



**CITY OF SAN ANTONIO
TRANSPORTATION & CAPITAL IMPROVEMENTS**

**SPECIFICATIONS
FOR**

**2017 - 2018 Task Order Contract for Spin Cast
Geopolymer Pipe Liner Projects**



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Prepared by

**TRANSPORTATION & CAPITAL IMPROVEMENTS
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Dale M. Keller, P.E. Date

PROJECT DESCRIPTION

1.1 PROJECT SCOPE

- 1.1.1 This is a Task Order Contract for the installation of Spin Cast Geopolymer Pipe Lining Systems relating to storm water projects throughout the City.
- 1.1.2 Project construction may include but is not limited to: reinforced concrete pipe, concrete box culverts, inlets, junction boxes, manholes, concrete riprap, headwalls, wingwalls, flowable fill, channel excavation, structural excavation, street and outfall reconstruction, sidewalks, driveways, concrete curbs, concrete retaining walls, wheel chair ramps, asphalt replacement, removing and relocating mail boxes, topsoil, sodding, sidewalk pipe railing, concrete steps, guard rail, pavement striping, signage, adjusting existing manholes and meter boxes, utility repairs, service laterals and any other items necessary to complete projects.

1.2 PERFORMANCE TIME

- 1.2.1 It is the Contractor's responsibility to provide sufficient work forces to accomplish the task orders as assigned and within the assigned schedules. The City does not guarantee that a Task Order will be issued within any specific timeline.

1.3 TASK ORDERS

- 1.3.1 It is the intent of the bid proposal to establish a fixed unit price for the various estimated line item quantities to be paid to the Contractor by the City during the term of this contract. Project Sites will be located throughout the City; however, they are unspecified at the time of bidding. At the discretion of the City, work for the individual construction sites will be assigned by way of the City's issuance of Task Orders which will be issued throughout the term of this Task Order Contract. Such Task Order authorizations will identify the needed work items and their associated quantities. Any construction plans that may be necessary to complete the work will be provided at that time.
- 1.3.2 The Contractor's ability to satisfactorily complete projects and within the approved construction schedules may affect the City's issuance of future Task Orders.
- 1.3.3 Work line items and quantities included in this contract, as well as the entire bid value amount, are not guaranteed. Unit prices established shall remain valid throughout the duration of the contract.

- 1.3.4 No direct payment shall be made for the following specification items as the Contractor shall include the cost of these items in various other bid items:
- 100.1 Mobilization
 - 100.2 Insurance and Bond
 - 101.1 Preparing Right-of-Way
 - 530.1 Barricades, signs and Traffic Handling
 - 540 Temporary Erosion, Sedimentation and Water Pollution Prevention and Control.
- 1.3.5 The responsibility of the Contractor to create and maintain a CPM Project Schedule as discussed in Article 1, General Provisions, Section 3.10, Contractor's Project Schedules, will not be a requirement for this contract.
- 1.3.6 Temporary Erosion, Sedimentation and Water Pollution Prevention and Control measures not specifically listed as bid items shall not be paid for directly but shall be included in the various other bid items.
- 1.3.7 Excavation due to construction of curb, sidewalk, retaining walls, driveways, wheelchair ramps, and parkway grading (edge of pavement/curb to property line) shall not be paid for directly but shall be included in various other bid items of which it forms a component part.
- 1.3.8 As the project sites require, the Contractor shall acquire all required approvals and permits associated with the TPDES regulations of the Texas Commission on Environmental Quality. All associated fees and expenses related to these efforts will be the responsibility of the Contractor.

1.4 GENERAL CONSTRUCTION NOTES

- 1.4.1 COSA Standard Specifications for Construction, Details for Construction and General Plan Sheet Notes which may be applicable to this contract are available on the City's website located at:
<http://www.sanantonio.gov/TCI/CurrentVendorResources/StandardSpecificationsandDetails.aspx>
- 1.4.2 Prior to construction, the Contractor shall obtain all required storm water permits, fees and approvals. No construction or fabrication shall begin until the Contractor has received and thoroughly reviewed all permits required for construction in drainage easements, right-of-ways and floodplains.
- 1.4.3 The Contractor shall notify Storm Water Engineering at least 24 hours prior to the installation of any drainage facility within a drainage easement or street right-of-way not indicated on the construction plans.

- 1.4.4 The contractor is responsible for protecting existing drainage facilities from damage. Any damage to existing drainage systems, whether or not shown on the plans, shall be the responsibility of the contractor to repair at his expense. The Contractor shall notify Storm Water Engineering at 207-8022 as soon as conflicts with utilities are encountered or any drainage system is damaged during Construction.
- 1.4.5 No structure, fences, walls, landscaping or other obstructions that impede drainage shall be placed within the limits of the drainage easements shown on the construction documents.
- 1.4.6 Upon completion of trenching, the area will be backfilled and compacted to its original condition. Trenches/bore pits to be open and unattended longer than 24 hours shall be protected to withstand all hydrodynamic and hydrostatic forces and prevent downstream impacts. Trenches/bore pits to be open longer than 30 days after starting excavation shall be backfilled with a semi-permanent repair backfill.
- 1.4.7 Construction spoils will not be allowed to be deposited anywhere within a drainage easement, right-of-way or floodplain within the limits of the project and shall be disposed offsite in compliance with the current applicable regulations.
- 1.4.8 Improved sections of earthen channels and/or waterways will be vegetated by seeding or sodding. Eighty-five percent (85%) of the channel surface area must have established vegetation before the City of San Antonio will accept the channel for maintenance.
- 1.4.9 Contractor shall respond to all COSA inquiries and submittals within 24 business day hours.
- 1.4.10 It is anticipated that some project sites may require working time restrictions. No additional cost will be paid to the contractor for reduced working schedules.
- 1.4.11 Contractor shall protect and provide temporary support to all utilities as necessary during construction at no direct pay.

1.5 CONSTRUCTION PHASING AND STAGING NOTES

- 1.5.1 Any questions regarding phasing or staging will be strictly handled by the Transportation & Capital Improvements Department which has complete authority to make final decisions on any changes or modifications. The contractor must contact the City's construction inspector 48 hours in advance (not including weekends or holidays) of any minor street closure. It will be the contractor's responsibility to advise Construction Inspections ten (10) days in advance of any arterial street closure. This much time is necessary to install advisory signs and give the motorists a minimum of seven (7) days notice before street closure. The construction inspector, after having been notified, will contact the engineering

office immediately to make the necessary arrangements. The temporary barricades and warning signs shall be located so as to afford the maximum protection to the public as well as construction personnel and equipment and to facilitate an expeditious flow of traffic at all times during construction.

- 1.5.2 If there are two (2) or more phases in the project, no more than two (2) phases of construction may be worked at one time, unless otherwise indicated in the plans. Partial construction at different scattered locations within the project will not be allowed. Projects that consist of distinct and separate areas may be under construction at the same time with COSA approval. All remaining streets within the project or separate area shall remain open at all times.
- 1.5.3 Unless otherwise indicated in the plans, two (2) phases in sequence may be worked at the same time in projects where there are at least three (3) phases. Such as Phase 1 and Phase 2 and before going to Phase 3, Phase 1 must be completed 100% with case material and approved densities (prime coated if base material is Item No. 200" Flexible Base") before beginning Phase 3. If there are only two (2) phases in the project, Phase 1 must be completed 100% with base material and approved densities (prime coated if base material is Item No. 200 "Flexible Base") before proceeding to Phase 2.
- 1.5.4 The plans are phased for street and storm drainage construction. No storm sewer construction will take place outside of the phasing limits under construction, unless specifically noted on the plans or authorized in writing by the COSA Project Manager.
- 1.5.5 All storm drainage pipes are not considered utilities, regardless of size. This work shall be part of the Phase.
- 1.5.6 Unless otherwise indicated in the plans, intersecting streets shall be constructed in stages so as to maintain access. Intersection work shall be done during weekend hours or as directed by the Engineer. No two adjacent intersections may be constructed simultaneously. With approval from the Engineer, the Contractor may close an entire intersection. The Contractor will be required to provide a detour plan for such a closure to the Engineer for approval.

1.6 CONSTRUCTION TRAFFIC NOTES AND SPECIAL CONDITIONS

- 1.6.1 It is the contractor's sole responsibility to see that all traffic control devices are properly installed and maintained at the job site in accordance with the plans, specifications and related industry standards and regulations. These notes do not, in of themselves, constitute a Traffic Control Plan. In the event that these plans do not include traffic control, or that the Contractor wishes to vary from traffic control included with these plans, he shall submit for review a Traffic Control Plan sealed by a Professional Engineer registered in the State of Texas, including a sign and

barricade plan conforming to the requirements of the Texas Manual on Uniform Traffic Control Devices. The City's construction observer / inspector (COI) and the traffic engineering representative will only be responsible to inspect the traffic control devices being deployed. If, in the opinion of the traffic engineering representative and the COI, the traffic control devices do not conform to established standards or are incorrectly placed or are insufficient in quantity to protect the general public, the COI shall have the option to stop construction operations at no expense to the City until such time as the conditions are corrected by the contractor.

- 1.6.2 Prior to starting construction, the contractor shall contact the City of San Antonio Traffic Operations Section for a traffic sign and traffic signal inventory. Prior to completion of the contract and removal of the barricades, the contractor shall again contact the Traffic Operations Section. The barricades shall not be removed until all applicable permanent traffic signs and signals are in place.
- 1.6.3 It is the contractor's responsibility to obtain and maintain temporary stop signs and all other traffic control devices required to protect the general public. If the City of San Antonio has removed permanent stop signs, the contractor shall request that the signs be returned to the construction site to be reinstalled by the contractor. All permanent signs or traffic control devices missing or damaged upon completion of construction shall be replaced at the contractor's expense.
- 1.6.4 The contractor must contact the City's COI 48 hours in advance (not including weekends) of any minor street closure. It will be the contractor's responsibility to advise the COI 10 days in advance of an arterial total street closure. This much time is necessary to install advisory signs and give the motorists a minimum of 7 days notice of the street closure. The COI after being notified will contact the traffic engineering office to make the necessary arrangements.
- 1.6.5 As work progresses, location of temporary traffic control devices will be adjusted and modified, as necessary by the contractor at contractor's expense.
- 1.6.6 If the need arises, additional temporary traffic control devices, special directional devices, and/or business name signs may be ordered by the traffic engineering representative at the contractor's expense.
- 1.6.7 Temporary traffic control devices shall conform to the City's "Typical Sign and Barricade Standards" sheets and to the Texas Manual on Uniform Traffic Control Devices.
- 1.6.8 The contractor must maintain all streets within project limits open to through traffic by repairing trenches, potholes, leveling up with asphalt, etc. at no direct payment, with the cost to be included in other items.
- 1.6.9 The contractor shall be responsible for providing suitable access accommodations for school children and pedestrians.

- 1.6.10 The contractor shall provide access for delivery of mail by the U.S. Postal Service.
- 1.6.11 The contractor shall provide for access to residences and all businesses at all times within all the phases of the work.
- 1.6.12 When construction work necessitates the utilization of vehicle paths other than the lanes normally used, traffic control markings no longer applicable shall be removed and approved temporary pavement markings and signs installed in accordance with Part VI-D of the Texas Manual on Uniform Traffic Control Devices.
- 1.6.13 After construction is completed and traffic is rerouted back to the original lanes, the traffic control markings and/or raised buttons that were originally removed from the existing pavement must be replaced. In addition, temporary markings must be removed. All of this is to be done at no direct payment; cost should be included in other items.
- 1.6.14 Permanent pavement markings shall be applied prior to the opening of the completed street to traffic. Temporary additional short-term expendable pavement markings may be provided prior to the application of permanent markings in minimum lengths of 36", or raised pavement markings to delineate continuity until such time as standard pavement markings in normal lengths can be placed at no direct payment.
- 1.6.15 All temporary traffic control devices, etc. shall be provided by the contractor without direct payment, unless otherwise noted or stated.
- 1.6.16 The COI will monitor the contractor's traffic control devices and will be responsible to furnish all residents and businesses with an information flyer on all jobs during construction.
- 1.6.17 Any damage to permanent traffic signals, the controller box, loops or conduits during or upon completion of the project shall be repaired or replaced at the contractor's expense. The decision to repair, as opposed to replace, the damaged equipment shall be made by the City's Traffic Engineer.
- 1.6.18 The contractor is responsible for repairing all streets outside of the project limits which are damaged due to construction activities. The replaced section must be approved by the City's Street Engineer. There will be no direct payment for this work. The cost is to be included in other items.
- 1.6.19 If split construction is shown, then the sanitary sewer shall be completed prior to beginning street and drainage construction, and traffic shall be maintained or detoured as directed by the Traffic Engineer. There will be no additional payment for the maintaining of traffic or detours.

- 1.6.20 The contractor shall provide the city an emergency telephone number for evenings, weekends, and holidays by the first working day of the project. This telephone number must be a commercial answering service. The answering service must be able to contact the contractor and have the contractor respond to the City staff within two hours of the initial contact.
- 1.6.21 The contractor shall maintain continuous access to all intersecting streets unless otherwise shown on these plans. When continuous access is scheduled to be blocked, the contractor shall contact the dispatchers for the Fire Department and EMS at (210) 227-5136 and the Police Department at (210) 207-7273, to apprise them of the pending street closure at least forty-eight hours in advance. If the closure falls along a bus route, the contractor shall also contact VIA at (210) 362-2439.
- 1.6.22 The contractor shall maintain either the existing or temporary street name signs at each intersection onsite throughout construction. If the existing street name signs are used, they must be maintained in the condition encountered prior to the beginning of construction, and then be turned in to the City Inspector at the end of the project. If temporary signs are used during construction, they shall have a minimum of 4-inch letters, and may be fabricated with construction zone material (black legend on orange background, using plywood substrate, etc.).
- 1.6.23 During construction, cooperation in the use of the right-of-way with the City and various other Public Utilities and their contractors may be required to allow adjustments to be made by others.
- 1.6.24 Traffic control plans for projects under this contract may or may not be provided under this contract. Any such plans that may require the contractor to provide will not be elaborate and will require approval of the City of San Antonio.

CITY OF SAN ANTONIO, TEXAS

GOVERNING SPECIFICATIONS, SPECIAL SPECIFICATIONS AND SPECIAL PROVISIONS FOR

2017 - 2018 Task Order Contract for Spin Cast Geopolymer Pipe Liner Projects

All Standard Specifications, Special Specifications and Special Provisions applicable to this project are identified as follows:

CITY OF SAN ANTONIO STANDARD SPECIFICATIONS FOR CONSTRUCTION JUNE, 2008

ITEM	DESCRIPTION
100	Mobilization
101	Preparing Right-of-Way
103	Remove Concrete
105	Channel Excavation
107	Embankment
203	Tack Coat
205	Hot Mix Asphaltic Concrete Pavement
208	Salvaging, Hauling, and Stockpiling Reclaimable Asphaltic Pavement
210	Rolling
300	Concrete
301	Reinforcing Steel
303	Welded Wire Flat Sheets
306	Structural Excavation
307	Concrete Structures
311	Concrete Surface Finish
404	Corrugated Metal Pipe
407	Concrete Encasement, Cradles, Saddles, and Collars
410	Subgrade Filler
413	Flowable Fill
500	Concrete Curb, Gutter, and Concrete Curb and Gutter
502	Concrete Sidewalks
503	Asphaltic Concrete, Portland Cement Concrete, and Gravel Driveways
505	Concrete Riprap
507	Chain Link Wire Fence
511	Cutting and Replacing Pavements (Trench Repair)
512	Adjusting Existing Manholes and Valve Boxes
513	Removing and Relocating Mailboxes
515	Top Soil
516	Sodding
520	Hydromulching

- 522 Sidewalk Pipe Railing
- 525 Concrete Traffic Barriers (Portable)
- 530 Barricades, Signs and Traffic Handling
- 535 Hot Applied Thermoplastic Pavement Markings
- 550 Trench Excavation Safety Protection

SPECIAL PROVISIONS TO CITY OF SAN ANTONIO STANDARD SPECIFICATIONS FOR CONSTRUCTION, JUNE 2008

MAY 2009:

- 502 Concrete Sidewalks
- 503 Asphaltic Concrete, Portland Cement Concrete and Gravel Driveways
- 505 Concrete Riprap
- 520 Hydromulching

City of San Antonio Standard Specifications and Special Provisions may be found on the City's Transportation & Capital Improvements website @:

<http://www.sanantonio.gov/TCI/CurrentVendorResources/StandardSpecificationsandDetails.aspx>

TEXAS DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS FOR CONSTRUCTION AND MAINTENANCE OF HIGHWAYS, STREETS, AND BRIDGES, 2004

- 432 Riprap

SPECIAL SPECIFICATIONS FOR CONSTRUCTION:

- 414 Heavy Debris Removal – Man Entry
- 415 Spin Cast Geopolymer Pipe Liner (SCGPL)
- 416 Exterior Point Repairs and Obstruction Removals
- 417 Storm Drain Main Television Inspection
- 801 Tree and Landscape Protection
- 802 Tree Pruning, Soil Amendment and Fertilization
- 810 Tree Removal
- 811 TCI “At Work” Project Sign
- 6001 Wooden Privacy Fence

ITEM 414
SPECIAL SPECIFICATION
HEAVY DEBRIS REMOVAL – MAN ENTRY

- 414.1.1 DESCRIPTION:** *This item shall govern the removal of debris from existing storm drains that cannot be cleaned without man entry to remove heavy debris, as approved by the Engineer.*

The work shall include all labor, tools, equipment and related items as may be required for the complete debris removal (including bypass pumping, drain dewatering and associated work) of the storm drain and removing and disposing of all large debris. As a part of this work ITEM 417 Pre and Post Televising Inspection shall be performed.

- 414.1.2 CLEANING PROCEDURES AND EQUIPMENT:** The Contractor shall remove heavy debris, utilizing equipment approved for use by the Engineer or City Inspector regardless of shapes, sizes and quantities of debris.

Cleaning equipment may consist of heavy duty bucket machines that can be used to drag line work with buckets, brushes, scrapers, swabs or other similar devices. The heavy duty equipment may be necessary for the removal of roots or heavy debris. Hydraulic high pressure jet machines may be used but water may not be released into sanitary sewers. Approved sediment traps shall be provided to capture and remove sediment and debris from wash prior to it being released.

The Contractor shall also submit his equipment list to the Engineer before commencement of the work.

The equipment utilized shall be capable of removing all sand, dirt, rocks and other debris, including roots (where ordered by the Engineer) such that 98% of the storm drain area is available for storm water flow, from the drain line to allow adequate internal inspection (in the opinion of the Engineer or City Inspector) of all internal surfaces. The equipment used shall suit the conditions and size of the sewer to be cleaned.

Debris removal shall be completed within the seventy-two (72) hours from when cleaning operations commence.

All safety precautions outlined in the General Requirements, or required by agencies having jurisdiction, shall be followed by the Contractor during cleaning operations. The cost of such precautions shall be included in the price bid for Heavy Debris Removal Item including Traffic Control in accordance with Item 530 “Barricades, Signs and Traffic Handling.”

Contractor shall protect the storm drain from damage that might result from the use of unsuitable equipment or improper use of cleaning equipment. Any drains damaged during

the cleaning operations as a result of the Contractor's operations shall be promptly repaired to an acceptable condition (as determined by the Engineer or City Inspector) at the expense of the Contractor.

If the Contractor's cleaning equipment becomes immobilized within a storm drain, exits the storm drain through broken pipe or portions break off within a storm drain, said equipment shall be retrieved at the Contractor's expense.

The Contractor shall act immediately to remedy problems created by the debris removal procedure, which represent a hazard to the general public, such as the collapse of the ground surface above a storm drain. If equipment retrieval necessitates excavation, the Contractor shall be responsible for accomplishing the work at his own expense. Following removal of the equipment, the Contractor shall restore the line and the site as approved by the City Inspector.

414.1.3 DEBRIS REMOVAL & DISPOSAL: Contractor shall remove and collect silt debris and material of any kind and prevent material from being discharged into the drainage system. Contractor shall dispose of all materials removed from existing drain system

Producing Soil, as follows:

- A.** Once material leaves the Project Limits, the Contractor is responsible for ensuring that the handling procedures, placement method, and disposal location are according to applicable Federal, State, and local laws, rules, and requirements, including permits that may be issued for the project.
- B.** If the disposal of excess material results in a violation notice from any governmental authority, Contractor shall immediately correct the violation. Indemnify and defend the City of San Antonio for any violation incurred, penalty assessed, or any claims, suits, losses, demands or damages of whatever kind or nature arising out of, or claimed to arise out of, the improper disposal of excess materials.
- C.** The Contractor is responsible for paying all disposal fees and assessed penalties including costs incurred by the Department to remedy the violations.

For regulated materials, the contractor shall pay fees associated with removal and disposal of regulated materials. Contractor shall submit the results of material sampling and analysis, waste facility applications and acceptance documentation, and fee payment requirements to the Engineer at least 15 days before planned removal of regulated material. Submit to the City Inspector or Engineer a bill of lading for each truckload of regulated material removed from the Project Limits. Ensure that each bill of lading and waste manifest include the following information:

- A.** Transport subcontractor name, address, permit number, and telephone number.
- B.** Type and quantity of material removed.
- C.** Weight of vehicle with weigh slip.

- D. Recycling or disposal facility name, address, permit number, and telephone number.
- E. Date removed from the Project Limits.
- F. Signature of transport vehicle operator.

The Engineer or City Inspector will sign the bills of lading for the City as the generator within the Project Limits. Contractor shall submit 1 copy of the bill of lading to the City by the end of each working day that the transport vehicle leaves the site.

The licensed hauler shall transport the regulated material to the disposal/recycling facility with no unauthorized stops in between, except as required by regulatory authority. The hauler shall use appropriate vehicles and operating practices to prevent spillage or leakage from occurring during transport. Remove excess soil adhering to the wheels or under carriage of the vehicles before leaving the Project Limits. If soil or water escapes to the public roads, immediately clean the road to restore it to the original condition and immediately notify the City Inspector or Engineer. Do not transport regulated material over public roads if they contain free liquid or are sufficiently wet to be potentially flowable during transport. Submit 1 copy of the documentation of the disposal facility's acceptance of the regulated material, including the weight ticket slips, to the City Inspector or Engineer within 5 days of acceptance at the disposal facility.

Immediately submit written notification to the City Inspector or Engineer if problems arise, regarding the facility chosen to accept the regulated material for off-site management, that would require the return of waste, or if the chosen facility has violated any environmental regulation that may result in regulatory enforcement action. Contractor shall propose an alternate disposal facility, and obtain the City Inspector or Engineer's written approval of off-site management at such facility.

Any water used in jet washing shall be captured and not allowed to enter the downstream drainage system. A vacuum tank truck shall be placed on the downstream location of cleaning where water used for cleaning will be collected. The water shall be tested to ensure it is acceptable to be released, if testing determines that regulated concentrations of solvents or suspensions the water shall be handle consistent with the local, state and federal regulations for the water's condition.

- 414.1.4 STORM DRAIN DEWATERING:** During the television inspection process, every effort shall be exerted to obtain a full view of the pipe interior. For instances where the camera lens becomes submerged or where a large portion of the pipe contains water, and these conditions persist for significant portions of the storm drain being inspected, the Contractor shall attempt to dewater the pipe. The City Inspector or Engineer shall determine when dewatering procedures are necessary.

Dewatering can be accomplished with a pump and discharge hose or by the nozzle of a hydraulic high-pressure jet machine. If the jet machine is used, it shall precede the television camera through the sewer pipe. The nozzle of the jet machine shall work in conjunction with the television camera's motion and be positioned so that several feet of

pipe length can be viewed by the camera. The dewatering procedure shall move standing or ponded water through the storm drain to a point within the storm drain downstream of the reach being inspected.

- 414.1.5 MEASUREMENT:** Heavy debris removal shall be measured by linear foot of heavy debris removed. As approved by the City Inspector or Engineer when determining that there are large objects such as tires or rocks or stones larger than 6” in diameter. This item will not apply to removing accumulated jetted smaller material and it shall be the City Inspectors and the Engineer that will determine if the debris meets the criteria needing manned removal.

The contractor shall make a pre-removal video in accordance with Item 417 prior to removal. If debris prevents the video, the contractor shall video as much as possible from both upstream and downstream of the obstruction. Further video should be completed as debris is removed so the complete pre-removal video is available. A post debris removal video is as required to document the debris removal. The pre and post video will not be paid directly. The payment shall be subsidiary to this bid item.

Needed Storm Drain Dewatering will not be paid for directly. The payment shall be subsidiary to this item.

The basis for non-acceptance by the Engineer or City Inspector shall be any evidence of poor cleaning observed on the video tape recording that prevents the proper internal inspection of the drain reach. No additional payment shall be made for the re-entry to remove previously designated areas for debris to be removed regardless of the number of times entry may be required.

- 414.1.6 PAYMENT:** Heavy debris removal will be paid at the unit price bid per linear foot, which shall be full compensation for the furnishing, cleaning, equipment, material, transport of material, disposal fees, permitting fees, televising inspections, labor, tools and all incidentals necessary to complete the work.

- 414.1.7 BID ITEM:** The bid items shall read as follows:

Item 414 - Heavy Debris Removal (Man Entry) - LF

ITEM 415

SPECIAL SPECIFICATION

SPIN CAST GEOPOLYMER PIPE LINER (SCGPL) FOR STORM DRAINS AND CULVERTS

415.1 GENERAL

415.1.1 THIS SPECIFICATION COVERS WORK, MATERIALS AND EQUIPMENT REQUIRED FOR THE PREPARATION AND INSTALLATION OF A SPIN CAST GEOPOLYMER PIPE LINING SYSTEM PROVIDING A MINIMUM 50-YEAR DESIGN LIFE FOR INTERNAL PROTECTION AND STRUCTURAL REHABILITATION FOR STORM DRAIN PIPES AND CULVERTS 30 INCHES IN DIAMETER OR LARGER USING AN APPROVED STRUCTURAL, MONOLITHIC SPRAY-APPLICATION OF A HIGH-BUILD, GEOPOLYMER LINER SYSTEM WITH CORROSION PROTECTION. THE PROTECTION LINING PROCESS SHALL INCLUDE ALL ACTIVITIES ASSOCIATED WITH THE PROTECTION LINING SYSTEM, NOT LIMITED TO THE FOLLOWING:

1. Design of approved continuous protection liners applied to the internal surface of the host pipe,
2. Pre-construction inspection and surface preparation of host pipe prior to application of protection lining system,
3. Installation of approved continuous protection liners to the internal surface of the host pipe,
4. Quality Control Measures, and
5. Post-construction inspection and testing.

415.1.2 REFERENCES

Applicable ASTM and ACI Standards and Specifications

Unless revised herein, the Contractor shall follow the latest revision of the practices and standards of the following American Society for Testing and Materials (ASTM) Standards, and American Concrete Institute (ACI) which are made part of this specification:

American Society for Testing and Materials (ASTM):

1. ASTM C 109 – Compressive Strength Hydraulic Cement Mortars
2. ASTM C 267 – Chemical Resistance of Mortars, Grouts, and Monolithic Surfacing and Polymer Concretes
3. ASTM C 293 – Flexural Strength of Concrete
4. ASTM C 469 – Static Modulus of Elasticity & Poisson's Ratio of Concrete Compression
5. ASTM C 496 – Splitting Tensile Strength of Cylindrical Concrete Specimens

6. ASTM C 882 – Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear
7. ASTM C 1140-03A – Preparing and Testing Specimens from Shotcrete Test Panels
8. ASTM F 2414 – Practice for Sealing Sewer Manhole Using Chemical Grouting

American Concrete Institute (ACI):

1. ACI 305R – Hot Weather Concreting
2. ACI 306R – Cold Weather Concreting
3. ACI Certified Concrete Field Testing Technician, Level 1

415.1.3 SUBMITTALS

Submittals shall be prepared and submitted in accordance with the General Conditions of the project.

The following items shall be submitted:

Before any field work by the Contractor, the Contractor shall submit to the City of San Antonio for his review the following:

1. Manufacturer-certified copies of all test reports on each product used, including ASTM test results indicating the product conforms to and is suitable for its intended use per these specifications. Test reports shall be performed at the Contractor's expense and shall be carried out by an approved laboratory or by a reputable independent testing body.
2. Detailed Minimum Liner Thickness Calculations as discussed further in Paragraph 2.04 of this Section, along with proposed plan for ensuring that the installed Geopolymer liner meets the minimum thickness requirements.
3. Applicator Qualifications
 - A. Manufacturer certification that Applicator has been trained and approved in the handling, mixing and application of the products to be used. At least one manufacturer certified crew member must be on-site at all times during related construction activities. A fully trained field technician shall apply the liner material.
 - B. Verification that both the Applicator and the sub-contractor doing the application or prime contractor if self-performing have experience in the placement of greater than 5000 LF of geopolymer liner within the past 2 years.
 - C. Certification that the equipment to be used for applying the products has been manufactured or approved by the manufacturer and Applicator personnel have been trained and certified for proper use of the equipment.
 - D. Proof of any required permits or licenses necessary for the project.

4. After cleaning and TV inspection by the Contractor of all pipe to be rehabilitated and before beginning lining of any pipe, the Contractor shall submit to the Owner/Engineer for his review the following:
 - A. DVD and log (1 copy of both) of the Contractor's TV inspection of the pipe prior to product application in accordance with Item 417. There is no prohibition on completing the cleaning so that the video serves as both the Item 414 post debris removal video and the Item 417 pre application video.
5. After rehabilitation of the pipe, the Contractor shall submit to the Owner/Engineer for his records the following:
 - A. DVD and log (1 copy of both) of the Contractor's TV inspection of the Completed Work in accordance with Item 417
 - B. Test results of samples of Geopolymer liner as specified in the contract documents.
6. Exterior Point Repair Locations and Justification shall be submitted in writing. The submittal shall document the reasons of why an exterior point repair is needed.

415.1.4 QUALITY ASSURANCE

Product Manufacturer: Company specializing in manufacturing quality Geopolymer liner products with minimum 5-years' experience.

Applicator: Company specializing in Geopolymer liner products pre-approved in the application of spray on lining systems. Applicator shall initiate and enforce quality control procedures consistent with applicable ASTM, ACI and SSPWC standards and the Geopolymer liner manufacturer's recommendations.

Applicator and the sub-contractor doing the application or prime contractor if self-performing have experience in the placement of greater than 5000 LF of geopolymer liner within the past 2 years.

Single Source Responsibility: Geopolymer liner and optional Antimicrobial Liquid shall be provided by same manufacturer. Use only products approved by Geopolymer liner manufacturer, and use only within recommended limits.

415.1.5 DELIVERY, STORAGE , AND HANDLING

Delivery: Deliver materials in original containers with seals unbroken and labels intact and free of moisture. Do not use materials that have been exposed to moisture or if there is visible damage to the packaging.

Receipt Process: All materials must be inspected upon receipt and properly documented as to the amount of material and the identification of the material by batch

numbers. Dates and times along with the shipping company delivering the material will be recorded for possible future reference. See Section 415.4.2 Daily Activity Logs.

Storage: Contractor shall designate a secure location at the project site for storing and mixing materials. Contractor shall protect this location and repair all damage resulting from use. Contractor shall not store kerosene nor gasoline in this space. Contractor shall remove all oily rags at the end of each day's work. Products are to be kept dry, protected from weather and stored under cover within the temperature ranges recommended by the manufacturer. Products are to be stored and handled according to their MSDSs or appropriate classification.

415.1.6 PROJECT CONDITIONS:

Environmental Requirements: Applicator shall conform with all local, state and federal regulations including those set forth by OSHA and the EPA and any other applicable authorities. Confined space entry requirements shall be followed.

Maintain the temperature inside the pipe at not less than 1.00° C (34° F) and no more than 38.00° C (100° F), or as otherwise directed by manufacturer, during application and finishing.

Provide continuous ventilation and if necessary cooling and heating facilities to maintain surface and ambient temperatures before, during, and following application of finishes, within temperature range and for duration as directed by manufacturer.

Protection: provide sufficient shielding to fully protect adjacent finished work.

415.1.7 WARRANTY

Manufacturer shall warrant all work against defects in materials and applicator shall warrant all work against defects in workmanship for a period of one (1) years, unless otherwise noted, from the date of final acceptance of the project. Contractor shall, within 60 days after receipt of written notice thereof, repair defects in materials or workmanship which may develop during said one (1) year period, and any damage to other work caused by such defects or the repairing of same, at his own expense and without cost to the Owner.

415.2 PRODUCTS

415.2.1 EXISTING PRODUCTS

Existing pipe may consist of RCP, brick, stone, corrugated metal, HDPE or other material.

415.2.2 ACCEPTABLE MATERIALS

Geopolymer liner products shall be a micro-fiber reinforced ultra-dense Geopolymer. This material shall provide a high strength fiber reinforced mortar specifically designed for ease of mechanical pumping, spraying and spin casting. The Geopolymer liner shall not clog spinner heads or spray equipment.

The Geopolymer liner shall be designed to produce a liner with improved compressive and flexural strength, high adhesion to damp surfaces, lower permeability and increased resistance to aggressive chemical attack.

The fiber reinforced formula shall be engineered to improve hydraulic abrasion resistance, provide dimensional stability and protect against penetration by substances such as fats, oils, gases and chloride ions.

415.2.3 GEOPOLYMER CHARACTERIZATION TECHNIQUES

A. Geopolymer shall include oxide composition and phase composition as follows:

1. (XRF). A geopolymer precursor must contain significant amounts of amorphous SiO₂ and Al₂O₃ in particular ratios. As Shown in Table One
2. Phase composition utilizing X-Ray Diffraction (XRD) shall be used to quantify crystalline amorphous phases in the geopolymer precursor powder. A significant amount of amorphous SiO₂ and Al₂O₃ is required for the geopolymerization process. Using (XRF) and (XRD) together provides optimum information for both oxide composition and phase composition. As Shown in Table One:

Table One

Oxides	Typical values
Amorphous SiO ₂ / Al ₂ O ₃	2-6 %
Total amorphous SiO ₂ + Al ₂ O ₃ (geopolymer precursor)	>50 %
Total amorphous Na ₂ O / Al ₂ O ₃	0.05-1.2 %
CaO from OPC phases	<15 %
Amorphous CaO	N/A

415.2.4 GEOPOLYMER PIPE DESIGN

The Contractor shall submit liner thickness calculations to the City for review. Calculations shall be used to determine the liner thickness to achieve desired 50-year design life. These calculations must be verified and approved by a registered Professional Engineer in the State of Texas. The minimum liner thickness shall be as thick as shown on the pay item. Any additional thickness required to meet the design strength will not be paid for directly but will be considered subsidiary to the bid item.

415.2.5 SECONDARY CORROSION PROTECTION

Application of Antimicrobial Liquid, or Epoxy shall be applied when Contractor determines application is necessary. Contractor shall provide Microbiologically Induced Corrosion (MIC) resistance. The work consists of rolling, spraying or centrifugally applying Antimicrobial Liquid, approved substitute, or epoxy to the inside of the newly cast pipe. Equipment required for application can include centrifugal spray mechanisms, pneumatic spray pumps, hand pumps or paint style roller.

The Antimicrobial Liquid, or Epoxy, shall be used as specified by the manufacturer and shall not be diluted.

The Antimicrobial Liquid, shall be applied during the application of the Geopolymer liner or anytime thereafter. Epoxies shall be applied after proper curing of the liner.

The Antimicrobial Liquid shall be applied adequately to achieve surface saturation. Epoxies must be applied at a minimum thickness of 125 mils.

The Antimicrobial Liquid, or Epoxies, must be allowed to cure for a minimum of 12 hours, or meet manufacturer recommended cure time, prior to releasing bypass or opening to any traffic.

415.2.6 PHYSICAL PROPERTIES

The finished pipe must be such that once the Geopolymer Liner sets, the total wall thickness will be homogeneous and monolithic.

The Geopolymer liner material shall conform to the minimum requirements shown in the Table Two:

Table Two

Physical Properties	ASTM Reference	Requirements
Compressive Strength	ASTM C 109	Min. 8,000 psi @ 28 days
Chemical Resistance	ASTM C 267	Max <2% @ 28 days
Flexural Strength	ASTM C 293	Min. 1,000 psi @ 28 days
Modulus of Elasticity	ASTM C 469	Min. 5,500,000 psi @ 28 days
Split Tensile Strength	ASTM C 496	Min. 800 psi @ 28 days
Shrinkage Test	ASTM C 596	Max <0.02% @ 28 days
Bond Strength to	ASTM C 882	Min. 3,000 psi @ 28 days
Density		Dry 111.11 lb/ft ³ Wet 120.4 lb/ft ³

415.2.7 GEOPOLYMER LINER APPLICATION EQUIPMENT

Manufacturer approved equipment shall be used in the application of the specified Geopolymer lining.

Major equipment components consist of a generator, an air compressor, a high pressure washer, a high shear mixer, a high output pump, a gyroscopic high speed spin cast delivery assembly, an electronic retraction system capable of +/- 5% repeatability, and high pressure hoses and couplings.

Application equipment shall include a high shear mixer and high output swing tube pump. In addition, the application equipment will have safety sensors that monitors specific operation parameters. This system ensures proper water to material ratios and material consistencies.

Application equipment will have visible display for the rate of water addition. This will ensure water/material ratios are known and controlled. Water/material ratio must be maintained per manufacturer's recommendations.

Application equipment shall measure the back pressure on the discharge side of the pump. The change in pressure will alert the operator to any potential changes in flow rates. Backpressures must not exceed the system manufacturer's recommendations at all times.

Spinner head needs to be attached to a gyroscopic mechanism to layer the materials. The gyroscopic mechanism can adjust the spinner head pattern and frequency. The multiple layering process allows more uniform application of the product and achieves higher thickness levels, in a single pass.

Retraction system will be capable of pulling the sled assembly with no more than +/-5% tolerance. The tolerance shall be verified on a daily basis, prior to product application, and recorded in the daily activity log.

Retraction system will have a visible display that monitors the controlled rate of retraction. The rate of retraction and the volume of material discharged will be used to calculate the thickness of the applied materials.

The rate of retraction, material application volume, dry material usage and length of pipe covered will be monitored and recorded on a daily activity basis. Thickness of the material applied will be calculated and recorded in the daily activity log.

Thickness design calculations must be provided as discribed in Paragraph 415.2.4 of this Section.

415.2.8 EQUIPMENT MAINTENANCE

All equipment shall be in clean and good working conditions.

Maintenance and service shall be performed on the equipment as per manufacturer's standards.

Inspect the dry material hopper in the mixer to ensure that there is no blockage or debris in the dry material feed point. Remove all debris prior to feeding dry powder.

Inspect the pre-mix chamber to ensure it that there is no blockage or debris. Remove any debris prior to mixing.

Inspect the mixing chamber to ensure there are no blockage or debris. Remove any debris or dry materials prior to application.

Inspect the rotor/stator pump to ensure there is no debris or blockage in the pump. Remove any debris prior to application.

Spare parts or extra equipment shall be kept on site to ensure rapid redeployment in the event of equipment failure.

415.3 EXECUTION

415.3.1 ACCEPTABLE APPLICATORS

Geopolymer liner shall be applied by a Certified Applicator of the Geopolymer lining manufacturer, as discussed further in Paragraph 415.1.4 of this Section, and according to manufacturer specifications.

Format and Submission of Process Control Sheets and Procedures Checklist:

1. Process Control Sheet and Procedure Checklist for all works shall be prepared prior to commencement of the works. These sheets shall be used to ensure that the work is carried out and audited at multi-level according to standard steps and procedures in the Process Control sheets and Procedures Checklist.

A Process Control Sheet shall be prepared for each shift/application at each location. Process Control Sheet shall contain the following information at minimum:

1. Location details, including chainage, upstream, downstream and all intermediate manhole/access chambers reference numbers, and the precise location of applied coating application within the pipe system;
2. Condition of pipe surface and prevailing atmospheric conditions prior to application and during the application and curing process;
3. Material(s) used in the application;
4. Record of time/date of delivery of materials to application point;
5. Time of commencement and completion of the application;
6. Record details of:
 - a. Quantity, weight of components, batch number of all coating materials used.
 - b.. Mixing temperature and time of application.

415.3.2 EXAMINATION

Applicator shall verify that surfaces and substrate conditions are ready to receive work as instructed by the product manufacturer.

Applicator shall examine surfaces scheduled to be finished prior to commencement of work. Applicator shall report to Owner any condition that may potentially affect proper application.

Appropriate actions shall be taken to comply with regulatory and other applicable agencies with regard to environment, health and safety.

Any active flows shall be dammed, plugged or bypassed as required to ensure that the conveyed flow is maintained below the surfaces to be coated. Flows shall be totally plugged and/or diverted when coating the invert and during required dry/cure periods. All extraneous flows into the pipe at or above the area coated shall be plugged and/or diverted until the Geopolymer liner has set per manufacturer recommendations.

Installation of the Geopolymer liner shall not commence until the host pipe has been properly cleaned and repaired in accordance with these specifications and Geopolymer liner manufacturer recommendations.

Prior to and during application, care should be taken to avoid exposure of direct sunlight or other intense heat source to the pipe being coated.

415.3.3 BYPASS PUMPING

Operations shall be scheduled so that anticipated rainfall does not occur during installation. Install and operate bypass pumping equipment to maintain flow around the segment of pipe being rehabilitated, and to prevent backup or overflow in compliance with Owner requirements. Pumping to the curb is an acceptable practice as long as the full length of pipe treatment remains dry and curb / street section can convey the bypass flow.

Install all bypass and isolation material and equipment so as to not affect flow in upstream or downstream structures.

There shall be no additional payment for any extra work caused runoff getting past the contractors bypass pumping. All necessary rework to conform to the specification shall be done at the contractor's expense.

415.3.4 SURFACE PREPARATION

The floor and interior walls of the pipe shall be thoroughly cleaned and made free of all foreign materials including dirt, grit, roots, grease, sludge and all debris or material that may be attached to the wall or bottom of the pipe.

High pressure water blasting with a minimum of 3,500 psi shall be used to clean and free all foreign material within the pipe.

When grease and oil are present within the pipe, water may be heated to 200° F or an approved detergent shall be used integrally with the high pressure cleaning water.

All materials resulting from the cleaning of the pipe shall be removed prior to application of the Geopolymer material.

Interior obstruction removal for repairing pipe sections consists of removing pieces of rusted pipes, roots or other obstructions that can be accomplished inside the pipe.

415.3.5 SEALING ACTIVE LEAKS

The work consists of hand applying a dry quick-setting cementitious mix or, for heavy leaks, chemical grout designed to instantly stop running water or seepage in all types of concrete and masonry pipes. The contractor shall apply an approved quick-setting mortar or chemical grout in accordance with manufacturer's recommendations.

Interior point repairs are those sections of pipe that require initial treatment as described above in this section that can be accomplished inside the pipe.

415.3.6 PRE-CONSTRUCTION INSPECTIONS

The Contractor's experienced personnel trained in the inspection of large diameter pipes and/or related manholes and structures will provide pre and post construction videos in conformance with Item 417. Pre-construction videos will be performed prior to the lining operation. The interior of the pipe shall be carefully inspected to determine the location of and conditions which may prevent the proper installation of the Geopolymer liner, and it shall be noted so that these conditions are corrected and video demonstrates corrections are made.

415.3.7 MIXING OF THE GEOPOLYMER LINING MATERIAL

Contractor shall add the Geopolymer material to the batch water following precisely the manufacturer's water/material ratio. Precision metering of water in mixer is required to maintain the strict water to material ratio. The ability to closely adjust and monitor the addition of water through the use of a water meter is required.

Mixing water temperatures will be determined before blending operations begin. The mixing water temperature will be recorded in the process control sheet at multiple times throughout the day during the installation process. Water temperatures shall be maintained at all times to within the limits required by the manufacturer. The ability to provide mixing water at a consistent temperature is a critical aspect of the mixing and installation process.

The lining material shall be mixed in a high shear mixer, or similar, to ensure thorough and uniform mix of water with the material prior to pumping.

The mixing operations must be performed so that minimum of dust is released into the surrounding environment.

The batch style mixing, precise metering of water and pump rate shall eliminate wet/dry and thick/thin variations resulting in a uniform structure regardless of the pumping distance.

Multiple spin cast nozzles shall be onsite at all times to address any application issues or failure of the nozzle. Multiple nozzles may be required to produce the required depth or finish of the liner surface.

415.3.8 APPLICATION OF SPIN CAST GEOPOLYMER LINING MATERIAL IN A PIPE

The Geopolymer lining material delivery hose shall be coupled to a medium-velocity spray application nozzle.

Pumping of the material shall cause material to be spin cast onto the pipe surface.

A gyroscopic head that has a speed adjustment for making multiple position changes per minute is required. The gyroscopic head allows the spin cast mechanism and the associated selected nozzle to make multiple passes on the pipe wall in a single pass of the sled assembly.

Spraying of a pipe shall be performed by starting at the downstream pipe end-project location and progressing towards the entrance of the upstream pipe.

At the beginning of each application segment the retraction system shall be recalibrated.

The measured rate observed and recorded must be within 5% of the expected speed and can be verified by this process.

Geopolymer liner shall be applied to a specified uniform minimum thickness as directed by the professional engineer registered in the State or Territory in which the work will be performed.

The Geopolymer delivery hose shall be coupled to a gyroscopic applicator device. The gyroscopic applicator shall then be positioned within the center, or positioned higher inside the pipe, as required by the diameter of the pipe.

As the material begins to be gyroscopically cast evenly around the interior of the cavity, the rotating applicator head shall produce a uniform material thickness to the repair surface.

Controlled multiple passes shall then be made, if necessary, until the specified minimum finished thickness is attained. If the procedure is interrupted for any reason, the operator shall arrest the longitudinal transition of the applicator head until flows are at recommenced rates.

Material thickness may be verified at any point with an approved depth gauge. If additional material is required at any level, the gyroscopic applicator head shall be placed at the location and application shall recommence until that area meets the required thickness.

The lining material shall be applied to a damp surface, with no free water.

The medium-velocity spray nozzle and the gyroscopic spin casting head may be used in conjunction to facilitate uniform application of the material to irregularities in the contour of the pipe walls.

If desired, the liner may be troweled following the spray application. Initial troweling shall be in an upward motion, to compress the material and solidify the pipe wall. Any troweling shall maintain required thickness of the finished product.

Proper steps shall be taken to ensure the material is cured in a moist and moderate climate as directed by the manufacturer. General underground conditions are usually adequate to meet this curing requirement. However, when situations of dry and/or hot conditions are present, the use of a wind barrier and fogging spray will be required.

415.3.9 CURING OF THE GEOPOLYMER LINING MATERIAL

The manufacturer's recommended cure schedule in the curing of Geopolymer liners must be strictly adhered to at all times. The Contractor must provide evidence of such adherence via the Process Control Sheet.

415.3.10 TERMINATION AND SEALING AT MANHOLES, INLETS AND SHAFTS.

Termination of the Geopolymer liner at the end of a pipe or manhole shall be completed by hand applying the liner to the outer surface of the pipe or into the interior of the manhole.

415.3.11 END OF SHIFT EQUIPMENT CLEAN UP PROCEDURES

All equipment used during the days/shifts operations shall be properly cleaned and stored at the end of the work day or application process.

All hoses, fittings, pumps, mixers, spray head equipment, retraction equipment well shall be cleaned both inside and out.

All mixed Geopolymer materials shall be captured and disposed of properly.

415.4 QUALITY ASSURANCE AND QUALITY CONTROL

415.4.1 QUALITY CONTROL, SAMPLING AND TESTING

During application, Applicator shall regularly perform and record Geopolymer lining thickness readings with a method approved by manufacturer. Applicator shall submit all documentation on thickness readings to Inspector on a daily basis when coating application occurs.

Compressive strength test shall be carried out, in accordance with Paragraph 415.1.4 of this Section, and shall be performed at a minimum of every 40,000 pounds of applied Geopolymer or as designated by the owner in the Contract documents or purchase order. The Geopolymer will be collected at the discharge of the pump or at the end of the hose near the discharge point. Use cylinders as in accordance with Test Method ASTM C 39/39M (4" x 8" minimum cylinder size) or shotcrete panels in accordance with Test Method ASTM C1140. The test shall be performed by the contractor and the result shall be provided to the City prior to acceptance of the lined pipe segment.

415.4.2 DAILY ACTIVITY LOGS

A Daily Activity Log will be filled out completely anytime a work crew is on site. This log includes listing the personnel present at the site, when they arrived and when they left the site.

Important spray data includes the times when material was applied and under which atmospheric conditions. The ambient air temperature, the dry powder temperature, the mixing water temperature, and the temperature inside the pipe are all recorded on the daily activity report.

The operating conditions shall be recorded. These measurements include the water addition rate taken at the meter tube, the retrieval speed of the retraction system and the pump motor speed recorded at the pump.

Any special conditions shall be noted in the daily log.

415.4.3 EQUIPMENT CALIBRATION REPORTS

Equipment calibration reports shall be maintained at all times for inspection by the City Inspectors and/or City staff.

415.4.4 FINAL INSPECTION

A final visual inspection shall be made by the Inspector and Applicator, periodically throughout the progression of construction prior to the completion of a lining stage. Any deficiencies in the finished coating shall be marked and repaired by Applicator according to the procedures set forth herein.

At the completion of a lining stage of the pipe, and once all repairs have been made and accepted, a video inspection DVD and log (1 copy of both) of the completed line segments shall be submitted to the Engineer by the Contractor. This inspection shall be performed by a color video inspection system. The finished Geopolymer shall be continuous over the entire length of all runs and be free of dry spots. No infiltration of groundwater shall be observed. All service entrances shall be accounted for and shall be unobstructed.

415.4.5 MEASUREMENT

Each diameter of liner shall be paid for by the linear foot price. Each Manhole or Inlet shall be paid by the linear foot along the direction of primary flow. Contractor is responsible for any re-application needed to address rainfall events that occur sooner than allowed for the liner to set as determined by liner manufacturer.

415.4.6 PAYMENT

The price shall include all materials and labor associated with applying the lining including all needed bypass pumping. The contractor is responsible for any re-

application needed to rainfall events that occur sooner than allowed the liner to set as determined by liner manufacturer.

Each manhole or inlet will be paid for by the linear foot along the direction of primary flow with the 1” thickness of the liner. This price shall include all materials and labor associated with applying the lining including all needed bypass pumping. The contractor is responsible for any re-application needed to rainfall events that occur sooner than allowed the liner to set as determined by liner manufacturer. There is no separate pay item for termination at manholes, inlets or shafts, but shall be subsidiary to the linear foot prices.

Filling in inverts shall be done with flowable fill and shall be paid for under Item 413 and shall cover all labor and materials to place the flowable fill in the invert of the pipe.

Exterior point repairs and exterior obstruction removal shall only be done when the Engineer agrees that an interior point repair or obstruction removal is not feasible. The contractor shall provide specific justification demonstrating the need for an exterior repair as compared to the interior point repair. Exterior point repairs will be paid for under special specification Item 416.

Interior point repairs, interior obstruction removals and cleaning not classified as Heavy Debris Removal shall be considered subsidiary to geopolymer lining and will not be paid for directly.

Pre and Post videos will not be paid for directly, but will be considered subsidiary to spin cast geo-polymer pipe liner.

415.7 BID ITEM: The bid items shall read as follows:

- Item 415.1** – 30” Storm Pipe Geopolymer Lining – 1” Minimum Thickness - LF
- Item 415.2** – 36” Storm Pipe Geopolymer Lining – 1” Minimum Thickness - LF
- Item 415.3** – 42” Storm Pipe Geopolymer Lining – 1” Minimum Thickness - LF
- Item 415.4** – 48” Storm Pipe Geopolymer Lining – 1” Minimum Thickness - LF
- Item 415.5** – 54” Storm Pipe Geopolymer Lining – 1.5” Minimum Thickness - LF
- Item 415.6** – 60” Storm Pipe Geopolymer Lining – 1.5” Minimum Thickness - LF
- Item 415.7** – 66” Storm Pipe Geopolymer Lining – 1.5” Minimum Thickness - LF
- Item 415.8** – 72” Storm Pipe Geopolymer Lining – 1.5” Minimum Thickness - LF
- Item 415.9** – 78” Storm Pipe Geopolymer Lining – 1.5” Minimum Thickness - LF
- Item 415.10** – 84” Storm Pipe Geopolymer Lining – 1.5” Minimum Thickness - LF
- Item 415.11** – 90” Storm Pipe Geopolymer Lining – 1.5” Minimum Thickness - LF
- Item 415.12** – Manhole/Inlet Rehabilitation with Geopolymer Lining– 1” Thickness - LF

END OF SECTION

ITEM 416
SPECIAL SPECIFICATION

**EXTERIOR POINT REPAIRS AND OBSTRUCTION
REMOVALS**

416.1 DESCRIPTION:

1. Repair of storm drain lines by replacing short lengths of failed pipe with new pipe.
2. Obstruction removal by excavation and replacement with new pipe.

416.2 MATERIALS:

1. Material of corrugated metal pipe:
Materials for corrugated metal pipe shall conform to Item No. 404, "Corrugated Metal Pipes".
2. Jointing Material: Use shielded couplings as manufactured by Fernco, or approved equal.

416.3 CONSTRUCTION:

1. Exterior Point Repair:
 - a. Locate and replace small lengths of one or more pipe sections where isolated line failure has occurred due to settlement, corrosion, crushing, or separation of joints up to 10 feet in length.
 - b. The Inspector may identify potential locations for point repair, but the Contractor is responsible for verifying all point repair locations.
 - c. The Inspector will authorize each point repair after failure points are located. Do not make point repairs without prior authorization of the Inspector. Perform point repairs only on those portions of storm drains which are located in an easement or right-of-way; perform no repairs to storm drains on private property.
 - d. Replace all identified damaged pipe for point repairs unless otherwise directed by the Inspector.
2. Exterior Obstruction Removal: Remove obstructions by the following methods:
 - a. Obstruction removal by excavation: Obstructions encountered during liner insertion that are removed by digging and exposing the damaged section of main.

3. Submittals: Submit product data for each pipe product, fitting and jointing material.
4. Sequencing:
 - a. Before rehabilitating a section of storm drain main between adjacent manholes, complete point repair and obstruction removal of that section.
 - b. Clean line and perform pre and post-installation video inspection for each point repair on storm drains scheduled for rehabilitation.
 - c. All approved pre and post installation video shall be performed in conformance to Item 417. Videos made for Item 414 and Item 415 may be used for this item as well as videos made for Item 416 may apply be used for Item 415 and 415 as long as the video accurate reflects the needed pre or post condition.
5. Protection:
 - a. Provide barricades, warning lights and signs for excavations created by point repairs. Comply with Item No. 530; “Barricades, Signs and Traffic Handling.” The provision of traffic control shall be subsidiary to the bid item for Exterior Point Repairs and Obstruction Removals.
 - b. Do not allow soil, sand, debris or runoff to enter storm drain system.
6. Bypass Pumping:

Install and operate bypass pumping equipment as required to maintain storm runoff flow and to prevent backup or overflow. Comply with Item 415, Section 415.3.3 “Bypass pumping section.”
7. Excavation:
 - a. Excavate and backfill trenches in accordance with Item No. 400, “Excavation, Trenching and Backfill.”
 - b. Perform work in accordance with OSHA standards. Employ a trench safety system as required in Item No. 550, “Trench Excavation Safety Protection.”
 - c. Remove and lawfully dispose of excess excavated material and debris from the work site daily.
8. Typical Sequence of Point Repair:
 - a. Perform pre-installation video inspection, if required, to verify location of storm drain main point repair locations. Perform service testing between manholes to verify location of service lateral point repair locations.
 - b. After the location of a point repair is determined, excavate the required length for the point repair.

- c. Prior to replacing a damaged section(s) of pipe, determine condition of the existing line on both sides of the point repair by lamping (illuminating and inspecting) the main at least 10 feet in each direction. Determine whether additional lengths of main (beyond "10 feet minimum length" criteria) need replacement. Report need for additional replacement to Inspector and obtain authorization before proceeding.
- d. Remove the damaged section(s) pipe and replace with new pipe, shaping the bottom of the trench and placing the required pipe bedding so that the grade of the replaced pipe matches the grade of the existing main. Establish proper grade for the section(s) of pipe being replaced using methods acceptable to the Inspector.
- e. Connect the new pipe to existing main using flexible adapters. If joints cannot be made watertight using flexible adapters, place waterstop gaskets on each joint and encase in a reinforced concrete collar.
- f. Backfill the excavation as specified in Item No. 400, "Excavation, Trenching and Backfill."
- g. Perform a post-installation video inspection as specified in Item No. 417, "Storm Drain Main Television Inspection." Point repairs that show offset joints, non-uniform grade, incorrect alignment, excessive deflection or similar conditions are considered defective work. Contractor shall replace pipe and bedding, as required, to correct defective work.

9. Abandonment of Point Repair:

- a. Notify the Inspector if a pipe is exposed by excavation and is found to be in good condition, not requiring a point repair. That point repair shall not be performed.
- b. Notify the Inspector if the pre-installation video inspection reveals that no point repair is required. The point repair shall not be performed.
- c. Backfill the excavation. Replace pavement or sidewalk, seeding and topsoil in accordance with COSA standard specifications.

10. Exterior Obstruction Removal:

- a. Remote Device: Remove obstructions identified on video of a storm drain segment which could cause a non-uniform liner pipe installation or obstruction of the liner during installation. Obtain authorization from the Inspector for obstruction removal with a remote device before proceeding.
- b. Excavate at the point where there is an obstruction. Use a trench

safety system as specified in Item No. 550, "Trench excavation Safety Protection."

- c. Break out the existing storm drain pipe as directed by the Inspector. Remove only that amount of material which is causing the obstruction. Remove the minimum amount of pipe.
- d. When replacement of the storm drain pipe is not required. Do not disturb the existing pipe bedding during excavation. However, if embedment is disturbed during the obstruction removal procedure, place cement-stabilized sand or crushed stone beneath the liner. No Separate pay item.
- e. When the repaired section liner is completely in place, encase it with crushed stone or cement- stabilized sand.

416.4 MEASUREMENT AND PAYMENT:

1. Unit Prices - Point Repair:

- a. Measurement for storm drain line point repair is on a unit price basis for each repair performed. Minimum length of pipe to be replaced for each repair is 10 feet. This shall be full compensation for all materials, equipment and labor needed to do the point repairs. Excavation and backfilling, Barricades, Signs and Traffic Handling, topsoil, seeding and sodding shall be considered part of this bid item. Trench Protection, Pavement and sidewalks shall be paid for under standard City bid items.
- b. Measurement for storm drain line point repair longer than 10 feet is on a per each basis based number of full 10' sections needed to be replaced plus one if a fraction of 10' remains after dividing into full 10' segments. (e.g. 26' of pipe needing repair would be paid as 3 External Point Repairs EA)
- c. Exterior obstruction removals shall be paid for as an exterior point repair. Minimum length of pipe to be replaced for each repair is 10 feet.
- d. If an authorized point repair is started but determined not to be needed in accordance with 416.3.9 full payment will be made for the point repair.
- e. No separate pay will be made for remote device or interior obstruction removal. That work is a part of Item 415 and will not be paid for directly.

- f. Measurement for hand excavation: When authorized by the Inspector in locations where excavation by machine is not suitable, no direct payment shall be made for hand excavation.
- g. The cost of the following items of work are included in the unit prices for point repairs, and all associated work:
 - (1) Excavation, embedment and backfill;
 - (2) Hauling away and lawful disposal of excess excavated materials and debris;
 - (3) Pipe, pipe fittings, adapters and concrete collars;
 - (4) Smoke testing and any required retesting;
 - (5) Restoration of site improvements, including sodding;
 - (6) Pre and Post-cleaning video inspection;
 - (7) All other necessary work to complete.
- h. The cost of the following items of work are not included in the unit prices for point repairs, and all associated work:
 - (1) Cut and Restore Pavement;
 - (2) Driveways, sidewalks and curbing.
 - (3) Pavement Markings
 - (4) Trench Excavation Protection

Removal of hard deposits, concrete, debris, pipes or any other material in a manhole, or that is accessible from the manhole wall, will be cleared under work items for rehabilitation of storm drain pipes and manholes in Item 415.

Bid Item:

- Item 416.1** – Exterior Point Repair 36” Diameter or Less - EA
- Item 416.2** – Exterior Point Repair 42” to 60” Diameter - EA
- Item 416.3** – Exterior Point Repair 66” Diameter or Greater - EA

- End of Specification -

ITEM 417
SPECIAL SPECIFICATION

STORM DRAIN MAIN TELEVISION
INSPECTION

417.1 DESCRIPTION: The Contractor shall furnish all labor, materials, equipment, and incidentals to provide the televising and a NASSCO-(PACP) standard video, recorded in MPEG-1 format and written to DVD video, of sewer main and manholes utilizing a color, closed-circuit television inspection unit to determine their condition. The video shall include an inclinometer, visible on the video being viewed, noting the slope of the main being televised.

417.2 GENERAL: After completion of the work specified in the contract documents, and prior to placement of the final course of asphalt or other final surface, the newly rehabilitated storm drain main shall be televised immediately upon lining being completed. Televising shall be observed by the Inspector or Engineer and contractor, as the camera is run through the system. Any abnormalities such as, but not limited to, cracked/defected pipe, rolled gaskets, shall be repaired by the Contractor in conformance with Item 415 section 415.3.4 "Surface Preparation", section 415.3.5 "Sealing Active Leaks" and Item 416 "Exterior Point Repair". Sections requiring repair shall be re-televised to verify condition of repair. Except as listed above, no additional compensation shall be provided for all needed repairs, re-cleaning, or re-televising.

417.3 EXECUTION: The Contractor shall provide a DVD and log of the televised system for review and approval by the Inspector. If the Contractor provides a DVD of such poor quality that it cannot be properly evaluated, the Contractor shall re-televising as necessary and provide a DVD of good quality at no additional cost to City of San Antonio. If the Contractor cannot provide a DVD of such good quality that can be reviewed by City of San Antonio, City of San Antonio may elect to televise the line at the Contractor's expense.

The television unit shall also have the capability of displaying in color, on DVD, pipe inspection observations such as pipe defects, sags, points of root intrusion, offset joints, and any other relevant physical attributes. Each DVD shall be permanently labeled with the following:

1. Project name / CoSA Job # / Work Order #;
2. Date of television inspection;
3. Station to station location and size of storm drain;
4. Street/easement location
5. Name of Contractor;

6. Date DVD submitted;
7. DVD number;
8. City of San Antonio Inspector Name.

The Contractor shall provide a line diagram area sketch and written log for each completed segment of DVD storm drain describing the section being televised, flow and camera direction, position of service connections, description and location of failures, pipe condition, weather conditions, and other significant observations.

The television inspection equipment shall have an accurate footage counter which displays on the monitor the exact distance of the camera from the center of the starting manhole. A camera with rotating and panning lens capabilities is required. The camera height shall be centered in the conduit being televised. The speed of the camera through the conduit shall not exceed 40 feet per minute.

The Contractor shall be required to have all materials, equipment, and labor force necessary to complete all videotaping on the job site prior to beginning videotaping operations.

Television inspection shall be done one section between two manholes at a time. Also the flow in the section being televised shall be bypassed.

The Contractor shall not be allowed to float the camera. There may be occasions during the televised inspection of a manhole section when the camera will be unable to pass an obstruction. At that time, and prior to proceeding, the Contractor shall contact the Inspector. If the length of storm drain cannot be televised because of obstructions, the Contractor shall clean the system as is necessary. If, in the opinion of the Inspector, the obstruction is attributed to a collapsed main or pipe deflection, televising shall be suspended and the remaining televising of the storm drain shall be continued upon successful correction of the blockage by the Contractor in accordance with the Contract Documents. No additional payment shall be made for additional setups required due to obstructions encountered during televising.

The Contractor is solely responsible for any damage of storm drain mains as a direct result of televising operations. Any repair shall also be the responsibility of the Contractor.

The method(s) used for securing passage of the camera are at the discretion of the Contractor, and as approved by the Inspector.

No storm drain main televising effort shall commence until all pertinent permits or required approvals have been obtained by the contractor.

No separate and/or additional payment will be made for any excavation, man entry, or any other method which may be required to retrieve video equipment that may have been hung up, destroyed, and/or lost during the operation.

417.4 STORM DRAIN BYPASS PUMPING: The Contractor shall perform bypass pumping operations in accordance with Item 415, "Spin Cast Geopolymer Pipe Liner." No separate pay item shall be made for bypass pumping and shall be subsidiary to this bid item.

417.4.1 MATERIALS REQUIRED FOR BYPASS OPERATION: The Contractor shall be required to have all materials, equipment, and labor necessary to complete the repair or replacement on the jobsite prior to isolating the storm drain manhole or line segment and beginning bypass pumping operations.

417.4.2 TRAFFIC CONSIDERATIONS: The Contractor shall locate bypass pumping suction and discharge lines so as to not cause undue interference with the use of streets, private driveways, and alleys to include the possible temporary trenching of force mains at critical intersections. Traffic management shall be done under the approval of respective City, County, or State Traffic, Barricade, and Signalization Departments. The Contractor shall not initiate any effort to accommodate bypass pumping piping operations until specific written approval is given. There will be no separate pay item for this work.

417.5 MEASUREMENT AND PAYMENT: Televising inspection including labor, materials, tools, logging, cleaning, by pass pumping and incidentals needed to accomplish the televising is subsidiary in various bid items, measurement and direct payment will not be made for the televising inspection.

- End of Specification -

ITEM 801

TREE AND LANDSCAPE PROTECTION

This item shall govern the placing of protection for trees and other landscape plant material or natural areas to be protected during construction. No site preparation work shall begin in areas where tree preservation and treatment measures have not been completed and approved. *Where removal of trees is indicated on the drawings, they shall be marked as directed by the engineer or designated representatives.* This item shall also govern the excavation, filling, *trenching and boring* around trees described on the plans, and for furnishing all materials, water, labor, tools, equipment and supplies required as specified by this item or as indicated on the plans.

Reference Standards: City of San Antonio Tree Preservation ordinance # 85262

MATERIALS:

LEVEL I FENCE PROTECTION (Detail 1.1.2):

Fabric: Fabric (4 foot height or 1.2 m) shall consist of orange plastic fencing as shown on the plans and shall be woven with 2-inch (50 mm) mesh openings such that in a vertical dimension of 23 inches (584 mm) along the diagonals of the openings there shall be at least seven meshes.

1. Installation Posts: Installation posts shall be a minimum of 72 inches (1.5 m) long and steel "T" shaped with a minimum weight of 1.3 pounds per linear foot (6.3 kg per meter).
2. Tie Wire: Wire for attaching the fabric to the t-posts shall be not less than No. 12 gauge galvanized wire. Sufficient fastening material shall be furnished to provide for the securing of the fabric to the "T" line posts.
3. Used Materials: Previously-used materials, meeting the above requirements and when approved by the Engineer, may be used.

LEVEL IIA FENCE PROTECTION (Detail 1.1.3):

Materials same as Level I -OR-

LEVEL IIB FENCE PROTECTION (Detail 1.1.4):

1. Sleeve: 2x4 lumber to a height of 4 feet above the root crown.
2. 2x4 shall be utilized as called for on plan.
3. Tie Wire: Wire for securing the 2x4s shall not be less than No. 12 gauge.

OTHER MATERIALS:

1. Tree Dressing - Asphaltic Tree Wound Paint

CONSTRUCTION METHODS:

LEVEL I FENCE PROTECTION:

All trees and shrubs in the proximity of the construction site shall be protected prior to beginning any development activity.

Protective fencing shall be erected outside the dripline at locations shown in the plans or as directed by the Inspector and/or City Arborist or in accordance with the details shown on the plans at the drip line of trees (Root Protection Zone, RPZ) and/or landscape plant material including natural areas. Fencing shall be maintained and repaired by the contractor during site construction.

Protective fence locations in close proximity to street intersections or drives shall adhere to the City of San Antonio's site distance criteria.

The protective fencing shall be erected before site work commences and shall remain in place during the entire construction phase. Access to fenced areas will be permitted only with the approval of the engineer.

The installation posts will be placed every 6 feet (2 m) around the drip line or RPZ and embedded to 18 inches (457 mm) deep. Fabric attachment shall be attached to the installation posts by the use of sufficient wire ties to securely fasten the fabric to the “T” posts as to hold the fabric in a stable and upright position.

1. Do not clear, fill or grade in the RPZ of any tree.
2. Do not store, stockpile or dump any job material, soil or rubbish under the spread of the tree branches.
3. Do not park or store any equipment or supplies under the spread of the tree branches.
4. Do not set up any construction operations under the spread of the tree branches. (E.g. pipe cutting and threading, mortar mixing, painting or lumber cutting)
5. Do not nail or attach temporary signs, meters, switches, wires, bracing or any other item to the trees.
6. Do not permit runoff from waste materials including solvents, concrete washouts, asphalt tack coats (MC-30 oil), etc. to enter the RPZ. Barriers are to be provided to prevent such runoff substances from entering the RPZ whenever possible, including in an area where rain or surface water could carry such materials to the root system of the tree.

The contractor shall avoid cutting roots larger than one inch in diameter when excavation occurs near existing trees. Excavation in the vicinity of trees shall proceed with caution. The contractor shall contact the city inspector.

Remove all trees, shrubs or bushes to be cleared from protected root zone areas as directed by engineer by hand.

Trees damaged or lost due to contractor’s negligence during construction shall be mitigated at the contractor’s expense and to the engineer’s satisfaction.

Any tree removal shall be approved by the city arborist prior to its removal.

Cover exposed roots at the end of each day with soil, mulch or wet burlap.

In critical root zone areas that cannot be protected during construction and where heavy traffic is anticipated, cover those areas with (8) inches of organic mulch to minimize soil compaction. This (8) inch depth of mulch shall be maintained throughout construction.

Water all trees, most heavily impacted by construction activities, deeply once a week during periods of hot dry weather. Spray tree crowns with water periodically to reduce dust accumulation on the leaves.

When installing concrete adjacent to the root zone of a tree, use a plastic vapor barrier behind the concrete to prohibit leaching of lime into the soil. See related specifications.

When an excavation or embankment is placed within the dripline of any tree greater than (8) inches in diameter, a Tree well shall be constructed to protect the tree as indicated, when the cut or fill exceeds (8) inches. See related specifications.

Where paving or filling is necessary within the dripline of any tree (8) inches or greater, a permeable pavement and aeration system must be installed as indicated. See related specifications.

CONSTRUCTION METHODS:

LEVEL II A FENCE PROTECTION:

Protective fencing shall be erected within the RPZ at locations shown in the plans or as directed by the Inspector and/or City Arborist or in accordance with the details shown on the plans at the drip line of trees (Root Protection Zone, RPZ) and/or landscape plant material including natural areas. Fencing shall be maintained and repaired by the contractor during site construction.

Fabric: Fabric (4 foot height or 1.2 m) shall consist of orange plastic fencing as shown on the plans and shall be woven with 2-inch (50 mm) mesh openings such that in a vertical dimension of 23 inches (584 mm) along the diagonals of the openings there shall be at least seven meshes.

1. Installation Posts: Installation posts shall be a minimum of 72 inches (1.5 m) long and steel "T" shaped with a minimum weight of 1.3 pounds per linear foot (6.3 kg per meter).
2. Tie Wire: Wire for attaching the fabric to the t-posts shall be not less than No. 12 gauge galvanized wire. Sufficient fastening material shall be furnished to provide for the securing of the fabric to the "T" line posts.
3. Used Materials: Previously-used materials, meeting the above requirements and when approved by the Engineer, may be used.

LEVEL II B FENCE PROTECTION:

Trunk protection shall be erected at locations shown in the plans or as directed by the Inspector and/or City Arborist shall be maintained and repaired by the contractor during site construction.

1. Installation Sleeve: 2x4 lumber to a height of 4 feet above the root crown.
2. Tie Wire for securing the 2x4s shall not be less than No. 12 gauge

MEASUREMENT:

Protective fencing will be measured by the linear foot of accepted work, complete in place for the duration of construction activity.

PAYMENT:

Tree and Landscape Protective Fencing will be paid for at the unit price bid per linear foot (meter), which price shall be full compensation for furnishing and placing all materials, manipulation, labor, tools, equipment and incidentals necessary to complete the work.

BID ITEMS

Item 801.1: Level I Protective Fencing - per linear foot (meter)

Item 801.2: Level IIA Protective Fencing - per linear foot (meter)

Item 801.3: Level IIB Protective Fencing - per linear foot (meter)

ITEM 802

SPECIAL SPECIFICATION

TREE PRUNING, SOIL AMENDING AND FERTILIZATION

PART 1 GENERAL

1.1 DESCRIPTION:

The purpose of this specification is to describe a procedure for maintaining preserved trees before, during and after construction and for furnishing all materials, water, labor, tools, equipments and supplies required as specified by this item or as indicated on the plans.

1.2 REFERENCE STANDARDS:

The contractor shall comply with the applicable provisions and recommendations of the publication listed below and these shall be utilized as reference standards, and form a part of this specification to the extent indicated by reference:

American National Standard Institute - ANSI A300-2002

PART 2 PRODUCTS

2.1 MATERIALS:

1. Tree pruning paint: Any latex, oil or asphalt base wound dressing.
2. Soil amendment: Organic soil amendment with nitrogen content 10% or less.
3. Commercial fertilizer: Urea form based liquid suspension, which is soil injected. Salt Index is less than 3.5 (True Green, Boost) and a longevity period of up to 2 years.
4. Mulch: Shredded wood residue with size of pieces not more than 6 inches in length.
5. Water-By truck for trees.

PART 3 EXECUTION

LEVEL I:

3.1 CARE OF TREES PRIOR TO AND DURING CONSTRUCTION:

1. Prior to erecting tree enclosure and the start of any phase of construction, arborist will provide mycorrhizal inoculation and deep root fertilization to the tree roots, using 3 lbs. of actual nitrogen per 1000 square feet of root area in a slow release soil injection method. Then a certified arborist will perform pruning before construction to remove dead wood, improve the health of the trees to better tolerate the stresses endured during construction activities. In addition all pruning shall adhere to the standard practices in the American National Standard Institute ANS/A300-1995, and to improve the level of safety
 - a. Crown Cleaning – shall consist of the removal of dead, dying, and diseased wood one inch in diameter and greater. Many of the existing trees are above and within the proposed walkway. This dead wood shall be removed to improve safety and liability issues.
2. No site preparation work shall begin in areas where tree preservation and treatment measures have not been completed and approved.
 - a. Crown Raising – shall consist of removing lower limbs to provide a clearance

specification of 8 feet over walkways and 13 feet over the main road for vehicle clearance. Branches may be tied back instead of removed, in order to alleviate conflict.

These specifications should protect the existing trees. Tree contractor is to be briefed by Project Engineer/Arborist prior to project commencement. All pruning and removals shall be overseen by a Certified Arborist. The awarded company shall have a Certified Arborist on staff to be able to bid on this Project.

3. No pruning or removal of limbs shall be allowed to provide clearance for work unless approved by the engineer.
4. Removal of limbs which are 6 inches in diameter or greater is prohibited without consent of the City Arborist. Occasional branches, up to 1/4 inch in diameter, which are dead, dying, diseased may remain when it is not practical to remove it.
5. Oak wounds must be painted with wound paint within 30 minutes to prevent infection of the Oak Wilt fungal organism.
6. Soil amendments will be applied within the drip line (RPZ).
7. Soil fertilization will be completed by a soil injection method, which will occur at a spacing of 3 feet on center around the tree within the drip line (Root Protection Zone, RPZ) only for those trees specified.
8. Excavate within drip line of trees only where required. Where excavating for new construction is required within drip line of trees, hand excavate to minimize damage to root systems. Use narrow spading forks and comb soil to expose roots. Relocate roots back into backfill areas wherever possible. If large main lateral roots are encountered, expose beyond excavation limits as required to bend and relocate without breaking. If root relocation is not practical, then contact Client representative for approval to cut roots 1/2" or greater. If approved, clean cut roots using handsaw or chainsaw approximately 3 inches back from new construction. Where existing grade is above new finish grade, carefully excavate within the drip line to the new finish grade. Carefully hand excavate an additional 8 inch below the finish grade. Use narrow line spading forks to comb the soil to expose the roots and prune the exposed root structure as recommended by the Arborist. After pruning and treatment is complete, backfill to within the finish grade with 8" of approved landscape fill material. Temporarily support and protect roots against damage until permanently relocated and do not allow exposure of root to air to occur beyond 12 hours. Cover with damp soil, peat moss, 8" bark or gunny sacks in order to keep moist so as not to dry out and permanently cover roots as soon as possible. Where it has been determined that trenching for utilities can seriously impact the roots of a desirable tree, then bore or tunnel under tree to minimize root impact.
9. The Contractor shall be responsible for coordinating all construction activities that may impact trees with client's representative and the Arborist, who will do the necessary pruning and deep root fertilization deemed necessary by the Arborist.

3.2 POST CONSTRUCTION CARE OF TREES:

1. The Contractor shall water when it is necessary to supplement natural rainfalls required preventing excess drying of the tree root area.

2. The Contractor is responsible for a fall and spring fertilization of the following year using a deep root fertilization method on trees deemed necessary by the Client.
3. The Contractor shall perform post construction care under the supervision of the arborist.

3.3 QUALITY ASSURANCE:

All tree pruning and fertilization work shall be performed by a single firm specializing in tree pruning work, with a minimum of 3 years experience in the acceptable performance of similar work to that specified. Pruning is to be performed by personnel who, by training and on the job experience, are familiar with the techniques and hazards of this work. The firm performing the work shall have the following minimum qualifications and certifications.

NAA - National Arborist Association Certified or
ISA - International Society of Arborists Certification
Be licensed for application and use of pesticides
Meet state requirements for insurance
Must be bonded

The Arborist shall:

- a. Establish lines of communication for all work which may potentially impact trees, under story, or areas that are to be protected from construction activity.
- b. Locate and properly identify or mark in the field trees, under story and areas that are to be protected from construction activity and are the responsibility of the Prime Contractor to protect.
- c. Identify limits and extent of protective fencing around these trees, under story vegetation and other areas.

LEVEL II:

3.4 CARE OF TREES PRIOR TO AND DURING CONSTRUCTION:

1. Prior to erecting tree enclosure and the start of any phase of construction; provide mycorrhizal inoculation and deep root fertilization to the tree roots, using 3 lbs. of actual nitrogen per 1000 square feet of root area. Then pruning will be performed by a certified arborist before construction to remove dead wood, improve the health of the trees to better tolerate the stresses endured during construction activities. In addition all pruning shall adhere to the standard practices in the American National Standard Institute ANS/A300-1995, and to improve the level of safety
2. No site preparation work shall begin in areas where tree preservation and treatment measures have not been completed and approved.
3. No pruning or removal of limbs shall be allowed to provide clearance for work unless approved by the engineer.
4. Removal of limbs which are 6 inches in diameter or greater is prohibited without consent of the City Arborist. Occasional branches, up to 1/4 inch in diameter, which are dead, dying, diseased may remain when it is not practical to remove it.
5. Oak wounds must be painted with wound paint within 30 minutes to prevent infection of the Oak Wilt fungal organism.

6. Excavate within drip line of trees only where required. Where excavating for new construction is required within drip line of trees, hand excavate to minimize damage to root systems. Use narrow spading forks and comb soil to expose roots. Relocate roots back into backfill areas wherever possible. If large main lateral roots are encountered, expose beyond excavation limits as required to bend and relocate without breaking. If root relocation is not practical, then contact Client representative for approval to cut roots 1/2" or greater. If approved, clean cut roots using a handsaw or chainsaw approximately 3 inches back from new construction. Where existing grade is above new finish grade, carefully excavate within the drip line to the new finish grade. Carefully hand excavate an additional 8 inch below the finish grade. Use narrow line spading forks to comb the soil to expose the roots and prune the exposed root structure as recommended by the Arborist. After pruning and treatment is complete, backfill to within the finish grade with 8" of approved landscape fill material. Temporarily support and protect roots against damage until permanently relocated and do not allow exposure of root to air to occur beyond 12 hours. Cover with damp soil, peat moss, bark or gunny sacks in order to keep moist so as not to dry out and permanently cover roots as soon as possible. Where it has been determined that trenching for utilities can seriously impact the roots of a desirable tree, then bore or tunnel under tree to minimize root impact.
7. Water deeply trees that are substantially trimmed or within drip line of excavation work for the duration of this contract.
8. Water deeply trees that show signs of stress and are located in areas where the groundwater table has been lowered due to construction activities.
9. The Contractor shall be responsible for coordinating all construction activities that may impact trees with client's representative and the Arborist, who will do the necessary pruning and deep root fertilization deemed necessary by the Arborist.

3.5 POST CONSTRUCTION CARE OF TREES:

1. The Contractor shall water when it is necessary to supplement natural rainfalls required preventing excess drying of the tree root area. Barring natural rainfall, the Contractor should apply 1" per week over entire root protection zone.
2. The Arborist shall monitor and authorize for removal the trees which show symptoms of stress, which might be indicated by branch die back chlorosis or fringe browning of the leaves. This would indicate that the crown is not in equilibrium with roots and additional pruning would be necessary. Subsequent pruning should remove only as much green wood as deemed necessary to reestablish equilibrium. If trees die during construction due to contractor negligence up to a one year post construction period, the Contractor will be required to replace trees at his or her own expense as called for in Paragraph 3.6.
3. The Contractor shall perform post construction care under the supervision of an arborist.

3.6 MEASUREMENT:

"Level I Pruning, Soil Amendment, and Fertilization" will be measured by each tree which has received Level I Pruning, Soil Amendment, and Fertilization.

"Level II Pruning, Soil Amendment, and Fertilization" will be measured by each tree which has received Level II Pruning, Soil Amendment, and Fertilization.

The work performed, materials furnished, equipment, labor, tools, hauling and incidentals for minor Pruning without the addition of Soil Amendment and Fertilization will not be measured directly but will be subsidiary to pertinent items.

3.7 PAYMENT:

Work performed and materials furnished as prescribed by this item and measured as provided under "Measurement" will be paid for as follows:

"Level I Pruning, Soil Amendment, and Fertilization" will be paid for at the unit price bid per each tree receiving "Level I Pruning, Soil Amendment, and Fertilization" which price shall be full compensation for furnishing all materials; preparation, hauling, handling charges, placement, labor, tools, and incidentals necessary to complete the work.

"Level II Pruning, Soil Amendment, and Fertilization" will be paid for at the unit price bid per each tree receiving "Level II Pruning, Soil Amendment, and Fertilization" which price shall be full compensation for furnishing all materials; preparation, hauling, handling charges, placement, labor, tools, and incidentals necessary to complete the work.

3.8 BID ITEM:

Item 802.1 - Level I Pruning, Soil Amendment, and Fertilization - per each tree

Item 802.2 - Level II Pruning, Soil Amendment, and Fertilization - per each tree

ITEM 810

SPECIAL SPECIFICATION

TREE REMOVAL

810.1 DESCRIPTION: *This item shall govern for the removal of trees of the sizes specified herein and when directed by the City. All other trees not specified under the provision of this specification and which are directed by the City to be removed shall be compensated for and shall conform to the provisions of Item No. 101, "Preparing Right-of-Way".*

Reference Standards: City of San Antonio Tree Preservation ordinance # 85262 and 2006 Tree Ordinance Amendments.

810.2 WORK METHODS: Do not damage trees, shrubs, sidewalks, driveways, utilities or other features which are to remain. Unless otherwise approved, dispose of debris within 48 hrs. of cutting off the right-of-way. Remove tree stumps to at least 12 in. below the surrounding terrain unless otherwise shown on the plans, or as directed by the Engineer. Backfill holes with an acceptable material and compact flush with the surrounding area.

810.3 MEASUREMENT: Tree removal will be measured by each tree removed of the size specified as measured at diameter breast height (DBH) where required by the plans or as directed by the Engineer.

810.4 PAYMENT: Tree Removal will be paid for at the unit price bid per each, which price shall be full compensation for furnishing and placing all materials, excavation, backfill, traffic control devices, manipulation, labor, tools, equipment, hauling, disposal and incidentals necessary to complete the work.

810.5 BID ITEMS:

Item 810: Tree Removal (6" Diameter and larger) – per each (EA)

ITEM 811

SPECIAL SPECIFICATION

TCI "At Work" Project Sign

- 811.1 DESCRIPTION:** *Provide project sign for the Department of Transportation & Capital Improvements (TCI) for duration of construction of individual project.*
- 811.2 MATERIALS:** Contractor to furnish all materials necessary to display the "At Work" project sign as depicted in the sign template as provided by COSA.
- 811.3 CONSTRUCTION:** It is the contractor's responsibility to see that all signs are properly installed and maintained at each job site.
- 811.4 MEASUREMENT:** TCI "At Work" Project Sign, as prescribed above, will be measured by the unit of each project sign furnished up to the quantity shown in the contract. The storage and transfer of sign from project to project, as well as the equipment & material required to mount the sign, will not be measured for payment. If additional TCI signs are needed, contractor shall submit written request to project manager for approval.
- 811.5 PAYMENT:** The accepted quantity of signs shall be paid at the contract unit price for each sign, which shall be full compensation for furnishing all materials, labor, tools, equipment and supplies to construct the signs, mountings, installation at the various sites, maintaining the signs, moving the signs, removal of signs and for all other incidentals necessary to complete the work.
- 811.6 BID ITEM:**

ITEM 811.1 - TCI "At Work" Project Sign- Each (EA)

IMP Transportation and Capital Improvements sign specs.



Colors: Burgundy vinyl, Columbia Blue vinyl, Black vinyl
Background: White High Intensity Prismatic sheeting.

Font: Century Gothic

Font: Clearview Hwy 2B

**Transportation and
Capital Improvements**

**For information
206-8480
City of San Antonio**

ITEM 6001

SPECIAL SPECIFICATION

WOODEN PRIVACY FENCE

6001.1 DESCRIPTION: *This item shall govern for the removing and replacing of the wooden privacy fence, maximum six feet high, at the locations designated on the plans, and for furnishing and installing any additional materials required as specified by this item.*

6001.2 MATERIALS: All materials furnished shall be equal to or better than the materials of the existing fence unless specifically designated otherwise on the plans. Use only new materials.

Concrete shall be in accordance with Item 300, "Concrete," Class "B". Wood shall be Wolmanized pine, cedar or as specified. The timber shall be sound and free from all decay, shakes, splits or any other defects, which would make it structurally unsuitable for the intended purpose. Post shall be (nominal) 4x4 by 8' cedar. Backer rails shall be nominal 2x4 by 8' pine. Pickets shall be nominal 1x4 by 6' cedar, dog-eared on one end. Fasteners shall be steel common nails

6001.3 EQUIPMENT: Provide the machinery, tools and equipment necessary for proper prosecution of the work. All machinery, tools and equipment used shall be maintained in a satisfactory and workmanlike manner.

6001.4 CONSTRUCTION: Fence shall be erected to the lines and grades indicated on the plans.

A. Erection of Posts: Posts shall be set plumb and permanently positioned and anchorages firmly set before fabric is placed. Posts shall be set in concrete, unless otherwise indicated on the Drawings. Concrete footings shall be carried to a depth of 24 inches and width of 12 inches minimum. Where rock is encountered within the required depth to which the post is to be erected, a hole of a diameter slightly larger than the largest dimension of the post may be drilled into the rock and the post grouted in. The regular dimensioned concrete footing as indicated on the Drawings shall then be placed between the top of the rock and required grade indicated on the Drawings. Posts shall be approximately centered in their footings. All concrete shall be placed promptly and compacted by tamping or other approved methods. Concrete shall be finished in a dome and shall be cured a minimum of 48 hours before further work is done on the posts.

B. Erection of Wood Fencing Material: After all posts have been permanently positioned and anchorages firmly set, two (2) backer rails shall be placed and fastened between each post and pickets fastened to the backer rails. No gap shall be present between pickets.

6001.5 MEASUREMENT: The work performed and the materials furnished as prescribed by this item will be paid for at the bid price per linear foot for "Wooden Privacy Fence", which price shall be full compensation for removing and reinstalling the existing fence gate and for furnishing all additional materials, all labor, tools, equipment and incidentals necessary to complete the work. Fence will be measured by the linear foot of fence at the bottom of the fence along the centerline of the fence from center to center of end post. "Wooden Privacy Fence" shall include all posts, backer rails, and pickets, complete in place.

6001.6 PAYMENT: “Wooden Privacy Fence” measured as prescribed above, will be paid for at the contract unit price bid per linear foot for “Wooden Privacy Fence”. The price shall be full compensation for furnishing and installing all fencing materials, end posts, backer rails, and pickets; digging post holes ‘ furnishing and placing concrete for posts; all hauling and hauling charges; and for all manipulation, labor, tools, equipment, and incidentals necessary to complete the work.

6001.7 BID ITEMS:

Item 6001.1 – Wooden Privacy Fence – per linear foot

Item 6001.2 – Wooden Privacy Fence (Vehicular Gates) – per linear foot

Item 6001.3 – Wooden Privacy Fence (Pedestrian Gates) – per linear foot