

TECHNICAL STANDARDS

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CHAPTER 1 – GENERAL STANDARDS

Article 01-01-010 Acronyms and Definitions

Acronyms:

AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
ACNM	Associated Contractors of New Mexico
AGC	Associated General Contractors of America, Inc.
ANSI	American National Standards Institute
APWA	American Public Works Association
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATSSA	American Traffic Safety Services Association
AWWA	American Water Works Association
BM	Benchmark
FH	Fire Hydrant
FHWA	Federal Highway Association
G	Gas Line
GIS	Geographic Information System
ID	Inside Diameter
Inv	Invert
MH	Manhole
mg/l	Milligrams per Liter
MUTCD	Manual on Uniform Traffic Control Devices
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NM811	New Mexico One-Call (https://www.nm811.org/)
NMAC	New Mexico Administrative Code
NMDOT	New Mexico Department of Transportation
NMPRC	New Mexico Public Regulation Commission
NMSA	New Mexico Statutes Annotated--1978 Compilation as Amended
OHP	Overhead Power
OHP&T	Overhead Power & Telephone
OHT	Overhead Telephone

OSHA	Occupational Safety and Health Association
PC	Point of Curvature
PMBP	Plant Mix Bituminous Pavement
Ppm	Parts per Million
PRC	Point of Reverse Curvature
Psf	Pounds per Square Foot
Psi	Pounds per Square Inch
PT	Point of Tangency
PVC	Polyvinyl Chloride Pipe
Pvmt	Pavement
Q	Rate of Flow
RCP	Reinforced Concrete Pipe
SCCP	Steel Cylinder Concrete Pipe
Sec	Section
Sta	Station
Std	Standard
TCT	Traffic Control Technician
UGT	Underground Telephone
UL	Underwriters' Laboratories, Inc.
V	Velocity

Definitions:

Alley – A public way, other than a street, intended for secondary access and service to the rear or side of the property.

Arterial Street – Is a roadway classification defined by higher traffic volumes, used for trips of moderate lengths, and offers connectivity to higher arterial systems (i.e., interstates). This roadway classification is characterized by a high degree of mobility with limited abutting direct access points.

Asphalt Treated Base Course – Is a dense-graded hot mix asphalt with a wide gradation band and lower asphalt content intended for use as a stabilizing base course.

Backfill – Is suitable material used to refill an excavation.

Building Setback – Is the required separation between a lot line and a building or structure.

City - The City of Alamogordo and all assigned representatives.

City Engineer – The City of Alamogordo’s Engineer.

Collector Street – Is a roadway classification which typically connects larger traffic generators to the Arterial network. Typically characterized by more connecting driveways, fewer travel lanes, lower speed limits, and are prevalent between Arterial routes.

Construction and Demolition Activities – Activities directly related to a public or private improvement project.

Contract Documents - The written agreement between the Contractor and the owner setting forth the obligations of the parties thereunder, including but not limited to the performance of the Work and the Basis of Payment. The Contract Documents are defined in the Agreement and may include: the Advertisement for Bids, Addenda (whether issued prior to the opening of Bids or the execution of the Agreement), Instructions to bidders, Contractor's Bid, the Performance Bonds and Labor and Payment Bond (for both Contractor and subcontractor, if applicable to subcontractor), the Certificate of Insurance, the Statement of Bidder’s Qualifications, the Campaign Contribution Disclosure Form, the Notice of Award, the Notice to Proceed, these General Conditions, the Contract Specifications, any Special Conditions, any referenced Specifications or Standards, Drawings and Plans, and all Modifications to the above, including Change Orders and extensions of Contract Time, all of which constitute one instrument.

Contractor - The person, firm, or corporation with whom an owner has executed the agreement.

Crown – Is the side-to-side or cross-sectional shape of a roadway surface. Roadways may have center-crown, in-sloped crowns, or out-sloped crowns.

Cul-De-Sac – A local street with only one (1) outlet having an appropriate terminus for the safe and convenient reversal of traffic movement.

Curb Cut – Is an opening in an existing curb to allow for a driveway, right-of-way entry from the street, or a temporary cut for the installation of subsurface utility.

Curb Return – Is a curved section of a curb located at a corner of intersecting roadways, connection point of curbs on the main road to an intersecting road.

Detour – An alternate route necessary to avoid something (i.e., vehicle crash, construction activities, etc.) within the existing travel route.

Drawings or Plans - The drawings which show the character and scope of the Work to be performed and which have been prepared or approved by an engineer.

Driveway, Private – A vehicular way not serving more than one (1) lot or parcel of land.

Driveway, Common – A vehicular way serving more than one (1) lot or parcel of land.

Engineer - The person or firm designated by an Owner, who is responsible for providing engineering services.

Easement, Private – A right-of-use granted for the limited use of private landowners and where general use and maintenance of such area is governed by an agreement which runs with the land. This easement is serviceable only by mutual consent of all of the parties that benefit from the Easement.

Easement, Public – An easement dedicated for use by the public, which is included within the dimensions or areas of lots or parcels of land.

Embankment – Excavation, borrow, or imported material suitable for use in fill sections above prepared existing grades.

Federal Highway Administration (FHWA) – Is a division of the United States Department of Transportation that specializes in highway transportation.

Field Order - A written order issued by an engineer or Public Works Inspector which clarifies or interprets the Plans and Specifications, that does not affect the cost or time to complete the work stipulated by the Contract Documents.

Frontage Road – Used to relieve Major Arterial streets of side traffic.

Grade – The slope of any surface specified in percentage terms or in terms of elevation.

Grading – Any disturbance of the surface of the land with earth moving equipment.

Hot Mix Asphaltic Concrete – Is a combination of stone, sand, or gravel bound together by asphalt cement. After it is mixes at a high temperature, laid and compacted, the result is an improved driving surface.

Intersection – the location where two (2) or more streets cross at grade.

Local Street – Is a roadway classification which typically carry no through traffic movement and are used to provide access to adjacent lands and developments.

Lot – is defined as an individual parcel of land for a development. Secondly, it is a particular batch or collection of materials (i.e., pipe or other material).

Median – A strip of land that separates the opposing flows of traffic on a street.

New Mexico One-Call (NM811) – Acts as a communication link between utility companies and individuals planning any digging activity.

OWNER – The City of Alamogordo’s representatives.

Parkway – Is defined as a buffer between a roadway and roadside improvements (sidewalks, walking paths, developments, etc.). Typically consisting of beautification or landscaping.

Pedestrian Way – A specifically designated place, means, or way by which pedestrians shall be provided safe, adequate and usable circulation; normally provides access through the interior of a property or development. Does not include street, vehicular easement, right-of-way, or required sidewalk along a street or vehicular way.

Plans – Documents governing construction of improvements.

Plat – Is a map, drawn to scale, depicting how a parcel of land is divided. A plat includes a description of the different boundaries, land features, and adjacent amenities.

Property Line – The line(s) of record bounding a lot or other parcel of land.

Project - The entire construction to be performed as provided in the Contract Documents.

Project Manager – The owner’s representative who is delegated the responsibility for administration of the Project and who is the primary point of contact for the Contractor.

Public Rights of Way – A general term denoting land, property, or interest therein which is acquired, dedicated, or reserved for use by state, county, or municipal transportation purposes.

Public Works Inspector – Inspector representing the City of Alamogordo responsible for inspection of all Work done and all materials furnished. He is authorized to call to the attention of the CONTRACTOR any failure of the Work or materials to conform to the City’s Standards, Plans and Specifications. He shall have the authority to reject materials or suspend Work until any questions at issue can be resolved.

Reference Specifications, Test Methods, and Applicable Codes - All Standard Specifications and test methods of any society, association, or organization, referred to herein, are hereby made a part of these Technical Standards the same as if written in full (any reference to a paragraph or subparagraph within an article shall include all general provisions of the article to which reference

is made). References to such Standards refer to the latest published issues as of the date of the development or Project is approved, unless otherwise specified. Reference to local or state codes and laws shall mean the latest adopted and published codes as of the date of the development or Project is approved, unless otherwise specified.

Roadway – A thoroughfare, including shoulders, for vehicular use.

Service Connections - Service Connections shall be construed to mean all or any portion of the pipe, conduit, cable, or duct which connects a utility main or distribution line to a building, home, residence, or property.

Shop Drawings - All drawings, diagrams, illustrations, brochures, schedules, and other data which are prepared by Contractor, a subcontractor, manufacturer, supplier, or distributor which have been approved by owner and/or the City Engineer and which illustrate the equipment, material, or some portion of the Work.

Shoulder – The portion of the roadway contiguous with the traveled way, outside of the edge of pavement (designated driving surface), for accommodation of stopped vehicles, emergency use, and lateral support of base and surface courses.

Sidewalk – A paved path (typically concrete pavement) paralleling roadways or parking lots.

Slope – The gradient or incline of the land. Typically expressed in percent (i.e., 2% slope) or in horizontal distance per vertical distance (i.e., 6:1 slope).

Special Conditions - Conditions which modify any article or paragraph of these Technical Standards.

Specifications (also Technical Specifications) - A written technical description of materials, equipment, construction systems, standards and workmanship as applied to the Work.

Street – A right-of-way dedicated to the use of the public by which vehicles and pedestrians shall have lawful and usable ingress and egress, which has been accepted for maintenance and control by the City, County or State. See Streets and Roads Detail Drawings for street classifications and typical cross sections.

Street, Stub – A street that has been designed to allow for the future extension of the street through subsequent developments.

Subcontractor - An individual, firm or corporation having a direct contract with Contractor or with any other subcontractor for the performance of a part of the Work at the site, and who has a current City of Alamogordo Business Registration.

Subgrade – The prepared earth surface on which an asphalt road section, concrete section, or other proposed surface treatment or foundation is to be placed.

Traffic Control Supervisor – An individual trained on the concepts and techniques of temporary traffic control as well as the design of setups, their implementation, and recognizing, analyzing, and correcting deficiencies. Typically certified by the American Traffic Safety Services Association (ATSSA) or Associated Contractors of New Mexico (ACNM).

Traffic Control Technician – An individual trained in a basic knowledge of temporary traffic control with experience in installing traffic control devices, monitoring their performance, and recognizing their deficiencies. Typically certified by the American Traffic Safety Services Association (ATSSA) or Associated Contractors of New Mexico (ACNM).

Utility - Overhead or underground wires, pipes, conduits, ducts, or structures, operated and maintained in or across a public right-of-way or easement or private easement operated and maintained to supply such commodities as water, gas, power, telephone, cable television, or sewer.

- (a) Public Utility - Owned and operated by a municipality or another political subdivision of the state.
- (b) Private Utility - Owned and operated by a private company or corporation.

Work - Any and all obligations, duties, and responsibilities necessary to the successful completion of the Project assigned to or undertaken by Contractor, including all labor, materials, equipment, incidentals, and the furnishing and installation thereof.

Article 01-01-020 Purpose

The following general standards and their requirements have been prepared and adopted by the City of Alamogordo, New Mexico, to guide and assist developers, sub-dividers, owners of subdivisions, engineers and Contractors, in the preparation of plans, specifications, and for the construction of City utilities, streets, and improvements inside the public right-of-way in accordance with the Alamogordo Municipal Code. These Technical Standards shall be the minimum requirements for the design and construction of these improvements.

All the Technical Standards and requirements in the Subdivision Regulations of the Alamogordo Municipal Code are hereby made part of these requirements, even though they may not be specifically mentioned and described herein.

Article 01-01-030 General

- (a) The Contractor is required to locate all existing utilities prior to commencing work on the Project. It shall be the Contractor's sole financial and legal responsibility to field verify locations and depths of all existing utilities and coordinate any relocation Work required. NMAC 18.60.5 provides guidance on the One-Call Notification System and utility locate requirements.
- (b) The Contractor shall be required to maintain adequate temporary access for the private residences and the businesses and facilities within the construction area, to the satisfaction of the City.
- (c) At the end of each workday, as required during each day, or as required due to weather conditions, the Contractor shall perform grading, shaping, and cleanup, to maintain an acceptable site condition, as determined by the engineer.
- (d) Notices and/or requests made by Contractors or Owners to the City shall be made in writing. Each written request will receive a written response with further direction or detail.

Article 01-01-040 Workmanship and Materials

- (a) These standards are prepared with the intention that only first-class workmanship and materials of the best quality will be provided. Materials and workmanship of less than best quality will not be acceptable. In the event that these Standards may not completely describe each and every part, item, and detail, it will not relieve the Contractor of the full responsibility for providing the necessary part, item or work necessary to complete the Project satisfactorily for proper operation, as intended.

- (b) The materials and equipment specified are considered the minimum standard of quality necessary to produce a satisfactory Project. Substitutions for the materials and equipment that have been specified will not be permitted except on written approval of the City.
- (c) Any materials that are found to be damaged either before or after installation shall be removed promptly and replaced with new materials. The City inspection of the materials before they are installed shall not relieve the Contractor from any responsibility to furnish and install good quality materials, totally undamaged.

Article 01-01-050 Water for Construction

- (a) The Contractor will be responsible for purchasing all construction water (reclaimed water or potable water) needed for construction from the City. The cost will be determined in accordance with the current reclaimed or potable water rates. It shall be the Contractor's responsibility to transport and apply the construction water as specified or as ordered by the engineer.

Reclaimed Hydrant Locations

Purple Hydrants

- (1) RS_HYD_01 – 3500 Airport Road (Airport use Only)
 - (2) RS_HYD_02 – 3500 Airport Road
 - (3) RS_HYD_03 – 2143 S. Walker Avenue
 - (4) RS_HYD_04 – 500 LaVelle Road
 - (5) RS_HYD_05 – 220 LaVelle Road
 - (6) RS_HYD_06 – 2150 US Highway 54 South
 - (7) RS_HYD_07 – 2518 Puerto Rico Avenue
 - (8) RS_FIL_01 – 800 E. First Street
- (b) The Contractor shall meter the reclaimed water used at the fire hydrant from which the reclaimed water is taken. Construction water is the sole responsibility and expense of the Contractor that requires water. Water for construction purposes is available for a fee from the City reclaimed water system. An application may be made to the Customer Service Division for which the Contractor will place a deposit, to be refunded when the meter is returned in good working condition. In cases where potable water is to be used for construction purposes and the Contractor does not have an air-gap method of utilizing water, a reduced pressure backflow preventor must be installed and certified by the City prior to being used.
 - (c) Construction water is generally made available by means of a City furnished meter attached to a reclaimed, purple fire hydrant, potable fire hydrant, or through the used of the automated reclaimed fill stand. The charges for City furnished construction water consist of a monthly rental fee plus a cost based on the actual

water usage recorded at the meter. Since fees vary, the Contractor is encouraged to determine the current cost of the service prior to utilizing the service.

- (d) The Contractor shall furnish and maintain the piping and/or equipment necessary to connect to the reclaimed water source and to convey the reclaimed water into the Contractor's reclaimed water tank. Contractor shall not allow reclaimed water to go to waste during the tank filling operations and shall not allow his piping and equipment to leak water.
- (e) The water truck tank filling equipment shall be placed and maintained in such a way as to provide prevention against accidents of any nature to Contractor personnel or the public in general.
- (f) The Contractor is required to connect the fill stand or fill equipment to the fire hydrant and leave the fire hydrant valve open. Contractor shall install a valve in the fill stand piping to control the water flow without leaks. The Contractor shall repair leaks from their respective plumbing immediately. The Contractor shall repair all asphalt/gravel driveways and turnouts that are damaged, during the utilization of locations to acquire water for construction, to pre-existing condition.
- (g) The hydrant valve shall not be closed except when water will not be needed over a weekend or a period of two (2) or more days.
- (h) If it is observed that water for construction is being used from a potable water source or a reclaimed water source that is not metered, the work will be shut down by the City and will not be allowed to resume until a source for metered construction water is provided.

Article 01-01-060 Quality Assurance Materials Testing

- (a) An independent material testing laboratory shall be retained by the City for quality assurance testing. The frequency of the quality assurance testing shall be as determined by the City. The Contractor shall notify the City 24-hours prior to being ready for each quality assurance test and cooperate fully in making way for the laboratory technician to make the required tests. The Contractor shall notify the City if any of the work fails to meet the standards specified, the Contractor shall correct such failures in a manner acceptable to the City. The Contractor shall pay for the cost of all quality assurance re-testing necessary due to failure to meet Specification requirements on previous quality assurance testing. If the Contractor requests the testing laboratory to obtain density tests and the area to be tested is not ready when the technician arrives at the job site, the Contractor shall pay for all trip charges or stand-by time assessed. All costs for failed test and stand-by time will be deducted from the amount due on the Contract.

- (b) Contractor shall notify the Geotechnical Testing Lab a minimum of twenty-four (24) hours in advance of readiness of the work for quality assurance tests.
- (c) Contractor shall be responsible for providing to the City the Proctor, Gradation, and Liquid Limits of subgrade material and base course material.
- (d) Material testing as referenced in this Article is for the City's, quality assurance. The Contractor is responsible for quality control of material, process, and method. Neither observations by the City nor inspections, tests, or approvals by persons other than Contractor shall relieve the obligations to perform the work in accordance with the requirements of the standards.
- (e) Minimum quality assurance testing intervals are provided at the end of this article.

Article 01-01-070 Surveying and Staking

The Contractor shall be responsible for all horizontal and vertical control required to build the Project; the latest City benchmarks are provided at the end of this Chapter. City benchmarks shall be used inasmuch as possible unless unnecessarily constrained by distance from the project. Any field adjustments made will be accepted as if incorporated herein and shall not make any claims for additional surveying or surveying expenses resulting therefrom. All Public Works Surveying shall be completed by a State of New Mexico Licensed Surveyor.

Article 01-01-080 Sanitary Facilities

- (a) The Contractor shall provide the necessary number of sanitary facilities for all the workers on the work site. The sanitation facilities shall be moved along the Project routes so that they will be convenient for the workers.
- (b) Adequate potable drinking water shall be provided on the work site as well as drinking cups, for the benefit of all employees.

Article 01-01-090 Truck Bed Covers

All trucks or other conveyances hauling any loose materials, including hot-mix bituminous materials, on public streets, highways, and detours shall be covered in such a manner as to prevent such materials from dropping, sifting, leaking, or otherwise escaping therefrom. Coverings for trucks or other conveyances hauling loose materials shall be securely fastened so as to prevent said covering or load from becoming loose, detached, or in any manner a hazard to public traffic. The Contractor shall observe legal load restrictions when

hauling materials or equipment within or outside the Project. Any vehicles in violation of this provision will not be permitted to operate.

Article 01-01-100 Method of Bidding

The Bid Schedule has been prepared for a Unit Price Contract procedure. All the quantities shown in the Bid Schedule are estimated and are not purported to be exactly correct. Contractor shall be required to furnish more or less of each estimated quantity that may be required to satisfactorily complete all the Work. The Contractor will be paid on the unit basis for all the material that is actually furnished and installed in the construction of the Project to plan dimensions. In no case shall the Contractor claim extra compensation for building any portion of the Project beyond plan dimensions.

Article 01-01-110 Underground and Overhead Utilities

- (a) Any interference with, or damage to, either underground or overhead utilities of any nature shall be the Contractor's legal and financial responsibility, saving the Owner harmless from any or all claims resulting from damage to these utilities by reasons of his operations.
- (b) The Contractor shall contact New Mexico One-Call at 1-800-321-2537 or by cell phone at 811 to request field utility locates forty-eight (48) hours prior to digging. New Mexico One-Call Website: <https://www.nm811.org/>.
- (c) Contractors shall reference NMAC – Public Regulation Commission Rules and Regulations, specifically Title 18 Chapter 60 found at <http://164.64.110.134/nmac/T18C060>.

Article 01-01-120 Contractor Communications

The Contractor shall contact the City to provide information related to traffic control impacts, as well as to obtain any new requirements or restrictions for traffic control procedures.

Article 01-01-130 Sequence of Works

- (a) The Work shall be carried out with the intent of causing as little disruption as possible to the public. The Contractor shall perform cleanup operations on a continuous basis. Any area requested to be cleaned up by the City shall be cleaned immediately.
- (b) Contractor shall be responsible for advising the businesses, residents, and occupants along each street as to when work will be done in that particular area.

Contractor will notify the businesses, residents, and occupants not less than two (2) days in advance of doing the Work.

- (c) The Contractor shall notify, in writing, the City of anticipated disruptions for issuance of PSA by the City if necessary. Additionally, the Contractor shall provide door hangers to alert businesses, residents, and occupants of upcoming work.
- (d) Contractor will request businesses, residents, and occupants to move their vehicles out of the way of construction if required. If occupant is unresponsive within 48-hours or uncooperative, the City will assist having the vehicles removed.

Article 01-01-140 Authority and Duties of Public Works Inspector(s)

- (a) Inspectors representing the City of Alamogordo shall be authorized to inspect all work done and all materials furnished. Such inspection may extend to all or any part of the work and to the preparation, fabrication, or manufacture of the materials to be used. The inspector is not authorized to revoke, alter, or waive any requirements of the Project. The inspector is authorized to call to the attention of the Contractor any failure of the work or materials to conform to the Project. The inspector shall have the authority to suspend the work when an imminent hazard condition is known to exist, or when the Contractor either delays in correcting or permits repeated occurrences of a hazardous condition. This authority to suspend work does not relieve the Contractor of the legal responsibility for safety at the jobsite.
- (b) The inspector shall have the authority to suspend work due to rejected materials or rejected work only at the direction of the City. Any questions at issue as to quality of materials and/or work installed may be referred to the City. If the Contractor refuses to suspend operations on verbal order, the inspector shall issue a written order giving the reason for suspending the work. After placing the order in the hands of the Contractor's person-in-charge, the inspector shall immediately leave the project. Work done during the absence of the inspector will not be accepted.
- (c) The inspector shall in no case act as foreman or perform other duties for the Contractor, nor shall they interfere with the management of the work by the Contractor. Any advice which the inspector may give the Contractor shall not be construed as binding the City in any way or releasing the Contractor from fulfilling all required Contract terms.
- (d) Contractor supplied photographic evidence will not replace physical observation and/or inspection by the City.

Article 01-01-150 Sanitary Landfill

All waste and recyclable materials shall be disposed of or stockpiled in approved locations per EPA regulations.

Article 01-01-160 Sign Removal and Replacement

The Contractor shall be responsible for removing and replacing all existing signs that are in the way of the Project construction. The existing sign location and height shall be indexed before removal. Removed signs shall be properly and adequately stored. When replaced, signs shall be in existing or better condition, in all respects, than before removal. The Contractor shall replace any signs that are damaged due to negligence, mishandling, or inadequate storage at their own expense.

Article 01-01-170 Protecting the Work

The Contractor shall be responsible for protecting all portions of the work against any and all damage including but not limited to vandalism, accidents, and weather conditions, until accepted. No additional payment will be allowed for rebuilding any portion of the Project caused by such damage.

Article 01-01-180 Fencing

The Contractor shall be responsible for removing and rebuilding any and all existing fencing that is damaged or is in the way of the Project construction. This work shall be considered incidental to the Project and no payment will be allowed for this work.

Article 01-01-190 Existing Water Valve Boxes

- (a) The Contractor shall reference the location of all existing water valve boxes within the construction areas. Any valve boxes that are damaged during construction shall be replaced in accordance with the Standard Details with no additional payment. After the new paving has been installed and approved, the Contractor shall neatly saw-cut an opening in the new pavement, centered on the valve, and the Contractor shall install a new reinforced concrete collar, as provided in the Standard Details. Valve box grade adjustments shall be completed in accordance with Standard Detail W-6 and W-7.
- (b) Existing valves scheduled for removal shall have the entire valve box and valve operating nut removed. Final valve position (open or closed) shall be provided by the City. Backfill requirements shall adhere to Chapter 6.

Article 01-01-200 Existing Manholes

- (a) The Contractor shall reference the location and carefully remove and store manhole rings and lids within the construction areas. Any manhole rings and lids damaged shall be replaced by the Contractor at their own expense. Any manhole lids and covers that do not conform to the requirements of the Standard Details shall be replaced by the Contractor. The top portion of the manhole shall be removed to a depth below the limits of work, and a steel plate covering over the manhole shall be provided. After the new surface treatment has been installed and approved, the Contractor shall neatly saw cut an opening in the new pavement, centered on the manhole, in conformance with Standard Details S-4 and S-5.
- (b) The Contractor shall provide concrete grade adjustment rings as required to reconstruct the top of the manhole to the proper elevation so that the manhole frame and lid are flush with the new surface treatment. A maximum of one foot of adjustment may be made utilizing grade adjustment rings. Each manhole shall receive a new reinforced concrete collar, as provided in the Standard Details.

Article 01-01-210 Water Shut-Offs

- (a) All water shut offs shall be done by the City. The Contractor shall notify the City forty-eight (48) hours prior to the time of the required shut-off. The Contractor shall also notify, at least twenty-four (24) hours in advance, each household, office, business, and/or other affected water user that a shut-off will be made.
- (b) The Contractor shall notify, in writing, the City of anticipated disruptions for issuance of PSA by the City if necessary. Additionally, the Contractor shall provide door hangers to alert businesses, residents, and occupants of upcoming work.

Table 1: Testing Requirements & Minimum Frequency

Materials/Products	Test	Feature	Frequency	Minimum	Specification
Subgrade and Base Course	Proctor ASTM D-1557	Determines the maximum density or compaction a soil sample can reach	At beginning of project, Contractor responsible to provide to Owner	1 Location per Soil Type	Chapter 5
Borrow, Embankment, Backfill	Compaction ASTM D-1557	Density of soil in-place	Every 500' each lift	1 Location	Chapter 5
Borrow, Embankment, Backfill	Moisture Content	Moisture content of soil in-place	Every 500' each lift	1 Location	Chapter 5 Chapter 6 Chapter 8
Borrow, Embankment, Backfill	Compaction	Lab moisture-density ASTM D-698	Every 500' each lift	1 Location	Chapter 5 Chapter 6 Chapter 8
Borrow, Embankment, Backfill	Compaction	Relative density of cohesionless soils ASTM D-4253/4254	Every 500' each lift	1 Location	Chapter 5 Chapter 6 Chapter 8
Backfill	Compaction ASTM D-1557	Density of soil	Every 500' each lift	1 Location	Chapter 6 Chapter 8
Trench Bedding & Backfill for Pipes	Compaction ASTM D-1557	See Article 02-022.1 (all tests apply)	Every 200' each lift	1 Location	Chapter 6 Chapter 8
Subgrade	Compaction & Density ASTM D-1557	Density of soil in -place	Every 200'	2 Locations	Chapter 5
Subgrade	1/2" Maximum Deviation	Surface Tolerances	---	---	Chapter 5
Subgrade, Subbase, or Base Course	Moisture Content	Moisture Content AASHTO T-99 AASHTO T-180	---	---	Chapter 5
Base Course	Compaction & Density ASTM D-1557	Density	Every 500' for Each Lift	2 Locations	Chapter 5
Base Course	3/8" Maximum Deviation	Surface Tolerance	---	---	Chapter 5
Plant Mix Bituminous Pavement (PMBP)	Compaction	Compaction ASTM D-2950	1 Test per 500 tons	1 per day of production	Chapter 5
Plant Mix Bituminous Pavement (PMBP)	3/16" Maximum Deviation	Surface Tolerance	---	---	Chapter 5
Plant Mix Bituminous Pavement (PMBP)	Density (Cores)	Physical Properties: thickness, density, specific gravity, air voids, stability, flow	---	2 Cut Pavement Samples per Acceptance Section	Chapter 5
Aggregates	Plasticity Index, Sand Equivalent, Fine Aggregate Angularity, Flat & Elongated Particles Count, & Fractured Face Count	Plasticity Index, Sand Equivalent, Fine Aggregate Angularity, Flat & Elongated Particles Count, & Fractured Face Count	At the Start of Production and at every 500 Tons	One per Project	Chapter 5

Table 1 Continued: Testing Requirements & Minimum Frequency					
Materials/Products	Test	Feature	Frequency	Minimum	Specification
Mineral Filler	Manufacturer Info.	Materials Content	---	---	Chapter 5
Aggregate Base Course – Pavement Patching	Gradation	Size of Aggregates	Every 200 SF	1 Minimum	Chapter 5
Aggregate Base Course – Pavement Patching	Percent Wear & Soundness Loss	Mix Composition	---	---	Chapter 5
Aggregate Base Course – Pavement Patching	Density & Moisture Content	Density and Moisture	---	1 Minimum	Chapter 5
Water Supply Pipes	Hydrostatic Pressure Test AWWA C-600	Tests for Leaking	All Water Lines	1 Minimum	Chapter 8
Water Supply Pipes – Air Valves & Access Points	Disinfection AWWA C-651	Tests for Chlorine Residual	All Water Lines	---	Chapter 8 Chapter 9
Water Supply Pipes – Air Relief Valves & Vacuum Relief Valves	Pressure Test	Test for Strength and Leakage	All Valves	---	Chapter 8 Chapter 9
Sanitary Sewer	Low Pressure Air or Water Test	Tightness Uni-Bell PVC Pipe Assn UNI-B-6-98	All Pipe	---	Chapter 6
Sanitary Sewer	Ex-Filtration Test	Pressure & Leakage	All Pipe	---	Chapter 6
Sanitary Sewer	Deflection Test	Pipe Strength	All Pipe	---	Chapter 6
Sanitary Sewer - Manholes	Water Test	Leakage	All Manholes	---	Chapter 6
Concrete	Slump, Unit Weight, Air Content ASTM C-143 ASTM C-172 ASTM C-231	Materials, Consistency, Content, and Properties	1 Sample from each of the first 3 Concrete loads delivered, then 1 randomly selected load from each sub-lot of 6 trucks	---	Chapter 5
Concrete	Compressive Strength Test Cylinders	Concrete Compressive Strength	7 and 28 Days	1 Set Total from first 3 loads (random)	Chapter 5
Concrete – Slip Form	Individual Strength Test	Concrete Compressive Strength ASTM C-39	7 Days, 14 Days for slip-form concrete, and 28 Days	4 Cylinders per Sample	Chapter 5
Concrete Curbs, Gutters, Walks, Driveways, Aprons, Curb Returns, Fillets, Valley Gutter & Slope Paving	Compressive Strength Test Cylinders	Concrete Compressive Strength	3 Cylinders for initial 10 yards placed, 3 cylinders for every 100 CY placed thereafter	1 Set of Three (3) Cylinders	Chapter 5

END OF CHAPTER 01

CHAPTER 02 - TRAFFIC CONTROL & MANAGEMENT

ARTICLE 02-01 - GENERAL

Article 02-01-010 Work Description

- (a) The work shall consist of providing Traffic Control and Traffic Control Management in accordance with the Contract and the MUTCD, current edition, including supervision of personnel and the installation, inspection, and maintenance of all traffic control devices on the Project.
- (b) Complex traffic control plans, as determined by the City, shall be developed and sealed by a State of New Mexico registered professional engineer prior to submittal to the City.

ARTICLE 02-02 – REQUIREMENTS

Article 02-02-010 Contractor Requirements

- (a) The Contractor may assign more than one (1) traffic control supervisor (TCS) to provide traffic control management for the Project provided that a schedule is submitted to the City.
- (b) If assigning more than one (1) TCS to provide traffic control management, submit to the City a weekly schedule identifying who shall be in charge of providing traffic control management each day.
- (c) The TCS shall possess, at all times, a set of approved traffic control plans and a current copy of the MUTCD.
- (d) Traffic control shall be required when any public street or alley requires work. Traffic control shall also be required to prevent through-traffic, where new development meets existing streets, until all utilities, new streets, and infrastructure have been completed.
- (e) Where more than one Contractor is working in an area requiring traffic control, the Contractor shall coordinate all traffic control operations.
- (f) If the Contractor is using a subcontractor to provide traffic control management, the Contractor shall ensure that the TCS is in accordance with the Contract.
- (g) The Contractor may assign one (1) or more traffic control technicians (TCT) to assist the TCS in inspection and maintenance of traffic control devices.

Article 02-02-020 Certification

- (a) Before commencing work that requires traffic control management, submit to the City a copy of the “Work Zone Safety Supervisor” certificate for the TCS (wallet size card) issued by the American Traffic Safety Services Association (ATSSA), the Associated Contractors of New Mexico (ACNM), or an agency or firm approved by the City.
- (b) The City will accept the TCS certification by ATSSA, ACNM, or any agency or firm only if the following requirements are met:
 - (1) Successful completion of an approved work-zone traffic control course;
 - (2) Passing a written examination on a work-zone traffic control course;
 - (3) At least one (1) year of full-time field experience, verified by the agency or firm, in work zone traffic control; the City may verify the experience at its discretion.

The TCT must only satisfy requirements 1 and 2, above.

- (c) Before commencing work that requires flagger traffic control, submit a copy of the “Flagger Training” certificate (wallet sized card) issued by ATSSA, ACNM, FHWA, or an agency or firm approved by the City.

Article 02-02-030 Re-Certification

- (a) Renew the TCS’s certification every four (4) years through the ATSSA, ACNM, or a City-approved agency or firm.
- (b) Re-certify in the fourth year, before the expiration date of the current certification.
- (c) Flaggers must obtain refresher training which meets the requirements of ATSSA, ACNM, FHWA, or agency or firm approved by the City prior to the fourth anniversary date shown on the current certificate.

Article 02-02-040 Duties

- (a) The TCS’s only responsibility is traffic control management. The City may allow exceptions to this rule if the Project is small and requires limited traffic control. The City will determine approval of the exception at the preconstruction conference.

- (b) The TCS's primary duties include the following:
- (1) Providing management and supervision services at the Project site.
 - (2) Preparing revisions requested by the Contractor to the traffic control plan in the Contract and submitting the new traffic control plan, in hard copy format, to the City.
 - (3) Coordinating the flagging and signing personnel training.
 - (4) Supervising the flagging and signing personnel.
 - (5) Coordinating traffic control operations for the duration of the Contract, including those of subcontractors, utility companies, and suppliers, to ensure that traffic control is in place and fully operational before the commencement of work. When dealing with utility companies, the TCS shall coordinate concurrent utility traffic control with other construction traffic control to avoid conflicts.
 - (6) Coordinating, in writing, Project activities with the appropriate individual traffic control, law enforcement, emergency services, and fire control agencies.
 - (7) Preparing and submitting statements concerning road closures, delays, and other project activities to the City for distribution, as necessary.
 - (8) Notifying the City of accidents related to the project traffic control.
 - (9) Recording time and date of accident notification in accordance with Article 02-02-040, "Traffic Control Diary".
 - (10) Attending the preconstruction conference.
 - (11) Maintaining, cleaning, and replacing traffic control devices in use per the current traffic control plan during working and non-working hours.

Article 02-02-050 Traffic Control Diary

- (a) The TCS shall maintain a project traffic control diary in a bound book. Obtain the diary from the ACNM.
- (b) The TCS shall keep the traffic control diary current each day and sign each daily entry.

- (c) The TCS shall make entries in ink, in a format approved by the City, without erasures or white-outs. The TCS shall strike out unacceptable entries and replace with acceptable ones. The TCS may use photographs to supplement the written text.
- (d) Ensure that the traffic control diary is always available for inspection by the City and submit a copy of the diary to the City at the end of each week. The traffic control diary shall be kept on site during construction activities.
- (e) The traffic control diary will become the property of the City at the completion of the Project. If the Contractor fails to submit the diary, the City may withhold final payment until it is submitted.

Article 02-02-060 Inspection of Traffic Control

- (a) The TCS shall inspect traffic control devices every day that traffic control devices are in use at least once a week during nighttime periods and at an interval not to exceed 12 hours not during standard working hours. The TCS shall provide for the immediate cleaning, repair, or replacement of traffic control devices that are not functioning as required to ensure the safety of the motorists, pedestrians, and construction personnel.
- (b) The TCS shall conduct inspections of the traffic control devices at the beginning and end of each day that traffic control devices are in use, and as scheduled or directed by the City during working hours.
- (c) The TCS shall inspect the traffic control devices during non-working hours on a schedule approved in writing by the City.
- (d) The TCS shall inspect traffic control devices and shall provide for the immediate repair, cleaning, or replacement of traffic control devices not functioning as required or not meeting MUTCD Standards to ensure the safety of the public and construction personnel.

Article 02-02-070 Availability of TCS

- (a) Provide traffic control management under the supervision and direction of the TCS on a 24-hour-per-day basis throughout the duration of the Project.
- (b) The TCS shall be on the Project whenever work is in progress, and available by telephone to be on the Project within 1 hour at all other times.

- (c) The provisions for availability of the TCS will also apply during times of partial or full project suspension.
- (d) Contact information for the TCS shall be provided prior to construction, including a cell phone number for contact during non-working hours.
- (e) An alternate contract who is a manager of TCS shall also be provided.

ARTICLE 02-03 - COMPLIANCE

Article 02-03-010 Failure to Comply

- (a) If the Contractor fails to comply with the approved traffic control plan or fails to immediately correct unsafe traffic conditions after written notification of the problem, the City may suspend all or part of the Contractor's operations.
- (b) In the event that the Contractor does not take appropriate action to bring the deficient traffic control into compliance with the approved Traffic Control Plan – or to correct the unsafe traffic conditions – the City may proceed with the corrective action and charge the Contractor for the additional cost incurred.
- (c) If the City suspends the Contractor's operations, the City will include the period necessary to correct these unsafe conditions and traffic control deficiencies in the normal assessment of contract time.
- (d) The City will not relieve the Contractor of the responsibility to provide traffic control safety to the traveling public if the City fully or partially suspends the Project.
- (e) If the City suspends the Project due to the Contractor's failure to comply with this Article, or the contract is in liquidated damages, the Contractor shall continue to provide traffic control management, at no additional cost to the City.
- (f) If the Contractor requests full or partial suspensions, the Contractor shall perform the additional traffic control management at no additional cost to the City.

Article 02-03-020 City Modification

The provisions included in the Contract Documents and Specifications for handling and controlling traffic during construction may be changed by the City due to actual field conditions encountered. Contract should only be changed by Field Order or Change Order.

END OF CHAPTER 02

CHAPTER 03 - CLEANUP

ARTICLE 03-01 – GENERAL

The work shall consist of cleanup, in accordance with this Article, the Contract Documents, and all applicable specification items in these documents. Contractor shall furnish all the labor, equipment, and materials necessary to perform all work required.

ARTICLE 03-02 – PROJECT CLEANUP

- (a) Cleanup of debris, trash, and waste materials shall be performed on a continuous basis by the Contractor in such a way that will always keep the work site(s) clean and neat.
- (b) The Contractor shall be responsible for cleaning up the Project. All areas disturbed shall be left in excellent condition, free of any debris, trash, and the like. All trees that were limbed during construction shall be neatly and properly coated so as to protect the cut face, in accordance with good tree surgery practices.
- (c) All areas disturbed shall be graded smooth and shall be free of ruts and uneven places.
- (d) All excess materials, trash, dirt, and rocks shall be disposed of at an approved site or at a place approved by the New Mexico Environment Department.

ARTICLE 03-03 – FINAL INSPECTION CLEANUP

Immediately before the final inspection tour is to be conducted, the Contractor shall cleanup the Project site in its entirety, removing all debris, waste, trash, excess materials, and equipment. Contractor shall review the entire Project before the final inspection and shall have it neat and clean in appearance.

END OF CHAPTER 03

CHAPTER 04 - PRODUCT OPTIONS

ARTICLE 04-01 - GENERAL

This section includes requirements for product options and substitution procedures.

ARTICLE 04-02 - PRODUCT OPTIONS

- (a) For products specified by reference standards or by description only, provide products meeting those standards or description as approved by the City.
- (b) For products specified by naming one or more manufacturers with the designation that no substitutions are allowed, provide only named products.
- (c) For products specified by naming one or more manufacturers, provide named products or approved substitute products.
- (d) Requests to use unspecified products shall be made in accordance with the “Substitution Request Procedures” as specified herein.

ARTICLE 04-03 – SUBSTITUTION REQUESTS

- (a) Where products are specified by naming specific products of one or more manufacturers, these products shall establish a minimum acceptable level of quality and performance.
- (b) Prior Approval: The City will consider requests made during bidding to use unspecified products only when indicated in individual standard sections.
 - (1) When substitution requests are allowed during bidding by individual standard sections, requests shall be made in accordance with the “Substitution Request Procedures” as specified herein.
 - (2) If product is acceptable, City will provide approval by addendum issued to known recipients of Bidding Documents.
- (c) After signing of Agreement between City and Contractor, City will consider written requests for substitutions.
 - (1) Requests shall be made in accordance with “Substitution Request Procedures” as specified herein.

- (2) City will determine acceptability of proposed substitutions and notify Contractor of decision in writing.
 - (3) Substitutions will not be considered when indicated or implied on shop drawings and product data submittals.
- (d) Request for substitution and use of approved substitution shall constitute representation that Contractor.
- (1) Has investigated product and determined it meets or exceeds quality level of specified product.
 - (2) Will provide same warranty for substitution as for specified product.
 - (3) Will coordinate installation and make changes to other work required to accommodate accepted substitution and complete work.
 - (4) Waives claims for additional costs or time extensions related to substitutions which later become apparent.

ARTICLE 04-04 – SUBSTITUTION REQUEST PROCEDURES

- (a) Submit separate request for each substitution with the “Substitution Request Form”.
Copy of form follows this Section.
- (b) Submit 3 copies of request for substitution and include the following:
 - (1) Complete data substantiating compliance of proposed substitution with Contract Documents.
 - (2) For products:
 - A. Product identification, including manufacturer's name and address.
 - B. Manufacturer's literature containing product description, performance and test data, and reference standards.
 - C. Samples as required.
 - D. For construction methods:
 - 1. Detailed description of proposed method.

2. Drawings illustrating methods.

- E. Itemized comparison of proposed substitution with product specified.
- F. Data relating to changes in construction schedule.
- G. Give cost data comparing proposed substitution with specified product.
- H. For substitution requests made after signing Agreement, include proposed changes to Contract Amount and Time if substitution is accepted.

END OF CHAPTER 04

Read **CHAPTER 04 - PRODUCT OPTIONS** prior to submission of this form.

The undersigned requests that the following product be accepted for use in the Project.

Product: _____

Model No: _____

Manufacturer: _____

Address: _____

The above product would be used in lieu of:

Product: _____

Specified in: _____ Section: _____ Paragraph: _____

Reason for substitution request: _____

Attached are the following items:

Product description including specifications, performance and test data, and applicable reference standards.

- Drawings
- Photographs
- Samples
- Tabulated comparison with specified product
- For items requiring color selections, full range of manufacturer's color samples
- Documentation of reason for request.
- Cost data for comparing proposed substitution with specified product
- Other: _____

The undersigned certifies that the following statements are correct. Explanations for all items which are **not** true are attached.

1. Proposed substitution has been thoroughly investigated and function, appearance, and quality meet or exceed that of specified product. True False
2. Same warranty will be provided for substitution as for specified product. True False

- 3. No aspect of Project will require re-design. True False
- 4. Use of substitution will **not** adversely affect:
 - a. Dimensions shown on Drawings. True False
 - b. Construction schedule and date of completion. True False
 - c. Work of other trades. True False
- 5. Maintenance service and replacement parts for proposed substitution will be readily available in the New Mexico area. True False
- 6. Proposed substitution does **not** contain asbestos in any form. True False
- 7. All changes to Contract Sum related to use of proposed substitution are included in price listed below. Contractor waives claims for additional costs related to acceptance of substitution which may subsequently become apparent. True False
- 8. Costs of modifying project design caused by use of proposed substitution which subsequently become apparent will be paid for by Contractor. True False

If substitution requested after signing of Agreement between Owner and Contractor is accepted:

Contract Sum will be [decreased] [increased] by \$ _____

Contract Time will be [decreased] [increased] by _____ calendar days.

Submitted By: _____

Company: _____

Address: _____

Telephone Number: _____

Name: _____ Date: _____

Signature: _____

TECHNICAL STANDARDS

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CHAPTER 05 – STREETS AND ALLEYS

ARTICLE 05-01 – General

Article 05-01-010 Street Standards

- (a) These standards will be used in conjunction with the most current edition of the NMDOT Standard Specifications for Highway and Bridge Construction.
- (b) Street Classification and Geometric Design Standards
 - (1) Existing streets are identified and classified in the City of Alamogordo Comprehensive Plan. Street classifications for new construction within public rights-of-way shall be determined by the City. Minimum street rights-of-way shall meet the requirements established herein as noted in Table 1.
 - (2) Cul-de-sac Geometric Standards
 - A. Maximum length of cul-de-sac shall not exceed 600-feet without approval from the City. Length of the cul-de-sac shall be measured from the back of curb of the perpendicular street to the radius point in the middle of the cul-de-sac.
 - B. Minimum diameter:
 - 1. Right-of-way – 100 feet
 - 2. Pavement (in bulb back-to-back of curb) – 96 feet
 - 3. Geometry must be approved by the City
- (c) Pavement Design Standards
 - (1) Typical sections for construction in the City shall be designed in accordance with the latest edition of the AASHTO “Guide for the Design of Pavement Structures.”, or as modified in this section.
 - (2) Laboratory analysis of the subgrade soils underneath the street is first required for pavement design.

Table 1: Street Geometric Design Standards

Parameter	Minimum Right-of-Way Width (feet)				Minimum Street Width (Feet) (Back-to-Back of Curb)				Minimum Fillet Radius (Feet) (Back of Curb)				Minimum Curve Radii (Feet) (Back of Curb)				Minimum Tangent Length Between Curves				Minimum Sight Distance (Feet)			
	Local Street	Collector Street	Minor Arterial	Major Arterial	Local Street	Collector Street	Minor Arterial	Major Arterial	Local Street	Collector Street	Minor Arterial	Major Arterial	Local Street	Collector Street	Minor Arterial	Major Arterial	Local Street	Collector Street	Minor Arterial	Major Arterial	Local Street	Collector Street	Minor Arterial	Major Arterial
Without Bike Lanes/Parking	48	72	80	112	28	52	60	92	30	35	40	45	100	100	300	500	150	150	250	350	200	240	275	300
With Bike Lanes/Parking	62	82	90	122	42	62	70	102	30	35	40	45	100	100	300	500	150	150	250	350	200	240	275	300

Minimum Fillet Radii may vary depending on existing right-of-way widths.

Parameters in the table above are minimums. Developer may exceed the minimums, or the City may require greater parameters based on the proposed development.

Refer to Detail R-6 for Local Collector Street Detail.

Refer to Detail R-7 for Collector Street Detail.

Refer to Detail R-8 for Minor Arterial Street Detail.

Refer to Detail R-9 for Major Arterial Street Detail.

(d) Engineering Data

- (1) Grades – The grades of all streets shall be a minimum of 0.30% except where topographical conditions unquestionably justify a departure from the minimum. Typical crown slopes shall be a minimum of two percent (2%). Street cross slopes shall not exceed five percent (5%) without prior authorization from the City.

Street construction drawings shall be submitted and shall contain a complete plan and profile exhibiting all existing grades, proposed grades, and elevations and grades of proposed connections to existing streets.

- (2) Temporary Street Terminations – Where new roadways are terminated in advance of future extension, the termination shall have a flush header curb installed to prevent premature pavement end damage.
- (3) Maximum Side Slopes – cut and fill slopes for roadway prism shall be two (horizontal) to one (vertical) maximum.
- (4) Street Intersections – shall be designed to intersect at right angles inasmuch as possible. Angles of intersection of 75 degrees or less shall be preapproved by the City.
- (5) AASHTO roadway design guidance shall be consulted for horizontal and vertical design elements based on intended roadway classification, design speeds, and traffic volumes.
- (2) Traffic Report – The City, at its discretion, may require traffic impact analysis for subdivisions and commercial developments. For commercial developments requiring more than 49 spaces, and for all properties fronting on New Mexico State Highways, the analysis must be performed by a registered engineer. Properties fronting on State Highways require additional separate permits from the NMDOT.

Article 05-01-020 Alley Standards

(a) Engineering Data

- (1) Use of Inverted Crown – Inverted crowns will not be allowed in alleys without prior approval by the City.

- (2) Paving of Alleys – In all cases, an alley to be paved shall be paved for its entire block length. In no case will a part or section of an alley be paved where other sections are left unpaved.
 - (3) All alleys in commercial and industrial zoned areas, locations where sole access is by an alley(s), or any alley used for drainage ways shall be paved.
- (b) Alley Entrances – A drive entrance (drivepad) will be required at the entrance and exit of all alleys and shall conform with Standard Drawing R-12. If difficult or unusual site conditions warrant, the designer may submit an alternate detail for approval by the City. If an alley requires a radius, the length must be approved by the City. All alley pads and access across alleys shall meet ADA accessibility requirements.

Article 05-01-030 Concrete Flatwork Standards

- (a) General - This section shall deal with the placement, replacement, and/or removal of sidewalks, valley gutters, fillets, and drivepads within the public rights-of-way within the City of Alamogordo. Construction shall meet the American Disabilities Act (ADA) requirements. Sidewalk and driveway installation and replacement shall be the responsibility of the property owner or developer.
- (b) Engineering Requirements – Sidewalk, valley gutter, fillet, and drivepad construction shall conform to the standard details contained herein, unless otherwise submitted by plan and approved by the City. The City may require that the plan illustrate existing and proposed grades of the curb and gutters and streets. No permits for construction will be issued until such information have been provided and approved by the City.
- (c) Sidewalk Placement
 - (1) Sidewalks shall be placed adjacent to the back of curb on both sides of the street/road regardless of the road type designation. Parkways between the back of curbs and proposed sidewalks shall be submitted by plan and approved by the City.
 - (2) Width and Section – All sidewalks will be constructed with a minimum width of five-feet (5'). Sidewalks shall be four-inches (4") thick in all areas except when used as a driveway or drivepad.
 - (3) Grades for Sidewalks – Sidewalks shall have a running slope concurrent with the adjacent street and a typical cross slope of 1.5 percent (2.0 percent maximum). The sidewalk shall slope toward the street. This stipulation

may be waived by the City in areas where topographical features will not allow for such slopes.

- (4) If an obstruction is located in the sidewalk (i.e. utility pole, mailbox, etc.) a minimum four-feet (4') clear space must be maintained at the obstacle along the sidewalk.
- (5) All concrete sidewalks, valley gutters, drivepads, fillets, etc. must be protected from freezing for a minimum of four (4) days.
- (6) Development on corner lots shall be required to construct or reconstruct existing fillets and sidewalks to comply with ADA requirements at the time the lot is developed or redeveloped.

(d) Drivepad Placement

- (1) Drivepads on interior lots (lots not on a corner) shall be located to allow the maximum slope of 15:1 where the drivepad ties to new or existing sidewalk. Drivepads on corner lots requiring a new building, remodel of existing building, curb cut, or driveway permit shall be located as follows:

Table 2: Drivepad Location

Street Type	Drivepad Location
Local Street	Minimum 20-feet from the curb return
Collector Street	Minimum 40-feet from the curb return
Minor Arterial Street	Minimum 50-feet from the curb return
Major Arterial Street	Minimum 50-feet from the curb return

- (2) Width and Section – All drivepads will be constructed to the back of sidewalk or to the property line, whichever is less. Drivepads shall be six-inches (6”) thick in all areas. Drivepads shall not be wider than forty-feet (40’) and may not be placed closer than twenty-feet (20’) from any curb return. Developer may submit alternate drivepad details for approval by the City. All drivepads shall meet ADA accessibility requirements. All drivepads shall have a typical cross slope of 1.5% across its width to accommodate the pedestrian travel path.

- (e) Fillets shall be a minimum of six-inches (6”) in thickness and shall meet all ADA requirements. Developments on corner lots may elect to construct or reconstruct fillets in lieu of radial pavement surfacing.

Article 05-01-040 Curb Cuts

- (a) General: This section deals with the removal and replacement of curb and gutter sections as defined below.
- (b) Engineering Data: Improvement Plan-The plan for the proposed curb cuts shall illustrate information regarding all the existing elevations of the existing curb. Additionally, proposed elevations shall be displayed. The grade of the replacement shall be such that it is continuous with the existing section to which it is being tied. Any existing utilities in the area shall be noted.

City of Alamogordo Code of Ordinances 2-01-030 (o) – Moratorium on Cut Cuts:

“At time of filing a request to cut a curb adjacent to a public right-of-way, applicant shall pay a non-refundable fee to cover costs of verification the curb cut meets building code and city ordinance requirements, administration, and other expenses. Additional costs for City personnel to cut the curb is extra and will be billed separately. A curb cut permit will not be issued within sixty (60) months of initial pavement, or repaving, of a road except due to emergency circumstances.

When curb/street cuts are required for installation, repair, or replacement of surface utilities the finished patch shall extend five-feet (5’) from the top surface edge on either side of the necessary trench. Cuts within pavement shall extend curb-to-curb insomuch as possible.

Article 05-02 – Materials Requirements

All streets shall be constructed in accordance with the current edition of the NMDOT Standard Specifications, as modified herein. Reference to the Department shall be replaced with the City of Alamogordo.

Article 05-02-010 Borrow

- (a) Borrow materials used in the embankment and fill shall not be uniformly fine-grained materials. The fill materials shall be classified as SC, SM-SC, GC, GM, or GM-GC according to the Unified Soil Classification System. No soils in the embankment shall have a median grain size (D50) finer than #200 USA Standard Sieve. Proper mixing and blending of materials will be required.
- (b) Areas of natural ground to receive embankment or fill not already at optimum moisture shall be scarified to a depth of eight (8) inches, wetted or dried to bring the moisture content to within plus two percent (+2%) to minus one percent (-1%) of optimum and re-compacted to the specified percent of the maximum density,

tested and approved before the first layer of suitable embankment material is placed.

- (c) Only suitable material for embankment and fill will be allowed in the permanent work at locations shown on the Contract Documents.
- (d) After areas to receive embankment or fill have been properly prepared, suitable material shall be placed and spread in loose eight-inch (8") lifts across the entire fill or backfill section. The City may authorize roadway fill materials to be placed in layers in excess of eight-inches (8") thickness if the Contractor can demonstrate that the required compaction can be achieved for the full depth of the lift. Lesser thickness shall be used if necessary, to achieve specified compacted density. Suitable material shall then be windrowed, disked, or manipulated by other suitable means to achieve a homogeneous mixture of proper moisture content, free of hard lumps of soil or frozen material, and compacted to the required density.
- (e) Rocks larger than two and one-half (2-1/2) inches shall not be placed within twelve inches (12") of the subgrade for paving.
- (f) Compacting shall begin only after the suitable material has been properly placed and the material to be compacted is at optimum moisture, not to exceed plus two percent (+2%) or minus one percent (-1%) of optimum. All materials used for embankments shall be compacted to a minimum of ninety five (95) percent of maximum dry density, modified proctor, (ASTM D 1557).
- (g) If the suitable material to be compacted contains excessive moisture, such material shall be processed to reduce the moisture to the specified content. If the suitable material has less than the specified moisture content or is likely to lose enough moisture to bring the moisture content below requirements before completion of compaction, water shall be added and the lift thoroughly mixed before compacting.
- (h) Subsequent layers of suitable material for embankment shall be placed, as described above, in generally horizontal layers of loose thickness not to exceed eight-inches (8"), unless otherwise approved, and shall extend across the full width of the embankment area.
- (i) After compacting of the material, in place density tests shall be made. If the compacted material fails to meet the density specified, the course shall be reworked as necessary to obtain the specified density.
- (j) Embankment, or fill, adjacent to structures such as concrete walls, culverts, boxes or similar structures shall not be compacted with heavy equipment but shall be

compacted with hand operated equipment to a distance of four (4) feet or greater, beyond the sides of the structure.

Article 05-02-020 Subgrade Preparation

- (a) Subgrade Preparation shall adhere to the requirements of Section: 207 Subgrade Preparation.
- (b) Add the following at the end of Section 207.3 Construction Requirements:

If subgrade preparation is left over 48-hours without procession of the next phase of construction, subgrade preparation may be rechecked for compaction, moisture, and surface tolerance at the discretion of the City. No separate measurement or payment will be made for rehandling or reworking of material resulting in need of this recheck and associated work.

Article 05-02-030 Base Course and Subbase

- (a) Base course and subbase shall adhere to the requirements of Section: 303 Base Course.
- (b) Add the following at the end of Section 303.3.2 Mixing and Placing:

If constructed base course or subbase course is left over 48-houts without procession of the next phase of construction, base course or subbase course may be rechecked for compaction, moisture, and surface tolerance at the discretion of the City. No separate measurement or payment will be made for rehandling or reworking of material resulting in need of this recheck and associated work.

If constructed base course or subbase course has been treated with a bituminous material, (prime coat) or other approved treatment, the City reserves the right to have base course or subbase course rechecked for surface tolerance and compaction.

At a minimum, Contractor will spray a light application of water and “tight roll” base course prior to asphalt pavement operations or the next phase of operations as per Project requirements.

Article 05-02-040 Plant Mix Bituminous Pavement

- (a) Superpave hot mix asphalt shall be used unless otherwise approved by the City. All of Section 423: Hot Mix Asphalt (HMA) (Major Paving) shall apply.

Article 05-02-050 Concrete Flatwork

- (a) Concrete flatwork shall consist of sidewalks, curb and gutter, valley gutters, fillets, ramps, median pavement, and drive or alley pads.
- (b) Concrete flatwork shall be constructed with Class A Concrete Classification as presented in Section 509: Portland Cement Concrete Mix Designs.

Article 05-02-060 Flowable Fill

- (a) Flowable fill shall adhere to the requirements of Section 516: Flowable Fill.

Article 05-02-070 Steel Reinforcement

- (a) Bar Reinforcement
 - (1) Bar reinforcement shall be deformed bars of Grade 60 and shall conform to the requirements of ASTM A 615. Field bending of Grade 60 bars will not be permitted.
 - (2) Bar mat reinforcement shall conform to the requirements of ASTM A 184, billet steel, Grade 60.
 - (3) Shop Bending: Bent bar reinforcement shall be cold shop bent around a pin to the shapes shown in the Contract Documents. Unless otherwise provided, bends shall have a radius measured on the inside of the bar of not less than two and one-half (2 ½) bar diameters.
 - (4) Bundling and Tagging: Bar reinforcement shall be shipped in standard bundles, tagged, and marked in accordance with the Code of Standard Practice of the Concrete Reinforcement Steel Institute. The Contractor shall furnish, from the fabricator, a certificate of compliance. Two (2) copies shall accompany all shipments of reinforcing steel to the Project. The certificates of compliance shall show the name of the manufacturer, pounds shipped, heat numbers, laboratory test report numbers, and grade of steel.
- (b) Welded wire fabric shall conform to the requirements of AASHTO M 55.
- (c) Metal chairs or other metal supports for reinforcement which contact the exposed surfaces of the concrete shall be galvanized and bond breaker provided between metal chairs and reinforcement.
- (d) Wire for reinforcement shall conform to the requirements of AASHTO M 32.

- (e) Dowels bars for load transfer in concrete shall be plain, straight, with ends square, and free from burrs, and shall conform to the requirements of ASTM A 306, Grade 80. Expansion caps for one (1) end of the dowel bars shall be close fitting and shall be a minimum length of three inches (3"). The enclosed end of the expansion cap shall contain a suitable stop to hold the end of the dowel bar one inch (1") from the end of the cap.

ARTICLE 05-03 – CONSTRUCTION STANDARDS

Article 05-03-010 Concrete Flatwork Forms

- (a) Form material shall be free from warps, with smooth and straight upper edges and, if used for the face of curb, shall be surfaced on the side against which the concrete is to be placed. Timber forms may be used for forming curved sections but shall not be used for straight work unless authorized in writing by the City. Metal forms for such work being of a gauge that will provide proper rigidity and strength for the purpose for which they are intended. Wood forms used on curb returns shall be not less than three-quarter (3/4) of an inch in thickness, cut in the length and radius shown on the Contract Documents and held rigidly in place using metal stakes and clamps. The curb face shall be cut to conform exactly with the curb face batter, as well as being cut to the required length and radius. In every case, however, the forms shall be of sufficient rigidity and strength and shall be so supported as to adequately resist springing or deflection because of the placing or tamping of the concrete.
- (b) All curb and combined curb and gutter shall be divided into blocks or stones in lengths of five (5) or ten (10) feet long using metal templates not less than one-sixteenth (1/16th) inch nor more than one-fourth (1/4th) inch thick cut to the same cross section as the curb or curb and gutter being constructed. Templates shall be securely attached to forms to prevent movement during concrete placement.
- (c) Form material shall be thoroughly clean at the time it is used and shall be given a coating of light oil or other suitable material immediately prior to the placing of the concrete.
- (d) Forms, except curb block planks, shall be set with the upper edges thereof flush with the specified grade of the finished surface of the adjacent portion of the work and shall be not less than a depth equivalent to the full specified depth of thickness of the concrete to be supported thereby.
- (e) Back forms shall be held securely in place by means of stakes driven in pairs, one at the front form and one at the back, at intervals not to exceed four feet (4'); clamps, spreaders, and braces being used in connection therewith to such extent as

may be necessary to insure proper rigidity of the forms. Forms for walks, gutters, and similar work shall be firmly secured by means of stakes driven flush with the upper edge of the forms at intervals not to exceed five feet (5'). The stakes shall be of sufficient size and shall be so driven as to support the forms properly and adequately.

- (f) Form clamps, specifically designed, and manufactured for the curb and gutter to be constructed, may be used if, in the opinion of the City, they fulfill the requirements herein above specified for curb and gutter forms.

Article 05-03-020 Reinforcing Bars

- (a) Before concrete is placed, the reinforcement shall be clean of dirt, mortar, oil, loose rust, loose mill scall, and any other analogous material that would reduce or destroy the bond.
- (b) Reinforcing bars shall be placed as shown on the Contract Documents and shall be securely tied in position with 0.080-inch or 0.0624-inch diameter wire at all intersections, except where spacing is less than one foot (1') in either direction. Where the spacing is less than one foot (1') in either direction, alternate intersections shall be tied. Metal spacers, chairs, hangers, and other approved devices of adequate strength to prevent crushing under full load shall be used to hold the reinforcing in position. The use of concrete blocks to support reinforcement will not be permitted, except that dense, rectangular concrete blocks may be used to support the bottom mat of reinforcement in slabs which are cast on earth. Such concrete blocks shall meet the following requirements.
 - (1) Have compressive strength and density equal to, or greater than, the concrete to be placed.
 - (2) Occupy a small area.
 - (3) Be free from subjection to deterioration.
 - (4) Contain embedded tie wires to provide for the attachment of reinforcement to the block.
 - (5) Reinforcement other than lower mats in slabs cast on earth shall be supported with metal spacers, chairs, or hangers/
 - (6) Wooden spacers or supports shall not be used to hold reinforcing in place.

- (c) Bars shall be placed with a variation in spacing between adjacent bars of not to exceed one-half inch (1/2") or one-twenty-fourth (1/24th) of the spacing dimension shown in the Contract Documents, whichever is greater. With the exception of slabs cast on earth, the clear coverage of the reinforcement shall not vary more than one-fourth inch (1/4") or one-eighth (1/8th) of the dimension shown on the Contract Documents, whichever is greater. The clear cover of reinforcing cast on earth shall not vary more than minus one-fourth inch (1/4") to plus one-half inch (1/2") from the position shown on the Contract Documents.
- (d) Reinforcement shall be furnished in the full length indicated on the Contract Documents, unless otherwise approved by the City. Splicing of bars will not be permitted, except when shown on the Contract Documents as allowable. Bars in lapped splices shall be placed and securely tied in a manner to maintain not less than the minimum distance to the surface of the concrete shown on the Contract Documents.
- (e) Welded wire fabric and bar mat reinforcement shall be lapped as shown on the Contract Documents but not less than two (2) mesh in width, and securely tied at the ends and edges.
- (f) Reinforcing steel shall be welded only when shown on the Contract Documents or authorized in writing by the City. Welding shall conform to the requirements of AWS Specification D12.1 – Reinforcing Steel Welding Code.
- (g) The minimum cover from the surface of the concrete to the face of any reinforcement bar shall not be less than shown below, unless otherwise shown on the Contract Documents.
 - (1) Minimum cover shall be as follows:
 - A. Concrete cast against and permanently exposed to earth – two inches (2").
 - B. Concrete exposed to earth or weather:
 - Principal reinforcement – two inches (2").
 - Stirrups, ties, and spirals – one inch (1").
 - C. Concrete not exposed to weather or in contact with the ground:
 - Principal reinforcement – one and one-half inch (1 ½").
 - Stirrups, ties, and spirals – one inch (1").

- (2) For bar bundles, minimum concrete cover shall be equal to the lesser of the diameter of a single bar of equivalent area or two inches (2”), but not less than the minimum cover given in (1) above.
- (3) Exposed reinforcing bars, inserts, and plates intended for bonding with future extensions shall be protected from corrosion.
- (h) Inspection: No concrete shall be placed until the City has inspected the reinforcing steel in placed and has authorized the Contractor to place the concrete. Acceptance of reinforcing steel will not relieve the Contractor of responsibility for coverage and position control of the steel.

Article 05-03-030 Concrete Placement

- (a) The concrete shall be placed on a thoroughly dampened subgrade sufficiently moist to ensure that no moisture will be absorbed from the fresh concrete.
- (b) Surfaces of structures in sidewalks, curbs, and gutters shall be adjusted as necessary prior to placing of concrete to meet the contiguous sidewalk surfaces.
- (c) Concrete shall be placed in horizontal layers not to exceed six (6) inches each in thickness, each layer being spaded along the forms and thoroughly tamped. However, if the section is more than six (6) inches in depth, the concrete may be placed to provide the thickness shown or specified if mechanical internal vibrators are used.
- (d) After the concrete for walk has been placed between the side forms, a strike-off shall be used to bring the surface to the proper section to be compacted. It shall then be spaded along the form faces and tamped with appropriate tampers not less than two (2) times, in order to assure a dense and compact mass, forcing the larger aggregate into the body thereof and bringing to the surface sufficient free mortar for finishing.
- (e) After the concrete has been placed and tamped, the upper surface shall be struck off uniformly smooth and true to the specified grade.
- (f) Weather and Temperature Limitations: Concrete shall have a temperature of at least 50° F and not more than 90° F at time of placement.
 - (1) Hot Weather Concrete: When concrete is placed during high ambient temperatures, low humidity, and/or windy conditions precautions shall be taken to reduce the rate of evaporation and control the temperature of the concrete per ACI 305, latest revision.

- (2) Cold Weather Concrete: When concrete is placed at or below an atmospheric temperature of 35° F, the water or aggregates, or both, shall be heated, and suitable enclosures and heating devices shall be provided. The mixed concrete shall have a temperature of at least 50° F and not more than 90° F at the time of placing. The heating equipment or methods shall be capable of heating the water and aggregates uniformly, and these materials shall not be heated to a temperature exceeding 150° F. Concrete shall not be placed on frozen ground.
- (3) Protection of Concrete: After any concrete is placed, the Contractor shall provide suitable measures to maintain a concrete surface temperature of 40° F or above for a period of not less than twenty-four (24) hours.

Article 05-03-040 Expansion Joints

- (a) Expansion joints shall be constructed in curbs, walks, and gutters as hereinafter specified, being filled with pre-molded joint filler strips. No such joints shall, however, be constructed in cross gutters, alley intersection, or driveway aprons.
- (b) Unless otherwise shown on the plans, one-half (1/2) inch joints shall be constructed in curbs and gutters at the end of all returns except where cross gutters are being constructed. They shall be at the ends of the cross-gutter transitions and also along the line of the work at regular intervals not to exceed fifty (50) feet, joints in gutter being continuous with those in adjacent curb. No joints shall be constructed in returns. Where continuous curb and gutter is constructed adjacent to cement concrete pavement, weakened plane joints shall be installed continuous with alternate joints installed in the adjacent pavement, in which case expansion joints for sidewalks shall be placed at intervals not to exceed twenty (25) feet with joint filler strips.
- (c) Expansion joint filler strips shall be placed in walks at the PT and PC of all walk returns, between walk and a building or structure, in walk returns between the walk and the back of the curb returns, and around all utility poles encountered along the line of the work. Joint filler strips shall extend the full depth of the concrete being placed. Joint filler strips between walk and curb shall be the full depth of the walk with the top of the filler strip set flush with the top of the concrete. Expansion joint filler strips including those around utility poles shall not be less than one-half (1/2) inch in thickness.
- (d) Expansion joint filler strips shall be vertical and shall extend to the full depth and width of the work in which they are installed, being constructed at right angles or radial to the line of the curb or gutter. The filler strips shall completely fill these joints at least to within one-fourth (1/4th) of an inch of any surface of the concrete

that will be exposed upon completion of the work and must fully extend at least to those surfaces that will not be exposed. However, before the work will be accepted, any joint filler that protrudes beyond a surface that will not be exposed or beyond one-fourth (1/4th) of an inch below a surface that is exposed shall be trimmed off to the specified dimension in a neat and workmanlike manner. During the placing and tamping of the concrete, the filler strip shall be held rigidly and securely in proper position.

Article 05-03-050 Concrete Finishing

Surfaces of the various items of work shall be finished as specified. Edges of concrete at expansion joints shall be rounded to one-fourth inch (1/4") radius. Upon completion, the finished surface shall be true to line and grade and free from irregularities.

(a) Curbs

- (1) The front forms may be stripped as soon as the concrete has set sufficiently but must be removed before the expiration of six (6) hours after pouring. Immediately following the stripping of the forms, mortar, as thinned to consistency of grout, shall be applied to the curb face. If monolithic curb and gutter is being constructed, this mortar shall be applied to the full-exposed face; otherwise, it shall extend for an additional two inches (2") below the gutter.
- (2) The face and top of the curb shall then be carefully troweled to a smooth and even finish, the top being finished to a transverse slope of one-fourth (1/4th) of an inch toward the front, with both edges rounded to a radius of three-fourth (3/4th) of an inch. The troweled surface shall be finished with a fine hair broom parallel with the line of the work.
- (3) Contraction joints or control joints shall not exceed intervals of five (5) feet. Joints shall be made at regular intervals along the line of the work. On straight work, the joints shall be parallel with and at right angles to the line of the work; at curves the joints shall, in general, be long lines concentric with and radial to the proportion of the work in which they are placed. The markings shall be made with jointed tools that will round the edges of the scoring lines to a radius of one-eighth (1/8th) of an inch, with a depth of not less than one inch (1"). The finished joint opening, excluding of radii, shall not be wider than one-eighth (1/8th) inch. The Contractor will be required to have a sufficient number of jointed tools on the job to accomplish the above specified requirements.

(b) Walks

- (1) Following the placing of concrete, the surface shall be worked to a true and even grade, free from waves and irregularities. After the preliminary troweling, the initial scoring for the block marking shall be made to a depth of one inch (1") to ensure the scoring depth required. The work shall then be carefully troweled to a smooth and even finish, with the edges rounded to a radius of one-half inch (1/2"), the scoring markings made to the required depth following which it shall be given a fine hair broom finish, applied transversely and remarked when required to insure a new uniform joint. Troweling may be done with a long-handled trowel or "Fresno."
- (2) Contraction joints or block joints shall not exceed intervals of five feet (5'). Joints shall be made at regular intervals along the line of the work. On straight work, the joints shall be parallel with and at right angles to the line of the work; at curves the joints shall, in general, be long lines concentric with and radial to the proportion of the work in which they are placed. The markings shall be made with jointed tools that will round the edges of the scoring lines to a radius of one-eighth (1/8th) of an inch, with a depth of not less than one inch (1"). The finished joint opening, excluding of radii, shall not be wider than one-eighth (1/8th) inch. The Contractor will be required to have enough jointed tools on the job to accomplish the above specified requirements.
- (3) The side forms shall remain in place after completion of the walk until the concrete is sufficiently set but must be removed before the work will be accepted.

(c) Gutters

- (1) After the concrete has been thoroughly tamped in such manner and to such extent as to force the larger aggregates into the body thereof and bringing to the top sufficient free mortar for finishing, the surface shall be worked to a true and even grade by means of a float, troweled with a long handled trowel or "Fresno" and then longitudinally broom finished, following which the flow line of the gutter shall be troweled smooth for a width of approximately three (3) inches and the outer edge rounded to a radius of one-half inch (1/2").
- (2) Side forms shall remain in place until the concrete is sufficiently set, after completion of the gutter, but must be removed before the work will be accepted.

- (3) Reinforcement shall be included as shown on the Contract Documents.
- (4) Construction joints and one-half inch (1/2") pre-molded expansion joints and other details of construction shall be as specified in the Contract Documents. The finished surface shall conform to the required roadway section as to both line and grade. The gutter sections will not be opened to traffic until specimen beams have attained a flexural strength of not less than five hundred (500) pounds per square inch (AASHTO T 97). When such tests are not conducted, the gutter shall not be opened to traffic until determined by the City.

(d) Slope Paving

- (1) All subgrade preparation required for this item shall be done in accordance with these Standards, with the exception that minimum density requirements will be ninety (90) percent of maximum density as determined by ASTM D 1557 in all cases, instead of ninety-five (95) percent of maximum in the top six (6) inches or twelve (12) inches of compacted fill.
- (2) Reinforcement shall be included as shown on the Contract Documents.
- (3) Thickness of concrete shall be as specified in the Contract Documents. Concrete shall be screeded and finished with wood float or equivalent to a plane surface having no variation when measured with a ten-foot (10') straight-edge more than one-fourth (1/4th) inch, unless a curvilinear surface is designated for a particular job.

(e) Curing

- (1) After the completion of the finishing operations, all curbing shall be sprayed with concrete curing compound. The surface of the concrete shall be kept thoroughly damp between the completion of the finishing operations and the application of the curing compound.
- (2) The curing compound shall be applied under pressure, by means of a spray nozzle, in such manner and quantity as to entirely cover all exposed surfaces of the concrete with a uniform film. The preparation so used shall be Type 2 as specified in ASTM C 309.

(f) Driveway and Alley Pad at Entrances

- (1) Driveway entrances shall be provided in new curbs at all existing driveways along the line of the work and at locations shown on the plans or as directed by the City.
 - (2) The location and construction details for driveways shall conform to the Contract Documents.
 - (3) Reinforcement shall be included as shown on the Contract Documents.
 - (4) Where walk is to be constructed across driveway, the thickness of the walk shall be not less than six (6) inches, unless otherwise specified or shown on the Contract Documents.
- (g) Miscellaneous Types of Curbs, Gutters, and Walks – extruded type concrete curb and gutter, precast curb and gutter sections, cut stone curbs, brick sidewalks, flagstone sidewalks, etc. will be permitted where approved by the City and in accordance with the Contract Documents.
- (h) Repairs and Replacement – New work that is found to be defective or damaged prior to the acceptance or existing work damaged by the Contractor’s operations shall be repaired or replaced by the Contractor with no additional compensation. Sidewalk that is to be replaced shall be neatly sawcut to the next control joint on either side of the defective or damaged portion. The minimum size slab that is removed and replaced shall be five feet (5’) long and for the full width of the walk. Curb and gutter shall be sawcut on a neat line at right angles to the face of the curb to the next control joint and/or gutter on either side of defective or damaged portion.
- (i) Backfilling and Cleanup
- (1) Backfilling to the finished surface of the newly constructed improvements must be completed prior to acceptance of the work by the City.
 - (2) Upon completion of the work, all earth or burlap covering shall be removed, the surface of the concrete thoroughly cleaned, and the site left in a neat and orderly condition, including disposal of excess materials and earth.

Article 05-03-060 Detectable Warnings

- (a) Detectable warning mats (consisting of standardized truncated domes) shall be placed where pedestrians encounter hazards in the path of travel. Detectable warnings shall be placed at the following:
- (1) At ramp landings immediately adjacent to the back of the curb at a street crossing.

- (2) At on-grade railroad crossings where sidewalks are present. Placement shall be six to fifteen feet (6' – 15') from the individual rails on either side.
 - (3) Within median islands if the cut through section exceeds six feet (6') in width.
- (b) Detectable warning mats shall be two feet (2') in depth and five feet (5') in width.

Article 05-03-070 Concrete Sampling and Testing

- (a) Slump, unit weight, air content tests and compressive strength test cylinders shall be prepared with concrete obtained from the point at which the concrete is placed by certified personnel (ACI or TTCP certified as Concrete Field-Testing Technicians). All results for the tests performed in accordance with this unit will be provided to the Contractor and the concrete supplier immediately upon completion of the final compressive strength test. If a super-plasticizer is used, the slump shall be measured before and immediately after the addition of the super-plasticizer. The slump specifications defined on the approved mix design shall not be exceeded before introduction of the super-plasticizer. The slump shall not exceed eight (8) inches after the super-plasticizer has been added. Super-plasticized concrete shall be checked for segregation before being placed and during the course of the placement. Segregated concrete shall not be placed. Concrete cylinders for compressive strength tests by the Contractor's certified personnel are to be molded and cured in accordance with AASHTO T 23 "Making and Curing Concrete Test Specimens in the Field" using four-inch (4") by eight inch (8") single use plastic cylinder molds with plastic lids or six inch (6") by twelve inch (12") cylinder molds and air content tests cast from slip-form concrete shall be accomplished with a vibrator. The Contractor is responsible for providing all vibratory equipment and all equipment required to operate the vibratory equipment. Rodding of slip-form concrete will not be permitted. Responsibility for transporting the test specimens to a certified testing lab shall belong to the party who originally prepared the test specimens.
- (b) Concrete Testing: At least one (1) sample shall be taken from each of the first three (3) concrete loads delivered to the Project site. Each of these loads shall be tested for slump, air content, and unit weight. Additionally, a set of compressive strength test cylinders will be cast from one of these three loads, determined on a random basis. Beginning with the fourth (4th) load of concrete delivered to the Project, one (1) randomly selected load from each sub-lot of six (6) trucks. All tests and cylinders shall be tested and handled in accordance with proper procedures.

- (c) Concrete Strength: Concrete compressive strength shall be determined from the average of two (2) or more concrete cylinders made from the same sample of concrete and tested at the specified age. The cylinders will be made, handled, and stored in accordance with AASHTO T 23 "Making and Curing Concrete Test Specimens in the Field" and tested in accordance with AASHTO T 22 "Compressive Strength of Cylindrical Concrete Specimens".

- (d) Individual Strength Test: Unless otherwise specified, an "individual strength test" will be determined by testing two (2) or more cylinders at twenty-eight (28) days (or at fourteen (14) days for slip-formed concrete). At least four (4) cylinders shall be made for each set. The first cylinder shall be tested at seven (7) days for use as an indicator of the early concrete compressive strength. The second and third cylinders shall be tested to determine the "Individual Strength Test" result. The fourth cylinder shall remain available for testing if the Within-Test-Coefficient-of-Variation (WTCV) exceeds five (5) percent, as determined by ACI 214.3.4.1. If the fourth cylinder is tested, the "Individual Strength Test" result will be the average of all of the cylinders tested at that age, unless one (1) or more of the following conditions exist:
 - (1) There is a visible defect in the cylinder or the capping, and/or orientation of the cylinder with respect to its perpendicularity or the parallelism of the ends.
 - (2) A significant irregularity occurred while loading the test specimen to failure, such as a sudden load burst, cyclic or pulsating loads, or a loading rate not in accordance with AASHTO T 22.

- (e) Unless less stringent requirements are specified in the Contract Documents, forms may be stripped, or traffic permitted on the structure or pavement when the correlated in-place compressive strength is at least equal to the strength required for the intended application.

- (f) Acceptance of Concrete Based on Cylinders: The concrete will be accepted with respect to compressive strength indicated by cylinder tests, when both of the following requirements are met:
 - (1) The running average of three (3) consecutive individual strength tests meets or exceeds the specified strength.
 - (2) No individual strength test falls below the specified strength by more than five hundred (500) psi; and,

3. When the cylinder-based acceptance requirements are not met, the City will review the strength tests and notify the Contractor in writing whether the concrete will be accepted or shall be removed and replaced by the Contractor. Only that area of concrete represented by the individual strength test failing to meet any one (1) of the cylinder based acceptance requirements, shall be subject to investigation or removal. When the cylinder-based acceptance requirements are not met, steps shall be taken by the Contractor to resolve the problem. The proposed resolution will be submitted in writing to the City. The mere addition of extra cement will normally not be considered a sufficient resolution.

ARTICLE 05-04 – SIGNAGE & STRIPING

Article 05-04-010 Permanent Signage

- (a) Permanent signage shall adhere to the guidance, dimensions, and layouts presented in the Manual on Uniform Traffic Control Devices (MUTCD) for Streets and Highways, Latest Edition.
- (b) Street name signs shall follow the guidance provided in Standard Drawing R-13.

Article 05-04-020 Striping

- (a) Permanent roadway striping shall follow the guidance provided in Standard Drawing R-4.
- (b) Roadway striping not covered by the Standard Drawings shall adhere to the guidance, dimensions, and layouts presented in the Manual on Uniform Traffic Control Devices (MUTCD), Latest Edition.

ARTICLE 05-05 – DRAINAGE CONSIDERATIONS

Article 05-05-010 General

- (a) The designer shall be responsible for compliance with all governing agencies potentially having jurisdiction over portions of the Project, including but not limited to the following:
 - (1) New Mexico Environment Department
 - (2) New Mexico Department of Transportation
 - (3) Union Pacific Railroad and their lessees
 - (4) Otero County
 - (5) United States Army Corps of Engineers
 - (6) New Mexico Office of the State Engineer
 - (7) NPDES/EPA Region 6

- (8) Federal Emergency Management Agency
- (b) Grading, drainage facilities, channels, and other improvements to control storm water shall be designed to:
 - (1) Limit post-development peak discharges from a project and in impacted conveyance systems at a pre-development peak discharge rate.
 - (2) Minimize erosion by providing erosion and sedimentation control systems as required to prevent erosion, scour, and sedimentation.
 - (3) Be compatible with existing improvements and drainage patterns.
- (c) Detention Design
 - (1) Retention ponds shall be avoided and will be authorized by the City on a case-by-case basis.
 - (2) The design storm for detention ponds shall be the 100-year return period rainfall event with 24-hour duration.
 - (3) Detention ponds shall have maximum side slopes of four to one (4:1) unless authorized by the City.
 - (4) Detention ponds shall have one foot of freeboard or 10% additional basin capacity.
 - (5) Maximum basin depth shall not exceed four feet, and minimum depth shall be eighteen inches unless otherwise approved by the City.
 - (6) Offsite runoff entering the development may occur in the drainage basin. If this is the case, the analysis of the detention facility must take these flows into account. Offsite flows may be routed around the detention facilities, but the entrance and exit points of the storm runoff shall not be altered nor shall the post development peak flow exceed the historic peak flow.
 - (7) An acceptable method of transporting water from the streets into the basin shall be provided to preserve the facility's integrity.
 - (8) Each facility shall be designed so that the stormwater will not stand for more than 24 hours after termination of the storm. Drainage shall be accomplished by infiltration or by controlled flow into an existing facility suitable to receive, transport, and convey the water.

- (9) If infiltration is the mean method of drainage, a soils report shall be included in the construction documents. Sufficient and representative soil borings and tests shall be required to illustrate suitability for the intended purposes and percolation characteristics.
 - (10) Fencing/railing will be required when hazards exist to those using the property.
- (d) Erosion and Sedimentation Control
- (1) All projects shall be designed so that erosion is minimized during construction as well as after the construction is complete. The volume, rate, and quality of stormwater runoff originating from the development must be controlled to prevent soil erosion. Specific efforts shall be made to keep sediment out of streets and watercourses.
 - (2) All projects requiring grading, disturbance or clearing of more than one (1) acre must comply with the requirements of the National Pollutant Discharge Elimination System (General Permit for Discharges from Construction Activities) and submit an Erosion and Sedimentation Control Plan to the City.

ARTICLE 05-06 – DRAINAGE STUDIES & FACILITY DESIGN

Article 05-06-010 Drainage Reports & Studies

Drainage reports and/or studies shall adhere to the requirements set forth in the New Mexico Department of Transportation’s Drainage Design Manual or as modified by the City.

Article 05-06-020 Facility Design

Drainage facilities, including but not limited to enclosed storm sewer systems, culverts, weirs, channels, etc., shall adhere to the requirements set forth in the New Mexico Department of Transportation’s Drainage Design Manual or as modified by the City.

ARTICLE 05-07 – STREET LIGHTING

Article 05-07-010 General

- (a) General – The City will preapprove and assume monthly electrical service costs of new streetlights once installed and energized as described in the Article. The installation of streetlights and service connection fees will be paid entirely by the developer or Owner. The City will agree to pay for the monthly service charge for each light. The developer or Owner shall be responsible for coordinating and

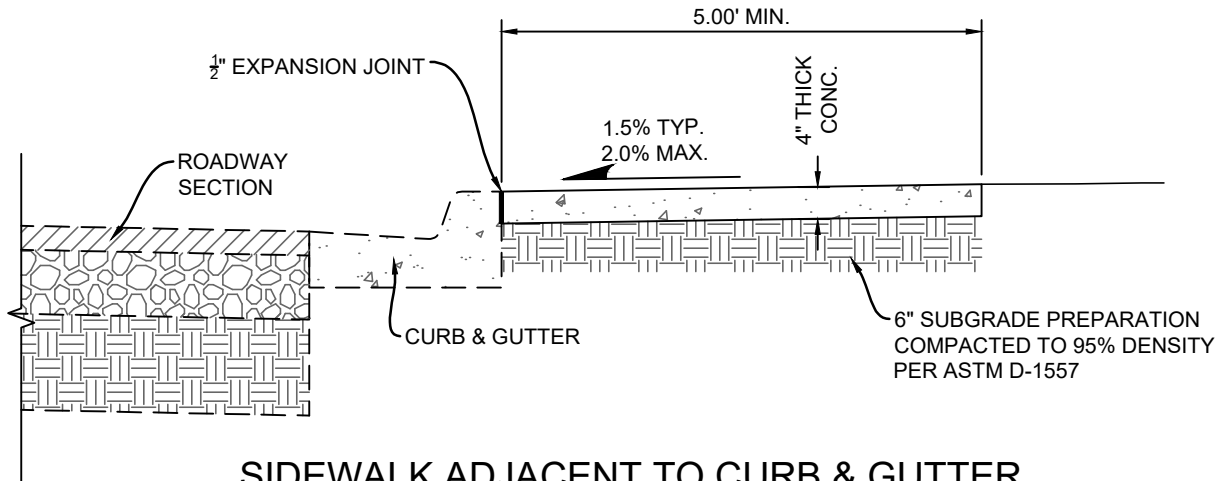
supplying any easements or right-of-way on a plat or deed to the local power company or the City.

- (b) **Underground Feed Lighting** – The developer or Owner shall provide the trench, conduit, and wiring from the location designated by the power company to the street light location approved by the City. The developer or Owner will also provide the pole foundation, pole, and luminaire. The power company will complete the connection once installation is complete. No overhead feeds will be allowed.
- (c) **Lighting Spacing** – The developer or Owner shall be responsible for light design based on a photometric lighting analysis. The Illumination Engineering Society of North America has established acceptable illumination levels and uniformity ratios for various public street types.

Article 05-07-020 Materials

- (a) **Light Pole** – The City’s preferred street light pole shall be Hapco Pole Products - Single Davit Pole Model Number: RTA35D8B4D1A-01. Alternative street light poles require prior authorization from the City.
- (b) **Luminaire** – The City’s preferred luminaire shall be American Electric Lighting Autobahn Series ATB2 Model Number: ATB240BLEDE10MVOLTR4SH. Alternative luminaries require prior authorization from the City.
- (c) **Foundation** – Luminaire foundations shall adhere to NMDOT Standard Specification Section 707 – Signal and Lighting Standards.

END OF CHAPTER 05



SIDEWALK ADJACENT TO CURB & GUTTER

SIDEWALK NOTES:

1. PROVIDE 1/2" EXPANSION JOINT MATERIAL WHERE SIDEWALK ABUTS AN IMMOVABLE OBJECT (I.E. UTILITY POLE, WALL, CURB AND GUTTER, SIDEWALK, DRIVE APRON, STRUCTURES, ETC.).
2. PROVIDE CONTROL JOINTS EVERY 5'-0" FOR SIDEWALKS AND EVERY 10'-0" FOR CURBS; PROVIDE EXPANSION JOINTS EVERY 25'-0" MAX. FOR SIDEWALKS AND EVERY 50'-0" FOR CURBS.

SCALE: NOT TO SCALE



CITY OF ALAMOGORDO TECHNICAL STANDARD DRAWINGS

SIDEWALK DETAILS

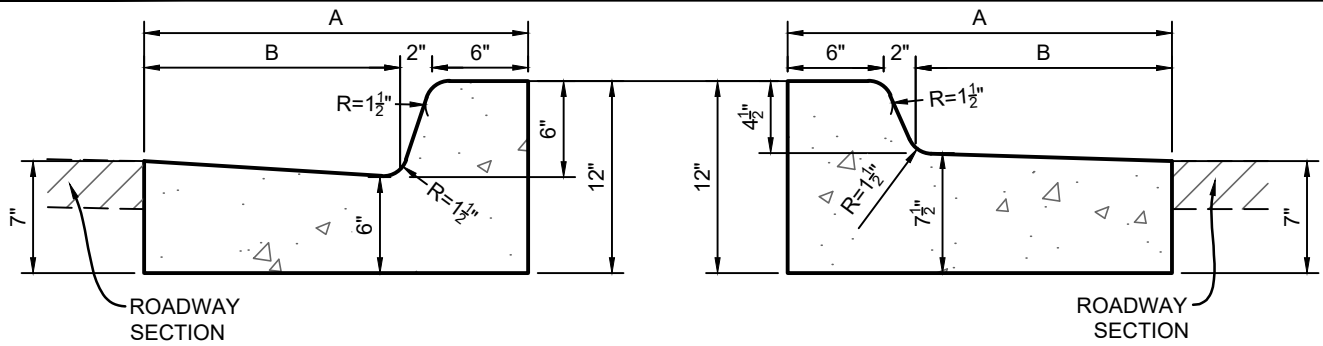
ISSUE DATE:

APRIL 2021

REVISION DATE:

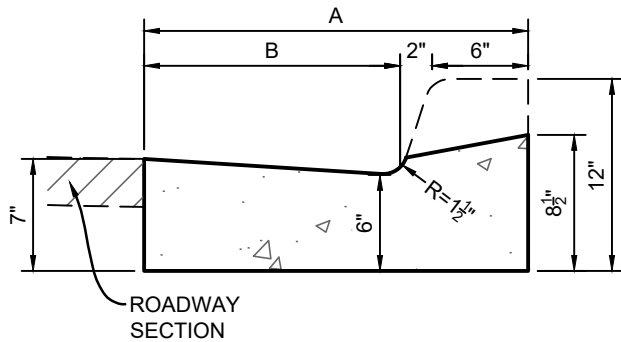
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R-1

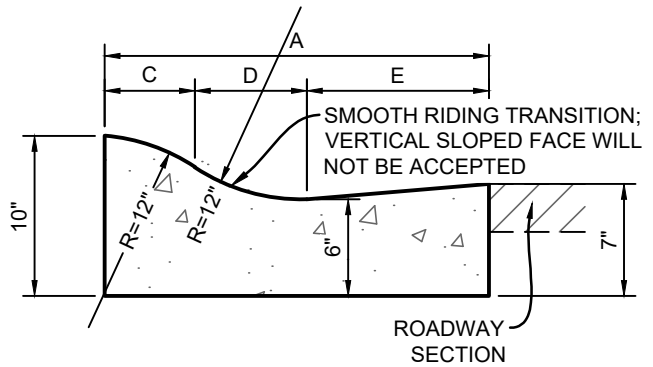


STANDARD CURB & GUTTER

REVERSE SLOPE CURB & GUTTER



LAYDOWN CURB & GUTTER



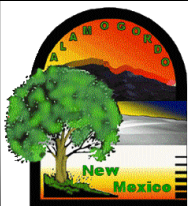
MOUNTABLE CURB & GUTTER

CURB AND GUTTER LEGEND			
TYPE	I	II	III
A	1'-6"	2'-0"	2'-6"
B	0'-10"	1'-4"	1'-10"
C	0'-5 5/8"	0'-5 5/8"	0'-5 5/8"
D	0'-5"	0'-7"	0'-7"
E	0'-7 3/8"	0'-11 3/8"	1'-5 3/8"

CURB & GUTTER NOTES:

1. NEW CURB & GUTTER PROFILE SHALL MATCH EXISTING ADJACENT CURB & GUTTER AND/OR STREET PROFILE.
2. NEW CURB & GUTTER SHALL INCLUDE EIGHT-INCH (8") SUBGRADE PREPARATION.
3. NEW CURB & GUTTER SHALL INCLUDE SIX-INCH (6") BASE COURSE.
4. EDGES OF CURB & GUTTER NOT SPECIFICALLY DIMENSIONS SHALL BE EDGED WITH A 3/8" EDGING TOOL.
5. DIMENSIONS AT ROUNDED CORNERS MEASURED TO INTERSECTION OF STRAIGHT LINES.
6. PROVIDE CONTROL JOINTS EVERY 5'-0". CONTROL JOINTS SHALL BE TOOL JOINTED WITH TOP ROUND EDGE OF 1/8" RADIUS, DEPTH OF ONE-INCH (1"). THE FINISHED JOINT OPENING EXCLUDING RADII SHALL NOT BE WIDER THAN 1/8".
7. PROVIDE 1/2" EXPANSION JOINTS EVERY 50'-0" ALONG CURB & GUTTER.
8. TACK COAT EDGE OF GUTTER PRIOR TO PLACEMENT OF NEW PAVEMENT OR PAVEMENT PATCH.
9. THE CONSTRUCTION OF CURB & GUTTER AND/OR PAVEMENT SHALL BE CONSTRUCTED SO THAT THE GUTTER FLOW WILL BE CONSTANT (NO PONDING AREAS WILL BE ACCEPTED).

SCALE: NOT TO SCALE



**CITY OF ALAMOGORDO
TECHNICAL STANDARD DRAWINGS**

CURB AND GUTTER DETAILS

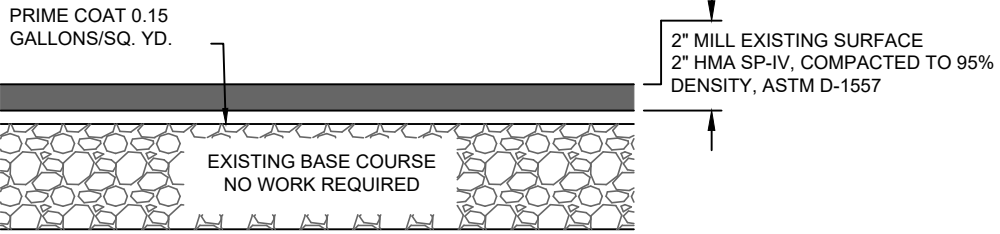
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APRIL 2021

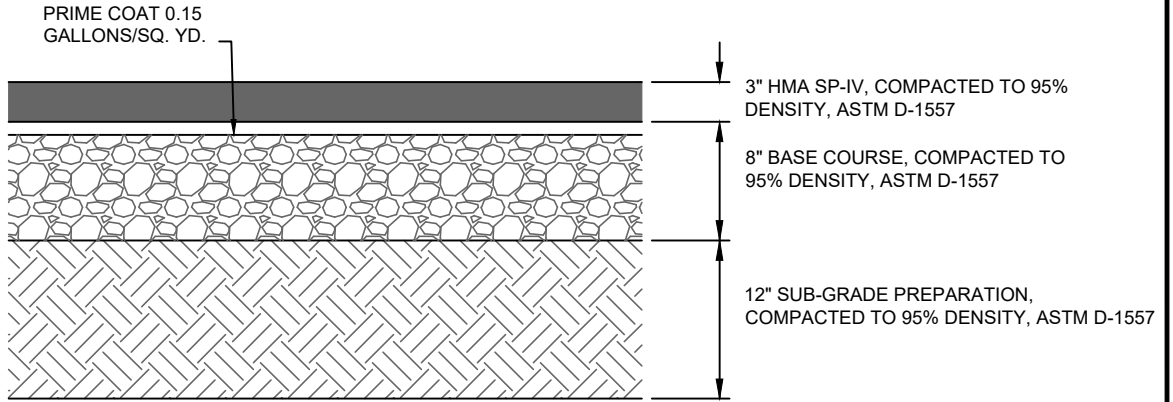
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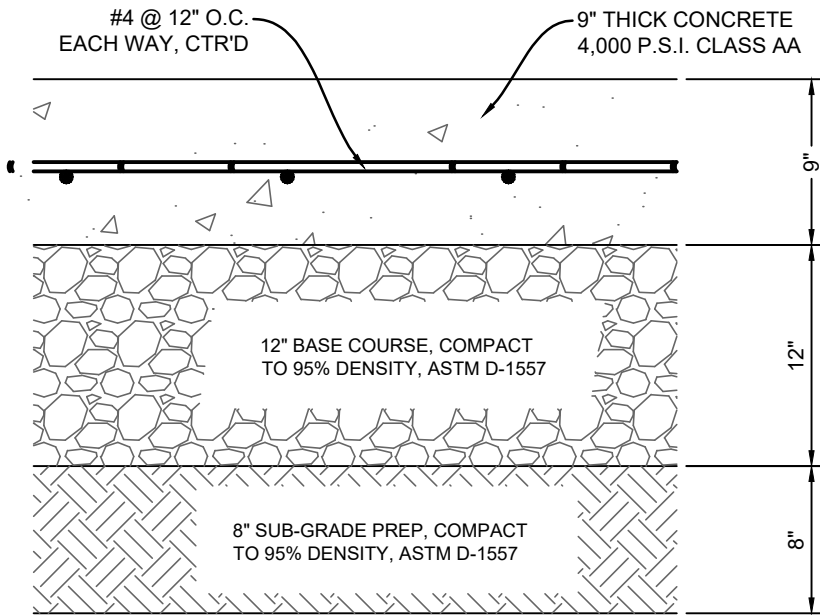
R-2



2-INCH PAVEMENT MILL/OVERLAY SECTION



TYPICAL PAVEMENT SECTION



9" CONCRETE PAVEMENT SECTION

GENERAL NOTES:

1. PROPOSED PAVEMENT SECTIONS FOR MINOR AND MAJOR ARTERIALS SHALL BE DETERMINED BASED ON SITE SPECIFIC GEOTECHNICAL INVESTIGATIONS.

SCALE: NOT TO SCALE



**CITY OF ALAMOGORDO
TECHNICAL STANDARD DRAWINGS**

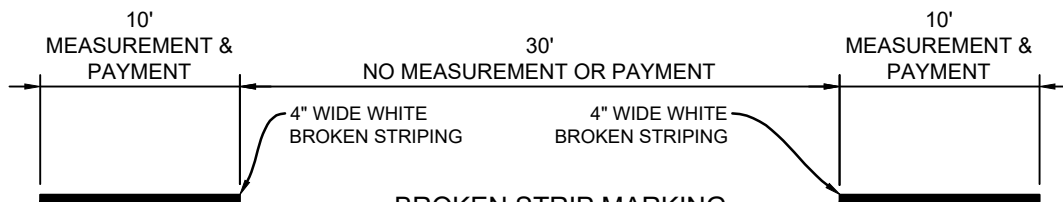
PAVEMENT SECTION DETAILS

ISSUE DATE:
APRIL 2021

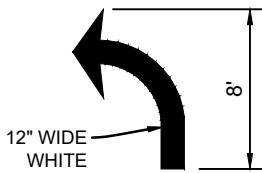
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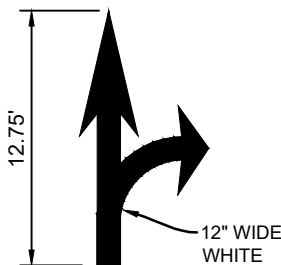
R-3



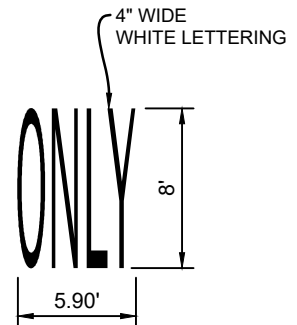
BROKEN STRIP MARKING



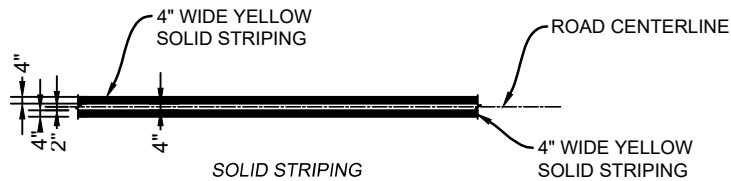
TURN ARROW



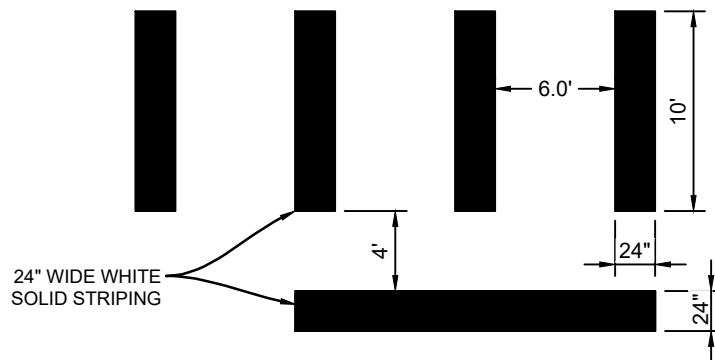
COMBO ARROW



WORD " ONLY "



DOUBLE YELLOW MARKING



CROSSWALK AND STOP BAR

CONTRACTOR NOTE:

1. CROSSWALK AND STOP BARS SHALL BE 3M-N380 PREFORMED PATTERNED MARKING OR APPROVED EQUAL (O.A.E.).
2. ALIGN CROSSWALK WITH CENTERLINE OF WHEEL PATH, COORDINATE WITH OWNER PRIOR TO INSTALLATION.
3. SYMBOLS AND LEGENDS SHALL BE 3M-380IES PREFORMED PATTERNED MARKING O.A.E.
4. BROKEN STRIPING, DOUBLE STRIPING AND SINGLE STRIPING SHALL BE 90 MIL HOT THERMOPLASTIC PAVEMENT STRIPING.
5. MEASUREMENT AND PAYMENT FOR BROKEN STRIPING (10 LF) SHALL BE CALCULATED BY MATERIAL USED.

SCALE: NOT TO SCALE



**CITY OF ALAMOGORDO
TECHNICAL STANDARD DRAWINGS**

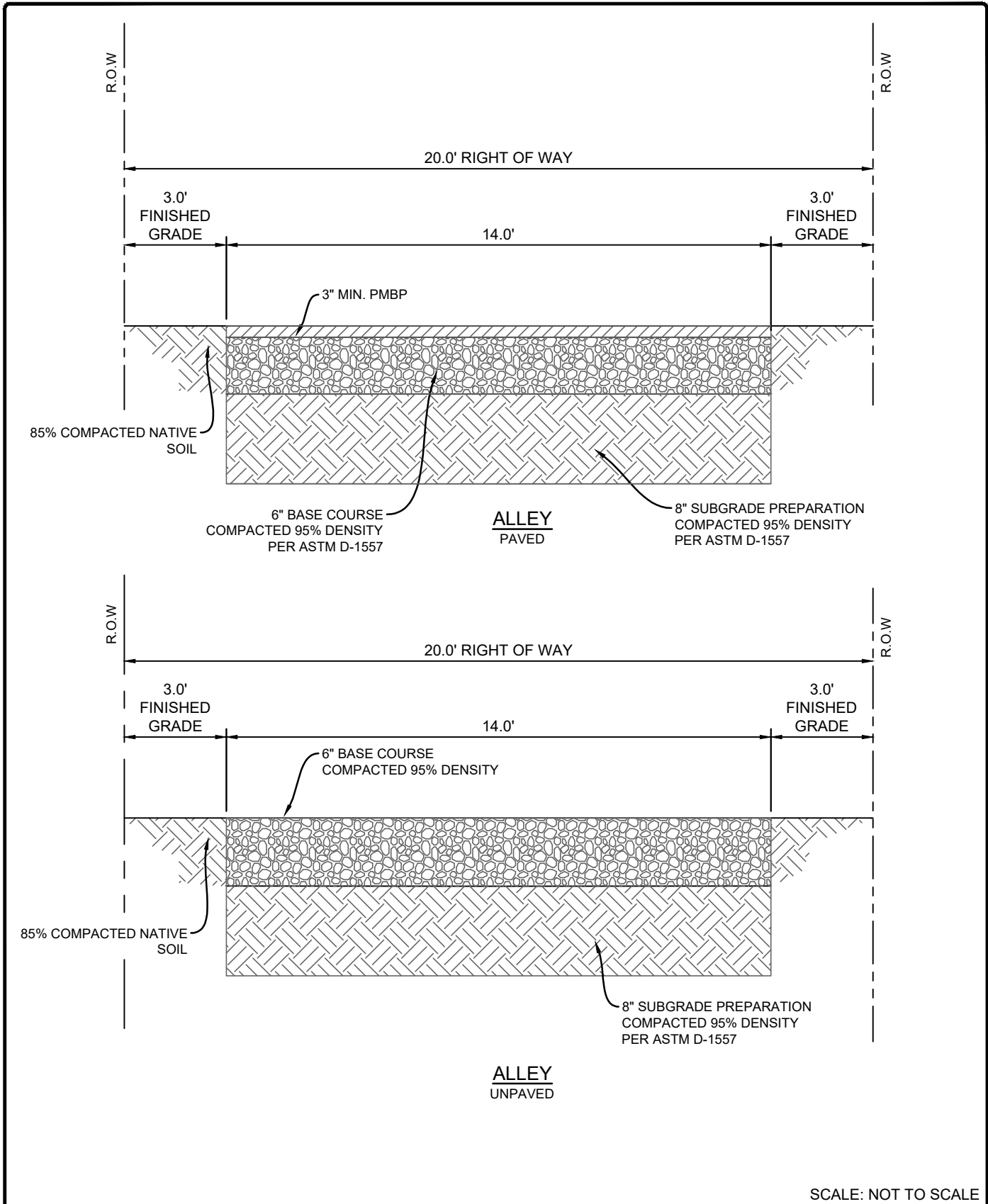
STRIPING DETAILS

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REVISION DATE:

SHEET NO:

R-4



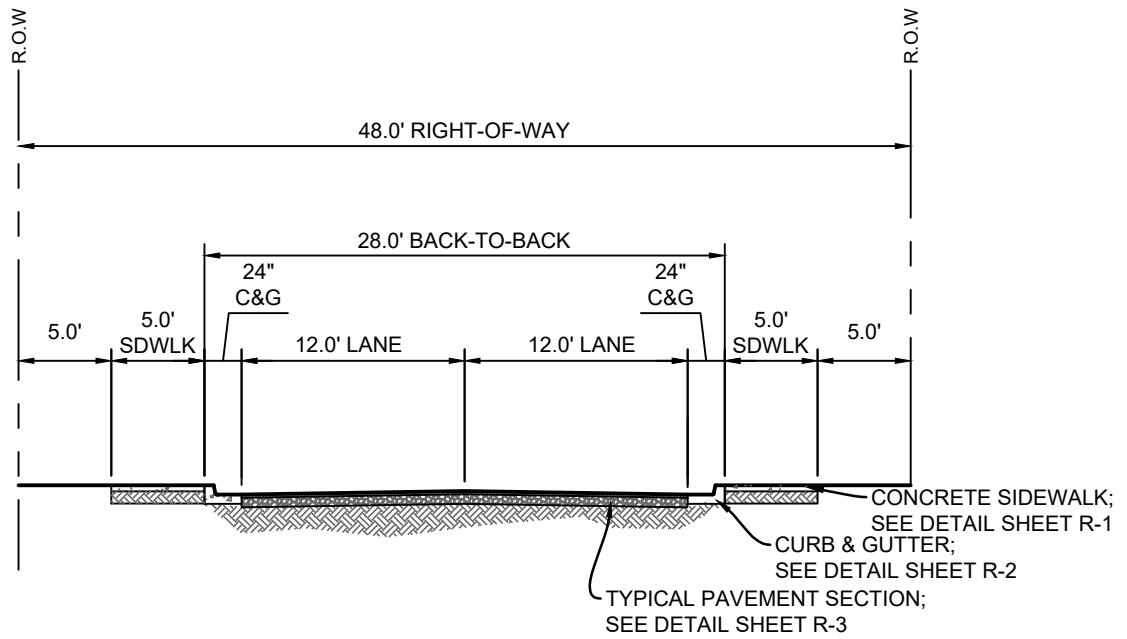
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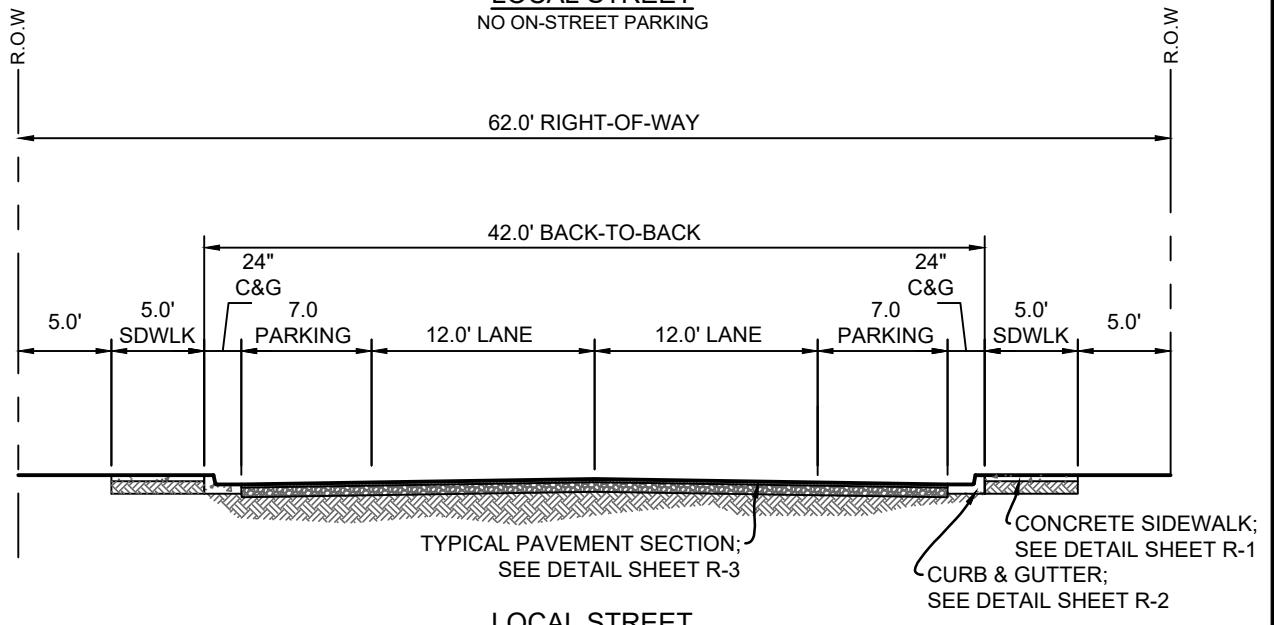
CITY OF ALAMOGORDO
 TECHNICAL STANDARD DRAWINGS

ALLEY DETAILS

ISSUE DATE: APRIL 2021
REVISION DATE: ----
SHEET NO: R-5



LOCAL STREET
NO ON-STREET PARKING



LOCAL STREET
WITH ON-STREET PARKING

NOTE:
FIVE-FOOT (5') PARKWAY BETWEEN BACK OF CURB AND SIDEWALK SHALL BE PRE-APPROVED BY CITY OF ALAMOGORDO ENGINEERING DEPARTMENT.

SCALE: NOT TO SCALE



CITY OF ALAMOGORDO
TECHNICAL STANDARD DRAWINGS

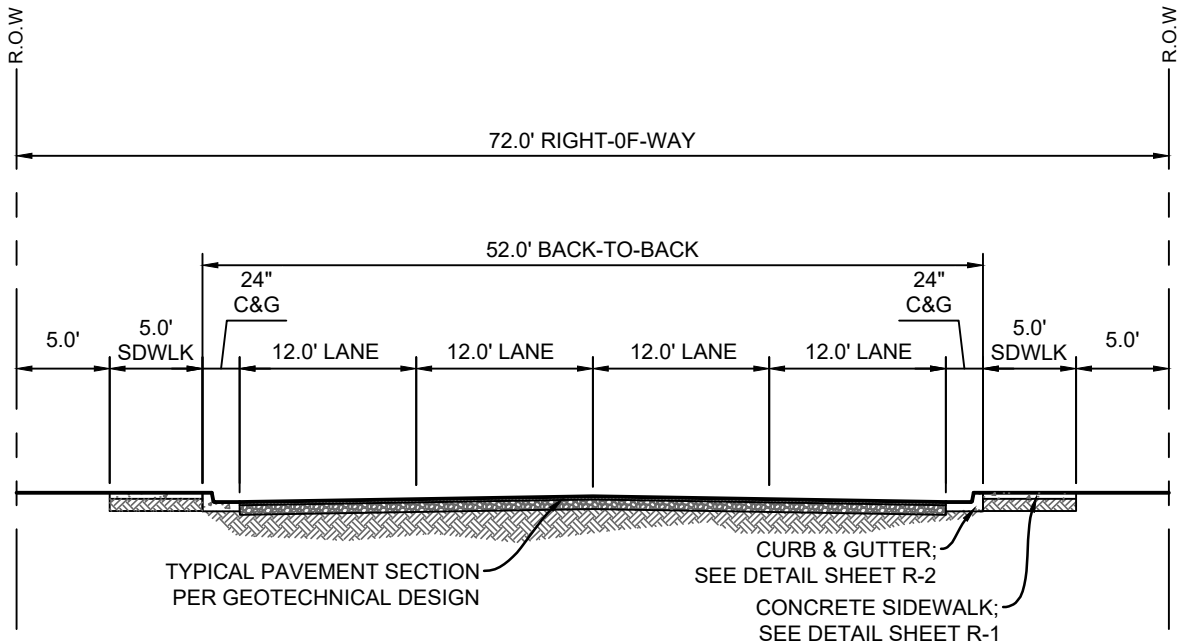
LOCAL STREET DETAIL

ISSUE DATE:
APRIL 2021

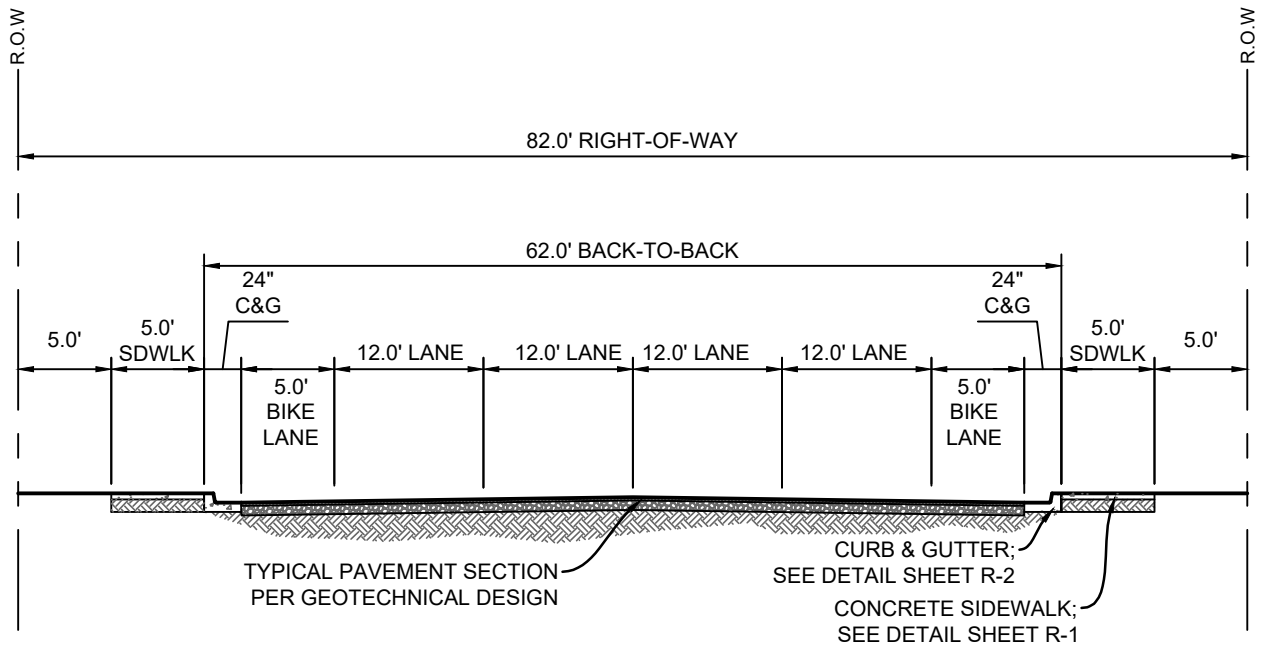
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SHEET NO:

R-6



COLLECTOR STREET



COLLECTOR STREET w/BIKE LANES

NOTE:
 FIVE-FOOT (5') PARKWAY BETWEEN BACK OF CURB AND SIDEWALK SHALL BE
 PRE-APPROVED BY CITY OF ALAMOGORDO ENGINEERING DEPARTMENT.

SCALE: NOT TO SCALE



**CITY OF ALAMOGORDO
 TECHNICAL STANDARD DRAWINGS**

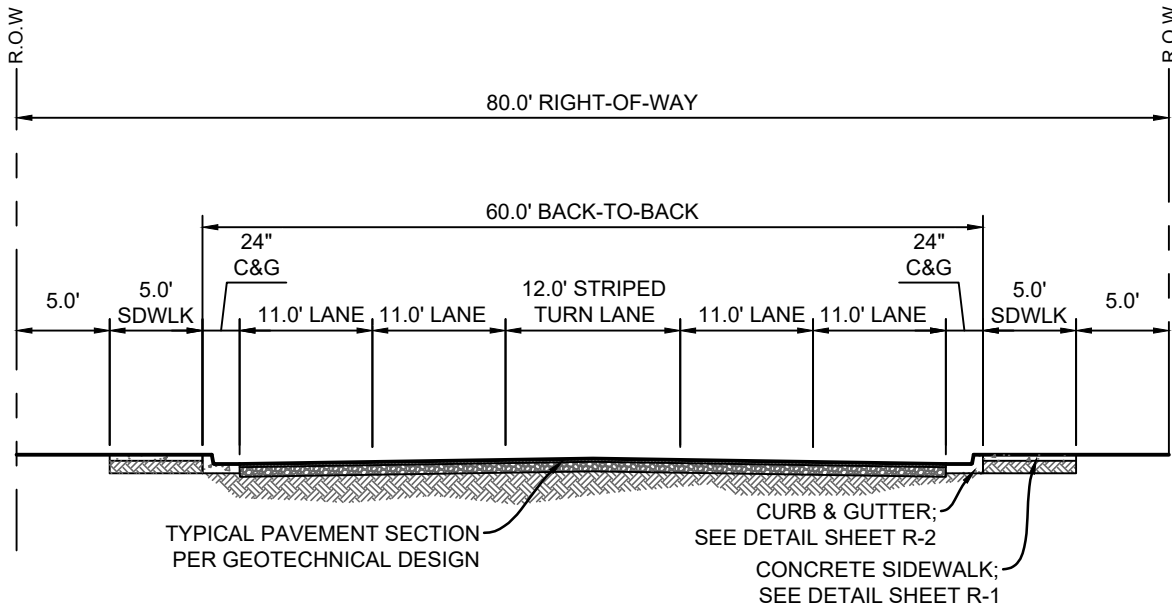
COLLECTOR STREET DETAIL

ISSUE DATE:
APRIL 2021

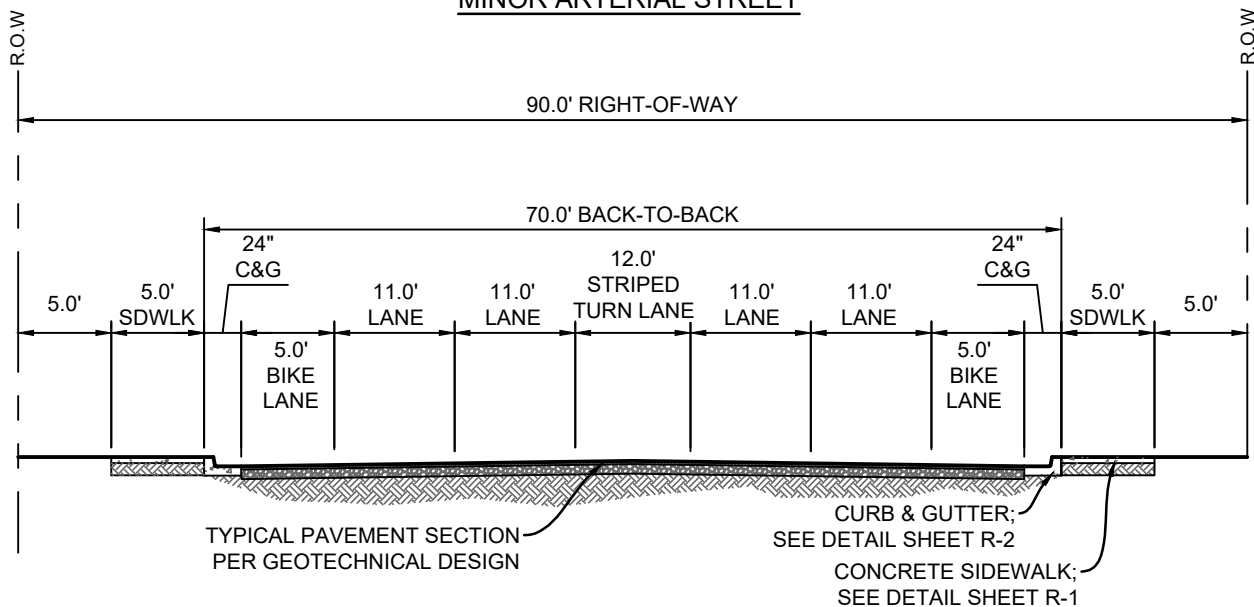
REVISION DATE:

SHEET NO:

R-7



MINOR ARTERIAL STREET



MINOR ARTERIAL STREET w/ BIKE LANES

NOTE:
 FIVE-FOOT (5') PARKWAY BETWEEN BACK OF CURB AND SIDEWALK SHALL BE PRE-APPROVED BY CITY OF ALAMOGORDO ENGINEERING DEPARTMENT.

SCALE: NOT TO SCALE



**CITY OF ALAMOGORDO
 TECHNICAL STANDARD DRAWINGS**

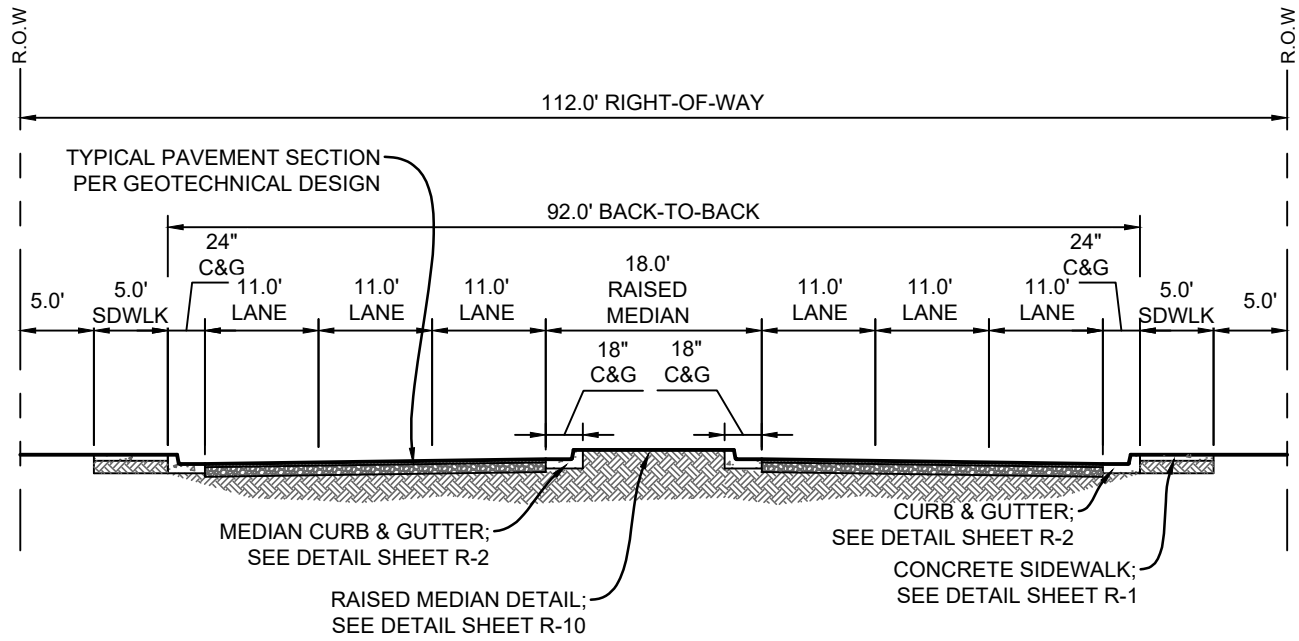
MINOR ARTERIAL STREET DETAIL

ISSUE DATE:
APRIL 2021

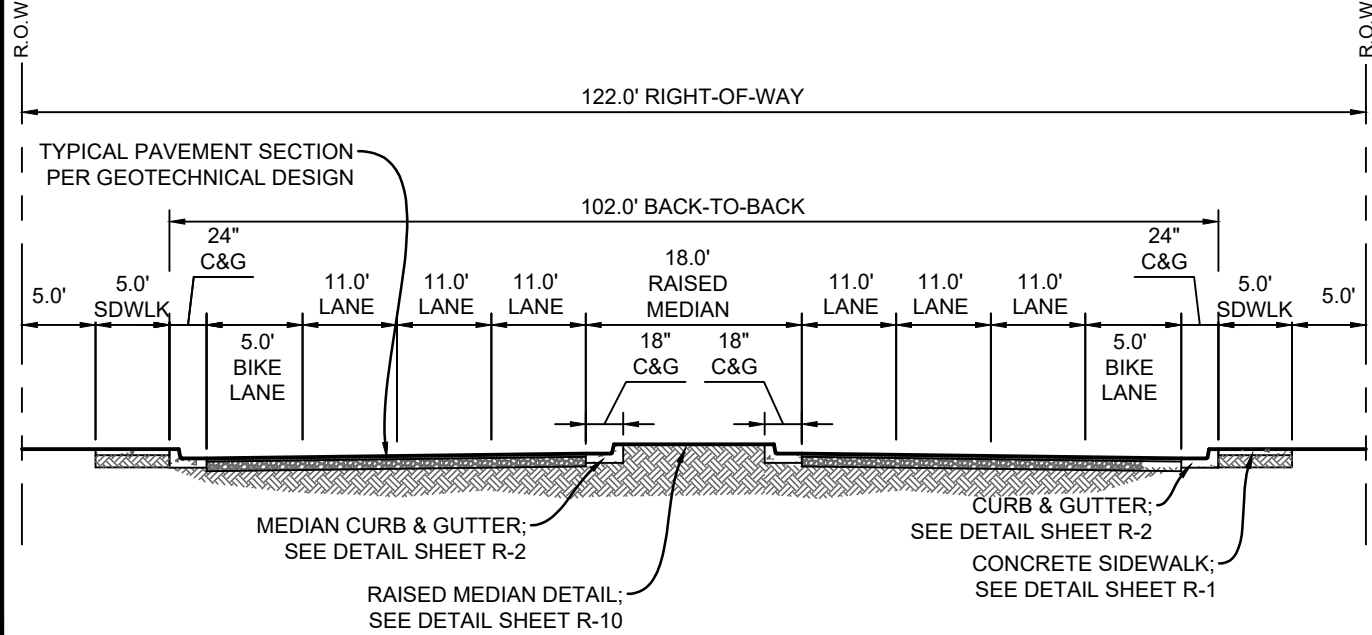
REVISION DATE:

SHEET NO:

R-8



MAJOR ARTERIAL STREET



MAJOR ARTERIAL STREET w/BIKE LANES

- NOTES:**
1. FIVE-FOOT (5') PARKWAY BETWEEN BACK OF CURB AND SIDEWALK SHALL BE PRE-APPROVED BY CITY OF ALAMOGORDO ENGINEERING DEPARTMENT.
 2. THE MEDIAN MAY BE DESIGNED TO PERMIT A SWALE FOR DRAINAGE CONVEYANCE.
 3. RAISED MEDIAN MAY CONTAIN A 12-FOOT DEDICATED LEFT TURN LANE.

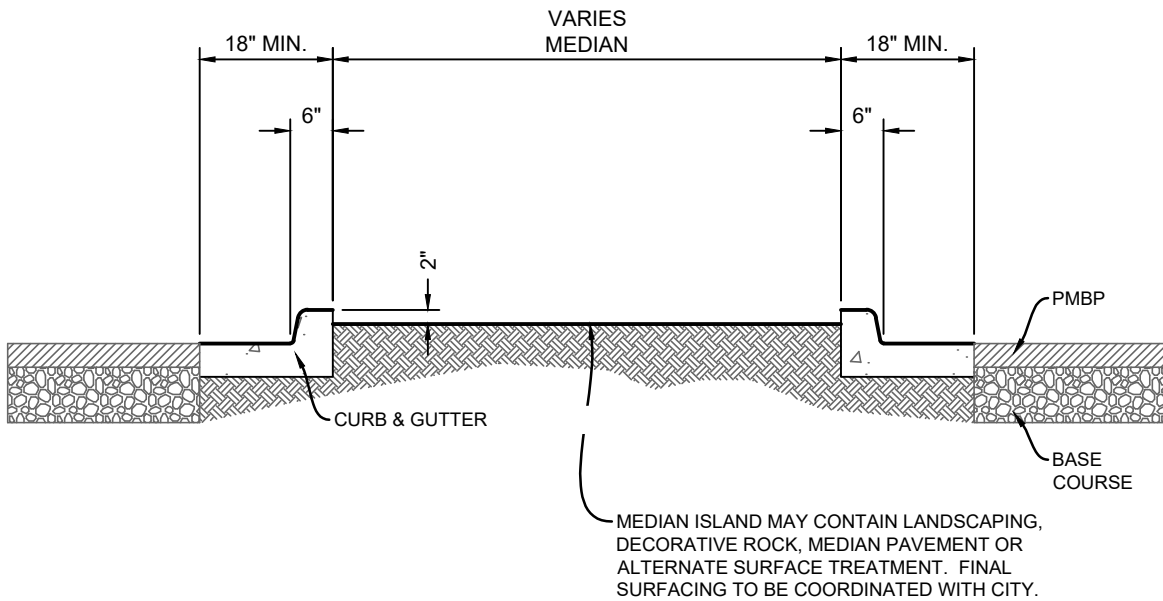
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**CITY OF ALAMOGORDO
TECHNICAL STANDARD DRAWINGS**

MAJOR ARTERIAL STREET DETAIL

ISSUE DATE: APRIL 2021
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SHEET NO: R-9



RAISED MEDIAN DETAIL

SCALE: NOT TO SCALE



CITY OF ALAMOGORDO
TECHNICAL STANDARD DRAWINGS

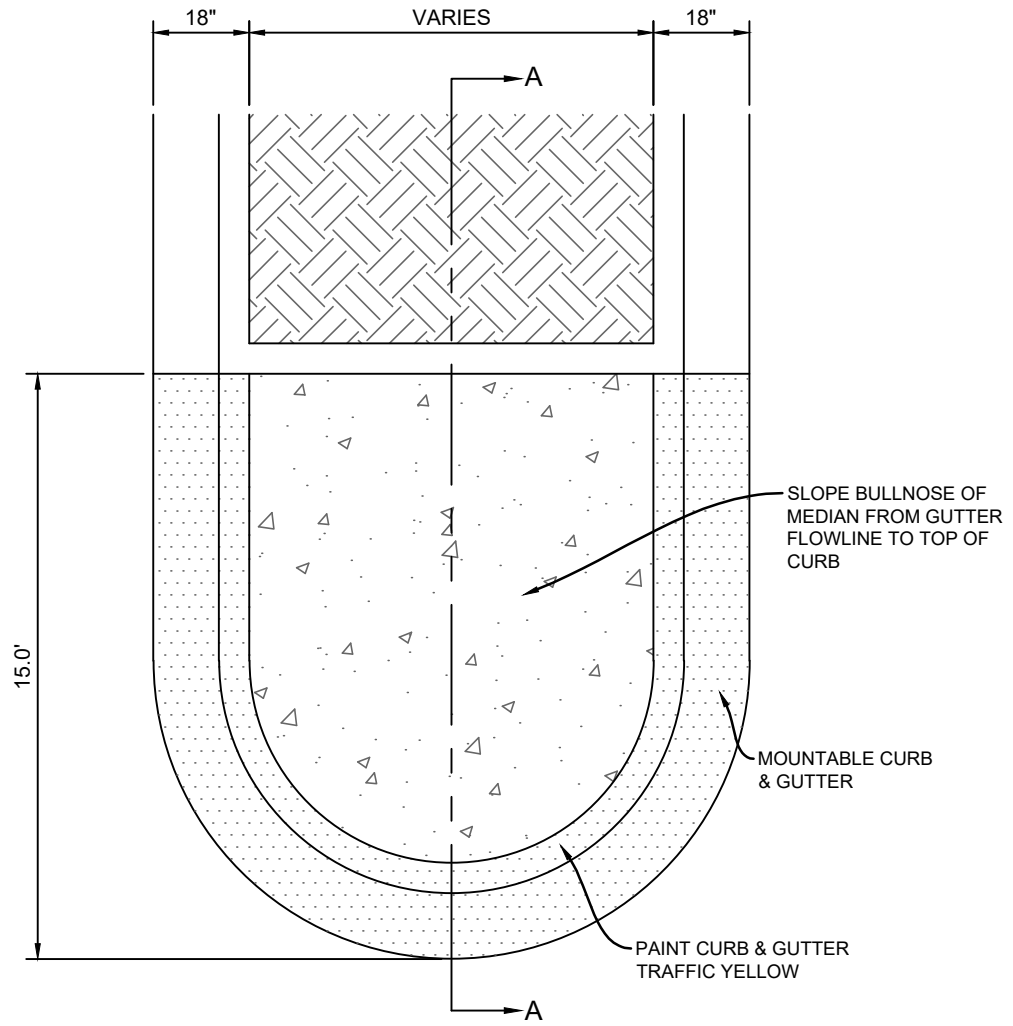
RAISED MEDIAN DETAIL

ISSUE DATE:
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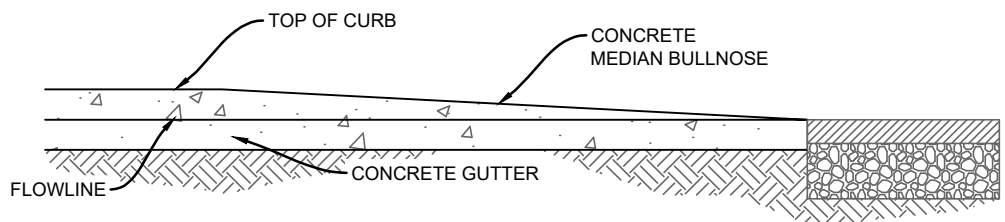
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R-10



PLAN VIEW



SECTION VIEW

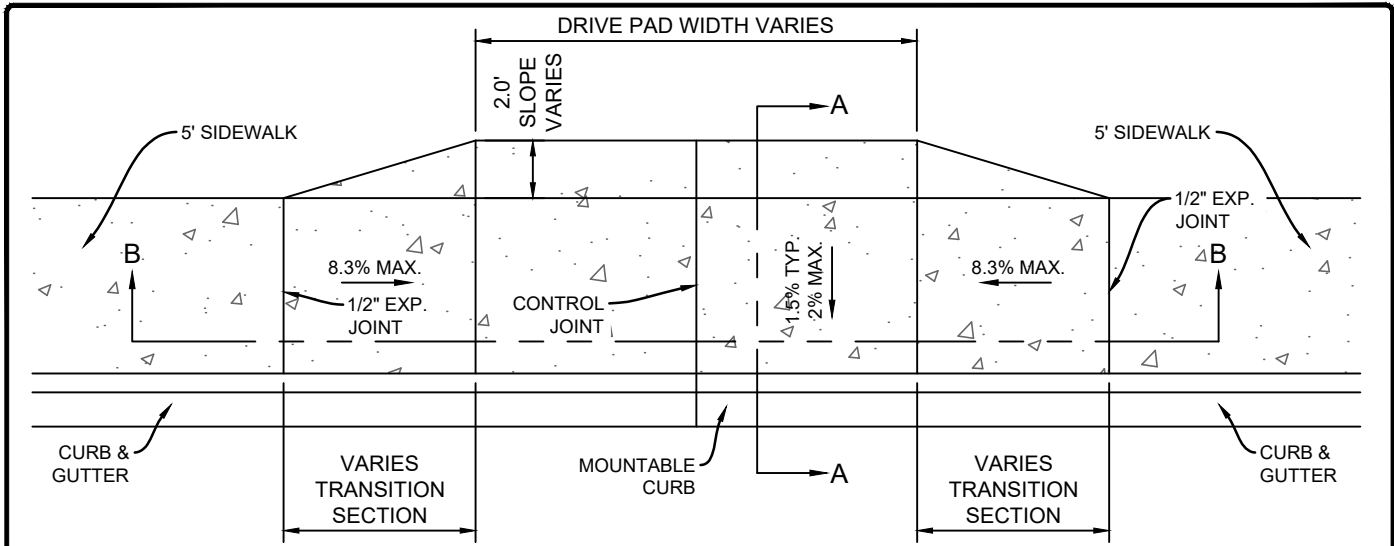
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CITY OF ALAMOGORDO
TECHNICAL STANDARD DRAWINGS

MEDIAN TERMINATION DETAIL

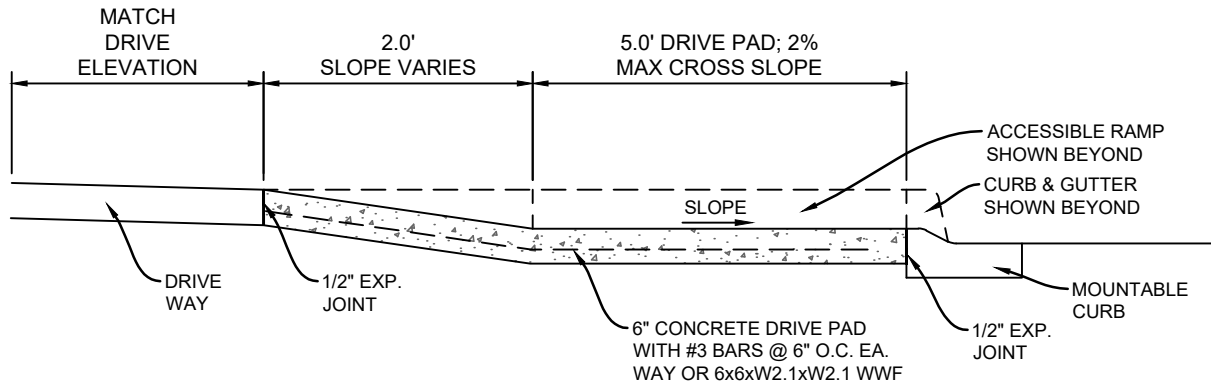
ISSUE DATE: APRIL 2021
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SHEET NO: R-11



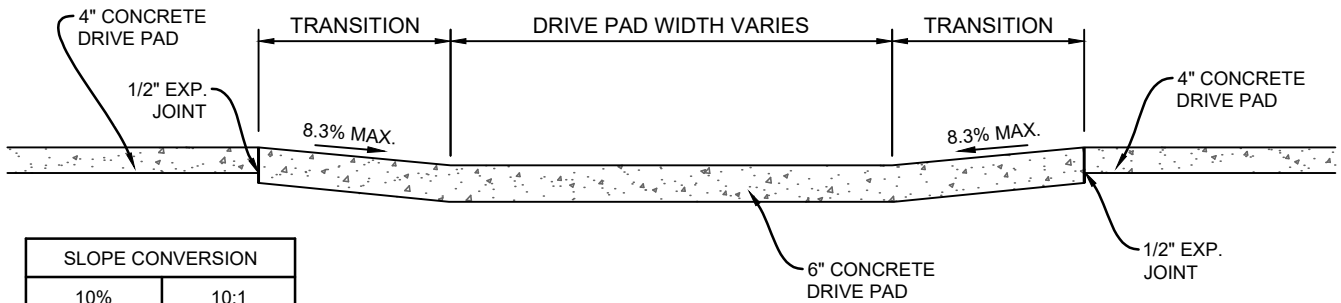
PLAN VIEW

NOTES:

PROVIDE 1/2" BITUMINOUS EXPANSION BOARD WHERE DRIVE PAD APRON ABUTS SIDEWALK, CURB AND GUTTER (TYP.)



SECTION A-A



SECTION B-B

SLOPE CONVERSION	
10%	10:1
8.3%	12:1
2%	50:1

SCALE: NOT TO SCALE



**CITY OF ALAMOGORDO
TECHNICAL STANDARD DRAWINGS**

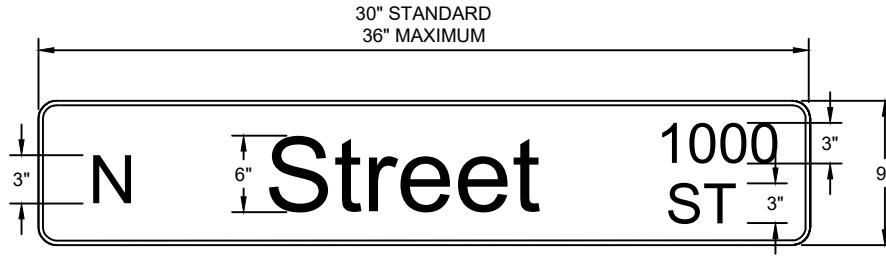
DRIVE PAD DETAIL

ISSUE DATE:
APRIL 2021

REVISION DATE:

SHEET NO:

R-12



D3-1 (DOUBLE SIDED)

DIMENSIONS VARY
GREEN

TYPE OF MOUNTING	TYPE OF STREET	SPEED LIMIT	INITIAL UPPER-CASE	LOWER-CASE
POST-MOUNTED	MULTI-LANE	MORE THAN 40 MPH	8 INCHES	6 INCHES
POST-MOUNTED	MULTI-LANE	40 MPH OR LESS	6 INCHES	4.5 INCHES
POST-MOUNTED	2-LANE	ALL SPEED LIMITS	6 INCHES	4.5 INCHES

ON LOCAL TWO-LANE STREETS WITH SPEED LIMITS OF 25 MPH OR LESS, 4-INCH INITIAL UPPER-CASE LETTERS MAY BE USED.

1. ALL REGULATORY, WARNING, SPECIAL, AND GUIDE SIGNS SHALL COMPLY WITH COLOR, LETTER SPACING, LETTER SHEETING AND BACKGROUND SHEETING REQUIREMENTS INDICATED ON THIS SHEET AND THE MOST CURRENT EDITION OF THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD) AND THE STANDARD HIGHWAY SIGNS AND MARKINGS BOOK.
2. ALL NEW WARNING AND REGULATORY SIGNS SHALL BE 0.080 GAUGE ALUMINUM PANEL.
3. ANTI-GRAFFITI COATING SHALL BE APPLIED ON ALL REGULATORY, WARNING, GUIDE, AND OTHER SPECIAL SIGNS.
4. EACH SIGN FACE SHOWN ON THE PLANS SHALL MEET THE REQUIREMENTS OF THE MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES (MUTCD-LATEST EDITION) FOR PROPER ARRANGEMENT, SPACING OF LETTERS, LETTER HEIGHT, SYMBOLS AND BORDERS FOR THE SPECIFIED SIZE AND MESSAGE AS SHOWN PER PLANS.
5. ALL SIGNING HARDWARE, INCLUDING BRACKETS (FOR MOUNTING ALL STREET NAME SIGNS, W1-8-18 BACK-TO-BACK MOUNTING, ETC.) ARE CONSIDERED INCIDENTAL TO SIGN INSTALLATION. NO ADDITIONAL PAYMENT SHALL BE MADE THEREFORE.
6. CONTRACTOR SHALL FIELD VERIFY ALL SIGNING INFORMATION, TEXT AND LOCATIONS PRIOR TO FABRICATION AND INSTALLATION. NEW SIGN LOCATIONS SHALL BE APPROVED BY THE PROJECT MANAGER.
7. WIDTH DIMENSION ON D3-1 (STREET NAME SIGNS) VARIES BASED ON NUMBER OF LETTERS AND FONT REQUIREMENTS AS PROVIDED IN THE MUTCD-LATEST EDITION.

SCALE: NOT TO SCALE



**CITY OF ALAMOGORDO
TECHNICAL STANDARD DRAWINGS**

STREET NAME SIGN DETAIL

ISSUE DATE:

APRIL 2021

REVISION DATE:

SHEET NO:

R-13

TECHNICAL STANDARDS

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TECHNICAL STANDARDS

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CHAPTER 06 - SANITARY SEWER SYSTEM

ARTICLE 06-01 – GENERAL

Article 06-01-010 Sanitary Sewer Materials

Item Description	Size or Drawing	Reference Standard	Manufacturer
Schedule 40 PVC Pipe (Sanitary Service Line)	4" & 6"	ASTM D1785 – PVC Standard for Schedule 40, 80, and 120 ASTM D2564 – Solvent Weld PVC ASTM D2235 – Solvent Weld for Acrylonitrile-Butadiene- Styrene (ABS) Plastic Pipe	
SDR 35 PVC Pipe (PS 46 PSI)	8" – 15"	ASTM D3034 – Pipe Standard ASTM D1784 – Pipe Compound ASTM F477 – Gasket Standard ASTM D2321 - Installation	
SDR 26 PVC Pipe (PS 115 PSI)	8"-15"	ASTM D3034 – Pipe Standard ASTM D1784 – Pipe Compound ASTM F477 – Gasket Standard ASTM D2321 - Installation	
PS46 PVC Pipe	18"-36"	ASTM F679 – Pipe Standard ASTM D1784 – Pipe Compound ASTM F477 – Gasket Standard ASTM D2321 - Installation	
PS115 PVC Pipe	18"-36"	ASTM F679 – Pipe Standard ASTM D1784 – Pipe Compound ASTM F477 – Gasket Standard ASTM D2321 - Installation	
Manhole Frames and Covers (H-20 Load Rated)	S-2 S-3	AASHTO Designation M306 ASTM A48 – C1 30 or Stronger	
Precast Manholes	S-6 S-10	ASTM C478 AASHTO M199 NMDOT Section 517 and 662	Western Precast Concrete, Inc.
Mastic Gasket for Precast Sections	S-6 S-10	AASHTO M198 ASTM C990	Ram-Nek Hamilton Kent
Concrete Coating	S-6 S-10	ASTM D7234	Raven 175 Raven 405
Glass Fiber Reinforced Polyester (FRP) Manholes	S-16	ASTM D3753	LFM Fiberglass Structures
Detectable Warning Tape	S-1	ASTM D2103	

Tracing Wire Open Trench Installation	#12 AWG	ASTM B1010 ASTM D1248	Copperhead Industries
Tracing Wire Directional Drilling	#12 AWG	ASTM B1010 ASTM D1248	Copperhead Industries
Tracing Wire Slip Lining/Bursting	7x7 Strand	ASTM B1010 ASTM D1248	Copperhead Industries
Tracing Wire Termination/Access Boxes	S-4 S-6	Per Manufacturer Instructions	Copperhead Industries
Tracing Wire Connectors	S-17	Per Manufacturer Instructions	Copperhead Industries
Tracing Wire Grounding	S-6	Per Manufacturer Instructions	Copperhead Industries
Inserta Tee	S-13		Inserta Tee
Repair Couplings			Fernco
Inflow Protectors	S-12		LFM Fiberglass Structures
Casing Pipe	S-15	ASTM A139 Grade B Cooper E-80	
Casing End Seals	S-15		T.D. Williamson, Inc Z-Seals
Casing Spacers	S-15		Advance Products & Systems

Article 06-01-020 Work Description

- (a) The Work covered by this specification consists of furnishing and installing all of the sanitary sewer pipe, fittings, and appurtenances required to tie into the existing sanitary sewer system.
- (b) The Contractor shall have the responsibility for furnishing the exact lengths of pipe, fittings, adapters, and couplings for proper "make-up" and connections of the pipes.

Article 06-01-030 Location

Sanitary sewer lines may be placed either in the streets or alleys. In either case the sanitary sewer line shall be located on the south side of East-West streets or alleys, and on the east side of North-South streets or alleys, at approximately five-feet (5') from the centerline of the street or alley.

Article 06-01-040 Depth of Sanitary Sewer Lines

Sanitary sewer lines shall be a minimum of three-feet (3') below the finish surface of the street or alley. The depth shall be measured from the top of the pipe to the finish surface of the street or alley.

Article 06-01-050 Sanitary Sewer Line Sizes

- (a) Gravity sanitary sewer mains shall be eight inches (8") in diameter minimum. The City should be consulted for area flow conditions and volumes for final determination of required main sizes.
- (b) Sanitary sewer service lines shall be four inches (4") in diameter minimum. Actual sewer line size shall be based on actual flow conditions.

Article 06-01-060 Manholes

- (a) Manholes shall be required as follows:
 - (1) At a maximum horizontal spacing of five-hundred feet (500').
 - (2) Where two or more sanitary sewer mains converge.
 - (3) Minimum inner diameter of four feet (4').
- (b) Grade differentials of more than twenty-four inches (24") between the highest incoming and outgoing sanitary sewer lines require construction of a drop manhole; Standard Detail S-10.
- (c) Where a sanitary sewer line passes through a manhole in a straight line, a drop between incoming and outgoing inverts will not be required. If a horizontal deflection in the sanitary sewer alignment is proposed at the manhole, a minimum of one-tenth of a foot (0.10') between inverts will be required when the angle is between 0 and 45-degree (0° - 45°). If the angle of deflection is greater than 45-degree (45°) a minimum of two-tenths of a foot (0.20') shall be held between incoming and outgoing inverts, such as a 90-degree (90°) bend. Where more than two pipes enter a common manhole, all incoming lines shall be a minimum of two-tenths of a foot (0.20') above the outgoing lines.
- (d) All manholes, regardless of type, shall have inflow protectors, LFM Fiberglass Structures or City approved equivalent complete with lift strap and gas relief valve.

Article 06-01-070 Water and Sanitary Sewer

Lines shall be laid parallel to each other and parallel to the street or alley centerline when both are installed in the same street or alley. Sanitary sewer lines may be placed in alleys instead of streets. If both are laid in the street, a minimum distance between the lines shall be ten-feet (10') horizontally, and the water line shall be at least two-feet (2') higher than the sanitary sewer line. Where the water and sanitary sewer lines cross each other, the water line shall be a minimum of two-feet (2') higher than the sanitary sewer line or the sanitary sewer line shall be concrete encased a minimum of ten-feet (10') on each side of the water line, per the detail W-11. If the water line crossing occurs below the sanitary/storm drain sewer the sewer line shall be encased per detail W-11.

ARTICLE 06-02 – SANITARY SEWER PIPE

Article 06-02-010 Materials

- (a) PVC sewer pipe and fittings shall be gravity sewer pipe, ASTM D 3034, SDR 35. All elastomeric gaskets for PVC pipe shall comply with ASTM F 477. PVC sewer pipe and fittings shall meet the requirements of ASTM 3034, ASTM D 3212, and Uni-Bell UNI-B-4.
- (b) A certification from the manufacturer shall be furnished to the City attesting compliance with appropriate ASTM Standards.
- (c) All PVC pipes shall be coded to eliminate future confusion and prevent accidental damage to or interruption of the water and sanitary sewer facilities. Detectable marking tape shall be installed as prescribed in these standards.
- (d) All pipes shall have a home mark on the spigot end to indicate proper penetration when joint is completed. The sockets and/or spigot configurations for the fittings and couplings shall be compatible to the pipe.
- (e) Pipe with gasketed joints shall be manufactured with a socket configuration that will prevent improper installation of the gasket and will ensure that the gasket remains in place during joining operations. The gasket shall be manufactured from a synthetic elastomer material and shall conform to the requirements of ASTM F 477.
- (f) Solvent cement joints shall be limited to four (4) inch diameter or six (6) inch diameter plastic pipe, which will be used exclusively for sanitary sewer service lines. The solvent cement shall be compatible to the pipe manufacturer's product and shall conform to the requirements of ASTM D 2564 for PVC pipe and ASTM D 2235 for ABS pipe.

- (g) When PVC pipe is stored outside and exposed to prolonged periods of sunlight, an obvious discoloration of the pipe can occur. This is an indication of reduced pipe impact strength, and any particular length of pipe that is discolored will be rejected. All pipe rejected by the City will be removed from the job site.
- (h) The materials in plastic pipe shall comply with ASTM D 1784.
- (i) All plastic pipes shall be push-on, flexible elastomeric gasketed, except plastic pipe used for sanitary sewer service lines, which will be joined per manufacturer's recommendations.
- (j) Polyvinyl chloride (PVC) pipe shall meet the requirements of ASTM D 3034 for pipe sizes eight (8) inch in diameter through fifteen (15) inches in diameter. Minimum wall classification shall be SDR 35 or SDR 26, as required. Only solid wall pipe will be acceptable.
- (k) PVC pipe used for sanitary sewer service lines shall conform to ASTM D 2665 for Schedule 40 pipe, or ASTM 3034 for SDR 35 or SDR 26.
- (l) Pipe for this purpose shall be solvent welded joined, per manufacturer's recommendations, or gasketed joints conforming to ASTM F 477.

ARTICLE 06-03 – SANITARY SEWER APPURTENANCES

Article 06-03-010 Manhole Bases

Manhole Bases: Manhole bases poured-in-place shall be Class A concrete, 3,000 psi, and reinforced per the Standard Detail S-6.

Article 06-03-020 Precast Manholes

- (a) Manhole Sections: Manhole riser sections shall be precast concrete sections, precast concentric cone sections and precast concrete grade rings, in conformance with ASTM Designation C 478, latest revision. All joints of the manhole sections shall be sealed with Ram-Nek or approved equal. See Standard Detail: S-6.
- (b) The entirety of manholes exposed surfaces shall be coated, prior to placement into service, to aide in corrosion and impact resistance. Manholes shall be coated with Raven 175 (prime coat) and Raven 405 (2nd coat) to 100 mil total dry thickness; alternate coating systems shall be pre-approved by the City.
- (c) Manhole Covers: Manhole covers shall be cast iron frame and solid lid, ASTM Designation A 48, Class 30 or stronger. The frames and lids shall be machined to provide a non-rocking bearing surface and uniform clearance around the edge of

the lid. The lids shall have the word "SEWER" embossed on them, and each lid shall have two (2) lifting lugs or pick holes. See Standard Details: S-2 and S-3.

- (d) Manhole Collars: Manhole collars shall be poured-in-place with Class A concrete, 3,000 psi, and reinforced per the detail S-4. Tracing wire test stations shall be placed integral with manhole collars. See Standard Detail S-4.

Article 06-03-030 Glass Fiber Reinforced Polyester (FRP) Manholes

- (a) Fiberglass reinforced manholes used for sanitary sewer systems shall consist of commercial grade polyester resin and meet or exceed the requirements of ASTM D3753. Manholes shall be manufactured by LFM Fiberglass Structures or City approved equivalent. The inner surface shall consist of a resin layer capable of resisting corrosive conditions, such as exposure to hydrogen sulfides. Each manhole shall be designed for an H-2) load rating, being water-tight and including a solid FRP anti-flotation bottom and fully enclosed fiberglass bench and invert area.
- (b) Concrete bench and invert shall be coated, prior to placement into service, to aide in corrosion and impact resistance. The coating shall consist of Raven 175 (prime coat) and Raven 405 (2nd coat) to 100 mil total dry thickness; alternate coating systems shall be pre-approved by the City.
- (c) Manhole Covers: Manhole covers shall be cast iron frame and solid lid, ASTM Designation A 48, Class 30 or stronger. The frames and lids shall be machined to provide a non-rocking bearing surface and uniform clearance around the edge of the lid. The lids shall have the word "SEWER" embossed on them, and each lid shall have two (2) lifting lugs or pick holes. See Standard Details: S-2 and S-3.
- (d) Manhole Collars: Manhole collars shall be poured-in-place with Class A concrete, 3,000 psi, and reinforced per the detail S-4. Tracing wire test stations shall be placed integral with manhole collars. See Standard Detail S-4.

Article 06-03-040 Cleanouts

- (a) Cleanouts shall consist of a cast-iron frame and cover and boot. After installation of the boot, a square concrete block twenty-four by twenty-four inches (24"x24") by six-inches (6") thick shall be placed level with the top of the boot, reinforced with #3 bars on ten-inches (10") center each way and 3,000 PSI concrete. Cleanouts shall be located so that two hundred fifty (250) feet of sanitary sewer rod can reach any point in the line.
- (b) A cleanout should be placed on all sanitary sewer lines where they leave public right-of-way or easement. The tracing wire on sanitary sewer service lines shall be terminated above ground at this cleanout.

Article 06-03-050 Flexible Markers

Where sanitary sewer lines travel across open country and not under pavement, marking posts shall be placed at two hundred- and fifty-foot (250') intervals, including every change in alignment direction. Marking posts shall be a minimum of four inches (4") wide by sixty inches (60") high, APWA green in color. Each marking post shall read "Warning Sewer Pipeline".

ARTICLE 06-04 – CONSTRUCTION REQUIREMENTS

Article 06-04-010 Trench Excavation

- (a) Pipe trenches shall be excavated along straight lines to the dimensions as required in the Contract Documents.
- (b) All trenching work shall be done in a safe manner, trenches shall be rendered safe for the workmen by complying with the applicable safety standards, and by practicing safety measures consistent with current OSHA Trenching and Excavation Safety Standards and good construction methods.
- (c) All excavations shall be adequately barricaded and secured in accordance with the current New Mexico Department of Transportation Standard Specifications. Flashing lights and barricades shall be employed along open excavations and trenches to protect the public from potential hazards; barricades and advance warning devices shall comply with MUTCD Standards as well as any special direction required by the City.
- (d) Unless trench banks are cut back on a stable slope, the trenches shall be braced as necessary to prevent caving or sliding, to provide protection for the workmen and the pipe. All trenching shall comply with OSHA Trenching and Excavation Safety Standards.
- (e) When over-excavation occurs beyond the limits indicated by the trench details, the over-excavated area shall be refilled with suitable material at optimum moisture and compacted to ninety-five (95) percent density per ASTM D 1557.
- (f) The maximum amount of open trench permitted in any one location shall be 100-feet, or the length necessary to accommodate the amount of pipe installed in a single day, whichever is greater, unless otherwise approved by the City. A trench shall be considered open until backfilled to the top of subgrade.
- (g) Excavation of pipe trenches for flexible and rigid pipe is as required in the table below. In all cases, the trench shall be wide enough to allow for the compaction equipment.

Table 1: Minimum Trench Widths

Flexible Pipe	Minimum shall be not less than 1.5 times the pipe outer diameter plus twelve inches (12")
Rigid Pipe	Minimum shall be not less than the outside pipe diameter times 0.33

- (h) When trench is to be backfilled with flowable fill, the minimum trench width may be reduced to the pipe diameter plus twelve inches (12") and enough room needed to allow for the proper placement of the flowable fill using tools to "spade" the material under the pipe haunches.
- (i) Maximum Trench Width: the maximum width of the trench shall be determined by the Contractor based on the method and means for the installation. However, trench width shall not exceed the width of a ride-along compactor plus two feet (2') when working alongside the pipe or culvert.
- (j) Street Crossings
 - (1) Trenches crossing streets shall be completely backfilled immediately after pipe, wire, or conduit installation and a temporary or permanent asphalt patch or flowable fill cap shall be installed as directed by the City to protect the integrity of the trenches within the roadway limits from excessive moisture.
 - (2) Substantial bridging, properly anchored, capable of carrying the vehicle loading, in addition to adequate trench bracing, shall be used to bridge across trenches at street crossings where trench backfill, and temporary patches have not been completed during regular working hours as directed and approved by the City. Safe and convenient passage for pedestrians and access to all properties shall be provided.
- (k) Disposal of Unsuitable Excavated Materials
 - (1) Excess material and excavated material unsuitable for backfill shall be removed from the Project by the end of each working day unless otherwise approved by the City and disposed of by the Contractor in an environmentally responsible manner at no cost to the Project.
 - (2) When unsuitable material is encountered that is not shown in the Contract Documents, the City shall order the removal of the material by the Contractor and issue a field order to change the contract price due to the Contractor for removal of the materials.

- (l) Portable trench shields or boxes that provide a movable safe working area for installing pipe may be used for the installation of the pipe. After placing the pipe in the trench, backfill material shall be placed in lifts and the shield shall be lifted to allow for the backfill material to be placed for each lift, trench wall to trench wall.
- (m) Transition Installations: When differential conditions of pipe support might occur, such as transitions from manholes to trench, a transition support region shall be provided to ensure uniform pipe support and preclude the development of shear, or other concentrated loading on the pipe.

Article 06-04-020 Bedding

- (a) The bottom of the trenches shall be smooth, and hand graded uniformly throughout. If rock or other unyielding material is encountered or if the trench is over-excavated, pipe bedding material shall be added, compacted, and graded to a smooth uniform surface. The compacted bedding shall support the pipe throughout its entire length, except at bells or couplings which shall not rest on the bedding.
- (b) After the bell or coupling holes are excavated and after the pipe pieces are connected and properly aligned and graded, successive layers of select material shall be placed and compacted, until the pipe is covered, as required in the Contract Documents. The Contractor shall maintain proper alignment and grade during the bedding process. Any bent, cracked, chipped, or damaged pieces of pipe shall be removed and replaced at Contractor's expense.

Article 06-04-030 Pipe Laying

- (a) The pipe shall be laid true to the line(s) and grade(s) indicated in the Contract Documents or as established by the City.
- (b) The pipe shall be protected during handling against impact shocks and free fall. Do not permit hooks, chains, cables, or handling equipment to come in contact with the pre-molded or pre-formed end surfaces.
- (c) Handle the pipe having pre-molded end surfaces or pre-formed end surfaces so that no weight, including the weight of the pipe itself, will bear on or be supported by the jointing material or surfaces. Do not drag the end of the pipe on the ground or allow pipes to be damaged by contact with gravel, crushed stone, or any other hard objects. No damaged or deformed pipe will be incorporated into the Project.
- (d) The interior of the pipelines shall be kept free from dirt and other foreign material as the work progresses and shall be clean upon completion of the pipe installation.

Tight stoppers or bulkheads shall be securely placed in the ends of all pipelines when the work is stopped temporarily, or at the end of a workday.

- (e) Immediately prior to jointing, both pipe ends shall be thoroughly cleaned, and a lubricant shall be applied according to the manufacturer's recommendations. For push-on type joints, sufficient pressure shall be applied in making up joints to insure proper seating of the joints.
- (f) All pipe shall be laid straight between ends, fittings or bends, and on uniform grade. Excavate bell holes for each pipe joint. After the pipe is jointed in the trench, the pipeline shall form a true line and consistent grade.
- (g) The City shall have the privilege of checking the pipe for line and grade by any method after the pipe is laid and before backfilling begins. The City shall also have the privilege of checking each pipe joint with a gauge or by any means necessary in order to be assured that the gaskets are in place and properly seated. Any run of pipe that is found to be appreciably offline or grade shall be removed from the trench, the trench bedding shall be re-graded and compacted, and the pipe shall then be laid accurately online and grade. Any joint that is found to be improperly gasketed and/or seated shall be un-jointed and correctly reassembled. If any gasket is found to be damaged, the entire pipe section containing the damaged gasket shall be replaced with a new section of pipe.
- (h) Contractor shall furnish any tools, gauges, and all items required for the checking of the gaskets and joints and shall check every joint to be sure that the gaskets are seated and located in the correct place to avoid leakage at the joints.
- (i) Pipe and appurtenances shall be new and unused. The type of pipe to be installed shall be as approved by these Technical Standards. Pipe and appurtenances shall be handled to insure delivery to the trench in sound, undamaged condition. Particular care shall be taken to prevent damage to any pipe coating.
- (j) The interior of 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 City without additional expense.
- (k) 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 Project has been completed and all work approved. The Contractor shall not flush or otherwise discharge any flow into an existing system unless approved in writing by the City.

- (l) Pipe shall be laid to line and grade as shown on the plans and as staked in the field. The bedding 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 adjustments 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 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.
- (m) Trenches shall be kept free from water during pipe installation until suitable backfill has been placed and compacted to prevent pipe flotation. Any standing water within the trench shall be evacuated and the trench bottom or bedding be restored per the standards contained herein.
- (n) Field cuts shall be completed with a hacksaw, handsaw, or a power saw with a steel blade or an abrasive disc. Field cuts shall be square to the pipe's flow area. The newly cut pipe end shall be beveled to the factory pipe chamfer. Completed field cuts shall be smooth and blunt free from shavings and rough edges.
- (n) Connections to existing manholes shall be made by core drilling through the manhole wall using concrete saw or other cutting device approved by the City. Sledgehammers are not acceptable. The Contractor shall take care to avoid unnecessary damage to the existing manhole. Manholes broken by the Contractor shall be replaced by the Contractor without additional expense to the City.
- (p) Pipe shall be laid up-grade in a continuous operation from structure to structure, with the socket or collar ends of the pipe up-grade, unless otherwise permitted by the City.
- (q) Sanitary sewer mains shall not be constructed under walkways, sidewalks, curbs and gutters, driveways, or similar concrete structures by tunneling underneath. The Contractor will cut these concrete structures by using a concrete saw. At the Contractor's option, he may remove the section of the concrete structure to the nearest full expansion joint or edge without addition expense to City.

- (r) Plastic sewer pipe shall be connected and placed in the trench in accordance with the manufacturer's recommendations.
- (s) The reference mark (a distinct circumferential line) is placed on the pipe's spigot end by the manufacturer to indicate the correct depth of spigot penetration into the pipe gasket joint. If the pipe is seated too deep or too shallow the pipe may buckle or separate due to thermal expansion/contraction. Spigot penetration shall be within one quarter (1/4) inch of the manufacturer's recommended mark.
- (t) For plastic pipe connection to manholes, the Contractor shall install an appropriately sized press seal gasket, such as PS-10 by Press Seal Gasket Corporation, Large Diameter Waterstops for Concrete Manhole Adapters by Fernco, or approved equal. The gasket shall be installed per manufacturer's directions. See Standard Detail: S-1.

Article 06-04-040 Sewer Service Taps

- (a) Sewer service line taps shall be completed by qualified and appropriately licensed Utility Contractors per Standard Detail S-9.
- (b) When the existing sanitary sewer line to be tapped is vitrified clay pipe (VCP) the Contractor shall remove a minimum five-foot (5') pipe segment and install SDR-35 PVC pipe of appropriate diameter coupled to existing sanitary sewer line, on either side, with leak-proof couplings (Fernco or approved equal). The sewer service line tap can be completed upon the PVC main line segment. See Standard Details: S-9 and S-10.

Article 06-04-050 Existing Manholes

- (a) Where the Contractor is required to connect to the existing manholes, the manholes shall be handled to avoid damage. Any damage to the existing manholes resulting from the Contractor's activities shall be corrected to the satisfaction of the City, at the Contractor's expense.
- (b) Each manhole penetration shall be sawcut along pre-marked lines to form a uniform opening. The existing manhole invert shall be removed as required to build the new sewer line through the manhole at the alignment and grade called for in the Contract Documents.
- (c) Prior to grouting the openings and manhole invert, the walls and floor of the manhole shall be clean and free of all foreign matter or other condition that would affect the bonding of the new grout. Additionally, a rubber manhole gasket shall be installed around the new sewer line where it will be in contact with the new

grout. All voids shall be filled, and the invert shall be grouted to form a smooth sloping surface toward the opening in the new pipe.

- (d) Existing sanitary sewer manholes designated for removal shall be demolished and disposed of at an appropriate site. The resulting excavation shall be properly refilled with compacted backfill. See Standard Details: S-8 and S-11.

Article 06-04-060 Temporary Bypasses

- (a) The Contractor will be required to control the sewage in the existing sewer lines and service lines.
- (b) The sewage shall be pumped, diverted, or otherwise accommodated to facilitate construction of the new sewer line.
- (c) The Contractor shall conduct sewer line construction so that fittings, couplings, and all required materials are on hand to quickly complete each section of sewer line, minimizing the timeframe that the bypass is in place. The Contractor shall present to the City a bypass proposal that accurately details operations, for approval by the City prior to beginning work on the sewer line.
- (d) Refer to Chapter 07 Temporary Bypass Pumping System for additional detail.

Article 06-04-070 Backfilling Trenches

- (a) Definitions
 - (1) Foundation: Over-excavation and backfill of the foundation only when the native trench bottom does not provide a firm-working platform for placement of the pipe bedding material.
 - (2) Bedding: In addition to bringing the trench bottom to required grade, the bedding levels out any irregularities and ensures uniform support along the length of the pipe.
 - (3) Haunch Zone: The backfill under the lower half of the pipe (haunches) distributes superimposed loadings.
 - (4) Initial Zone: The backfill from the pipe midline to the top of the pipe zone provides the primary support against lateral pipe deformation for flexible pipe.
 - (5) Final Zone: Backfill above the pipe zone to the top of the subgrade.

- (b) Materials for trench backfill may include flowable fill, Type I aggregate base course, Type II aggregate base course, and native materials. Individual pipe zone backfill requirements are presented below. The Contractor shall submit the material types to the City for approval prior to construction.

Native backfill shall only be utilized within the Final backfill zone. Native materials shall be free from sod, frozen earth, organic materials, rubbish, and debris. The material should be free of large stones (maximum clod size shall be < 3”) that may cause damage to the pipe, such as concentrated pipe loading.

Table 2: Type I Aggregate Base Course Gradation and Requirements

Sieve Size	Percentage of Dry Weight Passing Sieve
2-Inch	100
1-1/2-Inch	90-100
1-Inch	70-90
No. 4	30-65
No. 10	30-10
No. 16	15-20
No. 200	10-20
Plastic Index	12 Maximum
Liquid Limit	35 Maximum
Fractured Faces	70% Minimum
Total Available Water-Soluble Sulfates	Less than 0.3% by dry weight of soil

Table 3: Type II Aggregate Base Course Gradation and Requirements

Sieve Size	Percentage of Dry Weight Passing Sieve
1-Inch	100
¾-Inch	85-95
No. 4	40-70
No. 10	35-45
No. 16	25-35
No. 200	6-18
Plastic Index	12 Maximum
Liquid Limit	35 Maximum
Fractured Faces	70% Minimum
Total Available Water-Soluble Sulfates	Less than 0.3% by dry weight of soil

Table 4: Native Backfill Requirements

Percentage by Weight Passing No. 200 Sieve	Plasticity Index Maximum
0-20.0	12
20.1 – 50.0	10
50.1 – 80.0	8
80.1 – 100	6
Liquid Limit	50 Maximum

- (1) **Foundation:** Trench foundations shall be stable prior to placing bedding material. If the City determines that unsuitable materials exist at the trench foundations, the Contractor shall remove and replace the material as directed by the City.

- (2) **Pipe Bedding:** The trench shall be excavated to a depth of four- to six-inches (4”-6”) below the bottom of the pipe barrel and to a depth that will be sufficient to provide two- to four-inches (2”-4”) of clearance under the pipe bell (where applicable).

Uniform and stable bedding shall be provided for the pipe and any protruding features of its joints and/or fittings. The middle of the bedding equal to one-third (1/3) the pipe outside diameter may be loosely placed to allow for the pipe bell and other protruding features. Alternatively, the compacted bedding material may be excavated slightly to allow for continuous lines and grades of the pipe structure.

Pipe bedding shall consist of Type II aggregate base course or flowable fill. Bedding shall be backfilled to the required grade of the bottom of the pipe. The compaction shall provide a density, at minimum, equal to 95 percent of the maximum dry density in accordance with ASTM D 1557 with the exception of the middle-uncompacted area.

- (3) **Haunch Zone Backfill:** After the pipe or conduit is laid, the haunch areas shall be backfilled with Type II aggregate base course or flowable fill.

Compaction of the haunching material can be best accomplished by hand with tampers or suitable power compactors for maximum compacted lift thickness of six inches (6”). The Contractor shall take care to not disturb the pipe from its line and grade while compacting the backfill. Material suitably distant from the pipe shall be compacted to 95 percent of the maximum dry density in accordance with ASTM D 1557.

While compacting the embedment near the pipe with impact-type tampers, caution shall be taken to not allow direct contact of the equipment with the pipe.

- (4) **Initial Backfill Zone:** After the pipe or conduit is laid, the initial backfill area shall be backfilled with Type II aggregate base course or flowable fill. Avoid usage of impact tampers directly above the pipe until the full loose layer backfill depth above the pipe is obtained.

Table 5: Initial Backfill Zone Material Depths

Pipe or Conduit	Initial Zone
2-Inch or less diameter	6-Inches above the top of pipe
Greater than 2-Inch diameter	12-Inches above the top of pipe

- (5) **Final Backfill Zone:** The remaining backfill, to the top of subgrade, shall consist of Type I or Type II aggregate basecourse, native material, or floable fill. The material shall be compacted to a minimum of 95 percent of the maximum dry density in accordance with ASTM D 1557.
 - A. If flowable fill is used, flowable fill shall be placed from the top of the initial backfill zone to the bottom of the flexible pavement (replaces aggregate road base in the pavement section over the trench).
 - B. Flowable fille cap may be required in the upper portion of the Final Backfill Zone for all non-residential roadways with a minimum thickness of twelve inches (12”) for minor collectors and eighteen inches (18”) for all major collectors and arterials.

(d) **Compaction**

- (1) Compaction shall be performed by mechanical means except in the haunch zone where compaction may be required by hand tamping. Mechanically compacted backfill shall be placed in layers of thickness compatible with the characteristics of the backfill and the type of equipment being used and shall have a maximum lift thickness as shown in the table below. The lifts shall be placed on both sides of the pipe at the same time to reduce pipe movement.

Table 6: Backfill Lift Thickness

Location	Maximum Compacted Lift Thickness (inches)	Maximum Loose Lift Thickness (inches)
Bedding, Haunch, and Initial Zones	6	8
Final Zone	8	12

- (2) Each layer shall be evenly spread, moistened, and tamped or rolled until the specified relative compaction has been attained.
 - (3) Compaction minimum shall be 95 percent of the maximum dry density in accordance with ASTM D 1557 for trenches within the roadway prism. Compaction requirements for the final zone of trenches outside the roadway may be reduced to 90 percent of maximum dry density in accordance with ASTM D 1557.
 - (4) Density testing shall be completed every 200-feet on mains or any part thereof per day, one per every three services or any part thereof per day.
 - (5) Density testing per depth: Less than or equal to four-feet (4') shall require one at depth and one at subgrade per horizontal length above. Greater than four-feet (4') depths shall require one per six-inch (6") or larger pipe, then one every three (3) vertical feet, and one at subgrade per horizontal length above.
 - (6) Where test results reveal non-compliance with the requirements of the Contract, the Contractor shall bear the costs of subsequent rework and retesting until the required specification compliance is obtained to the satisfaction of the City.
- (e) **Minimum Pipe Spacing:** If the pipe space between parallel pipes in a single trench is not conducive to mechanical backfill, then flowable fill shall be used.

Article 06-04-080 Manhole Construction

- (a) Manholes shall be pre-cast reinforced concrete units or glass fiber reinforced polyester (FRP) in accordance with the detail drawings and as shown on the Contract Documents.
- (b) Soil foundations for manhole base shall be compacted to a density of ninety-five (95%) percent of the maximum density per ASTM D 1557.

- (c) 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 in the Contract Documents.
- (d) All cement used for poured foundations, mortar, fillets, grout, and concrete shelf construction shall be Type II or approved equal.
- (e) All concrete for formed-in-place foundations or bases shall be 3,000 psi compressive strength concrete.
- (f) Concrete, used for precast bases, vertical sections, and eccentric cones, shall be 4,000 psi compressive strength concrete.
- (g) Manhole risers should be constructed using the tallest barrels possible from the precast manufacturer. The base barrel shall be a minimum of four (4) feet, but not less than two (2) times the size of the sewer pipe penetrating the manhole.
- (h) All precast sections of the manholes shall conform to the requirements of ASTM C 478, latest revision.
- (i) Circular pre-cast manhole sections shall be provided with mastic gasket to seal joints between sections, such as Ram-Nek, Kent Seal, or approved equal.
- (j) Precast concrete manhole bases may be used; however, the Contractor shall be responsible for placing the bases at the specified elevation, location, and alignment.
- (k) All lifting holes and gaps at joints shall be filled with a nonshrink grout.

Article 06-04-090 Pavement Patching

After all trenching and backfilling is complete, the pavement shall be marked and sawcut to form a smooth, uniform edge. The resulting cut face shall be coated with tack coat and new plant mix bituminous pavement shall be placed and densified as specified. The resulting pavement patch shall have a smooth riding surface in any direction.

Article 06-04-100 Cased Sewer Lines

- (a) Where encasements or carrier pipe is required to be installed under railroad embankments or under highways, streets, or other facilities by jacking or boring methods, construction shall be made in a manner that will not interfere with the operation of the railroad, highway, or other facility, and will not weaken or damage any embankment or structure. During construction operations, barricades and

lights to safeguard traffic and pedestrians shall be furnished and maintained, as directed by the City.

- (b) Entry and exit pits shall be excavated for the purpose of conducting the boring/jacking operations and for placing end joints of the pipe. This excavation shall not be carried to a greater depth than is required for placing of the guide and boring/jacking machine. All open trenches and pits shall be braced and shored in such a manner as will adequately prevent caving or sliding of the walls into the open trench or pit.
- (c) Minimum casing specifications can be found on Standard Drawing S-15. Facility operator beneath which the casing is being installed to determine if more stringent requirements shall govern the installation.
- (d) Lateral or vertical variation in the final position of the pipe from the line and grade established by the Contract Documents will be permitted only to the extent of one-sixteenth inch (1/16") per ten feet (10'), however, final approval will be required by the City.
- (e) Entry and exit pits shall be backfilled, in compliance with the Contract Documents, immediately upon installation of the carrier pipe and approval by the City.

Article 06-04-110 Testing

- (a) **Testing for Tightness:** After the pipe has been laid and backfilled, the line shall be tested between manholes by a low-pressure air or water test at five (5) psi for two (2) hours, unless otherwise approved by the City.
- (b) **Exfiltration Test:** The maximum water exfiltration for a given pipe shall be at a rate of fifty (50) gallons per inch of internal pipe diameter per mile per day. During the ex-filtration testing, the maximum internal pressure at the lowest end may not exceed twenty-five (25) feet or 10.8 psi. The internal water head must be a minimum of two (2) feet higher than the top of the pipe.
- (c) **Deflection Testing:** Long term pipe deflection shall not exceed seven and a half (7½) percent. When required, the Contractor shall perform deflection test(s) between successive manholes using appropriate instruments. The City will designate when the test is to be performed. If it is determined that the pipe has exceeded deflection requirements, the pipe shall be removed and replaced at the Contractor's expense.

- (d) Manhole Testing: Manholes shall be filled with water to a minimum of one (1) section above the highest pipe penetration. Water level shall remain for a minimum of six (6) hours.

Article 06-04-120 Flushing Sewer lines

All completed sewer lines shall be flushed with water to remove any dirt or foreign matter from the line. The flushing shall be done in the presence of the City.

Article 06-04-130 Detectable (Underground) Warning Tape

- (a) Detectable warning tape shall be 6” wide, 5 mil overall thickness, with a .35 mil solid foil coil. APWA color coded with imprint of underground utility installed.
- (b) Detectable warning tape shall be laid in continuous manner and be placed above all sewer mains, sewer force mains, sewer service lines, and other sewer appurtenances. The detectable warning tape shall be placed eighteen inches (18”) below the final surface elevation.

Article 06-04-140 Tracing Wire

- (a) All tracing wire shall have HDPE insulation intended for direct bury service. HDPE insulation shall be color coated per APWA Standard for respective utility being installed.
- (b) Tracing wire shall be taped to the top of all sewer mains, sewer force mains, and sewer service lines at maximum 10-foot interval. Tracing wire along sanitary sewer service lines entering private property shall be terminated above ground at the cleanout adjacent to the developed structure.
- (c) Tracing wire shall be as following based on installation method:
 - (1) Open Trench Installation: #12 AWG copper clad steel, high strength with minimum 450-pound break load and minimum 30 mil HDPE insulation thickness. Copperhead Industries High Strength – 1230 CCS Tracer Wire or City approved equal.
 - (2) Directional Drilling/Boring: #12 AWG copper clad steel, high strength with minimum 1,150-pound break load and minimum 30 mil HDPE insulation thickness. Copperhead Industries Extra-High Strength – 1245 CCS Tracer Wire or City approved equal.

- (3) Pipe Bursting/Slip Lining: 7 x 7 stranded copper clad steel, extreme strength with minimum 4,700-pound break load and minimum 50 mil HDPE insulation thickness. Copperhead Industries SoloShot Xtreme – PBX-50 CCS Tracer Wire or Engineer Approved Equal.
 - (4) When a new trace wire is to be tied to an existing trace wire the connection shall be made with an approved splice connector and shall be properly grounded at the splice connection.
- (d) Connectors
- (1) All main line tracing wires shall be interconnected at intersections (tees and crosses). Connectors shall be lockable and manufactured specifically for use in underground trace wire installation. Connectors shall be dielectric silicon filled to seal out moisture and corrosion and shall be installed in a manner as to prevent any uninsulated wire exposure.
 - (2) Tee Connectors (service lines, main line tees, and fire hydrants) shall include a 3-way lockable connector main line to lateral lug connector. Copperhead Industries Mainline-to-Service Connector Part Number 3WB-01 or City approved equal.
 - (3) Cross Connectors (main line crosses) shall include two (2) 3-way lockable main line to lateral lug connectors. Copperhead Industries Mainline-to-Service Connector Part Number 3WB-01 or City approved equal.
 - (4) Main line tracing wire splices shall be completed utilizing twist-lock connectors. Copperhead Industries Locking Connector Part Number LSC1230C or City approved equal.
 - (5) Do not cut and splice main line trace wire.
 - (6) Non-locking friction fit, twist on, or taped connectors shall not be used.
- (e) Termination/Access Boxes
- (1) All trace wire termination points must utilize an approved trace wire access box, specifically manufactured for this purpose. Except as noted previously for termination on the upstream end of sewer service lines.
 - (2) All access boxes shall be identified with “sewer” or “water” cast into the cap and be APWA color coded according to the utility.

- (3) A minimum of two-feet (2') of slack is required in all trace wire boxes upon installation at final grade.
 - (4) All trace wire access boxes must include a manually interruptible conductive/connective link between the terminals for the trace wire connection and the terminal for the ground anode wire connection.
 - (5) Ground anode wire shall be connected to the identified terminal on all access boxes.
 - (6) Manholes must terminate at an in-ground tracing wire access box positioned within the manhole concrete collar. Copperhead Industries SnakePit Roadway with Two-Terminal Switchable Lid Access Point Part Number RB14*2T-SW or City approved equal.
- (f) Grounding
- (1) Trace wire must be properly grounded at all dead ends and stubouts.
 - (2) Grounding of trace wire shall be accomplished through the use of a drive-in magnesium grounding anode rod with a minimum of 20-feet of #12 AWG red HDPE insulated copper clad steel wire connected to the anode (minimum of 1.5-pound) specifically manufactured for the intended purposed. The ground anode shall be landed at the same elevation as the utility. Ground anode shall be Copperhead Industries Ground Rod with Twist-On Connector Part Number ANO-12 or City approved equal.
 - (3) When grounding the trace wire at dead ends or stubouts, the grounding anode shall be installed perpendicular to the trace wire at a maximum possible distance.
 - (4) When grounding the trace wire in long continuous runs, the grounding anode shall be installed directly beneath and in-line with trace wire. The grounding anode wire shall be trimmed to an appropriate length before connecting to trace wire with a mainline to lateral lug connector.
- (g) Testing
- (1) All new trace wire installations shall be located using typical low frequency line tracing equipment. The test trace shall be witnessed by the City prior to final acceptance.
 - (2) Continuity testing in lieu of actual line tracing will not be accepted.

END OF CHAPTER 06

CHAPTER 07 – TEMPORARY BYPASS PUMPING SYSTEM

ARTICLE 07-01 - GENERAL

Article 07-01-010 Description

This section includes requirements for implementing a temporary pumping system for the purpose of diverting existing sewage flow around work area for the duration of the Project.

Article 07-01-020 Quality Assurance

- (a) Follow national standards and as specified herein.
- (b) Perform leakage and pressure tests on discharge piping using clean water, before operation. Notify City 24 hours prior to testing.
- (c) Maintain and inspect temporary pumping system every two hours. Maintain a log of flows every two hours for each system. Responsible operator on site at all times when pumps are operating.
- (d) Keep and maintain spare parts for pumps and piping on site, as required.
- (e) Maintain adequate hoisting equipment and accessories on site for each pump, as necessary.
- (f) Bypassing Contractor (subcontractor) shall have no less than 2 years' experience in bypassing a system of similar characteristics. City may request a list of similar projects with references to be delivered to the City at the preconstruction conference.

Article 07-01-030 Submittals

Submit the following at Pre-Construction Conference:

- (a) Detailed plan and description of proposed pumping system at each location. Indicate the number, size, material, location, and method of installation of suction and discharge piping, size of pipeline or conveyance system to be bypassed, staging area for pumps, site access point, and expected flow. The plan shall, at a minimum, indicate the following information:
 - (1) Size and location of manhole or access points for suction and discharge hose or piping.

- (2) Sections showing suction and discharge pipe depth, embedment, select fill, and special backfill for existing vehicular accesses or roadways.
- (3) Temporary pipe supports, and anchoring required.
- (4) Thrust restraint block sizes and locations.
- (5) Sewer plugging methods and types or plugs.
- (6) Bypass pump sizes, capacity, number of each size to be on site, and power requirements.
- (7) Back up pump, power and piping equipment for each setup as indicated on plans.
- (8) Calculations on static lift, friction losses, and flow velocity. Pump curves showing pump operating range.
- (9) Design plans and computation for access to bypass pumping locations indicated on plans.
- (10) Calculations for selection of bypass pumping pipe size.
- (11) Method of noise control for each pump and /or generator.
- (12) Method for protecting discharge manholes or structures from erosion or damage.
- (13) Schedule for installation and maintenance of bypass pumping lines.
- (14) Procedures to monitor upstream mains for backup impacts.
- (15) Procedures for setup and breakdown of pumping operations.
- (16) Emergency plan detailing procedures to be followed in event of pump failures, power failures, generator failures, sewer overflows, rain events, service backups, and sewage spillage. A copy of this plan must be kept on site for the duration of the project.
- (17) Odor Control abatement measures at suction and discharge locations.

Article 07-01-040 Contractor's Responsibility for Overflows and Spills

- (a) Schedule and perform work in a manner that does not cause or contribute to incidence of overflows, release of spills of sewage from sanitary sewer system or bypass operation.
- (b) The Contractor shall be responsible for any damage to property, private or public, caused from bypass operations.
- (c) The Contractor shall be responsible for cleaning and disinfecting any spills caused by the bypass operations.
- (d) The Contractor shall be responsible for any fines from regulatory agencies for spills caused by the bypass operations.
- (e) The Contractor shall not surcharge any existing sewer mains. The water surface elevation shall not exceed the top of pipe at any suction location.

Article 07-01-050 Delivery and Storage

- (a) Transport, deliver, handle, and store pipe, fittings, pumps, ancillary equipment, and materials to prevent damage and following manufacturer's recommendations. Inspect all material and equipment for proper operation before initiating work.
- (b) Material found to be defective or damaged due to manufacturer or shipment.
 - (1) When City deems repairable: Repair as recommended by manufacturer.
 - (2) When City deems not repairable: Replace as directed before initiating work.
 - (3) Repair or replacement of defective or damaged material and equipment shall be at no additional cost to the City.

ARTICLE 07-02 - PRODUCTS

Article 07-02-010 Materials

- (a) Discharge and Suction Pipes: Approved by the City
 - (1) Discharge piping: Determined according to flow calculations and system operating calculations.

- (2) Suction piping: Determined according to pump size, flow calculations, and manhole depth following manufacturer's specifications and recommendations.
- (b) Polyethylene Plastic Pipe:
- (1) High density solid wall and following ASTM F714 Polyethylene (PE) Plastic Pipe (SDR DR) based on outside diameter, ASTM D1248 and ASTM D3550.
 - (2) Homogeneous throughout, free of visible cracks, discoloration, pitting, varying wall thickness, holes, foreign material, blisters, or other deleterious faults.
- (c) High-Density Polyethylene (HDPE)
- (1) Homogeneous throughout, free of visible cracks, discoloration, pitting, varying wall thickness, holes, foreign material, blisters, or other deleterious faults.
 - (2) Assembled and joined at site using couplings, flanges, or butt-fusion method to provide leak proof joint. Follow manufacturer's instructions and ASTM D 2657. Threaded or solvent joints and connections are not permitted.
 - (3) Fusing: By personnel certified as fusion technicians by manufacturer of HDPE pipe and/or fusing equipment.
 - (4) Butt fused joint: True alignment and uniform roll-back beads resulting from use of proper temperature and pressure.
 - A. Allow adequate cooling time before removal of pressure.
 - B. Watertight and have tensile strength equal to that of pipe.
 - C. Acceptance by City before insertion.
- (d) Flexible Hoses and Associated Couplings and Connectors
- (1) Abrasion resistant.
 - (2) Suitable for intended service.
 - (3) Rated for external and internal loads anticipated, including test pressure.
 - (4) External Loading Design: Incorporate anticipated traffic loadings, including traffic impact loading.

- (5) When subject to traffic loading, compose system, such as traffic ramps or covers.
- (6) Install system and maintain H-20 loading requirements while in use or as directed by the City.
- (e) Valves and fittings: Determined according to flow calculations, pump sizes previously determined, and system operating pressures.
- (f) Plugs: Selected and installed according to size of line plugged, pipe and manhole configurations, and based on specific site.
 - (1) Additional plugs: One available for each phase in the event a plug fails. Plugs will be inspected before use for defects which may lead to failure.
- (g) Aluminum "irrigation type" piping or glued PVC piping will not be permitted.
- (h) Discharge hose will only be allowed in short sections when approved by the City.

Article 07-02-020 Equipment

- (a) Pumps
 - (1) Fully automatic self-priming units that do not require the use of foot valves or vacuum pumps in priming system.
 - (2) Electric or diesel powered. Contractor shall provide necessary power.
 - (3) Constructed to allow dry running for long periods of time to accommodate cyclical nature of effluent flows.
- (b) Provide
 - (1) Necessary stop/start controls for each pump.
 - (2) Two pumps for each bypass location (primary and backup) for all bypass locations with average flow greater than 500 gpm.
 - (3) Each pump to be capable of estimated peak flow.
 - (4) Primary and backup pumps shall be capable of running simultaneously for wet flow conditions.

Article 07-02-030 Design Requirements

- (a) Bypass pumping systems:
 - (1) Wet flow conditions are estimated at twice the average flow. The online back pump may be used during wet flow conditions.
 - (2) No surcharging of existing incoming lines at bypass locations.
 - (3) In the event of a pump failure, the Contractor shall immediately replace primary or backup pump to avoid surcharging of manholes, overflowing of manholes, spills, and damage to property.
 - (4) Operate 24 hours per day for the duration of each phase.
 - (5) Bypass pumping systems shall have sufficient capacity to pump peak flows included with the plans.

ARTICLE 07-03 – EQUIPMENT

Article 07-03-010 Preparation

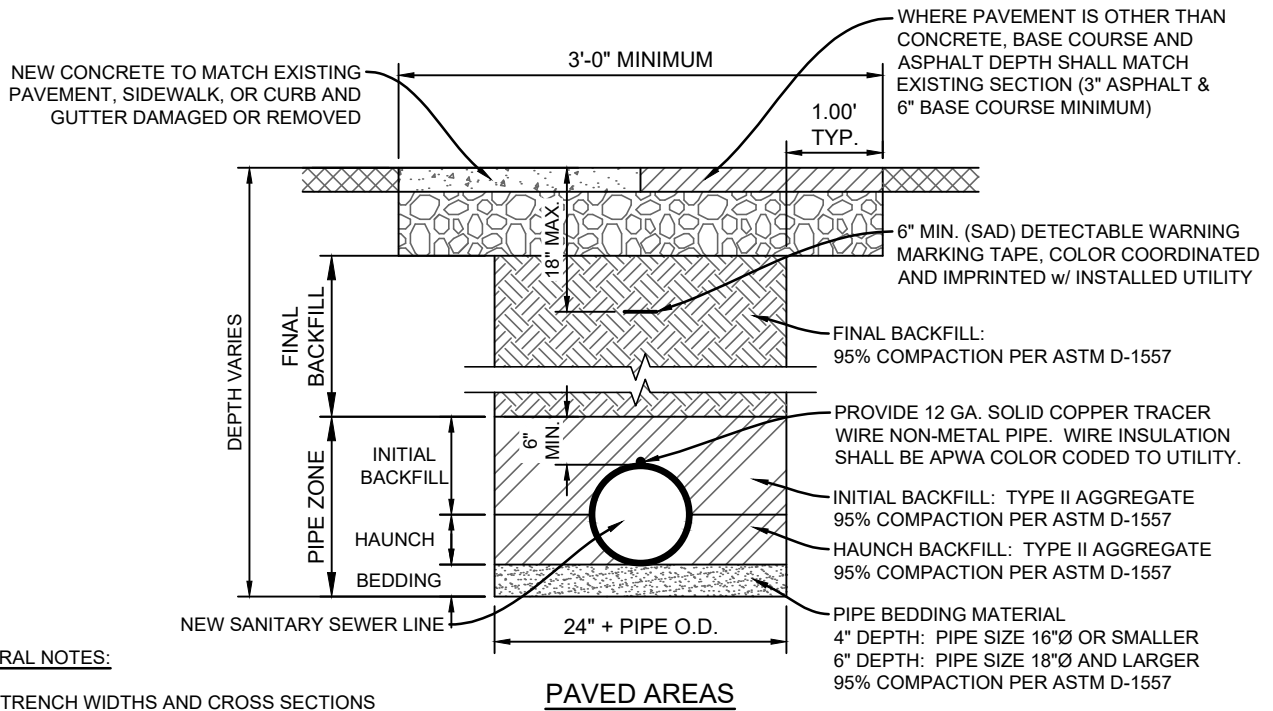
- (a) Determining location of bypass pipelines.
 - (1) Minimal disturbance to existing utilities. Field locate existing utilities in proposed bypass area.
 - (2) Obtain approvals for placement within public or private property.
 - (3) Obtain City's approval of location.
 - (4) Costs associated with relocation of utilities and obtaining approvals at no additional cost to the City.

Article 07-03-020 Installation and Removal

- (a) Provisions and requirements must be reviewed by the City before starting construction.
- (b) Remove manhole sections or make connections to existing sewer and construct temporary bypass pumping structures at access locations indicated on Contract Documents and as required to provide adequate suction conduit.

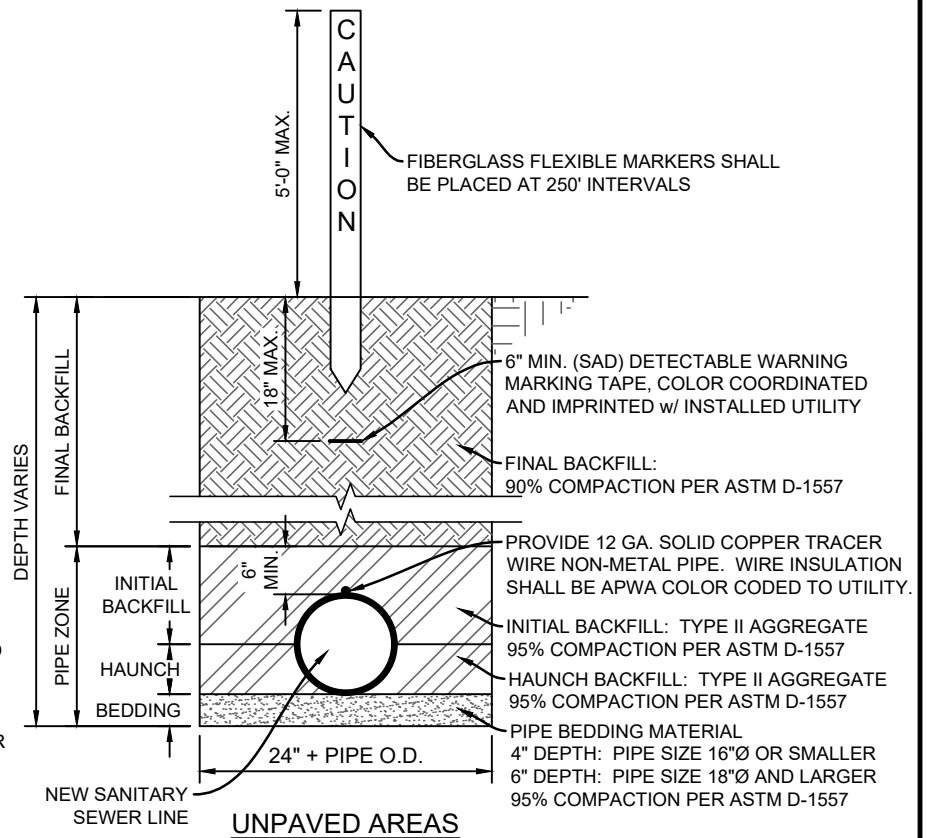
- (c) Plugging or blocking of sewage flows shall incorporate a primary and secondary plugging device for each bypass location. When plugging or blocking is no longer needed for performance and acceptance of work, remove in a manner that permits the sewage flow to slowly return to normal without surge, to prevent surcharging or causing other major disturbances downstream.
- (d) When working inside manhole or junction box, exercise caution. Follow OSHA, Local, State and Federal requirements. Take required measures to protect workforce against sewer gases and/or combustible or oxygen-deficient atmosphere.
- (e) Installation of Bypass Pipelines:
 - (1) Pipeline may be placed along gutter of streets. Do not place in sidewalks.
 - (2) When bypass pipeline crosses streets and private driveways, place in roadway ramps. When roadway ramps cannot be used, place bypass in trenches and cover with temporary pavement as approved by the City.
 - (3) Include provisions for Traffic Control including signs and barricades as applicable. The Contractor shall submit a traffic control plan for review prior to commencing this work.
- (f) During bypass operation, protect sewer lines from damage inflicted by equipment.
- (g) Upon completion of bypass pumping operations, and after the receipt of written permission from the City, remove piping, restore property to preconstruction condition, and restore pavement.

END OF CHAPTER 07



GENERAL NOTES:

1. TRENCH WIDTHS AND CROSS SECTIONS SHALL BE IN COMPLIANCE WITH APPLICABLE SAFETY STANDARDS AND REGULATIONS.
2. TESTING REQUIREMENTS INCLUDE VISUAL TESTING OF ALL MAIN LINES LAID AT OR FLATTER THAN MINIMUM SLOPES.
3. MECHANICAL TAMPERS SHALL NOT BE USED IN THE INITIAL BACKFILL SECTION FOR FLEXIBLE PIPE.
4. HAND PREPARED PIPE BED, PROVIDE A SMOOTH UNIFORM SURFACE, EXCAVATE FOR PIPE BELL.
5. TRACING WIRE REQUIRED TO BE PLACED ABOVE ALL FORCE MAINS.
6. TRACING WIRE SHALL BE TAPED TO MAIN AT 10- FEET ON CENTER.
7. TRACING WIRE TO BE ACCESSIBLE, WITHIN VALVE BOX, SERVICE POINT, OR WITHIN AN INSTALLED TWO POINT TEST BOX, AT 500- FEET ON CENTER MAXIMUM.
8. NATIVE SOIL MAY BE USED AS FINAL BACKFILL IF FREE OF ORGANIC MATTER/DEBRIS, MAXIMUM PARTICLE SIZE OF TWO-INCH (2"), LIQUID LIMIT OF <35, AND PLASTICITY INDEX OF <15. COMPACTION REQUIREMENTS FOR NATIVE MATERIAL SHALL REMAIN THE SAME AS IMPORT MATERIALS AND PLACEMENT SHALL OCCUR WITHIN ±2% OF OPTIMUM MOISTURE CONTEXT.



SCALE: NOT TO SCALE



**CITY OF ALAMOGORDO
TECHNICAL STANDARD DRAWINGS**

SANITARY SEWER TRENCH DETAIL

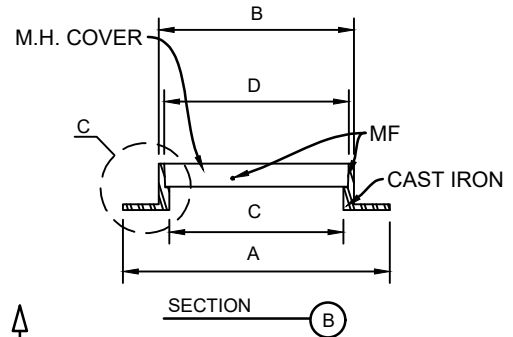
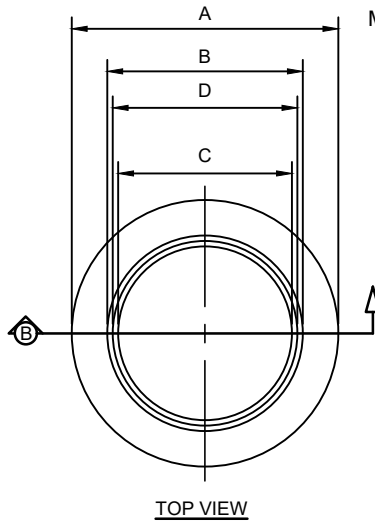
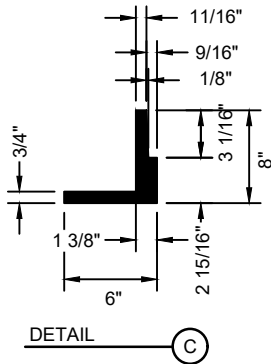
ISSUE DATE:

APRIL 2021

REVISION DATE:

SHEET NO:

S-1



NOTE:

1. MATCHING SURFACES MARKED "MF" TO BE MACHINE FINISHED OF ANY IRREGULARITIES THAT WOULD PREVENT A SNUG FIT.
2. CASTING TO BE SMOOTH AND FREE OF AIR VOIDS.

MANHOLE RING	48" MANHOLE	72" MANHOLE
WEIGHT	155 LBS.	225 LBS.
A	2'-10 1/2"	3'-6"
B	2'-1 1/4"	2'-8 3/4"
C	1'-10 1/2"	2'-6"
D	1'-11 7/8"	2'-7 3/8"

TYPICAL MANHOLE RING DETAIL

GENERAL NOTES:

1. MATCHING SURFACES MARKED "MF" TO BE MACHINE FINISHED AND BE FREE OF ANY IRREGULARITIES THAT WOULD PREVENT A SNUG FIT.
2. CASTING TO BE SMOOTH AND FREE OF AIR VOIDS.
3. MANHOLE RING AND LID SHALL BE DESIGNED FOR H-20 WHEEL LOADING.
4. MINIMUM TOTAL WEIGHT (RING AND LID) SHALL BE 300 LBS.
5. TOP OF LID MAY VARY FROM DETAIL SHOWN. LID SHALL BE MARKED FOR APPROPRIATE UTILITY.

SCALE: NOT TO SCALE



**CITY OF ALAMOGORDO
TECHNICAL STANDARD DRAWINGS**

MANHOLE RING DETAIL

ISSUE DATE:

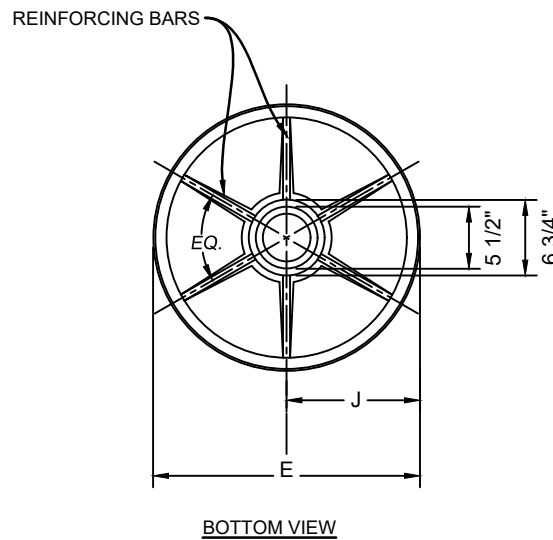
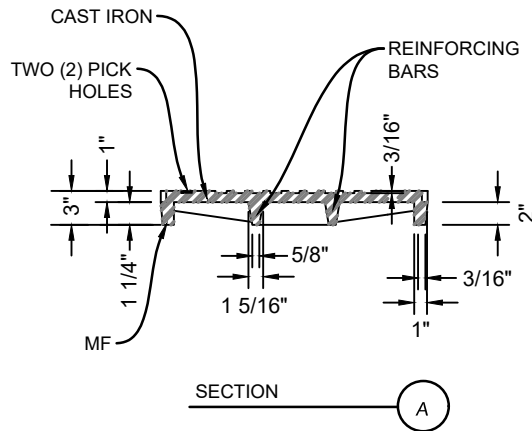
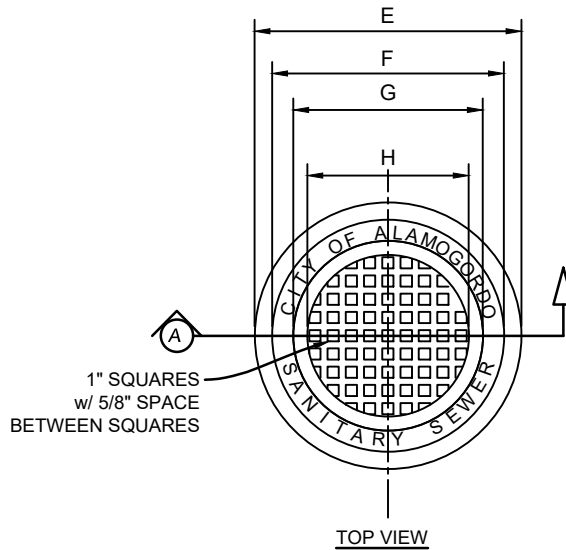
APRIL 2021

REVISION DATE:

SHEET NO:

S-2

MANHOLE RING	48" MANHOLE	72" MANHOLE
WEIGHT	175 LBS.	310 LBS.
E	23 3/4"	31 1/4"
F	20 5/8"	28 1/8"
G	16 7/8"	24 3/8"
H	14 3/8"	21 7/8"
J	11 7/8"	15 5/8"



NOTE:

1. MATCHING SURFACES MARKED "MF" TO BE MACHINE FINISHED OF ANY IRREGULARITIES THAT WOULD PREVENT A SNUG FIT.
2. CASTING TO BE SMOOTH AND FREE OF AIR VOIDS.

TYPICAL MANHOLE LID DETAIL

GENERAL NOTES:

1. MATCHING SURFACES MARKED "MF" TO BE MACHINE FINISHED AND BE FREE OF ANY IRREGULARITIES THAT WOULD PREVENT A SNUG FIT.
2. CASTING TO BE SMOOTH AND FREE OF AIR VOIDS.
3. MANHOLE RING AND LID SHALL BE DESIGNED FOR H-20 WHEEL LOADING.
4. MINIMUM TOTAL WEIGHT (RING AND LID) SHALL BE 300 LBS.
5. TOP OF LID MAY VARY FROM DETAIL SHOWN. LID SHALL BE MARKED FOR APPROPRIATE UTILITY.

SCALE: NOT TO SCALE



CITY OF ALAMOGORDO
TECHNICAL STANDARD DRAWINGS

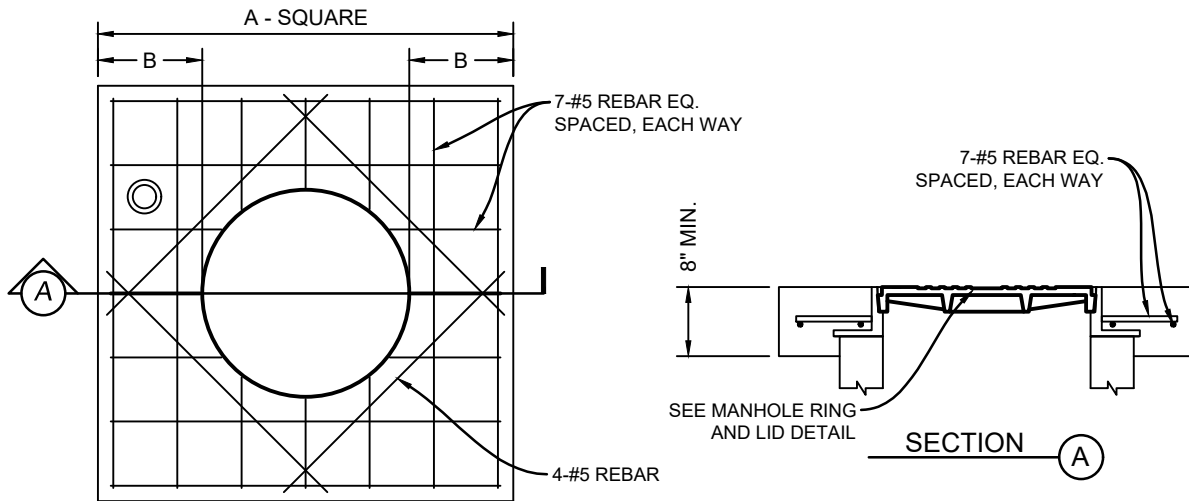
MANHOLE COVER DETAIL

ISSUE DATE:
APRIL 2021

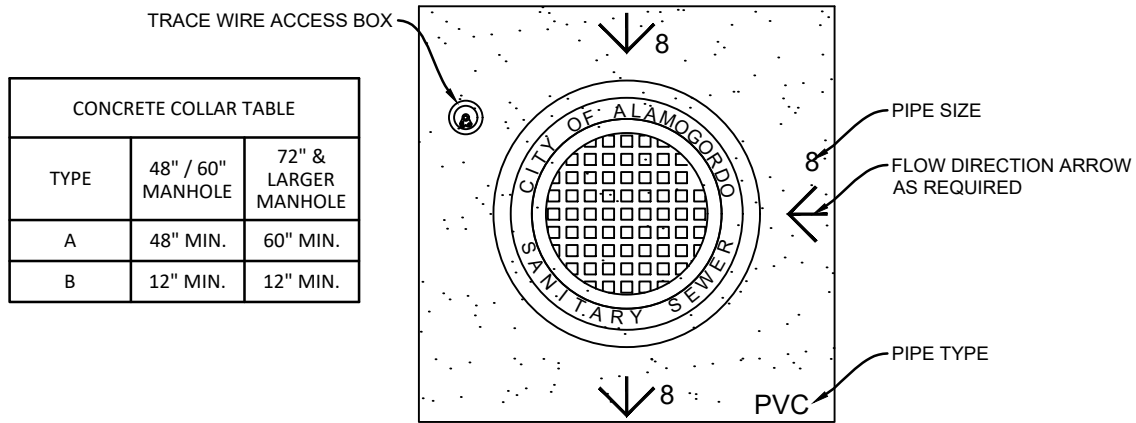
REVISION DATE:

SHEET NO:

S-3



MANHOLE CONCRETE COLLAR DETAIL



MANHOLE COLLAR MARKING DETAIL

GENERAL NOTES:

1. SIDES OF CONCRETE COLLAR TOP SHALL BE PARALLEL AND PERPENDICULAR TO THE NORMAL STREET TRAFFIC FLOW.
2. USE 3,000 P.S.I. CONCRETE FOR CONCRETE COLLAR.
3. SCRIBE CONCRETE WITH LINE DIRECTIONAL ARROWS, PIPE SIZE AND PIPE TYPE.
4. TEXT SIZE SHALL BE 4-INCHES TALL AND SCORED 3/8" DEEP IN A NEAT AND CONSISTENT MANNER, TYPICAL.

SCALE: NOT TO SCALE



**CITY OF ALAMOGORDO
TECHNICAL STANDARD DRAWINGS**

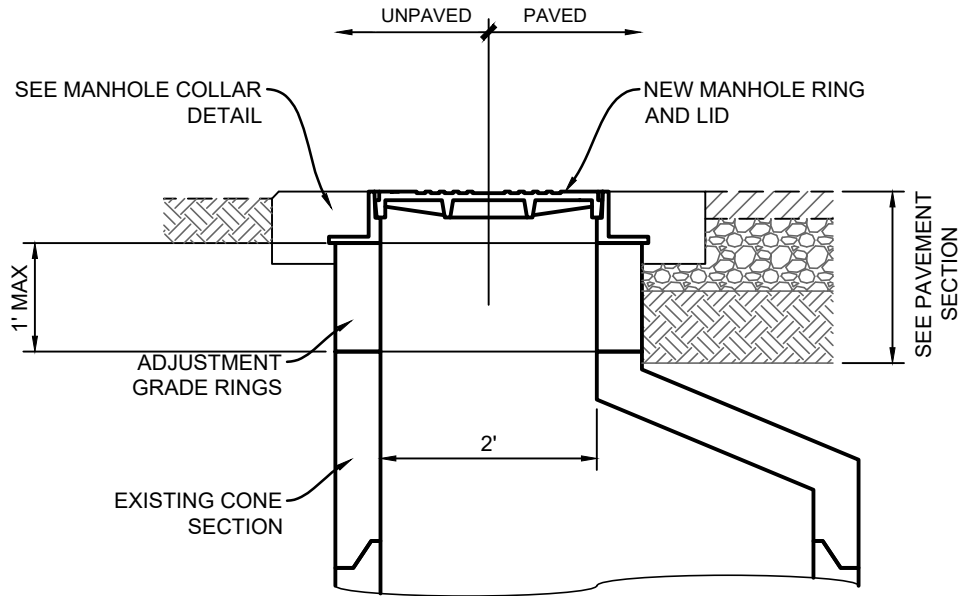
MANHOLE COLLAR DETAIL

ISSUE DATE:
APRIL 2021

REVISION DATE:

SHEET NO:

S-4



MANHOLE RING AND LID ADJUSTMENT DETAIL

GENERAL NOTES:

1. SIDES OF CONCRETE COLLAR TOP SHALL BE PARALLEL AND PERPENDICULAR TO THE NORMAL STREET TRAFFIC FLOW.
2. USE 3,000 P.S.I. CONCRETE FOR CONCRETE COLLARS.
3. SCRIBE CONCRETE WITH LINE DIRECTIONAL ARROWS, PIPE SIZE AND PIPE TYPE.
4. TEXT SIZE SHALL BE 4-INCHES TALL AND SCORED 3/8" DEEP IN A NEAT AND CONSISTENT MANNER, TYPICAL.

SCALE: NOT TO SCALE



**CITY OF ALAMOGORDO
TECHNICAL STANDARD DRAWINGS**

MANHOLE RING AND LID ADJUSTMENT

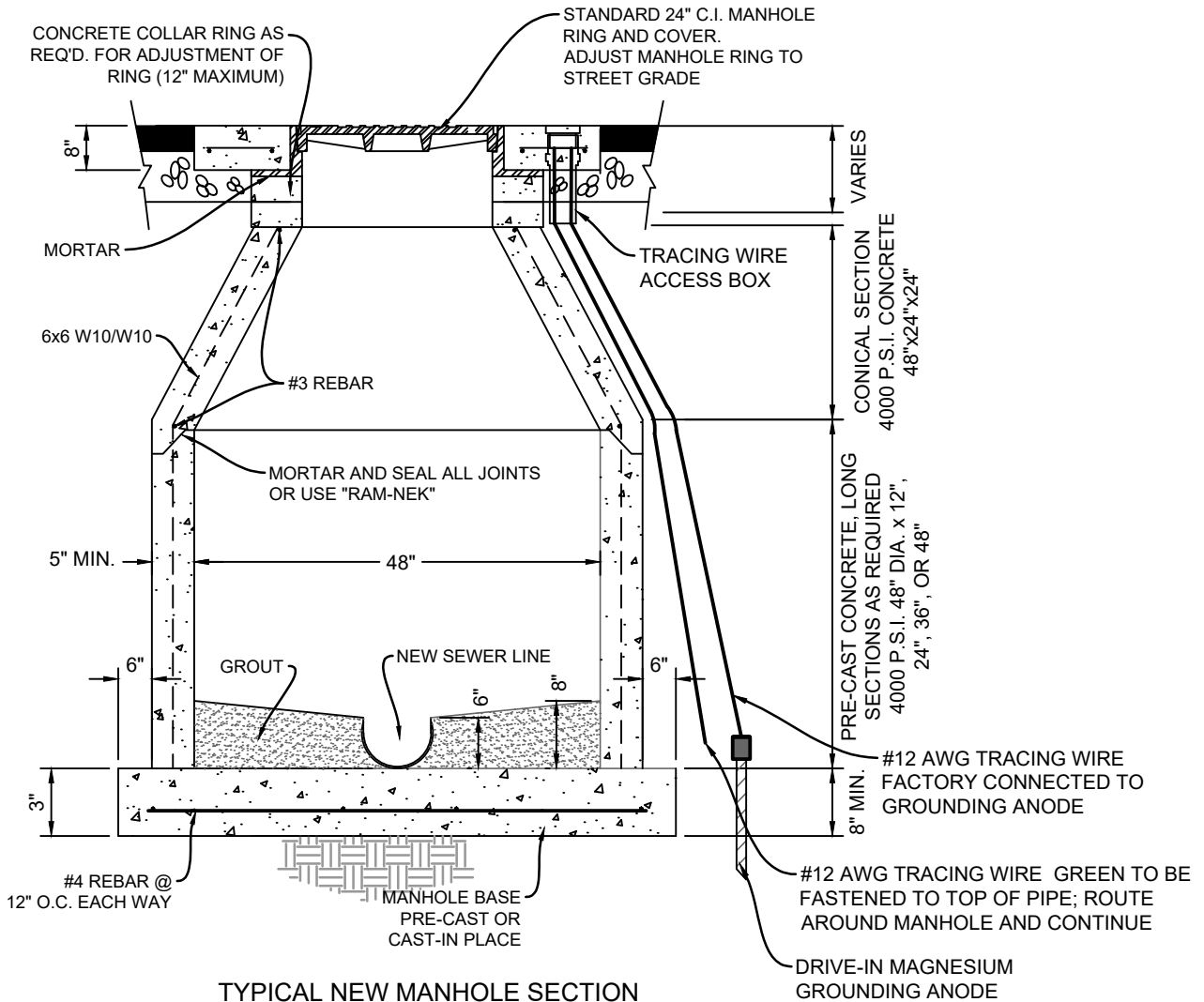
ISSUE DATE:

APRIL 2021

REVISION DATE:

SHEET NO:

S-5



GENERAL NOTES:

1. KNOCK OUT AND PRESS-BOOT CONNECTOR AS REQUIRED. PRECAST AS PART OF MANHOLE SECTION.
2. SEE PLAN AND PROFILE FOR INVERT ELEVATIONS.
3. THE ENTIRETY OF MANHOLES EXPOSED SURFACE SHALL BE COATED, PRIOR TO PLACEMENT INTO SERVICE, TO AIDE IN CORROSION AND IMPACT RESISTANCE. MANHOLE SHALL BE COATED WITH RAVEN 175 (PRIME COAT) AND RAVEN 405 (2ND COAT) TO 100 MIL TOTAL DRY THICKNESS; ALTERNATE COATING SYSTEMS SHALL BE PRE-APPROVED BY THE CITY.

SCALE: NOT TO SCALE



**CITY OF ALAMOGORDO
TECHNICAL STANDARD DRAWINGS**

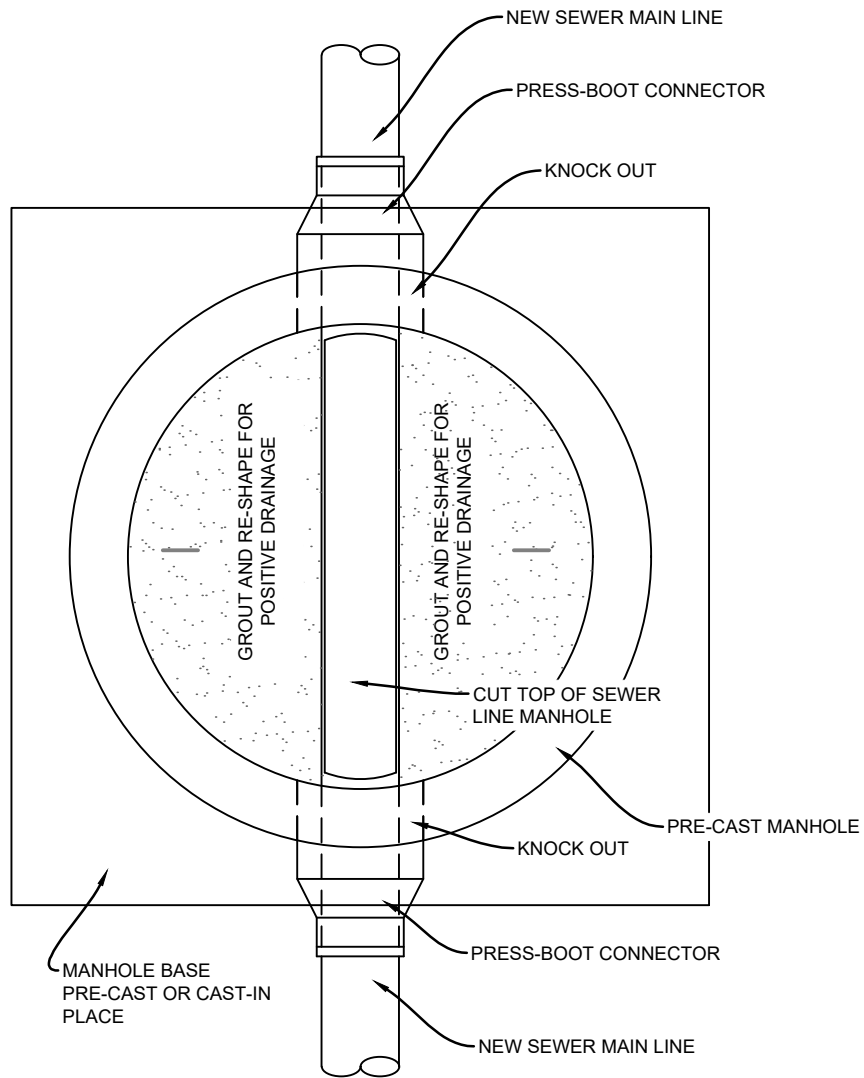
MANHOLE DETAIL

ISSUE DATE:
APRIL 2021

REVISION DATE:

SHEET NO:

S-6



NEW MANHOLE SEWER MAIN CONNECTION

GENERAL NOTES:

1. AFTER MANHOLE HAS BEEN SET AND THE CONNECTIONS MADE CONTRACTOR SHALL CUT TOP OF SEWER LINE IN MANHOLE.

SCALE: NOT TO SCALE



CITY OF ALAMOGORDO
TECHNICAL STANDARD DRAWINGS

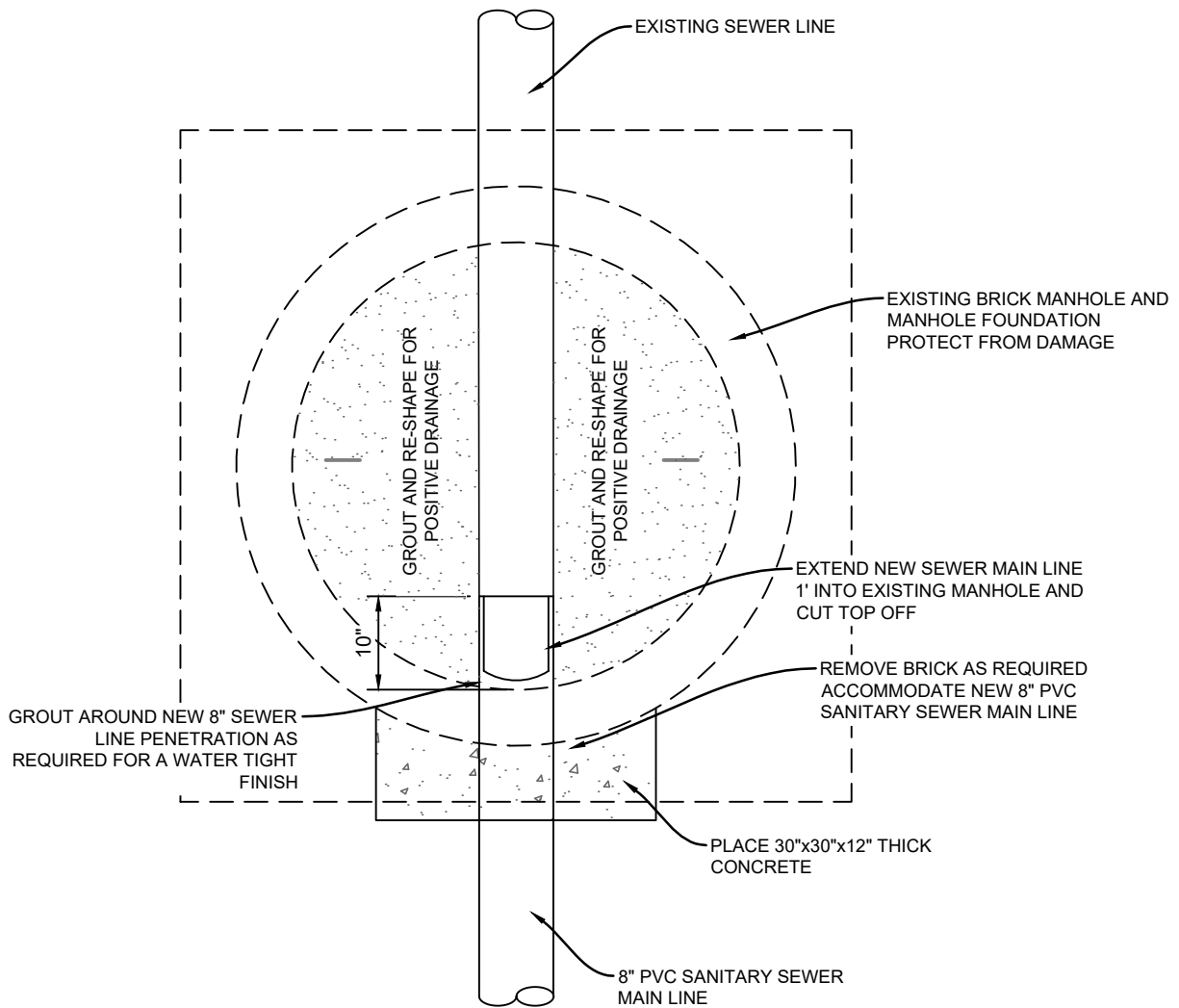
NEW MANHOLE SEWER CONNECTION DETAILS

ISSUE DATE:
APRIL 2021

REVISION DATE:

SHEET NO:

S-7



EXISTING MANHOLE SEWER MAIN CONNECTION

GENERAL NOTES:

1. AFTER MANHOLE HAS BEEN SET AND THE CONNECTIONS MADE CONTRACTOR SHALL CUT TOP OF SEWER LINE IN MANHOLE.
2. PER CITY ORDINANCE 28-02-080.(a) PUBLIC BUILDINGS-CONNECTIONS: NO PUBLIC SERVICE BUILDING, HOTEL, SCHOOL, PUBLIC SCHOOL, LAUNDRY OR OTHER KIND OF PUBLIC SERVICE ESTABLISHMENT SHALL BE PERMITTED TO CONNECT WITH THE PUBLIC SEWERS EXCEPT AT A MANHOLE.

SCALE: NOT TO SCALE



**CITY OF ALAMOGORDO
TECHNICAL STANDARD DRAWINGS**

EXISTING MANHOLE SEWER CONNECTION DETAIL

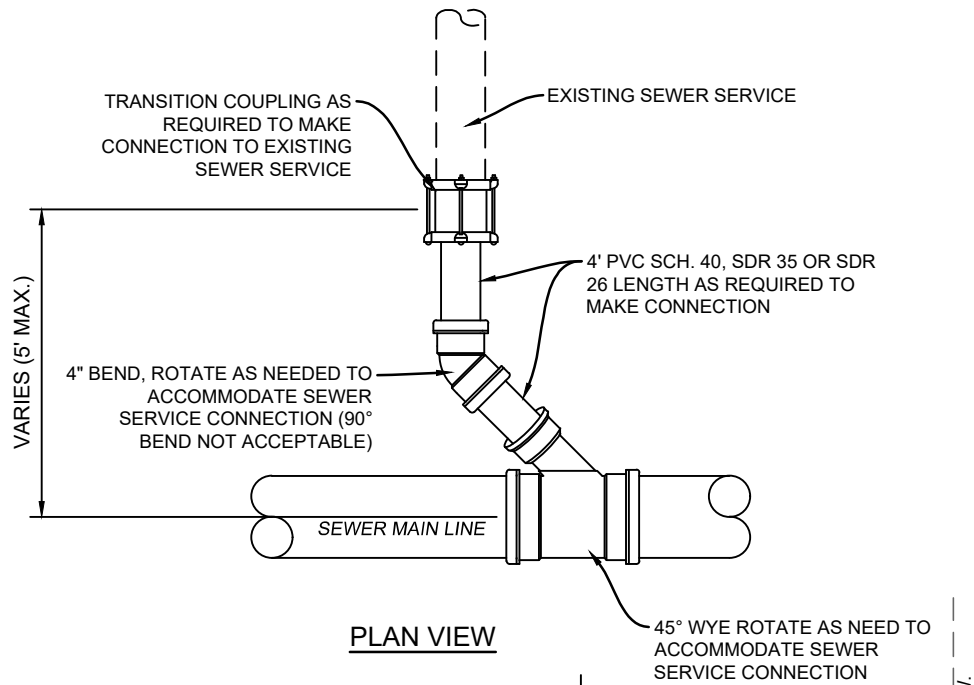
ISSUE DATE:

APRIL 2021

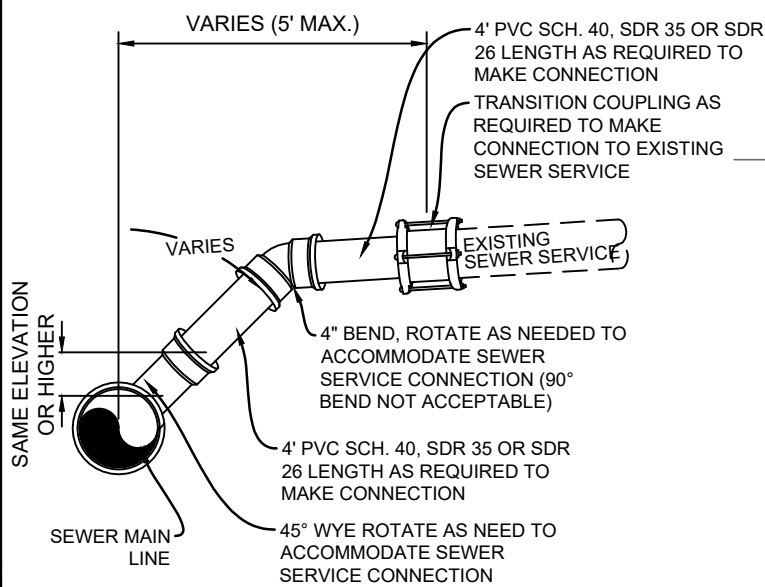
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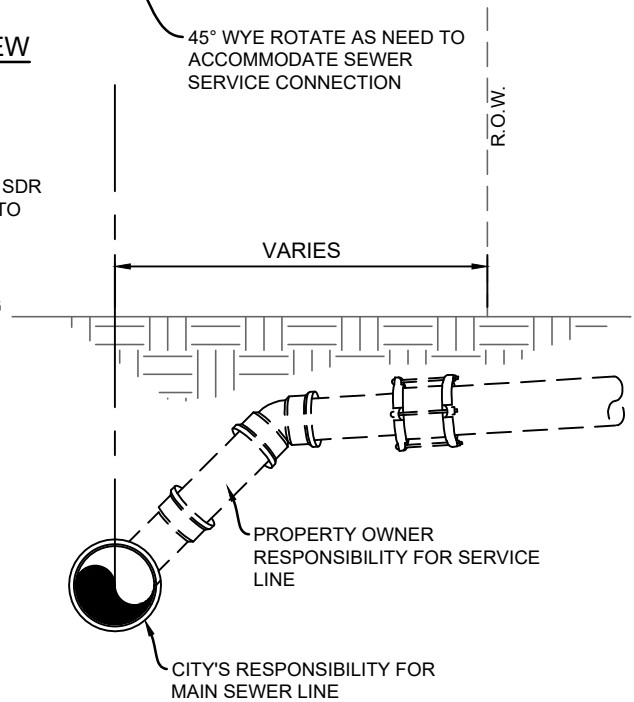
S-8



PLAN VIEW



CROSS SECTION



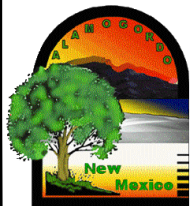
SERVICE RESPONSIBILITY

SEWER SERVICE LINE DETAIL

GENERAL NOTES:

1. ALL SEWER SERVICE LINE CONNECTIONS SHALL BE DRIP TIGHT.

SCALE: NOT TO SCALE



**CITY OF ALAMOGORDO
TECHNICAL STANDARD DRAWINGS**

SEWER SERVICE LINE DETAIL

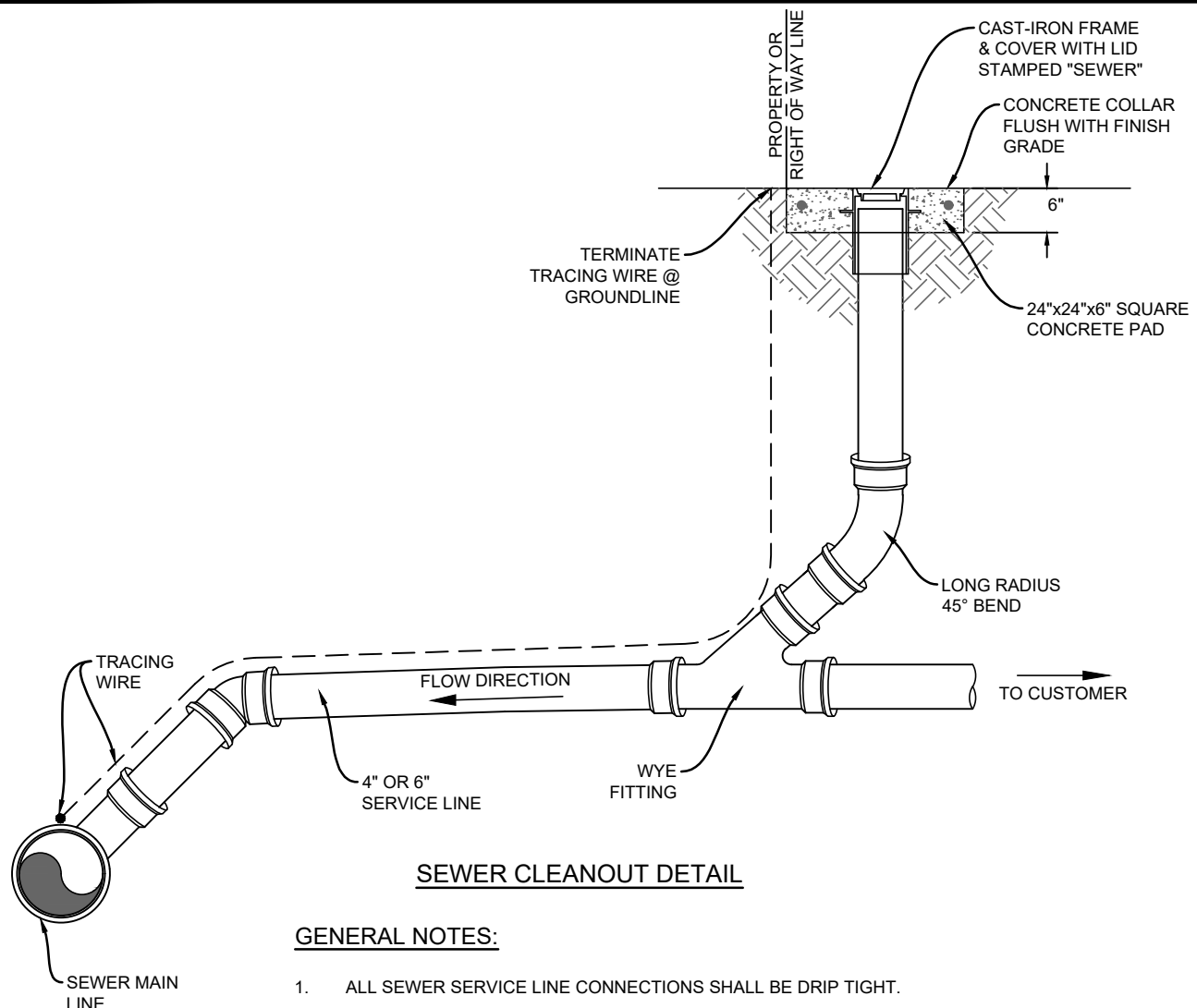
ISSUE DATE:

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SHEET NO:

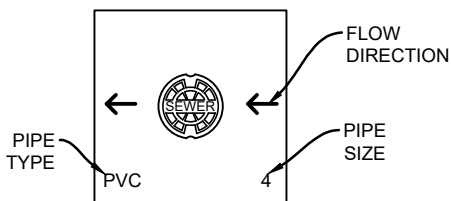
S-9



SEWER CLEANOUT DETAIL

GENERAL NOTES:

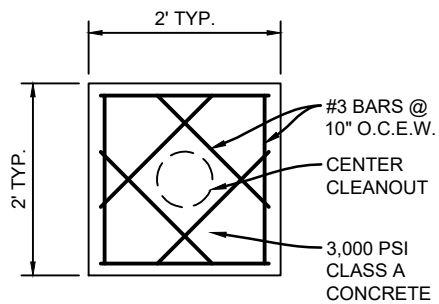
- 1. ALL SEWER SERVICE LINE CONNECTIONS SHALL BE DRIP TIGHT.



COLLAR CALLOUTS

GENERAL NOTES:

- 1. SCRIBE CONCRETE WITH LINE DIRECTIONAL ARROWS, PIPE SIZE AND PIPE TYPE.
- 2. TEXT SIZE SHALL BE 4-INCHES TALL AND SCORED 3/8" DEEP IN A NEAT AND CONSISTENT MANNER, TYPICAL.



COLLAR DETAIL

GENERAL NOTES:

- 1. SEWER CLEANOUT SHALL BE CENTERED IN CONCRETE COLLAR.
- 2. REBAR SHALL BE 1-1/2" CLEAR FROM CONCRETE EDGE TYPICAL.

SCALE: NOT TO SCALE



**CITY OF ALAMOGORDO
TECHNICAL STANDARD DRAWINGS**

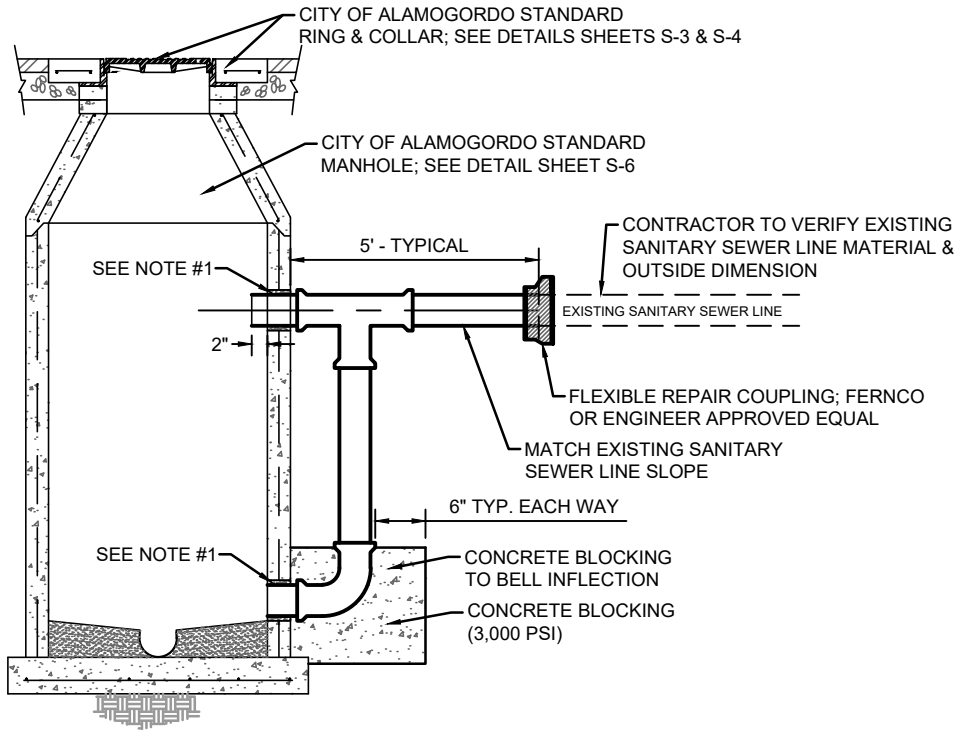
SEWER CLEANOUT DETAIL

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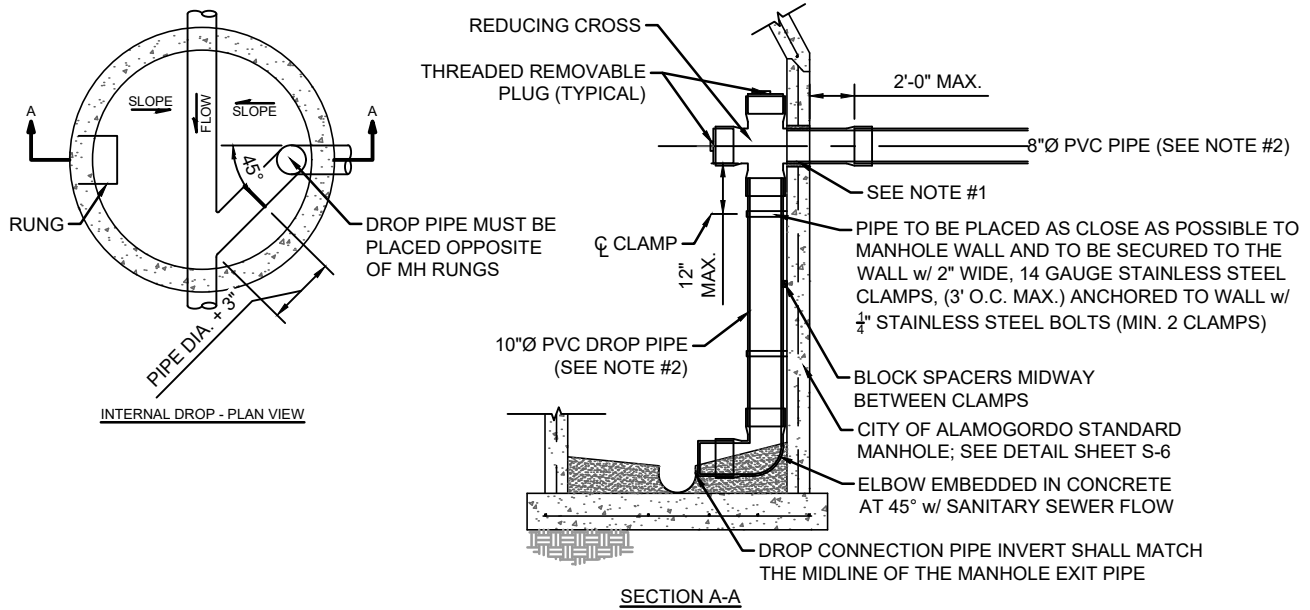
S-10



EXTERNAL DROP MANHOLE

NOTES:

1. MANHOLE STOP RING GASKETED AROUND NEW SEWER LINE AND SEAL COMPLETELY w/ NON-SHRINK GROUT.



INTERNAL DROP MANHOLE

NOTES:

1. MANHOLE STOP RING GASKETED AROUND NEW SEWER LINE AND SEAL COMPLETELY w/ NON-SHRINK GROUT.
2. FOR 8"Ø PVC PIPE PROVIDE 10"Ø PVC INTERNAL DROP PIPING. FOR 10"Ø PVC PIPE PROVIDE 12"Ø PVC INTERNAL DROP PIPING.

SCALE: NOT TO SCALE



**CITY OF ALAMOGORDO
TECHNICAL STANDARD DRAWINGS**

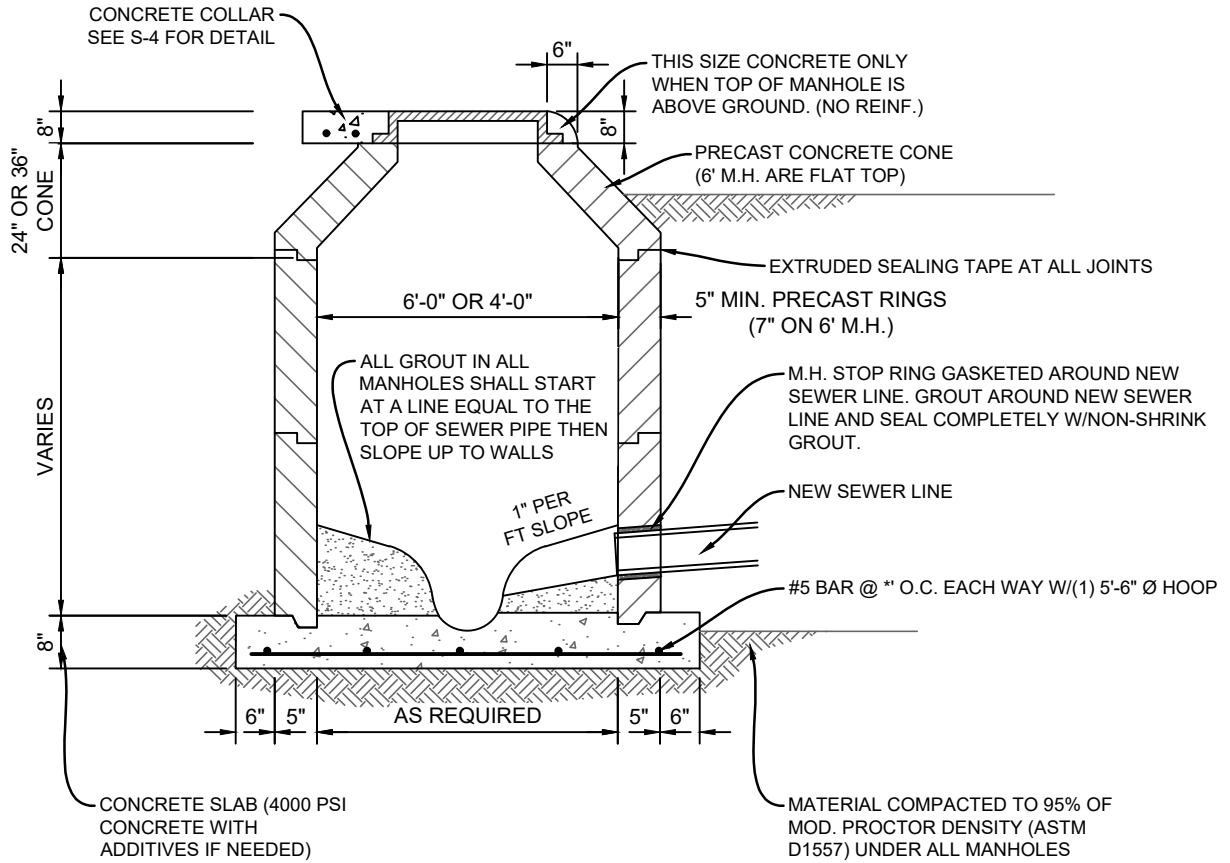
DROP MANHOLE DETAILS

ISSUE DATE:
APRIL 2021

REVISION DATE:

SHEET NO:

S-11



CONTRACTOR NOTES:

1. IF NEW PIPE INVERT IS BELOW EXISTING GROUTED SHELF, SHELF IS TO BE CUT OUT AS NEEDED AND RE-GROUTED.
2. PRECAST PORTION OF MANHOLES, EXCLUDING CAST IN PLACE BOTTOM, SHALL CONFORM TO ASTM C478 LATEST REVISIONS.

SCALE: NOT TO SCALE



CITY OF ALAMOGORDO
TECHNICAL STANDARD DRAWINGS

TAPPING INTO EXISTING STANDARD MANHOLE

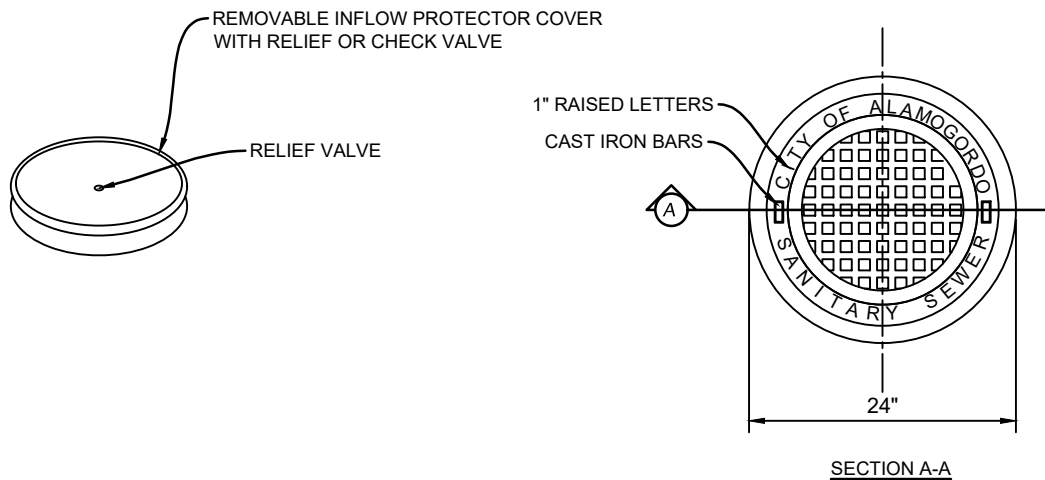
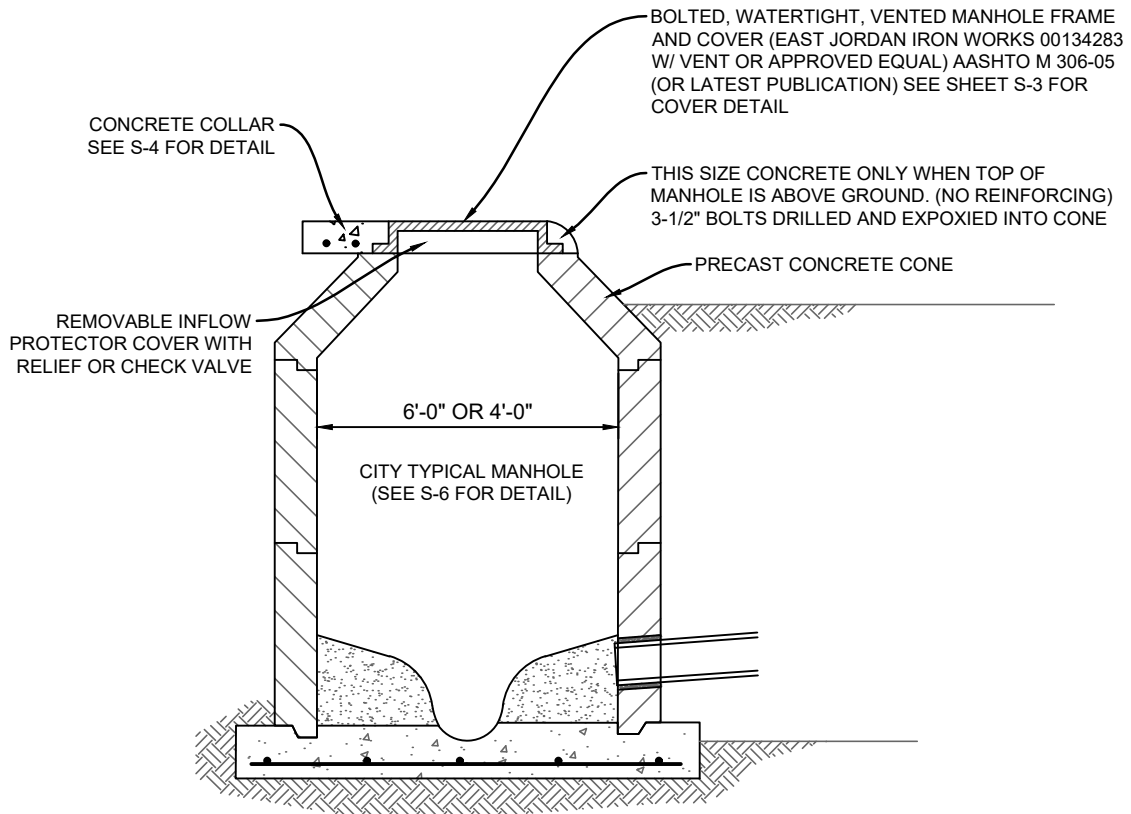
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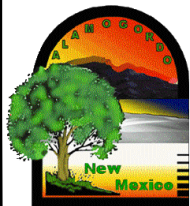
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SCALE: NOT TO SCALE



CITY OF ALAMOGORDO
TECHNICAL STANDARD DRAWINGS

WATERTIGHT VENTED MANHOLE DETAIL

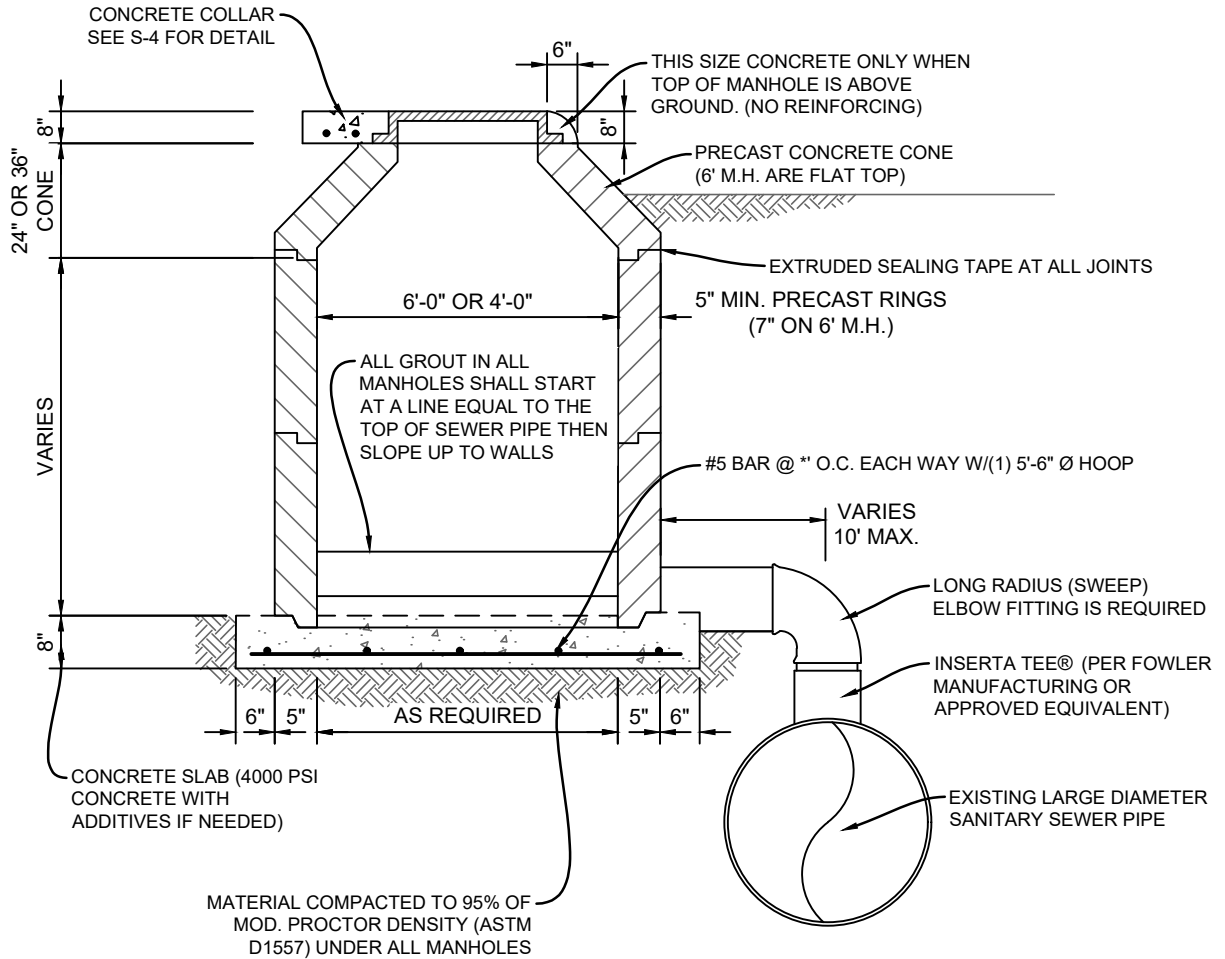
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SHEET NO:

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CONTRACTOR NOTES:

1. INSTERTA TEE® (OR APPROVED EQUAL) TO BE INSTALLED PER MANUFACTURERS SPECIFICATIONS..
2. PRECAST PORTIONS OF MANHOLES, EXCLUDING CAST IN PLACE BOTTOM, SHALL CONFORM TO ASTM C-478.

SCALE: NOT TO SCALE



CITY OF ALAMOGORDO
TECHNICAL STANDARD DRAWINGS

MAIN LINE INSTERTA TEE CONNECTION DETAIL

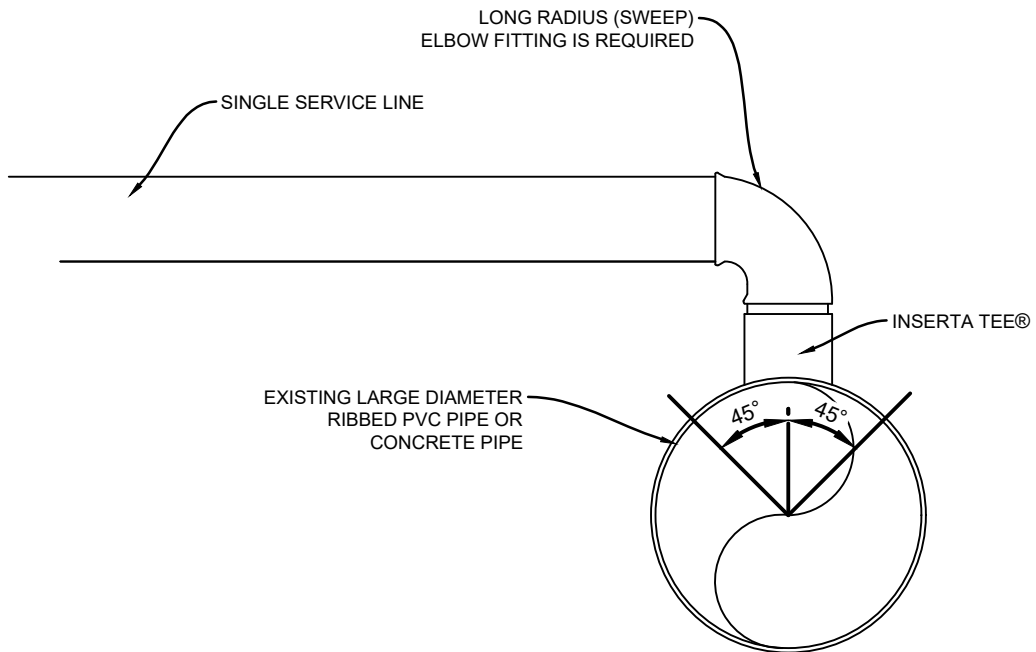
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SHEET NO:

S-14



NOTES:

1. INSERTA TEE® (OR APPROVED EQUAL) TO BE INSTALLED PER MANUFACTURES SPECIFICATIONS.
2. TEE CONNECTION SHALL BE IN THE TOP OR WITHIN 45° OF THE TOP.

SCALE: NOT TO SCALE



CITY OF ALAMOGORDO
 TECHNICAL STANDARD DRAWINGS

SERVICE LINE INSERTA TEE CONNECTION DETAIL

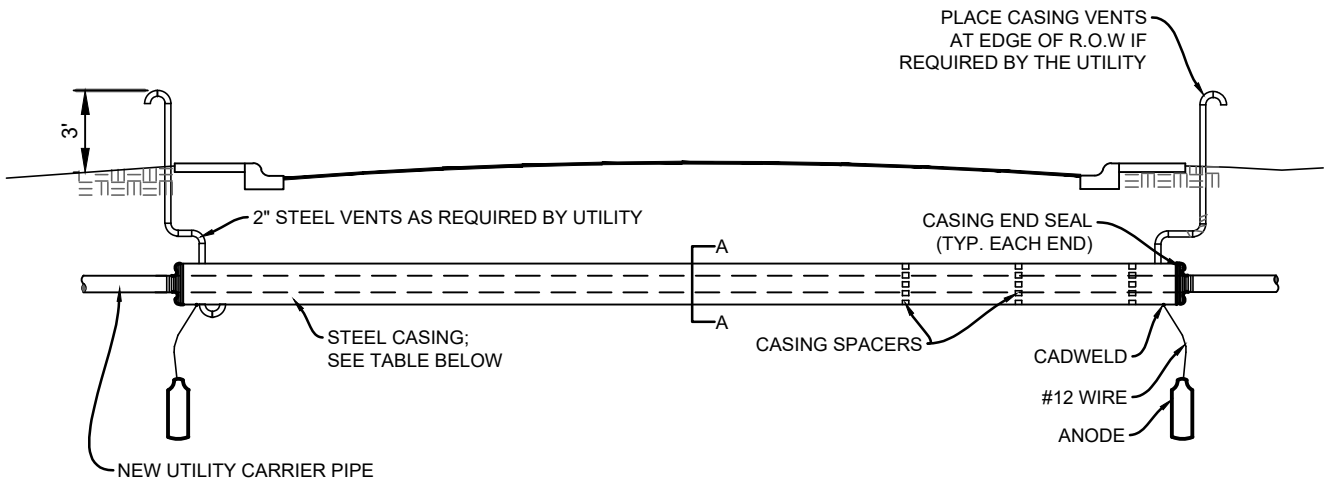
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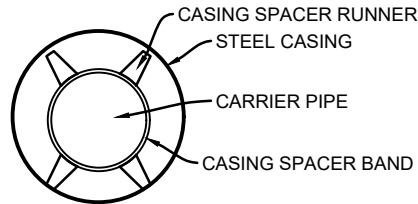
SHEET NO:

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GENERAL NOTES:

1. CASING END SEALS SHALL BE T.D. WILLIAMSON, INC Z-SEALS OR ENGINEER APPROVED EQUAL.
2. CASING SPACERS SHALL BE ADVANCE PRODUCTS & SYSTEMS, LLC MODEL SSIM OR ENGINEER APPROVED EQUAL.
3. STEEL CASING PIPE SHALL BE SIZED TO ADEQUATELY ACCOMMODATE CARRIER PIPE AND ADHERE TO THE REQUIREMENTS PROVIDED IN THE TABLE BELOW.
4. PIPE JOINT(S) INSIDE CASING SHALL BE JOINT RESTRAINED.
5. CASING VENTS TO BE PAINTED WITH AN OIL BASE ALKYD PRIMER AND AN OIL BASE ALKYD ENAMEL TOP COAT. COLOR SHALL BE PER APWA UNIFORM COLOR CODE FOR RESPECTIVE UTILITY.



SECTION A-A

STEEL CASING MINIMUM WALL THICKNESS		
NOMINAL DIAMETER (INCHES)	MIN. WALL THICKNESS FOR COATED (INCHES)	MIN. WALL THICKNESS NON-COATED (INCHES)
14 AND UNDER	0.1880	0.1880
16	0.2190	0.2810
18	0.2500	0.3120
20 AND 22	0.2810	0.3440
24	0.3120	0.3750
26	0.3440	0.4060
28	0.3750	0.4380
30	0.4060	0.4690
32	0.4380	0.5000
34 AND 36	0.4690	0.5310
42	0.5000	0.5630
48	0.5630	0.6250

1. WALL THICKNESS DESIGNATIONS FOR STEEL CASING PIPE FOR E-80.
2. STEEL PIPE SHALL HAVE A MINIMUM YIELD STRENGTH OF 35,000 PSI.
3. CORROSION CONTROL MEASURES MUST INCLUDE CATHODIC PROTECTION.

SCALE: NOT TO SCALE



**CITY OF ALAMOGORDO
TECHNICAL STANDARD DRAWINGS**

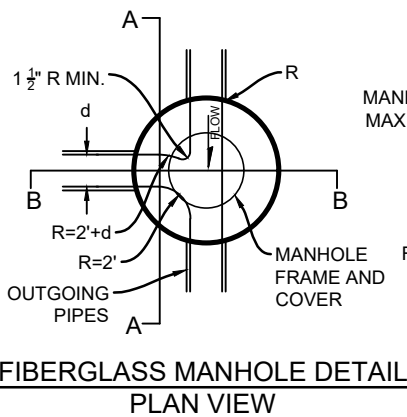
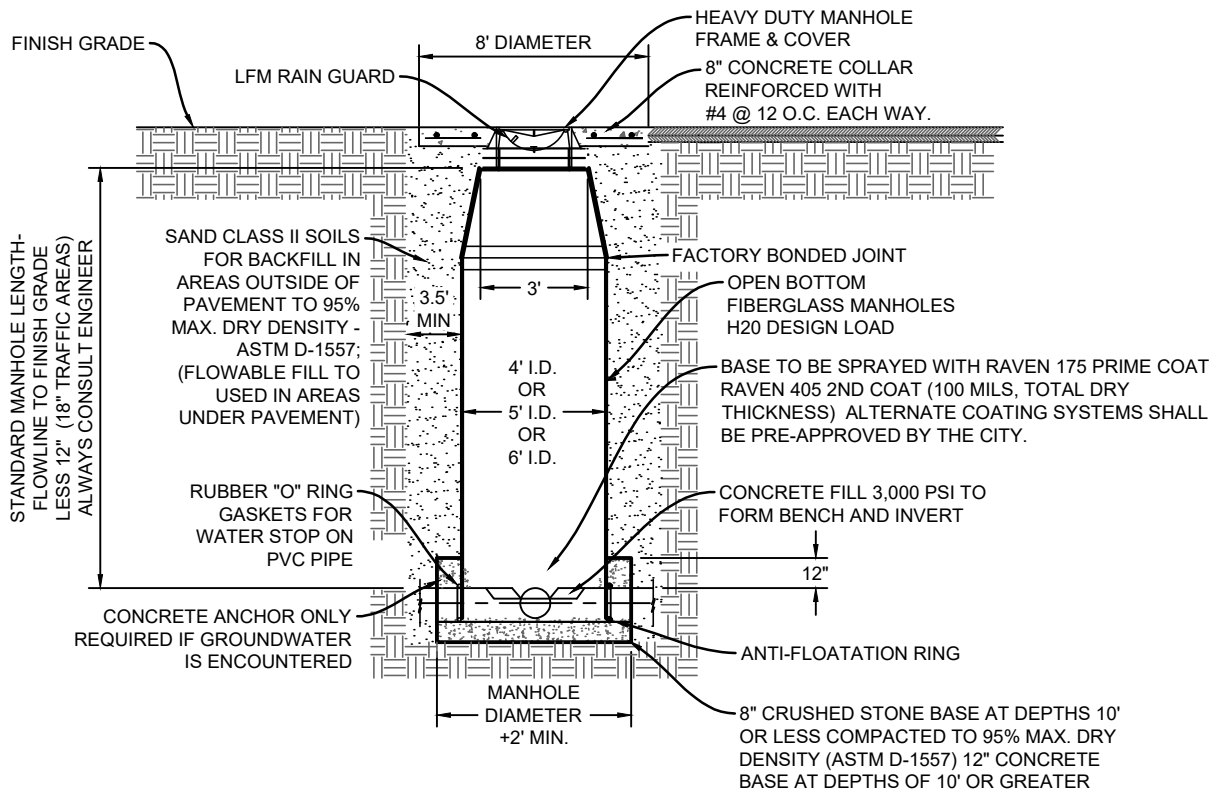
SEWER LINE BORE AND CASE DETAIL

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APRIL 2021

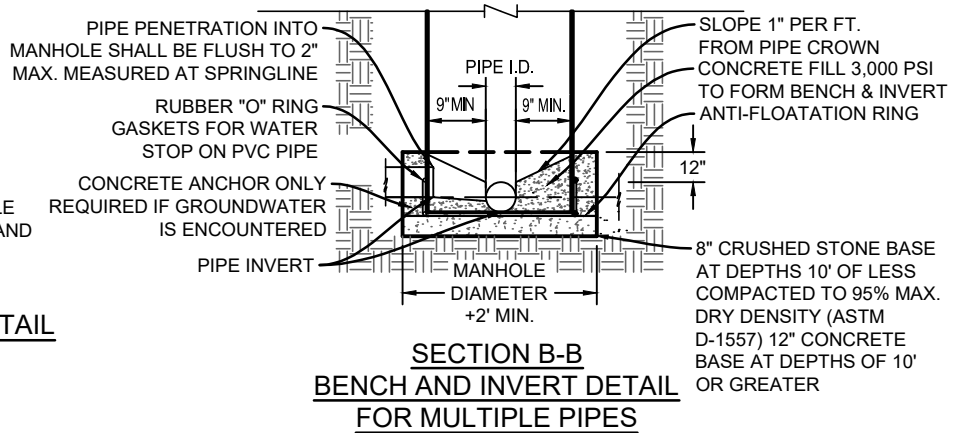
REVISION DATE:

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FIBERGLASS MANHOLE DETAIL
PLAN VIEW



SECTION B-B
BENCH AND INVERT DETAIL
FOR MULTIPLE PIPES

GENERAL NOTES:

1. CONCRETE ANCHOR WILL ONLY BE REQUIRED IF GROUNDWATER IS ENCOUNTERED.
2. WHERE A SANITARY SEWER LINE ENTERS AND EXITS A MANHOLE IN A STRAIGHT LINE, A DROP BETWEEN THE INCOMING AND OUTGOING INVERTS WILL NOT BE REQUIRED. IF A DEFLECTION IN THE SANITARY SEWER ALIGNMENT IS PROPOSED AT THE MANHOLE, A MINIMUM OF ONE-TENTH (0.10) OF A FOOT BETWEEN INVERTS WILL BE REQUIRED WHEN THE ANGLE IS BETWEEN 0 AND 45, A MINIMUM OF TWO-TENTHS (0.20) OF A FOOT SHALL BE HELD BETWEEN INCOMING AND OUTGOING INVERTS, SUCH AS 90° BENDS. TEE INTERSECTIONS WILL REQUIRE ALL INCOMING LINES TO BE A MINIMUM OF TWO-TENTHS (0.20) OF A FOOT ABOVE OUTGOING LINES.
3. WATER TIGHT FIBERGLASS (CLOSED BOTTOM) MANHOLES ARE MANUFACTURED WITH A PRE-BUILT FIBERGLASS BENCH AND INVERT. THE DESIGN ENGINEER WILL NEED TO CONFIRM PROJECT REQUIREMENTS PRIOR TO MANUFACTURING OF MANHOLES.

SCALE: NOT TO SCALE



CITY OF ALAMOGORDO
TECHNICAL STANDARD DRAWINGS

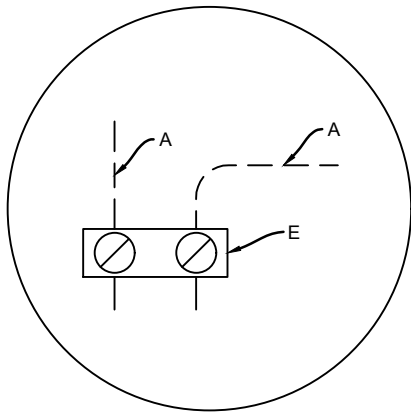
FIBERGLASS MANHOLE DETAIL

ISSUE DATE:
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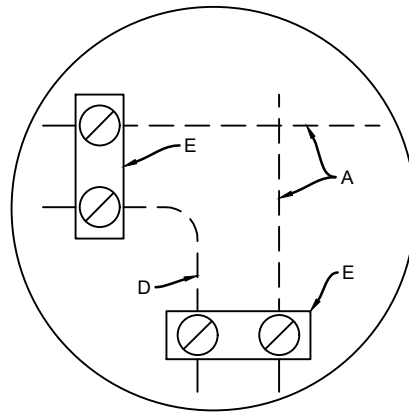
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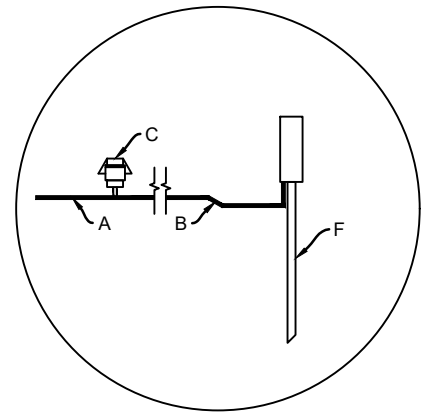
S-17



Tee Connection Detail



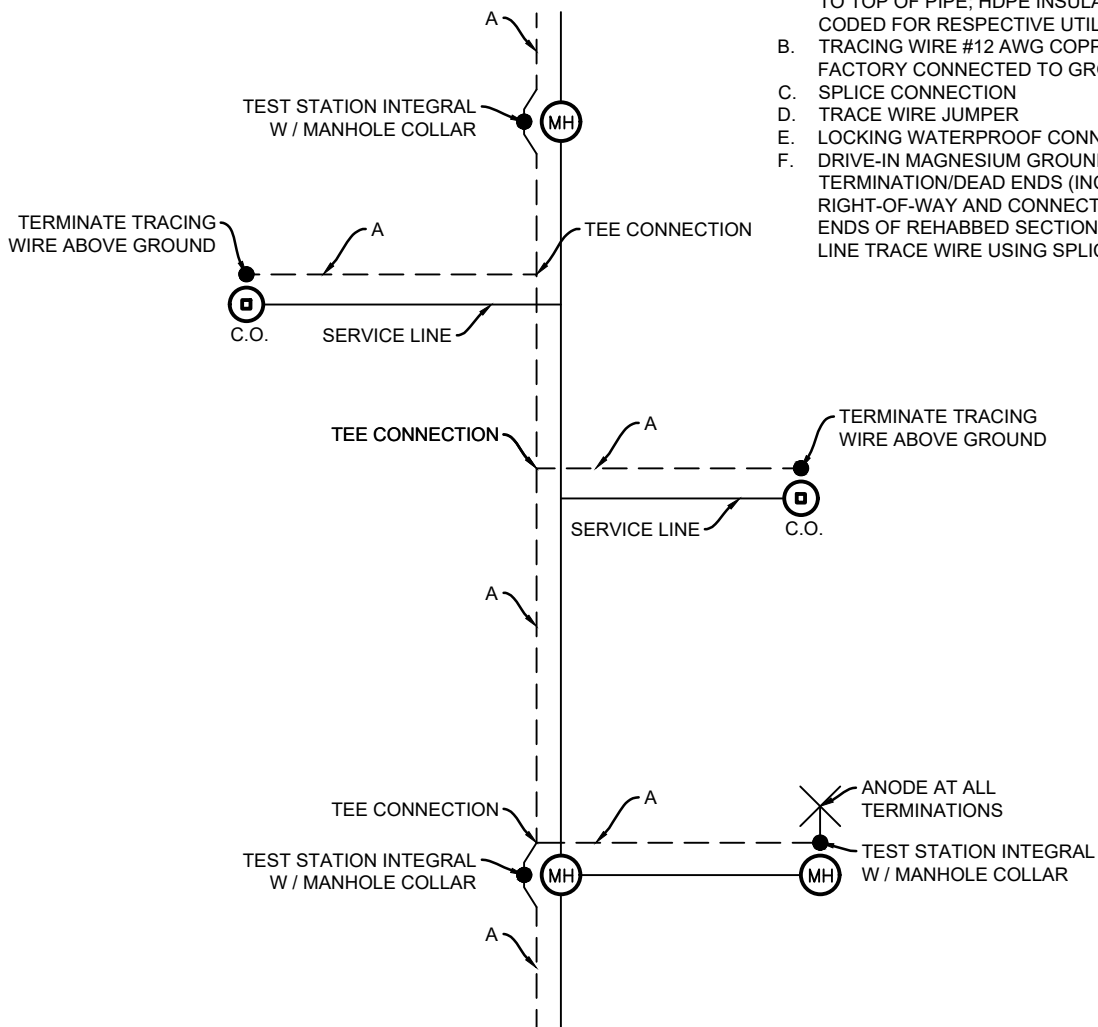
Cross Connection Detail



Anode Detail

CONSTRUCTION NOTES:

- A. TRACING WIRE #12 AWG COPPER CLAD STEEL, TAPED TO TOP OF PIPE; HDPE INSULATION APWA COLOR CODED FOR RESPECTIVE UTILITY
- B. TRACING WIRE #12 AWG COPPER CLAD STEEL - RED FACTORY CONNECTED TO GROUND ANODE
- C. SPLICE CONNECTION
- D. TRACE WIRE JUMPER
- E. LOCKING WATERPROOF CONNECTOR
- F. DRIVE-IN MAGNESIUM GROUNDING ANODE AT ALL TERMINATION/DEAD ENDS (INCLUDING EDGE OF RIGHT-OF-WAY AND CONNECTION POINTS/TERMINAL ENDS OF REHABBED SECTIONS), CONNECT TO MAIN LINE TRACE WIRE USING SPLICE CONNECTIONS.



SCALE: NOT TO SCALE



**CITY OF ALAMOGORDO
TECHNICAL STANDARD DRAWINGS**

SANITARY SEWER TRACER WIRE DETAILS

ISSUE DATE:

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TECHNICAL STANDARDS

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CHAPTER 08 – WATER SUPPLY SYSTEM

ARTICLE 08-01 - GENERAL

Article 08-01-010 Water System Materials

Item Description	Size or Reference	Specification	Manufacturer
Water Meter	$\frac{3}{4}$ " to 4" (W-1, W-2, W-26 & W-27)	AWWA C700 ANSI/NSF 61 AWWA C707	Zenner Stealth Reader System
PVC Pipe DR18	4" to 12"	AWWA C900-16 ASTM D1784 - Pipe Compound ASTM F477 - Gasket	
PVC Pipe DR25	14" to 36"	AWWA C900-16 ASTM D1784 – Pipe Compound ASTM F477 - Gasket	
PVC Fittings	6" to 12"	AWWA C153	
Ductile Iron Pipe	12" to 36"	ANSI/AWWA C151/A21.51	
High Density Polyethylene Pipe DR11 min.		AWWA C901 or AWWA C906	
Fittings for HDPE		AWWA C906	
Fiberglass Flexible Markers	W-30	APWA Color Code	
Couplings Mechanical and/or Flexible	W-16 thru W-18	AWWA C111	Romac or approved equal
Casing Pipe End Seals	W-22	See Manufacturer's Specifications	T.D. Williamson Z-Seal Casing Seals or approved Engineer Equal
Casing Spacer Band	W-22	See Manufacturer's Specifications	Advance Products & Systems, LLC Model SSIM or approved Engineer Equal
Gate Valves	4" and larger W-13	AWWA C515 NSF/ANSI 61 & 372	Waterous Company or approved equal
Valve Boxes	Series 6850 W-5 & W-6	ASTM A-48	Tyler Pipe, Tyler Corporation or approved equal
Valve Box Lockable Debris Cap	W-5	See Manufacturer's Specifications	SW Services LLC

Fire Hydrant	W-9	AWWA C502	Clow “Medallion” American Darling Model B-62 or B-84, Mueller Super Centurion Model A- 423
Post Type Flush Hydrant	W-29	ANSI/AWWA C502	Mueller Model A-411 or approved equal
Sampling Station	W-14	NSF/ANSI 372	Eclipse #88WC
Reduced Pressure Backflow Prevention Devices	2 -1/2” to 10”	AWWA C511-92	Watts Series LF909 or approved equal
Reduced Pressure Backflow Prevention Enclosure	W-31 and W-32		.
Polyethylene Service Lines	W-1 & W-2	ASTM D 2737	
Service Tapping Saddles	W-1 & W-2	ASTM A-536 – Body ASTM A-240 – Straps ASTM D-2000 - Gasket	
Corporation Stops	W-1 & W-2	AWWA C800 NSF 61	Mueller Insta-Tite or Approved Equal
Curb Stop	W-1 & W-2	AWWA C800 NSF 61	Mueller 300 ball curb valve or Pre- approved equal
Copper Meter Resetters	W-1 & W-2	NSF/ANSI/CAN 61 NSF/ANSI/CAN 372	A.Y. McDonald Mfg. Co. Model 76102 or Approved Equal
Water Meter Can	W-1, W-2, & W-12	ASTM C857-16	DFW Plastics Inc
Stainless Steel Tapping Sleeve	W-1 & W-2	AWWA C207 ASTM D2000	
Detectable Warning Tape	APWA Standard	ASTM D2103	
Tracing Wire	#12 AWG Copper Clad Steel W-20	ASTM B1010 – Wire ASTM B910/B910M – Wire ASTM D1248 -Insulation	Copperhead Industries or Approved Equal
Tracing Wire Connectors		See Manufacturer’s Specifications	Copperhead Industries Connector Part Number 3WB-01 or Approved Equal

Tracing Wire Access Boxes	W-20	ASTM D1788, Type 1 – Base Material APWA Standard	Copperhead Industries CD14*2T- SW or approved equal
Tracing Wire Access Box Lid	W-20	ASTM D1788, Type 1 – Base Material APWA Standard	Copperhead Industries RB14*2T- SW or LD14*2T-SW or approved equal
Tracing Wire Grounding (Ground Anode)	W-29	See Manufacturer’s Specifications	Copperhead Industries Ground Rod with ANO-12 or approved equal
Mechanical Joint Restraint	W-16 thru W-19	AWWA C600, C605 or ASTM D2774 ASTM A536 - Material	EBBA Iron Inc.
Repair coupling	2” to 12”	ANSI/AWWA C230 ASTM D2000 - Gasket	Romac or approved equal
Air-Release and Vacuum-Relief Valves	W-15	AWWA C512 ASTM A 48 ANSI B1.20.1	Val-Matic Model 201C.2 or equivalent
Air-Release and Vacuum-Relief Enclosure	Precast Manhole W-15 & W-26	ASTM C478 AASHTO M199 NMDOT Section 517 and 662	Western Precast Concrete Inc
Non Traffic Bearing Manhole ring and Cover	W-26		East Jordan
Manhole gap filler	W-26 & W-27	ASTM C990-09	RAM-NEK Joint sealant or Approved Equal
Air-Release and Vacuum-Relief Enclosure Lid	W-15	H20 traffic rated ASTM C478-93	

Article 08-01-020 Work Description

- (a) This Work consists of furnishing all of equipment, materials, and labor to perform all operations in connection with the installation of potable water lines and appurtenances. This section defines required characteristics and properties of Polyvinyl Chloride (PVC), High Density Polyethylene (HDPE), and Ductile Iron Pipe (DIP), valves, valve boxes, adapters, couplings, fire hydrants, materials, fittings, appurtenances, and construction practices.

- (b) Contractor shall provide, in place, all valves, adapters, couplings, and appurtenances necessary to meet the requirements of this Project, whether shown in the Contract Documents or not.
- (c) At all times, the new main shall be isolated from the active distribution system by physical separation until disinfecting water has been flushed out and satisfactory bacteriological testing has been completed in accordance with AWWA Standard C651. Water needed to fill the new main for testing and flushing purposes shall only be potable City water supplied through a temporary connection protected by a backflow device.
- (d) The backflow device must be tested and certified after installation on-site. A copy of the Certification shall be given to the City and a copy shall be kept on-site with the device. Testing must be completed by a certified testing facility on the City's approved listing.

Article 08-01-030 Location

Waterline shall be located in the streets and shall be approximately ten-feet (10') north of the street centerline on East-West bound streets, and ten-feet (10') west of the street centerline on the North-South bound streets. All water mains shall be laid with a minimum cover of three-feet (3'). The minimum pipe coverage shall apply to new construction only.

Water meters shall be located at the back of sidewalk or in landscape area between the curb and sidewalk (where parkways of ample width are present). Water meters shall not be located in driveways unless traffic rated meter cans are installed.

Article 08-01-040 Minimum Waterline Size

The minimum size of water mains shall be six-inches (6") in diameter.

ARTICLE 08-02 – MATERIALS

Article 08-02-010 General

- (a) Pipe and accessories shall be new and unused. Pipe shall be color-coded (blue for potable water, green for sanitary sewer, purple for reclaimed water). Detectable Marking Tape shall be installed as provided in the Contract Documents.
- (b) When PVC pipe is stored outside and exposed to prolonged periods of sunlight, an obvious discoloration of the pipe can occur. This is an indication of reduced pipe impact strength, and any length of pipe that is discolored will be rejected. All pipe rejected will be removed from the job site.

Article 08-02-020 PVC Pipe

- (a) PVC pipe four inches (4"-for existing tie-in locations only) through twelve inches (12") shall be not less than DR18, Class 235 and in conformance with AWWA C900, latest revision. Pressure class of PVC pipe shall be as required by Appendix A of AWWA C900. PVC pipe over twelve inches (12") shall be no less than DR25, Class 165 and in conformance with AWWA C900, latest revision.
- (b) All PVC pipes shall be approved for use in potable water systems by an agency such as NSF Testing Laboratory.
- (c) Joints: For pipe six inches (6") through twelve inches (12"), elastomeric gasket bell push-on type ends shall be used in accordance with ASTM F 477.
- (d) Specials and Fittings: For pipe six inches (6") through twelve inches (12"), specials and fittings for PVC pipe shall conform to the requirements of AWWA C153 and shall be cement mortar lined in accordance with AWWA C104. Fitting types shall include restrained mechanical joints and concrete thrust block where required. Restraining, standard mechanical joints, and fittings shall be submitted for City approval.

Article 08-02-030 Ductile Iron Pipe

- (a) Ductile iron pipe shall be in accordance with ANSI/AWWA C151/A21.51 and Federal Specification WW-P-421d, latest revision. All ductile iron pipe shall be minimum class 150, unless otherwise indicated in the Contract Documents. Ductile iron pipe fittings shall be pressure rated at three hundred fifty (350) psi and be in accordance with ANSI/AWWA C153/A21.53 and ANSI/AWWA C111/A21.11.
- (b) All ductile iron pipe and fittings shall be internally mortar lined in accordance with ANSI A21.4, latest revision, and shall have an exterior coating in accordance with ANSI A21.6, A21.8, or A21.51.
- (c) All ductile iron pipe and ductile iron fittings shall have a polyethylene encasement in accordance with ANSI/AWWA C105/A21.5, latest revision.
- (d) The ductile iron pipe shall be push-on type joints, unless indicated otherwise on the plans, and the fittings shall conform to the requirements of AWWA C153 and shall be cement mortar lined in accordance with AWWA C104. Fitting types shall include standard flange fittings and mechanical joints.

Article 08-02-040 High Density Polyethylene Pipe (HDPE)

- (a) HDPE pipe shall not be less than DR11.0, Class 160 and in conformance with AWWA C901 or AWWA C906.
- (b) Joints: Pipe shall be joined by heat fusion method and shall be performed as per manufacturer's safety instructions.
- (c) Specials and Fittings: Specials and Fittings for HDPE shall conform to the requirements of AWWA C906 and used in accordance with ASTM D 3350, and F 714. Fitting types shall include restrained mechanical joints where required. Transition gaskets for HDPE pipe shall be used when mechanical joints are used. Restraining, standard mechanical joints, and fittings shall be submitted for City approval.

Article 08-02-050 Adapters and Couplings

- (a) All adapters, pipe couplings, tap and sleeves, or mechanical type couplings required for any of the piping systems shall be of the type manufactured for the specific purpose of the use intended, and shall be installed in strict compliance with the manufacturer's specifications, and to the satisfaction of the City. Factory-made adapters shall be furnished for connecting transition material to the mechanical joint fittings and valves, where required, including plastic to steel and plastic to DIP.
- (b) Mechanical and/or flexible couplings shall be manufactured by Romac, or approved equal, and shall be sized and styled in accordance with the requirement for the particular coupling and used in accordance with the manufacturer's recommendations for the diameter, thickness and type of pipe to be connected. The mechanical and/or flexible couplings shall be provided with an acceptable joint harness to prevent separation of the joint where required due to pressure or change in direction of fittings. Couplings shall be polyethylene wrapped.

Article 08-02-060 Gate Valves: Four (4) Inch and Larger

All gate valves shall be resilient seated gate valves conforming to AWWA C515 rated for one hundred fifty (150) psi working pressure. Valves shall have a standard two (2) inch operating nut that opens counterclockwise. The wedge shall be constructed of ductile iron and shall be fully encapsulated in synthetic rubber except for the guide and wedge nut areas. The wedge shall seat against seating surfaces that are inclined to the vertical at a minimum angle of thirty-two (32) degrees when stem is in vertical position to eliminate abrasive wear. The non-rising stem shall be sealed by at least two (2) O-rings. The waterway shall be smooth and shall have no depressions or cavities. The valve body and bonnet shall be epoxy coated, inside and out, and wrapped with polyethylene sheet

encasement. Joints shall be restrained mechanical joint ends. Valve shall be as manufactured by Waterous Company or approved equal.

Article 08-02-070 Valve Boxes

Valve boxes shall be deep skirted, adjustable cast iron two (2) piece screw type, Series 6850 as manufactured by Tyler Pipe, Tyler Corporation, or approved equal. The valve boxes shall be five and one-quarter (5-1/4) inch diameter and the two (2) pieces shall overlap at least six (6) inches. The drop lid shall have a depth of two (2) inches, shall weigh thirteen (13) pounds, and shall have the word "WATER" embossed on top. Refer to Standard Details: W-5, W-6, and W-7.

Article 08-02-080 Fire Hydrants

- (a) Fire hydrants and extensions shall be in accordance with AWWA C502, traffic type, fire hydrants shall have two (2) two and one-half (2-1/2) inch hose nozzle connections, and one (1) four and one-half (4-1/2) inch steamer nozzle. All nozzle connections shall be National Standard Fire Hose Coupling screw threads. Fire hydrants shall have a bronze or cast-iron pentagon operating nut. The main inlet shall be six (6) inch restricted mechanical joint type. All fire hydrants shall be rated for one hundred fifty (150) psi working pressure. Any marks or scratches on new fire hydrants shall be corrected to the satisfaction of the City. Extensions will be used, when required, to bring the bottom of the break-off flange three (3) to six (6) inches above the top of the surrounding finished grade. All fire hydrants shall be Clow Medallion (preferred), American Darling B-62, American Darling B-84, Mueller Super Centurion A-423. All fire hydrants shall be fire engine red. Refer to Standard Details: W-9 and W-10.
- (b) Post type flush hydrants shall be installed on dead end lines. The feed line for the flushing shall be four inches (4") in diameter. Post hydrant shall be Mueller Model A-411 or Engineer Approved Equal. Refer to Standard Detail: W-29.

Article 08-02-090 Cross Connection, Prevention, and Control

- (a) The need, responsibilities, requirements, inspections, and maintenance of backflow prevention devices shall adhere to Article 8.08 of the City's General Ordinances.
- (b) All water lines supplying water-based fire protection systems outside of public utility easements and public rights-of-way shall require a Double Check Backflow Preventer, which must be sized accordingly by a New Mexico licensed engineer. The fire line, water-based fire protection, system, and double check backflow preventer shall meet the requirements of the adopted City fire code and be approved by the fire code official.

- (c) Reduced pressure backflow prevention devices shall be Watts Series LF909 or Engineer Approved Equal.
- (d) All approved containment and isolation backflow prevention assemblies which are classified as testable devices shall be tested at least one per year. For complete testing and maintenance requirements refer to Article 8.08 of the City's General Ordinances. Refer to Standard Details: W-31 and W-32.

Article 08-02-100 Water Services

- (a) All service lines to individual customers shall be three-quarter inch (3/4") minimum diameter. Larger diameters may be required based on available pressures and demands.
- (b) Polyethylene Service Lines: Polyethylene water service line tubing shall be fabricated from new polyethylene, PE 3406, SDR-9, 200 psi, manufactured in accordance with ASTM D 2737, latest revision, and be the size called for in the Contract Documents. The service line shall contain embedded tracing wire with connections to the water main.
- (c) All single-family residences shall be served by an individual service line and water meter. No service line splitting is allowed. Multiple dwelling units (duplexes, apartments, etc.) shall have a single service and master water meter; submetering units shall be installed downstream of the master meter.
- (d) Identification of Water Services at Top Back of Curbs: The location of each water service shall be stamped or scribed (marked as "W") into the top of the curb. The marking shall be located directly above each respective service.
- (e) Location of Water Services: Water service lines shall be tapped into the water main at 90-degrees and shall continue as a straight run (perpendicular to the main) to the water meter.
- (f) Domestic meters two inches and smaller ($\leq 2"$) are to be sized as per the International Plumbing Code (IPC). All other meters shall be sized in accordance with the American Water Works Association standards. Intermittent use shall not exceed three (3) hours per day. All water meters are supplied by the City.
- (g) Water Meter: Water meter shall be positive displacement (compound), reading in cubic feet (cf) and acceptable for use with **ZENNER STEALTH READER SYSTEM (NO SUBSTITUTIONS)**. It is the sole responsibility of the Contractor

to verify compatibility of the water meters with the **ZENNER STEALTH READER SYSTEM**.

- (1) Prior approval is a part of these specifications and any bidder or manufacturer wishing to obtain approval to use unspecified products shall submit a written request. The request shall be received, by the City, not later than seven (7) days prior to the bid opening date.
- (2) Request shall clearly describe the product for which approval is asked, including all data necessary to demonstrate acceptability. If the product is acceptable, the ENGINEER will approve it in an Addendum issued to all plan holders. Otherwise, the specified product or item shall be used. The burden of proof is the sole responsibility of the Contractor.
- (3) Meters shall comply with AWWA C700 Standard for Cold-Water Meters, Displacement Type, Bronze Main Case, of the latest revision. Meters shall also comply with the Safe Drinking Water Act and ANSI/NSF 61 requirements.
- (4) Meter Register housing and lid shall be plastic and the main case, bottom, shall be non-breakable plastic.
- (5) The size, model, and direction of flow through the meter shall be cast permanently into the outer case of the meter. The manufacturer's meter serial number shall be imprinted on the outer case and lid.
- (6) The meter connections shall be: 5/8" x 3/4" or the size called for in the Project Plans or Contract Documents and shall have standard male meter thread. Meter connections 1-1/2" and larger shall have flanged ends. Developments requiring a three-inch (3") service and meter shall be upsized to four inch (4").
- (7) Registers shall be an Encoder-Type register for use in AMR, drive-by or fixed network systems. They shall meet the requirements of the AWWA C707 Standard, for Encoder-Type remote registers, of the latest revision. The encoded register shall be preassembled to the meter and supplied with a wire assembly, at least 16-inches in length. The wire assembly connections to the register will be sealed to prevent any water/moisture damage. The pigtail supplied must have enough leads to interface with ZENNER STEALTH READER SYSTEM unit. Each encoded register must have its own unique identification number, either external or internal.
- (8) All encoded registers will have a 6-wheel odometer.

- (9) A letter of certification from the meter manufacturer, certifying that the product supplied will work properly with the ZENNER STEALTH READER SYSTEM units.
- (10) Existing water meters will be salvaged to OWNER.
- (h) Service (Tapping) Saddles: Service (tapping) saddles shall be pre-approved by City. Acceptable saddles shall have two (2) double straps, or one (1) large, wide, single strap secured by four (4) bolts and shall be the size called for in the Contract Documents.
- (i) Corporation Stops: Corporation stops shall be ball valve type, rated for 150 psi. (minimum) working pressure. Corporation stops shall be per the size called for in the Project Plans or Contract Documents, CC or IP threaded inlet with compression fitting or Mueller Insta-Tite connection, or pre-approved equal.
- (j) Curb stop: Curb stop shall be ball valve type, rated for 150 psi (minimum) working pressure. Corporation stops shall be per the size called for in the Project Plans or Contract Documents.
- (k) Copper meter resetters (meter yoke): Copper meter resetters (meter yoke) shall be pre-approved by City. Acceptable coppersetters shall be 5/8" x 3/4" copper or the size called for in the Project Plans or Contract Documents, with a lock wing and angle dual check backflow preventers/device. Existing copper meter resetters (meter yoke) will be salvaged to City.
- (l) Water Meter Cans: All water meter cans for this Project shall be the size called for in the Project Plans or Contract Documents. The diameter and height for each installation shall be as shown in the Project Plans. Cutouts for the water service lines shall be neatly cut and trimmed to allow one (1) inch clearance on all sides of the water service line.
 - (1) Specification is based on use of "DFW PLASTICS, INC." by DFW Plastics, Inc., 901 E Industrial Avenue, Saginaw TX 76131, with attributes as described below. Equal products of other water meter can manufacturers may be acceptable when pre-approved by City.
 - (2) This product is designed to withstand loading in non-deliberate and incidental traffic. Not to be installed in roadway. Meter pit lid shall be black and constructed out of modified polyethylene material for maximum durability and corrosion resistance. The black material is for maximum UV protection. The black material shall be uniform throughout the meter pit lid

for maximum longevity and not have a foaming agent that creates air pockets within the polymer lid.

A. Vertical and Lateral Load Rating:

- Compliant with AASHTO, Design Load of H-10; ASTM C857-16, Design Load of A-8, 8,000 lbs. transferred through a 10" x 10" steel plate centered in the cover and body.
- Compliant with AASHTO, Design Load of H-20; ASTM C857-16, Design Load of A-16, 16,000 lbs. transferred through a 10" x 20" steel plate centered on the cover and body.
- This product is designed to withstand H-10 and H-20 loading in non-deliberate or incidental traffic areas.

NOT INTENDED TO BE INSTALLED IN ROADWAYS.

B. Polymer Lid

- The polymer lid shall have a molded keyhole and Plastic Lock underneath lid - *as illustrated*.
- The polymer lid shall have one (1) molded slide mount for placement of AMR/AMI device - *as illustrated*.
- The polymer lid shall seat securely and evenly inside the meter pit and shall not overlap the top edge of the meter pit.
- The polymer lid shall have molded tread-pattern for skid resistance - tread dimensions shall be 0.188" x 0.938" x 0.150" deep.
- The polymer lid shall have "WATER METER" molded into the lid - Font shall be Std Fadal CNC Font with 1" characters x 0.150" deep.
- The polymer lid shall be black and have a molded recycled emblem with a minimum of 50% Post-Consumer Recycled and 50% Post Industrial/ Pre-Consumer Recycled Content- Verified with a Leed Product Documentation.

C. Polymer Body

- The polymer body shall be BLACK and have a minimum of 3/8" wall thickness - *as illustrated*.
- The polymer body shall have minimum inside working room of (23-1/4") - *as illustrated*.

- The polymer body shall have crush resistant ribbing along the outside of the box with 1-5/8" base footing located at the bottom of the meter pit to help eliminate sinking or floating once installed.
- The polymer body shall have a straight wall design and not be flared as to allow for adjustment to grade after installation.
- The polymer body shall have one pipe slot molded on each end of the body that measures (3" x 5-3/4").
- The polymer body shall have a molded recycled emblem with a minimum of 35% Post Industrial/ Pre-Consumer Recycled Content - Verified with a Leed Product Documentation.

Whenever in the specifications, any particular materials, process and/or equipment is indicated or specified by patent, proprietary, or brand name, or by name of manufacturer, such wording shall be deemed to be used for the purpose of facilitating description of the material, process, and/or equipment desired, and shall be deemed to be followed by the words "or equal". The lists of acceptable material are not intended to be comprehensive lists, or in any order of preference. The bidder may offer any material, process, and/or equipment which comply with the governing specifications which the bidder considers to be equivalent to that which is indicated or specified.

- (m) Temporary Service: Contractor shall maintain service to all connections during construction to minimize time water will be unavailable. Contractor shall complete work on new services and testing and disinfecting of new waterlines prior to removing service from existing waterline. Contractor shall submit a plan for temporary service for City approval prior to construction of new waterline. Refer to Standard Details: W-1 and W-2.

Article 08-02-110 Stainless Steel Tapping Sleeve

- (a) Body: 18-8 Type 304 Stainless Steel. All welds shall be fully passivated to restore stainless characteristics.
- (b) Bolts: 18-8 Type 304 Stainless Steel. Heavy hex nuts and washer are coated to prevent galling.

- (c) Flange: 18-8 Type 304 Stainless Steel Flange with recess per MSS-SP60 to accept standard tapping valve. Flange conforms to AWWA C207 Class D ANSI 150 lb. drilling.
- (d) Outlet: 18-8 Type 304 Stainless Steel. Scheduled 10 for 3" and 4" outlets. Scheduled 5 for all outlets larger than 4".
- (e) Test Plug: 18-8 Type 304 Stainless Steel in test outlet.
- (f) Gasket: Sleeve shall have a full wide gasket of Nitrile Butadiene Rubber (NBR, Buna-N) per ASTM D2000 with hydromechanical activated lip, captured in a recessed groove around the outlet. Gasket shall be suitable for water, salt solutions, mild acids, bases, and sewage.
- (g) Service Rating: 2"-12" outlets: 175 psi.
- (h) Only qualified and appropriately licensed Utility Contractors shall complete potable water taps on new installations not connected to the City's potable water system at the time of the tap. The City shall observe all tapping activities. Taps on the City's active potable water system shall be completed by the City.

Article 08-02-120 Detectable (Underground) Warning Tape

Detectable warning tape shall be 6" wide, 5 mil overall thickness, with a .35 mil solid foil coil. APWA Color coded with imprint of underground utility installed.

Article 08-02-130 Tracing Wire

- (a) All trace wire shall have HDPE insulation intended for direct bury service. HDPE insulation shall be color coated per APWA Standard for respective utility being installed.
- (b) Tracing wire shall be taped to the top of all water mains and fire hydrant/lines at a maximum 10-foot (10') interval. Tracing wire integral to water services shall be connected to the water main tracing wire.
- (c) Trace wire shall be as following based on installation method:
 - (1) Open Trench Installation: #12 AWG copper clad steel, high strength with minimum 450-pound break load and minimum 30 mil HDPE insulation thickness. Copperhead Industries High Strength – 1230 CCS Tracer Wire or City approved equal.

- (2) Directional Drilling/Boring: #12 AWG copper clad steel, high strength with minimum 1,150-pound break load and minimum 30 mil HDPE insulation thickness. Copperhead Industries Extra-High Strength – 1245 CCS Tracer Wire or City approved equal.
- (3) Pipe Bursting/Slip Lining: 7 x 7 stranded copper clad steel, extreme strength with minimum 4,700-pound break load and minimum 50 mil HDPE insulation thickness. Copperhead Industries SoloShot Xtreme – PBX-50 CCS Tracer Wire or City approved equal.
- (4) When a new trace wire is to be tied to an existing trace wire the connection shall be made with an approved splice connector and shall be properly grounded at the splice connection.

(d) Connectors

- (1) All main line trace wires shall be interconnected at intersections (tees and crosses). Connectors shall be lockable and manufactured specifically for use in underground trace wire installation. Connectors shall be dielectric silicon filled to seal out moisture and corrosion and shall be installed in a manner as to prevent any uninsulated wire exposure.
- (2) Tee Connectors (service lines, main line tees, and fire hydrants) shall include a 3-way lockable connector main line to lateral lug connector. Copperhead Industries Mainline-to-Service Connector Part Number 3WB-01 or City approved equal.
- (3) Cross Connectors (main line crosses) shall include two (2) 3-way lockable main line to lateral lug connectors. Copperhead Industries Mainline-to-Service Connector Part Number 3WB-01 or City approved equal.
- (4) Main line tracing wire splices shall be completed utilizing twist-lock connectors. Copperhead Industries Locking Connector Part Number LSC1230C or City approved equal.
- (5) Do not cut and splice main line trace wire.
- (6) Non-locking friction fit, twist on, or taped connectors shall not be used.

(e) Termination/Access Boxes

- (1) All trace wire termination points must utilize an approved trace wire access box, specifically manufactured for this purpose.

- (2) All access boxes shall be identified with “sewer” or “water” cast into the cap and be APWA color coded according to the utility.
- (3) A minimum of two-feet (2’) of slack is required in all trace wire boxes upon installation at final grade.
- (4) All trace wire access boxes must include a manually interruptible conductive/connective link between the terminals for the trace wire connection and the terminal for the ground anode wire connection.
- (5) Ground anode wire shall be connected to the identified terminal on all access boxes.
- (6) Fire hydrants must terminate at an in-ground trace wire access box positioned within the fire hydrant concrete collar. Copperhead Industries SnakePit Concrete/Driveway with Two-Terminal Switchable Lid Access Point Part Number CD14*2T-SW or City approved equal.
- (7) Main Line access boxes shall be placed at intervals not exceeding 500-feet in locations where fire hydrants are not present. Trace wire access boxes may be placed outside the roadway driving surface or may be placed integral with valve box collars if pre-approved by the City.
 - A. Trace wire access box placed integrally in concrete valve box shall be Copperhead Industries SnakePit Roadway with Two-Terminal Switchable Lid Access Point Part Number RB14*2T-SW or City approved equal.
 - B. Trace wire access box outside the roadway prism shall be Copperhead Industries SnakePit Lite Duty with Two-Terminal Switchable Lid Access Point Part Number LD14*2T-SW or Engineer Approved Equal. Access boxes placed outside of the roadway shall be identified with flexible marker per Standard Detail W-20.

(f) Grounding

- (1) Trace wire must be properly grounded at all dead ends and stubouts.
- (2) Grounding of trace wire shall be accomplished using a drive-in magnesium grounding anode rod with a minimum of 20-feet of #12 AWG red HDPE insulated copper clad steel wire connected to the anode (minimum of 1.5-pound) specifically manufactured for the intended purpose. The ground anode shall be landed at the same elevation as the utility. Ground anode

shall be Copperhead Industries Ground Rod with Twist-On Connector Part Number ANO-12 or City approved equal.

- (3) When grounding the trace wire at dead ends or stubouts, the grounding anode shall be installed perpendicular to the trace wire at a maximum possible distance.
- (4) When grounding the trace wire in long continuous runs, the grounding anode shall be installed directly beneath and in-line with trace wire. The grounding anode wire shall be trimmed to an appropriate length before connecting to trace wire with a mainline to lateral lug connector.

(g) Testing

- (1) All new trace wire installations shall be located using typical low frequency line tracing equipment. The test trace shall be witnessed by the City prior to final acceptance.
- (2) Continuity testing in lieu of actual line tracing will not be accepted.

Article 08-02-140 Cathodic Protection

Cathodic protection, if required, shall be designed by a licensed engineer in the State of New Mexico.

ARTICLE 08-03 – CONSTRUCTION REQUIREMENTS

Article 08-03-010 Trench Excavation

- (a) Pipe trenches shall be excavated along straight lines to the dimensions as required in the Contract Documents.
- (b) All trenching work shall be done in a safe manner, trenches shall be rendered safe for the workmen by complying with the applicable safety standards, and by practicing safety measures consistent with current OSHA Trenching and Excavation Safety Standards and good construction methods.
- (c) All excavations shall be adequately barricaded and secured in accordance with the current New Mexico Department of Transportation Standard Specifications. Flashing lights and barricades shall be employed along open excavations and trenches to protect the public from potential hazards; barricades and advance warning devices shall comply with MUTCD Standards as well as any special direction required by the City.

- (d) Unless trench banks are cut back on a stable slope, the trenches shall be braced as necessary to prevent caving or sliding, to provide protection for the workmen and the pipe. All trenching shall comply with OSHA Trenching and Excavation Safety Standards.
- (e) When over-excavation occurs beyond the limits indicated by the trench details, the over-excavated area shall be refilled with suitable material at optimum moisture and compacted to ninety-five (95) percent density per ASTM D 1557.
- (f) The maximum amount of open trench permitted in any one location shall be 100-feet, or the length necessary to accommodate the amount of pipe installed in a single day, whichever is greater, unless otherwise approved by the City. A trench shall be considered open until backfilled to the top of subgrade.
- (g) Excavation of pipe trenches for flexible and rigid pipe is as required in the table below. In all cases, the trench shall be wide enough to allow for the compaction equipment.

Table 1: Minimum Trench Widths

Flexible Pipe	Minimum shall be not less than 1.5 times the pipe outer diameter plus twelve inches (12")
Rigid Pipe	Minimum shall be not less than the outside pipe diameter times 0.33

- (h) When trench is to be backfilled with flowable fill, the minimum trench width may be reduced to the pipe diameter plus twelve inches (12") and enough room needed to allow for the proper placement of the flowable fill using tools to "spade" the material under the pipe haunches.
- (i) Maximum Trench Width: the maximum width of the trench shall be determined by the Contractor based on the method and means for the installation. However, trench width shall not exceed the width of a ride-along compactor plus two feet (2') when working alongside the pipe or culvert.
- (j) Street Crossings
 - (1) Trenches crossing streets shall be completely backfilled immediately after pipe, wire, or conduit installation and a temporary or permanent asphalt patch or flowable fill cap shall be installed as directed by the City to protect the integrity of the trenches within the roadway limits from excessive moisture.

- (2) Substantial bridging, properly anchored, capable of carrying the vehicle loading, in addition to adequate trench bracing, shall be used to bridge across trenches at street crossings where trench backfill, and temporary patches have not been completed during regular working hours as directed and approved by the City. Safe and convenient passage for pedestrians and access to all properties shall be provided.

- (k) Disposal of Unsuitable Excavated Materials
 - (1) Excess material and excavated material unsuitable for backfill shall be removed from the Project by the end of each working day unless otherwise approved by the City and disposed of by the Contractor in an environmentally responsible manner at no cost to the Project.
 - (2) When unsuitable material is encountered that is not shown in the Contract Documents, the City shall order the removal of the material by the Contractor and issue a field order to change the contract price due to the Contractor for removal of the materials.

- (l) Portable trench shields or boxes that provide a movable safe working area for installing pipe may be used for the installation of the pipe. After placing the pipe in the trench, backfill material shall be placed in lifts and the shield shall be lifted to allow for the backfill material to be placed for each lift, trench wall to trench wall.

- (m) Transition Installations: When differential conditions of pipe support might occur, such as transitions from manholes to trench, a transition support region shall be provided to ensure uniform pipe support and preclude the development of shear, or other concentrated loading on the pipe.

Article 08-03-020 Bedding

- (a) The bottom of the trenches shall be smooth, and hand graded uniformly throughout. If rock or other unyielding material is encountered or if the trench is over-excavated, pipe bedding material shall be added, compacted, and graded to a smooth uniform surface. The compacted bedding shall support the pipe throughout its entire length, except at bells or couplings which shall not rest on the bedding.

- (b) After the bell or coupling holes are excavated and after the pipe pieces are connected and properly aligned and graded, successive layers of select material shall be placed and compacted, until the pipe is covered, as required in the Contract Documents. The Contractor shall maintain proper alignment and grade during the

bedding process. Any bent, cracked, chipped, or damaged pieces of pipe shall be removed and replaced at Contractor's expense.

Article 08-03-030 Pipe Laying

- (a) Pipe shall be laid true to the line and grade indicated in the Contract Documents or as established by the City.
- (b) The pipe shall be protected during handling against impact shocks and free fall. Do not permit hooks, chains, cables, or handling equipment to come in contact with the pre-molded or pre-formed end surfaces.
- (c) Handle the pipe having pre-molded end surfaces or pre-formed end surfaces so that no weight, including the weight of the pipe itself, will bear on or be supported by the jointing material or surfaces. Do not drag the end of the pipe on the ground or allow them to be damaged by contact with gravel, crushed stone, or any other hard objects.
- (d) No damaged or deformed pipe will be incorporated in the work.
- (e) The interior of the pipelines shall be kept free from dirt and other foreign material as the work progresses and shall be clean upon its completion. Tight stoppers or bulkheads shall be securely placed in the ends of all pipelines when the work is stopped temporarily, or at the end of the workday.
- (f) Immediately prior to joining, both pipe ends shall be thoroughly cleaned, and a lubricant shall be applied according to the manufacturer's recommendations. For push-on type joints, sufficient pressure shall be applied in making up joints to insure proper seating of the joints.
- (g) The full length of each section of pipe shall rest solidly upon the bed, with recesses excavated to accommodate bells and joints. Any pipe that has the grade or joint disturbed after laying shall be taken up and re-laid. Pipe shall not be laid in water or when trench or weather conditions are unsuitable for the Work except by permission of the City. Minimum depth of cover over top of pipe shall be three feet, unless otherwise approved by the City.
- (h) All nuts, and bolts utilized in underground pipe connections shall be stainless steel, high strength cast iron or high strength wrought iron. Carbon steel nuts and bolts may be used except that they shall be protected by "cocoon" type protective coating of coal-tar and felt in accordance with AWWA Standard C 203.

- (i) Where connections are made between new work and existing lines, the connections shall be made using specials and fittings as recommended by pipe manufacturer and approved by the City. Couplings may be either cast iron or steel with bolts as stated above. If steel couplings are used, they will be cocoon wrapped as specified herein.
- (j) Water lines shall not be laid closer, along horizontal dimensions, than ten feet (10') from sewer lines, and with the water line at a higher elevation than the sewer. If this is not possible, and if concurrence from the City is obtained by the Contractor, separate trenches will be required, and the water line shall be at least two (2) feet above the sewer or concrete encased. When water and sewer lines cross each other, the water line shall be at least two (2) feet above the sewer or concrete encased, per Standard Detail W-11. If the water line crossing occurs below the sewer line the sewer line shall be encased per Standard Detail W-11.
- (k) Water main lines shall not be constructed under walkways, sidewalks, curbs and gutters, drive pads, or similar concrete structures by tunneling underneath. The Contractor will cut these concrete structures by using a concrete saw to the closest control joint or, at his option, may remove the section of the concrete structure to the nearest full expansion joint or edge.
- (l) Encasement shall be performed as shown in the Contract Documents at shallow crossings or other instances in which piping may be exposed or susceptible to excessive surface loading. DIP shall be used for these crossings with push-on or M.J. type connections, blocked with curved / conforming cinder blocks underneath, installed in prepared trench of adequate width to house pipe diameter and encasement. Trench excavation shall have ninety-five (95) percent relative compaction or shall be in freshly excavated native material, and as approved by the City may suffice with adequate dimensions to omit use of formwork for encasement concrete placement. Encasement concrete shall be aggregate and Type II cement meeting or exceeding 3,000 psi compressive strength. Rebar shall be placed as shown in the Contract Documents, shall be new and unused, and tied with minimum six-inch (6") lap distances, with minimum two inches (2") of concrete cover on outside dimensions.
- (m) All valves shall be set true, level, vertical and plumb. All valves shall have and be supported by a concrete thrust block, have retainer rods, and shall comply with the details shown in the Contract Documents. Backfill shall be compacted to ninety-five (95) percent density under pavement, ninety (90) percent in unpaved areas, ASTM D 1557.
- (n) The Contractor shall remove the valve box and operating nut from all existing valves that are to be abandoned. The resulting excavation shall be backfilled and

compacted to ninety-five (95) percent density, ASTM D 1557. The top six inches (6") of the excavation shall receive new base course placed to the above stated density. The pavement shall be sawcut to form a square opening. The cut faces of the existing asphalt shall be thoroughly coated with tack coat and new asphalt pavement shall be placed and densified to ninety-five (95) percent density, ASTM D 1557.

- (o) Cast iron valve boxes shall be set vertical and plumb centered over the operating nut. All valve boxes shall be adjusted to proper elevation, providing the minimum overlap of six inches (6") of the two (2) pieces, and a concrete collar shall be built around the top of each valve box. The concrete collar shall be of the size, shape, and dimensions shown in the Detail Drawings. The concrete shall be 3,000 psi at twenty-eight (28) days with one (1) inch aggregate and finished with a light broom finish. All concrete shall be removed from the top of the valve box and lid while it is still wet, and they shall be left clean. Backfill shall be compacted to ninety-five (95) percent density under pavement, ninety (90) percent in unpaved areas, ASTM D 1557. Valve stem extensions shall be required and installed on all valves for which the valve operator is more than four feet (4') below the finished surface.
- (p) Adapters and couplings shall be installed in strict compliance with the manufacturer's recommendations. Contractor shall provide, in place, all additional straps, rods, and harness required to make a secure water-tight connection.
- (q) The City shall have the privilege of checking the pipe for line and grade by any method that he wants to use after the pipe is laid, and before backfilling begins. The City shall also have the privilege of checking each pipe joint with a gauge or by any means that he deems necessary in order to be assured that the gaskets are in place and properly seated. Any run of pipe that is found to be appreciably off of line or grade shall be removed from the trench, the trench bedding shall be re-graded and compacted, and the pipe shall then be laid accurately online and grade. Any joint that is found to be improperly gasketed and/or seated shall be un-jointed and correctly reassembled. If any gasket is found to be damaged, the entire pipe section containing the damaged gasket shall be replaced with a new one.
- (r) Contractor shall furnish any tools, gauges, and all items required for the checking of the gaskets and joints, and he shall check every joint to be sure that the gaskets are seated and located in the correct place to avoid leakage at the joints.
- (s) Trenches shall be kept free from water during pipe installation until suitable backfill has been placed and compacted to prevent pipe flotation. Any standing water within the trench shall be evacuated and the trench bottom or bedding be restored per the standards contained herein.

- (t) Field cuts shall be completed with a hacksaw, handsaw, or a power saw with a steel blade or an abrasive disc. Field cuts shall be square to the pipe's flow area. The newly cut pipe end shall be beveled to the factory pipe chamfer. Completed field cuts shall be smooth and blunt free from shavings and rough edges.
- (u) Plastic sewer pipe shall be connected and placed in the trench in accordance with the manufacturer's recommendations.
- (v) The reference mark (a distinct circumferential line) is placed on the pipe's spigot end by the manufacturer to indicate the correct depth of spigot penetration into the pipe gasket joint. If the pipe is seated too deep or too shallow the pipe may buckle or separate due to thermal expansion/contraction. Spigot penetration shall be within one quarter (1/4) inch of the manufacturer's recommended mark.

Article 08-03-040 Utility Restraint Systems

- (a) Utility system piping thrust is to be restrained through the use of restrained joint fittings. Refer to Standard Details W-16 through W-18.
- (b) Bell joint restraints shall be utilized.
- (c) Where site conditions preclude the use of pipe restraints concrete thrust blocks may be utilized as follows. Thrust blocks shall be poured at all bends, valves, tees, reducers, and fittings, where changes in pipe diameter, alignment or grade occur, and as indicated in the Contract Documents or as required by City. Thrust blocks are only necessary where mechanical restraint joints are not being utilized. The minimum size of concrete thrust blocks shall be as shown in the Contract Documents or as directed by the City. The material of thrust blocks shall be concrete composed of concrete aggregates and shall have a compressive strength of no less than two thousand five hundred (2,500) psi in twenty eight (28) days for standard cement Type II and shall be placed between solid, undisturbed ground and the fitting to be anchored. The area of bearing on the fitting and on the ground shall in each instance be that required by the City. Unless otherwise directed by the City the thrust blocks shall be placed so that the pipe and fitting joints will be accessible for repair. Metal harness or tie rods, of the size and type shown in the Contract Documents, shall be used. Refer to Standard Details: W-3 and W-4.

Article 08-03-050 Backfilling Trenches

(a) Definitions

- (1) Foundation: Over-excavation and backfill of the foundation only when the native trench bottom does not provide a firm-working platform for placement of the pipe bedding material.
- (2) Bedding: In addition to bringing the trench bottom to required grade, the bedding levels out any irregularities and ensures uniform support along the length of the pipe.
- (3) Haunch Zone: The backfill under the lower half of the pipe (haunches) distributes superimposed loadings.
- (4) Initial Zone: The backfill from the pipe midline to the top of the pipe zone provides the primary support against lateral pipe deformation for flexible pipe.
- (5) Final Zone: Backfill above the pipe zone to the top of the subgrade.

- (b) Materials for trench backfill may include flowable fill, Type I aggregate base course, Type II aggregate base course, and native materials. Individual pipe zone backfill requirements are presented below. The Contractor shall submit the material types to the City for approval prior to construction.

Native backfill shall only be utilized within the Final backfill zone. Native materials shall be free from sod, frozen earth, organic materials, rubbish, and debris. The material should be free of large stones (maximum clod size shall be < 3”) that may cause damage to the pipe, such as concentrated pipe loading.

Table 2: Type I Aggregate Base Course Gradation and Requirements

Sieve Size	Percentage of Dry Weight Passing Sieve
2-Inch	100
1-1/2-Inch	90-100
1-Inch	70-90
No. 4	30-65
No. 10	30-10
No. 16	15-20
No. 200	10-20
Plastic Index	12 Maximum
Liquid Limit	35 Maximum
Fractured Faces	70% Minimum
Total Available Water-Soluble Sulfates	Less than 0.3% by dry weight of soil

Table 3: Type II Aggregate Base Course Gradation and Requirements

Sieve Size	Percentage of Dry Weight Passing Sieve
1-Inch	100
3/4-Inch	85-95
No. 4	40-70
No. 10	35-45
No. 16	25-35
No. 200	6-18
Plastic Index	12 Maximum
Liquid Limit	35 Maximum
Fractured Faces	70% Minimum
Total Available Water-Soluble Sulfates	Less than 0.3% by dry weight of soil

Table 4: Native Backfill Requirements

Percentage by Weight Passing No. 200 Sieve	Plasticity Index Maximum
0-20.0	12
20.1 – 50.0	10
50.1 – 80.0	8
80.1 – 100	6
Liquid Limit	50 Maximum

- (1) Foundation: Trench foundations shall be stable prior to placing bedding material. If the City determines that unsuitable materials exist at the trench foundations, the Contractor shall remove and replace the material as directed by the City.
- (2) Pipe Bedding: The trench shall be excavated to a depth of four- to six-inches (4"-6") below the bottom of the pipe barrel and to a depth that will

be sufficient to provide two- to four-inches (2"-4") of clearance under the pipe bell (where applicable).

Uniform and stable bedding shall be provided for the pipe and any protruding features of its joints and/or fittings. The middle of the bedding equal to one-third (1/3) the pipe outside diameter may be loosely placed to allow for the pipe bell and other protruding features. Alternatively, the compacted bedding material may be excavated slightly to allow for continuous lines and grades of the pipe structure.

Pipe bedding shall consist of Type II aggregate base course or flowable fill. Bedding shall be backfilled to the required grade of the bottom of the pipe. The compaction shall provide a density, at minimum, equal to 95 percent of the maximum dry density in accordance with ASTM D 1557 with the exception of the middle-uncompacted area.

- (3) Haunch Zone Backfill: After the pipe or conduit is laid, the haunch areas shall be backfilled with Type II aggregate base course or flowable fill.

Compaction of the haunching material can be best accomplished by hand with tampers or suitable power compactors for maximum compacted lift thickness of six inches (6"). The Contractor shall take care to not disturb the pipe from its line and grade while compacting the backfill. Material suitably distant from the pipe shall be compacted to 95 percent of the maximum dry density in accordance with ASTM D 1557.

While compacting the embedment near the pipe with impact-type tampers, caution shall be taken to not allow direct contact of the equipment with the pipe.

- (4) Initial Backfill Zone: After the pipe or conduit is laid, the initial backfill area shall be backfilled with Type II aggregate base course or flowable fill. Avoid usage of impact tampers directly above the pipe until the full loose layer backfill depth above the pipe is obtained.

Table 5: Initial Backfill Zone Material Depths

Pipe or Conduit	Initial Zone
2-Inch or less diameter	6-Inches above the top of pipe
Greater than 2-Inch diameter	12-Inches above the top of pipe

- (5) Final Backfill Zone: The remaining backfill, to the top of subgrade, shall consist of Type I or Type II aggregate basecourse, native material, or floable

fill. The material shall be compacted to a minimum of 95 percent of the maximum dry density in accordance with ASTM D 1557.

- A. If flowable fill is used, flowable fill shall be placed from the top of the initial backfill zone to the bottom of the flexible pavement (replaces aggregate road base in the pavement section over the trench).
- B. Flowable fill cap may be required in the upper portion of the Final Backfill Zone for all non-residential roadways with a minimum thickness of twelve inches (12”) for minor collectors and eighteen inches (18”) for all major collectors and arterials.

(d) **Compaction**

- (1) Compaction shall be performed by mechanical means except in the haunch zone where compaction may be required by hand tamping. Mechanically compacted backfill shall be placed in layers of thickness compatible with the characteristics of the backfill and the type of equipment being used and shall have a maximum lift thickness as shown in the table below. The lifts shall be placed on both sides of the pipe at the same time to reduce pipe movement.

Table 6: Backfill Lift Thickness

Location	Maximum Compacted Lift Thickness (inches)	Maximum Loose Lift Thickness (inches)
Bedding, Haunch, and Initial Zones	6	8
Final Zone	8	12

- (2) Each layer shall be evenly spread, moistened, and tamped or rolled until the specified relative compaction has been attained.
- (3) Compaction minimum shall be 95 percent of the maximum dry density in accordance with ASTM D 1557 for trenches within the roadway prism. Compaction requirements for the final zone of trenches outside the roadway may be reduced to 90 percent of maximum dry density in accordance with ASTM D 1557.
- (4) Density testing shall be completed every 200-feet on mains or any part thereof per day, one per every three services or any part thereof per day.

- (5) Density testing per depth: Less than or equal to four-feet (4') shall require one at depth and one at subgrade per horizontal length above. Greater than four-feet (4') depths shall require one per six-inch (6") or larger pipe, then one every three (3) vertical feet, and one at subgrade per horizontal length above.
- (6) Where test results reveal non-compliance with the requirements of the Contract, the Contractor shall bear the costs of subsequent rework and retesting until the required specification compliance is obtained to the satisfaction of the City.
- (e) Minimum Pipe Spacing: If the pipe space between parallel pipes in a single trench is not conducive to mechanical backfill, then flowable fill shall be used.

ARTICLE 08-04 – FLUSHING AND DISINFECTION

Article 08-04-010 Work Description

- (a) This work includes materials and procedures for flushing and disinfection of water mains by the continuous feed method and by the slug method. The tablet method to disinfect pipelines shall not be used. Disinfect piping in accordance with AWWA C651 as modified below.
- (b) At all times, the new main shall be isolated from the active distribution system by physical separation until disinfecting water has been flushed out and satisfactory bacteriological testing has been completed in accordance with AWWA Standard C651. Water needed to fill the new main for testing and flushing purposes shall only be potable City water supplied through a temporary connection protected by a backflow device.
- (c) The backflow device must be tested and certified after installation on-site. A copy of the certification shall be given to the City and a copy shall be kept on-site with the device. Testing must be completed by a certified testing facility and be on the City's approved tester list.

Article 08-04-020 Job Conditions

- (a) Disposal of the chlorinated disinfection water and the flushing water is the Contractor's responsibility. The chlorinated disinfection water shall be properly disposed of by either pumping the water into a tank truck or through de-chlorination using a neutralizing chemical applied to the wasted water in accordance with AWWA C655 "Field Dechlorination" prior to directing the dechlorinated water into the environment or the sewer system.

- (b) An air gap of two (2) times the hose diameter must be provided to prevent cross contamination. The Contractor shall notify City (24) hours prior to disposal into the sewer system. Schedule the rate of flow and locations of discharges in advance to permit review and coordination with the City. Use potable water for chlorination. Submit request for use of water from waterline of the City forty-eight (48) hours in advance. All notifications to the City shall be completed in writing and acknowledged in writing prior to commencement of activities by the Contractor.

Article 08-04-030 Materials

- (a) Liquid Chlorine: Inject with a solution feed chlorinator and a water booster pump. Use an experienced operator and follow the instructions of the chlorinator manufacturer.
- (b) Calcium Hypochlorite (Dry): Dissolve in water to a known concentration in a drum and pump into the pipeline at a metered rate.
- (c) Sodium Hypochlorite (Solution): Further dilute in water to desired concentration and pump into the pipeline at a metered rate.
- (d) Chlorine Residual Test Kit: For measuring chlorine concentration, supply and use a medium range, drop count, titration kit or an orthotolidine indicator comparator with wide range color discs. Products: Hach Chemical or Helliege. Maintain kits in good working order available for immediate test of residuals at point of sampling. The use of expired DPD compound is prohibited.

Article 08-04-040 Execution

- (a) Continuous Feed Method for Pipelines: The continuous-feed method consists of completely filling the main with potable water, removing air pockets, then flushing the completed main to remove particulates, and refilling the main with potable water that has been chlorinated to a minimum of 50 mg/L. After a 24-hour holding period in the main there shall be a free chlorine residual of not less than 25 mg/L. Table 7 below provides the amount of chlorine required for each 100-feet of pipe across various diameters. A complete step-by-step procedure can be found in AWWA C651.

Table 7: Chlorine required to produce an initial 50-mg/L concentration in 100ft of pipe by diameter.

Pipe Diameter (inches)	100% Chlorine (lb)	1% Chlorine Solution (gal)
4	0.027	0.33
6	0.061	0.73
8	0.108	1.30
10	0.170	2.04
12	0.240	2.88

- (b) Slug Method for Pipelines: Introduce the water in the pipeline at a constant measured rate. At the start of the test section, feed the chlorine solution into the pipeline at a measured rate so that the chlorine concentration created in the pipeline is three hundred (300) mg/L. Feed the chlorine for a sufficient period to develop a solid column or "slug" of chlorinated water that will, as it passes along the line, expose all interior surfaces to a concentration of at least three hundred (300) mg/l for at least three (3) hours.
- (c) Disinfection of Valves and Appurtenances: During the period that the chlorine solution or slug is in the section of pipeline, pen and close valves to obtain a chlorine residual at hydrants and other pipeline appurtenances.
- (d) Disinfection of Connections to Existing Pipelines: Disinfect per AWWA C651. Flush with potable water until discolored water, mud, and debris are eliminated. Swab interior of pipe and fittings with a one (1) percent sodium hypochlorite solution. After disinfection, flush with potable water again until water is free of chlorine odor.
- (e) After the chlorine solution applied by the continuous feed method has been retained in the pipeline for twenty-four (24) hours. Confirm that a chlorine residual of fifty (50) mg/l minimum exists along the pipeline by sampling at air valves and other points of access.
- (f) With the slug method, confirm by sampling as the slug passes each access point and as it leaves the pipeline. After confirming the chlorine residual, flush the excess chlorine solution from the pipeline until the chlorine concentration in the water leaving the pipe is within 0.5 mg/l of the existing potable water system.
- (g) Pipeline Flushing: After confirming the chlorine residual, dechlorinate the excess chlorine solution from the pipeline until the chlorine concentration in the water leaving the pipe is within 0.5 mg/l of the replacement water. Replacement water sample shall be verified by the City.

- (h) Bacteriologic Tests: Collect two (2) samples, deliver to a certified laboratory within six (6) hours of obtaining the samples, and obtain a bacteriologic quality test to demonstrate the absence of coliform organisms in each separate section of the pipeline after chlorination and refilling. The City shall observe while samples are taken; written notification shall be received 24-hours prior to desired sampling. Sampling shall only occur between 8:30 AM and 3:00 Monday through Thursday, excluding holidays, unless preapproved by the City. Hydrants shall not be utilized as sampling points.

- (1) New Mains: An initial set of samples shall be completed and then resampled 24-hours later. In order to place the line into service both sets of samples must show the absence of coliform bacteria and acceptable aesthetic quality (e.g. chlorine residual, pH, alkalinity, specific conductance, turbidity). At the option of the City a heterotropic plate count (HPC) may be required.
 - A. For new mains, sets of samples shall be collected every 1,200 feet of the new water main, plus one set from the end of the line and at least one from each branch greater than one pipe length.

 - B. If trench water has entered the new main during construction or if, in the opinion of the City, excessive quantities of dirt or debris have entered the new main, bacteriologic samples shall be taken at intervals of approximately 200 feet. Samples shall be taken of water that has stood in the new main for at least 16 hours after final flushing is completed.

- (2) Repaired Mains: For repaired mains that were depressurized and/or wholly or partially dewatered, one set of samples will be required. Samples shall be collected downstream of the repair site and at intervals of approximately 200 feet within the length of pipe that was shut down. If the direction of flow is not known, or known to flow both directions, samples shall be collected on either side of the repair site.

- (i) Repetition of Procedure: If the initial chlorination fails to produce required residuals and bacteriologic tests, repeat the chlorination and retesting until satisfactory results are obtained.

- (j) Test Facility Removal: After satisfactory disinfection, replace air valves, restore the pipe coating, and complete the pipeline where temporary disinfection or test facilities were installed.

Article 08-04-050 Hydrostatic Tests

- (a) The Contractor shall be required to test all piping and other lines and appurtenances in the presence of the City. Test reports shall be required for each test and submitted to the City. Testing of lines shall be done without being connected to existing lines. If such connections are allowed it is with the understanding that the Contractor assumes any and all responsibility in case of damage, failure and/or contamination to the existing system. The new water pipe will be tested before the backfilling is done. After the pipe is laid, earth cover shall be placed over the middle of the pipe joints, leaving the corp. stops, valves, service taps and laterals uncovered. The pipe will be filled with water, and the pressure in the pipeline shall be raised by means of a motor-driven water pump to a hydrostatic pressure of one hundred fifty (150) psi or one and one-half (1.5) times the normal working pressure, whichever is greater, at the lower end of the pipe section. Applicable AWWA C-600 standards and procedures shall be adhered to for determination of losses on pipes up to thirty-inches (30") in diameter. If any leaks appear in the pipe, they shall be repaired to the satisfaction of the City, and the test shall be performed until the pipe holds the prescribed pressure. As an alternative, the Contract may opt to test the pipeline in sections between mainline valves or as approved by the City.
- (b) All testing shall be conducted in accordance with AWWA Standard C600 for ductile iron mains and AWWA Standard C605 for PVC mains and those portions of the above standard related to hydrostatic tests shall apply to any type of water main construction. Test pressure shall be one hundred fifty (150) psi or one and one-half (1.5) times the normal working pressure, whichever is greater.
- (c) All taps, gauges and necessary equipment shall be provided by the Contractor; however, the City may utilize gauges provided by the City at their discretion.
- (d) Leakage Defined: Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain pressure within five (5) psi of the specified test pressure after the air in the pipeline has been expelled and the pipe has been filled with water. If the pressure drops more than five (5) pounds in thirty (30) minutes, the pipe has failed to pass the test. If the pressure drop is less than five (5) pounds in thirty (30) minutes, water shall be added to the pipe section to maintain the one hundred fifty (150) psi test pressure and the volume of water added shall be duly recorded. This procedure shall be repeated at each thirty (30) minute intervals for the test period. The total volume of water added to the pipe section to maintain the one hundred fifty (150) psi test pressure shall represent the total leakage during the test.
- (e) Allowable leakage: No pipe installation will be accepted if the leakage is greater than that determined by the following formula:

$$L = \frac{\text{DIP}}{133,200} \sqrt{SD\sqrt{P}} \quad \text{or} \quad L = \frac{\text{PVC}}{7,400} \sqrt{ND\sqrt{P}}$$

where L is the allowable leakage, in gallons per hour, S is the length of pipe tested, in feet; N is the number of joints in the length of pipeline tested, D is the nominal diameter of the pipe, in inches, and P is the average test pressure during the leakage test, in pounds per square inch gauge.

The table on the next page presents the allowable leakage per various pipe diameters per 1,000 feet of pipeline.

Table 8: Allowable Leakage (GPH) per 1,000 Feet of Pipeline (DIP)

Avg. Test Pressure	6	8	10	12	14	16	18	24	30
PSI	In.	In.	In.	In.	In.	In.	In.	In.	In.
350	0.84	1.12	1.40	1.69	1.97	2.25	2.53	3.37	4.21
300	0.78	1.04	1.30	1.56	1.82	2.08	2.34	3.12	3.90
275	0.75	1.00	1.24	1.49	1.74	1.99	2.24	2.99	3.73
250	0.71	0.95	1.19	1.42	1.66	1.90	2.14	2.85	3.56
225	0.68	0.90	1.13	1.35	1.58	1.80	2.03	2.70	3.38
200	0.64	0.85	1.06	1.28	1.48	1.70	1.91	2.55	3.19
175	0.59	0.80	0.99	1.19	1.39	1.59	1.79	2.38	2.98
150	0.55	0.74	0.92	1.10	1.29	1.47	1.66	2.21	2.76

Table 9: Allowable Leakage (GPH) per 1,000 Feet of Pipeline (PVC)

Avg. Test Pressure	6	8	10	12	14	16	18	24	30
PSI	In.	In.	In.	In.	In.	In.	In.	In.	In.
300	0.70	0.94	1.17	1.40	1.64	1.87	2.11	2.81	3.51
275	0.67	0.90	1.12	1.34	1.57	1.79	2.02	2.69	3.36
250	0.64	0.85	1.07	1.28	1.50	1.71	1.92	2.56	3.21
225	0.61	0.81	1.01	1.22	1.42	1.62	1.82	2.49	3.04
200	0.57	0.76	0.96	1.15	1.34	1.53	1.72	2.29	2.87
175	0.54	0.75	0.89	1.07	1.25	1.43	1.61	2.15	2.68
150	0.50	0.66	0.83	0.99	1.16	1.32	1.49	1.99	2.48

- (f) When testing against closed metal-seated valves, an additional leakage per closed valve of 0.0078 gal/h/in. (0.0012 L/h/mm) of nominal valve size shall be allowed.
- (g) When hydrants are in the test section, the test shall be made against the closed hydrant.

- (h) Acceptance of Installations: Acceptance shall be determined on the basis of allowable leakage. If any test of pipe laid disclosed leakage greater than specified the Contractor shall, at the Contractor's expense, locate and make repairs as necessary until the leakage is within the specified allowance.
- (i) All visible leaks are to be repaired regardless of the amount of leakage.
- (j) The Contractor shall be notified of any leaks that may occur during the two (2) year warranty period and shall make immediate arrangements after he is notified to return to the job site and repair any leaks that may develop in the pipeline.

Article 08-04-060 Asbestos Containing Materials

It is the Contractor's responsibility to follow all EPA, OSHA, New Mexico Solid Waste Management Regulations, and all other regulations when working with asbestos-cement (AC) pipe. Cutting of AC pipe will not be permitted. At the point of tie-in connection to an existing AC line, the Contractor shall excavate to the nearest joint and remove the section of pipe in a single piece. The AC pipe must remain wet and encapsulated with 6 mil or thicker plastic bag per NM Solid Waste Management Regulations until the pipe is delivered to the Special Waste Facility. Existing AC pipe shall remain abandoned in place whenever possible.

END OF ARTICLE CHAPTER 08

CHAPTER 09 – AIR-RELEASE AND VACUUM-RELIEF VALVES
ARTICLE 09-01 - GENERAL

Article 09-01-010 Work Description

This work includes materials and installation of combination air-release and vacuum-relief valves.

ARTICLE 09-02 – VALVE COMPONENTS

Article 09-02-010 Materials

Materials of construction for air and vacuum valves for water service shall be as follows:

Item	Material	Specification
Body and cover	Cast iron or brass	ASTM A 48, Class 30; or ASTM A 126, Class B
Float, guide rod, guide bushings	Stainless steel	AISI Type 316, ASTM A 240 or A 276
Seat	Buna-N	--

Article 09-02-020 Seating

Valves shall be seated drip-tight at a pressure of one (1) psi.

Article 09-02-030 Valves End Connections

Valves shall have threaded ends and comply with ANSI B1.20.1.

Article 09-02-040 Combination Air-Release and Vacuum Valves

Valves shall have a float with lever arm to actuate a poppet valve. A needle shall be attached to the float arm. The poppet valve shall serve to admit large quantities of air when the pipeline drains. The needle shall serve to release small quantities of air as the pipeline fills or as air accumulates in the pipeline. Valves shall have an operating pressure of three hundred (300) psi. Body and cover shall be cast iron (ASTM A 48, Class 30). Float, lever, and poppet shall be Type 316 stainless steel (ASTM A 240 or A 276). Seat shall be Buna-N. Valves shall be Val-Matic Model 202C, as scheduled on plans or equivalent.

Article 09-02-050 Service Saddles

Service saddles shall be sized as called out for in the Project Plans and shall be pre-approved.

Article 09-02-060 Gate Valves

Gate valves shall be sized as called out for in the Contract Documents; shall be non-rising stem, solid wedge, threaded ends; and shall be pre-approved.

Article 09-02-070 Enclosures

- (a) Precast Manhole
 - (1) Risers and adjustment rings shall be standard precast manhole sections of 4,000 psi reinforced concrete.
 - (2) Manhole frame and lid shall be ductile iron; H20 traffic rated, marked “Water” and shall have three (3) half-inch (1/2”) diameter vent holes.
- (b) Galvanized meter box shall be sized as called out for in the Contract Documents.
- (c) Steel frame and lid shall be sized as called out for in the Contract Documents and shall be vehicle traffic rated.

Article 09-02-080 Piping

Piping shall be brass, standard strength, highest quality, seamless, threaded, reamed and chamfered.

Article 09-02-090 Drainage Media

Drainage media shall be clean crushed rock, three-quarter inch (3/4”) size.

ARTICLE 09-03 – EXECUTION

Article 09-03-010 Installation

Locate combination, air-release and vacuum-relief valves at high points (“peaks”) of the pipeline. Holes in the pipe shall be the same size as the service saddle outlet. Position enclosure and manhole frame and lid to allow personnel entry. Valve and enclosure shall be set vertical. Clean threaded joints by wire-brushing or swabbing. Apply Teflon joint compound or Teflon tape to pipe threads prior to installation of threaded valves. All joints shall be watertight. Refer to Standard Detail W-15.

Article 09-03-020 Valve Pressure Testing

Test valves at the same time that the connecting pipelines are pressure tested. See Chapter 8 Water Supply System, for pressure testing requirements. Protect or isolate any parts of valves, operators, or control and instrumentation systems whose pressure rating is less than the test pressure.

END OF CHAPTER 09

CONTRACTOR NOTE:

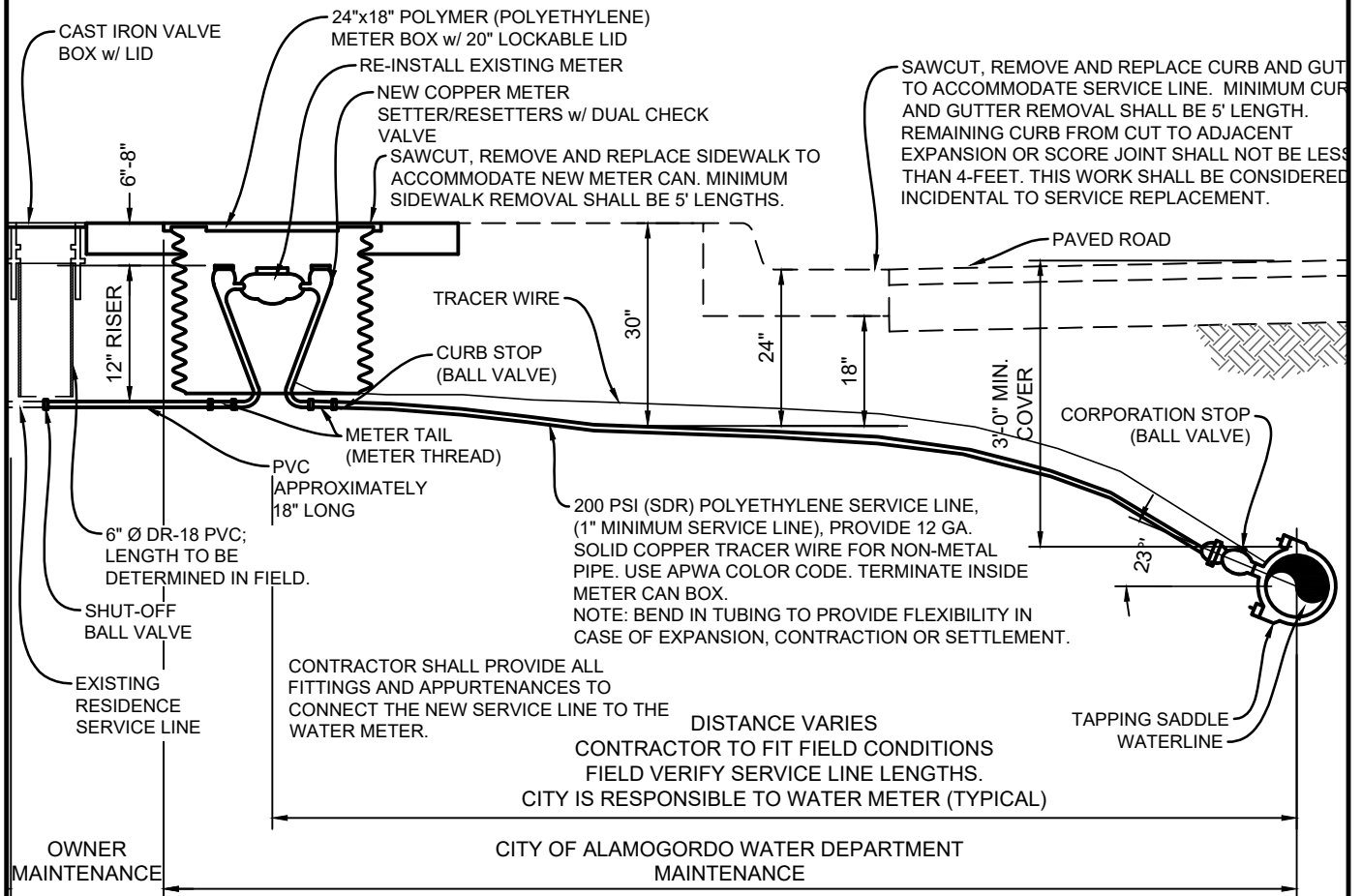
METER CAN SHALL NOT BE INSTALLED IN ACCESSIBLE (ADA) RAMP PAN, SLOPE OR LANDINGS.

IN SOME CASES THE EXISTING WATER METER IS SURROUNDED BY CONCRETE, ANY DAMAGE BY THE CONTRACTOR TO THE ADJACENT CONCRETE SHALL BE REPLACED AT CONTRACTOR'S EXPENSE.

CONTRACTOR SHALL INSCRIBE A 'W' ON TOP OF CONCRETE CURB (IN-LINE W/ NEW WATER SERVICE) TO INDICATE THE LOCATION OF THE NEW WATER SERVICE LINE. CONTRACTOR TO RE-INSCRIBE "W" INTO NEW CONCRETE IF EXISTING CONCRETE IS REMOVED AND REPLACED.

THE WATER SERVICE LINE MAY BE PUNCHED UNDERNEATH THE EXISTING CURB AND GUTTER AS LONG AS THE RESULTING HOLE IS LESS THAN 6-INCHES IN THE HORIZONTAL DIRECTION.

METER CAN SHALL BE INSTALLED IN SIDEWALKS OR LANDSCAPE AREA (BETWEEN SIDEWALK AND BACK OF CURB) WITHIN RIGHT OF WAY. METER CANS SHALL NOT BE INSTALLED IN DRIVEWAYS OR VEHICULAR TRAFFIC FLOWS UNLESS LOCATION(S) AND METER CAN TYPE(S) HAVE BEEN PRE-APPROVED IN WRITING BY THE PUBLIC WORKS DEPARTMENT AND THE ENGINEERING DEPARTMENT PRIOR TO INSTALLATION.



MAINTENANCE RESPONSIBILITY NOTE:


THE CITY OF ALAMOGORDO WATER DEPARTMENT WILL BE RESPONSIBLE FOR MAINTENANCE OF THE WATER LINE FROM THE WATER MAIN TO THE WATER METER. THE OWNER WILL BE RESPONSIBLE FOR MAINTENANCE OF THE WATER LINE FROM THE WATER METER TO THE BUILDING.

Typical City of Alamogordo Water Service Detail

NOTE:

1. THE CITY OF ALAMOGORDO RESERVES THE RIGHT TO CHANGE AND/OR MODIFY ANY ITEM(S) EITHER DETAILED OR SPECIFIED ON THIS DRAWING.
2. WATER SERVICE DETAIL AND WATER SERVICE INSTALLATION MATERIAL LISTING ARE TYPICAL FOR 3/4" WATER SERVICE. ADJUSTMENTS SHALL BE MADE TO FITTINGS, CONNECTIONS, SERVICE LINE, ECT. SIZE AS REQUIRED FOR WATER SERVICES LARGER THAN 3/4".
3. ALL FITTING, CONNECTIONS, SERVICE LINE, ETC. SHALL BE RATED FOR 200 P.S.I. (MINIMUM) WORKING PRESSURE.

SCALE: NOT TO SCALE

	<p>CITY OF ALAMOGORDO TECHNICAL STANDARD DRAWINGS</p>	<p>ISSUE DATE: APRIL 2021</p>
	<p>WATER SERVICE DETAIL</p>	<p>REVISION DATE: ----</p>
		<p>SHEET NO: W-1</p>

TYPICAL WATER SERVICE INSTALLATION MATERIAL LISTING:

COLD WATER METER: WATER METERS SHALL BE MULTIJET, READING IN CUBIC FEET AND ACCEPTABLE FOR USE WITH ZENNER STEALTH READER MIU SYSTEM. NO SUBSTITUTIONS. REFER TO ARTICLE 02-026.1 WATER SUPPLY SYSTEM FOR THE LIST OF COMPATIBLE WATER METERS. WATER METERS LARGER THAN 2-INCHES SHALL BE POSITIVE DISPLACEMENT (COMPOUND) METERS AND ACCEPTABLE FOR USE WITH ZENNER STEALTH READER MIU SYSTEM.

SERVICE (TAPPING) SADDLE: TAPPING SADDLES REQUIRE THE PRE-APPROVAL IN WRITING BY PUBLIC WORKS DEPARTMENT AND ENGINEERING DEPARTMENT PRIOR TO INSTALLATION. ACCEPTABLE SADDLES SHALL HAVE DOUBLE STRAPS SECURED BY FOUR BOLTS. SADDLES SHALL ALSO HAVE 1" IP THREADED OUTLET AND BE MADE OF THE FOLLOWING ACCEPTED MATERIALS:

BODY - DUCTILE IRON BODY, CONFORMING TO ASTM A-536, WITH 10-12 MIL FUSION EPOXY COATING OR NYLON COATED.

STRAPS - TYPE 304 (18-8) HEAVY GRADE STAINLESS STEEL, CONFORMING TO ASTM A-240.

NUTS & WASHERS - UNC ROLL THREAD TYPE 304 (18-8) STAINLESS STEEL BOLTS WITH HEAVY HEX NUTS. ROD FOR BOLTS, CONFORMING TO ASTM A-240, AND NUTS, CONFORMING TO ASTM A-194. ALL WELDS FULLY PASSIVATED FOR ENHANCED CORROSION RESISTANCE. NUTS COATED TO PREVENT GALLING. INSTALLATION SHALL CONFORM TO MANUFACTURER'S TORQUE SPECIFICATIONS.

GASKET - NITRILE BUTADIENE RUBBER (NBR), ASTM D-2000 MBC-610 OR HD EDPM O-RING.

NOTE: SADDLE WITH SLENDER SINGLE STRAPS SECURED BY TWO BOLTS, CAST IRON BODY AND STEEL STRAPS ARE NOT ACCEPTABLE.

CORPORATION STOP: CORPORATION STOP SHALL BE BALL VALVE TYPE AND RATED FOR 150 P.S.I. (MINIMUM) WORKING PRESSURE. CORPORATION STOP SHALL HAVE A 1" IP THREADED INLET WITH A PACK JOINT CONNECTION FITTING OR MUELLER INSTA-TITE CONNECTION FOR 1" PVC SERVICE LINE.

SERVICE LINE: SERVICE LINE SHALL BE 1" BLUE SDR POLYETHYLENE, 200 PSI, CONFORMING TO ASTM D2737 AND SPECIFIED FOR POTABLE WATER.

CURB STOP: CURB STOP SHALL BE BALL VALVE TYPE AND RATED FOR 150 P.S.I. (MINIMUM) WORKING PRESSURE.

COPPER METER RESETTER: COPPER METER RESETTER (METER YOKE) SHALL BE HORIZONTAL STYLE, 5/8"x3/4" (METER YOKE) BRASS/COPPER WITH LOCK WING STYLE ANGLE METER VALVE ON INLET AND TOP ENTRY ANGLE DUAL CHECK VALVE ON OUTLET WITH BRASS SUPPORT BAR. THE CONNECTIONS FOR METER SHALL BE BRASS SWIVEL NUT WITH WIRE SEAL HOLE AND METER SUPPORT LIP. INLET AND OUTLET THREADS SHALL BE METER THREAD. THE CONNECTION TO THE 1" SERVICE LINE SHALL BE MADE WITH AN AY McDONALD 76102 O.A.E. CTS MAC-PAC JOINTxFNPT CURB STOP AND A 3/4"x1" BRASS METER BUSHING. IF A THERMAL-COIL BOX IS UTILIZED THE FOLLOWING MATERIALS SHALL BE USED VERSUS THE METER YOKE:

- POLYBUTYLENE TUBING
- A LOCK WING METER STOP (INLET 3/4")
- A DUAL CHECK VALVE (OUTLET 3/4")
- A 3/4" OUTSIDE METER THREADED INLET
- A 3/4" OUTSIDE METER THREADED OUTLET

METER BOXES: SPECIFICATION IS BASED ON USE OF "DFW PLASTICS, INC." BY DFW PLASTICS, INC., 901 E INDUSTRIAL AVENUE, SAGINAW TX 76131, WITH ATTRIBUTES AS DESCRIBED BELOW. EQUAL PRODUCTS OF OTHER WATER METER CAN MANUFACTURERS MAY BE ACCEPTABLE WHEN PRE-APPROVED BY PUBLIC WORK DEPARTMENT AND ENGINEERING DEPARTMENT. PRE-APPROVED EQUAL, SUBSTITUTIONS UNDER ARTICLE 01-002.4.

THIS PRODUCT IS DESIGNED TO WITHSTAND LOADING IN NON-DELIBERATE AND INCIDENTAL TRAFFIC. NOT TO BE INSTALLED IN ROADWAYS, DRIVEWAYS, PARKING LOTS, OR ALLEYS. METER PIT LID SHALL BE BLACK AND CONSTRUCTED OUT OF MODIFIED POLYETHYLENE MATERIAL FOR MAXIMUM DURABILITY AND CORROSION RESISTANCE. THE BLACK MATERIAL IS FOR MAXIMUM UV PROTECTION. THE BLACK MATERIAL SHALL BE UNIFORM THROUGHOUT THE METER PIT LID FOR MAXIMUM LONGEVITY AND NOT HAVE A FOAMING AGENT THAT CREATES AIR POCKETS WITHIN THE POLYMER LID.

VERTICAL AND LATERAL LOAD RATING:

- COMPLIANT WITH AASHTO, DESIGN LOAD OF H-10; ASTM C857-16, DESIGN LOAD OF A-8, 8,000 LBS. TRANSFERRED THROUGH A 10" X 10" STEEL PLATE CENTERED IN THE COVER AND BODY.
- COMPLIANT WITH AASHTO, DESIGN LOAD OF H-20; ASTM C857-16, DESIGN LOAD OF A-16, 16,000 LBS. TRANSFERRED THROUGH A 10" X 20" STEEL PLATE CENTERED ON THE COVER AND BODY.
- THIS PRODUCT IS DESIGNED TO WITHSTAND H-10 AND H-20 LOADING IN NON-DELIBERATE OR INCIDENTAL TRAFFIC AREAS.

NOT INTENDED TO BE INSTALLED IN ROADWAYS.

POLYMER LID

- THE POLYMER LID SHALL HAVE A MOLDED KEY HOLE AND PLASTIC LOCK UNDERNEATH LID - AS ILLUSTRATED.
- THE POLYMER LID SHALL HAVE ONE (1) MOLDED SLIDE MOUNT FOR PLACEMENT OF AMR/AMI DEVICE - AS ILLUSTRATED.
- THE POLYMER LID SHALL SEAT SECURELY AND EVENLY INSIDE THE METER PIT AND SHALL NOT OVERLAP THE TOP EDGE OF THE METER PIT.
- THE POLYMER LID SHALL HAVE MOLDED TREAD-PATTERN FOR SKID RESISTANCE - TREAD DIMENSIONS SHALL BE 0.188" X 0.938" X 0.150" DEEP.
- THE POLYMER LID SHALL HAVE "WATER METER" MOLDED INTO THE LID - FONT SHALL BE STD FADAL CNC FONT WITH 1" CHARACTERS X 0.150" DEEP.
- THE POLYMER LID SHALL BE BLACK AND HAVE A MOLDED RECYCLED EMBLEM WITH A MINIMUM OF 50% POST CONSUMER RECYCLED AND 50% POST INDUSTRIAL/ PRE CONSUMER RECYCLED CONTENT- VERIFIED WITH A LEED PRODUCT DOCUMENTATION.

POLYMER BODY

- THE POLYMER BODY SHALL BE BLACK AND HAVE A MINIMUM OF 3/8" WALL THICKNESS - AS ILLUSTRATED.
- THE POLYMER BODY SHALL HAVE MINIMUM INSIDE WORKING ROOM OF (23-1/4") - AS ILLUSTRATED.
- THE POLYMER BODY SHALL HAVE CRUSH RESISTANT RIBBING ALONG THE OUTSIDE OF THE BOX WITH 1-5/8" BASE FOOTING LOCATED AT THE BOTTOM OF THE METER PIT TO HELP ELIMINATE SINKING OR FLOATING ONCE INSTALLED.
- THE POLYMER BODY SHALL HAVE A STRAIGHT WALL DESIGN AND NOT BE FLARED AS TO ALLOW FOR ADJUSTMENT TO GRADE AFTER INSTALLATION.
- THE POLYMER BODY SHALL HAVE ONE PIPE SLOT MOLDED ON EACH END OF THE BODY THAT MEASURES (3" X 5-3/4").
- THE POLYMER BODY SHALL HAVE A MOLDED RECYCLED EMBLEM WITH A MINIMUM OF 35% POST INDUSTRIAL/ PRE CONSUMER RECYCLED CONTENT - VERIFIED WITH A LEED PRODUCT DOCUMENTATION.

WHENEVER IN THE SPECIFICATIONS, ANY PARTICULAR MATERIALS, PROCESS AND/OR EQUIPMENT IS INDICATED OR SPECIFIED BY PATENT, PROPRIETARY, OR BRAND NAME, OR BY NAME OF MANUFACTURER, SUCH WORDING SHALL BE DEEMED TO BE USED FOR THE PURPOSE OF FACILITATING DESCRIPTION OF THE MATERIAL, PROCESS, AND/OR EQUIPMENT DESIRED, AND SHALL BE DEEMED TO BE FOLLOWED BY THE WORDS "OR EQUAL". THE LISTS OF ACCEPTABLE MATERIAL ARE NOT INTENDED TO BE COMPREHENSIVE LISTS, OR IN ANY ORDER OF PREFERENCE. THE BIDDER MAY OFFER ANY MATERIAL, PROCESS, AND/OR EQUIPMENT WHICH COMPLY WITH THE GOVERNING SPECIFICATIONS WHICH THE BIDDER CONSIDERS TO BE EQUIVALENT TO THAT WHICH IS INDICATED OR SPECIFIED.

THE NOTED METER BOX SIZE IS FOR A TYPICAL FOR 3/4" AND 1" WATER SERVICES. METER BOXES FOR WATER SERVICES LARGER THAN 1 1/2" SHALL BE PRE-APPROVED IN WRITING BY THE PUBLIC WORKS DEPARTMENT AND ENGINEERING DEPARTMENT. SCALE: NOT TO SCALE



CITY OF ALAMOGORDO
TECHNICAL STANDARD DRAWINGS

TYPICAL WATER SERVICE INSTALLATION MATERIAL LISTING

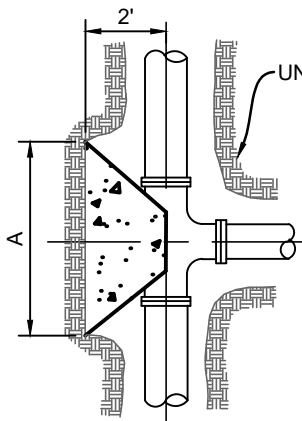
ISSUE DATE:

APRIL 2021

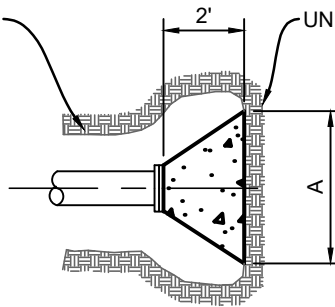
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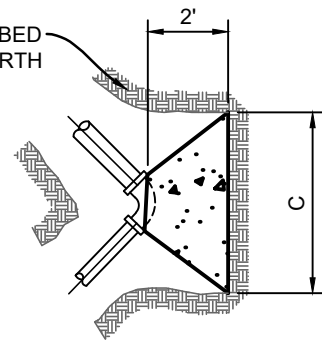
W-2



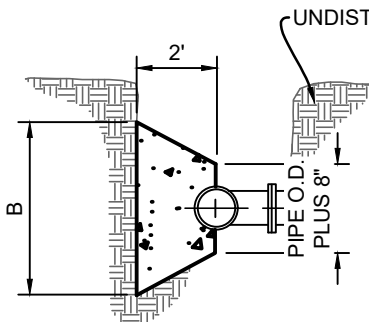
Plan View



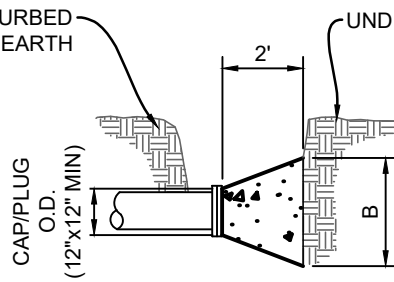
Plan View



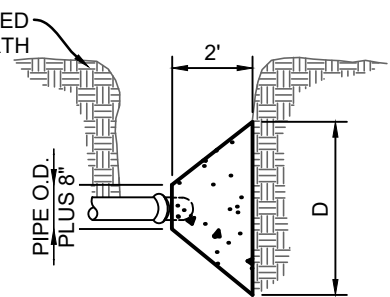
Plan View



ELEVATION
BLOCKING FOR TEE



ELEVATION
BLOCKING FOR PLUG/CAP



ELEVATION
BLOCKING FOR ELBOW

PIPE SIZE	TEE, CAP, PLUG, ELBOW ANGLE	A	B	C	D
4"	TEE OR CAP/PLUG	2'-0"	1'-0"	-	-
4"	90° 45°	-	-	2'-0"	2'-0"
4"	22 1/2" 11 1/4"	-	-	2'-0"	2'-0"
6"	TEE OR CAP/PLUG	2'-0"	2'-0"	-	-
6"	90° 45°	-	-	2'-0"	2'-0"
6"	22 1/2" 11 1/4"	-	-	2'-0"	2'-0"
8"	TEE OR CAP/PLUG	3'-0"	3'-0"	-	-
8"	90°	-	-	3'-0"	3'-0"
8"	45°	-	-	2'-0"	2'-0"
8"	22 1/2" 11 1/4"	-	-	2'-0"	2'-0"

PIPE SIZE	TEE, CAP, PLUG, ELBOW ANGLE	A	B	C	D
10"	TEE OR CAP/PLUG	3'-0"	3'-0"	-	-
10"	90°	-	-	3'-6"	3'-6"
10"	45°	-	-	3'-0"	3'-0"
10"	22 1/2" 11 1/4"	-	-	2'-0"	2'-0"
12"	TEE OR CAP/PLUG	3'-6"	3'-6"	-	-
12"	90°	-	-	4'-0"	4'-0"
12"	45°	-	-	3'-6"	3'-6"
12"	22 1/2" 11 1/4"	-	-	2'-0"	2'-0"
14"	TEE OR CAP/PLUG	4'-0"	4'-0"	-	-
14"	90°	-	-	5'-0"	5'-0"
14"	45°	-	-	3'-6"	3'-6"
14"	22 1/2" 11 1/4"	-	-	3'-0"	3'-0"

GENERAL NOTES:

1. ALL FITTINGS AND BURIED DUCTILE IRON PIPE SHALL BE ENCASED IN POLYETHYLENE.
2. ALL VERTICAL BENDS SHALL BE RESTRAINED JOINTS.
3. PIPE SIZES GREATER THAN 14-INCHES REQUIRES DESIGN AND CERTIFICATION BY ENGINEER.

SCALE: NOT TO SCALE



CITY OF ALAMOGORDO
TECHNICAL STANDARD DRAWINGS

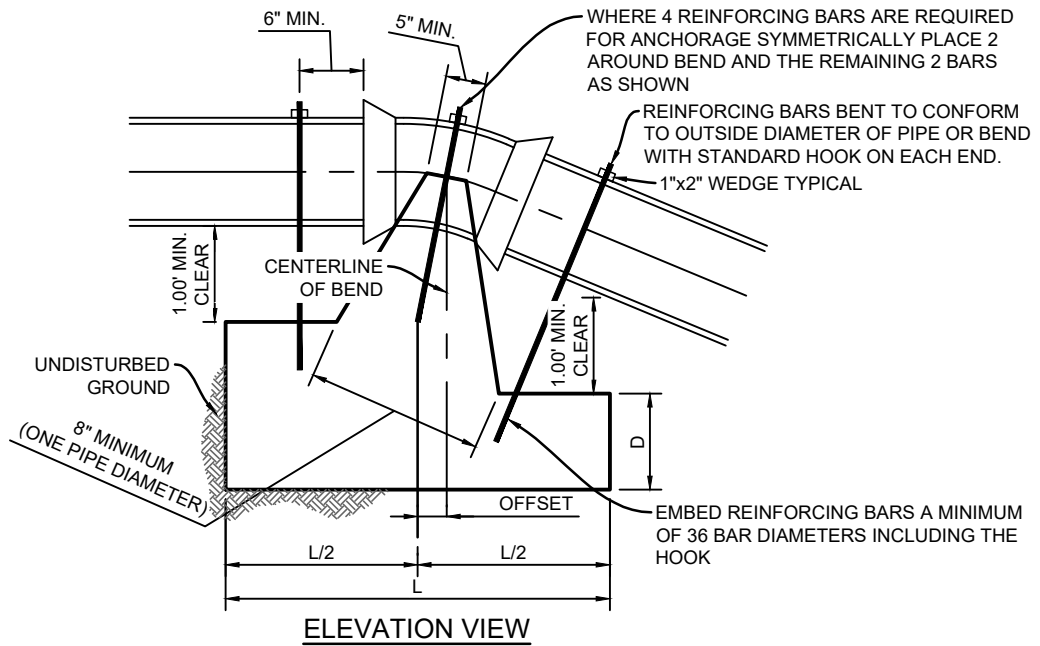
THRUST BLOCK DETAILS

ISSUE DATE:
APRIL 2021

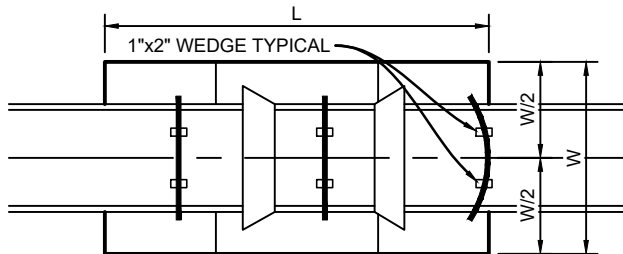
REVISION DATE:

SHEET NO:

W-3



ELEVATION VIEW



PLAN VIEW

GENERAL NOTES:

1. DESIGN TEST PRESSURE IS 150 PSI.
2. ALL REINFORCING BARS AND WEDGES SHALL BE FACTORY ZINC COATED. REPAIR DAMAGED COATING PER MANUFACTURER'S RECOMMENDATIONS.
3. PIPE SIZES GREATER THAN 14-INCHES REQUIRES DESIGN AND CERTIFICATION BY ENGINEER.

BEND		ANCHORAGE BLOCK DIMENSIONS					
		SIZE					
		4"	6"	8"	10"	12"	14"
11.25° BEND	D	2'-0"	2'-6"	3'-0"	3'-6"	3'-9"	4'-0"
	L	2'-0"	2'-6"	3'-0"	3'-6"	3'-9"	4'-0"
	W	1'-9"	2'-3"	2'-6"	3'-0"	3'-6"	4'-0"
	OFFSET	0'-6"	0'-6"	0'-6"	0'-6"	0'-6"	0'-6"
	REBAR	3 - #3	3 - #3	3 - #3	3 - #3	3 - #3	3 - #3
22.5° BEND	D	2'-6"	3'-0"	3'-9"	4'-3"	4'-9"	5'-0"
	L	2'-6"	3'-0"	3'-9"	4'-3"	4'-9"	5'-0"
	W	2'-0"	2'-9"	3'-3"	4'-0"	4'-6"	5'-0"
	OFFSET	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"
	REBAR	3 - #3	3 - #3	3 - #3	3 - #3	3 - #3	3 - #4
45° BEND	D	3'-0"	3'-9"	4'-6"	5'-3"	5'-9"	6'-6"
	L	3'-0"	3'-9"	4'-6"	5'-3"	5'-9"	6'-6"
	W	2'-9"	3'-6"	4'-3"	5'-0"	5'-6"	6'-0"
	OFFSET	1'-0"	1'-3"	1'-6"	1'-9"	2'-0"	2'-3"
	REBAR	3 - #3	3 - #3	3 - #3	3 - #4	3 - #4	3 - #5

SCALE: NOT TO SCALE



**CITY OF ALAMOGORDO
TECHNICAL STANDARD DRAWINGS**

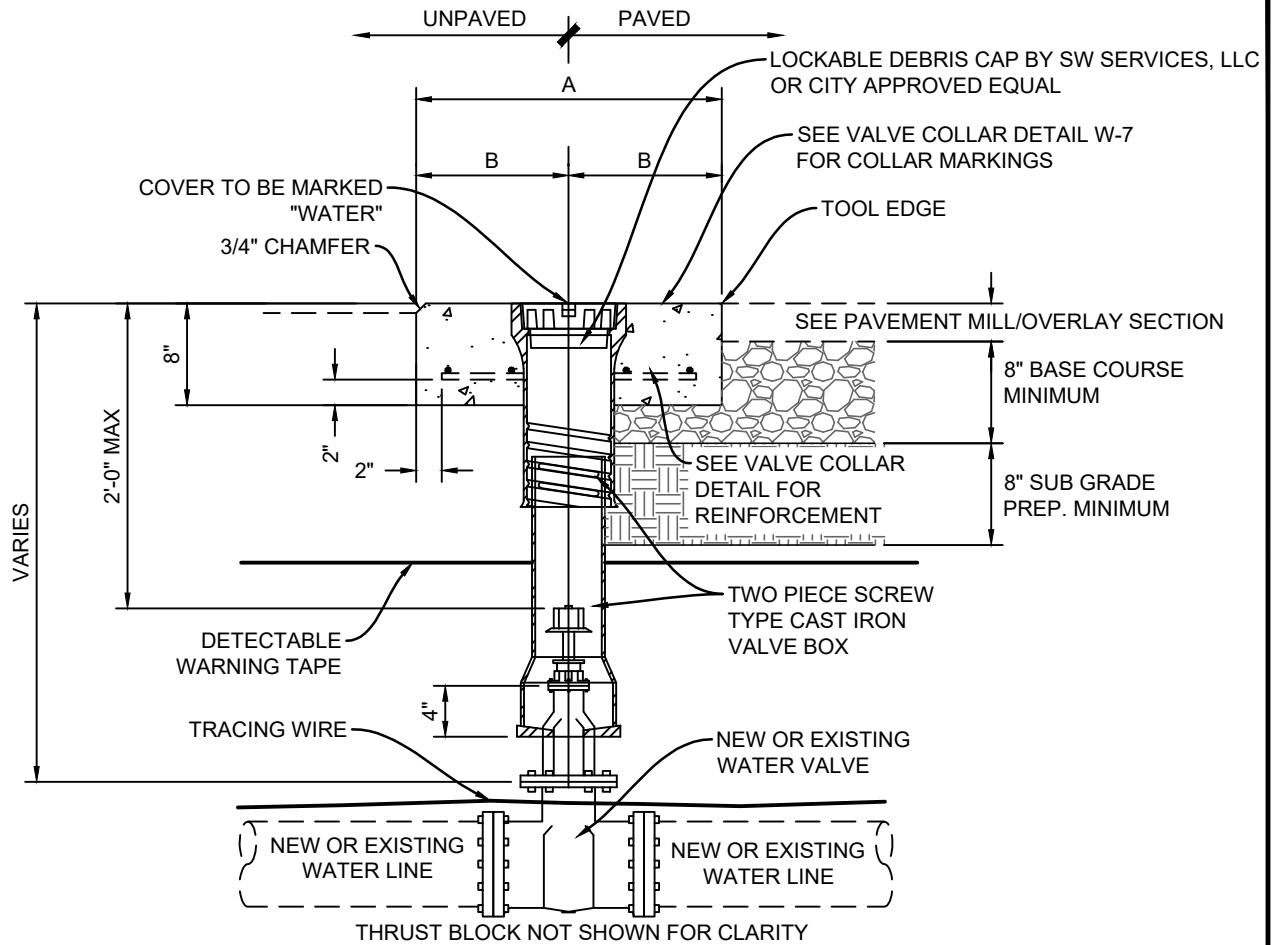
ANCHORAGE VERTICAL BEND DETAIL

ISSUE DATE:
APRIL 2021

REVISION DATE:

SHEET NO:

W-4



CONCRETE COLLAR TABLE		
TYPE	PAVED	UNPAVED
A	2'-0"	4'-0"
B	1'-0"	2'-0"

WATER VALVE NOTES:

1. VALVE EXTENSIONS ARE REQUIRED ON ANY VALVE NUT OVER 36-INCHES IN DEPTH. THE EXTENSION SHALL BE WITHIN 18-INCHES OF THE SURFACE.
2. INTERSECTING WATER MAINS SHALL BE EQUIPPED WITH 3 AND/OR 4 ISOLATION CONTROL VALVES.

SCALE: NOT TO SCALE



**CITY OF ALAMOGORDO
TECHNICAL STANDARD DRAWINGS**

VALVE BOX DETAIL

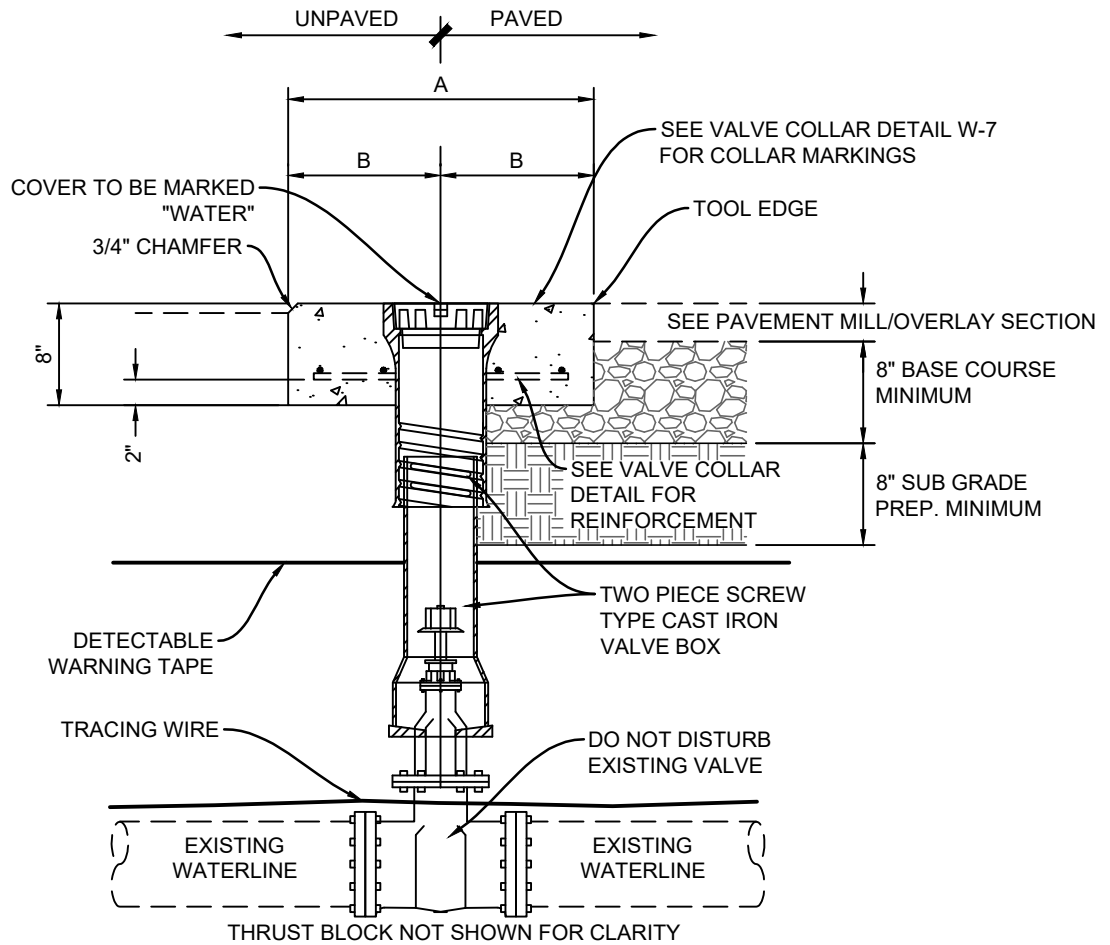
ISSUE DATE:

APRIL 2021

REVISION DATE:

SHEET NO:

W-5



Adjust Valve Box Detail

GENERAL NOTES:

1. SEE TECHNICAL SPECIFICATION FOR BACKFILL MATERIAL SPECIFICATIONS AND COMPACTION REQUIREMENTS.
2. SEE SECTION 2, STREET STANDARDS FOR PAVEMENT, BASE COURSE COURSE AND SUB-GRADE PREP. REQUIREMENTS.
3. SIDES OF CONCRETE COLLAR TOP SHALL BE PARALLEL AND PERPENDICULAR TO THE NORMAL STREET TRAFFIC FLOW.

SCALE: NOT TO SCALE



CITY OF ALAMOGORDO
TECHNICAL STANDARD DRAWINGS

ADJUST VALVE BOX DETAIL

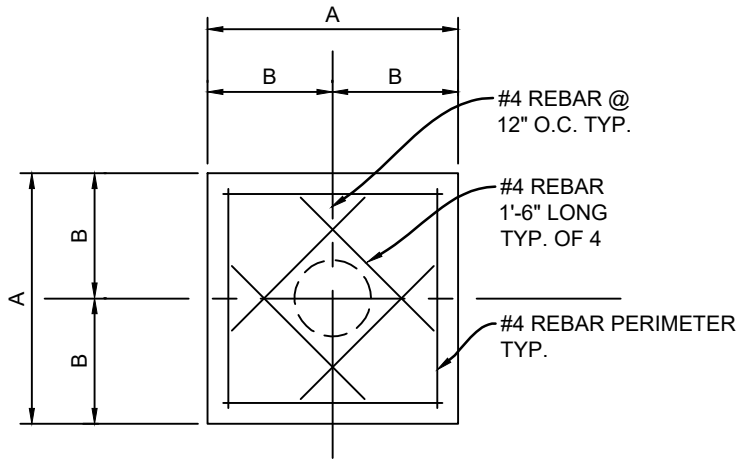
ISSUE DATE:

APRIL 2021

REVISION DATE:

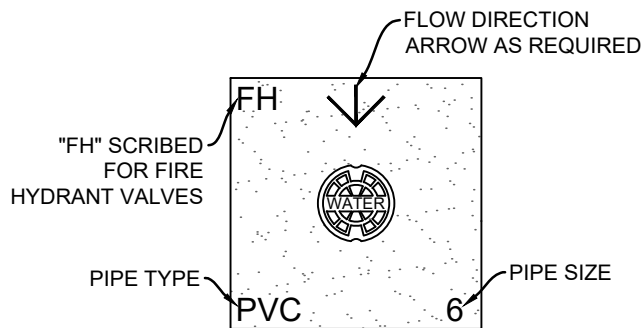
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W-6

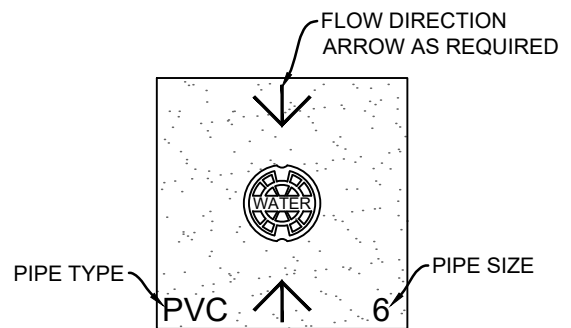


Valve Box Concrete Collar Detail

CONCRETE COLLAR TABLE		
DIMENSION	PAVED	UNPAVED
A	2'-0"	4'-0"
B	1'-0"	2'-0"



Valve Box Collar Marking
Fire Hydrant Valve Detail



Valve Box Collar
Marking Detail

GENERAL NOTES:

1. SIDES OF CONCRETE COLLAR TOP SHALL BE PARALLEL AND PERPENDICULAR TO THE NORMAL STREET TRAFFIC FLOW.
2. SCRIBE CONCRETE WITH LINE DIRECTIONAL ARROWS, PIPE SIZE AND PIPE TYPE. FIRE HYDRANT VALVES SHALL BE SCRIBED WITH "FH" FOR FIELD IDENTIFICATION.
3. TEXT SIZE SHALL BE 4-INCHES TALL AND SCORED 3/8" DEEP IN A NEAT AND CONSISTENT MANNER, TYPICAL.

SCALE: NOT TO SCALE



**CITY OF ALAMOGORDO
TECHNICAL STANDARD DRAWINGS**

VALVE BOX CONCRETE COLLAR DETAIL

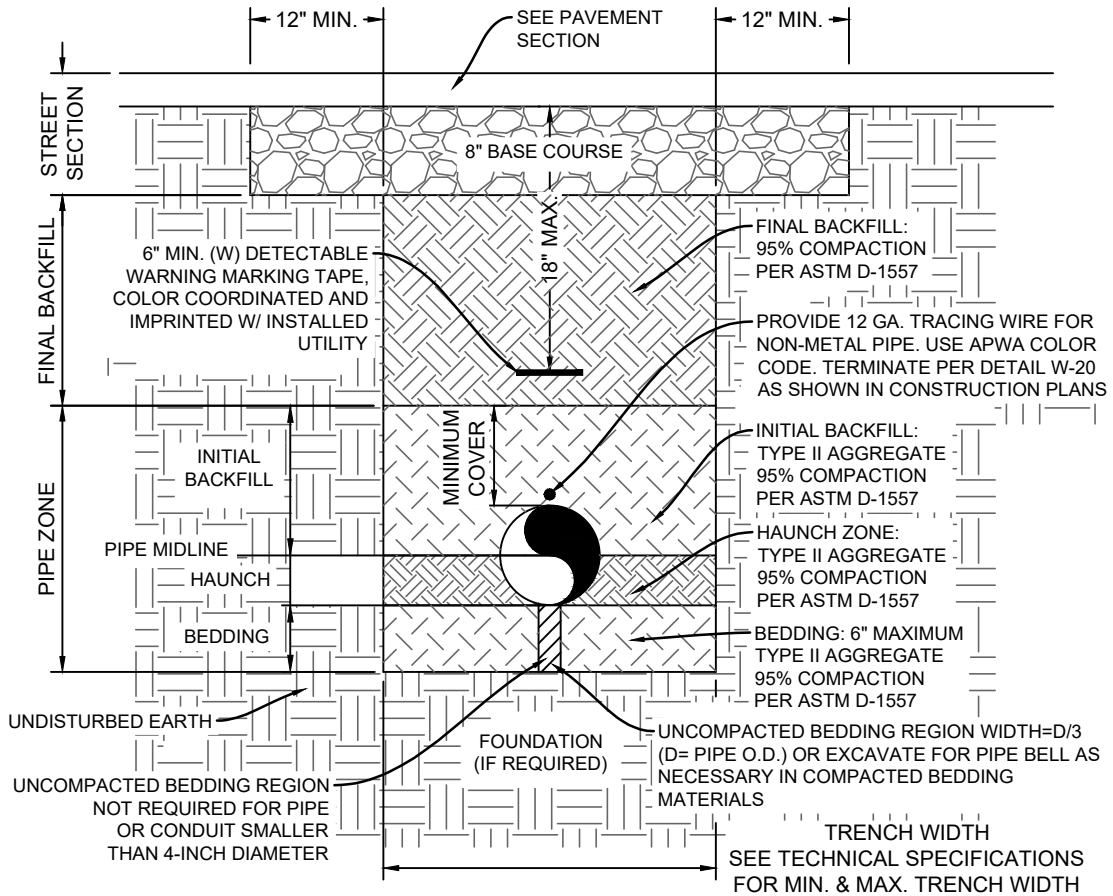
ISSUE DATE:

APRIL 2021

REVISION DATE:

SHEET NO:

W-7



TYPE II AGGREGATE BASE BACKFILL GRADATION AND REQUIREMENTS	
SIEVE SIZE	PERCENT OF DRY WEIGHT PASSING SIEVE
1-INCH	100
3/4 - INCH	85 - 95
NO. 4	40 - 70
NO. 10	35 - 45
NO. 16	25 - 35
NO. 200	06 - 18
PLASTIC INDEX	12 MAXIMUM
LIQUID LIMITS	35 MAXIMUM
FRACTURED FACES	70% MINIMUM
TOTAL AVAILABLE WATER SOLUBLE SULFATES	35 MAXIMUM

GENERAL NOTES:

- SEE TECHNICAL SPECIFICATIONS FOR BACKFILL MATERIAL SPECIFICATIONS AND COMPACTION REQUIREMENTS.
- NATIVE SOIL MAY BE USED AS FINAL BACKFILL IF FREE OF ORGANIC MATTER/DEBRIS, MAXIMUM PARTICLE SIZE OF TWO-INCH (2"), LIQUID LIMIT OF <35, AND PLASTICITY INDEX OF <15. COMPACTION REQUIREMENTS FOR NATIVE MATERIAL SHALL REMAIN THE SAME AS IMPORTED MATERIALS AND PLACEMENT SHALL OCCUR WITHIN ±2% OF OPTIMUM MOISTURE CONTENT.
- COMPACTION OF THE PIPE BEDDING MAY BE ACCOMPLISHED USING MECHANICAL TAMPING DEVICES PRIOR TO PLACEMENT OF THE PIPE OR CONDUIT. MINIMUM EXCAVATION FOR PIPE BELLS MAY BE ACCOMPLISHED AS NECESSARY TO ALLOW PROPER ALIGNMENT AND ELEVATION OF THE PIPE OR CONDUIT.
- COMPACTION IN THE HAUNCH ZONE SHALL BE COMPLETED BY HAND WITH TAMPERS OR SUITABLE POWER COMPACTORS IN MAXIMUM LIFTS OF SIX-INCHES (6"). TAMPERS SHALL NOT CONTACT PIPE OR CONDUITS DURING THE TAMPING PROCESS.
- THE CONTRACTOR SHALL NOT EMPLOY THE USE OF IMPACT TAMPERS DIRECTLY ABOVE THE PIPE OR CONDUIT UNTIL THE FULL LOOSE LAYER BACKFILL DEPTH ABOVE THE PIPE IS OBTAINED.
- TRENCHING AND EXCAVATION OPERATIONS SHALL CONFORM TO THE CURRENT FEDERAL, STATE, AND LOCAL SAFETY ORDINANCES; INCLUDING OSHA REGULATIONS.

SCALE: NOT TO SCALE



**CITY OF ALAMOGORDO
TECHNICAL STANDARD DRAWINGS**

UTILITY TRENCH CROSS-SECTION DETAIL

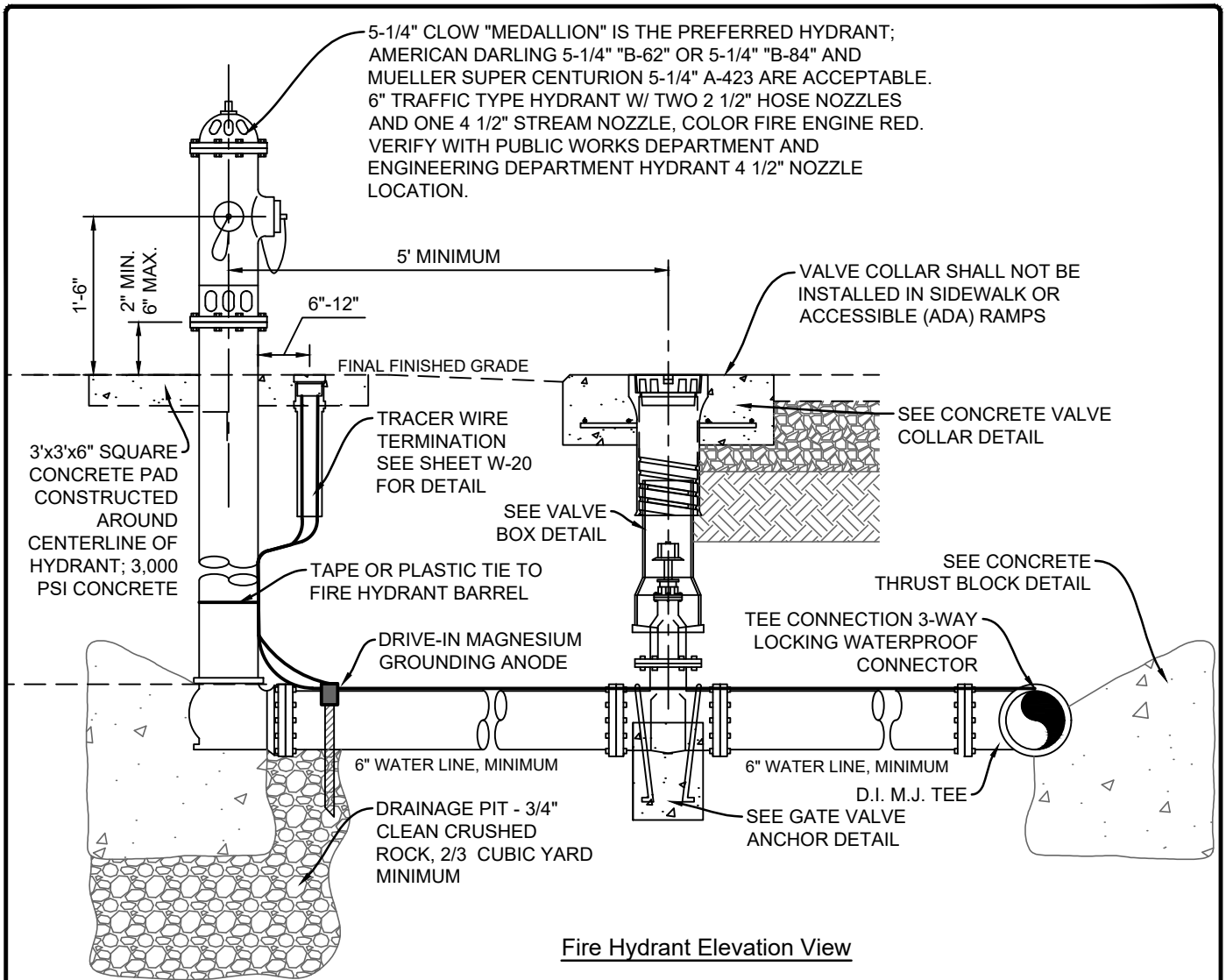
ISSUE DATE:

APRIL 2021

REVISION DATE:

SHEET NO:

W-8



GENERAL NOTE:

1. FIRE HYDRANT SHALL BE INSTALLED 6-FEET FROM BACK OF CURB TO CENTER OF HYDRANT OR AS SPECIFIED BY THE PUBLIC WORKS DEPARTMENT AND ENGINEERING DEPARTMENT.
2. ALL FITTINGS FROM WATER MAIN LINE TO FIRE HYDRANT SHALL BE M.J. FITTINGS.
3. GRIP RING PIPE RESTRAINED, OR PRE-APPROVED EQUAL, SHALL BE INSTALLED ON PIPE FROM HYDRANT VALVE TO HYDRANT BOOT WHEN VALVE IS LOCATED WITH-IN THE 5-FEET MINIMUM SEPARATION, THIS INSTALLATION MUST BE PRE-APPROVED BY PUBLIC WORKS DEPARTMENT AND ENGINEERING DEPARTMENT.
4. FIRE HYDRANT VALVE SHALL NOT BE LOCATED IN THE CURB OR THE GUTTER; CONSULT WITH PUBLIC WORKS DEPARTMENT AND ENGINEERING DEPARTMENT FOR APPROPRIATE LOCATION.

SCALE: NOT TO SCALE



**CITY OF ALAMOGORDO
TECHNICAL STANDARD DRAWINGS**

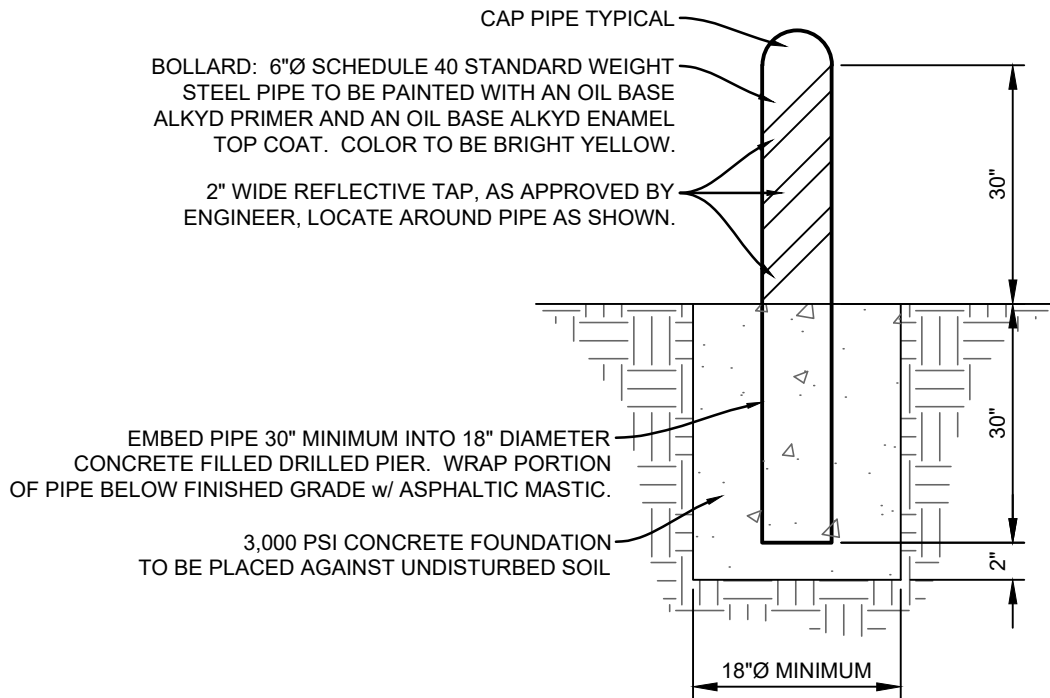
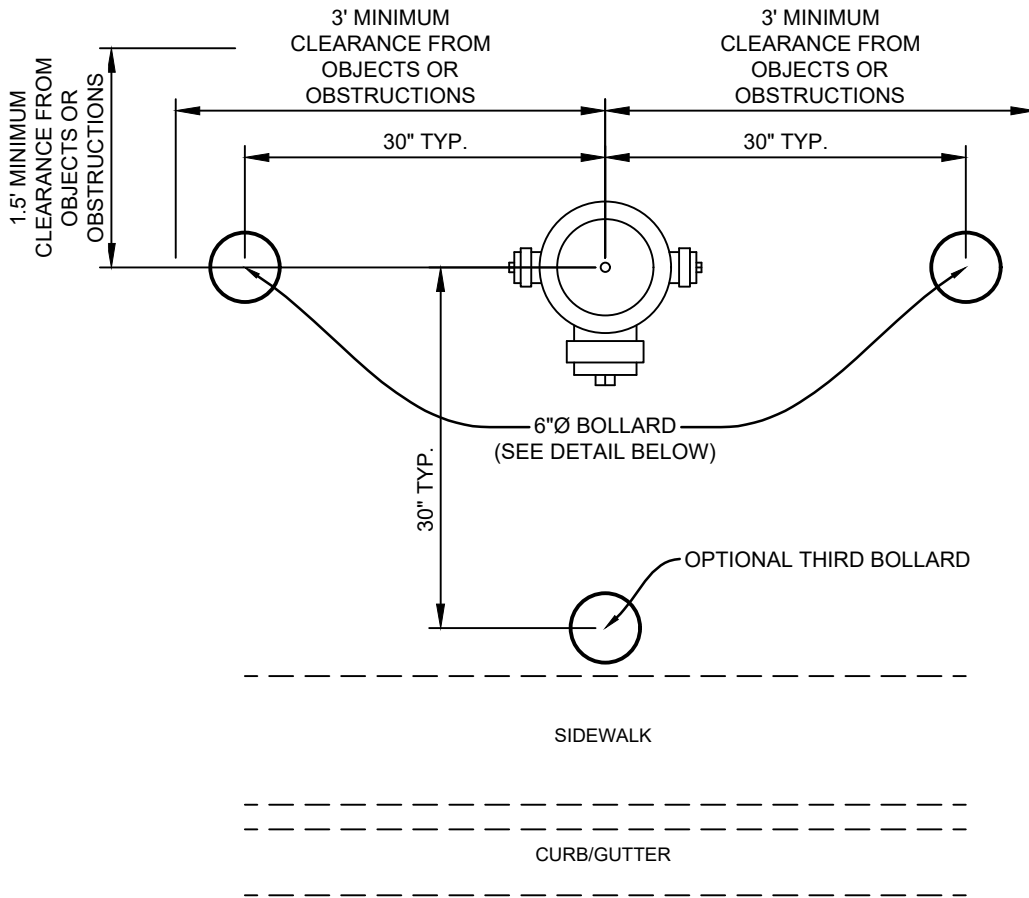
FIRE HYDRANT DETAIL

ISSUE DATE:
APRIL 2021

REVISION DATE:

SHEET NO:

W-9



SCALE: NOT TO SCALE



CITY OF ALAMOGORDO
TECHNICAL STANDARD DRAWINGS

FIRE HYDRANT BOLLARD DETAIL

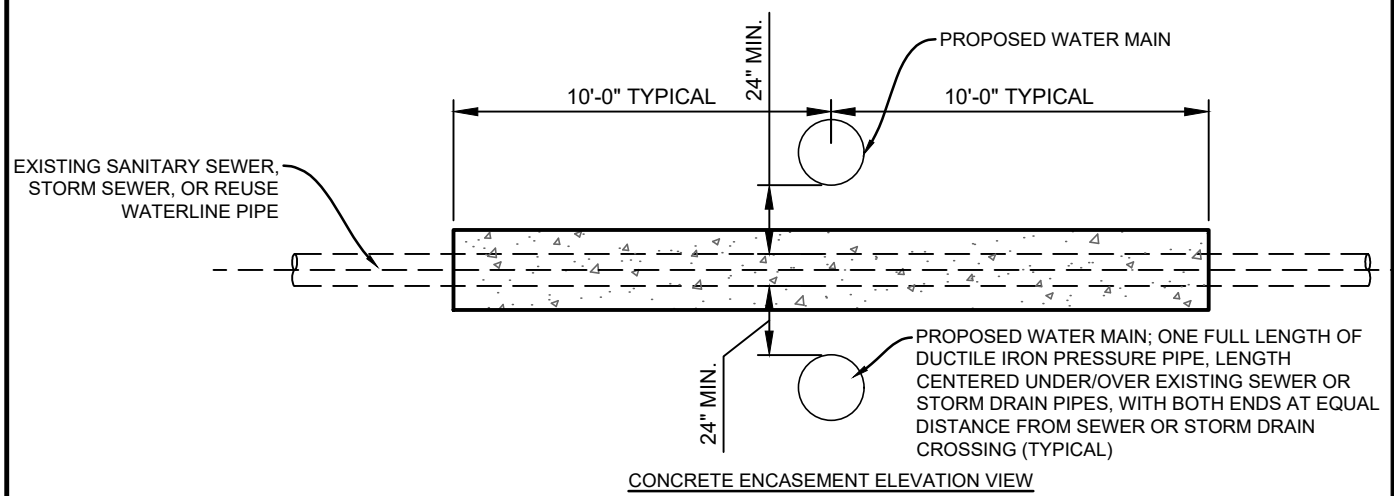
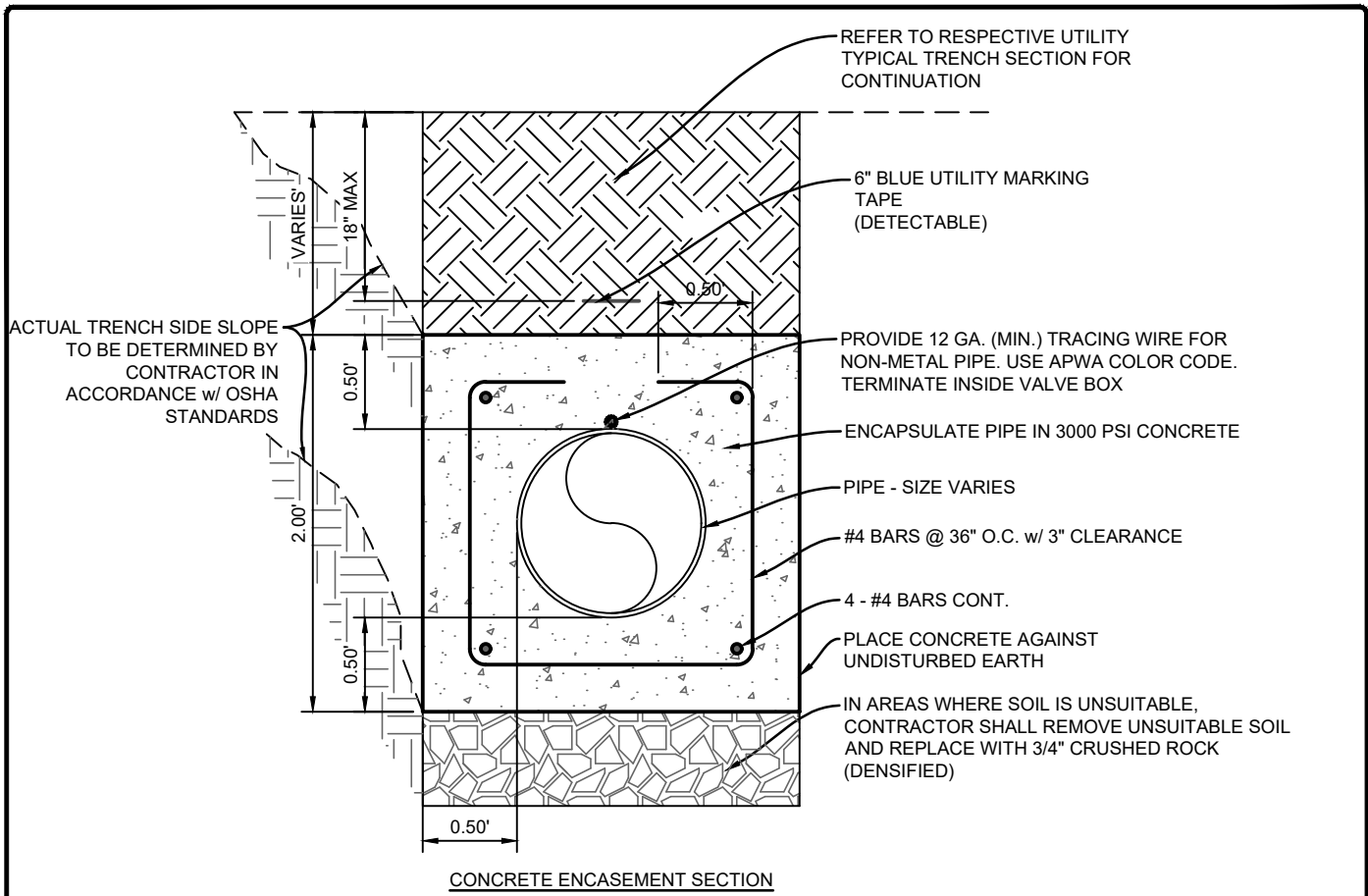
ISSUE DATE:

APRIL 2021

REVISION DATE:

SHEET NO:

W-10



GENERAL NOTES:

1. PROVIDE AT LOCATIONS WHERE WATERLINE CROSSES SANITARY SEWER LINE, STORM DRAIN LINE, AND/OR REUSE WATERLINE WITH A CLEARANCE LESS THAN 24-INCHES; ENCASE PIPE FOR A MINIMUM OF 10'-0" ON EACH SIDE OF THE CROSSING AND CROSSINGS TO BE ARRANGED SO THAT THE JOINTS WILL BE EQUIDISTANT AND AS FAR AS POSSIBLE FROM THE SANITARY SEWER LINE, STORM DRAIN LINE, AND/OR REUSE WATERLINE JOINTS.
2. WHERE 36-INCH MINIMUM COVER CANNOT BE MAINTAINED CONSULT WITH PUBLIC WORKS DEPARTMENT AND ENGINEERING DEPARTMENT ON LOWERING OF UTILITY.

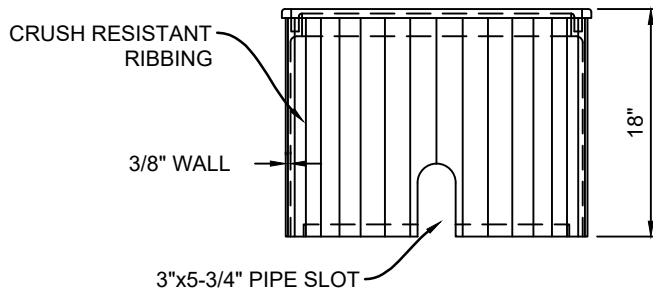
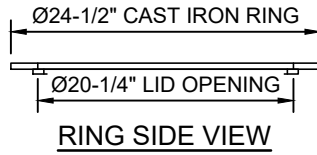
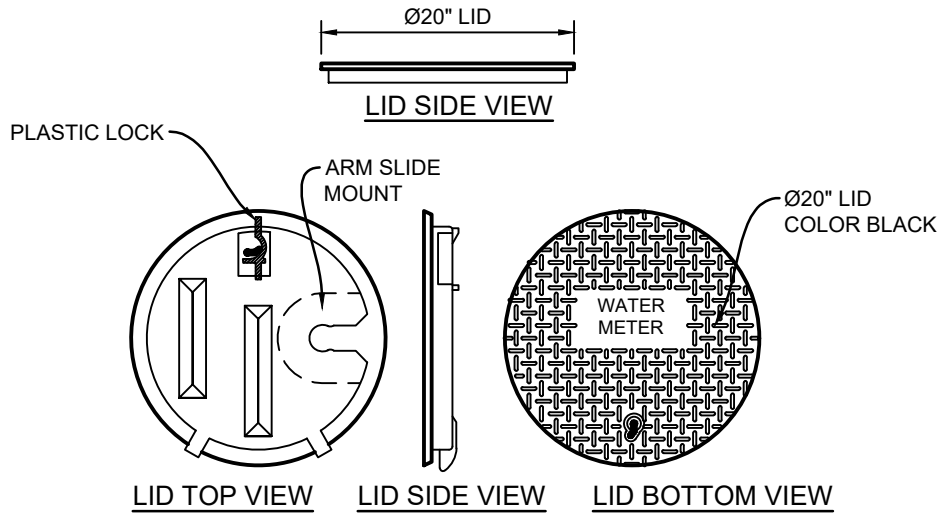
SCALE: NOT TO SCALE



**CITY OF ALAMOGORDO
TECHNICAL STANDARD DRAWINGS**

PIPE CONCRETE ENCASEMENT DETAIL

ISSUE DATE: APRIL 2021
REVISION DATE: ----
SHEET NO: W-11



METER CAN SIDE VIEW

GENERAL NOTES:

1. DIMENSION'S ±1/8" U.N.O.
2. LID MATERIAL: HDPE
3. BODY MATERIAL: LLDPE
4. WALL THICKNESS: 3/8"± MINIMUM
5. I.W.A. = INSIDE WORK AREA
6. SNAP LOCK POCKET WILL RECEIVE AMR/AMI DEVICE ENDPOINT. SNAP LOCK SLOT IS 1.80"± .015" TO ALLOW FOR A FINGER FORCE INSTALL. POCKET HEIGHT IS 15/16" FOR A MINIMUM 1/8" AIR GAP.

SCALE: NOT TO SCALE



CITY OF ALAMOGORDO
TECHNICAL STANDARD DRAWINGS

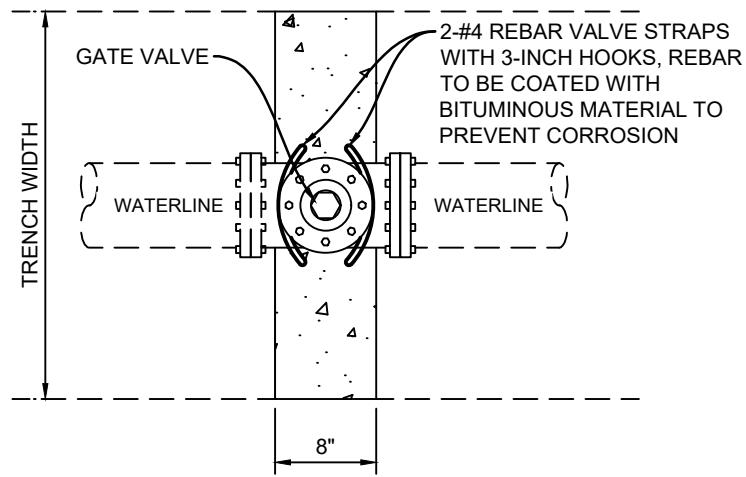
WATER METER CAN DETAIL

ISSUE DATE:
APRIL 2021

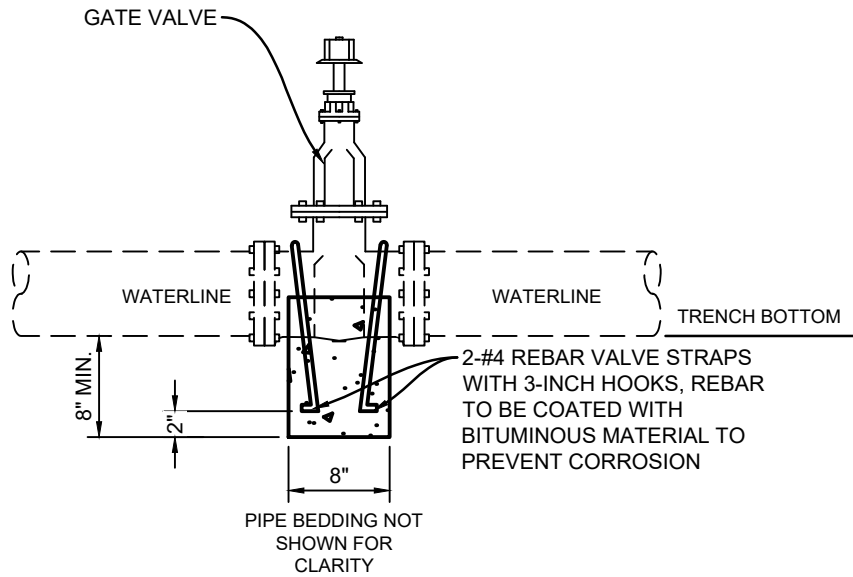
REVISION DATE:

SHEET NO:

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PLAN VIEW



GATE VALVE ANCHOR DETAIL

SCALE: NOT TO SCALE



CITY OF ALAMOGORDO
TECHNICAL STANDARD DRAWINGS

GATE VALVE ANCHOR DETAIL

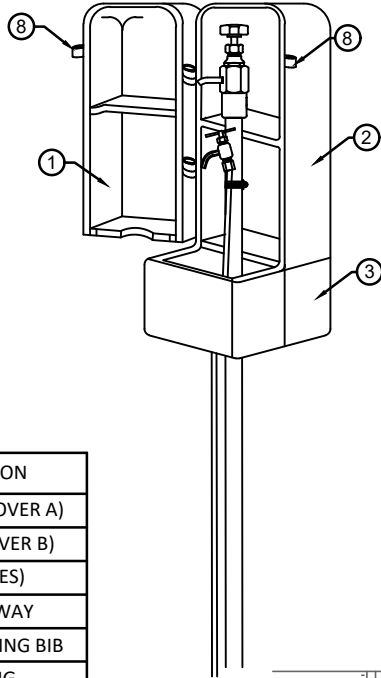
ISSUE DATE:

APRIL 2021

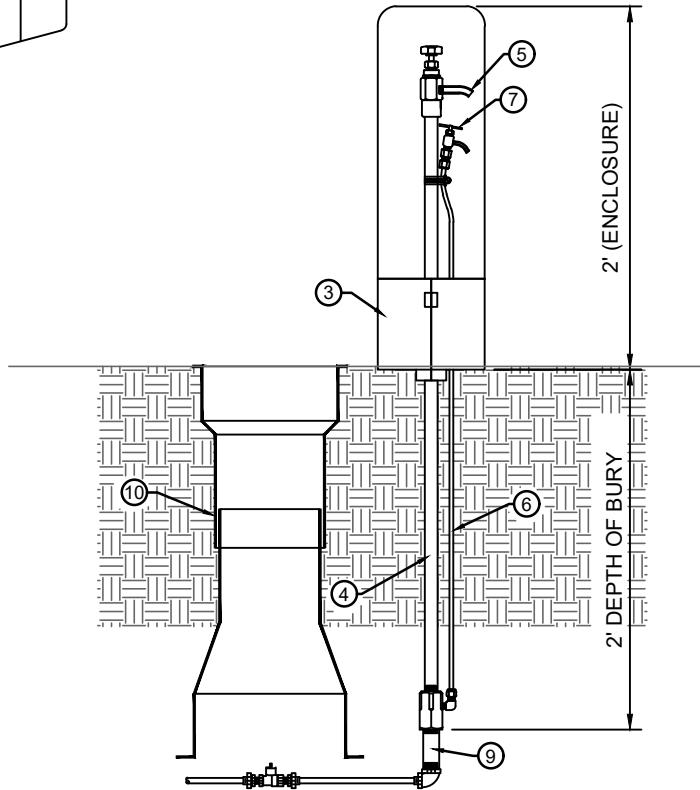
REVISION DATE:

SHEET NO:

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ITEM	ITEM/DESCRIPTION
1	88 FRONT DOOR (COVER A)
2	88 REAR DOOR (COVER B)
3	88 BASE (2-PIECES)
4	1/2" S.S. WATERWAY
5	BLOW OFF & SAMPLING BIB
6	1/4" S.S. TUBING
7	PET COCK
8	LOCKING HOLE
9	3/4" S.S. NIPPLE
10	VALVE BOX



SAMPLING STATION NOTES:

1. ALL NEW SUBDIVISIONS SHALL INCLUDE A MINIMUM OF ONE SAMPLING STATION. TOTAL NUMBER OF SAMPLE STATIONS REQUIRED SHALL BE COORDINATED WITH THE CITY WATER DEPARTMENT AND ENGINEERING DEPARTMENT.

SCALE: NOT TO SCALE



**CITY OF ALAMOGORDO
TECHNICAL STANDARD DRAWINGS**

SAMPLING STATION DETAIL

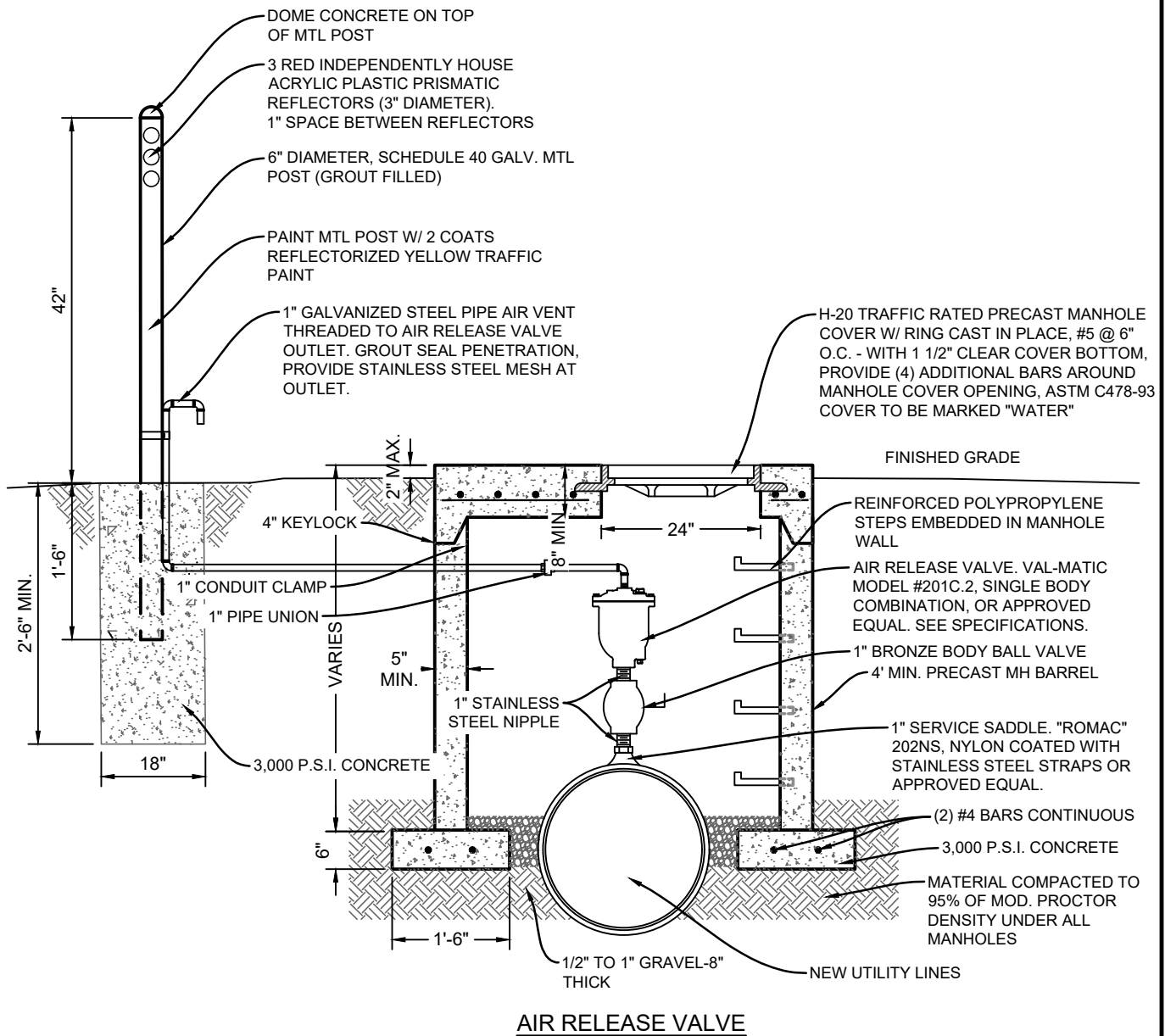
ISSUE DATE:

APRIL 2021

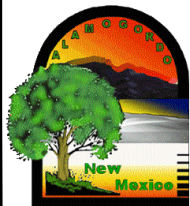
REVISION DATE:

SHEET NO:

W-14



SCALE: NOT TO SCALE



CITY OF ALAMOGORDO
 TECHNICAL STANDARD DRAWINGS

COMBINATION AIR & VACUUM RELEASE VALVE DETAIL

ISSUE DATE:

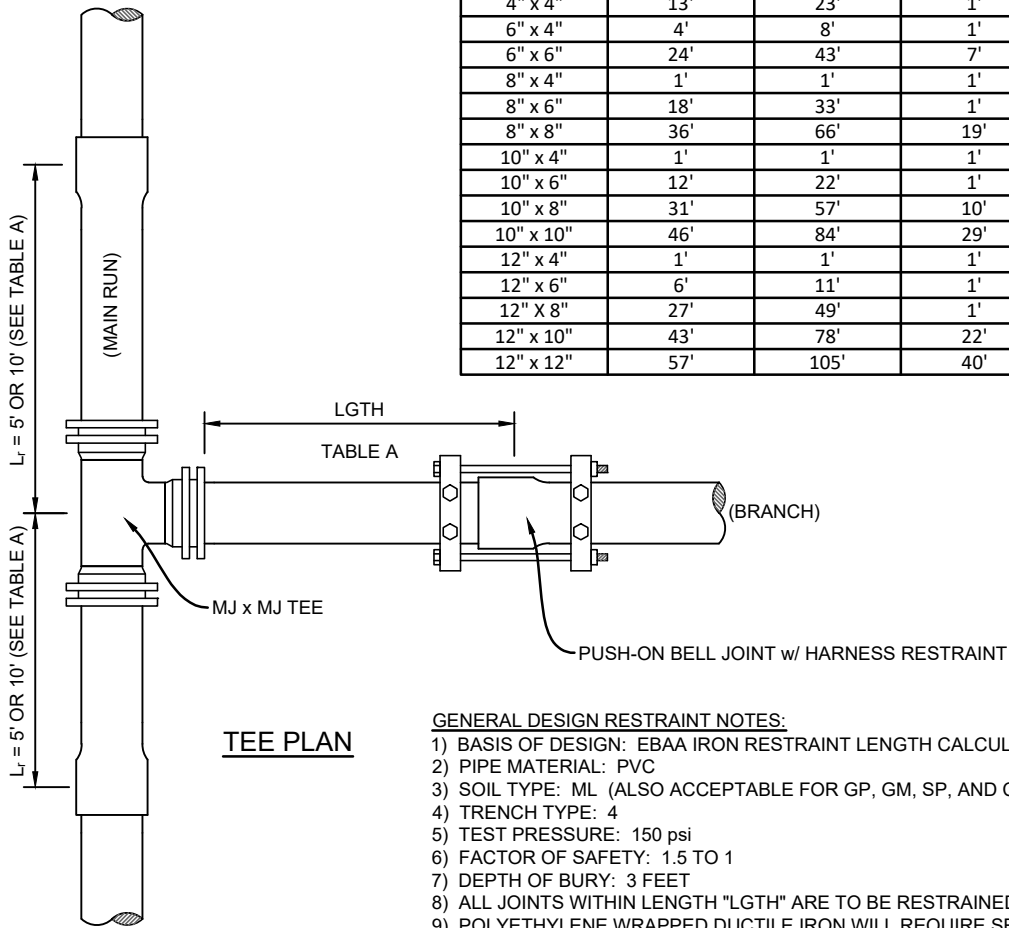
APRIL 2021

REVISION DATE:

SHEET NO:

W-15

TABLE A				
PIPE SIZE	L _r = 5' MINIMUM		L _r = 10' MINIMUM	
	LGTH (D.I.)	LGTH (PVC)	LGTH (D.I.)	LGTH (PVC)
4" x 4"	13'	23'	1'	1'
6" x 4"	4'	8'	1'	1'
6" x 6"	24'	43'	7'	13'
8" x 4"	1'	1'	1'	1'
8" x 6"	18'	33'	1'	1'
8" x 8"	36'	66'	19'	35'
10" x 4"	1'	1'	1'	1'
10" x 6"	12'	22'	1'	1'
10" x 8"	31'	57'	10'	18'
10" x 10"	46'	84'	29'	53'
12" x 4"	1'	1'	1'	1'
12" x 6"	6'	11'	1'	1'
12" x 8"	27'	49'	1'	1'
12" x 10"	43'	78'	22'	40'
12" x 12"	57'	105'	40'	73'



TEE PLAN

GENERAL DESIGN RESTRAINT NOTES:

- 1) BASIS OF DESIGN: EBAA IRON RESTRAINT LENGTH CALCULATOR
- 2) PIPE MATERIAL: PVC
- 3) SOIL TYPE: ML (ALSO ACCEPTABLE FOR GP, GM, SP, AND CL)
- 4) TRENCH TYPE: 4
- 5) TEST PRESSURE: 150 psi
- 6) FACTOR OF SAFETY: 1.5 TO 1
- 7) DEPTH OF BURY: 3 FEET
- 8) ALL JOINTS WITHIN LENGTH "LGTH" ARE TO BE RESTRAINED.
- 9) POLYETHYLENE WRAPPED DUCTILE IRON WILL REQUIRE SEPARATE CALCULATIONS.
- 10) PIPE SIZES LARGER THAN 12" DIAMETER WILL REQUIRE A SEPARATE DESIGN.

SCALE: NOT TO SCALE



**CITY OF ALAMOGORDO
TECHNICAL STANDARD DRAWINGS**

RESTRAINED TEE DETAIL

ISSUE DATE:

APRIL 2021

REVISION DATE:

SHEET NO:

W-16

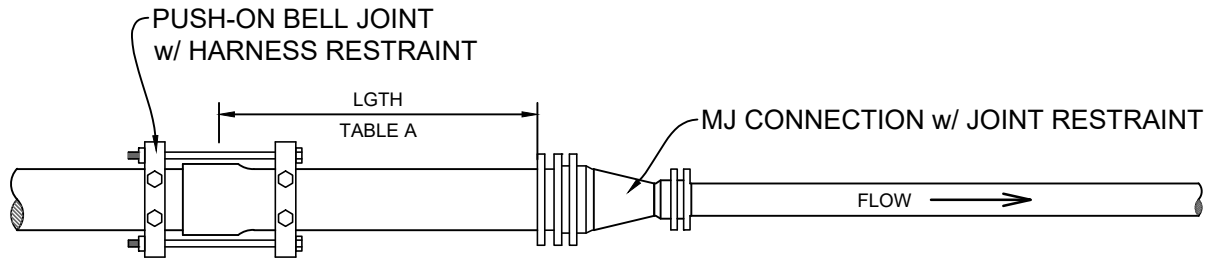
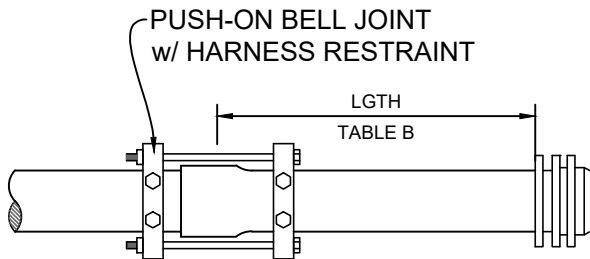


TABLE A		
PIPE SIZE	D.I.	PVC
6" x 4"	21'	38'
8" x 4"	38'	70'
8" x 6"	22'	41'
10" x 4"	52'	94'
10" x 6"	39'	71'
10" x 8"	22'	39'
12" x 4"	65'	118'
12" x 6"	54'	99'
12" x 8"	40'	73'
12" x 10"	22'	40'

REDUCER PLAN

GENERAL DESIGN RESTRAINT NOTES:

- 1) BASIS OF DESIGN: EBAA IRON RESTRAINT LENGTH CALCULATOR
- 2) PIPE MATERIAL: PVC
- 3) SOIL TYPE: ML (ALSO ACCEPTABLE FOR GP, GM, SP, AND CL)
- 4) TRENCH TYPE: 4
- 5) TEST PRESSURE: 150 psi
- 6) FACTOR OF SAFETY: 1.5 TO 1
- 7) DEPTH OF BURY: 3 FEET
- 8) ALL JOINTS WITHIN LENGTH "LGTH" ARE TO BE RESTRAINED.
- 9) POLYETHYLENE WRAPPED DUCTILE IRON WILL REQUIRE SEPARATE CALCULATIONS.
- 10) PIPE SIZES LARGER THAN 12" DIAMETER WILL REQUIRE A SEPARATE DESIGN.



DEAD END PLAN

TABLE B		
PIPE SIZE	D.I.	PVC
4"	29'	53'
6"	41'	74'
8"	53'	97'
10"	63'	116'
12"	74'	136'

SCALE: NOT TO SCALE



**CITY OF ALAMOGORDO
TECHNICAL STANDARD DRAWINGS**

RESTRAINED DEAD END & REDUCER DETAILS

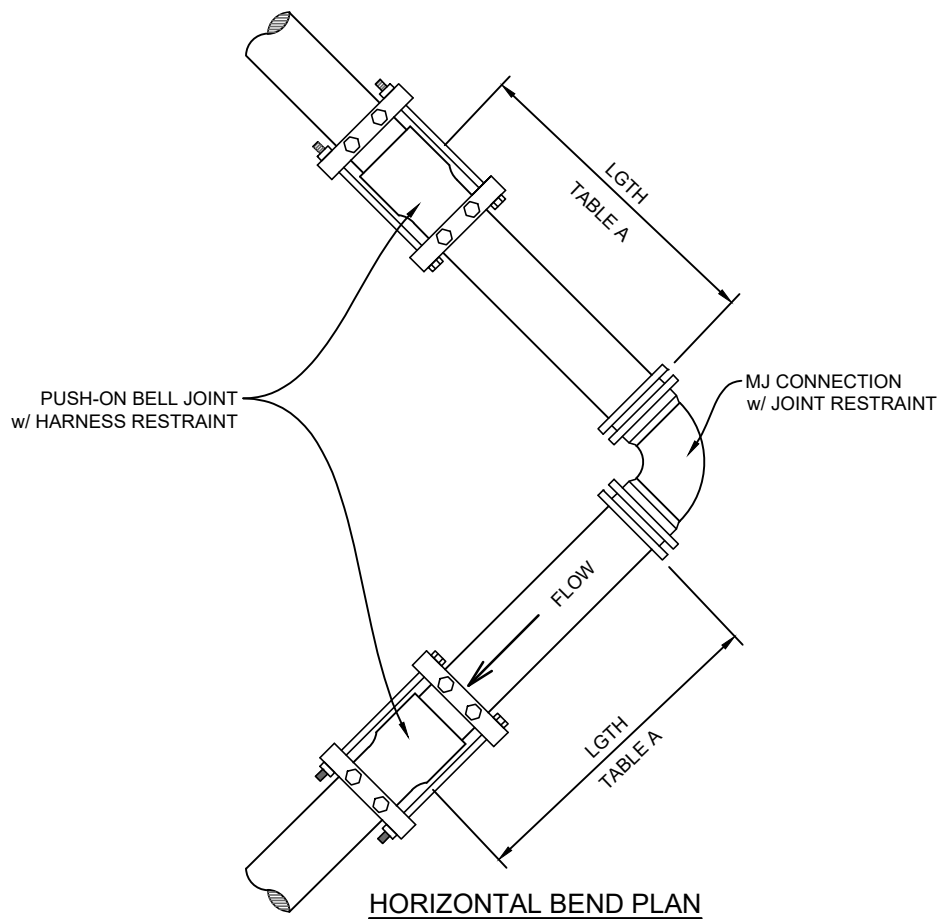
ISSUE DATE:

APRIL 2021

REVISION DATE:

SHEET NO:

W-17



PIPE SIZE	11.25° BEND	22.5° BEND	45° BEND	90° BEND
4"	2'	4'	8'	18'
6"	3'	5'	11'	25'
8"	4'	7'	14'	32'
10"	4'	8'	16'	38'
12"	5'	9'	19'	44'

PIPE SIZE	11.25° BEND	22.5° BEND	45° BEND	90° BEND
4"	2'	3'	6'	14'
6"	2'	4'	8'	19'
8"	3'	5'	11'	25'
10"	3'	6'	13'	30'
12"	4'	7'	15'	35'

GENERAL DESIGN RESTRAINT NOTES:

- 1) BASIS OF DESIGN: EBAA IRON RESTRAINT LENGTH CALCULATOR
- 2) PIPE MATERIAL: PVC
- 3) SOIL TYPE: ML (ALSO ACCEPTABLE FOR GP, GM, SP, AND CL)
- 4) TRENCH TYPE: 4
- 5) TEST PRESSURE: 150 psi
- 6) FACTOR OF SAFETY: 1.5 TO 1
- 7) DEPTH OF BURY: 3 FEET
- 8) ALL JOINTS WITHIN LENGTH "LGTH" ARE TO BE RESTRAINED.
- 9) POLYETHYLENE WRAPPED DUCTILE IRON WILL REQUIRE SEPARATE CALCULATIONS.
- 10) PIPE SIZES LARGER THAN 12" DIAMETER WILL REQUIRE A SEPARATE DESIGN.

SCALE: NOT TO SCALE



**CITY OF ALAMOGORDO
TECHNICAL STANDARD DRAWINGS**

RESTRAINED HORIZONTAL BEND DETAILS

ISSUE DATE:

APRIL 2021

REVISION DATE:

SHEET NO:

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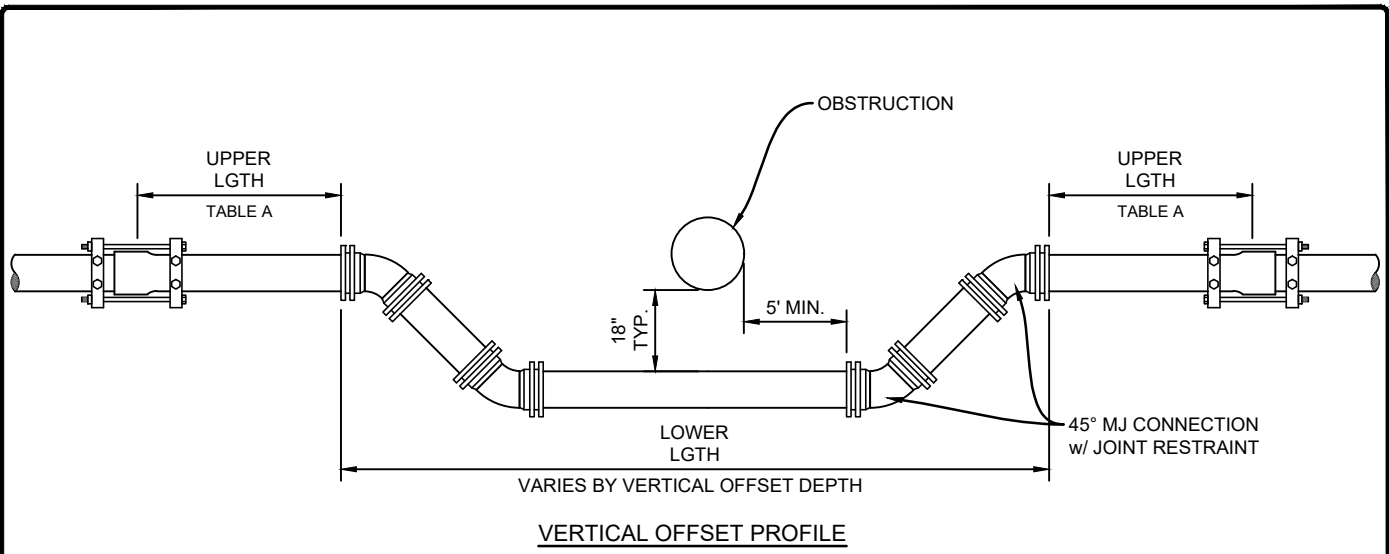


TABLE A		
PIPE SIZE	D.I.	PVC
4"	12'	22'
6"	17'	31'
8"	22'	40'
10"	27'	48'
12"	31'	57'

GENERAL DESIGN RESTRAINT NOTES:

- 1) BASIS OF DESIGN: EBAA IRON RESTRAINT LENGTH CALCULATOR
- 2) PIPE MATERIAL: PVC
- 3) SOIL TYPE: ML (ALSO ACCEPTABLE FOR GP, GM, SP, AND CL)
- 4) TRENCH TYPE: 4
- 5) TEST PRESSURE: 150 psi
- 6) FACTOR OF SAFETY: 1.5 TO 1
- 7) DEPTH OF BURY: 3 FEET
- 8) ALL JOINTS WITHIN LENGTH "LGTH" ARE TO BE RESTRAINED.
- 9) POLYETHYLENE WRAPPED DUCTILE IRON WILL REQUIRE SEPARATE CALCULATIONS.
- 10) PIPE SIZES LARGER THAN 12" DIAMETER WILL REQUIRE A SEPARATE DESIGN.

SCALE: NOT TO SCALE



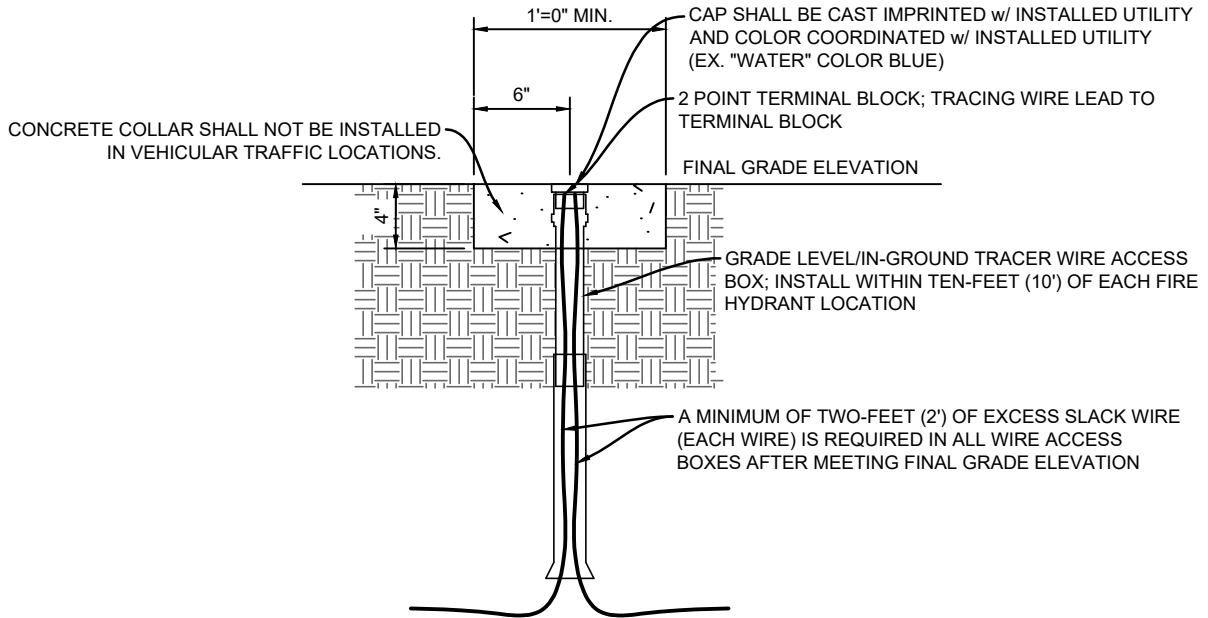
CITY OF ALAMOGORDO
TECHNICAL STANDARD DRAWINGS

WATER LINE LOWERING DETAIL

ISSUE DATE:
APRIL 2021

REVISION DATE:

SHEET NO:
W-19



Tracer Wire Termination Detail

CONTRACTOR NOTES:

1. TRACER WIRE ACCESS BOXES SHALL BE LOCATED AT ALL FIRE HYDRANT LOCATIONS.
2. TRACER WIRE ACCESS BOXES SPACING SHALL NOT EXCEED 500 LINEAR FEET.
3. COORDINATE WITH PUBLIC WORKS DEPARTMENT AND ENGINEERING DEPARTMENT FOR TRACER WIRE ACCESS BOXES FINAL LOCATION(S).

SCALE: NOT TO SCALE



CITY OF ALAMOGORDO
TECHNICAL STANDARD DRAWINGS

TRACER WIRE TERMINATION DETAIL

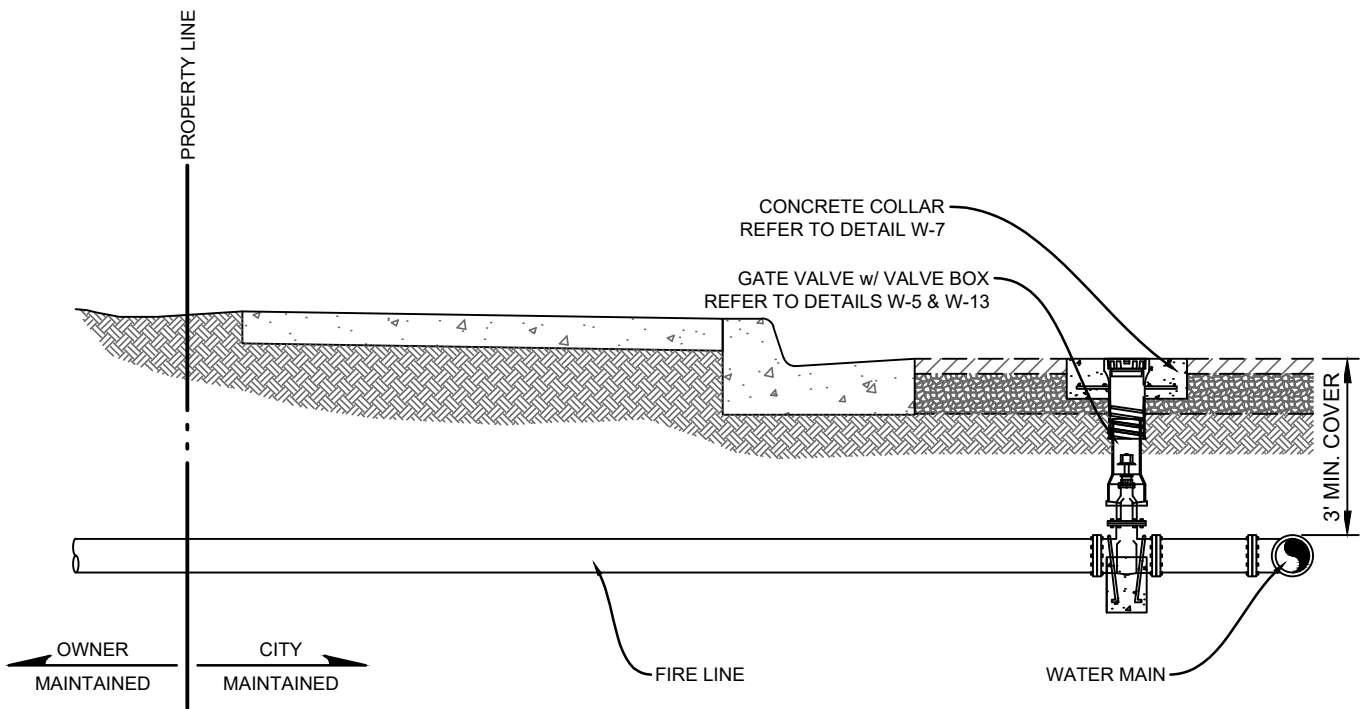
ISSUE DATE:

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REVISION DATE:

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MAINTENANCE RESPONSIBILITY NOTE:
 THE CITY OF ALAMOGORDO WATER DEPARTMENT WILL BE RESPONSIBLE FOR MAINTENANCE OF THE FIRE LINE FROM THE WATER MAIN TO THE PROPERTY LINE. THE OWNER WILL BE RESPONSIBLE FOR MAINTENANCE OF THE FIRE LINE FROM THE PROPERTY LINE TO THE BUILDING.

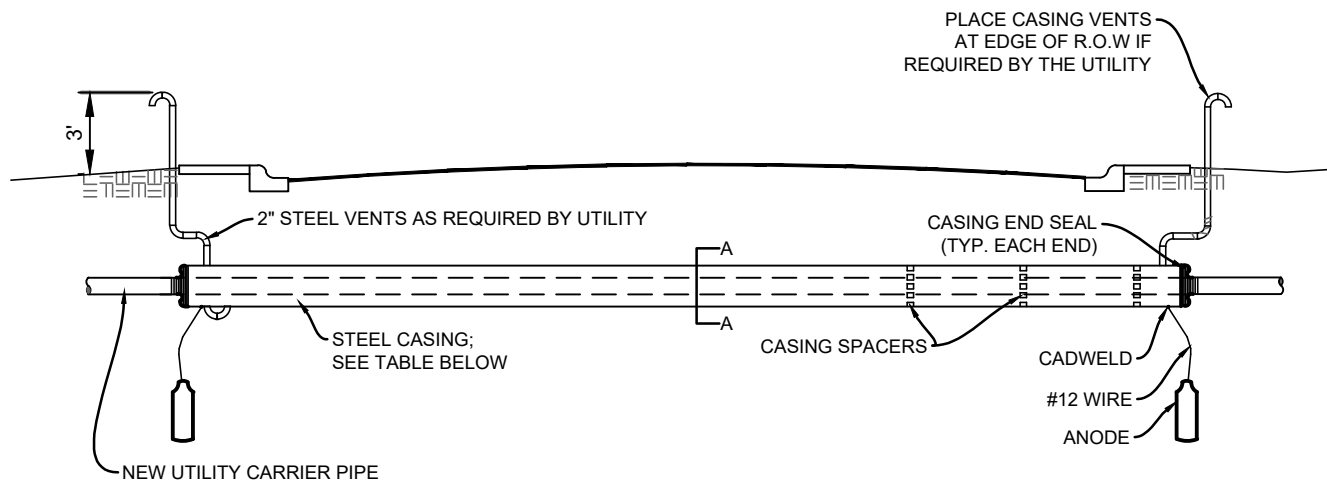
SCALE: NOT TO SCALE



CITY OF ALAMOGORDO
 TECHNICAL STANDARD DRAWINGS

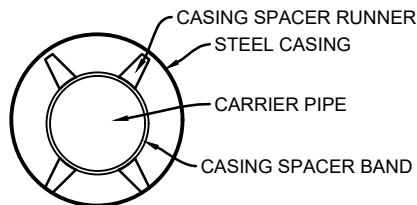
FIRE LINE DETAIL

ISSUE DATE: APRIL 2021
REVISION DATE: ----
SHEET NO: W-21



GENERAL NOTES:

1. CASING END SEALS SHALL BE T.D. WILLIAMSON, INC Z-SEALS OR ENGINEER APPROVED EQUAL.
2. CASING SPACERS SHALL BE ADVANCE PRODUCTS & SYSTEMS, LLC MODEL SSIM OR ENGINEER APPROVED EQUAL.
3. STEEL CASING PIPE SHALL BE SIZED TO ADEQUATELY ACCOMMODATE CARRIER PIPE AND ADHERE TO THE REQUIREMENTS PROVIDED IN THE TABLE BELOW.
4. PIPE JOINT(S) INSIDE CASING SHALL BE JOINT RESTRAINED.
5. CASING VENTS TO BE PAINTED WITH AN OIL BASE ALKYD PRIMER AND AN OIL BASE ALKYD ENAMEL TOP COAT. COLOR SHALL BE PER APWA UNIFORM COLOR CODE FOR RESPECTIVE UTILITY.



SECTION A-A

STEEL CASING MINIMUM WALL THICKNESS		
NOMINAL DIAMETER (INCHES)	MIN. WALL THICKNESS FOR COATED (INCHES)	MIN. WALL THICKNESS NON-COATED (INCHES)
14 AND UNDER	0.1880	0.1880
16	0.2190	0.2810
18	0.2500	0.3120
20 AND 22	0.2810	0.3440
24	0.3120	0.3750
26	0.3440	0.4060
28	0.3750	0.4380
30	0.4060	0.4690
32	0.4380	0.5000
34 AND 36	0.4690	0.5310
42	0.5000	0.5630
48	0.5630	0.6250

1. WALL THICKNESS DESIGNATIONS FOR STEEL CASING PIPE FOR E-80.
2. STEEL PIPE SHALL HAVE A MINIMUM YIELD STRENGTH OF 35,000 PSI.
3. CORROSION CONTROL MEASURES MUST INCLUDE CATHODIC PROTECTION.

SCALE: NOT TO SCALE



**CITY OF ALAMOGORDO
TECHNICAL STANDARD DRAWINGS**

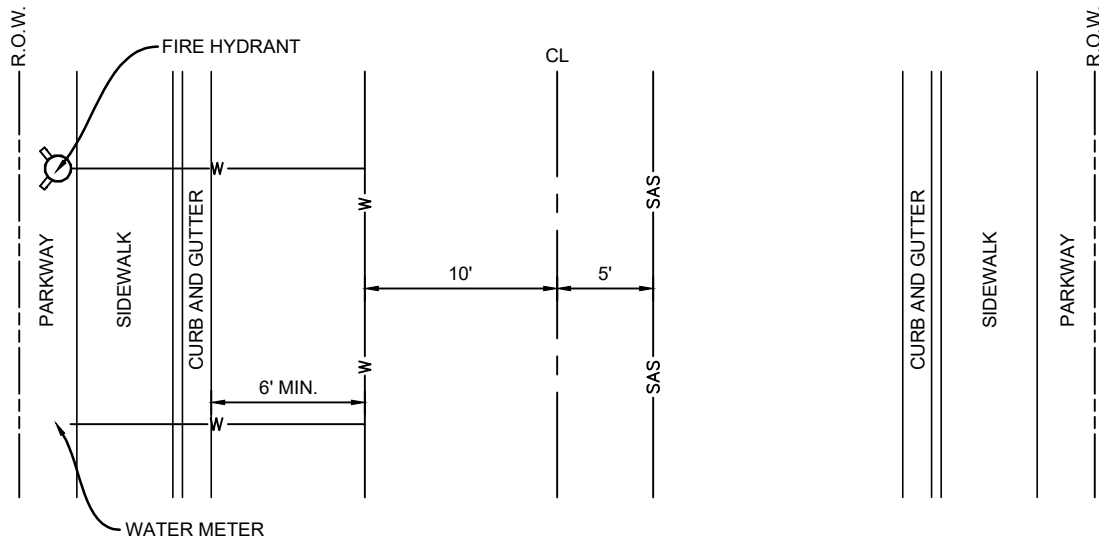
WATER LINE BORE & CASE DETAIL

ISSUE DATE:
APRIL 2021

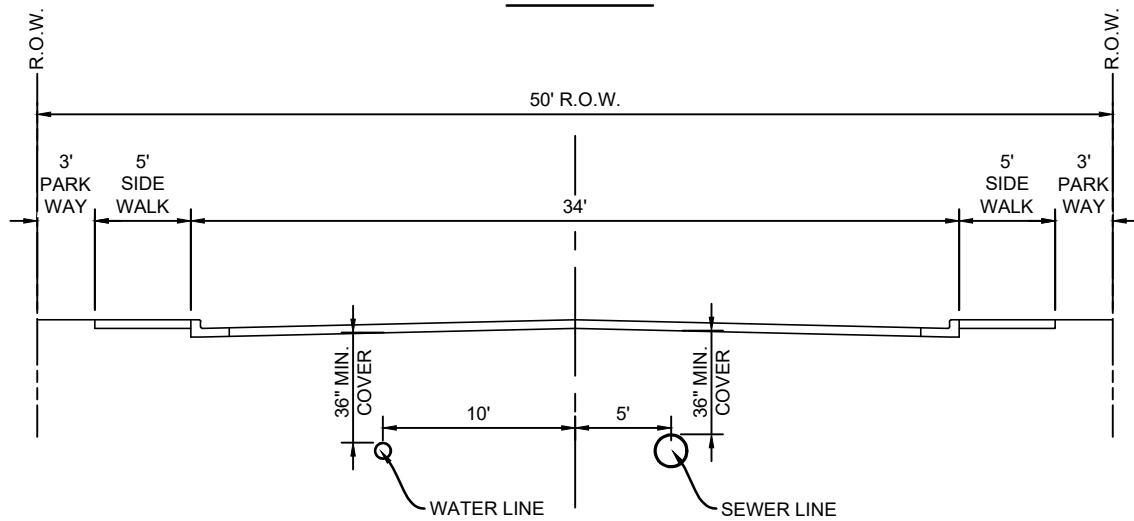
REVISION DATE:

SHEET NO:

W-22



PLAN VIEW



SECTION VIEW

CONTRACTOR NOTES:

1. WATER LINE WILL BE LOCATED 10' NORTH OF STREET CENTERLINE ON EAST TO WEST STREETS AND 10' WEST OF STREET CENTERLINE ON NORTH AND SOUTH STREETS.
2. WATER LINE MINIMUM COVER SHALL BE 36".
3. SANITARY SEWER MINIMUM COVER SHALL BE 36".
4. SANITARY SEWER WILL BE LOCATED 5' SOUTH OF STREET CENTERLINE ON EAST AND WEST STREETS AND 5' EAST OF STREET CENTERLINE ON NORTH AND SOUTH STREETS.
5. NONSTANDARD LOCATIONS REQUIRE WRITTEN APPROVAL OF THE CITY OF ALAMOGORDO .
6. UTILITY EASEMENT WILL BE AT THE DISCRETION OF THE CITY OF ALAMOGORDO.

SCALE: NOT TO SCALE



**CITY OF ALAMOGORDO
TECHNICAL STANDARD DRAWINGS**

TYPICAL UTILITY LOCATIONS

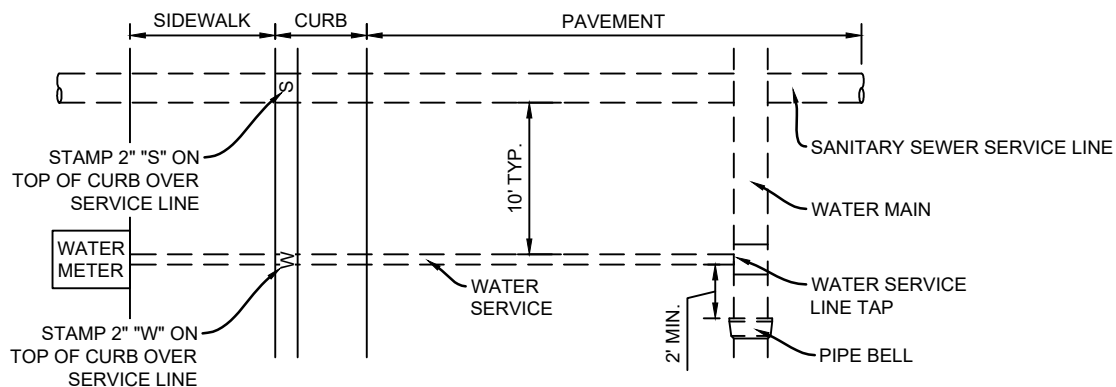
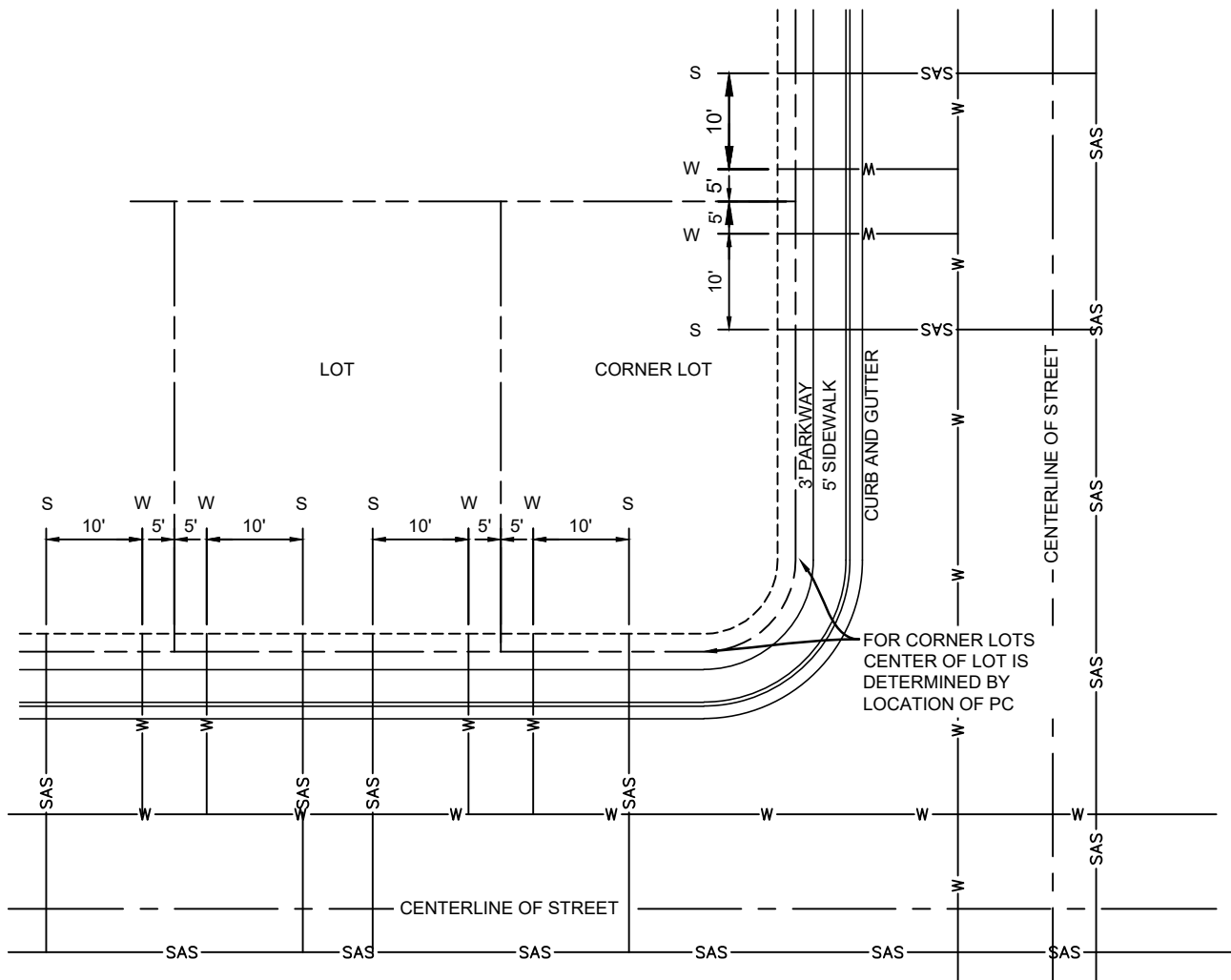
ISSUE DATE:

APRIL 2021

REVISION DATE:

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W-23



CONTRACTOR NOTES:

1. THE WATER SERVICE WILL ENTER 5' FROM THE PROPERTY LINE AS SHOWN. THE SEWER SERVICE WILL ENTER 10' FROM THE WATER SERVICE AS SHOWN.
2. FOR CORNER LOTS UTILITY STANDARD LOCATIONS AS SHOWN.
3. UTILITY EASEMENTS WILL BE AT THE DISCRETION OF THE CITY OF ALAMOGORDO.

SCALE: NOT TO SCALE



**CITY OF ALAMOGORDO
TECHNICAL STANDARD DRAWINGS**

TYPICAL LOT UTILITY LOCATIONS

ISSUE DATE:

APRIL 2021

REVISION DATE:

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W-24

TYPICAL MINIMUM HORIZONTAL UTILITY SEPARATION						
	GAS MAIN	GAS SERVICE	SEWER MAIN	SEWER SERVICE	WATER MAIN	WATER SERVICE
GAS MAIN	5 FEET	5 FEET	10 FEET	5 FEET	10 FEET	5 FEET
GAS SERVICE	5 FEET	5 FEET	5 FEET	5 FEET	5 FEET	5 FEET
SEWER MAIN	10 FEET	5 FEET	10 FEET	5 FEET	10 FEET	5 FEET
SEWER SERVICE	5 FEET	5 FEET	5 FEET	5 FEET	5 FEET	5 FEET
WATER MAIN	10 FEET	5 FEET	10 FEET	5 FEET	5 FEET	5 FEET
WATER SERVICE	5 FEET	5 FEET	5 FEET	5 FEET	5 FEET	5 FEET
STORM SEWER	10 FEET	5 FEET	10 FEET	5 FEET	5 FEET	5 FEET
WIRE UTILITY	5 FEET	5 FEET	5 FEET	5 FEET	5 FEET	5 FEET
MANHOLE	10 FEET	5 FEET	N/A	N/A	10 FEET	5 FEET
SEPARATION TYPICALLY MEASURED FROM CENTER OF UTILITY						
10 FOOT SEPARATION BETWEEN WATER AND SEWER MAINS SHALL BE MEASURED FROM OUTSIDE OF PIPE TO OUTSIDE OF PIPE						
SEPARATION MAY VARY WITH FIELD CONDITIONS AND WITH SUBSEQUENT CITY APPROVAL						

TYPICAL MINIMUM VERTICAL UTILITY SEPARATION						
	GAS MAIN	GAS SERVICE	SEWER MAIN	SEWER SERVICE	WATER MAIN	WATER SERVICE
GAS MAIN	NMGCO	NMGCO	NMGCO	NMGCO	NMGCO	NMGCO
GAS SERVICE	NMGCO	NMGCO	NMGCO	NMGCO	NMGCO	NMGCO
SEWER MAIN	12 INCHES	6 INCHES	12 INCHES	6 INCHES	24 INCHES	6 INCHES
SEWER SERVICE	6 INCHES	6 INCHES	6 INCHES	6 INCHES	6 INCHES	6 INCHES
WATER MAIN	12 INCHES	12 INCHES	24 INCHES	6 INCHES	12 INCHES	6 INCHES
WATER SERVICE	12 INCHES	12 INCHES	6 INCHES	6 INCHES	6 INCHES	6 INCHES
STORM SEWER	12 INCHES	6 INCHES	12 INCHES	6 INCHES	12 INCHES	6 INCHES
WIRE UTILITY	PNM/CITY	PNM/CITY	PNM/CITY	PNM/CITY	PNM/CITY	PNM/CITY
NMGCO - VERTICAL SEPARATION OF GAS MAINS AND GAS SERVICES SHALL BE PER REQUIREMENTS OF NEW MEXICO GAS COMPANY.						
PNM/CITY - VERTICAL SEPARATION OF WIRE UTILITIES SHALL BE DISCUSSED AND APPROVED WITH THE WIRE UTILITY PROVIDER.						
VERTICAL SEPARATION FROM GAS MAINS MAY VARY DEPENDING ON OPERATIONAL PRESSURES AND MAIN LINE MATERIAL (STEEL OR POLY); REQUIRED SEPARATION SHALL BE DISCUSSED WITH GAS PROVIDER.						
SEPARATION MAY VARY WITH FIELD CONDITIONS AND WITH SUBSEQUENT CITY APPROVAL						
WHEN REQUIRED VERTICAL SEPARATION OF SEWER MAINS AND WATER/REUSE MAINS CANNOT BE OBTAINED REFER TO DETAIL W-11 FOR ADDITIONAL GUIDANCE.						
WHEN WATER MAINS CROSS SEWER MAINS THE CROSSING SHALL BE ARRANGED SO THAT THE SEWER JOINTS WILL BE EQUIDISTANT AND AS FAR AS POSSIBLE FROM THE WATER MAIN JOINTS.						

SCALE: NOT TO SCALE



CITY OF ALAMOGORDO
TECHNICAL STANDARD DRAWINGS

TYPICAL UTILITY SEPARATION

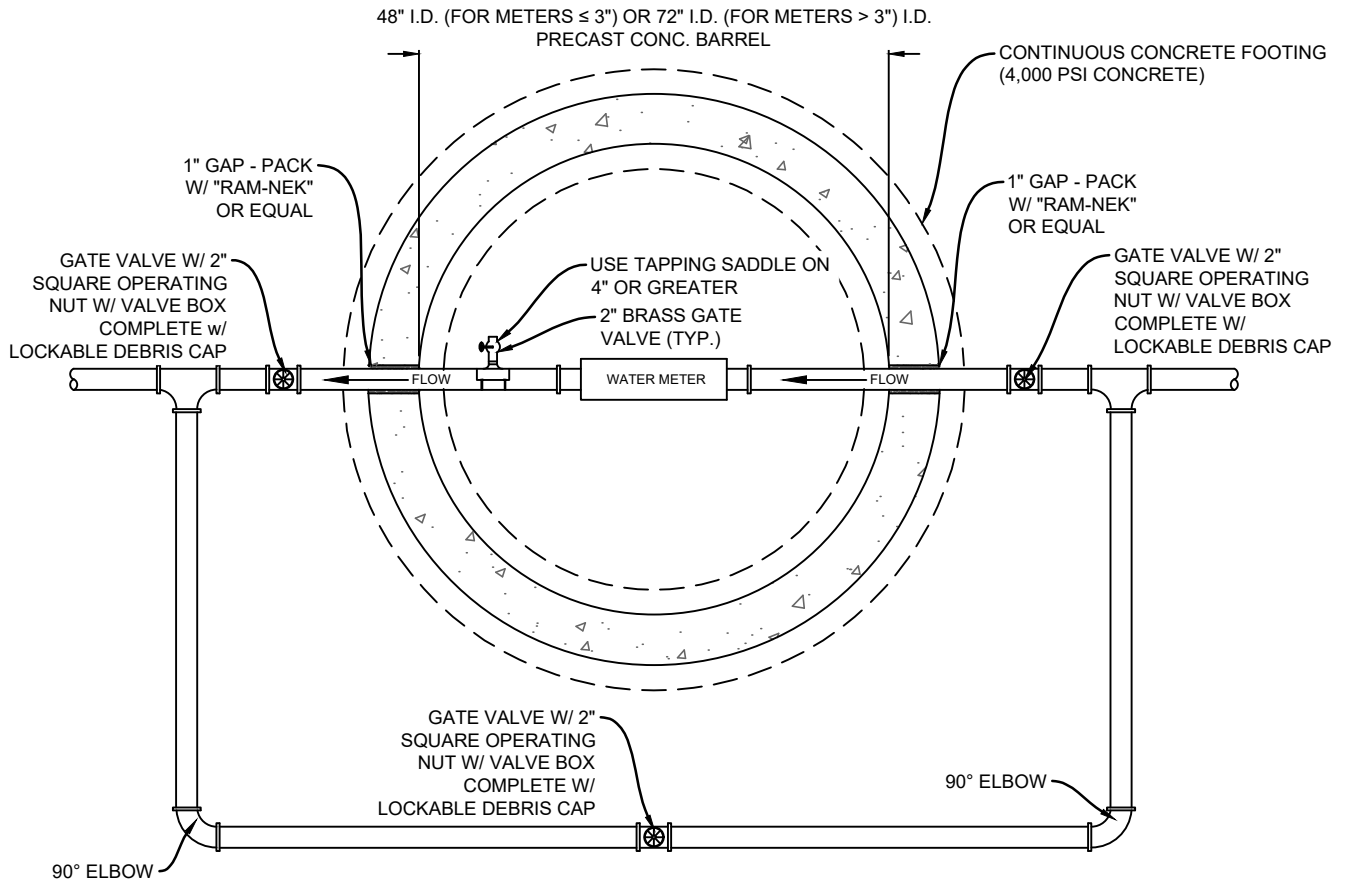
ISSUE DATE:

APRIL 2021

REVISION DATE:

SHEET NO:

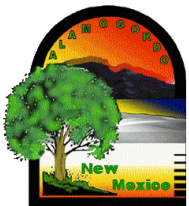
W-25



CONTRACTOR NOTES:

1. C-900 PVC PIPE OR DUCTILE IRON PIPE ON 3" OR GREATER.
2. MAINTENANCE BY CITY OF ALAMOGORDO UP TO AND INCLUDING THE METER, BPASS PIPING, AND THE BYPASS VALVES.
3. ALL CITY OF ALAMOGORDO MAINTAINED WATER PIPING SHALL BE EVEN PIPE SIZES WITH MINIMUM DIAMETER OF 4-INCHES.
4. DEBRIS CAP SHALL BE MANUFACTURED BY SW SERVICES, LLC OR CITY APPROVED EQUAL. LOCKS SHALL BE SUPPLIED BY THE CITY.

SCALE: NOT TO SCALE



CITY OF ALAMOGORDO
TECHNICAL STANDARD DRAWINGS

TYPICAL TRAFFIC WATER METER VAULT & BYPASS LINE

ISSUE DATE:

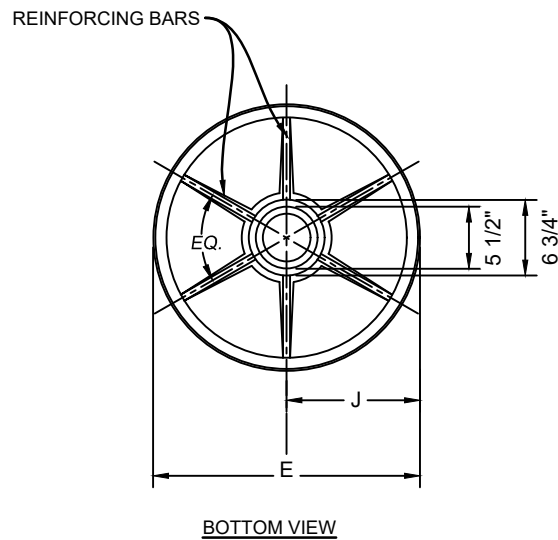
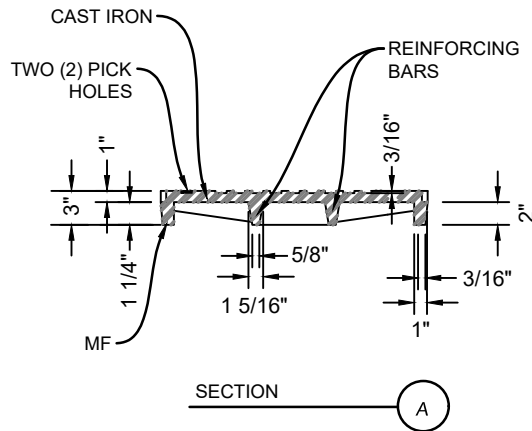
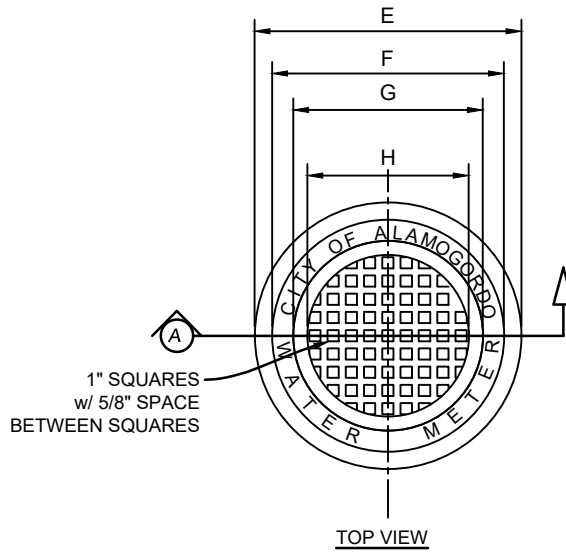
APRIL 2021

REVISION DATE:

SHEET NO:

W-27

MANHOLE RING	48" MANHOLE	72" MANHOLE
WEIGHT	175 LBS.	310 LBS.
E	23 3/4"	31 1/4"
F	20 5/8"	28 1/8"
G	16 7/8"	24 3/8"
H	14 3/8"	21 7/8"
J	11 7/8"	15 5/8"



TYPICAL LID DETAIL

GENERAL NOTES:

1. MATCHING SURFACES MARKED "MF" TO BE MACHINE FINISHED AND BE FREE OF ANY IRREGULARITIES THAT WOULD PREVENT A SNUG FIT.
2. CASTING TO BE SMOOTH AND FREE OF AIR VOIDS.
3. MANHOLE RING AND LID SHALL BE DESIGNED FOR H-20 WHEEL LOADING.
4. MINIMUM TOTAL WEIGHT (RING AND LID) SHALL BE 300 LBS.
5. TOP OF LID MAY VARY FROM DETAIL SHOWN. LID SHALL BE MARKED FOR APPROPRIATE UTILITY.

SCALE: NOT TO SCALE



CITY OF ALAMOGORDO
TECHNICAL STANDARD DRAWINGS

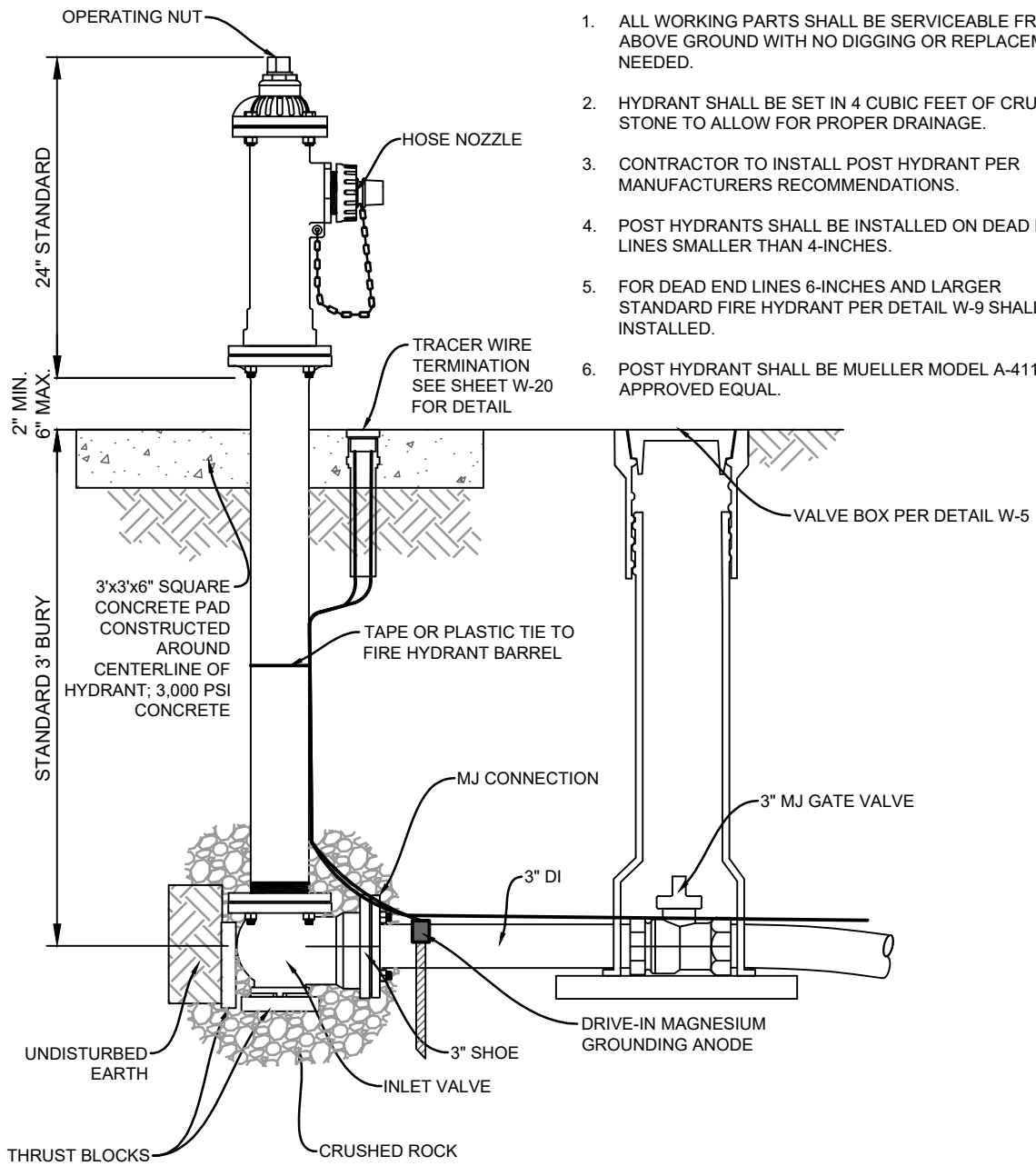
WATER METER LID DETAIL

ISSUE DATE:
APRIL 2021

REVISION DATE:

SHEET NO:

W-28



NOTES:

1. ALL WORKING PARTS SHALL BE SERVICEABLE FROM ABOVE GROUND WITH NO DIGGING OR REPLACEMENT NEEDED.
2. HYDRANT SHALL BE SET IN 4 CUBIC FEET OF CRUSHED STONE TO ALLOW FOR PROPER DRAINAGE.
3. CONTRACTOR TO INSTALL POST HYDRANT PER MANUFACTURERS RECOMMENDATIONS.
4. POST HYDRANTS SHALL BE INSTALLED ON DEAD END LINES SMALLER THAN 4-INCHES.
5. FOR DEAD END LINES 6-INCHES AND LARGER STANDARD FIRE HYDRANT PER DETAIL W-9 SHALL BE INSTALLED.
6. POST HYDRANT SHALL BE MUELLER MODEL A-411 OR APPROVED EQUAL.

SCALE: NOT TO SCALE



**CITY OF ALAMOGORDO
TECHNICAL STANDARD DRAWINGS**

POST TYPE FLUSH HYDRANT DETAIL

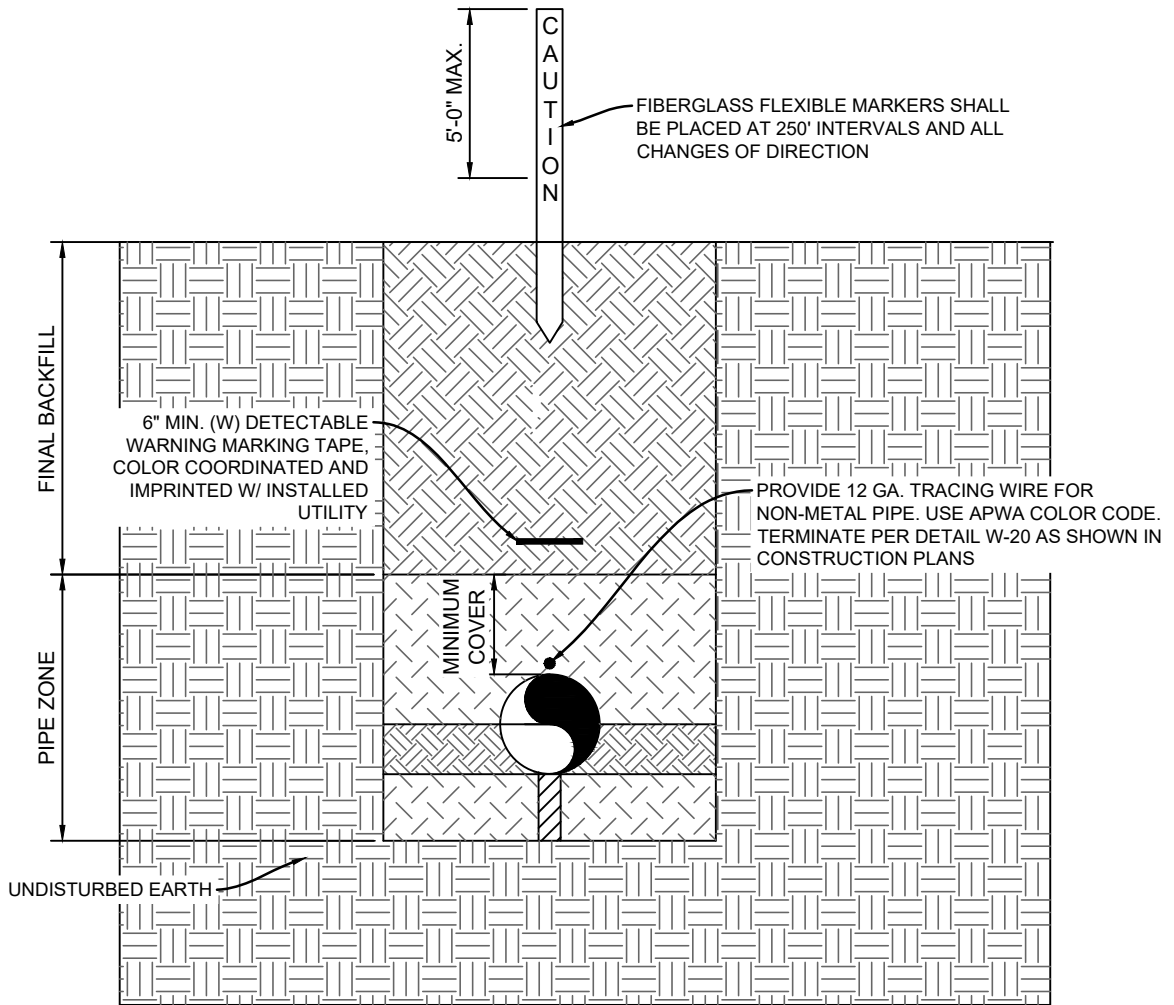
ISSUE DATE:

APRIL 2021

REVISION DATE:

SHEET NO:

W-29



UNPAVED AREAS

SCALE: NOT TO SCALE



CITY OF ALAMOGORDO
 TECHNICAL STANDARD DRAWINGS

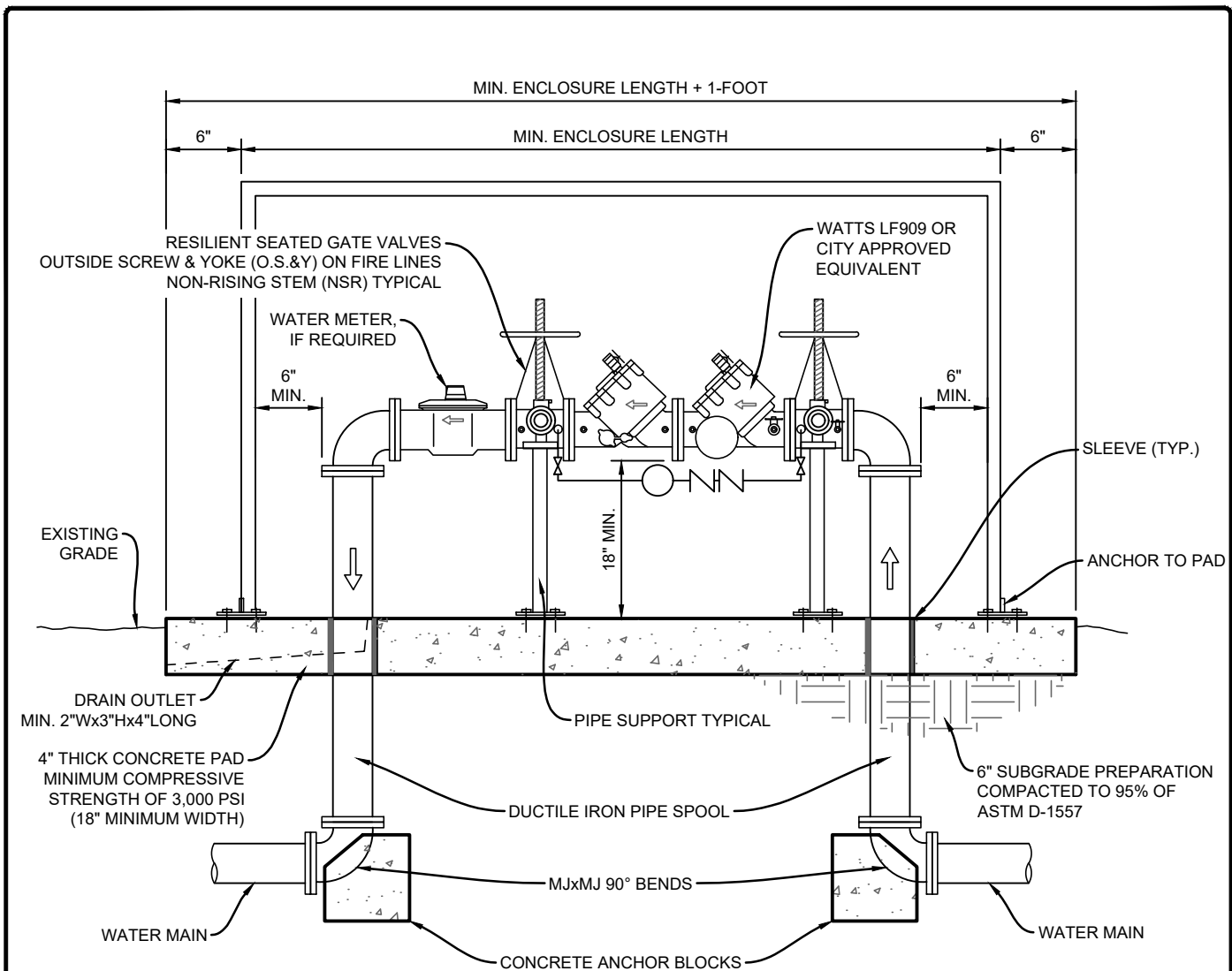
WATER LINE FLEXIBLE MARKER DETAIL

ISSUE DATE:
 APRIL 2021

REVISION DATE:

SHEET NO:

W-30



NOTES:

1. ALL ABOVE GROUND FITTINGS, VALVES, WATER METERS, BACKFLOW ASSEMBLY SHALL BE FLANGE-BY-FLANGE (FLxFL) CONSTRUCTION.
2. BOLLARDS MAY BE REQUIRED BY THE CITY FOR ADDITIONAL PROTECTION.
3. THE BACKFLOW PREVENTION DEVICE SHALL BE LOCATED ON PRIVATE PROPERTY AND A MAXIMUM OF FIVE-FEET (5') FROM THE METER VAULT OR AS DIRECTED BY THE CITY WATER AND ENGINEERING DEPARTMENT.
4. BACKFLOW ASSEMBLIES INSTALLED ON POTABLE WATER SERVICES SHALL BE LEAD FREE.
5. BACKFLOW ASSEMBLIES SHALL BE THE SAME SIZE AS THE WATER METER.
6. BACKFLOW ASSEMBLIES SHALL BE EQUIPPED WITH FOUR (4) TEST COCKS.
7. BACKFLOW ASSEMBLIES MUST BE TESTED ANNUALLY PER CITY OF ALAMOGORDO ORDINANCE NO. 1604.
8. ENCLOSURES OR SCREENING MEASURES FOR BACKFLOW ASSEMBLIES SHALL BE PRE-APPROVED BY THE CITY WATER AND ENGINEERING DEPARTMENT.

SCALE: NOT TO SCALE



**CITY OF ALAMOGORDO
TECHNICAL STANDARD DRAWINGS**

REDUCED PRESSURE BACKFLOW PREVENTION - 3IN AND OVER DETAIL

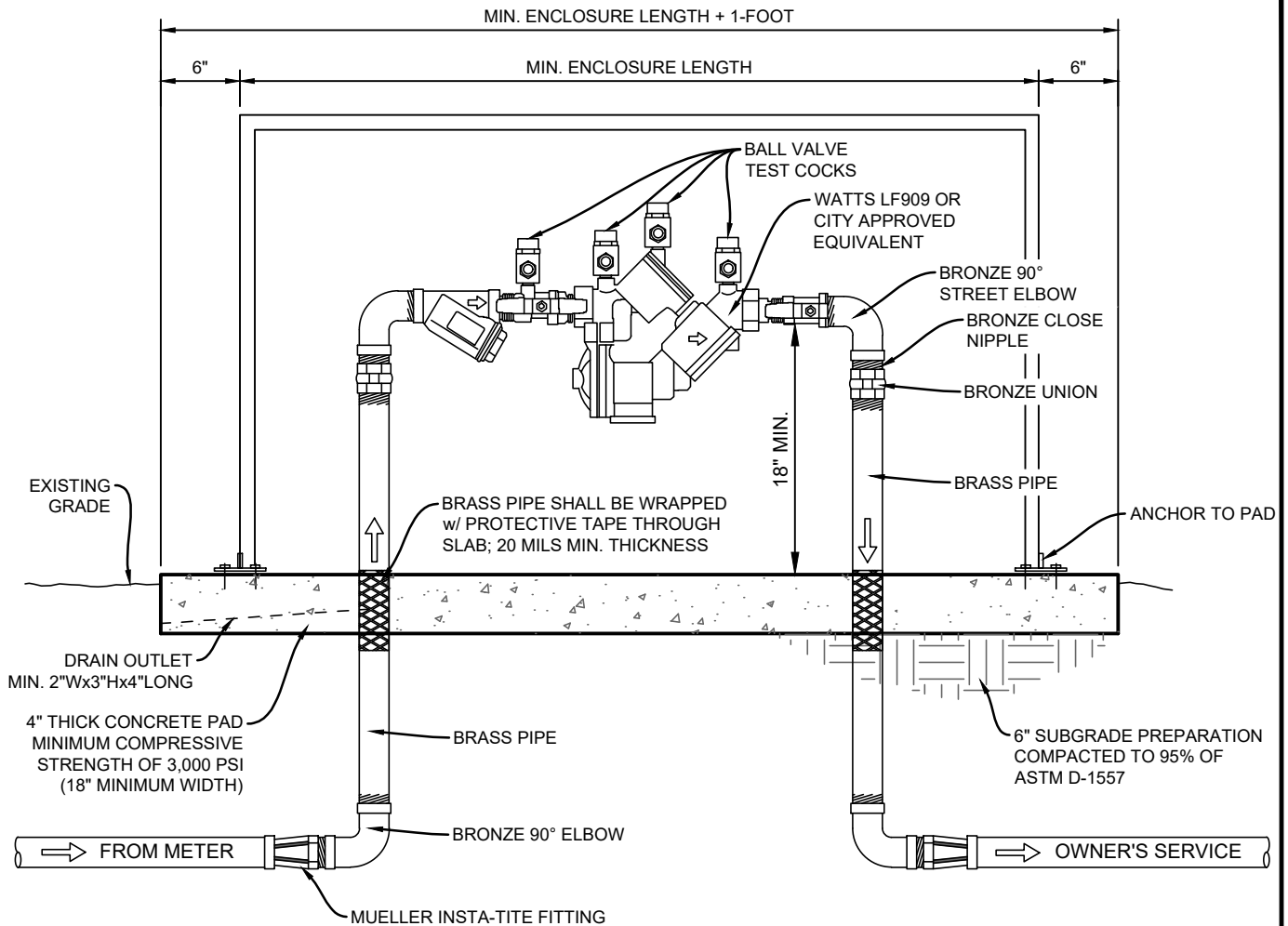
ISSUE DATE:

APRIL 2021

REVISION DATE:

SHEET NO:

W-31



NOTES:

1. BOLLARDS MAY BE REQUIRED BY THE CITY FOR ADDITIONAL PROTECTION.
2. THE BACKFLOW PREVENTION DEVICE SHALL BE LOCATED ON PRIVATE PROPERTY AND A MAXIMUM OF FIVE-FEET (5') FROM THE WATER METER OR AS DIRECTED BY THE CITY WATER AND ENGINEERING DEPARTMENT.
3. BACKFLOW ASSEMBLIES INSTALLED ON POTABLE WATER SERVICES SHALL BE LEAD FREE.
4. BACKFLOW ASSEMBLIES SHALL BE THE SAME SIZE AS THE WATER METER.
5. BACKFLOW ASSEMBLIES SHALL BE EQUIPPED WITH FOUR (4) TEST COCKS.
6. BACKFLOW ASSEMBLIES MUST BE TESTED ANNUALLY PER CITY OF ALAMOGORDO ORDINANCE NO. 1604.
7. ENCLOSURES OR SCREENING MEASURES FOR BACKFLOW ASSEMBLIES SHALL BE PRE-APPROVED BY THE CITY WATER AND ENGINEERING DEPARTMENT.

SCALE: NOT TO SCALE



**CITY OF ALAMOGORDO
TECHNICAL STANDARD DRAWINGS**

REDUCED PRESSURE BACKFLOW PREVENTION - 2IN AND UNDER DETAIL

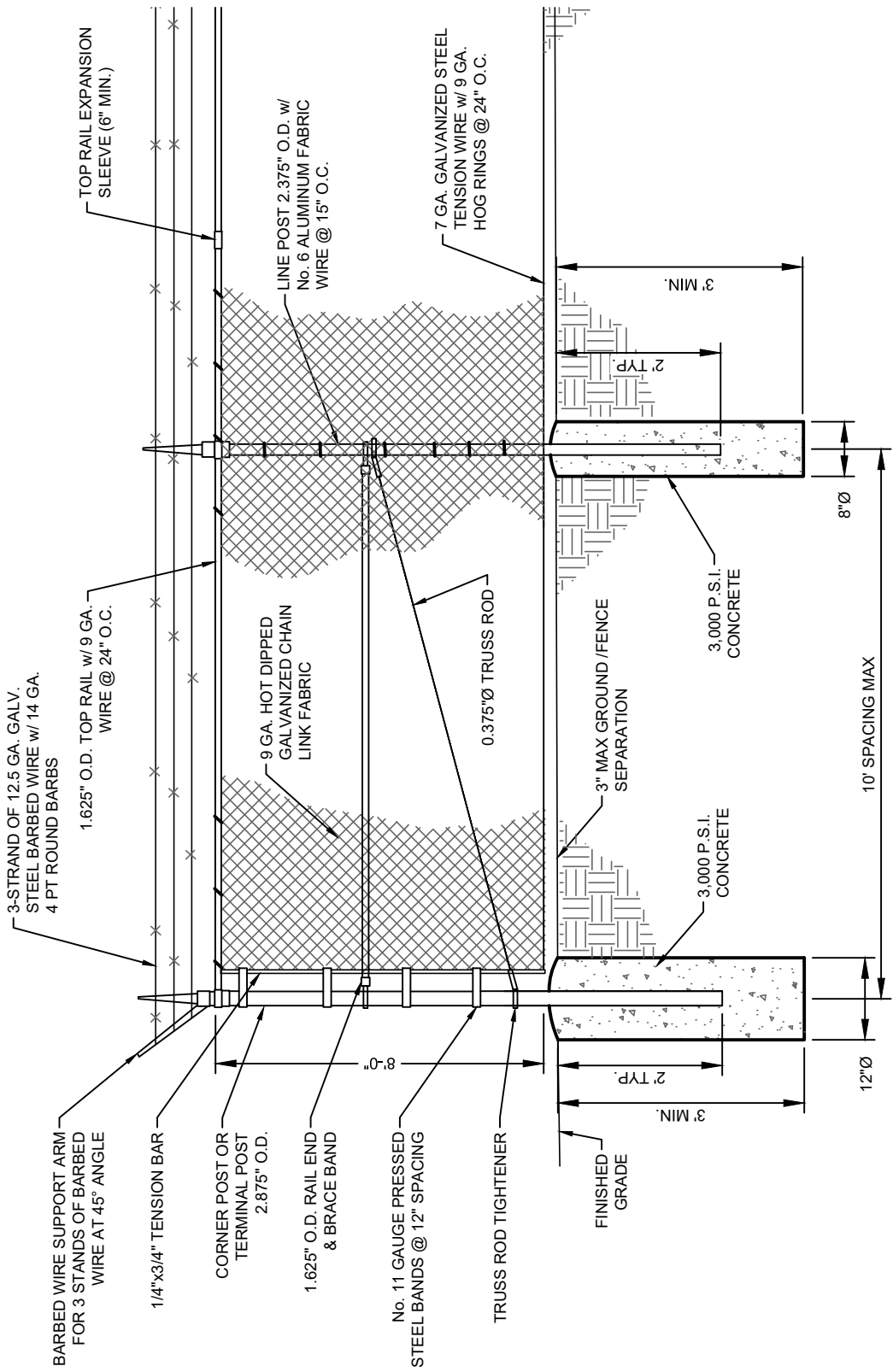
ISSUE DATE:

APRIL 2021

REVISION DATE:

SHEET NO:

W-32



CHAIN LINK FENCE DETAIL

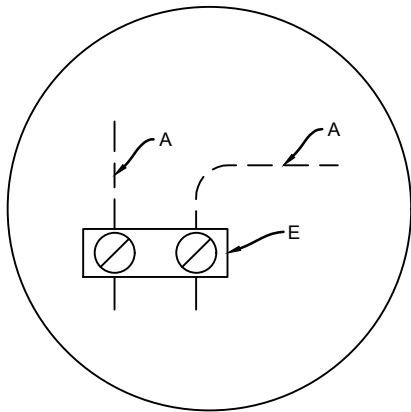
SCALE: NOT TO SCALE



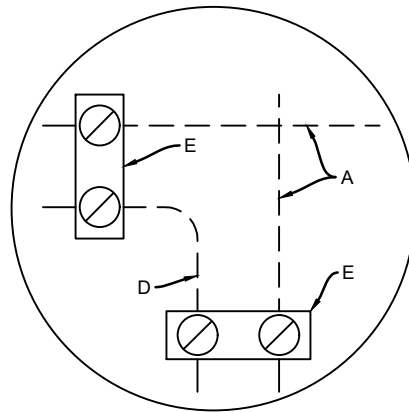
**CITY OF ALAMOGORDO
TECHNICAL STANDARD DRAWINGS**

FACILITY SECURITY CHAIN LINK FENCE DETAIL

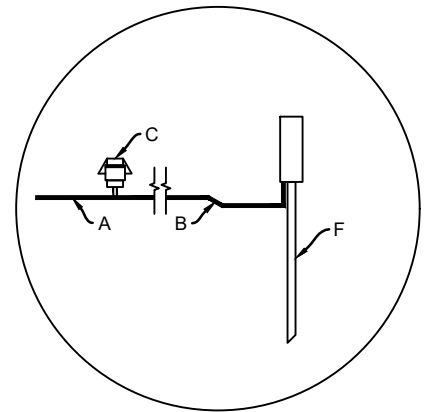
ISSUE DATE: APRIL 2021
REVISION DATE: ----
SHEET NO: W-33



Tee Connection Detail



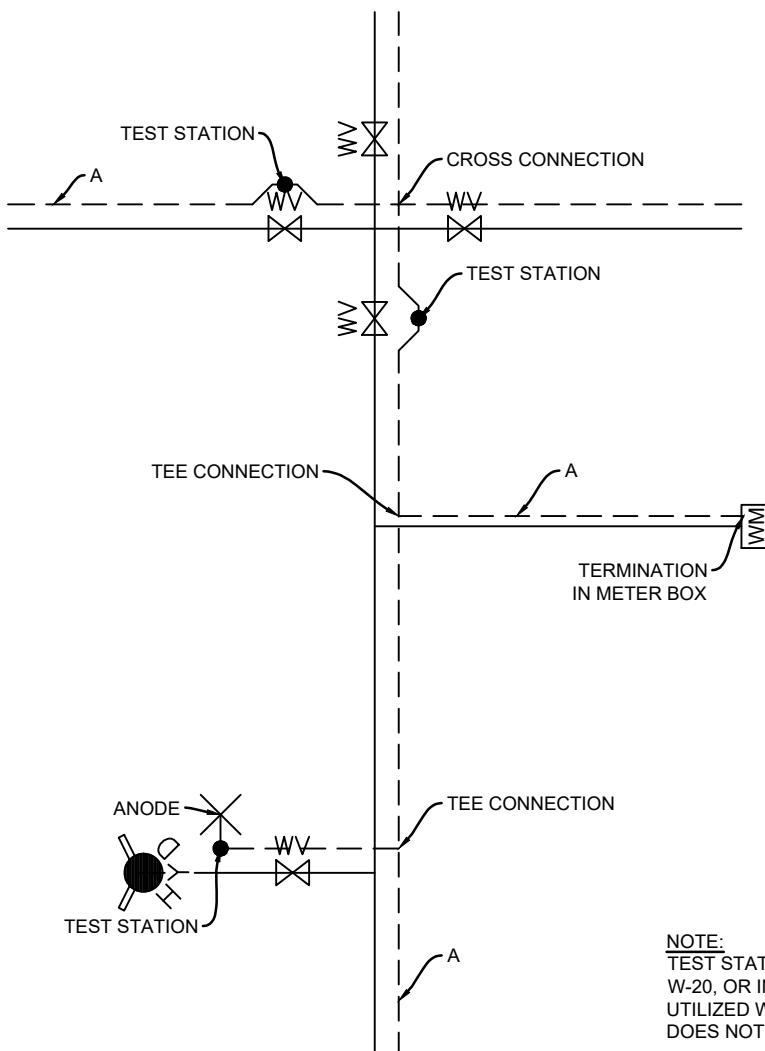
Cross Connection Detail



Anode Detail

CONSTRUCTION NOTES:

- A. TRACING WIRE #12 AWG COPPER CLAD STEEL, TAPED TO TOP OF PIPE; HDPE INSULATION APWA COLOR CODED FOR RESPECTIVE UTILITY
- B. TRACING WIRE #12 AWG COPPER CLAD STEEL - RED FACTORY CONNECTED TO GROUND ANODE
- C. SPLICE CONNECTION
- D. TRACE WIRE JUMPER
- E. LOCKING WATERPROOF CONNECTOR
- F. DRIVE-IN MAGNESIUM GROUNDING ANODE AT ALL TERMINATION/DEAD ENDS (INCLUDING EDGE OF RIGHT-OF-WAY AND CONNECTION POINTS/TERMINAL ENDS OF REHABBED SECTIONS), CONNECT TO MAIN LINE TRACE WIRE USING SPLICE CONNECTIONS



NOTE:

TEST STATIONS OUTSIDE THE ROADWAY SECTION, DETAIL W-20, OR INTEGRAL WITH VALVE BOX COLLAR SHALL ONLY BE UTILIZED WHERE FIRE HYDRANT SPACING W/ TEST STATION DOES NOT ALLOW FOR CONTINUITY OF TRACING WIRE.

SCALE: NOT TO SCALE



**CITY OF ALAMOGORDO
TECHNICAL STANDARD DRAWINGS**

WATERLINE OR RECLAIMED WATER TRACER WIRE DETAILS

ISSUE DATE:

APRIL 2021

REVISION DATE:

SHEET NO:

W-34

March 15, 2017

Smith Engineering Company
201 N. Church St., Suite 200A
Las Cruces, NM 88001

Attn: Francisco Urueta
P: 575-523-2395
E: franciscou@smithengineering.pro

Re: Geotechnical Engineering Report, Addendum No. 1
Scenic Drive Extension
West Terminus of Scenic Drive to Mesa Verde Ranch Road
Alamogordo, New Mexico
Terracon Project No. 68165080

Dear Mr. Urueta:

Terracon Consultants, Inc. (Terracon) has been requested to provide lateral earth pressures for retaining wall design addressing on-site soils at the above referenced project. The design parameters are presented below:

For soils above any free water surface, recommended equivalent fluid pressures for unrestrained foundation elements when using on-site sandy lean clay soils as backfill are:

- Active 40 psf/ft
- Passive 360 psf/ft
- Coefficient of base friction 0.25*

*The coefficient of base friction should be reduced to 0.16 when used in conjunction with passive pressure.

Where the design includes restrained elements, the following equivalent fluid pressures are recommended:

- At rest 60 psf/ft

The lateral earth pressures herein do not include any factor of safety and are not applicable for submerged soils/hydrostatic loading. Additional recommendations may be necessary if such conditions are to be included in the design.



Geotechnical Engineering Report, Addendum No. 1
Scenic Drive Extension ■ Alamogordo, New Mexico
March 15, 2017 ■ Terracon Project No. 68165080



Other requirements for construction should follow the recommendations presented in the original report referenced above. This referenced report recommendations not amended in this letter remain valid.

Sincerely,
Terracon Consultants, Inc.

A handwritten signature in blue ink, appearing to read "Dan Balderrama".

Daniel Balderrama
Staff Professional



J. Dan Cospers, P.E.
Senior Associate

Geotechnical Engineering Report

**Scenic Drive Extension
West Terminus of Scenic Drive to Mesa Verde Ranch Road
Alamogordo, New Mexico**

June 1, 2016

Terracon Project No. 68165080

Prepared for:

Smith Engineering Company
Las Cruces, New Mexico

Prepared by:

Terracon Consultants, Inc.
Las Cruces, New Mexico

Offices Nationwide
Employee-Owned

Established in 1965
terracon.com

Terracon

Geotechnical ■ **Environmental** ■ **Construction Materials** ■ **Facilities**

EXECUTIVE SUMMARY

A geotechnical exploration has been performed for the Scenic Drive Extension in Alamogordo, New Mexico. Terracon's geotechnical scope of work included the advancement of four (4) test borings to an approximate depth of 5 feet below ground surface (bgs).

The following geotechnical considerations were identified:

- n The site soils in the construction area generally consisted of lean clay with varying amounts of sand and gravel to the total explored depth. Groundwater was not encountered in the test borings at the time of drilling.
- n Scenic Drive Extension – 4" asphalt over 8" aggregate base course over 10" compacted subgrade or 7" concrete pavement over 10" compacted subgrade.
- n Close monitoring of the construction operations discussed herein will be critical in achieving the design subgrade support. We therefore recommend that Terracon be retained to monitor this portion of the work.

This geotechnical executive summary should be used in conjunction with the entire report for design and/or construction purposes. It should be recognized that specific details were not included or fully developed in this section, and the report must be read in its entirety for a comprehensive understanding of the items contained herein. The section titled **GENERAL COMMENTS** should be read for an understanding of the report limitations.

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Exhibit A-2	Boring Location Plan
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Exhibit A-4 to A-7	Boring Logs
Exhibit A-8	Pavement Design Sheet
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Exhibit B-2	Laboratory Testing Results
 APPENDIX C – SUPPORTING DOCUMENTS	
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Exhibit C-2	Unified Soil Classification System



June 1, 2016

Smith Engineering Company
201 N. Church St., Suite 200A
Las Cruces, NM 88001

Attn: Francisco Urueta
P: 575-523-2395
E: franciscou@smithengineering.pro

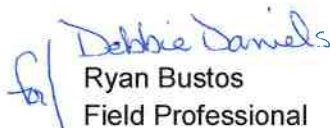
Re: Geotechnical Engineering Report
Scenic Drive Extension
West Terminus of Scenic Drive to Mesa Verde Ranch Road
Alamogordo, New Mexico
Terracon Project No. 68165080

Dear Mr. Urueta:

Terracon Consultants, Inc. (Terracon) has completed the geotechnical engineering services for the above referenced project. These services were performed in general accordance with our proposal number P68165080G dated May 13, 2016. This geotechnical engineering report presents the results of the subsurface exploration and provides geotechnical recommendations concerning the pavements for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report, or if we may be of further service, please contact us.

Sincerely,
TERRACON CONSULTANTS, INC.


Ryan Bustos
Field Professional



J. Dan Cosper, P.E.
Office Manager II

Copies to: Addressee (1 via email, 1 via mail)

Terracon Consultants, Inc. 4450 Bataan Memorial East Las Cruces NM 88011
P 575.527.1700 F 575.527.1092 www.terracon.com

GEOTECHNICAL ENGINEERING REPORT
SCENIC DRIVE EXTENSION
WEST TERMINUS OF SCENIC DR. TO MESA VERDE RANCH RD.
ALAMOGORDO, NEW MEXICO
Terracon Project No. 68165080
June 1, 2016

1.0 INTRODUCTION

This report contains our geotechnical engineering recommendations for the Scenic Drive Extension in Alamogordo, New Mexico. Items addressed in this report are as follows:

- n subsurface soil conditions
- n earthwork
- n groundwater conditions
- n pavement sections

Our geotechnical engineering scope of work for this project included the advancement of four test borings to an approximate depth of 5 feet below existing site grades (bgs).

Logs of the borings along with a Site Location Plan and Boring Location Plan (Exhibits A-1 and A-2) are included in Appendix A of this report. The results of the laboratory testing performed on soil samples obtained from the site during the field exploration are included in Appendix B of this report. Descriptions of the field exploration and laboratory testing are included in their respective appendices.

2.0 PROJECT INFORMATION

2.1 Project Description

Item	Description
Site layout	Refer to the Site Location Plan and Boring Location Plan (Exhibits A-1 and A-2 in Appendix A)
Structures/Elements	The proposed project will include extending Scenic Drive from the west terminus of Scenic Drive to the Mesa Verde Ranch Road (approximately 1,500 lf).
Construction	Asphalt surfaced roadway
Finished elevation	Matching the existing site grades along the project alignment.
Estimated maximum loads	ESALS = 200,000

2.2 Site Location and Description

Item	Description
Location	West terminus of Scenic Drive to Mesa Verde Ranch Road in Alamogordo, New Mexico
Existing site features	Undeveloped
Surrounding developments	Undeveloped
Current ground cover	Exposed native subgrade and sparse vegetation
Existing topography	Relatively level

3.0 SUBSURFACE CONDITIONS

3.1 Typical Subsurface Profile

Specific conditions encountered at the boring locations are indicated on the individual boring logs. Stratification boundaries on the boring logs represent the approximate location of changes in soil types; in-situ, the transition between materials may be gradual. Details for each of the borings can be found on the boring logs included in Appendix A of this report. Based on the results of the borings, subsurface conditions on the project site can be generalized as follows:

Description	Approximate Depth to Bottom of Stratum	Material Encountered	Consistency/Density
Stratum 1	5 feet	Lean Clay with varying amounts of sand and gravel.	N/A

Laboratory tests were conducted on selected soil samples and the test results are presented in Appendix B. Laboratory test results indicate that the surface and near surface soils have a correlated R-Value of 11.

3.3 Groundwater

Groundwater was not observed in the test borings at the time of field exploration. These observations represent groundwater conditions at the time of the field exploration and may not be indicative of other times, or at other locations. Groundwater conditions can change with varying seasonal and weather conditions, and other factors.

4.0 RECOMMENDATIONS FOR DESIGN AND CONSTRUCTION

4.1 Geotechnical Considerations

Geotechnical engineering recommendations for pavements and other earth connected phases of the project are outlined below. The recommendations contained in this report are based upon the results of field and laboratory testing (which are presented in Appendices A and B), engineering analyses, and our current understanding of the proposed project.

4.2 Earthwork

The following presents recommendations for site preparation, excavation, subgrade preparation, and placement of fills on the project. The recommendations presented for design and construction of earth supported elements including pavements are contingent upon following the recommendations outlined in this section.

Earthwork on the project should be observed and evaluated by Terracon. The evaluation of earthwork should include observation and testing of engineered fill, subgrade preparation, pavement materials, and other geotechnical conditions exposed during the construction of the project.

4.2.1 Site Preparation

Strip and remove the existing vegetation and other deleterious materials from the proposed pavement areas. All exposed surfaces should be free of mounds and depressions, which could prevent uniform compaction.

Exposed areas which will receive fill or be constructed upon, once properly cleared, should be scarified to a minimum depth of 10 inches, conditioned to near optimum moisture content, and compacted.

Although evidence of underground facilities such as septic tanks, cesspools, basements, and existing fill material was not observed during the site reconnaissance, such features could be encountered during construction. Underground facilities or existing fill material encountered should be removed and the excavation thoroughly cleaned prior to backfill placement and/or construction.

The individual contractor(s) is responsible for designing and constructing stable, temporary excavations as required to maintain stability of both the excavation sides and bottom. All excavations should be sloped or shored in the interest of safety following local and federal regulations, including current OSHA excavation and trench safety standards.

4.2.2 Excavation

It is anticipated that excavations for the proposed construction can be accomplished with conventional earthmoving equipment.

On-site soils may pump or become unstable or unworkable at high water contents. Workability may be improved by scarifying and drying. Overexcavation of wet zones and replacement with granular materials may be necessary. Lightweight excavation equipment may be required to reduce subgrade pumping.

4.2.3 Subgrade Preparation

Subgrade soils beneath pavements and placed backfill materials should be scarified, moisture conditioned and compacted to a minimum depth of 10 inches prior to construction. The moisture content and compaction of subgrade soils should be maintained until pavement construction.

4.2.4 Fill Material Types

Engineered fill should meet the following material property requirements:

Fill Type ¹	USCS Classification	Acceptable Location for Placement
Near Surface On-Site Soils	CL (LL<35, PI<15)	The on-site soils typically appear suitable for use as engineered fill.
Import ²	SM, SC, or CL (LL<35, PI<15)	On-site areas that require engineered fill.

1. Controlled, compacted fill should consist of approved materials that are free of organic matter and debris. A sample of each material type should be submitted to the geotechnical engineer for evaluation.
2. Silty Sand, Clayey Sand or Lean Clay.

4.2.5 Fill Material Placement and Compaction Requirements

Item	Description
Fill Lift Thickness	10 inches or less in loose thickness
Minimum Compaction Requirements ¹	95% of the materials maximum Modified proctor dry density (ASTM D 1557)
Moisture Content	Within 2% of optimum moisture content value as determined by the modified Proctor test at the time of placement and compaction

1. We recommend that engineered fill be tested for moisture content and compaction during placement. Should the results of the in-place density tests indicate the specified moisture or compaction limits have not been met, the area represented by the test should be reworked and retested as required until the specified moisture and compaction requirements are achieved.

4.2.6 Grading and Drainage

Positive drainage should be provided during construction and maintained throughout the life of the proposed project. Infiltration of water beneath the pavements must be prevented during construction. Grading adjacent to roadways should be as such to not allow moisture infiltration (due to roadway runoff and/or precipitation) into the base material or below the selected pavement type.

4.3 Pavement Recommendations

The following pavement section thicknesses have been performed to provide criteria for the construction of the proposed roadway.

4.3.1 Pavement Design and Construction

New pavement thicknesses developed for the project have been based on the procedures outlined in the Infrastructure Design Directive IDD-2008-05 by the New Mexico Department of Transportation (NMDOT). Estimated traffic criteria used for pavement thickness design includes single 18-kip equivalent standard axle loads (ESAL's) of 200,000 for the planned roadway. Actual design traffic loading should be verified. Reevaluation of the recommended pavement sections may be necessary if the actual traffic varies from the assumed criteria stated above.

For flexible pavement design of the roadway alignment, a terminal serviceability index of 2.0 was utilized along with an inherent reliability of 85 percent. Using the correlated design R-value (11), appropriate EAL/day, environmental criteria and other factors, the structural number (SN) of the pavement section was determined on the basis of the 1993 AASHTO design equation.

4.3.2 Recommended Pavement Sections

Recommended alternatives for flexible and rigid pavements are as follows:

PAVEMENT ALTERNATIVES

Traffic Area	Alternative	Recommended Pavement Section Thickness (inches)			
		Asphalt Concrete Surface	Portland Cement Concrete	Aggregate Base Course	Total
Scenic Drive Extension	A	4	---	8	12
	B	---	7	---	7

Aggregate base course should consist of a blend of sand and gravel that meets strict specifications for quality and gradation. Use of materials meeting New Mexico Department of Transportation (NMDOT Section 304) specifications is recommended. Aggregate base course material should be tested to determine compliance with these specifications prior to importation to the site.

Aggregate base course materials should be placed in lifts not exceeding 6 inches and should be compacted to a minimum of 95% of the material's maximum modified Proctor density (ASTM D 1557) within a moisture content range of 2 percent below to 2 percent above optimum.

Asphalt concrete should be obtained from an approved mix design stating the optimum asphalt content, job mix formula, and recommended mixing and placing temperatures. The mix design should be submitted prior to construction to verify its adequacy. The asphalt materials should be placed in maximum 3.0-inch lifts.

4.3.3 Compliance

Recommendations for pavement construction presented depend upon compliance with recommended material specifications. To assess compliance, observation and testing should be performed under the direction of the geotechnical engineer.

4.3.4 Pavement Performance

Long term pavement performance will be dependent upon several factors, including maintaining subgrade moisture levels and providing for preventive maintenance. The following recommendations should be considered the minimum:

- n Site grading at a minimum 2% grade away from the pavements;
- n The subgrade and the pavement surface have a minimum $\frac{1}{4}$ inch per foot slope to promote proper surface drainage.
- n Consider appropriate edge drainage and pavement under drain systems,
- n Install pavement drainage surrounding areas anticipated for frequent wetting
- n Install joint sealant and seal cracks immediately,
- n Seal all landscaped areas in, or adjacent to pavements to minimize or prevent moisture migration to subgrade soils;
- n Placing compacted, low permeability backfill against the exterior side of curb and gutter.

Preventive maintenance should be planned and provided for through an on-going pavement management program. Preventive maintenance activities are intended to slow the rate of pavement deterioration, and to preserve the pavement investment. Preventive maintenance consists of both localized maintenance (e.g. crack and joint sealing and patching) and global maintenance (e.g. surface sealing). Preventive maintenance is usually the first priority when implementing a planned pavement maintenance program and provides the highest return on investment for pavements. Prior to implementing any maintenance, additional engineering observation is recommended to determine the type and extent of preventive maintenance.

Site grading is generally accomplished early in the construction phase. However as construction proceeds, the subgrade may be disturbed due to utility excavations, construction traffic, desiccation, or rainfall. As a result, the pavement subgrade may not be suitable for

pavement construction and corrective action will be required. The subgrade should be carefully evaluated at the time of pavement construction for signs of disturbance or excessive rutting. If disturbance has occurred, pavement subgrade areas should be reworked, moisture conditioned, and properly compacted to the recommendations in this report immediately prior to paving.

We recommend the pavement areas be rough graded and then thoroughly proofrolled with a loaded tandem axle dump truck prior to final grading and paving. Particular attention should be paid to high traffic areas that were rutted and disturbed earlier and to areas where backfilled trenches are located. Areas where unsuitable conditions are located should be repaired by removing and replacing the materials with properly compacted fills. All pavement areas should be moisture conditioned and properly compacted to the recommendations in this report immediately prior to paving.

5.0 GENERAL COMMENTS

Terracon should be retained to review the final design plans and specifications so comments can be made regarding interpretation and implementation of our geotechnical recommendations in the design and specifications. Terracon also should be retained to provide observation and testing services during grading, excavation, pavement construction and other earth-related construction phases of the project.

The analysis and recommendations presented in this report are based upon the data obtained from the borings performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur across the site, or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either expressed or implied, are intended or made. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered

Geotechnical Engineering Report

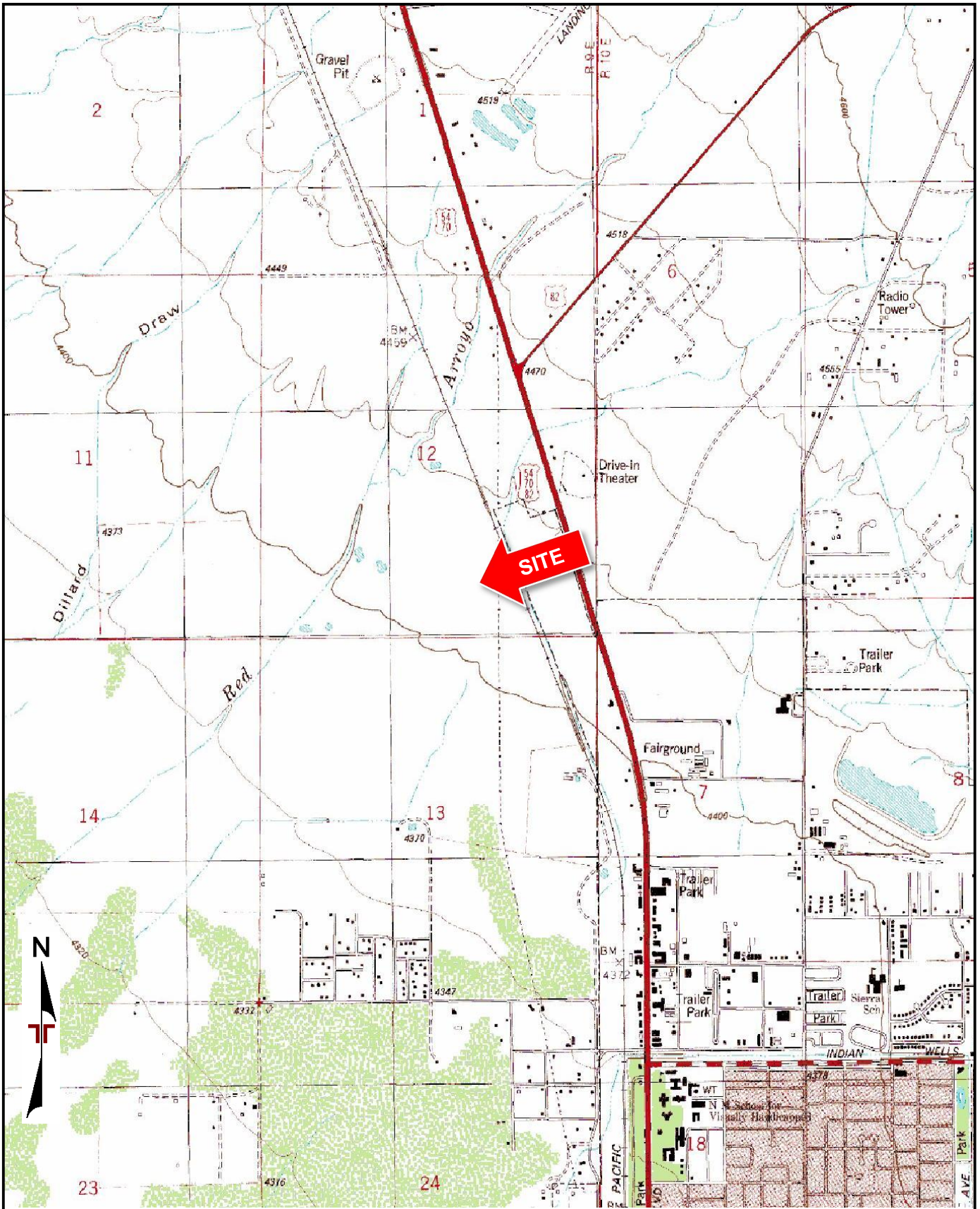
Scenic Drive Extension ■ Alamogordo, New Mexico

June 1, 2016 ■ Terracon Project No. 68165080



valid unless Terracon reviews the changes and either verifies or modifies the conclusions of this report in writing.

APPENDIX A
FIELD EXPLORATION



Project Manager:
JDC

Drawn by:
RB

Checked by:
JDC

Approved by:
JDC

Project No.
68165080

Scale:
1"=2,000'

File Name:
FIGURES

Date:
5/20/2016

Terracon

4450 Bataan Memorial E
 Las Cruces, NM 88011-6000

SITE LOCATION PLAN

Scenic Drive Extension
 West Terminus of Scenic Drive to Mesa Verde Ranch Road
 Alamogordo, NM

Exhibit
A-1



DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Approximate boring location

AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

Project Manager:	JDC	Project No.	68165080
Drawn by:	RB	Scale:	AS SHOWN
Checked by:	JDC	File Name:	FIGURES
Approved by:	JDC	Date:	5/20/2016

Terracon
 4450 Bataan Memorial E
 Las Cruces, NM 88011-6000

BORING LOCATION PLAN

Scenic Drive Extension
 West Terminus of Scenic Drive to Mesa Verde Ranch Road
 Alamogordo, NM

Exhibit

A-2

Geotechnical Engineering Report

Scenic Drive Extension ■ Alamogordo, New Mexico

June 1, 2016 ■ Terracon Project No. 68165080



Field Exploration Description

A total of 4 test borings were drilled at the site on May 18, 2016. The borings were drilled to an approximate depth of about 5 feet below the ground surface at the approximate locations shown on the attached Site Location Plan and Boring Location Plan, Exhibits A-1 and A-2, respectively. The test borings were located as follows:

Borings	Location	Depth (feet)
B-1 thru B-4	Scenic Drive	5

The test borings were advanced with a hand operated auger.

The borings were located in the field by using the proposed site plan and an aerial photograph of the site, and measuring from existing property lines. The accuracy of boring locations should only be assumed to the level implied by the method used.

Lithologic logs of each boring were recorded by the field engineering during the drilling operations. Bulk samples of subsurface materials were obtained.

Groundwater conditions were evaluated in the borings at the time of site exploration.

BORING LOG NO. B-1

PROJECT: SCENIC DRIVE EXTENTION

CLIENT: SMITH ENGINEERING COMPANY
 201 N. CHURCH ST., SUITE 200A, Las Cruces, NM

SITE: WEST TERMINUS OF SCENIC DRIVE TO MESA VERDE RANCH ROAD
ALAMOGORDO, NM

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 32.93457° Longitude: -105.96786°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS	PERCENT FINES
	Approximate Surface Elev: 4424 (Ft.) +/- ELEVATION (Ft.)							LL-PL-PI	
DEPTH	SANDY LEAN CLAY (CL) , trace gravel, reddish-brown	5				4		27-19-8	68
	Boring Terminated at 5 Feet								

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method: HAND AUGER	See Exhibit A-3 for description of field procedures. See Appendix B for description of laboratory procedures and additional data (if any). See Appendix C for explanation of symbols and abbreviations.	Notes:
Abandonment Method: Borings backfilled with soil cuttings upon completion.		
WATER LEVEL OBSERVATIONS	4450 Bataan Memorial E Las Cruces, NM	Boring Started: 5/18/2016 Boring Completed: 5/18/2016 Drill Rig: Drill: Project No.: 68165080 Exhibit: A-4

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL_68165080.GPJ TERRACON2015.GDT 6/1/16

BORING LOG NO. B-2

PROJECT: SCENIC DRIVE EXTENTION

CLIENT: SMITH ENGINEERING COMPANY
 201 N. CHURCH ST., SUITE 200A, Las Cruces, NM

SITE: WEST TERMINUS OF SCENIC DRIVE TO MESA VERDE RANCH ROAD
ALAMOGORDO, NM

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 32.93408° Longitude: -105.96847°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS	PERCENT FINES
	Approximate Surface Elev: 4404 (Ft.) +/- ELEVATION (Ft.)							LL-PL-PI	
5.0	SANDY LEAN CLAY (CL) , trace gravel, reddish-brown	5							
	Boring Terminated at 5 Feet								

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method: HAND AUGER	See Exhibit A-3 for description of field procedures. See Appendix B for description of laboratory procedures and additional data (if any). See Appendix C for explanation of symbols and abbreviations.	Notes:
Abandonment Method: Borings backfilled with soil cuttings upon completion.		
WATER LEVEL OBSERVATIONS	4450 Bataan Memorial E Las Cruces, NM	Boring Started: 5/18/2016 Boring Completed: 5/18/2016 Drill Rig: Project No.: 68165080 Exhibit: A-5

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL_68165080.GPJ TERRACON2015.GDT 6/1/16

BORING LOG NO. B-3

PROJECT: SCENIC DRIVE EXTENTION

CLIENT: SMITH ENGINEERING COMPANY
 201 N. CHURCH ST., SUITE 200A, Las Cruces, NM

SITE: WEST TERMINUS OF SCENIC DRIVE TO MESA VERDE RANCH ROAD
ALAMOGORDO, NM

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 32.93355° Longitude: -105.96889°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS	PERCENT FINES
	Approximate Surface Elev: 4410 (Ft.) +/- ELEVATION (Ft.)							LL-PL-PI	
	LEAN CLAY WITH SAND (CL) , trace gravel, reddish-brown	5				6		27-18-9	76
	Boring Terminated at 5 Feet	5							

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
HAND AUGER

Abandonment Method:
Borings backfilled with soil cuttings upon completion.

See Exhibit A-3 for description of field procedures.
 See Appendix B for description of laboratory procedures and additional data (if any).
 See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS



Boring Started: 5/18/2016	Boring Completed: 5/18/2016
Drill Rig:	Driller:
Project No.: 68165080	Exhibit: A-6


THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL_68165080.GPJ TERRACON2015.GDT 6/1/16

BORING LOG NO. B-4


PROJECT: SCENIC DRIVE EXTENTION

CLIENT: SMITH ENGINEERING COMPANY
 201 N. CHURCH ST., SUITE 200A, Las Cruces, NM

SITE: WEST TERMINUS OF SCENIC DRIVE TO MESA VERDE RANCH ROAD
ALAMOGORDO, NM

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 32.93246° Longitude: -105.96999°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS	PERCENT FINES
	Approximate Surface Elev: 4408 (Ft.) +/- ELEVATION (Ft.)							LL-PL-PI	
	<p>SANDY LEAN CLAY WITH GRAVEL (CL), reddish-brown</p>	5				6		30-19-11	56
	<p>Boring Terminated at 5 Feet</p>								

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method: HAND AUGER	See Exhibit A-3 for description of field procedures. See Appendix B for description of laboratory procedures and additional data (if any). See Appendix C for explanation of symbols and abbreviations.	Notes:	
Abandonment Method: Borings backfilled with soil cuttings upon completion.			
WATER LEVEL OBSERVATIONS	 <p>4450 Bataan Memorial E Las Cruces, NM</p>	Boring Started: 5/18/2016	Boring Completed: 5/18/2016
		Drill Rig:	Driller:
		Project No.: 68165080	Exhibit: A-7

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL_68165080.GPJ TERRACON2015.GDT 6/1/16

Pavement Design

(AASHTO 1993 Method)

Design Inputs

	<u>Asphalt</u>			<u>Concrete</u>	
Sugrade Support	CBR =	5			
	Mr =	7150	psi	k =	140
Reliability		85	%		85
Standard Deviation	So =	0.45			0.35
Initial Serviceability	Po =	4.2			4.2
Terminal Serviceability	Pt =	2.0			2.0
Design Serviceability Loss,	DPSI =	2.2			2.2

Layer Coefficients:

AC Surface and Binder	a ₁ =	0.42
Aggregate Base	a ₂ =	0.12

Concrete Compressive Strength =	4000	psi
Modulus of Elasticity of Concrete =	3,600	ksi
Modulus of Rupture of Concrete: =	580	
Load Transfer ("J" Factor) =	4.2	
Drainage Coefficient =	1.0	

Asphalt Section Traffic (18 kip ESAL) =

Arterial
200,000

Asphalt Pavement Section

	<u>Drainage, m</u>			
AC Surface + Binder		4.0	in.	
Aggregate Base	1.0	8.0	in.	

Structural Number: 2.64

Structural Number - Required 2.54

Concrete Section Traffic (18 kip ESAL) =

Section 1
275,000

Concrete Pavement Section

6.6 in.

Project: Scenic Drive Extension

Location: Alamogordo, New Mexico

Project No. 68165080

Date: 05/24/16



APPENDIX B
LABORATORY TESTING

Geotechnical Engineering Report

Scenic Drive Extension ■ Alamogordo, New Mexico

June 1, 2016 ■ Terracon Project No. 68165080



Laboratory Testing

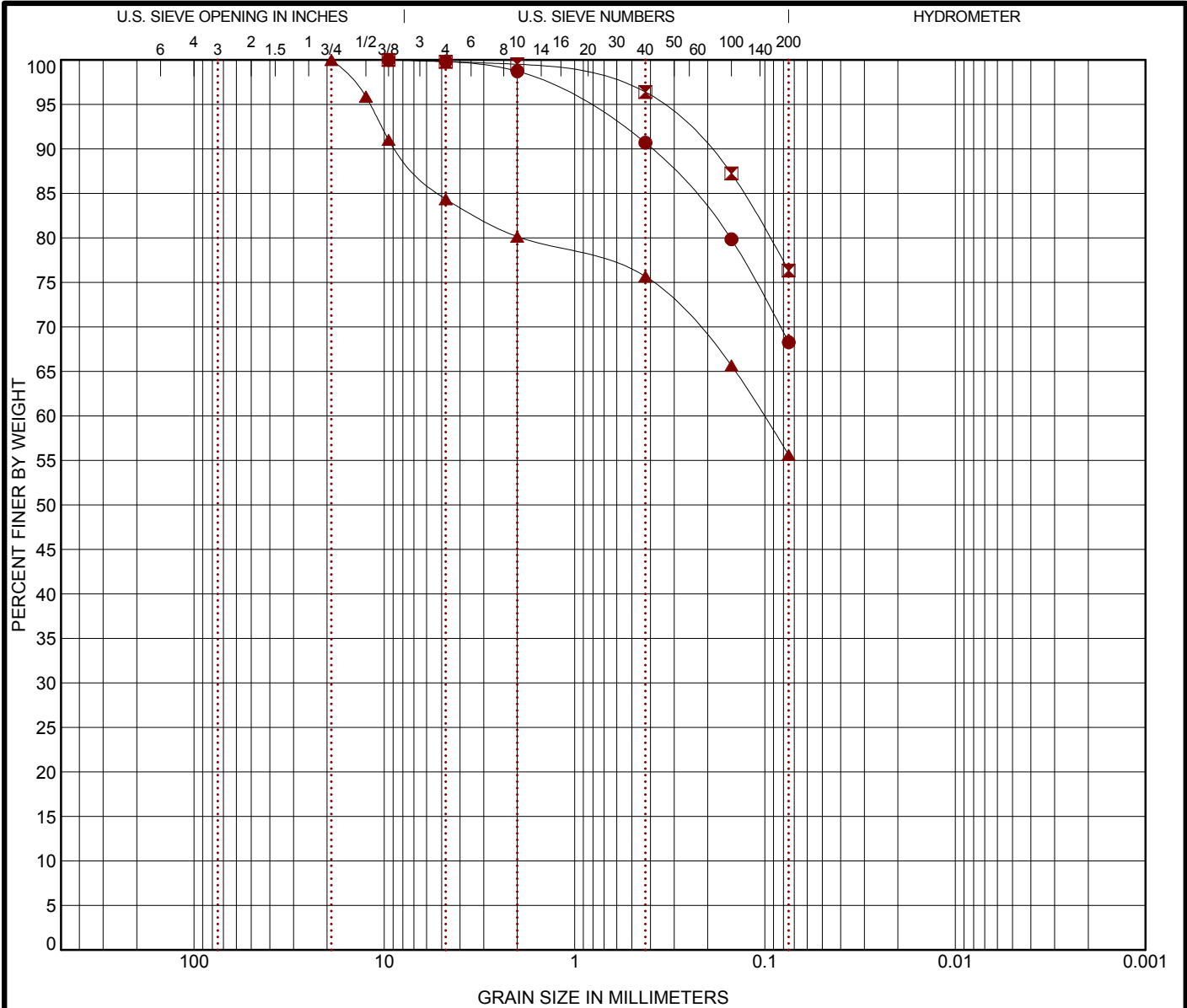
Soil samples were tested in the laboratory to measure their natural water content. Grain size analysis testing (ASTM D422) was also performed on selected samples. The test results are provided on the boring logs and presented in Appendix B.

Descriptive classifications of the soils indicated on the boring logs are in accordance with the enclosed General Notes and the Unified Soil Classification System. Also shown are estimated Unified Soil Classification Symbols. A brief description of this classification system is attached to this report in Appendix C. All classification was by visual/manual procedures, (ASTM D2487). Selected samples were further classified using the results of Atterberg limit testing, (ASTM D4318). The Atterberg limit test results are also provided on the boring logs.

Procedural standards noted above are for reference to methodology in general. In some cases, variations to methods are applied as a result of local practice or professional judgment.

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring ID	Depth	USCS Classification	LL	PL	PI	Cc	Cu
● B-1	0 - 5	SANDY LEAN CLAY (CL)	27	19	8		
☒ B-3	0 - 5	LEAN CLAY with SAND (CL)	27	18	9		
▲ B-4	0 - 5	SANDY LEAN CLAY with GRAVEL (CL)	30	19	11		

Boring ID	Depth	D ₁₀₀	D ₆₀	D ₃₀	D ₁₀	%Gravel	%Sand	%Fines
● B-1	0 - 5	9.5				0.2	31.6	68.3
☒ B-3	0 - 5	9.5				0.2	23.5	76.3
▲ B-4	0 - 5	19	0.101			15.6	28.7	55.6













LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS-2 68165080.GPJ 35159097 - ATTERBERG ISSUE.GPJ 6/1/16

PROJECT: SCENIC DRIVE EXTENTION	<p style="margin: 0;">4450 Bataan Memorial E Las Cruces, NM</p>	PROJECT NUMBER: 68165080
SITE: WEST TERMINUS OF SCENIC DRIVE TO MESA VERDE RANCH ROAD ALAMOGORDO, NM		CLIENT: SMITH ENGINEERING COMPANY 201 N. CHURCH ST., SUITE 200A, Las Cruces, NM
		EXHIBIT: B-2

APPENDIX C
SUPPORTING DOCUMENTS

GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

SAMPLING				WATER LEVEL		Water Initially Encountered	FIELD TESTS	(HP) Hand Penetrometer
						Water Level After a Specified Period of Time		(T) Torvane
						Water Level After a Specified Period of Time		(b/f) Standard Penetration Test (blows per foot)
	Auger	Shelby Tube	Split Spoon			Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.		(OVA) Organic Vapor Analyzer

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

LOCATION AND ELEVATION NOTES

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS	RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance Includes gravels, sands and silts.			CONSISTENCY OF FINE-GRAINED SOILS (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance		
	Descriptive Term (Density)	Standard Penetration or N-Value Blows/Ft.	Ring Sampler Blows/Ft.	Descriptive Term (Consistency)	Unconfined Compressive Strength, Qu, tsf	Standard Penetration or N-Value Blows/Ft.
Very Loose	0 - 3	0 - 6	Very Soft	less than 0.25	0 - 1	< 3
Loose	4 - 9	7 - 18	Soft	0.25 to 0.50	2 - 4	3 - 4
Medium Dense	10 - 29	19 - 58	Medium-Stiff	0.50 to 1.00	4 - 8	5 - 9
Dense	30 - 50	59 - 98	Stiff	1.00 to 2.00	8 - 15	10 - 18
Very Dense	> 50	≥ 99	Very Stiff	2.00 to 4.00	15 - 30	19 - 42
			Hard	> 4.00	> 30	> 42

RELATIVE PROPORTIONS OF SAND AND GRAVEL

<u>Descriptive Term(s) of other constituents</u>	<u>Percent of Dry Weight</u>
Trace	< 15
With	15 - 29
Modifier	> 30

RELATIVE PROPORTIONS OF FINES

<u>Descriptive Term(s) of other constituents</u>	<u>Percent of Dry Weight</u>
Trace	< 5
With	5 - 12
Modifier	> 12

GRAIN SIZE TERMINOLOGY

<u>Major Component of Sample</u>	<u>Particle Size</u>
Boulders	Over 12 in. (300 mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm)
Silt or Clay	Passing #200 sieve (0.075mm)

PLASTICITY DESCRIPTION

<u>Term</u>	<u>Plasticity Index</u>
Non-plastic	0
Low	1 - 10
Medium	11 - 30
High	> 30

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests ^A				Soil Classification			
				Group Symbol	Group Name ^B		
Coarse Grained Soils: More than 50% retained on No. 200 sieve	Gravels: More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels: Less than 5% fines ^C	$Cu \geq 4$ and $1 \leq Cc \leq 3$ ^E	GW	Well-graded gravel ^F		
		Gravels with Fines: More than 12% fines ^C	Fines classify as ML or MH	GP	Poorly graded gravel ^F		
			Fines classify as CL or CH	GM	Silty gravel ^{F,G,H}		
		Sands: 50% or more of coarse fraction passes No. 4 sieve	Clean Sands: Less than 5% fines ^D	$Cu < 4$ and/or $1 > Cc > 3$ ^E	GC	Clayey gravel ^{F,G,H}	
	Sands with Fines: More than 12% fines ^D		$Cu \geq 6$ and $1 \leq Cc \leq 3$ ^E	SW	Well-graded sand ^I		
			$Cu < 6$ and/or $1 > Cc > 3$ ^E	SP	Poorly graded sand ^I		
	Fines classify as ML or MH		SM	Silty sand ^{G,H,I}			
		Fines classify as CL or CH	SC	Clayey sand ^{G,H,I}			
Fine-Grained Soils: 50% or more passes the No. 200 sieve	Silts and Clays: Liquid limit less than 50	Inorganic:	$PI > 7$ and plots on or above "A" line ^J	CL	Lean clay ^{K,L,M}		
			$PI < 4$ or plots below "A" line ^J	ML	Silt ^{K,L,M}		
		Organic:	Liquid limit - oven dried	< 0.75	OL	Organic clay ^{K,L,M,N}	
			Liquid limit - not dried		OH	Organic silt ^{K,L,M,O}	
	Silts and Clays: Liquid limit 50 or more	Inorganic:	PI plots on or above "A" line	CH	Fat clay ^{K,L,M}		
			PI plots below "A" line	MH	Elastic Silt ^{K,L,M}		
		Organic:	Liquid limit - oven dried	< 0.75	OH	Organic clay ^{K,L,M,P}	
			Liquid limit - not dried		OH	Organic silt ^{K,L,M,Q}	
		Highly organic soils: Primarily organic matter, dark in color, and organic odor				PT	Peat

^A Based on the material passing the 3-inch (75-mm) sieve

^B If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

^C Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

^D Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

$$^E Cu = D_{60}/D_{10} \quad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$$

^F If soil contains $\geq 15\%$ sand, add "with sand" to group name.

^G If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

^H If fines are organic, add "with organic fines" to group name.

^I If soil contains $\geq 15\%$ gravel, add "with gravel" to group name.

^J If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

^K If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

^L If soil contains $\geq 30\%$ plus No. 200 predominantly sand, add "sandy" to group name.

^M If soil contains $\geq 30\%$ plus No. 200, predominantly gravel, add "gravelly" to group name.

^N $PI \geq 4$ and plots on or above "A" line.

^O $PI < 4$ or plots below "A" line.

^P PI plots on or above "A" line.

^Q PI plots below "A" line.

