	5261-I	HBL5261-I	5261-I

4. 15 and 20 amps single receptacles on circuits supplied by panel boards with integral surge suppression shall be Pass & Seymour NEMA 5-20R model number 5361-BL (blue), and NEMA 5-15R model number 5261-BL (blue) respectively. Equal receptacles by other Owner approved manufactures are acceptable.

5. For kiln receptacles and range receptacles, provide 3-pole, 4-wire, grounding type, rated 50 amps at 125/250 volts NEMA 14-50R. Provide with 2-gang, stainless steel plates, SS 703, or equal.

NEMA #	Pass & Seymour	Hubbell	Leviton
NEMA 14-50R	3894	HBL9450A	279
WALL PLATE	SS703	S703	84026

6. For dryer receptacles, provide 3-wire, non-grounding type, rated 30 amps at 125/250 volts, NEMA 10-30R, with 2-gang stainless steel plates. Coordinate location of junction box with the work of Section 10 2815, Hand and Hair Dryers.

NEMA #	Pass& Seymour	Hubbell	Leviton

NEMA 10-30R	3860	HBL9350	5207
WALL PLATE	SS703	S703	84026

7. Provide specification grade ground-fault circuit interrupter (GFCI) type receptacles in accordance with 2010 UL standards. GFCI receptacles shall have a trip indication light. Receptacle terminal screws shall be back and side wire with internal screw pressure plates. Test and reset buttons shall match device body and shall be ivory. GFCI receptacles shall be manufactured in standard configuration for installation with stainless steel smooth plates. Exterior mounted receptacles shall be mounted inside weatherproof enclosure.

NEMA #	Pass & Seymour	Hubbell	Leviton
NEMA 5-20R	2095-I	GFR5352-IA	7899-I
NEMA 5-15R	1595-I	GFR5252-IA	8598-I

8. Provide weatherproof receptacles, except where otherwise indicated or specified, consisting of GFCI receptacles, as specified herein, and metal plates with die-cast lockable hinged lids and weatherproof mats;

9. In Kindergarten and Early Education Center Classrooms provide tamper-resistant receptacles with thermoplastic dual mechanism shutter system to help prevent insertion of foreign objects. Receptacles shall have extra heavy-duty brass, one-piece mounting strap with integral ground. Receptacles shall be ivory color, impact resistant nylon face and back body. For tamper-resistant receptacles rated 20 amps/125 volts, provide NEMA 5-20R, ivory in color,. For tamper-resistant receptacles rated 15 amps/125 volts, provide NEMA 5-15R, ivory in color.

NEMA #	Pass & Seymour	Arrow Hart	Leviton
(20 amps) NEMA 5-20R	TR63-I	TR8300V	8300SGI
(15 amps) NEMA 5-15R	TR62-I	TR8200V	8200SGI

10. Provide transient voltage surge suppression (TVSS) receptacles offering metal oxide varistors (MOVs) protecting normal and common modes, (L-N, L-G, N-G) with 500V suppressed voltage. TVSS devices shall offer 3-mode equal protection with 210 joules minimum per mode of energy absorption and 13,000 amp maximum surge capability. TVSS devices shall have 3 thermal fuses and two over-current protection fuses. TVSS devices shall have LED visual only surge status indicator to alert user to surge suppression circuit condition. Visual indicator will be illuminated (red) when power is on and surge suppression circuit is fully functional. Visual indicator will not be illuminated when power is off or unit experiences loss of surge suppression protection. Terminals shall be back and side wire including ground terminal. Color shall be blue.

NEMA #	Pass& Seymour	Hubbell	Leviton
(20 amps) NEMA 5-20R	5352BLSP	HBL5360SA	5380B
(15 amps) NEMA 5-15R	5252BLSP	HBL5260SA	5280B

11. Receptacles within 6 feet of water fountains, counter tops, or any sources of water shall be GFCI type.

B. Switches:

1. Local Switches:

a. Provide local switches, high strength thermoplastic toggle, specification industrial grade, rated 20 amps at 120-277 volts AC only, with plaster ears, external screw pressure plate back and side wired, and standard size composition cups which fully enclose mechanism. Switches shall be approved for installation at currents up to full rating on resistive, inductive, tungsten filament lamp and fluorescent lamp loads, and for up to 80 percent of rating for motor loads. Switches shall have oversized silver alloy contacts for long life and better heat dissipation. Provide switches as single pole, double pole, 3-way, 4-way, non-lock type. Provide non-lock type switches with ivory handles;

	Pass & Seymour	Hubbell	Leviton
Single pole	PS20AC1I	HBL1221I	1221-2I
Double pole	PS20AC2I	HBL1222I	1222-2I
Three way	PS20AC3I	HBL1223I	1223-2I
Four way	PS20AC4I	HBL1224I	1224-2I

b. Provide lock type switches, specification industrial grade, 20 amp, 120-277 volts with metal or nylon key guides with on/off indication, and operable by same key. Key shall be District standardized vertically oriented, tamper resistant, forked key with two each 5/16-inch long forks, 5/32-inch spacing between forks and 5/16-inch width overall.

	Pass & Seymour	Arrow Hart
Single pole	PS20AC1L w/#500 Key-2L	1221L w/1201LK Key
Double pole	PS20AC2Lw/#500 Key	1222L w/1201LK Key
Three way	PS20AC3L w/#500 Key	1223L w/1201LK Key
Four Way	PS20AC4L w/#500 Key	1224L w/1201LK Key

c. Rotary lock switches shall incorporate a tumbler type lock to prevent unauthorized operation. Lock shall be tumbler type by Corbin, keyed to a HH41 key. Lock switch to be installed with pin tumblers facing downward. Key shall be removable in all positions. Each device shall be complete with 2 keys. Keys shall be delivered only to the OAR. Switches shall be rated at 20 amps, 120-277 volt AC. Switch plates shall be of stainless steel, engraved with on and off positions indicated.

	Arrow Hart
Single pole	AH1191N
Double pole	AH1192N
Three way	AH1193N

d. Pilot light switches shall be rated 20 amps and shall conform to specifications for local switches. Switches shall be furnished with red, Lexan handles that are lighted by long-lasting neon lamps. Pilot light shall light when load is on. Pilot light 120 volt switches

	Pass& Seymour	Hubbell	Leviton
Single pole	PS20AC1-RPL	HBL1221-PL	1221-PLR
Double pole	PS20AC2-RPL	HBL1222-PL	1222-PLR
Three way	PS20AC3-RPL	HBL1223-PL	1223-PLR

Same as above except rated at 20 amps at 277 volts.

	Pass & Seymour	Leviton	Hubbell
Single pole	PS20AC1-RPL	1221-7PR	HBL1221-PL7

e. Provide remote control switches for mechanically held contactors arranged for 3-wire control, toggle type, momentary contact, single pole, 3-position with center off position, rated 20 amps at 120-277 volts AC only, with plaster ears, binding screws for side wiring, standard size composition cups which fully enclose mechanism, and ivory handles

Pass & Seymour	Hubbell	Leviton
1251-I	HBL1557-I	1285-I

f. Provide remote control switches for magnetically held contactors arranged for 3-wire control, toggle type, maintained contact, single pole, 3-position with center off position, rated 20 amps at 120-277 volts AC only, with plaster ears, binding screws for side wiring, standard size composition cups which fully enclosed mechanism, and ivory handles.

Pass and Seymour	Hubbell	Leviton
1225-I	HBL 1385	1285-I

g. Momentary Contact locking key type switch. 20A 120/277V center off. Key shall be District standardized vertically oriented, tamper resistant, forked key with two each 5/16" long forks, 5/32" spacing between forks and 5/16" width overall.

Arrow Hart
AH1995L w/ AH2000 key

h. Momentary Contact switch low voltage 1 pole 3A 24VAC 3 position center off. Key for locking switch shall be District standardized vertically oriented, tamper resistant, forked key with two each 5/16" long forks, 5/31" spacing between forks and 5/16" width overall.

Pass and Seymour
Toggle 1081I
Locking 1081KGRY w/#500 Key

2. Time Switches and Photoelectric Controls for existing construction; use section 26 0923 for new construction.

   a. Provide time switches with a 7-day, solid-state, electronic type capable of fully automatic or manual operation and housed in a sheet steel enclosure unless built into a panel or switchboard. Contacts rated for 25 amps resistive or inductive, each pole 240 VAC; 5 amps tungsten or 277 VAC pilot duty, each pole 240 VAC. Time switches to contain a non-volatile clock and non-volatile memory with a built-in rechargeable super capacitor power carry-over system. Battery carryover is not acceptable. Provide a minimum of 15 on/off set points per week. Timing to be in one minute increments with a minimum on or off time of one minute. Time switch digital displays to indicate days of week, hours, and minutes. Display to contain a load status light to indicate when equipment is in operation. Time switches; Paragon Model EC7000 Series, Tork Model EW 101B series, Intermatic ET7000 series, or equal. Features required for application:.

      1) Liquid crystal display panel.

      2) Holiday scheduling: Up to 40 dates may be assigned special holiday schedules, up to one year in advance.

      3) Automatically adjusts to and from daylight savings time and for leap year.

      4) Contact ratings: 10 amp at 240 VAC.

      5) Safety override switch for each circuit to either provide shut down of circuit or to override on.

      6) Selective review: All or part of schedule shall be displayed at touch of a key.

      7) Super Capacitor for power carry over system.

      8) Supply voltage: 120 V.

      9) 365-day advance scheduling.

   b. Photoelectric control: Shall be rated 2,000 watts, 120V with single pole, single throw, normally closed contact, enclosed in a die-cast aluminum gasketed enclosure with 1/2 inch conduit fitting, Tork series 2100, or equal.

3. Emergency Lighting Control Unit

   a. The Emergency Lighting control Unit shall provide all required functionality to allow an standard lighting control device to control

emergency lighting in conjunction with normal lighting in any area within a building.

b. The emergency lighting control unit shall allow control of emergency lighting fixture in tandem with normal lighting in an area while ensuring that emergency lighting will turn on immediately to full brightness upon loss of normal power supplying the control device. Emergency lighting operation shall be independent for each controlled area and shall not require a generalized power failure for proper operation.

c. The device shall have normally closed dry contacts capable of switching 10 amp emergency ballast loads at 120-277 VAC, 60 Hz, or 2 amp tungsten loads at 120 VAC, 60Hz.

d. The device shall have universal rated voltage inputs provided for normal power sense and normal switched power at 120-277 VAC, 60 Hz.

e. The device shall provide separate LEDs to indicate the presence of normal and emergency power sources. The LEDs shall indicate the unit's current operational mode (normal or emergency)

f. The device's normal power input terminal shall be connected to the line side of the control device such that any upstream fault causing a loss of power, including the tripping of the branch circuit breaker, will force the unit into the emergency mode and turn on the emergency lighting.

g. The unit shall automatically switch emergency lighting on and off as normal lighting is switched. When normal power is not available, the unit shall force and hold emergency lighting on regardless of the state of any external control device until normal power is restored.

h. Device shall be WattStopper ELCU-100 Emergency Lighting Control Unit, LVS #EPC-PM Series, Lighting Control Design #GR 2001 series or Equal.

4. School Main Entrance Intercom Station: See other Division 26 sections

a. Hands free single button telephone auto dialer with major applications access control. Dialer shall dial a primary telephone number. If the number is busy or does not answer, the unit shall hang up and dial up to nine backup numbers. When call is answered and the visitor is identified, the called individual depresses telephone button to gain access. Unit shall be provided with a black and white camera, lighted hood, and an interface for Proximity option. Unit shall be a stand alone entry host for various types of access cards, through a 26-bit Wiegand protocol interface card.

b. Trigon Electronics HF-2 or equal.

c. Trigon Electronics HF-2 Weather mounts or equal.

2.03 IDENTIFICATION AND SIGNS

A. Identification Plates:

1. Provide identification plates for the following unless otherwise specified, for switchboards, unit substations, motor control centers, control panels, push-button stations, time switches, contactors, motor starters, motor switches, panelboards, and terminal cabinets.

2. Identification plates shall be of plastic stock and shall adequately describe function, voltage and phase of identified equipment. Where identification plates are detailed or described on Drawings, inscription and size of letters shall be as indicated. For lighting and power panels, identification plates shall indicate panel designation, voltage, and phase of panel. For terminal cabinets, identification plates shall indicate system contained in terminal cabinet.

3. Identification plates shall be black-and-white nameplate stock of bakelite with characters cut through black exposing white. Plates shall be furnished with beveled edges and shall be securely fastened in place with No. 4 Phillips-head, cadmium-plated steel, self-tapping screws. Characters shall be 3/16 inch high, unless otherwise indicated.

B. Markings:

1. Install identification markings to surface-mounted starters, switches, disconnect switches, contactors, and other devices controlling motors and appliances. Provide abbreviations required along with an identifying number. Markings to be provided with locking type stencils using paint of a contrasting color. Figures shall be 3/8 inch high unless otherwise indicated. Dymo Industries Inc., self-sticking plastic labels, with embossed characters made with a typewriter may be installed instead of stencils and paint; p-touch self adhesive plastic, or Brother P-Touch self sticking laminated plastic labels may be installed.

2. High Voltage: High voltage switchboards, cabinets, boxes, and conduits exposed in accessible locations, including under buildings and in attics, are required to be marked "WARNING-HIGH VOLTAGE- ABOVE 600 VOLTS". Markings for switchboards shall consist of 18 gage steel, porcelain enamel sign of standard manufacture. Markings for boxes, cabinets, and conduits shall be by means of stenciling or printed self-adhesive markers, Westline Tel-A-Pipe, or equal. Provide letters of black on orange background and not less than 1-7/8 inches high. On conduit runs, install markings at intervals not exceeding 10 feet in any individual area. Markings shall be installed after other painting Work is complete.

C. Warning Signs:

1. Provide a warning sign on outside of each door or gate to rooms or enclosures containing high voltage equipment. Signs required reading, "WARNING - HIGH VOLTAGE - KEEP OUT". Provide 2-inch high lettering.

2. Provide a warning sign on each high-voltage non-load break disconnect and fused cutout (not oil filled). Signs required reading, "DO NOT OPEN UNDER LOAD". Provide 2 inch high lettering.

3. Provide signs of standard manufacture, 18 gage steel, with porcelain enamel finish. Provide red lettering on a white background.

PART 3 - EXECUTION

3.01 INSTALLATION AND SUPPORT OF BOXES

A. Install outlet boxes flush with finished surface of wall or ceiling. Install plumb and securely fastened to structure, independent of conduit. Except where otherwise indicated, provide factory-fabricated adjustable attachment bar hangers between studs to support outlet boxes. When installation is performed in fire rated walls, maintain the wall's rating integrity by means of approved fire stop methods.

B. Outlet boxes installed in suspended or furred ceilings with steel runner or furring channels shall be supported, except where otherwise indicated, by a Unistrut P-4000 Tessco A1200HS-10, Cooper B-Line B22s-HG, or equal channel spanning main ceiling runner channels. Each box shall be supported from its channel by a 3/8 inch 16 threaded steel rod with a Unistrut P-4008, Fastenal #48604, Copper B-Line 78101140346 or equal nut and a Tomic No. 711-B Adapta-Stud, or equal. Rod shall be tightened to a jamb fit with channel and its nut. Box shall be locked to rod by means of a 1/2 inch locknut on stud and a 3/8 inch 16 hex nut locking stud to rod.

C. Heights of outlets and equipment indicated on Drawings shall govern. In absence of such indications, following heights shall be maintained with heights measured to centerline unless otherwise noted:

1. Install wall-mounted telephones, light switches, and other switches, 48 inches above finished floor. Refer to other Division 26, 27 and 28 Sections.

2. Outlet boxes for fire alarm pull stations shall be mounted at 45 inches above finished floor to insure that the operating handle of the initiating device is no higher than 48 inches at finished floor. Under no circumstances shall operating handle of the device exceed 48 inches above finished floor regardless of indicated height on drawing.

3. Wall mounted fire alarm strobe or horn/strobe devices shall be mounted such that the entire lens is not less than 80 inches above finished floor. If ceiling heights allow, wall mounted appliances shall have bottom of lens a minimum of 80 inches but not more than 96 inches to the top of lens.

4. Install outdoor fire alarm audible devices or fire alarm sprinkler flow bells at least 10 feet but not more than 12 feet above finished floor to center. Provide STI or equal protective covers for devices when required.

5. Voice evacuation speakers mounted indoors shall be mounted in ceiling space or if mounted on wall shall not be less than 10 feet to center above finished floor.

6. Install clocks and speakers~~, in~~, in classrooms and offices, 8 feet above finished floor. Unless otherwise indicated.

7. In rooms other than places of assembly such as, but not limited to, multipurpose rooms, auditoriums, and libraries, clock outlets and speakers in classrooms and offices shall be mounted 8 feet above finished floors. Other assembly areas such as gymnasiums shall be mounted 10 to 12 feet above finished floor. Provide STI, or equal protective covers for clocks when required.

8. Install fire alarm strobe lights 80 inches to bottom of light above finished floor.

9. Install outside bells and yard light outlets 4 feet above second floor level for 2 or more story buildings, 12 inches below top plate level for one story buildings without covered porch or arcade, and 12 inches below covered porch and arcade ceilings.

10. Install desk telephones, power receptacle outlets, and data outlets 15 inches above finished floor.

11. Install panelboards and terminal cabinets 6 feet 6 inches from finish floor to top of cabinet.

12. Install television outlets at a height corresponding to location of television monitor, or a minimum of 15 inches above finished floor.

13. The use of extension boxes shall be limited to not more than 1 times the original depth of junction box.

3.02 COVER PLATES

A. Provide a plate on each switch, plug, pilot light, data, interphone, public telephone, and television outlet, and on existing and reset outlets where so indicated or required. Plates shall be of stainless steel unless otherwise specified.

B. Flush wiring device and signal system outlets indicated to be blank covered, shall be covered with blank stainless steel plates. Flush lighting outlets to be blanked shall be covered with Wiremold 5736 steel covers, or equal, painted to match surrounding finish. Provide stainless steel covers to blank indicated or required surface-mounted outlets.

C. In the following cases, and at required locations. Switch and receptacle plates shall be engraved with the device(s), or fixtures being controlled, or as indicated:.

1. Three-gang and larger gang switches in locations other than classrooms.

2. Lock switches.

3. Pilot switches.

4. Switches so located that operator cannot see fixtures, or items of equipment controlled while his hand is on the switch.

5. Switches not in same room with fixtures or items of unit heaters, air curtains, fly fans, etcetera.

6. Receptacles operating at other than 120 V shall be identified with the operating voltage.

7. Switches operating on 277 V shall be identified with the operating voltage.

8. Where indicated on Drawings.

D. Designations shall be as indicated on Drawings or as specified by Architect.

E. Standard GFI cover plates shall be Pass & Seymour 4600, Raco 5028-0, or equal. GFI cover plates shall be provided with a CAM lock mechanism with two keys or a padlock hasp that does not protrude through the face of the cover and will allow the shank of locks keyed Corbin No. 60 keys.

3.03 IDENTIFICATION OF CIRCUITS AND EQUIPMENT

A. Provide descriptive nameplates or tags permanently attached to switchboards, motor control centers, transformers, panelboards, circuit breakers, disconnect switches, starters, pushbutton control stations and other apparatus installed for operation or control of circuits, appliances, fire alarm control panel(s), fire alarm annunciator(s), power supplies, terminal cabinets, energy management control units, and Information technology system backbone and distribution equipment points.

B. Provide nameplates of engraved laminated plastic, or etched metal. Submit Shop Drawings denoting dimensions and format to Architect before installation. Fasten to equipment with escutcheon pins, rivets, self-tapping screws, or machine screws. Self-adhering or adhesive backed nameplates are not permitted.

C. Fasten tags to feeder wiring in conduits at every point where runs are broken or terminated, including pull wires in empty conduits. Indicate circuit, phase, and function. Tag branch circuits in panel boards and motor control centers. Tags may be manufactured of pressure-sensitive plastic or embossed self-attached stainless steel or brass ribbon.

D. Provide circuit identification cards and cardholders in all panel boards. Cardholders shall consist of metal frame retaining a clear plastic cover permanently attached to inside of panel door. List of circuits shall be typewritten on a card. Circuit description shall include name or number of circuit, area and connected load.

E. Junction and pull boxes shall have covers stenciled with box number when indicated on Drawings, or circuit numbers according to panel schedules. Data shall be lettered in a conspicuous manner with a color contrasting with finish.

F. Name shall be correctly engraved, with a legend indicating function or areas, when required by codes or indicated on Drawings.

3.04 PROTECTION

A. Protect Work of this section until Substantial Completion.

3.05 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off Project site.

END OF SECTION 26 05 13

SECTION 26 05 19

LOW-VOLTAGE WIRES (600 VOLT AC)

PART 1 - GENERAL

1.01.1 SUMMARY

A. Provisions of Division 01 apply to this section.

B. Section Includes: Low-voltage wire, splices, terminations and installation.

1.01.2 SUBMITTALS

A. Provide in accordance with Division 01.

B. List of Materials: Submit a complete list of proposed materials.

C. Shop Drawings: Provide detailed and dimensioned Shop Drawings indicating kind, weight and thickness of materials, insulation type, resistivity, conductivity, impedance, and conductance. Drawings shall contain sufficient information to assemble and install equipment at the Project site without further instructions.

D. Prior to start of construction; provide letter from wiring and electrical cables manufacturer certifying that the products are qualified/ listed as low electromagnetic field products.

1.01.3 SUBSTITUTIONS

A. Deviations/Substitutions from these requirements shall not be accepted without written approval from OWNER'S Design Standards Section and Maintenance and Operations Technical Unit. When deviating are proposed the following information shall be submitted:

1. Substitution request form stating reasons and benefits to OWNER.

2. OWNER'S approval shall be obtained for any equipment or materials substitutions.

3. Proposed substitutions requests shall provide proof of compliance with OWNER'S requirements and applicable standards.

B. Submittals must comply with contract general provisions.

1.02 QUALITY ASSURANCE

A. Components and materials shall be listed and approved for the intended application by Underwriter's Laboratories (UL), or other Nationally Recognized Testing Laboratory (NRTL), and in compliance with applicable industry standards and codes.

B. Wiring installation shall be performed under the supervision of state certified electricians. Contractor or Installer’s electricians shall be certified in accordance with Labor Code sections 3099, and 3099.2 and section 209.0 of the California Code of Regulations.

C. Contractor shall have adequate experience installing systems of similar size and complexity.

1. Qualifications of Installer: Minimum five years of experience installing products and systems of similar scope and complexity.

2. Installer shall have completed at least five projects of equivalent scope and complexity.

3. Contractor shall have completed and commissioned a minimum of five service agreements that provide similar support services to those needed for this project.

4. System startup and testing shall be performed under direct observation of the Project Inspector and OAR.

D. The Project Inspector will observe installation of feeder cables. Notify the Project Inspector not less than two working days in advance of the proposed time of feeder installation.

1.03 WARRANTY

A. Provide a one year labor warranty.

B. Provide material warranty of no less than 10 years.

C. Warranty period begins at substantial completion or project acceptance for beneficial occupancy.

D. CONTRACTOR shall warranty all products and materials. Multiple warranty sources is not acceptable.

PART 2 - PRODUCTS

2.01 WIRES

A. Pressure cable connectors shall be pre-insulated 3M Scotchlok, Ideal Wing Nut, O-Z/Gedney or equal.

B. Wires shall be single conductor type THHN or THWN insulated with polyvinyl chloride and covered with a protective sheath of nylon, rated at 600 volts. Wires may be operated at a maximum continuous conductor temperature in dry locations of 90 degrees C. and 75 degrees C. in wet locations. Wires and cables shall be listed by Underwriter's Laboratories (UL) Standard 83 for thermoplastic insulated wires, and listed for installation in accordance with Article 310 of the California Electrical Code (CEC).

C. Conductors shall be solid copper for 12 AWG and smaller conductors, and stranded copper for 10 AWG and larger conductors.

D. Conductors shall be insulated with PVC and sheathed with nylon.

E. Wires shall be identified by surface markings indicating manufacturer's identification, conductor size and metal, voltage rating, UL symbol, type designations and optional rating. Indentations for lettering are not permitted.

F. Wires shall be tested in accordance with the requirements of UL standard for types THWN and THHN.

G. Conductors shall be solid Class B or stranded Class C annealed uncoated copper in accordance with UL standards, or another Nationally Recognized Testing Laboratory (NRTL).

2.02 STANDARDS

A. THWN/THHN wires shall comply with the following standards:

1. UL 83 for thermoplastic insulated wires.

2. UL 1063 for machine tool wires and cables.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Wires shall not be installed until debris and moisture is removed from conduits, boxes, and cabinets. Wires stored at site shall be protected from physical damage until they are installed and walls are completed.

B. Wire-pulling compounds furnished as lubricants for installation of conductors in raceways shall be compounds approved and listed by UL, NRTL, or equal. Oil, grease, graphite, or similar substances are not permitted. Pulling of 2 AWG or larger conductors shall be performed with a cable pull machine. Any runs shorter than 50 feet are exempt. When pulling conductors, do not exceed manufacturer's recommended values

C. At outlets for light, power, and signal equipment, pigtail splices with 8-inch circuit conductor leads for connection to fixtures, equipment, and devices.

D. Pressure cable connectors, Yellow, Red, or Blue spring-loaded twist-on type, may be furnished in splicing number 8 AWG or smaller wires for wiring systems. Listed Push-in spring clamp wire connectors, Ideal In-Sure, or equal may be used in luminaires for fixture wiring.

E. Joints, splices, taps, and connections to switchboard neutral, bonding or grounding conductors, conductors to ground busses, and transformer connections for wires 6 gage and larger shall be performed with high-pressure cable connectors approved for installation with copper conductors. Connectors shall be insulated with heavy wall heat shrink WCSM, or cold-applied roll-on sleeve RVS. Insulation level shall be a minimum of 600V and joints, splices, and taps shall be qualified to ANSI C 119.1, UL, NRTL, or equal listed mechanical pressure connections.

F. Connections to any bussing and high-press cable connectors shall be securely bolted together with corrosion-resistant plated carbon steel, minimum grade five machine screws secured with constant pressure-type locking devices.

G. Connection of any bonding or grounding conductors shall be securely bolted together with corrosion-resistant plated carbon steel, minimum grade five machine screws secured with constant pressure-type locking devices.

H. Wire switchboards, panel cabinets, pull boxes, and other cabinets except public address, shall be neatly grouped and tied in bundles with nylon ties at 10-inch intervals. In switchboards, panels and terminal blocks, wires shall be fanned out to terminals. If bundles are longer than 24 inches, a maximum of nine current carrying conductors may be bundled together.

I. Install conductor lengths with a minimum length within the wiring space. Conductors must be long enough to reach the terminal location in a manner that avoids strain on the connecting lug.

J. Maintain the conductor required bending radius.

K. Neutral conductors larger than 6 gage, which are not color identified throughout their entire length, shall be taped, painted white or natural gray, or taped white where they

appear in switchboards, cabinet, gutters or pull boxes. Neutral conductors 6 gage and smaller shall be white color identified throughout their entire length.

L. Fire alarm and clock wiring shall be continuous from terminal cabinets or from equipment to each device. Splices are not permitted between devices and/or terminal cabinets at junction and pull boxes. Wiring shall be terminated at terminal blocks or devices only.

M. Wiring systems shall be free from short circuits and grounds, other than required grounds. The contractor shall be responsible for the testing of feeder and branch circuit conductor's insulation resistance. The insulation of the conductors shall be tested prior to connections to any panelboards, switchboards, variable frequency drives, lighting control systems, ballasts, and wiring devices such as but not limited to GFI receptacles, TVSS receptacles, or equipment. Insulation testing of panelboards and switchboards shall be independently performed from the insulation testing of any conductors as specified in other sections of this specification.

1. Utilize the services of an approved independent testing laboratory to perform megger time-resistance insulation testing of feeder conductors. Tests must be conducted with wires disconnected at both ends.

   a. Provide calibration program records to assure the testing instrument to be within rated accuracy. The test equipment accuracy shall be in accord with the requirements stated by the National Institute of Standards and Technology (NIST).

   b. Test equipment shall be provided with a label stating the date of last calibration. As a minimum the equipment shall have been calibrated within the past 12 months.

   c. Test reports shall include the following:

      1) Identification of the testing organization.
      2) Equipment identification.
      3) Ambient conditions.
      4) Identification of the testing technician.
      5) Summary of project.
      6) Description of equipment being tested.
      7) Description of tests.
      8) Test results.
      9) Analysis, interpretation and recommendations.

2. Utilize the services of an approved independent testing laboratory or a qualified contractor's employee (Technician certified in accordance with ANSI/NETA ETT-2000 Standard for Certification of Electrical Testing Personnel) to perform megger time-resistance insulation testing of branch circuit conductors. Tests must be conducted with wires disconnected at both ends.

   a. Test equipment and report requirements stipulated under paragraph 3.01.N.1 apply to branch circuit testing.

3. Tests shall be performed in the presence of the Project Inspector.

4. Insulation resistance shall not be less than 100 mega-ohms.

3.02 COLOR CODES

A. General Wiring:

1. For phase and neutral conductors 6 gage or larger, permanent plastic-colored tape may be furnished to mark conductor end instead of coded insulation. Tape shall cover not less than 2 inches of conductor insulation within enclosure.

2. Color code conductor insulation as follows:

SYSTEM VOLTAGE		
Conductor	208Y/120	480Y/277
Phase A	Black	Brown
Phase B	Red	Orange
Phase C	Blue	Yellow
Neutral	White	Natural Gray

Neutrals shall be colored-distinguished if circuits of two voltage systems are used in the same raceway.

3. Where two voltage systems are combined in an enclosure; CONTRACTOR shall apply a permanent color code label where the circuits originate.

B. Signal Systems: Wires for signal systems shall be color-coded and installed under observation of the Project Inspector. Except where otherwise specified, color-coding shall be as follows:

EDIT NOTE: IN NEW SCHOOLS AND SOME EXISTING SCHOOLS THE PROGRAM SIGNAL IS THROUGH THE PA SYSTEM; PROGRAM BELLS ARE NOT PRESENT. DELETE REFERENCE TO PROGRAM BELLS AS NEEDED.

SYSTEM	COLOR CODE
Clocks	Pink, Gray and Orange
Program Bells (some existing elementary schools)	White (Common)Black
Initiating Devices (Non-Addressable)	Red (+) and Black (-)
Program Bells (some existing secondary schools)	White (120 volt, common) Black (C.R. program) Blue (Shop program) Brown (Gym program) Yellow (Auditorium fire alarm)
Fire Alarm Horns	Pink (+) and Gray (-)
Fire Alarm Strobes	Orange (+) and Blue (-)
Un-Interruptible 24 Volt Power (Annunciator, Water Flow, and Audible Device)	Yellow (+) and White (-) Note: A single white wire may be common to both
Interruptible 24 Volt Power (4 wire smoke detectors, duct detectors)	Brown (+) and White (-) Note: A single white wire may be common to both
Switch-Leg Sprinkler Bell (Between water flow and audible device)	Violet (+) and White (-)
Door Holding Magnets (Non Power Limited)	Black (+) and White (-)

3.03 FEEDER IDENTIFICATION

A. Feeder wires and cables shall be identified at each point the conduit run is broken by a cabinet, box, gutter, etc. Where terminal ends are available, identification shall be by means of heat shrink wire markers, which provide terminal strain relief. Markers shall be by Tyco Electronics, Panduit, Brady Perma-Sleeve, or equal. Identification in other areas shall be by means of wrap-around tape markers from Tyco Electronics, Panduit, Brady Perma-Code or equal. Markers shall include feeder designation, size, and description.

3.04 TAPE AND SPLICE KITS

A. Splices, joints, and connectors joining conductors in dry and wet locations shall be covered with insulation equivalent to that provided on conductors. Free ends of conductors connected to energized sources shall be taped. Voids in irregular connectors shall be filled with insulating compound before taping. Thermoplastic insulating tape approved by UL, NRTL, or equal for installation as sole insulation of splices shall be furnished and shall be installed according to manufacturer's printed specifications.

3.05 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.06 CLEANUP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

END OF SECTION 26 05 19

SECTION 26 05 26

GROUNDING AND BONDING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Provide and install grounding system as indicated or required.

B. Related Requirements:

1. Refer to related sections for their system grounding requirements.

2. Section 26 05 00: Common Work Results for Electrical.

3. Division 27: Communications.

1.02 QUALITY ASSURANCE

A. Reference Standards:

1. IEEE 142 Green Book.

2. Underwriter's Laboratories (UL).

3. California Electrical Code.

4. Building Industry Consultant Services International (BICSI) (Signal).

5. EIA/TIA (Signal and power).

6. Nationally Recognized Testing Laboratory (NRTL) or equal.

1.03 SYSTEM DESCRIPTION

A. Metallic objects on the Project site that enclose electrical conductors, or that are likely to be energized by electrical currents, shall be effectively grounded.

B. Metal equipment parts, such as enclosures, raceways, and equipment grounding conductors, and earth grounding electrodes shall be solidly joined together into a continuous electrically conductive system.

C. Metallic systems shall be effectively bonded to the main grounding electrode system.

D. A separately derived AC source shall be grounded to the equipment grounding conductor, and to separate “made” electrode of building grounding electrode system.

E. Electrical continuity to ground metal raceways and enclosures, isolated from equipment ground by installation of non-metallic conduit or fittings, shall be provided by a green insulated grounding conductor of required size within each raceway connected to isolated metallic raceways, or enclosures at each end. Each flexible conduit over six feet in length shall be provided with a green insulated grounding conductor of required size.

F. Cold water, or other utility piping systems, shall not be utilized as grounding electrodes due to the installation of insulating couplings and non-metallic pipe in such installations. In addition to bonding to cold water pipe provide at least one of the following made grounding electrodes:

1. A dedicated "made" electrode, fabricated of at least 20 feet of galvanized 1/2 diameter rebar encased by at least two inches of concrete, and placed next to the bottom of a concrete foundation, or footing in direct contact with earth A welded extended portion shall surface at the location of the common grounding electrode bus bar and be extended by a 3/0 CAD welded bare copper cable, or be CAD welded directly to the bus. The CAD weld shall be at least four inches above finished floor in a dry location. The main grounding electrode and associated grounding conductors shall be in an enclosure and in conduit.

2. Grounding electrodes as specified hereafter in this section.

3. Concrete enclosed electrode, fabricated of at least 20 feet of No. 2 AWG, minimum size, bare copper conductor, encased by at least two inches of concrete, located within or near bottom of a concrete foundation, or footing, which is in direct contact with earth. Footing rebar shall be connected to copper wire with approved connectors. An external electrode, as specified hereafter or as required by the CEC, shall be installed and connected to foundation or footing rebar.

G. Non-current carrying metal parts of high-voltage equipment enclosures, signal and power conduits, switchboard and panelboard enclosures, motor frames, equipment cabinets, and metal frames of buildings shall be permanently and effectively grounded. Provide a CEC sized grounding conductor in every raceway.

H. Metallic or semi-conducting shields and lead sheaths of cables operating at high voltage, shall be permanently and effectively grounded at each splice and termination.

I. Neutral of service conductors shall be grounded as follows:

1. Neutral shall be grounded at only one point within the Project site for that particular service. Preferable location of grounding point shall be at the service switchboard, or main switch.

2. Equipment and conduit grounding conductors shall be bonded to that grounding point.

3. If other buildings or structures on the Project site are served from a switchboard or panelboard in another building, power supply is classified as a feeder and not as a service.

4. Equipment grounding conductor is installed from switchboard to each individual building. At building, grounding conductor is bonded with power equipment enclosures, metal frames of building, etc., to "made" electrode for that building.

5. Feeder neutrals shall be bonded at service entrance point only, neutrals of separately derived systems shall be bonded at the source only.

J. If there is a distribution transformer at a building the secondary neutral conductor shall be grounded to "made" electrode serving the building.

K. Within every building, the main switchboard or panelboard, shall be bonded to the cold water line. Metallic piping systems such as gas, fire sprinkler, or other systems shall be bonded to the cold water line.

1.04 SUBMITTALS

A. Provide in accordance with Division 01.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Furnished yard boxes shall be precast concrete and shall be approximately 14 inches wide by 19 inches long by 12 inches deep or larger, if necessary to obtain required clearances. Boxes shall be furnished with bolt-down, checkered, cast iron covers and cast iron frames cast into boxes. Yard boxes shall be Jensen Precast, Oldcastle Precast, Western Precast, Kistner , or equal.

B. "Made" electrodes shall be copper-clad steel ground rods, minimum 3/4 inch diameter by ten feet long.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Grounding electrodes shall be installed in the nearest suitable planting area, where not otherwise indicated on Drawings, and each electrode shall terminate within a concrete yard box installed flush with finish grade. In planting areas, finish elevation of concrete yard boxes shall be two inches above planting surfaces.

B. If concrete enclosed electrode is provided, grounding wire shall be terminated to a suitable copper plate with grounding lugs and must be enclosed in a raceway or box..

C. Grounding rods shall be driven to a depth of not less than eight feet. Permanent ground enhancement material, (GEM) as manufactured by Erico Electrical Products, Loresco Powerset, Tessco Ultrafil or equal, shall be installed at each ground rod to improve grounding effectiveness. Install in accordance with manufacture's installation instructions.

D. Grounding electrodes shall provide a resistance to ground of not more than 25 ohms.

E. When installing grounding rods, if resistance to ground exceeds 25 ohms, two or more rods connected in parallel, or coupled together shall be provided to meet grounding resistance requirements.

F. Ground rods shall be separated from one another by not less than ten feet.

G. Parallel grounding rods shall be connected together with recognized fittings and grounding conductors in galvanized rigid steel conduit, buried not less than 12 inches below finish grade.

3.02 TESTING

A. Provide the services of an approved independent testing laboratory to test grounding resistance of “made” electrodes, ground rods, bonding of building steel, water pipes, gas pipes and other utility piping. Tests shall be performed as follows:

1. Visually and mechanically examine ground system connections for completeness and adequacy.

2. Perform fall of potential tests on each ground rod or ground electrode where suitable locations are available per IEEE Standard No. 81, Section 8.2.1.2. Where suitable locations are not available, measurements will be referenced to a known dead earth or reference ground.

3. Perform the two point method test per IEEE No. 81, Section 8.2.1.1 to determine ground resistance between ground rod and building steel, and utility piping - such as water, gas and panelboard grounds. Metal railings at building entrances and at handicapped ramps shall also be tested.

4. Test shall be performed in the presence of the Inspector.

B. Submit 3 copies of test results to the Architect. Test results shall be submitted on an official form from the independent testing laboratory recording Project location, test engineer, test conditions, test equipment data, ground system layout or diagram, and final test results.

3.03 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.04 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION 26 05 26

SECTION 26 05 33

RACEWAYS, BOXES, FITTINGS, AND SUPPORTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Raceways and wire ways.
2. Conduit installation.
3. Underground requirements.

B. Related Requirements:

1. Division 26: Electrical
2. Division 27: Communications.
3. Division 28 - Electronic Safety and Security.

C. Applicable Standards and Codes.

1. EIA/TIA 569 Standards.
2. National American Standards Institute (ANSI).
3. National Electrical Manufacturer's Association (NEMA).
4. Nationally Recognized Testing Laboratory (NRTL).
5. California Electrical Code (CEC).
6. Uniform Building Code (UBC).
7. Underwriters Laboratory (UL).

1.02 SUBMITTALS

A. Materials List: Provide in accordance with Division 01.

PART 2 - PRODUCTS

2.01 RACEWAYS

A. Conduit Materials:

1. Metallic conduit, and tubing shall be manufactured under the supervision of an UL, or another NRTL factory inspection and label service program. Each ten-foot length of conduit and tubing shall bear the UL or another NRTL label and manufacturer's name.

2. Rigid metallic conduit shall be rigid steel, heavy wall, mild steel, zinc-coated, with an inside and outside protective coating manufactured in accordance with ANSI C 80.1. Couplings, elbows, bends, conduits, bushings and other fittings shall be the same materials and finish as the rigid metallic conduit. Fittings, connectors, and couplings shall be threaded type, manufactured in accordance with ANSI C 80.1 and UL 6.

3. Electrical metallic tubing shall be steel tubing, zinc-coated with a protective enamel coating inside, manufactured in accordance with NEMA C 80.3. Fittings, couplings, and connectors shall be gland compression type, set screw couplings and connectors not permitted. All parts shall be manufactured in accordance with NEMA C80.3 and UL 6A Electrical metallic tubing is designated hereinafter as EMT. Steel and rain tight fittings shall be approved and listed for the intended application.

4. Flexible steel conduit shall be of flexible interlocking strip construction with continuous zinc coating on strips, manufactured in accordance with UL 1.

    a. Connectors and couplings shall be required fittings of the type, which threads into convolutions of flexible conduit.

5. Liquid-tight flexible metal conduit shall be galvanized heavy wall, flexible locked steel strip construction, UV rated, with smooth moisture and oil-proof, abrasion-resistant, extruded plastic jacket. Connectors shall be as required for installation with liquid-tight flexible conduit and shall be installed to provide a liquid-tight connection.

6. Non-metallic conduit shall be rigid PVC electrical conduit extruded to schedule 40 dimensions of Type II. Grade 1 high impact, polyvinyl chloride, sweeps, couplings, reducers and terminating fittings shall be listed under the UL, or another NRTL, and shall bear the manufacturer's listed marking.

7. Multi-cell raceway shall be four inch PVC, Type 40, UL or another NRTL listed for underground use with optical fiber and signal system cables. Raceway shall be furnished with 3-1/2 inch factory installed inner ducts with required internal spacers, and required couplers, sweeps, and end bells. Multicell raceway shall be Carlon Multigard, or District approved equal.

8. Metal Clad (MC) cable system is not allowed.

B. Sleeves for Conduits: Sleeves shall be adjustable type by Carlon, U.S. Plastic, PEP Plastic or equal.

C. Where conduit enters a building through a concrete foundation below grade, or ground water level, or where it is necessary to seal around a conduit where it passes through a concrete floor or wall, provide O-Z/Gedney Type FSK Thru Wall and Floor Seal, equivalent Cooper Crouse Hinds Thru-Wall, Legrand Thru-Wall, or equal.

D. Expansion Joints-Seismic Separations between building(s) and other locations as indicated on drawings:

1. Provide Thomas & Betts XJG-TB, O-Z/Gedney. type AX with bonding strap and clamps, Cooper XJGD or equal. At exterior locations, provide Thomas & Betts XJG-TB, O-Z/Gedney type EX, Cooper XJGD, or equal. Provide O-Z/Gedney type AXDX, or equal combination deflection/expansion fittings at all seismic separations. Provide manufacture's internal and external bonding jumpers at all locations. Liquid-tight metal conduit or flexible metal conduit shall not be approved at expansion joints, separations between buildings or seismic separations.

2. Provide expansion fittings at intervals not exceeding 100 feet in conduits exposed to direct sunlight. Fittings may be installed in the conduit run or where conduit attaches to junction or pull boxes. OZ/Gedney type AX, TX or EXE series, or equivalent by Thomas and Betts, Crouse-Hinds or approved equal.

E. Conduit Seal Fittings:

1. Provide conduit seal fittings where indicated on the Drawings. Conduit seals shall be of rigid galvanized steel. Seals in horizontal conduit installations shall be Thomas & Betts EYS, Appleton Type ESU, Crouse Hinds Type EYS, or equal. Seals in vertical conduit installations shall be Thomas & Betts EYD, Appleton Type SF, Crouse Hinds Type EYD, or equal, with continuous drain. When installing conduit seals make provision for percent fill space reduction in accordance with CEC.

2. Install sealing compound after wire has been installed. Ensure drain is not blocked in vertical seals when installing compound. Where conduit seals are installed in hazardous area applications, there shall be no conduit coupling, fitting, etc., between seal and boundary of hazardous area.

F. Surface Steel Raceway:

1. The surface steel raceway system for branch circuit wiring, data network, voice, video, and other low voltage wiring shall be as manufactured by the Wiremold Company, Hubbell, or Mono-Systems, Inc. or equal. The raceway system may be supplied pre-wired in accordance with all sections of these specifications and requirements herein, and shall be UL or another NRTL listed. Computer data installation shall be as required by other sections of this Division.

    a. If furnished pre-wired, the system must be listed in accordance with UL or another NRTL for "Multiple Outlet Assemblies" and so labeled on interior of the assembly. The pre-wired installation must contain no extra wire splices in the raceway as compared to a contractor assembled installation assembled from components. The pre-wired steel raceway shall be Hi-Pot tested at the factory to prevent any potential bare wire or shot circuit defects.

2. The raceway base, cover, and device bracket shall be manufactured of steel and finished in ivory, gray enamel or custom colors suitable for field painting to match adjacent finishes.

3. The raceway shall be a two-piece design with a metal base and snap-on metal cover, except for the Wiremold V700 system, Hubbell HBL750 series and Mono-Systems Inc. S145-700 series that shall be a one-piece design. The base and cover sections shall be a minimum of 0.040 inch wall thickness. The base section shall be available in ten-foot lengths. A hand-operated cutting tool shall be available for the base and cover to ensure clean, square cuts. Wiremold V500, Hubbell V500, and Mono Systems inc. SM500 series are not permitted.

4. A full complement of fittings shall be furnished, including but not limited to, flat internal and external elbows, tees, entrance fittings, wire clips, cover clips, couplings, support clips, C-hangers and end caps. The fitting color shall match the raceway color. Fittings shall be supplied with a base where indicated and/or required. A take-off fitting shall be furnished as required to adapt to existing flush wall boxes.

5. Device brackets shall be furnished for mounting single or two-gang devices within the raceway. Devices shall be provided with the ability of mounting flush or in conjunction with standard steel, stainless steel, or manufacturer's metal faceplates.

6. The raceway shall be furnished with a complete line of connectivity outlets and modular inserts for unshielded twisted pair including category 5, fiber-optic, coaxial, and other cabling types with face plates and bezels to facilitate

installation. Computer data installation shall be as required by other sections of this Division, and Division 27.

7. Raceway shall be furnished with corner elbows and tee fittings to maintain a cable bend radius which meets the requirements of fiber-optic and copper cables under EIA/TIA 569 for communications pathways.

G. Factory Pre-Wired Surface Metal Raceway:

1. Furnish and install pre-wired surface metal raceways as indicated on Drawings and as specified.

2. Metal Raceway shall be galvanized steel Wiremold V4000, Hubbell 4000 series, or Mono-Systems Inc. SMS-4000 series complete with raceway base, cover, fittings, receptacles and mounting plates required for a complete assembly. Raceway shall have two wiring compartments with integral dividing barrier for isolating the wiring compartments.

3. Pre-wired assembly shall be UL, or another NRTL listed as a multi-outlet assembly and surface raceway as labeled on interior of assembly.

4. Wiring devices and other components shall be factory installed, electrically wired and covers labeled as indicated on drawings. Each receptacle shall be identified with panelboard and circuit number from which it was fed. Grounding shall be maintained by means of factory installed grounding conductors.

5. Where shown on Drawings, Raceway covers shall have provisions for mounting computer data outlets.

6. Complete assembly is to consist of required fittings such as elbows, slide couplings for joining raceway sections, blank end caps and flat tees.

7. Prewired assembly must contain no wire splices.

8. Receptacles and wiring shall be as indicated on drawings and as specified.

9. Where raceway is used for power and computer data outlets, installation of data outlets shall be as required by other sections of this specification.

10. Prior and during installation, verify and comply with manufacturer's installation instructions.

11. Entire assembly shall be tested for shorts, opens, ground faults, and wire insulation at factory and certified. Raceways shall be electrically continuous and bonded in accordance with California Electrical Code.

12. Submit shop drawings for approval showing the complete layout of all components of each raceway, raceway lengths, each component description, location and circuit identification.

13. All wiring devices shall be removable without requiring disassembly of wireway.

14. Standard non OEM wiring devices shall be used as specified in District's specifications.

H. Wireways shall be 16 gage galvanized steel enclosed hinge/screw wiring troughs, surface metal raceway, wireway, and auxiliary gutter designed to enclose electrical wiring. Wireway fittings shall be furnished with removable covers and sides to permit complete installation of conductors throughout the entire wireway run. Cover shall be furnished with keyhole slots to accept captive screws locking the cover securely closed. Wireways shall be UL or another NRTL listed, and shall be Square D Type LDB NEMA-1 enclosure for interior applications, or Type RDB NEMA-3R enclosure for exterior applications, or equal by Cooper B-line, Hoffman, Wire Guard, or Circle AW.

I. Penetration in Fire-Rated Structures: Provide 3M, or equal, sealant and fire barriers for installing fire-rated seals around penetrations through floors, walls, and elevator hoistways. Fire stop system must be UL, or another NRTL listed, and classified for through-penetration applications of metallic conduits and busways.

J. Pull Wires: Install 1/8 inch polypropylene cords in empty or spare conduits.

PART 3 - EXECUTION

3.01 CONDUIT INSTALLATION

A. General Requirements:

1. Provide complete and continuous systems of rigid metallic conduit, outlet boxes, junction boxes, fittings and cabinets for systems of electrical wiring including lighting, power, and signal systems, except as otherwise specified.

2. EMT may be installed in interior concealed applications and in areas approved by owner. EMT shall not be installed in concrete, directly buried underground, outdoors, in boiler rooms, elevator pits, or where subject to damage.

3. Within buildings, flexible steel conduit may be installed instead of rigid steel conduit where permitted by code. Flexible steel conduit shall be installed:

   a. For continuous lengths not exceeding more than 50 feet between pull points (pull boxes, outlet boxes, etcetera).

   b. With no maximum total raceway length located within a building interior when the flex is located in concealed locations.

4. Flexible Steel conduit shall not exceed 1-1/2 inches in size.

5. Liquid-tight flexible steel conduit shall only be installed, except where otherwise specified, for final connection of motor terminal boxes, shop equipment, cafeteria equipment, HVAC equipment and other equipment, or for frequent interchange,

and shall be of sufficient length, not exceeding 36 inches, to permit full travel or adjustment of motor on its base. Liquid-tight flexible conduit shall not be used for equipment not requiring adjustment or frequent interchange.

6. Connectors for flexible metal conduit shall be made of steel, and of the types which threads into convolutions of conduit. Connectors for watertight flexible metal conduit shall be as required for installation and shall be installed to provide a watertight connection.

7. Exposed conduit shall be installed vertically and horizontally following the general configuration of the equipment, using cast threaded hub conduit fittings where required and shall be clamped to equipment with suitable iron brackets and one hole pipe strap.

8. If connection is from a flush wall-mounted junction box, install an approved extension box.

9. Underground feeder distribution conduits for systems may be non-metallic conduit instead of rigid conduit except where otherwise specified or indicated.

10. Conduit shall be concealed unless otherwise indicated. Conduits exposed to view, except those in attic spaces and under buildings, shall be installed parallel or at right angles to structural members, walls, or lines of building. Conduits shall be installed to clear access openings.

11. Bends or offsets will not be permitted unless absolutely necessary. Radius of each conduit bend or offset shall be as required by ordinance. Bends and offsets shall be performed with standard industry tools and equipment or may be factory fabricated bends or elbows complying with requirements for radius of bend specified. Heating of metallic conduit to facilitate bending is not permitted. Public telephone conduit bends and offsets shall be provided with a radius which is not less than ten times trade size of conduit unless otherwise permitted. Refer to underground installation, specified in this section, for radius of bends and offsets required for underground installations.

12. Running threads are not permitted. Provide conduit unions where union joints are necessary. Conduit shall be maintained at least six inches from covering of hot water and steam pipes and 18 inches from flues and breechings. Open ends of conduits shall be sealed with permitted conduit seals during construction of buildings and during installation of underground systems.

13. Expansion Joints/Seismic Separations/Separations between buildings/Locations Indicated: Provide Thomas & Betts XJG-TB, O-Z Electrical Mfg. Co. Inc. Type AX with bonding strap and clamps. Crouse Hinds XJGD, or equal. At exterior locations, provide Thomas & Betts XJG-TB, O-Z Electrical Mfg. Co. Inc. Type EX, Crouse Hinds XJGD, or equal. Provide Crouse Hinds, Thomas & Betts, or

O-Z Electrical Mfg. Co. Type AXDX, or equal Combination Deflection/Expansion Fittings at all seismic separations. Provide manufactures internal and external Bonding Jumpers at all locations. Liquid-tight flexible conduit shall not be approved at expansion joints or seismic separations.

14. Where conduits are terminated in groups at panelboards, switchboards, and signal cabinets, etc., provide templates or spacers to fasten conduits in proper position and to preserve alignment. Conduits terminating at signal cabinets shall only enter cabinets in the following locations:

    a. Conduits entering top, side, and bottom of cabinets shall be aligned in a single row, centered two inches from rear of cabinet.

    b. Conduits entering back of cabinet shall be aligned in a single row centered two inches from top of cabinet.

    c. Conduits shall not be spaced closer than three inches on centers.

15. Conduits above metal lath ceilings shall be rigidly suspended with pipe hangers or pipe racks or shall be secured to superstructure with factory fabricated pipe straps. Conduits in metal lath or steel stud partitions shall be tied to furring channels or studs. In ceiling spaces and in partitions, tie wires shall be spaced not more than 5 feet apart, shall fasten conduit tight against channels and studs at point of tie and shall not support any of conduit weight. Tie wire shall be 16 gage galvanized double annealed steel.

16. Where auxiliary supports, saddles, brackets, etc., are required to meet special conditions, they shall be fastened rigid and secure before conduit is attached.

17. Conduit in ceiling spaces, stud walls, and under floors, shall be supported with factory fabricated pipe straps or shall be suspended with pipe hangers or pipe racks. Pipe straps shall be attached to and shall fasten conduit tight at point of support against ceiling and floor joists, rafters, and wall studs, or two-inch x four-inch headers fitted between joists or wall studs.

18. Conduits installed on exposed steel trusses and rafters shall be fastened with factory fabricated conduit straps or clamps, which shall fasten conduit tight against supporting member at point of support.

19. Conduits installed under buildings shall be strapped with factory fabricated conduit straps to underside of concrete floor or joists, or wood floor joists, or shall be suspended with pipe hangers or pipe racks. Conduits under building are not permitted to be placed directly on grade; they shall be suspended from building or shall be buried below surface or ground. 1-1/4 inch and larger conduits under buildings shall be installed with conduit hangers or racks.

20. Pipe hangers for individual conduits shall be factory fabricated. Steel rods shall be 3/8 inch for two-inch conduit hangers and smaller and shall be 1/2 inch for 2 ½-inch conduit hangers and larger.

21. Pipe racks for groups of parallel conduits and for supporting total weights not exceeding 500 pounds shall be trapeze type and shall consist of a cross channel, Steel City Kindorf B-900, Unistrut P-1000, equivalent Cooper B-Line or equal, suspended with a 3/8 inch minimum diameter steel rod at each end. Rods shall be fastened with nuts, top and bottom to cross-channel and with square washers on top of channel. Conduits shall be clamped to top for cross-channel with conduit clamps, Steel City Kindorf C-105 or Unistrut P-1111 through P-1124, equivalent Cooper B-Line, or equal. Conduits shall not be stacked one on top of another, but a maximum of two tiers may be on same rack providing an additional cross-channel is installed. Where a pipe rack is to be longer than 24 inches, or if the supported weight exceeds 500 pounds, submit Shop Drawings of installation to the Architect for review.

22. Conduits suspended on rods more than two feet long shall be rigidly braced to prevent horizontal motion or swaying. Installation shall meet zone 4 seismic requirements.

23. Factory fabricated pipe straps shall be one or two-hole formed galvanized clamps, heavy-duty type, except where otherwise specified.

24. Hangers, straps, rods, or pipe supports under concrete shall be attached to inserts set at time concrete is placed, or with approved concrete anchors. Under wood, install bolts, lag bolts, or lag screws; under steel joists or trusses, install beam clamps. Contractor shall submit size of anchors, bolts, screws, and installation method to Architect for approval prior to start of any work.

25. Conduits shall be supported at intervals required by code, but not to exceed ten feet. One inch and smaller exposed conduits shall be fastened with one-hole malleable iron straps. Perforated straps and plumber's tape is not permitted for the support of conduits.

26. Conduits stubbed up through a roof or an arcade shall be flashed with a waterproof flashing. Refer to Division 07 for additional requirements.

27. Bushings and locknuts for rigid steel conduit shall be steel threaded insulating type. Setscrew bushings are not permitted.

28. Flex conduits shall be cut square and not at an angle.

29. Routing of conduits may be changed providing length of any conduit run is not increased more than ten percent of the length indicated on Drawings.

B. Underground Requirements:

1. Conduits and multicell raceways installed underground shall be entirely encased in three inch thick concrete on all sides , except where otherwise specified. Provide required spacers to prevent any deflection when concrete is placed and to preserve position and alignment. Conduits and raceways shall be tied to spacers. Anchors shall be installed to prevent floating of conduits and raceways during placing of concrete. Provide red colored concrete to encase conduits of systems operating above 600 volts.

2. Underground conduits and raceways shall be buried to a depth of not less than 24 inches below finished grade to top of the concrete envelope, unless otherwise specified.

3. Assemble sections of conduit with required fittings. Cut ends of conduit shall be reamed to remove rough edges. Joints in conduits shall be provided liquid-tight. Bends at risers shall be completely below surface where possible.

4. Conduits and raceways in a common trench shall be separated by at least three inches of concrete. Electrical power and/or lighting conduit runs installed in a common trench with conduits containing signal system wiring such as public address, telephone, intrusion detection, fire alarm, television, computer networking, and clock systems shall maintain a separation of a minimum of six inches from these types of signal system conduits and raceways. Electrical power, lighting and signal conduits and raceways installed in a common trench with other utility lines such as gas, water, sewer and storm lines shall maintain 12 inches separation from these types of utility lines.

5. The Inspector will observe underground installations before and during concrete placement. A mandrel shall be drawn through each run of conduit in presence of the Inspector before and after placing concrete. Mandrel shall be six inches in length minimum, and have a diameter that is within 1/4 inches of diameter of conduit to be tested.

6. Non-metallic conduit installations shall comply with following additional requirements. Joints in PVC conduit shall be sealed by means of required solvent-weld cement supplied by conduit manufacturer. Non-metallic conduit bends and deflections shall comply with requirements of applicable electrical code, except that minimum radius of any bend or offset for conduits sized from 1/2 inch to 1 ½-inch inclusive shall not be less than 24 inches. Bends at risers and risers shall be PVC-coated rigid steel conduit. Radius of curve of bends or offsets in non-metallic conduit for public telephone system shall be not less than ten times trade size of conduit, unless otherwise specifically permitted.

7. Furnish and install a six-inch wide, polyethylene, red underground barrier type 12 inches above full length of concrete reading, "CAUTION ELECTRIC LINE BURIED BELOW".

8. Underground conduit systems provided for utility companies shall be furnished to meet the requirements of the utility companies requiring service.

9. Protect inside of conduit and raceway from dirt and rubbish during construction by capping openings.

10. Add bell-end bushings for conduit stub-up including underground entries to pull boxes, and manholes. Under floor standing switchboards and motor control centers provide a four-inch galvanized nipple with ground bushing.

11. Underground conduit for systems operating above 600 volts shall be a minimum size of four inches.

12. At portable classroom all stub ups shall be installed with a coupling flush to finish grade.

13. Underground conduits and raceways shall be swabbed prior to wire pull.

C. Rooftop conduit shall be supported from channels, stands, clamps, trapezes, rollers, or structures mounted on 100% rubber, UV resistant rooftop supports with reflective strips, Dura-Blok, or equal. Roller type supports shall be provided below and above conduit to prevent its dislodgement. Bottom of conduits shall clear the roof surface by 10 inches.

1. At PVC roofing provide walk tread, polyester reinforced, UV resistant, with surface embossment at rooftop supports. Heat welding of walk pads shall only be done by manufacturer certified installers.

    a. Sika-Sarnafil and Carlisle: Walk tread shall be no more than one inch larger than the plan area of the pipe support blocks and adhered to the roof membrane with Sika 1A or Carlisle Universal Single-Ply sealant, as applicable.

    b. Johns Manville: Walk tread shall be installed under the pipe support blocks and adhered to the blocks, if possible, and left loose laid on top of the PVC roof system. Walk-pad shall have a minimum of 4 inches of material past perimeter on all 4 sides of block.

2. Built-up roofing: Provide APP granulated modified torch-down at each pipe support block. Torch-down shall extend 2 to 4 inches beyond the edges of the block and adhered by torch application over existing cap sheet membrane. This work shall be performed by a certified roofer.

D. General Installation Requirements for Computer Network System Conduits:

1. Location of outlet boxes and equipment on Drawings is approximate, unless dimensions are indicated. Drawings shall not be scaled to determine position and routing of wireways, drops, and outlet boxes. Location of outlet boxes and equipment shall conform to architectural features of the building and other Work already in place and must be ascertained in the field before start of Work.

2. The maximum pulling tensions of the specified cables shall not be exceeded and proper radius of cable bends shall be maintained.

3. For computer network wiring, conduit types shall be limited to rigid metal conduit, electrical metallic tubing, schedule 40 PVC, multi-cell raceways, and flexible metallic conduit for lengths less than six feet.

4. Interior section of conduit run shall be not longer than 100 feet and shall not contain more than two bends of 90 degrees between pull points or pull boxes.

5. The inside radius of a conduit bend shall be at least six times the internal diameter of the conduit. When the conduit size is greater than two inches, the inside radius shall be at least ten times the internal diameter of the conduit. For fiber-optic cable, the inside radius of a conduit bend shall be at least ten times the internal diameter of the conduit.

6. Conduit shall be sized in accordance with Table 4.4-1 of EIA/ TIA 569 standard.

7. Splicing or terminating cables in pull boxes is not permitted.

8. For indoor application, a pull box shall be provided in conduit run where:

   a. The length is over 100 feet.

   b. There are more than two bends of 90 degrees.

   c. There is a reverse bend in the run.

9. Boxes shall be provided in a straight section of conduit and shall not be installed in lieu of a bend. The corresponding conduit ends are to be aligned with each other. Conduit fittings shall not be installed in place of pull boxes.

10. Where a pull box is provided with raceways, pull box shall comply with the following:

    a. For straight pull-through, provide a length of at least eight times the trade-size diameter of the largest raceway.

    b. For angle and U-pulls:

       1) Provide a distance between each raceway entry inside the box and the opposite wall of the box of at least six times the trade-size

diameter of the largest raceway, this distance being increased by the sum of the trade-size diameters of the other raceways on the same wall of the box.

2) Provide a distance between the nearest edges of each raceway entry enclosing the same conductor of at least:

a) Six times the trade-size diameter of the raceway; or

b) Six times the trade-size diameter of the larger raceway if they are of different size.

c) For a raceway entering the wall of a pull box opposite to a removable cover, provide a distance from the wall to the cover of not less than the trade-size diameter of the largest raceway plus six times the diameter of the largest conductor.

11. Drawings generally indicate Work to be installed, but do not indicate all bends, transitions of special fittings required to clear beams, girders or other Work already in place. Investigate conditions where conduits and wireways are to be installed, and furnish and install required fittings.

E. Slabs on Grade:

1. Unless specifically reviewed by the Architect and DSA, conduits 1 ¼-inches and larger are not permitted to be installed in structural concrete slabs. Where conduits are permitted, and are installed in concrete slabs on grade, slabs shall be thickened at bottom where conduits occur to provide three inches of concrete between conduit and earth. Required excavation shall be part of the Work of this section.

2. If concrete slab is five inches or more in thickness with a moisture barrier plastic sheet between earth and slab, one inch and smaller conduits shall be installed in the slab with a minimum of one inch concrete between earth and conduit.

F. Concrete Walls, Beams, and Floors: Provide sleeves where conduits pierce concrete walls, beams, and floors, except floor slabs on grade. Sleeves shall provide 1/2 inch clearance around conduits. Sleeves shall not extend beyond exposed surfaces of concrete and shall be securely fastened to forms. Where conduits pass through walls below grade, seal with required sealant and backer materials between conduit and sleeve to provide a watertight joint. Sealant shall be as indicated in Section 07 9200: Joint Sealants.

3.02 STUBS

A. Panelboard: Install two one inch conduits from each flush mounted panelboard to access under floor space and to access above ceiling space where these conditions occur. Cap conduits with standard galvanized pipe caps.

B. Floor: At points where floor stubs are indicated in open floor areas, for connections to machines and equipment, conduits shall be terminated with couplings, tops flush with finished floor. Stubs shall extend above couplings the indicated distance. Where capped stubs are designated, couplings shall be closed with cast iron plugs with screw drive slots.

C. Underground:

1. Underground conduit stubs shall be terminated at locations indicated, and shall extend five feet beyond building foundations, steps, arcades, concrete walks and paving. Rigid metallic conduit stubs and non-metallic conduit stubs shall be capped by installing a coupling flush in end wall of concrete encasement and plugging with a permitted plug. Project record drawings shall indicate location of ends of underground conduit stubs fully dimensioned and triangulated with reference to buildings or permanent landmarks. These dimensions, including depth below finished grade, shall be marked on project record drawings in presence of the Inspector before backfilling trench. Where extending existing concrete encased stubs, clean, chip and wire brush end of existing concrete and brush on a heavy coat of neat cement paste or epoxy bonding agent.

2. Over ends of individual underground conduit stubs or groups of conduit stubs, install four-inch by 18-inch deep PVC filled with concrete, flush with finished grade in asphaltic concrete or lawns, and two inches above finished grade in planting areas. Cast a three-inch by three-inch brass plate engraved "ELECT" flush in top of concrete. Secure plate to concrete with brass dowels or as indicated on drawings.

3.03 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.04 CLEANUP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

END OF SECTION 26 05 33

SECTION 26 22 00

LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: This specification covers single-phase and three-phase general purpose individually mounted dry-type transformers, 600 V maximum, for power and lighting applications. It includes transformers as specified and as indicated on Drawings.

B. Work, material or equipment shall comply with the codes, ordinances and regulations of the local government having jurisdiction, including the regulations of serving utilities and any participating government agencies having jurisdiction.

C. Related Requirements:

1. Division 01 - General Requirements.

2. Section 26 05 00: Common Work Results for Electrical.

3. Section 26 05 13: Basic Electrical Materials and Methods.

4. Section 26 05 26: Grounding and Bonding.

5. Section 26 05 19: Low-Voltage Wires (600 Volts AC)

6. Section 26 05 33: Raceways and Boxes, Fittings and Supports.

7. Section 26 26 00: Power Distribution Units.

8. Division 27: Communications.

D. Codes and Applicable standards: Products and installation shall meet or exceed the latest edition of the following standards.

1. ANSI/IEEE C57.96, Distribution and Power Transformers, Guide for Loading Dry-Type Transformers; Appendix to ANSI C57.12 Standards.

2. Department of Energy, Energy Act of 2005.

3. International Electrical Code adopted by the State of California.

4. ANSI/NEMA 250 Enclosure for Electrical Equipment (1000 Volts Maximum)

5. IEEE C57.12.91, Test Code for Dry-Type Distribution and Power Transformers.

6. IEEE C57.110 – IEEE Recommended Practice for establishing liquid-filled and dry-type power and distribution transformer capability when supplying nonsinusoidal load currents.

7. 1100-IEEE Recommended Practice for Powering and Grounding Sensitive Electronic Equipment.

8. NEMA standard 20, Dry-Type Transformers for General applications.

9. UL 506, Specialty Transformers.

10. UL 1561, Dry-Type General Purpose and Power Transformers.

11. NEMA TP-1, Guide for Determining Energy Efficiency for Distribution Transformers.

12. NEMA TP-2, Standard Test Method for Measuring the Energy Consumption of Distribution Transformers.

13. NEMA TP-3, Standard for the Labeling of Distribution Transformer Efficiency.

14. CSA 802.2-00 Minimum Efficiency Values for Dry Type Transformers

15. California Building Code (CBC)

16. Tri-axial shake test results conducted in accordance with AC156 test protocol.

17. NFPA 70 National Electric Code

E. No requirement of these drawings and specifications shall be construed to void any of the provisions of the above standards. Any conflicts or changes required to the contract documents in order to obtain compliance with applicable codes shall be brought to the immediate attention of the Owner Authorized Representative by the CONTRACTOR.

F. ACRONYMS

ANSI American National Standards Institute

AOR Architect of Record

CEC	California Electrical Code
EOR	Engineer of Record
IBC	International Building Code
IEEE	Institute of Electrical and Electronics Engineers
NEC	National Electrical Code
NEMA	National Electrical manufacturers Association

1.02 DESIGN REQUIREMENTS

A. Premium Efficiency transformers with internal losses at 35 percent loading reduced by 30 percent when using temperature and material correction factor to 75 degrees C per NEMA Standard TP1

B. Load Mix: Transformer shall be UL 1561 listed to feed a mix of equipment load profiles such as computer without detracting or significant degradation of efficiency.

C. The transformer shall be labeled with a K-9 Rating in accordance with UL 1561 35.21 and 34.2.

D. K-7 rating is not allowed.

E. Construction: Windings shall be continuous wound copper with brazed or welded terminations.

1. Insulation and Varnish Systems: Epoxy Polyester impregnation

2. Terminals, including those for changing taps must be readily accessible by removing a front cover plate.

F. Performance of transformers shall meet or exceed the requirements of applicable codes and standards, the DOE Energy Policy Act of 2005 - Public Law 109-58 and the latest requirements of the California Energy Commission Appliance Efficiency Regulations. In addition; transformers shall be designed to an efficiency standard higher than the lowest legal standard for the purpose of contributing to LEED Energy and Atmosphere (Optimized Energy Performance) and Utility Rebates.

G. Transformers shall be self-cooled type with 220 degrees C. insulation and a maximum temperature rise of 130 degrees C. under continuous full load conditions with an ambient of 40 degrees C.

H. Transformers shall be furnished with four 2.50 percent (two above and two below normal voltage) taps. Windings shall be of fire-resistant type, designed for natural convection cooling through normal air circulation.

I. Core mounting frames and enclosures shall be of welded and bolted construction with sufficient mechanical strength and rigidity to withstand shipping, installation, and short circuit stresses.

J. Enclosure cover plates shall be sheet steel, captive bolted to enclosure framework. Enclosure shall provide suitable ventilating openings with rodent-proof screens, NEMA 1 enclosure. Enclosure shall be provided with lifting lugs and jacking plates as required. Transformers installed outdoors shall be provided with weatherproof NEMA 3R enclosure and weather proof kit.

1. Submit rodent-proof screen sample for OWNER's approval.

K. Transformers shall be furnished complete with mounting channels and mounting bolts. Metal parts, excepting cores and core mounting frames shall be furnished clean, rust-proofed, and provided with a coat of an inert primer.

L. Transformers up to 35 KVA shall not exceed 40 decibels. Transformers 36 KVA or more shall be a minimum of 5 decibels below NEMA standards per unit. Transformers shall be provided with vibration dampers consisting of California Dynamic, Mason Industries, Korfund or equal neoprene mounting pad and Elastorib sheeting. Size and number of shock mounts shall be in accordance with manufacturer's recommendations.

M. Transformers shall be UL listed.

N. Each transformer to be installed under this section shall be sound tested at the factory. CONTRACTOR shall provide two copies of transformers tests reports for EOR's review.

O. Equipment shown on drawings to scale is approximate only and based upon a general class of equipment specified. The CONTRACTOR shall verify dimensions and clearances prior to commencement of work.

P. Verify points of connection with the manufacturer's requirements, instructions, or recommendations prior to installation. Actual dimensions, weights, clearances and installation requirements shall be verified and coordinated by the CONTRACTOR.

Q. Provide transformers with a K rating as indicated on drawings. K-rated transformers shall be type NL-UL or NLP-UL as indicated on drawings and be equipped with the following features:

1. Electrostatic shield.

2. NLP series shall have a maximum sound level of 3 dB below NEMA standards.

3. Double-size neutral terminal.

4. Additional coil capacity to compensate for higher non-linear load loss.

5. Heavy-gage ventilated indoor enclosures (provide weather shields where installed indoors).

6. K-rated transformers shall meet other requirements of this section.

1.03 SUBMITTALS

A. Provide in accordance with Division 01.

B. Shop Drawings: Include make, catalog number, dimensions, weight, KVA Rating, Percent Impedance, finish, type, insulation class, design temperature, sound levels, efficiency and taps provided. Include regulation at 80 percent and 100 percent of full load, no-load loss, full-load loss, percent efficiency, percent impedance, noise level and continuous capacity rating.

C. Provide manufacturers data and inspection report that confirms transformers to be UL 1561 listed with K rating equal to that indicated on drawings.

D. Provide a connection schematic diagram.

E. Provide the following tests reports: Project Inspector will review the reports for conformance with specified criteria, and compliance with the applicable standards. Submit one copy for each set of shop drawings being submitted.

1. Load Losses: Measurements shall be taken at multiple load levels and plotted to show compliance with specifications and correlated to efficiency curve for the transformer size and type.

2. Provide No-Load and Total Losses report.

3. Applied Voltage.

4. Temperature Rise.

5. Induced Voltage.

6. Sound Level.

7. Impulse Test.

8. Manufacturer’s nonlinear load test representing real world load mix. Transformers not meeting this requirement shall not be installed.

F. Submit harmonics test plan as follows:

1. NEMA ST-20.

a. Open Circuit Test (no load losses):

1) Use for both Linear and non-Linear.

2) Measure Power.

b. Short Circuit Test (load losses):

1) Short Primary Winding.

a) Linear Test – complete with linear profile through secondary winding.

c. Non-Linear Test.

Harmonic Profile (K-7 Load)				
Harmonic Number	Rated % Current	Phase Shift		
		A	B	C
1	100.0	0	120	240
3	81.0	0	0	0
5	60.6	0	240	120
7	37.0	0	120	240
9	15.7	0	0	0
11	2.4	0	240	120
13	6.3	0	120	240
15	7.9	0	0	0

1) Complete with non-linear profile through secondary windings.

2) Measure Power.

2. Take data and graph efficiency per NEMA ST-20.

a. Graph-1 – Linear Loads 0 to 100 Percent Loads.

b. Graph 2 – Non-Linear Profile K-9 0 to 100 Percent loads.

3. Test Plans measuring Power IN and Power Out will not be accepted since procedures are not covered by any standard.

1.04 WARRANTY

A. Transformers shall be warranted to be free from defects in materials, fabrication and execution for a period of three years from the date of substantial completion.

PART 2 - PRODUCTS

2.01 EQUIPMENT

A. Transformers manufactured by Siemens, Square D, General Electric, PowerSmiths, MGM, and Cutler Hammer or equal.

B. There shall be no openings through which foreign objects such as sticks, rods, wires, or the like might enter and contact live parts. Provide means for padlocking compartment doors.

a. Connection terminal points shall be bottom fed and located as far as possible below vent openings, or below top connections.

b. Terminals shall be protected from external/foreign objects contact.

PART 3 - EXECUTION

3.01 DELIVERY AND STORAGE

A. Deliver, storage, protect and handle products in accordance with the manufacturer's recommendations.

3.02 INSTALLATION

A. Transformer core frame shall be installed level on shock absorbing pads within enclosure. Comply with seismic requirements of CBC.

B. Mounting bolts on floor mounted transformers shall be extended into pads only and shall not be in direct contact with building structural members.

C. Flexible jumpers shall be installed for grounding continuity from enclosure to conduits or bus ducts where required.

D. Transformers installed outdoors or below grade shall be mounted on concrete pads as specified in Section 03 3000: Cast-In-Place Concrete.

E. Install transformer ventilation openings not closer than 6 inches from wall surfaces.

F. Do not install transformers in corrosive environments such as swimming pool pump and boiler rooms, or similar areas.

3.03 VOLTAGE CHECK

A. Set taps on transformers to provide satisfactory operating voltages with present loads energized, including new loads and existing loads. A check shall be performed in the presence of the Project Inspector at a panel fed from each transformer, which is farthest from transformer. Voltages at transformers ranging from 118 to 122 volts inclusive, for 120 volt systems and proportionately equivalent for higher voltage systems are permitted.

B. Provide instruments and accessories required to perform checks. Voltmeters shall be accurate within .075 percent or one percent and shall have scales permitting voltage readings to be performed on upper half of scale. Calibration of the meters shall be observed by the Project Inspector.

C. Adjust transformer taps under full load operating conditions, to provide normal operating voltages at the loads.

3.04 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.05 CLEANUP

A. Remove rubbish, debris and waste materials and legally dispose of off Project site.

B. Repair scratched or marred surfaces affected during the execution of work. Repair surfaces shall match original finish.

END OF SECTION 26 22 00

SECTION 26 24 16

PANELBOARDS AND SIGNAL TERMINAL CABINETS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Lighting and power distribution facilities, including panelboards.

B. Related Requirements:

1. Division 01 - General Requirements.

2. Section 26 05 00: Common Work Results for Electrical.

3. Section 26 05 13: Basic Electrical Materials and Methods.

4. Section 26 26 00: Power Distribution Units.

5. Section 26 50 00: Lighting.

6. Division 27: Communications.

7. Division 28: Electronic Safety and Security.

1.02 SUBMITTALS

A. Provide in accordance with Division 01.

B. Shop Drawings: Include a front elevation indicating cabinet dimensions, make, location and capacity of equipment, size of gutters, type of mounting, finish, and catalog number of locks. General layout of internal devices, wiring drawings with wire numbers and device connections, vendor cut sheets of devices in enclosure and bill of materials listing description, manufacturer, part number, and quantity of items shall be included.

C. Installation Instructions: Submit manufacturer's written installation instructions.

1.03 DESIGN REQUIREMENTS

A. Panelboards:

1. Panelboards shall be wall-mounted, enclosed safety type with 120/240 volt, three-wire solid neutral 277/480 volt, four-wire or 120/208 volt, four-wire solid neutral mains as indicated on Drawings or specified. First panelboard of each building shall be provided with main or sub-feeder circuit breakers where so indicated.

2. Single pole branches shall be molded case, thermal magnetic circuit breakers with inverse time delay, trip free, quick-make, quick-break mechanism and silver alloy contacts. Circuit breakers shall be fully rated, with ampere rating marked on handle and shall indicate on/off and tripped positions. Ground fault interrupters shall be incorporated into circuit breakers where indicated. They shall be listed by UL, or other NRTL as ground fault devices. Provide appropriate lug kit of sufficient size to accommodate the feeders.

3. Two- and three-pole branches shall be enclosed, and shall be thermal magnetic circuit breakers with inverse time delay, tamper-proof, ambient compensated, single handle, internal common trip, and quick-make, quick-break mechanism with silver alloy contacts. Circuit breakers shall be fully rated or as otherwise indicated on the Drawings.

4. Main and subfeeder circuit breakers shall be enclosed, thermal magnetic type with inverse time delay, single handle common trip, quick-make, quick-break mechanism, corrosion-resistant bearings and silver alloy contacts. Ampere frame size and trip rating shall be as indicated on Drawings. Breakers over 225 amperes shall be furnished with interchangeable trip units. Handles of main and subfeeder circuit breakers shall be provided cabinet door. Voltage rating shall be as indicated on Drawings.

5. Circuit breakers shall be fully rated and of one-piece, bolt-on type and shall meet short-circuit interrupting capacity requirements indicated on Drawings. Series rated circuit breaker combinations are not acceptable.

6. Internal connections shall be fabricated with plated copper bus bars and the busses shall extend for full length of space available for branch circuit breakers. Feeder cable connectors shall be installed at point of feeder entrance. Terminals shall be furnished with copper conductors. Panelboards fed by conductors having over-current protection greater than 200 amperes shall be protected on supply side by over-current devices having a rating not greater than that of panelboards. Copper bussing shall be fully rated. Heat rated bussing is not acceptable.

7. Except where otherwise indicated, circuit breakers shall be in two vertical rows connected to bus bars in a distributed phase arrangement. Two-pole branches shall be balanced on busses. Single pole branches shall be numbered adjacent to its circuit breaker, with odd numbers on left and even numbers on right.

8. Specified circuit breaker spaces shall be furnished with hardware required for future installation of circuit breakers.

9. Provide locking devices for individual circuit breakers. Padlocking devices shall be secured to circuit breakers and by panel dead front plates.

B. Surge Suppressors: Where indicated on Drawings, provide transient voltage surge suppressors as an integral part of panelboards. Panelboards shall be complete with 200 percent rated copper neutral bus, ground bus and isolated ground bus in addition to requirements of this section. Surge suppressors shall be as follows:

1. Surge Capacity:

   a. Line-to-neutral for wye systems: 80 KA.

   b. Line-to-ground: 80 KA.

   c. Neutral-to-ground: 80 KA, three-phase wye.

   d. Line-to-neutral plus line-to-ground: 160 KA.

2. UL 1449 2nd Edition Suppressed Voltage Rating for 208/120 Wye System:

   a. Line-to-neutral: 400 volts.

   b. Line-to-ground: 400 volts.

   c. Neutral-to-ground: 400 volts.

   d. Maximum continuous over-voltage: 150 volts.

3. EMI/RFI High-Frequency Noise Power Filter (Characteristics):

   a. 100 KHz at 444 dB.

   b. 100 MHz at 44 dB.

   c. 10 MHz at 44 dB.

   d. 100 MHz at 444 dB.

4. MOVs shall be thermally protected for low current faults and shall be fused with surge-rated fuses. The surge-rated surge current passes and clears the circuit safely if the surge capacity is exceeded. Enhanced diagnostics shall continuously monitor the unit's status and shall include LEDs to signal a reduction in surge capacity or the loss of a suppression circuit. An audible alarm, with test and silence features, shall be furnished in diagnostic package.

5. Each phase or the entire unit shall be replaceable and have bolted-on, tin-plated copper connections. Unit to have UL witnessed fault current rating of 65,000 symmetrical amperes.

6. Surge suppression units shall comply with the following:

a. UL certified.

b. UL 1283.

c. UL 1449.

d. IEEE C 62.45.

e. IEEE C 62.41.

f. Nationally Recognized Testing Laboratory (NRTL) or equal.

C. Panelboard Cabinets:

1. Panelboard cabinets shall be code gage galvanized steel or blue steel; fronts, doors, and trims shall be code gage furniture steel. Cabinets shall be furnished with at least six-inch high gutters at top and bottom where feeder cable size exceeds four gage or where feeder cable passes through cabinet vertically. Cabinets shall be furnished with top and bottom gutters sized as required by inspection department having jurisdiction, but never less than six inches where more than one feeder enters top or bottom of cabinets. Side gutters shall not be less than four inches wide. Width of cabinets shall be 20 inches, unless otherwise indicated on Drawings.

2. Doors shall be cut true, shall accurately fit opening and finish smooth across joints. Rabbets shall be inside. Hinges shall be entirely concealed except for barrels and pins. Hinge flanges shall be welded to door and trim. Doors shall be equipped with flush type, spring-latching, Corbin locks for metal doors, keyed to Corbin No. 60 keys.

3. Where contactors, time switches, and control devices are specified or indicated to be installed within panelboard cabinets, a separate compartment and door shall be provided at top of cabinet for such devices. Door shall be sized as required to permit removal of contactor and other devices intact. Gutters shall be provided at sides and top of compartment. Doors shall be equipped with flush type, spring-latching, Corbin locks for metal doors keyed to Corbin No. 60 keys.

4. Provide and install panelboard manufacturer's permanent circuit number kit option.

5. Panelboards with control devices in compartment shall arrive at the Project site completely assembled with control devices installed and wired.

6. Outdoor cabinets shall be NEMA Type 3R. Construction shall be formed from code gage galvanized steel with ANSI No. 61 gray enamel finish. Provide heavy-duty, three point latching, vault type door handles with padlocking provisions.

Provide stainless steel or galvanized butt hinges on doors. Padlocks shall be furnished, keyed to Corbin No. 60 keys.

7. Self-tapping screws and bolts not permitted.

D. Panelboard Schedule: Provide a neatly typewritten schedule with number or name of room or area, or load served by each panelboard circuit. Room numbers or names shall be determined at the Project site and shall not necessarily be those indicated on the Drawings. Schedule shall also indicate panel designation, voltage and phase, building and distribution panel or switchboard from which it is fed. Schedule shall be installed in a frame under transparent plastic 1/32 inch thick on inside of each panelboard cabinet door.

E. Panelboard nameplate: Provide a nameplate identifying panelboard. Plates shall be black and white plastic nameplate stock, with character cut through black exposing white and shall bare designation of service. Name plate shall be mechanically fastened to switchboard.

F. Provide additional labeling on dead-front of panelboard. Label shall be a P-Touch or equal with a minimum width of 3/8 inch with black letters on white background. Label shall re-identify panelboard and also identify name and location of power source feeding this panel. Location information shall include building name if located in different building and name or room location. If power source is installed in same room, label should indicate source name and "In this Room"

G. Panelboard Standards: Panelboards shall be UL, or other NRTL listed and labeled. Panelboards shall meet latest revisions of following standards:

1. California Electric Code, Article 384.

2. UL 67, Panelboards.

3. UL 50, Cabinets and Boxes.

4. UL 943, GFCI.

5. UL 489, Molded Case Circuit Breakers.

6. NEMA PB1.

7. Federal Specifications W-P- 115C and WC-375B.

H. Signal Terminal Cabinets:

1. Signal terminal cabinets shall conform to the Specifications for panelboard cabinets, except as modified herein.

2. Terminal cabinets shall be flush type, with two-inch trim or surface mounted type, as indicated on Drawings. Terminal cabinets shall be furnished with sections and barriers to separate each system. Sections over 24 inches in width shall be provided with double doors and locks. Terminal cabinets, or sections of terminals housing separate systems, shall measure 12 inches long by 18 inches high by 5 ¾-inch deep, unless otherwise indicated on Drawings. Trims for sectional cabinets shall be of one-piece construction.

3. Terminal cabinets shall be furnished with ¾ inch thick plywood. Plywood shall be fastened in place with machine screws or factory installed mounting screws.

4. Flush-mounted terminal cabinets shall be finished as specified for flush-mounted panelboard cabinets. Surface and semi-flush mounted terminal cabinets shall be finished as specified for surface-mounted panelboard cabinets.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Panelboards shall be manufactured by Siemens, W.A. Benjamin, General Electric, Cutler Hammer, Square D or equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Panelboards shall be located so they are readily accessible and not exposed to physical damage.

B. Panelboards installed outdoors shall be specifically listed for wet locations and shall be weatherproof in NEMA Type 3R cabinets.

C. Panelboard locations shall provide sufficient working space around panels to comply with the California Electrical Code.

D. Panelboards shall be securely fastened to structure and mounted on surface by at least four points.

E. Unused openings in cabinets shall be effectively closed as required by the manufacturer.

F. Cabinets shall be grounded as specified in Article 250 of the California Electrical Code.

G. Conduits shall be installed so as to prevent moisture or water from entering and accumulating within the enclosure.

H. Lugs shall be suitable and listed for installation with the conductor being connected.

I. Conductor lengths shall be maintained to a minimum within the wiring gutter space. Conductors shall be long enough to reach the terminal location in a manner that avoids strain on the connecting lugs.

J. Maintain the required bending radius of conductors inside the cabinet.

K. Clean the cabinet of foreign material such as cement, plaster, and paint.

L. Distribute and arrange conductors neatly in the wiring gutters.

M. Use the manufacturer's torque values to tighten lugs.

N. Before energizing panelboards, the following steps shall be taken:

1. Retighten connections to the manufacturer's torque specifications. Verify that required connections have been provided.

2. Remove shipping blocks from component devices and panelboard interiors.

3. Manually exercise circuit breakers to verify they operate freely.

4. Remove debris from panelboard interior.

O. Follow manufacturer's instructions for installation.

P. Do not install in highly corrosive environments, unless rated for the application.

3.02 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.03 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION 26 24 16

SECTION 27 00 00
COMMUNICATIONS GENERAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General:

1. This specification section provides general conditions for all division 27 specifications. All contractors working within the division 27 specification shall adhere to this specification.

1.2 STATEMENT OF WORK

A. General:

1. This document describes the requirements for the contractors, products, and installation relating to furnishing and installing the described low voltage systems.
2. The Contractor will provide a bid including all labor, materials, tools and equipment required for the complete installation of work called for on the Construction Drawings and described in the specification sections. It is the responsibility of the Contractor to provide all material necessary to provide a complete and operable system. If the Contractor feels that the system described is incomplete they must address this in writing to the Owner's Representative before providing a bid.
3. All questions concerning non-specified products and services will be addressed to the Owner's Representative before the Contractor provides a bid. The Owner expects that by accepting the Contractor's bid proposal that the Contractor has provided a competent bid for a complete solution.
4. Product specifications, general design considerations, and installation guidelines are provided in this document. Typical installation details, and mounting details are provided in the Construction Drawings. The successful vendor shall meet or exceed all requirements for the systems described in this document.

PART 2 - REGULATIONS AND STANDARDS

2.1 REGULATORY REFERENCES

A. Federal:

1. National Electrical Code (NEC) 2008 or latest approved:
    a. Chapter 8: "Communications Systems"
    b. Article 250: "Grounding"
2. NFPA 70- National Electric Code
3. FCC - Part 15, Part 68
4. ADA -Americans with Disabilities Act

B. State of California:

1. CCR, Part 2 - California Building Code
2. CCR, Part 3 - California Electrical Code
3. Occupational Safety and Health Act (OSHA)
4. Title 24, Building Standards, State of California
5. Title 19, California Code of Regulations
6. Title 8, Electrical Safety, State of California

2.2 STANDARDS

A. ANSI Standards:

1. ANSI C2-2001 National Electrical Safety Code
2. ANSIC80.3 Specification for Zinc-Coated Electrical Metallic Tubing
3. ANSI/UL 797 Electrical Metallic Tubing
4. ANSI/CEA S-83-596-2001- Fiber Optic Premises Distribution Cable Technical Requirements

B. Industry Standards:

1. Telecommunications Industry Associations/Electronics Industry Association (TIAIEIA)
2. TIA/EIA-568-C Commercial Building Telecommunications Cabling Standard
3. TIAIEIA-568-C.1 General Requirements
4. TIAIEIA-568-C.2 Balanced Twisted Pair Cabling Components Standard
5. TIAIEIA-568-C.3 Optical Fiber Cabling Components Standard
6. TIA/EIA-569-A Commercial Building Standard for Telecom Pathways and Spaces
7. TIA/EIA-606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
8. TIA/EIA-607 Commercial Building Grounding/Bonding
9. TIA/EIA-758 Customer Owned Outside Plant Telecommunications Cabling Standard
10. TIA/EIA-758-1 Addendum No. 1 to TIA/EIA-758, Customer Owner Outside Plant Telecommunications Cabling Standard
11. National Electrical Manufacturers Association (NEMA)
12. Institute of Electrical and Electronic Engineers (IEEE)
    a. 802.3 (Ethernet)
    b. 802.3ab (Gigabit Ethernet over 4-pair Category 5e, 6 & 6A or higher)
    c. 802.3Z (Gigabit Ethernet over Optical Fiber)
13. Underwriters Laboratories Inc. (UL)
14. International Organization for Standardization/International Electromagnetic Commission (ISO/IEC) ISO 11801 Generic Cabling for Customer Premises
15. Building Industry Consulting Services International (BICSI) Telecommunications

Distribution Methods Manual (TDMM 14th Edition or latest)
16. ASCII -American Standard Code for Information Interchange
17. ASTM - American Society for Testing Materials

2.3 CONFLICT

A. General:

1. If there is a conflict between applicable documents, then the more stringent requirement shall apply. All documents listed are believed to 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.
2. This document does not replace any code, either partially or wholly. The Contractor must be aware of and comply with all local codes that may impact this project.

PART 3 - CONTRACTOR REQUIREMENTS/QUALIFICATIONS

3.1 SAFETY AND INDEMNITY

A. General:

1. The contractor shall be solely and completely responsible for conditions of the job site, including safety of persons and property during performance of work.
2. The Contractor shall ensure that all personnel working in or anywhere on the site shall be provided a hard hat, safety shoes, a face shield or safety goggles, etc. for their protection.
3. No act, service, drawing review or construction observance by the Owner's
4. Representative or any other party employed by the campus is intended to included review or approval of adequacy of the Contractor's safety measures, in, on or near the construction site.

3.2 CONTRACTOR QUALIFICATIONS

A. General:

1. Each low voltage contractor/sub-contractor shall submit their qualifications to the district prior to start of work.
2. Contractor shall have been in business for no less than five (5) years and have installed a minimum of three (3) projects of similar size and scope.
3. Contractors who do not meet the minimum requirements specified will not be accepted.

B. Manufacturer Certifications:

1. A Manufacturer Certified Installer shall complete the System installation. The Contractor shall have completed standards based product and installation training.
2. A copy of the Contractor's Manufacturer Certified Installed certificate shall be submitted with their submittal.

C. Sub-Contractor Qualifications:

1. General:

a. All Contractors shall submit a list of at least three (3) projects of similar dollar volume completed within the past 24 months for reference purposes.
b. The Contractor shall compile detailed information relating to similar work completed, including corporate references sufficient to enable the Owner to evaluate and agree to the Contractor' responsibility, experience and capacity to perform the work.

2. Certifications:

a. Each Contractor to perform telecommunications work on this project shall possess a C-10 or C-7 (formerly C-6) Limited Specialty License for Telecommunications.
b. Must be certified for installation, termination, splicing, and testing of copper cables, fiber optic cable, riser cable inside wiring, programming, camera installation and any other certifications required to complete the work as specified.
c. The appropriate contractor's license for underground construction and conduit installation is also required.

3. An on-site Contractor superintendent must be available at all times. Contact can be by person or telephone.

3.3 QUALITY ASSURANCE

A. General:

1. Contractors are required to comply with the following without exception:

a. The winning Contractor will assign this project to a competent Project Manager who has demonstrated their ability to supervise a telecommunications project of the same size and scope.
b. The Contractor will make this person available to the Owner/Owner's Representative before the start of this project for an interview. This person must be deemed acceptable by the Owner and/or their Representative before work can begin.
c. Project Manager will be required to be available for scheduled on-site project meetings at no additional cost to the Owner.

d. Project Manager will be required to be available to meet on-site with the Owner/Owner's Representative with a minimum of 24 hours' notice for non-emergency issues, and a minimum of 4 hours for emergency issues at no additional cost to the Owner.

e. All material and equipment to be installed on this project shall be "new". If the Owner/Owner's Representative discovers that "used" material or equipment has been installed on this project, the Contractor will be required to replace said materials and/or equipment with "new" products as no additional cost to the Owner.

f. "New" - Materials and products manufactured within one (1) year prior to installation, and meet or exceed the latest published specifications of the Manufacturer. Also, these materials and equipment may not have been in use before installation on this project unless directed otherwise in the project documents.

PART 4 - SPECIFIED PRODUCTS AND OTHER PRODUCTS

4.1 PRODUCTS

A. Specified Products:

1. The Specified Products shall be listed in the relevant specification section.

B. Pre-Approved Equals:

1. No pre-approved equals will be considered.

C. Other than Specified Products:

1. Contractors wishing to approve a system other than those specified in this document will be required to perform the following:
   a. Provide system specifications and cut sheets for all system components for the proposed new system(s).
   b. Provide an itemized comparison to each of the system functions as described in this specification. Include in that document how the proposed system compares to the specified system described in this document on a line-by-line basis, using one of the following three criteria:

      1) "exceeds"
      2) "matches"
      3) "unequal"

2. All other products than those specifically addressed in the bid documents the Contractor is seeking approvals for must be received by the Owner's Representative no later than 10 business days before the bid date. All Approved

Equals will be published in addendum form prior to the bid date.

3. Failure to receive written approval for products installed that deviate from the products called for in the specifications and/or in the project drawings, will result in the Contractor replacing the unapproved materials and equipment with the originally specified products at no additional cost to the Owner.

4. All proposed system documentation must be sent to the Owner's Representative via one of the following: mail, fax, or email. The Contractor will include the project name, their contact information, and the specification section number that the proposed system is comparable to.

PART 5 - DOCUMENTATION

5.1 SUBMITTAL DOCUMENTATION

A. General:

1. The successful Contractor shall provide their submittal package in accordance with Article 14 of the General Conditions and Article 14D of the supplemental General Conditions located in the Construction Manual.
2. The successful Contractor shall provide one (1) digital copy of their submittal package.

B. The Submittal Package will include:

1. All documentation given will be on a digital media device (USB thumb drive or CD/DVD)
2. A coversheet on the Contractor's Company Letterhead including:

    a. Contractor's Name
    b. Contractor's License Number
    c. The Project Name
    d. The specification Number and Description
    e. The date documentation was submitted.

3. A spreadsheet with a full material list of products, equipment and software included in the Contractor's bid price. The items on the spread sheet shall be listed in the same order as the specifications. The spreadsheet will include:

    a. Manufacturer’s Name
    b. Part Number
    c. Description
    d. Quantity

4. A legible copy of the Manufacturer's Catalog Cut sheet for each part included in the Contractor's Bid.

a. The catalog cut sheets shall be placed in the same order as shown on the spread sheet.
b. The catalog cut sheets shall have the specified part numbers clearly highlighted.

5. Copies of the Manufacturer's Certification for a minimum of the Project Foreman and 50% of the installation crew.

6. The Contractor will provide a sample for each cable identifier to be used on the project. Labeling schemes can be found in the installation details.
7. When submitting multiple sections for review, the contractor shall create digital bookmarks at each specifications section change. The digital book marks shall be easily identified and easily accessible through all standard PDF viewing software (i.e. Adobe, BlueBeam).

C. LEED/CHIPS/HPSA (when applicable)

1. Recycled content, segregated by per- and post-consumer percentages.
2. Rapidly renewable material content.
3. VOC Content
4. Distances from site to follow material process locations.

a. Raw material harvest, collection or extraction
b. Product of component fabrication
c. Final materials Manufacturer, if different than component fabrication.

5.2 ACCEPTANCE

A. Project Acceptance:

1. The Owner and the Contractor shall accept the project as complete based on the following criteria:

a. Before executing any performance testing, the Contractor shall present a test plan to the Owner's Representative for their approval.
b. The Contractor has completed all testing and delivered copies of all test resulting the Owner's Representative.
c. All test results have been examined and approved by the Contractor and Owner's Representative.
d. Copies of all documentation required by [close out documents section] have been delivered to the Owner's Representative.
e. All punch list items are completed to the satisfaction of the Inspector of Record.
f. Manufacturer Warranty Certification Certificates are provided to the Owner.

2. Following completion and/or compliance with the requirements listed above, the Contractor shall issue a Notice of Completion confirming that the project is

complete. A 45-day acceptance period shall begin immediately following the issuance of the Notice of Completion.

3. Minor failures shall be responded to at the Owner's discretion or within one (1) business day.

5.3 WARRANTIES

A. Manufacturer Warranty:

1. The Contractor shall be responsible for correcting any problems and malfunctions that are warranty related for the entire warranty period. In the event that a Contractor should not be in business at the time of an issue, the Manufacturer shall be responsible for all corrections, if deemed the responsible party.
2. Copies of an extended material warranties shall be passed through to the Owner.
3. The warranty for all copper cabling shall be a minimum of twenty (20) years.
4. The warranty for all surveillance camera systems shall be a minimum of three (3) years.

B. Contractor Warranty:

1. Contractor must warranty all materials, equipment and labor for a minimum of one (1) year from the Owner's acceptance of the work.

    a. Warranty will provide repair/replacement of all defective or improperly installed materials at no additional cost to the Owner (including labor, travel time/expenses, shipping, taxes, etc.).
    b. Contractor is required to keep in stock replacement parts for all items covered in this specification and provide a competent service technician to be on site to repair/replace defective items no later than 24 hours after receiving a trouble call.

2. Warranty will cover normal business hours, 8am-5pm, Monday through Friday.
3. All calls received on a Friday or the day before a holiday will be held until the following regular business day.
4. During the installation and up to the date of final acceptance, the Contractor shall protect all finished and unfinished work against damage and loss. In the event of such damage or loss, the Contractor shall replace or repair such work at no cost to the Owner or any other Trade Partnership working on the project.

5.4 CLOSE-OUT DOCUMENTATION

A. Structured Cabling:

1. Upon completion of the installation, the telecommunications contractor shall provide two (2) full documentation sets to the Owner's Representative for approval. One (1) to be a hard copy and one (1) to be an electronic copy. Documentation shall

include the items detailed in the sub-section below.

a. Documentation shall be submitted within thirty (30) days of the completion of each construction phase. This is inclusive of all test results and draft as-built drawings. Draft as built drawings must include annotations of any changes to the original plans. Machine generated final copies of all drawings shall be submitted within thirty (30) calendar days of the completion of each testing phase. At the request of the Owner's Representative, the telecommunications contractor shall provide copies of the original test results.

b. The As-Built drawing are to include conduit routes, utility vault/pull box locations, surface mount enclosure locations, PVC to GRC transition points and the approved labeling identifiers. Numbering, icons, and drawing conventions used shall be consistent throughout all documentation provided. The Owner will provide floor plans in paper and electronics {DWG, AutoCAD 2008) formats on which as built construction information can be added. These documents will be modified accordingly by the telecommunications contractor to denote as-built information as defined above and returned to the Owner.

c. The Owner's Representative/Engineer can 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 Owner's Representative/Engineer, up to and including 100% re-test. Any re-testes shall be at no additional cost to the Owner.

d. Test Result documentation shall be provided in two media, as listed above, one {1) hard copy and one (1) digital copy, within thirty {30) days after the completion of the project. The documentation 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) ID, measurement direction, reference setup, and crew member name(s).

e. 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, a bi-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.

f. Printouts generated for each cable by the wire test instrument shall be submitted as part of the documentation package.

g. 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.

END OF SECTION

SECTION 28 31 00

FIRE DETECTION AND ALARM

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Fire alarm system shall consist of fire alarm control panel or networked nodes, of the same make and CSFM (California State Fire Marshall) listed for the application.

2. Labor, equipment, materials, connections, testing, and performance of operations in the installation of fire alarm system.

B. Related Requirements:

1. Division 01 General Requirements.

2. Section 26 0500: Common Work Results for Electrical.

3. Section 26 0513: Basic Electrical Materials and Methods.

4. Section 26 0519: Low-Voltage Wire (600 Volt AC).

5. Section 26 0526: Grounding and Bonding.

6. Section 26 0533: Raceways, Boxes, Fittings, and Supports.

1.02 SYSTEM REQUIREMENTS

A. Fire detection system shall continually supervise and monitor the following initiating, signaling, and monitoring circuits:

1. Manual fire-pull stations.

2. Smoke and heat detectors, duct detectors, including those installed under other sections.

3. Fire sprinkler flow and tamper switches. In existing installations also include PIV tamper switches.

4. Alarm signaling circuits including alarm bells, horns and visual alarm units.

5. Annunciators.

6. Power supplies and batteries.

7. Interconnection with Central and Autonomous Public Address systems, telephone network system, Clock System-Classroom or Program schedule change, HVAC system where applicable, kitchen fire suppression system, Theatrical and House Lighting, and elevator equipment for control of recall function and elevator circuit breaker shunt trip.

B. System controls shall be UL listed for power limited applications in accordance with California Electrical Code.

C. The fire alarm devices and equipment shall be listed for installation for the fire alarm control panel to which they are being connected.

D. Complete installation shall conform to the version of NFPA 72, California Fire Code, California Building Code (CBC), and California Electrical Code (CEC) as approved by DSA on stamped drawings.

E. System labels and devices programming addresses shall be based on final signage and building labeling submittals. For existing facilities contractor shall obtain from Owner Authorized Representative a copy of the current site layout and building labeling designations.

1.03 CERTIFICATION

A. Certification: Installation of fire alarm system shall not begin until Shop Drawings, including State Fire Marshal listing numbers of fire alarm components, are submitted and reviewed by the Architect. Written certification by fire alarm equipment distributor or manufacturer shall be submitted to the Architect stating that system and its component parts are as approved and listed by the State Fire Marshal, and that the design conforms to requirements set forth in CBC.

1.04 PERFORMANCE

A. System shall be fully programmable, configurable, and expandable in the field without special tools or PROM programmers and shall not require replacement of memory ICs. Installer shall provide a CD of system installed software, site specific system programming and information and tools required to re-program or modify the system.

1.05 SYSTEM FUNCTIONAL OPERATION

A. When a fire alarm condition is detected by one of the system alarm initiating devices, the following functions shall occur:

1. System alarm LED shall flash.
2. Local sounding device in panel shall be activated.
3. The LCD display shall indicate type of device, custom label location label and point status alarm condition.
4. Appropriate change of status message shall be transmitted to remote annunciator(s).
5. Automatic programs assigned to alarm point shall be executed and associated indicating devices and relays activated.

6. In the event of a fire alarm control panel activation, manual and automatic electronic tone or electromechanical bell class passing signals shall be disabled.

7. In the event of a fire alarm condition the Central and Autonomous Public Address System shall be overridden.

8. UDACT (Universal Digital Alarm Communicator Transmitter) shall activate.

9. Provide necessary hardware and labor for a complete and tested interfacing of the fire alarm system with the lighting controls systems in Auditoriums, Multi-Purpose rooms, and Gymnasiums; lighting in these areas shall be brought to full brightness in the event of a fire alarm.

B. Trouble and Supervisory Conditions.

1. When any trouble condition is detected the following functions shall occur:

a. System trouble LED shall flash.

b. Local sounding device in panel shall be activated.

c. The LCD display shall indicate the type of trouble and custom label location associated with the trouble condition and its location. Unacknowledged alarm messages shall have priority over trouble messages. If such an alarm is displayed, then trouble messages shall not be displayed.

d. Appropriate message shall be transmitted to remote annunciators.

e. UDACT shall activate.

C. When any supervisory condition occurs such as a sprinkler valve tamper, the following function shall occur:

1. System supervisory LED shall flash.

2. Local sounding device in panel shall be activated.

3. Appropriate message shall be transmitted to remote annunciators.

4. UDACT shall activate.

D. Activation of control panel ACKNOWLEDGE switch in response to a single new alarm, trouble or supervisory condition shall silence panel sounding device and change system alarm, trouble, or supervisory LED from flashing to steady-ON. If additional new alarm, trouble, or supervisory conditions exist in the system; activation of this switch shall advance display to next alarm, trouble, or supervisory condition that exists, and shall not silence local audible device or change LED to steady until new conditions have been so acknowledged. New alarm conditions shall always be displayed before new trouble conditions. Occurrence of a new alarm, trouble, or supervisory condition shall cause panel to resound, and sequences as described above, shall repeat.

E. Activation of the signal silence switch shall cause appropriate notification (indicating) appliances and relays to return to normal condition. Selection of notification appliance circuits and relays silenced by this switch shall be fully programmable.

F. Activation of system reset switch shall cause electronically latched initiating devices or zones, as well as associated output devices and circuits, to return to normal condition after sixty seconds of alarm. If alarm conditions exist in system after system reset switch activation, system shall then re-sound alarm conditions as indicated hereafter.

G. Activation of lamp test switch shall turn on LED indicators, LCD display, and local sounding device in panel, and then return to previous condition.

H. Fire alarm indicating appliances may be silenced or extinguished, after one minute, by operating signal silence switch at the FACP or by use of key supervised alarm silence switch at remote annunciators. A subsequent zone alarm shall reactivate signals. Audible indicating appliances shall be automatically silenced after no less than five nor more than ten minutes of operation. Visual indicating appliances shall be extinguished at system reset, or automatically after no less than five nor more than ten minutes of operation. Fire sprinkler flow alarm bells shall not silence until the contacts in the fire sprinkler flow switch return to the normal non-alarm state. Appropriate signage must be installed on or next to the sprinkler alarm bell.

I. Elevator lobby, machine room and hoistway smoke detectors shall, in addition to operations listed above, cause elevator cars to be recalled as follows:

1. Elevator cars shall be recalled to main level of egress through the use of a primary recall interface relay.

2. Elevator cars shall be recalled to predetermine alternate level if main lobby smoke detector is activated.

3. Fire Fighter's hat light indicator in elevators shall provide visual warning when elevator lobby, machine room, and hoistway smoke detectors are activated.

NOTE Do not indicate smoke detectors where subject to exterior elements.

J. System's circuits including but not limited to initiation, indicating, and equipment interfacing shall be monitored for open or short circuit and ground fault conditions, these conditions shall be indicated on the Fire Alarm Control Panel and Annunciator displays while remaining circuits continue to operate normally.

K. Notification appliance circuits shall be silenceable for testing purposes by authorized persons. Protected pass-codes, keys, or another secure method that does not require entering into the system programming shall be used.

1.06 POWER REQUIREMENTS

A. The fire alarm control panel and remote power supply shall receive 120 VAC power, 60 Hz, through a dedicated 20 amps circuit. Circuit breaker protection for

the dedicated fire alarm power circuits shall be equipped with a handle lock-on device; the breaker handle shall be colored red and labeled "FIRE ALARM". Clearly label the Electrical panel name, location and circuit number on the inside of the fire alarm control panel and remote power supplies using a p-touch style labeling system. Transient voltage surge suppression shall be provided at the 120VAC input terminal.

B. System shall be provided with sufficient battery capacity to operate entire system upon loss of normal 120 VAC power, in a normal quiescent mode, for a period of 24 hours with five minutes of alarm indication at end of this period. System shall automatically transfer to standby batteries upon power failure. Battery charging and recharging operations shall be automatic. Batteries, once discharged, shall recharge at a rate to provide a minimum of 70 percent capacity in 12 hours.

C. Circuits requiring system operating power shall be 24 VDC and shall be individually protected at control panel.

1.07 SUBMITTALS

A. Provide in accordance with Division 01.

B. Component Plan Submittal: Availability and listing for its application shall be verified for system components before presentation of the submittal. Include the following information and details as applicable:

1. Installer name, address, telephone number.

2. List of system components, equipment and devices, including manufacturer model numbers, quantity and California State Fire Marshal listing numbers, mounting heights, and symbols per symbol list.

3. Copies of manufacturer specification sheets for equipment and devices indicated. Highlight or identify the specific components on Catalog cut sheets.

4. Voltage Drop Calculations: Include the following information for the worst case:

   a. Point-to-point or Ohms law calculations.

   b. Zone used in calculations.

   c. Voltage drop percent. Voltage drop shall not exceed manufacturer's requirements. If voltage drop exceeds ten percent, indicate manufacturer listed operating voltage ranges for equipment and devices.

5. Battery types, amp hours, and load calculations including the following:

   a. Normal operation: 100 percent of applicable devices for 24 hours to equal control panel amps plus list of amps per device that draw power form the panel during standby power condition including, but not limited to, zone modules, detectors and devices as identified.

b. Alarm condition: 100 percent of applicable devices for five minutes to equal control panel amps plus list of amps per device that draw power from panel during alarm condition including, but not limited to, the following:

1) Zone modules.

2) Signal modules.

3) Detectors.

4) Signal devises.

5) Annunciator.

6) Other devices as identified.

c. Normal operation plus alarm operation load calculation shall include total amp hours required and total amp hours provided.

6. Provide one copy of testing procedures.

C. Shop Drawings: Provide Shop Drawings, in the same size as the design Drawings, include the following:

1. Provide drawing scale, elevations of system enclosures, and actual layout of the Fire Alarm Control Panel, power supply, annunciator, and main system components.

2. Site Plan indicating PIV and related fire sprinkler system devices and equipment to be monitored or supervised; such as water flow valves, and main equipment such as control panels, power supplies, annunciators, and components such as outdoor wall-mounted horns, sprinkler bells, pull boxes, underground pull boxes , wiring routes on buildings exterior and underground locations. In each conduit or raceway run indicate conduit sizes, and quantities and type of wires.

a. In existing facilities make a distinction between existing and new installation.

3. Complete battery calculations, and voltage drop calculation shall be included; these calculations shall be based on the devices maximum UL current rating.

4. One line drawing for the entire system network indicating system components and wiring. The one line diagram shall show but not be limited to panel to panel interconnections, conductors gage and quantity, conduit size and type (designation) and specific function.

5. System panel one-line drawings indicating the quantity and type (designation) of conductors entering and exiting the fire alarm terminal cabinet in each building (enclosure) for initiating, notification, or other command control functions required for complete system operation:

a. Individual floor or building plan view drawings indicating device locations including end of line resistors "EOLR" in accordance with the legend provided.

b. Individual point addresses for initiation and notification devices.

c. Device "typical" wiring diagrams. These drawings shall indicate specific termination details for peripheral equipment and interface devices.

6. Provide interfacing with equipment furnished by others including voltages, and other required coordination items. Refer to 3.01-B.

7. Each of the pictorial diagrams included shall appear identical to the products they are intended to depict, in order to speed installation of the system, and to enhance the accuracy of the installation Work. Typical wiring diagrams or catalog sheets are not permitted.

8. Background Drawings with device locations of DSA approved drawings are available in electronic format and may be obtained from the Owner Authorized Representative (OAR). Contractor is solely responsible for the accuracy and completeness of shop drawings. Buildings that are not part of the contract shall be clearly identified "NOT IN CONTRACT". Shop Drawings shall be prepared in the latest version of AutoCAD with three – CD ROM electronic copies submitted along with full sized Shop Drawings.

9. Other installation and coordination drawings specifically related to this section shall be included as follows:

a. Size A (8 ½ by 11) and size B (11 by 17) shall be bound into the manual.

b. Larger drawings shall be folded and inserted into transparent envelopes and bound into the manual.

10. Installation and coordination drawings for items in other sections shall be included with submittal of Shop Drawings. Submit blue line copies and one reproducible copy of installation and coordination drawings.

11. Samples: Provide Samples of material and equipment as required by the Architect. If Samples are requested, they shall be submitted within ten days from date of request.

D. In addition to the above requirements, provide submittals to meet any additional requirements of DSA.

E. Submittal of Equivalent Systems:

1. In addition to the submittal requirements of this section, if an equivalent system listed in Section 2.01A is submitted in lieu of the designed system shown on DSA approved drawings, the Contractor shall also submit a letter stating that the system is equivalent, and that device locations and

quantities of devices are unchanged. Attached to this letter shall be a copy of the revised equipment schedule with corresponding CSFM numbers and a cut sheet for each item.

F. Modifications or additions to existing fire alarm systems shall be compatible and of the same manufacturer as the existing system. Contractor shall be solely responsible for engineering, plan check and any fees resulting form an installation that deviates from this requirement.

G. Prior to Substantial Completion submit to the Architect or Engineer of Record and to Owner Authorized Representative a complete updated set of the Shop Drawings showing changes made to the Fire Alarm System during construction. These drawings will become the System As-Built Drawing set for the Fire Alarm System Owner's Manual.

1.08 QUALITY ASSURANCE

A. Installer shall have successfully completed at least five projects of equal scope in the past five years, and have been in business of furnishing and installing fire alarm systems of this type for at least five years.

B. Installer shall be a factory authorized distributor and service provider for the brand of equipment offered and shall provide documentation to the Architect upon request.

C. Installer shall maintain a fully equipped service organization capable of furnishing repair service to the equipment and shall maintain a spare set of major parts for the system at all times.

D. Installer shall furnish a letter from manufacturer of equipment certifying equipment has been installed according to factory standards and that system is operating properly.

E. Certifications: Installer shall submit certification from the equipment manufacturer indicating that installer is an authorized representative of the equipment manufacturer and is trained on network applications.

F. Materials and equipment installed shall be new.

G. Equipment in this specification shall be furnished and installed by the Authorized Factory Distributor of the equipment. Furnish a letter from the manufacturer of major equipment, which certifies that the installer is an authorized distributor and that the equipment has been installed according to factory intended practices. Furnish a written guarantee from the manufacturer that they will have a service representative assigned to this area for the life of the equipment.

H. Installer shall be Underwriters Laboratory (UL) listed company under the UUJS classification, and shall certify that the installation has been made in accordance with UL requirements.

I. The fire alarm contractor shall have a NICET II Certified Technician on staff in their facility directly involved with this project to ensure technical expertise to this project and adherence with these specifications.

J. Contractor or Installer's Electricians and fire and life safety technicians shall be certified in accordance with Labor Code sections 3099, and 3099.2, and section 209.0 of the California Code of Regulations.

K. System startup and testing shall be performed under the direct observation of the Project Inspector and OAR. Provide a legible half size reproduction of the original completed fire alarm red-line drawings (this copy will be retained by the Owner), an accurate copy of the fire alarm system points list, and a copy of the construction drawings on CD in AutoCad format.

L. At the time of installation the most current software package available shall be provided.

M. Provide at the time of Owner Acceptance of the installation, equipment, and updated software which is to include the appropriate operating system, pass-codes, electronic keys and program disks, manuals and cables employed in the installation of the system. These components shall be delivered to the OAR.

N. Provide a backup copy of the most current software revision, in disk format. This copy shall be delivered to the OAR

O. A software license agreement shall be made available for the responsible Owner representative to sign at the time of training.

1.09 WARRANTY

A. The Fire Alarm Equipment Manufacturer shall provide a three year material warranty. Installer shall provide a three year labor warranty.

B. Complete maintenance and repair service for the fire alarm system shall be available from a factory trained authorized representative of the manufacturer for a period of five years after expiration of the warranty.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Fire alarm equipment shall be standard products of the Notifier Co. or equal.

B. Catalog and model numbers listed are intended to establish type and quality of equipment and system design as well as operating features required. Deviations from intended functions of specified system are not permitted. Equipment shall not be ordered or installed until such equipment has been reviewed and approved by the Architect.

C. Products specified below are based on Notifier system components. For other manufacturers approved system components, refer to Fire Alarm Plans.

2.02 FIRE ALARM CONTROL PANEL (FACP) OR NETWORK NODES

NOTE: Provide multiple networked panels when the needed capacity required for the project exceeds the capacity of the main panel.

A. Furnish Notifier Fire Alarm Control Panels as indicated on drawings.

B. Operator Control:

1. Acknowledge Switch: Activation of control panel acknowledge switch in response to a single new trouble or alarm condition shall silence panel sounding device and change system alarm or trouble LED from flashing to steady-ON. If additional new alarm or trouble conditions exist in system, activation of this switch shall advance display to next alarm or trouble condition that exists, and shall not silence local audible device or change LED to steady until new conditions have been so acknowledged. New alarm conditions shall always be displayed before new trouble conditions. Occurrence of a new alarm or trouble condition shall cause panel to resound, and sequences as described above, shall repeat.

2. Signal (Alarm) Silence Switch: Activation of the signal silence switch shall cause programmed alarm notification appliances and relays to return to the normal condition after an alarm condition. The selection of notification circuits and relays that are silenceable by this switch shall be fully fielded programmable within the confines of applicable standards at the job site. The FACP software shall include silence inhibit and auto-silence timers.

3. Alarm Activate (Drill) Switch: Alarm activate switch shall activate notification appliance circuits. The drill function shall latch until the panel is silenced or reset.

4. System Reset Switch: Activation of the System Reset switch shall cause electronically-latched initiating devices, appliances or software zone, as well as associated output devices and circuits, to return to their normal condition.

5. Lamp Test Switch: Switch shall activate local system LEDs, light each segment of the liquid crystal display and display the panel software revision for service personnel.

6. Hot Button Switch: Hot Button Key switch shall be provided in FACP to disable all output devices for testing or repair of system. Key switch shall silence all horn and strobes, disable PA cutouts, HVAC shutdowns, door closures, and Autonomous PA systems. Key switch shall be password protected to enable function. LED indicator shall illuminate a trouble condition while Hot Button Switch is activated and shall turn off when system is re-enabled.

C. System Capacity and General Operation

1. The control panel or each network node shall provide, or be capable of expansion to 318 intelligent or addressable devices for the NFS-320 or 636 Intelligent or addressable devices for the NFS2-640 and 3180 intelligent, addressable devices for the NFS2-3030.

2. The control panel or each network node shall include Form-C alarm, trouble, supervisory, and security relays rated at a minimum of two amps at 30 VDC. It shall also include four Class B (NFPA Style Y) or Class A (NFPA Style Z) programmable Notifications Appliance Circuits.

3. The control panel or each network node shall support up to two output modules (signal or relay) for a total of ten circuits for the NFS-320 or eight output modules (signal or relay), each with eight circuits for a total of 64 circuits for the NFS2-640. The NFS2-3030 shall support 12 output modules for a total of 96 circuits. Programmable notification appliance circuits shall be class B.

4. The system shall include a full featured operator interface control and annunciation panel that shall include a backlit Liquid Crystal Display (LCD), individual color coded system status LEDs, and an alphanumeric keypad with easy touch rubber keys for the field programming and control of the fire alarm system.

5. The system shall be programmable, configurable, and expandable in the field without the need for special tools, PROM programmers or PC based programmers. It shall not require replacement of memory ICs to facilitate programming changes.

6. The system shall allow the programming of any input to activate any output or group of outputs. The FACP shall support up to 20 logic equations, including "and" "or" and "not", or timed delay equations to be used for advanced programming. Logic equations shall require the use of a PC with software utility designed for programming.

7. The FACP or each network node shall provide the following features:

    a. Drift compensation to extend detector accuracy over life. Drift Compensation shall also include a smoothing feature, allowing transient noise signals to be filtered out.

    b. Detector Sensitivity tests, meeting requirements of NFPA 72 Chapter seven.

    c. Maintenance alert, with two levels (maintenance alert or maintenance urgent), to warn of excessive smoke detector dirt or dust accumulation.

    d. Nine sensitivity levels for alarm, selected by detector. The alarm level range shall be 0.5 to 2.35 percent per foot for photoelectric detectors and 0.5 to 2.5 percent per foot for ionization detectors. The system shall also support sensitive advance detection laser detectors with an alarm level range of 0.03 percent per foot to one percent per foot. The system shall also include up to nine levels of Pre- alarm, selected by detector, to indicate impending alarms to maintenance personnel.

e. Circuit boards, programming, and interconnecting cables to enable the system to display or print system reports.

f. Alarm verification, with counters and a trouble indication to alert maintenance personnel when a detector enters verification 20 times.

g. PAS pre-signal, meeting NFPA 72 requirements.

h. Rapid manual station reporting (less than three seconds) shall meet NFPA 72 Chapter one requirements for activation of notification circuits within ten Seconds of initiating device activation.

i. Periodic detector test, conducted automatically by the software.

j. Self optimizing pre-alarm for advance fire warning, which allows each detector to learn its particular environment and set its pre-alarm level to just above normal peaks.

k. Cross zoning with the capability of counting: two detectors in alarm, two software zones in alarm, or one smoke detector and one thermal detector.

l. Walk test, with a check for two detectors set to same address.

m. Control-by-time for non-fire operations, with holiday schedules.

n. Day or night automatic adjustment of detector sensitivity.

o. RS 232 serial port to support a District supplied printer to be used for silent testing and certification of the system.

8. The FACP shall be capable of coding main panel(s) node notification circuits in temporal code (NFPA 72 A-2-2.2.2).The panel shall also provide a coding option that will synchronize specific strobe lights designed to accept a specific “sync pulse”.

9. Network Communication:

a. The network architecture shall be based on a Local Area Network (LAN), a firmware package that utilizes a peer-to-peer, inherently regenerative communication format and protocol. The protocol shall be based on ARCNET or equivalent non-proprietary protocol.

b. Failure of any node shall not cause failure or communication degradation of any other node or change the network communication protocol among surviving nodes located within distance limitations. A node may be an intelligent Fire Alarm Control Panel (FACP), Network Control Station PC (NCS) or Network Control Annunciator (NCA).

c. Each network node address shall be capable of storing Event Equations which shall be used to activate outputs on one network node from inputs on other network nodes.

D. System Display:

1. Utilize the 640-character display option. The design of the CPU shall provide for a configuration with the 640-character display mounted on the front of the unit in place of the standard 80-character display.

2. The 640-character display shall provide the controls and indicators used by the system operator: The 640 character display shall include the following operator control switches; Acknowledge, Alarm, Silence, Alarm Activate (drill), System Reset and Lamp Test.

3. The display shall annunciate status information and custom alphanumeric labels for intelligent detector, addressable modules, internal panel circuits, and software zones.

4. The 640-character display shall provide ten Light-Emitting-Diodes (LEDs) that indicate the status of the following system parameters: AC Power and Network Communication, Fire Alarm, Pre alarm Warning, Security Alarm, Supervisory Event, System Trouble, Alarm Silence, Disabled Points, CPU failure.

5. The 640-character display shall use ten "soft" keys for screen navigation or to accomplish dedicated programming functions. Full programming access shall require use of a laptop and the proper programming utility. The programming utility shall be provided to the OAR who will forward it to the local maintenance area representative.

6. The system shall support the display of battery charging current and voltage on the LCD display.

E. Network Control Annunciator (NCA-2):

1. When a networked system is installed a network controlled annunciator shall be provided to display system intelligent points. The NCA-2 shall be capable of displaying information for all possible points on the network.

2. The NCA-2 shall include a minimum of 640 characters, backlit by a long life, solid-state LCD display. Additionally, the network display shall include ten soft keys for screen navigation and the ability to scroll events by type. i.e. Fire Alarm, Supervisory Alarm, Trouble, etc.

3. The NCA-2 shall have the ability to display up to eight events in order of priority and time of occurrence. Counters shall be provided to indicate the total number of event by type.

4. The NCA-2 shall mount in a Notifier ABS-2DB or equal box; provide the NCA-2 with a key enable or disable switch for the network node fire alarm control panels. The network display may mount in a backbox designed for this use. The network shall support the NCAs.

5. The network control annunciator shall have an event history buffer capable of storing a minimum of 1000 events in nonvolatile memory. Additionally, the NCA-2 shall have a fire alarm history buffer capable of storing a minimum of 200 events in nonvolatile memory.

6. The NCA-2 shall include two EIA-232 ports for UL864 listed printers and CRT's.

7. The NCA-2 shall include control switches for system wide control of Acknowledge, Signal Silence, System Reset, Drill, and local Lamp Test. A mechanical means, by which the controls switches are locked out, such as a key, shall be provided.

8. The NCA-2 shall include long life LEDs to display Power, Fire Alarm, Pre-Alarm, Security Alarm, System Trouble, Supervisory, Signals, Silenced, Disabled Prints, other (non-fire) Events, and CPU Failure.

9. The NCA-2 shall include a Master Password and up to nine user Passwords. The Master password shall be required to access the programming and alter status menus. Each User password may have different levels of authorization assigned by the Master password. Passwords installed into the NCA-2 shall be made available to the OAR who will forward them to the local maintenance area representative.

10. The NCA-2 shall allow editing of label for points within the network, control on or off of outputs, enable or disable of network points, alter detector sensitivity, clear detector verification counters for any analog addressable detector within the network, clear any history log within the network, change the Time or Date settings, initiate a Walk Test.

11. The NCA-2 shall include a time of day clock.

12. Each NCA-2 shall support 80-character remote display annunciators for displaying network activity. These "Terminal Mode" displays will mimic the activity appearing on the corresponding NCA. There shall be only one annunciator or control system consisting of components manufactured by one manufacturer for the fire alarm system.

F. Signaling Line Circuits (SLC):

1. Each FACP or FACP network node shall support a minimum of one SLC for the NFS-320 for the Notifier NFS2-640 or ten SLC's for the NFS2-3030. Each SLC interface shall provide power to and communicate with up to 159 intelligent detectors (ionization, photoelectric or thermal) and 159 intelligent modules (monitor or control) for a loop capacity of 318 devices.

2. CPU shall receive analog information from intelligent detectors to be processed to determine whether normal, alarm, pre-alarm, or trouble conditions exist for each detector. The software shall automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors including the accumulation of dust in each detector. The analog information shall also be used for automatic detectors testing and for the automatic determination of detector maintenance requirements.

G. Enclosures:

1. The control panel shall be housed in a UL-listed cabinet suitable for surface or semi-flush mounting. The cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.

2. The back box and door shall be constructed of 0.030 steel with provisions for electrical conduit connections into the sides and top.

3. The supplied door shall include a key lock and shall include glass or other transparent opening for viewing of indicators. For convenience, the door may be site configured for either right or left hand hinging.

H. Power Supply:

1. An off-line switching power supply shall be available for the fire alarm control panel or network node and provide six amps of available power for the NFS2-640, and 4.5 amps for NFS2-3030 and six amps for the NFS-320 for control panel and peripheral devices.

2. Provisions shall be made to allow the audio-visual power to be increased as required by adding modular expansion audio-visual power supplies.

3. Over-current protection shall be provided on power outputs. The power supply shall provide an integral battery charger. Battery arrangement may be configured in the field.

4. The power supply shall continuously monitor field wires for earth ground conditions, and shall have the following LED indicators:

   a. Ground Fault LED.

   b. AC Power Fail LED.

   c. NCA-2 on LED (4).

5. The main power supply shall operate on 120 VAC, 60 Hz, and shall provide power for the FACP or network node(s).

6. The main power supply shall provide a battery charger using dual rate charging techniques for fast battery recharge and be capable of charging batteries up to 60 AH for the NFS-640 and 200 AH for the NFS2-3030.

2.03 REMOTE ANNUNCIATORS

A. A non-networked fire alarm system annunciator is required when there is only one FACP in the system. Provide a Notifier Model LCD-80TM (CSFM7165-0028:0243), or LCD-160 (CSFM7120-0028:0227) alphanumeric display remote annunciator, or equal. A Network annunciator is required for any system that contains more than one fire alarm control panel (FACP) or network node. Provide a Notifier Model NCA-2 (CSFM7165-0028:0224, alphanumeric display remote annunciator, or equal. Display shall be back lit and be furnished with a maximum of 20 characters of 4 lines for the LCD-80, or 80TM and 40 characters on 16 lines for the LCD-160 or NCA-2. Provide the following functions:

1. Control switches for system acknowledge, signal silence and system reset via a touchpad.
2. Time and date display field.
3. Local piezo sounder with alarm or trouble resound.
4. On-line green LED (flashing).
5. Evacuation and drill switches, via a touchpad.
6. Pre-signal hold via a touchpad.
7. System test at control panel and CTR.

B. Following additional features shall be furnished:

1. Device Fire Annunciation.
2. Device Trouble Annunciation.
3. System Operation Annunciation.
4. "Power On" LED.

C. Typewritten operating instructions and a site map shall be posted adjacent to remote annunciator(s). The site map shall be sized and include designations and devices as described in paragraph 3.02 N. of this specification. Project site map shall depict fire alarm devices in the building(s) in which they are installed. The instruction and site map shall be mounted in suitable document frames and attached to the wall with a minimum of two screws each. Contractor's name and telephone number shall not be placed on either the instruction or the site map.

2.04 POWER SUPPLIES

A. Remote Notification Appliance Circuit (NAC) extender power supplies shall be Notifier No. FCPS-24S6 (CSFM 7315-0028:0225), or equal. Unit shall be furnished with main printed circuit board, transformers, lockable cabinet, and batteries. Unit shall be configured to drive 4 notification appliance circuits. The remote power supplies shall be configured with a monitor module to report trouble conditions to the controlling FACP via an SLC. Triggering of NAC inputs shall be directly controlled from the FACP without the use of addressable control or relay modules.

2.05 PERIPHERAL DEVICES AND EQUIPMENT

A. Manual Stations: Interior Use: Station shall be Notifier, Model No. BNG-1R (CSFM 7150-0028:0003) or equal, addressable semi-flush, non-breakable glass type. Station housing shall be fabricated of die-cast aluminum with reset lock and key. Provide an addressable monitor module Model No. FMM-101(A) (CSFM 7300-0028:0219) for each manual station.

B. Smoke Detectors: Smoke Detectors shall be Notifier Model No. FAPT-851 (CSFM 7272-0028:0206) or equal, addressable smoke detectors. Provide base Model No.

B710LP. (CSFM 7300-0028:0173). Detector shall be microprocessor based, using a combination of photoelectric, and thermal sensing technologies. The smoke detector shall have its loop number and electronic address permanently and clearly labeled onto the device base using a p-touch type labeling system. The label shall be visible without removing the detector head.

C. Non-Explosion Proof Automatic Heat Detectors shall be combination rate-of-rise and fixed-temperature type. When fixed-temperature portion is activated, units shall provide visual evidence of such operation (LED). Addressable Heat detectors shall be Notifier Model No. FST-851R (CSFM 7270-0028:0196) or equal. Provide base Model No. B-710LP. (CSFM 7300-0028:0173) The location of the heat detector must be clearly marked below the ceiling and the detector must be readily accessible. The heat detector shall have its electronic address permanently and clearly labeled onto the device and be readily accessible. For spaces where the normal ambient temperature can reach temperatures as high as 150 degrees F. such as in attic spaces, use Notifier FST-851H with base B-710LP. The heat detector shall have its loop number and electronic address permanently and clearly labeled onto the device using a p-touch labeling system. The label shall be visible without removing the detector head.

D. Explosion Proof Automatic heat Detectors: These detectors shall be Thermotech Model 302-EPM-135 (CSFM 7270-0021:0001) or equal; it shall be rated for 135 degree Fahrenheit alarm temperature. Mount the detector on a JL threaded hub cover manufactured by Killark Electric, or equivalent from other owner approved manufacturers. Seals, conduit type, and fittings shall be suitable for the hazardous zone and location where the device will be installed. Provide an appropriate wire protective cover over box and detector. Addressable module(s) associated with this type of devices shall be installed outside of the hazardous area.

E. Weatherproof Automatic heat Detectors: These detectors shall be Thermotech Model 302-ET-135 (CSFM 7270-0021:0001) or equal; it shall be rated for 135 degree Fahrenheit alarm temperature. Detector shall be mounted horizontally in a two gang weatherproof box with cover manufactured by Hubbell/Bell or equivalent from other owner approved manufactures. Install an appropriate wire protective cover over box and detector. Conduit type and fittings shall be suitable for the environment where the device will be installed.

F. Duct Smoke Detectors: Duct smoke detectors shall be Notifier Model No. FSD-751RPL(A) (CSFM 3240-0028:0205) or FSD-751PL(A) (CSFM 3240-0028:0205) or equal, and shall be of solid state photoelectric type and shall operate on light-scattering photodiode principle. The location of the duct detector must be clearly marked below the ceiling and the detector must be readily accessible. The duct smoke detector shall have its electronic address permanently and clearly labeled onto the device. The label shall be visible without removing the detector head. Duct smoke detectors that are already installed as part of packaged ventilation equipment that are not the detector specified above shall be connected to the fire alarm system via a monitor module. The existing power source shall be disconnected and resettable power from the FACP or Remote Power Supply shall

be connected in place of the existing power source for fire alarm system resettable power and alarm initiation.

G. Projected Beam Infrared Type Smoke Detectors shall be Notifier Model No. FSB-200S (CSFM 7260-0028:0228), or equal, and shall consist of a transmitter / receiver unit and reflector to be used in accordance with manufacturers recommendations. Each detector shall include six user-selectable sensitivity levels. Alignment shall be achieved with a signal strength meter incorporated into the beam detector. The detector shall feature automatic detection and adjustment to the optimum level for the specific environment. Provide remote test stations with key lock for detectors, Notifier Model RTS-451KEY, or equal, located below ceiling.

H. Linear Heat Detectors: Linear detectors shall be Protectowire Model No, PHSC-190-EPR less messenger wire or PHSC-190-EPR-M with messenger wire (CSFM 7270-0854:0101) or equal linear detectors rated for 150 degree Fahrenheit installed ambient temperature and 190 degree Fahrenheit alarm temperature. Damaged detector due to excessive bending or kinking during installation shall not be accepted. Interface the Protectowire detector with the FACP system via addressable monitor module(s) located on one extreme of the detector and an end of line resistor at the other extreme. End of line resistor shall be readily accessible for testing. Provide appropriate signs indicating the existence of linear heat detectors at the entrances of areas protected with this type of fire detection. Installation shall be done in accordance with applicable codes and standards, and manufacturer's published installation recommendations.

1. Provide a system that utilizes linear heat detectors in concealed or controlled access areas. The detection wire shall be installed within 20 inches of the underside of the building roof or the above floor as recommended by the manufacturer. In shallow areas install the detection wire within the upper part of the space to be protected.

    a. One circuit of linear heat detection shall be utilized for areas not exceeding 4,000 square feet above multiple rooms.

    b. Areas above Gymnasiums and Auditoriums exceeding 4,000 square feet shall be considered one zone.

    c. Areas divided by a fire rated wall shall be protected separately and considered an independent zone.

I. Multi-Criteria Fire Detectors (MS and HS Only) shall be Notifier Model FSC-851(A) IntelliQuad (CSFM 7272-0028:0255) or equal.

1. Multi-Criteria Fire Detectors shall be used on performing stages and surrounding areas of the performing stage where the use of special effect smoke is to be used.

2. Multi-Criteria Fire Detector shall combine four separate sensing elements into one unit:

    a. Photoelectric chamber shall sense airborne particulate for smoke detection.

b. Electrochemical cell technology shall monitor carbon monoxide.

c. Infrared sensing shall measure ambient light levels and flame signatures.

d. Thermal detection shall monitor temperature.

3. Multi-Criteria Detector shall be capable of generating only one alarm signal from at least two sensors of the four when positively confirming a fire. The sensor output shall be mathematically evaluated to determine when a signal is warranted.

4. Twin LED indicators shall provide 360 degree visibility.

J. Monitor Modules:

1. Monitor module shall be Notifier Model No. FMM-1(A) (CSFM 7300-0028:0219), or equal. Module shall connect a supervised zone of conventional initiating devices, N.O. dry contact devices, including four-wire smoke detectors, to one of SLC loops. Monitor module shall install in a four-inch square by 2 1/8-inch deep electrical box. The module shall have its loop number, electronic address, and function label on the front cover using a P-Touch type or equal labeling system.

2. Monitor module shall provide address-setting means using rotary decimal switches and shall store an internal type of device. An LED shall be provided which shall flash under normal conditions indicating that monitor module is operational and in regular communication with control panel.

K. Control Modules:

1. Control module shall be Notifier Model No. FCM-1 (CSFM 7300-0028:0219), or equal. Module shall be used to connect a conventional indicating appliance or MR type isolation relay to one of the SLC loops. Control module shall install in a standard four-inch square by 2 1/8-inch deep electrical box. Audio or visual or relay power shall be provided by a separate loop from main control panel or from supervised remote power supplies. The module shall have its loop number, electronic address, and function label on the front cover using a p-Touch type or equal labeling system. Provide Air Products PAM-3 Relay Model A77-716B (CSFM 7300-1004:0101) or equal power supervision relay to monitor 24 volt DC power.

2. Control module shall provide address-setting means using rotary decimal switches and shall store an internal identifying code which control panel shall use to identify type of device. An LED shall be provided which shall flash under normal conditions, indicating that control module is operational and in regular communication with control panel.

L. Relay Modules:

1. Relay Module shall be Notifier FRM-1(CSFM 7300-0028:0219) the module shall provide as a minimum one set of form “C” dry contacts and

have its loop number, electronic address, and function labeled on the front cover using a P-Touch type labeling system.

2. Provide a buffer relay that is part of the control system if controlled circuit(s) exceeds the voltage or current rating of the relay module.

3. Relays used to interface control of other systems shall be electrically supervised and shall only be wired in a fail-safe mode of function during a power failure.

M. Isolator Modules:

1. Isolator module shall be Notifier, Model No. ISO-X, (CSFM 7165-0028:0243) or equal. Module shall isolate wire-to-wire circuits on an SLC loop in order to limit number of other modules or detectors that are incapacitated by short circuit fault. If a wire-to-wire short occurs, isolator shall automatically open-circuit SLC loop. When short is corrected, isolators shall automatically reconnect isolated section of SLC loop.

2. Isolator module shall not require address setting, although isolators will electrically reduce capacity of loop by two detectors or module addresses. Isolator module will install in a standard 4-inch deep electrical box. It shall include a single LED that shall flash to indicate that isolator is operational and shall illuminate steadily to indicate that a short has been detected and isolated.

N. Horns and Strobes: Horns and strobes shall be products of the same manufacturer. In order to establish a standard of quality, items are specified from the products manufactured by System Sensor, acceptable manufacturers are Honeywell, Wheelock Inc., Gentex or District approved equal. Addressable or multifunction two wire indicating (Audible or Visual) appliances shall not be acceptable.

NOTE: The use of Gentex Strobe indicating appliances installed in a GOE enclosure does not comply with UL 1971 requirements.

1. Alarm horns shall be System Sensor Model No. HR (CSFM 7135-1653:0189) or equal, and shall be polarized and operated by 24 VDC. Entire unit shall be red finish. Horn assemblies shall be furnished with separate wire leads for in or out wiring for legs of associated signal circuits. T tapping of signal device conductors to signal circuit conductors is not permitted. Suitable gaskets shall be provided for weatherproof installation. Horns shall provide a minimum sound pressure level of 100 dB at 10 feet. Horns shall be mounted on manufacturer's recommended outlet boxes. Weatherproof horns shall be Model No. HRK (CSFM 7135-1653:0189); Provide a Model No. BBS-2 back box skirt on indoor surface mount outlet boxes.

2. Horn/strobe shall be wall mounted System Sensor Model No. P4R standard candela output or Model No. P4RH high candela output (CSFM 7135-

1653:188); or equal. Horn/strobe shall operate on two separate two wire 24 VDC polarized circuits and shall be provided with a semi-flush mounting plate. Entire unit shall be red finish. Strobe light shall have a clear Lexan lens. The word "FIRE" shall be printed on the two sides of the strobe body. Horn shall provide a minimum sound output of 100 dB at 10 feet. The strobe shall provide a selectable minimum light intensity of 15, 30, 60, 75, 90, 110, 135, 150, or 185 Candela as indicated on Drawings to meet or exceed requirements of CBC, CHAPTER 11B AND ADAAG and UL 1971. Horn/Strobes shall be mounted on manufacturer recommended outlet boxes. Weather proof horn or strobe shall be model No. P4RK or Model No. P4RHK. Provide a model No. BBS-2 back box skirt on indoor surface mounted outlet boxes.

3. Strobe indicating appliances shall be System Sensor Model No. SR standard candela output or Model No. SRH high candela output (CSFM 7125-1653:0186), or equal. Devices shall be UL listed and shall be wall-mounted. Entire unit shall be red finish. Strobe light shall have a clear Lexan lens. The word "FIRE" shall be printed on two sides of the strobe body. Strobes shall meet CBC, CHAPTER 11B AND ADAAG and UL 1971 requirements. The strobe shall provide a selectable minimum light intensity of 15, 30, 60, 75, 90, 110, 135, 150, or 185 Candela as indicated on the Drawings to meet or exceed requirements of CBC, CHAPTER 11B AND ADAAG and UL 1971. Strobes shall be mounted on manufacturer recommended outlet boxes. Weather proof strobe shall be model No. SRK or Model No. SRHK. Provide a model No. BBS-2 back box skirt on indoor outlet boxes.

4. Strobe synchronization modules if required shall be System Sensor Model No. MDL3R (CSFM 7300-1653:0202) or equal, to be installed in conjunction with two or more strobes located in same room or corridor or as indicated on Drawings. (Strobe synchronization modules must be compatible with installed strobes).

O. Electromagnetic Door Holder: Electromagnetic door holders shall be installed on doors as indicated on Drawings or as required. Electromagnetic Doors shall consist of a wall-mounted electromagnet and a door-mounted armature with an adjustable contact plate. Electromagnets shall provide a force of attraction of 35 pounds when energized and less than three pounds residual with power disconnected. Armature contact plates shall provide a horizontal adjustment of 25 degrees. The holding force of Electromagnetic Doors shall be totally electromagnetic and without the use of mechanical linkage or other moving parts. Electromagnetic Door Holders shall normally be energized, and a release shall be accomplished by interrupting the circuit. Door holders shall be Reliable Security Group DH Series (CSFM 3550-1039:0100) or equal. The door holder power supply shall be an Altronix Model AL400ULM (CSFM 7315-1335:0100) for three amp. Output, AL600ULM (CSFM 7315-1335:0100) for six amp output, AL1024ULM (CSFM 7315-1335:0100) for ten amp output. The power supply shall be equipped with a fail safe input trigger

circuit and five individually protected outputs. (Electromagnetic Door holders shall not be powered by an FACP or remote NAC power supplies).

NOTE: Indicate blocking or other means for attachment of box housing electromagnetic assembly capable of resisting a horizontal force of at least 100 lbs.

P. Bells: System Sensor Model No. SSM-24-10, or equal, with Weather proof back box No. WBB for installation with surface raceway. Bells shall be polarized and operated by 24 VDC. Bell shall be powered from FACP or Remote NAC power supply. When used as a notification appliance to indicate fire sprinkler water flow the bell shall be directly controlled by contacts in the associated flow switch. Addressable relays or control modules shall not be used to supervise sprinkler bells. Bell assemblies shall provide separate wire leads for in or out wiring for legs of associated signal circuits. Bells shall be vibrating type providing a minimum sound pressure level output of 84 - 87 dB at ten feet. Bells shall be ten inches in diameter, finished with baked-on red enamel paint, UL listed for fire alarm installation, and suitable for surface or semi-flush mounting. Provide a sign adjacent to the water flow bell with one inch tall and 3/8 inch stroke white lettering on a bright red background. The sign shall read: "NOTIFY FIRE DEPARTMENT WHEN ALARM SOUNDS".

Q. Water-flow Switches:

1. Water-flow switches shall be Potter Electric Model No. VSR-F (CSFM 7770-0328:0001) or equal. Vane-type water-flow switches shall be installed on system piping as designated on Drawings or as required. Detectors shall install on clear pipe spans of appropriate nominal size, either a vertical or horizontal run, at least six inches from fittings or valves which may change water direction, flow rate or pipe diameter, and not closer than 24 inches to valves or drains. Detector shall respond to water-flow in specified direction after a preset time delay that is field adjustable. Actuation mechanism shall include a polyethylene vane inserted through a hole in the pipe and connected by a mechanical linkage to delay mechanism. Output shall consist of ten amps (dual SPDT switches form-C contacts). A conduit entrance for standard electrical conduit fittings shall be provided on detectors. Detectors shall be listed by UL for indoor or outdoor installation. No more than 18 inches of seal-tight flex may be used to connect the water flow or tamper switch to the site conduit system at any one location.

2. Sprinkler valve tamper switches shall be System Sensor Model No. OSY2 (CSFM 7770-1653:0118) for use with outside screw-and-yoke valves or System Sensor Model No. PIBV2 (CSFM 7770-1653:0118) for use with post indicating valves or equal. Supervisory switch shall be installed on valves as designated on Drawings or as required. Switches shall be installed to not interfere with normal valve operation and shall be adjusted to operate within two revolutions of valve control or when stem has moved no more than 1/5 of distance from its normal position. Mechanism shall be housed in a weatherproof die cast metal enclosure, also providing a 3/4 inch tapped conduit entrance to incorporate necessary facilities for attachment to valve.

Switch mechanism shall be furnished with a minimum rated capacity of ten amps at 125 VAC and 2.5 amps at 24 VAC. Entire installed assembly shall be tamper-resistant. Tamper switches shall be UL listed. No more than 18 inches of seal-tight flex may be used to connect the water flow or tamper switch to the site conduit system at any one location.

R. Universal Digital Alarm Communicator Transmitter shall be Notifier Model No. UDACT (CSFM 7300-0028:0174). The UDACT is an interface for communication of digital information between a fire alarm control panel and a UL-Listed central station.

1. The UDACT shall be compact in size, mounting in a standard module position of the fire alarm control cabinet. Optionally, the UDACT shall have the ability for remote mounting, up to 6000 feet from the fire alarm control panel. The wire connections between the UDACT and the control panel shall be supervised with one pair for power and one pair for multiplexed communication of overall system status.

2. The UDACT shall include connections for dual telephone lines (with voltage detect), per UL or NFPA or FCC requirements. It shall include the ability for split reporting of panel events between up to three different telephone numbers.

3. It shall be completely field programmable from a built in keypad or laptop computer, and shall be capable of transmitting events in multiple formats.

4. Communication shall include vital system status such as:

   a. Independent Zone (Alarm, trouble, non-alarm, supervisory.

   b. Independent Addressable Device Status.

   c. AC (Mains) and Earth Fault.

   d. System Off Normal.

   e. 12 and 24 Hour Test Signal.

   f. Abnormal Test Signal (per UL requirements).

   g. EIA-485 Communications Failure.

   h. Phone Line Failure.

5. The UDACT shall support independent zone or point reporting when used in the Contact ID format. This enables the central station to have exact details concerning the origin of the fire or response emergency.

6. The UDACT shall be supplied with two eight conductor, two to six foot long line cords. One end of the cords shall plug into the jacks on the UDACT. The other end of the cords shall plug into industry standard RJ-31X surface mounted telephone jacks. Install jacks in a screw cover box adjacent to the FACP if sufficient space is not available within the FACP, or adjacent fire alarm terminal cabinet. The line cords shall be installed in conduit when it is necessary to locate the jacks remotely from the FACP

enclosure. The jacks shall be mounted to the rear of the box. The telephone number for each line shall be labeled on its respective jack.

S. Voice Evacuation System:

1. The Voice Evacuation Control (EVAC) Panel shall be Notifier Model No. NFV-25/50 (CSFM 6911-0028:0229) The self contained control panel shall be equipped with dual 25 watt audio amplifiers each with a single style Y (Class B) supervised 25 V rms output circuit. The EVAC panel shall have the ability to record a minimum of two field-programmable messages of up to 60 seconds total duration with an integral microphone or an external source via an audio input jack. The messages shall be stored digitally onto a non-volatile EEPROM. The message(s) shall be individually field programmable for three, four, six, eight, or indefinite repeat while triggered by the host FACP. Any message being delivered at the time of the trigger circuit(s) reset shall not stop in mid sentence but shall be completed to the end of the message. A tone generator shall be provided capable of emulating a field programmable lead-in or trailing alert tone or an Audible Emergency Evacuation Signal (Temporal Pattern). The EVAC panel shall be capable of electrically supervising in both active and standby conditions, the amplifier outputs, field wiring, message generator, tone generator, microphone and primary or secondary power supplies to an internal trouble relay(s). The trouble relay(s) contacts shall be accessible via a terminal strip and be configured and connected to report internal or external trouble conditions to the host FACP via the trigger circuit or a separate monitor module. The minimum of two trigger circuits shall be individually field-configurable for triggering with a NAC circuit or a supervised dry contact. The control panel shall be equipped with LED indicator lights for Power On, System Trouble, Message Generator Trouble, Tone Generator Trouble, Microphone Trouble, Battery Trouble, Charger Trouble, Ground Fault, Output Circuit Trouble and Amplifier Supervisory. The panel shall be equipped with an internal monitor speaker for reviewing the field recorded messages. The primary power supply shall operate at 120 VAC through a dedicated 20 amp. circuit and shall be capable of charging 18 AH lead acid batteries. Provide two 12 volt batteries that will provide a secondary power source for the same or longer duration than is required by the host FACP. An auxiliary 24 volt DC power output shall be provided for use by an associated addressable control module. The EVAC control panel shall be triggered either directly by the associated FACP with a NAC circuit or by an addressable control module. Provide 3/8 inch minimum P Touch labeling on the window in front of the built in microphone indicating that "THE INTERNAL MICROPHONE IS TO BE USED FOR THE RECORDING OF ANNOUNCEMENTS ONLY. NOT FOR USE BY STAFF OR FIRE DEPARTMENT PERSONNEL."

2. Ceiling Mounted eight Inch EVAC Speakers shall be Wheelock Model No. S8-70-25 (CSFM 7320-0785:0164) to be mounted in a Model CBB-8 backbox. The speaker assembly shall be supplied with a white 12 inch

round metal grill. The 8 inch speaker shall have an impedance of 8 ohms, minimum 9.5 ounce magnet and an attached 25 volt audio line matching transformer with 1/8, 1/4, 1/2, 1, 2, 4 and 8 watt tap settings and DC blocking capacitor. Wattage shall be selectable by the use of a jumper or shunt. Audio levels shall be 75, 78, 81 87, 90 or 93 dba at ten feet. Input or output terminals that will accommodate 12 to 18 AWG wire shall be provided. Speakers orientated in the same direction shall be connected in phase with each other. Multiple speakers in areas such as Auditoriums or Gymnasiums shall be divided into two circuits in a checker board pattern and connected separately to the two audio output circuits.

3. Wall Mount four Inch EVAC Speakers shall be SpectrAlert Model No. SPRV (CSFM 7320-1653:0201) to be mounted on a manufacture recommended outlet box. When mounted on a surface mount outlet box, Provide a Model No. BBS-SP201R surface mount backbox skirt. The speaker assembly shall be supplied with a square high impact red grill. The four inch speaker shall have an attached 25 volt audio line matching transformer with 1/4, 1/2, 1 and 2 watt tap settings and a DC blocking capacitor. Wattage shall be selectable by the use of a jumper or shunt. Audio levels shall be 80, 84, 86 or 89 dba at ten feet. Input or Output terminals that will accommodate 12 to 18 AWG wire shall be provided. Speakers orientated in the same direction shall be connected in phase with each other; but when installed facing opposite directions they shall be connected out of phase.

T. Network Cables or SLC or Annunciator Data or Audio Output Cables: The construction and physical characteristics such as aqua-seal water block, wire gage, insulation and jacket types, etc. shall not be altered. Equivalent cables must be specifically approved and recommended by the manufacturer of the fire alarm system equipment. Substitutions will require review from the Architect or Engineer of Record.

U. The cable types listed below are based and specified on the recommendations of Notifier Fire Alarm Systems. If the submitted fire alarm system requires a different cable configuration with additional conductors, multi-conductor versus twisted pairs, etcetera than is specified above, request a substitution to supply and install the configuration of cables by the make and model of the fire alarm system that is to be installed.

1. Indoor Network and EVAC System Audio Output Circuit(s) applications shall be in conduit or in surface mounted raceway as indicated on drawings: West Penn No. D980, one pair 18 gage solid copper, unshielded, Copolene II insulated and PVC jacketed, or equal.

2. Indoor SLC applications in conduit or in surface mounted raceway where it is indicated on drawings: West Penn No. D990, one pair 16 gage solid copper, unshielded, Copolene II insulated and PVC jacketed, or equal.

3. Indoor Annunciator applications in conduit or in surface mounted raceway where it is indicated on drawings: West Penn No. D975, one pair 18 gage solid copper, shielded, Copolene II insulated and PVC jacketed, or equal.

4. Outdoor or Underground Network Applications: West Penn AQ224, two-conductor 18 gage stranded copper, unshielded, water-blocked construction and PVC insulated, or equal.

5. Outdoor or Underground SLC applications: West Penn AQ225, 2-conductor 16 gage, AQ226, 2 conductor 14 gage, or AQ227, 2 conductor 12 gage stranded copper, unshielded water-blocked construction and PVC insulated, or equal.

6. Outdoor or Underground Annunciator applications: West Penn AQ293, 2 conductors, 18 gage stranded copper, shielded water-blocked construction and PVC insulated, or equal.

V. Protective Covers

1. Provide protective covers for pull stations, smoke and heat detectors, and audible and visual devices located in areas occupied by students that can be subjected to vandalism such as gyms, restrooms, locker and shower rooms, and all hallways and corridors associated with these spaces. Installation of cover must not protrude over current ADA limitations.

PART 3 - EXECUTION

3.01 GENERAL

A. Fire alarm system shall not be used for any purpose other than fire alarm functions.

B. Fire alarm shall be interconnected but not limited to the following systems:

1. Systems required by code to be connected to the fire alarm systems shall be connected.

2. Public address system for disabling the manual and automatic bell or tone class passing signals. Manual and automatic class passing signals shall not be operable during alarm conditions.

3. Ventilation systems where required for the purpose of fan shutdown

4. Damper control or smoke management systems.

5. Water based fire sprinkler systems.

6. Chemical fire extinguisher systems.

7. Central and Autonomous PA system(s).

8. Theatrical lighting control system.

9. Elevator controls for the purpose of elevator cab Phase 1 recall and shunt trip control, circuit supervision and shunt trip power supervision.

10. Fire pump controller for required signaling and trouble supervision.

C. Fire alarm system shall not be interconnected to any of the following:

1. Sump warning systems,
2. Carbon monoxide detection systems.
3. Methane gas detection systems.
4. Elevator car alarm bell circuit.
5. Other unrelated system.

3.02 SYSTEM INSTALLATION

A. Install required conductors to devices indicated on Drawings. Provide required conductor terminations to devices for a complete system to function as specified and indicated on Drawings. Refer to Section 26 0519: Low-Voltage Wire (600 Volt AC), for installation and color coding requirements.

B. Splices are not allowed in junction boxes. Terminations shall be in terminal cabinets or on equipment terminals.

C. Conductors shall be installed within conduits, boxes, and terminal cabinets in a totally enclosed installation. Furnish and install conductors required to connect incoming and outgoing circuits, including spare conductors, to terminal strips within terminal cabinets.

D. Wiring within equipment and terminal cabinets shall be installed to conform to contract documentation and NFPA 72 standards, and shall be terminated on terminal blocks having terminals for required connections. Wiring shall be cabled, laced, and securely fastened in place so that no weight is imposed on equipment or terminals.

E. Install required terminal blocks within terminal cabinets. Terminal blocks shall be installed on inside back of cabinets only, not on side. Incoming wiring shall be terminated on the left side of terminal blocks; outgoing wiring shall be terminated on the right side of the terminal blocks.

F. Conductors shall be color-coded per specification section 26 0519 Low Voltage wires and tagged with code markers at terminal cabinets, and equipment. A wire index shall be typed and installed on terminal cabinet doors. Index shall be covered with clear plastic adhesive covers. Wiring shall be identified as to building and location of devices in the index.

G. Wiring within equipment and terminal cabinets shall be carefully strapped, and shall be formed in rectangular configuration. Wires shall be properly numbered in numerical order and shall maintain same number throughout the Project site.

H. Complete installation shall comply with local building codes and applicable provisions of the California Electrical Code, California Fire Code and the NFPA 72 National Fire Alarm Code.

I. Location of outlet boxes and equipment on Drawings is approximate, unless dimensions are indicated. Do not scale Drawings to determine locations and routing of conduits and outlet boxes. Location of outlet boxes and equipment shall conform to architectural features of the building and other Work already in place, and must be ascertained in the field before the start of Work.

J. Drawings generally indicate Work to be provided, but do not indicate all bends, transitions or special fittings required to clear beams, girders or other Work already in place. Investigate conditions where conduits are to be installed, and furnish and install required fittings.

K. Provide P-touch label of approximately one inch wide with red lettering for each initiating device that is hidden from view. Tags shall indicate the name and type of device: Heat Detector, or Duct Smoke Detector. Tags shall be permanently attached on access panel or t-bar grid which is used to access a hidden device.

L. Provide smoke and heat detectors in elevator hoist-ways if a fire sprinkler head is located at the top of the elevator hoist-way. Provisions shall be made for access to the detector without entering the elevator hoist-way. Access shall be provided through an approved enclosure with self-locking fire rated door. The detectors shall be so placed as to allow service to them without the service personnel having to reach into the hoist-way in the way of travel of the elevator car. Access to elevator hoist-ways and machine rooms (including escalators) must be supervised by the Owner's licensed elevator or escalator maintenance contractor. OAR is responsible for coordinating access in accordance with Contractor's schedule. Contractor shall provide a minimum of 48 hours notice.

M. Provide adjacent to each annunciator a neatly typewritten copy of the Fire Alarm Operating Instructions. The instructions shall reflect the installed and programmed features of the system. Instructions that include information on non-installed or programmed features will not be acceptable. The instructions shall be placed into a suitably sized dark colored wood or metal frame with a glass document face cover. The frame shall be attached to the wall with a minimum of two screws into the wall material with appropriate anchors.

N. Provide adjacent to each annunciator a neatly drawn site map showing rooms with designations and buildings with names as programmed into the system. This map shall be sized to allow (normal vision) reading of the designations, names etc. A map so reduced in size to the point of not being readable will not be acceptable. This map shall include symbols indicating the locations of installed fire sprinkler flow switches, riser shut off valves, post indicating valves and manual pull stations. Provide a symbol list on the map for the symbols used. The site map shall be placed into a suitably sized dark colored wood or metal frame with a glass document face cover. The frame shall be attached to the wall with a minimum of two screws into the wall material with the appropriate anchors.

3.03 SYSTEM PROGRAMMING

A. Programming shall be performed in accordance with District requirements set forth in this section – the local authority having jurisdiction and applicable codes. If a conflict arises or a clarification is required, the contractor through the project's OAR shall contact the Districts Fire Life Systems Testing Group (FLSTG) for clarification

B. As part of the 50 percent construction completion label devices and locations in the manner indicted in the attached guidelines on a separate copy of the shop drawings. Request a meeting with OAR, Project Inspector, and representative of FLSTG to review, finalize and obtain approval of the proposed device, equipment and location descriptors that will be programmed into the system. The District may at time of substantial completion request minor changes to program descriptors if needed to conform to site conditions.

C. The following functions and features as required by the site or system configuration and installed peripheral equipment and systems shall be programmed into fire alarm systems. The definition of programming shall include but not be limited to the use of a built in keyboard, the use of a connected PC with the appropriate software, dip or rotary switches, wiring or installable or removable jumpers as required or provided in the fire alarm equipment.

1. Signal Silence Switch Inhibit: The audible signal silence switch located on the remote fire alarm annunciator(s) or any fire alarm control panel(s) shall be programmed to not silence the audible or extinguish the visual alarm circuits during the first minute (60 seconds) of the fire alarm horn or strobe activation. Activation of this switch after the initial 60 seconds signaling shall silence only the audible signals. Enabling or disabling this feature shall be allowed only by authorized District maintenance personnel and shall be protected by a maintenance level password.

2. Audible and Visual Signal Auto Silencing Extinguishing: Audible coded signals and visual signals throughout the site, unless silenced by the above switch, shall be programmed to automatically self-silence or extinguish in no less than 5 minutes (300 seconds) and no more than 10 minutes (600 seconds). This feature shall not apply to the fire sprinkler water flow audible appliance.

3. Fire Sprinkler Water Flow Audible Appliance: The fire sprinkler water flow appliance (bell) shall not require any programming because of our requirement for this appliance to be directly controlled by a set of dry contacts within the associated sprinkler water flow switch(s). The 24 volt DC auxiliary power for the sprinkler water flow audible appliances shall be supplied by an FACP or a remote power supply. This audible appliance shall operate continuously during the detection of fire sprinkler water flow and shall not be coded in any manner nor silenced automatically by any FACP or manually by any user controls at any FACP or remote annunciator.

4. Fire Sprinkler Water Flow Switch: Fire sprinkler water flow switches shall be programmed in a manner that shall prevent the above Signal Silence

Switch from silencing the audible coded signals or visual signals after the initiation of an alarm by a fire sprinkler flow switch.

5. Audible Notification Appliance Circuits: Audible notification appliance circuits shall be programmed to emulate the temporal code (ANSI S 3.41) from fire alarm audible appliances (horns). This coding shall originate and be controlled by a single coder residing within the FACP(s). The use of coders within remote power supplies either mounted adjacent to an FACP or at a remote location or directly by an audible notification appliance will not be permitted. Programmable audible notification appliances shall be configured to emulate a steady tone at approximately 1000 Hz. Audible notification appliance circuits shall be programmed to be silenced as described above. Notification appliance circuits throughout the site shall be activated by any alarm initiating device. Coded audible signals shall be controlled by a single synchronized FACP.

6. Visual Notification Appliance Circuits: Visual notification appliance circuits shall be programmed to provide steady non-coded power to the visual appliances (strobes). As required by code and the system configuration, a synchronization signal shall be superimposed onto the NAC by the FACP, a remote power supply or an add-on synchronization module. Visual notification appliance circuits shall be programmed to be extinguished as described above. Visual notification appliance circuits through out the site shall be activated by any alarm initiating device.

7. System Reset Button: The system reset button located on FACPs and remote annunciators in addition to resetting the fire alarm system and silencing or extinguishing notification appliances except for the sprinkler water flow appliances shall be programmed to reset analog and addressable smoke detectors, duct detectors, beam detectors and relays, addressable control modules and addressable relay modules used to interface to other systems and equipment. Each installed system reset button shall be programmed to operate as a “single point of reset” for the complete system.

8. HVAC Shutdown: Relays and addressable relay modules used to interface to HVAC equipment dampers, and supply and exhaust fan motors shall be programmed to shut down this equipment only within the same building where the detection of smoke, heat or fire sprinkler water flow has taken place. Manual pull stations within any building shall not effect the operation of the HVAC equipment. These relays shall return to normal only after the system is reset.

9. Elevator Recall: The addressable relay modules for the primary and alternate elevator recall function shall be programmed to activate only with the detection of smoke by a detector located in the elevator machine room, elevator hoistway or the main floor or alternate floor landing(s) smoke detector associated with that elevator or bank of elevators. Recall of an elevator shall be on a per-elevator or on a per-bank of elevators

basis. Activation of other initiating devices shall not cause the recall of an elevator.

10. Fire Fighter Warning: In conjunction with the above elevator recall function, an additional addressable relay module shall be programmed to operate only with the detection of smoke by a detector located in an elevator machine room or elevator hoistway to provide a warning signal to fire fighters attempting to use the phase II elevator function.

11. Elevator Shunt Trip: The addressable control module or MR control relay for the elevator shunt trip shall only be activated by the heat detector located within the elevator machine room or elevator hoistway for each elevator or bank of elevators. Circuit integrity, and AC and DC power to the MR control relay shall be electrically supervised. Activation of other initiating devices shall not operate the shunt trip.

12. Smoke Detector Maintenance Alert: Addressable smoke detectors shall be programmed with the capability of initiating a maintenance alert when any one detector becomes obscured by dust or any other contaminates at approximately 10 percent below the level of obstruction that would initiate an alarm.

13. Disabling Class Passing Signals: The relay or addressable relay module shall be programmed to disable the class passing signals during any alarm condition at the site. This relay or addressable module shall return to normal only after the system is reset.

14. Disabling Audio of a Public Address System: The relay or addressable relay module shall be programmed to mute the audio output of the associated public address system during any activation of an audible notification appliance circuit or a voice evacuation announcement. This or these relays shall automatically restore to normal upon the silencing of the audible NACs and the voice evacuation announcement.

15. Release of Electro-Magnetically Held Doors: The relay or addressable relay module shall be programmed to open or close the control circuit as needed of the 24 volt DC door holder power supply. This relay(s) shall operate during any alarm condition within the same building as the door holders. The contacts shall return to normal only after system reset.

16. Illumination of House Lighting: The relay or addressable relay module shall be programmed to turn on to full brilliance the house lighting of an Auditorium, MP Room, etc during any alarm condition at the site. This relay or addressable module shall return to normal only after the system is reset.

17. UDACT: The FACP and the associated Universal Digital Alarm Communication Transmitter shall be programmed to transmit to the central monitoring station separate indications for General Alarm, Fire Sprinkler Water Flow Alarm, System Trouble and Supervisory

Conditions. These indications shall be in addition to any indications initiated by the UDACT itself.

18. Voice Evacuation Panel: The NAC originating at, or the addressable control module controlled by the associated FACP that is controlling the EVAC panel shall be programmed to emulate the above paragraph "E" Audible Notification Appliance Circuits except that it shall be non-coded. Trouble conditions at the EVAC panel shall report back to the associated FACP via the controlling NAC or addressable control module or a separate addressable monitor module. Transformer taps at the EVAC speakers shall be selected to provide the proper balance of audio volume in larger and smaller areas. The message shall be programmed in a female voice in the English language as follows: A minimum of two but no more than three cycle sounding of an approximate 1000 Hz tone in the pattern of the NFPA required temporal code followed by: "May I have your attention please. May I have your attention please". The fire alarm has been activated in the building. The fire alarm has been activated in the building. Please proceed to the nearest exit and leave the building." The sounding of the temporal patterned signal followed by the indicated message shall repeat indefinitely until the controlling NAC is reset.

19. Power Failure Reporting Time Delay: Main and remote NAC power supplies shall be programmed to delay the reporting of a site AC power failure for a minimum of 6 hours.

D. Device Descriptors:

1. Descriptors shall enable responding personnel to identify the location of a fire quickly and accurately, and shall indicate the status of emergency equipment or fire safety functions that might affect the safety of occupants. The minimum required information for devices intended to report smoke, fire, or fire sprinklers water flow include, but may not be limited to: Building, floor (if multiple floors exist in the building), room or space description, and device type and digital address (Smoke detector, Heat detector, Fire sprinkler water flow switch, etc).

   a. Building: The building must always be included in the descriptor, even if there is only one building one the site. Additional building(s) may be added at a later date creating the possibility of confusion by similar designated spaces, such as "Work room" or "Staff restroom" if more than one building has these similar designated spaces. The building designation in the descriptor must be what the site-based personnel call the building. The building should be provided with signage to aid fire department personnel in the identification of the building.

   b. Floor: In multi-floor buildings the floor designation (1st, 2nd, etc) must be included in the descriptor.

c. Room Description: The room or space description must be unique. Using the same designation for multiple spaces, such as "Workroom", "Counselor's Office", or "Men's restroom", etc. is not acceptable. If, during a project, the room numbers or the use of the room changes then the room or space descriptor must be changed to agree with the change. Proper signage should be provided for each space to aid fire department personnel in the identification of the room or space.

d. Device Type, Address and Compass Designations: The device type and digital address must be included with the descriptor, such as smoke detector or heat detector, etc. Some systems provide this information automatically in the descriptor. Compass designations, (N, S, E, and W) are required in spaces such as corridors where there are multiple detectors and this information would be helpful to responding fire department personnel in locating the device reporting alarm. It is not necessary to include compass designations in smaller spaces where there are multiple detectors located in close proximity to each other.

E. ACCEPTABLE ABBREVIATIONS

Rm.- Room	Bldg.- Building	Smk. - Smoke
Corr.- Corridor	Lby- Lobby	Asst. - Assistant
Eng.- English	N – North	Nrs. - Nurse
Flr.- Floor	S – South	Cnclr - Counselor
Ht.- Heat	E – East	Off. - Office
Lib.- Library	W – West	PE – Physical Education
Lkr. – Locker	Kit- Kitchen	RR- Rest Room
Stu Str – Student Store	Sci - Science	By = near
Stor Rm – Store Room	Café - Cafeteria	PM – Plant Manager
1st- First	2nd- Second	3rd- Third
Hopr Rm – Hopper Room	Det - Detector	Elev - Elevator
Prin – Principal	Blr Rm – Boiler Room	Conf – Conference
Park – Parking	Bsmt –Basement	MPR.- Multi-Purpose room

3.04 SYSTEM OPERATION

A. Unless otherwise specified, but not limited to actuation of manual stations, smoke detectors, heat detectors, linear heat or smoke detectors, or water-flow switches shall cause the following operations to occur, refer to Attachment B:

1. Activate audible circuits.
2. Actuate strobe units until the panel is reset or strobe circuit time-out.
3. Release magnetic door holders to doors to adjacent zones on the floor from which the alarm was initiated.
4. Where required, return elevators to the primary or alternate floor of egress.
5. Smoke detectors in elevator lobbies shall, in addition to the above functions, return elevators to the primary or alternate floor of egress.
6. Smoke detectors in elevator machine rooms or tops of hoist-ways shall return elevators to the primary or alternate floor. Smoke detectors or heat detectors installed to shut down elevator power shall perform this function in accordance with ANSI A 17.1 requirements and shall be coordinated.
7. Duct type smoke detectors shall, in addition to the above functions, shut down the ventilation system or close associated control dampers as required.
8. Activation of fire sprinkler system low-pressure switches, post indicator valve or tamper switches shall initiate a system supervisory alarm indication.
9. UL listed central station shall be notified via – Universal Digital Alarm Communicator Transmitter (UDACT).

3.05 TESTING

A. A 48 hour notice shall be provided to the Project Inspector before final testing.

B. Testing of fire detection system shall be as required by the State Fire Marshal and local authorities having jurisdiction. Installer is responsible for identifying required testing, coordinating, scheduling, and conducting tests before Substantial Completion. Tests shall include the following:

1. Operation of signal-initiating devices (smoke detectors, heat detectors, pull stations etc.).
2. Operation of indicating devices (alarm horns, alarm bells and alarm strobes).
3. Operation of system features under normal operation.
4. Operation of system supervisory features.
5. Operation of system features on standby power, with primary power turned off.

6. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.

7. Close sprinkler system flow valves and verify proper supervisory alarm at the FACP.

8. Verify activation of flow switches.

9. Open initiating device circuits and verify that trouble signal actuates.

10. Open signaling line circuits and verify that trouble signal actuates.

11. Open and short notification appliance circuits and verify that trouble signal actuates.

12. Open and short (wire only) network communications and verify that trouble signals are received at network annunciators or reporting terminals.

13. Ground initiating device circuits and verify response of trouble signals.

14. Ground signaling line circuit and verify response of trouble signals.

15. Ground notification appliance circuit and verify response of trouble signals.

16. Check alert tone to alarm notification devices.

17. Check installation, supervision, and operation of intelligent smoke detectors.

18. Alarm conditions that the system is required to detect shall be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.

19. When the system is equipped with optional features, consult the manufacturer manual to determine proper testing procedures.

20. Theatrical lighting house light control override.

21. Central and Autonomous PA systems for muting during the sounding of the audible notification appliances and voice evacuation announcements.

22. Disabling electronic tone or electromechanical bell class passing signals until system reset.

C. Upon completion of installation of fire alarm equipment, provide to the OAR a signed, written statement confirming that fire alarm equipment was installed in accordance with the Specifications, Shop Drawings, instructions and directions provided by the manufacturer.

D. Demonstrate in presence of the Project Inspector that circuit and wiring tests are free of shorts and grounds and that installation performs as specified herein and within manufacturer's guidelines.

E. Software Modifications:

1. Provide the services of a factory trained and authorized technician to perform system software modification, upgrades or changes. Response time of the technician to the Project site shall not exceed 24 hours.

2. Provide hardware, software, programming tools, and documentation necessary to modify the fire alarm network on the Project site. Modification includes: addition and deletion of devices, circuits, zones and changes to system operation and custom label changes for devices or zones. The system structure and software shall place no limit on the type or extent of software modification on-site. Modification of software shall not require power-down of the system or loss of system fire protection while modifications are being provided.

F. Complete the inspection and testing form as required by NFPA 72, and submit one copy of the completed form to the Architect and Project Inspector.

3.06 SERVICE MANUALS

A. Deliver to OAR, three copies of the service manuals. Each manual shall include the following:

1. Installation manuals, programming manuals and user manual if applicable for every control panel, control panel power supply, FACP input or output or relay or control module, auxiliary power supply, UDACT, remote NAC extender power supply, door holder power supplies, installed annunciators, initiating and indicating devices and addressable monitor, relay and control modules. Catalog cut sheets are not acceptable.

2. A printed copy of the system configuration as programmed, including system labeling codes, and passwords.

3. An electronic copy on compact disk of the system configuration program

4. Final test report.

5. Detailed explanation of the operation of the system.

6. Instructions for routine maintenance.

7. Detailed wiring diagram for the connection of relays, addressable monitor, and control or relay modules as applied in the interfacing of peripheral systems or equipment to the fire alarm system. Updated shop drawings shall include revisions made in the field via plan changes, RFIs, Field Change Directives, and any other construction change documents including interface details with ancillary systems.

8. An electronic copy (CD) of the posted site or fire alarm map in Auto-Cad and pdf formats.

9. Provide a CD ROM electronic copy of the updated system As-Built Drawings to the OAR, prepare this copy in the latest version of AutoCAD; along with the electronic copy provide a full size bond copy. Include one CD-ROM of the up-dated As-Built Drawings into each of the Service

Manuals. CD and folded drawings shall be secured and inserted into the Service Manuals via a three-hole punched protective CD case and protective envelopes for the drawings.

10. Provide codes and passwords for fire alarm system at testing.

3.07 SPARE PARTS

A. The following new spare parts shall be furnished in unopened boxes:

1. Five percent spare pull stations including the associated monitor module (minimum one spare pull station per type).

2. Five percent spare smoke and heat detectors (minimum one spare smoke and heat detector per type).

3. Five percent spare audible devices (minimum one spare audible device per type).

4. Five percent spare strobe devices (minimum one spare strobe device per type).

3.08 SYSTEM USER AND MAINTENANCE PERSONNEL TRAINING

A. Before Substantial Completion, provide one instruction period for the Project site based Owner operators and system users. The instruction period shall be scheduled and coordinated by the OAR.

B. Training materials and required deliverables shall be submitted to the OAR.

1. Prior to beginning the operational demonstration, notify Central monitoring Station that an instructional activity is beginning; inform them that it includes setting and resetting the system in test mode. After the demonstration is completed and the system restored, notify the Central Monitoring Station that the system has been restored and it is back on line for continuous monitoring.

C. User Instruction and Training

1. Before substantial completion and with a fully functional fire alarm system installed at the site, the contractor shall provide a minimum of four hours of user training for site based staff. The date and time for this training shall be coordinated by the project OAR.

D. Instruction period training for site based staff shall consist of the following:

1. Overview:

a. Explain the fire system is “addressable” which means every device-smoke detector, heat detector, sprinkler water flow switch, manual pull station, etc. has a unique address or identity. This makes it possible to positively identify the exact device causing an alarm, trouble or supervisory condition.

b. Explain the fire alarm control panel also controls the horns and strobes throughout the campus or building.

c. Explain that the fire alarm system is interconnected to various other systems and equipment through out the site such as:

1) Elevators to recall them to the main floor or to an alternate floor and as an option dependent circumstances turn off the power to the elevators.

2) Heating and air conditioning equipment to turn off fans and close dampers to stop the spread of smoke through out a building.

3) The class passing signaling system to disable the bells or tones to not accidentally signal students and staff to return to the buildings.

4) Magnetically held doors to close them to stop the spread of smoke.

5) To turn up house lighting in an occupied Auditorium or Multi-Purpose room to provide adequate egress lighting.

6) The Central and Autonomous PA systems to mute them during the sounding of the alarm signal.

d. Explain the fire system has a battery backup in case of power failure and that it will continue to function for a minimum of 24 hours after a total power failure.

e. Explain that the fire alarm system components and wiring are monitored to report a malfunction, damage or vandalism. When this occurs, a trouble indication will appear on the fire alarm annunciator and FACP and this indication will be transmitted to the central monitoring station.

f. Explain that other equipment and systems are monitored for abnormal conditions such as the fire sprinkler water being turned off. When this occurs, a supervisory condition is created. A supervisory indication will appear on the fire alarm annunciator and FACP and this indication will be transmitted to the central monitoring station.

g. Explain that the fire system in addition to notifying the occupants of a possible fire condition also transmits an alarm indication to the central monitoring station that will in turn notify and dispatch the local fire department to your site.

2. Basic:

a. Hand out the SYSTEM OPERATION instructions to attendees.

b. Point out the Fire Alarm Control Panel and have them observe the normal LED status (one green LED only should be on):

1) GREEN = Normal.

2) YELLOW = Trouble.

3) RED = ALARM.

c. Have the attendees observe the LCD display that should be indicating a SYSTEM NORMAL message.

d. Point out the Fire Alarm System Annunciator and have attendees observe the LCD display that should be indicating a SYSTEM NORMAL message.

3. Operation and Demonstration:

a. After putting the system or having someone put the system central station monitoring into the test mode demonstrate the following:

b. Activate a Manual Pull Station to demonstrate ALARM.

1) Demonstrate audible and visual notification appliances and if installed the voice evacuation signal announcement.

2) Demonstrate panel or annunciator sounder tone for ALARM.

3) Have staff SILENCE system.

4) Show LCD display and LED of alarm.

5) Demonstrate and have staff reset the manual pull station.

6) Have staff RESET fire system.

c. Activate Smoke Detector with canned smoke to demonstrate address identification:

1) Have staff SILENCE system.

2) Show LCD and display LED of ALARM.

3) Have staff RESET fire system.

d. Remove Smoke Detector to demonstrate SYSTEM TROUBLE.

1) Demonstrate panel or annunciator sounder tone for TROUBLE.

2) Have staff SILENCE system.

3) Show LCD display and LED of TROUBLE.

4) Replace the smoke detector.

5) Have staff RESET fire system.

e. Remove power to demonstrate function during power failure.

1) Have staff SILENCE system.

2) Show LCD display and LED of TROUBLE.

3) Activate Manual Pull station to demonstrate audible or visual functions in power failure mode.

4) Reset manual pull station.

5) Reset fire system.

6) If applicable, point out sprinkler riser and shut off valves.

7) Show location of a water flow switch.

8) Show location of a valve tamper switch.

9) Point out valves must always be OPEN or fully counter clock wise.

10) Point out PIV (Post Indicator Valves) if applicable.

11) Have water flow through the inspectors test valve and point out the ringing water flow bell.

12) After the horns are silenced by an assistant, show that the water flow bell is ringing continuously indicating water flow.

13) Have the assistant turn off the inspectors test valve to show that water flow alarm bell turns off.

14) Reset system.

15) Unlock and turn off a PIV or riser valve to show a supervisory condition.

16) Turn valve back on, lock the valve open and demonstrate the end of the indication of a supervisory condition.

4. Training documentation.

a. Insure fire panel is reset and indicates normal and central station monitoring is taken off of the test mode.

b. Have staff attendees sign off training sheet and provide a copy to the PROJECT INSPECTOR.

3.09 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.10 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off Project site.

END OF SECTION

SECTION 31 10 00
SITE CLEARING

PART 1 GENERAL

1.01 SUMMARY

A. Inclusions:
   1. Provisions set forth in Divisions 0 and 1.
   2. Clear site of plant life and grass.
   3. Remove root system of trees and shrubs.
   4. Remove surface debris.
   5. Reuse or recycling.
   6. Clean up.

B. Related Sections:
   1. Section 02 41 13 Selective Site Demolition
   2. Section 31 22 00 Earthwork
   3. Section 31 31 19 Vegetation Control

1.02 SUBMITTALS

A. Record Drawings:
   1. Keep a record of the location and size of all capped pipe and /or conduit.
   2. Submit record drawings per Section 01 70 00 “Execution and Closeout Requirements” for record drawing submittal.

1.03 QUALITY ASSURANCE

A. Regulatory Compliance:
   1. Work shall comply with applicable provisions of local and State safety and health ordinances.
      a. Burning of removed materials is not permitted within the project limits.
   2. Take out and maintain required permits, approval and licenses necessary to legally complete this Work.
   3. Ensure that subcontractors are properly licensed and have the required permits to perform their work.

PART 2 PRODUCTS

2.01 MATERIALS

A. Provide materials, not specifically described, but required for proper completion of the work of this Section, as selected by the Contractor.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine the areas and conditions under which the work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work.
   1. Do not proceed until unsatisfactory conditions are corrected.

B. Accept the premises in the condition as found on the first day of work under this Contract.

3.02 PREPARATION

A. Notify utility companies concerning cut-off or restoration of service, or of relocation or modification of any such service that the work of this contract may require.
   1. Where utility cuffing, capping, or plugging is required, perform such work in accordance with requirements of the utility company or governmental agency having jurisdiction.

B. Utilities:
   1. Protect and maintain in operation utility, irrigation, or sewer lines that are required to remain operative during the period of this contract.
      a. If service is interrupted because of Work under this Section, immediately restore service by repairing the damaged utility at no additional cost to the Owner.
      b. If active utility lines are encountered and are not shown in the Drawings or otherwise made known to the Contractor/Construction Manager, promptly take necessary steps to assure that service is not interrupted.
      c. If existing utilities are found to interfere with the permanent facilities being constructed under this Section, immediately notify the Architect and secure his instructions.
         1) Do not proceed with permanent relocation of utilities until written instructions are received from the Architect.

C. Landscape Irrigation
   1. Modify and adjust existing irrigation in affected work areas as necessary to accommodate new work. Before site clearing, temporarily cap irrigation as necessary for work to continue.

3.03 PROTECTION OR ADJUSTMENTS

A. Enclose area of work with fence barricades.
   1. Protect trees and shrubs, where indicated to remain, by providing an additional fence around the tree or shrub so trees and shrubs will not be damaged in any way as part of the Work.

B. The work area shall be kept securely always locked work is in progress.

C. Post signs and warnings devices are necessary to exclude all persons, except those directly connected with the work from work areas.
   1. Barricade open depressions and holes occurring as part of this Work, and post warning lights on property adjacent to or with public access.
      a. Operate warning lights during hours from dusk to dawn each day and as otherwise required.

D. Always maintain access to the project site.

E. Protect adjacent buildings, shrubs, trees, and lawns from damage.
   1. Protect structures, utilities, sidewalks, pavements, water wells, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by operations under this Section.

F. Do not interfere with use of adjacent buildings or safe ingress or egress.

G. Use of explosives will not be permitted.

3.04 CLEARING

A. Remove from Site:
   1. Vegetation, including roots of plants not shown to remain.
      a. Roots under and/or within five feet of proposed structures shall be completely removed to a minimum depth of two (2) feet below the bottom of the lowest proposed structural footing or two (2) feet below existing grade, whichever is lower.
         1) Roots deeper than the elevation indicated above, shall be excavated to allow no roots larger than one and one-half (1-1/2) inches in diameter.
         2) Surface vegetation shall not be used as engineered fill or blended with and compacted.
      b. Remove roots outside five feet of proposed structures and larger than 1-1/2 inch in diameter to a depth of at least 12 (12) inches below the existing ground surface.
         1) Treat roots smaller than one and one-half (1-1/2) inch in diameter remaining in the soil with a weed killer as specified in Section 02282 – Vegetation Control.
   2. Rubbish and debris.
   3. Rocks larger than 1 1/2" in diameter not shown to remain.
   4. Remove vineyard vegetation, posts, wires, and irrigation lines designated for removal on Drawings.
      a. All underground irrigation lines shall be unearthed and removed from site.
         1) Plug or cap lines at property lines.

a) Coordinate with Contractor/Construction Manager, when applicable, or Architect.

5. Reuse or recycling: Per T24, Part 11, CGBSC Section 5.408.3 100% of trees, stumps, rocks, and associated vegetation resulting primarily from land clearing shall be recycled or reused. For phased project, such material may be stockpiled on site unite until the storage site is developed.
   a. Utilize a Waste Management Company that can provide verifiable documentation that waste was diverted from landfills.
   b. Conform to Waste Management Plan Developed for this project. Refer to Section 01 74 00 “Construction Wast Management and Disposal” for details.

3.05 CONSERVATION OF TOPSOIL

A. After the area has been cleared of vegetation, strip the existing topsoil to a depth necessary to provide at least 6-inch depth of topsoil in areas shown on the Drawings to receive turf or plants, and to fill planters, without contamination with sub-soils.
   1. Coordinate topsoil volume required with Contractor/Construction Manager, when applicable, or Architect. Remove excess topsoil from property and dispose of offsite in legal manner.

B. Stockpile in an area clear of new construction.
   1. Maintain the stockpile in a manner which will not obstruct the natural flow of drainage.
   2. Maintain stockpile free from debris and trash.

C. Keep the topsoil damp to prevent dust and drying out.

3.06 CLEANING OR REPAIR

A. Debris resulting from the work of this Section shall be removed and hauled away from the site.
   1. Debris and rubbish shall not be allowed to accumulate on the site.

B. All material generated by this work shall be disposed of properly outside the project limits, in accordance with all applicable regulations, laws, and ordinances.
   1. Sprinkle loose material while being stored, handled, or loaded.

C. Burning of removed materials is not permitted within the project limits.

3.07 CONDITION OF FINISHED WORK

A. Protections, tools, materials, plant apparatus, and rubbish or debris shall be removed.

B. Existing areas to remain, public or private property, that may have been damaged, made dirty, or otherwise disorderly because of this work shall be restored to good order.

END OF SECTION 31 10 00

EARTHWORK
SECTION 31 22 00

PART 1 GENERAL

1.01 SUMMARY

A. Inclusions:
   1. Provisions set forth in Divisions 0 and 1;
   2. Earth moving;
   3. Application of water as required for compaction or dust control;
   4. Importing or removal of soil as required to complete the work;
   5. Preparation of sub-grade below walks and paving;
   6. Dust control during earthwork operations;
   7. Clean up.

1.02 QUALITY ASSURANCE

A. Regulatory Compliance:
   1. Work shall be performed in strict compliance with laws, ordinances, or regulations that govern this work.

B. Project Record Documents:
   1. Any deviations from the work shown on the contract documents shall be clearly indicated on the project record documents.
   2. Deviations must receive approval by the Architect and DSA.

C. Preliminary Geotechnical Investigation Report:
   1. The General Recommendations listed in the "Geotechnical Engineering/Geologic Hazards Investigation Update Fletcher Elementary School-New Modular Classroom", dated 08/30/2024 as prepared by Krazan & Associates, Inc. have been incorporated in this Section and shall be followed. Geotechnical Report is attached to the end of this Project Manual.
   2. Where conflicts occur between the drawings, specifications, and/or the Geotechnical Report, the most stringent requirement shall govern.

PART 2 PRODUCTS

2.01 MATERIALS

A. Earth:
   1. Filling and back-filling earth shall be clean and essentially granular with sufficient silt and clay binders.

B. Imported Fill:
   1. If it becomes necessary to import materials from offsite to complete the site grading, import soils shall consist of essentially granular, silty sands with low expansion potential and free of grasses, weeds, debris, rocks larger than 4” in maximum dimension and soluble sulfates in excess of 200 parts per million. Import fill shall contain sufficient silt and clay binders to render them stable in footing trenches and capable of maintaining specified elevation tolerances during paving operations.
   2. Any earthen materials proposed to be brought onto the school sites are subject to testing to verify they comply with Dept. of Toxic Substance Control (DTSC) standards. Owner shall determine if testing of materials is required prior to any materials being brought onto the site. Testing of materials may take up to two weeks to verify compliance with DTSC standards.
   3. Imported fill material shall be approved by the Soils Engineer and meet the requirements stated in the Geotechnical Report.
   4. Contact the Soils Engineer a minimum of 48 hours prior to the placement of fill materials to allow for proper review of the bottom of excavations.

PART 3 EXECUTION

3.01 EXAMINATION

A. Contractor shall thoroughly examine the project site prior to submitting his bid to familiarize himself with the conditions of the site and the conditions in which he will be required to work.

B. Contractor shall thoroughly examine contract documents prior to bid.
   1. Documents do not necessarily indicate a balanced site.

C. Contractor shall familiarize himself with the locations of utilities found onsite and shall protect utilities not shown to be removed.
   1. Coordinate excavations near existing utilities with utility companies.

3.02 INSTALLATION

A. Excavations:
   1. Structural Over-Excavation:
      a. Upper three feet of native soils shall be removed withing proposed building areas
      b. Excavate to provide at least 24" of engineered fill beneath all footings and throughout the entire building.
         1) Extend over-excavation a minimum of five feet beyond the extent of exterior structural footings.

a) Exterior structural footings include footings for all covered walkway structures, unless noted otherwise.

c. Comply with noted requirements shown on drawings.
d. Over-excavation is not required below the bottom of 5-foot minimum deep round pier footings.
e. Over-excavation below concrete block yard wall footings may be reduced to a depth of two feet below bottom of footing.
f. Roots unearthed during excavation work shall be completely removed to a minimum depth of two (2) feet below the bottom of the lowest proposed structural footing or two (2) feet below finished subgrade, whichever is lower.
   1) Roots deeper than the elevation indicated above shall be excavated to allow no roots larger than one and one-half (1-1/2) inches in diameter.
g. Contractor shall notify Construction Manager/Architect/Project Inspector for proper inspection/review of the bottom of the excavations that can occur prior to continuing work.

2. Excavations for Concrete Footings:
   a. Trench and excavation bottoms shall be smooth and uniform.
   b. Do not excavate below required bottom of footing elevations.
      1) If over-excavated areas occur, they shall not be backfilled with earth materials.
      2) Fill with concrete to match footing at contractor's expense.
   c. Keep excavations free of standing water.
3. Pavement and exterior flatwork
   a. Excavate to a minimum depth of 18”
   b. Work until uniform and free from large clods
   c. Moisture content to a minimum of 2 percent above optimum moisture content

B. Fill
1. Preparation for Fill:
   a. Blade area to achieve a smooth uniform appearance.
   b. Scarify to a depth of 6".
   c. Moisten to a minimum of 2% above optimum moisture content.
   d. Compact to required 90% compaction.
2. Placing and Compacting Fill:
   a. Place fill material in even layers which do not exceed 6" thickness after compaction.
   b. Compact to required compaction.
      1) Not less than 90% of maximum dry density per ASTM D1557.
      2) Rework layers not complying with minimum density requirements until compliance is achieved.
   c. Fill to within 0.1 feet of indicated finished grades.
   d. Surface of fill to be smooth and uniform.

3. Placing Fill on a Slope:
    a. For sub-grades steeper than 10 to 1, place fill in flat bench layers.
        1) Benches shall be min. 10'-0" in width.

C. Sub-Grade Preparation:
    1. Prepare areas as if for fill.
    2. Leave smooth, uniform surface.

D. Back-Filling:
    1. After completion and inspection of concrete footings, fill voids between footings and earth banks with clean soil.
        a. Place in layers that do not exceed 6" in thickness after compaction.
        b. Compact to required compaction as specified for placing and compacting fill.
        c. Fill to within 0.1 feet of indicated finished grades.
        d. Surface to be smooth and uniform.
    2. No jetting or ponding will be allowed, unless approved by the Structural Engineer of Record.

E. Finish Grading:
    1. After cutting, filling, and back-filling are complete, finish grade site to within 0.1 feet of indicated grades, except as noted below.
        a. Planters at grade: 1-1/2” below adjacent walk.
        b. Above-grade planters: 4” below top of planter, unless noted otherwise.
        c. Lawn or turf areas: 1 /2” below adjacent walks.
        d. Grade a sufficient distance behind curbs to allow for placement of forms.
        e. Ground surface should slope away from building pad and pavement area to appropriate surface drainage devices.

F. Dust Control:
    1. During all phases of the earthwork, water material and site to reduce dust.

G. Noise Control:
    1. Use reasonable measures to control noise.

H. Cleanup:
    1. Rake clean.
    2. Remove unsuitable materials, excess materials, and debris, and dispose of offsite in a legal manner.
    3. Adjacent roadways shall be kept clean during the progress of this work.
    4. Upon completion of this work, water spray clean adjacent roadways.

3.03 PROTECTION

A. Contractor shall protect all adjacent properties from damage resulting from the work of this Section.

B. Contractor shall protect the work of other trades from damage resulting from the work of this Section.
   1. Layout or survey markers shall be carefully maintained.
      a. Damaged markers must be replaced at the contractor's expense.

C. Provide and maintain proper barricades or barriers to ensure the safety of workers and the public.
   1. Provide dusk-to-dawn warning lights at hazards adjacent to public access.
   2. Protect existing concrete walks, curbs, and other permanent structures that are to remain.
      a. Repair or replace damaged items to the satisfaction of the Architect.

D. Contractors shall take precautions to avoid loss of soil or debris during transit.

E. Underground Utilities:
   1. Maintain all underground utilities, unless noted otherwise.
      a. Comply with utility company requirements.
   2. Notify Owner and utility company of any utilities to be cut off, modified, or relocated.
      a. Comply with utility company requirements.

F. Take necessary precautions to guard against water accumulation in trenches, under buildings, or on adjacent property during the course of this work.

G. Take necessary precautions to guard against erosion of the project site or adjacent property during the course of this work.

3.04 QUALITY CONTROL

A. Tolerances:
   1. Variation from indicated grades may not exceed 1/10 of a foot.

B. Certification of Grades:
   1. Contractor shall hire a California state licensed civil engineer or surveyor to certify that the grades established during the earthwork comply with the requirements of the contract documents.
   2. Contractor shall deliver to Owner a 1"=30'-0" scale as-graded reproducible Mylar plan.
      a. Plan shall be produced in a professional manner.
      b. Plan shall show as-graded elevations.
      c. Plan shall be stamped and signed by the civil engineer or land surveyor hired by the Contractor to certify the grading.
   3. The Owner reserves the right, at their own discretion, to hire an independent civil engineer to perform a survey of the project site to confirm the accuracy of the grading work.

C. Field Testing:
   1. Field density testing shall be performed as directed by the Soils Engineer.

END OF SECTION 31 22 00

TERMITE CONTROL
SECTION 31 31 16

PART 1 GENERAL

1.01 SUMMARY

A. Inclusions:
   1. Provisions set forth in Divisions 0 and 1
   2. Pre-construction termite control
   3. Clean-up.

B. Related Sections:
   1. Section 03 31 00 Structural Concrete Work

C. Performance Requirements:
   1. Provide a toxic barrier under and around building areas to prevent termite entry.

1.02 SUBMITTALS

A. See Section 01 30 00 “Administrative Requirements” for submittal procedures.

B. Product or Material Data:
   1. Submit copies of material data sheets to the Architect for review prior to application.

1.03 QUALITY ASSURANCE

A. Regulatory Compliance:
   1. Comply with regulations governing the storage and application of these materials.
   2. Conform to State of California requirements for licensure and authority to use toxicant chemicals.

B. Qualifications:
   1. Application shall be performed by an applicator approved by the chemical manufacturer.

1.04 PROJECT CONDITIONS

A. Environmental Requirements:
   1. Apply materials only under environmental conditions within the manufacturer's range of recommended conditions.

1.05 WARRANTY

A. Warranty:
   1. Furnish to Owner a written five (5) year guarantee against subterranean termites.
   2. Areas of infestation appearing within the five (5) year period shall be retreated at no additional expense.

PART 2 PRODUCTS

2.01 MATERIALS

A. Use one of the following materials in working solution in strict conformance with governmental regulations:
   1. Premise, Pre-Construction Insecticide (Bayer)
   2. Dominion 2L
   3. Or approved equal.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine the area upon which work is to be performed.

B. Correct detrimental conditions prior to application.

3.02 DELIVERY, STORAGE AND HANDLING

A. Store materials in strict conformance with the manufacturer's written recommendations and government regulations.

3.03 INSTALLATION OR APPLICATION

A. Apply in accordance with the manufacturer's recommendation.

B. Apply under all building pads, footings, and areas within 2'-0" of buildings.

C. Apply to substrate immediately prior to the installation of the membrane vapor barrier to avoid losses due to evaporation.
   1. When substrate is crushed rock fill applied below membrane vapor barrier, apply additional treatment to soil prior to installation of fill.

D. Footing trenches shall be treated not more than 24 hours prior to concrete pour.

E. Treat critical locations, such as utility footing penetrations and expansion joints with linear treatment at the manufacturer's recommended rate.

1. Treat inside of utility trenches for a minimum of 48" beyond the building pad.

F. Retreat soil that is disturbed after original treatment.

3.04 PROTECTION OR ADJUSTMENTS

A. Take precautions to protect adjoining property and areas designated for planting.

END OF SECTION 31 31 16

VEGETATION CONTROL
SECTION 31 31 19

PART 1 GENERAL

1.01 SUMMARY

A. Inclusions:
   1. Provisions set forth in Divisions 0 and 1.
   2. Pre-construction vegetation control.
   3. Submittal preparation.
   4. Clean up.

B. Related Sections:
   1. Section 32 13 13 Site Concrete

1.02 SUBMITALS

A. See Section 01 30 00 “Administrative Requirements” for submittal procedures.

B. Product or Material Data:
   1. Submit copies of material data sheets to the Architect for review prior to application.
   2. Submittal shall include the manufacturers data sheets showing the appropriate application rate for the proposed use.

1.03 QUALITY ASSURANCE

A. Regulatory Compliance:
   1. Comply with regulations governing the storage and application of these materials.
   2. Conform to State of California requirements for licensure and authority to use toxicant chemicals.

B. Qualifications:
   1. Application shall be performed by an applicator approved by the chemical manufacturer.

C. Performance Requirements:
   1. Sterilization shall prevent seed germination and plant growth, under paving, sidewalks, curbs, gutters, and other areas indicated on the drawings.

1.04 PROJECT CONDITIONS

A. Environmental Requirements:
   1. Apply materials only under environmental conditions within the manufacturer's range of recommended conditions.

PART 2 PRODUCTS

2.01 MATERIALS

A. Use one of the following materials in working solution in strict conformance with governmental regulations:
   1. Under paving, sidewalks, curbs, gutters:
      a. Treflan (Trifluralin)
      b. Pramitol 25E (prometon)
      c. Or approved equal.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine the area upon which work is to be performed.
   1. Correct detrimental conditions prior to application.

3.02 DELIVERY, STORAGE AND HANDLING

A. Store materials in strict conformance with the manufacturer's written recommendations and government regulations.

3.03 INSTALLATION OR APPLICATION

A. Apply in accordance with the manufacturer's recommendation.

B. Apply to area receiving paving, sidewalks, curbs, and gutters immediately prior to installation.

C. Apply herbicide material to bottom of apparatus yards, jump pits, and sand areas immediately prior to installation of protective surfacing.

3.04 PROTECTION OR ADJUSTMENTS

A. Take precautions to protect adjoining property and areas designated for planting.

END OF SECTION 31 31 19

SITE CONCRETE PAVING
SECTION 32 13 13

PART 1 GENERAL

1.01 SUMMARY

A. Inclusions:
   1. Provisions set forth in Divisions 0 and 1
   2. Concrete flatwork other than buildings and structures
      a. Including concrete walks, drive approaches, curbs, gutters, ramps, steps, risers, mow strips, etc.
   3. Concrete finishing and special surfacing of site concrete
   4. Curing, protection, and patching of site concrete
   5. Vegetation control
   6. Expansion and tool joints in site concrete
   7. Caulking of expansion joints in site concrete
   8. Sealing of exposed aggregate finish site concrete
   9. Trench drains and grate covers
   10. Accessories and associated hardware
   11. Forming and shoring for site concrete
   12. Placing of sleeves, inserts, and embedded items in site concrete
   13. Clean sand fill under concrete flatwork or slabs as required for leveling and/or final grading of base
   14. Submittal preparation
   15. Clean up.

B. Related Sections:

1.	Section 03 21 00	Reinforcing Steel
2.	Section 03 31 00	Structural Concrete Work
3.	Division 26 00 00	Electrical
4.	Section 31 00 00	Earthwork
5.	Section 31 31 19	Vegetation Control
6.	Section 32 31 13	Chain Link fences and gates

1.02 REFERENCES

A. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; American Concrete Institute International.

B. ACI 302.1R - Guide for Concrete Floor and Slab Construction; American Concrete Institute International.

C. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; American Concrete Institute International.

D. ACI 305R - Hot Weather Concreting; American Concrete Institute International.

E. ACI 306R - Cold Weather Concreting; American Concrete Institute International.

F. ACI 308R - Guide to Curing Concrete; American Concrete Institute International.

G. ASTM C 33 - Standard Specification for Concrete Aggregates.

H. ASTM C 39/C 39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

I. ASTM C 94/C 94M - Standard Specification for Ready-Mixed Concrete.

J. ASTM C 143/C 143M - Standard Test Method for Slump of Hydraulic-Cement Concrete.

K. ASTM C 150 - Standard Specification for Portland Cement.

L. ASTM C 173/C 173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.

M. ASTM C 260 - Standard Specification for Air-Entraining Admixtures for Concrete.

N. ASTM C 618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.

O. ASTM C 685/C 685M – Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing.

P. ASTM C 1059 - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete.

Q. ASTM E 1155 - Standard Test Method for Determining F(F) Floor Flatness and F(L) Floor Levelness Numbers.

1.03 SUBMITTALS

A. See Section 01 30 00 “Administrative Requirements” for submittal procedures.

B. Product or Material Data:
   1. Submit copies of the concrete mix design to the Architect for review prior to installing materials.
   2. Submit copies of the product data to the Architect for review prior to installing the following:
   3. Expansion joints.
   4. Joint caulking material.
   5. Samples or Mockups:
      a. Provide a minimum 48" square mock-up of concrete finishes to jobsite for approval of finishes prior to pouring exposed portions of work.
      b. Mock-up may be incorporated into the project.

C. Shop Drawings or Layout Drawings:
   1. Submit copies of shop drawings to the Architect for review prior to beginning fabrication.

1.04 QUALITY ASSURANCE

A. Regulatory Compliance:
   1. Walks and sidewalks shall have a continuous common surface, not interrupted by steps or by abrupt changes in level exceeding 1/2 inch and shall be a minimum of 48 inches in width. Surfaces shall be slip-resistant as follows:
      a. Slopes less than 5 percent:3
         1) Surfaces with a slope of less than 5% gradient shall be at least as slip resistant as that described as a medium broom finish per 2022 CBC Sections 11B-302 and 11B-403.3.
      b. Slopes 5% percent or greater:
         1) Surfaces with a slope of 5 percent or greater gradient shall be at least as slip resistant as that described as a heavy broom finish per 2022 CBC Sections 11B-302 and 11B-403.3.
         2) Aluminum Oxide Aggregate surface-applied finish.
      c. Cross slopes:
         1) Surface slopes shall not exceed 1:48 per 2022 CBC Section 11B-403.3.

B. Testing:
   1. Prior to preparation of finish sub-grade for work of this Section, the Contractor shall give appropriate notification to the inspector and allow adequate time for compaction tests to be taken when required by the inspector prior to work to sub-grade.

PART 2 PRODUCTS

2.01 MATERIALS

A. Portland Cement:
   1. Conform to ASTM C150, Type II or V, with the following exceptions:
   2. Cement shall not contain more than 0.60% total alkali when calculated as Sodium Oxide.

B. Fly Ash:
   1. Conform to ASTM C618, Class F
      a. Fly Ash may substitute cement for up to 30% of mix C+P content provided that the design mix meets 28-day strength requirements.

C. Aggregates:
   1. Conform to ASTM C33.
   2. Fine aggregate shall consist of washed natural sand.
      a. Fine aggregate shall not contain more than two percent (2%) by weight of deleterious substances.
      b. Fine aggregate shall meet the requirements of Table 1 below.
   3. Coarse Aggregate shall consist of a clean, crushed rock or washed gravel.
      a. Shall not contain more than five percent (5%) by weight of flat, thin, elongated, or laminated material.
      b. Shall not contain more than two percent (2%) by weight shale or charty material.
      c. Coarse aggregate shall be 3/4" maximum size, see requirements of Table 1 below.

         Table 1 - GRADING OF COMBINED AGGREGATES
         1) Sieve (Woven Wire Cloth): Passing a 1-1/2"
            a) Percent by Weight 3/4" Maximum
         2) Sieve (Woven Wire Cloth): Passing a 1"
            a) Percent by Weight 3/4" Maximum
         3) Sieve (Woven Wire Cloth): Passing a 3/4"
            a) Percent by Weight 3/4" Maximum: 90-100
         4) Sieve (Woven Wire Cloth): Passing a 3/8"
            a) Percent by Weight 3/4" Maximum: 55-75
         5) Sieve (Woven Wire Cloth): Passing a #4
            a) Percent by Weight 3/4" Maximum: 40-60
         6) Sieve (Woven Wire Cloth): Passing a #8
            a) Percent by Weight 3/4" Maximum: 30-46
         7) Sieve (Woven Wire Cloth): Passing a #16
            a) Percent by Weight 3/4" Maximum: 23-40
         8) Sieve (Woven Wire Cloth): Passing a #30
            a) Percent by Weight 3/4" Maximum: 13-28

9) Sieve (Woven Wire Cloth): Passing a #503
   a) Percent by Weight 3/4" Maximum: 5-15
10) Sieve (Woven Wire Cloth): Passing a #100
   a) Percent by Weight 3/4" Maximum: 0-5

Note: "Pea Gravel" mixes (mixes with 3/8" max. aggregate size), other than mixes used for exposed aggregate finish, will not be allowed.

D. Water shall be potable, clean and free from organic materials.

2.02 ACCESSORIES

A. Concrete Expansion Joints:
   1. Expansion joints shall be formed with 3/8" x 3-1/2" expansion joint and 3/8" x 1/2" expansion joint cap.
      a. Basis of Design:
         1) Sealtight by W. R. Meadows:
            a) Fibre Expansion Joint.
            b) Snap-Cap Expansion Joint Cap.
   2. Expansion joint sealant shall be self-leveling polyurethane sealant for horizontal expansion joints.
      a. Conform to ASTM C 920, Type M, Grade P, Class 25, and Fed Spec. TT-S-00227E, Type I, Class A:
         1) W.R. Meadows, Sealtight Pourthane SL
         2) BASF Masterseal SL2
         3) Or equal.

B. Clean sand fill under concrete flatwork or slabs shall conform to the fine aggregate specification above.

C. Curing Compound shall white-pigmented.
   1. Conform to ASTM C309.

D. Fiber Reinforced Concrete: Where called out on plans.
   1. Manufacturers/Product:
      a. Master Builders microfilament fiber; MasterFiber M100.
      b. Sika micro-synthetic monofilament fiber; Fibermesh-150

E. Slip-Resistive Aggregate:
   1. Factory-graded, packaged, rustproof, non-glazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery with emery aggregate containing not less than 50 percent aluminum oxide and not less than 25 percent ferric oxide, unaffected by freezing, moisture, and cleaning materials.
      a. Basis of Design: EMAC-20 by Lambert Corp.

F. Pebble rock for exposed aggregate finish shall be 3/8" maximum river rock or crushed rock of a natural color blend.
   1. Color and texture shall be as selected by Architect.

G. Sealer hardener shall be clear, non-yellowing, sealer-hardener.
   1. Install per manufacturer's recommendations.
      a. BASF Kure-N-Harden water-based silicate sealer or equal.

H. Waterstops shall be 4" serrated center bulb PVC.
   1. Basis of Design:
      a. Greenstreak #702.

I. Retarder shall be specifically designed to retard the hydration in cement only for a depth required to expose the aggregate.
   1. Basis of Design:
      a. The Euclid Chemical Company-Formula S.

J. Prefabricated Contrasting-Color Tread Nosing
   1. Cast-in-place extruded aluminum nosing with replaceable safety tread.
      a. American Safety Tread Co., Inc. Type BF211D; Color black
      b. Snap-in screw down nosing piece after clean-up and curing to maintain clean abrasive surface.
      c. Or approved equal.

PART 3 EXECUTION

3.01 EXAMINATION

A. Start of work shall be considered as acceptance of existing conditions.

3.02 DELIVERY, STORAGE, AND HANDLING

A. A weighmasters certificate shall accompany each load of concrete.
   1. This certificate is to be delivered to the Project Inspector and Project Manager.

B. Cement shall be stored in such a manner so as to protect it from damage.

C. Only one (1) brand of cement shall be used for this work.

3.03 SEQUENCING AND SCHEDULING

A. Concrete shall be poured within 90 minutes of mixing.

3.04 VEGETATION CONTROL

A. Immediately prior to installing concrete, vegetation control chemicals shall be applied to the soil.

3.05 INSTALLATION OR APPLICATION

A. Install per the manufacturer's latest written recommendations.

B. Concrete shall conform to the recommendations of the Portland Cement Association and the American Concrete Institute, unless otherwise shown or noted in these specifications.

C. Preparation and Compaction:
   1. Concrete flatwork or vehicle traffic areas shall be placed over rolled sub-grade.
      a. Proof roll sub-grade and rework unsuitable areas prior to installing leveling sand fill.
      b. Compact subgrade to 95% relative compaction in traffic areas.
      c. Compact subgrade to 90% relative compaction in pedestrian walks and other slab areas.

D. Forms:
   1. Forms shall be built true-to-line and grade.
   2. Forms shall be rigid enough to prevent excessive deflection between supports.
      a. Supporting studs or joists shall not be spaced more than twelve inches on center.
   3. The site curbs and gutters shall conform to the CalTrans specifications. The surfaces are to be true and straight. The maximum tolerance for the top, edges or any face is 0.01' (1/8") from the edge of a ten foot straight-edge.
   4. The curved site curbs and gutters shall conform to the CalTrans specifications. The surfaces are to be true and uniform using flexable formboards. The maximum tolerance for the top, edges or any face is 0.01' (1/8") from the edge of a ten foot straight-edge.
   5. Arrangement and construction shall be subject to the approval of the Architect.
      a. Responsibility for the adequacy of the forms rests with the Contractor.

   6. Coordinate to properly receive other construction, accessories, and anchorage.
      a. Install sleeves, inserts, bolts, conduit, or other devices prior to placing concrete.
      b. Install waterstops at all vertical expansion joints and construction joints.

E. Forms for Exposed Vertical Concrete:
   1. Exposed concrete shall be formed with Douglas Fir "Plyform" placed with the grain of the outer plies in the direction of their span.
      a. The surfaces of the forms shall be smooth and free from irregularities.
      b. Wall-form panels shall be placed with their long dimension horizontal.
   2. All exposed sharp corners shall be formed with 3/4" chamfers or fillets.

F. Form ties or bolts shall be used to fasten the forms.
   1. Use sufficient strength and number to prevent spreading of forms.
      a. Wire ties will not be permitted.
   2. Ties shall be of such type that they can be entirely removed or cut back one inch (1") or more from the finished concrete surface.

G. Form Coating:
   1. Forms shall be coated with non-staining form oil.
      a. Apply shortly before the concrete is placed, prior to placing the reinforcement.

H. Form Removal:
   1. Form removal shall be performed in such a manner as to prevent damage to the concrete.
   2. Do not remove forms until the concrete has sufficiently hardened to permit their removal with safety.
      a. Form removal will not be allowed in less time than as follows:

Type of Work	Minimum Time
Walls, Vertical Forms	24 hours
Slabs	24 hours

      Note: Time is measured from addition of cement to aggregate.

I. Embedded Items:
   1. Cooperate with all trades to ensure that all conduit, anchor bolts, sleeves, inserts, hangers, trench drains, grates, etc., are properly installed and secured in the correct position.
      a. Embedded items shall be thoroughly clean and free from rust, scale, oil, or other foreign matter.
      b. All embedded items shall be securely held in their final positions by means of templates before concrete is poured.
      c. All pipes and conduits penetrating slabs shall be sleeved with PVC pipe, sized 1/2" larger I.D. vs pipe O.D. (1/4" gap around) and topped with self-leveling sealant.

J. Reinforcement:
   1. Concrete walks under roof areas shall be reinforced with #3 bars at 24" on center each way minimum, unless noted otherwise.

a. Provide #4 bar dowels at 24" O.C. into adjacent footings.
2. Locate reinforcement at mid height of flatwork or slab.

K. Mixing:
1. Transit-Mixed Concrete:
a. Mix and deliver in accordance with the requirements of ASTM C-94.
b. Weighmasters Certificate shall accommodate each load of concrete.
c. Water/(cement+fly ash) ratio shall be 0.50 or less.
2. Slump:
a. The amount of mixing water used shall not cause the slump to exceed the maximum allowed slump of 4 1/2".
b. Slump test shall conform to ASTM C-143.

L. Placing:
1. Concrete shall be used while fresh and before it has taken an initial set.
a. Retempering partially hardened concrete will not be permitted.
2. Place concrete in horizontal layers of such thickness that can be satisfactorily consolidated with vibrators.
3. Place concrete as close as possible to its final position.
a. Use of vibrators for extensive shifting shall not be permitted.
4. Fresh concrete shall not be permitted to fall more than six feet (6'-0").
5. Maximum spacing of deep-tooled joints for site work shall be as follows:
a. 10 feet on center for sidewalks.
b. 24 feet on center for curbs and gutters
c. 10 feet on center for mow strips.
d. Mow strips for chain link fencing shall have deep tool joints at each post.
6. Deep tool joints shall be 1/8” wide and a maximum of 1/3 depth of slab with 3/8" radii edging.
7. Tool edges of flatwork or slabs at construction joints and other exposed corners.
8. Tool and expansion joints shall be located where shown on plans. Align joints of curbs or curbs and gutters with adjacent sidewalks.
a. Tool joints shall be uniform, straight, made perpendicular to building face, and parallel to each other for a uniform and consistent look.
9. Expansion joints shall be placed at a maximum of 20 feet on center for sidewalks, curbs, and curbs and gutters.
a. Place expansion joints to align with the corners of buildings or structures and to align with the center of structural columns.
b. Shall have asphalt impregnated expansion joints with a removable cap per section 2.02.A
10. Planter or retaining walls shall have chamfer joints or tool joints to control cracking.
a. Chamfer joints shall be placed at a maximum of 20 feet on center. Place waterstop at chamfer joints of planters.

b. Tool joints shall be as indicated on drawings. When not indicated, place tool joints a maximum of 10 feet on center.
c. Joints shall be continuous across tops and down backs.

M. Cold Weather Requirements:
1. Do not place concrete on frozen ground.
2. Do not mix or place when atmospheric temperature is below 35 degrees F.
3. Protect concrete from freezing or frost for a period of five (5) days after placing.
4. Calcium Chloride shall not be added to the mix.

N. Curing:
1. Keep newly placed concrete moist for the first seven (7) days after the concrete has been placed, or;
2. Horizontal Surfaces:
a. Slabs poured in hot or dry weather shall have a fog spray applied to them during troweling.
b. Slabs shall be cured with curing compound.
1) Spray-applied curing compound having white pigment.
a) Conform to ASTM C-309.
b) Fully coat surface to a solid white color.
3. Vertical Surfaces:
a. If forms are removed prior to end of curing period, vertical surfaces shall be cured by one of the following methods:
1) Plastic film with joints sealed or taped
a) The perimeter of the film shall be sprinkled once daily.
b) Install as soon as form work is removed.
2) Curing Compound
a) Spray-applied curing compound having white pigment.
i) Conform to ASTM C-309.
ii) Fully coat surface to a solid white color.

O. Slip-Resistive Aluminum Oxide Aggregate Finish:
1. Before final floating, apply slip-resistive aggregate where indicated and to concrete ramps, landings, and stair treads.
a. Slip-Resistive Aluminum Oxide Granules Finish:
1) As soon as surface water has disappeared, make one pass with the steel trowel and broadcast aluminum oxide onto the surface of concrete ramps, landings, and stair treads where indicated.
a) Uniformly spread 1/4 pound of slip-resistive granules per square foot of surface (25#/100 sq.ft.). Lightly tamp aggregate flush with surface using a steel trowel, do not force below surface. After broadcasting and tamping, apply light float finish.
b) After curing, wash surface with a 10% solution of muriatic acid and flush with fresh water to expose slip-resistive aggregate.

P. Exposed Aggregate Finish:
   1. Where indicated on plans.
   2. Finish shall be uniform throughout the site. Maintain consistency in retarder application rate, length of time of set, and water blast pressure throughout the site.
   3. Submit a pea gravel mix for approval prior to application.
   4. Pebble Rock shall project a maximum of 1/8" above concrete surface.
   5. Install concrete as per standard finished concrete.
   6. After troweling, apply surface retarder per manufacturer recommendations.
   7. Water wash retarder after concrete set per manufacturer recommendations.
   8. Moisture cure concrete as listed above.
   9. 72 hours minimum after the concrete has been completed; clean the surface with a 5% solution of muriatic acid to remove any residual cement glazing from aggregate surfaces.
   10. Aggregate rock finish areas shall receive concrete sealer/hardener.
      a. Cure concrete per manufacturer recommendations prior to sealer application.
      b. Clean flatwork or slab prior to sealer application.

3.06 QUALITY CONTROL

A. Tolerances:
   1. Concrete flatwork shall be true-to-plane to within 1/4" in 10'-0".

B. Field Testing:
   1. Any concrete in question to its quality may be tested at the discretion of the Architect, Inspector, or Owner. The Inspector may take concrete test cylinders from each batch of concrete.

3.07 PROTECTION OR ADJUSTMENTS

A. Defective Concrete:
   1. Concrete will be considered defective for the following reasons:
      a. Not meeting the minimum strength requirement.
      b. Not formed as indicated.
      c. Not true to intended alignment.
      d. Containing voids or rock pockets.
      e. Surface deviation of greater than specified tolerance.
      f. Concrete damaged due to erection operations.
      g. Concrete that does not fully conform to the specifications.
      h. Inconsistent surface finishes.

2. Defective concrete shall be removed and replaced with concrete complying with the drawings and specifications.
    a. Unless otherwise approved by the Architect.

3.08 SCHEDULES

A. Typical Concrete Finish Schedule
    1. Type of Finish: slip-resistive aggregate finish
        a. Type of Surface: concrete ramps, landings, and stair treads
    2. Type of Finish: exposed aggregate finish
        a. Type of Surface: where indicated
    3. Type of Finish: heavy broom finish
        a. Type of Surface: concrete slopes exceeding 5%
    4. Type of Finish: medium broom finish
        a. Type of Surface: all other areas

B. Concrete Test-Strength Schedule
    1. Type: un-reinforced, reinforced and exposed aggregate finished concrete
        a. Required Strength: 3000 psi
        b. Minimum 7 Day Test: 1800 psi
        c. Minimum 28 Day Test: 3000 psi
    2. Type: fence post footings, thrust blocks
        a. Required Strength: 2500 psi
        b. Minimum 7 Day Test: 1500 psi
        c. Minimum 28 Day Test: 2500 psi
    3. Type: flagpole footings, equipment pads, block wall footings
        a. Required Strength: 3000 psi
        b. Minimum 7 Day Test: 1800 psi
        c. Minimum 28 Day Test: 3000 psi

3.09 CLEANING OR REPAIR

A. Formwork Cleaning:
    1. Remove dirt, chips, sawdust, nails, and other foreign matter from the forms before concrete is placed.
    2. Previously used forms shall be thoroughly cleaned of all dirt, mortar, and other foreign matter before reusing.

B. Upon completion of other work, clean exterior finished concrete surfaces.

C. Areas shall be swept and cleaned.

D. Remove from the premises surplus material, equipment and debris that result from this work.

END OF SECTION 32 13 13

PAVING ACCESSORIES AND STRIPING
SECTION 32 17 00

PART 1 GENERAL

1.01 SUMMARY

A. Inclusions:
   1. Provisions set forth in Divisions 0 and 1;
   2. Traffic and court striping and markings;
   3. Curb painting and markings;
   4. Accessories and associated hardware;
   5. Submittal preparation;
   6. Clean up.

B. Related Sections:
   1. Section 09 91 13: Exterior Painting
   2. Section 32 32 13: Site Concrete

1.02 SUBMITTALS

A. See Section 01 30 00 “Administrative Requirements” for submittal procedures.

B. Product or Material Data:
   1. Submit copies of product data sheets.
   2. Submit copies of agency product to be incorporated into the work.

C. Samples or Mockups:
   1. Submit one (1) sample of the manufacturer's complete color range to the Architect for color selection purposes prior to ordering material.

1.03 QUALITY ASSURANCE

A. Regulatory Compliance:
   1. Maintain material safety data sheets for materials used.
   2. File onsite in a central location.
   3. Comply with the requirements of local agencies having jurisdiction over matter dealing with air quality.

B. Qualifications:
   1. Work shall be performed only by individuals with specific knowledge and experience in this type of work.

C. Warranty:
   1. Warranty materials and application for one (1) year.
   2. Defects or areas of excessive wear that appear within one year shall be repaired or reworked by contractor at no additional cost.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Traffic Paint:
   1. Dunn Edwards Paints; Commerce, CA.
   2. Sherwin Williams; Cleveland, OH.
   3. Or approved equal.

2.02 MATERIALS

A. Traffic line and court marking paint shall be Sherwin Williams, Setfast Acrylic Latex or Latex (TM series) Traffic Marking Paints as follows:
   1. TM2160 WHITE

B. Reflective traffic line paint shall be US Specialty Coating liquid thermoplastic paint with the addition of glass beads for added reflectivity, color white.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify layout prior to beginning work.

B. Start of work shall be considered as acceptance of existing conditions.

3.02 DELIVERY, STORAGE, AND HANDLING

A. Materials shall be transported, handled, and stored in conformance with the manufacturer's recommendations.

B. Materials shall be delivered and stored in their original, unopened containers until they are incorporated into the work.

3.03 SEQUENCING AND SCHEDULING

A. When applicable, coordinate work with the schedule established by the Construction Manager or Contractor.

3.04 INSTALLATION OR APPLICATION

A. Traffic Lines and Court Markings:
   1. Install per the manufacturer's latest written recommendations.
   2. Apply traffic paint to clean dry surfaces.
   3. Apply paint at the manufacturer's recommended rate of application.
   4. Use mechanical equipment to apply paint in straight uniform lineage.

B. Curb Markings:
   1. Student Loading:
      a. Paint curbs yellow.
      b. Stencil "PASSENGER LOADING ONLY – NO PARKING" onto curb at 25 feet on center.
         1) Use 2-inch high black letters.

C. Bus Loading:
      a. Paint 3” white stripes at bus loading zone.
      b. Stencil "BUS LOADING ONLY NO PARKING" onto pavement
         1) Use 12-inch high white letters

3.05 PROTECTION OR ADJUSTMENTS

A. Protect work until final acceptance.

B. Remove wheel stops that have been damaged and replace with new.

C. Patching of concrete stops will not be permitted.

D. Repaint damaged or faded lines and markings.

3.06 CONDITION OF FINISHED WORK

A. The completed installation shall comply with approved plans.

B. Lines shall be straight, true, and uniform.

C. Over-spray shall not be permitted.

3.07 SCHEDULES

A. Line Color Schedule:
   1. Bus loading markings: White
   2. Student loading markings: Yellow

END OF SECTION 32 17 00

CHAIN LINK FENCES AND GATES
SECTION 32 31 13

PART 1 GENERAL

1.01 SUMMARY

A. Inclusions:
   1. Provisions set forth in Divisions 0 and 1.
   2. Chain link fencing.
   3. Posts, headrails, braces, fittings, fabric, hardware, gates, and accessories.
   4. Excavation and backfill for chain link fence work.
   5. Fence and gate post footings.
   6. Submittal preparation.
   7. Clean up.

B. Related Sections:
   1. Section 10 14 56: Site Signage
   2. Section 31 22 00: Earthwork
   3. Section 32 13 13: Site Concrete Paving

1.02 REFERENCES

A. ASTM International (ASTM)
   1. ASTM A120 – Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Ordinary Uses.
   2. ASTM D520 – Standard Specification for Zinc Dust Pigment.

B. California Building Code (CBC)
   1. Chapter 11B, Section 404 – Doors, Doorways and Gates.

1.03 SUBMITTALS

A. Product and Shop Drawings:
   1. Submit copies of product data and shop drawings to the Architect for review prior to fabrication or installation.

1.04 QUALITY ASSURANCE

A. Regulatory Compliance:
   1. Chain link gates shall comply with the following Division of the State Architect (DSA) requirements.
      a. All pass gates shall comply with exit door and general door requirements set forth by the California Building Code (landings, hardware, panic hardware, kick-plate, strike edge clearance and clear opening). 2022 CBC Section 11B-404.

b. School grounds may be fenced, and gates therein equipped with locks, provided safe dispersal areas are located not less than 50 feet from buildings. Dispersal areas shall be sized to provide an area of not less than three (3) square feet per occupant. Gates shall not be installed across corridors or passageways leading to such dispersal areas, unless they comply with exit requirements.

B. Qualifications:
   1. Workmen shall be experienced in their respective trades.
   2. Chain link fabric shall withstand six (6) one-minute immersions using the Preece Test.
      a. Test section:
         1) At least four inches (4") in length.
         2) Include at least one bend and one straight side of the formed link.
         3) Framework Material shall withstand twelve (12) one-minute immersions under the Preece test.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable manufacturers:
   1. US Steel Corporation Cyclone;
   2. Alcorn Fence;
   3. Or approved equal.

2.02 MATERIALS

A. Fencing:
   1. General Fence Schedule: Refer to site drawings for scope.
      a. Interior Fencing: 6'-0" high
   2. Fabric:
      a. Wire, hot-dip zinc-coated after weaving.
      b. No. 9 gauge wire.
         1) Tensile strength of 70,000 pounds per square inch.
      c. 2" nominal mesh size.
      d. Knuckle-knuckle top edge.
   3. Posts:
      a. General: Conform to ASTM A120 Schedule 40.
         1) Class 1 Steel Pipe, Grades A and B.
         2) 1.2 ounce zinc-coated.
      b. Terminal Posts:
         1) End, corner, and pull posts.
         2) Size per Post Schedule, unless noted otherwise.

c. Gate Posts:
   1) Size per Post Schedule, unless noted otherwise.
d. Line Posts:
   1) Vertical posts between terminal posts.
   2) Size per Post Schedule, unless noted otherwise.
e. Top Rail and Bracing:
   1) Top Rail shall be 1-1/4" hot-dip galvanized Schedule 40 pipe.
      a) Weight – 2.27 pounds per linear foot.
   2) Brace end and corner posts with Brace Rail matching Top Rail.
      a) Provide 3/8" galvanized rod bracing with turnbuckle at end posts.
   3) Bottom bracing shall be No. 7 coil spring tension wire at bottom of fence.
f. Fabric Bands:
   1) Fabric at end and corner posts
   2) Fabric shall be fastened with bands to end, corner and line posts at twenty-four inch (24") centers.
   3) Fabric shall be fastened with ties to top rail, stretcher bar or bottom bracing wire at twelve (12") centers.
g. Gates:
   1) Gate Frames:
      a) Hot-dip galvanized pipe two inches (2") O.D per linear foot.
      b) 1-1/2" diameter welded cross brace per leaf.
      c) Weld corners.
      d) Hot-dip galvanized after assembly.
   2) Fabric:
      a) Fabric to be same as fence.
h. Concrete:
   1) One part Portland cement to 2-1/2 parts of sand, to 3-1/2 parts 3/4" aggregate.
   2) Comply with Section 32 13 13 "Site Concrete".

2.03 ACCESSORIES OR HARDWARE

A. Latches:
   1. Plunger bar-type with attachments for padlock locking.

B. Post Tops:
   1. Hot-dip galvanized fittings with heavy steel tops.

C. Hinges and Catches:
   1. Heavyweight malleable iron.
   2. Single gate to have a fork latch with padlock attachment.

D. Fittings:
   1. Heavyweight malleable wrought iron or heavyweight pressed steel.

2. Hot-dip galvanized.

E. Rolling Gates:
   1. Heavy duty track, ball bearing hanger sheaves, overhead framing and supports, guides, stays, bracing, and all accessories for a complete operational gate.

F. Slats:
   1. Provide redwood or vinyl slats where indicated on Drawings.

G. Galvanized Finish Repair:
   1. Repair compound: ASTM D 520, Type III high purity grade zinc dust. 24 lbs/gallon minimum weight per gallon. 52% by volume minimum solids content. 94% by weight in dry film minimum metallic zinc content. Galvilite Galvanizing Repair, ZRC Worldwide. (800) 831-3275.
   2. RotoMetals Regalv lead free galvanizing repair stick. Heat applied.

2.04 FINISH

A. All components:
   1. Heavy galvanized.

PART 3 EXECUTION

3.01 EXAMINATION

A. Take measurements of the buildings, and site verify the dimensions.
   1. Report any deviations between existing site conditions and the drawings or specifications.

3.02 PREPARATION

A. Properly locate fencing within the property lines.

3.03 INSTALLATION OR APPLICATION

A. Posts:
   1. Set line posts 2'-3" in concrete base.
      a. Concrete base shall be 2'-6" deep x 10" diameter.
      b. Maintain at least three inches (3") concrete below bottom of post.
   2. Set gate and corner post 2'-9" in concrete base.
      a. Concrete base shall be 3'-0" deep x 12"+ pipe diameter.

B. Terminating posts, gate posts, and corner posts shall have a horizontal brace installed at mid-height and have a 3/8" solid diagonal brace rod with turnbuckle in each adjacent bay.

C. Fabric:
   1. Fasten to end corner and gate posts with 1/4" x 3/4" stretcher bars.
      a. Not less than 1/8" x 3/4" wide stretch bar bands at one foot (1'-0") center to center.

3.04 CLEANING OR REPAIR

A. Remove excess soil, debris, rubbish, etc., resulting from the work of this Section.
   1. Legally dispose offsite.

3.05 CONDITION OF FINISHED WORK

A. Headrails and top of fabric shall be level and true-to-line.

B. Posts shall be true-to-line and spaced not over ten-foot (10'-0") centers, or where shown on plans.

C. Accessories and appurtenances shall be installed, complete, and satisfactory.

D. Repair all damaged galvanized material with approved/specified repair material. Manufacturer's requirements for prep and application shall be strictly followed.

3.06 POST FOOTINGS

A. Gate post footings shall be 36" deep and a minimum diameter of post diameter plus 12".

B. Line post footings shall be 30" deep and 10" diameter

C. Terminal post footing shall be 36" deep and 12" diameter

D. Dimension may be taken from top of paving or grade

3.07 POST SCHEDULES

A. Gate # as indicated on Drawings:

Post/Gate#	Height	Spacing/ Opening Width	#Leaves	Sch.40 post O.D.	Post weight per foot
Line	6 ft or less	10'-0"	n/a	2.87"	5.79#
Line	8 ft or more	10'-0"	n/a	3.5"	7.58#

Terminal	6 ft or less	10'-0"	n/a	3.5"	7.58#
Terminal	8 ft or more	10'-0"	n/a	4.0"	9.11#

END OF SECTION 32 31 13

PLANTING IRRIGATION SYSTEM
SECTION 32 84 00

PART 1 GENERAL

1.01 SUMMARY

A. Inclusions:
   1. Provisions set forth in Divisions 0 and 1.
   2. Provide an underground irrigation system as shown and specified. The work includes:
      a. Automatic irrigation system including piping, fittings, sprinkler heads, and accessories.
      b. Valve, backflow preventer(s), and fittings.
      c. Controller(s) and control wire.
      d. Testing.
      e. Excavating and backfilling irrigation system work.
      f. Associated interior and exterior plumbing and accessories to complete the system.
      g. Pipe sleeves.
      h. Record drawings.
      i. Submittal procedure.
      j. Clean up.

B. Related Work:
   1. Section 31 22 00 Earthwork
   2. Section 32 92 19 Seeding
   3. Section 32 93 00 Planting

1.02 REFERENCES

A. ASTM International (ASTM)
   1. ASTM D2241 – Standard Test Method for Tensile Properties of Plastics.

1.03 SUBMITTALS

A. See Section 01 30 00 “Administrative Requirements” for submittal procedures.

B. Submit manufacturer's product data and installation instructions for each of the system components. No substitutions will be allowed without prior written approval by the Landscape Architect.

C. Submit shop drawings for the irrigation system. Include piping layout and details, illustrating location and types of sprinkler heads, valves control systems, and wiring, and list of fittings. Show sprinkler head coverage.

D. Submit complete material list prior to performing work for Landscape Architect review.

E. Submit the following material samples:
   1. Piping and fittings.
   2. Clamps.
   3. Paint.
   4. Wire connectors and sealer.

F. Submit the following equipment samples:
   1. Sprinkler heads:
      a. Each type, complete with housing.
   2. Valves and valve access boxes.
   3. Controller.

G. Approved equipment samples will be returned to Contractor and may be used in the work.

H. Upon irrigation system acceptance, submit written operating and maintenance instructions. Provide format and contents as directed by the Landscape Architect.

I. Provide irrigation system record drawings (As Built) on reproducible sepia Mylar.
   1. Legibly mark drawings to record actual construction.
   2. Indicate horizontal and vertical locations, referenced to permanent surface improvements.
   3. Identify field changes of dimensions, details, and changes made by Architects Supplemental Instruction or Change Order.

J. Submit operating and maintenance data.

1.04 QUALITY ASSURANCE

A. Installer's Qualifications:
   1. Minimum of 5 years of experience installing irrigation systems of comparable size.

B. Materials, equipment, and methods of installation shall comply with the following codes and standards:
   1. All local, municipal, and state laws, rules, and regulations governing or relating to any portion of this work, and hereby incorporated into and made part of these specifications and drawings shall take precedence.
   2. American Society for Testing and Materials (ASTM).

3. The Irrigation Association (IA).

C. Excavating, backfilling, and compacting operations shall comply with requirements of Section 31 22 00 “Earthwork”, as modified when indicated by this Section.

D. Obtain Landscape Architect's acceptance of installed and tested irrigation system prior to installing backfill materials.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver irrigation system components in manufacturer's original undamaged and unopened containers with labels intact and legible.

B. Deliver plastic piping in bundles, packaged to provide adequate protection of pipe ends, both threaded or plain.

C. Store and handle materials to prevent damage and deterioration.

D. Provide secure, locked storage for valves, sprinkler heads, and similar components that cannot be immediately replaced to prevent installation delays.

1.06 PROJECT CONDITIONS

A. Known underground and surface utility lines are indicated on Electrical and Grading Plans.

B. Protect existing trees, plants, lawns, and other features designated to remain as part of the final landscape work.

C. Demo existing irrigation in project work area as necessary to accommodate new work.

D. Promptly notify the Architect of unexpected sub-surface conditions.

E. Coordinate with District personnel for irrigation system layout. Exact location of piping, sprinkler heads, valves, and other components shall be established by Contractor in the field at time of installation with help from District personnel.
   1. Space sprinkler components as indicated.
   2. Minor adjustments in system layout will be permitted to clear existing fixed obstructions. Final system layout shall be acceptable to the Landscape Architect.

F. Cutting and Patching:
   1. Cut through concrete and masonry with core drills. Jack hammers are not permitted.

2. Materials and finishes for patching shall match existing cut surface materials and finish.
3. Methods and materials used for cutting and patching shall be acceptable to the Architect.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable manufacturers:
   1. Rainbird Sprinkler Mfg. Co.
   2. Pacific-Western or approved equal.
   3. Refer to Irrigation Schedule.

2.02 MATERIALS

A. General:
   1. Provide only new materials, without flaws or defects, and of the highest quality of their specified class and kind.
   2. Comply with pipe sizes indicated. No substitution of smaller pipes will be permitted. Larger sizes may be used subject to acceptance of the Landscape Architect. Remove damaged and defective pipes.
   3. Provide pipe continuously and permanently, marked with manufacturer's name or trademark size schedule and type of pipe, working pressure at 73 degrees F. and National Sanitation Foundation (NSF) approval.

B. Plastic Pipe, Fittings, and Connections:
   1. Polyvinyl Chloride Pipe:
      a. ASTM D2241, rigid, unplasticized PVC, extruded from virgin parent material. Provide pipe homogeneous through and free from visible cracks, holes, foreign materials, blisters, wrinkles, and dents.
         1) Main Line smaller than 3" diameter:
            a) Schedule 40 PVC.
         2) Main Line 3" diameter or larger:
            a) "O" ring type Class 200.
         3) Lateral Lines:
            a) Schedule 40 PVC.
   2. PVC Pipe Fittings:
      a. Fittings for "O" ring type Class 200 pipe shall be ductile iron fittings. Harco or approved equal. Install per manufacturer's specifications.
      b. Fittings for Schedule 40 PVC shall be ASTM D2241 Schedule 40 PVC molded fittings suitable for solvent weld, slip joint Ring Tite seal or screwed connections. Fittings made of other materials are not permitted.

1) Size slip fitting socket taper to permit a dry unsoftened pipe end to be inserted no more than halfway into the socket. Saddle and cross fittings are not permitted.
2) Use male adapters for plastic-to-metal connections. Hand tighten male adapters, plus one turn with a strap wrench.

C. Sprinkler Heads, Pumps, Valves, and Associated Equipment:
1. Refer to drawings for materials list.

D. Controls:
1. Refer to drawings for materials list.

E. Control Wire:
1. Control and Ground Wire:
a. Type UF 600 volt AWG control cable #14 or larger.
1) Wire shall be rated for direct burial.
2. Wire color code:
a. Provide a different color hot wire from controller to each valve. As many colors possible per bundle.
3. Identify wire colors and their functions on the record drawings.

2.03 ACCESSORIES

A. Drainage Fill:
1. 1/2" to 3/4" washed pea gravel.

B. Earth Fill:
1. Clean soil free of stones larger than 4" diameter foreign matter, organic material, and debris.
a. Provide imported fill materials when required.
b. Suitable excavated materials removed to accommodate the irrigation system work may be used as fill material subject to the Landscape Architect's review and acceptance.

C. Low Voltage Wire Connectors:
1. Socket seal-type wire connectors and waterproof sealer.

D. Valve Access Boxes:
1. Tapered enclosure of rigid plastic material comprised of fibrous components chemically inert and unaffected by moisture corrosion and temperature changes. Provide lid of same material, green in color. Apply valve numbers to each valve with Christy valve markers. Box shall be Ametek or equal. Valve box lids shall be bolted shut prior to final acceptance.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine final grades and installation conditions. Do not start irrigation system work until unsatisfactory conditions are corrected.

3.02 PREPARATION

A. Layout and stake the location of each pipe run and all sprinkler heads and sprinkler valves.

   a. Coordinate new layout with District personnel so water does not spray onto building or concrete pavement.

   b. Obtain District and Architect's acceptance of layout prior to excavating.

B. Strip sod for pipe trenches with a mechanical sod stripper uniformly 1" to 1-1/2" thick with clean-cut edges.

C. Place sleeves as indicated for installation of piping and control wire.

3.03 PREPARATION

A. Excavating and Backfilling:
   1. All excavation shall be considered unclassified excavation and include all materials encountered.
   2. Excavate trenches to depth and width indicated on drawings to permit proper handling and installation of pipe and fittings.
   3. Fill to match adjacent grade elevations with approved earth fill material. Place and compact fill in layers not greater than 6" depth.
   4. Provide compaction of 95% over main lines where they cross under areas with concrete or AC paving. Compact all other trench backfill to 90%.
   5. Replace stripped sod in sufficient time to allow for satisfactory sod recovery and growth. Water-stripped and reinstalled sod until irrigation system is placed in operation.
   6. Replace paving of same materials, using joints and patterns to match existing adjoining paving surfaces.

B. Plastic Pipe:

1. Install plastic pipe in accordance with manufacturer's installation instructions. Provide for thermal expansion and contraction.
2. Saw cut plastic pipe. Use a square-in sawing vice to insure a square cut. Remove burrs and shavings at cut ends prior to installation.
3. Make plastic-to-plastic joints with solvent weld joints for slip seal joints. Use only solvent recommended by the pipe manufacturer. Install plastic pipe fittings in accordance with pipe manufacturer's instructions. Contractor shall make arrangements with pipe manufacturer for all necessary field assistance.
4. Make plastic-to-metal joints with plastic male adapters.
5. Make solvent weld joints in accordance with manufacturer's recommendations.
6. Allow joints to set at least 24 hours before pressure is applied to the system.
7. Maintain pipe interiors free of dirt and debris. Close open ends of pipe by acceptable methods when pipe installation is not in progress.

C. Sprinklers, Fittings, Valves, and Accessories:
1. Install fittings, valves, sprinkler heads, risers, and accessories in accordance with manufacturer's instructions, except as otherwise indicated.
2. Set sprinkler heads perpendicular to finished grade, except as otherwise indicated.
3. Obtain Landscape Architect's review and acceptance of height for proposed sprinkler heads and valves prior to installation.
4. Locate sprinkler heads to assure proper coverage of indicated areas. Do not exceed sprinkler head spacing distance indicated.
5. Install risers for spray heads in shrub or flower bed areas and planters of sufficient height to prevent interruption of the stream by the plant material.
   a. Provide risers of PVC Schedule 80 pipe.
   b. Set risers in a row with top level and in-line.
6. Install pop-up gear-driven sprinklers with an adjustable double-swing joint riser of at least 3 standard 90 degree elbows. All swing joints for turf rotors shall be Lasco G series triple swing assemblies. Size to match size of rotor inlet. Refer to irrigation drawings. All other nipples of the swing joint riser shall be of length as required for proper installation of the sprinkler head.
   a. All turf heads should be mounted on triple-swing joints.
7. Install quick-coupling valves with an adjustable triple-swing joint riser by Lasco.
8. Install backflow prevention valve, fittings, and accessories as shown or required to complete the system.
9. Install controller(s) as detailed.
10. Install in-ground control valves in a valve access box as indicated.
11. Install valve access boxes on a suitable base of gravel to provide a level foundation at proper grade and to provide drainage of the access box.
12. Seal threaded connection on pressure side of control valves with Teflon tape or approved plastic joint-type compound.

D. Control Wiring:

1. Install control wire in the piping trenches wherever possible.
    a. Place wire in trench adjacent to pipe.
    b. Install wire with slack to allow for thermal expansion and contraction.
    c. Expansion joints in wire to be provided at 200-foot intervals by making 5-6 turns of the wire around a piece of 1/2" pipe instead of slack.
    d. Where necessary to run wire in a separate trench, provide a minimum cover of 18" as detailed.
2. Provide sufficient slack at site connections at remote control valve in control boxes and at all wire splices to allow raising the valve bonnet or splice to the surface without disconnecting the wires when repair is required.
3. Connect each remote-control valve to one station of a controller except as otherwise indicated.
4. Connect each remote-control valve to a common ground wire system independent of all other controllers.
5. Make wire connection to remote control electric valves and splices of wire in the field, using wire connectors and sealing cement in accordance with manufacturer's recommendations.
6. Provide tight joints to prevent leakage of water and corrosion build-up on the joint.
7. Wire splices shall only be made in accessible valve boxes.

E. Utilize sleeves for installation of the irrigation system where indicated on drawings.
    1. Provide new sleeves for all locations where existing sleeves are not indicated. Install new sleeve prior to paving installation wherever possible.
    2. Remove and replace existing concrete and asphalt surfaces where cutting is necessary. Obtain Owner's and Architect's permission before cutting existing concrete and asphalt.

F. Flushing, Testing, and Adjustment:
    1. After sprinkler piping and risers are installed and before sprinkler heads are installed, open control valves and flush out the system with full head of water.
    2. Perform system testing upon completion of each section. When main line installation has been completed, pressurize to 100 pounds for a period of 4 hours. Inspector and Landscape Architect shall observe test. Make necessary repair, and re-test repaired sections as required.
    3. Adjust sprinklers after installation for proper and adequate distribution of the water over the coverage pattern. Adjust for the proper arc of coverage.
    4. Tighten nozzles on spray-type sprinklers after installation. Adjust sprinkler adjusting screw on lateral line or circuit as required for proper radius. Interchange nozzle patterns, as directed by the Landscape Architect, to give best arc of coverage.
    5. Adjust all electric remote control valve pressure regulators and flow control stems for system balance and optimum performance.

6. Test and demonstrate the controller by operating appropriate day, hour, and station selection features as required of each season per Service Section below.

G. Service:
   1. When requested, return to the site during the subsequent fall season and winterize the system. Drain all water from the system or blow out the system with compressed air.
   2. When requested, return to the site during the subsequent spring season and demonstrate to the Owner of the proper procedures for system startup, operation, and maintenance.

3.04 DISPOSAL OF WASTE MATERIAL

A. Stockpile, haul from site, and legally dispose of waste materials, including unsuitable excavated materials, rock, trash, and debris.

B. Maintain disposal route clear, clean, and free of debris.

3.05 ACCEPTANCE

A. Test and demonstrate to the Landscape Architect and Owner satisfactory operation of the system free of leaks.

B. Instruct the Owner's designated personnel in the operation of the system, including adjustment of sprinklers, controller(s), valves, pump controls, and moisture sensing controls.

C. Upon acceptance, the Owner will assume operation of the system.

D. All record documents must be approved and submitted prior to final payment.

3.06 CLEANING

A. Perform cleaning during installation of the work and upon completion of the work. Remove from site all excess materials, soil, debris, and equipment. Repair damage resulting from irrigation system installation.

B. Extreme care shall be taken by the landscape contractor when backfilling of trenches. They shall be left flush with the existing surrounding soil level. Tamp soil and rake level to make level bed for turf to re-establish.

END OF SECTION 32 84 00

SEEDING
SECTION 32 92 19

PART 1 GENERAL

1.01 SUMMARY

A. Inclusions:
   1. Provisions set forth in Divisions 0 and 1.
   2. Soil preparation.
   3. Hydroseeding turf.
   4. Fertilizing.
   5. Maintenance.
   6. Submittal preparation.
   7. Clean up.

B. Related Sections:
   1. Section 31 22 00 Earthwork
   2. Section 32 82 00 Planting Irrigation System
   3. Section 32 93 00 Planting

1.02 SUBMITTALS

A. Submit seed vendor's certification for required grass seed mixture.
   1. Indicate percentage by weight, and percentages of purity, germination, and weed seed for each seeded lawn.

1.03 QUALITY ASSURANCE

A. Warranty:
   1. Provide a uniform stand of grass by watering, mowing, and maintaining seeded areas until final acceptance.
      a. Reseed areas with specified materials which fail to provide a uniform stand of grass until all affected areas are accepted by the Landscape Architect.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver seed and fertilizer materials in original, unopened containers, showing weight, analysis, and name of manufacturer.

B. Store in a manner to prevent wetting and deterioration.

1.05 PROJECT CONDITIONS

A. Notify Architect at least 7 working days prior to start of seeding operations.

B. Protect existing utilities, paving, and other facilities from damage caused by seeding operations.

C. Perform seeding work only after planting and other work affecting ground surface has been completed.

D. Restrict traffic from lawn areas until grass is established.

E. Provide hose and lawn watering equipment as required.

1. Erect signs and barriers as required.

F. Install irrigation system prior to seeding.
1. Locate, protect, and maintain the irrigation system during seeding operations.
2. Repair irrigation system components damaged during seeding operations at this Contractor's expense.

PART 2 PRODUCTS

2.01 MATERIALS

A. Hydro-seed mix for turf areas shall be as follows by volume:
1. Perennial Rye: 25%
2. Fescue Mix: 25%
3. Hulled Bermuda: 50%

B. The above mix is to be applied at 10 pounds per 1,000 sq. ft., equal in weight for each type of grass seed.

C. Seeds shall be dated for the current growth season.

D. In addition, the following shall be included in the mix:
1. Wood Cellulose Fiber Mulch: 45 pounds 1000 sq. ft.
2. 12-08-08 Slow-Release Fertilizer (Best Brand) at the rate of 10 pounds per 1000 sq. ft.
   a. Fertilizer shall be delivered to the site in original, unopened container, bearing manufacturer's guaranteed analysis.
      1) Fertilizer that is delivered caked or damaged will not be acceptable.

E. Incorporate soil amendments throughout entire depth of planting zone.
1. Areas to be planted and irrigated shall receive soil amendments.

2. The following soil amendments shall be incorporated per 1,000 square feet of soil surface area:
   a. Three (3) cubic yards organic amendment.
      1) Material shall be organic wood-based product consisting of redwood or fir only.
      2) Material shall contain no manure of any kind, weed seeds, or any foreign substance.
      3) Maximum particle size shall be 1/4".
      4) Product shall contain a minimum 1% available nitrogen.

   b. 5 lbs. soil sulfur.
   c. 15 lbs. Best Brand Triple 16 Fertilizer.
   d. 250 lbs. crystallized agricultural gypsum.
   e. A copy of delivery slips on all materials used on the project shall be delivered to the Owner.
      1) Delivery slips shall be provided at time of material delivery to site. Delivery will not be allowed without delivery slips on any items.

   Note: After imported soil is in place, a soil suitability and fertility analysis of planted areas shall be made by a soils laboratory. If recommendations for soil amendment according to test results exceed the above quantities, the Contractor will be reimbursed for an extra based on unit costs submitted with original bid for soil amendments required more than the above quantities.

PART 3 EXECUTION

3.01 PREPARATION

A. Remove foreign materials, plants, roots, stones, and debris from areas to be planted or seeded.
   1. At time of planting, areas to be planted or seeded shall be free of stones, stumps, roots, or other deleterious matter 1" in diameter or larger and shall be free from all wire, plaster, or similar objects that would be a hindrance to planting or maintenance.

B. Protect existing underground improvements from damage.

C. Remove contaminated subsoil.

D. Cultivate all planting areas by ripping to a depth of 12 inches with an agricultural implement designed for that purpose. Rip area in two directions, perpendicular to each other.
   1. Repeat cultivation areas where equipment has compacted subgrade.

3.02 INSTALLATION

A. After preparation of soil has been completed, the areas to be seeded shall be brought to a finish grade with the finish surface being smooth and even, and well-firmed.
   1. Contractor shall make the entire area smooth and even.
   2. Contractor shall insure that finish grades are generally one inch below the surface of walks, curbs, paved areas, and yard boxes without abrupt low the changes in gradient (yard boxes shall be level and 1/2" above grade).

B. The ground surface shall be inspected by the Landscape Architect prior to seeding to determine suitability for planting.
   1. The Contractor shall obtain such approval before seeding.

C. Seed types shall be as specified and shall be applied at the rate indicated.

D. Equipment and Application:
   1. Hydraulic equipment used for the application of slurry shall have a built-in agitation system with an operating capacity sufficient to agitate, suspend, and homogeneously mix the above slurry.
   2. Distribution lines shall be large enough to prevent stoppage and to provide even distribution of the slurry over the ground.
   3. The pump shall be capable of exerting at least 150 psi at the nozzle or sufficient additional pressure for proper coverage.
   4. The slurry tank shall have a minimum capacity of 1,500 gallons and shall be mounted on a traveling unit which will place the slurry tank and spray nozzles within sufficient proximity of the areas to be seeded to provide uniform distribution without waste and shall be thoroughly clean and free of seed species that are not specified.
   5. With the engine at half throttle, water shall be added to the tank. When the water level has reached the height of the agitator shaft, good re-circulation shall be established and, at this time, the seed shall be added. Fertilizer shall then be added to the mixture followed by wood pulp mulch. The wood pulp mulch shall only be added to the mixture after the seed, and when the tank is at least one-third filled with water. The engine throttle shall be opened to full speed when the tank is half filled with water. The engine throttle shall be opened to full speed when the tank is half filled with water. All the wood pulp mulch shall be added by the time the tank is two-thirds to three-fourths full. Spraying shall commence when the tank is full.
   6. Spray with a uniform, visible coat.
   7. The slurry shall be applied in a sweeping motion, in an arched stream to fall like rain allowing the wood fibers to build on each other until a good coat is achieved and the material is spread at the required rate per acre.

8. Slurry mixture which has not been applied to the slopes within four hours after mixing will be rejected and removed from the project at the Contractor's expense.

E. Watering Should be as Follows:
   1. Prior to Hydro-seed, the area shall be irrigated to provide a moist seed bed for the Hydro-seed application.
   2. Hydro-seed areas shall receive several consecutive waterings the day of the Hydro-seed to thoroughly saturate the soil.
   3. After initial irrigation, water shall be applied as often and in sufficient amounts as conditions may require, keeping the soil wet above, around and below the root systems of the plants (until germination is completing).

3.03 EARLY SEEDING OF TURF PLAYFIELD

A. After installation of irrigation system, Contractor shall complete seeding turf playfield by April 1st of the year following the start of the project. Contractor maintenance period for this turf shall begin when seeding has been completed. Contractor shall remain responsible for maintenance until the maintenance period for the entire project is completed.

3.04 MAINTENANCE PERIOD

A. Maintain seeded lawns for a period of at least 90 days after completion and acceptance of seeding operations for the entire project.

B. Maintain seeded lawn areas, including watering, spot weeding, mowing, applications of herbicides, fungicides, insecticides, and re-seeding until a full, uniform stand of grass free of weeds, undesirable grass species, disease, and insects is achieved and accepted by the Landscape Architect.
   1. Water daily to maintain adequate surface soil moisture for proper seed germination.
   2. Maintenance Period work includes all mowing (at height approved by Owner), watering, weeding, reseeding, mulching, cultivating, spraying, and trimming necessary to bring the planted areas to healthy growing conditions, and any additional work needed to keep the areas neat, edged, and attractive.
   3. Any day the Contractor fails to adequately water, replace unsuitable plants, weed, and other work determined to be necessary by the Landscape Architect, he will NOT be credited as part of the Maintenance Period.
   4. Constant diligence shall be maintained for the advent of disease, insects, and/or rodent infestations, and proper preventative or control measures taken.
   5. On the 90th day of the Maintenance Period, all lawn areas shall receive 25 pounds of Best Brand Triple 16 Fertilizer per 1,000 sq. ft. or approved equal.

6. At completion of Maintenance Period, all areas included in the Contract shall be substantially clean and free of debris and seeds, and plant materials shall be alive, healthy, and free of infestations.
7. Any erosion or slippage of soil caused by watering shall be repaired by the Contractor at his expense.
8. All walks, curbs, and gutters shall be kept clear of debris, mud, dust, and standing water by sweeping, mopping, or hosing down as required to maintain cleanliness throughout.
9. The Contractor, within fourteen (14) days of written notification by the Owner, shall remove and replace all guaranteed plant materials that for any reason fail to meet the requirements of the guarantee.
10. All plant material replaced shall be guaranteed for the original period, starting from the date of replacement.
11. Contractor shall provide a temporary barrier string line with colored flags between new turf area and general play area until turf is established and is ready for play.

3.05 ACCEPTANCE

A. Inspection to determine acceptance of seeded lawns will be made by the Landscape Architect, upon Contractor's request.
   1. Provide notification at least 10 working days before requested inspection date.
   2. Seeded areas will be acceptable provided all requirements, including maintenance, have been complied with, and a healthy, uniform, close stand of the specified grass is established free of weeds, undesirable grass species, disease, and insects.
   3. No individual lawn areas shall have bare spots or unacceptable cover totaling more than 2% of the individual areas, in areas requested to be inspected.

B. Upon acceptance, the Owner will assume lawn maintenance.

3.06 CLEAN UP

A. Perform clean up during installation of the work and upon completion of the work.
   1. Remove from site all excess materials, debris, and equipment.
   2. Repair damage resulting from seeding operations.

END OF SECTION 32 92 19

TRENCHING AND BACKFILLING FOR UTLITITES
SECTION 33 05 28

PART 1 GENERAL

1.01 SUMMARY

A. Inclusions:
   1. Provisions set forth in Divisions 0 and 1.
   2. Bedding and backfilling materials.
   3. Staking and grades.
   4. Existing Utilities.
   5. Trenching and excavating.
   6. Bedding and backfilling.
   7. Field quality control.

B. Related Sections:

1.	Section 03 31 00	Structural Concrete Work
2.	Section 22 00 00	General Plumbing Requirements
3.	Section 26 01 00	General Conditions of Electrical Work
4.	Section 31 22 00	Earthwork
5.	Section 32 13 13	Site Concrete Paving
6.	Section 33 05 25	Support and Protection of Utilities
7.	Section 33 33 13	Sanitary Utility Sewerage
8.	Section 33 41 00	Storm Utility Drainage Systems
9.	Section 33 44 16	Storm Utility Trench Drains

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM)
   1. ASTM C33 – Standard Specification for Concrete Aggregates.

B. California Code of Regulations (CCR)
   1. Title 8, Chapter 4, Construction Safety Orders.

C. State of California, Department of Transportation (Caltrans):
   1. Standard Specifications, Sections 68, Engineering Fabrics.
   2. Office of Structure Construction, Trenching and Shoring Manual.

1.03 SUBMITTALS

A. Refer to Section1 30 00 “Administrative Requirements” for submittal procedures.

B. Submittals for trenches of five (5) feet or more in depth shall be submitted to the Engineer for review and approval.

1.04 REQUIRED NOTIFICATIONS

A. This Section includes specifications for excavating, trenching and backfilling for utilities and related structures, as indicated, including underground piping for water supply, sanitary and storm sewerage piping, trackway and roadway site subsurface and drainage; underground electrical conduits and duct banks; and utility boxes, catch basins, manholes, inlets, pull boxes and vaults.

B. Trenching and backfilling for utilities includes restoration of existing pavements, where applicable, to the conditions existing before the excavation. Conform with applicable requirements of Section 32 12 16 “Asphaltic Concrete Paving” and 32 13 13 “Site Concrete Paving”.

1.05 REGULATORY REQURIEMENTS

A. Regulatory requirements that govern the work of this Section include the following governing codes:
   1. California Code of Regulations (CCR):
      a. Title 8, Chapter 4, Subchapter 4 “Construction Safety Orders”
      b. Title 8, Chapter 4, Subchapter 19 “Trench Construction Safety Orders”
         1) Trench excavations of five (5) feet or more in depth.
      c. Title 24, Part 2 “California Building Code”, Chapter 33 “Safeguards During Construction” and Appendix ‘J’ “Grading”.

1.06 DEFINITIONS

A. Measurement: Maintenance, support and protection of existing utilities will be measured for payment by the lump-sum method, acceptably performed and completed.

B. Payment: Maintenance, support and protection of existing utilities will be paid for at the Contract lump sum price, as indicated in the Bid Schedule of the Bid Form.

PART 2 PRODUCTS

2.01 BEDDING AND BACKFILLING MATERIALS

A. Bedding:
   1. Sand: Sand for bedding of pipe utility trenches shall be a clean and graded, washed sand all passing a No. 4 U. S. Standard sieve and conforming generally to ASTM C33 for fine aggregate. A finer sand may be used, if convenient, provided the sand is clean and does not contain deleterious substances more than the amounts specified in ASTM C33, Table 3.
      a. Only sand will be permitted for bedding of plastic, concrete pipe, clay pipe and cast-iron pipe.

2. Pea Gravel: Clean and graded, washed river-run, ASTM C33, Size No. 7. Pea gravel may be used in trenches requiring additional drainage and for backfilling above the pipe's upper half (above the horizontal centerline).

B. Backfill Material: Backfill for excavations and trenches under structures and paving shall be Structural Fill (as indicated). Refer to Section 31 22 00 "Earthwork" for requirements. Common Fill will be permitted only for backfilling of excavations and trenches in open areas and landscape areas.

C. Slurry Cement Backfill Material: Slurry cement backfill shall consist of a fluid, workable mixture of Portland cement, clean and graded aggregate, and water.

D. Filter Fabric Material: Geotextile engineering fabric conforming to Caltrans Standard Specifications, Section 68-2.02G, "Filter Fabric".

PART 3 EXECUTION

3.01 STAKING AND GRADES:

A. Refer to Section 31 22 00 "Earthwork" for requirements.

3.02 EXISTING UTILITIES

A. Refer to Section 31 22 00 "Earthwork", Section 33 05 25 "Support and Protection of Utilities" for requirements.

3.03 TRENCHING AND EXCAVATING

A. Comply with California Code of Regulations (CCR), Title 8 "Trench Construction Safety Orders" and Chapter 33 and Appendix J as applicable.

B. Perform trenching and excavating as indicated and required for drainage and utility piping, conduits, and related structure, and provide shoring, bracing, pumping, and planking as required.

C. Excavate to the lines and grades indicated.

D. Excavate trenches for pipes and conduits by the open-cut method, except where tunneling or jacking are indicated. Hand-excavate for crossing pipelines.

E. In paved areas, cut pavement on the neat lines at the width indicated for trench. Pavement shall be sawcut. After compacting the backfill, restore pavement to a condition equivalent to that existing at the start of construction. Restore pavement damaged outside the neat lines.

1. Where indicated or required, by local agency having authority, provide slurry cement backfill for trench excavation to underside of pavement.

F. Excavate trenches to the indicated width at all points below a horizontal plane two (2) feet above the top of the pipe. Excavation above this plane may exceed the indicated width as required. Where the width is not indicated, make the width not less than 6 inches nor more than 18 inches from the outside of the pipe. **If the excavation exceeds permissible dimensions, install a higher strength pipe or encase the pipe in Class 3000 concrete.**

G. The bottoms of excavations shall be firm, undisturbed earth or cut sub grade, clean and free from loose material, debris, and foreign matter. When bottoms of excavations or trenches are a soft or unstable material, the bed shall be made firm and solid by removing said unstable material to a sufficient depth and replacing same with sand or pea gravel, compacted to at least 90 percent relative compaction.

H. Where water is encountered in the trench, remove the water, or provide sand or pea gravel as required to drain the water and stabilize the bed.

I. Bell holes shall be accurately placed and shall not be larger than required to make the joint.

J. Excavations for structures shall conform to applicable requirements of Section 31 22 00 “Earthwork”.

3.04 BEDDING AND BACKFILLING

A. Material for bedding of pipe shall be sand. Minimum thickness of sand bedding under plastic, concrete, clay and cast-iron pipe shall be 2 inches. Provide firm and uniform support of piping at indicated elevations and grades. Tamp sand bedding as required for firm support.
   1. The joints of gravity flow piping shall be wrapped with filter fabric all around the pipe. Place filter fabric before laying pipe in sand bedding. Filter fabric shall extend at least twelve (12) inches on each side of the joint.

B. Backfill the horizontal centerline of pipe shall be sand. Backfill to six (6) inches above the top of pipe from the horizontal centerline of pipe shall be the material herein specified in Paragraph 2.01A.2 and 2.01.B, as applicable.

C. Backfill shall be placed in six-inch (6”) layers, leveled, rammed, and tamped in place. Each layer shall be compacted with suitable compaction equipment to at least 90 percent relative compaction, taking care not to damage or misalign any pipe. The top twelve inches (12”) under structures and pavement shall be compacted to at least ninety-five percent (95%) relative compaction.

D. Backfilling around concrete structures and for duct banks and similar utilities shall conform to the applicable requirements of Section 31 22 00 “Earthwork”.

END OF SECTION 33 05 28

SANITARY UTILITY SEWERAGE SYSTEMS
SECTION 33 33 13

PART 1 GENERAL

1.01 SUMMARY

A. Inclusions:
   1. Provisions set forth in Divisions 0 and 1;
   2. Excavation;
   3. Piping;
   4. Backfilling and compaction;
   5. Concrete manholes; catch basins, boxes, and lids;
   6. Accessories and associated hardware;
   7. Submittal preparation;
   8. Clean up.

B. Related Sections:
   1. Section 22 80 00 Plumbing
   2. Section 31 22 00 Earthwork
   3. Section 33 05 25 Support and Protection of Utilities
   4. Section 33 05 28 Trenching and Backfill for Utilities

1.02 REFERENCES

A. ASTM International (ASTM)
   1. ASTM C76 – Standard Specification for Reinforced Concrete.
   2. ASTM D520 – Standard Specification for Zinc Dust Pigment.
   3. ASTM D1557 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3).
   4. ASTM D2321 – Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
   5. ASTM D3034 – Standard Specification for Type PSM Poly (Vinyl Chloride) Sewer Pipe and Fittings.
   6. ASTM F477 – Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

1.03 SUBMITTALS

A. See Section 01 30 00 “Administrative Requirements” for submittal procedures.

B. Product or Material Data:
   1. Submit copies of manufacturer's technical product data and installation instructions prior to beginning fabrication.

C. Shop Drawings or Layout Drawings:
   1. Submit copies of shop drawings to the Architect for review prior to beginning fabrication.

D. Close-Out Submittals:
   1. Update Project record documents on a regular basis and at the completion of work, review and sign the project record documents attesting to their accuracy.
      a. Include exact locations of storm drain piping, invert elevations, and top-of-grate elevations.

1.04 QUALITY ASSURANCE

A. Warranty:
   1. As required by the General Conditions.

PART 2 PRODUCTS

2.01 MATERIALS

A. For pipe diameters of 18 inches or larger - Reinforced Concrete Pipe.
   1. Comply with ASTM C76, Class ll, unless noted otherwise.
   2. Use rubber gasket joints per ASTM F477.

B. For pipe diameters less than 18 inches - PVC Pipe.
   1. Use SDR 35 per ASTM D3034.
   2. Use rubber gasket joints per ASTM F477.

C. HDPE piping will not be allowed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify layout prior to beginning work.

B. Start of work shall be considered as acceptance of existing conditions.

C. Inspect pipe prior to installation.

   1. Defective materials shall be marked as such and promptly removed from site.

3.02 INSTALLATION OR APPLICATION

A. Install in compliance with ASTM D2321.

B. Install in compliance with governing authorities.

C. Install per the manufacturer's latest written recommendations.
   1. Lay pipe beginning at low point of system.
   2. Place bell and groove ends of piping upstream.
   3. Install waterstop gaskets for plastic to concrete interfaces.

D. Tap Connections:
   1. Install tap connections to existing piping and underground structures to conform as nearly as possible to the requirements for new construction.

E. Backfilling: *(coordinate with soils report)*
   1. Backfill after inspection of piping. Sanitary sewer piping with rubber gasket joints will not require pressure testing.
   2. Backfill piping with vibrated sand to 12" above the top of pipe.
      a. Compact to 90% of maximum density per ASTM D1557 for non-cohesive materials
   3. Backfill remainder of trench with native soils compacted to 90% per ASTM D1557, unless noted otherwise.
      a. Top six inches below paved areas shall be compacted to 95% per ASTM D1557.

3.03 QUALITY CONTROL

A. Field Inspection:
   1. Inspect piping to determine that line displacement or other damage has not occurred.
      a. Inspect after two (2) foot of cover has been installed and compacted.
      b. Correct any defects.
   2. Verify that piping, boxes, and accessories are installed true-to-line, and at elevations indicated on the Drawings.

3.04 CLEANING OR REPAIR

A. Clear interior of piping of dirt and other materials.
   1. Pull swab past each joint as it is completed.
   2. Place plugs in the ends of uncompleted piping at the end of each work session.
   3. Flush lines between manholes and catch basins to remove debris.
   4. Repair all damaged galvanized material with approved/specified repair material. Manufacturer's requirements for prep and application shall be strictly followed.

3.05 CONDITION OF FINISHED WORK

A. The completed installation shall be clean, true to line and grade, and accurately set to elevation.

B. Backfill shall be compacted.

C. Rake out dirt over trench locations to blend smooth and level with adjacent areas:
   1. Dirt clods shall be a maximum of 1/2" in size;
   2. Surface rocks greater than 1/2" shall be removed;
   3. Leave dirt areas acceptable for turf planting.

END OF SECTION 33 33 13

STORM UTILITY DRAINAGE SYSTEMS
SECTION 33 41 00

PART 1 GENERAL

1.01 SUMMARY

A. Inclusions:
   1. Provisions set forth in Divisions 0 and 1
   2. Excavation
   3. Piping
   4. Backfilling and compaction
   5. Concrete manholes; catch basins, boxes, and lids
   6. Accessories and associated hardware
   7. Submittal preparation
   8. Clean up.

B. Related Sections:
   1. Section 22 80 00 Plumbing
   2. Section 31 22 00 Earthwork
   3. Section 33 05 25 Support and Protection of Utilities
   4. Section 33 05 28 Trenching and Backfill for Utilities

1.02 REFERENCES

A. ASTM International (ASTM)
   1. ASTM C76 – Standard Specification for Reinforced Concrete.
   2. ASTM D520 – Standard Specification for Zinc Dust Pigment.
   3. ASTM D1557 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3)).
   4. ASTM D2321 – Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
   5. ASTM D3034 – Standard Specification for Type PSM Poly (Vinyl Chloride) Sewer Pipe and Fittings.
   6. ASTM F477 – Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

1.03 SUBMITTALS

A. See Section 01 30 00 “Administrative Requirements” for submittal procedures.

B. Product or Material Data:
   1. Submit copies of manufacturer's technical product data and installation instructions prior to beginning fabrication.

C. Shop Drawings or Layout Drawings:
   1. Submit copies of shop drawings to the Architect for review prior to beginning fabrication.

D. Close-Out Submittals:
   1. Update Project record documents on a regular basis and at the completion of work, review and sign the project record documents attesting to their accuracy.
      a. Include exact locations of storm drain piping, invert elevations, and top-of-grate elevations.

1.04 QUALITY ASSURANCE

A. Warranty:
   1. As required by the General Conditions.

PART 2 PRODUCTS

2.01 MATERIALS

A. For pipe diameters of 18 inches or larger - Reinforced Concrete Pipe.
   1. Comply with ASTM C76, Class ll, unless noted otherwise.
   2. Use rubber gasket joints per ASTM F477.

B. For pipe diameters of 18 inches or smaller - PVC Pipe.
   1. Use SDR 35 per ASTM D3034.
   2. Use rubber gasket joints per ASTM F477.

C. HDPE piping will not be allowed.

2.02 ACCESSORIES OR HARDWARE

A. Precast Concrete Catch Basins:
   1. Include galvanized metal frames, covers, and grating from the same manufacturer.
      a. Catch Basin shall have cast-in galvanized frame for bolt-down grate provision.
      b. Grates shall be ADA-compliant when located in site concrete areas.
         1) Grid openings in gratings shall be limited to 1/2 inch in the direction of traffic flow.
            a) Elongated openings shall be placed so that the long dimension is perpendicular to the dominant direction of travel. Alternate direction of grate openings in plazas, courts, and other wide pedestrian areas.
      c. Grates shall be vandal proof.
         1) Grates shall be galvanized steel and bolted down.
   2. Approved Manufacturers:

a. Old Castle, Infrastructure;
b. Or approved equal.

B. Fittings and accessories shall be of the same materials and weight/class as pipes

C. Manufactured saddle wyes may be used in lieu of inline wyes.

D. Galvanized Finish Repair.
1. Repair compound: ASTM D 520, Type III high purity grade zinc dust. 24lbs/gallon minimum weight per gallon. 52% by volume minimum solids content. 94% by weight in dry film minimum metallic zinc content. Galvilite Galvanizing Repair, ZRC Worldwide. (800) 831-3275.
2. RotoMetals Regalv lead free galvanizing repair stick. heat applied.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify layout prior to beginning work.

B. Start of work shall be considered as acceptance of existing conditions.

C. Inspect pipe prior to installation.

1. Defective materials shall be marked as such and promptly removed from site.

3.02 INSTALLATION OR APPLICATION

A. Install in compliance with ASTM D2321.

B. Install in compliance with governing authorities.

C. Install per the manufacturer's latest written recommendations.
1. Lay pipe beginning at low point of system.
2. Place bell and groove ends of piping upstream.
3. Install waterstop gaskets for plastic to concrete interfaces.
4. Install storm drain leads to roof downspouts to within five (5) feet of the downspout location.
a. Cap for future connection.
b. Verify location with Civil and Architectural Drawings.

D. Tap Connections:
1. Install tap connections to existing piping and underground structures to conform as nearly as possible to the requirements for new construction.
2. Tap roof drains into larger diameter storm drain lines using manufacturer's fittings for wyes and saddles.

E. Backfilling:
   1. Backfill after inspection of piping. Storm sewer piping with rubber gasket joints will not require pressure testing.
   2. Backfill piping with vibrated sand to 12" above the top of pipe.
      a. Compact to 90% of maximum density per ASTM D1557 for non-cohesive materials
   3. Backfill remainder of trench with native soils compacted to 90% per ASTM D1557, unless noted otherwise.
      a. Top six inches below paved areas shall be compacted to 95% per ASTM D1557.

3.03 QUALITY CONTROL

A. Field Inspection:
   1. Inspect piping to determine that line displacement or other damage has not occurred.
      a. Inspect after two (2) foot of cover has been installed and compacted.
      b. Correct any defects.
   2. Verify that piping, catch basins, manholes, boxes, and accessories are installed true-to-line, and at elevations indicated on the Drawings.

3.04 CLEANING OR REPAIR

A. Clear interior of piping of dirt and other materials.
   1. Pull swab past each joint as it is completed.
   2. Place plugs in the ends of uncompleted piping at the end of each work session.
   3. Flush lines between manholes and catch basins to remove debris.
   4. Repair all damaged galvanized material with approved/specified repair material. Manufacturer's requirements for prep and application shall be strictly followed.

3.05 CONDITION OF FINISHED WORK

A. The completed installation shall be clean, true to line and grade, and accurately set to elevation.

B. Backfill shall be compacted.

C. Rake out dirt over trench locations to blend smooth and level with adjacent areas:
   1. Dirt clods shall be a maximum of 1/2" in size;
   2. Surface rocks greater than 1/2" shall be removed;
   3. Leave dirt areas acceptable for turf planting.

END OF SECTION 33 41 00

STORM UTILITY TRENCH DRAINS
SECTION 33 44 16

PART 1 GENERAL

1.01 SUMMARY

A. Inclusions:
   1. Provisions set forth in Divisions 0 and 1.
   2. Surface drainage, precast trench drain systems.

B. Related Sections:

1.	Section 03 21 00	Reinforcing Steel
2.	Section 31 22 00	Earthwork
3.	Section 32 13 13	Site Concrete
4.	Section 32 05 25	Support and Protection of Utilities
5.	Section 33 05 28	Trenching and Backfill for Utilities
6.	Section 33 41 00	Storm Utility Drainage Systems

1.02 REFERENCES

A. American Society of Mechanical Engineers (ASME):
   1. ASME A112.21.1M Floor Drains.

1.03 SUBMITTALS

A. See Section 01 30 00 “Administrative Requirements” for submittal procedures.

B. Product Data: submit product data and installation instructions including manufacturer's SPEC-DATA product sheet, for specified products.

C. Shop Drawings: submit shop drawings showing layout, profiles, and product components, including anchorage, accessories, finish colors, patterns, and textures.

D. Samples: submit selection and verification samples for finishes, colors, and textures.

E. Quality Assurance Submittals:
   1. The following documents shall be submitted:
      a. Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
      b. Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

F. Close-Out Submittals:
   1. The following documents shall be submitted:
      a. Warranty: warranty documents specified herein.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project.

1.05 SYSTEM DESCRIPTION

A. Performance Requirements: provide trench drain system which has been manufactured and installed to withstand loads per DIN 19580 Standard Load Classes and to maintain performance criteria stated by manufacturer without defects, damage, or failure.
   1. Sidewalks: no traffic - Load Class B
   2. Parking Lots: minimum light traffic - Load Class C
   3. General Road and Delivery Areas: Load Class D
   4. Light Industrial Forklift Areas: Load Class E
   5. Heavy Industrial Forklift Areas: Load Class F

1.06 DELIVERY, STORAGE AND HANDLING

A. General: comply with Division 01 Product Requirements Sections.

B. Ordering: comply with manufacturer's lead time requirements to avoid construction delays.

C. Delivery: deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

D. Storage and Protection: store materials protected from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.

1.07 PROJECT CONDITIONS

A. 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. Heavy Industrial Forklift Areas: Load Class F

1.08 WARRANTY

A. Warranty:
   1. Project Warranty: refer to Conditions of the Contract for project warranty provisions.
   2. 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.
      a. Warranty Period: 12 months commencing on Date of Notice of Completion.

PART 2 PRODUCTS

2.01 PRECAST TRENCH DRAIN SYSTEMS (Load Class B or C listed - adjust as required)

A. Acceptable Manufacturers:

B. Basis of Design:
   1. ACO Polymer Products, Inc., ACO Drain, Model #K100S Polymer Concrete System with Zurn # Z886 HDPE System with HD Galvanized Frame.

B. Precast Trench Drain Systems:
   1. ACO Drain K100S Polymer Concrete System:
      a. Material: polymer concrete
      b. Channels: 4 inches (100 mm) internal width
      c. Slope: 0.6% sloped, neutral, or 0.75%, as applicable
      d. Metal Edge Rail: galvanized steel
      e. Grates: 410/411 galvanized steel, perforated - ADA compliant, 420/425/435 galvanized steel, slotted, 405 galvanized steel, mesh, 430 stainless steel, mesh, 479 ductile iron, mosaic, 477 ductile iron, longitudinal slotted, 478 ductile iron, slotted - ADA compliant, 461 ductile iron, slotted.
      f. Grate Locking System: QuickLok
      g. Grate Load Class: Class C250 - 56,200 lb/1162 psi (25,515 kg/8006 kPa) [Class D400 - 89,920 lb/1859 psi] [Class E600 - 134,800 lb/2788 psi] in compliance with DIN 19580.
      h. Catch Basins: Type 900, Series 600
      i. Outlets: channel bottom drill-out for 4 inches, 6 inches, schedule 40 pipe.

PART 3 EXECUTION

3.01 EXAMINATION

A. Site Verification of Conditions: verify that conditions of substrates previously installed under other sections are acceptable for product installation in accordance with manufacturer's instructions.

3.02 PREPARATION

A. Surface Preparation: ensure ground conditions are suitable. Poor site conditions require engineering advice.

3.03 INSTALLATION

A. Precast Trench Drain System Installation: ensure channels are surrounded on all 3 sides by concrete of minimum 3000 psi compressive strength. Check relevant installation section drawings for dimensions required.

B. Interface with Other Work.

3.04 MANUFACTURER'S INSTRUCTIONS

A. Comply with manufacturer's product data, including product technical bulletins, product catalog, installation instructions, and installation section drawings.

3.05 FIELD QUALITY CONTROL

A. Site Tests: flood test for positive drainage.

B. Inspection:
   1. Ensure grates are in correct position and captive.
   2. Ensure pipe and outlet connections are cleared and checked.

3.06 PROTECTION OR ADJUSTMENT

A. Protection: protect installed product and finish surfaces from damage during subsequent construction.

3.07 CLEANING

A. Cleaning: remove temporary coverings and protection of adjacent work areas. Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance. Remove construction debris from project site and legally dispose of debris.

END OF SECTION 33 44 16

GEOLOGIC HAZARDS INVESTIGATION UPDATE
PROPOSED FLETCHER ELEMENTARY SCHOOL – NEW MODULAR CLASSROOM
SEC VINELAND ROAD AND HIGHLAND KNOLLS DRIVE
BAKERSFIELD, CALIFORNIA

PROJECT NO. 022-24107
AUGUST 29, 2024

Prepared for:

MR. DANIEL WASTAFERRO
BAKERSFIELD CITY SCHOOL DISTRICT
1501 FELIZ DRIVE
BAKERSFIELD, CALIFORNIA 93307

Prepared by:

KRAZAN & ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING DIVISION
2205 COY AVENUE
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Krazan & ASSOCIATES, INC.

GEOTECHNICAL ENGINEERING • ENVIRONMENTAL ENGINEERING
CONSTRUCTION TESTING & INSPECTION

August 30, 2024

KA Project No. 022-24107

Mr. Daniel Wastaferro
Bakersfield City School District
1501 Feliz Dr.
Bakersfield, California 93307

RE: Geotechnical Engineering/Geologic Hazards Investigation Update
Proposed Fletcher Elementary School - New Modular Classroom
Vineland Road and Highland Knolls Drive
Bakersfield, California

Dear Mr. Wastaferro:

In accordance with your request, we have completed a Geotechnical Engineering/Geologic Hazards Investigation Update for the above-referenced site. The results of our investigation are presented in the attached report.

If you have any questions, or if we may be of further assistance, please do not hesitate to contact our office at (661) 837-9200.

Respectfully submitted,
KRAZAN & ASSOCIATES, INC.

David R. Jarosz, II
Managing Engineer
RGE No. 2698/RCE No. 60185

DRJ:wa

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GEOTECHNICAL ENGINEERING/GEOLOGIC HAZARDS INVESTIGATION UPDATE
FLETCHER ELEMENTARY SCHOOL - NEW MODULAR CLASSROOM
SEC VINELAND ROAD AND HIGHLAND KNOLLS DRIVE
BAKERSFIELD, CALIFORNIA

INTRODUCTION

This report presents the results of our Geotechnical Engineering/Geologic Hazards Investigation Update for the proposed Fletcher Elementary School - new modular classroom to be located at the southeast intersection of Vineland Road and Highland Knolls Drive in Bakersfield, California. Prior Geotechnical Engineering/Geologic Hazards Investigations were prepared by Krazan & Associates for the proposed New Elementary and Middle School June-July 2009 and February-March 2011 (022-11004), and August 15, 2023 (022-23118). Discussions regarding site conditions are presented herein, together with conclusions and recommendations pertaining to site preparation, Engineered Fill, utility trench backfill, drainage and landscaping, foundations, concrete floor slabs and exterior flatwork, retaining walls, pavement design and soil cement reactivity.

A site plan showing the approximate boring locations is presented following the text of this report. A description of the field investigation, boring logs, and the boring log legend are presented in Appendix A. Appendix A contains a description of the laboratory testing phase of this study, along with the laboratory test results. When conflicts in the text of the report occur with the general specifications in the appendices, the recommendations in the text of the report have precedence.

PURPOSE AND SCOPE

This investigation was conducted to evaluate the soil and groundwater conditions at the site, to make geotechnical engineering recommendations for use in design of specific construction elements, and to provide criteria for site preparation and Engineered Fill construction.

Our recent update scope of services was outlined in our proposal dated August 2, 2024 (KA Proposal No. P572-24) and included the following:

- A site reconnaissance by a member of our engineering staff to evaluate the surface conditions at the project site.
- A review of available data for evaluation of subsurface conditions at the project site.
- Aerial photograph interpretation.

- A search of geologic and seismologic literature pertaining to the area of the site.
- Evaluation of potential geologic hazards.
- Prior field investigations consisting of drilling 56 borings in June-July 2009 and February-March 2011, and 4 borings on August 15, 2023 (Borings No. B-101 and B-104) to depths ranging from approximately 4 to 70 feet for evaluation of the subsurface conditions at the project site. An additional 2 exploratory borings were conducted on August 12, 2024 (Borings No. B-201 and B-202) within the proposed New Modular Classroom area located on the northern area of the existing Fletcher Elementary School to a depth of 5½ to 17 feet for evaluation of the subsurface conditions at the project site. The 2024 borings were terminated due to very dense gravelly and cobbly soil conditions.
- Performing laboratory tests on representative soil samples obtained from the borings to evaluate the physical and index properties of the subsurface soils.
- Evaluation of the data obtained from the investigations and an engineering analysis to provide recommendations for use in the project design and preparation of construction specifications.
- Preparation of this report summarizing the results, conclusions, recommendations, and findings of our investigation.

PROPOSED CONSTRUCTION

We understand that design of the proposed new structure is currently underway. Some of the final details pertaining to the structure are unavailable. It is understood the Fletcher Elementary School campus had been completed and the modular classroom is in the design stages. The existing buildings at Fletcher Elementary School range from approximately 6,000 to 25,000 square feet. The proposed modular classroom is planned to be approximately 5,000 to 6,000 square foot and foundation loads are anticipated to be light to moderate. Modifications to on-site paved areas and landscaping are also planned for the development of the project.

In the event these structural or grading details are inconsistent with the final design criteria, the Soils Engineer should be notified so that we may update this writing as applicable.

SITE LOCATION, SITE HISTORY AND SITE DESCRIPTION

The subject site is located in Kern County within the southern portion of the San Joaquin Valley in California (refer to Vicinity Map, Figure 1). The school property consists of approximately 44 acres and is located within the City of Bakersfield. The site is bound to the north by Highland Knolls Drive, a partially graded residential development, and a completed residential development; classroom buildings and asphaltic concrete play courts to the south; a lawn play field, track, and Bedford Green Drive to the east; and a classroom, asphaltic concrete parking lot, multi-purpose building, and Vineland Road to the west. The proposed modular classroom is located at longitude 118.893803° West and latitude 35.392411° North. The USGS Oil Center, California 7.5-minute Quadrangle, dated 1992, indicates that

surface elevations in the vicinity of the site are on the order of 698 feet above mean sea level (AMSL). A major watercourse identified as the Kern River is located approximately 2.9 miles north of the subject site.

Site history was obtained by reviewing historical aerial photographs taken in 1946, 1956, 1967, 1972, 1989, 1994, 2002, 2010, 2016, and 2022. Review of the 1946 aerial photograph indicates that the site was utilized as grazing land. Several seasonal creeks/drainages generally flowed northwest to southeast across the site and Kern Canyon Road was located to the southeast of the site.

Review of the 1956 aerial photograph indicates that the project site conditions appeared to be relatively similar to that noted in the 1946 aerial photograph.

Review of the 1967 aerial photograph indicates that the project site conditions appeared to be relatively similar to that noted in the 1956 aerial photograph.

Review of the 1972 aerial photograph indicates that the project site conditions appeared to be relatively similar to that noted in the 1967 aerial photograph.

Review of the 1989 aerial photograph indicates that the project site conditions appeared to be relatively similar to that noted in the 1972 aerial photograph with multiple dirt access roads crossing the site. A race track, sports complex, and Highway 178 also appeared to the north and northeast of the site.

Review of the 1994 aerial photograph indicates that the project site conditions appeared to be relatively similar to that noted in the 1989 aerial photograph.

Review of the 2002 aerial photograph indicates that the project site conditions appeared to be relatively similar to that noted in the 1994 aerial photograph, with mass grading or fill placement visible along the eastern portion of the site.

Review of the 2010 aerial photograph indicates that the project site conditions appeared to be relatively similar to that noted in the 2002 aerial photograph with residential house pads appearing to the north of the project area. The previously mentioned race track and sports complex to the northeast were removed.

Review of the 2013 aerial photograph indicates that Highland Knoll Drive and Vineland Road were constructed on the north and west sides of the site and construction of multiple school buildings appeared in the northern and western portions of the site.

Review of the 2016 aerial photograph indicates that the site consisted of completed elementary and middle school campuses. Together, the schools consisted of approximately 15 buildings, asphaltic concrete parking lots, drop off lanes, play courts, lawn play fields, two tracks, and solar arrays. The update project area consisted of a lawn play area primarily.

Review of the 2022 aerial photograph indicates that the project site conditions appeared to be relatively similar to that noted in the 2016 aerial photograph, with houses appearing on the eastern portion of the previously mentioned residential area to the north of the site.

The conditions shown on the aerial photographs indicate the site predominately consisted of grazing land and jeep trails prior to the school completion in 2014. With the exception of several lineal features identified as drainage channels, jeep trails, previously graded areas, and streets, no distinct lineaments, tonal variations, or other potential fault related features are shown on or adjacent to the property in the aerial photographs.

Presently, the site conditions appear similar to those noted in the 2022 aerial photograph. Several medium sized trees, a chain linked fence, Highland Knolls Drive, and a residential subdivision are located to the north; a chain linked fence, utility area, and an asphaltic concrete parking lot are located to the west; two classroom buildings and asphaltic concrete play courts are located to the south; and lawn play fields area located to the east. Buried utility lines are located within or near the proposed development. The project area is relatively level with no major changes in grade.

No evidence of surface faulting was observed on the property during our recent site visit. No evidence of slope failures or instabilities were observed on the subject property or adjoining properties.

GEOLOGIC SETTING

General

The subject property is located along the east margin of the southern San Joaquin Valley portion of the Great Valley Geomorphic Province of California. The San Joaquin Valley is bordered to the north by the Sacramento Valley portion of the Great Valley, to the east by the Sierra Nevada, to the west by the Coast Ranges, and to the south by the Transverse Ranges. The San Joaquin sedimentary basin is separated from the Sacramento basin to the north by the buried Stockton arch and associated Stockton Fault. The buried Bakersfield arch near the south end of the valley separates the relatively small Maricopa-Tejon subbasin at the south end of the San Joaquin basin from the remainder of the basin. The 450-mile long Great Valley is an asymmetric structural trough that has been filled with a prism of Mesozoic and Cenozoic sediments up to 5 miles thick.

The Sierra Nevada, located east of the San Joaquin Valley, is gently southwesterly tilted fault block comprised of igneous and metamorphic rocks of pre-Tertiary age that comprise the basement beneath the San Joaquin Valley. The Coast Ranges, located west of the San Joaquin Valley, are comprised of folded and faulted sedimentary and metasedimentary rocks of Mesozoic and Cenozoic age.

The Kern River is the principal river in the area. Alluvial fans formed by this river are the predominant geomorphic features in the Bakersfield area. The area of the subject site is characterized by alluvial fans, rolling foothills with ridges, and plains, which constitute a belt of coalescing alluvial fans of low relief between the dissected uplands, adjacent to the Sierra Nevada and the valley trough.

The general area of the subject site is known for significant oil and gas production. Six medium-to large-size oil fields are located in the vicinity: the Kern River, the Kern Bluff, the Fruitvale, the Mountain View, the Ant Hill, and the Edison Oil Fields. The project site is located just east of the areas designated as the Ant Hill Field and the Kern Bluff Field. These oil fields were discovered in the 1920's, but it was not until the middle 1930s that production began to increase significantly.

A regional geologic map and a regional geologic cross section are presented on Figures 4 and 5, respectively.

Lithology

The thick accumulation of deposits within the San Joaquin Valley range in age from Jurassic to Holocene and include both marine and continental rocks and deposits. The thickness of sediments underlying the valley is probably in excess of 35,000 feet in the Buena Vista-Kern Lake area about 23 miles southwest of the property. These beds, ranging in age from Cretaceous to Holocene, rest unconformably upon a crystalline basement complex. The uppermost lithologic unit in the Ant Hill Oil Field, situated just east of the property, consists of the Plio-Pleistocene Kern River formation. The Kern River formation extends to a depth of about 700 feet where it is unconformably underlain by more than 3,000 feet of Miocene marine sediments. Schist of upper Jurassic age forms the basement rocks at a depth of about 4,000 feet. The central portion of the property is shown to be overlain by Pleistocene higher terraces and extensive older alluvial fans.

The 1984 Geologic Map and Cross Sections of the Southern Margin of the San Joaquin Valley, California (Alan Bartow, 1984) indicates that the near-surface deposits in area of the subject site are identified as Pleistocene age underlying higher terraces and in extensive older alluvial fans (Qoa2) and Plio-Pleistocene to upper Miocene Kern River Formation (QTkr) (refer to Figure 5). Oil entrapment is due to a faulted anticline and lenticular sands (California Division of Oil and Gas, 1973). The subsurface geology beneath the subject property should be nearly identical to that shown on the above referenced figure.

The surface and near surface deposits at the property consist of clayey sand, silty sand, and silty sand/clayey sand with gravel and cobble was encountered. The surface soil is classified as the Chanac Clay Loam, Cnyama Loam, and Delano Sandy Loam, 2 to 15 percent slopes (U.S. Department of Agriculture, 1988). This soil association consists of moderately fine to coarse texture and well drained soils derived dominantly from granitic rock. The 1964 Geologic Map of California, Bakersfield Sheet, indicates that the near-surface deposits in area of the subject site consist of Plio-Pleistocene Nonmarine Sedimentary deposits composed of poorly bedded, loosely consolidated sand, silt, clay, gravel, cobbles, and boulders. Bartow and Doukas (1976) mapped the sediments as the Kern River formation of Anderson (1911). In general, the Kern River Formation is a poorly bedded, loosely consolidated brownish-colored unit. The lower portion consists of alternating lenses of gray-green mudstone and coarse-grained, pebbly, cross-bedded sandstone. The unit coarsens upwards to lenticular coarse-grained sandstone and conglomerate.

The subsurface information obtained in conjunction with the subsurface Investigation performed concurrent with this study indicates that the surface and near-surface deposits at the subject site generally consist of sandy silts, silty sands, sands, and silty clayey sands with gravel and cobbles. These observed deposits are consistent with those mapped in the area, and are further described in soil profile and subsurface conditions section of this report.

Structure and Faults

The general area of the subject site is underlain by a monoclinal series of Cenozoic deposits dipping 4 to 6 degrees to the southwest toward the center of the San Joaquin Valley. The contact between the Cenozoic and basement rocks dips nearly 8 degrees southwest, or at a slightly greater inclination than does the on-lapping homoclinal Cenozoic sequence. A slightly elevated basement structure, the Bakersfield Arch is located in the vicinity of the site. This structure is considered to have controlled sedimentation within the far southern portion of the valley.

The south end of the San Joaquin Valley is bordered on the west, south, and east by three major fault systems: the San Andreas, Garlock, and Breckenridge-Kern Canyon faults, respectively. All three of these faults zone appear to be directly related to the uplifting of the mountain ranges in which they are located and the downwarping of the intermediate land mass which constitutes the San Joaquin Valley portion of the Great Valley Geosyncline. The forces which have resulted in the formation of these major fault zones and the continuing movements along them have had great influence locally in the valley floor in the form of folding and faulting of the thick section of sedimentary beds and the underlying basement complex. Deformation of the sedimentary rocks in the area has not been restricted to faulting. Localized folding had also occurred within the geosyncline forming entrapments for oil and gas accumulations.

Numerous surface faults have been mapped in the vicinity of the project site. Review of published geologic mapping (CGS 1964, Bartow 1974-1986, CGS 1994 and 2010) shows six unnamed inferred faults located within the project site vicinity. Two of the faults mapped approximately 1,000 feet west and 4,000 feet east of the project site and were determined to be undivided Quaternary faults showing evidence of displacement during the last 1.6 million years. Geologic mapping performed by J. Alan Bartow between 1974 and 1986 showed one inferred fault trending roughly northwest-southeast within the Kern River Formation (Pleistocene, Pliocene, and Upper Miocene) and Older Alluvium (Pleistocene) through the central portion of the site (refer to Local Geologic Map, Figure 6). In addition, Bartow showed several other inferred faults within the project site vicinity during his previous mapping. Prior to January 1976, the State of California evaluated these faults mapped by Bartow, as well as other previously mapped faults in the vicinity. The State Geologist determined that the inferred fault trending through the project site as well as several other inferred faults in the project site vicinity, are not well-defined and not active faults. The faults in this region were again evaluated prior to January 1985 by the State of California. The conclusions for the project site and vicinity were similar to the 1976 conclusions. Therefore, the faults inferred by Bartow (1974-1986) within the project site and vicinity are not included on the original Special Studies Zones Map "Oil Center Quadrangle," dated January 1, 1976, and are not included on the current Fault-Rupture Hazard Zones Map "Oil Center Quadrangle,

Revised Official Map," Effective January 1, 1985. The nearest mapped Fault-Rupture Hazard Zones are located approximately 6,300 feet northeast of the site and are associated with the 1952 earthquake(s) (refer to Earthquake Epicenter Map, Figure 8).

During our site visits, an effort was made to locate the previously inferred faults mapped by Bartow. No obvious evidence of the faults was observed on the project site or vicinity during our site visit. No faults were observed within the area proposed for development during our site visit. Even though the inferred fault that trends through the project site and those faults that are inferred to trend within the project site vicinity, may be well defined locally, the State of California has determined that these faults do not appear sufficiently active to warrant zoning as active faults under the Alquist-Priolo Earthquake Fault Zoning Act. The above referenced inferred faults are depicted on geologic maps as cutting or inferred to cut Pleistocene deposits or older sediments/rock. None are shown to offset Holocene (less than 11,700 years) deposits. Since no evidence has been found that would indicate that an active fault is located on the project site, we have found no fault-related reason to discourage the proposed development.

The Sierra Nevada and Coast Ranges are geologically young mountain ranges and possess active and potentially active fault zones. Major active faults and fault zones occur at some distance to the east, west, and south of the project site. The Sierra Nevada and Owens Valley Fault Zones bound the eastern edge of the Sierra Nevada block approximately 52 and 74 miles east of the site, respectively. Numerous active faults are present within the San Joaquin Valley, San Emigdio Mountains, and Tehachapi Mountains south of the site including the White Wolf, Pleito Thrust, Garlock, and San Andreas Faults. These faults are located approximately 15, 28, 34, and 39 miles from the site, respectively.

The White Wolf Fault (responsible for a 1952 earthquake that caused extensive damage in the Bakersfield area) is located in the tectonically active Tehachapi Mountains as the southerly terminus of the valley, approximately 15 miles south of the subject site.

A significant seismotectonic source located northwesterly of the site is the Great Valley Fault Zone (Coast Ranges-Central Valley boundary zone) located approximately 73 miles northwest of the site. The Great Valley Fault zone is the geomorphic boundary of the Coast Ranges and the Central Valley and is underlain by a 300-mile long seismically active fold and thrust belt that has been the source of recent earthquakes, such as the 1983 magnitude 6.5 Coalinga and the 1985 magnitude 6.1 Kettleman Hills earthquakes. Nearly the entire thrust system is concealed or "blind".

Tensional forces resulting in normal faults are reported to be related to crustal stress relief in the southeast portion of the San Joaquin Valley. Numerous relatively short, normal faults traverse this region. Creep activity is the prominent mode of slip on those faults in this region that are active. These movements have continued on an intermittent basis from the early Miocene to Recent time. This faulting is directly related to and controls the accumulation of oil in several oil fields within the easterly portion of the valley. Most authors agree that current creep movements can be ascribed to subsidence promoted by extensive withdrawal of petroleum, and in some cases, groundwater. Those faults considered to be active in the southern valley are the Kern Front and Pond Faults located approximately 9 miles northwest of the subject site.

The Kern Front, Premier and New Hope Faults, are actively creeping westerly-dipping normal faults in oil-producing areas. The Buena Vista Fault, also located within a nearby oil producing area, is indicated to be a north-dipping thrust fault. Recent aseismic movement along these pre-existing faults is considered to be related to oil field fluid withdrawal. In addition, numerous unnamed faults are mapped within the oil fields in the vicinity of the site. The majority of the mapped faults associated with the oil fields, do not extend through the Kern River Formation to the surface and have been mapped based on extensive subsurface exploration associated with the oil industry. The Pond Fault is a relatively minor, actively creeping west-dipping to vertical normal fault which is considered to be due to differential subsidence caused by groundwater withdrawal.

Numerous faults are mapped east of Bakersfield, including the Kern Gorge, the Edison, the Breckenridge Faults, and several unnamed faults. These faults are typically northwest trending normal faults. Several of these faults display features indicative of Holocene displacement.

As noted above, several dominant faults with seisomgenic structures are located in the vicinity of the subject site. Table I is a listing of active faults or seismogenic structures within 50 miles of the site, and a Fault Activity Map is provided on Figure 7.

GEOLOGIC HAZARDS

Fault Rupture Hazard Zones in California

The Alquist-Priolo Geologic Hazards Zones Act went into effect in March, 1973. Since that time, the act has been amended 11 times (Hart, 2007). The purpose of the Act, as provided in DMG Special Publication 42 (SP 42), is to prohibit the location of most structures for human occupancy across the traces of active faults and to mitigate thereby the hazard of fault-rupture." The act was renamed the Alquist-Priolo Earthquake Fault Zoning Act in 1994, and at that time, the originally designated "Special Studies Zones" was renamed the "Earthquake Fault Zones."

As indicated by SP 42, "the State Geologist is required to delineate "earthquake fault zones" (EFZs) along known active faults in California. Cities and counties affected by the zones must regulate certain development 'projects' within the zones. They must withhold development permits for sites within the zones until geologic investigations demonstrate that the sites are not threatened by surface displacement from future faulting. The State Mining and Geology Board provides additional regulations (Policies and Criteria) to guide the cities and counties in their implementation of the law (CCR, Title 14, Division 2)."

Special Publication 42 also provides definitions of certain terms, which are important to the evaluation of seismic hazards. These include the definitions for a fault and a fault trace. They also include the following:

Active Fault: One which has had surface displacement within Holocene time (about the last 11,000 years), hence constituting a potential hazard to structures that might be located across it.

Potentially Active Fault: Initially, faults were defined as *potentially active*, and were zoned, if they showed evidence of surface displacement during Quaternary time (last 1.6 million years). The term "recently active" was not defined, as it was considered to be covered by the term "potentially active."...the term "potentially active" continued to be used as a descriptive term on map explanations on EFZ maps until 1988.

Sufficiently Active and Well-Defined: There are so many potentially active faults in the State that it would be meaningless to zone all of them. The State Geologist made a policy decision to zone only those potentially active faults that have a relatively high potential for ground rupture. To facilitate this, the terms "sufficiently active" and "well-defined," were defined for zoning faults other than the 4 named in the Act. These two terms constitute the present criteria used by the State Geologist in determining if a given fault should be zoned under the Alquist-Priolo Act.

Sufficiently active: A fault is deemed sufficiently active if there is evidence of Holocene surface displacement along one or more of its segments or branches. Holocene surface displacement may be directly observable or inferred.

Well-defined: A fault is considered well-defined if its trace is clearly detectable by a trained geologist as a physical feature at or just below the ground surface. The fault may be identified by direct observation or by indirect methods. The critical consideration is that the fault, or some part of it, can be located in the field with sufficient precision and confidence to indicate that the required site-specific investigations would meet with some success.

Review of the current Fault Rupture Hazard Zones Map "Oil Center Quadrangle, Revised Official Map, Effective January 1, 1985" indicates that the site is not within a Fault-Rupture Hazard Zone. The nearest Fault Rupture Hazard Zones are located approximately 6,300 feet northeast of the site and are associated with the 1952 earthquake.

Seismic Hazard Zones in California

In 1990, the California State Legislature passed the Seismic Hazard Mapping Act to protect public safety from the effects of strong shaking, liquefaction, landslides, or other ground failure, and other hazards caused by earthquakes. The Act is codified in the Public Resources Code as Division 2, Chapter 7.8, Sections 2690-2699.6 and became operative on April 1, 1991. The program and actions mandated by the Seismic Hazards Mapping Act closely resemble those of the Alquist-Priolo Earthquake Fault Hazards Zones Act (described above in Section 7.1). The Act requires that the State Geologist delineate various seismic hazards zones on Seismic Hazards Zones Maps. Specifically, the maps identify areas where soil liquefaction and earthquake-induced landslides are most likely to occur. The Act directs cities, counties, and state agencies to use the maps in their land use planning and permitting processes. A site-specific geotechnical evaluation is required prior to permitting most urban developments within the mapped zones. The Act also requires sellers of real property within the zones to disclose this fact to potential buyers.

Due to the recency of enaction of the Act, a limited number of Seismic Hazard Zone Maps have been prepared as of this writing. Areas covered by the preliminary maps released to date include portions of the immediate San Francisco Bay area and several areas in Los Angeles, Orange, and Ventura Counties. The area of the subject site is not included on any of the maps released to date.

In the 1970's, the Kern County Council of Governments contracted with consultants to prepare a Seismic Hazards Atlas for the various United States Geological Survey, 7.5-minute topographic quadrangle maps throughout the Kern County region. According to the Geologic Map and Cross Sections of the Southeastern Margin of the San Joaquin Valley, California by Alan Bartow, 1984, one inferred fault is located within the project site. Multiple other faults were inferred to be located approximately 1,500 feet west and 3,400 feet northeast of the proposed school site. Review of the Earthquake Zones of Required Investigations Map indicates the proposed school site is not located within a seismic hazard zone and a previous Fault Rupture Potential Study by Krazan & Associates was completed on October 28, 2011 to identify if this inferred fault existed within the school limits. The study showed that the inferred fault running through the school site was not found to a hazard to the school development. Therefore, no active faults were shown to be located on the proposed school site (Earthquake Zones of Required Investigation, Figure 10).

Historic Seismicity/Earthquake Epicenter Distribution

The Bakersfield area has historically experienced a low to moderate degree of seismicity. A listing of historic earthquakes with magnitudes greater than 4.0 within approximately 50 miles (80 kilometers) of the subject site was obtained from the comprehensive California Geological Survey computerized earthquake catalog for the State of California, the Townley and Allen (1939) catalog and the U.S. Geological Survey Earthquake Data Base System. In addition, a listing of historic earthquakes with magnitudes greater than 5.0 within approximately 100 miles of the subject site was obtained. The listings include the date, time, location, depth, magnitude, and intensity all recorded events within the search radius between 1800 and 2023. A review of the literature for pre-1900 earthquakes (Toppozada, 1991) does not reveal any significant recorded seismic events in the vicinity of the subject site prior to the period covered by the above noted listings.

The historic earthquake listings are included in **Table II.** A plot of epicenters associated with historic earthquakes in the region of the site with magnitudes greater than 5 is shown on Figure 8, Epicenter Map. The earthquake data indicates that 332 events with magnitudes greater than 4.0 occurred within 50 miles of the subject site between 1800 and 2023. The earthquake closest to the site was about 1.9 miles away. The largest magnitude found in the search radius was 7.9 occurring January 9, 1857.

The most recent earthquake significant to the site area was the seismic event which occurred on July 21, 1952. A significant number of the listed historic earthquakes occurred in 1952 and are considered related to the Arvin-Tehachapi earthquake of July 21, 1952. This magnitude 7.7 event affected all of Kern County as well as parts of Los Angeles and Santa Barbara Countries. The earthquake took place near Wheeler Ridge on the White Wolf Fault, located approximately 15 miles southeasterly of the subject site. Vertical displacements of as much as three feet occurred at the fault line. Destruction in the communities of Arvin and Tehachapi was extensive; the quake caused numerous landslides and

damaged highways, bridges, and railroads. Damage to Bakersfield from the main shock was slight, however, on July 29 and August 5, 1952, aftershocks generated just east of Bakersfield produced a great deal of damage to older buildings.

Geologic Subgrade

Information obtained from the geologic literature, as well as data from the above-described site exploration, indicate the general soil profile at the site consists predominately of silty sands, sandy silts, clayey sands, sands, and silty clayey sands. Some of these soils were intermixed with varying amounts of gravel and cobbles. With the exception of a limited occurrence of near-surface loose soils, penetration resistance and laboratory testing indicate that these materials are at least medium dense. Accordingly, the upper 100 feet of geologic subgrade of the site can be conservatively characterized as stiff soil and a Joyner-Boore Class C subgrade classification is considered appropriate for the site and corresponds with a National Earthquake Hazard Reduction Program (NEHRP) (BSSC, 1994) Site Class D. The Site Class per the 2022 California Building Code (2022 CBC) is based upon the site soil conditions. It is our opinion that Site Class D is most consistent with the subject site soil conditions.

Soil Liquefaction

Soil liquefaction is a state of soil particles suspension caused by a complete loss of strength when the effective stress drops to zero. Liquefaction normally occurs in soils such as sand in which the strength is purely friction. However, liquefaction has occurred in soils other than clean sand. Liquefaction usually occurs under vibratory conditions such as those induced by seismic event.

To evaluate the liquefaction potential of the site, the following items were evaluated:

1) Groundwater depth;

2) Soil type;

3) Relative density;

4) Initial confining pressure;

5) Intensity and duration of groundshaking.

Due to the fact that we encountered auger refusal at a depth of 5½ to 17 feet during our recent update investigation due to shallow gravel and trace cobbles, the soil conditions for the liquefaction analysis for the New Elementary and Middle School June-July 2009 and February-March 2011 (022-11004) were also used for the update report.

The soils encountered within the project site predominately consist of silty sands, sandy silts, clayey sands, sandy clays, silty clayey sand, and sands. These soils were occasionally intermixed with varying amounts of gravel and cobbles. Moderate cohesion strength is associated with the clayey soils. Groundwater was not encountered below the site within a depth of 70 feet during subsurface exploration.

Available groundwater depth mapping indicates that historically groundwater has been located at depths greater than 200 feet below site grade. Based on our findings, it is our opinion that the potential for soil liquefaction within the project site is very low due to the moderate to high corrected standard penetration blow counts (N-Values predominately greater than 30), and the lack of groundwater. Therefore, measures to mitigate seismic-induce liquefaction are not necessary.

Seismic Settlement

One of the most common phenomena during seismic shaking accompanying any earthquake is the induced settlement of loose unconsolidated soils. Based on the nature of the subsurface materials, and the relatively low to moderate seismicity of the region, we would not expect seismic settlement or lateral spread to represent a significant geologic hazard to the site.

The estimated seismic settlement was determined at the site using the settlement analysis method by Tokimatsu, Seed, and Bolton (1987). The results of the settlement analyses are included as follows:

Seismic Settlement (inches)						
Location	**Depth**	**Saturated Settlement**	**Unsaturated Settlement**	**Total Settlement**	**Range of Differential Settlement**	**Design for Differential Settlement**
B2 – 2009	23	0.0	0.04	0.04	0.009 to 0.025	**1 Inch in 100 Feet**
B2 – 2009	50	0.0	0.05	0.05	0.248 to 0.328	
B22 – 2009	20	0.0	0.03	0.03	0.014 to 0.019	
B22 – 2009	50	0.0	0.47	0.47	0.237 to 0.313	
B24 – 2009	20	0.0	0.04	0.04	0.019 to 0.025	
B24 – 2009	50	0.0	0.32	0.32	0.159 to 0.210	
B1 – 2011	44	0.0	0.13	0.13	0.065 to 0.086	
B2 – 2011	52	0.0	0.19	0.19	0.095 to 0.125	
B8 – 2011	70	0.0	0.25	0.25	0.124 to 0.164	
B201 - 2024	17	0.0	0.03	0.03	0.017 to 0.022	
B101 - 2023	Shallow refusal at 15 feet-gravels/trace cobbles					

Some of the borings were terminated due to auger refusal in cobbles. However, for the settlement analysis the lower soils were projected to a depth of 50 feet using a conservative N-value.

The above settlement values were determined at specific boring locations. The consolidated settlement (under static load of specific structures) and differential settlement (per specified length in building area) should be included in the Geotechnical Engineering Investigation reports for each building or cluster of building as needed.

The upper native soils within the project site are moisture sensitive and conducive to hydrocollapse. In addition, any loose fill materials at the site could be vulnerable to hydrocollapse. However, this hazard can be mitigated by following the design and construction recommendations of current and future Geotechnical Engineering Investigations (over-excavation and rework of any loose soils and/or uncertified fill materials).

Unnamed drainage channels are located in ravines that trend roughly north to south approximately 300 feet east of the school site. These drainage channels consist of natural ravines and swales up to 8 feet deep with sidewalls sloping approximately 15 degrees. Some of the channels are planned to be piped underground. The structures planned for development will be located greater than 500 feet away from the open drainage channels. The potential for lateral spreading was evaluated using the "Revised Multilinear Regression Equations for Predication of Lateral Spread Displacement" by Youd, Hansen, Corbett and Bartlett (2002). Based on a lack of liquefiable soils within the project site and the distance of proposed structures from the existing canals and a lack of saturated cohesionless sediments with $(N1)_{60}$ less than 15, the site is not likely subject to lateral spreading hazards.

Subsidence Due to Fluid Withdrawal

Portions of the San Joaquin Valley have been subject to land subsidence due to fluid withdrawal (groundwater and petroleum). However, the area of the subject site is not known to be subject to such subsidence hazards.

Expansive Soils

The surface and near-surface soils observed on the site surface consist of silty sands, sandy silts, clayey sands, sands, and sandy clayey silts. These soils were occasionally intermixed with varying amounts of gravel and cobbles. These materials are considered to have a low to moderate expansion potential. However, this hazard can be mitigated by following the design and construction recommendations of current and future Geotechnical Engineering Investigations (support slab-on-grade and exterior flatwork areas with a minimum 24 inches of non-expansive or lime-treated Engineered Fill).

Inundation Hazards

A review of Federal Emergency Management Agency (FEMA) Flood Insurance Mapping for the area of the subject site (Community Panel Number 0600751050B, unprinted) indicates that the subject site is within "Zone X", "Areas of minimal flooding."

A review of the Office of Emergency Services and Corps of Engineers Dam Inundation Mapping for the area of the subject site indicates that the subject site is not within an "Inundation Area" should a failure occur at the Isabella Lake Dam located 29 miles northeast.

Tsunamis and Seiches

A tsunami is a series of ocean waves generated in the ocean by an impulsive disturbance. Due to the inland location of the subject site, tsunamis are not considered a threat to the site. Seiches are standing waves in a body of water such as a lake or reservoir. Because such a body of water is not located near the site, seiches are not anticipated to affect the subject site.

Slope Stability and Potential for Slope Failure

The site is located within a generally gentle sloping to slightly hilly topography with a maximum relief of approximately 41 feet across the site. It is recommended that proposed cut and fill slopes be constructed to 2:1 (horizontal to vertical) or flatter. In lieu of the slopes, a retaining wall may be used. Cut and fill slopes for the slab areas should not exceed to 2:1 (horizontal to vertical). Cut and fill slopes may be revised as recommended by the Geotechnical Engineer of Record upon his review of a more definite site plan.

In order to reduce post-construction differential settlement, all structures that are in cut/fill transition zones should be cut to a minimum of 3 feet below the bottom of the deepest foundation. This excavation should extend a minimum of 5 feet beyond structural elements or to a minimum distance equal to the depth of over-excavation, whichever is greater. The resulting excavations should be backfilled with Engineered Fill.

Where fills greater than 8 feet are to be constructed on original ground that slopes at inclinations exceeding 6:1 (horizontal to vertical), benches should be cut into the natural slope as the filling operations proceed. Each bench should consist of a level terrace a minimum of 10 feet wide, with the rise to the next bench held for 4 feet or less. Where fills of comparable height will be constructed on ground slopes at an inclination exceeding 4:1 (horizontal to vertical), a keyway should be provided in addition to the benches. Each keyway should consist of level trench at least 10 feet wide and at least 2 feet deep, with side slopes not exceeding 1:1 (horizontal to vertical), cut into the natural slope.

Due to the generally gentle sloping to slightly hilly nature of the site and surrounding areas, and the plan to construct a relatively level school site, problems from landslides are not anticipated to affect this site, provided the grading conforms to the requirements of the 2022 California Building Code as well as current and future Geotechnical Engineering Investigation reports.

Volcanic Hazards

The subject site is not within an area known to be affected by volcanic hazards (Miller, 1989, USGS Bulletin, 1847).

County Seismic Safety Element

Documentation and mapping included in the Safety Element of the Kern County General Plan, dated March 2007, the Seismic Safety Element of the Metropolitan Bakersfield General Plan, dated December 2007 and General Plan Update EIR, dated June 2002 were reviewed. The Metropolitan Bakersfield

General Plan is currently in the process of being updated. In addition, we reviewed the Seismic Safety Supplement to the Safety Element adopted June 1987. The seismic information contained within the Seismic Safety Elements is somewhat dated and/or generalized and is superseded by more detailed or recent information and analyses described herein. The referenced documents generally indicate that the site area is subject to relatively moderate seismicity and related hazards.

FIELD AND LABORATORY INVESTIGATIONS

Subsurface investigations, consisting of exploratory drilling, were performed at the site in June-July 2009 and February-March 2011, August 2023, and August 2024. Subsurface soil conditions were explored by drilling 62 borings to depths ranging from approximately 4 to 70 feet, using a truck-mounted drill rig. In addition, 3 bulk subgrade samples were collected for laboratory R-Value testing. The approximate boring and bulk sample locations are shown on the Site Geologic Map, Figure No. 2. During drilling operations, penetration tests were performed at regular intervals to evaluate soil consistency and to obtain information regarding engineering properties of the subsoils. Soil samples were retained for laboratory testing. The soils encountered were continuously examined and visually classified in accordance with the Unified Soil Classification System. Three Site Geologic Cross Sections based on the exploratory drilling data are provided on Figures 3.1, 3.2, and 3.3.

Laboratory tests were performed on selected soil samples to evaluate their physical characteristics and engineering properties. The laboratory testing program was formulated with emphasis on the evaluation of natural moisture, density, gradation, expansion potential, shear strength, consolidation potential, and moisture-density relationships of the materials encountered. This information, along with the field observations, was used to prepare the final boring logs in Appendix A.

SOIL PROFILE AND SUBSURFACE CONDITIONS

Based on our findings, the subsurface conditions encountered appear typical of those found in the geologic region of the site. In general, the surface soils in the borings drilled throughout the school site consisted of 6 to 12 inches of very loose silty sand, sandy silt, clayey sandy silt, and silty clayey sand. These soils are disturbed, have low strength characteristics, and are highly compressible when saturated.

Approximately 1 to 12 feet of fill material was encountered along the edges and within the southeast portion of the site. The fill material predominately consisted of silty sand, sandy silt, sandy clayey silt, and silty clayey sand. These soils were occasionally intermixed with varying amounts of gravel and cobbles. The thickness and extent of fill material was determined based on limited test borings and visual observation. Thicker fill may be present at the site. Verification of the extent of fill should be determined during site grading. Limited testing was performed on the fill soils during the time of our field and laboratory investigations. The limited testing indicates that the fills soils had varying strength characteristics ranging from loosely placed to compacted. Representative samples of the clayey soil had expansion indices of 34 and 77.

Below the loose surface soils and fill material, approximately 2 to 3 feet of loose to very dense silty sand, sandy silt, clayey sand, sandy clay, clayey sand/silty sand, silty clayey sand, and sand were encountered. Some of these soils were intermixed with varying amounts of gravel and cobbles. Field

and laboratory tests suggest that these soils are moderately strong and slightly to moderately compressible. The clayey soils have a low to moderate potential for expansion. Penetration resistance ranged from 13 blows per foot to greater than 50 blows per 6 inches. Dry densities ranged from 93 to 123 pcf. Representative soil samples consolidated approximately 1½ to 5 percent under a 2 ksf load when saturated. Representative soil samples had angles of internal friction of 31 to 36 degrees. Representative samples of the clayey soils had expansion indices of 43 and 130.

Below 2½ to 4 feet, predominately medium dense to very dense silty sand, clayey sand, sandy silt, silty sand, or sand were encountered. These soils were occasionally intermixed with varying amounts of gravel and cobbles. Field and laboratory tests suggest that these soils are moderately strong and slightly compressible. The clayey soils had a moderate potential for expansion. Penetration resistance ranged from 29 blows per foot to greater than 50 blows per 6 inches. Dry densities ranged from 93 to 131 pcf. Representative soil samples consolidated approximately 1 to 3 percent under a 2 ksf load when saturated. These soils extended to the termination depth of our borings. Several of the borings were terminated at a shallower depth due to auger refusal within gravel and cobbles.

For additional information about the soils encountered, please refer to the logs of borings in Appendix A.

GROUNDWATER

Test boring locations were checked for the presence of groundwater during and immediately following the drilling operations. Groundwater was not encountered within a depth of 70 feet below site grade during the field investigation. Review of the Kern County Water Agency map entitled "Depth to Groundwater, Spring 2000" indicates that groundwater depth in the area of the subject site is on the order of 500 feet. Review of groundwater elevation maps prepared by the Department of Water Resources dating from 1961 to 2004 indicates a lack of available data within the project site vicinity in order to determine groundwater depths. Groundwater within this region of Kern County is typically encountered at depths greater than 200 feet below site grade. It should be recognized that water table elevations may fluctuate with time, being dependent upon seasonal precipitation, irrigation, land use, and climatic conditions as well as other factors.

CONCLUSIONS AND RECOMMENDATIONS

Based on the findings of our field and laboratory investigations, along with previous geotechnical experience in the project area, the following is a summary of our evaluations, conclusions, and recommendations.

Administrative Summary

In brief, the subject site and soil conditions, with the exception of the existing development, upper moisture sensitive soils, fill material and the expansive nature of the clayey soils, appear to be conducive to the development of the project. Of primary importance in the development of this site is the removal of the upper moisture sensitive soils from areas of proposed development. In addition, in order to reduce the potential for differential settlement, it is recommended that following stripping and fill removal

operations, the upper 3 feet of native soil within the proposed building areas be excavated, worked until uniform and free from large clods, moisture-conditioned to a minimum of 2 percent above optimum moisture content, and recompacted to a minimum of 90 percent of maximum density based on ASTM Test Method D1557. Furthermore, it is recommended that the proposed foundations be supported by a minimum of 2 feet of Engineered Fill. Over-excavation should extend to a minimum of 5 feet beyond proposed footing lines. The base width of the over-excavation should be established on the basis of a 60-degree upward projection from the bottom of the footings. Prior to fill placement, the exposed subgrade soils should be scarified to a depth of 6 inches, moisture-conditioned to a minimum of 2 percent above optimum moisture content, and recompacted to a minimum of 90 percent of maximum density based on ASTM Test Method D1557.

Approximately 1 to 12 feet of fill material was encountered in the southeast portion and along the edges of the site. Approximately 3½ to 5½ feet of fill material was encountered in the area of the new modular classroom. These soils consisted of clayey sand and clayey sand with gravel. The fill material encountered in our previous investigations predominately consisted of silty sand, sandy silt, sandy clayey silt, and silty sand with clay. Some of these soils were intermixed with varying amounts of gravel and cobbles. The thickness and extent of fill material was determined based on limited test borings and visual observation. Thicker fill may be present at the site. Verification of the extent of fill should be determined during site grading. Limited testing was performed on the fill soils during our field and laboratory investigations. The limited testing indicates the fill soil ranged from loosely placed to compacted. Therefore, it is recommended that fill soils which have not been properly compacted and certified be completely removed so that the native soils may be properly prepared. The clayey soils will not be suitable for reuse as non-expansive Engineered Fill. The clayey soils will be suitable for reuse as General Engineered Fill within pavement areas and below 24 inches from finished pad grade in slab-on-grade and exterior flatwork areas, provided they are cleansed of excessive organics, debris, fragments larger than 4 inches in diameter and moisture-conditioned to a minimum of 2 percent above optimum moisture. Prior to backfilling, Krazan & Associates, Inc. should inspect the bottom of the excavation to verify no additional removal is required.

Clayey sands and sandy clayey silts were encountered in portions of the site. These clayey soils have a moderate swell potential. The estimated swell pressures of the clayey soils may cause minor movement affecting slabs and possible stucco or similar brittle exterior finishes. To reduce potential soil movement, it is recommended the upper 24 inches of soil within slab-on-grade and exterior flatwork areas consist of non-expansive Engineered Fill. During construction, it is recommended that additional tests be performed on the on-site soils to verify their physical and index properties. Prior to backfilling, Krazan & Associates, Inc. should inspect the bottom of the excavations to verify no additional excavation will be required.

As an alternative to the use of non-expansive soils, the upper 24 inches of soil supporting slab-on-grade areas can consist of lime-treated clayey soils. The lime-treated soils should be recompacted to a minimum of 90 percent of maximum density. Preliminary application rate of lime should be 5 percent by dry weight. The lime material should be calcium oxide, commonly known as quick-lime. The clayey soils should be at or near optimum moisture during the mixing operations. An acceptable alternate section consists of 18 inches of lime-treated clayey soils overlain by 6 inches of Class 2 aggregate base.

Residential and commercial developments are located within the project site vicinity. Associated with these developments are buried structures that may extend into the project site. Any buried structures, including loosely backfilled excavations, encountered within the site during construction should be properly removed and the resulting excavations backfilled with Engineering Fill. Disturbed areas caused by demolition activities should be removed or recompacted.

In order to reduce post-construction differential settlement, all structures that are in cut/fill transition zones should be cut to a minimum of 3 feet below the bottom of the deepest foundation. This excavation should extend a minimum of 5 feet beyond structural elements or to a minimum distance equal to the depth of over-excavation, whichever is greater. The resulting excavations should be backfilled with Engineered Fill.

The site is located within a hilly topography. It is recommended that proposed cut and fill slopes be constructed to 2:1 (horizontal to vertical). In lieu of the slopes, a retaining wall may be used. Cut and fill slopes for the slab area should not exceed to 2:1 (horizontal to vertical). Cut and fill slopes may be revised as recommended by the Soils Engineer upon his review of a more definite site plan.

Where fills greater than 8 feet are to be constructed on original ground that slopes at inclinations exceeding 6:1 (horizontal to vertical), benches should be cut into the natural slope as the filling operations proceed. Each bench should consist of a level terrace a minimum of 10 feet wide, with the rise to the next bench held for 4 feet or less. Where fills of comparable height will be constructed on ground slopes at an inclination exceeding 4:1 (horizontal to vertical), a keyway should be provided in addition to the benches. Each keyway should consist of level trench at least 10 feet wide and at least 2 feet deep, with side slopes not exceeding 1:1 (horizontal to vertical), cut into the natural slope.

Sandy and gravelly soil conditions were encountered at the site. These cohesionless soils have a tendency to cave in trench wall excavations. Shoring or sloping back trench sidewalls may be required within these sandy and gravelly soils.

After completion of the recommended site preparation, the site should be suitable for shallow footing support. The proposed structure footings may be designed utilizing an allowable bearing pressure of 2,500 psf for dead-plus-live loads. Footings should have a minimum embedment of 18 inches.

Groundwater Influence on Structures/Construction

Based on our findings and historical records, it is not anticipated that groundwater will rise within the zone of structural influence or affect the construction of foundations and pavements for the project. However, if earthwork is performed during or soon after periods of precipitation, the subgrade soils may become saturated, "pump," or not respond to densification techniques. Typical remedial measures include: discing and aerating the soil during dry weather; mixing the soil with dryer materials; removing and replacing the soil with an approved fill material; or mixing the soil with an approved lime or cement product. Our firm should be consulted prior to implementing remedial measures to observe the unstable subgrade conditions and provide appropriate recommendations.

Site Preparation

General site clearing should include removal of vegetation; existing utilities; structures including foundations; basement walls and floors; existing stockpiled soil; trees and associated root systems; rubble; rubbish; and any loose and/or saturated materials. Site stripping should extend to a minimum depth of 2 to 4 inches, or until all organics in excess of 3 percent by volume are removed. Deeper stripping may be required in localized areas. These materials will not be suitable for use as Engineered Fill. However, stripped topsoil may be stockpiled and reused in landscape or non-structural areas.

Approximately 1 to 12 feet of fill material was encountered in the southeast portion and along the edges of the site. Approximately 3½ to 5½ feet of fill material was encountered in the area of the new modular classroom. These soils consisted of clayey sand and clayey sand with gravel. The fill material encountered in our previous investigations predominately consisted of silty sand, sandy silt, sandy clayey silt, and silty sand with clay. Some of these soils were intermixed with varying amounts of gravel and cobbles. The thickness and extent of fill material was determined based on limited test borings and visual observation. Thicker fill may be present at the site. Verification of the extent of fill should be determined during site grading. Limited testing was performed on the fill soils during our field and laboratory investigations. The limited testing indicates the fill soil ranged from loosely placed to compacted. Therefore, it is recommended that fill soils which have not been properly compacted and certified be completely removed so that the native soils may be properly prepared. The clayey soils will not be suitable for reuse as non-expansive Engineered Fill. The clayey soils will be suitable for reuse as General Engineered Fill within pavement areas and below 24 inches from finished pad grade in slab-on-grade and exterior flatwork areas, provided they are cleansed of excessive organics, debris, fragments larger than 4 inches in diameter and moisture-conditioned to a minimum of 2 percent above optimum moisture. Prior to backfilling, Krazan & Associates, Inc. should inspect the bottom of the excavation to verify no additional removal is required.

Following stripping and fill removal operations, the exposed subgrade in pavement and exterior flatwork areas should be excavated to a minimum depth of 18 inches, worked until uniform and free from large clods, moisture-conditioned to a minimum of 2 percent above optimum moisture content, and recompacted to a minimum of 90 percent of maximum density based on ASTM Test Method D1557. Limits of recompaction should extend 5 feet beyond structural elements. This compaction effort should stabilize the surface soils and locate any unsuitable or pliant areas not found during our field investigation.

Structures within the general vicinity have experienced excessive post-construction settlement when the foundation soils become near-saturated. Accordingly, mitigation measures are recommended to reduce the potential for excessive soil settlement. It is recommended that following stripping, fill removal, and demolition activities, the upper 3 feet of native soils within the proposed building areas be excavated, worked until uniform and free from large clods, moisture-conditioned to a minimum of 2 percent above optimum moisture content, and recompacted to a minimum of 90 percent of maximum density based on ASTM Test Method D1557. In addition, it is recommended that the proposed foundations be supported by a minimum of 2 feet of Engineered Fill. Over-excavation should extend to a minimum of 5 feet beyond structural elements. Prior to fill placement, the exposed subgrade soils should be scarified to a

depth of 6 inches, moisture conditioned to a minimum of 2 percent above optimum moisture content. Fill material should be compacted to a minimum of 90 percent of maximum density based on ASTM Test Method D1557. This compaction effort should stabilize the surface soils and locate any unsuitable or pliant areas not found during our field investigation.

In addition, it is recommended that the upper 24 inches of soil within proposed slab-on-grade and exterior flatwork areas consist of non-expansive Engineered Fill or lime-treated Engineered Fill. The intent is to support slab-on-grade and exterior flatwork areas with 24 inches of non-expansive or lime-treated fill. The fill placement serves two functions: 1) it provides a uniform amount of soil which will more evenly distribute the soil pressures and 2) it reduces moisture content fluctuation in the clayey material beneath the building area. The non-expansive fill material should be a well-graded silty sand or sandy silt soil. A clean sand or very sandy soil is not acceptable for this purpose. A sandy soil will allow the surface water to drain into the expansive clayey soil below, which may result in soil swelling. Imported Fill should be approved by the Soils Engineer prior to placement. The replacement soil and/or the upper 24 inches of Imported Fill soils should meet the specifications as described under the subheading Engineered Fill. The replacement soils should extend 5 feet beyond the perimeter of the building. The non-expansive replacement soil should be compacted to at least 90 percent relative compaction based on ASTM Test Method D1557. The exposed native soils in the excavation should not be allowed to dry out and should be kept continuously moist prior to backfilling. In addition, it is recommended that slab-on-grade continuous footings and slabs be nominally reinforced to reduce cracking and vertical off-set.

Residential and commercial developments are located along the edges of the site. Associated with these developments are possible buried structures that may extend into the project site. Any buried structures, including loosely placed fill, encountered within the site during construction should be properly removed and the resulting excavations backfilled. Disturbed areas caused by demolition activities should be removed or recompacted. Excavations, depressions, or soft and pliant areas extending below plan finish subgrade level should be cleaned to firm undisturbed soil and backfilled with Engineered Fill. In general, any septic tanks, debris pits, cesspools, or similar structures should be entirely removed. Oil wells should be abandoned in accordance with state and federal guidelines. Concrete footings should be removed to an equivalent depth of at least 3 feet below proposed footing elevations or as recommended by the Soils Engineer. Any other buried structures should be removed in accordance with the recommendations of the Soils Engineer. The resulting excavations should be backfilled with Engineered Fill compacted to at least 90 percent of maximum density based on ASTM Test Method D1557.

In order to reduce post-construction differential settlement, all structures that are in cut/fill transition zones should be cut to a minimum of 3 feet below the bottom of the deepest foundation. This excavation should extend a minimum of 5 feet beyond structural elements or to a minimum distance equal to the depth of over-excavation, whichever is greater. The resulting excavations should be backfilled with Engineered Fill.

The site is located within a hilly topography. It is recommended that proposed cut and fill slopes be constructed to 2:1 (horizontal to vertical). In lieu of the slopes, a retaining wall may be used. Cut and fill slopes for the slab area should not exceed to 2:1 (horizontal to vertical). Cut and fill slopes may be revised as recommended by the Soils Engineer upon his review of a more definite site plan.

Where fills greater than 8 feet are to be constructed on original ground that slopes at inclinations exceeding 6:1 (horizontal to vertical), benches should be cut into the natural slope as the filling operations proceed. Each bench should consist of a level terrace a minimum of 10 feet wide, with the rise to the next bench held for 4 feet or less. Where fills of comparable height will be constructed on ground slopes at an inclination exceeding 4:1 (horizontal to vertical), a keyway should be provided in addition to the benches. Each keyway should consist of level trench at least 10 feet wide and at least 2 feet deep, with side slopes not exceeding 1:1 (horizontal to vertical), cut into the natural slope.

The upper soils, during wet winter months, become very moist due to the absorptive characteristics of the soil. Earthwork operations performed during winter months may encounter very moist unstable soils, which may require removal to grade a stable building foundation. Project site winterization consisting of placement of aggregate base and protecting exposed soils during the construction phase should be performed.

A representative of our firm should be present during all site clearing and grading operations to test and observe earthwork construction. This testing and observation is an integral part of our service as acceptance of earthwork construction is dependent upon compaction of the material and the stability of the material. The Soils Engineer may reject any material that does not meet compaction and stability requirements. Further recommendations of this report are predicated upon the assumption that earthwork construction will conform to recommendations set forth in this section and the Engineered Fill section.

Slope Construction/Reconstruction

Slopes can be reconstructed by placement of Engineered Fill utilizing a keying and benching procedure as described below. Reconstructed slopes should be constructed at an inclination not exceeding 2:1 (horizontal to vertical). Krazan and Associates, Inc. should be retained to review all slope reconstruction plans and specifications prior to initiating the repair work.

General site clearing should include removal of vegetation, any loose and/or saturated materials. Excavations or depressions extending below subgrade levels should be cleaned to firm, undisturbed soil and backfilled with Engineered Fill, placed and recompacted in accordance with the recommendations stated herein.

Where fills greater than 8 feet are to be constructed on original ground that slopes at inclinations steeper than 6:1 (horizontal to vertical), benches should be cut into the existing slope as the filling operations proceed. Each bench should consist of a level terrace a minimum of 10 feet wide, with the rise to the next bench held to 4 feet or less. Where fills of comparable height will be constructed on ground that slopes at an inclination steeper than 4:1 (horizontal to vertical), a keyway should be provided in addition to the benches. Each keyway should consist of a level trench at least 10 feet wide and at least 2 feet

deep, with side slopes not exceeding 1:1 (horizontal to vertical), cut into the existing slope. Where fills of comparable height will be constructed on ground that slopes at an inclination steeper than 2:1 (horizontal to vertical), geotextile fabric and retaining structures should be utilized in slope construction where subsequent specific building site investigations warrant.

Site grading near the crowns of the reconstructed slopes should be accomplished such that excessive sheet run-off is prevented.

The completed slopes should be seeded or otherwise vegetated to protect from future erosion. Well vegetated slopes at the recommended configuration should be reasonably protected from typical erosional effects. However, vegetated slopes may not be protected from unusual flow conditions, such as flood events or over-topping of the development's storm drainage system. If erosion control from unusual flow conditions is desired, more substantial erosion protection measures, such as grouted cobble slope facing or manufactured slope protection products should be considered.

Engineered Fill

The organic-free, on-site, upper native and fill soils are predominately silty sand, clayey sand, sandy silt, sandy clayey silt, sandy clay, or sand. Some of these soils were intermixed with varying amounts of gravel and cobbles. The silty sands and sandy silts that do not contain clay will be suitable for reuse as non-expansive Engineered Fill, provided they are cleansed of excessive organics, debris, and fragments larger than 4 inches in diameter. The clayey soils will not be suitable for reuse as non-expansive Engineered Fill. The clayey soils will be suitable for reuse for fill placement within the upper 24 inches of slab-on-grade and exterior flatwork areas, provided they are lime-treated. The lime material should be calcium oxide, commonly known as quick-lime. The clayey soils should be at or near optimum moisture-condition during mixing operations. Additional testing is recommended to determine the appropriate application rate of lime prior to placement. These clayey soils will be suitable for reuse as General Engineered Fill, within pavement areas and below 24 inches from finished pad grade in slab-on-grade and exterior flatwork areas, provided they are cleansed of excessive organics, debris, fragments larger than 4 inches of maximum size, and are moisture-conditioned to at least 2 percent above optimum moisture.

The preferred materials specified for Engineered Fill are suitable for most applications with the exception of exposure to erosion. Project site winterization and protection of exposed soils during the construction phase should be the sole responsibility of the Contractor, since he has complete control of the project site at that time.

Imported non-expansive Fill should consist of a well-graded, slightly cohesive, fine silty sand or sandy silt, with relatively impervious characteristics when compacted. This material should be approved by the Soils Engineer prior to use and should typically possess the following characteristics:

Percent Passing No. 200 Sieve	20 to 50
Plasticity Index	10 maximum
UBC Standard 29-2 Expansion Index	15 maximum

Fill soils should be placed in lifts approximately 6 inches thick, moisture-conditioned as necessary, and compacted to achieve at least 90 percent of the maximum density based on ASTM Test Method D1557. Additional lifts should not be placed if the previous lift did not meet the required density or if soil conditions are not stable.

Drainage and Landscaping

The ground surface should slope away from building pad and pavement areas toward appropriate drop inlets or other surface drainage devices. In accordance with Section 1804 of the 2022 California Building Code, it is recommended that the ground surface adjacent to foundations be sloped a minimum of 5 percent for a minimum distance of 10 feet away from structures, or to an approved alternative means of drainage conveyance. Swales used for conveyance of drainage and located within 10 feet of foundations should be sloped a minimum of 2 percent. Impervious surfaces, such as pavement and exterior concrete flatwork, within 10 feet of building foundations should be sloped a minimum of 2 percent away from the structure. Drainage gradients should be maintained to carry all surface water to collection facilities and off-site. These grades should be maintained for the life of the project.

Grade the site to prevent water/run-off flow over the face of cut and fill slopes. To accomplish this, use asphalt berms, brow ditches, or other measures to intercept and slowly redirect flow. Plant all disturbed areas with erosion-resistant vegetation suited to the area. As an alternative, jute netting or geotextile erosion control mats may be considered for control of erosion. Slopes should be inspected periodically for erosion and repaired immediately if detected. Where only 1 drainage terrace is necessary, it should be located at mid-height of the slope. Brow ditches and drainage terraces should be cleaned before the start of each rainy season and, if necessary, after each rainstorm.

Slots or weep holes should be placed in drop inlets or other surface drainage devices in pavement areas to allow free drainage of adjoining base course materials. Cutoff walls should be installed at pavement edges adjacent to vehicular traffic areas; these walls should extend to a minimum depth of 12 inches below pavement subgrade to limit the amount of seepage water that can infiltrate the pavements. Where cutoff walls are undesirable, subgrade drains can be constructed to transport excess water away from planters to drainage interceptors. If cutoff walls can be successfully used at the site, construction of subgrade drains is considered unnecessary.

Utility Trench Backfill

Utility trenches should be excavated according to accepted engineering practices following OSHA (Occupational Safety and Health Administration) standards by a Contractor experienced in such work. The responsibility for the safety of open trenches should be borne by the Contractor. Traffic and vibration adjacent to trench walls should be reduced; cyclic wetting and drying of excavation side slopes

should be avoided. Depending upon the location and depth of some utility trenches, groundwater flow into open excavations could be experienced, especially during or shortly following periods of precipitation.

Sandy and gravelly soil conditions were encountered at the site. These cohesionless soils have a tendency to cave in trench wall excavations. Shoring or sloping back trench sidewalls may be required within these sandy and gravelly soils.

Utility trench backfill placed in or adjacent to buildings and exterior slabs should be compacted to at least 90 percent of maximum density based on ASTM Test Method D1557. The utility trench backfill placed in pavement areas should be compacted to at least 90 percent of maximum density based on ASTM Test Method D1557. Pipe bedding should be in accordance with pipe manufacturer's recommendations.

The Contractor is responsible for removing all water-sensitive soils from the trench regardless of the backfill location and compaction requirements. The Contractor should use appropriate equipment and methods to avoid damage to the utilities and/or structures during fill placement and compaction.

Foundations - Conventional

After completion of the recommended site preparation, the site should be suitable for shallow footing support. The proposed structures may be supported on a shallow foundation system bearing on a minimum of 2 feet of Engineered Fill. Spread and continuous footings can be designed for the following maximum allowable soil bearing pressures:

Load	Allowable Loading
Dead Load Only	1,875 psf
Dead-Plus-Live Load	2,500 psf
Total Load, including wind or seismic loads	3,325 psf

The footings should have a minimum embedment depth of 18 inches below pad subgrade (soil grade) or adjacent exterior grade, whichever is lower. Footings should have a minimum width of 12 inches, regardless of load.

The footing excavations should not be allowed to dry out at any time prior to pouring concrete. It is recommended that all footings be reinforced by at least one No. 4 reinforcing bar in both top and bottom.

The total movement is not expected to exceed 1 inch. Differential movement should be less than 1 inch. Most of the settlement is expected to occur during construction as the loads are applied. However, additional post-construction settlement may occur if the foundation soils are flooded or saturated.

Resistance to lateral footing displacement can be computed using an allowable friction factor of 0.35 acting between the base of foundations and the supporting subgrade. Lateral resistance for footings can alternatively be developed using an allowable equivalent fluid passive pressure of 300 pounds per cubic foot acting against the appropriate vertical footing faces. The frictional and passive resistance of the soil may be combined without reduction in determining the total lateral resistance. A ⅓ increase in the above value may be used for short duration, wind, or seismic loads.

Foundations - Drilled Caissons

The proposed solar panels can be supported on caissons using an allowable sidewall friction of 300 psf. This value is for dead-plus-live loads. This value may be increased ⅓ for short duration loads, such as wind or seismic. The upper 1 foot should be neglected from friction calculations. Uplift loads can be resisted by caissons using an allowable sidewall friction of 175 psf of the surface area plus the weight of the pier. Caissons should have a minimum embedment depth of 6 feet. The total and differential settlements of the piers are not expected to exceed ½ inch. Most of the settlement is expected to occur during construction as the loads are applied.

Caissons may be designed using a lateral bearing capacity of 175 psf/ft using the applicable formula for unconstrained or constrained conditions in the 2022 California Building Code. Unconstrained or flexible cap conditions apply to isolated piers, and constrained or rigid cap (fixed against rotation) conditions apply to piers with a rigid connection to the structure.

Sandy and gravelly soils were encountered at the site. These sandy and gravelly soils may be subject to caving during drilling operations. Accordingly, cased caissons may be required. The drilled holes should be left open for as short of time as possible and should be protected from run-off.

Floor Slabs and Exterior Flatwork

In areas where moisture-sensitive floor coverings will be used, concrete slab-on-grade floors should be underlain by a water vapor retarder. The water vapor retarder should be installed in accordance with accepted engineering practice. The water vapor retarder should consist of a vapor retarder sheeting underlain by a minimum of 3 inches of compacted, clean, gravel of ¾-inch maximum size. To aid in concrete curing an optional 2 to 4 inches of granular fill may be placed on top of the vapor retarder. The granular fill should consist of damp clean sand with at least 10 to 30 percent of the sand passing the 100 sieve. The sand should be free of clay, silt, or organic material. Rock dust which is manufactured sand from rock crushing operations is typically suitable for the granular fill. This granular fill material should be compacted.

The floor slabs should be reinforced at a minimum with #3 reinforcement bars at 18 inches on-center each way within the floor slab's middle-third. Thicker floor slabs with increased concrete strength and reinforcement should be designed wherever heavy concentrated loads, heavy equipment, or machinery is anticipated.

The exterior floors should be poured separately in order to act independently of the walls and foundation system. All fills required to bring the building pads to grade should be Engineered Fills.

Moisture within the structure may be derived from water vapors, which were transformed from the moisture within the soils. This moisture vapor can travel through the vapor membrane and penetrate the slab-on-grade. This moisture vapor penetration can affect floor coverings and produce mold and mildew in the structure. To reduce moisture vapor intrusion, it is recommended that a vapor retarder be installed. It is recommended that the utility trenches within the structure be compacted, as specified in our report, to reduce the transmission of moisture through the utility trench backfill. Special attention to the immediate drainage and irrigation around the building is recommended. Positive drainage should be established away from the structure and should be maintained throughout the life of the structure. Ponding of water should not be allowed adjacent to the structure. Over-irrigation within landscaped areas adjacent to the structure should not be performed. In addition, ventilation of the structure (i.e. ventilation fans) is recommended to reduce the accumulation of interior moisture.

Lateral Earth Pressures and Retaining Walls

Walls retaining horizontal backfill and capable of deflecting a minimum of 0.1 percent of its height at the top may be designed using an equivalent fluid active pressure of 40 pounds per square foot per foot of depth. Walls incapable of this deflection or are fully constrained walls against deflection may be designed for an equivalent fluid at-rest pressure of 60 pounds per square foot per foot of depth. Expansive soils should not be used for backfill against walls. The wedge of non-expansive backfill material should extend from the bottom of each retaining wall outward and upward at a slope of 2:1 (horizontal to vertical) or flatter. The stated lateral earth pressures do not include the effects of hydrostatic water pressures generated by infiltrating surface water that may accumulate behind the retaining walls; or loads imposed by construction equipment, foundations, or roadways.

Retaining and/or below grade walls should be drained with either perforated pipe encased in free-draining gravel or a prefabricated drainage system. The gravel zone should have a minimum width of 12 inches and should extend upward to within 12 inches of the top of the wall. The upper 12 inches of backfill should consist of native soils, concrete, asphaltic concrete, or other suitable backfill to reduce surface drainage into the wall drain system. The aggregate should conform to Class 2 permeable materials graded in accordance with CalTrans Standard Specifications (2018). Prefabricated drainage systems, such as Miradrain®, Enkadrain®, or an equivalent substitute, are acceptable alternatives in lieu of gravel, provided they are installed in accordance with the manufacturer's recommendations. If a prefabricated drainage system is proposed, our firm should review the system for final acceptance prior to installation.

Drainage pipes should be placed with perforations down and should discharge in a non-erosive manner away from foundations and other improvements. The pipes should be placed no higher than 6 inches above the heel of the wall, in the center line of the drainage blanket and should have a minimum diameter of four inches. Collector pipes may be either slotted or perforated. Slots should be no wider than ⅛ inch in diameter, while perforations should be no more than ¼ inch in diameter. If retaining walls are less than 6 feet in height, the perforated pipe may be omitted in lieu of weep holes on 4 feet maximum spacing. The weep holes should consist of 4-inch diameter holes (concrete walls) or unmortared head joints (masonry walls) and not be higher than 18 inches above the lowest adjacent

grade. Two 8-inch square overlapping patches of geotextile fabric (conforming to CalTrans Standard Specifications for "edge drains") should be affixed to the rear wall opening of each weep hole to retard soil piping.

During grading and backfilling operations adjacent to any walls, heavy equipment should not be allowed to operate within a lateral distance of 5 feet from the wall, or within a lateral distance equal to the wall height, whichever is greater, to avoid developing excessive lateral pressures. Within this zone, only hand-operated equipment ("whackers," vibratory plates, or pneumatic compactors) should be used to compact the backfill soils.

R-Value Test Results and Pavement Design

Three subgrade soil samples were obtained from the project site for R-Value testing at the locations shown on the attached site plan. The samples were tested in accordance with the State of California Materials Manual Test Designation 301. The results of the tests are as follows:

Sample	Depth	Description	R-Value at Equilibrium
1	12-24"	Sandy Clay (CL)	Less than 5
2	12-24"	Clayey Sand (SC)	7
3	12-24"	Clayey Sand (SC)	8

The test results are low and indicate poor subgrade support characteristics under dynamic traffic loads. The following table shows the recommended pavement sections for various traffic indices.

Traffic Index	Asphaltic Concrete	Class II Aggregate Base*	Class III Aggregate Subbase	Compacted Subgrade**
4.0	2.0"	8.5"	--	12.0"
4.0	2.0"	4.5"	4.5"	12.0"
4.5	2.5"	9.0"	--	12.0"
4.5	2.5"	4.0"	5.5"	12.0"
5.0	2.5"	11.0"	--	12.0"
5.0	2.5"	5.0"	6.5"	12.0"
5.5	3.0"	11.5"	--	12.0"
5.5	3.0"	5.0"	7.0"	12.0"
6.0	3.0"	13.5"	--	12.0"
6.0	3.0"	6.5"	8.0"	12.0"
6.5	3.5"	14.0"	--	12.0"
6.5	3.5"	6.0"	9.0"	12.0"
7.0	4.0"	15.5"	--	12.0"

7.0	4.0"	6.5"	10.0"	12.0"
7.5	4.0"	17.0"	--	12.0"
7.5	4.0"	7.5"	10.5"	12.0"

** 95% compaction based on ASTM Test Method D1557 or CAL 216*
*** 90% compaction based on ASTM Test Method D1557 or CAL 216*

If traffic indices are not available, an estimated (typical value) index of 4.5 may be used for light automobile traffic, and an index of 7.0 may be used for light truck traffic.

The following recommendations are for light-duty and heavy-duty Portland Cement Concrete Pavement Sections based on the design procedures developed by the Portland Cement Association.

PORTLAND CEMENT PAVEMENT
LIGHT DUTY

Traffic Index	Portland Cement Concrete***	Class II Aggregate Base*	Compacted Subgrade**
4.5	6.0"	5.0"	12.0"

HEAVY DUTY

Traffic Index	Portland Cement Concrete***	Class II Aggregate Base*	Compacted Subgrade**
7.0	7.0"	6.0"	12.0"

** 95% compaction based on ASTM Test Method D1557 or CAL 216*
*** 90% compaction based on ASTM Test Method D1557 or CAL 216*
****Minimum compressive strength of 3000 psi*

As indicated previously, fill material is located throughout the site. It is recommended that any uncertified fill material encountered within pavement areas be removed and/or recompacted. The fill material should be moisture-conditioned to near optimum moisture and recompacted to a minimum of 90 percent of maximum density based on ASTM Test Method D1557. As an alternative, the Owner may elect not to recompact the existing fill within paved areas. However, the Owner should be aware that the paved areas may settle which may require annual maintenance. At a minimum, it is recommended that the upper 12 inches of subgrade soil be moisture-conditioned as necessary and recompacted to a minimum of 90 percent of maximum density based on ASTM Test Method D1557.

Seismic Parameters – 2022 California Building Code

The Site Class per Section 1613 of the 2022 California Building Code (2022 CBC) and ASCE 7-16, Chapter 20 is based upon the site soil conditions. It is our opinion that a Site Class D is most consistent with the subject site soil conditions. A site modified peak ground acceleration (PGA_M) of 0.482 may be used for seismic analysis. For seismic design of the structures based on the seismic provisions of the 2022 CBC, we recommend the following parameters:

Seismic Item	Value	CBC Reference
Site Class	D	Section 1613.2.2
Site Coefficient F_a	1.127	Table 1613.2.3 (1)
S_s	0.932	Section 1613.2.1
S_{MS}	1.051	Section 1613.2.3
S_{DS}	0.701	Section 1613.2.4
Site Coefficient F_v	1.967	Table 1613.2.3 (2)
S_1	0.333	Section 1613.2.1
S_{M1}	0.655	Section 1613.2.3
S_{D1}	0.437	Section 1613.2.4
T_S	0.623	Section 1613.2

* Based on Equivalent Lateral Force (ELF) Design Procedure being used.

Soil Cement Reactivity

Excessive sulfate in either the soil or native water may result in an adverse reaction between the cement in concrete (or stucco) and the soil. HUD/FHA and UBC have developed criteria for evaluation of sulfate levels and how they relate to cement reactivity with soil and/or water.

Soil samples were obtained from the site and tested in accordance with State of California Materials Manual Test Designation 417. Some of the sulfate concentrations detected from these soil samples were greater than 150 ppm (12.7 to 4,308 ppm) and are above the maximum allowable values established by HUD/FHA and UBC. Therefore, it is recommended that a Type V cement be used within the concrete to compensate for sulfate reactivity with the cement.

Compacted Material Acceptance

Compaction specifications are not the only criteria for acceptance of the site grading or other such activities. However, the compaction test is the most universally recognized test method for assessing the performance of the Grading Contractor. The numerical test results from the compaction test cannot be used to predict the engineering performance of the compacted material. Therefore, the acceptance of compacted materials will also be dependent on the stability of that material. The Soils Engineer has the option of rejecting any compacted material regardless of the degree of compaction if that material is considered to be unstable or if future instability is suspected. A specific example of rejection of fill material passing the required percent compaction is a fill which has been compacted with an in-situ moisture content significantly less than optimum moisture. This type of dry fill (brittle fill) is susceptible to future settlement if it becomes saturated or flooded.

Testing and Inspection

A representative of Krazan & Associates, Inc. should be present at the site during the earthwork activities to confirm that actual subsurface conditions are consistent with the exploratory fieldwork. This activity is an integral part of our service, as acceptance of earthwork construction is dependent upon compaction testing and stability of the material. This representative can also verify that the intent of these recommendations is incorporated into the project design and construction. Krazan & Associates, Inc. will not be responsible for grades or staking, since this is the responsibility of the Prime Contractor.

LIMITATIONS

Soils Engineering is one of the newest divisions of Civil Engineering. This branch of Civil Engineering is constantly improving as new technologies and understanding of earth sciences advance. Although your site was analyzed using the most appropriate and most current techniques and methods, undoubtedly there will be substantial future improvements in this branch of engineering. In addition to advancements in the field of Soils Engineering, physical changes in the site, either due to excavation or fill placement, new agency regulations, or possible changes in the proposed structure after the soils report is completed may require the soils report to be professionally reviewed. In light of this, the Owner should be aware that there is a practical limit to the usefulness of this report without critical review. Although the time limit for this review is strictly arbitrary, it is suggested that 2 years be considered a reasonable time for the usefulness of this report.

Foundation and earthwork construction is characterized by the presence of a calculated risk that soil and groundwater conditions have been fully revealed by the original foundation investigation. This risk is derived from the practical necessity of basing interpretations and design conclusions on limited sampling of the earth. The recommendations made in this report are based on the assumption that soil conditions do not vary significantly from those disclosed during our field investigation. If any variations or undesirable conditions are encountered during construction, the Soils Engineer should be notified so that supplemental recommendations may be made.

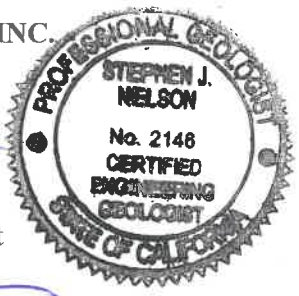
The conclusions of this report are based on the information provided regarding the proposed construction. If the proposed construction is relocated or redesigned, the conclusions in this report may not be valid. The Soils Engineer should be notified of any changes so the recommendations may be reviewed and re-evaluated.

This report is a Geotechnical Engineering Investigation with the purpose of evaluating the soil conditions in terms of foundation design. The scope of our services did not include any Environmental Site Assessment for the presence or absence of hazardous and/or toxic materials in the soil, groundwater, or atmosphere; or the presence of wetlands. Any statements, or absence of statements, in this report or on any boring log regarding odors, unusual or suspicious items, or conditions observed, are strictly for descriptive purposes and are not intended to convey engineering judgment regarding potential hazardous and/or toxic assessment.

The geotechnical engineering information presented herein is based upon professional interpretation utilizing standard engineering practices and a degree of conservatism deemed proper for this project. It is not warranted that such information and interpretation cannot be superseded by future geotechnical engineering developments. We emphasize that this report is valid for the project outlined above and should not be used for any other sites.

If you have any questions, or if we may be of further assistance, please do not hesitate to contact our office at (661) 837-9200.

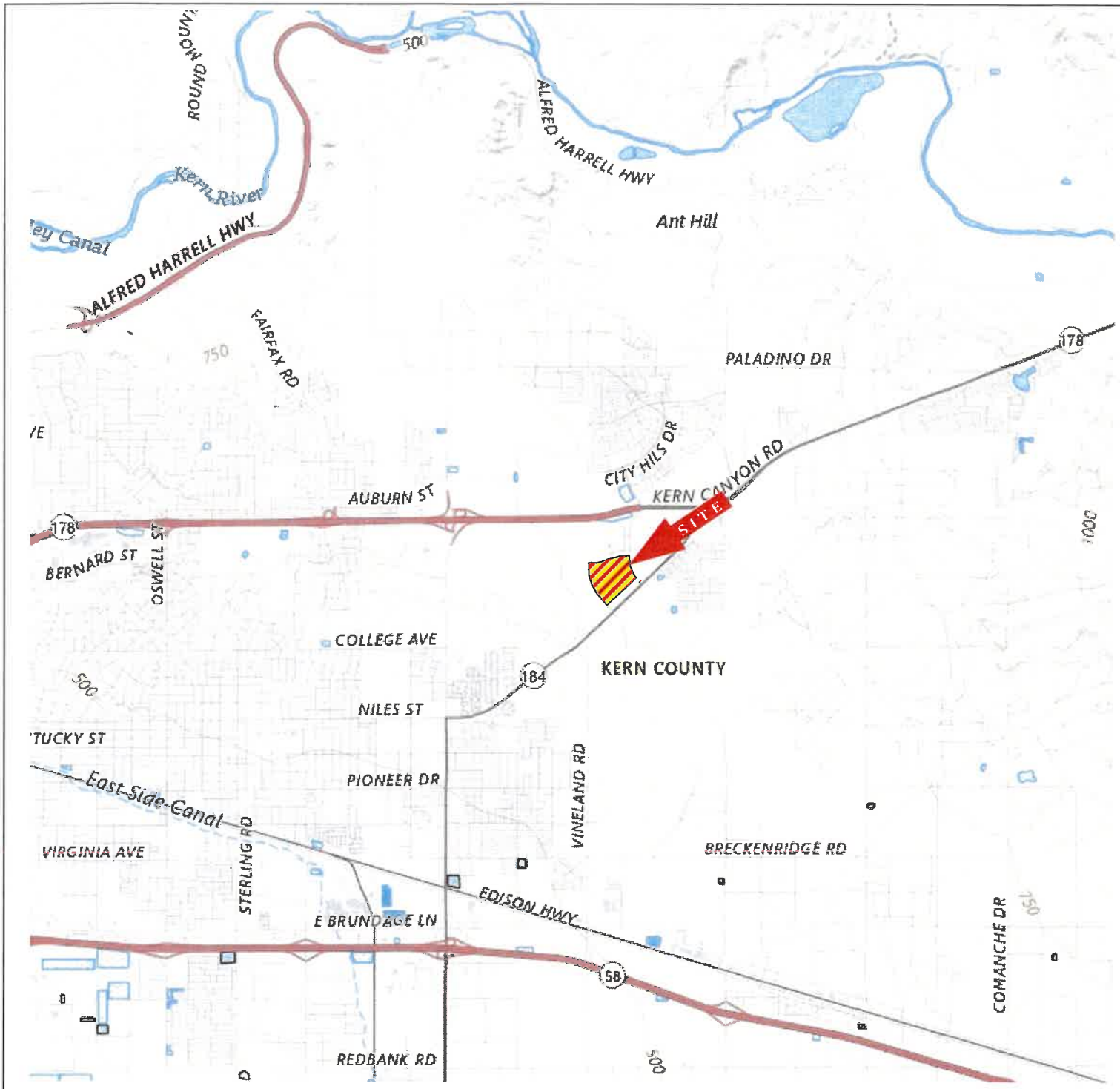
Respectfully submitted,
KRAZAN & ASSOCIATES, INC.



Stephen J. Nelson
Certified Engineering Geologist
CEG No. 2146

David R. Jarosz, II
Managing Engineer
RGE No. 2698/RCE No. 60185

SJN/DRJ:wa



VICINITY MAP

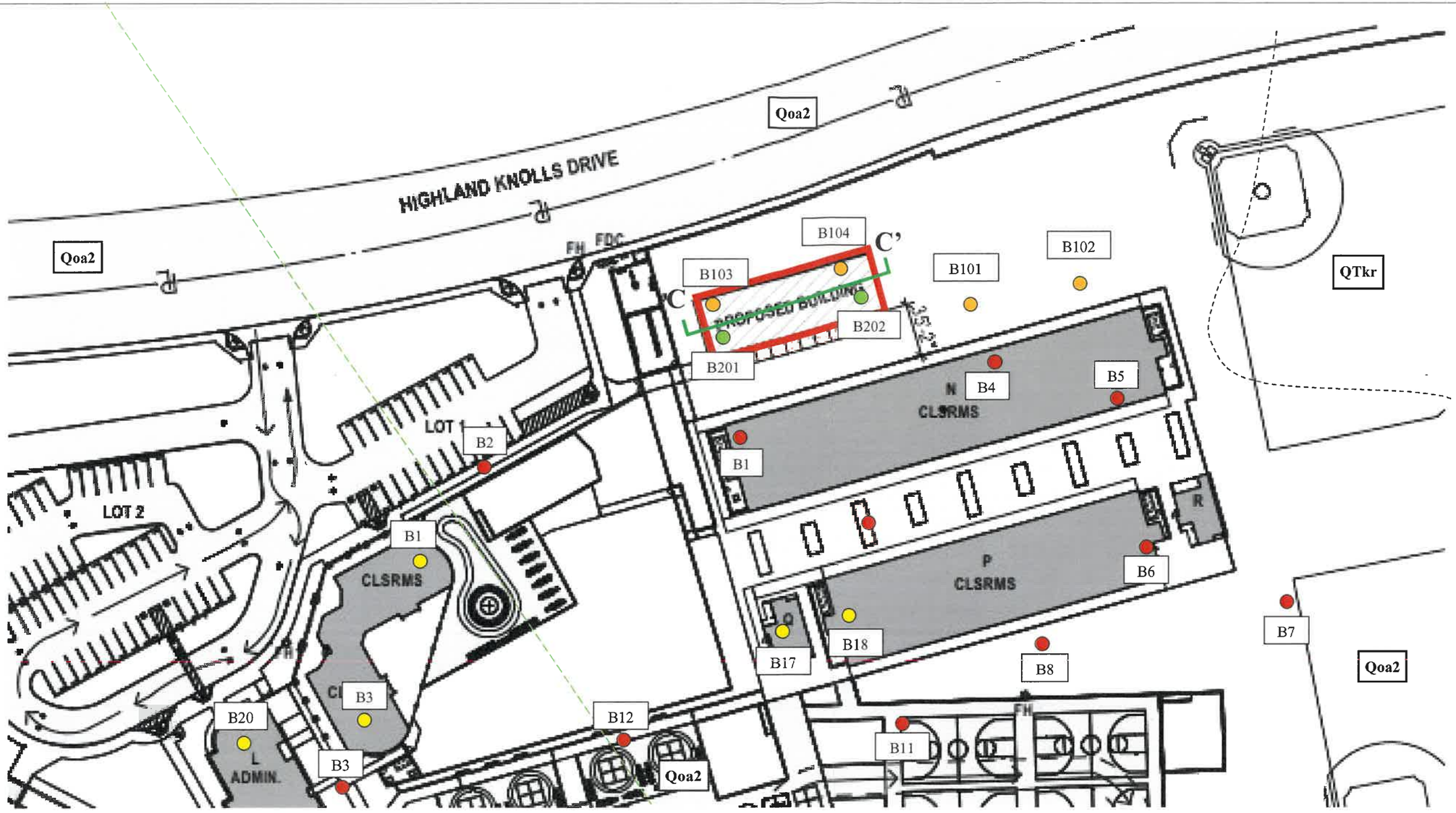
NORTH

0 1 2

SCALE IN MILES (±)

MAP SOURCE:
U.S.G.S. Topo Zone

GEOTECHNICAL ENGINEERING INVESTIGATION UPDATE FLETCHER ELEMENTARY SCHOOL NEW MODULAR CLASSROOM 9801 Highland Knolls Dr. Bakersfield, California	**Scale:** As Shown	**Date:** August 2024	Krazan GEOTECHNICAL ENGINEERING
	Drawn by: WA	**Approved by:** SN	
	Project No. 022-24107	**Figure No.** 1	



- APPROXIMATE BORING LOCATION (2009)
- APPROXIMATE BORING LOCATION (2011)
- APPROXIMATE BORING LOCATION (AUGUST 2023)
- APPROXIMATE BORING LOCATION (AUGUST 2024)
- Qoa2 — QUATERNARY OLDER ALLUVIALFAN DEPOSITS
- QTkr — PLIO-PLEISTOCENE TO UPPER MIOCENE KERN RIVER FORMATION

- FLETCHER ELEMENTARY SCHOOL - NEW MODULAR CLASSROOM - AUGUST 2024 UPDATE
- INFERRED PLEISTOCENE FAULT (BARTOW 1974, 1986)
- INFERRED GEOLOGIC CONTACT
- A A' — CROSS SECTION (A-A' Shown on Figure 2.1, B-B' in SW portion of site out of view)

SITE GEOLOGIC MAP

GEOTECHNICAL ENGINEERING INVESTIGATION UPDATE FLETCHER ELEMENRARY SCHOOL NEW MODULAR CLASSROOM
9801 Highland Knolls Drive
Bakersfield, California

Scale: As Shown

Date: August 2024

Project No. 022-24107

Drawn by: WA

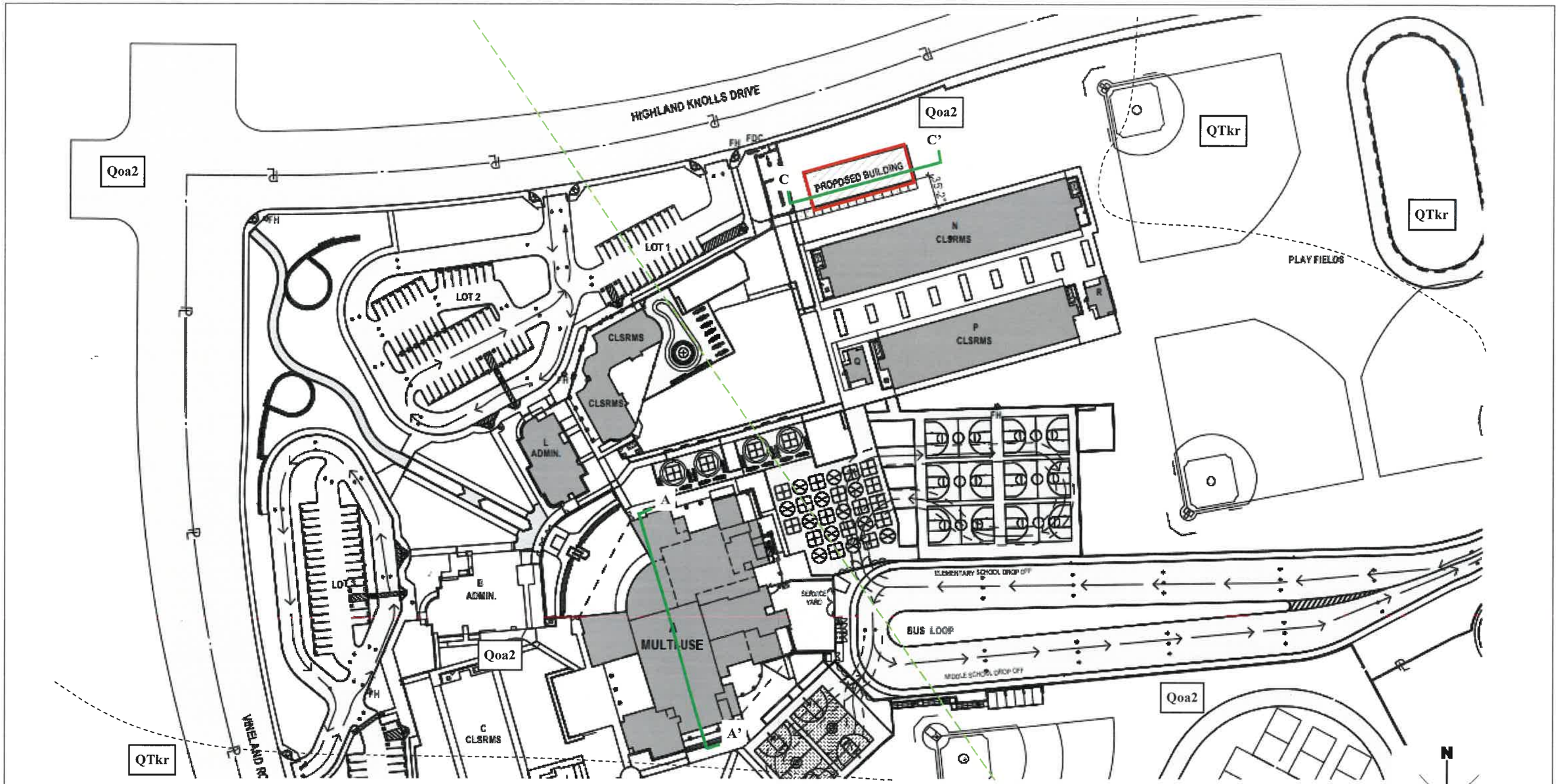
Approved by: DJ

Figure No. 2

Krazan
GEOTECHNICAL ENGINEERING

0' 70'

N
W E
S



Qoa2 QUATERNARY OLDER ALLUVIALFAN DEPOSITS

QTkr PLIO-PLEISTOCENE TO UPPER MIOCENE KERN RIVER FORMATION

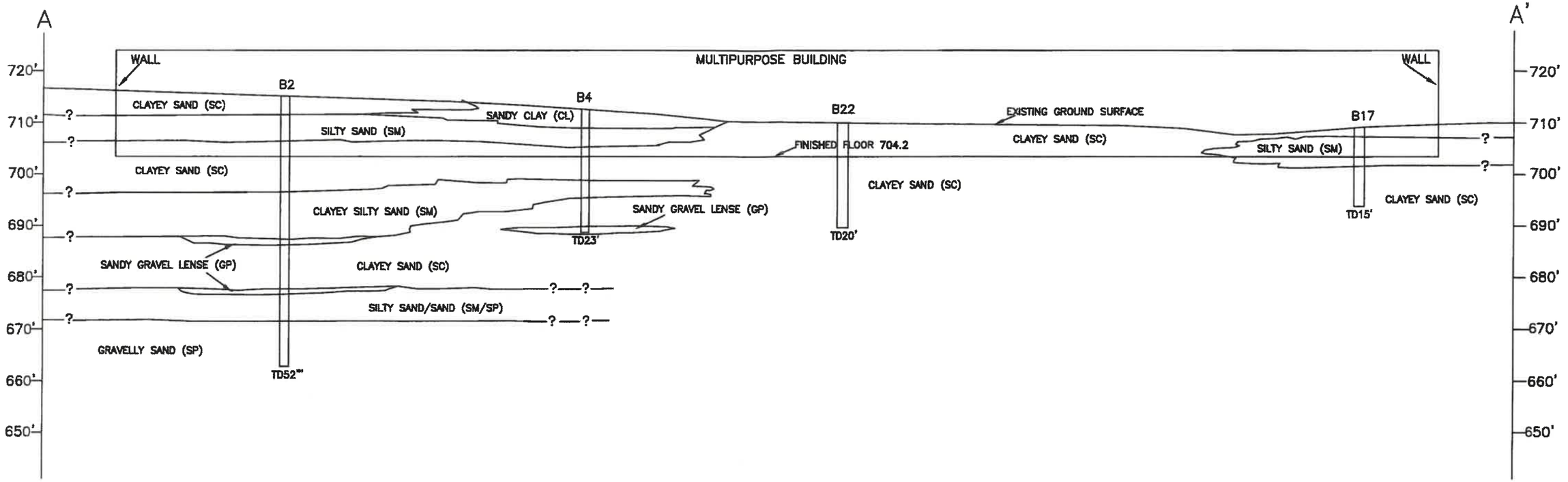
FLETCHER ELEMENTARY SCHOOL NEW MODULAR CLASSROOM- AUGUST 2024 UPDATE REPORT

INFERRED PLEISTOCENE FAULT (BARTOW 1974, 1986)

INFERRED GEOLOGIC CONTACT

CROSS SECTIONS A-A' & C-C'

SITE MAP	Scale: As Shown	Date: August 2024	Krazan GEOTECHNICAL ENGINEERING
GEOTECHNICAL ENGINEERING INVESTIGATION UPDATE FLETCHER ELEMENRARY SCHOOL NEW MODULAR CLASSROOM 9801 Highland Knolls Drive Bakersfield, California	Drawn by: WA	Approved by: DJ	
	Project No. 022-24107	Figure No. 2.1	

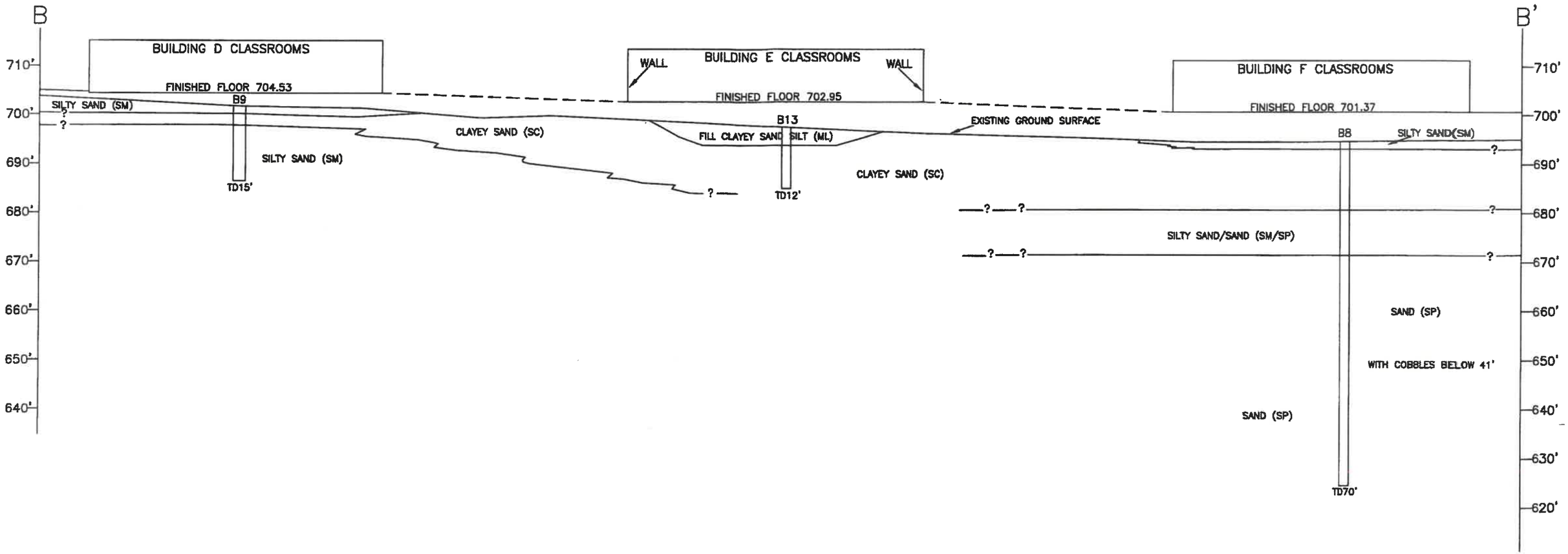


GEOLOGIC CROSS SECTION A-A'

0' 20'

Scale: Vertical and Horizontal the same

GEOTECHNICAL ENGINEERING INVESTIGATION UPDATE	**Scale:** As Shown	**Date:** August 2024	Krazan GEOTECHNICAL ENGINEERING
GEOTECHNICAL ENGINEERING INVESTIGATION UPDATE **FLETCHER ELEMENRARY SCHOOL-NEW MODULAR CLASSROOM** 9801 Highland Knolls Drive Bakersfield, California	**Drawn by:** WA	**Approved by:** SN	
	Project No. 022-24107	**Figure No.** 3.1	

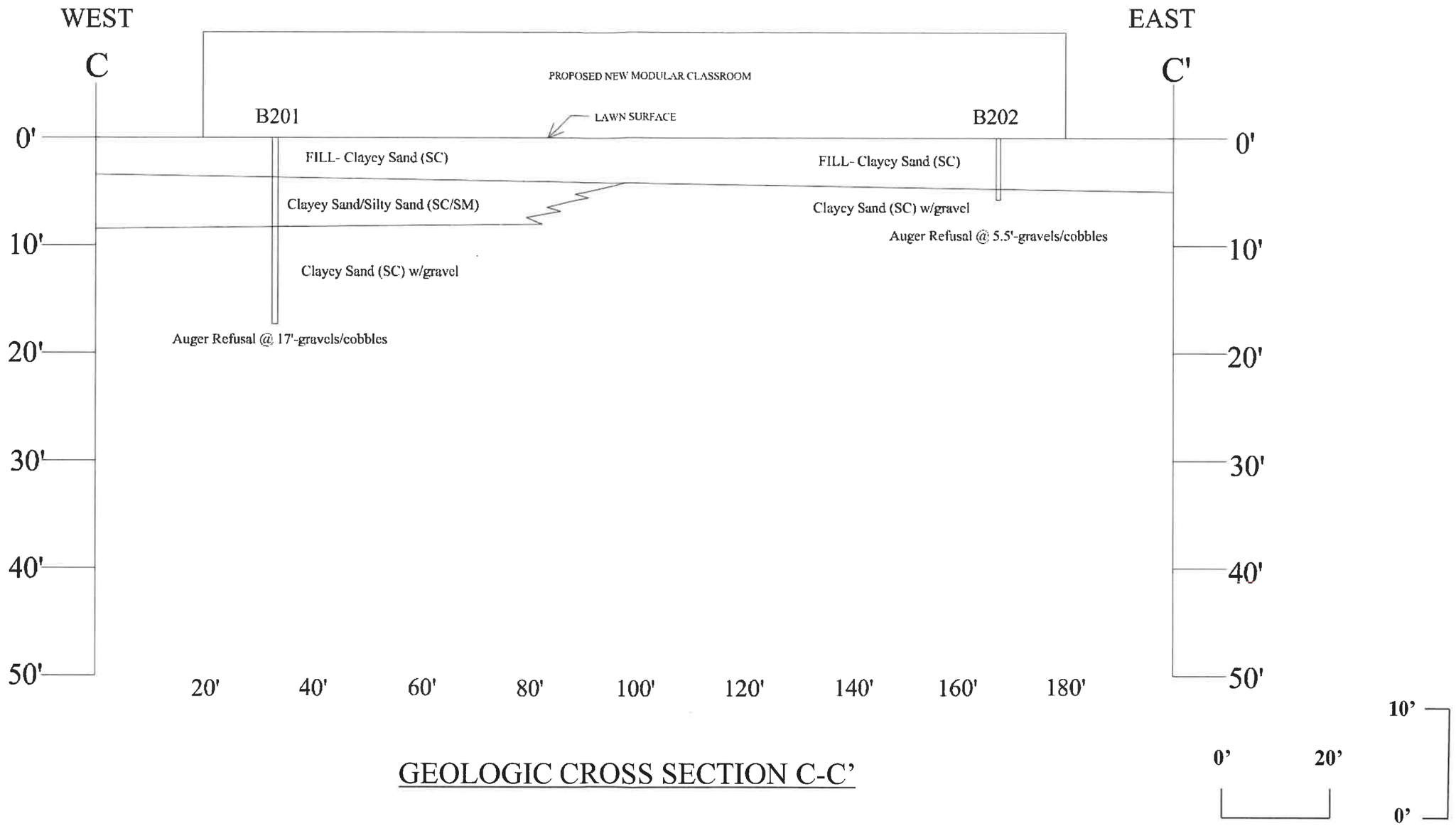


GEOLOGIC CROSS SECTION B-B'

0' 20'

Scale: Vertical and Horizontal the same

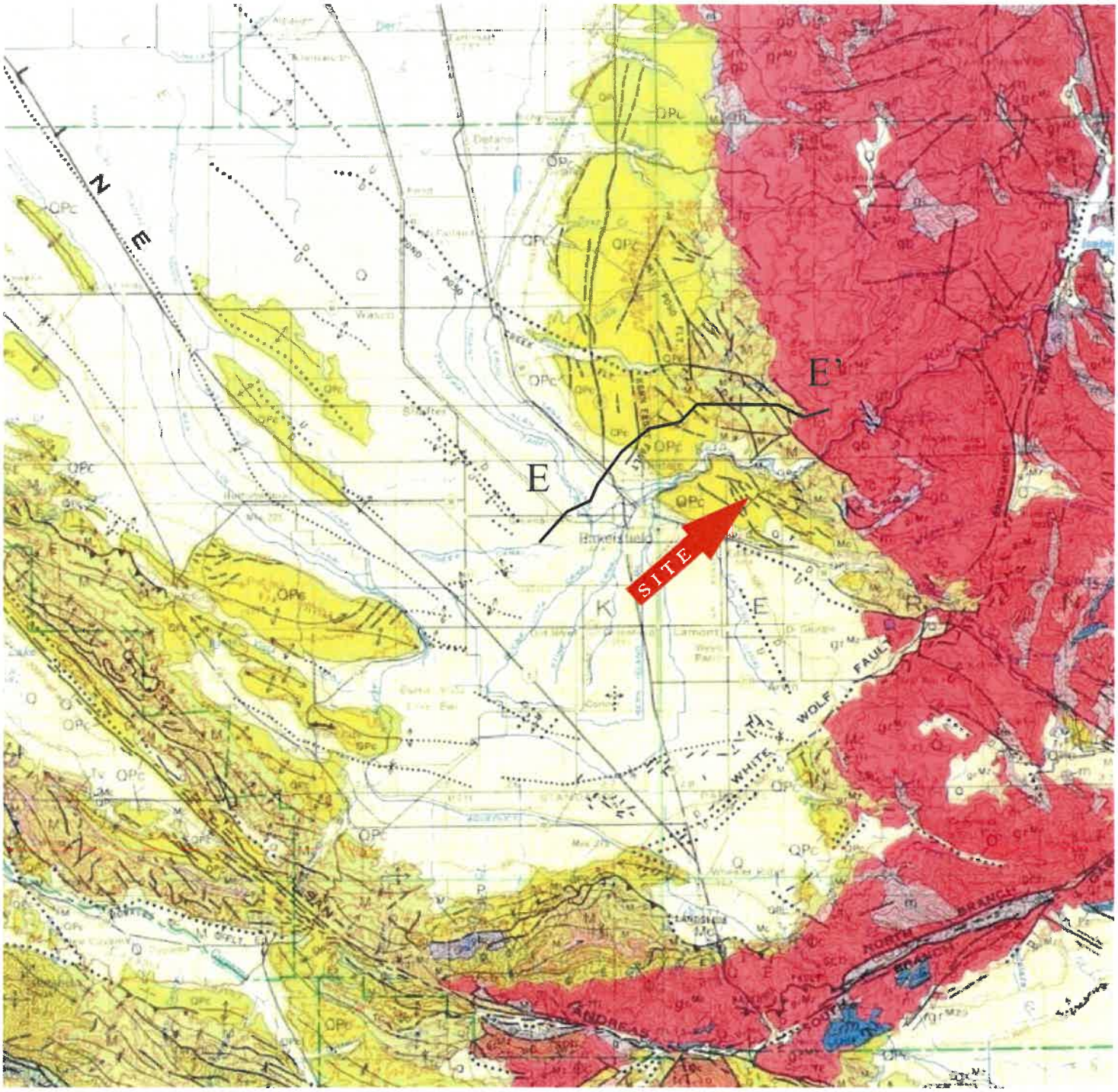
GEOTECHNICAL ENGINEERING INVESTIGATION UPDATE	**Scale:** As Shown	**Date:** August 2024	Krazan GEOTECHNICAL ENGINEERING
GEOTECHNICAL ENGINEERING INVESTIGATION UPDATE **FLETCHER ELEMENRARY SCHOOL-NEW MODULAR CLASSROOM** 9801 Highland Knolls Drive Bakersfield, California	**Drawn by:** WA	**Approved by:** SN	
	Project No. 022-24107	**Figure No.** 3.2	



GEOLOGIC CROSS SECTION C-C'

Scale: Vertical 1" =10' and Horizontal 1" =20'

GEOTECHNICAL ENGINEERING INVESTIGATION UPDATE	**Scale:** As Shown	**Date:** August 2024	Krazan GEOTECHNICAL ENGINEERING
GEOTECHNICAL ENGINEERING INVESTIGATION UPDATE **FLETCHER ELEMENRARY SCHOOL-NEW MODULAR CLASSROOM** 9801 Highland Knolls Drive Bakersfield, California	**Drawn by:** WA	**Approved by:** SN	
	Project No. 022-24107	**Figure No.** 3.3	



REGIONAL GEOLOGIC MAP

FROM:
GEOLOGIC MAP OF CALIFORNIA
COMPILATION BY: CHARLES W. JENNINGS
WITH ASSISTANCE FROM R.G. STRAND AND
T.H. ROGERS 1977

E——E'
REGIONAL CROSS SECTION

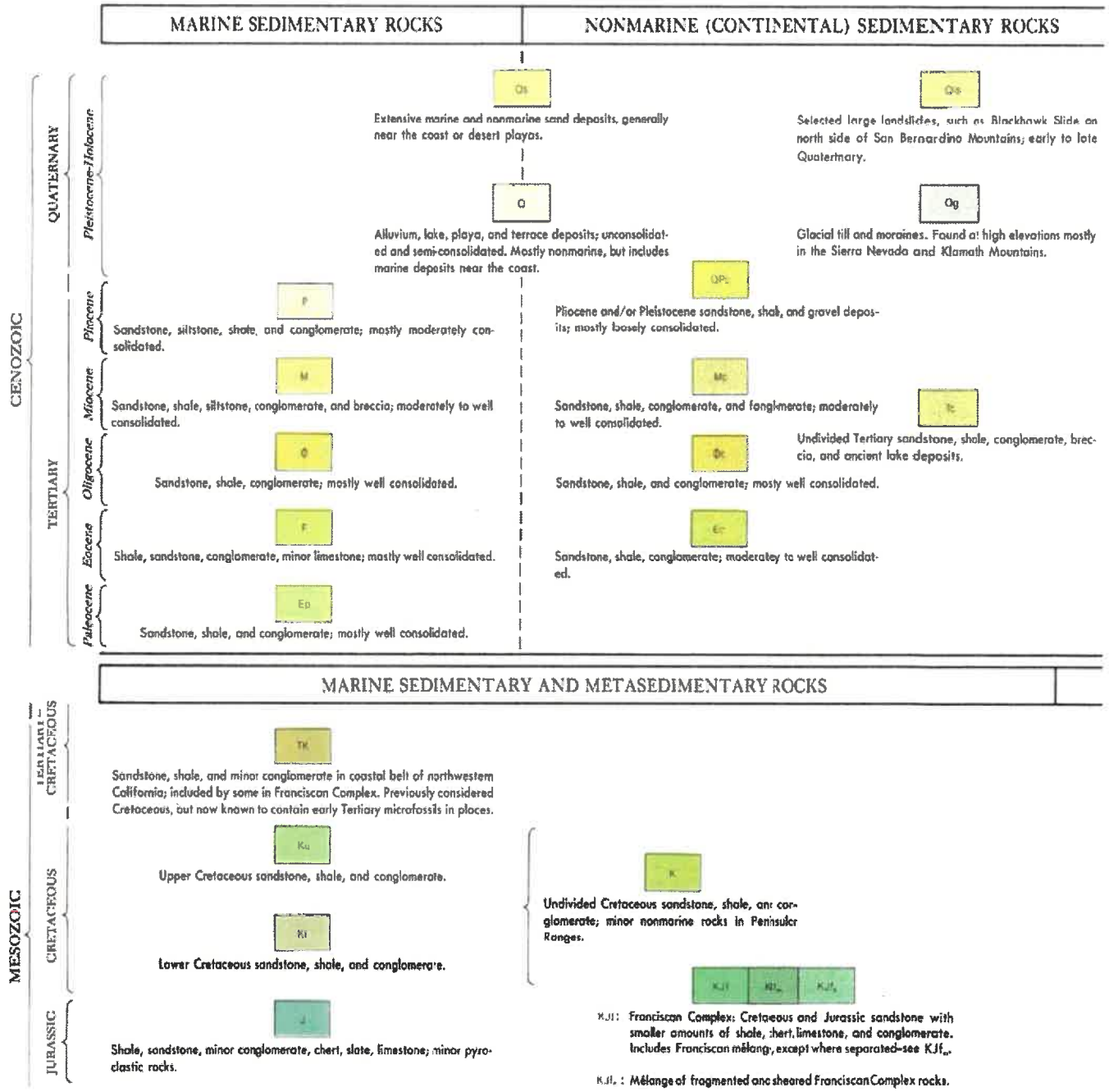
NORTH

0 10 20
SCALE IN MILES (±)

GEOTECHNICAL ENGINEERING INVESTIGATION UPDATE
FLETCHER ELEMENTARY SCHOOL
NEW MODULAR CLASSROOM
9801 Highland Knolls Dr.
Bakersfield, California

Scale: As Shown	**Date:** August 2024
Drawn by: WA	**Approved by:** SN
Project No. 022-24107	**Figure No.** 4

Krazan
GEOTECHNICAL ENGINEERING



REGIONAL GEOLOGIC MAP EXPLANATION

FROM:
GEOLOGIC MAP OF CALIFORNIA
COMPILATION BY: CHARLES W. JENNINGS WITH
ASSISTANCE FROM R.G. STRAND AND T.H. ROGERS. 1977

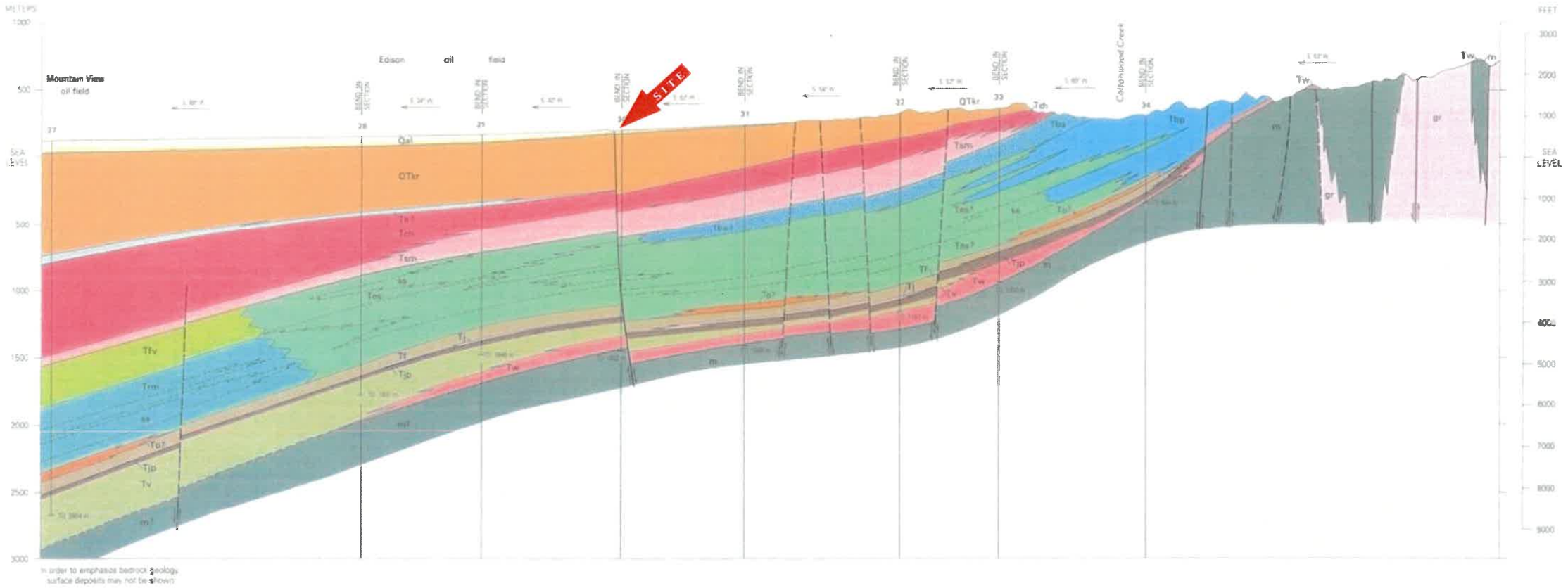
GEOTECHNICAL ENGINEERING INVESTIGATION UPDATE **FLETCHER ELEMENTARY SCHOOL** **NEW MODULAR CLASSROOM** 9801 Highland Knolls Dr. Bakersfield, California	**Scale:** As Shown	**Date:** August 2024	Krazan GEOTECHNICAL ENGINEERING
	Drawn by: WA	**Approved by:** SN	
	Project No. 022-24107	**Figure No.** 4a	

Southwest

E

Northeast

E’

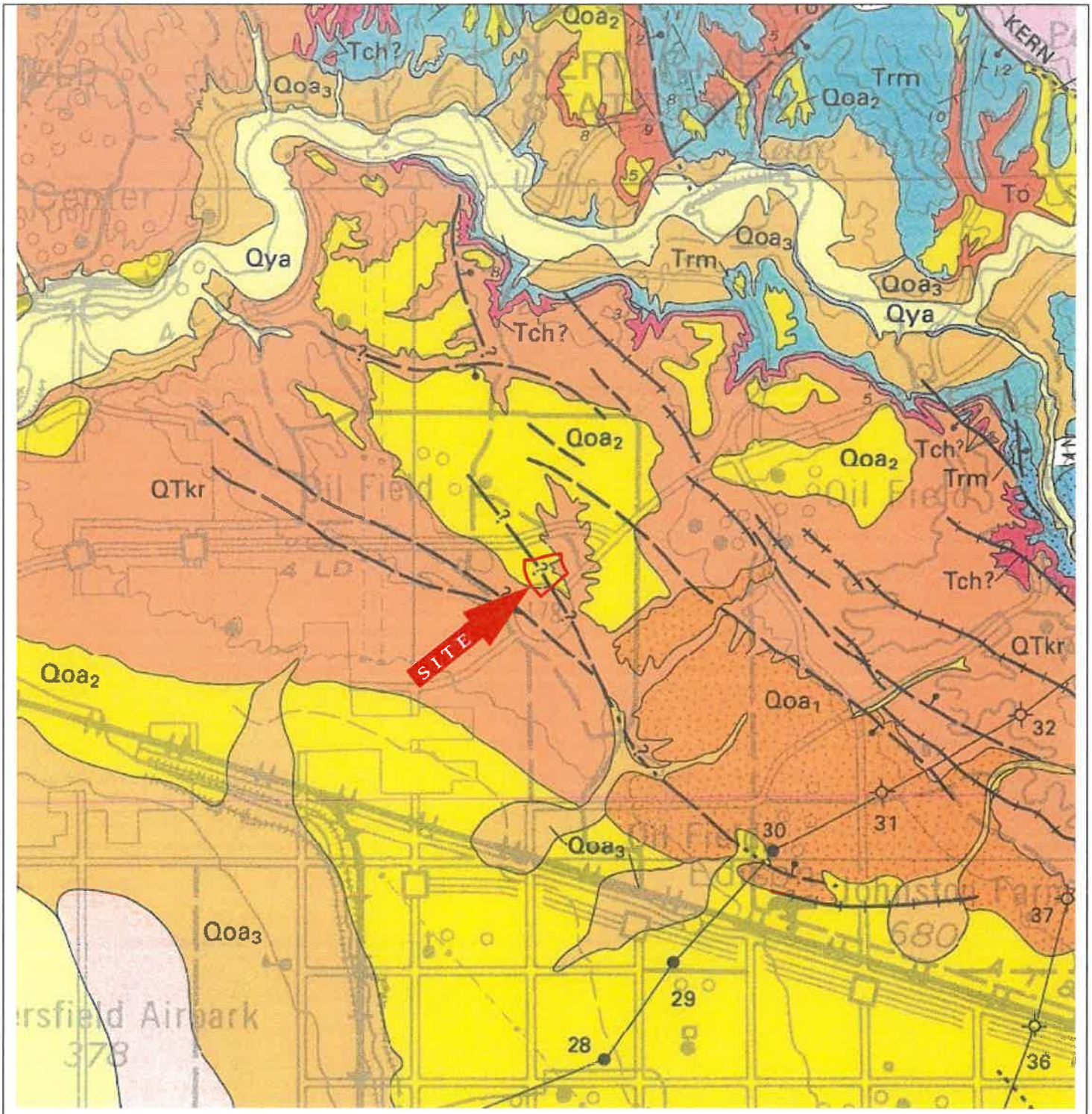


FROM:
GEOLOGIC MAP AND CROSS SECTIONS OF THE SOUTHEASTERN MARGIN OF THE SAN JOAQUIN VALLEY, CALIFORNIA.
CROSS SECTION C-C’
BY: J. ALAN BARTOW, 1984

REGIONAL GEOLOGIC CROSS SECTION E-E’

SCALE
HORIZONTAL 1” =5,280’
VERTICAL 1” = 2,500’

GEOTECHNICAL ENGINEERING INVESTIGATION UPDATE FLETCHER ELEMENRARY SCHOOL NEW MODULAR CLASSROOM 9801 Highland Knolls Drive Bakersfield, California	**Scale:** As Shown	**Date:** August 2024	Krazan GEOTECHNICAL ENGINEERING
	Drawn by: WA	**Approved by:** SN	
	Project No. 022-24107	**Figure No.** 5	



LOCAL GEOLOGIC MAP

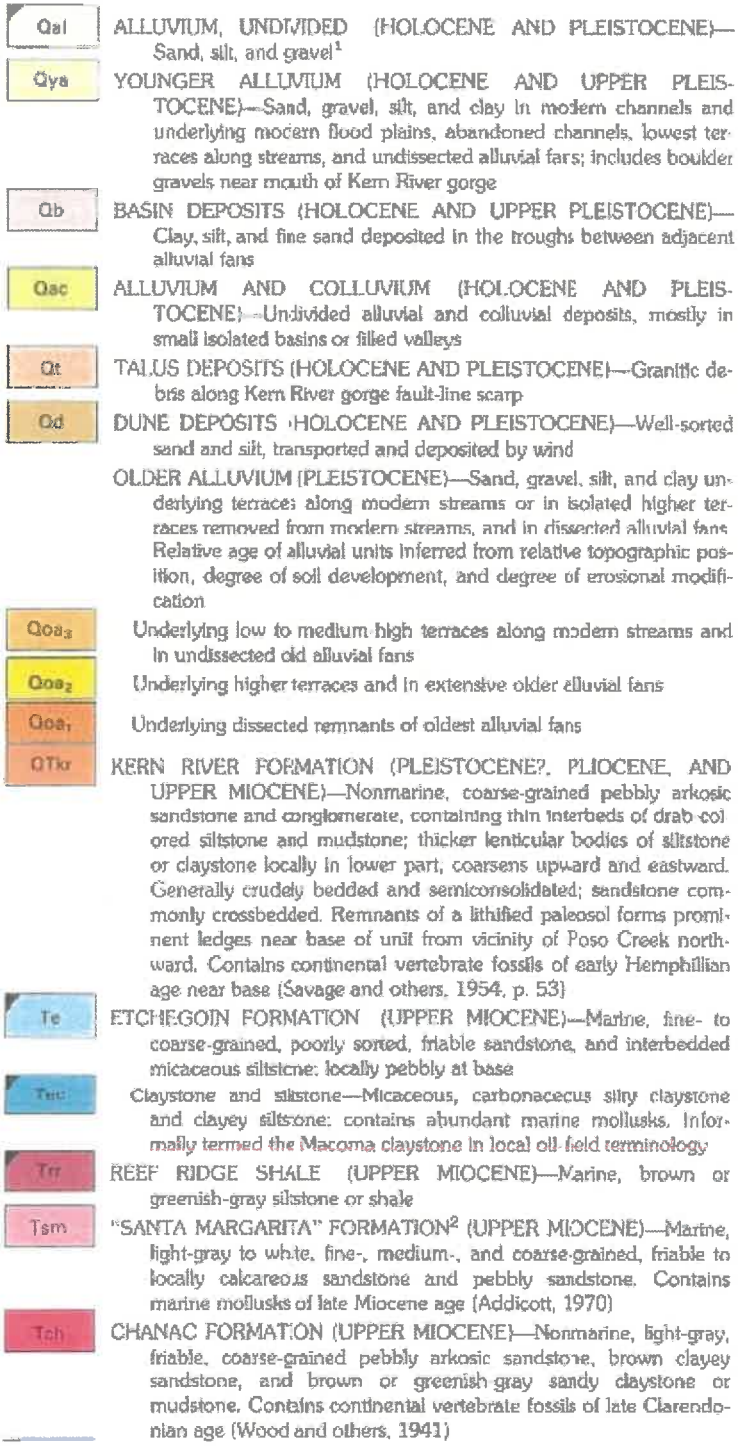
FROM:
GEOLOGIC MAP AND CROSS SECTIONS OF THE SOUTHEASTERN MARGIN OF THE SAN JOAQUIN VALLEY, CALIFORNIA.
CROSS SECTION C-C'
BY: J. ALAN BARTOW, 1984

NORTH

0 1.3 2.6

SCALE IN MILES (±)

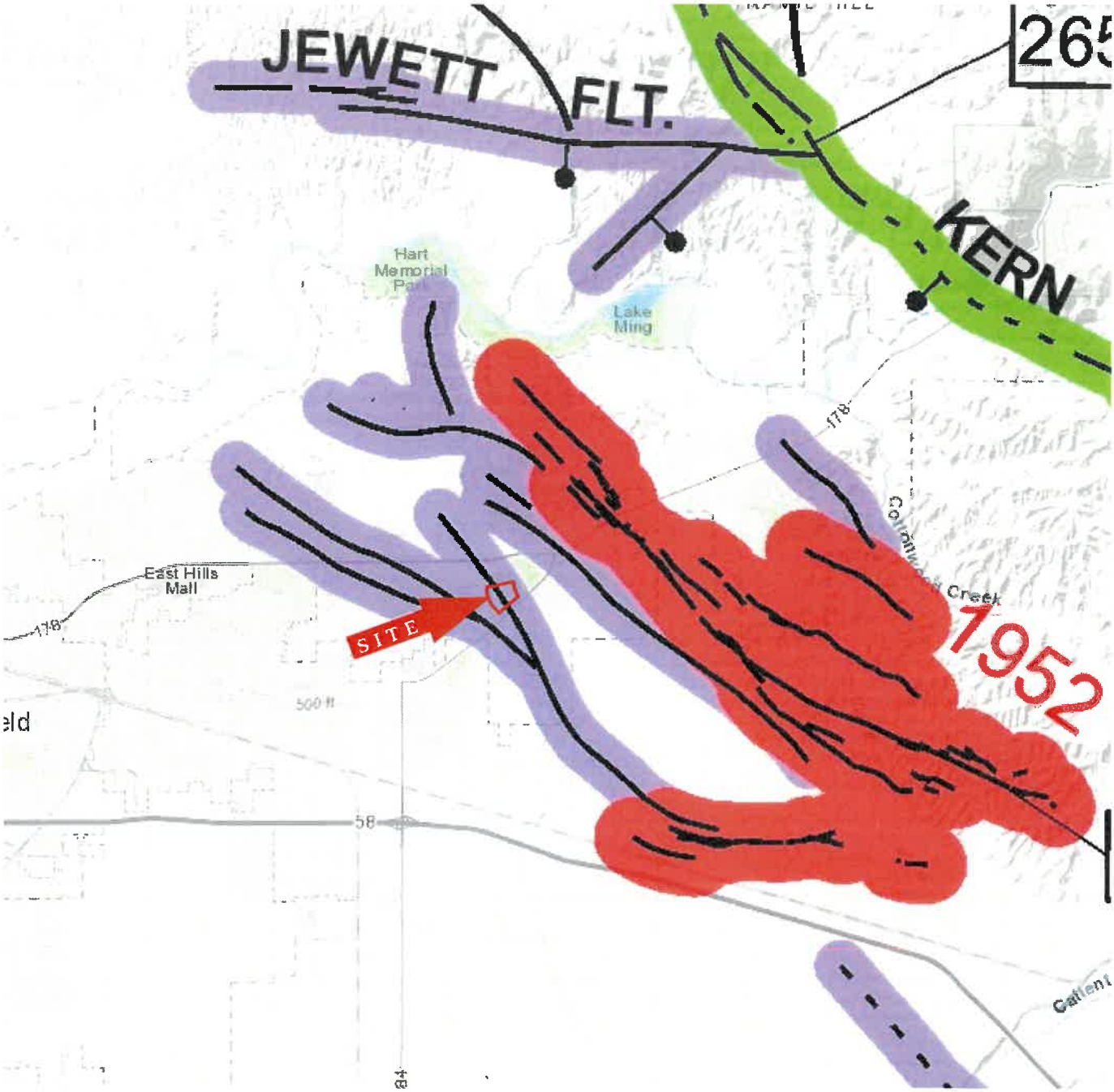
GEOTECHNICAL ENGINEERING INVESTIGATION UPDATE FLETCHER ELEMENTARY SCHOOL - NEW MODULAR CLASSROOM 9801 Highland Knolls Dr. Bakersfield, California	**Scale:** As Shown	**Date:** August 2024	Krazan GEOTECHNICAL ENGINEERING
	Drawn by: WA	**Approved by:** SN	
	Project No. 022-24107	**Figure No.** 6	



LOCAL GEOLOGIC MAP EXPLANATION

FROM:
GEOLOGIC MAP AND CROSS SECTIONS OF THE SOUTHEASTERN MARGIN OF THE SAN JOAQUIN VALLEY, CALIFORNIA.
CROSS SECTION C-C'
BY: J. ALAN BARTOW, 1984

GEOTECHNICAL ENGINEERING INVESTIGATION UPDATE FLETCHER ELEMENTARY SCHOOL - NEW MODULAR CLASSROOM 9801 Highland Knolls Dr. Bakersfield, California	**Scale:** As Shown	**Date:** August 2024	Krazan GEOTECHNICAL ENGINEERING
	Drawn by: WA	**Approved by:** SN	
	Project No. 022-24107	**Figure No.** 6a	



FAULT ACTIVITY MAP

FROM:
PREPARED FROM THE C.G.S. "FAULT ACTIVITIY MAP OF CALIFORNIA" JENNINGS AND BRYANT, 2010
FAULT TRACES ON LAND ARE INDICATED BY SOLID LINES WHERE WELL LOCATED, BY DASHED LINES WHERE CONCEALED BY YOUNGER ROCKS OR BY LAKES OR BAYS. FAULT TRACES ARE QUERIED WHERE CONTINUATION OR EXISTENCE IS UNCERTAIN.

NORTH

0 1.8 3.6

SCALE IN MILES (±)

GEOTECHNICAL ENGINEERING INVESTIGATION UPDATE FLETCHER ELEMENTARY SCHOOL NEW MODULAR CLASSROOM 9801 Highland Knolls Dr. Bakersfield, California	**Scale:** As Shown	**Date:** August 2024	Krazan GEOTECHNICAL ENGINEERING
	Drawn by: WA	**Approved by:** SN	
	Project No. 022-24107	**Figure No.** 7	

Fault along which historic (last 200 years) displacement has occurred and is associated with one or more of the following:

(a) a recorded earthquake with surface rupture. (Also included are some well-defined surface breaks caused by ground shaking during earthquakes, e.g. extensive ground breakage, not on the White Wolf fault, caused by the Arvin-Tehachapi earthquake of 1952). The date of the associated earthquake is indicated. Where repeated surface ruptures on the same fault have occurred, only the date of the latest movement may be indicated, especially if earlier reports are not well documented as to location of ground breaks.

(b) fault creep slippage - slow ground displacement usually without accompanying earthquakes.

(c) displaced survey lines.

A triangle to the right or left of the date indicates termination point of observed surface displacement. Solid red triangle indicates known location of rupture termination point. Open black triangle indicates uncertain or estimated location of rupture termination point.

Date bracketed by triangles indicates local fault break.

No triangle by date indicates an intermediate point along fault break.

Fault that exhibits fault creep slippage. Hachures indicate linear extent of fault creep. Annotation (creep with leader) indicates representative locations where fault creep has been observed and recorded.

Square on fault indicates where fault creep slippage has occured that has been triggered by an earthquake on some other fault. Date of causative earthquake indicated. Squares to right and left of date indicate terminal points between which triggered creep slippage has occurred (creep either continuous or intermittent between these end points).

Holocene fault displacement (during past 11,700 years) without historic record. Geomorphic evidence for Holocene faulting includes sag ponds, scarps showing little erosion, or the following features in Holocene age deposits: offset stream courses, linear scarps, shutter ridges, and triangular faceted spurs. Recency of faulting offshore is based on the interpreted age of the youngest strata displaced by faulting.

Late Quaternary fault displacement (during past 700,000 years). Geomorphic evidence similar to that described for Holocene faults except features are less distinct. Faulting may be younger, but lack of younger overlying deposits precludes more accurate age classification.

Quaternary fault (age undifferentiated). Most faults of this category show evidence of displacement sometime during the past 1.6 million years; possible exceptions are faults which displace rocks of undifferentiated Plio-Pleistocene age. Unnumbered Quaternary faults were based on Fault Map of California, 1975. See Bulletin 201, Appendix D for source data.

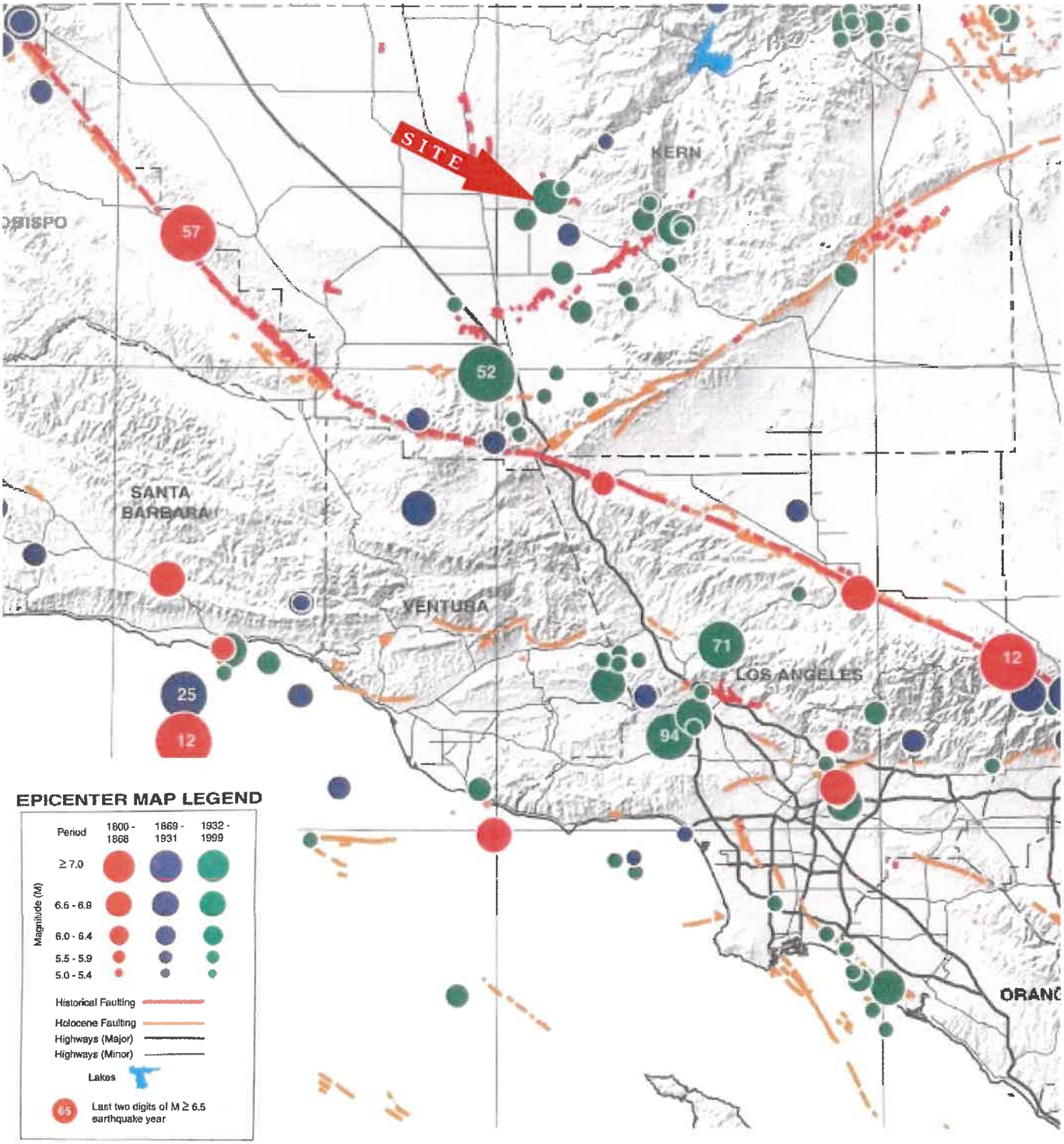
Pre-Quaternary fault (older that 1.6 million years) or fault without recognized Quaternary displacement. Some faults are shown in this category because the source of mapping used was of reconnaissnce nature, or was not done with the object of dating fault displacements. Faults in this category are not necessarily inactive.

FAULT ACTIVITY MAP
EXPLANATION

FROM:

PREPARED FROM THE C.G.S. "FAULT ACTIVITIY MAP OF CALIFORNIA" JENNINGS AND BRYANT, 2010
FAULT TRACES ON LAND ARE INDICATED BY SOLID LINES WHERE WELL LOCATED, BY DASHED LINES WHERE CONCEALED BY YOUNGER ROCKS OR BY LAKES OR BAYS. FAULT TRACES ARE QUERIED WHERE CONTINUATION OR EXISTENCE IS UNCERTAIN.

GEOTECHNICAL ENGINEERING INVESTIGATION UPDATE FLETCHER ELEMENTARY SCHOOL NEW MODULAR CLASSROOM 9801 Highland Knolls Dr. Bakersfield, California	**Scale:** As Shown	**Date:** August 2024	Krazan GEOTECHNICAL ENGINEERING
	Drawn by: WA	**Approved by:** SN	
	Project No. 022-24107	**Figure No.** 7a	



EPICENTER MAP

NOTES:
MAP SOURCE:
CGS MAP SHEET 49
EPICENTERS OF AND AREAS
DAMAGED BY M > 5 CALIFORNIA
EARTHQUAKES, 1800-1999
BY TOPPOZADA, BRANUM, PETERSEN,
HALLSTROM, CRAMER & REICHLE, 2000

NORTH

0 20 40

SCALE IN MILES (±)

GEOTECHNICAL ENGINEERING INVESTIGATION UPDATE
FLETCHER ELEMENTARY SCHOOL
NEW MODULAR CLASSROOM
9801 Highland Knolls Dr.
Bakersfield, California

Scale:	Date:
As Shown	August 2024
Drawn by:	**Approved by:**
WA	SN
Project No.	**Figure No.**
022-24107	8

Krazan
GEOTECHNICAL ENGINEERING

AERIAL PHOTO

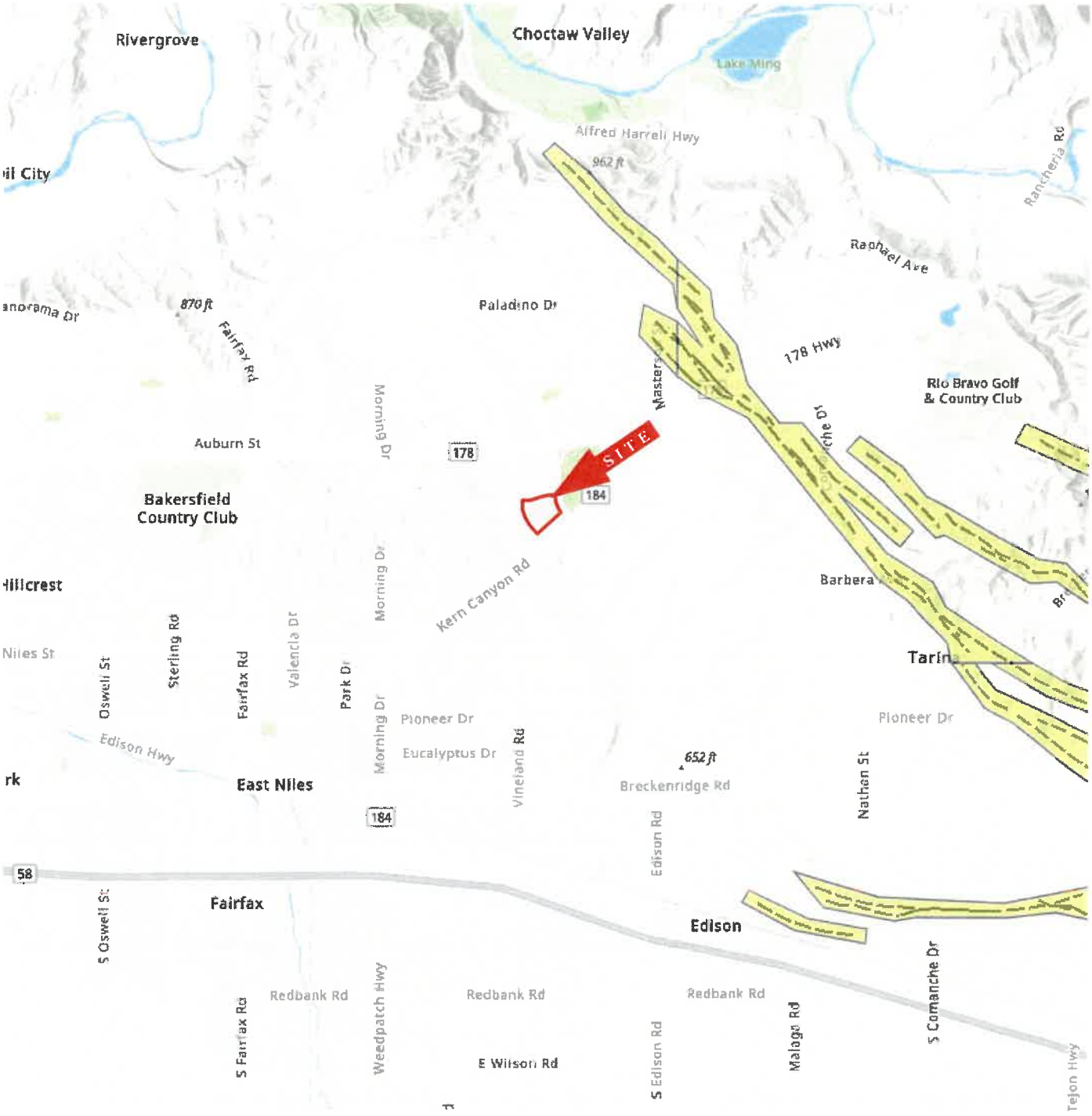
FROM:
GOOGLE EARTH PRO, 2024

NORTH

0’ 200’ 400’

SCALE IN FEET (±)

GEOTECHNICAL ENGINEERING INVESTIGATION UPDATE FLETCHER ELEMENTARY SCHOOL NEW MODULAR CLASSROOM 9801 Highland Knolls Dr. Bakersfield, California	**Scale:** As Shown	**Date:** August 2024	Krazan GEOTECHNICAL ENGINEERING
	Drawn by: WA	**Approved by:** SN	
	Project No. 022-24107	**Figure No.** 9	



EARTHQUAKE ZONES OF REQUIRED INVESTIGATION

FAULTS, LIQUEFACTION, AND LANDSLIDES

MAP SOURCE:
California Geologic Survey-Earthquake Zones of Required Investigation, 2023

NORTH

0 2 4

SCALE IN MILES (±)

GEOTECHNICAL ENGINEERING INVESTIGATION UPDATE FLETCHER ELEMENTARY SCHOOL NEW MODULAR CLASSROOM 9801 Highland Knolls Dr. Bakersfield, California	**Scale:** As Shown	**Date:** August 2024	Krazan GEOTECHNICAL ENGINEERING
	Drawn by: WA	**Approved by:** SN	
	Project No. 022-24107	**Figure No.** 10	

Earthquake Zones of Required Investigation

This Map Shows Both Alquist-Priolo Earthquake Fault Zones and Seismic Hazard Zones

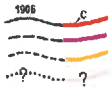
This map shows the location of Alquist-Priolo (AP) Earthquake Fault Zones and Seismic Hazard Zones, collectively referred to here as Earthquake Zones of Required Investigation. The Geographic Information System (GIS) digital files of these regulatory zones released by the California Geological Survey (CGS) are the "Official Maps." GIS files are available at the CGS website http://maps.conservation.ca.gov/cgs/informationwarehouse/. These zones will assist cities and counties in fulfilling their responsibilities for protecting the public from the effects of surface fault rupture and earthquake-triggered ground failure as required by the AP Earthquake Fault Zoning Act (Public Resources Code Sections 2621-2630) and the Seismic Hazards Mapping Act (Public Resources Code Sections 2690-2699.6). For information regarding the general approach and recommended methods for preparing these zones, see CGS Special Publication 42, *Earthquake Fault Zones, a Guide for Government Agencies, Property Owners/Developers, and Geoscience Practitioners for Assessing Fault Rupture Hazards in California*, Appendix C, and CGS Special Publication 118, *Recommended Criteria for Delineating Seismic Hazard Zones in California*.

For information regarding the scope and recommended methods to be used in conducting required site investigations refer to CGS Special Publication 42, and CGS Special Publication 117A, *Guidelines for Evaluating and Mitigating Seismic Hazards in California*. For a general description of the AP and Seismic Hazards Mapping acts, the zonation programs, and related information, please refer to the website at www.conservation.ca.gov/cgs/

MAP EXPLANATION

EARTHQUAKE FAULT ZONES

Earthquake Fault Zones
Zone boundaries are delineated by straight-line segments; the boundaries define the zone encompassing active faults that constitute a potential hazard to structures from surface faulting or fault creep such that avoidance as described in Public Resources Code Section 2621.5(a) would be required.



Active Fault Traces
Faults considered to have been active during Holocene time and to have potential for surface rupture: Solid Line in Black or Red where Accurately Located; Long Dash in Black or Solid Line in Purple where Approximately Located; Short Dash in Black or Solid Line in Orange where Inferred; Dotted Line in Black or Solid Line in Rose where Concealed; Query (?) indicates additional uncertainty. Evidence of historic offset indicated by year of earthquake-associated event or C for displacement caused by fault creep.

SEISMIC HAZARD ZONES

Liquefaction Zones
Areas where historical occurrence of liquefaction, or local geological, geotechnical and ground water conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

Earthquake-Induced Landslide Zones
Areas where previous occurrence of landslide movement, or local topographic, geological, geotechnical and subsurface water conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

OVERLAPPING EARTHQUAKE FAULT AND SEISMIC HAZARD ZONES

Overlap of Earthquake Fault Zone and Liquefaction Zone
Areas that are covered by both Earthquake Fault Zone and Liquefaction Zone.

Overlap of Earthquake Fault Zone and Earthquake-Induced Landslide Zone
Areas that are covered by both Earthquake Fault Zone and Earthquake-Induced Landslide Zone.

Note: Mitigation methods differ for each zone –
AP Act only allows avoidance; Seismic Hazard Mapping Act allows mitigation by engineering/geotechnical design as well as avoidance.

EARTHQUAKE ZONES OF REQUIRED INVESTIGATION EXPLANATION

MAP SOURCE:
Earthquake Fault Zones and Seismic Hazard Zones.
By John Parrish, PHD., State Geologist, 2003

GEOTECHNICAL ENGINEERING INVESTIGATION UPDATE FLETCHER ELEMENTARY SCHOOL NEW MODULAR CLASSROOM 9801 Highland Knolls Dr. Bakersfield, California	**Scale:** As Shown	**Date:** August 2024	Krazan GEOTECHNICAL ENGINEERING
	Drawn by: WA	**Approved by:** SN	
	Project No. 022-24107	**Figure No.** 10a	

FLOOD MAP

NOTE:
FEMA FLOOD INSURANCE MAP
EFFECTIVE 9/26/2008

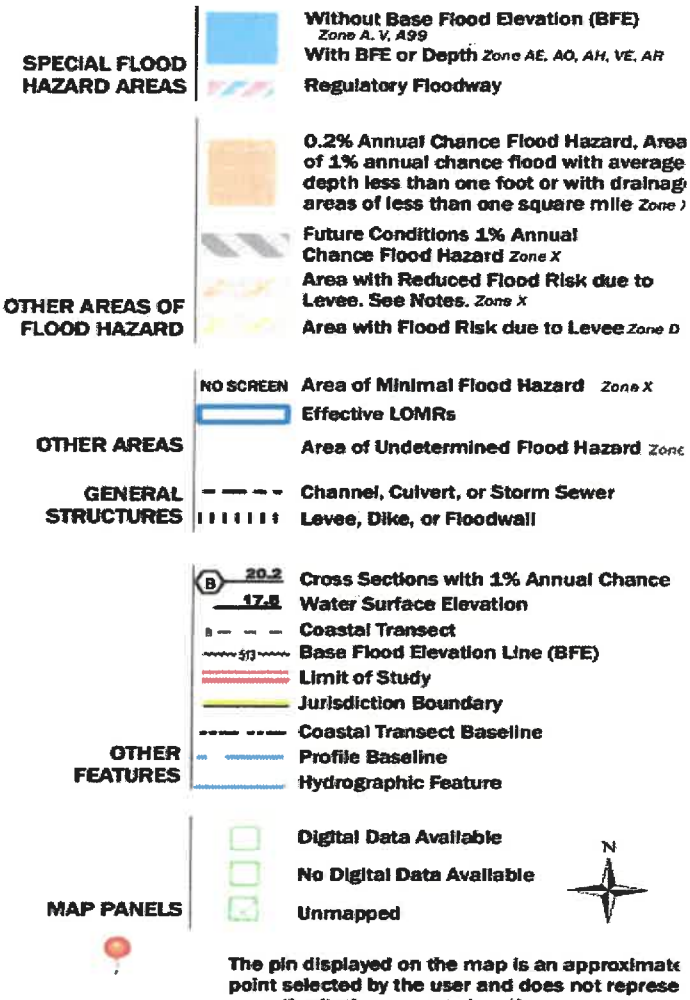
NORTH

0' 600' 1,200'

SCALE IN FEET (±)

GEOTECHNICAL ENGINEERING INVESTIGATION UPDATE FLETCHER ELEMENTARY SCHOOL NEW MODULAR CLASSROOM 9801 Highland Knolls Dr. Bakersfield, California	**Scale:** As Shown	**Date:** August 2024
	Drawn by: WA	**Approved by:** SN
	Project No. 022-24107	**Figure No.** 11

Krazan
GEOTECHNICAL ENGINEERING



This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

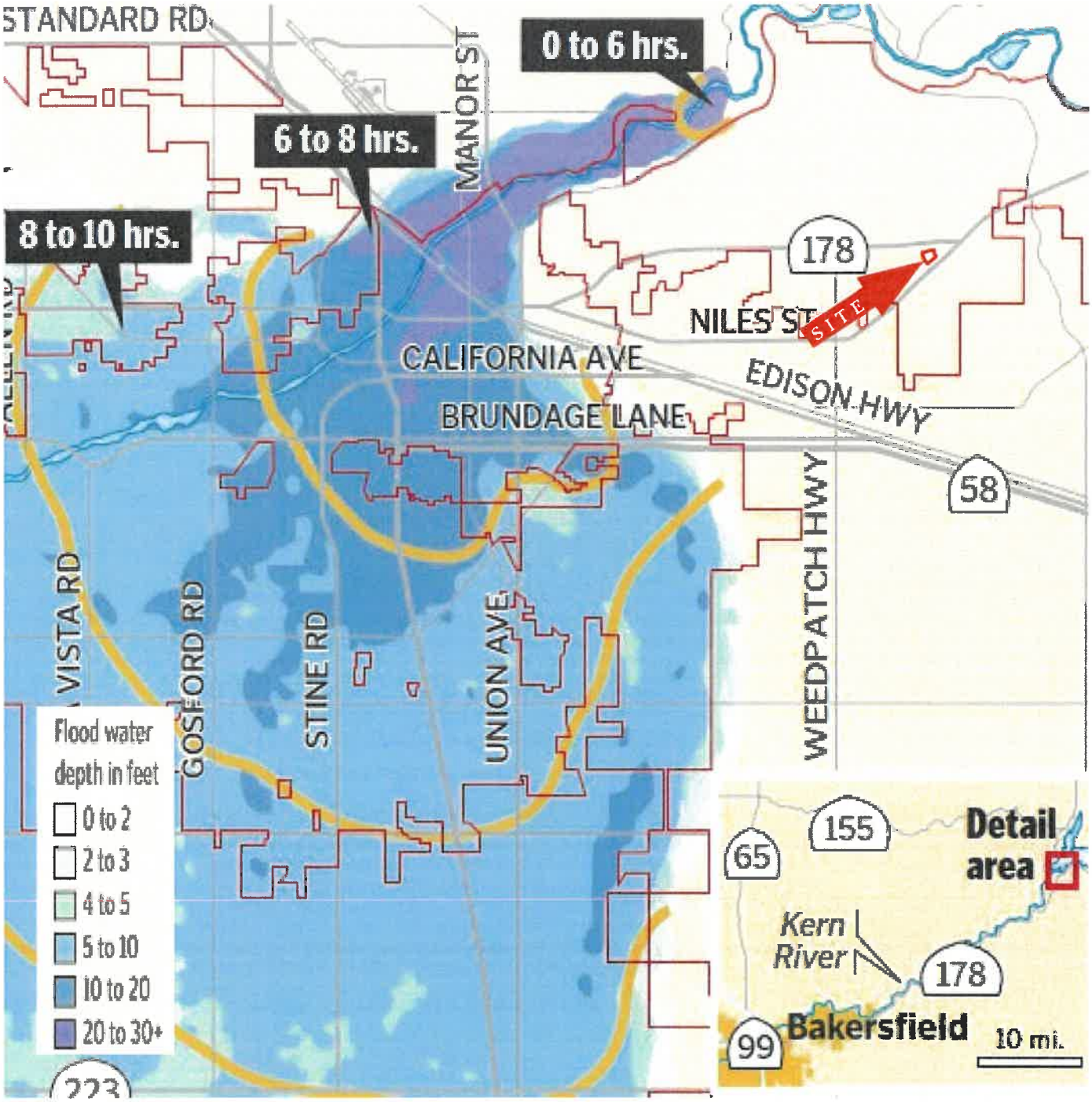
The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 4/1/2021 at 1:53 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

FLOOD MAP EXPLANATION

NOTE:
FEMA FLOOD INSURANCE MAP
EFFECTIVE 9/26/08

GEOTECHNICAL ENGINEERING INVESTIGATION UPDATE FLETCHER ELEMENTARY SCHOOL NEW MODULAR CLASSROOM 9801 Highland Knolls Dr. Bakersfield, California	**Scale:** As Shown	**Date:** August 2024	Krazan GEOTECHNICAL ENGINEERING
	Drawn by: WA	**Approved by:** SN	
	Project No. 022-24107	**Figure No.** 11a	



DAM INUNDATION MAP
(Isabella Dam – Lake Isabella)

NORTH

0 2½ 5
SCALE IN MILES (±)

FROM:
U.S. ARMY CORPS OF ENGINEERS/THE BAKERSFIELD CALIFORNIAN
JANUARY 14, 2017

GEOTECHNICAL ENGINEERING INVESTIGATION UPDATE FLETCHER ELEMENTARY SCHOOL NEW MODULAR CLASSROOM 9801 Highland Knolls Dr. Bakersfield, California	**Scale:** As Shown	**Date:** August 2024
	Drawn by: WA	**Approved by:** SN
	Project No. 022-24107	**Figure No.** 12

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GEOTECHNICAL ENGINEERING

U.S. Geological Survey - Earthquake Hazards Program

Unified Hazard Tool

Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the U.S. Seismic Design Maps web tools (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Please also see the new USGS Earthquake Hazard Toolbox for access to the most recent NSHMs for the conterminous U.S. and Hawaii.

Input

Edition

Dynamic: Conterminous U.S. 2014 (u…

Spectral Period

Peak Ground Acceleration

Latitude

Decimal degrees

35.3924165

Time Horizon

Return period in years

2475

Longitude

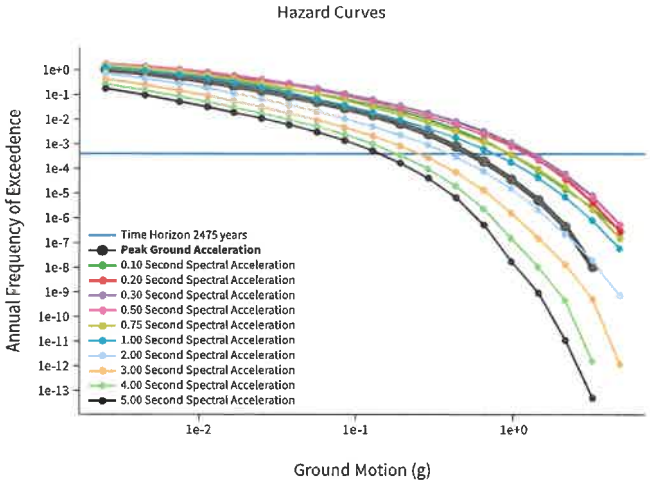
Decimal degrees, negative values for western longitudes

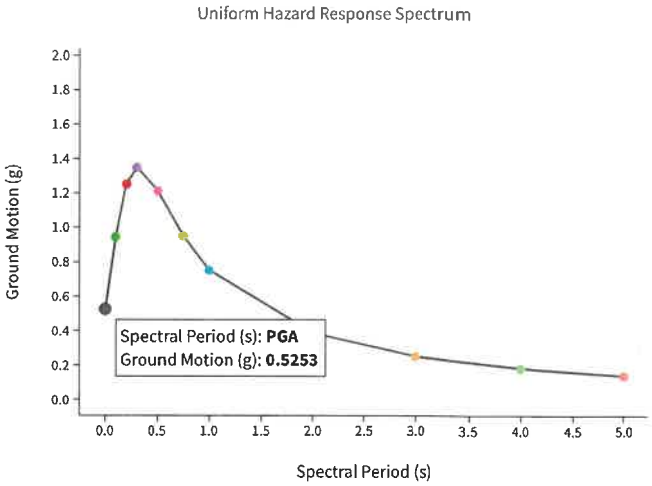
-118.8938981

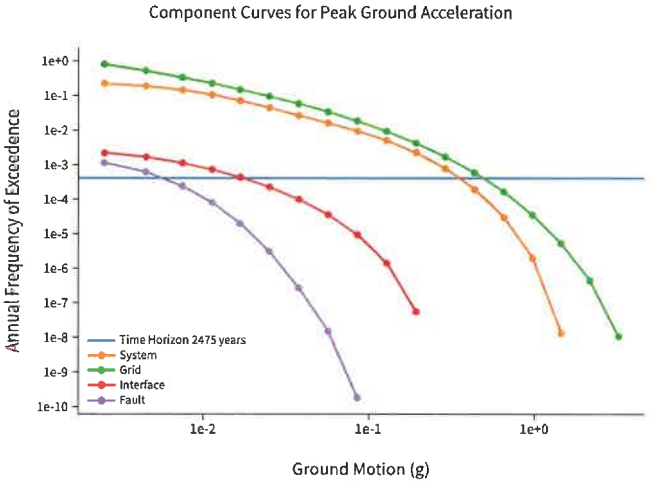
Site Class

259 m/s (Site class D)

Hazard Curve





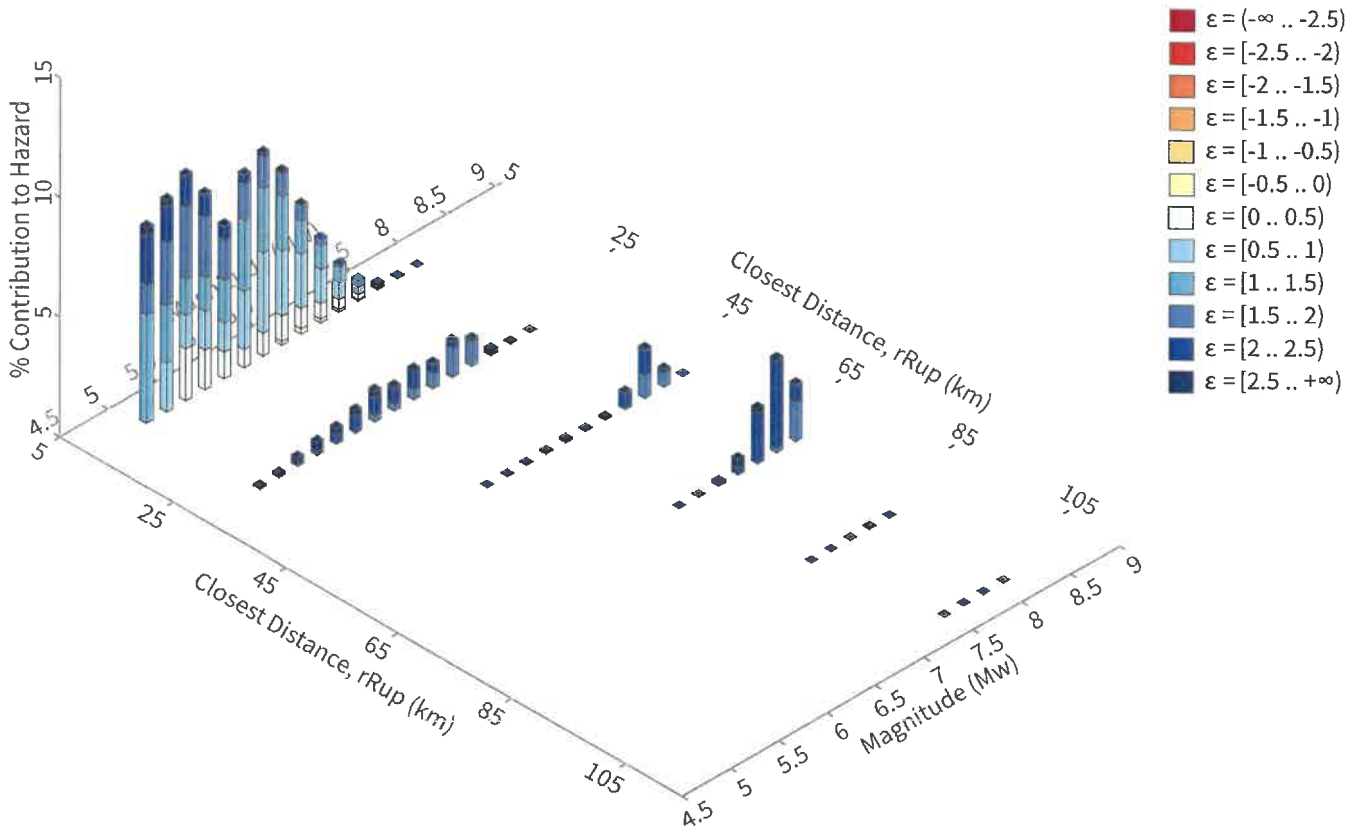


View Raw Data

Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 2475 yrs
Exceedance rate: 0.0004040404 yr^{-1}
PGA ground motion: 0.52530396 g

Recovered targets

Return period: 2828.2 yrs
Exceedance rate: 0.00035358179 yr^{-1}

Totals

Binned: 100 %
Residual: 0 %
Trace: 0.1 %

Mean (over all sources)

m: 6.28
r: 17.75 km
ε_0: 1.41 σ

Mode (largest m-r bin)

m: 5.5
r: 9.15 km
ε_0: 1.3 σ
Contribution: 9.43 %

Mode (largest m-r-ε_0 bin)

m: 5.1
r: 5.17 km
ε_0: 1.17 σ
Contribution: 4.51 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km
m: min = 4.4, max = 9.4, Δ = 0.2
ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)
ε1: [-2.5 .. -2.0)
ε2: [-2.0 .. -1.5)
ε3: [-1.5 .. -1.0)
ε4: [-1.0 .. -0.5)
ε5: [-0.5 .. 0.0)
ε6: [0.0 .. 0.5)
ε7: [0.5 .. 1.0)
ε8: [1.0 .. 1.5)
ε9: [1.5 .. 2.0)
ε10: [2.0 .. 2.5)
ε11: [2.5 .. +∞]

Deaggregation Contributors

Source Set ↳ Source	Type	r	m	ε_0	lon	lat	az	%
UC33brAvg_FM31 (opt)	Grid							41.82
PointSourceFinite: -118.894, 35.406		5.17	5.69	0.73	118.894°W	35.406°N	0.00	6.62
PointSourceFinite: -118.894, 35.406		5.17	5.69	0.73	118.894°W	35.406°N	0.00	6.60
PointSourceFinite: -118.894, 35.469		9.03	5.91	1.22	118.894°W	35.469°N	0.00	2.44
PointSourceFinite: -118.894, 35.469		9.03	5.91	1.22	118.894°W	35.469°N	0.00	2.42
PointSourceFinite: -118.894, 35.487		10.36	5.98	1.35	118.894°W	35.487°N	0.00	1.86
PointSourceFinite: -118.894, 35.487		10.36	5.98	1.35	118.894°W	35.487°N	0.00	1.85
PointSourceFinite: -118.894, 35.478		9.69	5.94	1.29	118.894°W	35.478°N	0.00	1.82
PointSourceFinite: -118.894, 35.478		9.69	5.94	1.29	118.894°W	35.478°N	0.00	1.82
PointSourceFinite: -118.894, 35.523		13.13	6.13	1.56	118.894°W	35.523°N	0.00	1.57
PointSourceFinite: -118.894, 35.523		13.13	6.13	1.56	118.894°W	35.523°N	0.00	1.56
PointSourceFinite: -118.894, 35.496		11.04	6.02	1.40	118.894°W	35.496°N	0.00	1.15
PointSourceFinite: -118.894, 35.496		11.04	6.02	1.40	118.894°W	35.496°N	0.00	1.14
PointSourceFinite: -118.894, 35.514		12.51	6.07	1.53	118.894°W	35.514°N	0.00	1.06
PointSourceFinite: -118.894, 35.514		12.51	6.07	1.53	118.894°W	35.514°N	0.00	1.05
UC33brAvg_FM32 (opt)	Grid							41.77
PointSourceFinite: -118.894, 35.406		5.17	5.69	0.74	118.894°W	35.406°N	0.00	6.62
PointSourceFinite: -118.894, 35.406		5.17	5.69	0.74	118.894°W	35.406°N	0.00	6.59
PointSourceFinite: -118.894, 35.469		9.03	5.91	1.22	118.894°W	35.469°N	0.00	2.44
PointSourceFinite: -118.894, 35.469		9.03	5.91	1.22	118.894°W	35.469°N	0.00	2.42
PointSourceFinite: -118.894, 35.487		10.36	5.98	1.35	118.894°W	35.487°N	0.00	1.85
PointSourceFinite: -118.894, 35.487		10.36	5.98	1.35	118.894°W	35.487°N	0.00	1.85
PointSourceFinite: -118.894, 35.478		9.69	5.94	1.29	118.894°W	35.478°N	0.00	1.82
PointSourceFinite: -118.894, 35.478		9.69	5.94	1.29	118.894°W	35.478°N	0.00	1.81
PointSourceFinite: -118.894, 35.523		13.14	6.13	1.56	118.894°W	35.523°N	0.00	1.57
PointSourceFinite: -118.894, 35.523		13.14	6.13	1.56	118.894°W	35.523°N	0.00	1.56
PointSourceFinite: -118.894, 35.496		11.04	6.02	1.40	118.894°W	35.496°N	0.00	1.14
PointSourceFinite: -118.894, 35.496		11.04	6.02	1.40	118.894°W	35.496°N	0.00	1.14
PointSourceFinite: -118.894, 35.514		12.51	6.07	1.53	118.894°W	35.514°N	0.00	1.05
PointSourceFinite: -118.894, 35.514		12.51	6.07	1.53	118.894°W	35.514°N	0.00	1.05
UC33brAvg_FM31	System							8.22
San Andreas (Big Bend) [4]		63.82	8.08	2.17	119.053°W	34.833°N	193.12	4.46
White Wolf [4]		25.39	7.09	1.85	118.735°W	35.205°N	145.38	1.23
UC33brAvg_FM32	System							8.18
San Andreas (Big Bend) [4]		63.82	8.08	2.17	119.053°W	34.833°N	193.12	4.44
White Wolf [4]		25.39	7.07	1.86	118.735°W	35.205°N	145.38	1.22

U.S. Geological Survey - Earthquake Hazards Program

2008 National Seismic Hazard Maps - Source Parameters

New Search

Distance in Miles	Name	State	Pref Slip Rate (mm/yr)	Dip (degrees)	Dip Dir	Slip Sense	Rupture Top (km)	Rupture Bottom (km)	Length (km)
15.44	White Wolf	CA	2	75	S	reverse	0	14	63
28.00	Pleito	CA	2	46	S	reverse	0	14	44
34.25	Garlock;GE+GC+GW	CA	n/a	90	V	strike slip	0.3	12	256
34.25	Garlock;GW	CA	6	90	V	strike slip	0.7	14	98
34.25	Garlock;GC+GW	CA	n/a	90	V	strike slip	0.4	12	210
39.59	S. San Andreas;BB+NM+SM+NSB+SSB+BG+CO	CA	n/a	85		strike slip	0.1	13	390
39.59	S. San Andreas;CH+CC+BB+NM+SM+NSB+SSB+BG+CO	CA	n/a	86		strike slip	0.1	13	512
39.59	S. San Andreas;BB+NM	CA	n/a	90	V	strike slip	0	15	87
39.59	S. San Andreas;BB+NM+SM	CA	n/a	90	V	strike slip	0	14	184
39.59	S. San Andreas;PK+CH+CC+BB	CA	n/a	90	V	strike slip	0.1	12	208
39.59	S. San Andreas;PK+CH+CC+BB+NM	CA	n/a	90	V	strike slip	0.1	12	245
39.59	S. San Andreas;PK+CH+CC+BB+NM+SM	CA	n/a	90	V	strike slip	0.1	13	342
39.59	S. San Andreas;PK+CH+CC+BB+NM+SM+NSB	CA	n/a	90	V	strike slip	0.1	13	377
39.59	S. San Andreas;PK+CH+CC+BB+NM+SM+NSB+SSB	CA	n/a	90	V	strike slip	0.1	13	421
39.59	S. San Andreas;PK+CH+CC+BB+NM+SM+NSB+SSB+BG	CA	n/a	86		strike slip	0.1	13	479
39.59	S. San Andreas;PK+CH+CC+BB+NM+SM+NSB+SSB+BG+CO	CA	n/a	86		strike slip	0.1	13	548
39.59	S. San Andreas;BB+NM+SM+NSB	CA	n/a	90	V	strike slip	0	14	220

39.59	S. San Andreas;BB+NM+SM+NSB+SSB	CA	n/a	90	V	strike slip	0	14	263
39.59	S. San Andreas;BB+NM+SM+NSB+SSB+BG	CA	n/a	84		strike slip	0	14	321
39.59	S. San Andreas;CH+CC+BB+NM+SM	CA	n/a	90	V	strike slip	0	14	306
39.59	S. San Andreas;CC+BB	CA	n/a	90	V	strike slip	0	15	109
39.59	S. San Andreas;CC+BB+NM	CA	n/a	90	V	strike slip	0	15	146
39.59	S. San Andreas;CC+BB+NM+SM	CA	n/a	90	V	strike slip	0	14	243
39.59	S. San Andreas;CC+BB+NM+SM+NSB	CA	n/a	90	V	strike slip	0	14	279
39.59	S. San Andreas;CC+BB+NM+SM+NSB+SSB	CA	n/a	90	V	strike slip	0	14	322
39.59	S. San Andreas;CC+BB+NM+SM+NSB+SSB+BG	CA	n/a	85		strike slip	0	14	380
39.59	S. San Andreas;CC+BB+NM+SM+NSB+SSB+BG+CO	CA	n/a	86		strike slip	0.1	13	449
39.59	S. San Andreas;BB	CA	34	90	V	strike slip	0	15	50
39.59	S. San Andreas;CH+CC+BB	CA	n/a	90	V	strike slip	0	14	171
39.59	S. San Andreas;CH+CC+BB+NM	CA	n/a	90	V	strike slip	0	14	208
39.59	S. San Andreas;CH+CC+BB+NM+SM+NSB	CA	n/a	90	V	strike slip	0	14	341
39.59	S. San Andreas;CH+CC+BB+NM+SM+NSB+SSB	CA	n/a	90	V	strike slip	0	14	384
39.59	S. San Andreas;CH+CC+BB+NM+SM+NSB+SSB+BG	CA	n/a	86		strike slip	0	14	442
40.32	S. San Andreas;NM+SM	CA	n/a	90	V	strike slip	0	14	134
40.32	S. San Andreas;NM+SM+NSB	CA	n/a	90	V	strike slip	0	13	170
40.32	S. San Andreas;NM+SM+NSB+SSB	CA	n/a	90	V	strike slip	0	13	213
40.32	S. San Andreas;NM+SM+NSB+SSB+BG	CA	n/a	83		strike slip	0	14	271

40.32	S. San Andreas;NM	CA	27	90	V	strike slip	0	15	37
40.32	S. San Andreas;NM+SM+NSB+SSB+BG+CO	CA	n/a	84		strike slip	0.1	13	340
42.30	S. San Andreas;PK+CH+CC	CA	n/a	90	V	strike slip	0.2	11	158
42.30	S. San Andreas;CC	CA	34	90	V	strike slip	0	15	59
42.30	S. San Andreas;CH+CC	CA	n/a	90	V	strike slip	0	14	122
46.78	San Gabriel	CA	1	61	N	strike slip	0	15	71
47.57	So Sierra Nevada	CA	0.1	50	E	normal	0	14	112
49.65	Garlock;GE+GC	CA	n/a	90	V	strike slip	0	12	156
49.65	Garlock;GC	CA	7	90	V	strike slip	0	12	111

APPENDIX A

FIELD AND LABORATORY INVESTIGATIONS

Field Investigation

The field investigation consisted of a surface reconnaissance and a subsurface exploratory program. Three 6½-inch exploratory borings were recently advanced. The boring locations are shown on the site plan.

The soils encountered were logged in the field during the exploration and, with supplementary laboratory test data, are described in accordance with the Unified Soil Classification System.

Modified standard penetration tests and standard penetration tests were performed at selected depths. These tests represent the resistance to driving a 2½-inch and 1½-inch diameter split barrel sampler, respectively. The driving energy was provided by a hammer weighing 140 pounds falling 30 inches. Relatively undisturbed soil samples were obtained while performing this test. Bag samples of the disturbed soil were obtained from the auger cuttings. The modified standard penetration tests are identified in the sample type on the boring logs with a full shaded in block. The standard penetration tests are identified in the sample type on the boring logs with half of the block shaded. All samples were returned to our Clovis laboratory for evaluation.

Laboratory Investigation

The laboratory investigation was programmed to determine the physical and mechanical properties of the foundation soil underlying the site. Test results were used as criteria for determining the engineering suitability of the surface and subsurface materials encountered.

In situ moisture content, dry density, consolidation, direct shear, and sieve analysis tests were determined for the undisturbed samples representative of the subsurface material. Expansion index tests were completed for select bag samples obtained from the auger cuttings. These tests, supplemented by visual observation, comprised the basis for evaluation of the site material.

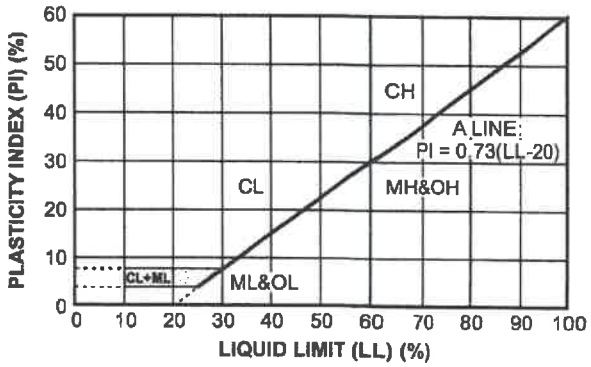
UNIFIED SOIL CLASSIFICATION SYSTEM

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART			
COARSE-GRAINED SOILS (more than 50% of material is larger than No. 200 sieve size.)			
GRAVELS More than 50% of coarse fraction larger than No. 4 sieve size	Clean Gravels (Less than 5% fines)		
		GW	Well-graded gravels, gravel-sand mixtures, little or no fines
		GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
	Gravels with fines (More than 12% fines)		
		GM	Silty gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-clay mixtures
SANDS 50% or more of coarse fraction smaller than No. 4 sieve size	Clean Sands (Less than 5% fines)		
		SW	Well-graded sands, gravelly sands, little or no fines
		SP	Poorly graded sands, gravelly sands, little or no fines
	Sands with fines (More than 12% fines)		
		SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS (50% or more of material is smaller than No. 200 sieve size.)			
SILTS AND CLAYS Liquid limit less than 50%		ML	Inorganic silts and very fine sands, rock flour, silty of 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
SILTS AND CLAYS Liquid limit 50% or greater		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
HIGHLY ORGANIC SOILS		PT	Peat and other highly organic soils

CONSISTENCY CLASSIFICATION	
Description	**Blows per Foot**
Granular Soils	
Very Loose	< 5
Loose	5 – 15
Medium Dense	16 – 40
Dense	41 – 65
Very Dense	> 65
Cohesive Soils	
Very Soft	< 3
Soft	3 – 5
Firm	6 – 10
Stiff	11 – 20
Very Stiff	21 – 40
Hard	> 40

GRAIN SIZE CLASSIFICATION		
Grain Type	*Standard Sieve Size*	*Grain Size in Millimeters*
Boulders	Above 12 inches	Above 305
Cobbles	12 to 13 inches	305 to 76.2
Gravel	3 inches to No. 4	76.2 to 4.76
Coarse-grained	3 to ¾ inches	76.2 to 19.1
Fine-grained	¾ inches to No. 4	19.1 to 4.76
Sand	No. 4 to No. 200	4.76 to 0.074
Coarse-grained	No. 4 to No. 10	4.76 to 2.00
Medium-grained	No. 10 to No. 40	2.00 to 0.42
Fine-grained	No. 40 to No. 200	0.42 to 0.074
Silt and Clay	Below No. 200	Below 0.074

PLASTICITY CHART



Log of Boring B201

Project: Fletcher Elementary School New Modular Classroom

Project No: 022-24107

Client: Bakersfield City School District

Figure No.: A-201

Location: 9801 Highland Knolls Drive, Bakersfield, California

Logged By: Michael Rupright

Depth to Water> **Initial:** None **At Completion:** None

Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
0		Ground Surface				
0		***CLAYEY SAND (SC)*** FILL, fine- to coarse-grained; orange-brown, moist, drills hard				
2			123.3	10.6		77
4		***SILTY SAND/CLAYEY SAND (SM/SC)*** Very dense, fine- to coarse-grained; orange-brown, moist, drills hard				
6			122.1	9.2		75
8						
10		***CLAYEY SAND (SC)*** Dense, fine- to coarse-grained with GRAVEL; light brown, moist, drills firmly	109.2	9.9		32
12						
14		Very dense and drills hard below 14 feet				
16			122.1	9.2		66
		Auger refusal at 17 feet				
		End of Borehole				
18						
20						

Penetration Test blows/ft: 20 40 60

Water Content (%): 10 20 30 40

Drill Method: Hollow Stem

Drill Rig: B80

Driller: David Lopez

Krazan and Associates

Drill Date: 8-12-24

Hole Size: 6½ Inches

Elevation: 17 Feet

Sheet: 1 of 1

Log of Boring B202

Project: Fletcher Elementary School New Modular Classroom

Project No: 022-24107

Client: Bakersfield City School District

Figure No.: A-202

Location: 9801 Highland Knolls Drive, Bakersfield, California

Logged By: Michael Rupright

Depth to Water> **Initial:** None **At Completion:** None

Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
0		Ground Surface				
0		***CLAYEY SAND (SC)*** FILL, fine- to coarse-grained with GRAVEL; orange-brown, moist, drills hard				
2			116.8	11.5		50+
4		Gray-brown below 5 feet				
		Auger refusal at 5½ feet	114.7	8.5		50+
6		End of Borehole				
8						
10						
12						
14						
16						
18						
20						

Penetration Test blows/ft: 20 40 60

Water Content (%): 10 20 30 40

Drill Method: Hollow Stem

Drill Rig: B80

Driller: David Lopez

Krazan and Associates

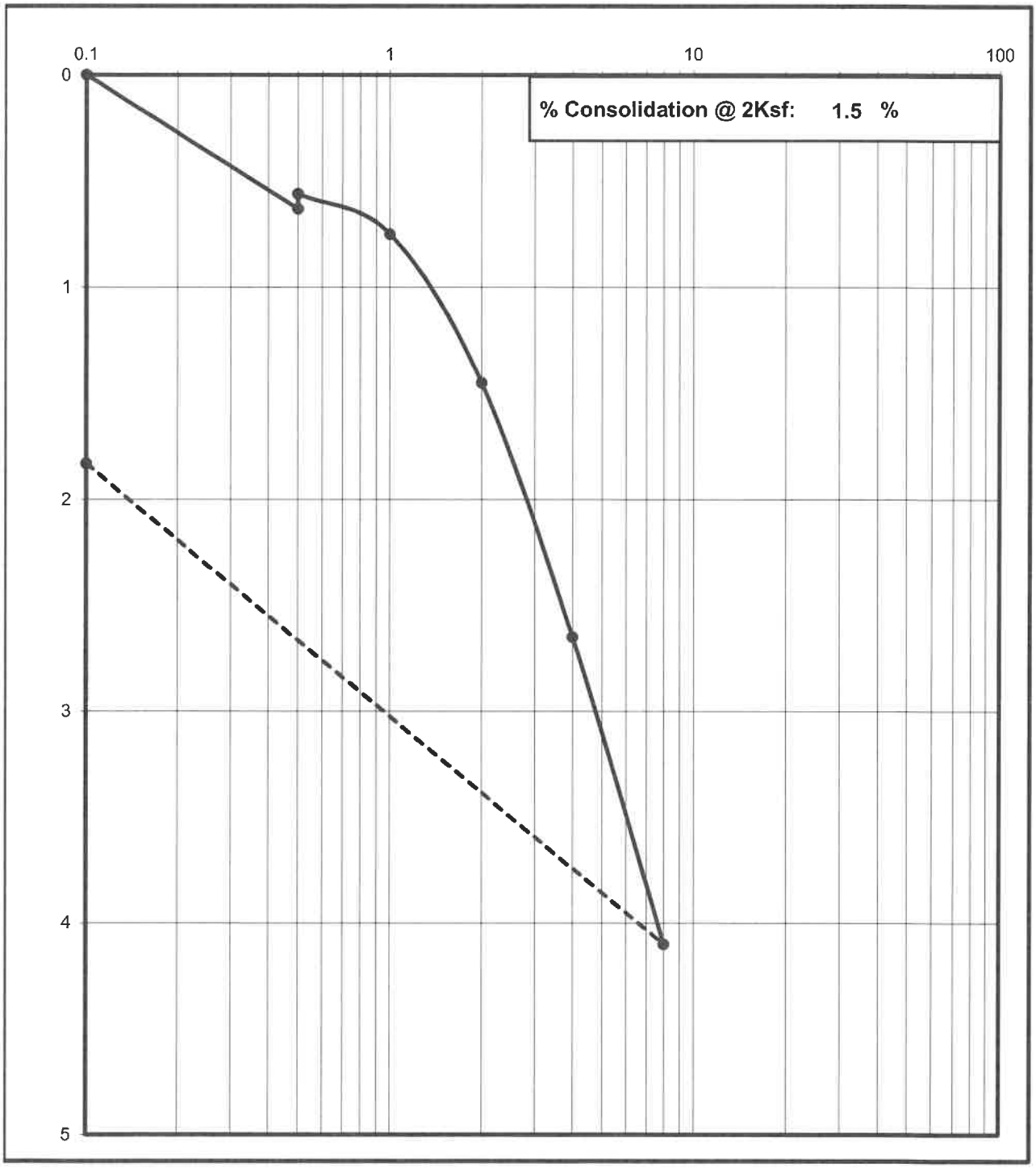
Drill Date: 8-12-24

Hole Size: 6½ Inches

Elevation: 5½ Feet

Consolidation Test

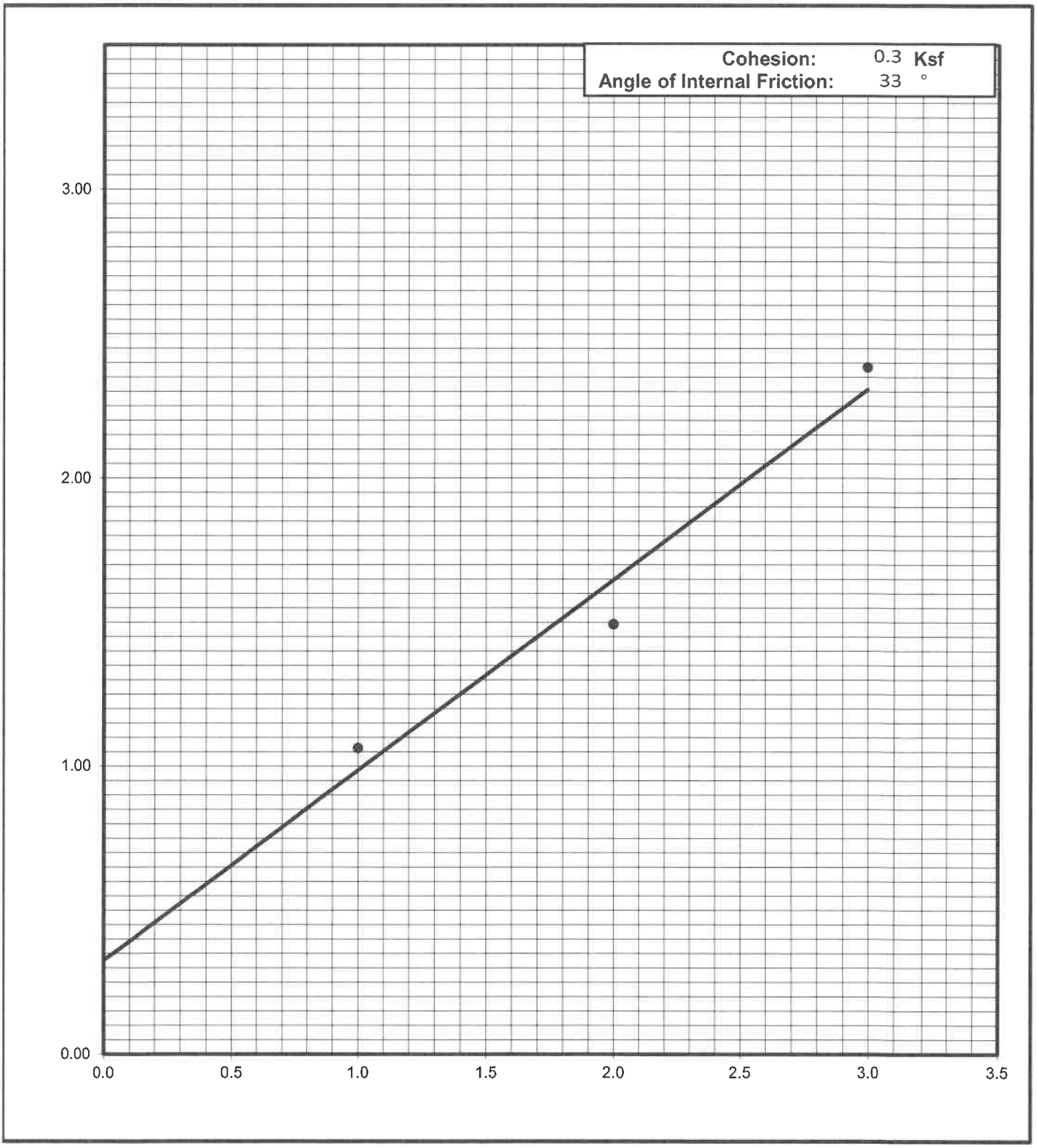
Project No	Boring No. & Depth	Date	Soil Classification
022-24107	B201 @ 2-3'	8/26/2024	SC



Krazan Testing Laboratory

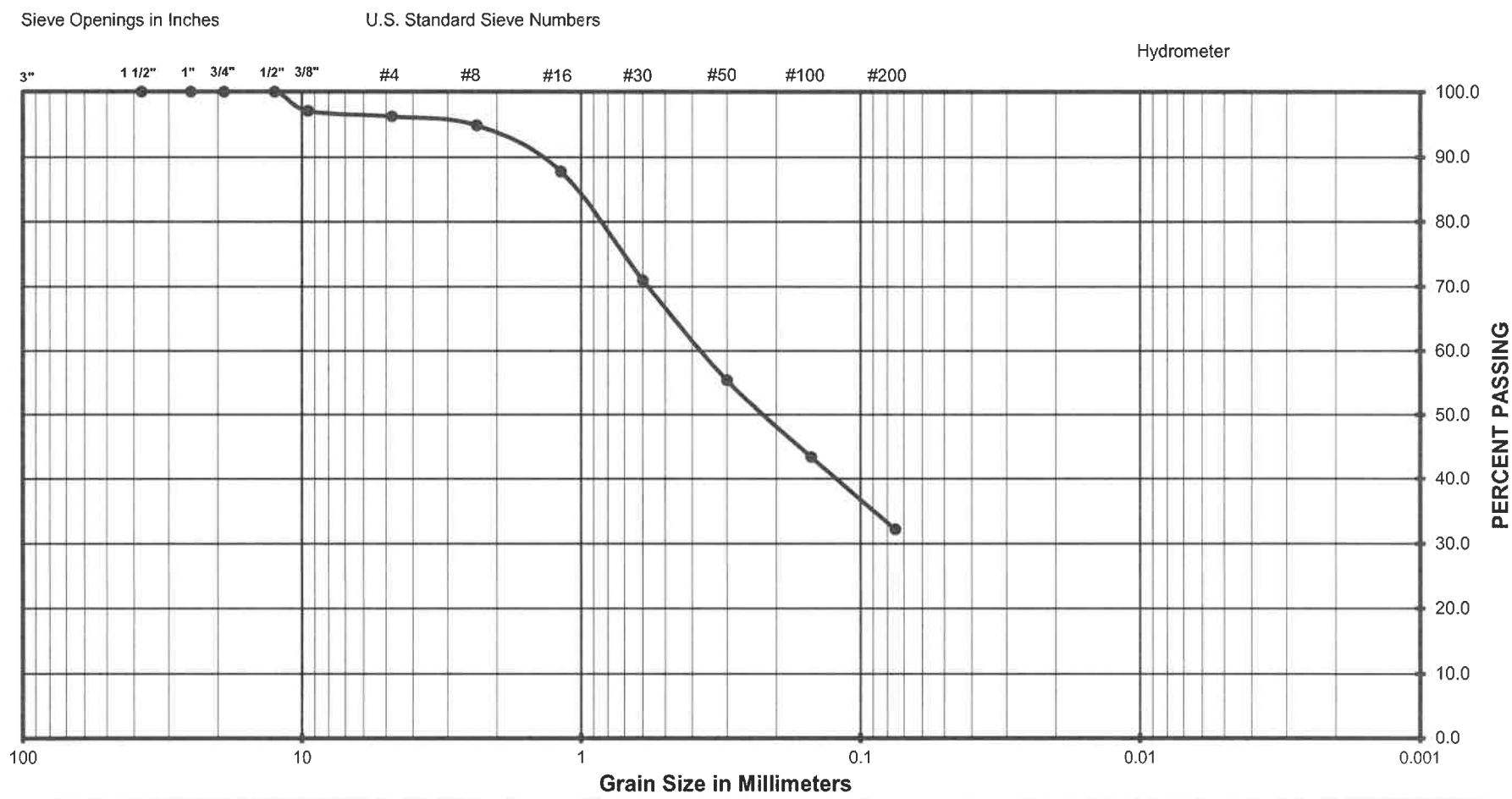
Shear Strength Diagram (Direct Shear)
ASTM D - 3080 / AASHTO T - 236

Project Number	Boring No. & Depth	Soil Type	Date
022-24107	B202 @ 2-3'	SC w/ grvl	8/26/2024



Krazan Testing Laboratory

Grain Size Analysis

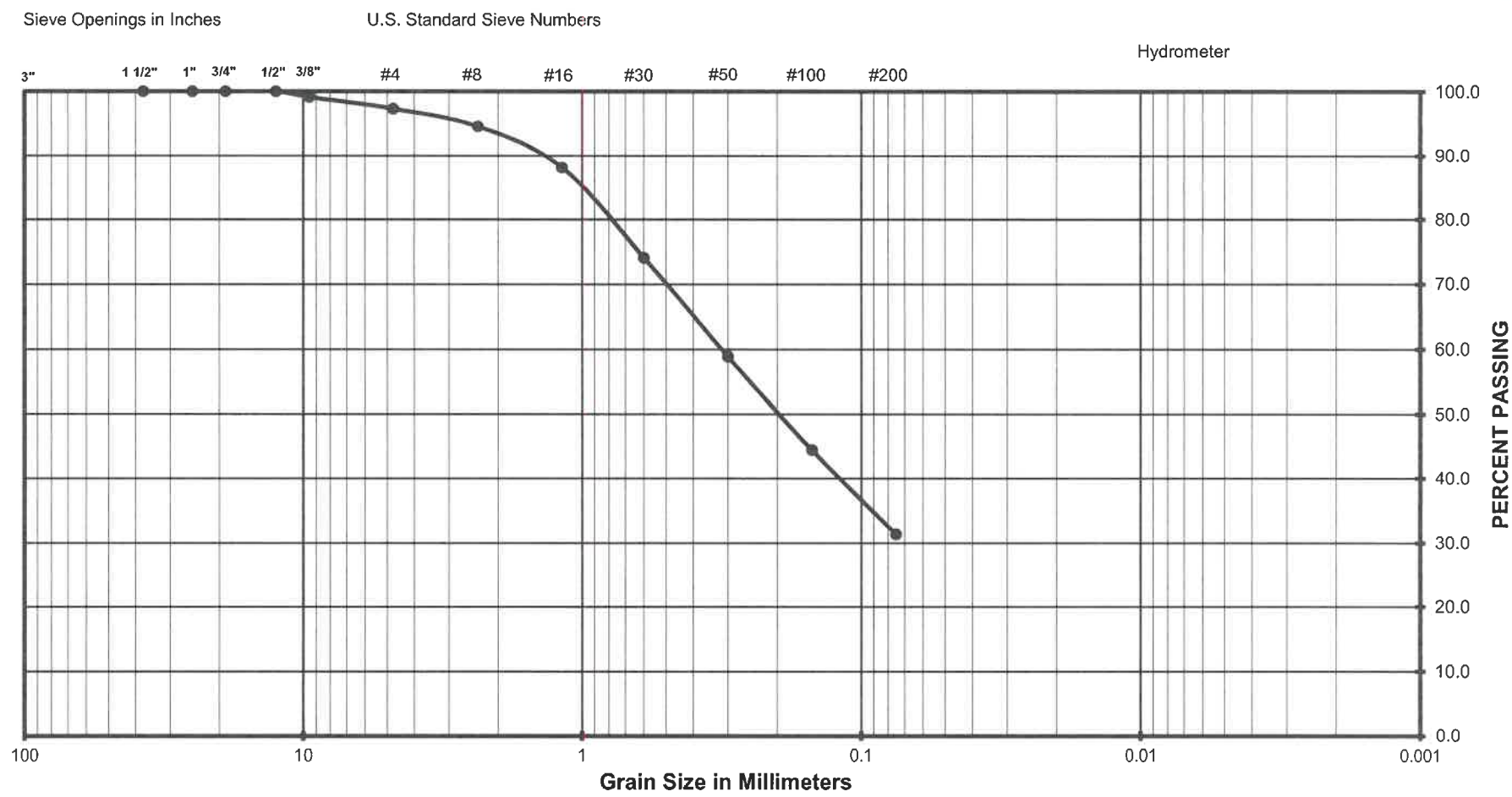


(Unified Soils Classification)

Project Name	Fletcher Elementary School New Modular Classroom
Project Number	022-24107
Soil Classification	SC
Sample Number	B201 @ 2-3'

Krazan Testing Laboratory

Grain Size Analysis



(Unified Soils Classification)

Project Name	Fletcher Elementary School New Modular Classroom
Project Number	022-24107
Soil Classification	SC/SM
Sample Number	B201 @ 5-6'

Krazan Testing Laboratory

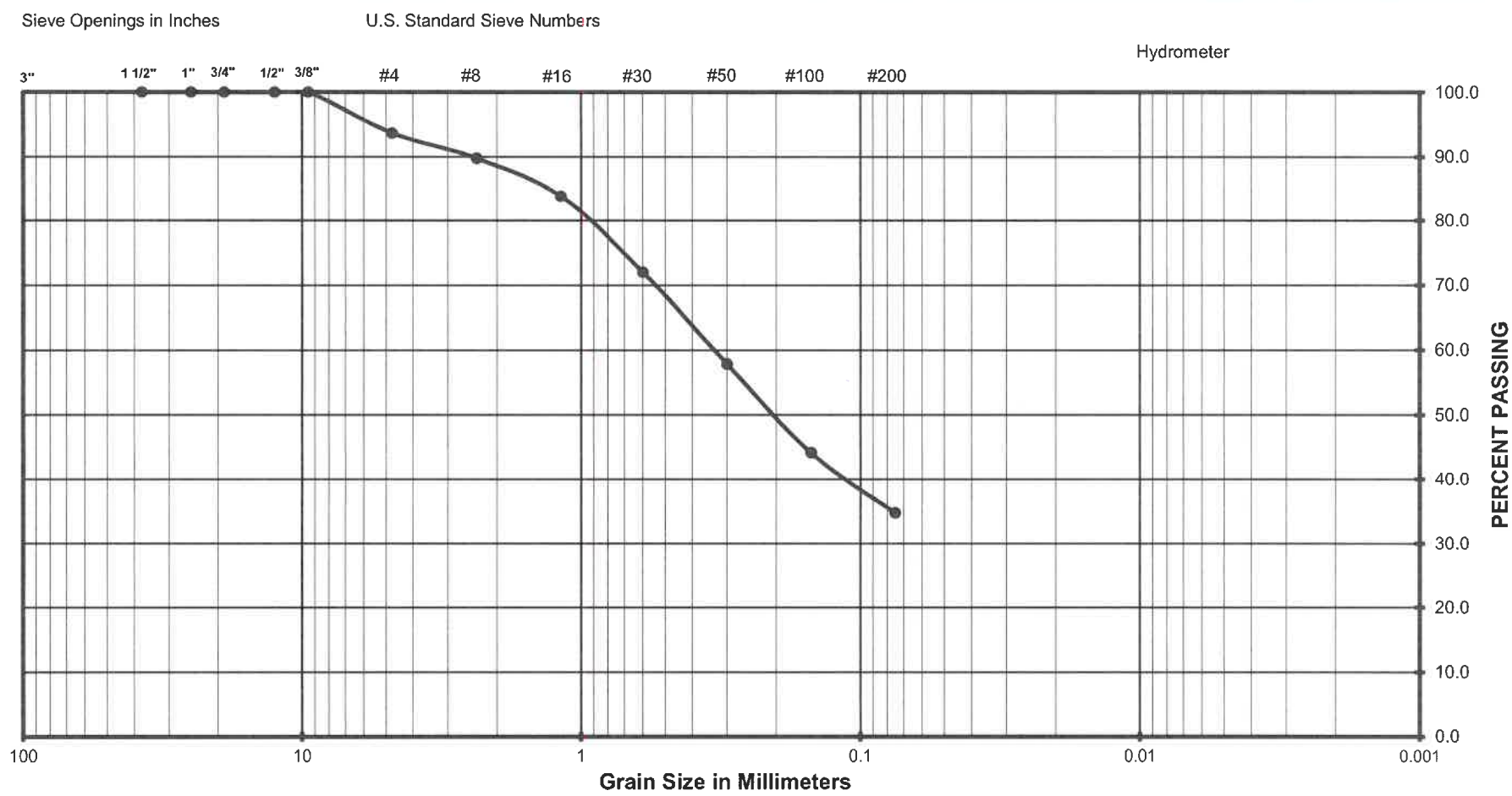
Grain Size Analysis

(Unified Soils Classification)

Project Name	Fletcher Elementary School New Modular Classroom
Project Number	022-24107
Soil Classification	SC w/ grvl
Sample Number	B201 @ 10-11'

Krazan Testing Laboratory

Grain Size Analysis



(Unified Soils Classification)

Project Name	Fletcher Elementary School New Modular Classroom
Project Number	022-24107
Soil Classification	SC
Sample Number	B201 @ 15-16'

Krazan Testing Laboratory

Expansion Index Test

ASTM D - 4829

Project Number	: 022-24107
Project Name	: Fletcher Elementary School New Modular Classr
Date	: 8/26/2024
Sample location/ Depth	: B201 @ 0-2'
Sample Number	: X1
Soil Classification	: CL

Trial #	**1**	**2**	**3**
Weight of Soil & Mold, gms	755.3		
Weight of Mold, gms	367.0		
Weight of Soil, gms	388.3		
Wet Density, Lbs/cu.ft.	117.1		
Weight of Moisture Sample (Wet), gms	200.0		
Weight of Moisture Sample (Dry), gms	180.0		
Moisture Content, %	11.1		
Dry Density, Lbs/cu.ft.	105.4		
Specific Gravity of Soil	2.7		
Degree of Saturation, %	50.1		

Time	Inital	30 min	1 hr	6hrs	12 hrs	24 hrs
Dial Reading	0	--	--	--	--	0.0772

Expansion Index $_{measured}$ = 77.2

Expansion Index = **77**

Expansion Potential Table	
Exp. Index	Potential Exp.
0 - 20	Very Low
21 - 50	Low
51 - 90	Medium
91 - 130	High
>130	Very High

Krazan Testing Laboratory

Expansion Index Test

ASTM D - 4829

Project Number	: 022-24107
Project Name	: Fletcher Elementary School New Modular Classr
Date	: 8/26/2024
Sample location/ Depth	: B201 @ 2-5'
Sample Number	: Bulk #1
Soil Classification	: SC

Trial #	**1**	**2**	**3**
Weight of Soil & Mold, gms	754.5		
Weight of Mold, gms	367.7		
Weight of Soil, gms	386.8		
Wet Density, Lbs/cu.ft.	116.7		
Weight of Moisture Sample (Wet), gms	200.0		
Weight of Moisture Sample (Dry), gms	180.2		
Moisture Content, %	11.0		
Dry Density, Lbs/cu.ft.	105.1		
Specific Gravity of Soil	2.7		
Degree of Saturation, %	49.2		

Time	Inital	30 min	1 hr	6hrs	12 hrs	24 hrs
Dial Reading	0	--	--	--	--	0.0338

Expansion Index $_{measured}$ = 33.8

Expansion Index = **34**

Expansion Potential Table	
Exp. Index	Potential Exp.
0 - 20	Very Low
21 - 50	Low
51 - 90	Medium
91 - 130	High
>130	Very High

Krazan Testing Laboratory

APPENDIX B

EARTHQUAKE DATA FILE

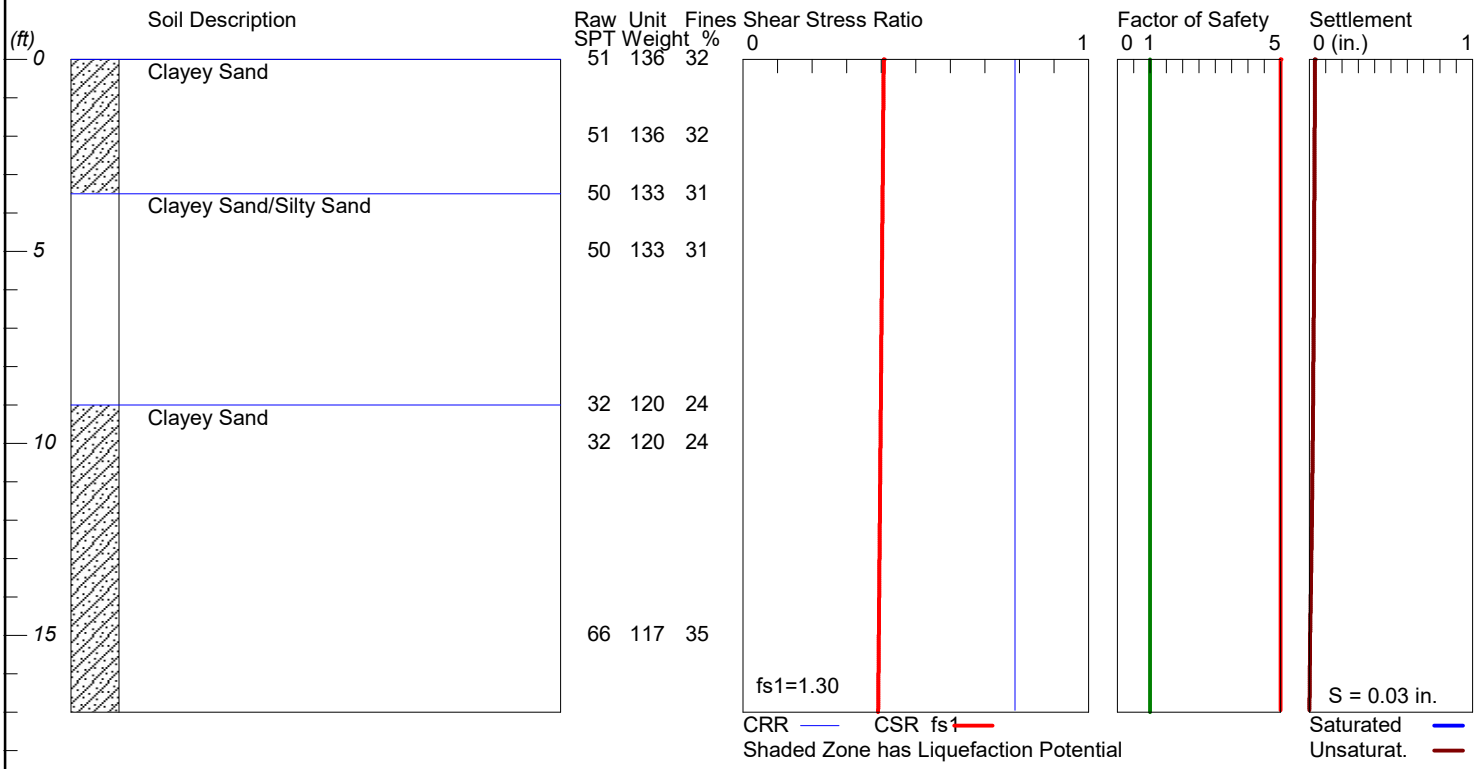
LIQUEFACTION AND SETTLEMENT ANALYSIS CALCULATION SHEETS

LIQUEFACTION ANALYSIS

Fletcher Elementary School-New Modular Classroom

Hole No.=B201 Water Depth=50 ft

Magnitude=6.28
Acceleration=0.482g



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LIQUEFACTION ANALYSIS SUMMARY
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Input File Name: P:\022\24\107\Fletcher ES.liquefaction.liq
Title: Fletcher Elementary School-New Modular Classroom
Subtitle: 02224107

Surface Elev.=
Hole No.=B201
Depth of Hole= 17.00 ft
Water Table during Earthquake= 50.00 ft
Water Table during In-Situ Testing= 50.00 ft
Max. Acceleration= 0.48 g
Earthquake Magnitude= 6.28

Input Data:
Surface Elev.=
Hole No.=B201
Depth of Hole=17.00 ft
Water Table during Earthquake= 50.00 ft
Water Table during In-Situ Testing= 50.00 ft
Max. Acceleration=0.48 g
Earthquake Magnitude=6.28
No-Liquefiable Soils: CL, OL are Non-Liq. Soil

1. SPT or BPT Calculation.
2. Settlement Analysis Method: Tokimatsu/Seed
3. Fines Correction for Liquefaction: Modify Stark/Olson
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio, Ce = 1.25
7. Borehole Diameter, Cb= 1.15
8. Sampling Method, Cs= 1
9. User request factor of safety (apply to CSR) , User= 1.3
   Plot one CSR curve (fs1=User)
10. Use Curve Smoothing: No
* Recommended Options

In-Situ Test Data:

Depth ft	SPT	gamma pcf	Fines %
0.00	51.00	136.00	32.00
2.00	51.00	136.00	32.00
3.50	50.00	133.00	31.00
5.00	50.00	133.00	31.00
9.00	32.00	120.00	24.00
10.00	32.00	120.00	24.00
15.00	66.00	117.00	35.00

Output Results:
Settlement of Saturated Sands=0.00 in.
Settlement of Unsaturated Sands=0.03 in.
Total Settlement of Saturated and Unsaturated Sands=0.03 in.
Differential Settlement=0.017 to 0.022 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	0.79	0.41	5.00	0.00	0.03	0.03
0.05	0.79	0.41	5.00	0.00	0.03	0.03
0.10	0.79	0.41	5.00	0.00	0.03	0.03
0.15	0.79	0.41	5.00	0.00	0.03	0.03

0.20	0.79	0.41	5.00	0.00	0.03	0.03
0.25	0.79	0.41	5.00	0.00	0.03	0.03
0.30	0.79	0.41	5.00	0.00	0.03	0.03
0.35	0.79	0.41	5.00	0.00	0.03	0.03
0.40	0.79	0.41	5.00	0.00	0.03	0.03
0.45	0.79	0.41	5.00	0.00	0.03	0.03
0.50	0.79	0.41	5.00	0.00	0.03	0.03
0.55	0.79	0.41	5.00	0.00	0.03	0.03
0.60	0.79	0.41	5.00	0.00	0.03	0.03
0.65	0.79	0.41	5.00	0.00	0.03	0.03
0.70	0.79	0.41	5.00	0.00	0.03	0.03
0.75	0.79	0.41	5.00	0.00	0.03	0.03
0.80	0.79	0.41	5.00	0.00	0.03	0.03
0.85	0.79	0.41	5.00	0.00	0.03	0.03
0.90	0.79	0.41	5.00	0.00	0.03	0.03
0.95	0.79	0.41	5.00	0.00	0.03	0.03
1.00	0.79	0.41	5.00	0.00	0.03	0.03
1.05	0.79	0.41	5.00	0.00	0.03	0.03
1.10	0.79	0.41	5.00	0.00	0.03	0.03
1.15	0.79	0.41	5.00	0.00	0.03	0.03
1.20	0.79	0.41	5.00	0.00	0.03	0.03
1.25	0.79	0.41	5.00	0.00	0.03	0.03
1.30	0.79	0.41	5.00	0.00	0.03	0.03
1.35	0.79	0.41	5.00	0.00	0.03	0.03
1.40	0.79	0.41	5.00	0.00	0.03	0.03
1.45	0.79	0.41	5.00	0.00	0.03	0.03
1.50	0.79	0.41	5.00	0.00	0.03	0.03
1.55	0.79	0.41	5.00	0.00	0.03	0.03
1.60	0.79	0.41	5.00	0.00	0.03	0.03
1.65	0.79	0.41	5.00	0.00	0.03	0.03
1.70	0.79	0.41	5.00	0.00	0.03	0.03
1.75	0.79	0.41	5.00	0.00	0.03	0.03
1.80	0.79	0.41	5.00	0.00	0.03	0.03
1.85	0.79	0.41	5.00	0.00	0.03	0.03
1.90	0.79	0.41	5.00	0.00	0.03	0.03
1.95	0.79	0.41	5.00	0.00	0.03	0.03
2.00	0.79	0.41	5.00	0.00	0.03	0.03
2.05	0.79	0.41	5.00	0.00	0.03	0.03
2.10	0.79	0.41	5.00	0.00	0.03	0.03
2.15	0.79	0.41	5.00	0.00	0.03	0.03
2.20	0.79	0.41	5.00	0.00	0.03	0.03
2.25	0.79	0.41	5.00	0.00	0.03	0.03
2.30	0.79	0.41	5.00	0.00	0.03	0.03
2.35	0.79	0.41	5.00	0.00	0.03	0.03
2.40	0.79	0.41	5.00	0.00	0.03	0.03
2.45	0.79	0.40	5.00	0.00	0.03	0.03
2.50	0.79	0.40	5.00	0.00	0.03	0.03
2.55	0.79	0.40	5.00	0.00	0.03	0.03
2.60	0.79	0.40	5.00	0.00	0.03	0.03
2.65	0.79	0.40	5.00	0.00	0.03	0.03
2.70	0.79	0.40	5.00	0.00	0.03	0.03
2.75	0.79	0.40	5.00	0.00	0.03	0.03
2.80	0.79	0.40	5.00	0.00	0.03	0.03
2.85	0.79	0.40	5.00	0.00	0.03	0.03
2.90	0.79	0.40	5.00	0.00	0.03	0.03
2.95	0.79	0.40	5.00	0.00	0.03	0.03
3.00	0.79	0.40	5.00	0.00	0.03	0.03
3.05	0.79	0.40	5.00	0.00	0.03	0.03
3.10	0.79	0.40	5.00	0.00	0.03	0.03
3.15	0.79	0.40	5.00	0.00	0.03	0.03
3.20	0.79	0.40	5.00	0.00	0.03	0.03
3.25	0.79	0.40	5.00	0.00	0.03	0.03
3.30	0.79	0.40	5.00	0.00	0.03	0.03
3.35	0.79	0.40	5.00	0.00	0.03	0.03
3.40	0.79	0.40	5.00	0.00	0.03	0.03
3.45	0.79	0.40	5.00	0.00	0.03	0.03
3.50	0.79	0.40	5.00	0.00	0.03	0.03
3.55	0.79	0.40	5.00	0.00	0.03	0.03
3.60	0.79	0.40	5.00	0.00	0.03	0.03

3.65	0.79	0.40	5.00	0.00	0.03	0.03
3.70	0.79	0.40	5.00	0.00	0.03	0.03
3.75	0.79	0.40	5.00	0.00	0.03	0.03
3.80	0.79	0.40	5.00	0.00	0.03	0.03
3.85	0.79	0.40	5.00	0.00	0.03	0.03
3.90	0.79	0.40	5.00	0.00	0.03	0.03
3.95	0.79	0.40	5.00	0.00	0.03	0.03
4.00	0.79	0.40	5.00	0.00	0.03	0.03
4.05	0.79	0.40	5.00	0.00	0.03	0.03
4.10	0.79	0.40	5.00	0.00	0.03	0.03
4.15	0.79	0.40	5.00	0.00	0.03	0.03
4.20	0.79	0.40	5.00	0.00	0.03	0.03
4.25	0.79	0.40	5.00	0.00	0.03	0.03
4.30	0.79	0.40	5.00	0.00	0.03	0.03
4.35	0.79	0.40	5.00	0.00	0.03	0.03
4.40	0.79	0.40	5.00	0.00	0.03	0.03
4.45	0.79	0.40	5.00	0.00	0.03	0.03
4.50	0.79	0.40	5.00	0.00	0.03	0.03
4.55	0.79	0.40	5.00	0.00	0.03	0.03
4.60	0.79	0.40	5.00	0.00	0.03	0.03
4.65	0.79	0.40	5.00	0.00	0.03	0.03
4.70	0.79	0.40	5.00	0.00	0.03	0.03
4.75	0.79	0.40	5.00	0.00	0.03	0.03
4.80	0.79	0.40	5.00	0.00	0.03	0.03
4.85	0.79	0.40	5.00	0.00	0.03	0.03
4.90	0.79	0.40	5.00	0.00	0.03	0.03
4.95	0.79	0.40	5.00	0.00	0.03	0.03
5.00	0.79	0.40	5.00	0.00	0.03	0.03
5.05	0.79	0.40	5.00	0.00	0.03	0.03
5.10	0.79	0.40	5.00	0.00	0.03	0.03
5.15	0.79	0.40	5.00	0.00	0.03	0.03
5.20	0.79	0.40	5.00	0.00	0.03	0.03
5.25	0.79	0.40	5.00	0.00	0.03	0.03
5.30	0.79	0.40	5.00	0.00	0.03	0.03
5.35	0.79	0.40	5.00	0.00	0.03	0.03
5.40	0.79	0.40	5.00	0.00	0.03	0.03
5.45	0.79	0.40	5.00	0.00	0.03	0.03
5.50	0.79	0.40	5.00	0.00	0.03	0.03
5.55	0.79	0.40	5.00	0.00	0.03	0.03
5.60	0.79	0.40	5.00	0.00	0.03	0.03
5.65	0.79	0.40	5.00	0.00	0.03	0.03
5.70	0.79	0.40	5.00	0.00	0.03	0.03
5.75	0.79	0.40	5.00	0.00	0.03	0.03
5.80	0.79	0.40	5.00	0.00	0.03	0.03
5.85	0.79	0.40	5.00	0.00	0.03	0.03
5.90	0.79	0.40	5.00	0.00	0.03	0.03
5.95	0.79	0.40	5.00	0.00	0.03	0.03
6.00	0.79	0.40	5.00	0.00	0.03	0.03
6.05	0.79	0.40	5.00	0.00	0.03	0.03
6.10	0.79	0.40	5.00	0.00	0.03	0.03
6.15	0.79	0.40	5.00	0.00	0.03	0.03
6.20	0.79	0.40	5.00	0.00	0.03	0.03
6.25	0.79	0.40	5.00	0.00	0.03	0.03
6.30	0.79	0.40	5.00	0.00	0.03	0.03
6.35	0.79	0.40	5.00	0.00	0.03	0.03
6.40	0.79	0.40	5.00	0.00	0.03	0.03
6.45	0.79	0.40	5.00	0.00	0.03	0.03
6.50	0.79	0.40	5.00	0.00	0.03	0.03
6.55	0.79	0.40	5.00	0.00	0.03	0.03
6.60	0.79	0.40	5.00	0.00	0.03	0.03
6.65	0.79	0.40	5.00	0.00	0.03	0.03
6.70	0.79	0.40	5.00	0.00	0.03	0.03
6.75	0.79	0.40	5.00	0.00	0.03	0.03
6.80	0.79	0.40	5.00	0.00	0.03	0.03
6.85	0.79	0.40	5.00	0.00	0.03	0.03
6.90	0.79	0.40	5.00	0.00	0.03	0.03
6.95	0.79	0.40	5.00	0.00	0.03	0.03
7.00	0.79	0.40	5.00	0.00	0.03	0.03
7.05	0.79	0.40	5.00	0.00	0.03	0.03

7.10	0.79	0.40	5.00	0.00	0.03	0.03
7.15	0.79	0.40	5.00	0.00	0.03	0.03
7.20	0.79	0.40	5.00	0.00	0.03	0.03
7.25	0.79	0.40	5.00	0.00	0.03	0.03
7.30	0.79	0.40	5.00	0.00	0.03	0.03
7.35	0.79	0.40	5.00	0.00	0.03	0.03
7.40	0.79	0.40	5.00	0.00	0.03	0.03
7.45	0.79	0.40	5.00	0.00	0.03	0.03
7.50	0.79	0.40	5.00	0.00	0.03	0.03
7.55	0.79	0.40	5.00	0.00	0.03	0.03
7.60	0.79	0.40	5.00	0.00	0.03	0.03
7.65	0.79	0.40	5.00	0.00	0.02	0.02
7.70	0.79	0.40	5.00	0.00	0.02	0.02
7.75	0.79	0.40	5.00	0.00	0.02	0.02
7.80	0.79	0.40	5.00	0.00	0.02	0.02
7.85	0.79	0.40	5.00	0.00	0.02	0.02
7.90	0.79	0.40	5.00	0.00	0.02	0.02
7.95	0.79	0.40	5.00	0.00	0.02	0.02
8.00	0.79	0.40	5.00	0.00	0.02	0.02
8.05	0.79	0.40	5.00	0.00	0.02	0.02
8.10	0.79	0.40	5.00	0.00	0.02	0.02
8.15	0.79	0.40	5.00	0.00	0.02	0.02
8.20	0.79	0.40	5.00	0.00	0.02	0.02
8.25	0.79	0.40	5.00	0.00	0.02	0.02
8.30	0.79	0.40	5.00	0.00	0.02	0.02
8.35	0.79	0.40	5.00	0.00	0.02	0.02
8.40	0.79	0.40	5.00	0.00	0.02	0.02
8.45	0.79	0.40	5.00	0.00	0.02	0.02
8.50	0.79	0.40	5.00	0.00	0.02	0.02
8.55	0.79	0.40	5.00	0.00	0.02	0.02
8.60	0.79	0.40	5.00	0.00	0.02	0.02
8.65	0.79	0.40	5.00	0.00	0.02	0.02
8.70	0.79	0.40	5.00	0.00	0.02	0.02
8.75	0.79	0.40	5.00	0.00	0.02	0.02
8.80	0.79	0.40	5.00	0.00	0.02	0.02
8.85	0.79	0.40	5.00	0.00	0.02	0.02
8.90	0.79	0.40	5.00	0.00	0.02	0.02
8.95	0.79	0.40	5.00	0.00	0.02	0.02
9.00	0.79	0.40	5.00	0.00	0.02	0.02
9.05	0.79	0.40	5.00	0.00	0.02	0.02
9.10	0.79	0.40	5.00	0.00	0.02	0.02
9.15	0.79	0.40	5.00	0.00	0.02	0.02
9.20	0.79	0.40	5.00	0.00	0.02	0.02
9.25	0.79	0.40	5.00	0.00	0.02	0.02
9.30	0.79	0.40	5.00	0.00	0.02	0.02
9.35	0.79	0.40	5.00	0.00	0.02	0.02
9.40	0.79	0.40	5.00	0.00	0.02	0.02
9.45	0.79	0.40	5.00	0.00	0.02	0.02
9.50	0.79	0.40	5.00	0.00	0.02	0.02
9.55	0.79	0.40	5.00	0.00	0.02	0.02
9.60	0.79	0.40	5.00	0.00	0.02	0.02
9.65	0.79	0.40	5.00	0.00	0.02	0.02
9.70	0.79	0.40	5.00	0.00	0.02	0.02
9.75	0.79	0.40	5.00	0.00	0.02	0.02
9.80	0.79	0.40	5.00	0.00	0.02	0.02
9.85	0.79	0.40	5.00	0.00	0.02	0.02
9.90	0.79	0.40	5.00	0.00	0.02	0.02
9.95	0.79	0.40	5.00	0.00	0.02	0.02
10.00	0.79	0.40	5.00	0.00	0.02	0.02
10.05	0.79	0.40	5.00	0.00	0.02	0.02
10.10	0.79	0.40	5.00	0.00	0.02	0.02
10.15	0.79	0.40	5.00	0.00	0.02	0.02
10.20	0.79	0.40	5.00	0.00	0.02	0.02
10.25	0.79	0.40	5.00	0.00	0.02	0.02
10.30	0.79	0.40	5.00	0.00	0.02	0.02
10.35	0.79	0.40	5.00	0.00	0.02	0.02
10.40	0.79	0.40	5.00	0.00	0.02	0.02
10.45	0.79	0.40	5.00	0.00	0.02	0.02
10.50	0.79	0.40	5.00	0.00	0.02	0.02

10.55	0.79	0.40	5.00	0.00	0.02	0.02
10.60	0.79	0.40	5.00	0.00	0.02	0.02
10.65	0.79	0.40	5.00	0.00	0.02	0.02
10.70	0.79	0.40	5.00	0.00	0.02	0.02
10.75	0.79	0.40	5.00	0.00	0.02	0.02
10.80	0.79	0.40	5.00	0.00	0.02	0.02
10.85	0.79	0.40	5.00	0.00	0.02	0.02
10.90	0.79	0.40	5.00	0.00	0.02	0.02
10.95	0.79	0.40	5.00	0.00	0.02	0.02
11.00	0.79	0.40	5.00	0.00	0.02	0.02
11.05	0.79	0.40	5.00	0.00	0.02	0.02
11.10	0.79	0.40	5.00	0.00	0.02	0.02
11.15	0.79	0.40	5.00	0.00	0.02	0.02
11.20	0.79	0.40	5.00	0.00	0.02	0.02
11.25	0.79	0.40	5.00	0.00	0.02	0.02
11.30	0.79	0.40	5.00	0.00	0.02	0.02
11.35	0.79	0.40	5.00	0.00	0.02	0.02
11.40	0.79	0.40	5.00	0.00	0.02	0.02
11.45	0.79	0.40	5.00	0.00	0.02	0.02
11.50	0.79	0.40	5.00	0.00	0.02	0.02
11.55	0.79	0.40	5.00	0.00	0.02	0.02
11.60	0.79	0.40	5.00	0.00	0.02	0.02
11.65	0.79	0.40	5.00	0.00	0.02	0.02
11.70	0.79	0.40	5.00	0.00	0.02	0.02
11.75	0.79	0.40	5.00	0.00	0.02	0.02
11.80	0.79	0.40	5.00	0.00	0.02	0.02
11.85	0.79	0.40	5.00	0.00	0.02	0.02
11.90	0.79	0.40	5.00	0.00	0.02	0.02
11.95	0.79	0.40	5.00	0.00	0.02	0.02
12.00	0.79	0.40	5.00	0.00	0.02	0.02
12.05	0.79	0.40	5.00	0.00	0.02	0.02
12.10	0.79	0.40	5.00	0.00	0.01	0.01
12.15	0.79	0.40	5.00	0.00	0.01	0.01
12.20	0.79	0.40	5.00	0.00	0.01	0.01
12.25	0.79	0.40	5.00	0.00	0.01	0.01
12.30	0.79	0.40	5.00	0.00	0.01	0.01
12.35	0.79	0.40	5.00	0.00	0.01	0.01
12.40	0.79	0.40	5.00	0.00	0.01	0.01
12.45	0.79	0.40	5.00	0.00	0.01	0.01
12.50	0.79	0.40	5.00	0.00	0.01	0.01
12.55	0.79	0.40	5.00	0.00	0.01	0.01
12.60	0.79	0.40	5.00	0.00	0.01	0.01
12.65	0.79	0.40	5.00	0.00	0.01	0.01
12.70	0.79	0.40	5.00	0.00	0.01	0.01
12.75	0.79	0.40	5.00	0.00	0.01	0.01
12.80	0.79	0.40	5.00	0.00	0.01	0.01
12.85	0.79	0.40	5.00	0.00	0.01	0.01
12.90	0.79	0.40	5.00	0.00	0.01	0.01
12.95	0.79	0.39	5.00	0.00	0.01	0.01
13.00	0.79	0.39	5.00	0.00	0.01	0.01
13.05	0.79	0.39	5.00	0.00	0.01	0.01
13.10	0.79	0.39	5.00	0.00	0.01	0.01
13.15	0.79	0.39	5.00	0.00	0.01	0.01
13.20	0.79	0.39	5.00	0.00	0.01	0.01
13.25	0.79	0.39	5.00	0.00	0.01	0.01
13.30	0.79	0.39	5.00	0.00	0.01	0.01
13.35	0.79	0.39	5.00	0.00	0.01	0.01
13.40	0.79	0.39	5.00	0.00	0.01	0.01
13.45	0.79	0.39	5.00	0.00	0.01	0.01
13.50	0.79	0.39	5.00	0.00	0.01	0.01
13.55	0.79	0.39	5.00	0.00	0.01	0.01
13.60	0.79	0.39	5.00	0.00	0.01	0.01
13.65	0.79	0.39	5.00	0.00	0.01	0.01
13.70	0.79	0.39	5.00	0.00	0.01	0.01
13.75	0.79	0.39	5.00	0.00	0.01	0.01
13.80	0.79	0.39	5.00	0.00	0.01	0.01
13.85	0.79	0.39	5.00	0.00	0.01	0.01
13.90	0.79	0.39	5.00	0.00	0.01	0.01
13.95	0.79	0.39	5.00	0.00	0.01	0.01

14.00	0.79	0.39	5.00	0.00	0.01	0.01
14.05	0.79	0.39	5.00	0.00	0.01	0.01
14.10	0.79	0.39	5.00	0.00	0.01	0.01
14.15	0.79	0.39	5.00	0.00	0.01	0.01
14.20	0.79	0.39	5.00	0.00	0.01	0.01
14.25	0.79	0.39	5.00	0.00	0.01	0.01
14.30	0.79	0.39	5.00	0.00	0.01	0.01
14.35	0.79	0.39	5.00	0.00	0.01	0.01
14.40	0.79	0.39	5.00	0.00	0.01	0.01
14.45	0.79	0.39	5.00	0.00	0.01	0.01
14.50	0.79	0.39	5.00	0.00	0.01	0.01
14.55	0.79	0.39	5.00	0.00	0.01	0.01
14.60	0.79	0.39	5.00	0.00	0.01	0.01
14.65	0.79	0.39	5.00	0.00	0.01	0.01
14.70	0.79	0.39	5.00	0.00	0.01	0.01
14.75	0.79	0.39	5.00	0.00	0.01	0.01
14.80	0.79	0.39	5.00	0.00	0.01	0.01
14.85	0.79	0.39	5.00	0.00	0.01	0.01
14.90	0.79	0.39	5.00	0.00	0.01	0.01
14.95	0.79	0.39	5.00	0.00	0.00	0.00
15.00	0.79	0.39	5.00	0.00	0.00	0.00
15.05	0.79	0.39	5.00	0.00	0.00	0.00
15.10	0.79	0.39	5.00	0.00	0.00	0.00
15.15	0.79	0.39	5.00	0.00	0.00	0.00
15.20	0.79	0.39	5.00	0.00	0.00	0.00
15.25	0.79	0.39	5.00	0.00	0.00	0.00
15.30	0.79	0.39	5.00	0.00	0.00	0.00
15.35	0.79	0.39	5.00	0.00	0.00	0.00
15.40	0.79	0.39	5.00	0.00	0.00	0.00
15.45	0.79	0.39	5.00	0.00	0.00	0.00
15.50	0.79	0.39	5.00	0.00	0.00	0.00
15.55	0.79	0.39	5.00	0.00	0.00	0.00
15.60	0.79	0.39	5.00	0.00	0.00	0.00
15.65	0.79	0.39	5.00	0.00	0.00	0.00
15.70	0.79	0.39	5.00	0.00	0.00	0.00
15.75	0.79	0.39	5.00	0.00	0.00	0.00
15.80	0.79	0.39	5.00	0.00	0.00	0.00
15.85	0.79	0.39	5.00	0.00	0.00	0.00
15.90	0.79	0.39	5.00	0.00	0.00	0.00
15.95	0.79	0.39	5.00	0.00	0.00	0.00
16.00	0.79	0.39	5.00	0.00	0.00	0.00
16.05	0.79	0.39	5.00	0.00	0.00	0.00
16.10	0.79	0.39	5.00	0.00	0.00	0.00
16.15	0.79	0.39	5.00	0.00	0.00	0.00
16.20	0.79	0.39	5.00	0.00	0.00	0.00
16.25	0.79	0.39	5.00	0.00	0.00	0.00
16.30	0.79	0.39	5.00	0.00	0.00	0.00
16.35	0.79	0.39	5.00	0.00	0.00	0.00
16.40	0.79	0.39	5.00	0.00	0.00	0.00
16.45	0.79	0.39	5.00	0.00	0.00	0.00
16.50	0.79	0.39	5.00	0.00	0.00	0.00
16.55	0.79	0.39	5.00	0.00	0.00	0.00
16.60	0.79	0.39	5.00	0.00	0.00	0.00
16.65	0.79	0.39	5.00	0.00	0.00	0.00
16.70	0.79	0.39	5.00	0.00	0.00	0.00
16.75	0.79	0.39	5.00	0.00	0.00	0.00
16.80	0.79	0.39	5.00	0.00	0.00	0.00
16.85	0.79	0.39	5.00	0.00	0.00	0.00
16.90	0.79	0.39	5.00	0.00	0.00	0.00
16.95	0.79	0.39	5.00	0.00	0.00	0.00
17.00	0.79	0.39	5.00	0.00	0.00	0.00

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* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

Units: Unit: qc, fs, Stress or Pressure = atm (1.0581tsf); Unit Weight = pcf; Depth = ft; Settlement = in.

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1 atm (atmosphere) = 1 tsf (ton/ft2)
CRRm Cyclic resistance ratio from soils

CSRsf	Cyclic stress ratio induced by a given earthquake (with user request factor of safety)
F.S.	Factor of Safety against liquefaction, F.S.=CRRm/CSRsf
S_sat	Settlement from saturated sands
S_dry	Settlement from Unsaturated Sands
S_all	Total Settlement from Saturated and Unsaturated Sands
NoLiq	No-Liquefy Soils

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*                       *
*    E Q S E A R C H    *
*                       *
*     Version 3.00      *
*                       *
*************************

          ESTIMATION OF
       PEAK ACCELERATION FROM
   CALIFORNIA EARTHQUAKE CATALOGS

JOB NUMBER: 02224107
                                                  DATE: 08-29-2024

JOB NAME: 02224107

EARTHQUAKE-CATALOG-FILE NAME: ALLQUAKE.DAT


MAGNITUDE RANGE:
   MINIMUM MAGNITUDE:  4.00
   MAXIMUM MAGNITUDE:  9.00

SITE COORDINATES:
   SITE LATITUDE:  35.3925
   SITE LONGITUDE:  118.8937

SEARCH DATES:
           START DATE:   1800
           END DATE:   2023

SEARCH RADIUS:
           50.0 mi
           80.5 km

ATTENUATION RELATION:   3) Boore et al. (1997) Horiz. - NEHRP D (250)
   UNCERTAINTY (M=Median, S=Sigma): M       Number of Sigmas:  0.0
   ASSUMED SOURCE TYPE:  DS [SS=Strike-slip, DS=Reverse-slip, BT=Blind-thrust]
   SCOND:   0  Depth Source:  A
   Basement Depth:  5.00 km     Campbell SSR:        Campbell SHR:
   COMPUTE PEAK HORIZONTAL ACCELERATION

MINIMUM DEPTH VALUE (km):  0.0
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EARTHQUAKE SEARCH RESULTS

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FILE CODE	LAT. NORTH	LONG. WEST	DATE	TIME (UTC) H M Sec	DEPTH (km)	QUAKE MAG.	SITE ACC. g	SITE MM INT.	APPROX. DISTANCE mi [km]
DMG	35.3670	118.8830	09/12/1953	64116.0	0.0	4.10	0.147	VIII	1.9(3.0)
DMG	35.3830	118.8500	07/29/1952	7 347.0	0.0	6.10	0.395	X	2.5(4.1)
DMG	35.3830	118.8500	10/13/1952	222035.0	0.0	4.00	0.130	VIII	2.5(4.1)
GSP	35.3700	118.8500	12/18/1990	165643.0	6.0	4.20	0.139	VIII	2.9(4.7)
DMG	35.3670	118.8330	03/17/1935	2026 0.0	0.0	4.00	0.113	VII	3.8(6.2)
PAS	35.4520	118.8990	02/08/1985	65816.9	11.1	4.60	0.150	VIII	4.1(6.6)
DMG	35.3330	118.9170	07/29/1952	195132.0	0.0	4.50	0.140	VIII	4.3(6.9)
DMG	35.3330	118.9170	08/22/1952	224124.0	0.0	5.80	0.277	IX	4.3(6.9)
DMG	35.3330	118.9170	08/07/1952	1919 7.0	0.0	4.20	0.119	VII	4.3(6.9)
DMG	35.3330	118.9170	07/31/1952	195314.0	0.0	4.50	0.140	VIII	4.3(6.9)
DMG	35.4000	118.8170	07/29/1952	8 146.0	0.0	5.10	0.191	VIII	4.3(7.0)
DMG	35.3500	118.9670	02/04/1954	204841.0	0.0	4.00	0.099	VII	5.1(8.1)
DMG	35.3170	118.9500	09/01/1952	1039 0.0	0.0	4.10	0.094	VII	6.1(9.8)
PAS	35.3720	118.7740	12/15/1987	182346.1	3.2	4.10	0.087	VII	6.9(11.1)
T-A	35.3300	119.0000	01/04/1870	7 0 0.0	0.0	4.30	0.093	VII	7.4(11.9)
DMG	35.3000	118.8000	12/23/1905	2223 0.0	0.0	5.00	0.125	VII	8.3(13.3)
DMG	35.5000	118.9670	09/29/1948	4 648.0	0.0	4.20	0.080	VII	8.5(13.7)
MGI	35.3000	119.0000	09/04/1908	0 0 0.0	0.0	4.60	0.097	VII	8.7(14.1)
MGI	35.3000	119.0000	01/08/1903	030 0.0	0.0	4.60	0.097	VII	8.7(14.1)
DMG	35.3330	118.7330	08/05/1952	65010.0	0.0	4.40	0.080	VII	9.9(16.0)
DMG	35.4330	118.7000	05/01/1954	22 439.0	0.0	4.20	0.066	VI	11.2(18.1)
DMG	35.3790	118.6680	11/21/1955	205527.6	5.3	4.30	0.064	VI	12.7(20.5)
DMG	35.2170	118.8170	07/23/1952	1317 5.0	0.0	5.70	0.132	VIII	12.9(20.7)
DMG	35.2170	118.8170	12/15/1953	124436.0	0.0	4.60	0.074	VII	12.9(20.7)
DMG	35.5000	118.7000	01/06/1905	1430 0.0	0.0	5.00	0.090	VII	13.2(21.2)
DMG	35.4320	118.6640	09/30/1964	175125.8	7.4	4.00	0.053	VI	13.2(21.3)
DMG	35.4650	118.6680	02/07/1964	221052.0	-0.5	4.20	0.058	VI	13.6(22.0)
DMG	35.3000	118.6670	08/13/1952	212548.0	0.0	4.10	0.053	VI	14.3(23.0)
GSP	35.3180	118.6540	01/25/2003	091610.2	5.0	4.50	0.065	VI	14.4(23.2)
DMG	35.4000	118.6330	10/02/1952	231021.0	0.0	4.20	0.055	VI	14.7(23.6)
GSP	35.3900	118.6230	09/29/2004	225454.2	3.0	5.00	0.081	VII	15.2(24.5)
DMG	35.6000	118.8000	06/30/1926	1331 0.0	0.0	5.00	0.081	VII	15.3(24.6)
DMG	35.3950	118.6200	08/08/1955	32150.5	4.1	4.70	0.069	VI	15.4(24.8)
DMG	35.3580	118.6160	08/24/1955	17 540.9	7.2	4.00	0.046	VI	15.8(25.4)
DMG	35.3830	118.6000	09/05/1953	192436.0	0.0	4.10	0.047	VI	16.5(26.6)
DMG	35.4540	118.6050	02/07/1964	22 750.3	-2.0	4.40	0.055	VI	16.8(27.0)
DMG	35.3330	118.6000	08/10/1952	6 118.0	0.0	4.00	0.044	VI	17.0(27.4)
DMG	35.3330	118.6000	07/31/1952	12 9 9.0	0.0	5.80	0.113	VII	17.0(27.4)
DMG	35.3330	118.6000	09/16/1952	142454.0	0.0	4.00	0.044	VI	17.0(27.4)
DMG	35.3330	118.6000	07/23/1952	164853.0	0.0	4.50	0.057	VI	17.0(27.4)
DMG	35.3330	118.6000	07/23/1952	161838.0	0.0	4.50	0.057	VI	17.0(27.4)
DMG	35.4000	118.5830	07/24/1952	114756.0	0.0	4.40	0.053	VI	17.5(28.1)
DMG	35.4000	118.5830	07/25/1952	7 351.0	0.0	4.10	0.045	VI	17.5(28.1)
DMG	35.3670	118.5830	07/27/1952	73539.0	0.0	4.20	0.048	VI	17.6(28.3)
DMG	35.3670	118.5830	07/23/1952	62628.0	0.0	4.00	0.043	VI	17.6(28.3)
DMG	35.3670	118.5830	09/16/1952	1521 8.0	0.0	4.30	0.050	VI	17.6(28.3)
DMG	35.3670	118.5830	07/23/1952	03832.0	0.0	6.10	0.130	VIII	17.6(28.3)
DMG	35.3670	118.5830	07/23/1952	4 140.0	0.0	4.70	0.062	VI	17.6(28.3)
DMG	35.3670	118.5830	07/28/1952	154120.0	0.0	4.00	0.043	VI	17.6(28.3)
DMG	35.3670	118.5830	07/23/1952	65342.0	0.0	4.20	0.048	VI	17.6(28.3)
DMG	35.3670	118.5830	07/23/1952	04738.0	0.0	4.60	0.059	VI	17.6(28.3)
DMG	35.3670	118.5830	07/23/1952	31923.0	0.0	5.00	0.073	VII	17.6(28.3)
DMG	35.2170	118.6670	09/14/1952	204324.0	0.0	4.10	0.045	VI	17.6(28.3)

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FILE CODE	LAT. NORTH	LONG. WEST	DATE	TIME (UTC) H M Sec	DEPTH (km)	QUAKE MAG.	SITE ACC. g	SITE MM INT.	APPROX. DISTANCE mi [km]
DMG	35.3830	118.5670	07/23/1952	546 3.0	0.0	4.70	0.060	VI	18.4(29.6)
DMG	35.1840	119.0990	07/01/1959	234923.4	9.0	4.70	0.060	VI	18.5(29.7)
DMG	35.3330	118.5670	08/08/1952	51718.0	0.0	4.00	0.041	V	18.8(30.3)
DMG	35.1500	119.0500	11/11/1952	1722 8.0	0.0	4.20	0.045	VI	18.9(30.4)
DMG	35.2830	118.5830	07/31/1952	1719 8.0	0.0	4.50	0.053	VI	19.1(30.7)
DMG	35.1330	118.7670	07/21/1952	194122.0	0.0	5.50	0.088	VII	19.3(31.0)
DMG	35.1330	118.7670	07/25/1952	143442.0	0.0	4.40	0.049	VI	19.3(31.0)
DMG	35.2000	118.6330	07/22/1952	321 5.0	0.0	4.40	0.048	VI	19.8(31.9)
DMG	35.2330	118.6000	07/22/1952	91025.0	0.0	4.50	0.051	VI	19.9(32.0)
DMG	35.2330	118.6000	01/10/1953	221738.0	0.0	4.00	0.039	V	19.9(32.0)
DMG	35.1830	118.6500	07/21/1952	151358.0	0.0	5.10	0.070	VI	19.9(32.1)
DMG	35.3560	118.5380	07/19/1955	2 425.5	6.4	4.10	0.041	V	20.2(32.5)
DMG	35.3670	118.5330	07/23/1952	195134.0	0.0	4.20	0.043	VI	20.4(32.8)
DMG	35.4500	119.2500	01/23/1935	1352 0.0	0.0	4.00	0.038	V	20.4(32.9)
DMG	35.3370	118.5370	08/30/1952	45954.8	3.5	4.00	0.038	V	20.4(32.9)
DMG	35.3330	119.2500	01/20/1941	135816.0	0.0	4.00	0.038	V	20.5(32.9)
DMG	35.3210	118.5400	07/24/1952	141012.2	9.5	4.00	0.038	V	20.5(33.0)
DMG	35.1500	118.6830	08/13/1952	173925.0	0.0	4.70	0.055	VI	20.5(33.0)
GSP	35.1490	119.1040	05/28/1993	044740.6	21.0	5.20	0.072	VI	20.6(33.1)
DMG	35.1000	118.9670	08/25/1952	62026.0	0.0	4.70	0.055	VI	20.6(33.2)
DMG	35.3330	118.5330	08/01/1952	103556.0	0.0	4.00	0.038	V	20.7(33.3)
DMG	35.2830	118.5500	07/23/1952	737 0.0	0.0	4.80	0.058	VI	20.8(33.4)
DMG	35.2830	118.5500	07/31/1952	41022.0	0.0	4.20	0.042	VI	20.8(33.4)
DMG	35.2830	118.5500	07/23/1952	34928.0	0.0	4.70	0.055	VI	20.8(33.4)
DMG	35.2830	118.5500	08/01/1952	31611.6	0.0	4.50	0.049	VI	20.8(33.4)
DMG	35.2830	118.5500	07/22/1952	15151.0	0.0	4.40	0.047	VI	20.8(33.4)
DMG	35.2830	118.5500	07/26/1952	922 6.0	0.0	4.30	0.044	VI	20.8(33.4)
DMG	35.3510	118.5270	08/11/1952	132149.2	-2.0	4.40	0.047	VI	20.8(33.5)
DMG	35.1330	118.7000	09/02/1952	124132.0	0.0	4.60	0.052	VI	21.0(33.8)
DMG	35.1000	119.0000	07/22/1952	14 511.0	0.0	4.30	0.044	VI	21.1(33.9)
DMG	35.1000	119.0000	07/24/1952	311 7.0	0.0	4.10	0.039	V	21.1(33.9)
DMG	35.3140	118.5300	07/26/1952	225856.1	6.8	4.30	0.044	VI	21.2(34.1)
DMG	35.3380	118.5230	08/06/1952	34624.2	12.6	4.30	0.044	VI	21.2(34.1)
DMG	35.3000	118.5330	09/02/1952	1638 9.0	0.0	4.00	0.037	V	21.3(34.3)
DMG	35.3000	118.5330	07/30/1952	95929.0	0.0	4.00	0.037	V	21.3(34.3)
DMG	35.3000	118.5330	07/21/1952	182338.0	0.0	4.50	0.048	VI	21.3(34.3)
DMG	35.3000	118.5330	07/21/1952	182628.0	0.0	4.10	0.039	V	21.3(34.3)
DMG	35.1830	119.1740	06/04/1956	83319.3	14.3	4.00	0.037	V	21.4(34.5)
DMG	35.2410	118.5600	07/21/1952	1912 7.4	5.8	4.30	0.043	VI	21.5(34.6)
GSP	35.4663	118.5210	04/19/2014	121513.0	-0.8	4.24	0.042	VI	21.6(34.7)
DMG	35.3200	118.5180	07/27/1952	0 915.6	6.5	4.20	0.041	V	21.7(35.0)
DMG	35.3150	118.5160	07/25/1952	194323.7	11.2	5.70	0.089	VII	21.9(35.3)
DMG	35.1830	118.6000	07/26/1952	63850.0	0.0	4.00	0.036	V	22.0(35.4)
DMG	35.1830	118.6000	07/29/1952	154950.0	0.0	4.90	0.058	VI	22.0(35.4)
DMG	35.1830	118.6000	07/26/1952	2241 3.0	0.0	4.60	0.050	VI	22.0(35.4)
DMG	35.3450	118.5070	07/23/1952	18 328.3	10.4	4.00	0.036	V	22.0(35.4)
DMG	35.3160	118.5140	07/24/1952	14 525.9	5.4	4.30	0.042	VI	22.0(35.4)
DMG	35.3080	118.5160	07/31/1952	19 515.4	7.3	4.00	0.036	V	22.1(35.5)
DMG	35.3300	118.5070	05/29/1968	22938.7	3.1	4.00	0.036	V	22.2(35.7)
DMG	35.3670	118.5000	06/20/1953	231852.0	0.0	4.40	0.044	VI	22.2(35.8)
DMG	35.1500	118.6330	01/27/1954	141948.0	0.0	5.00	0.061	VI	22.3(35.8)
DMG	35.2350	118.5480	03/03/1973	181449.5	8.0	4.00	0.036	V	22.3(35.9)
DMG	35.0670	118.8830	08/17/1952	21 442.0	0.0	4.30	0.042	VI	22.5(36.2)

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FILE CODE	LAT. NORTH	LONG. WEST	DATE	TIME (UTC) H M Sec	DEPTH (km)	QUAKE MAG.	SITE ACC. g	SITE MM INT.	APPROX. DISTANCE mi [km]
DMG	35.0670	118.8830	08/14/1952	114146.0	0.0	4.20	0.040	V	22.5(36.2)
DMG	35.0670	118.9330	07/23/1952	223220.0	0.0	4.10	0.037	V	22.6(36.3)
DMG	35.3050	118.5070	08/09/1952	10 732.1	-2.0	4.20	0.039	V	22.6(36.4)
DMG	35.1000	119.0830	12/06/1934	743 0.0	0.0	4.00	0.035	V	22.8(36.8)
DMG	35.1000	119.0830	07/24/1946	019 8.0	0.0	4.00	0.035	V	22.8(36.8)
DMG	35.0830	118.7500	07/26/1952	15 831.0	0.0	4.40	0.043	VI	22.8(36.8)
DMG	35.0830	118.7500	07/26/1952	18 244.0	0.0	4.00	0.035	V	22.8(36.8)
DMG	35.0830	118.7500	07/22/1952	84734.0	0.0	4.70	0.051	VI	22.8(36.8)
DMG	35.4170	119.3000	06/04/1941	84719.0	0.0	4.00	0.035	V	22.9(36.9)
DMG	35.3110	118.4990	07/25/1952	1313 8.2	2.8	5.00	0.060	VI	22.9(36.9)
DMG	35.0670	118.9830	08/04/1952	194750.0	0.0	4.00	0.035	V	23.0(37.1)
DMG	35.3210	118.4940	02/11/1955	194431.5	14.7	4.50	0.046	VI	23.0(37.1)
DMG	35.3000	118.5000	02/19/1953	812 6.0	0.0	4.40	0.043	VI	23.1(37.1)
DMG	35.3170	118.4940	07/25/1952	19 944.6	5.5	5.70	0.086	VII	23.1(37.2)
DMG	35.2330	118.5330	07/21/1952	174244.0	0.0	5.10	0.062	VI	23.1(37.2)
DMG	35.2330	118.5330	07/22/1952	15 314.0	0.0	4.20	0.039	V	23.1(37.2)
DMG	35.2330	118.5330	07/24/1952	1735 6.0	0.0	4.20	0.039	V	23.1(37.2)
DMG	35.2330	118.5330	03/17/1953	161517.0	0.0	4.00	0.035	V	23.1(37.2)
DMG	35.2330	118.5330	07/30/1952	144650.0	0.0	4.10	0.037	V	23.1(37.2)
DMG	35.2330	118.5330	07/29/1952	173643.0	0.0	4.40	0.043	VI	23.1(37.2)
DMG	35.5000	118.5000	07/27/1952	24912.0	0.0	4.00	0.035	V	23.4(37.6)
DMG	35.3240	118.4860	01/20/1953	81322.8	7.2	4.00	0.035	V	23.4(37.7)
DMG	35.3130	118.4890	10/20/1952	181443.6	14.0	4.30	0.040	V	23.4(37.7)
DMG	35.3160	118.4870	09/15/1952	44013.2	4.2	4.90	0.055	VI	23.5(37.8)
DMG	35.0670	118.7670	07/22/1952	21 211.0	0.0	4.20	0.038	V	23.6(37.9)
DMG	35.0500	118.9000	09/25/1952	162136.0	0.0	4.10	0.036	V	23.6(38.1)
DMG	35.2390	118.5180	07/21/1952	2021 5.1	-2.0	4.20	0.038	V	23.7(38.1)
DMG	35.0670	119.0330	07/27/1952	113438.0	0.0	4.10	0.036	V	23.8(38.3)
DMG	35.0670	119.0330	07/23/1952	175329.0	0.0	4.10	0.036	V	23.8(38.3)
DMG	35.3140	118.4820	08/30/1952	45559.8	5.5	4.70	0.049	VI	23.8(38.3)
DMG	35.0500	118.9500	08/17/1952	614 4.0	0.0	4.00	0.034	V	23.9(38.4)
DMG	35.0500	118.9500	11/14/1952	2334 1.4	0.0	4.00	0.034	V	23.9(38.4)
DMG	35.4540	118.4760	11/23/1953	2039 0.9	5.9	4.40	0.042	VI	23.9(38.4)
DMG	35.3350	118.4740	07/23/1952	172224.0	6.6	4.50	0.044	VI	24.0(38.6)
DMG	35.3400	118.4730	07/24/1952	5 249.6	2.1	4.50	0.044	VI	24.0(38.6)
DMG	35.3030	118.4810	09/04/1952	18 649.1	5.8	4.40	0.042	VI	24.0(38.7)
DMG	35.3360	118.4720	07/23/1952	105413.5	19.7	4.10	0.036	V	24.1(38.7)
DMG	35.0660	119.0490	01/24/1974	5 2 0.8	6.4	4.30	0.040	V	24.2(38.9)
DMG	35.2290	118.5130	06/28/1957	1132 0.8	1.6	4.10	0.035	V	24.2(39.0)
DMG	35.3460	118.4650	12/25/1952	55633.0	4.6	4.10	0.035	V	24.3(39.2)
DMG	35.1990	118.5310	09/01/1961	165148.9	4.5	4.00	0.033	V	24.4(39.3)
DMG	35.3030	118.4730	08/01/1952	213522.4	4.2	4.00	0.033	V	24.5(39.4)
DMG	35.0670	119.0670	02/24/1954	223022.0	0.0	4.50	0.043	VI	24.5(39.4)
PAS	35.0460	119.0010	06/05/1975	144645.3	9.0	4.10	0.035	V	24.7(39.7)
DMG	35.0450	119.0040	03/23/1956	212327.1	12.1	4.30	0.039	V	24.8(39.9)
DMG	35.0330	118.9170	07/23/1952	211658.0	0.0	4.10	0.035	V	24.9(40.0)
DMG	35.2900	118.4700	07/24/1952	12 757.6	14.1	4.10	0.035	V	24.9(40.0)
DMG	35.0330	118.9330	07/22/1952	223133.0	0.0	4.70	0.048	VI	24.9(40.1)
DMG	35.0330	118.8500	10/07/1953	145921.0	0.0	4.90	0.053	VI	24.9(40.1)
GSP	35.0430	119.0130	09/22/2005	202448.6	11.0	4.70	0.047	VI	25.0(40.3)
DMG	35.2500	118.4830	07/23/1952	93842.0	0.0	4.20	0.036	V	25.1(40.5)
DMG	35.2500	118.4830	07/23/1952	1330 4.0	0.0	4.40	0.040	V	25.1(40.5)
DMG	35.2890	118.4600	07/26/1952	1 221.3	10.8	4.20	0.036	V	25.4(40.9)

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FILE CODE	LAT. NORTH	LONG. WEST	DATE	TIME (UTC) H M Sec	DEPTH (km)	QUAKE MAG.	SITE ACC. g	SITE MM INT.	APPROX. DISTANCE mi [km]
DMG	35.1000	118.6170	09/26/1952	202120.0	0.0	4.00	0.032	V	25.5(41.1)
DMG	35.0330	119.0000	07/22/1952	101939.0	0.0	4.10	0.034	V	25.5(41.1)
DMG	35.3600	118.4380	08/03/1952	15156.1	7.0	4.10	0.034	V	25.7(41.4)
PAS	35.2970	119.3460	05/06/1985	231433.0	24.4	4.40	0.039	V	26.3(42.3)
DMG	35.0330	119.0500	07/27/1952	71611.0	0.0	4.10	0.033	V	26.3(42.4)
DMG	35.0330	119.0500	08/18/1952	44010.0	0.0	4.70	0.046	VI	26.3(42.4)
DMG	35.0330	119.0500	08/07/1952	163151.0	0.0	4.90	0.051	VI	26.3(42.4)
GSP	35.4530	118.4310	05/06/1997	191253.8	6.0	4.50	0.041	V	26.4(42.4)
DMG	35.0170	118.9830	08/17/1952	9 9 7.0	0.0	4.10	0.033	V	26.4(42.5)
DMG	35.2670	118.4500	07/21/1952	191619.0	0.0	4.30	0.037	V	26.4(42.6)
DMG	35.2990	118.4350	07/25/1952	20 6 6.1	-1.4	4.80	0.048	VI	26.6(42.8)
DMG	35.3000	118.4320	07/23/1952	61045.9	14.5	4.20	0.035	V	26.8(43.1)
GSP	35.4730	118.4250	05/01/2008	081143.2	6.0	4.40	0.038	V	26.9(43.4)
DMG	35.0500	119.1330	05/23/1953	75255.0	0.0	4.20	0.034	V	27.2(43.8)
DMG	35.0500	119.1330	08/06/1953	1120 4.0	0.0	4.40	0.038	V	27.2(43.8)
DMG	35.0000	118.8330	12/01/1952	52610.0	0.0	4.40	0.038	V	27.3(44.0)
DMG	35.0000	118.8330	07/23/1952	75319.0	0.0	5.40	0.064	VI	27.3(44.0)
DMG	35.0000	118.8330	07/23/1952	181351.0	0.0	5.20	0.058	VI	27.3(44.0)
DMG	35.0670	118.6170	07/23/1952	235136.0	0.0	4.00	0.031	V	27.4(44.0)
DMG	35.0170	119.0500	08/05/1953	122059.0	0.0	4.30	0.036	V	27.4(44.1)
DMG	35.0330	119.1000	02/07/1954	0 953.0	0.0	4.40	0.038	V	27.4(44.1)
DMG	35.0330	119.1000	09/02/1953	152756.0	0.0	4.00	0.031	V	27.4(44.1)
DMG	35.0330	119.1000	01/12/1954	234037.0	0.0	4.10	0.032	V	27.4(44.1)
DMG	35.0330	119.1000	01/13/1954	14531.0	0.0	4.40	0.038	V	27.4(44.1)
DMG	35.0830	118.5830	08/04/1952	535 0.0	0.0	4.00	0.030	V	27.6(44.5)
DMG	35.0830	118.5830	07/22/1952	81624.0	0.0	4.40	0.038	V	27.6(44.5)
DMG	35.0000	119.0000	07/21/1952	1311 0.0	0.0	4.10	0.032	V	27.8(44.7)
DMG	35.0000	119.0000	07/21/1952	1617 0.0	0.0	4.10	0.032	V	27.8(44.7)
DMG	35.0000	119.0000	07/21/1952	1451 0.0	0.0	4.20	0.034	V	27.8(44.7)
DMG	35.0000	119.0000	07/21/1952	1553 0.0	0.0	4.50	0.040	V	27.8(44.7)
DMG	35.0000	119.0000	07/21/1952	1638 0.0	0.0	4.50	0.040	V	27.8(44.7)
DMG	35.0000	119.0000	01/25/1919	2229 0.0	0.0	4.00	0.030	V	27.8(44.7)
DMG	35.0000	119.0000	08/10/1952	194424.0	0.0	4.10	0.032	V	27.8(44.7)
DMG	35.0000	119.0000	07/21/1952	1417 0.0	0.0	4.10	0.032	V	27.8(44.7)
DMG	35.0000	119.0000	07/21/1952	1259 0.0	0.0	4.20	0.034	V	27.8(44.7)
DMG	35.0000	119.0000	07/21/1952	13 8 0.0	0.0	4.50	0.040	V	27.8(44.7)
DMG	35.0000	119.0000	07/25/1952	0 3 0.0	0.0	4.00	0.030	V	27.8(44.7)
DMG	35.0000	119.0000	07/21/1952	1442 0.0	0.0	4.20	0.034	V	27.8(44.7)
DMG	35.0000	119.0000	07/21/1952	1313 0.0	0.0	4.50	0.040	V	27.8(44.7)
DMG	35.0000	119.0000	07/21/1952	1415 0.0	0.0	4.40	0.037	V	27.8(44.7)
DMG	35.0000	119.0000	07/21/1952	1218 0.0	0.0	4.40	0.037	V	27.8(44.7)
DMG	35.0000	119.0000	07/21/1952	1359 0.0	0.0	4.60	0.042	VI	27.8(44.7)
DMG	35.0000	119.0000	07/21/1952	1239 0.0	0.0	4.20	0.034	V	27.8(44.7)
DMG	35.0000	119.0000	02/16/1919	1557 0.0	0.0	5.00	0.051	VI	27.8(44.7)
DMG	35.0000	119.0000	07/21/1952	1240 0.0	0.0	4.90	0.049	VI	27.8(44.7)
DMG	35.0000	119.0000	07/21/1952	12 6 0.0	0.0	4.80	0.046	VI	27.8(44.7)
DMG	35.0000	119.0000	03/13/1929	228 0.0	0.0	4.50	0.040	V	27.8(44.7)
DMG	35.0000	119.0000	07/21/1952	14 6 0.0	0.0	4.20	0.034	V	27.8(44.7)
DMG	35.0000	119.0000	07/21/1952	1536 0.0	0.0	4.20	0.034	V	27.8(44.7)
DMG	35.0000	119.0000	07/21/1952	1225 0.0	0.0	4.70	0.044	VI	27.8(44.7)
DMG	35.0000	119.0000	07/21/1952	1228 0.0	0.0	4.20	0.034	V	27.8(44.7)
DMG	35.0000	119.0000	07/22/1952	175236.0	0.0	4.10	0.032	V	27.8(44.7)
DMG	35.0000	119.0000	07/21/1952	18 0 0.0	0.0	4.50	0.040	V	27.8(44.7)

EARTHQUAKE SEARCH RESULTS

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FILE CODE	LAT. NORTH	LONG. WEST	DATE	TIME (UTC) H M Sec	DEPTH (km)	QUAKE MAG.	SITE ACC. g	SITE MM INT.	APPROX. DISTANCE mi [km]
DMG	35.0000	119.0000	07/21/1952	1212 0.0	0.0	4.60	0.042	VI	27.8(44.7)
DMG	35.0000	119.0000	07/22/1952	191024.0	0.0	4.10	0.032	V	27.8(44.7)
DMG	35.0000	119.0000	07/21/1952	1336 0.0	0.0	4.10	0.032	V	27.8(44.7)
DMG	35.0000	119.0000	07/21/1952	1317 0.0	0.0	4.00	0.030	V	27.8(44.7)
DMG	35.0000	119.0000	07/21/1952	12 531.0	0.0	6.40	0.108	VII	27.8(44.7)
DMG	35.0000	119.0000	07/23/1952	043 8.0	0.0	4.40	0.037	V	27.8(44.7)
DMG	35.0000	119.0000	07/21/1952	1210 0.0	0.0	4.50	0.040	V	27.8(44.7)
DMG	35.0000	119.0000	07/22/1952	82122.0	0.0	4.10	0.032	V	27.8(44.7)
DMG	35.0000	119.0000	07/21/1952	1222 0.0	0.0	4.90	0.049	VI	27.8(44.7)
DMG	35.0000	119.0000	07/21/1952	1542 0.0	0.0	4.20	0.034	V	27.8(44.7)
DMG	35.0000	119.0000	07/22/1952	133143.0	0.0	4.80	0.046	VI	27.8(44.7)
DMG	35.0000	119.0000	07/21/1952	132512.0	0.0	4.50	0.040	V	27.8(44.7)
DMG	35.0000	119.0000	07/21/1952	12 7 0.0	0.0	4.70	0.044	VI	27.8(44.7)
DMG	35.1940	118.4650	07/22/1952	19 858.2	3.7	4.30	0.036	V	27.8(44.7)
DMG	35.1330	118.5170	08/14/1952	72822.0	0.0	4.10	0.032	V	27.8(44.7)
DMG	35.1330	118.5170	07/22/1952	141 2.0	0.0	4.50	0.039	V	27.8(44.7)
DMG	35.1330	118.5170	07/28/1952	54554.0	0.0	4.20	0.034	V	27.8(44.7)
DMG	35.1330	118.5170	07/23/1952	152524.0	0.0	4.00	0.030	V	27.8(44.7)
GSB	35.0380	119.1300	02/14/2004	124311.4	12.0	4.60	0.042	V	27.9(44.8)
DMG	35.0000	119.0170	07/21/1952	115214.0	0.0	7.70	0.212	VIII	28.0(45.0)
DMG	35.0000	119.0170	05/25/1953	324 1.0	0.0	4.80	0.046	VI	28.0(45.0)
DMG	35.0000	119.0170	01/12/1954	233349.0	0.0	5.90	0.082	VII	28.0(45.0)
DMG	35.2890	118.4110	08/10/1952	122318.0	4.0	4.60	0.041	V	28.1(45.2)
DMG	35.0000	119.0330	07/21/1952	1159 0.0	0.0	4.50	0.039	V	28.2(45.4)
DMG	35.0000	119.0330	07/21/1952	1154 0.0	0.0	4.50	0.039	V	28.2(45.4)
DMG	35.0000	119.0330	07/21/1952	12 2 0.0	0.0	5.60	0.070	VI	28.2(45.4)
DMG	35.0000	119.0330	07/21/1952	1157 0.0	0.0	4.50	0.039	V	28.2(45.4)
DMG	35.0000	119.0330	07/21/1952	1155 0.0	0.0	4.50	0.039	V	28.2(45.4)
DMG	35.0000	119.0330	07/21/1952	1158 0.0	0.0	4.60	0.041	V	28.2(45.4)
DMG	35.0500	119.1670	12/14/1950	135623.0	0.0	4.40	0.037	V	28.2(45.4)
PAS	35.0350	119.1370	06/16/1978	42131.6	1.8	4.30	0.035	V	28.2(45.4)
DMG	34.9830	118.9000	03/23/1953	17 637.0	0.0	4.00	0.030	V	28.3(45.5)
DMG	34.9830	118.9000	07/24/1952	95032.0	0.0	4.30	0.035	V	28.3(45.5)
DMG	35.0000	119.0500	09/12/1952	103525.0	0.0	4.50	0.039	V	28.5(45.9)
DMG	35.2940	118.4010	08/13/1952	42940.6	14.5	4.60	0.041	V	28.6(46.0)
DMG	35.0000	118.7330	04/29/1953	124745.0	0.0	4.70	0.043	VI	28.6(46.0)
DMG	35.0000	118.7330	08/23/1952	6 3 3.0	0.0	4.30	0.035	V	28.6(46.0)
DMG	35.0830	119.2330	03/03/1956	62412.0	0.0	4.20	0.033	V	28.7(46.2)
DMG	34.9830	118.9830	05/23/1954	235243.0	0.0	5.10	0.053	VI	28.7(46.2)
GSP	35.5423	119.3728	02/24/2016	000223.6	22.1	4.87	0.047	VI	28.9(46.4)
DMG	35.0000	119.0830	11/07/1952	85535.0	0.0	4.60	0.040	V	29.1(46.9)
DMG	34.9830	119.0330	07/21/1952	235328.0	0.0	4.50	0.038	V	29.3(47.2)
PAS	35.0180	119.1410	11/10/1981	223435.5	3.1	4.50	0.038	V	29.4(47.3)
PAS	35.0950	118.5190	06/22/1981	45747.3	5.0	4.00	0.029	V	29.5(47.4)
DMG	34.9670	118.9500	07/30/1952	11 255.0	0.0	4.10	0.031	V	29.5(47.5)
DMG	34.9670	118.9500	11/27/1952	153641.0	0.0	4.00	0.029	V	29.5(47.5)
PAS	35.0000	119.1030	05/13/1975	02135.6	19.1	4.50	0.038	V	29.6(47.6)
GSP	35.0310	119.1800	05/06/2005	022909.5	11.0	4.10	0.030	V	29.7(47.8)
PAS	35.2700	119.4020	09/26/1980	131841.1	5.0	4.10	0.030	V	29.9(48.0)
GSB	35.0270	119.1780	04/16/2005	191813.0	10.0	4.60	0.039	V	29.9(48.1)
DMG	34.9670	119.0000	09/02/1952	204556.0	0.0	4.70	0.041	V	30.0(48.2)
DMG	35.1170	118.4810	05/01/1953	64820.9	2.4	4.10	0.030	V	30.0(48.4)
DMG	35.0500	119.2330	08/19/1952	191226.0	0.0	4.50	0.037	V	30.4(48.9)

EARTHQUAKE SEARCH RESULTS

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FILE CODE	LAT. NORTH	LONG. WEST	DATE	TIME (UTC) H M Sec	DEPTH (km)	QUAKE MAG.	SITE ACC. g	SITE MM INT.	APPROX. DISTANCE mi [km]
DMG	34.9500	118.8670	07/21/1952	121936.0	0.0	5.30	0.056	VI	30.6(49.2)
DMG	34.9500	118.9500	10/16/1952	1222 7.0	0.0	4.30	0.033	V	30.7(49.4)
PAS	35.0120	119.1790	11/10/1981	2237 5.0	9.4	4.20	0.031	V	30.8(49.6)
DMG	35.4400	118.3470	01/02/1964	194841.0	6.3	4.20	0.031	V	30.9(49.8)
DMG	34.9450	118.9680	03/04/1963	201042.3	8.5	4.00	0.028	V	31.2(50.2)
DMG	34.9500	119.0170	11/11/1952	181225.0	0.0	4.10	0.029	V	31.3(50.4)
DMG	34.9410	118.9870	11/15/1961	53855.5	10.7	5.00	0.047	VI	31.6(50.9)
PAS	35.7550	118.5420	04/17/1975	91833.8	9.6	4.00	0.027	V	31.9(51.3)
DMG	34.9320	118.9760	03/01/1963	02557.9	13.9	5.00	0.046	VI	32.1(51.7)
PAS	34.9430	118.7430	06/10/1988	23 643.0	6.8	5.40	0.057	VI	32.2(51.8)
DMG	34.9280	118.9700	01/15/1955	1 3 6.7	9.1	4.30	0.032	V	32.4(52.1)
GSP	35.0220	119.2530	05/08/2010	192306.6	15.0	4.30	0.031	V	32.6(52.5)
T-A	34.9200	118.9200	01/20/1857	0 0 0.0	0.0	5.00	0.045	VI	32.7(52.5)
T-A	34.9200	118.9200	08/29/1857	0 0 0.0	0.0	4.30	0.031	V	32.7(52.5)
T-A	34.9200	118.9200	05/23/1857	0 0 0.0	0.0	5.00	0.045	VI	32.7(52.5)
GSP	35.6800	118.4300	11/11/1991	045327.0	4.0	4.00	0.027	V	32.7(52.7)
GSP	35.7310	118.4790	07/11/1999	182046.8	4.0	4.40	0.033	V	33.0(53.1)
DMG	34.9330	119.0670	02/10/1954	235838.0	0.0	4.50	0.034	V	33.2(53.4)
DMG	35.6670	118.4040	03/08/1971	23 8 7.7	5.9	4.10	0.028	V	33.4(53.8)
GSP	34.9180	119.0200	12/24/2000	010421.9	14.0	4.40	0.032	V	33.5(53.9)
DMG	34.9110	118.9730	02/23/1939	84551.7	10.0	4.50	0.034	V	33.5(54.0)
DMG	34.9000	118.9000	10/23/1916	244 0.0	0.0	6.00	0.075	VII	34.0(54.7)
DMG	34.9000	118.9500	08/01/1952	13 430.0	0.0	5.10	0.046	VI	34.1(55.0)
DMG	35.6590	118.3780	03/03/1971	12 516.0	4.1	4.00	0.026	V	34.3(55.2)
DMG	34.9220	119.1030	01/09/1963	6 4 3.8	8.7	4.00	0.026	V	34.6(55.6)
DMG	35.8000	118.5330	07/26/1932	65158.3	0.0	4.50	0.033	V	34.7(55.8)
GSP	35.4860	118.2875	07/24/2013	164602.6	5.5	4.29	0.030	V	34.7(55.8)
GSP	35.4803	118.2853	08/25/2013	185028.7	1.2	4.20	0.028	V	34.8(55.9)
DMG	34.9030	119.0380	05/08/1939	248 5.3	10.0	4.50	0.033	V	34.8(55.9)
DMG	35.0630	118.4230	08/26/1952	205640.6	-0.8	4.40	0.031	V	35.0(56.3)
DMG	34.9000	119.0500	07/22/1952	143018.0	0.0	4.30	0.030	V	35.1(56.5)
DMG	35.6470	118.3450	06/05/1946	215932.4	0.0	4.30	0.029	V	35.5(57.1)
DMG	34.8850	119.0020	02/23/1939	91846.7	10.0	4.50	0.033	V	35.6(57.2)
DMG	34.8830	119.0330	08/20/1952	84747.0	0.0	4.20	0.028	V	36.0(58.0)
DMG	34.8670	118.8670	07/22/1952	74455.0	0.0	4.10	0.026	V	36.3(58.4)
DMG	34.8670	118.9330	09/21/1941	1953 7.2	0.0	5.20	0.046	VI	36.3(58.5)
MGI	35.2000	119.5000	12/01/1920	130 0.0	0.0	4.60	0.034	V	36.7(59.0)
DMG	35.2000	119.5000	06/09/1928	822 0.0	0.0	4.00	0.025	V	36.7(59.0)
DMG	35.5340	118.2640	05/28/1955	194420.0	12.3	4.50	0.032	V	36.7(59.1)
DMG	34.8670	119.0170	07/21/1952	2153 9.0	0.0	4.30	0.029	V	36.9(59.4)
DMG	34.8430	119.0260	03/07/1939	195331.8	10.0	4.00	0.024	IV	38.7(62.2)
DMG	34.8350	118.9880	11/29/1936	55445.3	10.0	4.00	0.023	IV	38.9(62.5)
DMG	35.6320	118.2680	03/17/1946	81636.0	-2.0	4.60	0.032	V	38.9(62.5)
GSP	35.0980	118.3060	12/31/1995	214823.1	7.0	4.00	0.023	IV	38.9(62.6)
T-A	34.8300	118.7500	11/27/1852	0 0 0.0	0.0	7.00	0.112	VII	39.7(63.8)
DMG	35.6870	118.2630	05/03/1936	1421 1.8	10.0	4.00	0.023	IV	40.8(65.7)
DMG	34.7840	118.9020	07/27/1972	03117.4	8.0	4.40	0.027	V	42.0(67.6)
DMG	34.8000	119.1000	09/05/1883	1230 0.0	0.0	6.00	0.063	VI	42.5(68.4)
DMG	34.8410	119.2400	01/11/1958	23 847.4	10.8	4.00	0.022	IV	42.8(68.9)
DMG	35.5820	118.1590	07/26/1948	1750 1.4	4.6	4.50	0.028	V	43.3(69.7)
DMG	35.6770	118.2050	06/11/1935	162046.3	-1.4	4.00	0.022	IV	43.4(69.8)
DMG	35.6480	118.1870	01/19/1937	235738.5	10.0	4.00	0.021	IV	43.5(69.9)
DMG	35.7330	118.2330	07/10/1943	31233.0	0.0	4.00	0.021	IV	43.9(70.7)

EARTHQUAKE SEARCH RESULTS

FILE CODE	LAT. NORTH	LONG. WEST	DATE	TIME (UTC) H M Sec	DEPTH (km)	QUAKE MAG.	SITE ACC. g	SITE MM INT.	APPROX. DISTANCE mi [km]
GSG	35.9280	118.4280	07/13/1992	095305.9	5.0	4.00	0.021	IV	45.3(72.8)
DMG	34.7170	118.9670	06/11/1935	1810 0.0	0.0	4.00	0.020	IV	46.8(75.3)
DMG	35.7890	118.2040	04/16/1946	1037 4.7	0.0	4.10	0.021	IV	47.4(76.3)
DMG	35.7500	119.6170	04/15/1950	115632.0	0.0	4.60	0.028	V	47.5(76.5)
DMG	36.0800	118.8300	05/29/1915	830 0.0	0.0	4.50	0.026	V	47.6(76.6)
DMG	36.0800	118.8200	05/29/1915	646 0.0	0.0	5.00	0.034	V	47.6(76.7)
DMG	36.0900	118.8700	02/11/1948	32928.3	11.7	4.60	0.027	V	48.2(77.5)
DMG	34.7000	119.0000	10/23/1916	254 0.0	0.0	5.50	0.044	VI	48.2(77.5)
GSP	35.2100	118.0660	07/11/1992	181416.2	10.0	5.70	0.049	VI	48.3(77.7)
PAS	35.9300	118.3410	10/19/1983	14 037.2	1.5	4.00	0.020	IV	48.4(77.8)
PAS	35.9260	118.3340	10/21/1983	224413.3	0.0	4.50	0.026	V	48.4(77.9)
DMG	34.6830	119.0000	04/06/1943	223624.0	0.0	4.00	0.019	IV	49.4(79.4)
DMG	35.6740	118.0780	03/17/1946	6 347.1	0.0	4.40	0.024	IV	49.8(80.1)
DMG	35.6790	118.0770	03/25/1946	233644.9	0.0	4.30	0.023	IV	50.0(80.4)

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-END OF SEARCH- 332 EARTHQUAKES FOUND WITHIN THE SPECIFIED SEARCH AREA.

TIME PERIOD OF SEARCH: 1800 TO 2023

LENGTH OF SEARCH TIME: 224 years

THE EARTHQUAKE CLOSEST TO THE SITE IS ABOUT 1.9 MILES (3.0 km) AWAY.

LARGEST EARTHQUAKE MAGNITUDE FOUND IN THE SEARCH RADIUS: 7.7

LARGEST EARTHQUAKE SITE ACCELERATION FROM THIS SEARCH: 0.395 g

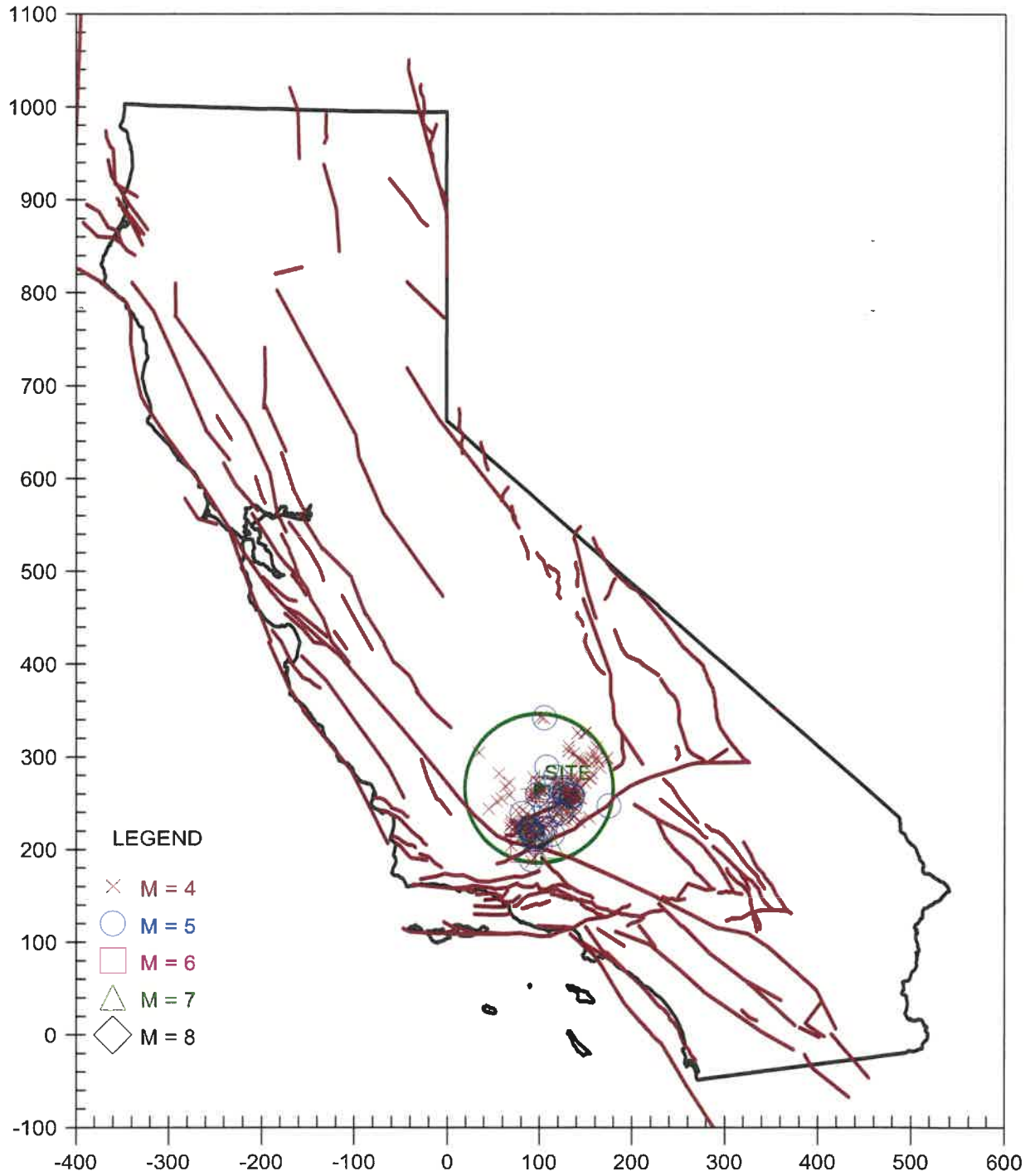
COEFFICIENTS FOR GUTENBERG & RICHTER RECURRENCE RELATION:
a-value= 3.546
b-value= 0.846
beta-value= 1.949

TABLE OF MAGNITUDES AND EXCEEDANCES:

Earthquake Magnitude	Number of Times Exceeded	Cumulative No. / Year
4.0	332	1.48879
4.5	129	0.57848
5.0	41	0.18386
5.5	17	0.07623
6.0	7	0.03139
6.5	2	0.00897
7.0	2	0.00897
7.5	1	0.00448

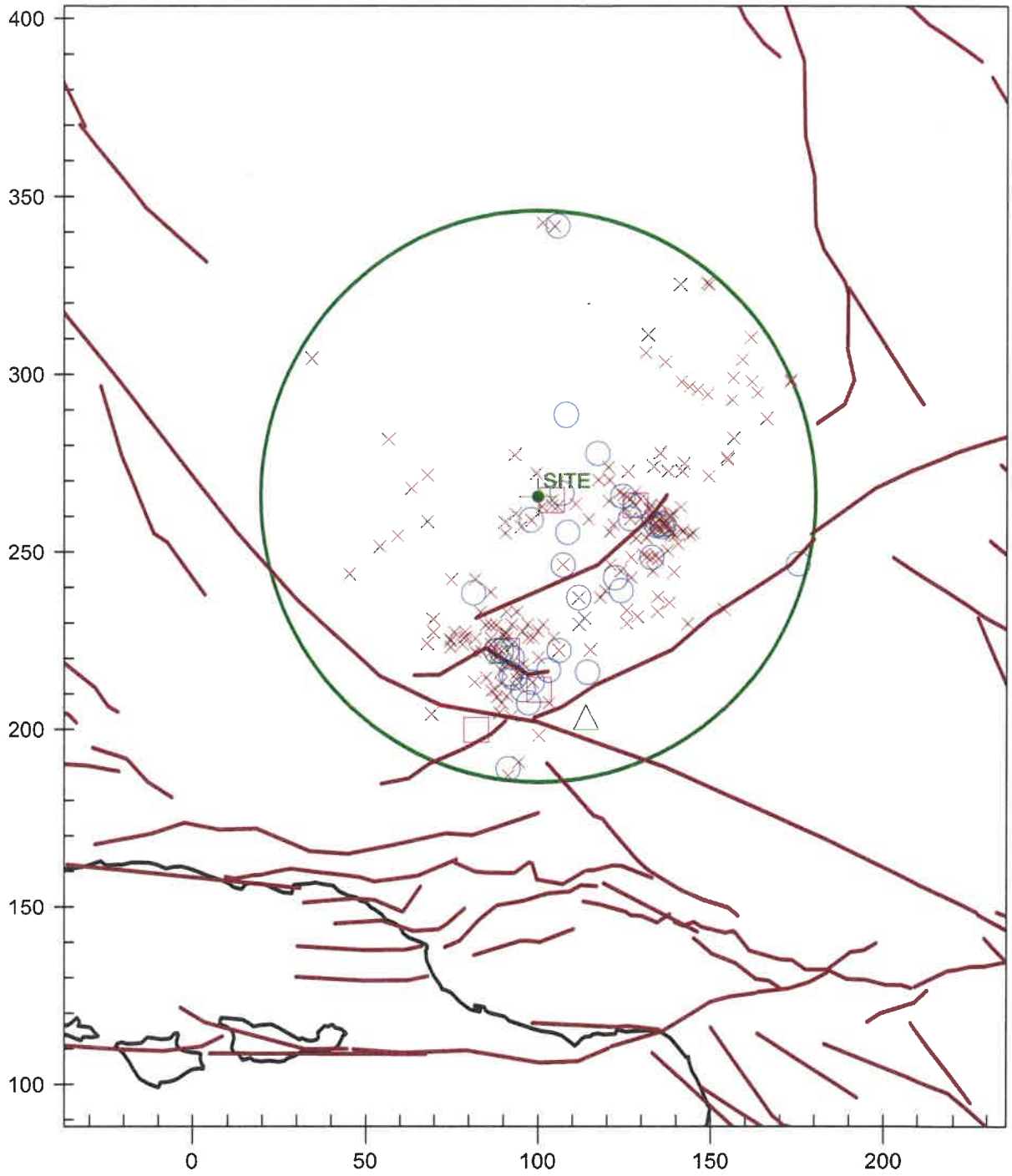
EARTHQUAKE EPICENTER MAP

02224107



EARTHQUAKE EPICENTER MAP

02224107



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*    E Q S E A R C H    *
*                       *
*     Version 3.00      *
*                       *
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ESTIMATION OF
PEAK ACCELERATION FROM
CALIFORNIA EARTHQUAKE CATALOGS

JOB NUMBER: 02224107

DATE: 08-29-2024

JOB NAME: 02224107

EARTHQUAKE-CATALOG-FILE NAME: ALLQUAKE.DAT

MAGNITUDE RANGE:
   MINIMUM MAGNITUDE: 5.00
   MAXIMUM MAGNITUDE: 9.00

SITE COORDINATES:
   SITE LATITUDE: 35.3925
   SITE LONGITUDE: 118.8937

SEARCH DATES:
           START DATE: 1800
           END DATE: 2023

SEARCH RADIUS:
           100.0 mi
           160.9 km

ATTENUATION RELATION: 3) Boore et al. (1997) Horiz. - NEHRP D (250)
   UNCERTAINTY (M=Median, S=Sigma): M   Number of Sigmas: 0.0
   ASSUMED SOURCE TYPE: DS [SS=Strike-slip, DS=Reverse-slip, BT=Blind-thrust]
   SCOND: 0 Depth Source: A
   Basement Depth: 5.00 km   Campbell SSR: Campbell SHR:
   COMPUTE PEAK HORIZONTAL ACCELERATION

MINIMUM DEPTH VALUE (km): 0.0

EARTHQUAKE SEARCH RESULTS

FILE CODE	LAT. NORTH	LONG. WEST	DATE	TIME (UTC) H M Sec	DEPTH (km)	QUAKE MAG.	SITE ACC. g	SITE MM INT.	APPROX. DISTANCE mi [km]
DMG	35.3830	118.8500	07/29/1952	7 347.0	0.0	6.10	0.395	X	2.5(4.1)
DMG	35.3330	118.9170	08/22/1952	224124.0	0.0	5.80	0.277	IX	4.3(6.9)
DMG	35.4000	118.8170	07/29/1952	8 146.0	0.0	5.10	0.191	VIII	4.3(7.0)
DMG	35.3000	118.8000	12/23/1905	2223 0.0	0.0	5.00	0.125	VII	8.3(13.3)
DMG	35.2170	118.8170	07/23/1952	1317 5.0	0.0	5.70	0.132	VIII	12.9(20.7)
DMG	35.5000	118.7000	01/06/1905	1430 0.0	0.0	5.00	0.090	VII	13.2(21.2)
GSP	35.3900	118.6230	09/29/2004	225454.2	3.0	5.00	0.081	VII	15.2(24.5)
DMG	35.6000	118.8000	06/30/1926	1331 0.0	0.0	5.00	0.081	VII	15.3(24.6)
DMG	35.3330	118.6000	07/31/1952	12 9 9.0	0.0	5.80	0.113	VII	17.0(27.4)
DMG	35.3670	118.5830	07/23/1952	03832.0	0.0	6.10	0.130	VIII	17.6(28.3)
DMG	35.3670	118.5830	07/23/1952	31923.0	0.0	5.00	0.073	VII	17.6(28.3)
DMG	35.1330	118.7670	07/21/1952	194122.0	0.0	5.50	0.088	VII	19.3(31.0)
DMG	35.1830	118.6500	07/21/1952	151358.0	0.0	5.10	0.070	VI	19.9(32.1)
GSP	35.1490	119.1040	05/28/1993	044740.6	21.0	5.20	0.072	VI	20.6(33.1)
DMG	35.3150	118.5160	07/25/1952	194323.7	11.2	5.70	0.089	VII	21.9(35.3)
DMG	35.1500	118.6330	01/27/1954	141948.0	0.0	5.00	0.061	VI	22.3(35.8)
DMG	35.3110	118.4990	07/25/1952	1313 8.2	2.8	5.00	0.060	VI	22.9(36.9)
DMG	35.3170	118.4940	07/25/1952	19 944.6	5.5	5.70	0.086	VII	23.1(37.2)
DMG	35.2330	118.5330	07/21/1952	174244.0	0.0	5.10	0.062	VI	23.1(37.2)
DMG	35.0000	118.8330	07/23/1952	75319.0	0.0	5.40	0.064	VI	27.3(44.0)
DMG	35.0000	118.8330	07/23/1952	181351.0	0.0	5.20	0.058	VI	27.3(44.0)
DMG	35.0000	119.0000	07/21/1952	12 531.0	0.0	6.40	0.108	VII	27.8(44.7)
DMG	35.0000	119.0000	02/16/1919	1557 0.0	0.0	5.00	0.051	VI	27.8(44.7)
DMG	35.0000	119.0170	07/21/1952	115214.0	0.0	7.70	0.212	VIII	28.0(45.0)
DMG	35.0000	119.0170	01/12/1954	233349.0	0.0	5.90	0.082	VII	28.0(45.0)
DMG	35.0000	119.0330	07/21/1952	12 2 0.0	0.0	5.60	0.070	VI	28.2(45.4)
DMG	34.9830	118.9830	05/23/1954	235243.0	0.0	5.10	0.053	VI	28.7(46.2)
DMG	34.9500	118.8670	07/21/1952	121936.0	0.0	5.30	0.056	VI	30.6(49.2)
DMG	34.9410	118.9870	11/15/1961	53855.5	10.7	5.00	0.047	VI	31.6(50.9)
DMG	34.9320	118.9760	03/01/1963	02557.9	13.9	5.00	0.046	VI	32.1(51.7)
PAS	34.9430	118.7430	06/10/1988	23 643.0	6.8	5.40	0.057	VI	32.2(51.8)
T-A	34.9200	118.9200	01/20/1857	0 0 0.0	0.0	5.00	0.045	VI	32.7(52.5)
T-A	34.9200	118.9200	05/23/1857	0 0 0.0	0.0	5.00	0.045	VI	32.7(52.5)
DMG	34.9000	118.9000	10/23/1916	244 0.0	0.0	6.00	0.075	VII	34.0(54.7)
DMG	34.9000	118.9500	08/01/1952	13 430.0	0.0	5.10	0.046	VI	34.1(55.0)
DMG	34.8670	118.9330	09/21/1941	1953 7.2	0.0	5.20	0.046	VI	36.3(58.5)
T-A	34.8300	118.7500	11/27/1852	0 0 0.0	0.0	7.00	0.112	VII	39.7(63.8)
DMG	34.8000	119.1000	09/05/1883	1230 0.0	0.0	6.00	0.063	VI	42.5(68.4)
DMG	36.0800	118.8200	05/29/1915	646 0.0	0.0	5.00	0.034	V	47.6(76.7)
DMG	34.7000	119.0000	10/23/1916	254 0.0	0.0	5.50	0.044	VI	48.2(77.5)
GSP	35.2100	118.0660	07/11/1992	181416.2	10.0	5.70	0.049	VI	48.3(77.7)
DMG	35.7150	118.0740	03/15/1946	14 035.4	0.0	5.30	0.038	V	51.1(82.3)
DMG	35.3000	119.8000	01/09/1857	16 0 0.0	0.0	7.90	0.147	VIII	51.4(82.8)
DMG	35.7250	118.0550	03/15/1946	134935.9	22.0	6.30	0.062	VI	52.4(84.3)
DMG	35.7450	118.0390	03/16/1946	94617.9	0.0	5.10	0.033	V	53.8(86.6)
DMG	35.7780	118.0490	01/28/1961	81246.2	5.5	5.30	0.036	V	54.4(87.5)
DMG	35.7510	118.0290	03/15/1946	215433.4	0.0	5.20	0.034	V	54.5(87.7)
DMG	35.7140	117.9770	03/15/1946	191853.6	0.0	5.40	0.037	V	56.1(90.2)
DMG	35.7530	117.9860	03/15/1946	1321 0.9	0.0	5.20	0.033	V	56.7(91.3)
T-A	36.1700	119.3200	07/25/1868	230 0.0	0.0	5.00	0.029	V	58.7(94.5)
DMG	35.7470	117.9080	03/18/1946	155042.6	4.4	5.30	0.033	V	60.5(97.4)
GSP	34.3940	118.6690	06/26/1995	084028.9	13.0	5.00	0.025	V	70.1(112.8)
DMG	35.8310	117.7610	10/19/1961	5 943.9	-2.0	5.20	0.028	V	70.4(113.3)

EARTHQUAKE SEARCH RESULTS

FILE CODE	LAT. NORTH	LONG. WEST	DATE	TIME (UTC) H M Sec	DEPTH (km)	QUAKE MAG.	SITE ACC. g	SITE MM INT.	APPROX. DISTANCE mi [km]
DMG	34.5000	119.5000	08/05/1930	1125 0.0	0.0	5.00	0.025	V	70.5(113.5)
DMG	34.5000	119.5000	06/29/1926	2321 0.0	0.0	5.50	0.033	V	70.5(113.5)
GSB	34.3790	118.7110	01/19/1994	210928.6	14.0	5.50	0.032	V	70.7(113.8)
GSP	34.3770	118.6980	01/18/1994	004308.9	11.0	5.20	0.028	V	71.0(114.2)
GSP	34.3780	118.6180	01/19/1994	211144.9	11.0	5.10	0.026	V	71.8(115.5)
GSP	34.3690	118.6720	04/26/1997	103730.7	16.0	5.10	0.026	V	71.8(115.5)
DMG	34.5190	118.1980	08/23/1952	10 9 7.1	13.1	5.00	0.025	V	72.0(115.9)
DMG	34.4110	118.4010	02/09/1971	14 1 8.0	8.0	5.80	0.037	V	73.3(117.9)
DMG	34.4110	118.4010	02/09/1971	141028.0	8.0	5.30	0.028	V	73.3(117.9)
DMG	34.4110	118.4010	02/09/1971	14 041.8	8.4	6.40	0.051	VI	73.3(117.9)
DMG	34.4110	118.4010	02/09/1971	14 244.0	8.0	5.80	0.037	V	73.3(117.9)
GSP	35.7760	117.6620	08/17/1995	223959.0	5.0	5.40	0.030	V	74.1(119.2)
GSP	34.3260	118.6980	01/17/1994	233330.7	9.0	5.60	0.033	V	74.5(119.8)
GSP	35.7660	117.6490	01/07/1996	143253.1	5.0	5.20	0.027	V	74.5(119.9)
GSB	35.7610	117.6390	09/20/1995	232736.3	5.0	6.10	0.043	VI	74.9(120.5)
T-A	34.5000	119.6700	06/01/1893	12 0 0.0	0.0	5.00	0.024	IV	75.7(121.8)
GSP	34.3050	118.5790	01/29/1994	112036.0	1.0	5.10	0.025	V	77.2(124.2)
DMG	34.3000	118.6000	04/04/1893	1940 0.0	0.0	6.00	0.039	V	77.2(124.3)
GSB	34.3010	118.5650	01/17/1994	204602.4	9.0	5.20	0.026	V	77.6(124.9)
DMG	34.3080	118.4540	02/09/1971	144346.7	6.2	5.20	0.025	V	78.9(127.0)
DMG	35.6310	117.5130	09/17/1938	1423 4.1	-2.0	5.00	0.023	IV	79.3(127.7)
DMG	35.7500	120.2500	03/10/1922	112120.0	0.0	6.50	0.050	VI	80.1(128.8)
DMG	34.3670	119.5830	07/01/1941	75054.8	0.0	5.90	0.036	V	80.9(130.1)
MGI	34.4000	119.7000	03/25/1806	8 0 0.0	0.0	5.00	0.022	IV	82.3(132.5)
PAS	36.1510	120.0490	08/04/1985	12 156.0	6.0	5.80	0.034	V	83.3(134.0)
GSP	34.2310	118.4750	03/20/1994	212012.3	13.0	5.30	0.026	V	83.6(134.6)
GSP	34.2130	118.5370	01/17/1994	123055.4	18.0	6.70	0.054	VI	83.9(135.0)
GSP	36.0750	117.6500	11/27/1996	201724.1	1.0	5.30	0.026	V	84.1(135.4)
DMG	35.7500	120.3300	08/18/1922	512 0.0	0.0	5.00	0.022	IV	84.4(135.7)
GSP	36.0670	117.6380	03/06/1998	054740.3	1.0	5.20	0.024	V	84.4(135.8)
T-A	34.4200	119.8200	00/00/1862	0 0 0.0	0.0	5.70	0.031	V	85.2(137.1)
PAS	34.3470	119.6960	08/13/1978	225453.4	12.8	5.10	0.023	IV	85.3(137.3)
DMG	35.8000	120.3300	06/08/1934	447 0.0	0.0	6.00	0.037	V	85.4(137.4)
DMG	35.8000	120.3300	12/28/1939	121538.0	0.0	5.00	0.022	IV	85.4(137.4)
DMG	35.8000	120.3300	06/08/1934	430 0.0	0.0	5.00	0.022	IV	85.4(137.4)
DMG	35.8000	120.3300	06/05/1934	2148 0.0	0.0	5.00	0.022	IV	85.4(137.4)
DMG	36.4000	118.0000	07/05/1871	21 6 0.0	0.0	5.20	0.024	V	85.7(137.8)
GSP	36.0760	117.6180	03/07/1998	003646.8	1.0	5.00	0.022	IV	85.7(137.9)
GSB	35.8190	120.3640	09/28/2004	171524.2	8.0	6.00	0.036	V	87.6(141.0)
MGI	36.6000	118.4000	09/04/1868	0 0 0.0	0.0	5.00	0.021	IV	87.8(141.3)
GSP	36.3880	117.8580	10/01/2009	100124.7	5.0	5.00	0.021	IV	89.9(144.7)
GSP	36.3910	117.8610	10/03/2009	011600.3	0.0	5.20	0.023	IV	89.9(144.7)
MGI	35.2500	120.5000	07/10/1917	045 0.0	0.0	5.30	0.024	V	91.0(146.5)
MGI	35.2500	120.5000	07/10/1917	043 0.0	0.0	5.30	0.024	V	91.0(146.5)
MGI	35.2500	120.5000	07/09/1917	2238 0.0	0.0	5.30	0.024	V	91.0(146.5)
MGI	35.2500	120.5000	07/09/1917	2222 0.0	0.0	5.00	0.021	IV	91.0(146.5)
MGI	34.3000	119.8000	07/03/1925	1821 0.0	0.0	5.30	0.024	V	91.2(146.8)
MGI	34.3000	119.8000	07/03/1925	1638 0.0	0.0	5.30	0.024	V	91.2(146.8)
DMG	34.3000	119.8000	06/29/1925	144216.0	0.0	6.25	0.040	V	91.2(146.8)
MGI	34.9000	120.4000	03/29/1928	625 0.0	0.0	5.30	0.024	V	91.6(147.4)
DMG	34.0650	119.0350	02/21/1973	144557.3	8.0	5.90	0.033	V	92.0(148.1)
DMG	34.7000	120.3000	07/31/1902	920 0.0	0.0	5.50	0.026	V	92.8(149.3)
DMG	34.7000	120.3000	01/12/1915	431 0.0	0.0	5.50	0.026	V	92.8(149.3)

EARTHQUAKE SEARCH RESULTS

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FILE CODE	LAT. NORTH	LONG. WEST	DATE	TIME (UTC) H M Sec	DEPTH (km)	QUAKE MAG.	SITE ACC. g	SITE MM INT.	APPROX. DISTANCE mi [km]
GSP	34.2620	118.0020	06/28/1991	144354.5	11.0	5.40	0.025	V	93.0(149.6)
DMG	34.1000	119.4000	05/19/1893	035 0.0	0.0	5.50	0.026	V	93.7(150.9)
MGI	36.5800	118.0800	07/06/1917	11 1 0.0	0.0	5.70	0.029	V	93.7(150.9)
T-A	36.5800	118.0700	04/18/1872	0 0 0.0	0.0	5.00	0.020	IV	94.0(151.3)
T-A	36.5800	118.0700	08/13/1882	0 0 0.0	0.0	5.00	0.020	IV	94.0(151.3)
PAS	36.1820	120.2680	02/14/1987	72650.8	6.0	5.10	0.021	IV	94.3(151.8)
MGI	34.8000	120.4000	12/12/1902	0 0 0.0	0.0	5.70	0.029	V	94.4(151.9)
MGI	36.6000	118.1000	05/17/1872	21 0 0.0	0.0	5.00	0.020	IV	94.4(152.0)
MGI	35.0000	120.5000	11/19/1927	332 0.0	0.0	5.00	0.020	IV	94.6(152.2)
GSB	35.9170	120.4650	12/20/1994	102747.2	8.0	5.00	0.020	IV	95.3(153.4)
BRK	36.2200	120.2600	09/09/1983	91614.0	0.0	5.40	0.024	V	95.5(153.7)
DMG	36.7000	118.3000	08/17/1896	1130 0.0	0.0	5.90	0.032	V	96.2(154.8)
DMG	36.1700	120.3200	12/27/1926	919 0.0	0.0	5.00	0.020	IV	96.2(154.9)
MGI	35.5000	120.6000	01/01/1830	0 0 0.0	0.0	5.00	0.020	IV	96.3(154.9)
DMG	34.0000	119.0000	09/24/1827	4 0 0.0	0.0	7.00	0.056	VI	96.3(155.0)
MGI	34.0000	119.0000	12/14/1912	0 0 0.0	0.0	5.70	0.028	V	96.3(155.0)
DMG	35.9300	120.4800	12/24/1934	1626 0.0	0.0	5.00	0.020	IV	96.4(155.2)
DMG	35.9500	120.4700	11/16/1956	323 9.0	0.0	5.00	0.020	IV	96.4(155.2)
BRK	36.2200	120.2900	05/02/1983	2346 6.0	0.0	5.60	0.027	V	96.8(155.8)
BRK	36.2200	120.2900	05/02/1983	234239.0	0.0	6.70	0.048	VI	96.8(155.8)
DMG	34.2000	119.8000	12/21/1812	19 0 0.0	0.0	7.00	0.056	VI	97.1(156.2)
MGI	34.0800	118.2600	07/16/1920	18 8 0.0	0.0	5.00	0.019	IV	97.5(156.9)
BRK	36.2400	120.2900	05/09/1983	24912.0	0.0	5.20	0.022	IV	97.6(157.1)
DMG	35.9500	120.5000	06/28/1966	42613.4	0.0	5.50	0.025	V	98.0(157.7)
GSB	35.9530	120.5020	09/29/2004	171004.0	11.0	5.10	0.020	IV	98.2(158.0)
DMG	35.9700	120.5000	06/28/1966	4 856.2	0.0	5.10	0.020	IV	98.5(158.5)
MGI	34.0000	118.5000	11/19/1918	2018 0.0	0.0	5.00	0.019	IV	98.7(158.8)
DMG	34.0000	118.5000	08/04/1927	1224 0.0	0.0	5.00	0.019	IV	98.7(158.8)
DMG	34.1180	119.7020	07/05/1968	04517.2	5.9	5.20	0.021	IV	99.2(159.7)
DMG	36.0000	120.5000	02/02/1881	011 0.0	0.0	5.60	0.026	V	99.4(159.9)
DMG	36.0000	120.5000	03/03/1901	745 0.0	0.0	5.50	0.025	V	99.4(159.9)
DMG	35.9500	120.5300	06/29/1966	195325.9	0.0	5.00	0.019	IV	99.5(160.2)
DMG	34.3700	117.6500	12/08/1812	15 0 0.0	0.0	7.00	0.055	VI	99.7(160.5)
DMG	34.2000	117.9000	08/28/1889	215 0.0	0.0	5.50	0.025	V	99.8(160.5)
MGI	34.1000	118.1000	07/11/1855	415 0.0	0.0	6.30	0.038	V	100.0(160.9)

****

-END OF SEARCH- 141 EARTHQUAKES FOUND WITHIN THE SPECIFIED SEARCH AREA.

TIME PERIOD OF SEARCH: 1800 TO 2023

LENGTH OF SEARCH TIME: 224 years

THE EARTHQUAKE CLOSEST TO THE SITE IS ABOUT 2.5 MILES (4.1 km) AWAY.

LARGEST EARTHQUAKE MAGNITUDE FOUND IN THE SEARCH RADIUS: 7.9

LARGEST EARTHQUAKE SITE ACCELERATION FROM THIS SEARCH: 0.395 g

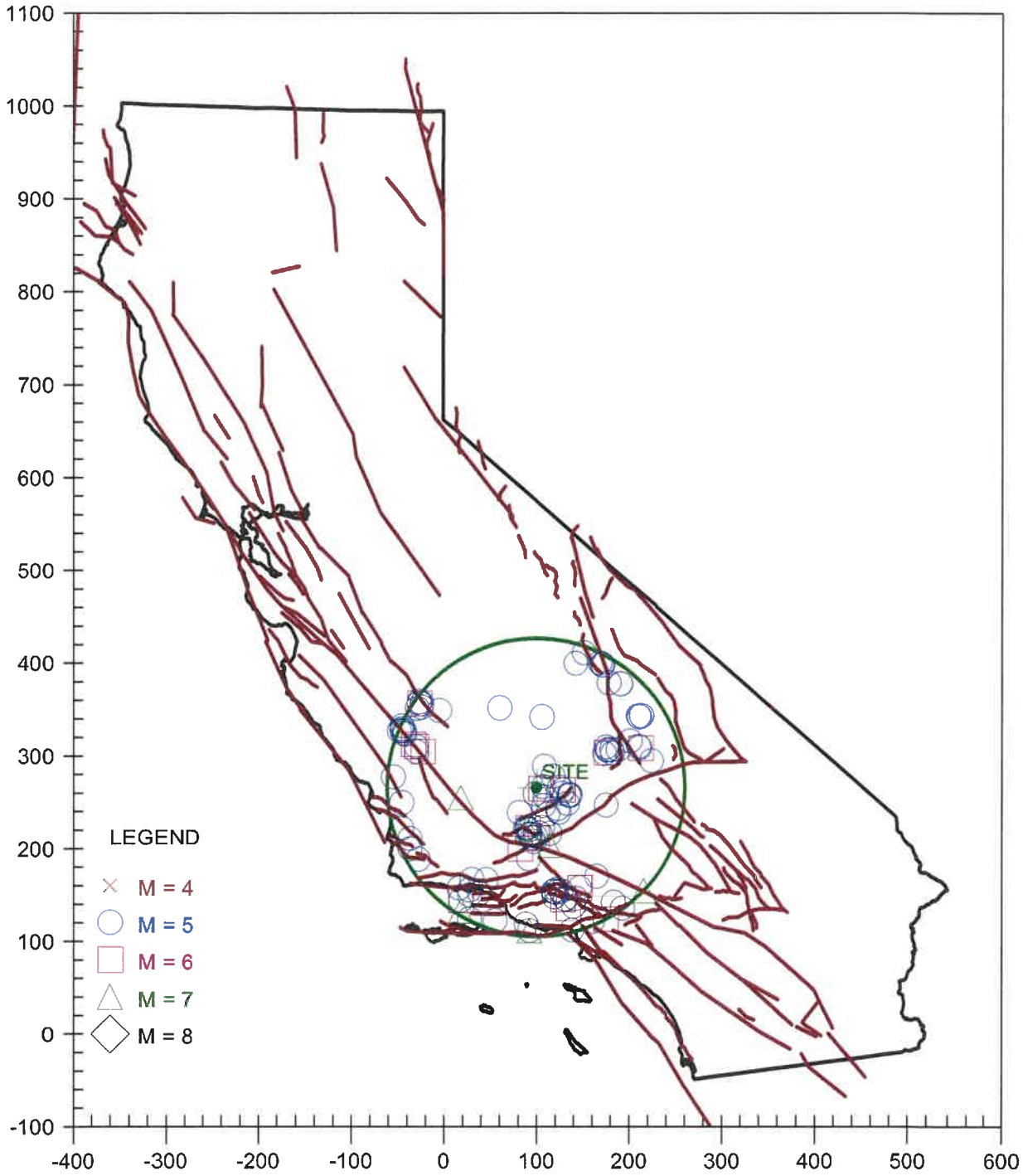
COEFFICIENTS FOR GUTENBERG & RICHTER RECURRENCE RELATION:
a-value= 1.591
b-value= 0.408
beta-value= 0.939

TABLE OF MAGNITUDES AND EXCEEDANCES:

Earthquake Magnitude	Number of Times Exceeded	Cumulative No. / Year
4.0	141	0.63229
4.5	141	0.63229
5.0	141	0.63229
5.5	53	0.23767
6.0	22	0.09865
6.5	9	0.04036
7.0	6	0.02691
7.5	2	0.00897

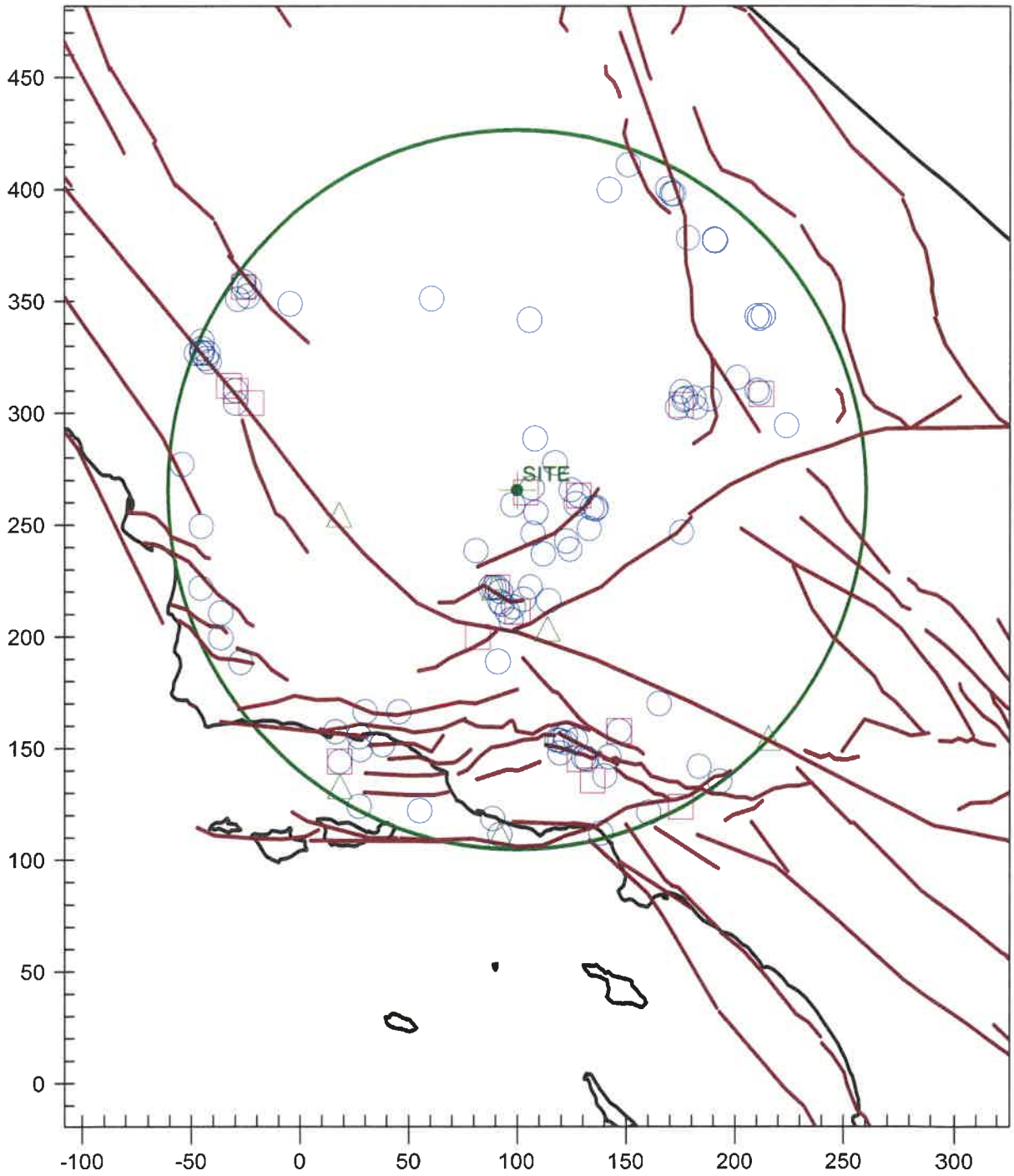
EARTHQUAKE EPICENTER MAP

02224107



EARTHQUAKE EPICENTER MAP

02224107



APPENDIX C

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AND BACKGROUND SOURCES
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Date	Source	Index	Frame	Scale
1946	First Search	N/A	N/A	1" – 375'
1952	Fairchild	ABL-20K	84, 85	1" – 1700'
1956	First Search	N/A	N/A	1" – 375'
1967	First Search	N/A	N/A	1" – 375'
1972	First Search	N/A	N/A	1" – 375'
1973	Beal Library	G14	12,16	1" – 660'
1989	First Search	N/A	N/A	1" – 750'
1992	USGS	N/A	N/A	1" – 500'
1994	First Search	N/A	N/A	1" – 375'
2000	Wac Corp	26	49, 50	1" – 660'
2002	USGS	N/A	N/A	1" – 375'
2009	USGS	N/A	N/A	1" – 500'
2010	USGS	N/A	N/A	1" – 375'
2011	USGS	N/A	N/A	1" – 375'