RIPARIA PONDS

BID AND CONTRACT DOCUMENTS

Volume 2 of 2: Project Specifications

SOUTHERN SANDOVAL COUNTY ARROYO FLOOD CONTROL AUTHORITY (SSCAFCA)

SSCAFCA Project Number BL_P0001-03

February 2023

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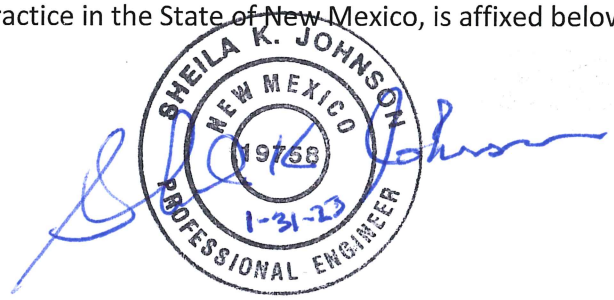
The technical material and data contained in this document were prepared under the supervision and direction of the undersigned, whose seal as a professional engineer licensed to practice in the State of New Mexico, is affixed below.



WHPAcific Project No.: 229022-A000231.00

Riparia Ponds Technical Specifications and Geotechnical Report
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TECHNICAL SPECIFICATION 1510

EXCAVATION, BORROW, AND FILL

Revised 09/16/2021

1510.1 GENERAL

1510.1.1 Excavation, borrow, and fill shall consist of all earthwork operations involved in grading and construction in accordance with the plans and specifications, except for excavation and backfill for structures; excavation and backfill for trenching; and any other earthwork operations separately designated.

1510.2 REFERENCES

This section incorporates the following publications by reference:

- ASTM D-1557
- ASTM D-422
- ASTM D-4318
- ASTM D-6938

This publication:

- NM APWA Section 201
- Tech. Spec. 1513
- Tech. Spec. 1514

1510.3 MATERIAL CLASSIFICATIONS

1510.3.1 UNSUITABLE MATERIAL

Unsuitable materials shall include all material that contains debris, roots, organic matter, stones or boulders too large to be used in the intended construction, or other materials that are determined by the Engineer to be unsuitable. Otherwise suitable materials which are unsuitable due to excess moisture content will not be classified as unsuitable material unless it cannot be dried by manipulation, aeration or blending with other materials satisfactorily as determined by the Engineer.

Material that is unsuitable for the intended use shall be excavated and removed from the site or otherwise disposed of as approved by the Engineer. Unsuitable material shall be disposed in accordance with environmental requirements and as approved by the Project Manager.

The removal and disposal of such unsuitable material will be paid for as excavation, removal and disposal for the quantities involved.

1510.3.2 FILL MATERIAL

All fill material shall be free of vegetation and debris. Clods or hard lumps of earth of 6 inches in greatest dimension shall be broken up. Fill materials shall be free of

vegetation and debris and contain no rocks larger than 3 inches. All fill and backfill material, including selection and blending of material, shall be subject to approval by the Geotechnical Engineer. All fill material shall conform to the requirements for Structural Fill as outlined below.

1510.3.3 STRUCTURAL FILL AND BACKFILL

Structural fill and backfill shall consist of material excavated from on-site or Borrow Material that meets the requirements described in this section. The blended excavated site soils from within the area will be generally suitable for use as structural fill. Blending of soils shall be considered incidental to the Work and no separate payment will be made for this effort. Gradation of the fill material, as determined in accordance with ASTM D-422, shall be as follows:

Sieve Size (Square Openings)	**Percent Passing (by Weight)**
3 inch	100
No. 4	60-100
No. 200	5-40

All structural fill shall be blended as necessary to produce a homogeneous material. The plasticity index of the structural fill shall be no greater than 15 when tested in accordance with ASTM D-4318.

1510.3.4 BORROW MATERIAL

Borrow material is defined as material obtained from an approved borrow source to be used as structural fill material for construction. If borrow material is required, the Contractor shall identify a borrow site and tests will be performed to verify compliance of the material with structural fill requirements per this specification. The Contractor shall not import any borrow material prior to verification that material meets the requirements contained herein and he has received approval to import the material by the Owner.

1510.3.5 SURPLUS MATERIAL

The Contractor shall make all arrangements for disposal of surplus material in accordance with environmental requirements and as approved by the Project Manager. If the material is disposed of on-site, the Contractor shall place material in locations as designated by the Owner. Do not remove materials from the project limits without the approval of the Owner. The Contractor shall satisfy himself that there is

sufficient material available for the completion all items requiring fill material before disposing of any indicated surplus material inside or outside of the project area. Any shortage of material caused by premature disposal of surplus material by the Contractor shall be replaced by the Contractor and no payment will be made for such replacement.

1510.4 CONSTRUCTION REQUIREMENTS

1510.4.1 GENERAL

Contractor shall perform necessary clearing, grubbing and stripping in accordance with Section 201 of the Specifications and Supplemental Technical Specification 201, "Clearing and Grubbing", prior to any excavation, grading, or other earthwork operations. Excavation, fill construction and backfill shall be finished to reasonably smooth and uniform surfaces.

All slopes and cuts should be made in accordance with CFR 29 Part 1926 Subpart P, and all other applicable regulations.

1510.4.2 EXCAVATION

Excavation shall consist of the removal of earth involved in grading and construction according to the plans, except other excavations separately designated.

Temporary construction excavations shall be made in accordance with CFR 29 Part 1926 Subpart P, and all other applicable regulations. Surface water shall be routed such that it does not flow down the face of the excavation slopes. Where insufficient space exists for open cut excavations, a shoring system will be required. All required shoring systems shall be considered incidental to the cost of excavation and no additional payment will be made for this item. All excavations shall comply with all applicable safety regulations.

1510.4.3 FILL CONSTRUCTION

Fill construction shall consist of constructing embankments, the placing and compacting of approved material within areas where unsuitable material has been removed; and the placing and compacting of suitable materials in holes, pits, and other depressions.

1510.4.4 PLACING AND COMPACTING

Fill or backfill, consisting of soil approved by the Engineer and/or project's Geotechnical Report, should be placed in controlled compacted layers not exceeding 8 inches (compacted) with approved compaction equipment. All fill material should be blended as necessary to produce a homogeneous fill. The fill should be raised uniformly and should be benched into the native soils. All compaction should be

accomplished to a minimum of 95 percent of maximum dry density. No lifts of high permeability material or material differing substantially from the lift below shall be permitted.

At locations where it would be impractical to use mobile power compacting equipment, fill layers shall be compacted to the specified requirements by any approved method that will obtain the specified compaction.

1510.5 TESTING

1510.5.1 Tests for degree of compaction should be determined in accordance with ASTM D-1556 or ASTM D-6938.

Continuous, full time observation and field tests should be conducted during fill and backfill placement by a representative of the Engineer to assist the contractor in evaluating the required degree of compaction. If less than the required compaction is required, additional compaction effort should be made with adjustment of the moisture content as necessary until 95 percent compaction is obtained.

1510.6 MEASUREMENT AND PAYMENT

1510.6.1 EXCAVATION

Payment will be made on the unit price per cubic yard for unclassified excavation as provided in the Unit Price Bid Proposal. Payment will include the cost for all excavation, removal, storage and disposal of unsuitable material, hauling of surplus material to the designated location(s), and hauling of select material within the construction site. No payment will be made for excavation of stockpiled materials, structural excavation of previously placed materials and over depth cuts. No payment will be made for shrink or swell. Excavation beyond the authorized cross section will not be included in measurement or payment.

1510.6.2 BORROW

Borrow material will be measured by the cubic yard in-place after compaction. Field topographic surveys, as described in SSCAFCA Technical Specification 1513 or 1514 “Construction Staking”, will be used to determine in-place quantities.

Payment will be made on the unit price per cubic yard for Borrow. Payment will include excavation & haul from Borrow Area, moisture conditioning, required blending of soils, placement, compaction, and other related work.

END OF SECTION

TECHNICAL SPECIFICATION 1511

NPDES COMPLIANCE

Revised 08/21/2020

1512.1 SCOPE OF WORK

The work under this section includes compliance with the U.S. Environmental Protection Agency (EPA), National Pollutant Discharge Elimination System (NPDES) Regulations for Storm Water Discharges from construction sites. This work consists of implementing and maintaining a plan to control erosion, pollution, sediment and runoff during the construction of the project.

1512.2 MEASUREMENT AND PAYMENT

1511.2.1 UNIT PRICE BID PROPOSALS

For Unit Price Bid Proposals, NPDES Compliance shall be a Lump Sum (LS) item, paid for as follows:

1511.2.1.1 Fifteen (15) percent of the Lump Sum unit price amount shall be paid after the Contractor has completed an EPA Notice of Intent (NOI) for Storm Water Discharges Associated with Construction Activity Under a NPDES General Permit, Form 3510-9, or a Low Erosivity Waiver (LEW) form, if applicable. A copy of the NOI or LEW form must be delivered to the Owner and the original filed with the EPA. All required erosion control measures sufficient to begin construction must also be in place. This will be defined in the plan specifications and/or the SWPPP.

1511.2.1.2 Payment for an additional sixty percent (60%) of the Lump Sum unit price amount shall be prorated based on the Actual Percent Complete on the Application for Payment as approved by the Architect, Engineer or Landscape Architect. For example, if the Contractor is 20% complete, the contractor can take the 20% (0.2) and multiply it by 60% (0.6) of the Lump Sum unit price amount and receive that portion.

In order to receive payments, the field inspection forms must be sent in with the Application for Payment each month. If there are deficiencies maintaining or implementing the SWPPP and its Best Management Practices (BMPs), the payment will be withheld until the deficiencies are corrected.

1511.2.1.3 The remaining twenty-five (25) percent of the Lump Sum unit price amount will be based on the completion of an EPA Notice of Termination (NOT) of Coverage Under a NPDES General Permit for Storm Water Discharges Associated with Construction Activity and BMP removal. A copy of the NOT must be delivered to the Owner and the original filed with the EPA. BMPs must be removed as defined in the plan specifications or SWPPP. This is done in case there are some BMPs that must remain until final stabilization is met, and that there are no more NPDES concerns for the Contractor.

END OF SECTION

TECHNICAL SPECIFICATION 1512

CONTROL OF STORM WATER AND NUISANCE FLOW

Revised 07/24/2020

1512.1 DESCRIPTION

This work covers the control of storm and nuisance flow water in the vicinity of this project.

1512.2 CONSTRUCTION REQUIREMENTS

All permanent work shall be performed in areas free from water. The CONTRACTOR shall construct and maintain all dikes and drainage ditches necessary for the elimination of water from work areas and shall furnish, install, maintain, and operate all necessary pumping and other dewatering equipment required for dewatering the various work areas. Two (2) types of flow can be expected;

1) Continuous or intermittent flow through the main arroyo;

2) Local sheet flow from adjacent properties or adjacent streets.

The CONTRACTOR is responsible for adequacy of the scheme or plans, or for furnishing all equipment, labor and materials necessary for dewatering the work areas and breaking up and removing such ice or snow as may have formed or settled in the work area. The CONTRACTOR shall be fully responsible for all dewatering operations, and the cost of all dewatering operations shall be included in the lump sum price for this work. The CONTRACTOR shall also be responsible for removal of any sediment deposited by storm and nuisance water, and the cost of sediment removal work shall be included in the lump sum price for this work.

In the event that storm flow, snowmelt or other water flows overtop the Contractor's diversion method, the Contractor will be responsible for any and all damage, including damage to the existing channel and any damage to new work and is responsible for immediate resolution and repair in a manner acceptable to SSACFCA.

Diversion methods may be by use of sandbag diversion channels, sandbag dams, pumping or piping around or over the work areas, or any method or combination.

1512.3 BASIS OF PAYMENT

The bid item for this effort will be on a Lump Sum (LS) basis. Providing and maintaining the diversion and care of water, regardless of the amount of water actually handled, shall be paid for as follows:

Payment will be made as a percentage of the dollar amount of work completed to date minus the Mobilization bid item.

Pay Item	Pay Unit
Control of Storm Water and Nuisance Flow	LS

END OF SECTION

TECHNICAL SPECIFICATION 1514

CONSTRUCTION STAKING – SIMPLIFIED VERSION

Revised 09/16/2021

1514.1 DESCRIPTION

This work consists of construction staking lines, grades, and layouts by the Contractor in accordance with the plans and specifications and as directed by the Engineer for the control and completion of the project.

1514.2 MATERIALS

The Contractor shall furnish all stakes, templates, straightedges, surveying equipment and other devices necessary for establishing, checking, marking, and maintaining points, including P.I.'s, P.C.'s, P.T.'s, and lines, grades and layouts. As directed by the Engineer, points shall be referenced so that the y may later be re-established.

1514.3 CONSTRUCTION REQUIREMENTS

The Contractor shall be responsible for all control, slope stakes, cut stakes, offset stakes, benchmarks, blue tops or other staking necessary for proper execution of the work, or as requested by the Project Manager, to assure compliance with the plans.

1514.4 CONSTRUCTION SURVEYS

The contractor shall obtain and pay for the services of a Professional Surveyor registered in the State of New Mexico to perform surveys consisting of the following phases:

Phase 1: A cross-section survey, with no greater than 50 foot spacing, to determine the Project Site (including Borrow Area, if applicable) existing ground elevations prior to construction, after clearing and grubbing and after removal of trash and debris. Data collected shall be of sufficient detail, including all breaks in the terrain, to be able to create an original ground digital terrain model (DTM). The Project Site & Borrow Area "original ground" DTM shall be submitted to the Engineer for review and acceptance prior to proceeding with excavation and export of material. Survey data must be sufficient to determine future earthwork quantities.

Phase 2: A cross-section survey, with no greater than 50 foot spacing, to determine the Borrow Area (if applicable) finished ground elevations post-construction, after all required borrow material is removed. Data collected shall be of sufficient detail, including all breaks in the terrain,

to be able to create a finished ground digital terrain model (DTM). The Borrow Area "finished ground" DTM shall be submitted to the Engineer for review and acceptance prior to payment for "Borrow" Bid Item. Survey data must be sufficient to determine earthwork quantities.

Phase 3: A cross-section survey, with no greater than 50 foot spacing, will be completed for the project site (excluding borrow area) after construction to demonstrate compliance with the design grades, structure elevations, inverts, alignments/profiles, etc. shown on the plan set. Phase 3 Survey will also include the update and completion of as-built survey for the project. It is the responsibility of the contractor to coordinate with the surveyor on a regular basis to provide as-built information to incorporate in the survey.

All surveys must be certified by the Professional Surveyor and include complete documentation. Borrow Area surveys (Phases 1 and 2) must be used by the Professional Surveyor to compute the quantity of excavation, subject to the provisions for measurement in Technical Specification 1510. Volume shall be determined based on the "average end area" computation. All computations of excavation must be submitted to the Engineer in sufficient detail. This submittal shall be such that methods and computations can be fully verified and are subject to approval by the Engineer. The Contractor shall also submit the electronic survey point files, including break lines, in a format compatible with AutoCAD Civil3D such that the Engineer can use the data for verification of cut/fill quantities.

At the end of the Project, the Engineer will transcribe the as-built information provided by the Contractor onto the Record Drawing. The Contractor's Professional Surveyor will be required to stamp, sign and certify the information shown on the As-Built drawings.

1514.5 METHOD OF MEASUREMENT

Submit a construction-staking schedule of values as part of each Pay Application to the Project Manager for approval.

1514.6 BASIS OF PAYMENT

Pay Item	Pay Unit
Construction Staking	Lump Sum

SSCAFCA will make partial payments in accordance with the approved construction-staking schedule of values.

END OF SECTION

TECHNICAL SPECIFICATION 1515

REMOVAL OF STRUCTURES & OBSTRUCTIONS

Revised 11/16/2021

1515.1 DESCRIPTION

This work shall consist of removing and disposing of surface and subsurface features to clear the project site for construction. This includes concrete debris, fences, structures, pavements, curb and gutter, sidewalks, buried pipes, and any other items listed within the construction plans. All removal and salvage features included in these items will be designated in the contract.

1515.2 MATERIALS

Suitable materials are those materials which can be compacted to the required embankment densities and meet all other contract requirements for embankment materials. If applicable, the project Geotechnical Report would include this information.

1515.3 CONSTRUCTION REQUIREMENTS

1515.3.1 Suitable Materials

Suitable materials are those materials which can be compacted to the required embankment densities and meet all other contract requirements for embankment materials. If applicable, the project Geotechnical Report would include this information.

1515.3.1.1 Marking of Removal Limits

Prior to work on the site, the Contractor shall establish the right-of-way lines and construction limits confining the removal operations and will designate those surface and subsurface features for removal and those for preservation. The Owner or designee shall be offered the opportunity to review the removal limits before work commences.

1515.3.1.2 Temporary Erosion Control

Ensure all erosion control requirements and all necessary temporary sediment and erosion control protection devices (TESCP), if called for in the contract, are installed prior to initiating removal operations on the construction site. The TESCP items will be paid for under the SWPPP pay item.

1515.3.1.3 Protection of Site Features

The Contractor shall preserve and protect all existing improvements, adjacent property, utilities, and surface or subsurface features not to be removed from injury or damage resulting from their operations. This may require the Contractor to install

temporary signing, temporary fencing, or other temporary features at their cost. Should any damage occur to these site features due to the Contractor's operations, the Owner or designee may withhold payment until the damage is remediated or require the damaged items to be replaced at the Contractor's expense.

1515.3.2 Removal and Salvage Operations

Remove all surface features and subsurface features designated for removal in the contract and dispose of them at a properly permitted disposal site. Provide the Owner or designee with a copy of the written permission from the property owner and copies of any other necessary disposal permits or approvals.

Carefully remove and salvage all surface features and subsurface features designated for salvage in the contract and store and deliver these materials in accordance with the contract requirements. The Contractor shall repair any damage to salvageable items that occurs during their removal, storage, or delivery operations at no cost to the Owner.

Backfill holes created by structure or obstruction removals as per SSCAFCA Standard Specification 1510 with suitable materials, unless the area is within the area of new construction.

1515.3.2.1 Removal of Pavements, Sidewalks, Curb and Gutter

Pavements, sidewalks, and curb and gutter shall be removed to neat saw cut lines as identified in the Contract, and dispose of them off the project site.

1515.3.2.2 Removal of Culverts and Drainage Structures

The Contractor shall sequence the removal of existing culverts and drainage structures so drainage is maintained on the project. This may require installation of temporary drainage features at Contractor's sole cost.

1515.3.2.3 Removal of Sanitary Sewer and Water Utilities

The Contractor shall sequence the removal of existing sanitary sewer and water utilities to minimize the impacts to local businesses and residents. The sequencing of removals shall be coordinated with the City Utilities Department or designee prior to performing removal operations in the field.

1515.3.2.4 Removal of Bridges and Arroyo Features

If the Contract includes the removal of a bridge or feature in an arroyo, remove the existing structures down to the arroyo bottom elevation OR an elevation sufficient to allow for proposed grading, proposed over-excavation, or proposed installation of infrastructure, as shown in the Contract documents.

Remove existing structures outside the arroyo to one (1) foot below ground surface, unless otherwise directed in the Contract.

1515.3.2.5 Removal and/or Salvage of Fencing

If the contract includes removal of fencing materials, remove all fence materials, including posts and post foundations and backfill holes with suitable materials.

If the Contract includes salvaging of fencing materials, place barbed wire into single-strand rolls and minimize the damage to fence posts when pulling them.

1515.3.2.6 Hauling and Stockpiling Salvageable Material

If the Contract requires the Contractor to haul and stockpile salvageable material, load, haul, unload, and stockpile the materials in accordance with the Contract.

Place the salvageable material on blocks or other approved materials and maintain the stockpile area, as directed by the Owner or designee.

1515.3.2.7 Site Appearance

The site shall have a neat and finished appearance when removal operations are finished, except for areas where construction activities are planned.

1515.3.2.8 Disposal

Dispose of all removal items outside the project at a permitted location. If applicable, a disposal plan, including written permission from private property owners used for debris material disposal, shall be submitted to the Owner or designee prior to commencement of disposal activities.

1515.3.2.9 Burying

No burying of any removed debris will be allowed on the project site.

1515.3.2.10 Burning

No burning of any removed debris will be allowed on the project site. In addition, no accumulation of combustible materials shall be stored on the project site near property lines or areas where an unexpected fire could cause damage to existing site features.

1515.4 METHOD OF MEASUREMENT

No measurement will be made for lump sum removal of structures and obstructions.

No measurement of the removal of surfacing will be made if the lump sum basis of payment is used.

Removal of surfacing will be made by the Square Yard if Square Yard basis of payment is used.

1515.5 BASIS OF PAYMENT

Pay Item	Pay Unit
Removal of Structures and Obstructions	Lump Sum
Removal of Surfacing	Lump Sum or Square Yard

Removal of Structures and Obstructions payment shall be considered all-inclusive of the costs of the work including: marking the removal limits; installation of temporary features to protect the site; saw- cutting, removing, and salvaging all items as designated in the Contract; filling depressions associated with the work; providing temporary drainage features associated with the removals; obtaining disposal locations and disposing of debris; and, removing, stockpiling, transporting, and unloading salvaged items.

Removal of Surfacing payment shall be considered all-inclusive of the costs of the work including: removing the surfacing to neat lines; filling depressions associated with the work; providing temporary drainage features associated with the removals; obtaining disposal locations and disposing of debris; and, removing, stockpiling, transporting, and unloading items.

Additional payment for minor removals not specified in the Contract shall not be made.

Unknown buried features not identified in the Contract are not included in this item.

Payments shall be made based on percentage of the pay item completed at the date of monthly Pay Application submittal.

END OF SECTION

SECTION 101

PORTLAND CEMENT CONCRETE

101.1.1 GENERAL: Portland cement concrete, prestressed concrete, post tensioned concrete, shotcrete, gunite, and light weight structural concrete shall consist of a mixture of Portland cement, aggregates, water, and admixtures, proportioned, batched and delivered as specified herein. All materials and design mixes used in Portland cement concrete, either batched at or delivered to a project shall be certified in accordance with the requirements of Section 13 of these specifications. Each design mix submitted and authorized for use under this Specification shall be identified by a design mix number, unique to that design mix. If either a change in material(s) or material supplier(s) from that specified in the authorized design mix occurs during a project, authorized use of the job mix formula on the project may be canceled as directed by the ENGINEER. A concrete design mix shall not be used on a project without written authorization of the ENGINEER. A design mix, upon request by a concrete supplier, may be authorized by the OWNER for use on OWNER and OWNER-related projects for a period of 14 months from the date of sampling of reference aggregates in the design mix.

101.1.2 For construction and reconstruction projects requiring portland cement concrete continuous placement(s) equal or greater than either 100 cubic yards of concrete per day, the CONTRACTOR shall have a full time portland cement concrete construction supervisor on site to direct the construction operations. The supervisor shall be certified either as an ACI certified Concrete Field Testing Technician Grade I, or the equivalent National Institute for Certification of Engineering Technologies Technician, with Specialty Concrete Work Elements Level I 82001, 82002, and Level II 84002, 84003, 84004, 84010. The supervisor shall be identified by the CONTRACTOR at the preplacement conference and shall be the contact person for the ENGINEER during concrete construction.

101.1.3 Pre-Placement Conference
A Pre-Placement Conference shall be held by the CONTRACTOR, as directed by the ENGINEER, no later than seven (7) calendar days prior to the start of construction for concrete continuous placement(s) equal or greater than either 100 cubic yards of concrete per day. The following meeting agenda/assigned responsibilities shall be accomplished at the conference.

I. ENGINEER/OWNER
   A. Scope of the project.
   B. Identify construction management team and contact telephone numbers.
   C. Review CONTRACT requirements for construction.
   D. Review Quality Assurance Program.

II. CONTRACTOR
   A. Review construction schedules.
      1. Placement schedules.
      2. Proposed construction schedule for duration of the project.
   B. Identify construction personnel and contact telephone numbers.
      1. Contractor Staff
      2. Sub-Contractor (s)
      3. Supplier (s)
      4. Safety Manger
   C. Present construction placement procedure plans.
      1. Equipment Schedule
      2. Concrete Design Mix
      3. Construction methodology
      4. Concrete pumping plan
      5. Traffic Control Plan
      6. Quality Control Plan

III. DISCUSSION AND COMMENT

101.2 REFERENCES

101.2.1 American Society for Testing and Materials (Latest Edition) (ASTM)

C31 Making & Curing of Concrete Test Specimens in the Field
C33 Specification for Concrete Aggregates
C39 Test for Compressive Strength of Cylindrical Concrete Specimens
C42 Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
C78 Test for Flexural Strength of Concrete (Using Simple Beam With Third-Point Loading)
C94 Specification for Ready-Mixed Concrete
C125 Definition of Terms Relating to Concrete and Concrete Aggregates
C138 Air Content (Gravimetric), Unit Weight, and Yield of Concrete
C143 Test for Slump of Portland Cement Concrete specification. If required, certification
C150 Specification for Portland Cement
C172 Sampling Fresh Concrete
C173 Test for Air Content of Freshly Mixed Concrete by the Volumetric Method
C192 Making & Curing of Concrete Test Specimens in the Laboratory
C227 Test for Potential Alkali Reactivity of Cement-Aggregate Combinations (Mortar Bar Method)
C231 Test for Air Content of Freshly Mixed Concrete by the Pressure Method
C260 Specification for Air Entraining Admixtures for Concrete
C330 Specification for Lightweight Aggregates for Structural Concrete
C441 Test for Effectiveness of Mineral Admixtures in

Preventing Excessive Expansion of Concrete Due to Alkali-Aggregate Reaction
C494 Specification for Chemical Admixtures in Concrete
C567 Unit Weight of Structural Lightweight Concrete
C617 Capping Cylindrical Concrete Specimens
C618 Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
C685 Specification for Concrete Made by Volumetric Batching & Continuous Mixing
C803 Test for Penetration Resistance of Hardened Concrete
C805 Test for Rebound Number of Hardened Concrete
D2419 Sand Equivalent Value of Soils and Fine Aggregates

101.2.2 American Concrete Institute (Latest Editions)

ACI 211.1 Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
ACI 211.2 Standard Practice for Selecting Proportions for Structural Lightweight Concrete
ACI 318-89 Building Code Requirements for Reinforced Concrete

101.2.3 This Specification:

SECTION 337 PORTLAND CEMENT CONCRETE PAVEMENT
SECTION 340 PORTLAND CEMENT CONCRETE CURBS, GUTTERS, WALKS, DRIVEWAYS, ALLEYS, INTERSECTIONS, SLOPE PAVING, AND MEDIAN PAVING
SECTION 346 TEXTURED CONCRETE
SECTION 349 CONCRETE CURING
SECTION 420 TRAFFIC SIGNAL AND STREET LIGHTING CONDUIT, FOUNDATIONS AND PULL BOXES
SECTION 510 CONCRETE STRUCTURES
SECTION 512 PRECAST PRESTRESSED MEMBERS
SECTION 602 PORTLAND CEMENT CONCRETE FOR CHANNEL LINING AND DIKE AND DAM SURFACING

SECTION 701 TRENCHING, EXCAVATION AND BACKFILL
SECTION 800 INSTALLATION OF WATER TRANSMISSION, COLLECTOR AND DISTRIBUTION LINES
SECTION 900 SANITARY AND STORM SEWER FACILITIES
SECTION 915 STORM DRAINAGE APPURTENANCES
SECTION 1500 MONUMENTS

101.3 PORTLAND CEMENT

101.3.1 Portland cement to be used or furnished under this Specification shall comply either with the requirements of ASTM C150, Types I LA, II LA, III LA, and V LA, cements, or as specified herein, in the Supplementary Technical Specifications, Drawings, or as approved by the ENGINEER. The CONTRACTOR shall submit certification of compliance signed by the cement manufacturer, identifying the cement type and source (plant location), stating the Portland cement furnished to the project, and or used in the concrete delivered to the project complies with this Specification. If required, certification of the Portland cement used for each day's concrete placement shall be submitted to the ENGINEER for each type of cement and each design mix used on the project.

101.3.2 Portland cement specified in an authorized design mix shall be of the same source and type for all concrete batched at and/or delivered to a project under the authorized design mix identification number.

101.3.3 When suitable facilities (such as those recommended by the Concrete Plant Manufacturer's Bureau and/or approved by the ENGINEER) are available for handling and weighing bulk cement, such facilities shall be used. Otherwise, the cement shall be delivered in original unopened bags of the Manufacturer and the type of cement plainly marked thereon, each bag to contain 94 pounds (42.6 kg) of cement.

101.3.4 Cement shall be stored in such a manner as to permit ready access for the purpose of inspection and be suitably protected against damage by contamination or moisture. Should any lot of bulk cement delivered to the site show evidence of contamination, the ENGINEER may require that such lot be removed from the site.

101.3.5 Portland cement shall be measured by weight, lbs, (mass, kg) for concrete produced in accordance with the requirements of ASTM C94 and by volume for concrete produced accordance with the requirements of ASTM C685.

101.4 AGGREGATES:

101.4.1 Aggregates shall comply with the requirements of ASTM C33 and as amended herein, or as specified in the Supplementary Technical Specifications and Drawings, or as approved by the ENGINEER. Aggregates shall be certified to comply with the requirements of this Specification and authorized for use by the ENGINEER before the materials may be incorporated in the construction. Prior to delivery of the aggregates or material containing the aggregates, The CONTRACTOR may be required to furnish samples of the aggregates to the ENGINEER for testing. The CONTRACTOR's daily production aggregate gradations used in concrete shall be submitted to the ENGINEER upon request. Aggregates specified in an authorized design mix shall be of the same source and type for all

concrete batched and delivered under the authorized design mix identification number.

101.4.2 In placing materials in storage or in moving them from storage to the mixer, no method shall be employed which may cause the segregation, degradation, or the combining of materials of different grading which will result in any stockpile not meeting specified requirements.

101.4.3.1 Aggregates supplied under this Specification shall be assumed to be "alkali-silica reactive", ASR. Variance from this position for a particular aggregate source may be authorized by The ENGINEER. Application for a variance may be made to The ENGINEER.

101.4.3.2 An aggregate may be classified non-alkali-silica reactive if, when tested in accordance with ASTM C227, using low alkali cement demonstrates an expansion at one (1) year not greater than 0.05%, and the rate of expansion is negative decreasing, based on test measurements at 1 month, 3 months, 6 months, 9 months, and 15 months, as authorized by the ENGINEER.

101.4.3.3 Portland cement concrete design mixes using non alkali-silica reactive aggregates complying with 101.4.3.2 will not be required to be proportioned with Class F fly ash.

101.4.4.1 Coarse aggregates shall meet the gradation limits as specified in Table 2 of ASTM C33. Fine aggregates shall comply with the gradation requirements of ASTM C33, Section 4, Grading. The sand equivalent of fine aggregate, when tested in accordance with ASTM D2419, Sand Equivalent Value of Soils and Fine Aggregates, shall be greater than 75.

101.4.4.2 The maximum size aggregate shall comply with either these specifications, or the requirements of Table 101.A, or the Supplementary Technical Specifications, or the recommendations of ACI 318-89, paragraph 3.3.2, or as required by the ENGINEER.

101.4.5 Aggregates shall be measured by weight (mass) for concrete batched under the requirements of ASTM C94 and by volume for concrete batched in accordance with the requirements of ASTM C685.

TABLE 101.A
MAXIMUM SIZE AGGREGATE

	Application	Size, in
I.	Pavement, Sidewalk, Curb and Gutter, Drive Pads, Wheel Chair Ramps, Slab on grade, Foundations, and Structures,	1
II.	Channels, minimum 5% retained on the 1 in sieve	I-1/2
III.	High Early Release Concrete, minimum 5% retained on the ½ in sieve	3/4
IV.	Stamped, Patterned, Stairs and Steps, minimum 5% retained on the 3/8 in sieve	½
V.	Formed Concrete	
	A. 1/5 the narrowest dimension between sides of forms,	
	B. 1/3 the depth of slab,	
	C. 3/4 of the minimum clear spacing between individual reinforcing bars or wires, bundles of bars, or prestressing tendons or ducts, or reinforcing and forms.	

101.5 WATER

Water used in Portland cement concrete shall be clean and free from injurious amounts of oil, acids, alkalis, salts, organic materials, or other substances that may be deleterious to the concrete or reinforcement. Non-potable water shall not be used unless the requirements of ACI 318.3.4.3.2 are met. Water shall be measured by weight or volume for concrete batched under the requirements of ASTM C94 and by volume for concrete batched in accordance with the requirements of ASTM C685.

101.6 ADMIXTURES:

101.6.1 Admixtures shall comply with the requirements of this specification. The CONTRACTOR shall submit a certification of compliance signed by the admixture manufacturer, identifying the admixture and its source (plant location), stating the admixture furnished to the project and/or used in the concrete delivered to the project complies with this Specification. Certification laboratory testing of an admixture shall be submitted by the CONTRACTOR to the ENGINEER upon request. Admixtures specified in an authorized design mix shall be of the same source and type for all concrete batched and delivered as defined under a design mix identification number. Admixtures shall be measured accurately by mechanical means into each batch by equipment and in a method approved by the ENGINEER. An admixture shall not be used on a project without authorization by the ENGINEER.

101.6.2 Air-entraining agent, conforming to ASTM C260, shall be measured accurately by mechanical means into each batch by equipment and in a method approved by the ENGINEER. The air-entraining agent used shall not contain more than 0.035% chloride by weight. Air-entrainment content shall comply with the requirements Table 101.B., the Supplementary Technical Specifications, or the recommendations of ACI 318, latest edition.

TABLE 101.B ENTRAINED AIR CONTENT

Nominal Maximum Size Aggregate, in.	Air Content Range, (%)	
	min	max
1 / 2	5.5	8.5
3/4	4.5	7.5
1	4.5	7.5

101.6.3 Chemical admixtures shall conform to either the requirements of ASTM C494, or as specified in the Supplementary Technical Specifications, or as specified by the ENGINEER. Chemical admixtures shall not contain more than 0.035% chloride by weight.

101.6.4.1 Mineral admixtures shall be class "F" fly ash complying with the requirements of ASTM C618 including the requirements of TABLE 4, UNIFORMITY REQUIREMENTS, and the requirements of this Specification.

101.6.4.2 Mineral admixtures, when ested in accordance with ASTM C441, shall conform to the following:

Reduction in expansion @ 14 days, % , min, 100% Reliability	65.0
Mortar expansion @ 14 days, max, %	0.20
Expansion must be less than control sample expansion.	

101.6.4.3 The "Reactivity with Cement Alkalis" shall be determined using new Dow Corning glass rod base for aggregate. If a fly ash does not comply with the above requirement using the specified cement type, it may be authorized if the criteria is met using the low alkali Portland cement typically available to the Albuquerque area, as directed by the ENGINEER.

101.6.4.4 Mineral admixtures used or furnished under this Specification shall be certified quarterly, in a calendar year, to comply with this Specification by the supplier. Certification shall include test results and specifications, source and location.

101.6.4.5 Mineral admixtures shall be measured by weight (mass) for concrete batched under the requirements of ASTM C94 and by volume for concrete batched in accordance with the requirements of ASTM C685.

101.6.5 Accelerating admixtures may be used in Portland cement concrete batched and supplied under this Specification only when approved by the ENGINEER. The accelerating admixture used shall be a non-chloride type. A design mix proportioned with an accelerating admixture shall be submitted as specified in paragraph 101.8.8. and authorized by the ENGINEER, prior to use on a project.

101.7 PROPORTIONING

101.7.1 Portland cement concrete shall be proportioned in accordance with the requirements of ACI 318, latest edition, Chapter 5, either ACI 211.1 or ACI 211.2 (latest editions), and Table 101.C of this Specification, either field experience or trial mixtures, and the construction placement requirements selected by the CONTRACTOR. The CONTRACTOR shall be solely responsible for the portland cement concrete design mix proportions for concrete either batched at, or delivered to, placed and finished at the site. Certification of a design mix and all component materials, including all formulations of a mix and any and all admixtures which may be used under special construction conditions and environments with that mix to include high range water reducers (super-plasticizer), accelerating admixtures and retarders, and any other admixture, shall comply with the requirements of Section 13 of this Specification.

101.7.1.1 Design mix(es) shall be prepared in a laboratory accredited in accordance with the requirements of the New Mexico State Highway and Transportation Department “Procedure for Approval of Testing Laboratories to Perform Inspection, Testing, and Mix Design Services”, April 13, 1998 Edition, and operated under the direct supervision of a New Mexico registered Professional Engineer.

101.7.1.2 The testing equipment used in the design development testing shall be calibrated annually with calibration standards traceable to the National Bureau of Standards. Certificates of calibration shall be maintained at the laboratory for review by the ENGINEER. A copy of the certifications shall be submitted to the ENGINEER upon request. A portland cement concrete design mix shall not be batched at and/or delivered to a job site without written authorization of the ENGINEER.

101.7.1.3 A design mix shall be prepared under the direct supervision of a New Mexico Registered Professional Engineer.

101.7.2 Portland cement shall be proportioned to comply with the requirements specified in Table 101.C, or as specified in the Supplemental Technical Specifications, or Plans, or as authorized by the ENGINEER.

101.7.3 The mineral admixture Class F fly ash shall be proportioned by weight of cement to provide a fly ash to portland cement ratio not less than 1:4, not less than 20 per cent of the total cementitious material. Portland cement concrete submitted under this Specification shall be proportioned with Class F fly ash, unless a variance is authorized by the ENGINEER.

107.7.4 The water to total cementitious material ratio shall not be greater than specified in Table 101.C, or the maximum determined from a "trial mix" compressive strength vs. water to cementitious ration curve, defined in accordance with ACI 318, latest edition, Chapter 5. The trial mix compressive strength water to cementitious material ratio curve shall be developed with the target slump at design application maximum, ±0.75 inches, and the target entrained air content at design application maximum, ± 0.5 per cent, using materials specified in the design submittal. The cementitious material shall be defined as the total weight of portland cement and Class F fly ash in design mix.

101.7.5.1 A design mix submittal shall include but not be limited to the following information, as directed by the ENGINEER.

A. Certification of compliance of the design mix with the requirements of this Specification in accordance with Section 13 of these specifications by the New Mexico Registered Professional Engineer in responsible charge of the design mix development;

B. Certification of compliance of design mix's component materials by a manufacturer/supplier. The certification shall include laboratory test results of companion samples of the component material used in the laboratory prepared design mix, verifying the component materials comply with the specifications. For a mix design based on statistical methods, certification(s) of component materials shall be based on results performed within two (2) months of the submittal date.

C. Plastic characteristics of the design mix to include concrete temperature, slump, entrained air content, wet unit weight, yield and cement factor, reported in English and metric units;

D. Performance characteristics of the hardened concrete to include the compressive strength of all test cylinders averaged for a respective test and the corresponding average compressive strength reported in English units;

E. Compressive strength test (3 cylinder tests each point) shall be reported for each water to cementitious material ratio design mix proportioned at 3, 7, 14 and 28 days laboratory cure normal concrete; and, 1 day, 3 days, 7 days and 28 days laboratory cure for high early release concrete.

F. The "trial mix" compressive strength vs. water to cementitious ratio curve graphically plotted to include the water to cementitious ratio for the proposed design mix. A proposed design mix water to cementitious ratio outside the limits of a trial mix curve shall be rejected.

G. When a proposed design mix is based on statistical analysis of historical data, certification that the design mix represented by the historical data was batched with the same or similar materials from the same sources as the materials proposed in the design mix shall be included in the submittal. Under this design certification procedure, the proposal shall include a statistical analysis for a period of 12 months prior to sampling aggregates of the characteristics of a) slump, b) entrained air, and c) f'_c@28 day compressive strength test. A compressive strength test shall be the average of two (2) cylinders tested at 28 days. An annual average aggregate gradation analysis may be used if the data represents the 12 month period prior to sampling for a design mix. A minimum of three production gradations per month will be required in the data base, as directed by the ENGINEER.

H. Batch proportions for concrete made by Volumetric Batching and Continuous Mixing, ASTM C685, shall include 1) component batch weights, 2) component batch volumes, and 3) gate settings for each type of batching equipment the design mix that may be batched.

J. High Range Water Reducing Admixture(s) (hrwra), Superplastizers

a. A prescription for use of the hrwra in a design mix shall be provided by the CONTRACTOR to include but not limited to the following
   1. Maximum dosage per cubic yard (meter) by standard measure, ozs/yd^3;
   2. Admixture introduction location (plant or Job site);
   3. Minimum mixing after admixture introduction (drum revolution count at mixing speed);
   4. Air entrainment dosage adjustment, if required;
   5. Base mix water reducing admixture (wra) dosage adjustment, if required;
   6. Consistency (slump) targets for before and after admixture introduction;
   7. Concrete temperature limitations, if required; and,
b. Laboratory demonstrated performance of the design mix, at the specified maximum admixture dosage, shall be reported, including slump, entrained air content, unit weight, water to cementitious materials ratio, seven (7) and twenty eight (28) day compressive strength (fc), and three (3) days and seven (7) day compressive strength (fc) for high early release concrete. Submittal compressive strength shall be based on the average value of three cylinders required.

K. Accelerating Admixture(s)

a. A prescription for use of the accelerating admixture in a design mix shall be provided by the CONTRACTOR to include but not limited to the following:
   1. Maximum dosage per cubic yard (meter) by standard measure, ozs/yd^3;
   2. Concrete temperature limitations, if required;
   3. Admixture introduction location, plant or project;
   4. Restrictions of use in combination with other

admixtures, as applicable; and,

b. Special considerations for mixing, placing, and curing, as applicable.

L. Color Admixture(s)

a. A prescription for use of a color admixture in a design mix shall be provided by the CONTRACTOR to include but not limited to the following:
   1. Maximum dosage per cubic yare (meter) by standard measure, ozs/yd^3;
   2. Admixture introduction location, plant or project;
   3. Restrictions of use in combination with other admixtures; and

b. Special considerations for mixing, placing, and curing, as applicable.

M. Submittal Format

a. A standard design mix submittal may include some or all of the above information as directed by the CONTRACTOR to define use as "optional" admixture(s). The standard design mix code would be the same for applications with and without the optional admixture(s)

b. A specific design mix submittal can be made to include either color, or accelerating, or high range water reducing admixture for use under a specified application only. Separate design mix submittals will be required to include the information specified above.

101.7.5.2 A submittal shall be rejected if it does not include the specified information and samples. A design mix submittal shall be accepted or rejected within ten (10) days of receipt by the ENGINEER.

TABLE 101.C - DESIGN MIX SPECIFICATIONS-PORTLAND CEMENT CONCRETE [1, 2, 3]

Application	Use In Section(s)	f 'c @ 28 days psi, min [4]	Entrained Air Range [11]	Slump, Not To Exceed, nte [5] inches			Portland Cement min, lbs./yd^3	w:(c+fa) max [7]
				Placement	Norm	HRWRA		
Interior Concrete (heated areas) Foundations and slab on grade.	510	3,000	(See par.101.7.2)	Hand Place	4	6	423	0.50
Exterior Concrete a) Structure, foundations, slab on grade, steps/stairs; b) sidewalks, drive pads, wheel chair ramps, stamped pattern concrete, curb & gutter, and valley gutter; c) storm drain structures, channels, drop inlets, and manhole bases; d) retaining walls; and, e) miscellaneous concrete.	340, 346, 420, 510, 511, 602 [12,13], 701, 800, and, 1500	3,000	(See par.101.7.2)	Hand Place Slip Formed	4 2	6 3	470	0.45
Pavement For design of PCCP, use MR= 600 lbs/in^2 [4]	337	4,000	(See par.101.7.2)	Hand Place Slip Formed	4 2	6 3	564	0.40
Hydraulic Structures Reservoirs	510 and 512	3,500	(See par.101.7.2)	Hand Place Slip Formed	4 2	7 3	517	0.40
Structures Buildings, bridges/bridge decks, and parking structures	500	4,000 [8, 9]	(See par.101.7.2)	Hand Place Slip Formed	4 2	7 3	564	0.40
Sanitary Sewer Facilities Structures, manholes and bases.	900	4,000 [8, 9]	(See par.101.7.2)	Hand Place Slip Formed	4 2	7 3	658 [6]	0.40
High Early Release Concrete fcr= 3,400 lbs/in^2 @ release to service [10]	All applications	4,000 @ 7 days	(See par.101.7.2)	Hand Place Slip Formed	4 2	7 3	Design	Design

1. Use of material(s) not defined by this specification must be approved by the ENGINEER.
2. Maximum size aggregate shall comply with the requirements of par. 101. 4.4.2.
3. Portland cement concrete shall be proportioned with Class F fly ash complying with the requirements of 101.6.4, proportioned 1: 4, minimum, fly ash to portland cement, by weight.
4. *MR*-Modulus of Rupture, *f'c*-compressive strength at 28 days.
5. When authorized by the ENGINEER, a high range water reducing admixture (HRWRA), super plasticizer, may be used to increase slump. When a HRWRA is proposed for use on a project. The design mix shall be proportioned to include the HRWRA. The use of a HRWRA in a design mix that was not originally proportioned with a HRWRA is not acceptable under this specification. Higher slump(s) may be used, as directed by the ENGINEER.
6. If portland cement complying with ASTM C150 Type VLA is used, a minimum of 564 lbs/cy may be used.
7. "w : (c+fa)" is defined as *water to cementitious* materials ratio: w-water; (c+fa)-cementitious material as the sum of the portland cement and fly ash. Units are lbs/yd^3.
8. Lightweight structural concrete for structures, parking decks, and bridge decks shall be proportioned with a minimum compressive strength of f'c= 4,750 lbs/in^2 @ 28 days.
9. Minimum requirements for prestressed/post tensioned concrete. Actual criteria may differ as specified in the plans and supplemental technical

specifications.

10. "High Early Release Concrete" may be used where early release of structure to either service or construction loads may be required ($\leq$ 3 days), as authorized by the ENGINEER. "fcr" is the minimum compressive strength for release, as determined by field cured cylinders. Maximum size aggregate shall be 3/4 inch.
11. Designated interior concrete, placed, finished, cured, and maintained by the Contractor in a temperate environment of 40^{O}F or greater, may be constructed with non air entrained concrete complying with all other requirements of this specification for the calendar period after April 30 and before October 1, as authorized by the Engineer. Concrete for wet exposures, showers and wash down areas, vehicle repair and storage floors shall not be included in this variance.

101.8 BATCHING

101.8.1 Portland cement concrete shall be batched in accordance with the requirements of either ASTM C94, or ASTM C685, and the requirements of this Specification, as authorized by the ENGINEER. Batching facilities, mixing, and transporting equipment shall be certified within 12 months prior to batching of a design mix. The plant shall be certified by a NM Registered Professional Engineer, to comply with the requirements of this Specification and Section 13. The certification shall have been competed within 12 months of batching an authorized portland cement concrete design mix. Written certification shall be available for review at the plant by the ENGINEER, and, submitted to the ENGINEER upon request.

101.8.2.1 Ready-mix concrete batch plants shall be certified to comply with the requirements of this Specification. Written certification of compliance shall be available for review at the batch plant by the ENGINEER.

101.8.2.2 Central-Mix Batch Plants shall be certified to comply with this Specification and standards of the National Ready-Mix Concrete Association. The central-mixers rated capacity shall be posted at the batch plant in the operator's area.

101.8.2.3 Portable batch plants shall be certified after erection at a project and prior to batching concrete to be used at the project site. The batch plants rated capacity shall be posted at the batch plant in the operator's area.

101.8.2.4 Ready-mix concrete trucks shall be certified to comply with the requirements of this Specification and the "Standards for Operation of Truck Mixers and Agitators of the National Ready-Mix Concrete Association", and the "Truck Mixer Manufacturer Bureau", latest editions. Written certification of compliance shall be carried in/on the vehicle for verification by the ENGINEER. The manufacturers rated capacity, mixing and agitating speeds shall be posted on the truck mixer. Mixers shall have an operable mixer drum revolution counter and water metering system to measure temper water that may be added to a mixer after batching and prior to discharge of a load.

101.8.2.5 Shrink-mixed concrete batching shall be certified to comply with the requirements of this Specification. Written certification of the program to include a) maximum concrete volume defined for the process/equipment, b) minimum time of mixing in the stationary mixer of materials after the addition of all cementitious material, and, c) minimum supplemental mixing revolutions in the transit mix truck. A copy of the certified procedure shall be shall be available at the batch plant for review by the ENGINEER, and submitted upon request. the ENGINEER shall be notified by the CONTRACTOR in writing which concrete supplied to a project is produced with this procedure. Shrink mixed batching shall not be used on a project without authorization by the ENGINEER.

101.8.2.6 Volume batching central mix and concrete mobile trucks shall be certified to comply with this Specification. Certification shall include discharge gate settings/material weight batching references for each material carried and a certified water meter and calibration chart to define water settings. Discharge calibration settings shall be established for each production batching rate and authorized design mix batched. The equipment shall be recalibrated if a change in materials or source of materials occurs. Written certification of compliance shall be carried in/on the vehicle for verification by the ENGINEER.

101.8.2.7 On-site batching and mixing equipment for concrete volumes of less than 1 cubic yard shall conform to the requirements of ASTM C192, and shall be approved by the ENGINEER. On-site batched concrete for volumes less than 1 cubic yard shall be either "Redi-2-Mix", "Quikrete", or equal prepackaged concrete mix. The concrete shall be proportioned with water not to exceed a maximum of 1.5 gallons per 60 lbs./bag or equivalent. Concrete batched under this paragraph shall not be used for finished, interior and/or exterior exposed concrete surfaces.

101.9 MIXING

101.9.1 Concrete batched in accordance with ASTM C94, shall be mixed in accordance with the requirements of that Specification and as follows.

101.9.2 Central-Mixed Plants: Concrete mixed in a stationary mixer and transported to the point of delivery shall be mixed from the time all the solid materials are in the drum. The batch shall be so charged with some water in advance of the aggregates and cementitious materials, and all water shall be in the drum by the end of one-fourth the specified mixing time. Mixing time shall be a minimum of 1 minute for the first cubic yard plus 15 seconds for each additional cubic yard, or fraction there of additional capacity. Where mixer performance tests have been conducted in accordance with ASTM C94, with the mixer to rated capacity, the mixing time may be reduced to the time at which satisfactory mixing defined by the performance tests shall have been accomplished. When the mixing time is so reduced the maximum mixing time shall not exceed this reduced time by more than 60 seconds for air entrained concrete. Certified concrete uniformity tests shall be conducted in accordance with ASTM C94 and Section 13. If the uniformity requirements are not met, that mixer shall not be used until the condition is corrected.

101.9.3 Shrink-Mixed Concrete:
Concrete mixed in a shrink mix production program shall be mixed in accordance with the certified shrink mix program as defined by the CONTRACTOR. Concrete shall be mixed in a stationary mixer not less than the certified minimum mixing time after all ingredients are batched into the drum, and not less than the minimum mixing revolutions specified for the transit mix truck after the load is transferred into the transit mix truck. Mixing in the transit mix truck shall not exceed the maximum requirements of paragraph 101.9.4. Shrink-mixed concrete procedures shall be certified to provide concrete that complies with the uniformity specifications of ASTM C94 as determined by uniformity tests specified in ASTM C94, for the maximum batch volume of concrete defined by the CONTRACTOR. If uniformity requirements are not met for the combination of stationary plant and transit mixers , the shrink mix program shall not be used. Tempering of shrink mix concrete at the job site shall comply with the requirements of 101.10 and 101.11.

101.9.4 Truck-Mixed Concrete:
Concrete mixed in a truck mixer shall be mixed after all ingredients including water, are in the drum at least 70 revolutions and not more than 100 revolutions at the mixing speed as defined by the Manufacturer. The mixing speed for the mixer shall be identified on the mixer. Certified concrete uniformity tests shall be conducted on transit mixer trucks in accordance with ASTM C94 and Section 13 annually. If the uniformity requirements are not met, that mixer shall not be used until the condition is corrected. Mixing beyond the number of revolutions at mixing speed found to produce the required uniformity of concrete shall be at the agitation speed defined by the mixer manufacturer. The manufacturer's recommended mixing and agitation speeds shall be posted on the truck mixer.

101.9.5 Volume Batched Concrete:
Concrete batched in accordance with ASTM C685, shall be mixed in accordance with the requirements of this Specification and the Manufacturer's recommendations. The continuous mixer shall be an auger type mixer or any other type suitable for mixing concrete to meet the requirements for uniformity specified in ASTM C685,

101.10 TEMPERING BATCHED CONCRETE

101.10.1.1 The slump of a concrete mix sampled at final discharge shall comply with the requirements of TABLE 101.C. Non complying material shall be removed from the structure as directed by the ENGINEER.

101.10.1.2 A load of concrete may only be tempered with water after the mix cycle is complete when, upon arrival at the job site, the slump of the concrete is less than specified, and the time limit and revolution limit specified in 101.9 are not exceeded.. When additional water is required, the total water in the truck shall not exceed the maximum water to cementitious ratio specified in the authorized design mix when the concrete is discharged. When tempering is required and allowed as defined by the water to cementitious ratio for the design mix, the water shall be injected into the mixer and the drum or blades turned a minimum of 30 revolutions at mixing speed before discharge as long as the revolution limit specified in 101.9 is not exceeded.. Additional water shall not be added to the batch after tempering without authorization by the ENGINEER.

101.10.1.3 When the slump of a sample taken within the time limits specified in 101.9 the specification requirements of TABLE 101.C, the mixer truck may be mixed a minimum of 15 revolutions at mixing speed, as long as the revolution limit specified in 101.9 is not exceeded, sampled and tested. If the slump of the second sample exceeds the maximum specified slump by 0.25 in (6 mm), the load may be rejected as directed by the Engineer.

101.10.2.1 The air content in air entrained concrete, when sampled from the transportation unit at the point of discharge, shall comply with the requirements of this specification. Non complying material shall be removed from the structure as directed by the ENGINEER.

101.10..2.2 When a preliminary sample taken within the time limits specified in 101.9 and prior to discharge for placement shows an air content below the minimum specified level, the CONTRACTOR may add additional air entraining admixture to achieve the specified air content, if the revolutions on the drum counter are less than 300, and the total revolutions, after air entrainment addition will not exceed 300 following mixing a minimum of 30 revolutions at mixing speed after dosage with the admixture. Additional air entraining admixture may not be added to the batch after the initial air entraining admixture tempering. Air entraining admixture shall be batched in accordance with 101.7.2. In addition to sampling and testing for compliance after tempering with the air entraining admixture, a sample shall be taken during discharge from the second half of the load to verify slump and entrained air compliance through the load with the specification.

101.10.2.3 When the entrained air exceeds the specified requirements, the load may be mixed a minimum of 15 revolutions, sampled and tested, if the drum revolutions do not exceed 300, and will not exceed 300 following mixing. If the entrained air exceeds the specification by 0.1 %, the load may be rejected as directed by the ENGINEER.

101.10.3 High range water reducing admixtures,

superplasticizers shall be batched as recommended by the manufacturer.

101.10.4 Aggregates and cementious material may not be used to temper a batched load of portland cement concrete.

101.10.5 All samples shall be tested for slump, entrained air, and unit weight after tempering..

101.10.6 The field dosage amounts of admixtures and water shall be reported on the truck ticket.

101.10.7 The OWNER shall pay for quality assurance sampling and testing specified 101.15, or as directed by the ENGINEER.

101. 11 DELIVERY & DISCHARGE:

101.11.1 Discharge of the concrete shall be completed within 1-1/2 hours or before the drum has revolved 300 revolutions, whichever comes first after the introduction of the mixing water to the cement and aggregates. These limitations may be waived by the ENGINEER if (1) the concrete is proportioned and certified for use after mixing/agitation time in excess of 1-1/2 hrs, or (2) is of such a slump that it can be placed and finished, without the addition of water to the batch after the time limit noted above is exceeded. In hot weather or under conditions contributing to quick stiffening of the concrete, a time less than 1-1/2 hrs. may be specified by the ENGINEER.

101.11.2 The minimum discharge temperature of concrete in cold weather shall be equal or greater than the temperature specified in Table 101.D.

TABLE 101.D - Cold Weather Construction Concrete Temperature, min [1]

Ambient Air Temperature	Thin Sections	Heavy Sections & Mass Concrete [2]
30 to 45 ^{O}F	60^{o}F	50^{o}F
0 to 30 ^{O}F	65^{o}F	55^{o}F
Below O ^{O}F	70^{o}F	60^{o}F

[1] The maximum concrete discharge temperature of all concrete, except “high early release concrete”, produced with heated aggregates, heated water, or both, shall be 70^{o}F. The discharge temperature of “high early release concrete” in cold weather shall be 70 ^{o}F - 76 ^{o}F.

[2] Sections having dimensions in all directions greater than 2 feet (24 inches)

101.11.3 The discharge temperature of concrete in hot weather should be kept as cool as possible. Concrete supplied to a project site having a discharge temperature greater than 90 ^{o}F may be rejected by the ENGINEER if the concrete cannot be placed and finished after a single tempering with water as authorized under 101.10. Retarding admixtures may be used to control setting in hot weather. The discharge temperature of “high early release concrete”in hot weather shall be specified by the CONTRACTOR.

101.11.4 The CONTRACTOR shall provide to the ENGINEER with each batch of concrete batched and/or delivered to the job site, before unloading at the site, a delivery batch ticket on which the information specified in TABLE 101.E is printed, stamped or written, certifying said concrete. One copy of the ticket shall be available for the ENGINEER and one copy of the ticket shall be available for the quality assurance testing program.

TABLE 101.E
BATCHING TICKET INFORMATION REQUIREMENTS

A. Name of Concrete Supplier
B. Delivery Ticket Number
C. Date of Delivery
D. Contractor
E. Project Name (Optional)
F. Design Mix Number
G. Volume of Concrete in Load
H. Time loaded
J. Batched Weight (mass) of Cement
K. Batched Weight (mass) of Fly Ash
L. Batched Weight (mass) of Fine Aggregate
M. Batched Weight (mass) of Coarse Aggregate(s)
N. Batched Weight (mass) or Volume of Each Admixture
O. Weight or volume of water batched at the plant
P. Design Mix Target Proportions
Q. Weight or volume (gal.) of temper water added at the site
R. Weight or volume of each temper admixture added at the site
S. Signature and name (printed) of CONTRACTOR’S representative who authorized the tempering, if any, at the site and affiliation to project

101.12 PLACEMENT

101.12.1 Portland cement concrete shall be placed to the lines, sections, grades and elevations, with the procedures specified in the CONTRACT documents. The material shall be consolidated to eliminate all voids, internal rock pockets and defects in the finish

concrete. Casting subgrade and formed surfaces shall be damp, at the placement of the concrete. Removable forms shall be treated with a form release agent prior to placement of the forms for ease of removal of the forms without damage to the supported concrete. Forms shall be sealed to prevent leakage. Form release agents shall not stain the adjacent concrete. Placement and finishing shall be completed prior to the start of the initial set of the concrete.

101.12.2.1 The CONTRACTOR shall submit a concrete pumping plan to the ENGINEER for review and authorization one week prior to the start of a pumped concrete construction program for placements complying with 101.1.1. The submittal should identify the pump manufacturer, size and type, rated capacity(s) for the line diameter(s) to be used and distance(s) to be pumped.

101.12.2.2 Pumping shall conform to the recommendations of the pump manufacturer. The pump manufacturer's operation manual shall be available on the pump equipment, and submitted to the ENGINEER, upon request.

101.12.2.3 Concrete shall be pumped in a uniform continuous flow to point of discharge, with all lines kept full, during the pumping operation. The CONTRACTOR shall provide either a system for controlled discharge of the concrete, or the last 5 feet of the pump line, immediately prior to the line discharge opening, shall have a slope equal or less than 10:1, horizontal to vertical, during the pumping of concrete, as authorized by the ENGINEER. The concrete shall not be dropped a vertical distance greater than four feet at discharge from the pump line without a tremey. Concrete placed by pump shall conform to the requirements of this specification after discharge from the pump line. Pumping of concrete shall not commence without authorization by the ENGINEER.

101.13 FINISHING

The CONTRACTOR shall finish Portland cement concrete as required by the CONTRACT documents, Supplemental Technical Specifications, or as directed by the ENGINEER.

101.14 CURING CONCRETE

The CONTRACTOR shall cure concrete as required by the CONTRACT documents, SECTION 349 of this specification, the Supplemental Technical Specifications, or as directed by the ENGINEER. A concrete structure or element shall not be released to service loads until it has achieved a minimum of 85% of the design strength, f'c, at the time the structure is placed in service, or the curing program specified in SECTION 349 is completed, or as directed by the ENGINEER. Service loads shall include construction loads, design loads and environmental exposure.

101.15 QUALITY ASSURANCE SAMPLING AND TESTING

101.15.1.1 Quality assurance sampling and testing shall be performed in accordance with the requirements of this Specification, the Supplemental Technical Specifications, or as required by the ENGINEER. Concrete shall be sampled and tested by a technician/engineer certified as either an ACI certified Concrete Field Testing Technician Grade I, or the equivalent National Institute for Certification of Engineering Technologies Technician, with Specialty Concrete Work Elements Level I 82001, 82002, and Level II 84002, 84003, 84004, 84010.

101.15.1.2 Quality assurance testing and analysis shall be performed in a laboratory accredited in accordance with the requirements of the New Mexico State Highway and Transportation Department "Procedure for Approval of Testing Laboratories to Perform Inspection, Testing, and Mix Design Services", April 13, 1998 Edition, under the direct supervision of a New Mexico Registered Professional Engineer.

101.15.1.3 Testing equipment sed in the performance of specified testing shall be calibrated annually with calibration standards traceable to the National Bureau of Standards. Certification records shall be maintained at the laboratory for review by the ENGINEER. A copy of the certifications shall be submitted upon request to the ENGINEER. Quality assurance testing shall be directed by the ENGINEER and paid by the OWNER

101.15.2.1 Samples will be taken in the field by the ENGINEER, in accordance with ASTM C172, at discharge to the structure/application after all tempering at the job site has been completed.

101.15.2.2 A sample shall be taken for each design mix of concrete placed each day, once for each 100 cu yd of concrete, once for each 5000 sq.ft. area of slabs or walls, or fractions thereof, whichever is greater, or as directed by the ENGINEER. Hi-lo thermometers will be provided by the CONTRACTOR to monitor field curing concrete temperatures and companion test specimens while in the field , as directed by the ENGINEER.

101.15.3 Slump tests will be performed on each quality assurance sample in the field in accordance with ASTM C143. Concrete used for slump tests shall not be used in specimens for strength tests. The slump shall not exceed the maximum value defined in TABLE 101.C plus 0.25 in (6 mm). Slumps shall be reported to the nearest 1/4 inch (1 mm).

101.15.4 Entrained air tests will be performed on each quality assurance sample in accordance with the requirements of ASTM C231 for normal weight concrete, and ASTM C173, light weight concrete as specified in TABLE 101.C. Concrete used for entrained air tests shall not be used in specimens for strength tests. The entrained air shall not be less than the minimum nor greater than the maximum entrained air specified plus 0.1 % . Entrained air shall be reported to the nearest one tenth of one percent.

101.15.5.1 The cement content per cubic yard for a load of concrete shall be determined on each quality assurance sample in accordance with ASTM C138. The unit weight shall be reported to the nearest one tenth of a pound per cubic foot (one kilogram per cubic meter). The cement factor shall be reported to the nearest pound per cubic yard (kilogram per cubic meter).

101.15.5.2 The portland cement content per cubic yard for a load of concrete shall be calculated by dividing the batched weight of the portland cement reported on the truck ticket for the load represented by a quality assurance test sample, by the yield, in cubic yards, determined in 101.15.1. The cement content shall be reported to nearest one pound per cubic yard. The portland cement content shall not be less than the minimum cement content for the application specified in TABLE 101.C.

101.15.5.3 The water to cementitious ratio for a load of concrete sampled and tested under this specification shall be calculated by comparing the total water in a load, by weight, the batched water reported on the load's batch ticket plus any water added in the field, to the sum of the portland cement and fly ash reported on the batch ticket. The weight of the water shall be divided by the weight of the cementitious materials and reported to the nearest one hundredth value (xx.xx). The water to cementitious ratio shall be less than or equal to the water to cementitious ratio for the application specified in TABLE 101.C.

101.15.6 A non complying field test, slump test, entrained air test, cement content, shall be verified by sampling and testing a second sample from the same load represented by the non complying sample/tests. If the second sample/tests determine the material is in compliance, the load may be authorized for placement and the all quality assurance tests required shall be performed. If the second test confirms the initial test results, the concrete load may be rejected as directed by the ENGINEER. If the second test confirms the initial sample non complying test, the second sampling and testing shall be payed by the CONTRACTOR, as specified in SECTION 13. The OWNER shall pay for all complying test.

101.15.7.1 Quality assurance compressive strength concrete specimens/cylinders shall be molded in accordance with ASTM C31. Cylinders shall be sealed metal or plastic molds complying with ASTM C31. The specimens will be submerged in water during the initial field curing at the site when the average ambient temperature is equal or greater than 60 ^{O}F, site conditions permitting, as directed by the ENGINEER. If the initial field cure submersion procedure is not used, high-low thermometers shall be used to monitor the initial field cure temperature of the quality assurance specimens, and the recorded temperatures shall be reported in the sampling and testing report. If the curing temperature recorded on the high-low thermometer exceeds 85 ^{o}F, concrete compressive test strengths shall be reported as information only, and the lab of record shall revise the initial cure procedure for the assurance specimens to control the curing temperature to less than 85 ^{o}F. Cylinders left in the field longer than the maximum specified time shall be so identified and reported "for information only". A sample may be taken to the testing laboratory for testing and casting provided the cylinders can be molded within 15 minutes after sampling.

101.15.7.2 Strength specimens shall be molded and tested in accordance with ASTM C31, C39, C78 & C93, C192, and this specification. The number and type of compressive strength test cylinders shall be a minimum of four (4) 6"dia. x 12"H cylinders for channel concrete, and normal concrete with nominal maximum size aggregate of 1.5 inch to 2.0 inch. The number and type of compressive strength test cylinders shall be a minimum of four (4) 4" dia x 8" cylinders for normal concrete with nominal maximum size aggregate 1 inch and less. The number and type of cylinders shall be a minimum of six (6) 4" dia x 8" cylinders for high early release concrete compressive strength tests. The number and type of Modulus of Rupture flexure test beams shall be a minimum of three (3) 6"x6"x42" beams or equivalent for Modulus of Rupture Tests, as directed by the ENGINEER. Strength specimens shall be cast using concrete from the same load as the concrete field tests. When 4"dia. x 8" cylinders are used, they shall be cast in two equal lifts, each lift rodded twenty five times with a three eights inch (9.5 mm) diameter rod with a three eights inch (9.5 mm) semi spherical tip. The rodding of a lift placed on a lift of concrete shall penetrate into the top of the preceding lift.

101.15.7.3 When strength tests are required for stripping of forms or release of structure, a minimum of 2 test specimens complying with the specimen type specified in 101.15.7.2 for each test shall be molded and cured at the site under the same conditions as the concrete represented by the specimens. The specimens shall be returned to the Lab at the end of the field curing period and tested in accordance with ASTMC39. The test strength shall be the average of the test strengths of the two specimens. The critical concrete compressive

strength (f'_c) shall be a minimum of 85% of the specified design strength.

101.15.7.4 Concrete strength test specimens shall be tested at 7 days and 28 days. One specimen shall be tested at 7 days and 2 specimens shall be tested at 28 days, and reported to The Engineer. The test strength shall be the average of the test strengths of the two specimens tested at either 28 days, or as specified in the Supplemental Specifications, drawings, or by the ENGINEER.

101.15.7.5 High early release concrete strength test specimens shall be tested at 3, 7, and 28 days for concrete. One specimen shall be tested at 3 days and 2 specimens shall be tested at 7 and 28 days, and reported to the ENGINEER. The test strength for high early release concrete shall be the average of the test strengths of two specimens tested at 7 days, or as specified in the Supplemental Specifications, drawings.

101.15.8. Not Used.

101.15.9.1 Evaluation and acceptance of concrete shall meet the criteria established in Chapter 5, Section 5.6, "Evaluation and acceptance of concrete," ACI 318-89. Each strength test result shall be the average of two cylinders from the same sample tested at 28 days or the specified age. The strength level of the concrete will be considered satisfactory if the averages of all sets of three consecutive strength tests results equal or exceed the required f'c and no individual strength test result falls below the required f'c by more than 500 psi. Quality assurance compressive strength specimens sampled and cast when the average ambient temperature is greater than 60 °F, and cured with an initial field cure procedure other than submersion method specified in

101.15.7.1, shall be evaluated using the highest curing temperature recorded by the high-low thermometer provided for the field cure and Table 101.E. The test compressive strength shall be compared to the estimated strength corresponding to the highest initial cure temperature indicated in Table 101.E. An assurance compressive strength test shall be equal or greater than the compressive strength defined by Table 101.E when the initial field cure temperature is equal or greater than 85 °F and the initial field cure is not the submerged method specified in 101.15.7.1.

TABLE 101.E

MINIMUM COMPRESSIVE STRENGTH, f_C

f_c ▯ P_{TI} x f'_c / 100, psi

°F [2]	73	80	85	90	95	100	105	110	115	120
Cure Day(s)	P_{TI}, % of Specified Strength, f'_c [1,3]									
3	100	108	114	120	122	123	125	120	115	110
7	100	101	102	103	100	98	95	91	78	75
28	100	97	95	93	90	88	85	82	78	75

Notes: 1. Reference ACI 306, 6.6.1
2. The Non Submerged assurance cylinder cure recorded maximum initial field cure temperature. If a high- low thermometer was not used, the highest ambient temperature recorded for the initial cure period by the national weather service will be used as the initial cure temperature.
3. f'_c specified compressive strength

101.15.9.2 If individual tests of either laboratory-cured specimens produce strengths more than 500 psi (3.4 MPa) below f'c, or, if tests of field-cured cylinders indicate deficiencies in protection and curing, steps shall be taken to assure that the load-carrying capacity of the structure is adequate. If the presence of low-strength concrete is confirmed and computations indicate that the load-carrying capacity may have been significantly reduced, tests of cores drilled from the area in question shall be required in accordance with ASTM C42, as directed by the ENGINEER. Three cores shall be taken for each case of an individual cylinder test more than 500 psi (3.4 MPa) below f'c or where the average of any set of three consecutive strength test results is below f'c. If the concrete in the structure will be dry under service conditions, the cores shall be air dried (temperature 60 to 80 °f and relative humidity less than 60 percent) for seven days before test and shall be tested dry. If the concrete

in the structure will be more than superficially wet under service conditions, the cores shall be immersed in water for at least 48 hours and tested wet. If coring is required a coring plan will be prepared by the ENGINEER no later than 42 calendar days after the placement date. Coring shall be completed and a report submitted no later than 56 calendar days after placement. Core sampling for non complying tests shall be taken at the direction of the ENGINEER and paid by the OWNER. The CONTRACTOR shall be responsible for material replacement of the same design mix in adjacent concrete at no cost to the OWNER where samples are removed.

101.15.9.3 Concrete in the area represented by core tests shall be considered structurally adequate if the average strength of three (3) cores is equal or greater than 85% of the specified design strength (f'c), and no single core has a compressive strength less than 75% of the specified design strength. To check testing accuracy, locations represented by erratic core strength may be retested. If these strength acceptance criteria are not met by the core tests, and if structural adequacy remains in doubt, The OWNER and ENGINEER may order load tests as outlined in Chapter 20, ACI 318 for the questionable portion of the structure. Load tests shall be paid for by the CONTRACTOR.

101.15.9.4 If the structure under consideration does not satisfy the above strength acceptance criteria or the criteria of Section 20.2 or 20.4, ACI 318 The OWNER may order The CONTRACTOR to remove and replace any portion of the structure which is not in compliance with the above. If so ordered, the CONTRACTOR shall perform such work at his own expense. The CONTRACTOR shall patch all core sample holes with the same or similar materials adjacent to the core hole. The patching concrete shall be placed and cured in accordance with the requirements of this specification.

101.15.10 TEST REPORTS

101.15.10.1 Test reports shall include but not limited to the following, as directed by the ENGINEER.

A. Field Data
1. Date of Sampling
2. Time of Sampling
3. City of Albuquerque Project or
4. City of Albuquerque project or Permit Number
5. Contract Title
6. Portland Cement Concrete Supplier
7. Delivery Ticket Number
8. Design Mix Number
9. Sampling location as defined by the Project Plans and Specifications
10. Ambient temperature at time of sampling, ^{O}F
11. Material temperature at time of sampling, ^{O}F
12. Mixer drum revolution count at start of discharge of concrete

B. Field Tests Results, with specifications.	Accuracy	
1 Slump, in (mm)	0.25	1
2 Entrained Air, %	xx.x	
3 Unit Weight, pcf (kg/m^3)	xxx.x	(xxxx)
4 w:(c+fa) ratio	x.xx	x.xx
5 Cement Factor, C.F., lbs/yd^3 (kg/m^3)	xxx	(xxxx)
6 Cement pay factor determined in accordance with 101.16.2		

C. Comments
1. Report any addition of water and materials and amounts by either volume or weight, prior to and after sampling.
2. Report mixer revolutions count at time of discharge.
3. Record number of mixer revolutions after field tempering with water and/or admixtures, and @ what mixer speed, mixing or agitating speed.

D. Laboratory Tests

1	Calendar reference and day count from date of sampling for each strength test sample		
2	fc compressive strength test result reported to psi/ MPa	10	1
3	M.R. Modulus of rupture reported to psi/ MPa	5	0.5

E. Analysis & Certification

The testing laboratory shall provide certification the sampling and testing were performed in compliance with the requirements of the specifications. Certification shall be provided by the New Mexico Registered Professional Engineer in direct responsible charge of the laboratory testing program.

101.15.10.2 Test results shall be reported to the ENGINEER, CONTRACTOR, concrete supplier and OWNER in writing, within 7 working days of completion of the test, as directed by the ENGINEER. Non-complying tests shall be reported within one working day of completion of the test.

101.16 MEASUREMENT AND PAYMENT

101.16.1 Measurement for Portland cement concrete supplied under this specification shall be by LOTS as the area, volumes, and as specified in the contract documents, as directed by the ENGINEER.

101.16.2 Payment for Portland cement concrete supplied under this specification shall be for each LOT, at the contract unit price adjusted in accordance with the formula below and TABLE 101.F, as directed by the ENGINEER. A LOT shall be defined as either the volume or area of concrete for each design mix placed on a project in a day as defined in the CONTRACT. The adjusted unit price shall be calculated using the formula below and the pay factor, CF_P, defined in TABLE 101.F. The pay factor shall be defined by the number of samples representing a LOT, and, the % variance of the mean/average (M) portland cement content of the LOT from the minimum cement content specified in TABLE 101.C for the application, as determined by field quality assurance sample test results. Acceptance samples for a LOT shall be sampled and tested in accordance with 101.15. All acceptance samples taken in one day for a type of concrete shall represent a LOT of that type of concrete.

UP' = PF X UP

UP', Adjusted Contract Unit Price

PF, Pay Factor , PF= 0.50 x (1.00+ CF_P)

UP, Contracted Unit Price

TABLE 101.F - CEMENT PAY FACTOR CALCULATION, CF_P

n, number of samples	Deficiency, D = (C - M)/C	CF_P
3, OR MORE	D ≤ 0.0	1.00
	0.0 < D ≤ 1.0	1.00
	1.0 < D ≤ 2.0	0.95
	4.0 < D ≤ 6.0	0.90
	6.0 < D ≤ 8.0	0.85
	8.0 < D ≤ 10.0	[1]
	D > 10.0	Remove and Replace

D,	Deficient cement content as % of C, minimum
C,	Minimum cement content specified for the application in TABLE 101.C
M,	Average or mean (M) cement factor for a LOT. The cement factor shall be calculated as the average of cement factors of all tests taken for a LOT, but not less than three tests, determined in accordance with 101.15.6.
[1]	If determined by the ENGINEER to be more practical to accept the material, the LOT may be accepted under written agreement between the OWNER and the CONTRACTOR at an assigned pay factor CFp= 0.70.

APWA (2006) SECTION 101

PORTLAND CEMENT CONCRETE

Revised 09/16/2021

1. In the Subsection 101.15 QUALITY ASSURANCE SAMPLING AND TESTING, paragraph 101.15.2.2, delete the first sentence and replace with the following:

   At least one sample from each of the first three concrete loads delivered to the site shall be tested at the point of placement for slump, air content, and unit weight. Example: If a concrete pump is used, the point of placement location would be the end of the pump's outlet hose/nozzle.

   One set of compressive strength test cylinders shall be obtained from one of the first three loads, as directed by SSCAFCA. Beginning with the fourth load of concrete delivered to the project, one load from each sub-lot of ten (10) loads will be randomly selected for testing to include slump, air content, unit weight, cement content per cubic yard, and one set of compressive strength test cylinders. Sample requirements are subject to change at the discretion of the Engineer.

END OF SECTION

SECTION 109

RIPRAP STONE

109.1 GENERAL

The riprap stone provided and installed under this specification shall be angular rock, stone or recycled Portland cement concrete complying with the requirements of this specification. The material shall be certified to comply with these specifications. If a change in material and/or source from that authorized occurs during a project, the CONTRACTOR shall resubmit to include the changed material and/or source for authorization by the ENGINEER. A riprap material shall not be used on a project without written authorization of the ENGINEER.

109.2 REFERENCES

109.2.1 ASTM:

C88
C127

109.2.2 AASHTO:

T103

109.2.3 This Publication

603
610

109.3 MATERIAL

109.3.1 Riprap stone shall be stone, rock or recycled Portland cement concrete complying with this specification. The material shall be free of seams, fractures and coatings and of such characteristics that it will not disintegrate when subject to the action of flowing water.

109.3.2 The minimum specific gravity of the stone shall be 2.65 for sizes and gradation specified in TABLE 109.A, as determined in accordance with ASTM C127, latest edition. If the specific gravity of a stone is less than 2.65. the minimum size of the stone and the depth of the riprap shall be increased in accordance with TABLE 109.B.

109.3.3 The maximum resistance to abrasion shall be fifty (50) percent determined in accordance with the requirements of ASTM C535.

109.3.4 The maximum soundness loss shall be twenty (20) percent determine in accordance with ASTM C88.

109.3.5 The maximum loss to freeze thaw shall be ten (10) percent for 12 cycles determined in accordance with the AASHTO TI03, Ledge R, Procedure A.

109.4 SHAPE AND GRADATION

109.4.1 Riprap material shall be rectangular in shape rectangular in shape having maximum to minimum dimension ratio not more than 3:1.

109.4.2 Riprap stone shall comply with the gradation requirements of TABLES 109.A and 109.B.

109.4.3 Waste Portland cement concrete complying with the requirements of this specification may be used as riprap as specified in the plans and specification, as directed by the ENGINEER.

109.5 PLACEMENT

109.5.1 The placement of riprap stone shall be to the line and grade shown on the plans or as authorized by the ENGINEER. The depth of the riprap shown on the plans shall be adjusted based on Table 109.B for the specific gravity of the material provided. The surface tolerances shall be within the maximum variations shown in Table 109.C.

109.6 MEASUREMENT AND PAYMENT

109.6.1 Riprap shall be measured by the cubic yard (cy) placed to the lines and grades in the plans and specifications complete in place.

109.6.2 Payment for riprap will be made at the contract unit price per cubic yard for the type of riprap required, which payment shall include all material, labor and equipment required in placing riprap stone as specified in Section 603 and/or 610.

TABLE 109.A
CLASSIFICATION GRADATION

DESIGNATION	MAX. DIMENSIONS inches (m)	% SMALLER	Km [1]
A. GABIONS			
TYPE VL	12 (0.30)	100	
	9 (0.25)	50-70	
	6 (0.15)	35-55	6
	3 (0.08)	10	
TYPE L	18 (0.45)	100	
	12 (0.30)	50-70	
	6 (0.15)	30-55	9
	3 (0.08)	10	
B. RIPRAP			
TYPE M	24 (0.60)	100	
	18 (0.45)	50-70	
	12 (0.30)	30-55	12
	6 (0.15)	10	
TYPE H	36 (0.90)	100	
	24 (0.60)	50-70	
	12 (0.30)	30-55	18
TYPE VH	48 (1.20)	100	
	36 (0.90)	50-70	
	18 (0.45)	30-55	24
	9 (0.23)	10	

[1] Km = mean particle size

TABLE 109.B
SPECIFIC GRAVITY MULTIPLIER

SPECIFIC GRAVITY	MULTIPLIER
2.65	1.00
2.65	1.05
2.50	1.15
2.40	1.25
2.30	1.35
<2.30	REJECT

TABLE 109.C
CONSTRUCTION TOLERANCES

RIPRAP DESIGNATION	MAXIMUM VARIATION FROM SPECIFIED FINISH GRADE inches (meters)
TYPE VL +/-	3 (0.08)
TYPE L	6 (0.15)
TYPE M	9 (0.25)
TYPE H	12 (0.30)
TYPE VH +/-	12 (0.30)

SECTION 123

REINFORCED CONCRETE PIPE

123.1 GENERAL

123.1.1 These specifications cover reinforced concrete pipe intended to be used for the construction of storm drains, sewers, and related structures.

123.1.2 The size and class of the concrete pipe to be furnished shall be as shown on the plans or as specified under the item of work for the project of which the pipe is a part.

123.1.3 Unless otherwise specified, pipe will shall be either cast, spun, or manufactured by an approved equal method.

123.1.4 The interior surface shall be smooth and well finished. Joints shall be of such type and design and so constructed as to be adequate for the purpose intended so that, when laid, the pipe will form a continuous conduit with smooth and uniform interior surface.

123.1.5 Bell and spigot shall be free from any deleterious substance or condition which might prevent a satisfactory seal at the joints.

123.1.6 Pipe stronger than that specified may be furnished at the manufacturer's option and at his own expense, provided such pipe conforms in all other respects to the applicable provisions of these specifications.

123.1.7 Reinforced concrete pipe utilized for sanitary sewers shall be fully lined with no longitudinal seams in accordance with Section 122.

123.2 REFERENCES

123.2.1 ASTM:

C-33
C-76
C-150 C-260
C-361 C-441
C-443 C-494
C-618

123.2.2 American Concrete Pipe Association (ACPA)

Concrete Pipe Design Manual

123.2.3 This Publication
Section 102
Section 122

123.3 PIPE LINE LAYOUTS

123.3.1 When specials and radius pipe and/or fittings are required, the required number of sets of the pipe line layout be furnished to the ENGINEER prior to the manufacture of the concrete pipe. Storm inlet or inlet connector pipe need not be included in the pipe line layout; however, pipe stubs shall be included. In lieu of including storm inlet connector pipe line layout, a list of storm inlet connector pipes shall accompany the layout. The connector pipe list shall contain the following information:
123.3.1.1 Size, class. and wall type.

123.3.1.2 Station at which pipe joins main line.

123.3.1.3 Number of sections of pipe, length or section, type of sections (straight. horizontal bevel, vertical bevel, etc.).

123.4 MATERIALS

123.4.1 Reinforced Concrete Pipe shall consist of a mixture of Portland cement, aggregates, water and admixtures, proportioned and manufactured accordance with the requirements of ASTM C76, latest edition, and this specification. The pipe shall be certified in accordance with the requirements of these specifications. Certification of compliance shall be submitted by the CONTRACTOR and approved by the ENGINEER prior to manufacture of the Reinforced Concrete Pipe, Reinforced Concrete Pipe shall not be

used on a project without written approval of the ENGINEER.

123.4.2 Portland cement shall comply either with the requirements of ASTM C 150. Types I, II, III, and V, Low Alkali (LA) cements, or as specified herein. in the Supplementary Technical Specifications, plans, or as approved by the ENGINEER. The CONTRACTOR shall submit certification of compliance signed by the cement manufacturer, identifying the cement type and source (plant location), stating the portland cement used in the Reinforced Concrete Pipe delivered to the project complies with this specification. Portland cement concrete used in the manufacture of Reinforced Concrete Pipe shall have a minimum cemetitious content of 470 lbs./cu.yd.. except as either specified herein, as specified in the Supplemental Technical Specifications, or as approved by the ENGINEER. Portland cement shall be of the same source and type for all Reinforced Concrete Pipe delivered to a project.

123.4.2.1 Portland cement concrete for Reinforced Concrete Pipe shall be proportioned to provide a minimum cemententitious content of 470 lbs./c.y. (5 sks/c.y.) and a maximum water (W) to cementitious material ratio by weight, W:(C+FA)=0.40. Cementitious material shall consist of portland cement and class F fly ash complying with this specification. The fly ash shall be proportioned to provide a fly ash (FA) to portland cement (C) ratio by weight of 1:5, minimum.

123.4.3 Mineral admixtures shall be "Class F fly ash" and comply with the requirements of ASTM C 618 including Table 4 "Supplementary Optional Physical Requirements."

A. Uniformity requirements, air entraining agent dosage for 18.0% vol of mortar, shall not vary by more than 20%

B. Reactivity with cement alkalies: Reduction of mortar bar expansion at 14 days, minimum (ASTM C441) 65%

Reactivity with cement alkalis shall be determined in accordance with the requirements of ASTM C44l, using DOW CORNING glass rod base for aggregates. The CONTRACTOR shall submit certification of compliance identifying the type fly ash and source (plant location), stating the fly ash used in the Reinforced Concrete Pipe delivered to the project complies with this specification. Fly ash shall be of the same source and type for all Reinforced Concrete Pipe delivered to the project.

123.4.4 Admixtures of any type, shall not be used without written approval of the ENGINEER. The CONTRACTOR shall submit certification of compliance signed by the admixture manufacturer, identifying the admixture and its source (plant location), stating the admixture(s) used complies with this specification. Admixtures shall be of the same source for all reinforced concrete Pipe delivered to a project.

123.4.4.1 Air entraining admixtures shall be used in all Reinforced Concrete Pipe provided under this specification. It shall conform to the requirements of ASTM C 260. Entrained air content shall comply with the following requirements:

Nominal Max Size Aggregate (inches)	Air Cont. Range (%)
3/8, ½ & ¾	4 - 8
1	4 - 7
1-1/2	3 - 6

or as required by the Supplementary Technical Specifications, on the plans and/or as approved by the ENGINEER.

123.4.4.2 Chemical admixtures shall conform to either the requirements of ASTM C 494, and/or as specified in the Supplementary Technical Specifications, on the plans, and/or as approved by the ENGINEER.

123.4.4.3 Neither calcium chloride nor non-calcium chloride accelerating admixtures shall be used in Reinforced Concrete Pipe provided to a project under this specification.

123.4.4 Aggregates shall be assumed to be alkali-reactive. Variance for a specific aggregate may be approved by the Engineer upon written request by the CONTRACTOR and submittal of test data, as required by the ENGINEER. Aggregates shall comply with the requirements of ASTM C 33 and ASTM C 76 and as specified herein. Aggregates

shall be of the same source and type for all Reinforced Concrete Pipe manufactured and delivered to the project.

123.4.5 Reinforcement shall comply with the requirements of this specification and Section 102. The CONTRACTOR shall submit certification of compliance signed by the reinforcement manufacturer, identifying the material and its source (plant location), stating the reinforcement complies with this specification. Reinforcement shall be of the same source for all Reinforced Concrete Pipe delivered to the project.

123.5 CAUSES FOR REJECTION

Such inspection of pipe as may be deemed necessary by the ENGINEER will be made at the place of manufacture and pipe may be rejected for any of the reasons described in ASTM C 76, unless it can be repaired in accordance with the requirements noted therein and the approval of the ENGINEER.

123.6 ACCEPTANCE

Basis of acceptance shall be in compliance with ASTM C 76.

123.6.1 D-LOAD BEARING STRENGTH METHOD

123.6.1.1 The ENGINEER will select at random at the point of manufacture test specimens of the pipe to be furnished for the project.

123.6.1.2 The required number of test specimens and the test pipe shall conform in all respects to the applicable requirements of ASTM C 76. The pipe shall be tested by one of the two standard methods of testing; namely, (A) the three-edge bearing, (B) the sand bearing, as prescribed in ASTM C 76, and the required strength of the pipe specimens undergoing the bearing tests shall conform with the D-Load requirements designated therein.

123.6.2 STRUCTURAL DESIGN METHOD:

Where structural details of the pipe are shown on the plans, the manufacture of pipe shall be checked by making the appropriate tests on the concrete placed in the pipe forms, by inspection of the steel reinforcing cages that are to be used in the pipe. and by inspection of the fabrication of the pipe.

123.6.3 "DOWNGRADING" OF PIPE:

123.6.3.1 For the purpose of these specifications, "downgraded" pipe shall be defined as pipe which is to be used under loads less than that for which they have been designed.

123.6.3.2 Pipe manufactured in accordance with these specifications which have not met their designed test loads may be "downgraded" by the ENGINEER and used provided that:

123.6.3.2.1 Enough load tests are made to establish the load under which they may be used. The number of tests to be made shall be as determined by the ENGINEER; this may require the testing of each section for acceptance.

123.6.3.2.2 The comply with the test and inspection requirements of these specifications.

123.6.3.3 Individual specimens of pipe embodying major repairs or having numerous hairline cracks extending the full length of the section on the inside of the pipe at the minor axis or on the outside of the pipe at the major axis may be tested for acceptance at the discretion of the ENGINEER.

123.6.4 STOCKPILED PIPE:

123.6.4.1 Stockpiled pipe may be used only when approved by the ENGINEER provided the pipe meets all other specified requirements.

123.6.4.2 For the purpose of these specifications, "stockpiled" pipe shall be defined as pipe manufactured in quantity which will meet requirements of this section but which was not manufactured for use in specific projects; however, pipe which has been rejected by another agency will not be considered as "stockpiled" pipe. nor will such pipe be accepted.

123.7 JOINTS

123.7.1 For circular pipe, rubber gasket joints shall be required. Such joints shall conform to the requirements of ASTM C 443 and the requirements set forth in this document. The joint shall be designed for not less than 15%, or more than 50%

deformation of the rubber gasket when the pipe is joined off-center with all manufacturing tolerances considered. Minimum manufacturing tolerances shall be assumed to result in a centered annular space of 1.75 times the nominal design annular space. Joint mating surfaces shall be parallel and not be greater than 3.5° slopes. In addition to the hydrostatic joint test requirements per ASTM C 443, the pipe shall be loaded to cause maximum joint annular space to occur at the top. The pipe shall then be subjected to an internal hydrostatic pressure of 13 psi for 10 minutes. The test set up shall include a minimum of (2} pipe sections per lot. Bulkheaded end joints are acceptable, only mating pipe joints are allowed. Moisture or beads of water appearing on the surface of the joint will not be considered as leakage. If leakage of joints should initially occur, the manufacturer shall have the option to allow the pipe to soak under pressure for up to 24 hours and then retest. Any leakage during such retest will constitute failure of the test.

Pipe with beveled ends or pipe joints specifically designed to allow unsymmetrical joint closure may be provided for use around curves, the radii of which are shown on the drawings. Unless otherwise shown on the plans or specified in the Supplementary Specifications, either one or both ends may be beveled up to a maximum of 5 degrees, as required to provide well fitted joints. Beveled ends may conform to the Typical Method of Designing Curved Concrete Pipe sewers, as shown in the ACPA Concrete Handbook. Deflections per joint shall be limited to the manufacturer's standards for each particular diameter and type of pipe used.

123.7.2 For elliptical or arch reinforced concrete pipe, the joints shall be either bell and spigot or tongue and groove. Mastic material, such as RAMNEK, KENT SEAL, or approved equal, will be used to seal the joints.

123.7.3 Cement mortar joint fillers will not be accepted for round, elliptical, or arch reinforced concrete pipe.

123.7.4 If required by the ENGINEER to meet specified laying tolerances, the pipe shall be "match marked" at the place of manufacture, and laying diagrams furnished to the CONTRACTOR by the manufacturer shall be subject to approval by the ENGINEER.

123.8 DIMENSIONS

123.8.1 LENGTH

123.8.1.1 The nominal length shall be as supplied by the manufacturer unless otherwise specified in the Supplementary Technical Specifications on the plans or required for bends or special joints.

123.8.1.2 Except for special shapes, the plain of the ends of the pipe shall be perpendicular to the longitudinal axis of the pipe, with the exception that variations in laying lengths of two opposite sides of pipe shall be not more than 1/8 inch per foot of diameter with a maximum of 5/8 inch in any length of pipe.

123.8.2 WALL THICKNESS

The wall thickness of pipe shall conform to the requirements indicated for Wall B or Wall C. reinforced concrete pipe specified in ASTM C 76 unless otherwise specified.

123.9 REINFORCEMENT

Fabrication and placement of reinforcement for the various sizes and strengths of pipe shall conform to the applicable requirements of ASTM C 76.

123.10 CURING REQUIREMENTS

The pipe shall be cured in conformance with the applicable requirements of ASTM C 76.

123.11 MARKINGS:

123.11.1 Each section of pipe shall be marked in conformance with the requirements of ASTM C 76. The ENGINEER may at the place of manufacture, indicate his acceptance of the pipe for delivery to the job by marking the pipe with the Contracting Agency's mark. Such acceptance, however, shall not be considered a final acceptance.

123.11.2. If the pipe is subsequently rejected, the mark placed thereon by the ENGINEER shall be defaced. No pipe will be marked, "Reject." Only pipe accepted shall be marked, "Accepted ."

123.12 LOW-HEAD PRESSURE PIPE

Reinforced concrete low-head pressure pipe shall conform to the requirements of ASTM C 361.

123.13 SELECTION FOR CLASS OF PIPE

123.13.1 The classes of reinforced concrete pipe and the D-Load to produce a 0.0l-in. crack for each class of pipe are specified in ASTM C 76.

123.13.2 The appropriate formulas, tables and figures contained in the "Concrete Pipe Design Manual," prepared by the American Concrete Pipe Association, will be used, to determine the class of pipe to be installed between manholes or for a culvert. It is essential that maximum trench width, class of bedding and soil weight be considered in the pipe class selection.

123.13.3 The construction plans will indicate the following information for each length of pipe between manholes or for a culvert: the nominal diameter of the pipe, the class of pipe, the class of bedding and the maximum trench width at top of pipe.

123.14 MEASUREMENT AND PAYMENT

123.14.1 The measurement and payment for the materials specified in this section will be made as specified in section will be made as specified in the applicable section of these specifications or as specified in the supplemental technical specifications or as called for in the plans and as shown in the Bid Proposal.

SECTION 201

CLEARING AND GRUBBING

201.1 GENERAL

This work shall consist of removing natural and man-made objectionable material from the right-of-way, construction areas, road approaches, material and borrow sites, areas through which ditches and channels are to be excavated, and such other areas as may be shown on the plans. Clearing and grubbing shall be performed in advance of grading operations except that in cuts over 3 feet in depth, grubbing may be done simultaneously with excavation, provided stumps, roots, embedded wood, foundations and slabs are removed as specified. Clearing and grubbing shall be in accordance with the requirements herein specified, such as erosion control requirements. Demolition of structures, other than foundations or slabs, shall be as shown on the plans.

201.2 REFERENCES

201.3 PRESERVATION OF PROPERTY

Existing improvements, adjacent property, utility and other facilities, and trees and plants not to be removed shall be protected from injury or damage resulting from the CONTRACTOR's operations. Only trees and plants designated or marked for removal by the ENGINEER shall be removed.

201.4 CONSTRUCTION METHODS

201.4.1 The natural ground surface shall be cleared of vegetable growth, such as trees, tree stumps, logs, roots or downed trees, brush, grass, weeds, and surface boulders, as well as fences, walls, rubbish, foundations and slabs.

201.4.2 Unless otherwise shown on the plans, the entire area of the project within the limit lines specified below shall be cleared and grubbed. No payment will be made to the CONTRACTOR for clearing and grubbing outside these limits, unless such work is authorized by the ENGINEER.

201.5 LIMIT LINES: Except when limit lines for clearing and grubbing are shown on the plans or are staked by the ENGINEER, clearing and grubbing shall extend only within reasonable limits of the work area.

201.6 REMOVAL OF TREES AND TREE BRANCHES

201.6.1 Trees shall be removed in such a manner as not to injure standing trees, plants, and improvements which are to remain. Tree branches extending over a roadway and which clear finish grade by 12 feet or less shall be cut off close to the boles in a workmanlike manner.

201.6.2 Trees requiring trimming to facilitate normal construction operations shall be trimmed by a tree surgeon.

201.7 REMOVAL AND DISPOSAL OF DEBRIS

Debris to be removed shall be disposed of outside the right-of-way at a location satisfactory to the ENGINEER, except when burning of combustible debris is permitted. The area to be graded and adjacent areas shall be left with a neat and finished appearance. No accumulation of flammable material shall remain on or adjacent to the property line. In case burning precedes construction operations, the piles may be placed in the center of the area; otherwise, the piles shall be placed in the most convenient location at the side of the area and beyond slope lines where they may be burned without damage to surrounding forest cover or adjacent property. Burning shall be done in conformance with local regulations and at such times and in such manner as to prevent the fire from spreading to areas adjoining the construction site. In areas where burning is prohibited by local regulations, all removed material shall be disposed in an approved solid waste disposal site.

201.8 REMOVAL AND DISPOSAL OF SALVAGEABLE ITEMS

Items and materials of salvage value as shown on the plans or as determined by the ENGINEER, unless incorporated in the new work, shall remain the property of the OWNER and shall be delivered to approved storage areas as directed by the ENGINEER. Such items and materials shall be carefully removed and delivered in such a manner as to permit re-use.

201.9 MEASUREMENT AND PAYMENT

201.9.1 CLEARING AND GRUBBING:

201.9.1.1 When the proposal includes an item for clearing and grubbing, the quantity for measurement shall be as indicated in the Bid Proposal.

201.9.1.2 The unit price per acre paid for clearing and grubbing shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in clearing and grubbing as shown on the plans, as provided in these specifications and as directed by

the ENGINEER, including the removal and disposal of resulting material.

201.9.1.3 When the Bid Proposal does not include a pay item for clearing and grubbing as above specified and unless otherwise specified in the Supplementary Specifications, full compensation for any necessary clearing and grubbing required to perform construction operations specified shall be considered as included in the price paid for other items of work and no additional compensation will be allowed therefore.

201.9.2 REMOVAL AND DISPOSAL OF TREES: If the Bid Proposal includes separate estimates of quantities for the removal of trees, the trees shall be classified by size as follows:

201.9.2.1 Trees less than 12 inches in circumference at 3 feet above the original ground surface shall be considered as included in the price for clearing and grubbing or excavation, and no additional compensation will be allowed therefor.

201.9.2.2 Trees between 12 and 30 inches in circumference shall be measured as a unit price for each tree in the item provided in the Bid Proposal for trees of this dimension.

201.9.2.3 Trees more than 30 inches in circumference shall be measured as a unit price for each tree in the item provided in the Bid Proposal for trees of this dimension.

APWA (2006) SECTION 201

CLEARING AND GRUBBING

Revised 07/24/2020

1. In the Subsection 201.1 GENERAL, delete the second sentence and replace with the following: Clearing and grubbing shall be performed in advance of the grading operations.

2. In the Subsection 201.4.1 CONSTRUCTION METHODS, add the following:

   Clearing and grubbing operations shall include stripping of the existing ground surface. Stripping shall be achieved only by cutting, i.e., ground depressions or narrow sections of tributary arroyos should not be inadvertently filled during the foundation preparation. The resulting area shall be cut to provide a uniform, relatively level surface.

3. In Subsection 201.5 LIMIT LINES, add the following:

   Unless otherwise approved by the Engineer or otherwise specifically designated on the plans, limits of clearing & grubbing shall not exceed slope limits as shown with finished grade contours on plans.

END OF SECTION

APWA (2006) SECTION 204

FILL CONSTRUCTION

Revised 07/24/2020

1. Delete this section in its entirety and replace with SSCAFCA Technical Specification 1510, EXCAVATION, BORROW AND FILL.

END OF SECTION

SECTION 207

LEAN FILL CONSTRUCTION

207.1 GENERAL

LEAN FILL CONSTRUCTION shall consist of filling shallow excavations, pipe zones in deep excavations and as authorized by the ENGINEER, with LEAN FILL, a flowable mixture of Portland cement, aggregates, admixtures and water. It shall be identified by a unique design mix number as defined by the supplier. A design mix shall not be used on a project without written authorization of the ENGINEER.

207.2 REFERENCES

207.2.1 ASTM:

C31	C33
C94	C150
C172	C173
C192	C231
C260	C558
C618	C685
D1633	D2922
C3017	

207.2.2 ACI:

211
340.2R

207.3 PORTLAND CEMENT

207.3.1 Portland cement to be either or furnished under this specification shall conform to the requirements of ASTM C150. The type of cement shall be either Type I or Type II. “low alkai;” (LA) cement.

207.3.2 The CONTRACTOR shall submit certification of compliance signed by the Type and source (plant location), stating the Portland cement furnished to the cement manufacturer, identifying the cement project, and or used in the concrete delivered to the project complies with this specification. If required, certification of the Portland cement used for each day’s concrete placement, shall be submitted to the ENGINEER for each type of cement and each design mix used on the project.

207.3.3 Portland cement used in the manufacture of LEAN FILL for a project shall be of the same brand and type for all LEAN FILL batched and delivered to a project under the authorized design mix identification, unless authorized by the ENGINEER.

207.3 AGGREGATES

207.4.1 Aggregates shall be sampled and ASTM tested as prescribed in said specification. The CONTRACTOR shall obtain a certification of compliance identifying the aggregates, reporting test results, and stating the aggregates comply with this specification.

207.5 AGGREGATE GRADING

207.5.1 The maximum nominal aggregate size shall be one (1) inch.

207.6 WATER

207.6.1 Water shall conform to the Made by requirements of ASTM C94.

207.7 AIR ENTRAINING ADMIXTURES

207.7.1 Air entraining admixtures shall conform to the requirements of ASTM C260, as authorized by the ENGINEER.

207.8 MINERAL AOMIXTURES

207.8.1 Mineral admixtures shall be fly ash complying with the requirements of Class “F” fly ash as specified in ASTM C618 and Section 101 of this specification.

207.8.2 Mineral admixtures shall be proportioned by weight as required to improve pumpability.

207.9 PROPORTIONING

207.9.1 The CONTRACTOR shall be solely responsible for the LEAN FILL design mix proportions either batched at and/or delivered to the site. A design mix shall be prepared in a laboratory under the direct supervision of a Registered New Mexico Professional Engineer. The testing

equipment used in the design/development testing shall be calibrated annually with calibration standards traceable to the National Bureau of Standards. Certificates of calibration shall be maintained at the laboratory for review by the ENGINEER. A copy of the certificates shall be submitted to the ENGINEER upon request. The mix shall be certified that it complies with the requirements of this specification.

207.9.1.1 The materials shall be proportioned such that if placed at maximum slump, the laboratory dry density, as determined from molded specimens, at 24 (+/- 4) hours, is equal to or greater than 95 per cent of the maximum dry density of the blended cement and aggregate, determined in accordance with ASTM D558. The dry density of the laboratory molded LEAN FILL specimens shall be computed based on the average unit weight of the compressive strength specimens, corrected for the moisture content at the time of testing.

207.9.2 The Portland cement content shall be one-half (1/2) sack, 47 lbs., per cubic yard in all LEAN FILL produced under this specification, except as noted herein, or as specified in the Supplemental Specifications, or plans or as authorized by the ENGINEER.

207.9.3 The combined aggregate gradation shall comply with the following limits.

SCREEN SIZE	% PASSING
1 in.	100
¾ in.	95-100
3/8 in	82-100
no.4	70-100
no.8	55-85
no.16	38-60
no.50	6-30
no. l00	2-10

The mix gradation, when plotted on a US Bureau of Public Road 0.45 Power Gradation Chart. shall be similar to the plots of the specified gradation limits in the shape of the characteristic gradation curve.

207.9.4 Air-entraining admixtures shall conform to the requirements of ASTM C260. Air entraining admixtures shall be proportioned to provide air entrainment of not less than 2 per cent, as authorized by the ENGINEER.

207.9.5 Water shall be proportioned as required.

207.9.6 The design mix shall be proportioned to provide a slump of not less than 5 inches and not greater than 8 inches.

207.9.7 The compressive strength of the design mix shall not exceed 60 psi at 28 days when sampled and tested in accordance with ASTM C172 and D1633, and as specified in this section.

207.9.8 Laboratory compressive strength test specimens shall consist of cylinders molded by pouring a sample of the design mix in two equal lifts, into drained rigid molds, conforming to the dimensional requirements of ASTM 0558, having a capacity of 1/30, +/-0.0004, c.f., with an internal diameter of 4.0, +/-.016, inches (4" dia. x 4.5" ht., nominal dimensions). Molds cut from PVC (SCHD40) pipe having the specified internal dimensions and volume of that specified in ASTM 0558 may be used. Molds shall be free draining at the base. If molds complying with the requirements of ASTM 0558 are used, they shall not be clamped to the base. A free draining base may be accomplished by setting the molds on plywood for molding and initial curing. The cylinders shall be cured in the molds for the first 24 +/-4 hours. After 24 +/-4 hours curing in the molds, the cylinders shall be extruded and cured until testing.

207.9.9 Laboratory strength test specimens shall be cured in accordance with ASTM C192. Test specimens shall not be cured in a curing tank.

207.9.10 Four (4) specimens shall be weighed, measured and tested for compressive strength in accordance with the requirements of ASTM D558 at one (1) day, seven (7) days, and two (2) at 28 days, respectively.

207.9.11 An optimum moisture maximum density relationship for the combined aggregates and cement, proportioned by weight as defined by the proposed blends of the aggregates and cement, shall be determined in accordance with the requirements of ASTM D558.

207.9.12 The LEAN FILL design mix submittal shall include but not be limited to

the following information, as directed by the ENGINEER:

a. Certification of compliance of the design mix under the requirements of this specification,

b. Certification of the component materials used in the design mix,

c. Plastic characteristics of the design mix to include temperature, slump, air entrainment, wet unit weight, yield and cement factor,

d. Performance characteristics of the hardened LEAN FILL to include the compressive strength of all test specimens and the corresponding average compressive strength, compressive strength test shall be reported for 1 day, 7 days and 28 days laboratory cure,

e. Dry unit weight and moisture content of the compressive strength specimens at the time of testing, average dry unit weight for each test series reported as a percent of the maximum dry density as determined by ASTM D 558,

f. The optimum moisture maximum dry density relationship for the combined aggregates and cement and a graphical plot of the moisture density relationship as determined in accordance with ASTM D 558 in the laboratory.

207.10 BATCHING, MIXING AND DELIVERY

207.10.1 Batching, mixing and delivery shall conform to the requirements of either ASTM C94 or ASTM C685. The CONTRACTOR shall provide to the ENGINEER with each load of LEAN FILL batched and delivered to the job site, before unloading at the site, a delivery ticket on which the information specified in the following table is printed, stamped or written, certifying said LEAN FILL.

TABLE 207

Name of LEAN FILL Supplier
Delivery Ticket Number
Date of Delivery
Contractor
Project (optional)
Design Mix Number
Volume of LEAN FILL in Load
Time Loaded
Batched Weight of Cement
Batched Weight of Fine Aggregate
Batched Weight of Coarse Aggregate
Batched Weight or Volume of Admixtures
Weight or volume (gal.) of water batched/ added at the plant
Reading of Mixer Drum Revolution Counter at the Start of Mixing
Certification that the materials delivered are the same brand, type and source as the materials defined in the reference Design Mix, as authorized by the ENGINEER.
Design Mix Target Proportions
Weight or Volume (gal.) of water added at the site
Weight or Volume of Admixtures added at the Job Site
Signature & name of person who authorized the addition of water at the site and affiliation to project

207.11 TESTS

207.11.1 Lean Fill material tests shall be performed in accordance with the requirements of this specification. the supplemental technical specifications, or as required by the ENGINEER. Testing equipment used in the performance of specified testing shall be calibrated annually with calibration standards traceable to the National Bureau of Standards. Certification records shall be maintained at the laboratory for review by the ENGINEER. A copy of the certifications shall be submitted upon request to the ENGINEER. A test sample shall be taken in the field for each 150 c.y. or each day's placement, whichever is greater. Field testing shall include standard tests for slump, air entrainment, unit weight, temperature, yield and cement factor. A minimum of four (4) compressive strength specimens shall be molded from a single sample. The samples shall be molded in accordance with the requirements, of paragraph 207.8. Compressive strength specimens shall not be molded with material used either for slump or air entrainment tests. The cylinders shall be allowed to set for 24 (+/-4) hours in a closed plastic bad and then transported in the molds to the laboratory. The cylinders should be extruded from the molds and moist cured until

compressive strength testing. The samples shall be tested for compressive strength in accordance with requirement of ASTM 01633. One specimen shall be tested for compressive strength at seven (7) days, two (2) samples shall be tested for compressive strength at 28 days. Test results shall be reported to the ENGINEER, CONTRACTOR, and SUPPLIER, in writing, within four (4) days of completion of a test. Non-complying test results shall be reported within one working day after completion of a test.

207.11.2 Curing of field strength specimens for acceptance tests shall be conducted in accordance with ASTM C3l. Cylinders shall not be cured in a water bath.

207.11.3 Field density/compaction tests in accordance with the requirements of ASTM 02922 and ASTM D3017 shall be taken at the rate of two tests per 150 c.y. of material or fraction thereof placed, as directed by the ENGINEER. The material shall either have an in-place density equal to or greater than 95% of maximum dry density of the combined dry materials as determined under paragraph 207.8, or 24 hours cure, prior to placement of fill, subbase, base course, treated base, pavement or structure.

207.12 TEMPERATURE/ENVIRONMENTAL CONTROLS

207.12.1 When the ambient temperature at the time of placement is less than 40 degrees F, the temperature of the LEAN FILL placed shall not be less than 50 degrees F. The materials shall be cured at a minimum temperature of 40 degrees F for 24 hours after placement.

207.13 PLACEMENT

207.13.1 LEAN FILL shall be placed in lifts not exceeding four (4) feet in height, at time intervals of not less than 1 hour per lift, as authorized by the ENGINEER. Fill shall not be placed to a height above top of pipe exceeding two (2) feet when used to fill a pipe zone, nor placed full depth in a trench to finish subgrade elevation, unless authorized by the ENGINEER. Caution should be taken in placing material in the pipe zone to above the pipe. If the buoyancy of the pipe will result in flotation, the pipe should be anchored or filled with water to counteract the buoy condition until the LEAN FILL densifies.

207.13.2 LEAN FILL shall not be placed in standing water and shall be protected from flooding for at least 12 hours after placement.

207.13.3 LEAN FILL shall not be placed on either frozen and/or saturated ground.

207.13.4 LEAN FILL shall only be vibrated after placement if required by the ENGINEER.

207.14 MEASUREMENT AND PAYMENT

207.14.1 Unless Lean Fill is specified in the specification or shown on the plans or required by the OWNER, the CONTRACTOR has the option of using Lean Fill in place of conventional backfill and compaction. The Lean Fill material, placement, and the disposal of the excess material generated by the use of the Lean Fill shall be considered incidental to the item of work in which it is used and no separate or direct payment will be made for Lean Fill.

207.14.2 When Lean Fill is specified in the specification or shown on the plans, it shall be measured by the cubic yard, complete in place. Payment for Lean Fill shall be at the contract unit price per cubic yard, complete in place, which shall include all labor, material and equipment required in placing the Lean Fill and removal and disposal of the excess material generated by the use of the Lean Fill.

SECTION 301

SUBGRADE PREPARATION

301 GENERAL

301.1 The work performed under this specification shall include. but not be limited to providing the equipment. labor and materials for the preparation of soil subgrade and maintenance of the prepared subgrade for the construction of graded aggregate base, asphalt treated base, cement treated base, asphalt concrete, Portland cement concrete, sidewalks, curb and gutter. drive pads, valley gutter, median pavements and/or any other roadway improvements.

301.2 REFERENCES

301.2.1 ASTM:

C136	D423
D424	D698
D1140	D1557
D2844	D2922
D3017	

301.2.2 This publication

Section 204

301.3 MATERIAL

301.3.1 Subgrade material may be on site soil, combinations of pulverized asphalt concrete and soil, and/or pulverized Portland cement concrete and soil, imported soils, complying with the requirements of this specification. Flowing, sugar sands shall not be used for subgrade material.

301.3.2 All soft and unstable material and other portions of the subgrade which will not compact readily or serve the intended purposes shall be removed and replaced with suitable material from excavation or borrow or suitable materials shall be added and. by manipulations, be incorporated into the subgrade to produce a material meeting subgrade requirements.

301.3.3 All subgrade material shall have a minimum Resistance Value (R-Value), as determined by ASTM D-2844, equal to or greater than the design R-Value for the pavement section. If the subgrade soils encountered during construction have a R-Value less than the design R-Value, those subgrade materials shall be removed to a depth of not less than two (2') feet below the finished subgrade elevation or as authorized by the ENGINEER and to the horizontal limits authorized by the ENGINEER, and replaced with subgrade material having an R-Value greater than the design R-Value. On small projects, in areas that just involve replacement of existing roadway items or when no design R-Value has been established this R-Valve requirement may be waived if authorized by the ENGINEER.

301.4 SUBGRADE COMPACTION

301.4.1 Subgrade preparation shall extend to one foot (1') beyond the limits of the improvement to be placed on the subgrade except when that improvement abuts an existing structure and/or the limits of the right of way. Where an improvement abuts an existing structure and/or the limits of right of way, the subgrade preparation shall extend to the edge of the existing structure and/or the limits of right of way, as specified in the plans, specifications, supplemental technical specifications or as directed by the ENGINEER. Where existing structures are in the right of way or construction easements, subgrade preparation shall extend to the face of the structure, as specified above. Subgrade preparation shall not extend below the bottom of the foundation of an existing structure without specific authorization by the ENGINEER.

301.4.1.1 Subgrade preparation for roadway improvements shall be performed after completion of earthwork construction, subsurface utility installation and trenching back fill within the limits specified, as directed by the ENGINEER. The subgrade preparation shall extend the full width of the roadway to either one (1) foot back of new curb and gutter, and/or to the face of existing structures. and or the limits of right of way, as specified in the plans and specifications. as directed by the ENGINEER.

301.4.1.2 Subgrade preparation for sidewalks and drive pads shall extend a minimum of one (1') beyond the free edge of the improvement, and/or to the limits of right of way, and/or to the face of existing structures.

301.4.1.-3 The subgrade preparation for roadway construction without curb and gutter, shall extend one (1 ') beyond the edge of the pavement, and/or to the face of existing structures, and/or to the limits of right of way, as specified in the plans and specifications, as authorized by the ENGINEER.

301.4.1.4 Subgrade preparation shall extend the full width of roadway medians four (4) feet wide or less. In areas that the medians are wider than four feet (4') the subgrade compaction shall extend one foot

(1') beyond the median edge of the pavement or back of the median curb.

301.4.2. The subgrade for arterial/collector roadway shall be ripped to a minimum depth of one (1) foot, brought to uniform moisture content, and compacted to the requirements of plans and specification, as authorized by the ENGINEER. Subgrade material with either 20 per cent or more material passing a no. 200 sieve sha11 be uniformly mixed and moisture conditioned using a tractor mounted mixer or disced after ripping, as specified in the plans and specifications, as authorized by the ENGINEER. The subgrade for reconstructed curb and gutter, sidewa1ks, drive pads, residential roadways, bicycle paths and other roadways shall be scarified to a minimum depth of six (6) inches, brought to uniform compaction moisture content, and compacted to the requirements of p1ans and specification, as authorized by the ENGINEER.

301.4.3 Subgrade area shall be compacted to a dry density greater than 95 per cent of maximum dry density in a moisture range of optimum moisture +/- 2% as determined in accordance with ASTM D1557, unless the material contains 35% or more material finer than the No.200 sieve. If the subgrade material has 35% or more material finer than the No.200 sieve, the subgrade shall be compacted to a dry density greater than 95 percent of maximum dry density in a moisture content range of at least optimum moisture to optimum moisture +4%, as determined in accordance with ASTM D698.

301.4.4 Areas on which roadway pavement items are to be placed shall be compacted uniformly to the required subgrade density at the same time. Obtaining the required subgrade density in trench areas at a different time than obtaining the required subgrade density in the adjacent pavement areas will not be permitted.

301.4.5 Upon completion of the subgrade preparation, the CONTRACTOR shall maintain the compacted subgrade density and moisture content at the specified levels until the next lift of material is completed. The CONTRACTOR shall provide continuous moisture protection of the subgrade by either sprinkling or the application of a prime coat, as directed by the ENGINEER.

301.5 SUBGRABE TOLERANCES

Subgrade upon which pavement, sidewalk, curb and gutter, drive pads, or other structures are to be placed shall not vary more than +1/4 inch or -1/2 inch per 10 foot in any direction from the specified grade and cross section. Subgrade upon which base material is to be placed shall not vary more than +1/2 inch or -1 inch per 20 foot in any direction from the specified grade and cross section. Variations within the above specified tolerances shall be compensating so that the average grade and cross section specified are met.

301.6 TESTING:

301.6.1 A sample of each type of soil encountered shall be classified in accordance with the requirements of ASTM D2487, the moisture density relationship determined in accordance either ASTM D698 or D1557, whichever is applicable and an estimated resistance R-value assigned based on plasticity index, PI, and percent material passing the No.200 sieve.

301.6.2 Compaction tests shall be taken for each 500 sy or less, as directed by the ENGINEER. Compaction tests shall be taken in accordance with ASTM D2922 and D3017. Areas represented by non complying tests shall be reworked as specified, and retested for compliance.

301.6.3 Test reports shall include but not be limited to the requirements of TABLE 301.A.

TABLE 301.A
TEST REPORT INFORMATION

A. Field Data
- Date of Sampling/Field Test
- Project Number or
- Permit Number
- Project Title
- Location of sample/field test as defined by the project plans and specifications
- Time of Sampling/field testing
- Field test results with reference specification limits

B. Laboratory Data
- Soil classification
- Soil gradation
- Plasticity index

Liquid limit
Optimum moisture/maximum dry density relationship and graph
Estimated soil resistance R-Value

301.6.4 Test results shall be reported to the ENGINEER, CONTRACTOR, and Materials and Testing Laboratory, Construction Division, Public Works Department, in writing, within 4 working days of completion of the sampling and or field test. Non-complying test shall be reported within 1 working day of completion of the test.

301.7 MEASUREMENT AND PAYMENT:

301.7.1 Measurement for payment of roadway subgrade preparation will be by the square yard to the limits of the surfacing, as authorized by the ENGINEER. Payment for subgrade preparation shall include all labor and equipment required to shape, mix, add moisture, compact, bring to grade and maintaining the prepared subgrade moisture and density until the next course of material is placed.

301.7.2 The measurement of payment for subgrade preparation for non-pavement roadway items such as curb and gutter, valley gutter, drive pads and sidewalks etc., shall be included in that item. No separate payment will be made.

SECTION 302

AGGREGATE BASE COURSE CONSTRUCTION

302.1 GENERAL

The work provided under this specification shall include the furnishing, placement and compaction of aggregate base course (ABC) to the lines, grades, dimensions, moisture, density and typical sections as specified in the plans and specifications, and or as directed by the ENGINEER. The CONTRACTOR shall be solely responsible for the aggregate base course either batched at and/or delivered to the site. A job mix formula for aggregate base course, shall be certified in accordance with the requirements of Section 13 of these specifications. Each job mix formula submitted and authorized for use under this specification shall be identified by a number, unique to that job mix formula and aggregate production plant/pit. If a change in material(s) from that specified in the job mix formula occur during a project, the CONTRACTOR shall submit a new job mix have formula to include the changed materials for approval by the ENGINEER. A job mix formula shall not be used on a project without written approval of the ENGINEER. A job mix formula, upon request by an aggregate supplier, may be authorized by the OWNER for a period of 14 months, from the date of sampling of aggregates used in the job mix formula.

302.2 REFERENCES

302.2.1 ASTM:

C136	D75
D422	D423
D424	D1557
D2419	D2844
D2922	D2940
D3017	

302.2.2 This Publication:

Section 113
Section 301

302.3 MATERIALS

302.3.1.1 Aggregate base course shall be coarse aggregate of either crushed stone, or crushed gravel, or crushed asphalt concrete, or crushed Portland cement concrete, or any combination, and natural sand, the combination of materials conforming to the requirements of ASTM D2940 and the plans and specifications, as authorized by the ENGINEER.

302.3.1.2 Coarse aggregates retained on the No.4 sieve shall consists of durable particles of either crushed gravel, or crushed asphalt concrete pavement, or crushed portland cement concrete, or any combination, capable of withstanding the effects of handling, spreading and compacting without degradation production of deleterious fines. At least 50% of the particles retained on the 3/8-inch sieve, shall have two or more fractured faces. Coarse aggregate shall comply with the requirements of TABLE 302.A.

302.3.1.3 Fine aggregate passing the No.4 sieve shall consists of fines from the operation of crushing coarse aggregate; where available and suitable, natural sand or finer mineral matter or both, may be added. Fine aggregate shall comply with the requirements of TABLE 302.A.

302.3.1.4 The job mix formula and gradation shall comply with the requirements of TABLE 302.B, and have the same or similar characteristic gradation curve as either range limit, when graphically plotted on a standard "0.45 POWER" Gradation Chart.

302.3.1.5 Aggregate base course furnished and placed under this specification shall have a resistance value, (R-Value), not less than 76 as determined by ASTM D2844.

302.3.1.6 A job mix formula, certified by a Registered New Mexico Professional Engineer to comply with the requirements of this specification, shall be submitted to and authorized for use by the ENGINEER before the material may be incorporated in the construction. A submittal shall include, but not be limited to, the items in TABLE 302.C. Prior to delivery of the material, the CONTRACTOR may be required to furnish samples of the aggregates base course to the ENGINEER for testing. Gradations for the aggregate base course used in a particular day's placement shall be submitted to the ENGINEER upon request.

302.3.2 Prime coat for surface sealing of compacted aggregate base course shall comply with the requirements of CSS-1H Cationic Emulsified Asphalt as specified in Section 113.

302.4 TRANSPORTATION AND PLACEMENT

302.4.1 Aggregate base course shall be transported in suitable vehicles with a cover. A load shall be covered immediately after loading and remain covered until unloading.

302.4.2 The CONTRACTOR shall provide to the ENGINEER with each load of batched and/or delivered to the job site, before unloading at the site.

a copy of the delivery ticket on which is printed, stamped or written. the information defined in TABLE 302.D.

302.4.3 Aggregate base course shall be placed on prepared subgrade, prepared in accordance with the requirements of SECTION 301, the plans and specifications, and or as directed by the ENGINEER.

302.4.4 Aggregate base course shall be placed in lifts which will provide not less than four (4) inches and not more than 6 inches compacted thickness. The material shall be moisture conditioned within a range of optimum moisture plus or minus two percent (+/-2%), and compacted to a dry density greater than ninety-five (95) percent of maximum dry density as determined in accordance under the procedures specified in ASTM D1557.

302.4.5 The finish surface of the compacted aggregate base course shall not deviate from finish grade in excess of 1/2 inch in 10 feet when tested with a 10-feet straight edge in any direction. All deviations in excess of the specified shall be corrected by the CONTRACTOR prior to authorization for placement of the next life of material.

302.4.6 Immediately upon completion of compaction, the CONTRACTOR shall seal the surface of the compacted aggregate base course with a prime coat. The prime coat shall be applied as required to provide a uniform coverage of the surface. Application shall be between 0.05 and 0.15 gallons per square yard of surface. If final surfacing is to be placed within twenty four (24) hours after completion of compaction, the prime coat may be waived as authorized by the ENGINEER. The surface shall be kept at compaction moisture until the final surfacing is placed in the event the prime coat is waived.

302.4.7 Traffic on compacted aggregate base course shall be limited to moisture control application and final surfacing traffic only, as authorized by the ENGINEER.

302.5 TESTING

302.5.1 A sample of material delivered to the project shall be taken for each 300 tons placed or each days placement, whichever is greater, and tested for gradation and moisture density relationship. The average value of individual gradation tests, for all sieve size determinations, shall comply with the job mix formula within the tolerances specified in TABLE 302.B. Individual sample gradation test results, for all sieve size determinations, shall comply with the tolerance range plus two (2) percent. Non complying material shall be re-sampled and tested for compliance. Material not in compliance after the initial and follow up testing shall be removed and replaced by the CONTRACTOR at no cost to the OWNER, as directed by the ENGINEER.

302.5.2 Compaction tests shall be taken at the rate of one test for each 500 sy/lift placed, or as directed by the ENGINEER, in accordance with the requirements of ASTM D 2922 and D 3017. Areas represented by non complying tests shall be reworked and retested for compliance.

302.5.4 Test reports shall include but not be limited to the requirements of TABLE 302.E.

302.5.5 Test Results shall be reported to the ENGINEER, CONTRACTOR, and OWNER in writing, within 4 working days of completion of the sampling and or field test. Non-complying test shall be reported within 1 working day of completion of the test.

302.6 MEASUREMENT AND PAYMENT

302.6.1 Measurement of aggregate base course shall be by the square yard per each thickness required, complete in place.

302.6.2 Payment shall be at the contract unit price per square yard per each thickness required, complete in place which shall include all material, labor and equipment required in placing, grading and compacting the aggregate base course.

Table 302.A
ENGINEERING REQUIREMENTS

CHARACTERISTIC	SPECIFICATION LIMIT(S)	
Aggregate Type	Fine	Course
Los Angeles Abrasion Wear (ASTM C 131)		40% max.
Soundness (5 cycles ASTM C 88)	15% max.	15% max.
Crushed Aggregate (% Material Retained on 3/8inch sieve by wt., having at least two (2) fractured faces)		50% max.
Maximum % passing No. 200	60% of -No.30	
Plasticity Index (Material finer than No.40 sieve)	4.0 max.	
Sand Equivalent Value	35 min.	

TABLE 302.B
GRADATION RANGES AND TOLERANCES

	PRODUCTION RANGE (% passing)		PRODUCTION TOLERANCES (+/-%)
SIEVE SIZE/TYPE	I	II	
1-1/2 inch	100	100	
1 inch	95-100	100	
¾ inch		90-100	8
½ inch	64-75		8
3/8 inch		65-80	8
No.4	35-46	48-55	8
No.30	12-18	18-25	5
No.200	5-12	6-15	3

TABLE 302.C
SUBMITTAL REQUIREMENTS

A. Supplier
B. Date
C. Design Mix Identification Number
D. Contractor
E. Construction project number
F. Construction Project Title (contract)
G. Certification of compliance
H. Target Gradation of Material
I. Optimum moisture and maximum dry density relationship of material and graph

The submittal shall be rejected without review if the specified data is not included.

TABLE 302.D
DELIVERY TICKET INFORMATION

A. Name of Supplier
B. Date of Delivery
C. Delivery Ticket Number
D. Name of Contractor
E. Project Name (optional)
F. Job mix formula identification number
G. Weight of load
H. Time loaded

TABLE 302.E
TEST REPORT INFORMATION

A. Field Data

Date of Sampling/Field Test
Project Number or
Permit Number
Project Title
Location of sample/field test as defined by the project plans and specifications
Time of Sampling/field testing
Field test results with reference specification limits

B. Laboratory Data

Base course classification
Gradation
Plasticity index
Liquid limit
Optimum moisture/maximum dry density relationship and graph
Estimated soil resistance R-Value

SECTION 511

PNEUMATICALLY APPLIED CONCRETE

511.1 GENERAL

Pneumatically applied mortar or concrete, designated herein as gunite or approved equal, shall consist of premixed sand and portland cement pneumatically transported in a dry state to a nozzle where hydration takes place immediately prior to expulsion.

511.2 REFERENCES

511.2.1 ASTM
C 39
C 42

511.2.2 This publication
SECTION 105

511.3 EQUIPMENT

511.3.1 The cement gun should be operated at a minimum air pressure of 45 pounds per square inch on the gun tank when 100 feet or less of material hose is used, and the pressure should be increased 5 pounds for each additional 50 feet of hose required. Nozzles used for applying the material shall have a maximum size of 1 5/8 inches unless otherwise permitted by the ENGINEER.

511.3.2 Water used for hydration shall be maintained at a uniform pressure, which shall be at least 15 pounds per square inch above air pressure at the gun.

511.4 PROPORTIONS AND MIXING

Unless otherwise specified, the material shall consist of a mixture of cement and sand in the proportions, by volume, of 1 part of cement to 4 1/2 parts sand. The sand and cement shall be thoroughly mixed in a power mixer for at least 1 1/2 minutes before placement in the chamber of the gun. The dry mixed material shall be used promptly after mixing, and any material that has been mixed for more than 45 minutes shall be wasted.

511.5 TESTS

511.5.1 During the application of the material, the CONTRACTOR shall cooperate with the ENGINEER in making compressive tests required to determine the quality of the material being placed in the work. The tests shall be conducted in conformity with the requirements of ASTM C 39. Test specimens shall be made so as to represent the quality of material being placed in the work by each nozzle man and shall consist of 6 inches x 12 inches cylinders made by shooting the material vertically into cylindrical cages of 1/2 inch mesh hardware cloth mounted on a board. The material outside the mold should be removed immediately after shooting the specimen so that the wire mesh can be detached before testing. The number of test specimens to be taken shall be as provided in the Supplementary Specifications or as determined by the ENGINEER. Separate test specimens made at the same place and time shall be tested at the age of 7 and 28 days. The specimens at the age of 7 days shall develop a minimum compressive strength of 2,400 pounds per square inch, and at the age of 28 days the specimens shall develop a minimum compressive strength of 3,500 pounds per square inch unless otherwise specified herein. In lieu of the above tests, the ENGINEER may elect to perform core tests. A minimum of 3 cores shall be taken for each 250 cubic yards or fraction thereof of material deposited.

511.5.2 Cores shall be obtained and tested in accordance with ASTM C 42. One core shall be removed and tested at an age of 14 days, the other 2 cores at an age of 28 days. Fourteen day cores shall develop a minimum strength of 2,200 psi. Twenty-eight day cores shall develop a minimum strength of 3,000 psi unless otherwise specified herein.

511.5.3 If the cores show deficient strength, additional cores shall be taken at the CONTRACTOR's expense from adjacent areas. Two cores shall be required for each deficient core. Should such deficiency be evident in 14 day cores, on approval of the ENGINEER, the CONTRACTOR may proceed with the work on his own responsibility until the 28 day cores are tested.

511.5.4 Where conditions preclude the possibility of obtaining cores from the material in place, the ENGINEER may approve cores taken from a representative test panel made at the same time and under the same conditions as the material being placed in the work.

511.6 PLACEMENT

511.6.1 Earth surfaces to which the material is to be applied shall be neatly trimmed to line and grade and shall be free of all loose material. The surface need not be compacted by slope rolling or other measures

unless required by the plans or Supplementary Specifications.

511.6.2 No high subgrade will be permitted and excavation made below subgrade shall be backfilled with compacted fill or, at the CONTRACTOR's option, with the material. However, no additional compensation will be allowed for such compacted fill nor for increased thickness of material placed on account of low subgrade.

511.6.3 Asphaltic concrete surfaces shall be thoroughly cleaned of any growth, silt and clay, or any other material detrimental to the material and then washed with water under pressure.

511.6.4 Masonry, rock, and concrete surfaces shall be examined and all loose material removed there from. The surface shall be thoroughly cleaned with steel scrapers or brushes to remove all dust, dirt, mortar, grease, or other deleterious substances and then washed with water.

511.6.5 Whenever brushing and scraping do not secure suitable results, sandblasting may be required.

511.6.6 All surfaces shall be wetted with water before application of the material, and no material shall be applied to surfaces on which free water exists.

511.6.7 The velocity of the material as it leaves the nozzle shall be maintained uniformly at a rate determined for given job conditions. Material which rebounds and does not fall clear of the work or which collects on the surfaces shall be blown off or otherwise removed. Rebound shall not be used in any portion of the work, and no pavement will be incorporated for rebound or other losses.

511.6.8 The nozzle shall be held at such distance and position that the stream of flowing material will impinge at approximately right angles to the surface being covered. Any portions of the placed material which tend to sag or which show soft or sandy pockets or are otherwise unsatisfactory shall be cut out and replaced. Reinforcement thus damaged or destroyed shall be replaced by trimming back and properly lapping and tying, to the satisfaction of the ENGINEER.

511.6.9 Reinforcement shall be firmly supported in the position shown on the plans. Mortar blocks, metal chairs, clips, or spacers with wire ties or other acceptable means shall be used to properly anchor and place the reinforcement.

511.6.10 Where material is placed on overhead surfaces, the amount of water used shall be so adjusted that approximately 3/4 inch of the placed material shall adhere without support. The limit of thickness has been exceeded when the material begins to sag or slough.

511.7 FORMS AND GROUND WIRES

511.7.1 The forms shall be built in accordance with applicable provisions of the specifications, except all forms shall be built so as to permit the escape of air and rebound.

511.7.2 Ground wires shall be installed in such manner that they accurately outline the finished surface as indicated on the plans. They shall be located at intervals sufficient to insure proper thickness throughout. Wires shall be stretched tight and shall not be removed prior to application of the finished coat.

511.7.3 Headers will be required where the plans indicate a formed edge and at plan joints.

511.8 JOINTS

511.8.1 Construction joints shall be sloped off at an angle of approximately 45° to the surface being shot. Before shooting the adjacent sections, the sloped portion shall be thoroughly cleaned and wetted by means of air and water blast.

511.8.2 The plan joint shall be formed in accordance with and placed in the locations as designated on the plans.

511.9 FINISH

511.9.1 Upon reaching the thickness and shape outlined by forms and ground wire, the surface shall be rodded off to true lines.

511.9.2 Any low spots or depressions shall be brought up to proper grade by placing additional material. Ground wires shall then be removed; and unless otherwise specified, the surface shall then be broom finished to secure a uniform surface texture. Rodding and working with a wood float shall be held to a minimum.

511.9.3 Rebound or accumulated loose sand shall be thoroughly cleaned up and disposed of to the satisfaction of the ENGINEER. In no case shall it be floated into the surface of the work.

511.9.4 When a nozzle finish is specified on the plans, ground wires shall not be used and the surface shall be left as uniform as possible without rodding. Nozzle finishes will not be permitted where the underlay has been floated.

511.10 CURING

511.10.1 The pneumatically placed material shall be cured as prescribed for concrete curing, Section 105.

511.10.2 The CONTRACTOR shall at all times protect the finished work from being scarred or damaged in any way.

511.11 MEASUREMENT AND PAYMENT

Measurement for pneumatically placed concrete will be made in conformity with the terms of the Contract and will be based on units and/or quantities as set forth in the Bid Proposal. Such payment shall be full compensation for furnishing all labor, materials, tools, and equipment and doing all work required to complete the Work in conformity with the plans and specifications.

SECTION 910

STORM SEWER PIPE INSTALLATIONS

910.1 GENERAL

910.1.1 The construction items, specified in this section, are common to storm sewer pipe installation and pipe type culverts.

910.1.2 Reinforced concrete pipe may be used for storm sewer pipe installations or pipe type culverts. Corrugated metal pipe will only be used for pipe-type culverts.

910.2 REFERENCES

910.2.1 ASTM

C 43	C 478
C 361	D 3034
C 425	F 679
C 443	

910.2.2 AWWA

C 603

910.2.3 This publication per SECTIONS:

101	125
102	129
105	135
106	136
108	137
121	161
123	801
124	

910.3 MATERIALS

910.3.1 PIPE: Sewer line pipe and fittings shall be as specified in other sections, as follows:

Reinforced Concrete Pipe	Section 123
Reinforced Concrete Pressure Pipe	Section 124
Corrugated Metal Pipe and Arches	Section 135
Structural Plate for Pipe, Arches, and Pipe Arches	Section 136
Corrugated Aluminum Pipe and Arches	Section 137

910.4 CERTIFICATION

The OWNER/ENGINEER will be supplied with a certification on each item or type of material required in the sewer line, as to that item meeting the specifications and/or the reference specifications before that item is installed.

910.5 INSTALLATION

910.5.1 GENERAL:

910.5.1.1 Pipe and appurtenances shall be new and unused. The type of pipe to be installed shall be as approved by these specifications or unless otherwise shown on the drawings. Pipe and appurtenances shall be handled in such a manner as to insure delivery to the trench in sound, undamaged condition. Particular care shall be taken to prevent damage to any pipe coating.

910.5.1.2 The interior of the pipe shall be thoroughly cleaned of foreign material before being lowered into the trench and shall be kept clean during construction operations. When work is not in progress, the open ends of pipe shall be securely closed so that no foreign materials will enter the pipe. Any section of pipe found to be defective before or after laying shall be replaced with sound pipe, or repaired in a manner satisfactory to the ENGINEER, without additional expense to the OWNER.

910.5.1.3 The CONTRACTOR shall install a plug in the new sewer at any point of connection to an existing system. The plug shall remain in place until the ENGINEER authorizes its removal in writing. The CONTRACTOR shall not flush or otherwise discharge any flow into an existing system unless approved in writing by the ENGINEER.

910.5.1.4 Pipe shall be laid to line and grade as shown on the plans and as staked in the field. The bottom of the trench shall be graded and prepared to provide a firm and uniform bearing throughout the entire length of the pipe barrel. Suitable excavation shall be made to receive the bell of the pipe and the joint shall not bear upon the bottom of the trench. All adjustment to the line and grade shall be made by scraping away or filling in with pipe zone material under the body of the pipe, and not by wedging or blocking. When connections are to be made to any existing manhole, pipe, or other improvement, the actual elevation or position of which cannot be determined without excavation, the CONTRACTOR shall excavate for and expose the existing improvement before laying the connecting pipe or conduit. When existing underground improvements may reasonably be expected to conflict with the line

or grade established for the new sewer line, the ENGINEER shall request and the CONTRACTOR shall excavate as necessary to expose and locate such potentially conflicting underground improvements prior to laying the new pipe. Any adjustment in line or grade which may be necessary to accomplish the intent of the plans will be made, and the CONTRACTOR will be paid for any additional work resulting from such change in line or grade in the manner provided for in the General Conditions.

910.5.1.5 CONTRACTOR shall submit to the ENGINEER the proposed method for making connections to existing manholes. Connection methods will be dependent upon manhole size and pipe sizes. Unnecessary damage to the existing manhole should be avoided.

910.5.1.6 Pipe shall be laid upgrade in a continuous operation from structure to structure, with the socket or collar ends of the pipe upgrade unless otherwise permitted by the ENGINEER. Concrete pipe with elliptical reinforcement shall be laid with the minor axis of the reinforcement cage in a vertical position. Corrugated metal pipe shall be laid with the external laps of the circumferential seams toward the inlet end.

910.6 JOINTS FOR PIPE

910.6.1 JOINT FOR CONCRETE PIPE:

910.6.1.1 The type of joint to be used shall be O-ring rubber gasket joints conforming to ASTM C 361 and C 443.

910.6.1.2 Gasketed Type of Joints for Reinforced Concrete Pipe

910.6.1.2.1 General--The ends of the pipe shall be so formed that when the pipes are laid together and joined, they shall make a continuous and uniform line of pipe with a smooth and regular surface.

910.6.1.2.2 Rubber gaskets for making compression-type joints for concrete pipe shall be factory fabricated in accordance with ASTM C 443; for pipes 12 inches in diameter and larger shall be O-ring and shall be handled, primed, installed, etc. in strict accordance with the manufacturer's recommendations.

910.6.1.2.3 The CONTRACTOR'S attention is particularly called to ASTM C 443, regarding storage of gaskets.

910.6.1.2.4 The CONTRACTOR shall furnish the ENGINEER complete information concerning the type and make of all joint material which he intends to use under the contract, including certification that the joint material meets the requirements of the specifications.

910.6.2 JOINTS FOR CORRUGATED METAL PIPE:

910.6.2.1 The seams of the pipe are to be placed at the sides, not on the bottom. The inside circumferential seams should be placed pointing downstream. Care should be taken to insure that dirt or other particles do not get between the outside of the pipe and the pipe coupling. Paved inverts should be placed and centered on the bottom of the trench. Any damage to the protective lining and coating shall be repaired prior to the backfilling around the pipe.

910.6.2.2 If waterproof joints are called for on the plans or specified in the Supplementary Specifications, the caulking compound or other waterproofing material used shall be subjected to the approval of the ENGINEER.

910.7 TESTING FOR LEAKAGE

Normally storm sewer lines need not be tested, but if in the opinion of the ENGINEER, the workmanship or materials do not appear to be satisfactory, the ENGINEER may require that a section of the storm sewer line be tested in a similar manner as that for a sanitary sewer line, see Section 905.

910.8 CLEANING AND INSPECTION

910.8.1 CLEANING: No pipe spalls, rocks, dirt, joint compounds, cement mortar and other trash or obstructions shall be left in a sewer pipe of any size or type. During flushing operations the manhole outlet shall be bagged or plugged so that the debris will not be carried into an existing active line.

910.8.2 INSPECTION: Before lines become operational or final acceptance of the installation, small size lines shall be inspected by a television camera and larger size lines will be inspected by walking through the line.

910.8.3 TELEVISION: After the CONTRACTOR has cleaned and flushed the line, the CONTRACTOR will notify the ENGINEER that the line is ready for television inspection, if required. Prior to the television inspection (possibly during flushing operation) the CONTRACTOR will insert a 1/4-inch nylon rope in the line for the purpose of

towing the television unit through the pipe. The OWNER will perform the first television inspection at no cost to the CONTRACTOR. If during the first inspection debris is found in the line, the television inspection will cease. When further cleanup has been completed, the CONTRACTOR will request the ENGINEER to have a second inspection performed. The cost of the second inspection and any subsequent inspections of that segment of the line will be paid for by the CONTRACTOR at the rate of $75.00 per hour while the television crew is at the line site.

910.9 MEASUREMENT AND PAYMENT

910.9.1 STORM SEWER PIPE: Installed pipe shall be measured and paid for as follows:

910.9.1.1 For straight lines the pipe length shall be the intervening distance between the centers of manholes along a line parallel to the pipe invert.

910.9.1.2 For curvilinear lines the pipe length shall be the intervening arc distance between the centers of manholes along a line parallel to the pipe invert.

910.9.1.3 For lateral lines, such as from main or manhole to a storm inlet, the pipe length shall be the distance between the center of a manhole or centerline of the main to the interior wall face of the storm inlet along a line parallel to the pipe invert.

910.9.1.4 Payment for pipe will be in accordance with the unit price per linear foot per size and material as defined in the Bid Proposal, and shall include pipe installed in the trench, jointing and coupling materials, and other materials necessary to connect to other sections of pipe, manholes, and other appurtenances.

910.9.2 REMOVAL AND DISPOSAL OF STORM SEWER PIPE: Removal and disposal of storm sewer pipe shall be measured by the linear foot within the specified pipe size increments. Payment will be made on the unit price per linear foot of specified pipe size in the Bid Proposal. Trenching, backfilling, and pavement removal and replacement will be paid for based on the unit prices for each appropriate bid item in the Bid Proposal. If new pipe is to be installed in the same trench as the removed pipe, only one payment will be made for trenching, backfilling, and pavement removal and replacement.

910.9.3 TESTING OF PIPE: No payment will be made for required initial or subsequent tests on sections of the storm sewer line.

SECTION 920

SANITARY AND STORM SEWER MANHOLES

920.1 GENERAL

This section contains items which are relative to the installation of sanitary and storm sewer manholes.

920.2 REFERENCES

920.2.1 ASTM

C 43	C 497
C 139	C 1557
C 478	

920.2.2 This publication

SECTION 101	SECTION 106
SECTION 102	SECTION 161
SECTION 105	

920.3 MANHOLE MATERIALS

Sewer manhole materials shall be as specified in other sections, as follows:

Portland Cement Concrete	Section 101
Steel Reinforcing	Section 102
Concrete Curing Compound	Section 105
Cement Mortar and Grout	Section 106
Gray Iron Castings	Section 161

920.4 MANHOLE CONSTRUCTION

920.4.1 GENERAL:

920.4.1.1 Soil Foundations for manhole base shall be compacted to a density of 95 percent of the maximum density per ASTM D 1557. Compaction limits shall be one foot beyond the perimeter of the concrete base and shall be a minimum of one foot in depth.

920.4.1.2 Manholes shall be constructed in accordance with the Standard Detail Drawings and as shown on the construction plans. Precast reinforced concrete units, concrete blocks or formed inplace, reinforced concrete may be used to construct the manhole.

920.4.1.3 Invert elevation of the pipes entering or exiting the manhole and interior inverts shall not vary more than 0.05 foot from the elevations indicated on the construction plans.

920.4.1.4 All cement used for poured foundations. Mortar, fillets, grout, and concrete shelf construction shall be Type II or approved equal.

920.4.1.5 All concrete for formed in place foundations or bases, concrete shelves. and pipe supports shall be 3000 psi compressive strength concrete.

920.4.1.6 Depending on the size of the pipe, connections to existing and new manholes shall be made by either core drilling through the manhole wall, per-formed for new precast units, or for large-size pipe the manhole wall may be removed by carefully chipping the wall segment which will permit entry of the pipe. In the latter operation, exposed manhole reinforcement should be bent and tied to the reinforcement of the pipe collar. If core drilling is not practical, the CONTRACTOR shall request the ENGINEER to authorize the chipping operation. During either operation the CONTRACTOR shall take care to avoid unnecessary damage to the manhole surfaces or walls.

920.4.2 PRECAST CONCRETE MANHOLES:

920.4.2.1 The vertical sections of the manhole may be of different dimensions in order that manholes of various depths can be readily assembled.

920.4.2.2 Concrete, used for precast bases, vertical sections, and eccentric cones, shall be 4000 psi compressive strength concrete.

920.4.2.3 Vertical sections of the manhole shall conform to the requirements of ASTM C 478.

920.4.2.4 The CONTRACTOR shall submit shop drawings of the precast base and eccentric cone to the ENGINEER for review and approval.

920.4.2.5 Circular precast manhole sections shall be provided with mastic gasket to seal joints between sections, such as RAM-NEK. KENT SEAL. or approved equal.

920.4.2.6 All lifting holes, except Type "C" manhole covers, and gaps at joints shall be filled with a nonshrink grout.

920.4.2.7 Precast concrete manhole bases may be used when approved by the ENGINEER. If approved. it shall be with the understanding that the CONTRACTOR shall be responsible for placing the bases at the specified elevation, location, and alignment.

920.4.3 FORMED INPLACE REINFORCED CONCRETE MANHOLE:

920.4.3.1 The CONTRACTOR shall submit preconstruction drawings of the proposed manholes to the ENGINEER for review and approval.

920.4.3.2 Concrete used for this type of manhole construction shall be 4000 psi compressive strength concrete.

920.4.3.3 If desired, a precast eccentric cone or a flat cover can be used.

920.4.4 CONCRETE BLOCK MANHOLE:

920.4.4.1 The CONTRACTOR shall submit preconstruction drawings of the proposed manhole to the ENGINEER for review and approval.

920.4.4.2 Concrete masonry units for the construction of this type of manhole shall conform to ASTM C 139 and the Standard Detail Drawings. All blocks shall be mortared into place.

920.4.4.3 Eccentric cone or flat-type cover shall be used.

920.4.5 TEE PIPE MANHOLE:

920.4.5.1 Tee pipe manholes will be used for all 4-foot-diameter mainline pipes and larger. Horizontal section of the tee pipe shall be the same class of pipe as the adjacent sections. The vertical sections shall comply with the requirements set forth in ASTM C 478.

920.4.5.2 Top of the vertical portion of tee pipe unit will extend a minimum of 18 inches above the outside diameter of the horizontal pipe. The 4-foot-diameter vertical section of the tee pipe shall be connected at the longitudinal center point of the horizontal pipe section. The minimum length of horizontal pipe section shall be 8 feet.

920.4.5.3 The CONTRACTOR shall submit to the ENGINEER for review and approval preconstruction shop drawings on the fabrication of the tee pipe section as developed by a precast reinforced concrete pipe manufacturer. Field fabrication of this eccentric pipe unit will not be accepted. Shop drawings for the eccentric cone will also be submitted for review and approval.

920.4.5.4 RAM-NEK, Kent Seal, or OWNER - approved equal sealants shall be used to seal the joints in the vertical portion of this manhole.

920.4.5.5 All lifting holes, except for Type "C" manhole covers, and gaps at joints shall be filled with a nonshrink grout.

920.4.5.6 Standard Detail Drawings show some of the components of the tee-type pipe manhole.

920.4.6 COATING OF MANHOLES:

920.4.6.1 Exterior of Manholes: Exterior coating of manholes shall be required in areas where ground water is present. The coating shall be a water-proofing type of bitumastic or asphaltic material, as approved by the ENGINEER. Application shall be in accordance with the manufacturer's published recommendations.

920.4.6.2 Interior of Manholes: Interior coating of manholes shall be required only when specified on the construction plans. The coating shall be an epoxy resin-type material, be an epoxy resin-type material such as: "Zebron," "Plastite 7122," or approved equal, and shall be capable of protecting the concrete from deterioration due to a gaseous environment. Application shall be in accordance with the manufacturer's published recommendations.

920.4.6.3 Plastering of Manholes: The work shall include the coating of the surface of existing block manholes with plaster as required on the plans.

920.4.7 MANHOLE STEPS:

920.4.7.1 Manhole steps shall be 1/2" diameter, grade 60, reinforcing rod completely encapsulated in copolymer polypropylene or corrosion resistant rubber compound. Steps shall be designed to be cast in place or hammered into holes in manhole walls.

920.4.7.2 Approved manhole steps of only one manufacturer model shall be used on any specific project and shall not be intermixed with other approved steps. Approved steps must bear the manufacturer name and model on the exposed surface of the step and shall be one of the following products or approved equals: M.A. Industries, Inc. -Model PS-2-PFS H. Bowen Co.-Bowco, Model 81213 or 93813 Delta Pipe Products -WEDG-LOK, Model W-II

920.4.7.3 The minimum width of step tread shall be 11 inches. Steps will be spaced uniformly in each manhole. Spacing may be between 12 inches to 16 inches on center. Lower step will be 12 inches above manhole shelf or top of main. The upper step shall be 6 inches below the top portion of the eccentric cone or 6 inches below the bottom

of the flat cover. Also the steps shall be aligned vertically with the opening of the cone or cover.

920.4.7.4 Steps shall be embedded in the manhole wall a minimum of 3" inches and protrude from the manhole interior surface a minimum of 4 3/4 inches.

920.4.7.5 Holes for step installation shall be drilled or precast per manufacturer's recommended size. or of sufficient size to allow for step insertion into the wall. Cast-in-plan sockets or tapered holes recommended by the step manufacturer may be used with prior approval of ENGINEER. If the hole has been drilled too large, then the step shall be secured in place by using epoxy grout for the full depth of the drilled hole.

920.4.6 Acceptable manhole step installations must be capable of withstanding a 400 pound. horizontal, pull out load applied in accordance with ASTM C-497.

920.4.8 ADJUSTMENT BRICKS:

920.4.8.1 Manhole adjustment bricks shall conform to the requirements for manhole bricks. per ASTM C 32 for Grade MS.

920.4.8.2 Mortar shall be used to lay the bricks. as well as coating the interior and exterior surfaces of the laid brick. Thickness of the mortar coating shall be 1/2 inch.

920.4. 9 MANHOLE FRAME AND COVER:

The manhole frame and cover for either the sanitary or storm sewer manholes shall conform to the specifications contained in Section 161.

920.5 TESTING OF SEWER MANHOLES:

920.5.1 All sanitary sewer manholes shall be tested for leakage by either a water exfiltration test or a vacuum test. Whichever test is utilized it is recommended that the test be performed prior to backfilling around the manhole and prior to placement of the manhole frame and cover. All inlet and outlet lines shall be properly plugged and the lift holes and barrel joints filled and sealed as specified. The CONTRACTOR shall be responsible for all materials and equipment necessary to perform the test and shall conduct the test in the presence of the ENGINEER or his representative. The CONTRACTOR has the option of performing a manhole test in increments appropriate to the depth of the manhole.

920.5.2 The water exfiltration test shall consist of filling the entire manhole with water to the bottom of the frame elevation. A stabilization period of one hour will be allowed for absorption. After which the manhole shall be refilled as necessary before starting the test. The test period shall be two (2) hours. After which the manhole shall be refilled, measuring the necessary quantity of water. The allowable leakage shall be 0.25 gallons per foot diameter per vertical foot per day, and is represented by the following formula:

$$V = 0.25\ DHT/24$$

where; V = Allowable loss in gallons
D = Manhole diameter in feet
H = Initial depth of water to invert in feet
T = Duration of test in hours

920.5.3 The vacuum test shall consist of utilizing an inflatable compression band, vacuum pump, gauges and appurtances specifically designed for vacuum testing. Test procedures shall be in accordance with the manufacturer's printed recommendations. The ENGINEER shall be the sole judge as to the adequacy of the equipment.

920.5.3.1 A vacuum of 10" Hg shall be placed in the manhole and the time measured for a drop to 8.5" Hg. The test shall be considered to be successful if the measured time exceeds the test period. Should the test fail, the man- hole shall be repaired as necessary and the test rerun. The test periods are:

920.5.3.2 Sixty (60) seconds for four (4) foot diameter manholes.

920.5.3.3 Seventy-five (75) seconds for five (5) foot diameter manholes.

920.5.3.4 Ninety (90) seconds for six (6) foot diameter manholes.

920.5.3.5 One hundred and Twenty (120) seconds for eight (8) foot diameter manholes.

920.5.4 Normally storm sewer manholes need not be tested unless specifically required by the project plans or supplemental technical specifications. However, if in the opinion of the ENGINEER, the workmanship or materials do not appear to be satisfactory, the ENGINEER may require that any storm sewer manhole be tested in a similar manner as that for a sanitary sewer manhole.

920.6 ABANDONMENT OF MANHOLES

920.6.1 Abandonment of manhole, which is part of a sewer line being abandoned, shall entail the following work and materials:

920.6.2 Manhole will not be removed but will be abandoned in place.

920.6.3 All manhole inlet and outlet lines shall be plugged with a 12-inch- thick concrete or concrete mortar plug.

920.6.4 Salvageable material shall be stockpiled on the job site. The CONTRACTOR shall contact the OWNER to arrange for a representative to inspect the materials for usability. Salvageable materials shall be transported by the CONTRACTOR as directed by the OWNER. CONTRACTOR will receive a receipt for the turned-in materials. Receipts will be submitted to the ENGINEER prior to final acceptance of the Project. Unusable materials will be disposed of by the CONTRACTOR.

920.6.5 Manhole bottom will be pulverized.

920.6.6 The manhole shall be filled with cement treated base (CTB) material to the bottom elevation of the asphalt base course of the pavement or to the ground surface level.

920.6.7 All labor, materials, and equipment necessary to complete this work shall be furnished by the CONTRACTOR.

920.6.8 For historical information the ENGINEER shall have a survey performed which will locate the abandoned manhole, relative to permanent survey markers.

920.7 SEWER MANHOLE REHABILITATION IN REPLACEMENT WORK

920.7.1 The work under this item shall be to replace the existing manhole frame and cover and to place a concrete pad around the existing manhole as required per the construction plans. This work will be done only when an existing man-hole is encountered in the normal course of the replacement work that has a light- weight, vented, multi-holed manhole cover.

920.7.2 The work and materials shall include the following:

920.7.2.1 Remove any and all existing brick under frame and replace with new Grade MS brick as necessary to bring new frame and cover up to street grade.

920.7.2.2 Remove and replace existing concrete pad, or construct a new pad.

920.7.2.3 Remove existing steps and replace with new steps or, if steps are nonexistent, install new steps. Steps will be installed as per Subsection 815.4.7.

920.7.2.4 Remove and replace pavement.

920.7.2.5 Excavation and compaction of backfill as necessary.

920.7.2.6 All materials, labor, and equipment necessary to do the work under this item shall be furnished by the CONTRACTOR.

920.7.2.7 The work and materials under this item shall be done according to the manner set forth in the Standard Detail Drawings and other sections of these specifications.

920.7.3 Salvageable material shall be stockpiled on the job site. The CONTRACTOR shall contact the OWNER to arrange for a representative to inspect the materials for usability. Salvageable materials shall be transported by the CONTRACTOR as directed by OWNER. CONTRACTOR will receive a receipt for the turned-in materials. Receipts will be submitted to the ENGINEER prior to final acceptance of the Project. Unusable materials will be disposed of by the CONTRACTOR.

920.8 MEASUREMENT AND PAYMENT

920.8.1 NEW MANHOLES:

920.8.1.1 Type "C," "E," "F," or "G" manholes of 4-foot or 6-foot diameters shall be measured per each within the following increments of depth: 3 to 6 feet, 6 to 10 feet, and 10 to 14 feet. Manholes which are greater in depth than 1 foot shall be measured by the vertical foot. Measurements will be made to the nearest foot and will be from the manhole rim elevation to the manhole invert elevation.

920.8.1.2 Payment for manholes 14 feet deep or less will be made on the unit price per manhole diameter per depth increment as specified in the Bid Proposal. Payment for manhole depths which exceed 14 feet will be made on the unit price per manhole diameter per vertical foot. This payment is in addition to the manhole unit price for the portion above the 14 foot depth.

920.8.1.3 Type "A" or Tee-type manholes shall be measured and paid for by the methods described

in 920.8.1.1 and 920.8.1.2. Measurement will be from the invert of the main line to the manhole rim. Payment under this item will include the normal manhole costs described below, as well as any additional pipe costs for the precast tee and for the concrete cradle under the tee.

920.8.1.4 Payment for any type diameter or depth of manhole will include excavation, compacted backfilling, shelving, cover or cone, leveling bricks, frame and cover, and concrete pad or collar.

920.8.2 ELEVATION ADJUSTMENTS:

920.8.2.1 When a new manhole is installed, no measurement or payment will be made for rim elevation adjustments to conform to street surface grades.

920.8.2.2 The following measurements and payments for rim elevation adjustments on existing manholes will be made for indicated conditions:

920.8.2.2.1 Unit price per inch of adjustment ring for adjustment to manhole frame by the addition of adjustment ring.

920.8.2.2.2 Unit price per inch of leveling brick adjustment.

920.8.2.2.3 Unit price per manhole diameter per vertical foot of adjustment to cone and/or barrel.

920.8.2.3 As required, the following items will be included in the unit price per appropriate adjustment: pavement removal and replacement, excavation, compacted backfilling, concrete collar or pad, leveling bricks, adjusting rings, and/or frame and cover.

920.8.3 COATING OF MANHOLE: Plastering or epoxy coating for manholes shall be measured and paid for on the unit price per square foot of surface area covered.

920.8.4 MANHOLE STEPS: Unless otherwise shown on the Bid Proposal, the cost of manhole steps shall be incidental to the unit prices for construction of manholes of various types and depths.

920.8.5 ABANDONMENT OF MANHOLES: Measurement and payment for abandonment of a manhole shall be the unit price per manhole for defined work in Subsection 920.6.

920.8.6 MANHOLE REHABILITATION IN RE-PLACEMENT WORK: Work under this item shall be measured and paid for by the unit price per manhole for work specified in the Bid Proposal.

920.8.7 TESTING: There will be no payment for required testing of sewer manholes.

SECTION 1012

NATIVE GRASS SEEDING

1012.1 GENERAL:

Work under this section consists of preparing all area indicated on the plans for native grass seeding, furnishing and installing all seed, fertilizer and soil amendments as specified herein and on the plans, or as authorized by the ENGINEER.

1012.2 REFERENCES:

1012.2.1 This Publication:

Section 1011

1012.3 WORK AREA/TIMING:

1012.3.1 Areas that are disturbed by the CONTRACTOR that are outside the construction limits shown on the plans or authorized by the ENGINEER shall be seeded with native grasses as specified herein at no cost to the OWNER.

1012.3.2 The seeding of disturbed areas shall commence upon completion of the other work in the area.

1012.4 MATERIALS:

1012.4.1 Native Seed: The native seed species and rate of application shall be as shown below and shall be used based on the type of soil or as specified on the plans or in the Supplemental Technical Specification.

1012.4.1.1 Sandy Soils. Seed rate is given in pounds of pure live seed (P.L.S.) per acre.

Variety/ Common Name	Genus/ Species	P.L.S/Acre
"Paloma"Indian Rice grass	Oryzopsis hymenoides	5.0
"Viva" Galleta grass	Hilaria jamesii	1.0
"Niner" Side oats grama	Bouteloua curtipendula	3.0
"Hatchita" Blue grama	Bouteloua gracilis	1.0
Sand dropseed (NM Region)	Sporobolus cryptandrus	1.0
Fourwing saltbush (NM Region)	Atriplex canescens (de-winged)	1.0
Total rate		12.0 lbs/ acre

1012.4.1.2 Clay, Clay Loam, and Sandy gravelly clay loam soils. Seed rate is given in pounds of pure live seed (P.L.S.) per acre.

Common Name	Genus/species	PLS/acre
"Paloma" Indian rice grass	Oryzopsis hymenoides	2.0
“Viva” Galleta grass	Hilaria jamesii	2.0
"Niner" Sideoats grama	Bouteloua curti pendula	2.0
"Hatchita" Blue grama	Bouteloua gracilis	3.0
Sand dropseed (NM Region)	Sporobolus cryptandrus	1.0
Four-wing Saltbush (NM Region)	Atriplex canescens (de-winged)	1.0 1.0
Total rate		11.0 lbs/ac

NOTE: If the area to be seeded is along a recreational trail of any type the seed mixes for either type of soil listed above shall exclude the one (1) pound per acre of Four-wing saltbush. The seeding rate shall be lowered by one (1) pound per acre.

1012.4.1.3 Seeds may be pre-mixed by a seed dealer. Each bag of seed shall be sealed and labeled by the seed dealer in accordance with Federal Seed Laws and New Mexico Department of Agriculture Labeling Laws. This includes: variety, kind of seed, lot number, purity, germination, percent crop, percent inert, percent weed (including noxious weeds), origin, test data and net weight. Federal Seed Laws require that analysis shall be no older than 5 months for seed shipped interstate and no older than 9 months for seed shipped intra-state. The ENGINEER shall receive all labels from all bags of seed used for verification.

1012.4.2 Fertilizer and Soil Amendments: Unless otherwise specified on the plans or in the Supplemental Technical Specification, no fertilizer or other soil amendments are required on areas specified to receive native seeding. If fertilizer and/or other soil amendments are required they shall be in accordance with Section 1011 of these specifications.

1012.4.3 MULCH:

1012.4.3.1 Hay Mulch: Perennial native or introduced grasses of fine-stemmed varieties shall be used unless otherwise specified on the plans. At least 65 percent of the herbage by weight of each bale of hay shall be 10 inches in length or longer. Hay with noxious seed or plants will not be acceptable. Rotted, brittle, or moldy hay will not be acceptable. Marsh grass or prairie hay composed of native grass of species to be seeded will be acceptable. Tall wheat grass, intermediate wheat grass, switch grass, or orchard hay will be acceptable if cut prior to seed formation. Marsh grass hay shall be composed of mid and tall native, usually tough and wiry grass and grass-like plants found in the lowland areas within the Rocky Mountain region. Hay shall be properly cured prior to use. Hay which is brittle, short fibered or improperly cured is not acceptable.

1012.5.2 Straw Mulch: Small grain such as wheat, barley, rye, or oats will not be allowed except by prior approval of the ENGINEER and with the concurrence of the Air Division, Environmental Health Department. Alfalfa or the stalks of corn, maize or sorghum is not acceptable. Material which is brittle, shorter than 10 inches or which breaks or fragments during the crimping operation will not be acceptable.

1012.4.3.3 Gravel Mulch: Gravel mulch shall be crushed or screened gravel 3/4" to 1" maximum size with a minimum of one fractured face unless otherwise specified.

1012.4.3.4 Erosion Control Matts, Fabric or Blankets: The type of erosion control mats, fabric or blankets used shall be as specified or allowed on the plans or in the Supplemental Technical Specifications.

1012.5 SEED BED PREPARATION:

1012.5.1 General:

1012.5.1.1 Prior to the starting of any seed bed preparation the final grades of all earth work shall be inspected and approved by the ENGINEER.

1012.5.1.2 No preparation shall be performed when the surface is wet or muddy or when the soil moisture content is such that the soil is not fully loosened by the discing operation.

1012.5.1.3 The extent of seed bed preparation shall not exceed the area on which seeding, mulching and crimping operations can be completed prior to crusting or wind or water erosion of the prepared surface. If erosion, crusting or re-compaction occurs, the affected area shall be re-worked beginning with seed bed preparation. Depth of preparation must be approved by the ENGINEER prior to the seeding and mulching operations.

1012.5.2 Mechanical Preparation: The seed bed shall be loosened to a minimum depth of 6" (six inches) by means of disc or harrow. Area of heavy or compacted soil may require additional preparation such as chiseling or ripping if discing alone does not result in preparation to the full minimum depth of 6". The soil shall be worked to a smooth surface free of clods, stones 4" and larger or any other debris or foreign material that could interfere with seeding or crimping equipment operations.

1012.5.3 Hand Preparation: Areas which cannot be prepared with mechanized equipment because of small size irregular shape or slope angle may be prepared to a minimum depth of 2" using hand tools or a rototiller. Any such areas will be specified on the plans.

1012.6 SEEDING:

1012.6.1 General:

1012.6.1.1 Seeding shall not start until the seed bed preparation has been inspected and approved by the ENGINEER.

1012.6.1.2 No more area may be seeded than can be covered with mulch and crimped, or covered with gravel mulch or erosion control mats by the end of the work day. No seeding operations may be conducted when steady wind speed exceeds 10 miles per hour. If winds exceed 10 mph while seeding is underway, seeding operations will be halted and any areas seeded to that point completed.

1012.6.2 Seed Application:

1012.6.2.1 Drill Seeding: Drill seeding is required unless otherwise specified on the plans or in the Supplemental Technical Specifications. Seed shall be applied with a "rangeland" type seed drill equipped with packer wheels. Seed shall be drilled to a maximum depth of 1/2" unless otherwise specified. Direction of seeding shall be across slopes and on the contour whenever possible.

1012.6.2.2 Broadcast Seeding: Seed may be applied using the broadcast method when size, irregular shape or slope angle exceeding 3.1 prevents the use of a seed drill. Seed may be broadcast by hand or by means of a mechanical seeder provided that the seed is evenly distributed over the seeding area. Areas of broadcast seeding

will be hand raked to cover seed. Areas which are broadcast seeded shall be seeded at rate which is double that used for drill seeding.

1012.6.2.3 Seeding With Gravel Mulch: Areas to receive gravel mulch will be seeded at the broadcast seed rate with 1/2 the seed applied prior to application of gravel and 1/2 the seed applied on the surface of the gravel. Water shall be applied in quantity sufficient to wash seed from the surface and into the gravel.

1012.6.2.4 Hydro Seeding: Hydro seeding will not be allowed on areas of non-irrigated native grass seeding unless specified on the plans or in the Supplemental Technical Specifications or authorized by the ENGINEER.

1012.7 MULCHING:

1012.7.1 General:

1012.7.1.1 All seeded areas shall be mulched unless otherwise specified on the plans or in the Supplemental Technical Specifications.

1012.7.1.2 On seeded areas that are level or have slopes 3:1 or less, any of the four (4) types of mulching or erosion control specified herein may be used. On seeded areas that have slopes steeper than 3:1 only gravel mulch or erosion control materials may be used as specified on the plans and in the Supplemental Technical Specifications.

1012.7.2 Hay Mulch: Hay mulch shall be applied at a minimum rate of 1.5 tons per acre of air dry hay.

1012.7.3 Straw Mulch: Straw mulch shall be applied at a minimum rate of 2.5 tons per acre of air dry straw.

1012.7.4 Crimping: Hay and/or Straw mulch shall be crimped into the soil. The mulch shall be spread uniformly over the area either by hand or with a mechanical mulch spreader. When spread by hand, the bales of mulch shall be torn apart and fluffed before spreading. Mulching will not be permitted when wind velocity exceeds 15 miles per hour. The mulch shall be wetted down and allowed to soften for 15 to 20 minutes prior to crimping. A heavy disc such as a mulch-tiller, with flat serrated discs at least 1/4 inch in thickness, having dull edges and the disc spaced 6 inches to 8 inches apart shall be used to crimp (or anchor) the mulch into the soil to a minimum depth of 2 inches or as specified on the plans or the Supplemental Technical Specifications. The discs shall be of sufficient diameter to prevent the frame of the equipment from dragging the mulch. The crimping operations shall be across the slope where practical but not be parallel to prevailing winds or by tight interlocking “S” curves to avoid straight crimp lines.

If small grain straw mulch is used it shall be crimped in two (2) directions in a cross-hatch pattern.

1012.7.5 Gravel Mulch: Gravel mulch shall be placed by hand or by mechanized equipment that provides full coverage at a uniform thickness of 2 inches in depth.

1012.7.6 Erosion Control Matts, Fabric or Blankets: the type of erosion control mats, fabric or blankets used shall be as specified on the plans or the Supplemental Technical Specifications or as approved by the ENGINEER. The anchoring of the erosion control items shall be as per the manufacturer's recommendations.

1012.8 PROTECTION OF NATIVE GRASS SEEDED AREA:

1012.8.1 GENERAL: The CONTRACTOR shall be responsible for protecting and caring for seeded areas until final acceptance of the work and shall repair at his expense any damage to seeded areas caused by pedestrian or vehicular traffic or vandalism.

1012.9 INSPECTION FOR NATIVE GRASS AREA:

1012.9.1 The following inspection shall be the minimum required inspections to native grass during the course of construction. Additional inspections shall be made at any time at the discretion of the ENGINEER.

1012.9.2 It shall be the responsibility of the CONTRACTOR to notify the ENGINEER, in writing, 48 hours in advance of each required inspection.

1012.9.3 The sequence of required inspections shall not be changed from the sequence listed below. The CONTRACTOR shall not proceed with work of the next sequence without written approval of the work of the previous sequence. Payment will not be approved for items which have not been inspected and approved in writing.

1012.9.3.1 Each phase of soil preparation shall be inspected in process.

1012.9.3.2 Finish grade shall be inspected.

1012.9.3.3 Seed shall be inspected prior to seeding.

1012.9.3.4 Seeded area shall be inspected after completion.

1012.9.3.5 Final inspection of the project and acceptance.

1012.10 MEASUREMENT AND PAYMENT

1012.10.1 MEASUREMENT: The measurement of native grass seeding shall be by the acre.

1012.10.2 Payment: Payment shall be made at the contract unit price per acre of native grass seeding complete in place, which shall include the seed, fertilizer, (if required) area preparation, seeding, soil amendments, (if required) and mulching.

APWA (2006) SECTION 1012 – SUPPLEMENTAL SPEC

NATIVE GRASS SEEDING

Revised 07/24/2020

1. In subsection 1012.4 MATERIALS delete paragraphs 1012.4.1.1 and 1012.4.1.2 in their entirety and replace with the following:

Grass Seed Mix shall include the following species and rates:

Indian Rice Grass	5 lb/ac
Galleta	5 lb/ac
Sideoats Gramma	5 lb/ac
Blue Gramma	5 lb/ac
Sand Dropseed	5 lb/ac

Total Grass Seed Mix application rate = 25.0 lbs / acre

Wildflower Seed Mix shall include the following species and rates:

Globemallow	1 lb/ac
Purple Aster	1 lb/ac
Blue Flax	1 lb/ac
Mexican Hat	1 lb/ac
Blanket Flower	1 lb/ac

Total wildflower seed mix application rate = 5.0 lbs / acre

Seed rate is given in pounds of pure live seed (P.L.S.) per acre.

END OF SECTION

SECTION 1502

SUBMITTALS

1502.1 GENERAL

The requirements of this section of the specifications consist of furnishing all manufacturer's data, shop drawings, samples, certifications, guarantees, reports, operation manuals, maintenance manuals, lubrication charts, spare parts lists, special tools and factory representative required for installation of special items, in strict accordance with the specifications and the applicable drawings, and subject to the terms and conditions of the contract.

1502.2 SUBMITTAL CHECK LIST

The Submittal Check List that will be part of the Supplemental Specifications on each project, lists items which will be required to construct the project for which submittals will be required by the ENGINEER. The list of submittals is for the convenience of the CONTRACTOR and supplier, and should not be considered as the complete and final requirements. Additional submittals and material may be required by the ENGINEER as project progresses.

1502.3 WHAT TO SUBMIT

1502.3.1 The following is an explanation of what to submit if indicated on the check list.

A. Manufacturer's Data: Any catalog type literature on the item.

B. Shop Drawings: Detail drawings with all dimensions and locations shown.

C. Samples: The item that will be supplied.

D. Certifications: Any certifications required by these specifications or standard specifications and/or requirements for that item, to cover raw materials and testing of the final product.

E. Guarantees: A copy of the guarantee to be given to the Owner on that item.

F. Lab Test Reports: Laboratory test reports required to show that the item meets all specified requirements.

G. Operation Manuals and Maintenance Manuals: The manufacturer's standard Operation and Maintenance Manuals on that item.

H. Special Tools: A list of special tools required to operate and maintain that item and the number of each tool the manufacturer will supply.

I. Lubrication Charts and Grease Specs: A list of all lubrication points on that item with frequency and type of lubricant to be used at each point.

J. Spare Parts List: A list of spare parts that the manufacturer recommends the Owner maintains.

K. Factor Representative: A factory representative will be required to be present for installation and/or start-up of that item of equipment.

L. Field Test Reports: The field test reports are reports and/or tests that have been conducted on the item in an existing installation over a period of time.

M. Pump and Blower Curves: Certified curves based on the test performance of each pump or blower to be installed on this project.

N. Load Design: Load design calculations shall show the maximum load the item can carry under the support conditions shown on the drawings for both uniform and concentrated loads. These calculations shall be under a New Mexico registered professional engineer's signature.

0. Additional literature, reports and/or tests may be required by the ENGINEER.

1502.3.2 When pumps of any type are part of the project, in addition to the other information required on pump submittals the CONTRACTOR shall submit the following data for each unit of pumping equipment.

A. Name of manufacturer
B. Type of pumps.
C. Number of stages and speed.
D. Diameter of impeller.
E. Type of bearings.
F. Size of suction and discharge piping and barrel.
G. Type of thrust bearing.
H. Shut-off pressure.
I. Impeller material.
J. Pump shaft material and diameter.
K. Capacity and head.
L. Make and type of motor.
M. Horsepower of motor with proper NEMA Standard insulation.
N. Type of motor bearings.
0. Net weight of complete unit.

P. Guaranteed KWH required to pump 1,000 gallons against the required head.
Q. Discharge column:
    Material
    Weight per foot
    Type of Joint
    Spacing of joints
    Inside diameter
R. Line shaft:
    Material
    Diameter
    Length of sections
S. Line Shaft Bearing:
    Length
    Spacing Type
    Material
T. Thrust Bearing:
    Complete computations on thrust conditions.
    Computed pump thrust at shut-off.
    Computed pump thrust at operating condition.
    Rated bearing capacity.
    Manufacturer.
    Method of cooling.
    Weight of bearing.
U. Combined overall efficiency of pump and motor when operating at rated condition.
V. Does equipment offered differ from specification requirement?
W. Do catalogs, descriptive literature, etc., covering all equipment accompany the bid?

SECTION 1502

SUBMITTAL CHECK LIST

SUBMITTALS FOR		Manufacturer's Data	Shop Drawings	Samples	Cerifications	Guarantees	Lab Test Reports	Operation Manuals	Maintenance Manuals	Special Tools	Lubrication Charts & Grease Specs.	Spare Parts List (Recom-mended)	Factory Representative Re-quired for Install.	Field Test Reports
ITEM DESCRIPTION														

SECTION 602: SLOPE AND EROSION PROTECTION STRUCTURES

602.1 DESCRIPTION

This Work consists of providing and placing riprap, gabions, revetment mattresses, sacked concrete revetment, concrete block revetment, wrapped rock faces, and other systems on the Embankment slopes and the sides and bottoms of channels, drain outlets, ditches, and other such locations.

602.2 MATERIALS

Unless otherwise specified in the Contract, the Contractor shall provide slope protection Structures as follows:

1. Hexagonal double-twisted wire mesh riprap, gabions, and revetment mattresses; or
2. Welded wire mesh gabions, revetment mattresses, and wrapped rock faces.

The Contractor shall provide galvanized slope protection items in accordance with ASTM A 641. If specified in the Contract, the Contractor shall coat galvanized items with PVC in accordance with Section 602.2.2.2.9, "PVC Coating."

The Contractor shall provide double-twisted riprap, gabions, and revetment mattresses in accordance with ASTM A 975. The Contractor shall provide welded wire mesh gabions, revetment mattresses, and wrapped rock faces in accordance with ASTM A 974.

602.2.1 Classifications

The Department will classify riprap and gabions in accordance with Table 602.2.1:1, "Riprap Classifications and Gabion Requirements."

The Contractor shall provide riprap with at least 80% of the stones meeting the specified size requirements. The Contractor shall use stones less than the minimum dimensions to fill voids. For riprap Class A, wrapped rock faces, and gabions, the Contractor shall not use stones smaller than the mesh openings.

The Department will classify riprap and gabions in accordance with Table 602.2.1:1 "Riprap Classifications and Gabion Requirements" with the exception of Class D, Derrick Stone. Class D, Derrick Stone will follow the gradation requirements in Table 602.2.1:2 "Gradation Requirements for Class D, Derrick Stone" shown below.

Table 602.2.1:1
Riprap Classifications and Gabion Requirements

Class	Description	Stone volume (ft^3)		Minimum dimension (in)[a]
		Minimum	Maximum	
A	Wire enclosed riprap	1/6	2/3	4
B[b]	Non-enclosed riprap	1	2	6
C[b]	Non-enclosed riprap	2	4	9
E	Grouted riprap	1/3	1	3
F	Grouted riprap	1	2	6
G	Rock plating	—	—	4–8[c]

Table 602.2.1:1
Riprap Classifications and Gabion Requirements

Class	Description	Stone volume (ft^3)		Minimum dimension (in)[a]
		Minimum	Maximum	
N/A	Wrapped rockfacing	—	—	1
N/A	Gabions	—	—	4–8[c]

[a]Minimum size in the least dimension.

[b]Class B and C stone — at least two (2) Fractured Faces.

[c]70% to 80% of the stone — at least four (4) inches but not more than eight (8) inches in the smallest dimension. 30 to 20% of the stone — no larger than four (4) inches in any dimension.

Table 602.2.1:2
Gradation Requirements for Class D, Derrick Stone

Class, Description	Percent of Rock Equal or Smaller By Count, D_X	Range of Intermediate Dimension[1], (inches)	Range of Rock Weight[2], (pounds)
D, Derrick Stone[3]	100	30	5000
	70	24 – 18	1780 – 2500
	40	11 – 14	360 – 500
	20	6 – 8	70 - 100

[1] Intermediate dimension measured as the shortest straight-line distance from one side of the rock or rock particle to the other on the maximum projection plane (plane of rock or rock particle with the largest projected surface area).

[2] Weights based on a specific gravity of 2.65.

[3] Include spalls and rock fragments to provide a stable dense mass.

602.2.2 Riprap, Gabions, and Revetment Mattresses

602.2.2.1 Stone for Riprap, Gabions, Revetment Mattresses, and Rock Faces

Except for Class G riprap, the Contractor shall provide rocks or rough quarry stone with no more than 60% wear, in accordance with AASHTO T 96. The Contractor shall provide stone with a soundness loss of no more than 21, in accordance with AASHTO T 104 using a magnesium sulfate solution with a five (5)-cycle test duration.

The Contractor shall provide stone for riprap, gabions, revetment mattresses, and rockfaces in accordance with Section 602.2.1, “Classifications.”

602.2.2.2 Wire Mesh

The Contractor shall provide non-raveling, double-twisted wire mesh forming hexagons for riprap, gabions, and revetment mattresses in accordance with Section 602.2.2.3, “Pull-Apart Test.” The Contractor shall provide non-raveling welded wire mesh for gabions, wrapped rock faces, and revetment mattresses forming squares or rectangles in accordance with ASTM A 974, Section 7, *Material Properties,* except that the strength requirement for mattress joints is 900 lb per foot instead of 600 lb per foot.

602.2.2.2.1 Wire

The Contractor shall provide soft temper wire with a Class 3 zinc coating for constructing wire mesh in accordance with ASTM A 641. The Contractor shall provide 0.120-inch diameter wire for gabions and riprap and 0.087-inch diameter wire for revetment mattresses and wrapped rock faces.

602.2.2.2.2 Mesh Openings

The Contractor shall ensure that mesh openings are uniform and hexagonal. The Contractor shall make mesh openings for riprap and double-twisted gabions approximately 3 1/4 inch × 4 3/4 inch, and for double-twisted revetment mattresses approximately 2 1/2 inch × 3 1/4 inch. The Contractor shall make mesh openings for welded wire mesh gabions approximately three (3) inch × three (3) inch, and for welded wire mesh revetment mattresses and wrapped rock faces approximately 1 1/2 inch × three (3) inch.

602.2.2.2.3 Selvedges

The Contractor shall mechanically selvedge the edges of double-twisted gabions, revetment mattresses, and wrapped rock face, including, end panels and diaphragms. The Contractor shall use a selvedge wire with a diameter of at least 0.150 inch.

602.2.2.2.4 Lacing and Tie Wire

The Contractor shall provide lacing wire for double-twisted gabions, revetment mattresses, and wrapped rock faces with a diameter of at least 0.087 inch. The Contractor shall provide tie wire for double-twisted gabions and revetment mattresses with a diameter of at least 0.087 inch. The Contractor shall provide tie wire for riprap with a diameter of at least 0.120 inch. The Contractor shall provide lacing and tie wire with the same tensile strength and coating as the mesh wire.

602.2.2.2.5 Spiral Binders

The Contractor shall provide spiral binders for welded wire mesh gabions, revetment mattresses, and wrapped rock faces, of the same wire quality as the mesh wire with a diameter of at least 0.106 inch. Unless otherwise approved, the Contractor shall provide spiral binders with a maximum inside diameter of 2 1/2 inches and with a maximum pitch of three (3) inches.

602.2.2.2.6 Alternate Fasteners

The Contractor may use alternative fasteners, such as ring fasteners, with double-twisted wire mesh, and welded wire mesh riprap, gabions, revetment mattresses, and wrapped rock faces, if approved by the Project Manager. The Contractor shall provide wire for alternative fasteners in accordance with Section 602.2.2.2.5, “Spiral Binders.”

602.2.2.2.7 Minimum Strength of Fasteners

The Contractor shall use fasteners that provide a minimum strength of 1,400 lb per foot for gabion baskets, and 900 lb per foot for revetment mattresses and wrapped rock faces.

602.2.2.2.8 Approval of Alternative Fasteners

The Contractor shall use a certified Laboratory to test alternative fasteners in accordance with Section 602.2.2.3, “Pull-Apart Test.” At least 60 Days before using alternative fasteners, the Contractor shall submit CTRs to the Project Manager verifying that the fasteners meet the pull-apart test requirements.

The Contractor shall provide a description of the fastener, with drawings and photographs showing the number of fasteners required, details of the fasteners, and load capacities. In addition the Contractor shall:

1. Lock and close each interlocking fastener. For gabions, use fasteners in every other opening. For revetment mattresses and wrapped rock faces, use fasteners in every opening; and
2. Close each overlapping ring fastener and overlap ends a minimum of one (1) inch. Provide one (1) ring for each opening.

The Department will allow this fastener for forming individual baskets, but not for interconnecting baskets.

602.2.2.2.9 PVC Coating

The Contractor shall provide PVC coating with an average thickness of 0.0216 inch and a minimum thickness of 0.0150 inch per side. The Contractor shall apply PVC coating over the galvanizing.

The Contractor shall coat the galvanized wire with extruded or fusion bonded PVC Material. Unless otherwise specified, the Contractor shall use a gray or green colored coating. The Contractor shall use a PVC coating that meets the following requirements:

1. Specific gravity of from 1.20 to 1.40, if tested in accordance with ASTM D 792;
2. Abrasion resistance of less than 12% weight loss, if tested in accordance with ASTM D 1242-95A, Method B at 200 cycles, CSI-A Abrader Recording, 80 grit;
3. Brittleness temperature no higher than 15° F, if tested in accordance with ASTM D 746;
4. Tensile strength no less than 2,980 psi for extruded coating, if tested in accordance with ASTM D 412; and no less than 2,275 psi for fusion bonded coating, if tested in accordance with ASTM D 638;
5. Modulus of elasticity no less than 2,700 psi at 100% strain for extruded coating, if tested in accordance with ASTM D 412; and no less than 1,980 psi at 100% strain for fusion bonded coating, if tested in accordance with ASTM D 638;
6. Ultraviolet light exposure for a test period of no less than 3,000 h, using apparatus Type E at 145 °F, if tested in accordance with ASTM G 152; and
7. Salt spray test for a test period of no less than 3,000 h, if tested in accordance with ASTM B 117.

602.2.2.3 Pull-Apart Test

602.2.2.3.1 Sample Preparation

The Contractor shall prepare two (2) identical rectangular panels along a selvedge wire, each about 10 1/2 mesh-openings wide. The Contractor shall attach the two (2) panels along the two (2) selvedge wires using the proposed fastener system. If the Contractor uses alternative fasteners to join two (2) individual gabion baskets, the Contractor shall include two (2) additional selvedge wires (each mechanically wrapped with mesh wires) so that each fastener contains two (2) selvedges and two (2) mesh wires.

602.2.2.3.2 Test Procedures

The Contractor shall mount the joined test panels in a loading machine with grips or

clamps that secure the panels uniformly along the full width. The Contractor shall use grips or clamps designed to transmit only tension forces. The Contractor shall apply the load at a uniform rate of 50.7 lb per second until failure occurs. The Department will define failure as a drop in strength under continuous loading or, when an opening between two (2) joined selvedge wires exceeds two (2) inch. The minimum allowable strength at failure is 1,400 lb per foot for joined gabions; and 900 lb per foot for joined revetment mattresses and wrapped rock face panels.

602.2.2.4 Certification

The Contractor shall submit a certificate, to the Project Manager, stating that the following proposed items meet the requirements of this Specification before their use:

1. Wire mesh;
2. Gabion baskets;
3. Lacing wire;
4. Tie wire; and
5. Approved alternative fastener systems.

602.2.2.5 Stakes

The Contractor shall use steel railroad rails, standard weight galvanized steel pipe, or steel angles for riprap stakes. The Contractor shall use railroad rails with a unit weight of at least 30 lb per yard. The Contractor shall use standard weight galvanized steel pipe with a minimum outside diameter of four (4) inches. The Contractor shall use steel angles that are at least four (4) × four (4) × 3/8 inch.

602.2.2.6 Grout

The Contractor shall provide portland cement, aggregate, and water for grout in accordance with Section 509, “Portland Cement Concrete Mix Designs.”

602.2.2.7 Material

The Contractor shall provide geotextile (filter fabric) Class one (1) as per Section 604, “Soil and Drainage Geotextiles.”

602.2.3 Sacked Concrete Revetment

The Contractor shall provide sacked concrete revetment from a vendor on the Department’s *Approved Products List.* The Contractor shall provide bags of concrete that weigh from 60 lb to 80 lb each, dry weight, and contain from 0.018 yd^3 to 0.025 yd^3 of concrete. The Contractor shall ensure each bag contains one (1) of the following mixes:

1. One (1) part cement to three (3) parts sand;
2. A mix design in accordance with the Contract; or
3. A mix design approved by the State Materials Bureau.

The Contractor shall provide a concrete mix capable of attaining a minimum compressive strength of 3,500 psi after 28 Days, unless otherwise specified in the Contract. The Contractor shall keep the sacked concrete in dry storage until application.

602.2.3.1 Packaging

The Contractor shall use permeable, biodegradable sacks made of jute, cotton, or scrim-reinforced paper that are capable of holding the sand-cement mix without significant leakage and allowing sufficient water to hydrate the concrete mix.

The Contractor shall provide non-asphaltic, three (3)-layer laminated, polyester-fiber-scrim-reinforced paper sacks. The Contractor shall perforate each of the three (3) layers and offset the perforations to prevent cement leakage.

The Contractor shall use only one (1) type and size of sack throughout the Project, unless otherwise specified in the Contract.

602.2.3.2 Portland Cement

The Contractor shall provide portland cement in accordance with Section 509, “Portland Cement Concrete Mix Designs.”

602.2.3.3 Aggregate

The Contractor shall provide fine aggregate in accordance with Section 509, “Portland Cement Concrete Mix Designs.”

602.2.3.4 Steel Anchorage

The Contractor shall provide steel staples in accordance with Section 540, “Steel Reinforcement.” The Contractor shall use steel staples either epoxy coated in accordance with AASHTO M 284, or galvanized in accordance with ASTM A 153.

602.2.4 Concrete Block Revetment

The Contractor shall provide concrete block revetment products from the Department’s *Approved Products List.* The Contractor shall provide concrete block units compatible with the geotextiles being used and with a minimum compressive strength of 3,000 psi, unless otherwise specified in the Contract.

602.3 CONSTRUCTION REQUIREMENTS

602.3.1 General Placement Requirements

The Contractor shall place riprap stones forming a continuous blanket in accordance with the Contract. Unless otherwise specified, the Contractor shall construct rock plating using riprap Class G to minimum thickness of 12 inches. The Contractor shall place stones with the long axis parallel to the toe of the slope, with a stable bearing upon the underlying soil or stones.

The Contractor shall place large stones as close together as possible. The Contractor shall use smaller stones to fill the areas between the larger stones, except when the Contract requires Class E or F (grouted) riprap.

The Contractor shall ensure that the finished riprap surface varies no more than three (3) inches from the specified slope; and derrick stone riprap varies no more than eight (8) inches from the specified slope.

Unless otherwise specified, the Contractor shall place the riprap foundation course in a trench excavated to 24 inches below the toe of the slope of the Embankment or side of channel.

The Contractor shall place a layer of Class 1 geotextile filter fabric between the slope and erosion protection Structures, and the backfill Material.

602.3.1.1 Grouted Riprap Placement

The Contractor shall fill riprap voids with grout to the full riprap thickness. After placing grout, the Contractor shall sweep the riprap surface with a stiff broom.

The Contractor shall protect grout from freezing for at least four (4) Days after placement.

The Contractor shall cure grouted riprap placed in hot, dry weather in accordance with Section 511.3.9, “Curing.”

602.3.1.2 Proportioning and Mixing Grout

The Contractor shall use grout that consists of one (1) part portland cement and three (3) parts fine aggregate (by volume). The Contractor shall mix with water to a workable consistency.

602.3.1.3 Class A Riprap Placement

The Contractor shall enclose Class A riprap with wire mesh drawn tightly on all sides. The Contractor may connect wire mesh using approved fasteners or lacing wire. The Contractor shall weave adjacent edges at least once with double loops of lacing wire that is as strong and flexible as the mesh.

The Contractor shall provide continuous lacing as far as possible that passes through each mesh opening. Where splicing is necessary, the Contractor shall overlap the lacing at least 12 inches.

The Contractor shall space galvanized wire ties connecting top and bottom mesh layers approximately 24 inches on centers. The Contractor shall anchor the ties to the bottom wire-fabric layer. The Contractor shall extend the ties through the rock layer and secure to the top wire-fabric layer. The Contractor shall anchor wire-enclosed riprap to slopes with steel stakes driven into the Embankment. The Contractor shall space stakes in accordance with the Contract.

602.3.1.4 Placement of Geotextile

The Contractor shall place Class 1 non-woven geotextile (filter fabric) between the riprap or revetment mattresses and the supporting soil. The Contractor shall ensure that the fabric is in accordance with Section 604, “Soil and Drainage Geotextiles.”

602.3.2 Sacked Concrete Revetment Placement

The Contractor shall place sacked concrete revetment within ± 0.2 ft of the specified grade and slope, or as directed by the Project Manager.

The Contractor shall place the foundation course in a trench excavated to 24 inches below the toe of the slope of the Embankment or side of channel. The Contractor shall stagger the sack ends and steel staple anchors of succeeding courses.

The Contractor shall tamp each row of sacks, round out the bags, eliminate wrinkles, minimize voids, and prepare an even surface for the next row.

The Contractor shall obtain the Project Manager's approval of the compaction method prior to backfill and compact soil behind each row of sacks before placing the next row. The Contractor shall not place large stones and jagged objects adjacent to the bags.

The Contractor shall anchor the sacks with steel staples without damaging the sacks.

After placing the sacks, the Contractor shall wet thoroughly and keep moist for at least three (3) Days.

602.3.3 Concrete Block Revetment Placement

The Contractor shall construct concrete block revetment systems in accordance with the manufacturer's recommendations and the Contract.

The Contractor shall remove slope obstructions, and fill voids with approved Material or grade slopes before placing concrete blocks.

602.3.4 Gabions

The Contractor shall supply gabions within ± five percent (5%) of the manufacturer's stated sizes.

602.3.4.1 Assembly of Gabion Baskets

The Contractor shall fabricate gabions for individual assembly at the construction site.

If a gabion is greater than 1 1/2 times as long as it is wide, the Contractor shall divide the gabion into cells using diaphragms of the same wire mesh as the body of the gabion. The Contractor shall create cells that are no longer than the gabion is wide and anchor diaphragms to the base section of the gabion. The Contractor shall selvedges or bind perimeter edges so the joints are as strong as the gabion body. The Contractor shall assemble perimeter edges using approved fasteners or lacing wire. The Contractor shall place fasteners in each mesh opening. The Contractor shall secure lacing wire by double looping through every other mesh opening. The Contractor shall assemble gabions using one (1) of the following:

1. Double looped lacing twice; or
2. Connect with approved fasteners and double looped lacing once.

602.3.4.2 Foundation Preparation

The Contractor shall level and compact the top six (6) in of the gabion foundation to at least 95% of maximum density in accordance with AASHTO T 180 (Modified Proctor), Method D (TTCP Modified), and to field densities in accordance with AASHTO T 310.

602.3.4.3 Placement of Gabion Baskets

The Contractor shall set assembled, empty baskets into the specified positions and wire each unit to adjacent units along the top and vertical edges before placing stone.

602.3.4.4 Placement of Gabion Stone

The Contractor shall place stone in equal layers of from nine (9) inch to 12 inch. The Contractor shall minimize local deformations by not filling a gabion more than 12 inches higher than an adjacent gabion. The Contractor shall hand place stone at exposed surfaces.

The Contractor shall provide cross-connecting wires on gabions with cells 18 inches or higher. The Contractor shall place cross connecting wires directly above each layer of stone. The Contractor shall equally space and tightly tie two (2) connecting wires in each direction for each layer through two (2) mesh openings at opposite faces of each gabion cell.

The Contractor shall maintain alignment while filling gabions (minimizing voids and bulges, and finishing to a neat square appearance).

After filling, the Contractor shall bend the lid over and tightly bind to the perimeters and diaphragms in accordance with Section 602.3.4.1, “Assembly of Gabion Baskets.”

602.3.4.5 Gabion Marking

The Contractor shall mark each gabion in an identifiable manner that clearly indicates its size.

602.3.4.6 Placement of Geotextile

The Contractor shall install Class 1 non-woven geotextile (filter fabric) between gabion baskets and supporting soil, and between gabion baskets and backfill.

602.3.5 Placement of Wrapped Rock Faces

The Contractor shall place wrapped rock faces within ± 0.2 ft of the specified grade and slope.

The Contractor shall place the foundation course 18 inches below the toe of the slope of the Embankment or side of channel.

The Contractor shall place each level of welded wire forms with biaxial geogrid embedded in the rock face in accordance with the Contract, and tensioned with anchor pins to remove slack. The Contractor shall lap the geogrid a minimum of 12 inches at the edges of adjacent panels. The Contractor shall tamp the welded wire form face to eliminate wrinkles, minimize voids, and finish to an even surface.

The Contractor shall backfill and compact behind each welded wire form level before placing the next row. The Contractor shall obtain the Project Manager's approval of the compaction method.

602.4 METHOD OF MEASUREMENT

The Department will measure *Riprap Class___ and Sacked Concrete Revetment* based on the specified thickness and Accepted surface area.

The Department will measure *Concrete Block Revetment* and *Wrapped Rockfacing* based on the Accepted surface area.

The Department will measure *Gabions* and *Revetment Mattresses* based on the specified basket dimensions.

602.5 BASIS OF PAYMENT

Pay Item	Pay Unit

Riprap Class___	Cubic Yard
Riprap Class G	Square Yard
Sacked Concrete Revetment	Cubic Yard
Concrete Block Revetment	Square Yard
Gabions	Cubic Yard
Revetment Mattresses	Cubic Yard
Wrapped Rockfacing	Square Yard

602.5.1 Work Included in Payment

The following Work and items will be considered as included in the payment for the main item(s) and will not be measured or paid for separately:

1. Excavation, backfilling and disposal of Material required for the placement of slope and erosion protection Structures;
2. Dewatering; and
3. Stakes and steel staples, drainage geotextile(s).

SECTION 604: SOIL AND DRAINAGE GEOTEXTILES

604.1 DESCRIPTION

This Work consists of providing and installing geotextiles.

604.2 MATERIALS – RESERVED

604.2.1 Classifications

The Contractor shall use the class of geotextile in accordance with Table 604.2.1:1, "Cross Reference of Old Classes to New Classes of Geotextiles."

Table 604.2.1:1
Cross Reference of Old Classes to New Classes of Geotextiles

Geotextile	Old class	New class
Subsurface drainage	A or B	2 or 3
Sediment control	B	2
Erosion control	C or D	1 or 2
Separation	C or D	2 or3
Stabilization	None	1

The Department specifies Class 1 for more severe or harsh installation conditions where there is a great potential for geotextile damage and specifies Class 2 and 3 for less severe conditions.

604.2.2 Subsurface Drainage Geotextiles

The Department prohibits the use of woven slit film geotextiles or geotextiles made from yarns of a flat, recording-like character.

The Contractor shall provide Class 2 geotextiles for drain system installations that require use of very coarse, sharp angular aggregate with a one (1) inch diameter or greater, or require a depth of trench greater than six (6) ft.

The Contractor shall provide Class 3 geotextiles for general underdrain installations that require smooth graded surfaces having no sharp angular projections and fine aggregate.

604.2.3 Erosion Control Geotextiles

The Department prohibits the use of woven slit film geotextiles or geotextiles made from yarns of a flat recording-like character. If the Contractor uses a woven monofilament geotextile, the Contractor shall provide a Class 2 geotextile; otherwise the Contractor shall provide a Class 1 geotextile.

604.2.4 Separation Geotextiles

The Contractor shall provide separation geotextiles that are of woven or non-woven Material.

The Contractor shall use a Class 2 separator for Pavement Structures constructed over soils with an R-value greater than 20 to separate dissimilar Materials where water seepage is

allowable. The Contractor shall use Class 2 geotextiles where installation requires a depth of trench greater than ten (10) ft, where stone drop height is to be more than zero (0), or where there is no sand cushion protection. The Department requires field trials where stone drop height exceeds three (3) ft or where individual stone weight exceeds 250 lb.

The Contractor shall use Class 3 geotextiles to prevent mixing of a Subgrade soil and an aggregate cover Material (Subbase, base, select Embankment, etc.), to separate dissimilar Materials where water seepage is allowable. The Contractor shall not use Class 3 geotextiles under pavement. The Contractor may also use Class 3 geotextiles in Structures or under conditions where the geotextile is protected by a sand cushion or by "zero (0) drop height" placement of stone.

The Contractor shall use Table 604.2.4:1, "Required Class of Separator Geotextile and Cover Thickness for R-values Greater Than or Equal to 20," to determine the class of separator geotextile and the required minimum thickness.

Table 604.2.4:1
Required Class of Separator Geotextile and Cover Thickness for R-values Greater Than or Equal to 20

Required minimum cover thickness, compacted	Required class of geotextile
6 inch.	2
12 inch.	3

The Contractor shall not use aggregate larger than one (1) inch.

604.2.5 Stabilization Geotextiles

The Contractor shall provide stabilization geotextile in wet, saturated conditions to provide separation, filtration, and also reinforcement. The Contractor shall use stabilization geotextiles for Pavement Structures constructed over soils with R-values from ten (10) to 20. The Contractor may provide stabilization geotextiles made of woven or non-woven Material.

The Contractor may use stabilization geotextiles in applications that require a design by a licensed professional Engineer. The Contractor shall obtain Department approval of these designs.

604.2.6 Certification

For each class of geotextile fabric, the Contractor shall provide a certificate from the manufacturer stating that the geotextile meets the physical and chemical requirements in accordance with AASHTO M 288, and that geotextile fabric meets R-value requirements for the respective application.

The Contractor shall include in the certification the product name, chemical composition of the filaments or yarns, or other relevant information to fully describe the geotextile.

The Contractor shall submit the certification to the Project Manager before geotextile placement.

R-values corresponding to California bearing ratio (CBR) used in AASHTO M 288 are presented in Table 604.2.6:1, "CBR Values Used in AASHTO M 288 and Corresponding R-values."

Table 604.2.6:1
CBR Values Used in AASHTO M 288 and Corresponding R-values

Soil strength (CBR)	Corresponding R-value
1	10
2	15
3	20

604.3 CONSTRUCTION REQUIREMENTS

604.3.1 Geotextile Packaging, Storage, and Handling

The Contractor shall use geotextile rolls wrapped with a Material to protect the geotextile, including the ends of the roll, from damage.

The Contractor shall cover and elevate geotextile rolls during storage to protect them from the following:

1. Site construction damage (tearing, excessive mud, wet cement, or epoxy);
2. Precipitation;
3. Extended ultraviolet radiation including direct sunlight;
4. Chemicals that are strong acids or strong bases;
5. Flames including welding sparks; and
6. Temperatures above 160 °F and below -22 °F.

604.3.2 Geotextile Exposure After Placement

The Contractor shall not expose geotextiles to the elements after placement for more than 14 Days, unless otherwise directed by the Project Manager.

604.3.3 Site Preparation

The Contractor shall prepare the installation site by clearing and grading the area and preparing a firm, smooth surface on which to place the geotextiles. The Contractor shall remove sharp objects and large stones and cut trees and shrubs flush with the smooth surface.

The Contractor shall ensure correct orientation (roll direction). The Contractor shall place geotextiles as smoothly as possible on the prepared surface; pull tight, align, and anchor such that the geotextile is free of wrinkles and does not show evidence of holes, tears, or rips before placing cover Material on the geotextile. Before placing cover Material, the Contractor shall hold geotextiles in place by pins, staples, or piles of fill or rock as required by fill placement procedures. On curves, the Contractor shall fold or cut geotextiles to conform to the curve.

The Department will not allow vehicles directly on the geotextile, but will allow vehicles after the Contractor places at least six (6) inches of cover Material on the geotextile. The Contractor shall not allow vehicles to turn on the cover Material until at least two (2) lifts of cover Material have been placed.

604.3.4 Backfill

The Contractor shall obtain approval from the Project Manager before beginning backfill operations. The Contractor shall not end dump backfill directly onto exposed geotextile. The

Contractor shall backfill by end dumping onto previously spread backfill and then pushing the dumped backfill over the exposed geotextile. On Subgrades having an R-value less than ten (10), the Contractor shall dump and spread the Material placed on the geotextile to minimize the potential of a localized Subgrade failure.

The Contractor shall backfill in layers from six (6) inches to eight (8) inches deep (uncompacted) unless otherwise specified in the Contract. After placement, the Contractor shall compact each lift to 95% of maximum density in accordance with AASHTO T 180 (Modified Proctor), Method D (TTCP Modified). The Contractor shall compact the top lift in accordance with Section 207, "Subgrade Preparation." The Contractor may use vibratory compaction Equipment on initial layers of Material, if approved by the Project Manager.

The Contractor shall repair ruts occurring during construction by filling with additional Material and compacting to the specified density to maintain an even backfill surface and the minimum lift thickness over the geotextile.

The Contractor shall obtain the Project Manager's approval of geotextile placement before covering.

604.3.5 Subsurface Drainage Geotextiles

The Contractor shall place geotextiles in accordance with Section 605, "Drains," where specified.

The Contractor shall use subsurface drainage geotextiles against soil in an underground drainage system or in an edgedrain to allow for long-term passage of water into a subsurface drain system while retaining the in-situ soil. The primary function of the geotextile in subsurface drainage applications is filtration.

The Contractor shall provide one (1) soil sample to the Department for testing to confirm the applicable apparent opening size based on the percent of in-situ soil passing the No. 200 sieve and cohesiveness (PI).

The Contractor shall compact the aggregate with vibratory Equipment to a minimum compaction of 95% of maximum density in accordance with AASHTO T 180 (Modified Proctor), Method D (TTCP Modified). If a higher compactive effort is necessary, the Contractor shall substitute a geotextile suited for more severe installation conditions.

604.3.6 Sediment Control Geotextiles

The Contractor shall place geotextiles in accordance with Section 603, "Temporary Erosion and Sediment Control," where necessary.

The Contractor shall place and maintain sediment control geotextiles as a temporary control measure to prevent eroded soil from being transported off the construction site to rivers, streams, and impoundments and to prevent damage to private property from storm water runoff.

604.3.7 Erosion Control Geotextiles

The Contractor shall place geotextiles in accordance with Section 602, "Slope and Erosion Protection Structures," where necessary.

The Contractor shall use erosion control geotextiles between erosion control Structures (rip-rap and gabions) and the in-situ soil to prevent soil loss resulting in excessive scour and to

mitigate hydraulic uplift pressures that may cause instability of an erosion control Structure.

604.3.8 Separation/Stabilization Geotextiles

The Contractor shall use separation/stabilization geotextiles as a semi-permeable separator to prevent mixing of a Subgrade soil and sub-base or base Material.

The Contractor shall fold, overlap, sew, or join adjacent geotextile rolls in accordance with Table 604.3.8:1, "Minimum Overlap Requirements for Separation/Stabilization Geotextiles," unless manufacturer's recommendations or the Contract are more stringent.

Table 604.3.8:1
Minimum Overlap Requirements for Separation/Stabilization Geotextiles

Soil strength R-value	Un-sewn seams overlap (inch)	Sewn seams overlap (inch)
<10	—	9
10–15	40	8
15–20	30	3
>20	24	—

The Contractor shall ensure that both factory and field sewn or sealed seams meet or exceed the strength requirements as required by the manufacturer.

604.3.9 Repair of Damaged Geotextiles

To repair subsurface drainage, erosion control, and sediment control geotextiles, the Contractor shall clear the damaged area and repair in accordance with the manufacturer's recommendations. The Contractor shall obtain the Project Manager's approval of repairs.

To repair separation/stabilization geotextiles, the Contractor shall clear the damaged area plus an additional three (3) ft around the damaged area and repair in accordance with Table 604.3.8:1, "Minimum Overlap Requirements for Separation/Stabilization Geotextiles," unless manufacturer's recommendations or the Contract are more stringent. The Contractor shall replace removed cover Material and compact to the specified density.

604.4 METHOD OF MEASUREMENT

The Department will only measure the area of one (1) layer at geotextile overlaps.

604.5 BASIS OF PAYMENT

Pay Item	Pay Unit
Geotextile Class	Square Yard

Payment for achieving Subgrade preparation in accordance with Section 207, "Subgrade Preparation" will be paid as Subgrade Preparation.

604.5.1 Work Included in Payment

The following Work and items will be considered as included in the payment for the main item(s) and will not be measured or paid for separately:

1. Repair of damaged geotextile fabric as a result of the Contractor's negligence, improper shipping, handling, packaging, or storing;

2. Geotextile packaging, storage and handling; and
3. Overlaps, anchoring, splicing and seam assemblies.

SECTION 607: FENCE

607.1 DESCRIPTION

This Work consists of constructing fence and gates.

607.2 MATERIALS

607.2.1 Certification

The Contractor shall submit independent testing Laboratory certification to the Project Manager that indicates the fencing Materials meet these Specifications. The Department may inspect the manufacturing methods at manufacturing plants and may obtain Material samples for testing and may base Acceptance on the quality of manufacturing lots.

607.2.2 Barbed Wire and Woven Wire Fence

607.2.2.1 Wire

The Contractor shall provide wire and wire components with at least a Class 1 zinc coating in accordance with ASTM A 121 or ASTM A 116, unless otherwise specified in the Contract. Instead of Class 1 coating, the Contractor may coat the wire with aluminum alloy covering at least 0.3 oz per square foot of wire surface.

607.2.2.1.1 Barbed Wire

The Contractor shall provide barbed wire and barbs in accordance with ASTM A 121. The Contractor shall provide composite barbed wire strands that consist of two (2) coated wires with diameters of 0.099 inch. The Contractor shall provide round barbs that have a coated diameter of 0.08 inch, with either two (2)-point barbs spaced four (4) inches apart or four (4)-point barbs spaced five (5) inches apart. The Contractor shall provide stays for barbed wire fences in accordance with ASTM A 116, with a coated diameter of at least 0.142 inch and with lengths and spacing in accordance with the Contract.

607.2.2.1.2 Woven Wire

The Contractor shall provide woven wire in accordance with ASTM A 116, Design Number 832-6-11, unless otherwise specified in the Contract.

607.2.2.1.3 Post Fasteners

The Contractor shall provide coated staples with a diameter of at least 0.148 inch and a length of at least 1 1/2 inch; use for fastening fence wire to wood posts.

607.2.2.1.4 Brace Wire

The Contractor shall provide coated brace wire with a diameter of at least 0.148 inch; use for constructing braces and intermediate braces with wood posts.

607.2.2.1.5 Tie Wire

The Contractor shall provide coated tie wire for fastening barbed or woven wire to steel posts with a diameter of at least 0.099 inch. The Contractor may use wire fasteners or metal clamps with thicknesses of 0.12 inch or greater instead of tie wires, if approved by the Project Manager.

607.2.2.2 Posts

The Contractor shall provide metal or wood corner, brace, intermediate brace gate, and line posts of the specified type, size, and length in accordance with the Contract. The Contractor shall permanently cap all vertical metal pipes on fence and gate supports. The Contractor shall ensure that the top coating and color of the pipe is maintained.

607.2.2.2.1 Metal Posts

The Contractor shall provide metal posts and braces of rail, billet, or commercial-grade steel in accordance with ASTM A 702 or ASTM F 1083 for galvanized, standard weight pipe. The Contractor shall provide C-section posts in accordance with ASTM A 1011.

The Contractor shall galvanize steel posts in accordance with AASHTO M 181 for Grade 1 steel and provide a top coating specified for Grade 2 steel, or an equivalent or better coating, from the Department's *Approved Products List.* The Contractor shall coat edges and damaged areas of posts in accordance with ASTM A 780. The Contractor shall use posts of the same coating and color.

The Contractor shall provide posts that weigh no less than 95% of the specified weight; and are of the specified length + two (2) inch, - one (1) inch.

The Contractor shall provide line posts with a minimum weight of 1.33 lb per foot, not including anchor plates. The Contractor may provide I-beam, T-beam, U-beam, Y-bar, or C-section line posts. The Contractor shall provide line posts with corrugations, lugs, ribs, or notches spaced one (1) inch on centers to attach fence wire. The Department will not Accept posts with punched tabs used for crimping around the wire.

The Contractor shall provide anchor plates with an area of at least 18 $inch^2$ and that weigh at least 0.67 lb. The Contractor shall clamp, weld, or rivet anchor plates to the post section to prevent displacement when driving the posts.

607.2.2.2.2 Wood Posts

The Contractor shall provide wood posts cut from live southern yellow pine, lodge pole pine, or ponderosa pine trees. The Contractor shall provide straight posts that are free of decay and other defects, bark-free, trimmed smooth of knots and projections, and with both ends sawed off perpendicular to the centerline.

The Contractor shall provide an average nominal diameter at the top of each post of at least six (6) inches. The Contractor shall ensure the circumference of corner, brace, intermediate brace, and gate posts is at least 19 inches, measured six (6) inches below the top of the post.

The Contractor may provide line posts with a slight crook in one (1) direction, but the post may not vary more than 1 1/2 inch from a straight line connecting both ends of the post. The Contractor shall ensure the average nominal diameter of the top of each line post is at least three (3) inches. The Contractor shall ensure the circumference of line posts is at least nine (9) inches, measured six (6) inches below the top of the post.

The Contractor shall provide coast region douglas fir or New Mexico red spruce or fir braces for wood posts.

607.2.2.2.2.1 Preservative Treatment of Wood Posts

The Contractor shall provide wood posts pressure treated with pentachlorophenol in accordance with Section 550.2.2, “Preservatives and Treatment Methods,” treated according to AASHTO M-133, all in accordance with AWPA Standard U1 and Commodity Standard B: Posts and AWPA Standards P8 and P9.

607.2.2.3 Gates

The Contractor shall provide two (2)-inch 16-gauge tubular gates meeting the requirements of ASTM A513 with a wall thickness of .065 inches and a tolerance of plus (+0.003) or minus (-0.011) unless otherwise specified in the Contract.

Gates shall be coated in accordance with Section 607.2.2.2.1, “Metal Posts,” or coat in accordance with Section 545, “Protective Coating for Miscellaneous Structural Steel.” The Contractor shall use “Interstate Green” as the finished color coating, except for galvanized gates and unless otherwise shown in the Contract.

607.2.2.4 Fittings

The Contractor shall provide fittings, hardware, and appurtenances for fences and gates that are of commercial-quality steel, malleable iron, or wrought iron, and galvanized in accordance with ASTM A 153.

607.2.3 Chain Link Fence

607.2.3.1 Posts

The Contractor shall provide posts that are tubular steel, H-column, or C-section (for line posts). The Contractor shall provide either Grade 1 or Grade 2 steel posts in accordance with AASHTO M 181. The Contractor shall provide Grade 1 tubular posts, braces, and top rails in accordance with ASTM F 1083 for galvanized, standard weight pipe. The Contractor shall provide Grade 2 steel posts in accordance with ASTM A 1011 or ASTM A 653.

The Contractor shall provide C-section line posts in accordance with ASTM A 1011. The Contractor shall provide H-column posts in accordance with ASTM A 36.

The Contractor shall provide pipe with minimum wall thickness as specified in the Contract. The Contractor shall ensure that the product of the yield strength and section modulus of the pipe is in accordance with ASTM F 1083.

The Contractor shall provide posts that securely hold tension wires in position without vertical movement.

607.2.3.2 Fittings

The Contractor shall provide fittings in accordance with Section 607.2.2.4, “Fittings.”

The Contractor shall provide stainless steel straps and seals in accordance with ASTM A 176.

The Contractor shall provide coated tension wires that are galvanized coil spring steel wire of commercial quality with a diameter of 0.148 inch. The Contractor shall provide galvanized ferrules for tension take-up in accordance with ASTM A 1011.

The Contractor shall provide pull cable and tension truss rods with diameters of at least

3/8 inch, with drop forged turnbuckles or other approved tension devices.

The Contractor shall provide pull cable and tension wires with a minimum zinc coating of 0.8 oz per square foot of uncoated individual wire surface, tested in accordance with ASTM A 90.

The Project Manager will determine the uniformity of the coating by visual inspection. The Project Manager may reject coating with excessive roughness, blisters, discoloration spots, bruises, and flaking. The Department may make other inspections and tests at the manufacture's plant, before shipment.

607.2.3.3 Tie Wires and Fasteners

The Contractor shall provide galvanized, coated tie wires for fastening chain link fabric to posts and rails with a diameter of at least 0.148 inch. The Contractor may provide galvanized steel or non-corrosive metal bands or fasteners instead of tie wires, as recommended by the manufacturer.

607.2.3.4 Compression Braces

The Contractor shall provide compression braces that meet the same requirements as top rails in accordance with Section 607.2.3.1, "Posts."

607.2.3.5 Chain Link Fabric

The Contractor shall provide chain link fabric in accordance with AASHTO M 181, with a Class C coating or better. The Contractor shall provide chain link fabric full height. The Contractor shall provide galvanized, coated wire with a diameter of 0.148 inch. The Contractor shall provide two (2) inch mesh fabric. The Contractor shall measure the mesh size as the distance between the wires forming parallel sides of the mesh.

607.2.3.6 Gates

The Contractor shall provide double drive, single drive, or single walk gates. The Contractor shall provide galvanized steel pipe gate frames in accordance with ASTM F 1083 and ASTM A 123.

607.2.3.7 Vinyl-Coated Chain Link Fence

The Contractor shall provide vinyl-coated chain link fences in accordance with Section 607.2.3, "Chain Link Fence," except as modified in this subsection.

If providing PVC coated chain link fabric, the Contractor shall use vinyl-coated fabric, posts, and hardware in accordance with AASHTO M 181 for Class A PVC coating. The Contractor shall continuously bond the vinyl coating (do not spray or dip) over the galvanized steel wire by the extrusion bonding process under pressure.

The Contractor shall ensure the vinyl coating resists damage from prolonged exposure to dilute solutions of common mineral acids, sea water, and dilute solutions of salts and alkali.

The Contractor shall galvanize using the electrolytic process before coating with PVC.

The Contractor shall provide wire that was vinyl-coated before weaving and is free and flexible at the joints.

607.2.4 Post and Cable Access Fence

607.2.4.1 Cable

The Contractor shall provide wire cable in accordance with AASHTO M 30. The Contractor shall provide cable of Type I, Class A, 0.75 in diameter rope, unless otherwise specified in the Contract.

607.2.4.2 Hardware and Fittings

The Contractor shall provide galvanized or cadmium plated parts, hardware, and fittings. The Contractor shall galvanize in accordance with AASHTO M 232. The Contractor shall provide cadmium plating in accordance with ASTM B 766, for Class 12, Type III. The Contractor shall provide bolts in accordance with ASTM A 307 and nuts in accordance with ASTM A 563.

The Contractor shall provide externally threaded fittings such as end tie rods, anchor rods, and splicing rods that transmit direct tensile stress, having a minimum tensile strength of 75,000 psi.

The Contractor shall provide internally threaded fittings such as turnbuckles, cable sockets, and nuts capable of withstanding a proof load that is 85% of the proof load requirements for nuts, as specified in accordance with ASTM A 563, Table 3.

The Contractor shall provide cable splices and connections that withstand a proof load equal to the tensile strength required of the attached wire rope cable.

The Contractor shall provide steel rectangular plate washers and cable clamps with a minimum tensile strength of 60,000 psi. The Contractor shall provide plain washers of ferrous metal in accordance with ANSI B 18.22.1, Type A.

607.2.4.3 Wood Posts

The Contractor shall provide wood posts from one (1) of the following species:

1. Northern White Cedar;
2. White Pine;
3. Jack Pine;
4. Red (Norway) Pine;
5. Southern Yellow Pine; or
6. Ponderosa Pine.

The Contractor shall provide posts from live trees that are stacked and properly seasoned. The Contractor shall peel the entire length of each post, closely trim knots, saw both ends square, and shave the entire length of the post to the white.

The Contractor shall provide posts with a top diameter after shaving of four (4) inches; -1/2 inch, +1 1/4 inch.

The Contractor shall ensure posts are free of sap rot, woodpecker holes, plugged holes, ant-eaten areas, and hollow knots extending to center of the post. The Contractor shall not allow butt rot to exceed five percent (5%) of the butt area. The Contractor shall provide posts with sound tops, however, the Department will allow one (1) pipe rot not exceeding a diameter of 3/8 inch on a cedar post. The Contractor shall provide posts that do not have excessive

checking. The Contractor shall ensure that the posts do not have short kinks or more than one (1) one-way sweep exceeding two (2) inches, however, the post may have a winding twist.

The Department will not allow posts exhibiting both the maximum crook and maximum butt rot, and will not allow more than ten percent (10%) of the posts specified in the Contract to contain the maximum crook or butt rot.

The Department may reject posts with other defects that give the post an unsightly appearance or impair its durability or strength. The Contractor shall complete debarking, trimming, and sizing operations before treatment.

607.2.4.4 Preservative Treatment of Posts for Post and Cable Barrier

The Contractor shall provide pressure treated wood posts with pentachlorophenol in accordance with Section 550.2.2, “Preservatives and Treatment Methods,” treated according to AASHTO M-133, in all accordance with AWPA Standard U1 and Commodity Standard B: Posts and AWPA Standards P8 and P9.

607.2.5 Snow Fence

The Contractor shall provide snow fence of 1/2 inch × 1 1/2 inch wooden pickets spaced 3 1/2 inch on center and woven between five (5) cables. Each cable will consist of at least two (2) strands of galvanized steel wire with diameters of 0.099 in or larger.

The Contractor shall provide wooden pickets that are at least 48 inches long and treated or painted in accordance with the manufacturer’s recommendations.

The Contractor shall provide wire, braces, attachments, and fittings in accordance with ASTM A 116 and applicable requirements of Section 607.2.2, “Barbed Wire and Woven Wire Fence.”

607.2.6 Concrete

The Contractor shall provide Class A concrete bearing blocks and anchors in accordance with Section 510, “Portland Cement Concrete.” The Contractor may provide a prepackaged, pre-blended cementitious Material to which the Contractor only adds water at the site.

607.3 CONSTRUCTION REQUIREMENTS

607.3.1 General

The Contractor shall clear the fence lines of trees, bush, stumps, logs, weeds, existing fences, and other obstructions that may interfere with fence construction, unless the Project Manager requires certain trees to remain in place. The Contractor shall dispose of removed Material in accordance with Section 601, “Removal of Structures and Obstructions.”

If the Contractor is to embed posts, braces, or anchors in concrete, the Contractor shall install temporary guys or bracing to hold the posts in position until the concrete sets. Unless otherwise specified, the Contractor shall not install Materials on posts and do not strain posts, braces, or anchors set in concrete until seven (7) Days after concrete placement, or until the concrete has reached a compressive strength of 2,500 psi, whichever occurs first. The Contractor shall crown the concrete at the top of the foundation to shed water.

The Contractor shall only cut the tops of posts as approved by the Project Manager. The

Contractor shall apply protective coating to cut posts in accordance with Section 607.3.8, “Repair of Damaged Coating on Pull Cables and Tension Wires.”

The Contractor shall firmly attach wire and fencing to the posts and braces. The Contractor shall tightly stretch wire and install it at the required elevations. The Contractor shall place fence wire on the field side of the posts, except on the inside of curves.

At each location where an electric transmission, distribution, or secondary line crosses new fence, the Contractor shall provide and install a ground connection in accordance with the NEC®.

The Contractor shall build new fences adjacent to existing fence before removing existing fences. When removing and rebuilding fences, the Contractor shall maintain the security of livestock and protect adjacent properties and the traveling public. The Contractor shall remove the existing fence or unused Materials and neatly roll it up in single strand rolls. The Contractor shall remove the fence posts without damaging them and place the posts with the rolls of wire within the Right of Way for property owners to salvage, unless otherwise directed by the Project Manager. If the property owners do not pick the fence up within the allotted time, the Contractor shall dispose of the fence as directed by the Project Manager.

607.3.2 Barbed Wire and Woven Wire Fence

The Contractor shall set posts plumb and in accordance with the Plans. The Contractor may drive metal line posts. The Contractor shall excavate for footings and anchors in accordance with the Plans or as directed by the Project Manager. The Contractor shall place post hole backfill in thin layers and compact each layer.

The Contractor shall attach Right of Way fences to Roadway Structures, in accordance with the Plans.

607.3.2.1 Fence Tensioning

The Contractor shall stretch fence wire with a mechanical stretcher or other similar device. The Contractor shall not allow the length between pull posts to exceed 990 ft for barbed wire, and 660 ft for woven wire.

607.3.2.2 Braces and Corner Posts

The Contractor shall place intermediate braces at intervals of 990 ft or less and at every fence grade-change, such as edges of arroyos, bottoms and tops of hills, and as directed by the Project Manager. The Contractor shall maintain the required distance between the bottom wire and the ground. The Contractor shall space intermediate braces evenly between corner and gateposts or cattle guards. The Contractor shall place a corner post and brace at the intersection of cross fences and the Right of Way fence. The Contractor shall stretch the wires and firmly attach them to the corner posts.

607.3.3 Chain Link Fence

The Contractor shall install braces, tension rods, cables, hardware, and appurtenances in accordance with the manufacturer’s recommendations and the Contract.

The Contractor shall not attach chain link fabric to posts until the concrete footings have reached a compressive strength of 2,500 psi, or until three (3) Days after concrete placement, whichever occurs first.

After permanently positioning posts, setting anchorages firmly, and drawing tension wires and pull cables tight with turnbuckles or other approved tension devices, the Contractor shall secure the tension wires to the posts with tension bands and tie wires. The Contractor shall secure the chain link fabric at one end and stretch away from the secured end. The Contractor shall stretch the fabric with a mechanical stretcher or other device approved by the Project Manager.

607.3.3.1 Chain Link Fence Post Placement

The Contractor shall set posts plumb in concrete footings. The Contractor shall space chain link fence posts at intervals of ten (10) feet or less. The Contractor shall measure the intervals from center to center of posts. Pull posts are line posts braced to adjacent line posts. The Contractor shall position pull posts at intervals of 500 ft or less. The Contractor shall provide end posts with an outside diameter of at least 2.875 inch. The Contractor shall brace end posts in the same way as corner posts.

607.3.3.2 Chain Link Security Fence

The Contractor shall use chain link security fence in accordance with Section 607.3.3, “Chain Link Fence.” The Contractor shall supply security appurtenances on gates for access.

607.3.4 Post and Cable Access Fence

607.3.4.1 Post Placement

The Department will allow a depth of post embedment that is greater than specified in the Contract if the finished top of the post meets the required elevation. The Contractor shall compact the bottom of the holes to provide a stable foundation. The Contractor shall set the posts plumb with the front faces in a neat uniform line and with full contact on the foundation surface. The Contractor shall backfill holes with granular Material and compact in layers so the posts maintain the specified position and alignment.

Instead of setting posts in previously dug holes and backfilling, the Contractor may drive the posts, except if the Contract specifies bearing blocks. The Contractor shall only drive if there is adequate lateral stability and as long as the Shoulders and adjacent slopes are not damaged from the driving operations.

The Contractor shall remove posts that do not meet the requirements or are damaged below cutoff during driving, and replace with sound posts. If upward vertical adjustment of posts is necessary, the Contractor shall remove and reinstall them.

The Contractor may cut off the tops of posts to the elevation specified in the Contract. The Contractor shall round the tops of round posts to an approximate domed hemispherical shape centered on the axis of the post. After cutting off treated posts, the Contractor shall apply two (2) coats of pentachlorophenol preservative to the cut surfaces.

607.3.4.2 Setting of Anchors, Cable, and Fittings for Post and Cable Access Fence

If a bolt projects more than one (1) inch from the nut, the Contractor shall cut off 1/2 inch and burr. The Contractor shall paint the ends of cut-off bolts with aluminum paint. The Contractor shall bore holes for cable supports after the posts are set. The Contractor shall place end and intermediate anchorages and bearing blocks in accordance with the Contract.

The Contractor shall excavate trenches for anchor blocks to their neat lines. The Contractor shall perform excavation for anchor rod installation without excessively disturbing

the earth between the block and the anchored posts. The Contractor shall excavate holes for bearing blocks to their neat lines, then place and level the block with anchor rods in place on undisturbed soil. The Contractor shall place backfill Material and compact in layers. The Contractor shall not apply final tension to the anchor assembly until after completing the backfilling.

After completing the anchor assemblies, the Contractor shall properly adjust and securely fasten the cables, draw the cables tight, then loosen them to meet Contract requirements for the applicable temperature range.

The Contractor shall use three (3) inch wide reflective sheeting in accordance with Section 701.2.2.1, “Retroreflective Sheeting,” Silver White No. 2. The Contractor shall mount the sheeting on flexible aluminum alloy. The Contractor shall fix the sheeting to each end post and at maximum intervals of 100 ft on intermediate posts, with a minimum of three (3) strips per installation. The Contractor shall completely wrap the reflective strips around each post before installing the post plate washers.

607.3.5 Snow Fence

The Contractor shall construct snow fence in accordance with the manufacturer’s recommendations and the Contract.

607.3.6 Pedestrian/Bicycle Railing

The Contractor shall construct pedestrian and bicycle railing in accordance with the Contract or as directed by the Project Manager.

607.3.7 Removing and Rebuilding Fence

The Contractor shall remove and rebuild existing fences in accordance with the Contract or as directed by the Project Manager. The Contractor shall construct new fences in the same or better condition than the original fence.

The Contractor shall salvage Materials from removed fences and incorporate into the rebuilt fences. If the Project Manager determines that some Materials are not reusable, the Contractor shall replace those Materials as necessary and in accordance with Section 109.5, “Payment for Changes, Differing Site Conditions, and Extra Work.”

The Contractor shall firmly reset posts to the staked alignment. The Contractor shall use the same spacing of the posts and the same number of wires strung and stapled to the posts as the original fence. The Contractor shall use new staples to fasten the wires to the posts.

607.3.8 Repair of Damaged Coating on Pull Cables and Tension Wires

The Contractor may repair pull cables and tension wires that exhibit minor damage to the zinc coating by wire-brushing the damaged area and removing loose, cracked, or weld-burned zinc coating. The Contractor shall paint the cleaned area with two (2) coats of zinc oxide-zinc dust paint in accordance with Federal Specification TT-P-641 or Military Specification MIL-P-21035 or with an equivalent coating approved by the Project Manager. The Contractor shall make repairs and provide repair Materials at no additional cost to the Department.

607.3.9 Gates

The Contractor shall fabricate and construct gates, and stile and post wire traps in accordance with the Contract.

607.3.9.1 Remove and Reset Gate

The Contractor shall remove and reset existing gates in accordance with the Contract or as directed by the Project Manager.

607.4 METHOD OF MEASUREMENT

The Department will measure fences and watergap gates along the top from outside to outside of end posts for each continuous run of fence or watergap gate.

607.5 BASIS OF PAYMENT

Pay Item	Pay Unit
Barbed Wire Fence ___ft	Linear Foot
Game Fence ___ft	Linear Foot
Woven Wire Fence ___ft	Linear Foot
Chain Link Fence ___ft	Linear Foot
Chain Link Security Fence ___ft	Linear Foot
Vinyl-Coated Chain Link Fence ___ft	Linear Foot
Snow Fence ___ft	Linear Foot
Pedestrian/Bicycle Railing ___ft	Linear Foot
Pedestrian Screening Fence Type ____ft	Linear Foot
Post and Cable Access Fence ___ft	Linear Foot
Remove and Rebuild (type) Fence	Linear Foot
Standard Gate ___ft	Each
Barbed Wire Gate, ___ft	Each
Chain Link Gate, ___ft Span	*Each*
Chain Link Gate, ___ft Span by ___ft Rise	*Each*
Pipe Gate ___ft	Each
Water Gap Gate	Linear Foot
Turnstile Gate ___ft	Each
Remove and Reset Gate	Each
Stile and Post Wire Trap	Each
Braces/Corner Posts	Each

607.5.1 Work Included in Payment

The following Work and items will be considered as included in the payment for the main item(s) and will not be measured or paid for separately:

1. Clearing and grubbing,
2. Grading,
3. Excavation,
4. Backfill,
5. Disposal of surplus Material,
6. Concrete, fasteners,

7. Galvanizing,
8. Coating repairs; and
9. All additional bracing required for grade changes.

SUPPLEMENTAL TECHNICAL SPECIFICATION

SECTION 1501

TEMPORARY PLASTIC BARRIER FENCE

1501.1 DESCRIPTION

This work shall consist of furnishing, installing, and maintaining Temporary Plastic Barrier Fences of the type and at the locations shown in the plans or where directed by the Engineer.

1501.2 MATERIALS

Materials for Temporary Plastic Barrier Fences shall meet the following requirements:

- **Fence**: High-density polyethylene mesh, ultraviolet-stabilized min. 2 years; minimum height 4.0 feet. Color: high-visibility orange or green. When used to protect trees or other vegetation, color shall be high-visibility orange.
- **Posts**: Rigid metal or wood posts, minimum length 6.0 feet.
- **Ties:** Steel wire, #14 gauge or nylon cable ties.
- **Warning signs**: Sheet metal, plastic or other rigid, waterproof material, 1.5 feet by 2.0 feet with 4 inch black letters on a white background. Text shall be: "Protected Site - Keep Out" unless otherwise specified.

1501.3 CONSTRUCTION DETAILS

Fences shall be erected prior to moving construction equipment onto any area designated for protection.

The line of fences as indicated on the plans shall be staked or marked out on the ground by the Contractor and approved by the Engineer before any fence is installed. Where used for protection of individual trees, fence shall be placed at the drip line (extent of canopy). If not possible, placement shall be as close to the drip line as possible and in no case less than 5.0 feet away from the tree trunk.

On approval of the stakeout, posts shall be securely driven on 6.0 foot-maximum centers, normal to the ground, to a depth 1/3 of the total post length. Plastic barrier fence shall be placed along the side of all posts. Ends of fencing segments shall overlap a distance of at least one half the fence height.

Fencing shall be secured to posts with wire or cable ties at top, middle and bottom of post. Fastener shall be tight enough to prevent the fencing from slipping down. Overlaps shall also be securely fastened.

Barrier fence which is not orange in color shall be flagged at 6.0 foot intervals with red or orange florescent tape. Warning signs shall be mounted on the fence at no more than 100 foot intervals.

Maintenance shall commence immediately after erection of the fence and

continue until one week prior to acceptance of the contract, and shall consist of: replacing damaged post(s) and fencing; re-fastening and tightening fencing; and restoring fence to its intended height.

Fencing used for tree or other vegetation protection shall not be temporarily removed to allow equipment access over a protected area, except as required for items of work specifically shown on the plans and approved by the Engineer in writing.

1501.4 METHOD OF MEASUREMENT

The quantity to be measured for payment will be the number of feet of Temporary Plastic Barrier Fence erected, measured along the top, to the nearest whole foot.

1501.5 BASIS OF PAYMENT

The unit price bid shall include the cost of all labor, materials and equipment necessary to satisfactorily complete the work. Relocation of a fence from one location to another as directed by the Engineer shall be considered as a new location and will be separately paid.

SUPPLEMENTAL TECHNICAL SPECIFICATION

SECTION 1503

MOBILIZATION

1503.1 DESCRIPTION

This work shall consist of preparatory and final work and operations, including, but not limited to, those necessary for the movement of personnel, equipment, supplies and incidentals to and from the project site; for the establishment of all offices, buildings and other facilities necessary for work on the project; and, for all other work and operations which must be performed or costs incurred prior to beginning work on the project.

1503.2 MOBILIZATION ADMINISTRATION REQUIREMENTS

1503.2.1 DEFINITIONS

The following definitions shall apply:

a) Total original contract amount shall mean the total amount bid as compensation for the contract.

b) Total original contract amount less mobilization and demobilization shall mean the total amount bid as compensation for the contract less the amounts bid for mobilization.

1503.2.2 GENERAL

It is the intent of this specification to provide for the Contractor to:

a) Receive 100% of the amount bid for mobilization by the time the Contractor has performed 10% of the total original contract amount bid less the amount bid for mobilization.

1503.2.3 PAYMENT PROCEDURES FOR MOBILIZATION

The following will apply in effecting mobilization payments:

a) When the Contractor is eligible for payment of less than 5% of the total original contract amount bid less mobilization, the Contractor will be paid 25% of the amount bid for mobilization.

b) When the Contractor is eligible for payment of from 5% to less than 10% of the total original amount bid less mobilization, the Contractor will be paid 50% of the amount bid for mobilization minus any mobilization amount already paid.

c) When the Contractor is eligible for payment of 10% or more of the total original contract amount less mobilization, the Contractor will be paid 100% of the amount bid for mobilization minus any mobilization amount already paid.

P_M	=	Mobilization Payment
M	=	Total amount bid for Mobilization
f_M	=	Mobilization payment percentage factor
	=	0.25, or 0.50, or 1.0, as applicable
P_M	=	**M x f_M**

EXAMPLE 1
MOBILIZATION

Total Original Contract Amount Bid $110,000
Amount Bid for Mobilization ..... $ 5,000
Total Original Contract Amount Less Mobilization $105,000

Percent of Work Completed	f_M		M		P_M
<5% of $102,000	0.25	x	5,000	=	$1,250
>5% to <10% of $102,000	0.50	x	5,000	=	$2,500*
≥10% of $102,000	1.00	x	5,000	=	$5,000*

*minus previously paid amounts

1503.3 METHOD OF MEASUREMENT

Mobilization will be measured by lump sum unit.

1503.4 BASIS OF PAYMENT

Mobilization will be paid for at the contract price per Mobilization Bid Item. The amount Bid for Mobilization shall not exceed 5% of the Total Base Bid.

No additional payments will be made for demobilization and remobilization due to shutdowns or suspensions of the work or for other mobilization and demobilization activities required to complete the contract.

SUPPLEMENTAL TECHNICAL SPECIFICATION

SECTION 1507

MATERIALS TESTING AND QUALITY ASSURANCE

1507.1 GENERAL

A. This Section includes testing and quality control measures required on this project. The Section is additional to requirements specified for testing and quality assurance in the standard specifications and other supplemental specifications.

B. Materials and equipment are subject to inspection, sampling, and testing before acceptance of the work.

1507.2 RELATED WORK

A. General and Supplemental General Conditions of the Contract.

1507.3 REFERENCES AND DEFINITIONS

A. All materials and equipment shall be tested, by the CONTRACTOR, pursuant to their technical specification (unless otherwise specified herein) and the manufacturer's recommendations.

B. Structure shall include but is not limited to: parking lots, pavement, sidewalk, curb and gutter, foundations, structural concrete, piping, wet-wells, manholes, retaining walls, junction boxes, and buildings.

1507.4 SUBMITTALS

A. Test Reports from tests performed by independent testing firm: Submit for acceptance, complete test reports from approved independent testing laboratories certifying that product conforms to performance characteristics and testing requirements specified herein and in other supplemental/standard specifications. Independent firm to submit reports to the ENGINEER and CONTRACTOR, in duplicate, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.

B. Test Reports from tests performed by CONTRACTOR: Submit for acceptance, complete test reports from CONTRACTOR certifying that product conforms to performance characteristics and testing requirements specified herein and in other supplemental/standard specifications.

1507.5 QUALITY ASSURANCE

A. Quality Assurance/Control of Installation – The CONTRACTOR shall:

   1. Comply fully with manufacturers' instructions, including each step in sequence.

2. Request clarifications from ENGINEER before proceeding should manufacturers' instructions conflict with Contract Documents.

3. Request clarification from ENGINEER before proceeding should specified reference standards conflict with Contract Documents. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

4. Comply with specified standards as a minimum quality for the work except when more stringent specified tolerances, codes, or requirements indicate higher standards or more precise workmanship are required.

5. Make sure work is performed by qualified persons.

6. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion or disfigurement.

B. Testing Laboratory Services

1. Reports will be submitted by the independent firm to the ENGINEER and CONTRACTOR, in duplicate, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.

1507.6 TESTING METHODS

Testing methods shall comply with ASTM Standards and as specified in the technical specifications for the project.

1507.7 EXECUTION

A. Testing Laboratory Services

1. The CONTRACTOR will employ and pay for services of an independent testing firm to perform testing.

2. The independent firm will perform tests and other services specified in individual Specification Sections and as required by the OWNER.

3. CONTRACTOR shall:

a) Cooperate with independent firm; furnish samples of materials, design mix, equipment, tools, storage and assistance as requested.

b) Notify ENGINEER and independent firm 8 hours prior to expected time for operations requiring services.

c) Make arrangements with independent firm and pay for additional samples and tests required for CONTRACTOR'S use.

B. Retesting required because of non-conformance to specified requirements shall be performed by the same independent firm on instructions by the ENGINEER. No additional payment will be made for re-testing due to failing tests.

1507.8 TESTING FREQUENCY AND TYPE OF TESTING

Frequency and type of testing shall be per the requirements listed in the specifications for each type of Work. The Engineer may increase and/or add testing for any Work items. The Testing Allowance will be adjusted for increases in testing by Section 1507.9.D.

1507.9 MEASUREMENT AND PAYMENT

Testing shall be paid for as an allowance on a Lump Sum basis. The Contractor may request percent of LS cost payments during construction, however, the Contractor shall provide actual testing lab invoices as back-up for the percent complete that is being requested in a Pay Application.

Testing allowances are provided as part of the project and invoiced for testing will be paid for through this allowance.

Costs included in testing price include:

A. Cost of engaging an independent testing firm, execution of tests by the testing firm, and reporting results by the testing firm.

B. Costs of incidental labor and facilities required to assist testing firm.

C. Costs of testing laboratory services used by CONTRACTOR separate from Contract Document requirements

D. Costs of re-testing due to failure of previous tests will be included in the cost for testing and no additional payment will be made for this work.

The CONTRACTOR shall submit two copies of the testing firm's invoice to OWNER with Pay Application. Reimbursement to the Contractor will be for actual invoiced costs and no mark-up will be added to this invoice. The Contractor shall receive reimbursement for actual invoice of testing firm upon certification that payment has been made to the testing laboratory. Payment will be made at the next application for payment from OWNER.

END OF SECTION

SUPPLEMENTAL TECHNICAL SPECIFICATION

SECTION 1508

PROJECT RECORD DOCUMENTS

1508.1 GENERAL

This Section includes administrative and procedural requirements for Project Record Documents, including the following:

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.

1508.2 RECORD DRAWINGS

Record Prints: Maintain one set of red-lined prints of the Contract Drawings and Shop Drawings. These prints shall be updated no less frequently than once per week. These prints will be reviewed for verification of updates by the construction observer on a regular basis, depending on the length of the contract. Immediately before inspection for Certificate of Substantial Completion, review marked-up Record Prints with ENGINEER.

1508.2.1 Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Mark whichever drawing is most capable of showing field conditions fully. Require individual or entity who obtained record data, whether individual or entity is Installer, SUB-CONTRACTOR, or similar entity, to prepare the marked-up Record Prints.

a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.

b. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.

1508.2.2 Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-references on the Contract Drawings.

1508.2.3 Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.

1508.2.4 Note Construction Change Directive numbers (field orders or Request for Information changes), alternate numbers, Change Order numbers, and similar identification, where applicable.

1508.2.5 Verification of current record prints status will be included in the monthly payment approval process that will be noted by the construction's observer's field reports.

1508.3 RECORD SPECIFICATIONS

Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later. Note related Change Orders, field order notes, Request for Information (RFI) notes, Record Product Data, and Record Drawings where applicable.

1508.4 MISCELLANEOUS RECORD SUBMITTALS

Assemble Certifications, Lab Test Reports, and Field Test Reports required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

1508.5 SUBMITTALS

See New Mexico Standard Specifications For Public Works Construction Section 1502.

1508.6 RECORDING AND MAINTENANCE

1508.6.1 Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur.

1508.6.2 Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. It is not advisable to use Project Record Documents for construction purposes. Provide access to Project Record Documents for Engineer's reference on the project site.

1508.7 MEASUREMENT AND PAYMENT

The cost of project record documents shall be incidental to the Work and no separate payment shall be made for this effort. However, the Project Record Documents shall be reviewed per Section 1508.2.5 and they shall be updated prior to pay applications being processed.

END OF SECTION

RIPARIA PONDS
Rio Rancho, New Mexico
June 2, 2022

Prepared For:

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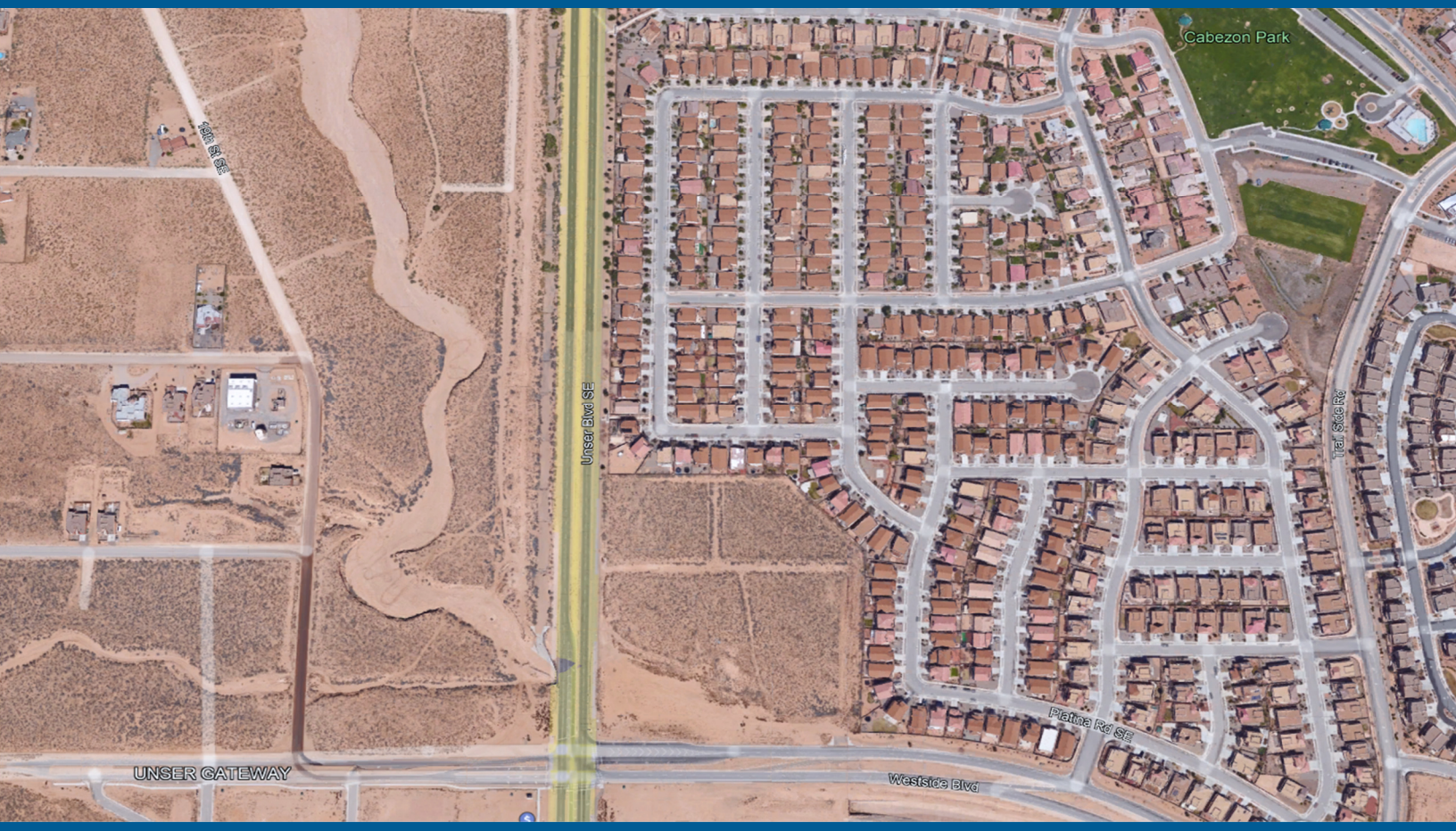

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Phone: 505.344.7373

PROJECT NUMBER: 229022-A000231.00

TABLE OF CONTENTS

1.0 INTRODUCTION

This report presents the results of our geotechnical investigation for the Riparia Ponds Project located in Rio Rancho, New Mexico.

The investigation was performed to determine site subsurface conditions and, based upon the conditions observed in the borings, to develop geotechnical recommendations in general accordance with the scope of work indicated in the April 11, 2022 proposal:

Earthen Berm Construction;
Suitability of On-Site Soils for Use in Earthen Berm Construction;
Cut-off walls; and
Slope Protection with Soil-Cement Liner.

The conclusions and recommendations presented are based on information provided to us regarding the proposed development, on subsurface conditions disclosed by the borings, on laboratory testing, and upon the local standards of our profession at the time this report was prepared.

This investigation was not performed to determine the presence of potentially hazardous waste or radon gas. Determination of the presence of potentially hazardous materials was beyond the scope of this investigation and requires the use of exploration techniques and analytic testing which were not appropriate for this investigation. If desired, NV5, Inc. will perform an environmental audit of the site.

2.0 PROPOSED CONSTRUCTION

It is proposed to construct three (3) ponds constructed with earthen berms which will receive a gravel mulch lining along the inside perimeter of each pond. Each pond will receive runoff from new diversion channels extending from the existing man-made drainage ditch, which is located parallel and adjacent to Unser Boulevard. Each sloping face of the new diversion channel will be lined with a gravel mulch and the bottom of channel lined with riprap. Each pond will receive a cut-off wall starting at the northeast corner and generally extending westward along the south toe of pond, at least in ponds A2 and A3. Ponds A1 and A2 will also include two (2) 36-inch diameter culverts at the southwest corner of pond. Pond A3 will include three (3) 42-inch diameter culverts at the south side of the pond. The west facing slopes and portions of the east facing slopes of the re-aligned arroyo will be lined with soil cement. The existing arroyo will be modified by removing existing soils and re-grading the west embankment so as to allow for continued flow of storm runoff around the west side of these ponds. Portions of the newly re-graded arroyo will receive slope protection using soil cement. Two other drainage features at the southwest end and below and existing concrete runoff will receive riprap.

3.0 SITE CONDITIONS

The proposed project site is located nearly parallel and west of Unser Boulevard and between Westside Boulevard and 14th Street. The project site are characterized by vegetation consisting of numerous small shrubs and weeds, sparse native grasses and two large shrubs within the existing

arroyo. Topographical data indicates that approximately 36 feet of relief occurs within the immediate proposed project area. Configuration of the site is indicated on the Site Plan, Figure 1.

4.0 SITE SUBSURFACE CONDITIONS

To explore the site subsurface conditions, four (4) borings were drilled at the approximate locations shown on the Site Plan, Figure 1. Two near surface soil samples were obtained from within the existing arroyo, one near the upstream portion and the other at the downstream portion of the arroyo as shown on the Site Plan, Figure 1. The soils encountered at this site generally consist of well-graded sand (SW-SM) with silt, poorly graded sand (SP-SM) with silt and varying amounts of gravel and silty sand (SM).

The various sand strata were generally described as dry to slightly moist and very loose to very dense.

Neither flowing groundwater nor bedrock was encountered in the borings at a depth of approximately 26.5 feet, the maximum depth of exploration. Groundwater conditions may change with time due to precipitation, variations in groundwater level, seepage from ponding areas, or leaking utilities.

The borings allow observation of a small portion of the soils below the site. Significant variations in subsurface conditions may occur across the site, which were not disclosed by the borings.

5.0 LABORATORY TESTING

A laboratory testing program was performed on samples obtained during the field investigation, which appeared representative of the soils encountered in the borings. The laboratory testing program was structured to determine the general physical properties of the soils encountered in the borings necessary for development of geotechnical recommendations.

The laboratory testing program included:

- Moisture Content;
- Dry Density;
- Sieve Analysis;
- Atterberg Limits; and
- Consolidation/Collapse Tests.

Moisture Content and Dry Density tests were performed to evaluate the in-place soil density and moisture content. Test results also help to evaluate settlement potential. Test results from representative soil samples obtained from the borings exhibited dry density values ranging from 104 pounds per cubic foot to 116 pounds per cubic foot. Natural moisture content ranged from 0.4 percent to 10.9 percent. Test results are presented on the Logs of Borings, Figures 2 through 5, and are summarized on Table 1.

Sieve Analysis and Atterberg Limits tests were performed to confirm field soil classifications and to provide information on general physical soil properties. Test results are presented and summarized on Table 1.

Consolidation/collapse tests were performed to evaluate structure settlement and to determine the effect of water on site soils. The results indicate that the tested soils exhibited moderate compressibility under anticipated loads. Moderate additional settlement (collapse) occurred upon inundation of the tested soils with water. Test results are presented on Figures 7 through 9.

6.0 EARTHEN BERMS

Based on the most recent grading plan provided by the Client, the three ponds will incorporate 3 horizontal to 1 vertical slopes surrounding the inside of the pond. The inside slopes will incorporate a gravel mulch.

The on-site soils on the east side of the existing arroyo are anticipated to be suitable for constructing the earthen berms. By re-configuring the arroyo, the present design will result in obtaining an appreciable amount of fill materials derived from excavating the soils along the west side of the existing arroyo.

7.0 CUT-OFF WALLS

The type of cut-off walls currently under consideration may include concrete diaphragm walls placed under bentonite slurry. The sandy soils at this site may limit the length of concrete wall that can be constructed at a time subject to the required depth of wall and minimum wall thickness. As the excavation progresses, the resulting slot should be kept full of bentonite slurry. The slurry should be kept at a sufficient density that will hold back the earth sides of the cut. Whether the concrete wall is to be reinforced or unreinforced, the concrete should be tremied to displace the slurry.

8.0 SLOPE PROTECTION WITH SOIL-CEMENT LINER

The re-alignment of the existing arroyo will require appreciable cut and fill either side of the current arroyo configuration and grading of new slopes. The new re-graded slopes will receive a soil-cement liner. Prior to placing the soil-cement liner, the natural soils should be scarified to a depth of 8 inches, moistened to not less than 1.0% and not more than 3.0% of optimum moisture content and compacted to a minimum of 95% of maximum dry density as determined in accordance with ASTM D 1557. Detailed earthwork procedures are presented in the Appendix.

9.0 SEISMIC CONSIDERATIONS

Based upon the results of this investigation, an International Building Code Site Classification of "D" may be utilized for design. Based on the SEAOC and OSHPD Seismic Design Map Tool and using the coordinates for boring B-3, the 0.2 second and 1.0 second spectral coordinates at this site are S_s = 0.458g and S_1 = 0.148g, respectively, for Site Class D. Results also indicate F_a = 1.434 and F_v = 2.305. Additional information is presented in Appendix B.

10.0 EARTHWORK

10.1 GENERAL

Presented below is a summary of the site earthwork recommendations. Detailed earthwork procedures are presented in the Appendix.

Prior to commencing earthwork, the Contractor should obtain appropriate Proctor tests. Field density testing and evaluation of the suitability of the proposed materials performed prior to completion of the Proctor is "Preliminary" and may change based upon the results of the Proctor testing.

10.2 CLEARING AND GRUBBING

Prior to placing non-expansive fill, all borrow and fill areas should be stripped of vegetation and deleterious materials. All strippings should be hauled off-site or utilized in landscaped areas.

All existing utilities and disturbed soil should be removed from below the proposed amenities. The resulting excavations should be backfilled with compacted fill as specified in the Appendix.

10.3 EXCAVATION

We anticipate that on-site soils can be excavated with conventional earthwork equipment. Cobbles and boulders, if encountered, should be disposed of off-site or utilized for landscaping. Cobbles and boulders should not be placed within structural fills. Cobbles and boulders as defined in ASTM D-2487.

10.4 NATURAL GROUND PREPARATION

Prior to placing fill and subsequent to final grading, the natural soils should be scarified to a depth of 8 inches, moistened to not less than 1.0% and not more than 3.0% of optimum moisture content and compacted to a minimum of 95% of maximum dry density as determined in accordance with ASTM D-1557.

If vibratory compaction poses a threat to nearby structures, static compaction should be utilized.

10.5 FILL PLACEMENT AND COMPACTION

Structural fill should be placed in horizontal lifts a maximum of eight inches in loose thickness, moisture conditioned to not less than 1.0% and not more than 3.0% of optimum moisture content, and mechanically compacted to a minimum of 95% of maximum dry density as determined by ASTM D-1557. The on-site soils within the upper 25 feet and east of the existing arroyo are anticipated to be suitable for re-use in the construction of each proposed Riparia Pond.

10.6 OBSERVATION AND TESTING

Placement and compaction of fill should be observed and tested by a qualified geotechnical engineer or his representative. The purpose of the observation and testing is to confirm that the

recommendations presented herein are followed and to provide supplemental recommendations, if subsurface conditions differ from those anticipated.

10.7 FREQUENCY OF TESTING

Earthwork should be tested periodically to confirm the fill is compacted to the criteria presented in this report. Prior to placing fill, the natural ground should be moisture conditioned, compacted, and tested to confirm it is properly compacted. Fill should be placed in maximum eight-inch thick loose lifts, but in no case thicker than can be compacted with the equipment being utilized. Fill should be moisture conditioned and compacted as detailed in this report. Fill areas should be tested at maximum six-inch vertical intervals, unless otherwise specified by the project documents. If fill areas are worked at different times, each individual area should be tested. Following finish grading, the final surface should be tested.

11.0 BEDDING AND TRENCH BACKFILL

All trenches greater than four feet in depth must be sloped, shored or braced or otherwise supported according to OSHA Construction and Safety Standards. Material excavated from the trench or spoil must be placed a minimum of two feet from the edge of the excavation. The spoil should be retained in an effective manner such that no loose material can fall into the excavation.

Temporary construction excavations should be sloped no steeper than 1½:1 (horizontal:vertical). If deeper excavations are required, this office should be contacted for supplemental recommendations. Limited raveling of slopes will occur particularly as the exposed soils dry out. Heavy equipment and material stockpiles should be located a minimum of five feet from the top of slope.

The bedding depth should be a minimum of 1/8th the pipe outside diameter for pipe sizes greater than 27 inches in diameter. For a 42-inch dimeter pipe, a minimum bedding depth of 6 inches is recommended. The bedding should provide uniform support for the entire pipeline length and should extend a lateral distance of 1/4th the pipe diameter, but not less than 6 inches. Bedding material should consist of granular soils classified as Class II or III per Table 701.3.5 of the New Mexico Standard Specifications for Public Works Construction. On-site soils satisfying these requirements should be compacted to not less than 95 percent of maximum density prior to installation of the pipe.

Trench backfill may consist of the soils derived from trench excavations. Beginning at a height of 12 inches above the pipe zone, backfill should be placed in horizontal lifts a maximum of twelve inches in loose thickness. Moisture conditioned to not less than 1.0 percent and not greater than 3.0 percent of optimum moisture content, and mechanically compacted. Trench backfill should be compacted to a minimum of 90% of maximum dry density as determined by ASTM D-1557, except for the upper 12 inches below base course, if any, or pavement where the trench passes below paved roadways. The upper 12 inches should be placed in horizontal lifts a maximum of eight inches in loose thickness, moisture conditioned to not less than 1.0 percent and not greater than 3.0 percent of optimum moisture content, and compacted to not less than 95 percent of maximum dry density as determined by AST D-1557.

12.0 EMBANKMENT SAFETY INSPECTION AND MAINTENANCE

Following major storm events and not less than bi-annually, the embankments and ponds should be inspected by a qualified engineer for seepage failure, slope failure, excessive erosion, and silt accumulation. Any deficiencies found should be repaired.

Following significant storm events, the proposed ponds should be cleaned of accumulated silt and debris.

13.0 CLOSURE

This report was prepared for the exclusive use of our Client. The recommendations presented in this report are based upon the subsurface conditions disclosed by the test holes. Soil and groundwater conditions may vary between test holes and with time.

This report reflects our interpretation of the site subsurface conditions. We strongly recommend that prior to bidding all contractors perform their own subsurface investigation to form their own opinion of the site soil, rock, and groundwater conditions. Should contractors elect to use this report for construction, bidding or estimating purposes, they do so at their own risk.

In a southwest climate, it is particularly important to protect the soils supporting the proposed structure from an increase in moisture content. If soils supporting the structure increase in moisture content due to any cause such as poor site drainage, ponding areas, or leaking utility lines, significant structural settlement and distress may occur.

If conditions are encountered during construction which differ from those presented herein, this office should be contacted for supplemental recommendations. The staff of NV5, Inc. is available for supplemental consultation as necessary.

This office would be pleased to review site grading and drainage plans to evaluate conformance with the recommendations presented herein. All site earthwork should be observed by a qualified geotechnical engineer or his representative. NV5 would be pleased to provide these services.

Respectfully submitted,
NV5, Inc.

RALPH L. ABEYTA
NEW MEXICO
10852
REGISTERED PROFESSIONAL ENGINEER

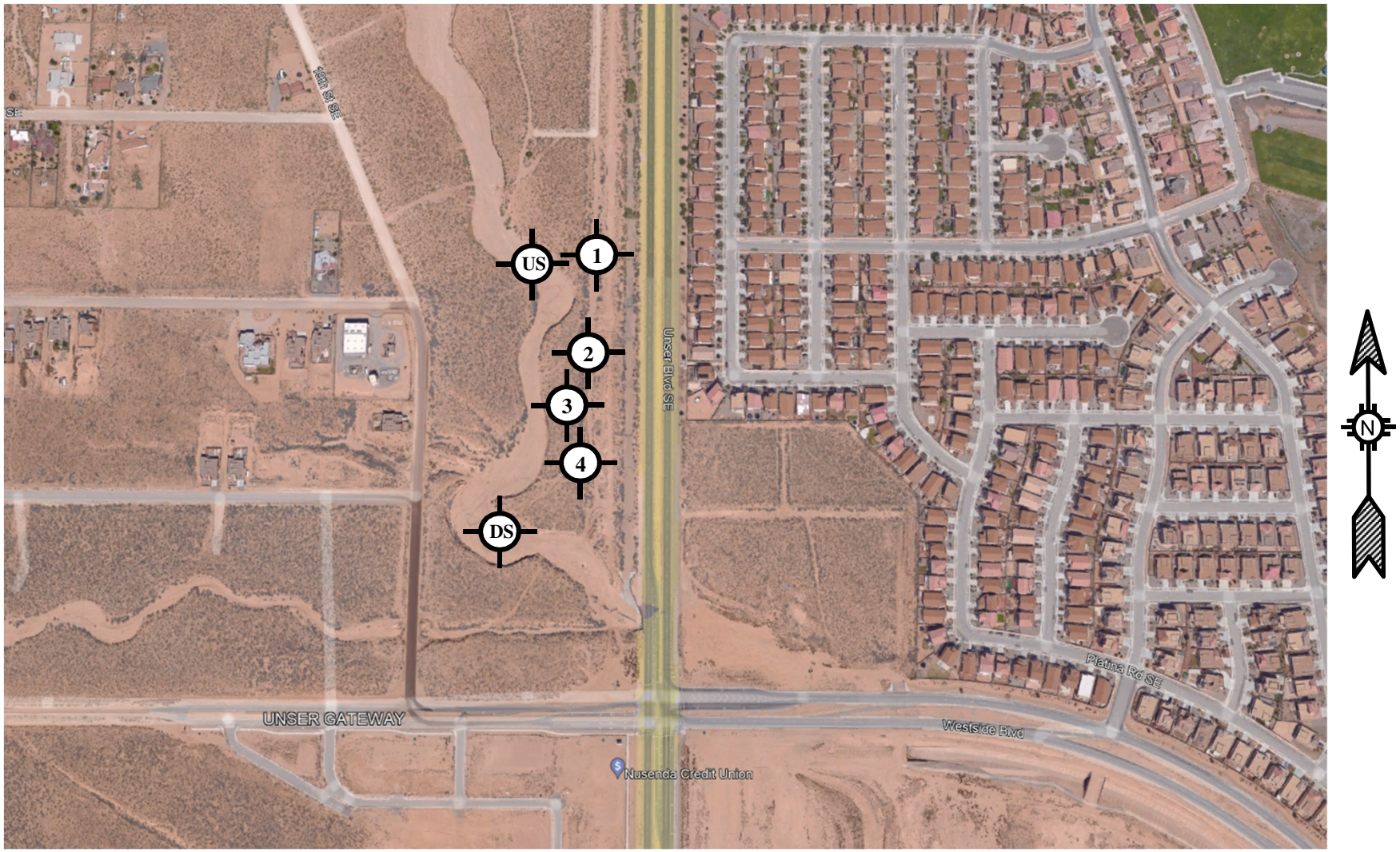
06/02/2022

Ralph L. Abeyta, P.E., M. ASCE
Senior Geotechnical Engineer

Carl Henderson, PhD, PE (CA), GE (CA)
Senior Geotechnical Engineer

NV5 Project No.: 229022-A000231.00

SITE PLAN
***Scale Unknown**



Boring Location

US Upstream Sample

DS Downstream Sample

FIGURE 1

BORING LOG NO. 1

Project: Riparia Ponds - Rio Rancho, NM
Elevation: N/A
Depth to Groundwater: Not Encountered

Project No.: 229022-A000231.00
Date Drilled: 4/26/22
Drilling Method: 7" H.S.A.

Depth, feet	Blows/Foot	Sample Type	Dry Density pcf	Water Content, %	Additional Testing	Unified Classification	Material Description
5	13	CAL	116	10.1		SM	SAND, silty, fine to coarse grained, loose, dry, light brown Slightly moist
10	9	CAL	106	6.0	1,2,5	SP-SM	SAND, poorly graded with silt, fine to medium grained, loose, slightly moist, light brown
	6	S		6.9			
	10	S		3.6			
15							
20	30	S		2.7	1,2	SM	SAND, silty, fine to coarse grained, medium dense, dry, light brown
25	25	S		1.9	1,2	SP-SM	SAND, poorly graded with silt, fine to coarse grained, medium dense, dry, light brown
	24	S		2.2	1,2		Gravelly
30							Bottom of boring at 26½'
35							

ADDITIONAL TESTS: 1= Sieve Analysis 2= Atterberg Limits 3=Direct Shear 4=R-Value 5=Other

Figure: 2

BORING LOG NO. 2

Project: Riparia Ponds - Rio Rancho, NM
Elevation: N/A
Depth to Groundwater: Not Encountered

Project No.: 229022-A000231.00
Date Drilled: 4/26/22
Drilling Method: 7" H.S.A.

Depth, feet	Blows/Foot	Sample Type	Dry Density pcf	Water Content, %	Additional Testing	Unified Classification	Material Description
						SM	SAND, silty, fine to coarse grained, loose, slightly moist, brown
	6	S		10.9	1,2		Slightly moist
5							
	5	S		9.0	1,2		
	12	CAL	104	2.7			Dry
10							
	27	CAL	111	2.8	1,2,5		Medium dense
15							
	20	S		2.6	1,2		
20							
	32	S		2.0			Dense
25							
	26	S		1.9	1,2		Medium dense
							Bottom of boring at 26½'
30							
35							

ADDITIONAL TESTS: 1= Sieve Analysis 2= Atterberg Limits 3=Direct Shear 4=R-Value 5=Other

Figure: 3

BORING LOG NO. 3

Project: Riparia Ponds - Rio Rancho, NM
Elevation: N/A
Depth to Groundwater: Not Encountered

Project No.: 229022-A000231.00
Date Drilled: 4/26/22
Drilling Method: 7" H.S.A.

Depth, feet	Blows/Foot	Sample Type	Dry Density pcf	Water Content, %	Additional Testing	Unified Classification	Material Description
						SM	SAND, silty, fine to coarse grained, loose, dry, light brown
	16	S		5.2			Medium dense, slightly moist
5							
	31	S		4.4	1,2		Caliched sand pieces, dense
		S		3.5			
10							
	17	CAL	105	2.7			
15							
	37	CAL	114	2.3	1,2,5		Dense
20							
	26	S		1.8	1,2		Trace gravel, medium dense
25							
	50	S		2.9			Very dense
30							Bottom of boring at 26½'
35							

ADDITIONAL TESTS: 1= Sieve Analysis 2= Atterberg Limits 3=Direct Shear 4=R-Value 5=Other

Figure: 4

BORING LOG NO. 4

Project: Riparia Ponds - Rio Rancho, NM
Elevation: N/A
Depth to Groundwater: Not Encountered

Project No.: 229022-A000231.00
Date Drilled: 4/26/22
Drilling Method: 7" H.S.A.

Depth, feet	Blows/Foot	Sample Type	Dry Density pcf	Water Content, %	Additional Testing	Unified Classification	Material Description
						SM	SAND, silty, fine to coarse grained, loose, dry, light brown
	14	S		3.9	1,2		Fine to medium grained, medium dense, slightly moist
5							
	24	CAL	104	5.8			
					1,2		
	25	CAL	106	2.3			Dry
10							
	15	S		1.9			Caliched, sand pieces
15							
	19	S		0.4	1,2	SP-SM	SAND, poorly graded with silt, fine to medium grained, medium dense, dry, light brown
20							
	26	S		2.2	7.2	SM	SAND, silty, fine to medium grained, medium dense, dry, light brown
25							
	28	S		2.2			Trace gravel
							Bottom of boring at 26½'
30							
35							

ADDITIONAL TESTS: 1= Sieve Analysis 2= Atterberg Limits 3=Direct Shear 4=R-Value 5=Other

Figure: 5

NOTES - LOGS OF BORE HOLES

Bore hole locations were determined by compass bearing and pacing distances from known topographic points.

"Drilling Method" refers to the equipment utilized to advance the bore hole. A seven-inch outside diameter, continuous flight, hollowstem auger was utilized.

"S" under "Sample Type" indicates a Standard Penetration test (ASTM D-1586). The Standard Penetration sampler is 2 inches in outside diameter and 1 3/8 inches inside diameter.

"CAL" under "Sample Type" indicates a 3-inch outside diameter by 2.5-inch inside diameter sampler. The sampler is lined with 1-inch high brass rings.

"B" under "Sample Type" indicates a bulk sample.

"Blows Per Foot" indicates the number of blows of a 140-pound hammer falling 30 inches required to drive the indicated sampler 12 inches.

"NR" under "Blows/Foot" indicates that no sample was recovered.

"Dry Density PCF" indicates the laboratory determined soil dry density in pounds per cubic foot.

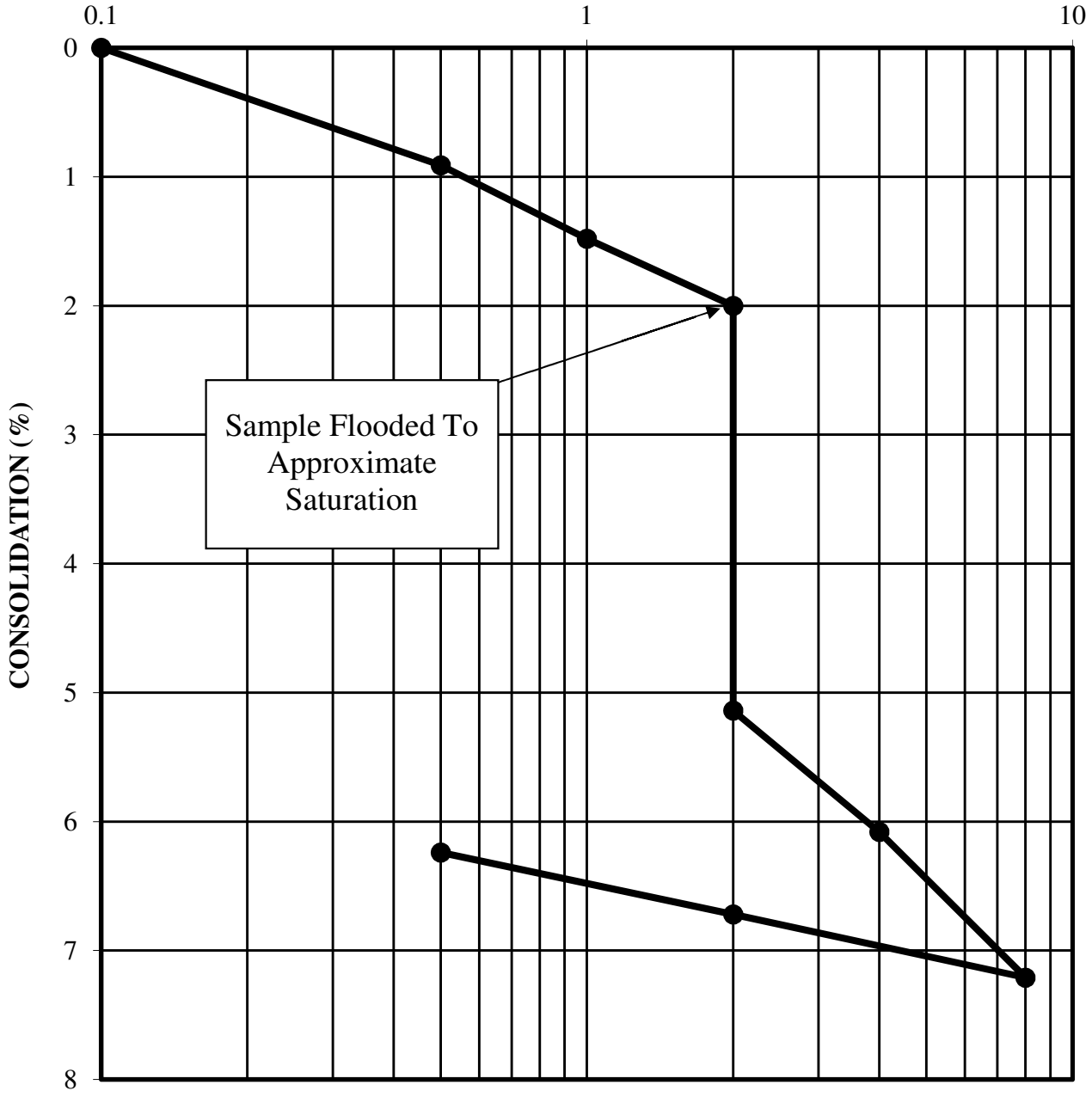
"Water Content %" indicates the laboratory determined soil moisture content in percent (ASTM D-2216).

"Unified Classification" indicates the field soil classification as per ASTM D-2488. When appropriate, the field classification is modified based upon subsequent laboratory tests.

Variations in soil profile, consistency, and moisture content may occur between bore holes. Subsurface conditions may also vary between bore holes and with time.

Figure No.: 6

CONSOLIDATION TEST RESULTS

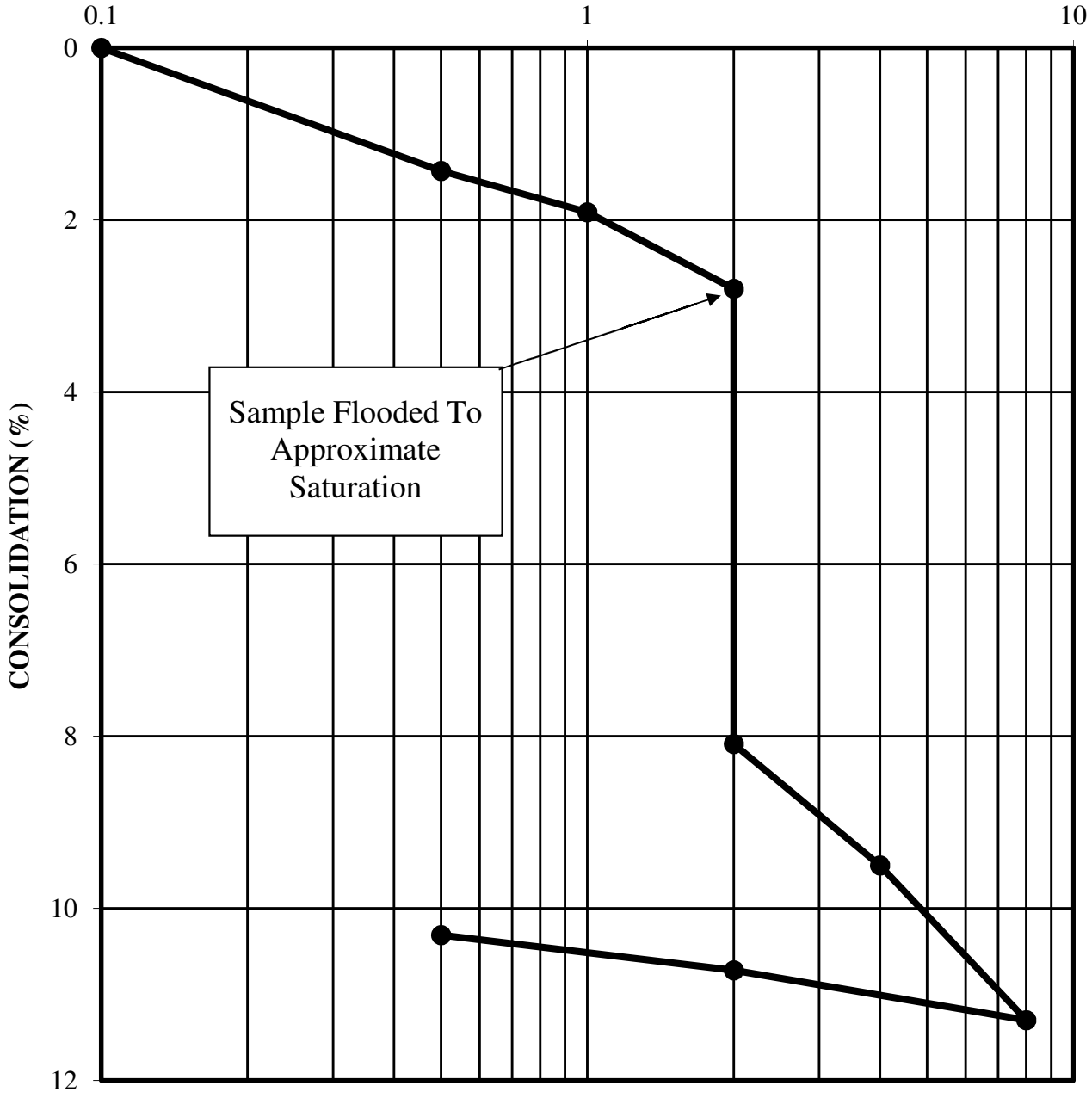


TEST HOLE NUMBER: B-1
SAMPLE DEPTH: 5.0 - 6.0 FEET
SOIL DESCRIPTION: Poorly graded SAND w/silt (SP-SM)
MOISTURE CONTENT: 6.0 %
BULK UNIT WEIGHT: 106 pcf

PROJECT: Riparia Ponda, Rio Rancho, New Mexico
PROJECT NO.: 229022-A000231.00

FIGURE NO.: 7

CONSOLIDATION TEST RESULTS

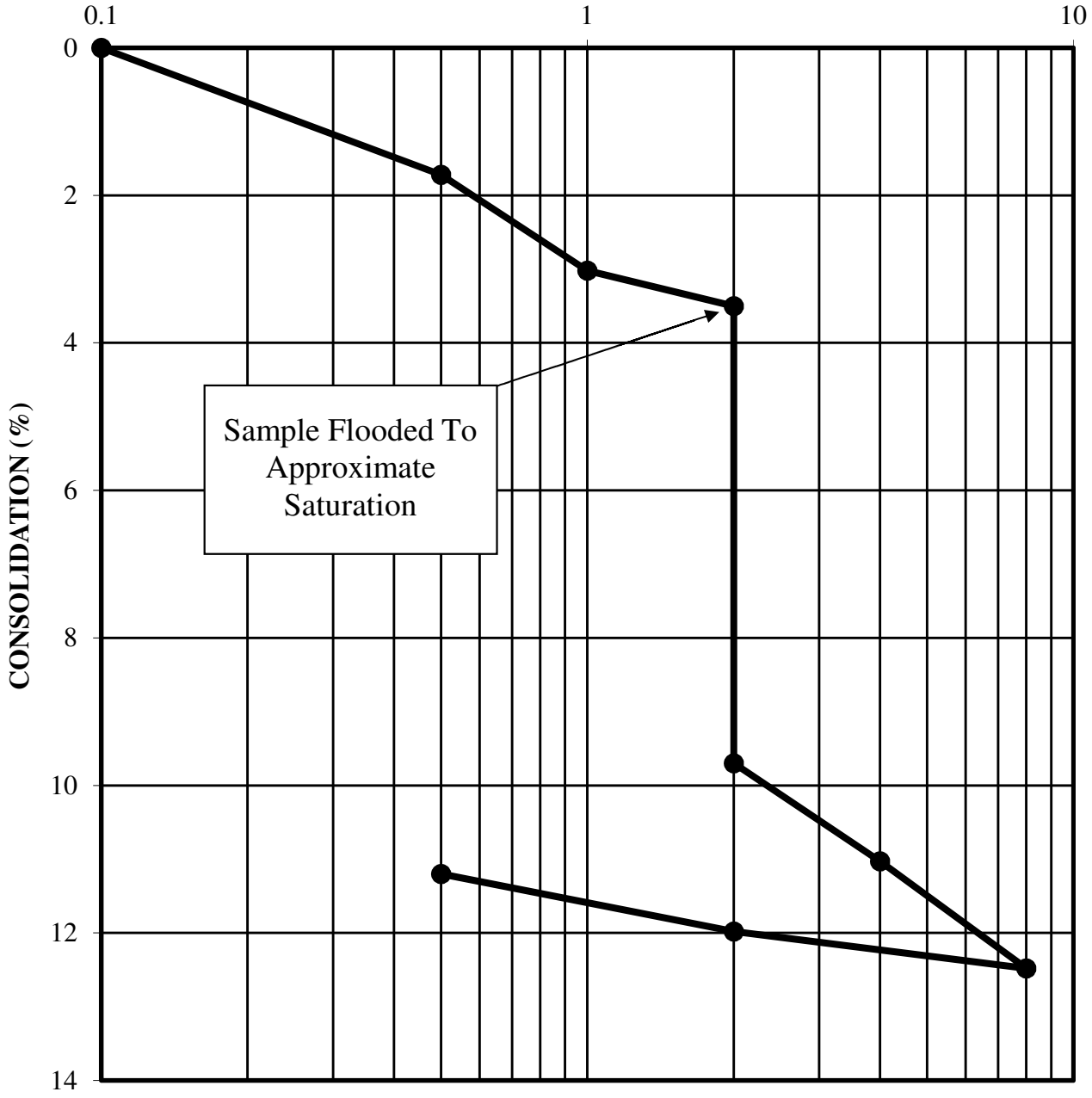


TEST HOLE NUMBER: B-2
SAMPLE DEPTH: 10.0 - 11.0 FEET
SOIL DESCRIPTION: Silty SAND (SM)
MOISTURE CONTENT: 2.8 %
BULK UNIT WEIGHT: 111 pcf

PROJECT: Riparia Ponds, Rio Rancho, New Mexico
PROJECT NO.: 229022-A000231.00

FIGURE NO.: 8

CONSOLIDATION TEST RESULTS



TEST HOLE NUMBER: B-3
SAMPLE DEPTH: 15.0 - 16.0 FEET
SOIL DESCRIPTION: Silty SAND (SM)
MOISTURE CONTENT: 2.3 %
BULK UNIT WEIGHT: 114 pcf

PROJECT: Riparia Ponds, Rio Rancho, New Mexico
PROJECT NO.: 229022-A000231.00

FIGURE NO.: 9

SUMMARY OF LABORATORY TEST DATA

Test Hole	Depth (feet)	Unified Classification	Natural Dry Density (pcf)	Natural Moisture Content (%)	Atterberg Limits		SIEVE ANALYSIS-% PASSING BY WEIGHT										Description
					LL	PI	1 1/2"	3/4"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200	
1	2.5		116	10.1													
1	5	SP-SM	106	6.0	NV	NP					100	98	94	79	39	9.8	Poorly graded SAND with silt
1	7.5			6.9													
1	10			3.6													
1	15	SM		2.7	NV	NP			100	98	93	87	79	61	33	14.6	Silty SAND
1	20	SP-SM		1.9	NV	NP		100	98	93	82	67	54	37	18	8.3	Poorly graded SAND with silt
1	25	SP-SM		2.2	NV	NP	100	96	93	85	75	63	54	41	23	11.2	Poorly graded SAND with silt and gravel
2	2.5	SM		10.9	NV	NP				100	99	97	93	81	56	35.6	Silty SAND
2	5	SM		9.0	NV	NP					100	97	93	81	52	27.1	Silty SAND
2	7.5		104	2.7													
2	10	SM	111	2.8	NV	NP				100	99	94	84	65	35	14.5	Silty SAND
2	15	SM		2.6	NV	NP			100	99	98	93	85	67	35	13.0	Silty SAND
2	20			2.0													
2	25	SM		1.9	NV	NP						100	98	88	41	12.6	Silty SAND
3	2.5			5.2													
3	5	SM		4.4	NV	NP					100	98	95	83	52	28.3	Silty SAND
3	7.5			3.5													
3	10		105	2.7													
3	15	SM	114	2.3	NV	NP			100	99	97	92	86	71	40	16.1	Silty SAND
3	20	SP-SM		1.8	NV	NP		100	95	87	77	66	58	46	24	9.1	Poorly graded SAND with silt

NV5 Project No.: 229022-A000231.00

Project: Riparia Ponds - Rio Rancho, NM **Table No.: 1**

SUMMARY OF LABORATORY TEST DATA

Test Hole	Depth (feet)	Unified Classification	Natural Dry Density (pcf)	Natural Moisture Content (%)	Atterberg Limits		SIEVE ANALYSIS-% PASSING BY WEIGHT										Description
					LL	PI	1 1/2"	3/4"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200	
3	25			2.9													
4	2.5	SM		3.9	NV	NP			100	99	99	98	94	81	49	23.8	Silty SAND
4	5		104	5.8													
4	7.5	SM	106	2.3	NV	NP					100	99	95	78	39	12.6	Silty SAND
4	10			1.9													
4	15	SP-SM		0.4	NV	NP			100	99	97	93	83	58	27	9.8	Poorly graded SAND with silt
4	20	SM		2.2	NV	NP		100	100	99	98	96	91	73	37	12.8	Silty SAND
4	25			2.2													
Upstream	14" - 26"	SP-SM		4.4			100	81	76	71	68	62	52	34	14	5.7	Poorly graded SAND with silt and gravel
Downstream	12" - 24"	SW-SM		7.8				100	96	93	90	85	74	49	19	6.0	Well-graded SAND with silt

NV5 Project No.: 229022-A000231.00

Project: Riparia Ponds - Rio Rancho, NM

Table No.: 1

APPENDIX A

EARTHWORK PROCEDURES

APPENDIX
EARTHWORK PROCEDURES

General

The Geotechnical Engineer shall be the Owner's representative to observe and evaluate the earthwork operations. The Contractor shall cooperate with the Geotechnical Engineer in the performance of the Engineer's duties.

Clearing and Grubbing

Prior to placing structural fill all borrow areas and areas to receive structural fill shall be stripped of vegetation and deleterious materials. Strippings shall be hauled off-site or stockpiled for subsequent use in landscaped areas or nonstructural fill areas as designated by the Owner or his representative and approved by the Geotechnical Engineer.

Site Preparation - Fill Areas

Prior to placing structural fill the areas to be filled shall be scarified to a depth of eight inches and moisture conditioned as described below. The area to be filled shall then be compacted to a minimum of 95 percent of maximum density as determined by ASTM D-1557. If vibratory compaction techniques pose a threat to the structural integrity of nearby facilities a static compactor shall be used. Any soft or "spongy" areas shall be removed as directed by the Geotechnical Engineer and replaced with structural fill as described herein.

Site Preparation - Cut Areas

Following excavation to rough grade, all building and pavement areas shall be scarified to a depth of eight inches and moisture conditioned as described below. All building and paved areas shall be compacted to a minimum of 95 percent of maximum density as determined by ASTM D-1557. If vibratory compaction techniques pose a threat to the structural integrity of nearby facilities, a static compactor shall be used. Any soft or "spongy" areas shall be removed as directed by the Geotechnical Engineer and replaced with structural fill as described herein.

Foundation, Slab and Pavement Subgrade Preparation

Prior to placing reinforcement, footings, slabs, or pavement, the supporting soils shall be prepared, moisture conditioned, and compacted as described herein.

Fill Material

Fill material shall be nonexpansive soil which may be gravel, sand, silt or clay, or a combination there of.

Sieve Size	Percent Passing By Weight
4”	100
1”	90-100
No. 4	70-100
No. 200	10-40

Fill material shall exhibit a plasticity index of ten or less. No organic, frozen or

decomposable material shall be utilized. All fill material shall be approved by the Geotechnical Engineer.

Fill Placement

Fill material shall be blended as necessary to produce a homogeneous material. Fill material shall be spread in horizontal lifts no greater than eight inches in uncompacted thickness, but in no case thicker than can be properly compacted with the equipment to be utilized. If fill is to be placed on slopes steeper than 5:1 (horizontal:vertical) the natural ground shall be benched with minimum three foot wide benches at maximum two foot vertical intervals.

Moisture Conditioning

Fill material shall be dried or moistened as necessary, prior to compacting, to within ± three percent of optimum moisture content as determined by ASTM D-1557. Moisture shall be distributed uniformly throughout each lift.

Compaction

Structural fill shall be mechanically compacted to the following:

	Minimum Compaction ASTM D-1557
Foundation Support	95%
Slab Support	95%
Below Slab Utility Trenches	90%
General Site Grading	90%
Pavement Support	
Upper 8" of Subgrade	95%
All other fill below pavement	90%

Aggregate Base Course shall be compacted to a minimum of 95% of maximum density as determined by ASTM D-1557.

Asphaltic concrete shall be compacted to a minimum of 96% of maximum Marshall Density (75 Blows).

Compaction by flooding and jetting is specifically prohibited unless authorized in advance by the Owner or his representative and the Geotechnical Engineer.

Observation and Testing

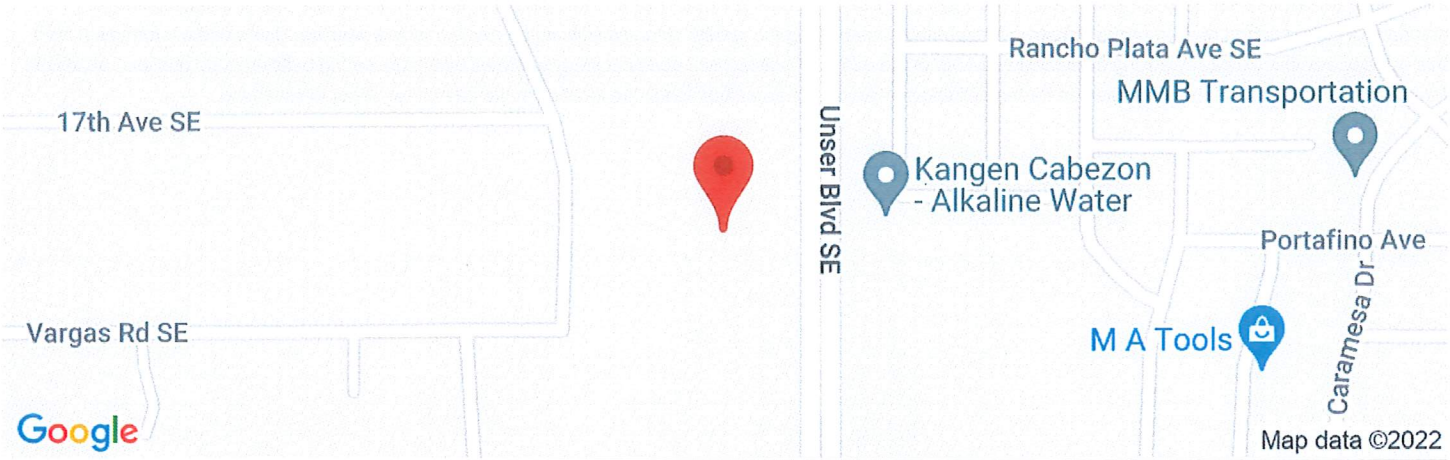
The Geotechnical Engineer or his representative shall perform field density tests with a frequency and at the locations he feels appropriate. The Geotechnical Engineer or his representative will perform Proctor tests on representative samples of all fill material. To minimize delays, the Earthwork Contractor is encouraged to submit soil samples prior to use for proctor testing.

APPENDIX B

SEAOC AND OSHPD SEISMIC DESIGN MAP TOOL

OSHPD

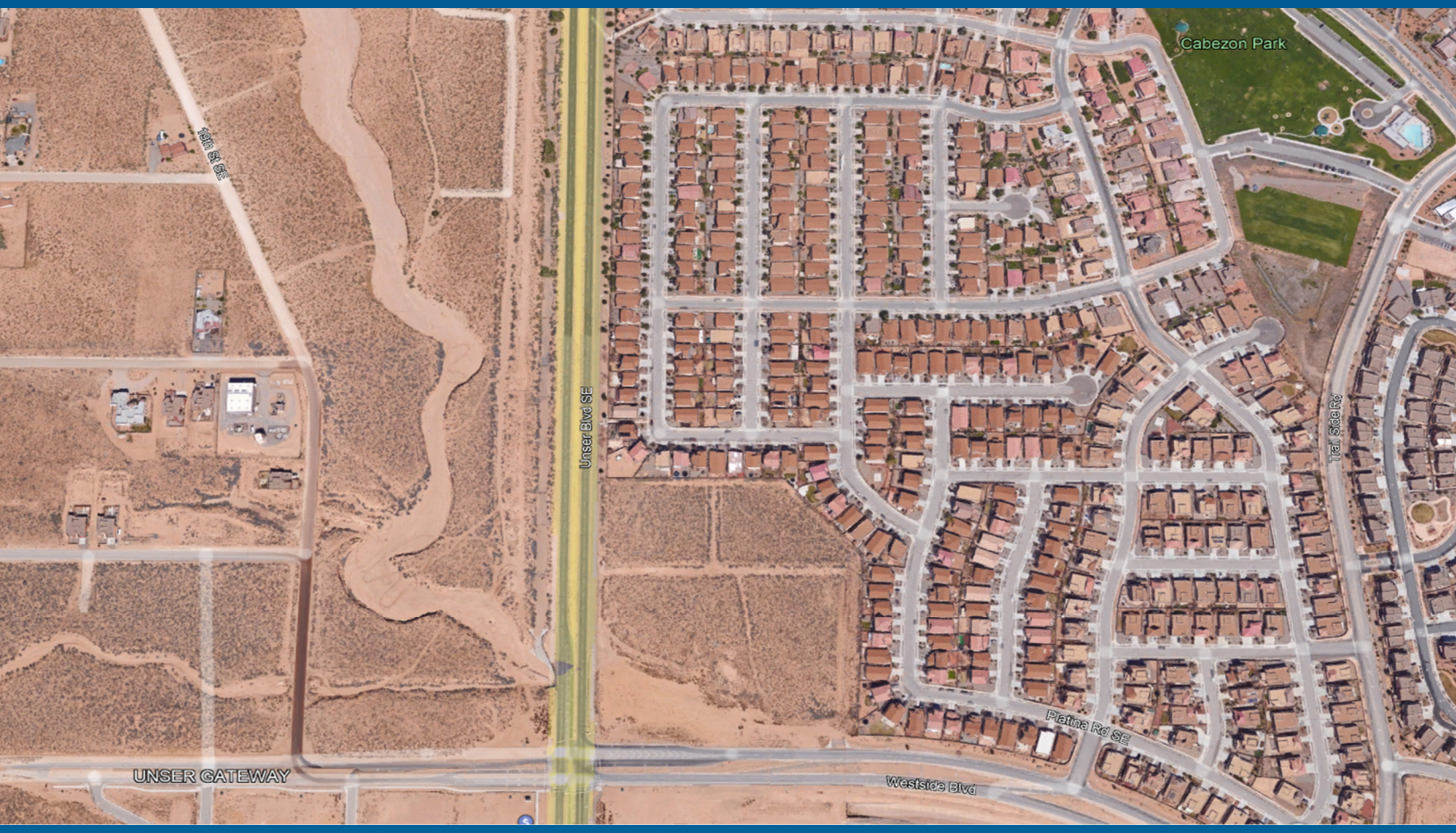
Latitude, Longitude: 35.2277025, -106.6971581



Date	5/26/2022, 10:26:19 AM
Design Code Reference Document	ASCE7-16
Risk Category	II
Site Class	D - Default (See Section 11.4.3)

Type	Value	Description
S_S	0.458	MCE_R ground motion. (for 0.2 second period)
S_1	0.148	MCE_R ground motion. (for 1.0s period)
S_{MS}	0.657	Site-modified spectral acceleration value
S_{M1}	0.34	Site-modified spectral acceleration value
S_{DS}	0.438	Numeric seismic design value at 0.2 second SA
S_{D1}	0.227	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	D	Seismic design category
F_a	1.434	Site amplification factor at 0.2 second
F_v	2.305	Site amplification factor at 1.0 second
PGA	0.198	MCE_G peak ground acceleration
F_{PGA}	1.405	Site amplification factor at PGA
PGA_M	0.278	Site modified peak ground acceleration
T_L	6	Long-period transition period in seconds
SsRT	0.458	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	0.492	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	1.5	Factored deterministic acceleration value. (0.2 second)
S1RT	0.148	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.157	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.6	Factored deterministic acceleration value. (1.0 second)
PGAd	0.5	Factored deterministic acceleration value. (Peak Ground Acceleration)
C_{RS}	0.93	Mapped value of the risk coefficient at short periods
C_{R1}	0.942	Mapped value of the risk coefficient at a period of 1 s



NV5

Delivering Solutions
Improving Lives