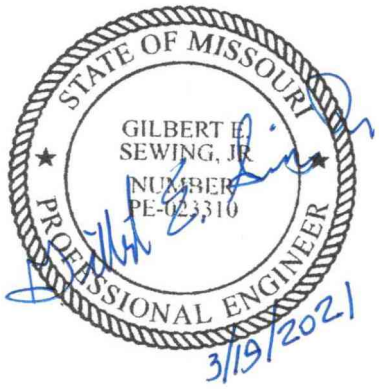
SANITARY SEWERAGE FACILITIES

STANDARD CONSTRUCTION SPECIFICATIONS

FOR

THE CITY OF JACKSON, MISSOURI

CAPE GIRARDEAU COUNTY



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Engineering Department
Kent A. Peetz, P.E.
Director of Public Works
101 Court Street
Jackson, MO 63755
Phone: (573) 243-2300 Fax: (573) 243-3322
Email: kpeetz@jacksonmo.com
Website: www.jacksonmo.org

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SANITARY SEWERAGE FACILITIES
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FOR
THE CITY OF JACKSON, MISSOURI

PART 1 - GENERAL CONDITIONS

Section A. PURPOSE AND APPLICATION.

These specifications apply to all sanitary sewerage facility construction projects intended to be dedicated to the City for future operation and maintenance. For City-contracted projects, the project specifications developed specifically for each given project (if any) shall take precedence over these standard specifications.

Section B. DEFINITIONS.

Acceptance of the Work: That action by which the City acknowledges that all provisions of the contract have been fully performed.

Award: Notice to the Contractor of acceptance of bid, subject to conditions of invitation for bids and applicable ordinances.

Backfill: The material used to fill an excavation.

Base: The foundation or substructure resting on the underlying earth and supporting a pavement or structure.

Bedding: The material on which the pipe or conduit is supported and protected.

Bidder: The person or legal entity that submits an offer in accordance with the invitation for bids.

Cash Contract: A contract providing for payment in money.

Channel: A natural or artificial water course.

City: City of Jackson, Missouri

Concrete: A proportioned uniform mixture of graded fine and coarse aggregates and cementing material. The cementing material shall be Portland Cement and water for cement concrete, and bituminous cements for asphaltic concrete.

Contract: The agreement by which the successful bidder obligates the bidder to do the work in accordance with the invitation for bids.

Contract Bond: A performance bond for the full amount of the contract in the form provided by the City as directed by ordinance, and secured by a corporation engaged in the bonding business, duly licensed to do business in Missouri, and approved by the City.

Contractor: The Individual, Partnership, Joint Venture, Corporation, or other legal entity who performs the work under the terms of the contract documents.

Culvert: A closed conduit for the free passage of surface drainage water under a roadway, railroad, or other embankment.

Developer: The Individual, Partnership, Joint Venture, Corporation, Governmental Agency, or other or legal entity responsible for the funding and construction of a project that will require sewer service.

Direct Conflict: With regard to sanitary house lateral services, utility services, utility mains: When the proposed structures or conduits intrude into the surface of an existing structure or conduit, or when an existing conduit is found to be within the payline limits of and parallel to the proposed conduit, or when an existing conduit crosses the proposed conduit at an angle of 45 degrees or less to parallel they will be considered to be in direct conflict. With regard to utility surface conflicts (i.e. power poles, guy anchors, valve boxes, etc.), they must be within the excavation payline limits to be in direct conflict.

Director: The Public Works Director of the City of Jackson or his properly authorized agents (such as the City Engineer or consultants employed by the City).

Easement: The right of the City to use land of another for sewer and drainage and construction purposes. Easements for construction and subsequent operation of sanitary or combined sewers shall be a minimum width of 15 ft.

Engineer: A person or firm licensed by the State of Missouri as a Professional Engineer.

Force Main: A pressurized sewer carrying wastewater.

Grout: A mortar of semi-fluid consistency.

Hazardous Waste: This term shall have the meaning prescribed in Section 1004 of the Solid Waste Disposal Act (42 USC Section 6903), as amended from time to time. Wastewater is not a “Hazardous Waste”.

House Connection: The point of connection between the house lateral and public sewer.

House Lateral: Private sewer from building drain(s) to public sewer.

Industrial Wastewater: The water-borne wastes from industrial operations, including contaminated cooling water, as distinct from sanitary wastewater.

Mortar: A proportioned uniform mixture of graded fine aggregate, cement and water.

Neat Cement: A uniform mixture of cement and water.

Payline Limits: The dimensions that have been set forth in these specifications by which quantities will be determined for payment.

Private Sewer: A sewer not accepted for public use or maintenance, as determined by the City.

Project Plans and Specifications: The plans, profiles, cross-sections, drawings, and project specifications, or reproductions thereof, which are approved by the City and which show and describe the details of the work to be done. Where either plans or specifications is used it means both.

Proposal: An offer to do the work in accordance with the invitation for bids.

Proposal Guaranty: The bid security of a certified check or cashier's check or a bid bond security by a duly licensed surety company in an amount as set forth in the invitation to bidders, to become the property of the City if the offer of the bidder is accepted by the City and the bidder fails or refuses to enter into a contract pursuant to bidder's offer.

Public Right-of-Way: The real property used by a public utility, agency, or municipality.

Public Sewer: A sewer which has been accepted for public use or maintenance, as determined by the City.

Reach: The section of sewer line between two structures.

Roadway: That portion of a highway, street or road which is used for vehicular traffic.

Sanitary Sewer: A pipe or conduit designed and intended to receive and convey wastewater as defined herein.

Sanitary Wastewater: Wastewater emanating from the sanitary conveniences, including toilet, bath, laundry, lavatory, and/or kitchen sink, of residential and non-residential sources, as distinct from industrial waste.

Sewage: See "Wastewater".

Sewer: A pipe or closed conduit designed for carrying wastewater.

Shop Drawings: Detailed fabrication or construction drawings of specific items of a project provided by the contractor.

Specifications: The particular requirements of the work to be done.

Standard Details of Sewer Construction: Plans of structures or devices or of construction details commonly used on City work and referred to on the plans or in the specifications as details and standard details.

Stank: A section of earth left in place above a short tunneled section between sections of open trench in a line of a trenching operation.

Stormwater Sewer: A sewer which carries surface runoff and subsurface waters.

Subcontractor: One who has, with City consent, entered into a contract to perform part of the work with the entity that has already contracted with the City for its performance.

Subgrade: The surface of the supporting earth or rock upon which a foundation base, pavement, walk, bedding, conduit, or a structure is to be placed.

Surety: A corporation acceptable to the City, that is duly authorized under Missouri laws to assume the responsibility of assuring the bonds of the Contractor to the City.

Swale: A shallow, natural, or constructed water course.

Temporary Construction Easement: Permission to use private property during construction for ingress/egress, removal of trees and vegetation, excavate, grade, fill and temporarily relocate utilities.

Utilities: Public service facilities for supplying gas, electricity, water, power, cable TV, telephone and telegraph communication, railway transportation, and the like. Sewers are not considered utilities for purposes of this specification.

Wastewater: The water-borne wastes of a community, either sanitary or industrial (as defined herein), together with such groundwater or surface water that cannot reasonably be prevented from entering the sewer system.

Work: The construction of the public and private sewerage facilities contracted for completion.

Work Day: All calendar days except weekends and City holidays.

Section C. SCOPE OF WORK.

1. Meaning of Plans and Specifications: All work contemplated and described in these specifications shall be done in accordance with the detailed drawings and all directives which will be given from time to time during the progress of the work. The drawings and specifications form a part of the contract. If any discrepancy appears between any of the drawings and the specifications, or between any of the drawings, such discrepancy shall be interpreted and adjusted in writing by the Director whose decision shall be final. Any doubts as to the meaning of these specifications or any ambiguity in wording shall be explained and interpreted by the Director who shall have the right to correct any error or omission in them when such correction is, in his opinion, necessary for the proper fulfillment of their intention. The City shall not be liable for any increase in price as a result of such interpretation. When reference is made to a particular specification, it shall be interpreted to be the latest current revision thereof.

2. Decision of Director Conclusive: To prevent all disputes and litigation, the Director shall in all cases decide all questions which may arise relative to interpretations of the plans and specifications, to the acceptability of work done by the Contractor, and to the estimates. The Director’s decisions shall be final and conclusive.

3. Or Equal Clause: Whenever in these specifications or in any of the contract documents, any articles, appliance, device, or material is designated by a trade name and such words are not followed by the condition "or equal", it shall be deemed that the words "or equal" do follow such designation, unless the text clearly requires a contrary interpretation. Any article or material equaling the standards fixed may be used in place of that specifically mentioned by the specifications, provided the material proposed is first submitted to and approved by the Director.

4. Ambiguity of Plans or Specifications: If the Contractor does not clearly understand the plans and specifications or is not sure of their meaning, the Contractor shall make a

written request to the Director. The Director's written explanation and interpretation shall be final.

5. Rights-of-Way and Easements: All public sewers and appurtenances shall be constructed in easements and public rights-of-way.

6. Additions or Deletions of Work: The City shall have the right to make changes in the plans or specifications or the character of the work or to increase or decrease the quantity of work provided the total value of such changes, together with all previous changes, is not in excess of 25% of the original total monetary amount of the contract. Should it become necessary or in the best interests of the City to make increases or decreases exceeding this limitation, they will be covered by a supplemental written agreement entered into by the Contractor and the City.

7. Work Directive Change: Should a change be required and it is not feasible to delay construction of that portion of the improvement affected by the change until such time as a regular change order can be issued, and the estimated increase or decrease in contract cost does not exceed $ 1,000, a written work directive change may be issued in the field by the Director's representative, and the Contractor shall then proceed with the work without delay. Such emergency change orders will be confirmed by regular change orders at a later date.

8. Changes Requested by the Contractor: The Director may, at the Contractor's request, authorize in writing changes in the plans or specifications to facilitate or expedite the work of the Contractor, provided such changes are not detrimental to the work or to the best interests of the City. Requests for such changes shall be submitted in writing to the Director. Such changes as are authorized under this provision shall be made without additional cost to the City, and the City reserves the right to receive an equitable adjustment in the contract price or contract time as a consideration for authorizing any such change. The Contractor shall maintain sole responsibility for assuring these changes meet all of the requirements of Part 1, Section F, RESPONSIBILITIES OF THE CONTRACTOR.

9. Changed or Unforeseen Conditions: During the progress of the work, if the Contractor should encounter conditions materially different from those shown on the plans or indicated in the Project Specifications, or unknown conditions of a nature differing materially from those ordinarily encountered and generally recognized as being inherent in work of the character being performed, the Contractor shall, before proceeding further with work affecting or affected by such conditions, immediately notify the Director who which will promptly make an investigation. If conditions do materially differ and the Contractor could not reasonably have been expected to ascertain in advance the true nature of the existing conditions, a change order will be issued to provide for any increase or decrease in cost and difference in contract time resulting from any such condition.

10. Submittal of Claims: Any and all claims for additional compensation or completion time extension must be submitted to the City in writing within 30 days of the occurrence of the event from which the claim allegedly arises, or no consideration will be given to such claim.

Section D. CONTROL OF WORK.

1. Subcontract: The Contractor may not subcontract more than 50% of the work unless approved by the Director. Requests for permission to subcontract any portion shall be submitted to the Director in writing. Such requests shall state the type of work to be subcontracted and the names of the proposed subcontractors. No work shall be subcontracted without the written consent of the Director and approval of the subcontracting parties by the City. Such consent to subcontract shall not be construed to relieve the Contractor of any of his responsibility under the contract.

2. Contractor's Responsibility for Work as a Whole: The Contractor shall be responsible for the entire work until its final acceptance by the City. The Contractor shall not be released from any responsibility for any part of the work until the entire work embraced in his contract is finally accepted. The Contractor shall be solely responsible for the safety of the public and those engaged or employed during construction until completion of the work.

3. Authority of the City's Representative: The Director, who is authorized by the City Council, may act in the City's behalf in all matters affecting the work covered by these specifications. Within the scope of the contract, the Director and his inspection representatives are authorized to enforce compliance with plans and specifications, to determine the acceptability of materials and workmanship, and to prepare and process progress and final payment estimates. In the event of dispute between the Contractor and the inspection representative, the latter is authorized to reject materials or to suspend work until questions at issue can be referred to and decided by the Director.

4. Contractor to Stake Out Work: The Contractor shall stake out the work and furnish all survey party personnel, instruments, labor, and stakes required. The Contractor shall also furnish all means of alignment and grade control and the labor for setting them. The Contractor shall be careful to preserve stakes and surveyor's marks from damage or dislocation during construction activities, and shall replace all stakes and survey marks destroyed, lost, or displaced because of his negligence.

5. Approved Plans: No work shall begin until the plans have been approved by the City.

6. Supplemental Drawings:

    a. The Contractor shall furnish shop drawings, having been approved by the Engineer, for all steel reinforcement in reinforced concrete structures, and for all work as required by the plans, the project specifications, or these standard specifications. Shop drawings shall be fully detailed fabrication plans and shall include any erection plans needed to determine the location of individual members in the proposed structure.

    b. The Contractor shall submit three prints of each drawing to the Director two weeks prior to the date on which such work shall begin. After being checked, one print of the drawing will be returned to the Contractor who shall correct the original drawing as indicated on the print and furnish to the Director a printable transparency of the corrected drawing. This transparency, if found correct, will be approved and retained by the Director. Prints from the approved transparency will be furnished to the Contractor by the City without cost to the Contractor. Work to which any of these drawings is applicable shall not be

performed prior to the approval of such drawings by the City. No change shall be made on any supplemental drawing after it has been approved by the City, except on further approval of the City.

c. If a drawing, submitted by the Contractor as hereinbefore required, includes any modifications or changes of any specific requirements of the contract plans or specifications, the Contractor shall make a clearly legible note of such changes on the drawing. Such drawings, when approved by the City, shall then supersede the requirements of the contract plans and specifications in these particulars. If a modification causes a change in contract cost or other change of a substantial nature, a change order will be issued.

d. The City's approval of drawings submitted by the Contractor will indicate approval only insofar as the finished work may be affected, or approval of the proposed methods of construction. Such approval will not indicate that these drawings have been completely checked for accuracy of dimensions and details and conformity with plans and specifications. The Contractor shall be responsible for any field measurements required, for accuracy of dimensions and of details, and for conformity with plans and specifications. Full compensation for furnishing all drawings required to be furnished by the Contractor shall be considered as included in the prices bid.

7. Methods and Appliances: The methods, labor, equipment, and other facilities used by the Contractor must be such as shall assure performance of the work in accordance with the plans and specifications, and within the time specified for completion.

8. Inspection of the Work:

a. The City and its authorized representatives shall be given free access to the work, storage sites, and all material-producing facilities. Every reasonable aid shall be provided for ascertaining that the materials and workmanship are in accordance with the plans and specifications. The inspection of all work, unless otherwise specified, will be under the jurisdiction of the Director.

b. The Director shall be notified prior to beginning any work to determine if the presence of a City inspector is required. Any work performed without notification of the Director and permission to proceed with work granted, will be subject to rejection.

c. Any work not constructed in accordance with plans and specifications, whether or not constructed in the presence of a City inspector, shall be subject to rejection at any time prior to formal acceptance.

d. At the beginning of the work, or on resumption thereof after temporary suspension for any reason for more than one workday, the Contractor shall make application for an inspector prior to noon of the working day before inspection service is required on the work.

e. Whenever the Contractor is permitted or directed to perform night work or to vary the period during which work is carried on by day, the Contractor shall give reasonably adequate notice to the City inspector so that inspection may be provided.

f. When the work has been completed and the job site has been restored as required, a final inspection of the work will be made under the supervision of the Director.

9. Rejected or Unauthorized Work:

a. Work which has been rejected shall be repaired, or removed and replaced by the Contractor as ordered by the City and without extra compensation for such corrective work. On failure of the Contractor to comply with such order, the City may cause such defective or rejected work to be removed and replaced, and shall deduct the cost of such repair or removal and replacement from any moneys due or to become due to the Contractor. Furthermore, the Contractor may be removed from the City's list of eligible bidders for future City projects.

b. No additional payment will be made for any work done beyond the lines and grades shown on the plans or established by the Director, or any extra or additional work done without prior written City authority and direction. The payment of any estimate or of any retained percentage shall not relieve the Contractor of any obligation to correct any defective work.

Section E. PROSECUTION, PROGRESS AND ACCEPTANCE OF THE WORK.

1. Time of Commencement: The work embraced in these specifications shall start within ten calendar days after the date of written notice to commence work, and shall be carried on regularly thereafter with such force and equipment and in such manner as to insure its completion within the contract time. If the Contractor does not comply with the foregoing without a written, City-approved explanation, he may be removed from the list of eligible bidders for future City projects.

2. Order of Work: The work to be done under these specifications shall be begun and carried on at such locations and in such order of precedence as the Director may require, and shall be completed on or before such date as is specified in the contract. The Contractor shall employ such means and methods in doing his work so as not to interrupt, delay, damage or interfere with the work of any other contractor. All sewer construction shall begin at the most downstream end of the project and proceed upstream, unless otherwise approved in writing in advance by the City.

3. Work to Stop During Unsuitable Weather:

a. During unsuitable weather adverse to the prosecution and welfare of the work, all work must stop when so ordered by the Director and all work must be protected from possible injury.

b. No cost claim shall be made by the Contractor for delay by extreme or unusual weather, but, an extension of completion time shall be given to the Contractor by the City equal to the time of delay as determined by the Director, provided the request is made in writing by the Contractor of such an extension in time promptly on termination of such delay in accordance with Part 1 Section C.10, and the Director has approved such request in writing.

4. City's Liability for Delays: Delays caused by the City, and claimed in writing by the Contractor, will be considered for reimbursement and/or an extension of completion time. Consideration will only be given to the actual time that no progress was made.

5. Contractor's Delays or Abandonment:

    a. If the Contractor should unnecessarily delay the work, the Director shall give notice in writing to the Contractor and to his surety that the work is being unnecessarily delayed; that all measures shall be taken to insure the completion of the work within the required time limit; and that, if adequate effective measures are not taken within five calendar days after the date of delivery by registered mail of such notice, to increase the rate of doing acceptable work so that the work may be completed within the contract time limit, the contract may be terminated or cancelled.

    b. If the Contractor should abandon the work to be done under this contract, or should neglect or refuse to comply with the instructions of the Director relative to delay or abandonment, or should fail in any manner to comply with the specifications or stipulations herein contained, the City will have the right to annul and cancel this contract on ten days prior notice by registered mail to the Contractor and to his surety, and to complete the contract at the expense of the Contractor and his surety. In such event, the City will have the right to use any and all tools, material and equipment belonging to the Contractor for the completion of the work.

6. Contractor's Liability for Exceeding the Contract Period:

    a. The work embraced in the agreement shall be carried on regularly and uninterruptedly at a sufficient rate to secure its full completion within the time limit specified in the contract. Normally expected delays on account of rain or unfavorable weather shall be taken into account in planning the work.

    b. The rate of progress and the time of completion are essential conditions of the contract. If the Contractor fails to complete work within the time contracted, payment shall be made to the City for liquidated damages as provided by the project specifications. Such payments to the City are regarded by both parties to the contract as liquidated damages for the actual costs to the City of delay in completion of the work and shall not be considered as a penalty. Saturdays, Sundays, and legal holidays are excluded as working days unless work is one under special permission or emergency requiring the presence of the City.

7. City's Right to Use Work Prior to Acceptance:

    a. City shall have the right to use the whole or any part of the construction work which is in usable condition prior to the acceptance of all of the work, provided such parts have received prior field approval. Use of this work shall not be considered as acceptance either in whole or in part.

    b. Whenever a property owner desires to connect to a sewer before acceptance of all the work, the Director may approve the application for a connection permit only with the written consent of the Contractor.

8. Contractor's Relief from Maintenance and Responsibility. On the request of the Contractor and with the approval of the Director, or on the order of the Director, the Contractor will be relieved of the duty of maintaining and protecting certain portions of contract improvements which are ready to be placed in service and which have been completed in accordance with the plans and specifications, including cleanup. In addition, such action by the Director will relieve the Contractor of responsibility for injury or damage to said completed portions of the improvements resulting from use or from other cause, excepting injury or damage resulting from the Contractor's own operations or from his negligence. The Contractor will not be required again to clean up such portions of the improvement prior to acceptance except for such items as result from his operations or negligence. Warranties on mechanical equipment shall begin on the day of acceptance by the City of such mechanical equipment.

9. Field Approval of the Work:

   a. Field approval shall be limited to acknowledgment by the Director that the work has been performed in accordance with the plans and specifications.

   b. On completion of the work and after final clean-up, the Contractor shall request the Director to make a final inspection of the work. The Director will commence with such final inspection within two working days, if practicable, and proceed diligently with such inspection. If the work has been completed in accordance with the plans and specifications, the Director will proceed with preparing the final payment and recommendations for City acceptance. However, the Contractor shall be responsible for the work except as otherwise provided, until such acceptance.

10. Acceptance of the Work: Acceptance indicates that all due performance of the contract has been completed except for the requirements of certification of payment for labor and materials and for final payment of any amounts due to the Contractor from the City.

11. Record Drawings: Upon completion of the work and acceptance of the work by the City, the Contractor shall provide the following as-built measurements of all completed structures (manholes, pump stations, valve vaults, etc.):

    a. North and East coordinates of the center of the structure lid.

    b. Top elevation of the structure lid.

    c. Sizes, material and invert elevations of all connecting pipes.

    All measurements shall be certified by either a land surveyor or engineer registered in the State of Missouri and submitted to the City in the following format: N,E,Z,D (Northing, Easting, Elevation, Description). Submitted point files shall be digital Microsoft EXCEL or comma delineated (CSV) text file format. Horizontal and vertical accuracy shall be sub centimeter using GPS or traditional survey methods. The City's control system is Missouri State Plane East – NAD 83 (feet) for horizontal control and NAVD 88 (feet) for vertical datum. Contractor shall provide to the City one paper copy, in addition to an electronic copy in both CADD (.dwg) and PDF formats of the final as-built plans.

12. Time of Completion:

a. The Contractor shall complete the work within the time specified in the contract, modified by such extensions during the contract period as are granted in writing by the Director.

b. In connection with any requests by the Contractor for extensions of time, the Director will give due consideration to delays in the commencement, prosecution, or completion of the work due to causes beyond the control and not the fault or negligence of the Contractor, including, but not restricted to, failure of the City to provide rights-of-way, acts of God or of the public enemy, acts of the Federal Government or any State or political subdivisions thereof, acts of another Contractor in the performance of a contract with the City, fires, floods, explosions, earthquakes or other catastrophes, epidemics, quarantine restrictions, strikes, freight embargoes, unusually severe weather, or delays in the delivery of material when the City has specified the procurement of such material from a particular source; provided that the Contractor shall, within ten days from the beginning of any such delay, notify the City in writing of the causes of the delay.

c. In those instances or circumstances as set forth in the preceding subparagraphs, the Director will determine the extent of the delay and grant a commensurate extension of time. An extension of time granted by the City shall not release the sureties on the Contractor's bonds. Such bonds shall remain in full force and effect according to their terms.

Section F. RESPONSIBILITIES OF THE CONTRACTOR.

1. Observance of Laws and Regulations:

a. The Contractor shall keep fully informed of all federal, state and municipal laws, ordinances and regulations which may affect the conduct of the work, the safety of the public and those engaged or employed, and the materials used; and of all orders and decrees of bodies having jurisdiction or authority over the work. The Contractor shall observe and comply therewith, and shall cause his agents and employees to observe and comply therewith. The Contractor shall be solely responsible for the observance of Laws and Regulations and shall not rely on the City or its agents in fulfilling this requirement. The Contractor shall protect and indemnify the City and all its officers, agents, and employees against any claim or liability arising from or based on the violation thereof by himself or his employees or subcontractors.

b. Prevailing rates of pay shall be paid to skilled and unskilled labor employees on the contract work.

c. No discrimination shall occur in the selection or employment of labor on account of age, creed, race, color, sex or disability unrelated to performance of the position.

d. When plan, plats, detailed drawings or specifications for any part of the work are required to be submitted to the City, they shall be signed, sealed and stamped in accordance with the provisions of the latest revision of the act providing for the registration of architects, land surveyors, geologists, and professional engineers in the State of Missouri.

e. The Contractor shall procure all permits and licenses, pay all charges and fees, and give all notices necessary and incident to the due and lawful prosecution of the work and submit copies to the City prior to the first project payment. The Contractor shall pay all taxes lawfully imposed by any taxing authority on the sale, purchase, and use of any materials or equipment in the work.

f. The Contractor shall keep the City free and harmless from payment of any and all damages, costs, expenses, royalties, patent fees, lawyers' fees, or sums of money whatsoever by reason of any patent or patented device, article, system, or arrangement that may be used by the Contractor in the execution of the work.

g. The Contractor shall provide and maintain in a neat and sanitary condition such accommodations for the use of his employees as may be necessary to comply with the requirements and regulations of the public health authorities and ordinances, regulations, and requirements of bodies having jurisdiction. The Contractor shall commit no public or private nuisance.

h. The Contractor should be alert to the fact that workers may be exposed to sanitary and industrial wastes during the performance of this work. Therefore, any workmen involved in the removal, renovation, or installation of equipment or materials within or near the sewers, may be exposed to residuals from such wastes. It is the Contractor’s responsibility to urge its personnel to observe hygienic precautions, including tetanus and typhoid inoculations, as required. Applicable inoculations will be made available to all of the Contractor’s personnel by the Contractor. Because of the danger of noxious gases, solvents, gasoline, and other hazardous material entering the sewers with the domestic sewage, various areas may be considered hazardous to open flame, sparks, or unventilated occupancy. The Contractor shall be aware of these dangers and shall take the necessary measures to assure that its personnel observe proper safety precautions when working in these areas.

2. Superintendence: The Contractor, or his authorized representative in charge of the work, shall be present at the site of the work at all times while work is in progress. Any order or communication given to this authorized representative shall be considered to have been delivered to the Contractor. Where the Contractor is comprised of two or more persons, partnerships, or corporations functioning on a joint venture basis, such Contractor shall designate in writing to the City the name of the authorized representative in charge of the work.

3. Labor Competency: The Contractor shall retain in his employment only competent superintendents, foremen, mechanics, and laborers. Any person employed on the work who, in the opinion of the Director, is intemperate, incompetent, troublesome, or otherwise undesirable, or who fails or refuses to perform the work in the manner specified herein, shall be discharged immediately from employment on the work. Such person shall not again be employed on the work without the consent of the Director.

4. Project Site Maintenance:

   a. The Contractor shall be fully responsible for maintaining completed work in an acceptable condition and protecting the completed work until relieved of such responsibility. The Contractor shall be solely responsible for the safety of the public and those engaged or employed during construction until completion of the work. During construction the Contractor shall keep the work site free and clean from all rubbish and debris. The Contractor shall also keep his haul routes outside the work site free and clean from all rubbish and debris resulting from his operations.

   b. On completion of the work and before acceptance and final payment are made, the Contractor shall remove all surplus and discarded material, rubbish, equipment, debris, and temporary structures from the site, and restore the working site as required. The sewers and appurtenant structures shall be clean, free from debris or deposits, and ready for use as required by the plans and specifications. All costs of such work shall be considered to be completely paid for under the various contract pay items.

5. Public Convenience and Safety: The Contractor shall have sole responsibility for public convenience and safety as described in this paragraph. The Contractor shall observe and adhere to the safety requirements of all federal, state and local authorities having jurisdiction. During the progress of the work, the Contractor shall maintain suitable barricades and warning lights or employ such other devices and measures for the safety of the public as required by law and shall take all necessary precautions to prevent accidents. The Contractor shall employ flagmen as required by the railroad or other jurisdictional authority. The Contractor shall make suitable and adequate provisions for the convenience and safety of the public and of the residents along the route of construction. The Contractor shall give adequate notice in writing to all owners or occupants of property, buildings, structures, or utilities which may be affected by this work and which may require protection or adjustment. The Contractor shall not hinder their protective measures, but shall exercise due care to protect all property. The Contractor shall not obstruct access to fire hydrants and service valves, nor to U. S. mail boxes. The Contractor shall repair and restore without delay to service any utility service facilities damaged by his operations, and shall cooperate with utility companies in the restoration of their service.

6. Overhead High Voltage Powerlines: In accordance with Missouri's "Overhead Powerline Safety Act," the Contractor shall not operate any equipment within a 10 foot radius of any high voltage (600 volts or greater) electric line without first contacting the local electric utility and allowing them to provide temporary clearance or other safety precautions. The Contractor shall submit a written plan to the City prior to construction of how they will avoid coming within 10 foot of the power lines. All costs involved with providing temporary clearance or safety precautions by the electric utility will be at the Contractor's expense unless the City authorizes payment. If the City's representative observes the Contractor operating any equipment within the required 10 foot safety radius without the electric cables having been properly protected by the electric utility he/she shall have the authority to order the Contractor to stop work until the electric cable is relocated or protected by the electric utility. The Contractor will not be allowed any additional compensation or time for being so ordered to stop work.

7. Indemnification: The Contractor and any subcontractor shall defend (and have the right to select counsel for the City), indemnify and save harmless the City, its Council and employees, from and against any and all loss, damages, liability, costs and expenses (including but not limited to attorneys' fees of counsel for the City that the Contractor authorizes) arising out of any claim, suit or action against the City for or on account of any personal injuries, including death, or property damages sustained or claimed to be sustained by any person or persons arising out of or resulting from performance of the work, but only to the extent caused in whole or in part by negligent acts or omissions of the Contractor or any subcontractor, their agents or employees. This indemnity shall continue not only during the time period in which the Contractor performs the work but shall continue thereafter for a period of one (1) year.

8. Insurance:

   a. The Contractor shall carry and maintain adequate public liability and property damage insurance for the joint and several benefit of the Contractor and the City with a company licensed to do business in the State of Missouri and satisfactory to the City. The amounts of coverage required for public liability or property damage shall not be construed to limit the liability of the Contractor in protecting the City from damage or injury claims. If the Director determines that unusual or special risks revealed by the work so require, the City shall have the right to require the Contractor to increase any or all such insurance policy limits while the contract work is in progress, and in such amounts as the Director may determine to be adequate, and without thereby limiting the liability of the Contractor in protecting the City from damage or injury claims.

   b. As partial security for the defense of claims and the payments required under such indemnity, the Contractor and any subcontractor shall furnish at his cost an Owner's Protective Insurance Policy satisfactory to the City and naming the City as insured for amounts not less than the Contractor's public liability and property damage insurance covering the work.

   c. The coverage shall insure the City and its officers and employees, while acting within the scope of their duties, against all claims arising out of or in connection with the work to be performed. The cost of the insurance shall be included in the prices bid for the various items of work and no additional payment will be made thereof.

9. Public Officials Not Personally Liable: There shall be no personal liability on the part of public officials of the City or its agents or employees for any act performed in the discharge of any duty imposed, or the exercise of any power or authority conferred on them by or within the scope of the contract. It is understood that in all such matters such persons act solely as agents and representatives of the City.

10. Use of Explosives: The responsibility of the Contractor with respect to the use of explosives includes compliance with all laws, rules and regulations of federal, state and local authorities and the insurer governing the keeping, storage, use, manufacture, sale, handling, transportation, or other disposition of explosives shall be conducted with every precaution by a few trained, reliable men under satisfactory, experienced supervision. Blasts shall not be fired until all persons in the vicinity have had ample notice and have reached positions out of danger.

The Contractor shall be responsible for any and all damage resulting from the use of explosives, and the Contractor shall notify the Director in advance when charges are to be set off. The Contractor agrees to save the City, its officers and employees harmless from any claim growing out of the use of such explosives.

11. Disposition of Materials: When materials are to be disposed of outside the right-of-way, the Contractor shall obtain permission beforehand in writing from the property owner on whose property the disposal is to be made and shall file a copy of such permission with the City. Unless otherwise provided in the Project Plans and Specifications, the Contractor shall make his own arrangements for disposing of such materials outside the right-of-way in a manor consist with the applicable laws governing such disposal.

12. Cooperation Between the Contractor, Utility Owners, and Other Contractors:

    a. Ordinarily, utility owners and public agencies responsible for facilities located within the right-of-way will be expected to complete any installation, relocation, repair, or replacement prior to the commencement of work by the Contractor. However, when this is not feasible or practicable, or the need for such work was not foreseen, such utility owners or public agencies shall have the right to enter upon the right-of-way and upon any structure therein for the purpose of making new installations, changes, or repairs, and the Contractor shall so conduct his operations as to provide the time needed for such work to be accomplished during the progress of the improvement.

    b. Any difference or conflict which may arise between the Contractor and other contractors who may be performing work in behalf of the City, or between the Contractor and workmen of the City in regard to their work shall be adjusted as determined by the Director. If the work of the Contractor is delayed because of any acts or omissions of any other Contractor of the City, the Contractor shall on that account have no claim against the City other than for an extension of time.

13. Traffic: The Contractor shall submit a traffic plan to the proper authorities for approval, detailing his activities along the roadway, lane closures or detours prior to beginning any work. All traffic control shall be provided in compliance with the Manual on Uniform Traffic Control Devices (MUTCD). The Contractor shall notify the proper authorities at least seven (7) working days in advance of starting work on a traveled street or roadway and shall comply with the directives of such authorities regarding traffic control.

Section G. MEASUREMENT AND PAYMENT.

1. Measurement of Quantities:

    a. All materials and items to be paid for on the basis of measurement shall be measured and determined by the City's Inspector in accordance with the plans and specifications, or as authorized by the Director.

    b. Measurements shall be in accordance with United State Standard Measures.

    c. Work or materials involved in lump sum payments will not be measured, but will be paid for in accordance with the details described in the Project Plans and Specifications.

d. Materials normally will be paid for on a volume, area, or other unit of measure basis. Factors for conversion from weight measurement to volume measurement will be determined by the City's Inspector and shall be agreed to by the Contractor before the weight basis of measurement of pay quantities will be used.

e. Material paid for by the ton shall be weighed on a certified public scale, and a certified copy of the weight ticket shall be furnished to the City's Inspector in evidence of the delivered weight of the material.

f. Trucks used to haul material being paid for by weight shall be weighed empty at such times as the City's Inspector directs. Each truck shall bear a plainly legible identification mark.

g. Full compensation for all expense involved in conforming to the above requirements for measuring and weighing materials shall be considered as included in the unit price paid for the material being measured or weighed, and no additional allowance will be made therefore.

2. Limitation on Pay Quantities: Quantities of materials wasted or disposed of in a manner not called for under the contract, including rejected loads of material not unloaded from vehicles, material rejected after it has been placed, material placed outside the pay lines, and material remaining on hand after completion of the work, will not be paid for and will not be included in the final pay quantities. Any variance in the number of actual bid units from the estimated number of units shall not constitute a changed or unforeseen condition although a time extension will be considered. No compensation will be allowed for disposing of rejected or excess material.

3. Scope of Payment: The Contractor shall accept the compensation as herein provided in full payment for furnishing all materials, labor, services, supervision, tools and equipment necessary to the complete work (including overhead and profit); and for performing all work contemplated and embraced under the contract; and for loss or damage arising from the nature of the work or from the action of the elements, except as hereinbefore provided; or from any unforeseen difficulties which may be encountered during the prosecution of the work until the acceptance by the Director; and for all risks of every description connected with the prosecution of the work; and for all expenses incurred in consequence of the suspension of discontinuance of the work as herein specified; and for completing the work according to the plans and specifications. The payment of any estimate or of any retained percentage shall not relieve the Contractor of any obligation to replace or to make good any defective work or material.

4. Payment for Changes and Extra Work:

a. When extra work for which no provision has been made under the contract is ordered by the City, payment will be made in accordance with bid prices for the given items of work. In the absence of a bid price for a given item of work not provided for nor fairly included in bid prices for other items of work, a written agreement may be made between the City and the Contractor to be included in the written order for such extra work. If the City and the Contractor are unable to reach an agreement, the Director may order the Contractor to proceed with the work by force account in accordance with the following sections.

b. Whenever the Contractor and the City are unable to agree on prices for the extra work, and the City orders the Contractor to proceed with the work by force account, the work will be paid for in the manner hereinafter described and the compensation thus provided shall constitute full payment for said work. Payment will be determined as follows:

i. For all materials purchased by the Contractor and used in this specific work, the Contractor will be paid the actual cost of such materials and freight and delivery charges as shown by original receipted bills; to which will be added an amount equal to 15% of the sum thereof. The total amount so paid will be full compensation for all costs of materials, whether direct or indirect. If necessary to facilitate the progress of the work, the City reserves the right to furnish and deliver the materials to the Contractor at the site. No percentage will be paid to the Contractor on any material furnished by the City.

ii. The Contractor will be paid the cost of wages for all labor required in the specific operation plus the actual cost chargeable to the force account work for workmen's compensation insurance, social security taxes, unemployment compensation insurance, and such additional amounts as are paid by the Contractor by reason of an employment contract generally applicable to his employees, to which total sum will be added to an amount equal to 35% of the wages and other costs listed above. To the cost of any work subcontracted by the contractor will be added an amount not to exceed 10% of the cost as submitted by the subcontractor.

iii. Wage rates used in determining the amount of the payment will be the actual wage rates paid by the Contractor, except that no rate used shall exceed the rate of comparable labor currently employed on the project.

iv. Payment will be made for the services of foremen in direct charge of the specific operation. Payment for the services of superintendents, timekeepers or other overhead personnel will not be made nor will payment for the services of watchmen be made unless required specifically for the force account work. The actual function performed by an employee rather than his payroll title will be the criterion used in determining the eligibility of an employee's services for payment under this provision.

c. The types and amount of equipment and machinery used by the Contractor in carrying out his work under the force account order shall be in keeping with normal practice for work of a similar nature, except that the City may, at its discretion, limit by specific instruction the types and amounts of equipment to be used. For the cost of such equipment, the Contractor will be paid reasonable rental prices to which shall be added the cost of fuel and lubricant to which no percentages will be added.

d. In computing the hourly rental of such equipment, less than 30 minutes shall be considered one-half hour, except that the minimum rental time to be paid shall be one hour. Rental time will not be allowed while equipment is inoperative due to breakdowns. The rental time of equipment to be paid for shall be of the time the equipment is in operation on the force account work being performed, and in addition, shall include the time required to move the equipment to the work and return it to its original location. When approved in advance by the Director, towing or transporting costs will be allowed when the equipment is moved by means other than its own power. No payment will be allowed for the use of small tools and minor items of equipment which, as used herein, are defined as individual tools or pieces of equipment having a replacement value of $500.00 each or less. Equipment rental may be based on Rental Rate Blue Book monthly rates pro-rated to the applicable hour, day or week. In lieu thereof, equipment rental may be based on the Contractor's actual equipment costs as verified by a certified public accountant.

e. The Contractor will be reimbursed for all additional bond and insurance premiums which are required and expended because of the force account work. No percentage will be added to this reimbursement.

f. The Contractor and Inspector shall compare records of the work performed on a force account basis at the end of each day. These records shall be prepared in triplicate by the Contractor and shall be signed by both the Inspector and the Contractor's representative, one copy being retained by the Contractor and one copy forwarded to the City's Inspector.

g. In evidence of the costs of labor, equipment, and materials for which payment is to be made under the force account order, the Contractor shall provide a certified statement of wages actually paid together with copies of supporting payrolls, of equipment rental charges, and of bills for materials. On special tax bill projects, a percentage equivalent to the tax bill discount, verified by the Contractor, will be added to the force account payments.

h. Payment for force account work will be included in monthly progress payments. City emergency projects that are to be paid for entirely by the force account method will be constructed and paid for under provisions set forth in "The Method and Procedure of Payment for Major Force Account Work." The project will then be constructed and paid for in accordance to said directive, in lieu of this Section of the Standard Construction Specifications.

5. Materials and Labor Bills: Before final payment is made to the Contractor, the Contractor shall certify in writing to the City that all bills, for materials, services, labor and equipment have been paid, and shall submit waivers from subcontractors and suppliers for unpaid amounts due them.

6. Payment on Cash Contracts:

   a. During the progress of the work, the Contractor shall submit within ten days after the first of each month an invoice for the estimated cost of the work satisfactorily completed to the first day of that month. It shall be in such form and detail as required by the Director, and shall be based on the City's estimated quantity of completed work in place and the unit bid prices. The cost of critical materials and equipment received by the Contractor with approval of the Director, of materials procured in substantial quantities and major items of equipment received and scheduled to be incorporated in the construction within thirty days from the date of the invoice, and of all other materials and equipment actually incorporated in the construction shall be considered as work done or accomplished for the purpose of invoicing or making monthly payments.
   The Contractor is responsible for all equipment and materials so paid for in advance before their incorporation in the work. From the amount so determined shall be deducted five percent of such amount and all sums previously paid or properly retained under this contract, and the remainder certified for payment on account to the Contractor. If the Director finds that satisfactory progress is being made in the work, the Director may, at his discretion, reduce the amount to be retained to conform with the following schedule of retention rates:

Range of Contract	Retention Rate
For first $1,000,000 of Contract amount	5%
For all amounts in excess of $ 1,000,000	2 1/2%

   b. The total amount retained equals the sum of the amounts retained within each range.

   c. When all the work provided for under this contract is completed in conformance with the Project Plans and Specifications and the project has been accepted, a final cost estimate based on a final measurement survey shall be made. The remainder shall be certified as any appropriate charges, and deductions will be made and the amount due to the Contractor, and on approval by the Director and on certification by the Contractor that all bills for materials, services, labor, equipment, and other items due or chargeable under the contract have been paid or waivers obtained, payments shall be made to the Contractor who shall give a release from all claims arising from the contract.

7. Taxes: In accordance to Section 144.030 of the Missouri State Statutes, the City will not pay Missouri State Sales Tax on material, machinery, equipment, appliances, and devises used solely for the purpose of preventing, abating, or monitoring water pollution. Missouri State Statutes, Section 144.062, allows for a Sales Tax Exemption to Contractors constructing, repairing, or remodeling facilities or purchasing personal property and materials to be incorporated into and consumed in the construction of projects for a tax exempt entity, such as the City.

PART 2 - MATERIALS OF CONSTRUCTION

Section A. INTRODUCTION.

1. This part sets forth requirements governing the quality of the various materials specified for use in the construction of sanitary sewerage facilities in the City of Jackson, Missouri.

2. Whenever in these specifications reference is made to the requirement of the ASTM (American Society for Testing and Materials), AWWA (American Water Works Association), ANSI (American National Standards Institute), AASHTO (American Association of State Highway and Transportation Officials), or other specified standard specifications, the current revision thereof shall be used.

Section B. CONTROL OF MATERIALS.

1. Approval: All materials shall be the best of their respective kinds, subject to sampling, testing, and approval or rejection by the City. Unless otherwise specified, all materials incorporated into the work shall be new and unused in previous construction. Used materials, in acceptable condition, may be used for trenching bracing, forms, falsework, and similar uses.

2. Sources of Supply: The Contractor shall furnish to the Director prior to starting work a complete list of the sources from which the Contractor proposed to obtain materials, and shall notify the Director prior to any change in the source of such materials.

3. Sampling, Inspection and Testing:

    a. All materials to be used in the work shall be sampled, inspected, and tested in accordance with current standard methods of testing of the ASTM, AWWA, ANSI, AASHTO, or other Specified Standard Specifications. The cost of all testing is the responsibility of the Contractor. The Contractor shall furnish the City with three copies of certified reports from a reputable testing laboratory showing the results of the test carried out on representative samples of materials delivered and to be used in this project. The Contractor shall notify the City in advance of any deliveries of the materials and shall make whatever provisions are necessary, including the furnishing of such labor as may be required to aid the Director in the examination, inspection, and culling of the materials on the site prior to installation in the work. All rejected materials shall be immediately and permanently removed from the site.

    b. The Contractor shall cooperate fully with all representatives of the City in the inspection of materials to be furnished for the purpose of verifying that they correspond strictly with the plans and specifications.

4. Materials and Equipment Not Locally Produced: When the Contractor intends to purchase materials or mechanical, electrical or manufactured equipment to be permanently installed in accordance with the plans and specifications from sources located more than 150 miles from the City, the City may require the Contractor to furnish certification by a testing laboratory approved by the City that the materials or such equipment meet all applicable specifications.

The representative of the testing laboratory shall be governed in his judgment of the materials or equipment by the requirements of the specifications, and shall forward to the Director whatever reports are required by the City. No such materials shall be shipped nor shall any processing, fabrication, or treatment of such materials be done without proper inspection by the approved agent. These materials shall be subject to reinspection at the job site.

5. Storage of Materials: The Contractor shall provide such storage facilities and exercise such measures as will insure the preservation of the specified quality and fitness of materials and equipment to be incorporated in the work.

6. Rejected Materials: Materials and equipment not conforming to the specifications, whether in place or not, may be rejected. Rejected materials shall be removed immediately and permanently from the site of the work, unless otherwise permitted by the Director. No rejected material, the defects of which have been subsequently corrected, shall be used unless approved in writing by the Director. On failure of the Contractor to remove and replace rejected material, the Director shall have authority to do so and to deduct the cost thereof from any moneys due or to become due to the Contractor. The payment of any estimate or of any retained percentage shall not relieve the Contractor of any obligation to replace and make good any rejected material.

Section C. CONCRETE.

1. Portland Cement: It shall conform to the requirements of Specifications for Portland Cement, ASTM C150. Type II cement shall be used, unless otherwise specified.

2. Air-Entraining Admixtures for Concrete: They shall conform to the requirements of the Specifications for Air-Entraining Admixtures for Concrete, ASTM C260.

3. Aggregates for Concrete:

    a. Aggregate shall conform to the requirements of Specifications for Concrete Aggregates, ASTM C33, except as further specified herein.

    b. Natural sand shall consist of clean, hard, durable, uncoated grains. Mississippi and Missouri River sands or other sands containing lignite are not acceptable for exposed architectural concrete. Gravel shall be washed, hard, strong, durable pieces free from thin, porous, elongated or laminated particles. Crushed limestone for coarse aggregate shall consist of uncoated particles of sound, durable rock of uniform quality, without an excess of flat, elongated or laminated pieces. No surface, yellow or soft stone shall be permitted. The specific gravity of the stone shall be not less than 2.56.

4. Water: When used with cement in mortar or concrete or for curing of concrete or for testing of structures for water-tightness the water shall be potable.

5. Metal Reinforcement in Concrete:

    a. Reinforcing bars shall conform to the requirements of the Specifications for Steel Bars for Concrete Reinforcement, ASTM A615, A616, or A617.

b. Welded wire fabric or cold-drawn wire for concrete reinforcement shall conform to the requirements of the Specifications for Cold-Drawn Steel Wire for Concrete Reinforcement, ASTM A82, or the Specifications for Welded Steel Wire Fabric for Concrete Reinforcement, ASTM A185.

c. Certified mill tests shall be furnished for all reinforcing steel, if required by the Project Specifications or by the Director.

Section D. STEEL AND CASTINGS.

1. Structural Steel: Steel shall conform to the requirements of the Specifications for Steel for Bridges and Buildings, ASTM A6. The grades to be used will be specified in the Project Specifications.

2. Gray Iron Castings:

   a. Iron castings shall conform to the requirements of the Specifications for Gray Iron Castings, ASTM A48. All castings shall be clean and free of scale, adhesions or inclusions. They shall be completely coated, as required herein.

   b. Gray Iron Castings for manhole frames and covers shall be fabricated of Class 30B cast iron. Bearing surfaces between manhole frames and covers shall be such that the cover shall seat in any position onto the frame without rocking. Bearing surfaces for standard manhole frames and covers shall be machined.

3. Watertight Type Castings for Existing Structures:

   a. Manhole Frame Seals

      i. Material: Internal – The sleeves and extensions shall have a minimum thickness of 3/16 inches and shall be extruded or molded from a high grade rubber compound conforming to the applicable requirements of ASTM C923, with a minimum 1500 psi tensile strength, maximum 18% compression set and a hardness (durometer) of 48 + 5. The bands for compressing the sleeve against the manhole shall be fabricated from 16 gauge stainless steel conforming to ASTM A420 Type 304, any screws, bolts, or nuts used o this band shall be stainless steel conforming to ASTM F593 and 594, Type 304. The sleeve shall be either double or triple pleated with a minimum unexpanded vertical height of 8-inchesor 10-inches respectively and be capable of vertical expansion of not less than 2-inches when installed.

      ii. Manufacturer: Cretex Chimney Seal or Equal.

   b. Manhole Cover Gasket Seals:

      i. Manufacturer: Cretex Lid Gasket.

4. Watertight Type Castings for New Structures

a. Manhole Frame Seals

i. Material : External – The sleeves and extensions shall have a minimum thickness of 2.5mm with a length sufficient to envelope the frame, adjustment rings and manhole cone. The material shall be a cross linked high density polyethylene membrane complete with mastic; peel strength shall be a minimum of 11 lbs per inch per ASTM D-1000. Tensile strength shall be 3,300 PSI per ASTM D-638.

ii. Manufacturer: Infi-Shield Uni-Band as manufactured by Sealing Systems Inc., or Riser-Wrap as manufactured by PSI, Inc, or approved Equal.

b. Manhole Cover Gasket Seals

i. Material – The cover gaskets furnished shall be molded from a high quality rubber compound such as Nitrile, EPDM or a blend thereof. The rubber product shall have a minimum tensile strength of 2000 psi with a hardness (durometer) of 60 + 5.

ii.

iii. Gasket – It shall have a minimum thickness of 3.32 inches and a splice used in fabrication shall have the strength such that it will withstand a 180-degree bend without visible separation.

c. Manhole Joint Seals: Infi-Shield Seal GatorWrap as manufactured by Sealing Systems, Inc., or approved Equal.

Section E. BRICK.

1. Sewer Brick:

a. Brick shall conform to the Specifications for Sewer Brick, ASTM C32 for Grade SM. Bricks shall conform to the following dimensions, unless otherwise approved by the Director.

SEWER BRICK	DEPTH (Inches)	WIDTH (Inches)	LENGTH (Inches)
Standard Size	2¼	3¾	8
Allowable Variation	±¼	±⅜	±½

b. All brick shall be new and whole, of uniform standard size and with substantially straight and parallel edges and square corners. Bricks shall be of compact textures, burned hard entirely through, tough and strong, free from injurious cracks and flaws and shall have a clear ring when struck together. No soft or salmon brick shall be used in any part of the work. Brick shall be culled after delivery, if required, and no culls shall be used except at such places, to such extent, and under such conditions as may be approved by the Director.

c. The Contractor may be required to furnish the Director with at least five bricks of the character and make the Contractor proposes to use, at least one week before any bricks are delivered for use. All brick shall be of the same quality as the accepted samples.

2. Building Brick: Building brick shall conform to the requirements of the Specifications for Building Brick (Solid Masonry Units Made from Clay or Shale), ASTM C62, Grade MW, with dimensions as required in the Project Specifications.

3. Facing Brick: Facing brick shall conform to the requirements of the Specifications for Facing Brick (Solid Masonry Units Made from Clay or Shale), C216, Grade MW, Type FBS, with dimensions as required in the Project Specifications.

Section F. PRECAST MANHOLES.

1. Reinforced Concrete Manholes: Precast reinforced concrete manholes shall conform to the standard specifications for precast reinforced concrete manhole sections, ASTM-C478 and the approved Standard Details of Sewer Construction. The Portland cement used shall be Type II. All precast sections shall be manufactured with vibrated concrete (wet cast) and provided with an exterior waterproof coating.

2. Manhole Cones: Manhole cones shall be eccentric and base sections shall have the base riser section integral with the floor.

3. Manhole Steps: Manhole steps shall be cast into the full depth of the wall section or installed by an approved alternate method.

4. Connections: Connections for inlet and outlet pipes shall be of an approved patented compression type connection, A-Lok or Z-Lok, as required by angle of pipe entry, or Equal.

5. Riser Sections: The minimum inside diameter for the base and riser sections shall be 48 inches.

6. Grade Adjustment Rings: Precast reinforced concrete grade rings may be used for manhole adjustments provided the rings have minimum dimensions of 24” opening, 3” height, and outside diameter shall match the outside diameter of the manhole cone section. No more than one grade ring shall be used per adjustment unless the total height of adjustment is (6”) or greater; then a maximum of two will be allowed as long as the total adjustment doesn’t exceed a maximum dimension of 12” from top of cone to top of frame. No metal adjustment rings are allowed, for new construction. When grade rings are used, rings must be constructed of concrete within areas subject to vehicular traffic.

   a. Expanded Polypropylene (EPP) grade rings shall be acceptable as a substitute for concrete grade rings provided the EPP materials meet or exceed the specifications set forth for concrete rings, as well as conform to the additional specifications below. EPP grade rings shall not be allowed to be installed in paved areas subject to vehicle loading.

      i. Capable of supporting the minimum requirements of AASHTO M-306, H-25, and HS-25.

ii. Materials shall conform to ASTM D3575 and ASTM D4819-13 with a minimum finished density of 120 g/l (7.5 pcf).

iii. Provide and install adhesive/sealant for watertight installation of the manhole grade adjustment rings conforming to ASTM C-920, Type S, Grade NS, Class 25.

iv. Cementitious grout: ASTM C-191 and C-827.

v. Install "grade," “angle,” and “finish/flat” rings as needed per manufacturer’s typical installation details.

vi. Adhesive/sealant shall be “M-1” by CHEM LINK INC. or per grade ring manufacturer’s typical recommendation.

vii. EPP grade rings shall be PRO-RING by Cretex, or equal.

7. Overlay Adjustment Rings: The use of metal adjusting rings will be allowed to adjust existing structures under pavement to grade or to the overlay grade. The rings shall be two piece. A maximum of one ring will be allowed. The maximum adjustment is 4 inches. Rings must be approved by Director prior to use.

8. Waterproofing: All manholes shall be waterproofed on the external surface of the manholes.

Section G. PIPE.

1. Sanitary Sewer Pipe: For projects where it is intended to dedicate the sewers to the City for maintenance, or unless otherwise indicated on the project plans or specifications, the following types of pipe may be used:

   a. Vitrified clay pipe (VCP).

   b. Reinforced concrete pipe with Type "B" joint for sewer larger than 27” in diameter. (RCP).

   c. Polyvinyl chloride pipe (PVC)

   d. Fiberglass pipe (RPM)

2. Clay Pipe and Fittings: These shall be of the best quality of hard-burned vitrified clay pipe, meeting the latest requirements of the Standard Specifications for Clay Sewer Pipe, Extra strength ASTM C700. Extra strength pipe shall be used.

   a. The ends of rubber-gasketed pipe shall be formed by machined metal rings and be accurately manufactured so that, when the adjacent pipe sections are drawn together, the rubber gaskets will be uniformly compressed around the periphery of the Pipe to provide a watertight seal.

3. Reinforced Concrete Pipe:

   a. It shall be precast and shall conform to the requirements of the Specifications for Reinforced Sewer Pipe, ASTM C14 or C985. Strength class or classes shall be as required by the Project Plans and Specifications. The interior surfaces of the pipe shall be a smooth true cylindrical surface free from undulations or corrugations. No lifting holes will be allowed for sanitary sewers. Coal and lignite, if present, shall constitute no more than a maximum of 0.25 percent by weight of the fine aggregates. Cement shall meet all the requirements of the Specifications for Portland Cement, ASTM C150, Type II. Cut pipe for curved alignments shall be of uniform cut and length along the same curve, and shall otherwise meet the same requirements as for straight pipe.

   b. When Project Specifications require or the Director orders the use of flexible rubber-type gaskets, the shape, dimensions and tolerances of the bell and spigot or tongue and groove ends of the pipe shall meet all requirements of the Specifications for joints for Circular Concrete Sewer and Culvert Pipe, using Flexible, Watertight, Rubber-type Gasket ASTM C443 or C361 and be subject to the approval of the Director.

   c. The ends of rubber-gasketed pipe shall be formed by machined metal rings and be accurately manufactured so that, when the adjacent pipe sections are drawn together, the rubber gasket will be uniformly compressed around the periphery of the pipe to provide a watertight seal. No lifting holes will be allowed on sanitary sewers.

4. Ductile Iron Pipe:

   a. Ductile iron pipe shall conform to the requirements of American National Standard Specifications for Ductile Iron Pipe Centrifugally Cast In Metal Molds or Sandlined Molds for Water and Other Liquids, ANSI A21.51 (AWWA C151).

   b. Approved ring gasketed slip-type joints shall be used on the ductile iron pipe unless otherwise noted in the Project Specifications. Push-on and mechanical joints shall conform to AWWA C111 (ANSI A21.11). Provide gasket composition suitable for exposure to sanitary sewage.

   c. Joints at all inflection points in the force main alignment shall be made with mechanical joint fittings in accordance with AWWA C110 and AWWA C153. Fitting shall conform to the Specifications for Cast Iron Fittings, 2 inch through 48 inch, for water or other liquid, ANSI A21.10 (AWWA C110) and/or AWWA C153. Fittings to be designated to accommodate the type of pipe used.

   d. The minimum allowable thickness shall be Class 52, unless otherwise specifically designed on the contract documents.

   e. The pipe shall be encased in green polyethylene tubes meeting the requirements of ANSI/AWWA A.21/C105, unless otherwise noted on the contract documents or where the pipe is encased in Class A concrete.

f. The interior of the pipe shall be lined with “Polybond-Plus” as manufactured by American Ductile Iron Pipe Company or the “Protecto 401" lining system.

g. Coat exterior of pipe intended for below grade installation with a bituminous material as specified in AWWA C151, approximately one (1) mil thick.

5. Polyvinyl Chloride Pipes: All PVC pipe (15 inches in diameter or less) shall conform to the requirements of ASTM D-3034 Standard Specifications for the PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings, SDR35. All PVC pipe (18 inches in diameter or larger) shall conform to the requirements of ASTM F-679 Standard Specifications for Poly (Vinyl Chloride) (PVC) Large Diameter Plastic Gravity Sewer Pipe and Fittings with a minimum pipe stiffness of 46 psi. Fittings for PVC pipe shall be of the same material and strength requirements as the sewer, as well as monolithic in construction, unless approved otherwise in writing. Fittings shall be per ASTM F1336 “Standard Specification for Polyvinyl Chloride (PVC) Sewer Pipe and Fittings.”

6. Plastic Pipe for Force Mains: Refer to Section 4.0 – Piping and Valves of the City of Jackson Sanitary Sewerage Lift Station Standard Design and Construction Requirements for specifications relating to Force Main piping.

7. Cured-in-Place Pipe (CIPP): It shall conform to the requirements of ASTM F1216 “Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin Impregnated Tube” or F1743 “Rehabilitation of Existing Pipelines and Conduits by Pulled in Place Installation of Cured-In-Place Thermosetting Resin Pipe (CIPP).” The design thickness shall be as approved by the Director.

8. Fiberglass Pipe: It shall conform to the requirements of ASTM D3262 Standard Specification for “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer Pipe, PS46.

9. Other Types of Pipe: The Director may consider for approval, a written request by the Contractor to use other types of pipe. Special bedding requirements may be required if other types of pipe are approved.

Section H. JOINTS.

1. Joint Selection:

a. The type of joint or jointing material to be used shall be compatible with the specified pipe material as follows:

Pipe Material	Joint Type
Vitrified Clay Pipe (VCP)	B
Reinforced Concrete Pipe (RCP) – Larger than 36”	A
Polyvinyl Chloride (PVC)	C
Fiberglass Pipe (RPM)	D

b. When compression joints Type A, B, C or D are specified, a sample joint of a specific type, design material, resiliency, and manufacturer must be submitted for approval by the Director before it may be used. No pipes shall be delivered to the work site without previous approval by the Director.

c. All pipes shall be so handled and stored that the jointing parts and the jointing materials will not deteriorate or be damaged. No joint shall be made under water. The bell, socket, or groove, and the spigot or tongue shall be clean and dry before preparing the joint for laying, and the prepared joint shall be kept clean and dry before and during laying and jointing the pipe. In cold weather, suitable measures must be taken to attain proper adhesion and workability of the jointing material and to insure a satisfactory joint. All work shall be done in an approved manner by skilled workmen so that the completed sewer shall have a continuous smooth uniform invert and interior surface. Care shall be used during laying and jointing of a pipe to avoid disturbing or damaging previously laid pipes and joints.

2. Type A Joints: When used with concrete pipes, they shall be approved compression-type joints and shall conform to the requirements of the Specifications for joints for Circular Concrete Sewer and Culvert Pipe, using Flexible, Watertight, Rubber-type Gaskets ASTM C361 with a 25 foot head. Band- type gaskets depending entirely on cement for adhesion and resistance to displacement during jointing shall not be used.

3. Type B Joints: When used with vitrified clay pipes, they shall be approved factory-molded compression type joints using resilient materials. They shall conform to the requirements of the Specification for Vitrified Clay Pipe joints using materials having Resilient Properties, ASTM C425.

4. Type C Joints: Shall be used with PVC pipes and they shall be elastomeric gasket joints providing a water tight seal. They shall conform to the requirements of the Specification for joints for Drain and Sewer Plastic Pipes and Fittings Using Flexible Elastomeric Seals, ASTM D3212.

5. Type D Joints: When used with fiberglass pipes, they shall be elastomeric gasket joints providing a watertight seal. They shall conform to the requirements of ASTM D4161.

6. Other Type Joints: The Director may consider for his approval, a written request by the Contractor to use other types, materials, methods, or kinds of joints.

7. Lubricants for Prefabricated Pipe Gaskets: The material to be used as a lubricant in jointing pipes or fittings fitted with flexible, watertight, rubber- type gaskets, either factory or job-applied shall be compatible with the material of the gaskets and as recommended by the manufacturer.

8. Primers and Adhesives: The material to be used as a primer or adhesive for jointing materials or for prefabricated gaskets shall be compatible with the material of the gasket or jointing materials. Adhesives used to fasten flexible rubber or rubber-type gaskets shall conform to the requirements of the manufacturer of the gaskets.

9. Adapters and Couplings:

   a. At the direction of the Director or as noted on the contract documents, connection of sanitary sewer pipe (4 inch through 18 inch) of dissimilar material or of different sizes or for the repair of sanitary sewer pipes of similar materials may be made by means of an approved connector or adapter of the compression or mechanical seal type and encased in Class A concrete.

b. The connector or adapter shall be manufactured of an approved pre-formed elastomeric material conforming to applicable sections of ASTM Standards C425, C443, C564, and D3212. Couplings of the mechanical seal type shall have tightening clamps or devices made of 300 series stainless steel with a stainless steel shear ring and stainless steel hardware, as specified in ASTM A167.

c. The compression joint connector or adapter and flexible coupling shall be installed as recommended and specified by the manufacturer. Each connector and adapter shall bear the manufacturer's name and required markings.

d. Acceptable Manufacturers: Fernco, Inc. or Equal.

e. All costs associated with the connection of pipe shall be included in the unit price pay items for pipe and not paid for separately.

Section I. CRUSHED LIMESTONE AND SCREENINGS FOR SEWER BEDDING, BACKFILL AND SUBGRADE REPLACEMENT MATERIALS.

1. Requirements: All stone or crushed limestone shall be sound, durable and free from Cracks and other structural defects that would cause it to deteriorate. It shall not contain any soapstone, shale, or other material easily disintegrated.

2. **Designation: Type 1 - Bedding.** For pipes 27 inch in diameter and smaller, bedding shall meet following gradation:

Type 1 - Bedding (% by Weight Passing)		
Sieve	**Maximum**	**Minimum**
1 inch	100	100
¾ inch	100	90
½ inch	60	35
# 100	10	0

3. **Designation: Type 2 – Bedding.** For pipes 30 inch in diameter and larger, bedding shall meet the following gradation:

Type 2 - Bedding (% by Weight Passing)		
Sieve	**Maximum**	**Minimum**
2 inch	100	100
1-1/2 inch	100	75
1 inch	90	50
¾ inch	80	35
½ inch	55	15
#100	10	0

4. **Designation: Type 3 – Backfill.** Crushed limestone and screenings to be used for backfill and bedding for flexible pipe over 18 inches shall be 3/4 inch minus.

5. **Designation: Type 4 - Subgrade Replacement.** Crushed limestone and screenings to be used for subgrade replacement shall be crusher-run, 2-1/2 inch maximum size (95% to 100% passing a 2-1/2 inch screen) graded to allow satisfactory compaction.

6. **Designation: Type 5 - Rock Blanket - Light.** Light limestone rock shall be at least 7 inches in size and all stones shall weigh not less than 25 pounds, and at least 75 percent shall weigh not less than 50 pounds.

7. **Designation: Type 6 - Rock Blanket - Heavy.** Heavy limestone rock shall be at least 12 inches in size and all stones shall weigh not less than 50 pounds, and at least 60 percent shall weigh not less than 100 pounds.

Section J. GEOTEXTILE FABRIC.

1. **Designation: Type 1.** Fabric for the use under rock blanket. Geotextile shall be needlepunched nonwoven polypropylene fibers.

   a. Minimum Average Roll Values (MARV)
   Mechanical Properties

Grab Tensile Strength ASTM D4632	300 Lbs.
Grab Tensile Elongation ASTM D4632	50%
Trapezoid Tear Strength ASTM D4533	115 Lbs.
Mullen Burst Strength ASTM D3786	580 psi
Puncture Strength ASTM D4833	175 Lbs.
UV Resistance After 500 Hrs. ASTM D4355	70% Strength

   b. (MARV)
   Hydraulic Properties

Apparent Opening Size ASTM D4751	100 U.S. Sieve
Permittivity ASTM D4491	0.8 / SEC

2. **Designation: Type 2.** Fabric for pipe bedding stabilization shall be woven polypropylene yarns. Geotextile shall be wrapped around aggregate subgrade below pipe.

   a. (MARV)
   Mechanical Properties

Wide Width Tensile Strength (Ultimate) ASTM D4632	400 Lb. / In.
Grab Tensile Elongation ASTM D4632	120%
Trapezoid Tear Strength ASTM D4533	180 Lbs.
Mullen Burst Strength ASTM D3786	1,200 psi
Puncture Strength ASTM D4833	160 Lbs.
UV Resistance After 500 Hrs. ASTM D4355	70% Strength

   b. (MARV)
   Hydraulic Properties

Apparent Opening Size ASTM D4751	30 U.S. Sieve
Permittivity ASTM D4491	0.4 / SEC

PART 3 - EXCAVATION

Section A. GENERAL.

1. Type: The Contractor shall make all excavations required for constructing all sewers and appurtenant structures as required by the Project Plans and Specifications. Except where otherwise required by the Project Plans and Specifications, or ordered in writing by the Director, all excavations shall be in open cut to the specified widths and depths.

2. Protection: The Contractor shall be responsible for the conditions of all excavations made by the Contractor and shall properly and adequately protect the excavation from caving or sliding. All slides and cave-ins shall be handled, removed, or corrected by the Contractor without extra compensation at whatever time and under whatever circumstances they may occur. To confirm the existence or change in classified excavation or the location of underground obstructions and conditions, the City may require a reasonable number of test pits to be dug by the Contractor along the lines of the sewer, as shown on the drawings, in advance of the excavation. No additional payment will be made for this work unless the test pits are in a paved area or the number of test pits should exceed one test pit per reach of new sewer.

Section B. CLASSIFICATION OF EXCAVATION.

1. Excavation Classes: There shall be three classes of excavation:

    a. Class A: Any material in original beds, or well defined ledges such as solid limestone, hard sandstone, or hard shales. Also, any material where each piece is more than one cubic yard in volume such as large boulders, detached pieces of limestone, hard sandstone, or mass concrete.

    b. Class B: Densely packed materials such as most shales, soft sandstone, or rubble. Also, detached pieces of material each being more than one cubic foot in volume such as broken concrete or rock. If the contractor chooses and is permitted to use drilling, blasting, or wedging for the removal of Class B material, such material will be measured and classified as Class B and not Class A.

    c. Class C: All materials not included in Class A and Class B excavation.

2. Record of Excavation Materials: The class of excavation, with its location and dimensions, shall be recorded in the Director's record of the work. The results of borings are shown on the Project Plans for design purpose only, and without any expressed or implied agreement or guarantee that depths or character of materials are correctly shown, or that conditions affecting the work will not differ from those shown on the plans. If the contractor desires to make his own investigations and borings, and so requests in due time, the City will provide the necessary access to the site.

Section C. CLEARING.

1. This work shall consist of removal, grubbing, and disposing of all vegetation such as trees, bushes, shrubs, plants, vines, brush, weeds, and sod necessary for the construction of the project, as well as, removing and properly disposing of all trash and railroad ties. At the City's direction, specific trees, shrubs, or plants may be required to be removed and properly disposed of or left in place and protected. If trimming of trees is required to accommodate equipment, it shall be done prior to starting excavation. Upon the direction of the Director, railroad ties shall be removed and stacked on the property and not removed from the site, remaining the property of the original owner.

Section D. WORK INCLUDED IN EXCAVATION.

1. General: All of the following items are included in excavation, unless otherwise directed or provided by the Project Plans and Specifications.

    a. The removing of all surface obstructions in streets, alleys, rights of-way, easements, and public places.

    b. The making of all necessary excavations.

    c. The providing of all necessary clearing.

    d. The furnishing and installing of all shoring and bracing as necessary or directed.

    e. The pumping, controlling and bailing to keep trenches free of ground water and infiltration during pipe laying and jointing, and thereafter until each joint, mortar, or concrete is set.

    f. The providing for uninterrupted surface water flow during work progress.

    g. The providing for bypass pumping and properly disposing of flows from sewers, storm drains, creeks, or other sources.

    h. The protecting of all pipes, conduits, culverts, tracks, utility poles, wires, fences, buildings, trees shown to be protected and other public and private property adjacent to or in the line of work.

    i. The removing of all shoring and bracing not ordered or required to be left in place.

    j. The hauling away and disposing of all excavated or disturbed materials within the “working room” limits not necessary or else unsuitable for backfilling purposes.

    k. The backfilling by mechanical compaction of all excavated trenches, except where granular backfill is required by the Project Plans and Specifications.

Section E. UNUSUAL EXCAVATION CONDITIONS.

1. Extra Payment Requests: The Contractor may make detailed requests to the City in writing for extra payment to the Contractor by the City for additional costs involved in fulfilling the Contract because of the following unusual conditions if these are not covered by pay items in the Contract:

    a. Unusual infiltration of ground water into the trench requiring the use of well-points or other special dewatering methods, if considered necessary and ordered by the Director.

    b. Necessity for using sheet piling, if considered necessary and ordered by the Director.

    c. Other unforeseeable, special, or unusual construction required to protect life and property when ordered by the Director.

2. Written Request For Special Items: Before the Contractor incorporates any of the above special items of work for which the Contractor expects reimbursement, the Contractor shall make a written request to the Director and receive his written approval of the use of such special methods, which are defined above. Such request to the Director shall include a detailed statement of the additional costs involved.

Section F. OPEN CUT EXCAVATION.

1. Alternative Methods of Excavation: Unless otherwise shown on the plans, all excavation for construction of sewers and their appurtenant structures shall be in open cut from the surface. Unless otherwise shown on the plans, tunneling, stanking, boring or jacking, will be allowed only on permission of the Director, with the requirement that a complete record thereof shall be kept in the project records.

2. Underground Structures, Pipe Lines, or Utilities: The Contractor shall proceed with caution in any excavation and shall use every means to determine the exact vertical and horizontal location of both public and private underground structures, pipe lines, conduits, etc. (including sanitary manholes, sewers and laterals), prior to excavation in the immediate vicinity thereof. When there is reason to believe that a utility conflict may exist, the Contractor shall determine the plan and elevation location of the suspected utility in conflict prior to commencing work on reaches adjacent to the reach in which the utility conflict may occur. This will enable the City to evaluate field adjusting lines or grade to avoid potential conflicts. This field verification of utility locations and existing sewers shall be accomplished at no additional cost to the City.

3. Utilities:

    a. Whenever it becomes necessary to perform any work on any public or private utility, the Contractor shall make satisfactory arrangements for such work with the affected utility.

b. The City has shown on the Project Plans the readily available record of location of existing structures and facilities, both above and below the ground, but assumes no responsibility for the accuracy or completeness of this information. Utility service connections will not be shown on the Plans, but reasonably can be expected in built-up areas, and if it is necessary to relocate them, it shall be the Contractor's responsibility. If the method of operation for the construction of the sewers requires the removal and replacement or protection of any overhead wires or poles, the Contractor shall make satisfactory arrangements for such work with the owners of such wires and poles and no additional payment will be made.

c. It shall be the Contractor's responsibility to protect any sewer or utility within the limits of the construction. The City will not be responsible for the cost of protection or repair or replacement of any structure, pipe line, conduit, service connection, etc., above and below ground which may be broken or otherwise damaged by Contractor’s operations. All water and gas pipes and other conduits adjacent to or crossing the trench must be properly supported and protected by the Contractor. Sewer and utility services between mains and buildings shall be maintained by the Contractor in as nearly a continuous operation as reasonably can be expected. This shall be accomplished in any way that the Contractor may desire, provided that the individual service must not be inoperative more than six consecutive hours. When a break occurs, the Contractor shall notify the affected householder of the probable length of time that the service will be cut off.

4. Limits of Excavation for Pipe Sewers:

a. Except where otherwise shown in the Project Plans and Specifications, or where ordered by the Director, trenches shall be excavated to the depths shown on the plans and to the payline widths shown in of the Standard Details of Sewer Construction. Excavated materials will be classified for measurement and payment as specified.

b. The sides of the trench shall be vertical, and the width of the trench below a level one foot above the outside top of pipe shall not exceed the payline widths for pipe sewers set forth in the Standard Details, unless specifically so provided in the Project Plans. If the trench width at or below that level exceeds the payline width, provision shall be made for the additional load upon the pipe as required by the Director and the Standard Details.

Change of Trench Location: If the Director orders that the location of an excavation be moved a reasonable distance from that shown on the drawings, due to an obstruction or other cause, or if a changed location is authorized at the Contractor's request, the Contractor shall not be entitled to extra compensation or to a claim for damage, if the change is made before the excavation is begun. If such a change is made at the order of the Director, and involves the abandonment of excavation already made, such abandoned excavation together with the necessary backfill will be measured, classified, and paid for in the same manner as other trench excavation and backfill of the same character. If the excavation is abandoned in favor of a new location at the Contractor's request, abandoned excavation and backfill shall be at the Contractor's expense.

If an obstruction should lie within the excavation in such manner that the trench has to be excavated to extra depth or width in order that sheeting or bracing may be properly placed, or in order that the structure to be placed in the excavation may be properly built, such extra depth and width of the excavation shall be measured, classified, and paid for in the same manner as other trench excavation and backfill of the same character.

5. Length of Open Trench: The length of trench which may be opened in advance of the completed sewer shall be limited to 200 feet in earth, except with permission of the City. In rock, the length shall be sufficient to protect the completed sewer.

6. Unauthorized Excavation:

   a. All unauthorized excavation carried beyond or below the lines and grades given by the Project Plans or Specifications, together with the removal of such excess excavated materials, and the cost of refilling the space of such overdig or unauthorized excavation, shall be at the Contractor's expense.

   b. The excess space between the undisturbed bottom and sides of the excavation and pipe bedding shall be refilled and compacted with crushed limestone as directed by the City.

7. Removal of Unsuitable Subgrade: Soft or spongy earth, muck, mud, unconsolidated earth fill, unsuitable fill such as decayed vegetable or organic matter, or soft, friable, unconsolidated materials such as ashes or rusted cans, or any other materials unsuitable as a firm base for the pipe or sewer or structure shall be removed, as ordered by the Director, and shall be replaced with compacted crushed limestone. The Contractor will be paid for the additional excavation as specified, except where the unsuitable base is caused by the activity of the Contractor or by his failure to control water in the trench.

8. Excavation in Rock:

   a. Trench bottoms in rock shall be excavated to a depth below the outer pipe bottom as shown on the Standard Details, and to the maximum payline width at and below the outside top of the pipe with no point or rock being closer than four inches from the pipe barrel. The responsibility of the Contractor with respect to the use of explosives in blasting includes compliance with all laws, rules and regulations of the federal, state and local municipalities and the insurer governing the keeping, storage, use, manufacturer, sale, handling, transportation, or other disposition of explosives. All operations involving the handling, storage, and use of explosives shall be conducted with every precaution under the supervision of a properly licensed individual. The Contractor shall take special precautions for the proper use of explosives both at or near the top of the excavation and in the excavation in order to prevent harm to human life and damage to surface structures, utilities, sewers or other subsurface structures. The Contractor shall advise the Director in advance when charges are be set off. Blasts shall not be fired until all persons in the vicinity have had ample notice and have reached positions of safety.

b. After a blast is fired, the Contractor shall cause the excavation to be thoroughly scaled. All loose, shattered rock or other loose material which may be dangerous to the workmen, pipe, or structure, shall be removed and the excavation made safe before proceeding with the work. The fact that the removal of loose or shattered rock or other loose material may enlarge the excavation beyond the required limits shall not relieve the Contractor from the necessity for making such removal and filling the extra space. The Contractor shall not be entitled to extra compensation therefore.

9. Control of Water:

a. While sewers and appurtenances are under construction, the Contractor shall keep all excavations free of water at Contractor's own expense. The Contractor shall provide all dams, flumes, channels, sumps, or other works necessary to keep the excavation entirely clear of water and shall provide and operate pumps or other suitable equipment of adequate capacity for the control of water in the excavations. No additional payment will be made for control of water in excavations or other construction techniques required for installation of the pipe under or adjacent to existing bodies of surface water (rivers, creeks, ditches, ponds, etc.). The Contractor shall avoid producing mud in the trench bottom by his operations, and if necessary or so ordered, shall place crushed limestone at his own expense to maintain a firm dry excavation bottom and base. Pipe bedding, laying, jointing, and the placing of concrete or masonry shall be done in a water- free trench or excavation, which shall be kept clear of water until pipe joints, concrete and masonry have set and are resistant to water damage. The water shall be disposed of in a manner approved by the Director.

b. All gutters, pipes, drains, conduits, culverts, catch basins, stormwater inlets, ditches, creeks, and other stormwater facilities shall be kept in operation, or their flows be satisfactorily diverted and provided for during construction. Any facilities disturbed during construction shall be restored to the satisfaction of the Director. All costs of handling water and providing a stable subbase during construction shall be included in the prices bid for the various classes of excavation.

10. Disposition of Excavated Materials:

a. Excavated materials suitable for backfill shall be stored no closer than two feet from the edge of the excavation or from areas designated as "to be protected" on the plans or in the contract document. They shall not obstruct crosswalks, sidewalks, street intersections, nor interfere unreasonably with travel on the street by occupants of adjoining property. Gutters or other surface drainage facilities must not be obstructed. When clear access to fire hydrants, mail boxes, sewer and conduit manholes, gas stops, and similar utility or municipal service facilities is required, the Contractor must provide such access. Handling and storage of excavated materials must meet the requirements of local government agencies having jurisdiction.

b. All materials, excavated, or disturbed, or damaged, or removed by the Contractor and not to be used for refilling trenches, channels, or structure excavations, nor to be used in restoration of subsurface or surface facilities or conditions, shall be

removed from the site and disposed of by the Contractor at his expense, unless otherwise directed.

If the Contractor proposes to store or place such excess excavated material upon any property, written consent of the property owner or owners must be secured in advance and a certified copy or copies thereof be filed with the Director. No surplus or excess materials shall be deposited in any stream channel, floodway, floodplain, nor in any place where pre-construction surface drainage would be changed, without written permission of the Director.

11. Bracing and Shoring:

a. The Contractor shall furnish, place, and maintain such sheeting, bracing, shoring, etc. as necessary or may be required to support the sides of the excavation to protect workmen in the trench and to prevent any earth movement which might in any way injure or delay the work, change the required width of the excavation, or endanger adjacent pavement, utilities, sewers, buildings, or other structures above or below the ground surface. The sheeted trench width, as measured between those faces of the sheeting in contact with the earth trench wall, shall not exceed the payline width of trench below an elevation one foot above the top of the pipe. Walers and other bracing shall be so designed and installed as to present no obstructions to proper placement of the pipe, bedding, cradle or encasement, nor shall they interfere with the satisfactory laying and jointing of the pipe.

b. Sheeting, bracing, and shoring shall be withdrawn and removed as the backfilling is being done, except where and to such extent as the Director shall order that such sheeting, bracing, and shoring be left in place, or where the Director will permit the same to be left in place at the Contractor's request. In any case, the Contractor shall cut off any such sheeting at least two feet below the surface and shall remove the cutoff material from the excavation.

c. If shoring is left in place the trench width shall be backfilled with granular backfill. If in grass area two feet of earth shall be backfilled to existing grades above the granular backfill. Granular backfill shall be compacted by tamping in 6 inch lifts. Adjacent to buildings the shoring shall be resistant to decay and insect attack, such as termites.

d. All sheeting, bracing, and shoring which is not left in place under the foregoing provisions shall be removed in a manner as not to endanger the completed work or other structures, utilities, sewers, or property, whether public or private.

12. Trenches with Sloping Sides: Where working conditions permit and where the necessary agreements have been made with the affected property owners, and the Director has given approval, the Contractor may excavate the upper part of sewer trenches with sloping sides above a level one foot above the top of the pipe. Trench excavation below this level shall be carried out with vertical sides having a width between vertical earth sides not greater than the payline width shown in the Standard Details. Bedding, concrete cradling, or encasement shall be specified for vertical side trenching. All trenches in highways, streets, parking lots, or alleys shall be excavated with vertical sides.

13. Stanking:

a. Where required by the Project Plans or ordered by the Director, a line of open trench excavation will be interrupted by a stank or short section of unexcavated earth with an excavated opening beneath for constructing the pipe sewer, in order to avoid disturbing existing improvements or the necessity of removing surface or subsurface structures. The locations of the stank faces will be set by the Director.

b. The excavated opening shall be sufficiently large to provide adequate working room for proper bedding, installing the pipe sewer, and compacting the backfill. The top of the opening shall be sloped sufficiently to permit solid backfilling without voids. The Contractor may undercut the stank at its face if permitted by the Director, but only in such amount that will maintain a depth of stank at the face not less than twice the actual trench width, and will insure safety of the improvements or structures for which stanking was required.

c. Class “C” bedding shall be used and after placing the bedding, the remaining space above the top of the pipe shall be packed solidly with tamped earth free from debris, rocks, lumps, or organic matter or at the election if the Contractor with tamped limestone and screenings. The Contractor shall carry out the work of stanking in a safe prudent manner to avoid endangering human life or property.

Section G. EXCAVATION FOR MANHOLES AND OTHER APPURTENANT STRUCTURES.

1. Limits of Excavation: The Contractor shall excavate as required for all structures with foundations carried to firm, undisturbed earth at the elevation of the underside of the structure. In rock, the Contractor shall excavate all rock at least to the minimum limits shown on the Standard Details for trenches and to the grade of the bottom of the manholes, junction chambers, or other structures as required by the Project Plans. Where the bottom of the excavation for structures is in rock, no rock shall project above the lower surface of the concrete base in such a manner as to reduce the required thickness of such base. All spaces between the bottom of such base and the solid rock surface shall be completely filled with the same materials used for the foundation or base, placed simultaneously as an integral part of the foundation or base.

Section H. METHODS OF MEASUREMENT AND BASIS OF PAYMENT.

1. Clearing: Payment for "Clearing" shall include all costs incurred due to "Clearing", protecting trees, shrubs, and plants, as well as, properly disposing of all trash and railroad ties. Payment will be made for "Clearing" at the Lump Sum price as bid per the Project Specifications. If there is no specific pay item, all costs for "Clearing" shall be included in excavation.

2. Trench Excavation:

   a. The volume of excavation for which payment will be made will be determined for each size of pipe and for each class of excavation as computed from actual final measurements and from measurements made during construction. The total volume of excavation for each size of pipe sewer laid shall be computed as a square-bottomed trench with vertical sides separated a distance equal to the payline trench width given in the Standard Details, a length equal to the actual horizontal distance between the payline limits for excavation of the connected structures; and a depth equal to the average vertical distance, measured at twenty-five foot intervals from a point directly below the pipe flow line, a distance equal to the pipe wall thickness plus four inches or six inches, as applicable, to the bottom of concrete pavement base, the original surface of the ground, or the roadway surface. No additional measurement, computation, or payment will be made for excavation for pipe bells.

   b. In case that either or both Class B or Class A excavation is encountered, the volume of each class of excavation will be computed from its limits and location in the trench, similarly measured as described for Class C excavation.

   c. In the event that any Class B or Class A excavation is authorized by the Director to be removed, less than a full payline width across the trench, to facilitate the proper installation and bedding of the new pipe, the volumes of Class B or Class A excavations will be computed as if the full payline width entirely contained these same appropriate classifications of excavations from their limits in the trench.

   d. When construction of a new sewer requires excavation of existing sewer pipe or structures, the removal of the existing pipe or structures shall be paid for as Class "C" Excavation. The pay volume for this excavation shall be the full payline volume as previously defined with no deduction for the void within the existing pipe or structure.

3. Excavation for Structures: Unless the Project Plans and Specifications stipulate that a lump sum or unit price for any specific structure shall include the entire cost of excavation and backfill related to that structure, the volume of excavation shall be measured and computed as follows:

   a. For structures other than manholes, the volume of excavation for which payment will be made will be computed as a prism with vertical walls, with a base extending 12 inches from the outermost lines of the structure base, and with a height equal to the average vertical distance between the bottom of the structure base and the bottom of the concrete pavement base or the original surface of the ground, or the roadway surface.

   b. For manholes the volume of excavation for which payments will be made will be computed as a prism with vertical walls, with a base extending six inches from the outermost lines of the structure base, and with a height equal to the average vertical distance between the bottom of the structure base and the bottom of the concrete pavement base or the original surface of the ground, or the roadway surface.

c. In case that either or both Class B or Class A excavation is encountered, the volume of each class of excavation will be computed from its limits and location in the trench, similarly as described for Class C excavation.

4. Removal of Unsuitable Subgrade: When the Contractor is ordered to remove unsuitable subgrade beyond the paylines the volume of such removal as directed will be computed from actual measurements. Payment will be made for the computed volume at the unit bid price per cubic yard for Class C excavation and for an equal volume of compacted crushed limestone. If the unsuitable material is mud or muck caused by the activity of the Contractor or by his failure to provide adequate drainage for the excavation, no payment shall be made for the removal or replacement of such material.

5. Payment for Excavation: The payment for Class A, B, or C excavation will be made for the computed volumes of each at the respective bid unit price. Such payment shall cover the whole cost of providing all the labor, tools, equipment, materials, and any other requirements for the removal, storage, and rehandling of any surface materials, unless covered by other prices bid in accordance with the Project Plans and Specifications; for the excavation of all materials encountered, for necessary or required sheeting and bracing, and for the backfilling and mechanical compaction of the excavation around the completed structure, except where granular backfill is required, specified, or ordered.

6. Material to Replace Unsuitable Subgrade: The quantity of replacement material for unsuitable subgrade which has been removed from the bottom of the trench or from the structure subgrade, shall be measured and computed in the same manner as described for measuring and computing the volume of excavation of unsuitable subgrade materials.

7. Payment for Shoring Ordered Left in Place: The cost of furnishing, placing and removing all bracing, sheeting, etc., of any kind, shall be included in the bid prices for the various classes of excavation. For lumber that has been ordered left in place by the Director, the Contractor will be paid for the computed amount at the price specified per thousand feet board measure for "Lumber Ordered Left in Place", which shall be considered to be the salvage value of the lumber. No payment will be made for any lumber left in place at the election of the Contractor with permission of the Director.

8. Payment for Stanking: No additional payment will be made for stanking where required in the project plans and specifications but payment will be made under appropriate pay items as if that portion of the trench were made in open cut.

9. Payment for Sanitary House Laterals and Utility Removal and Relocation:

   a. When it becomes necessary to remove or relocate an existing sanitary house lateral service, utility service, utility main or utility pole, the cost of which is to be paid by the City, the service must be in direct conflict with the new sewer and the work must be authorized by the Director prior to any such removal or relocation.

   b. For sanitary house laterals all cost involved for reconnecting the service, but excluding the cost for granular fill, paving replacement, and curb replacement will be paid for under the unit bid price per lineal foot of in place 6 inch pipe. For sanitary house laterals which are not in direct conflict with the new pipe but are removed or replaced or relocated, no separate payment will be made.

c. The removal and relocation of water service connections will be paid for under the unit bid price, per place, for "Relocation of Water Service."

d. Any removal or relocation of cable T.V., gas services, utility mains or poles shall be paid for at the exact amount for the cost of such removal or relocation as billed by the utility company. The amount under the extended price for pay item "Utility Relocation" shall be included in the total bid price.

10. Payment For Private Underground Facilities:

a. When private underground facilities, such as sprinkler systems, electric dog fences, or other facilities are indicated on the Project Plans in close proximity to actual location, and removal or interruption cannot be avoided, payment for the repair or replacement of those facilities shall be included in the amount bid for pay item "Protection and Restoration of Site."

b. When private underground facilities are not indicated on the Project Plans or the approximate location of same is unknown, and the Contractor has made a reasonable effort to locate the facilities, payment for the repair or replacement of those facilities shall be made in accordance with provisions of Section E, Unusual Excavation Conditions of Part 3 of this Standard Specification.

PART 4 - PIPE SEWER CONSTRUCTION

Section A. GENERAL.

1. General Construction Conditions:

   a. Pipe sewers shall be constructed of the sizes, classes and materials and to the alignments and grades given by the Project Plans and Specifications. All pipe shall be inspected on delivery and such pipe as does not conform to the requirements of these specifications and which are not suitable for use shall be rejected and immediately removed from the site of the work or destroyed.

   b. All materials shall conform to the requirements of the pertinent current specifications of ASTM and Part 2 of this Standard Specification, except as otherwise specified in the Project Plans and Specifications.

   c. The grade shown on the profiles to which the work must conform is that of the pipe flowline or the low point of the pipe invert. Construction stakes are the responsibility of the Contractor and will be set at 25-foot intervals for control of alignment, grades and excavation quantity computations. If a laser system is utilized, the construction stakes will be set at each structure, 25 feet upstream, and continuing at 100 foot intervals. Cut sheets are required to be submitted, and must be prepared by a Licensed Surveyor or Engineer of the State of Missouri.

   d. For sewer pipe with a design grade less than one percent (1%), verification of the pipe grade will be required for each installed reach of sewer, prior to any surface restoration or installation of any surface improvements. The Contractor's field supervisor will be required to provide daily documentation verifying that the as-built pipe grade meets the design grade through the submittal of signed cut sheets to the City Inspector upon request. The Contractor will be required to remove and replace any sewer reach having an as-built grade which is flatter than the design grade by more than 0.1%. Sewers with grades greater than the design slope may be left in place, provided no other sewer grade is reduced by this variance in the as-built grade. The City also reserves the right to require the Contractor to remove and replace any sewer (at any time prior to construction approval) for which the as-built grade does not comply with the grade tolerance stated in the above paragraph. Field surveyed verification must be made under the direction of the licensed land surveyor or registered engineer. The Contractor shall be responsible for any cost associated with the field verification of the sewer grade, or removal and replacement of the sewer pipe or associated appurtenances.

Section B. FIELD TESTS.

1. General: The Contractor shall be responsible for the following:

   a. Performing and recording all tests on sanitary sewer systems in the presence of a City Inspector.

b. Furnishing all equipment, mandrels, hoses, water, piping connections, test pumping equipment, pressure gauges, pumps, bulkheads, regulators, and any other miscellaneous items as required. Certification of gauges will be required from the gauge manufacturer. Certification and calibration data shall be available to the Director whenever air tests are preformed.

c. Any by-pass pumping as required.

d. Making any corrections, repairs or replacement as a result of the tests. Having the corrections, repairs or replacement inspected and approved and completing retesting of any part of the system that failed during any initial tests.

e. Payment of all cost associated with field tests or retesting including all costs associated with any required correction, repair or replacement of the sanitary sewer system. No separate payment will be made for field tests or the corrections, repairs or replacement of the sanitary sewer system required to meet these field tests.

2. Air Testing. Air testing shall be performed after completion of the backfill operation. As applicable, for pipe diameters 8 inch through 27 inch, the air test for leakage shall conform to ASTM C-828 “Standard Test Method For Low-Pressure Air Test Of Vitrified Clay Pipe Liners” for VCP sewer pipe or ASTM F-1417-11a(2015) “Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air” for plastic, composite, or ductile iron pipe. The air test shall not be conducted unless the pipe is secured so that the application of air pressure will not separate the pipe joints. All branches, laterals, tees and wyes shall be plugged and braced adequately to withstand the test pressure. Air testing shall start with a stabilized test pressure of 3.5 psi. If the pressure drops more than 1.0 psi during the test time, the line is presumed to have failed the test. The test time for each type of pipe shall be as indicated in the appropriate ASTM specification. For example, the testing times for 400 feet of plastic pipe sewer lines shall be as follows: eight-inch (8”) diameter 10:08 (min:s); ten-inch (10”) diameter 15:49 (min:s); twelve-inch (12”) diameter 22:47 (min:s).

3. Replacement of Existing Sewers / Test Modifications. Where existing 8 inch through 18 inch diameter sewers with live laterals are being replaced with new sewers in the same location as the existing sewers, modifications to the methods of testing will be considered and tests will be performed as approved and directed by the Director.

4. Joint Testing. Joint tests for sanitary using air or water shall be performed on all types of pipe materials larger than 27 inches in diameter following the procedure of ASTM C-1103 “Standard Practice for Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines.” Each joint will be tested at the time of installation prior to complete backfilling of the trench. The sewer shall be kept clean prior to testing so that equipment used in conducting the test can properly seal against the pipe. The test shall not be conducted unless the pipe is secured so that the application of air or water pressure will not separate the pipe joint. The equipment used for conducting the test shall span the joint and be securely placed. Air or water pressure shall be applied into the joint test area at a minimum pressure of 3.5 psi greater than the pressure exerted by ground water above the pipe. Maintain the pressure for at least ten (10) seconds after the established pressure has been reached and stabilized. A maximum pressure drop of

one psi is allowable. In addition, after backfilling and prior to acceptance, any visible leaks are to be repaired as approved by the Director.

5. Mandrel Testing. Prior to construction approval and after completion of the backfill operation or compaction processes, all flexible pipe shall be tested, by the use of an approved nine arm mandrel to insure that no pipe deflection has occurred greater than 5.0 % of the inside diameter of the pipe. These tests shall be performed without mechanical pulling devices and without additional cost to the City. Ductile iron pipe will not require a mandrel test unless required by the Project Plans or Specifications.

6. Manhole Testing: After completion of the sanitary sewer system and backfilling around the manholes, all manholes shall be tested by vacuum testing after the completion of the sanitary sewer system. The vacuum test shall be in accordance with ASTM C-1244-11(2017) “Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill”. The required test period is one minute (minimum) for all sizes and manhole depths. After the complete installation of the manhole, including the frame installation, a vacuum test shall be performed at 10” Hg (mercury). After the pressure has stabilized, a maximum of 1” Hg drop in a minimum of one minute will be allowed for manholes up to 48 inches in diameter. For larger manholes, the time for a maximum of 1” Hg drop shall be a minimum of two minutes. If the vacuum test fails to meet the above requirements, repeat test after all leaks and defects have been repaired.

7. Closed Circuit Television Inspection: After the Contractor has completed the above noted field tests on the sanitary sewer system and prior to construction approval, the City, at their own expense, will televise and videotape each sewer reach. Any defects noted by the City during this inspection shall be repaired by the Contractor at no additional cost to the City.

Section C. BEDDING.

1. Bedding, Cradling, or Encasement Types: The Project Plans and Specifications will indicate the specific type of bedding, cradling, or encasement required in the various sections of the pipe sewer construction. The types and detailed requirements of bedding, concrete cradling, and concrete encasement are shown in the Standard Details of Sewer Construction.

2. Use of Bell and Spigot Pipe: Where bell and spigot pipe is to be used, provision must be made for suitable bell holes to avoid pipe support on the bells and to insure continuous uniform bearing and support at the specified grade for the pipe barrel between pipe bells. No blocks, wedges, or other devices shall be used to support the pipe or to prevent uniform bearing of the pipe on its bedding.

3. Class C Bedding:

   a. The standard bedding is Class C. It is to be used when the trench width below one foot above the top of the pipe does not exceed the payline width as shown in the Standard Details. The bedding shall be placed as shown in the Standard Details of Sewer Construction.

   b. The bedding must be compacted to a minimum of 90% modified proctor density.

Section D. PIPE LAYING.

1. Handling of Pipe: Equipment used to handle, lay and joint pipe shall be so equipped and used as to prevent damage to the pipe and its jointing materials. All pipe and fittings shall be carefully handled and lowered into the trench. Damaged pipe or jointing material shall not be installed.

2. Laying of Pipe:

    a. Pipes shall be laid true to the lines and grades given on the plans. The bell or groove end shall be laid upstream with the ends abutting to form a concentric joint without shoulders or unevenness of any kind along the invert of the pipe. Bell holes shall be dug to relieve the bell of all load and to be no larger than necessary. For all pipe required to be laid to a curved alignment, three copies of a proposed laying diagram must be submitted to the Director and approved prior to construction.

    b. Suitable means shall be used to force the spigot end of the pipe into the bell end without damage to the pipe and its jointing materials, and without disturbing the previously laid pipes and joints.

3. Bedding, Cradling, or Encasement:

    a. Special care shall be taken to insure that the pipes are solidly and uniformly bedded, cradled, or encased in accordance with the type of bedding, cradle, or encasement required by the Project Plans and Specifications, and as shown in the Standard Details of Sewer Construction. No pipes shall be brought into position until the preceding length has been bedded and secured in place.

    b. Where concrete encasement is required, the pipe shall be supported at not more than two places with masonry supports or selected cut hardwood (as approved by the City) of minimum size sufficient to provide the required clearance and to prevent displacement during placing of concrete.

4. Lifting Holes: Lifting holes in pipe are not allowed.

5. Water in Excavation: Water shall not be allowed to rise in the excavation until the joint materials and any concrete cradle or encasement is hardened and cannot be damaged by the water. Particular care shall be used to prevent disturbance or damage to the pipe and the joints during backfilling or at any other time.

6. Cleaning of Pipe Interior: As the work progresses, the interior of the sewer shall be cleaned of all dirt, cement, extruded joint materials, debris, and other extraneous materials.

7. Protection of Pipe: Whenever pipe laying is stopped for any significant length of time, such as at the end of a workday, the unfinished end shall be protected from displacement, flotation, cave-in, in-wash of soil or debris, or other injuries. A suitable temporary tight-fitting plug, stopper, or bulkhead shall be placed in the exposed bell, groove or socket end.

8. Fittings and Special Pipes: Tees (T-junction), wyes (Y-junction), slants, stubs, reducers, bends, elbows, curves, radius-pipe, curved pipe, fittings, or other special pipes shall be installed at the places shown on the Project Plans or where ordered by the Director. The fittings and special pipes shall be made of a compatible material, type, and class or strength designation as the pipe required by the Project Plans and Specifications, and shall be installed in accordance with the pertinent Standard Details of Sewer Construction and these specifications.

9. House Connections: Wye and tee-branches may be used on lateral pipes for house connections and shall be installed as detailed on the Standard Details of Sewer Construction. For new construction all lateral pipes shall be connected to the sewer with a wye unless approved by the Director.

10. Future Connections: Wye and tee-branches, slants, stubs, or other fittings installed in the pipe or built into manholes, junction chambers, or appurtenant structures for future connections shall be closed at the outer end. For all pipes, an approved stopper or cap shall be installed in the bell or socket using the same type joint or jointing material as required for the sewer, unless otherwise required by the Project Plans and Specifications. Care in backfilling shall be used so that such closure and its seal will not be disturbed.

11. Force Mains: Refer to Section 4.0 – Piping and Valves of the City of Jackson Sanitary Sewerage Lift Station Standard Design and Construction Requirements for specifications relating to the installation of Force Main piping.

Section E. CONCRETE CRADLE.

1. When a concrete cradle is required by the Project Plans and Specifications, it shall be of low slump Class "A" concrete. It shall be constructed according to the details in the Standard Details of Sewer Construction. Backfill materials may not be placed above the concrete until it attains its initial set.

Section F. CONCRETE ENCASEMENT.

1. When an encasement is required by the Project Plans and Specifications, it shall be a low slump Class "A" concrete. It shall be constructed according to the details in the Standard Details of Sewer Construction. Backfill materials shall not be placed until the concrete attains its initial set.

Section G. STRUCTURES.

1. General: The Contractor shall build manholes, junction chambers, and such other miscellaneous structures as are required at the locations shown on the Project Plans, and of the forms, dimensions, and materials as shown in the Standard Details of Sewer Construction or Project Plans and Specifications or as otherwise directed. The structures will be of precast concrete or cast-in-place reinforced concrete as required. Where the top elevation is not shown on the plans, the structure or appurtenance shall be built to conform to the elevation ordered by the Director.

2. Vertical Alignment:

    1. The various structures shall be built as the pipe laying or sewer construction progresses. The Director, at his discretion, may stop the laying of pipe or the building of other structures until the structure just passed has been completed. Completion of the structure shall include the installation of fittings and connections to pipes and other construction as shown on the plans.

    2. Structures shall not be out of plumb more than one foot in thirty feet of depth.

3. Concrete Structures:

    a. Concrete structures shall be built of Class “A” steel reinforced concrete as shown on the Standard Details of Construction or on the Project Plans. The structure shall be built on prepared foundations, conforming to the dimensions and shapes shown on the plans. The construction shall conform to the methods, forms, mixture, placement, and curing for concrete as specified in Part 5 of these specifications, the Standard Details, and the Project Plans and Specifications.

    b.

    c. Any required reinforcement shall be of the kind, type, and size, and shall be located, spaced, bent, and fastened as shown in the Standard Details or the Project Plans. Concrete reinforcing in place shall be approved by the Director before any concrete is placed.

    d.

    e. All invert channels shall be accurately constructed and shaped so as to be smooth, uniform, give minimum resistance to flow and shall slope downward toward the outlet. Invert bench slopes shall be no less than one-half inch per foot (0.5 in./ft.).

4. Precast Manholes and Appurtenances:

    a. Where precast concrete structures are permitted or required by the Project Plans, they will be manufactured in accordance with Part 2 of this Specification and to the sizes and shapes detailed in the drawings for this Specification.

    b. Precast manholes will require eccentric cones in all cases. Flat slabs and special shallow manholes will only be allowed with special permission from the Director.

    c. Joints for the precast manhole structures shall be formed with male and female ends so that when the manhole base, riser and top section are assembled, they will make a continuous, uniform manhole. The sealant between manhole sections shall be an elastomeric 0-ring joint conforming with ASTM C443, or it may be of two rows of a flexible rubber mastic sealant conforming to the requirements of AASHTO M-198B.

    d. The project plans shall indicate the required orientation of the precast concrete unit.

    e. All precast units shall have cured undisturbed a minimum of fourteen (14) days prior to shipping to jobsite. When the precast units are delivered to the jobsite,

damaged, cracked or imperfect sections will not be allowed to be installed unless approved by the City.

f. No field modification will be allowed to the structure unless it is determined that such modifications will not adversely affect the strength of the structure.

g. After the excavation has been completed to the required dimensions specified on the detailed plan, a minimum 6” thick compacted crushed limestone base shall be leveled off to receive the bottom section. The base must be set level so all water in the structure will drain toward the designed outlet.

h. Assemble the multi-section structure by lowering each section into the excavation, and firmly position one section on top of the other before backfilling.

i. The jointing material required shall be installed at the job site.

j. To ensure joint integrity, give particular attention to removing all foreign materials, such as dirt, mud and stones, from the joint surfaces and see that all sealing materials are placed in accordance to the manufacturer's recommendation.

k. If a misalignment of sections occurs during installation, remove the upper section. If the sealing material is damaged, clean the joint surfaces before replacing new sealing material.

l. The allowable variance in vertical plumb is one foot in thirty vertical feet.

m. Backfill the precast structure as soon as practical.

n. The precast base of all structures shall require that the inlet and outlet openings be installed prior to delivery to the project site, except when installation has been approved on existing pipes.

o. All connections shall be by an approved patented compression type and will not be allowed through joints; therefore, the height of riser sections should be designed accordingly. The maximum percent grade and/or horizontal deflection for the use of “A-Lok” or “Z-Lok” connections are 12% (7º) and 46% (25º), respectively.

p. Waterproofing. The outside surfaces of each precast manhole unit shall be painted with a heavy coat of black coal tar paint. Surfaces to receive paint shall be dry. Waterproofing may be applied to precast units in the shop. If shop coating is damaged during construction, a touch-up coat of paint as required shall be applied and allowed to dry prior to backfilling.

q. Manhole Joint Seals. Each manhole joint shall be sealed with a 12 inch wide external membrane similar to the Mac Wrap external joint sealers as manufactured by MARMAC Construction Products, Inc. or approved equal. External joint seals shall consist of a collar with an outer layer of polyethylene, with a minimum tensile strength of 4,000 psi and a minimum tear resistance of 1,500 psi, and an under layer of rubberized mastic that is reinforced with a woven polypropylene fabric. Two 5/8-inch steel straps with self-contained tensioning

ratchets shall be located within the collar ¾-inches from each edge. The straps shall be confined in tubes that isolate them from the mastic and allow them to slip freely when mechanically tightened around the manhole. A second layer of rubberized mastic shall cover the entire internal surface of the collar. The collar shall be furnished with a minimum 6-inch overlap. The joint seal shall prevent the intrusion of water and soil through the joint sections of the manhole. This seal shall be provided in addition to the joint sealing requirements outlined in the Standard Specification Details.

r. Manhole Frame Seal. Each manhole casting shall be sealed to the manhole with an external sealing system similar to the Mar Mac Chimney Wrap as manufactured by Mar Mac Construction Products, Inc. or approved equal. Chimney seal shall consist of a collar, a minimum of 14-inches wide, with two layers of woven polypropylene fabric conforming to ASTM D-1682 and rubberized mastic. Three stainless steel hose clamps shall be confined in tubes that isolate them from the mastic and allow them to slip freely when mechanically tightened around manhole. A second layer of rubberized mastic shall cover the entire internal surface of the collar. The collar shall be furnished with a minimum 6-inch overlap. The external sealing system shall be installed according to Standard Specification Details and the manufacturer's recommendations.

5. Inlet and Outlet Pipes: Inlet and outlet pipes shall extend through the walls of structures only a sufficient distance beyond the outside surface to allow for connections as shown in the Standard Details, on the Project Plans, or otherwise directed. All pipe connections to new cast-in-place concrete structures and precast manholes shall be made as an integral part of the structure or manhole with an approved patented compression type joint. For pipe connections to existing structures and manholes, the wall of structure or manhole shall be core-drilled to the correct elevation and diameter to allow pipe to be installed with an approved water stop as detailed in the Standard Construction Details, or as approved by the Director. Existing manholes that are of such condition that a watertight pipe connection is not possible or if directed by the Director, the existing manhole shall be replaced with a new precast manhole.

6. Setting of Castings, Frames, Fittings and Steps:

a. All castings, frames, and fittings shall be placed in the positions shown in the Standard Details of Construction or Project Plans or as directed, and shall be set true to line and to correct elevation upon 2 rows of 1 inch butyl rope to ensure a water-tight seal. If frames or fittings are to be bolted or anchored in concrete, the top surface of the concrete shall be cleaned of all dust/debris from drilling of anchor holes prior to installing butyl rope material.

b. Frames and cover, or other similar pairs of items, shall have true common bearing surfaces such that the covers will seat firmly without rocking or shifting.

c. Steps shall be installed as shown in the Standard Details of Construction.

Section H. TRENCH BACKFILL.

1. Placing of Backfill:

a. After the pipe or conduit has been properly bedded, jointed, and inspected, and all measurements to record location of Y-junctions, tees, etc. have been made by the City, and sufficient time has, elapsed for the joint materials or for any concrete or mortar to set and harden, upon permission of the Director, the backfill may be placed. All requirements of the agency of jurisdiction must be adhered to.

b. Backfill in trenches which are not within or immediately adjacent to pavements of concrete or pavements on stone or concrete base, and where granular backfill is not desired, shall consist of selected job-excavated earth thoroughly compacted with suitable mechanical tampers to the density of the adjacent undisturbed earth, or compacted to not less than 90 percent of maximum dry unit weight as determined by ASTM D698. Non-granular job-excavated material shall be free from debris, organic matter, perishable compressible materials, and shall contain no stones or lumps of rock fragments larger than six inches in dimension, nor be in such amount that will interfere with the consolidating properties of the fill material. Care shall be taken that stones and lumps are kept separated and well distributed, and that all voids are completely filled with fine materials. The upper three feet of backfill in sodded or planted areas shall be free of such rocks or lumps larger than one inch in diameter with the upper six inches being free of all objectionable material. The approved backfill materials shall be placed in uniform layers not more than 9 inches in loose depth for material compacted by heavy compaction equipment, and not more than 5 inches in loose depth for material compacted by hand-operated tampers.

c. If the trench is flooded before or during backfilling or subjected to conditions which might cause flotation of the pipe before sufficient backfill has been placed, the Contractor shall take the necessary precautions to prevent flotation of the pipe, conduit, or structure.

d. Before final acceptance of the work, additional tamped earth shall be added to restore settled trench surfaces to the required level of the adjacent earth surfaces or the base or crushed rock wearing surfaces or to the finished earth base for sodding or for seeding. Where seeding or sodding are not required, the excess earth shall be uniformly and neatly mounded above the trench.

e. No separate payment will be made for compaction of trench backfill in unpaved areas, all costs of which are considered to be included in the bid prices for excavation.

2. Granular Backfill:

a. Backfill in trenches through pavements of concrete, or wearing surface on concrete or stone base, or brick, or macadam in highways, streets, rights-of-way, or wherever prevention of backfill settlement is considered essential, and where the Project Plans or Specifications require or the Director orders, shall be made with mechanically compacted granular fill from the level six inches above the top of the pipe to the subgrade elevation of the pavement, or to within 18 inches of finished grade where located in grassed areas.

b. Granular backfill shall consist of 3/4" minus crusher-run limestone (Type 3 – Backfill).

c. Place granular backfill material in layers not more than 9 inches in loose depth for material compacted by heavy compaction equipment, and not more than 5 inches in loose depth for material compacted by hand-operated tampers. Granular backfill shall be compacted to not less than 98 percent of maximum dry unit weight as determined by ASTM D698.

3. Backfill - Flowable Fill: When required by the project specifications or jurisdictional agency this work shall consist of placing flowable fill to fill trenches for pipe, structures, culverts, utility cuts, and other work under pavement or as designated in the project specifications. In pipe trenches the flowable fill will be used in the top five (5) feet of the pipe trench.

Section I. METHODS OF MEASUREMENT AND BASIS OF PAYMENT.

1. General:

a. Payment will be made for the materials furnished and completed work done under the contract as stated herein in accordance with actual measurements. The Contractor shall not be entitled to receive additional compensation for anything furnished or work done, except for extra work authorized by written order of the Director, or for which provision has been made in the Project Plans or Project Specifications which will state the method of measurement and basis of payment for any item of construction not covered by this section of the Standard Specifications.

b. It is the intent of these specifications to pay only once for any given item of work or material to be furnished, except where it is clearly specified as an addition to the bid price for the unit quantity. Duplication of quantities, units, or bid items will not be permitted, even though the Project Plans or Specifications may, through error or oversight, allow such duplication.

2. Pipe Sewers: Payment will be made for completed pipe sewers, round or elliptical, for each size, kind, and class of pipe laid at the respective bid price per lineal foot. The length for which payment will be made will be the measured horizontal distance for each along the centerline of the pipe exclusive of the distance between the inside faces of each connected structure, sewer, manhole, junction chamber, transition section, or other similar structures. The payments made shall include all costs of labor, materials, tools, and equipment, and shall be full payment for furnishing and installing pipe, jointing materials, tracer wire system, crushed limestone in replacement of overdig, and furnishing, placing, and compacting the bedding. In addition, unless otherwise specified for force mains, the payments made shall include all costs for appurtenances such as air relief valves, thrust blocks, cleanouts, cleanout manholes at low points in force main, and tuned locator disks as specified.

3. Curved or Radius Pipe: Unless otherwise provided in the Project Specifications, no additional payment will be made for curved or radius pipe which shall be measured and paid for in the same manner as described for straight pipe. Any additional costs for curved or radius pipe shall be included in the bid price per lineal foot for pipe of the size, kind, and class involved.

Tees, Wyes, Bends, Stubs, Etc.: Payment will be made for tees, wyes, bends, stubs, slants, and other specials where required by the Project Plans and Specifications or

where ordered by the Director, at the bid price for each and as an addition to the amount paid for the completed pipe sewer containing such special, except where the cost of a special is included in the lump sum bid price for a given bid item. The payment for the special shall include furnishing and installing of an approved watertight stopper, cap or cover.

4. Concrete for Encasement:

   a. Payment will be made for Class “A” concrete in encasements at the bid price per cubic yard for the class of concrete used. The quantity for which payment will be made will be the respective quantity per lineal foot for each size pipe as tabulated in the Standard Details and for the actual length of sewer so encased.

   b. Such payment shall include the entire cost of furnishing and placing the concrete cradle or encasement as shown in the Standard Details. It also shall include the costs of the necessary excavation beyond paylines and also the cost of supporting and securing the jointed pipe against movement during the placing of the concrete.

5. Manholes:

   a. Payment will be made for each manhole on pipe sewers twenty-four (24) inches in diameter and smaller at the bid price per lineal foot for completed standard manhole construction for the vertical distance between the elevation of the top of the cast iron frame and the average elevation of the flowline at the manhole center. Such payment shall include all costs of the manhole base, invert, walls, making pipe connections, and steps, frames and covers, and joint and frame seals; but exclude payment for lumber ordered left in trench, and excavation.

   b. Payment will be made for each manhole on pipe sewers twenty-seven (27) inches in diameter and larger at the bid price per lineal foot for completed standard manhole construction for the vertical distance between the elevation of the top of the cast iron frame and the elevation for the top of the bottom section of manhole. Such payment shall include all costs of such manhole construction, steps, frame and cover, and joint and frame seals and making pipe connections; but exclude payments for lumber ordered left in trench, excavation, and the bottom section of manhole.

   c. Payment for the bottom section of manhole shall include all costs of such construction, including the base, invert, walls, manhole steps, and making pipe connections, but exclude payments for lumber ordered left in trench, and excavation. The bottom section of manhole shall include all construction below that elevation determined by the sum of the average elevation of the flowline at the manhole center and one of the following: Inside vertical dimension of outlet pipe + 12 inches for pipes with vertical dimensions 27 inches through 51 inches. Inside vertical dimension of outlet pipe + 18 inches for pipes with vertical dimensions 54 inches through 72 inches. Inside vertical dimension of outlet pipe + 24 inches for pipes with vertical dimensions 75 inches through 96 inches.

   d. Payment for the bottom section of manhole shall include all costs of such construction, including the base, invert, walls, manhole steps, and making pipe connections, but exclude payments for lumber ordered left in trench, and excavation.

e. Payment will be made for completed foulwater drop construction as an addition to the payment made for the completed manhole. Such payment will be made at the lump sum bid price of each location or for the designated location, and shall include all costs of excavation, labor, lumber left in trench, concrete or brick masonry, drop pipe, pipe elbow, jointing fasteners, and the additional cost of the pipe junction on the sewer and its concrete encasement.

6. Junction Chambers: Payment will be made for each junction chamber completed as required by the Project Plans and Specifications at the lump sum bid price for constructing the junction chamber. Such payment shall include all cost of masonry, forms, concrete, reinforcing steel, steps, manhole construction above the top of the chamber, and making pipe connections; but exclude payments for lumber ordered left in trench, excavation, and granular fill.

7. Trench Backfill:

   a. No separate payment will be made for the placing of mechanically-compacted backfill in the trench, unless granular backfill or flowable fill is required or ordered by the Director. All such costs shall be included in the bid prices for excavation.

   b. Payment will be made for flowable fill at the bid price per cubic yard for flowable fill. Such payment shall include all costs for material, labor, equipment, and testing required to place flowable as specified. The quantity for which payment will be made is computed volume based on a trench width equal to the payline width for the given size of pipe, a length equal to the measured horizontal distance between vertical planes representing the average ends of the tamped backfill as placed in the trench, or to the payline of an intermediate structure, as shown on the Project Plans or as required; and a depth equal to the average vertical distance measured along the centerline of the sewer at twenty-five foot (25') intervals between the elevation, either six inches (6") above the top of the pipe, or at the top of the concrete encasement, and the bottom of the pavement base, or the elevation given on the Project Plans or ordered by the Director.

8. Backfill Around Structures:

   a. No separate payment will be made for mechanically-compacted backfill around manholes, junction chambers, and other structures unless granular backfill or flowable fill is required or ordered by the Director. For manholes, the volume for which payment will be made for granular backfill or flowable fill shall be that of a prism bounded by vertical planes or surfaces six inches from and parallel with the outermost lines of the structure, and a height equal to the average distance between the original ground surface, subgrade of replacement pavement base, or the elevation shown on the Project Plans or ordered by the Director, and the subgrade for the structure, less the computed gross volume of the structure. For junction chambers or other special structures requiring form work, the volume for which payment will be made for granular backfill or flowable fill shall be that of a prism bounded by vertical planes or surfaces twelve inches from and parallel with the outermost lines of the structure and an average height computed as described immediately above for manholes, etc., less the computed gross volume of the structure.

b. Payment for the computed quantity of granular backfill or flowable fill for manholes, junction chambers, or other structures will be made at the respective bid price per cubic yard for “Granular Backfill” or “Flowable Fill”.

9. Granular Backfill:

a. Payment will be made for granular backfill at the bid price per cubic yard for "Granular Backfill" for the computed volume measured in place after final compacting. Payment shall include all costs of material, labor, equipment and mechanical compaction of the granular backfill.

b. The volume of compacted granular fill for each sewer will be based on a square-bottomed trench with vertical sides a distance apart equal to the payline trench width; a length equal to the measured horizontal distance between vertical planes representing the average ends of the granular fill as placed in the trench, or to the payline limits of an intermediate structure as shown on the Project Plans or as required; and a depth to the average vertical distance measured along the centerline of the sewer at twenty-five foot intervals between the elevation either six-inches above the top of the pipe or at the top of concrete encasement, and either the bottom of the pavement base or the elevation to which granular fill is required on the Project Plans ordered by the Director. The volume of compacted granular fill surrounding manholes, inlet-manholes, inlets and catch basins, of junction chambers and special structures requiring form work will be computed separately.

c. The cost of any additional granular fill required beyond payline limits due to unauthorized excavation beyond payline limits is to be borne by the Contractor.

PART 5 - CONCRETE CONSTRUCTION

Section A. GENERAL.

Concrete shall be composed of Portland cement, fine and coarse aggregates and water, all properly proportioned by weight, thoroughly mixed, and of proper consistency. An air-entraining agent or an admixture, uniformly dispersed through the concrete during mixing, shall be added only when specifically required in Part 5, the Standard Details, the Project Specifications, or for appropriate special structures by the Director.

Section B. MATERIALS.

Materials for concrete shall conform to the pertinent paragraphs in Part 2 of these specifications. In general, only one source and kind of material conforming to these specifications shall be used throughout the work of constructing each complete unit of the particular contract. Previous to beginning the work, the Director shall be informed of the kind and source of materials to be used. When reference is made to a material, it is intended to relate only to the kind and source of material, washed gravel, crushed limestone, Mississippi or Missouri River sand, or Meramec River sand, and not to its grading requirements. All fine and coarse aggregate must be stored separately and shall be kept clean and free from contamination. The mixing of materials from different sources will not be permitted. In no case shall frozen lumps or partially cemented materials be used.

Section C. CLASSES OF CONCRETE.

1. General:

   a. Concrete will be designated by classes. These Standard Specifications and the Standard Details will state which class and type of cement is to be used for each structure, except where otherwise required in the Project Plans and Specifications Class “A” concrete is required. Type I cement normally will be used, except for sanitary sewer construction for which Type II cement shall be used. The following table shows the classes of concrete, the minimum cement content per cubic yard, and the maximum water content per sack of cement, including free moisture in the aggregates. Class "A" concrete is required unless otherwise stated.

CONCRETE		
Class	PORTLAND CEMENT (Sacks) Per Cubic Yard	MAXIMUM WATER (including Free Moisture in Aggregates) Gallons Per Sack
A	6	6 ½
B	4	8 ½
C	2	9 ½

   b. If the Contractor desires to add more water to a given class of concrete than is permitted by the table in order to facilitate placing, and the Contractor is given permission to do so, the Contractor must maintain the same water-cement ratio as shown in the table by adding proportionally additional cement. The minimum compression strength for Class A Concrete shall be 4,000 psi at 28 days.

2. Proportioning:

   a. The proportions of materials shall be such as to produce a concrete of the required strength that can be placed easily into the corners and angles of forms and around reinforcements with the method of placing used in the work, and without separation or segregation of the materials or collection of free water on the concrete surface.

   b. All materials shall be proportioned by weight. The quantities of fine and coarse aggregates for each batch shall be exactly sufficient for one or more sacks of cement. No batching requiring fractional sacks of cement will be permitted. Proportioning by volume will be allowed only with permission during emergencies and for a total volume less than one cubic yard.

   c. Prior to the start of a construction project the concrete mix design intended to be used shall be submitted to the Director for approval.

3. Admixtures: No admixture shall be used without the permission of the Director. Whether specified or permitted by request, prior written approval from the Director shall be obtained for the admixture to be used. The proposed mix design supported with independent test results shall be submitted with all admixture approval requests. Air-entraining admixtures shall conform to the requirements of Part 2. When an admixture is to be used, a dispenser capable of accurately measuring and adding the required amount of admixtures to the batch at the beginning of the mixing period shall be provided at the mixer. The minimum required compression strength and durability shall not be reduced or compromised by any admixture.

4. Air-entrained Concrete:

   a. All Class “A” concrete shall be air-entrained.

   b. Freshly mixed air-entrained concrete shall contain the following amounts of entrained air when measured by the volumetric method ASTM C173, or by the pressure method ASTM C231.

AIR CONTENT BY VOLUME		
MAXIMUM SIZE OF COARSE AGGREGATE	MAXIMUM %	MINIMUM %
1 ½”, 2” or 2 ½”	6	4
¾” or 1”	7	5
3/8” or ½”	8 ½	6 ½

   Mixes should be designed for the recommended air content and adequate control provided to keep air content within required limits. The Contractor shall maintain close control over the uniformity of the concrete, and over the cement, aggregates, water content, consistency, operation and accuracy of proportioning, mixing time, and operating equipment, until finally placed in the forms.

c. Air entrainment shall be obtained by the use of an approved air-entraining agent added in the quantity required to obtain an air content within the specified limits. All air-entraining agents shall be added to the concrete during the process of mixing. The agent shall be accurately measured and dispensed by means of an approved mechanical dispenser, which will automatically and gradually discharge the required amount of material into the stream of mixing water before all of the mixing water has entered the mixer drum.

5. Consistency:

a. The consistency of the concrete shall be such that the slump, when measured according to ASTM C143 is the least compatible with workability and ease of placing. In general, the slump tested at the placement site shall meet the following requirements:

REQUIRED SLUMP	
KIND OF WORK	INCHES
Paving	4
Reinforced Concrete Structure	4 ± ½
Unreinforced Structure	3 ± ½
Tremie-placed Concrete	7 ± 1

b. Additional water shall not be added at the site except with permission and under strict supervision of the Director, and then only in an emergency. Such additional water shall be added only in small increments and then only in the smallest amount necessary within the required limits of consistency for the particular work, and shall be uniformly mixed and incorporated into the unplaced concrete before deposition in the forms.

Section D. BATCHING AND MIXING.

1. Plant-mixed or Ready-mixed Concrete:

a. Along with its preparation, it shall conform to the requirements of Standard Specifications for Ready-mixed Concrete ASTM C94 and these specifications. All scales and measuring equipment shall be regularly tested and approved by the Inspector of Weights and Measures of the State of Missouri, and as often thereafter as may be required by the Director. Concrete plants shall be open to inspection by the Director and his duly authorized agents at any reasonable time that may be necessary and also during the time while furnishing concrete to any City project. All batching, mixing, and approved delivery equipment shall be maintained in good condition, adjustment, and operation. Batching of aggregate from bins where the aggregates come directly from the screening plant or washer, or in which the aggregate may segregate, shall not be permitted. Any batch of concrete which does not meet the requirements of these specifications shall be rejected and replaced with acceptable concrete at the expense of the Contractor whether at the plant or delivered at the site of work.

b. The concrete shall be mixed until all materials are uniformly distributed within the mixture, and for a period not less than one minute after all materials are in the mixer drum, when the drum is revolving at the speed for which it was designed. No materials for a batch of concrete shall be placed in the drum until all of the previous batch has been discharged therefrom. The water shall be added at the time the materials are being run into the mixer.

c. During construction, test cylinders shall be taken as directed by the Project Specifications or at the discretion of the Director. The Director shall be responsible for the cost of testing, unless otherwise stated in the Project Specifications.

2. Handmixing:

a. Handmixing of concrete shall not be permitted except in case of an emergency.

b. If handmixing is permitted, it shall be done on an impervious surface, such as a concrete pavement, using the same proportions with the addition of one extra sack of cement for each cubic yard of concrete mixed. The sand and cement shall be mixed dry until the mixture shows an even color throughout. The mixture shall be spread to a depth of eight inches on the mixing board, and the coarse aggregate then be spread to an even depth over it. The combined mixture shall then be cut through, turned and mixed with square-end shovels. Water shall be added from time to time and mixing continued until all materials are uniformly distributed throughout the mixture. Excess water shall be avoided in order to meet the requirements of the slump test. Aggregates and water shall be accurately measured.

Section E. CONVEYING AND PLACING.

1. Standard Practice:

a. The standard practice for conveying and placing concrete as outlined by the American Concrete Institute shall be followed. Concrete shall be conveyed from the mixer to the place of final deposit by methods which will prevent separation or loss of materials and contamination due to debris, dirt, or any foreign material. The maximum height of an unconfined drop of concrete shall be six feet. Equipment used shall be suitable and in good clean mechanical condition. Approved equipment for placing concrete by pumping shall be used when gravity methods become impractical or difficult. Before placing concrete in the forms or in the place of deposit, all debris and foreign materials, soft earth, mud, and water shall be removed. No concrete shall be placed in water unless entirely unavoidable, and then only with permission and approval of such method of placing that will prevent washing and dilution of the concrete. Steel or wood forms shall be oiled and treated to prevent adhesion of concrete and damage to the concrete surface upon removal of the forms. Concrete shall be placed as nearly as practicable in its final position to avoid segregation due to rehandling or flowing. Concreting shall be carried on at such a rate that the concrete is at all times plastic and flows readily into the forms and around reinforcing. No concrete shall be used that has partially hardened or has been contaminated by foreign material or that has been retempered.

b. When concreting has once started, it shall be carried on as a continuous operation until the section or structural unit is completed. The top surface shall be leveled or screeded or finished to the shape, level, and type of finish required by the Project Plans or Specifications and Standard Details. When construction joints are required, they shall be made in conformance with Part 5. Care must be used to avoid displacing or disturbing the reinforcing steel.

c. All concrete shall be thoroughly compacted by vibrators, spading, or other suitable means during the operation of placing to insure that concrete will flow around all reinforcement, embedded fixtures and into the corners and against the surfaces of the forms to give a dense finished product with true surfaces free from honey-combing and other imperfections.

d. Concrete, when delivered to the project, shall be subjected to reinspection and acceptance or rejection after its arrival.

e. No more concrete shall be delivered to the project than can be readily placed. All delivery tickets from the concrete shall be machine stamped with time of batch. All concrete not in place 90 minutes from batch time shall be subject to rejection

Section F. MORTAR AND GROUT.

1. Mortar Mixture For Sewer Construction:

   a. Mortar for sewer construction shall consist of a uniform mixture of Portland cement and sand with the minimum amount of water to produce the required consistency for the particular required use. No admixtures shall be used without the permission of the Director. All materials shall conform to the requirements specified in Part 2.

   b. Mortar shall be prepared in suitable mixing equipment or, for small amounts, on a hard impervious surface. It shall be kept free from contamination, debris, or other deleterious substances until incorporated in the construction. Retempered mortar or partially set mortar shall not be used.

2. Mortar For Other Purposes: Mortar for brick masonry is described in Part 4. Mortar for building or architectural purposes, or for special uses, will be described in the Project Specifications or on the Project Plans for such work.

3. Grout:

   a. Grout will be described in the Project Specifications or on the Project Plans or in the Standard Details with the item for which it is used. Retempered grout shall not be used. Grout shall be kept in a uniformly mixed condition during placing.

   b. Grout for filling the voids in grouted rip-rap, revetment, or rock surfacing shall consist of an eight sack mix of Portland cement per cubic yard with the minimum amount of water required to permit the grout to flow into the spaces. An approved air-entrainment agent shall be added to the grout. No separate payment will be made for mortar or for grout. Its costs are included in the various bid items requiring its use.

c. Special grout mixes will be considered for use by the Director at the time of construction.

Section G. FLOWABLE FILL.

1. Materials and Proportioning:

a. The contractor shall use the mix design as designated below. The mix design shall include a list of all ingredients, the source of all materials, the gradation of all aggregates, the names of all admixtures and dosage rates, and the batch weights.

	Ingredients	**Design Amounts Per Cubic Yard**
(1)	Cement	75 lbs
(2)	Fly Ash Type C	250 lbs
(3)	Fine Aggregate	2,800 lbs
(4)	Water	48.5 gallons (or as needed)
(5)	Air Entrainment	10 – 15%, by volume
(6)	Slump	8” minimum

b. Only the materials and proportions listed above may be used in the flowable fill mix design and the materials must be in accordance with the materials as listed per section in the current edition of the Missouri Standard Specification for Highway Construction.

2. Placement:

a. The mixture shall be discharged from the mixing equipment by a reasonable means into the space to be filled, or other methods approved by the Director. The flowable fill shall be brought up uniformly to the fill line as shown on the construction plans or as approved by the Director. Placing of material over the flowable fill may commence as specified or as approved by the Director. A vibrator shall not be used in placement of the flowable fill. The materials shall be mixed, delivered, and discharged within two (2) hours. During the filling operation, plugs may be required. Plugs shall be installed to confine the flowable fill as approved by the Director.

b. Flowable fill shall not be placed on frozen ground. Mixing and placing shall begin only if the air temperature is 35 F minimum and rising. At the time of placement, the material temperature shall be 40 F minimum. Mixing and placing shall stop when the air temperature is 40 F and falling.

c. The flowable fill shall not be placed in standing water or wet weather conditions. Flowable fill shall be protected from freezing and wet weather conditions until the material has stiffened and bleed water subsided during the first 24 hours after placement.

d. The flowable fill shall not be subject to load nor disturbed by construction activities until a minimum compressive strength of 30 psi for Portland cement

concrete pavement or 50 psi for bituminous concrete pavement has been attained or as approved by the Director.

Section H. CONSTRUCTION JOINTS.

1. Construction Joints:

   a. The placing of concrete shall be so planned that construction joints may be made where shown on the Standard Details or on the Project Plans, or where approved by the Director, and be so located and constructed as to impair the structure as little as possible. Additional reinforcement shall be provided at construction joints as required by the Project Plans and Specifications, and as directed. A structural key shall be provided as shown on the Project Plans or as directed. For a horizontal key, concrete shall be left with a roughened surface. Before concrete is to be placed against any keyed joint, its surface shall be cleaned and all laitance removed. Immediately before placing the new concrete, the surface of the joint shall be thoroughly coated with neat cement grout. Concrete in walls and columns shall be placed continuously from the base to the bottom of the slab or slab and beam construction. After placing concrete in columns or walls, at least two hours shall elapse before placing the concrete for the slabs or beams and slabs.

   b. Column caps, haunches, and corner fillets shall be considered as a part of the slab or floor construction and shall be placed integrally therewith. Joints in slabs shall be parallel and midway between the main reinforcing. Joints in slab and beam construction shall be located near the middle of the span of slab, beams, or girders. If a beam intersects a girder, the joint in the girder shall be offset a distance twice the width of the beam.

Section I. FINISHING.

1. General: Immediately after removing the forms, all fins or irregular projections shall be removed from all surfaces except those in contact with backfill and which are not to be exposed. All construction or special joints in the completed work shall be carefully tooled and be free of all mortar and concrete. On all surfaces, cavities produced by form ties, holes, honeycomb areas, broken edges or corners, and other surface defects shall be cleaned, and carefully filled, pointed and troweled to a true uniform smooth surface with sand-cement mortar mixed in the proportions used in the grade of concrete being finished. Such repaired surfaces shall be kept moist for a period of twenty-four hours.

2. Rubbed Surface Finish: Rubbed surface finish will not be required unless specifically required by the Project Plans and Specifications, except in the case of repaired surfaces where the uniform finished appearance of the exposed surface is important. Rubbing will not be permitted until the repaired surface has set for at least twenty-four hours. The final finish shall be attained by rubbing the repaired area and adjacent surface with a carborundum stone and water until the entire surface is of smooth uniform texture and color matching the adjoining surface. After rubbing is completed, any remaining paste, powder, or objectionable evidence of repair shall be completely removed.

Section J. CURING AND PROTECTION.

1. General: Provisions shall be made for protecting concrete, brick masonry, and cement plastering against damage from freezing or from lack of moisture. All concrete placed into the forms shall have a temperature between 50 and 90 degrees F. The Contractor will be responsible for all damage to the concrete surface due to the flow of water over uncured concrete, vandalism, etc. Unless otherwise provided in the Project Specifications, the cost of curing and protection are included in the payments made for the bid items of construction requiring the use of curing and protection for cement and concrete work.

2. Cold Weather: All job-stored materials shall be covered and protected from ice and snow. The temperature of mixing water shall not be less than 55 degrees F nor more than 165 degrees F. All reinforcement, forms, fill material and ground which the concrete will contact shall be free of frost or ice and snow. Whenever the temperature of the surrounding air is 40 degrees F and falling, no concrete shall be placed unless the Contractor has on hand sufficient, suitable, and approved means of protecting the concrete. The subgrade of any structures on which concrete is to be placed shall be adequately protected, if necessary, to prevent freezing prior to placing. Whenever the temperature of the surrounding air is below 40 degrees F adequate means shall be provided for maintaining a temperature in the surrounding air of not less than 70 degrees F for as much time as necessary to insure proper curing of the concrete. The housing, covering, or other protection used shall remain intact and in place at least twenty-four hours. If the structure is backfilled the next day, the backfill will be considered adequate protection in lieu of the housing or covering that is initially required. Salt or chemicals shall not be used to prevent freezing. Whenever the temperature of the surrounding air reaches 32 degrees F and lower, concrete shall not be placed except with approval of the Director, who shall state the time in addition to that specified herein that artificial heat and protection must be supplied. Whenever the temperature of the surrounding air reaches 20 degrees F or lower, no concrete shall be placed except for emergencies and only with permission of the Director.

3. Hot Dry Weather: Provision must be made to protect concrete, brick masonry, and cement plastering from drying, and to maintain a moist condition for curing for at least five days after placing of concrete and at least two days after laying and plastering brick masonry. For high-early-strength concrete, moist curing shall be provided for at least two days after placing. Plastering on the outside of manholes and the top and side surfaces of monolithic sewers may be cured by use of approved curing compounds uniformly sprayed as recommended by the manufacturer.

Section K. CONCRETE FORMS.

1. Forms:

    a. Forms shall conform to the shape, lines, dimensions, and elevations of the structures shown on the Project Plans or the Standard Details. They shall be substantial and tight to prevent the leakage of mortar. Be of adequate strength and properly braced to rigidly maintain their shape, position, and elevation under all loading conditions. Forms for exposed surfaces such as the interior of sewers, faces of headwalls and architectural concrete shall produce a smooth regular true surface without offset, joint marks or surface blemishes.

b. Joints shall be butt joints. Forms and centering shall be designed to allow their removal without damage to the structure. Forms for walls of rectangular section sewers on curves shall be laid to a true curve using a maximum of two feet form sections and they shall be plumbed and constructed in a manner so that they are uniform and in proper alignment. Inside exposed edges of walls, and edges next to expansion joints in walls shall be chamfered 3/4 inch. Other exposed corners and edges next to expansion joints shall be properly tooled.

c. Wood spreaders shall not be used. Only metal form ties and spreaders with removable heads shall be used, so that, upon removal of forms, exposed metal ends can be covered with at least one inch cement mortar.

d. Concrete in walls to be placed against rock excavation may be placed against the rock without back forms, provided care and precautions are taken to prevent the contamination of the placed concrete due to falling earth and other debris. Back forms must be provided for walls to be placed against earth excavation. Loose earth likely to fall into the forms must be stripped back, and precautions taken to prevent contamination of the placed concrete. In cases where circumstances require placing of concrete against vertical earth excavation for walls, similar precautions must be taken, and the earth surface stabilized with sprayed asphalt emulsion.

e. Forms and supporting forms or shoring shall not be removed until the concrete has attained sufficient strength to permit removal without injury to the concrete or to the strength of the construction, and able to support safely its own weight and the load upon the construction. Supporting forms for all beams, arches or slabs shall remain in place for a minimum of seven days. Supporting shores may be required after removal of forms. The Contractor shall be responsible for all damage due to premature removal of forms. Forms shall be cleaned and oiled upon removal. Defects in the exposed surfaces of the concrete shall be repaired.

Section L. REINFORCING STEEL.

1. General Requirements:

a. All reinforcing steel shall conform to the requirements of Part 2. The Contractor shall provide shop drawings for bending and placing, and a bar list of furnished reinforcing and accessories. With the Director's permission, Grade 40 steel will be allowed to be field bent, one time only. The steel shall be cold bent around an appropriate template. All other grades of steel shall not be field bent.

b. Steel reinforcing bars shall be of the sizes and be accurately placed, spaced, and located as shown on the details of the Project Plans or Standard Details. Bars shall not be spliced except where shown on the plans or permitted by the Director.

c. Use of bar-splices at locations of maximum stress shall be avoided, and if unavoidable, shall develop the full strength of the bar. The length of splice for main stressed bars shall be not less than 30 diameters; and for non-stress or temperature bars, shall be not less than 20 diameters. In case that the plans do not show the required thickness of concrete cover for reinforcement in sewer construction, the required concrete thickness shall be as follows: three inches at bottom and sides of footings and slabs in contact with earth, two inches in formed walls and at inside face of sewers.

d. Exposed reinforcement or dowels for bonding future extensions shall be protected from corrosion by concrete or other adequate covering. Bars shall be securely wired and held in position by approved chairs and spacers. When use of chairs is impractical, approved concrete supports may be used. The methods used must be such that reinforcing cannot be disturbed or moved from the required position during placing of the concrete.

e. Reinforcing steel shall be free of mud, mill scale, rust, paint, oil, or other deleterious coating. No reinforcing shall be set in a muddy or wet excavation. Reinforcing shall be inspected and approved by the Director before any concrete is placed.

PART 6 – TRENCHLESS SEWER CONSTRUCTION

Section A. GENERAL.

1. Type: Trenchless sewer construction consists of either new installation or existing pipe renewal through the construction of sewers with a minimal amount of surface excavation as compared to open trench construction.

2. General Construction Condition:

    a. Pipe sewers shall be constructed of the sizes, classes and materials and to the alignments and grades given by the Project Plans and Specifications.

    b. All materials shall conform to the requirements of the pertinent current specifications of ASTM and Part 2 Materials, except as otherwise specified in the Project Plans and Specifications. All materials shall be inspected on delivery and such material which is not suitable for use, as determined by the City, shall be rejected and immediately removed from the site of the work or destroyed.

    c. The grade shown on the profiles to which the work must conform is that of the pipe flowline or the low point of the pipe invert.

    d. The Contractor shall verify the exact location and elevation of existing utilities and sewers immediately prior to actual construction. Any differences should then be brought to the attention of the Director.

3. Settlement Monitoring: The contractor shall monitor ground movement during it's new and pipe replacement operations. Monitoring of ground movement directly over the new pipe alignment and at adjacent structures will be required. Immediately report to the Director any movement, cracking or settlement which is detected. The Contractor shall adjust his means and methods to prevent additional movement.

Section B. PIPE SEWERS IN EARTH TUNNEL.

1. Construction Alternatives: Pipe Sewers in tunnel in earth shall be constructed where required by the Project Plans and in accordance with these Standard Specifications. If not prohibited on the Plans, and if otherwise practicable and desirable, the Contractor may request permission to construct this sewer in a bored hole, jacked liner, by the tunnel bore method, or by jacking. Considerations by the City for construction alternatives will include:

    a. No additional costs to the City for the alternative construction method.

    b. The Contractor shall be responsible for all cost of engineering review and design of the alternate method.

    c. No additional time shall be added to the contract duration, as described in the contract documents.

2. Tunneling:

   a. The Contractor shall carry out the work of tunneling and supporting the tunnel face, roof, walls, and floor so that there will be no fall or flow or caving or heaving of earth or other materials into the tunnel excavation, nor any other cause for endangering human life, or any public or private property above or adjacent to the tunnel. If there should be any fall or movement of earth into the tunnel at any time, the Contractor shall proceed with the work with all necessary precautions and in such a manner as will insure the safety of life and of all sewers, utilities and public and private property above and adjacent to the tunnel. If any sewer or utility above or adjacent to the tunnel is endangered or has been damaged because of the tunneling operations or movements of earth, that utility shall be notified immediately and shall be given access to the work to carry out all necessary safeguards and repairs to such sewers or utilities. If any public or private property is endangered or has been damaged, it shall be repaired at the Contractor's expense. All cost and expense to the Contractor of carrying out the above requirements shall be considered to be included in his bid prices for the completed sewer in tunnel.

   b. The Contractor shall make all excavations necessary for the construction of sewers in tunnel, whether in earth or partly in earth and in rock, shall furnish, place, and maintain all sheeting, bracing, lining or casing required to support the tunnel floor, roof, sides, and face until the pipe and its bedding, jointing, encasement, and backfilling has been completed. All liners shall remain in place. Methods are optional with the Contractor, provided the work can be carried out expeditiously, carefully, and in compliance with these specifications. Care shall be used in trimming the surfaces of the excavated section and in placing the liners or sheeting and bracing, so that the required minimum clearance between the outside of the pipe and the final position of the liners, sheeting and bracing in the tunnel will be attained without any deviation in sewer alignment. Sheeting or lining must be placed and held tightly against the trimmed earth surface of the excavated section so that there will be no voids between the earth and the lining or sheeting placed against it. No part of the lining, bracing, or flanges of steel liner plates shall project closer to the outside of the pipe or pipe bells than the clearance limits shown on the Project Plans, or a minimum of two inches, if not shown on the Plans. If timber is used for lining and bracing instead of steel liner plates, invert struts shall be placed at the required intervals but in such manner that the pipe and its bedding will be supported entirely by the original earth floor of the tunnel and not on timber lining or bracing. Timbering shall be so designed and placed that there will be no space or pockets that cannot be packed and filled. All excavated material not required for backfilling abandoned shafts shall be removed from the site and disposed of by the Contractor at his expense.

3. Shafts:

   a. Shafts shall be constructed at the location shown on the Project Plans and in accordance with the Project Specifications. Temporary construction shafts shall be of adequate size and properly constructed and equipped to meet all requirements of safety to personnel and to the work. All shafts shall be fenced and properly guarded from the beginning of the excavation until the completion of the construction requiring the shaft.

b. Additional shafts, if requested by the Contractor, will not be allowed unless the Contractor secures additional access and unless the City approves the request in writing.

c. Provision shall be made at all shafts so that plumblines suspended on the centerline of the sewer at each end of the shaft will hang freely from the surface.

d. A substantially constructed ladder shall be provided in each shaft, and shall be kept in safe good repair, clean and clear of debris.

e. Lights, barricades, signs, and watchmen (when watchmen are required by the Project Plans or Specifications, or when ordered by the Director) shall be provided and maintained to properly protect the public, the workmen, and the work against injury.

4. Tunnel Plant: When necessary, requirements for power machinery and equipment within shafts and tunnels will be given in the Project Specifications.

5. Tunnel Drainage: The Contractor shall furnish and operate all necessary pumping equipment of ample capacity and make all necessary provisions to keep tunnels and shafts free of water during construction, and to satisfactorily dispose of such water. During placing of concrete, drainage and pumping shall be so arranged that concrete is placed in the dry and that no water will flow over the concrete until it has set and will not be damaged, and not sooner than two hours after initial set. The Contractor shall have on hand at all times sufficient equipment in good working order for all ordinary emergencies that are likely to arise.

6. Spaces Between Tunnel Excavation and Liner: Tunnel excavation shall be trimmed as nearly as practicable to exact line and grade and to such shape and size as will allow the construction of the sewer section as shown on the Project Plans. Cavities or spaces between the actual surfaces of excavation and the tunnel liner plates, whether from avoidable or unavoidable causes, shall be completely filled with a uniform sand-cement grout, consisting of one part Portland cement and seven parts sand and the minimum amount of water necessary for proper placing, placed under pressure through grout-hole nipples in the steel liner plates. The grout-holes shall be so located and the grout be placed in such sequence as to insure the complete filling of all cavities and spaces, and of carrying loads uniformly from the undisturbed material to the tunnel lining.

7. Pipe Laying: After the tunnel section is excavated and lined, the pipe shall be placed on and supported by steel rails or other approved supports. The supporting system shall assure line and grade and shall allow space below the pipe for concrete. Care shall be used to avoid damage to the pipe or to the liner plates. Any such damage shall be replaced when so directed by the Director.

8. Spaces Between Pipe and Tunnel Liner or Rock Surfaces: After laying the pipe, uniformly compacted or pumped Class "B" concrete shall be placed to fill all spaces between the outside of the pipe and inside surface of the lining or the prepared surface of the rock if the tunnel is in sound rock.

9. Removal of Temporary Shafts: Temporary shafts shall be completely abandoned. Unless otherwise specified on the Project Plans and Specifications, all sheeting, bracing, etc., may be removed or left in place at the Contractor's option. No payment will be made for sheeting, bracing, etc., left in place at the Contractor's option. If the Project Plans or Specifications require leaving the sheeting, bracing, etc., in place, payment will be made as provided in the Project Specifications. The shafts will be backfilled with approved material.

Section C. PIPE SEWERS INSTALLED BY TUNNEL BORE METHOD.

1. General: When permitted as an alternate method of construction by the Project Plans and Specifications or when permitted by the Director upon written request by the Contractor in substitution for the method of construction shown on the Plans, pipe sewers may be constructed by the Tunnel Bore Method. When planning to use the Tunnel Bore Method, the Contractor shall submit full detail of materials, equipment, and method of operation. Approval in writing by the Director shall be obtained in advance of starting the work. In any case, the Contractor shall retain full responsibility for the adequacy of the Tunnel Bore Method equipment, materials, and method to ensure that the work is installed as described in the contract documents, including construction within the time limits also described in the contract documents.

2. Equipment and Methods: Equipment and methods for the Tunnel Bore Method as proposed by the Contractor shall include:

    a. All applicable requirements of Section B, "Pipe Sewers in Earth Tunnel", in order to meet line and grade of the sewer as described in the contract documents.

    b. The Contractor shall provide all additional access and working room as may be required to accommodate the Contractor's method.

    c. The Contractor shall describe pipe repair procedures to be taken for damaged pipe, if damage should occur during installation.

    d. The Contractor shall provide the pipe joint design and any special care required for the application proposed.

    e. All utilities required to operate equipment for the tunnel bore method unless otherwise provided.

3. Material: Sewer pipe material and class will be as approved by the City.

4. Tunnel Bore Machine: The tunnel bore machine shall, as a minimum:

    a. Be capable of fully supporting the face both during excavation and shutdown.

    b. Be steerable and capable of controlling the advance of the heading to maintain line and grade.

    c. Be capable of supporting the surrounding excavated surfaces.

d. Be capable of preventing soil and water infiltration between excavation at the face and the installation of the ground support system.

5. Tunnel Bore Lining: Tunnel lining shall be provided to support the surrounding excavation. The following materials are allowable:

a. Steel liner plate.

b. Ring beams and lagging.

c. Carrier pipe of approved type, thickness or class. The carrier pipe must be of sufficient strength for use as a liner and for tunnel construction. The carrier pipe design must be reviewed and approved by a Registered Engineer at no cost to the City.

Section D. PIPE SEWERS IN ROCK TUNNEL.

Sewers in rock tunnel shall be constructed with a concrete lining only when required for the particular project. It shall be constructed in accordance with the Project Plans and Specifications and the applicable requirements of Parts 3, 4 and 5 of these Standard Specifications.

Section E. PIPE SEWERS IN BORED HOLES.

1. Construction Requirements:

a. When permitted as an alternate method of construction by the Project Plans and Specifications, or when permitted in writing by the Director upon written request by the Contractor in substitution for the method of construction shown on the Plans, pipe sewers may be constructed in bored holes. The boring machine to be used shall be in good mechanical condition and capable of drilling the bore hole within the required limits of accuracy. A smooth liner of sufficient strength shall be forced into the bored hole to give a tight fit against the earth sides of the bore hole and still provide a uniform clearance of at least two inches around the pipe flange to permit pressure grouting. For gravity and force main sewers eight inches in diameter and larger the smooth liner shall be a minimum of two feet in diameter. The liner pipe shall be carefully inspected to insure that the carrier pipe can be properly placed. The pipe to be placed in the bore hole shall be ductile iron pipe of the required size and class. No plastic pipe shall be allowed. The mechanical or approved slip- joint connections between ductile iron pipe lengths shall be made carefully in accordance with the manufacturer's instructions. After placing the assembled pipe in the borehole, the ends shall be blocked to secure the proper flowline elevations at each end and to insure the placing of grout at the bottom and sides of the pipe. If necessary or required, a skid or shoe shall be provided for the pipe bell to permit flow or grout beneath the pipe, and to prevent sagging and pockets along the pipe flowline. The assembled and jointed pipe shall be placed in the borehole only by such method that will keep the joint in compression. Any method tending to unjoint the pipe while being placed will not be permitted.

b. The spaces between the liner and the outside of the pipe shall be filled solidly with grout placed under mechanical pressure. Before placing grout, the carrier pipe shall be carefully inspected for uniformity of grade along its alignment, and any required corrections made. Particular attention shall be given to insuring that the pipe will be solidly supported by grout at its bottom and sides. The method of injection under mechanical pressure shall be approved by the Director. Grout shall consist of an approved mix and it shall be placed by inserting the grout pipe to its greatest distance to insure filling all spaces, and then gradually withdrawing the pipe as filling proceeds.

c. Manholes at the ends of a section of sewer, part or all of which is constructed in a bored hole, shall not be constructed until the bored section is completed, in order to allow corrections for slight deviations in line and grade. The completed sewer constructed in a bored hole shall not deviate from its required alignment more than one percent of the total length of the bored hole, nor more than one-tenth foot from its required terminal elevation. If the deviations are greater than these, the construction shall be removed and replaced unless the Director, in writing, accepts and approves the actual construction as a result of a written request made by the Contractor for such acceptance and approval.

2. Abandoned Bored Hole:

a. When the Project Plans specifically state that the sewer be constructed in a bored hole, and unforeseen obstructions require abandonment of a partially completed borehole, and the starting of a new hole, the Contractor will be paid for his expense of drilling and backfilling such abandoned borehole by force account. It is required that complete detailed records be kept of time, labor, materials, and equipment on all work of boring each hole, whether completed or abandoned.

b. If the Contractor was permitted, or requested and obtained approval to use a bored hole in lieu of the method specified in the contract documents, but is not successful in completing the construction by the boring method, the Contractor shall receive no compensation for any expenses incurred by his unsuccessful attempt.

3. Use of Ductile Iron Pipe: When a section of ductile iron pipe adjoins a section of dissimilar sewer pipe without an intervening manhole, the method of joining will require approval by the Director prior to its construction. Care shall be used to insure alignment of the inside surfaces of the pipes and their flowlines.

Section F. PIPE SEWERS IN JACKED LINER.

When permitted as an alternate method of construction by the Project Plans and Specifications, or when permitted by the Director upon written request by the Contractor in substitution for the method of construction shown on the Plans, pipe sewers may be constructed by jacking a pipe as a liner and inserting a carrier pipe of required size, type and class. When planning to use jacking for liners, the Contractor shall state in writing the kind, type and strength of liner, the type of joint proposed and the method of operation. Approval in writing by the Director shall be obtained in advance of starting the work. In any case, the Contractor shall retain full responsibility for the adequacy of his jacking operation equipment and materials.

Section G. SEWERS INSTALLED BY JACKING.

When permitted as an alternate method of construction by the Project Plans and Specifications, or when permitted in writing by the Director upon written request by the Contractor in substitution for the method of construction shown on the Plans, pipe sewers may be constructed by jacking. When planning to use jacking, the Contractor shall submit full details of materials and method of operation. Approval in writing by the Director shall be obtained in advance of starting the work. In any case, the Contractor shall retain full responsibility for the adequacy of his jacking operations equipment and materials.

Section H. PIPE SEWERS INSTALLED BY MICROTUNNELING.

1. General: When permitted as an alternate method of construction by the Project Plans and Specifications or when permitted by the Director upon written request by the Contractor in substitution for the method of construction shown on the Plans, pipe sewers may be constructed by microtunneling. The contractor may use the pilot-tube microtunneling (PTMT) or microtunneling boring machine (MTBT) method. When planning to use the microtunneling method the contractor shall submit full detail of materials, equipment and method of operation. Approval in writing by the Director shall be obtained in advance of starting the work. In any case the contractor shall retain full responsibility for the adequacy of the microtunneling method, equipment, materials and means to insure that the work is installed as described in the contract documents, including construction within the time limits also described in the contract documents.

2. Performance:

    a. Microtunneling equipment selected for the project shall be compatible with the geologic conditions described in the Geotechnical Data and Interpretive Reports.

    b. Only pressurized, closed-face, remotely operated microtunneling equipment shall be used for all microtunneling work required for this project. Face pressure exerted at the heading by the microtunneling machine shall be maintained as required to balance soil and groundwater pressures present, and prevent loss of ground and groundwater inflows. Dewatering for groundwater control shall be utilized only at the jacking and receiving pits. Methods and equipment used shall control surface settlement and heave above the pipeline to prevent damage to existing utilities, facilities, and improvements. The contractor shall repair any damage resulting from surface settlement or heave caused by microtunneling, or tunnel shaft construction at no additional cost to the City.

    c. The contractor shall assume full responsibility for selection of appropriate pipe and pipe joints to carry thrust of any jacking forces or other construction loads in combination with overburden, earth and hydrostatic loads. Design of any pipe indicated on the Construction Drawings considers in-place loads only and does not take into account any construction loads. Criteria for longitudinal loading (jacking forces) on the pipe and pipe joints shall be determined, based on the Contractors' selected method of microtunneling. Contractor shall also take into account loads on pipe from handling and storing.

Section I. PIPE SEWERS INSTALLED BY DIRECTIONAL DRILLING.

1. When permitted as an alternate method of construction by the Project Plans and specifications or when permitted by the Director upon written request by the contractor in substitution for the method of construction shown on the plans and specifications, pipe sewers may be constructed by horizontal directional drilling (HDD)

2. The contractor shall submit in writing the planned procedure for performing the bore within the line and grade as shown on the plans including:

    a. Describe and provide a means for accurately verifying the location of the pilot bore at points throughout the bore. Verification may be by visible or electronic detection. If electronic detection alone is used, the manufacturer of the equipment must supply a guarantee that the equipment is accurate within 0.10 feet at all points throughout the bore.

    b. Describe and provide a means that the pilot bore stem will remain in the correct alignment prior to back reaming.

3. No individual bore shall exceed a maximum overall distance of 400 feet unless approved by the Director prior to the start of the bore.

4. Pipe materials shall be as approved by the Director.

5. Unsuccessful reamed bore holes shall be filled with an approved grout.

6. The Contractor shall retain full responsibility for the adequacy of its directorial drilling operations, equipment and material.

Section J. PIPE SEWERS INSTALLED BY PIPE BURSTING.

When permitted as an alternate method of construction by the Project Plans and specifications, or when permitted in writing by the Director upon written request by the contractor in substitution for the method of construction shown on the plans pipe sewers may be constructed by pipe bursting the existing pipeline and pulling or pushing in a replacement pipe. When planning to use pipe bursting the contractor shall submit full details of materials and methods of operation. Approval in writing by the Director shall be obtained in advance of starting the work. In any case the contractor shall retain full responsibility for the adequacy of its pipe bursting operations, equipment and materials.

Section K. SEWERS REHABILITATED USING CURED-IN-PLACE PIPE.

Pipe rehabilitation using cured in place pipe shall be as specified in the Project Plans and specifications.

Section L. POINT REPAIRS.

When during the trenchless rehabilitation of an existing pipeline it becomes necessary to excavate over the existing pipeline as determined by the contractor and approved by the Director. The contractor shall excavate the minimum volume required to expose the existing

damaged/collapsed pipeline and replace it as approved by the Director. This does not include existing pipe broken as a result of the contractor's rehabilitation method.

Section M. GROUTING.

1. General: When required by the Project Plans and Specifications, or by the Standard Details of Construction and Specifications, or when ordered by the Director, grouting shall be done by the Contractor. Grout may be required to set anchors or dowels in holes drilled in rock or concrete, to fill spaces between excavated tunnel surfaces and linings of tunnels or bored holes, or voids in packed rock, etc.

2. Mixtures: Grout shall consist of a uniform mixture of Portland cement and sand, as specified for a particular purpose, either in these Specifications or in the Project Specifications, and with the minimum volume of water as may be found necessary to accomplish the intended result. If ordered by the Director, neat cement grout shall be used. The use of special cements or admixtures for particular uses will be specified in the Project Specifications, if required.

3. Grouting Requirement and Application:

    a. All grouting equipment and appurtenances shall be in good mechanical working condition, of an approved type of design with ease of control to permit uniform operation without excessive pressures, and with adequate capacity to permit continuous satisfactory progress in the required grouting. Grout for filling voids or spaces shall be applied through a pipe or hose in a continuous operation without disturbance of grout which has taken initial set. The grouting operation and sequence shall be so conducted as to insure complete filling of voids or spaces and shall be sufficient to fill all spaces without distorting or damaging the structure, or without lifting or distorting the adjacent or overlying confining materials.

    b. Grouting for filling voids and connecting surface irregularities in mass crushed-rock, rip-rap, or similar paving is described in Part 5.

Section N. METHODS OF MEASUREMENT AND BASIS FOR PAYMENT.

1. General:

    a. Payment will be made for the materials furnished and completed, work done under the contract as stated herein in accordance with actual measurements or as specified in the Project Plans and specifications. The contractor shall not be entitled to receive additional compensation for anything furnished or work done, except for extra work authorized by written order of the Director, or for which provision has been made in the Project Plans and specifications which will state the method of measurement and basis of payment for any item of construction not covered by this section of the standard specifications.

    b. It is the intent of these specifications to pay only once for any given item of work or material to be furnished, except where it is clearly specified as an addition to the bid price for the unit quantity. Duplication of quantities, units or bid items will not be permitted, even though the Project Plans or specification may, through error or oversight, allow such duplication.

2. Pipe Sewers in Earth Tunnel:

   a. Payment will be made for the construction of completed pipe sewers in earth tunnel at the respective bid price for each size and type per lineal foot for Completed Sewer in Earth Tunnel. The length for which payment will be made will be the measured horizontal distance along the centerline of the sewer to the paylines of excavation for shafts or to the portal of the tunnel excavation. The payments made shall include all cost of shafts, headings, liner plates, timbering, grouting, drainage, lighting, ventilation, all Class C excavation, pipe in place, concrete, reinforcing, masonry, bedding, cradling or encasing, backfilling tunnel and any additional costs required to construct the completed pipe sewer in tunnel in earth. If Class B excavation is encountered in earth tunnel, payment will be made at the actual volume of Class B excavation removed within limits, which shall not extend more than twelve inches on either side of the pipe bell or the diameter of the tunnel liner, whichever is smaller. The minimum volume paid will be that of a four foot diameter casing pipe. Payment will be made at the bid price for Class B excavation in Earth Tunnel and will be an additional payment to the payment made for completed sewer in earth tunnel.

   b. If Class A excavation is encountered in Earth Tunnel, payment will be made for the actual volume of Class A excavation removed within the same limits as set for Class B excavation. Payment will be made at the bid price for Class A excavation in Earth Tunnel or, in absence of a bid price or an agreed price, by force accounts and will be an additional payment to the payment made for Completed Sewer in Earth Tunnel.

3. Pipe Sewers Installed by Tunnel Bore Method: Payment will be made for the construction of completed pipe sewers installed by the "tunnel bore method" by the same method outlined for the payment of pipe sewers in earth tunnel, as delineated in these Specifications.

4. Pipe Sewers in Bored Holes:

   a. Payment for completed pipe sewer in a bored hole, when required or permitted as an alternate to pipe sewer in tunnel shall be made at the bid price for the construction method specified and for the length constructed in a bored hole. When permitted as an alternate to open-cut construction, payment will be as if the sewer has been constructed in open-cut with payment for Class C excavation, for the type and class of pipe originally specified, with allowance for pavement to be removed and replaced, and for required granular or compacted backfill. There will be no payment for the additional cost of the pipe and its encasement, and no allowance for lumber left in trench. Permission to use construction involving a bored hole and ductile iron pipe instead of the construction originally specified shall not entitle the Contractor to any compensation for costs of an unsuccessful or an incomplete attempt to use a bored hole. Any excavated material removed by an earth boring auger will be considered Class C for payment purposes other than material that has been identified as Class A excavation.

b. Payment for completed pipe sewer in a bored hole where specified by the Project Plans and Specifications, or where ordered by the Director, shall be made at the bid price per lineal foot of completed specified sewer constructed in a bored hole. The length of sewer for which payment will be made shall be the measured horizontal distance along the centerline of the pipe between the faces of the bore limited to the length required by the Project Plans and Specifications, unless such length has been ordered increased by the Director. Such payment shall cover all costs of labor, materials, equipment and tools to prepare the boring pit, bore the hole, install the liner pipe, lay and joint the ductile iron pipe, provide concrete collars at the junctions with other types of pipe, completely fill the annular space around the pipe, backfill the boring pit, and do all other things necessary or required for constructing the completed pipe sewer in a bored hole.

5. Pipe Sewers in Jacked Liners: Payment for completed pipe sewer in a jacked liner, where permitted by the Project Plans and Specifications as an alternate to a pipe sewer in tunnel in earth, shall be made at the bid price for the construction method originally specified. Permission to use construction involving a jacked liner shall not entitle the Contractor to any compensation for any additional expenses or for the costs of an unsuccessful or incomplete attempt to use jacking. When permitted as an alternate to open-cut construction, the method shall be approved by the Director.

6. Pipe Sewers Installed by Jacking: Payment for the construction of pipe sewers installed by jacking at the approved request of the Contractor as an alternate to tunneling will be made at the bid price for the given size of specified pipe sewer in tunnel, unless an agreed price has been established. The length of sewer for which payment will be made shall be the measured horizontal distance along the centerline of the pipe between the ends of the completed pipe sewer jacked into final position, limited to the length which shall not exceed the distance between tunnel faces. Such payment shall cover all cost of labor, materials, equipment and tools for the jacking pit, guides, and jacks; drainage and excavation; furnishing, jointing, and jacking the pipes; and doing all things necessary to construct the completed pipe sewer by jacking. Permission to install a pipe sewer by jacking instead of the construction originally specified, shall not entitle the Contractor to any compensation for any additional expenses or for the costs of an unsuccessful or an incomplete attempt to use jacking.

7. Grouting: Unless otherwise provided by the Project Plans and Specifications, no separate payment will be made for grouting. Any costs of furnishing and placing grout as required by the specifications for any specific item shall be considered to be included in the payments made for such item or items.

8. Pipe Sewers Installed by Microtunneling: Payment will be made for the construction of completed pipe sewers installed by the microtunneling method, by the same method outlined for the payment of pipe sewers in earth tunnel, as delineated in these specifications.

9. Pipe Sewers Installed by Directional Drilling

   a. Payment for completed pipe sewer in a directionally drilled hole, when required or permitted as an alternate to pipe sewer in tunnel shall be made at the bid price for the construction method specified and for the length constructed in a bored hole. When permitted as an alternate to open-cut construction, payment will be as if the sewer has been constructed in open-cut with payment for class “C” excavation, for the type and class of pipe originally specified, with allowance for pavement to be removed and replaced, and for required granular or compacted backfill. There will be no payment for the additional cost of pipe and no allowance for lumber left in place. Permission to use the directional drilling method shall not entitle the contractor to any compensation for costs of an unsuccessful or an incomplete attempt to use a bored hole. Any excavated material removed by the directional bore will be considered Class “C” for payment purposed other than material that has been identified as Class ”A” excavation.

   b. Payment for completed pipe sewer in a directional bored hole where specified by the Project Plans and specifications, or where ordered by the director, shall be made at the bid price per linear foot of completed specified sewer constructed in a drilled hole. The length of sewer for which payment will be made shall be the measured horizontal distance along the centerline of the pipe between the faces of the bore, limited to the length required by the Project Plans and specifications, unless such length has been ordered increased by the Director. Such payment shall cover all costs of labor, materials, equipment and tools to prepare the site, bore the hole, install the pipe, handle and dispose of drilling fluid and material removed, completely fill the annular space around the pipe if greater than ½ inch, connecting pipe at junctions with other pipe or structures, and do all other things necessary or required for constructing the completed pipe in a directionally drilled hole.

10. Pipe Sewers Installed by Pipe Bursting: Payment will be made for the construction of completed pipe sewers installed by pipe bursting for each size and type per linear foot. The length of which payment will be made will be the measured horizontal distance along the centerline of the sewer to the paylines of excavation for pits and structures. The payment shall include all costs of labor, materials, equipment and tools to prepare the access pits, burst the existing pipe supply and install the new pipe, make connections to existing pipe or structures at each end, backfill the pits and do all things necessary or required for constructing the completed pipe sewer in a burst pipe.

11. Pipe Sewer Rehabilitated Using Cured-In-Place Pipe: Payment will be made for the successful installation of cured-in place pipe for each size and thickness per linear foot. The length for which payment will be made will be the measured horizontal distance from inside face of manhole or structure to the inside face of manhole or structure. The payment shall include all costs of labor, materials, equipment and tools to prepare installation and receiving manholes, supply and install the liner, cure the liner, re-install service, seal the liner at manholes and structures and do all things necessary or required for constructing the cured-in-place pipe.

12. Point Repairs:

    a. Payment for point repairs shall be at the unit bid price for point repairs. The price shall include all costs of labor, materials, tools and equipment required to excavate and repair the existing pipeline, backfill and restore the point repair site.

    b. No payment shall be made for point repairs required to repair damage done by the contractor or to retrieve any of the contractor's equipment.

13. Monitoring and Testing: All costs for settlement monitoring and product testing required during construction shall be included in the respective costs for pipe and will not be paid for separately. All testing shall be done by an approved independent tester with the results sent directly to the City.

PART 7 - MISCELLANEOUS

Section A. GENERAL.

Requirements for items of construction not previously described in the preceding Parts are set forth in this Part.

Section B. CONNECTIONS TO EXISTING FACILITIES.

1. General:

    a. New pipe sewers shall be connected to existing sewers only at existing manholes, or at locations requiring the construction of a new manhole on the existing sewer, unless otherwise approved by the Director.

    b. Lateral connections to existing sewers shall be installed as shown in the Standard Details of Sewer Construction. All connections shall be an approved watertight manufactured fitting. Connection of lateral to existing pipe sewer by grouting is not allowed.

    c. The Contractor shall verify the exact location and elevation of existing sewers immediately prior to actual construction. Any differences should then be brought to the attention of the City.

2. Existing Manholes:

    a. If a bulkhead opening of adequate size or a stub of proper size, elevation, location, and direction exists at the manhole, the pipe connection will be made as required for pipe laying. The cost of removing the bulkheads and making the pipe connection is included in the cost of laying the new pipe sewer. If the existing stub is not suitable for use, or if no stub exists, a new connection must be made to the manhole in accordance with the standard detail for new pipe connection to existing manhole or structure. Particular care shall be given to insure that the earth sub-base and bedding adjacent to the manhole will provide firm solid support to the pipe.

    b. Payment will be made for the costs of properly handling all existing flows, cutting a hole in the existing manhole, adjusting the invert, and making a completed pipe connection at the bid price for making a pipe connection to an existing manhole. New connections at levels above the manhole flowline for inlet lines will be made similarly except for the requirements of invert adjustment, unless otherwise required in the Project Plans and Specifications. Payment will be made at the bid price for making a pipe connection to an existing manhole.

3. New Manholes:

    a. If a new manhole must be constructed for the connection, the new manhole and invert shall be constructed over and around the sewer pipe to the elevation shown on the Project Plans. The work shall be done carefully to avoid breaks in the existing sewer until the manhole is completed.

b. After construction of the manhole, the top half of the existing pipe shall be carefully cut and removed to be flush at each end with the inside wall and pointed up to present a neat smooth surface at the junction of the cut pipe with the invert and wall. The newly placed concrete, mortar, or plastering at the connection shall be protected from sanitary sewage or foulwater by completely covering with a thick coat of emulsified asphalt applied after initial set of the mortar or concrete. No sewage or water shall be permitted to touch the protected surfaces until the emulsion has set and properly hardened.

c. Payment will be made for constructing a new manhole over an existing sewer at the bid price as described for manhole construction. The costs of properly handling all existing flows, cutting and removing the pipe, and pointing up are included in the payment made for manhole construction.

Section C. CROSSINGS OF RAILROADS, STREETS, HIGHWAYS AND STREAMS/CHANNELS.

1. General: Sewer crossings of railroads, State highways, and City streets shall be made as shown on the Project Plans and required in these specifications and the Project Specifications. The Contractor also shall inform himself of any additional requirements or permits of the railroad, Missouri Department of Transportation (MoDOT), or City of Jackson Street Department for working within its jurisdiction.

2. Crossings In City Streets: Crossings in City streets normally are made in open-cut construction, unless otherwise required by the City and shown on the Project Plans. Construction and payment are described in Parts 3 and 4 for the particular items involved.

3. Crossings Under MoDOT Highways: Crossings under highways will be made in bore-holes or tunnels beneath paving, unless otherwise approved by the MoDOT and shown on the Project Plans.

4. Crossings Under Railroads: Crossings beneath railroads will be made in tunnels, unless otherwise required by the railroad and shown on the Project Plans. Work shall be done in full cooperation with the railroad company. The Contractor shall inform himself of any additional requirements of the railroad for working beneath its tracks or within its right-of-way.

5. Crossings under Streams/Channels: Crossings under streams and channels normally are made in open-cut construction unless otherwise shown on the Project Plans. Stream and channel crossings shall be installed as shown in the Standard Details of Sewer Construction with concrete encasement and rock blanket or other approved stream stabilization/channel protection methods approved by the Director, Missouri Department of Natural Resources, and U.S. Army Corps of Engineers.

Section D. REMOVAL AND REPLACEMENT OF PAVEMENTS AND ROAD SURFACES.

1. General:

    a. All existing paving or roadway surfacing, curb and gutter, of streets, alleys, driveways, sidewalks, paved areas, roads and highways, either removed or else damaged by the Contractor in his operations, shall be replaced to a condition at least equal to the condition before removal, and in conformance with the regulations of the agency of jurisdiction as indicated below, and as required in these specifications. Cuts in all rigid base pavements and asphaltic concrete pavements shall be made to straight true saw cut lines parallel with each edge of the trench for the pipe or structure, or, if directed by the City, to the construction joint nearest the trench. Reasonable efforts shall be made to avoid contrast, clash, or lack of harmony in the color and texture of the restored surfaces.

    b. City of Jackson: “City of Jackson Standard Specifications for Street Improvements”.

    c. MODOT: “Missouri Standard Specifications for Highway Construction”.

    d. Pavement paylines shall not apply unless paving is encountered within the excavation payline widths.

    e. Final approval for restoration of pavements, wearing surfaces, sidewalks and drives will be given by the City or MoDOT.

2. Partially-Improved Roadway Wearing Surfaces:

    a. For partially-improved roadway wearing surfaces consisting of thin layers of crushed stone or gravel, either waterbound or treated with oils to provide an all-weather wearing surface, excavation will be classified as Class C excavation. Excavation and compacted granular backfill will be made as described in Parts 3 and 4. A base of compacted crushed limestone and screenings, not less than eight inches thick, and with voids filled with ½ inch minus screenings, shall be placed in the top eight inches of the trench. The surface shall be waterbound or treated with oils, and after drying, shall be submitted to the action of traffic. Before completion of the project, any settlement below the finished grade shall be refilled with additional compacted crushed limestone and screenings and similarly waterbound or oiled.

    b. Payment will be made for the crushed limestone base at the bid price per square yard for "Crushed Limestone Base" for the area within payline limits for excavation for sewers and manholes or similar structures. Such payment shall include the cost of any additional crushed limestone and screenings used.

3. Bituminous Wearing Surfaces:

    a. Excavation and compacted granular backfill of the trench will be made as described in Parts 3 and 4. A base of compacted limestone and screenings, not less than eight inches thick and with voids filled with ½-inch minus limestone screenings, shall be placed in the top eight inches of trench.

b. A bituminous wearing surface consisting of bituminous materials and pea gravel shall be applied as required by the current specifications for patching bituminous pavement of the MoDOT (Standard Specifications for Highway Construction) to a strip, centered on the trench.

c. Payment will be made at the bid price per square yard for "Replacement of Bituminous Wearing Surface" for the area replaced, which shall not extend beyond two feet each side of the standard payline width of excavation for sewers, manholes and other structures, and shall exclude inlet sumps and curbing. Such payment shall include all costs of labor, equipment, oil, gravel, and crushed limestone and screenings for the completed base and wearing surface.

4. Asphaltic Concrete Street Pavement:

a. Excavation and compacted granular backfill of the trench will be made as described in Parts 3 and 4. Asphaltic concrete, not less than eight inches thick, shall be placed on a primed base in accordance with the requirements of the City (Standard Specifications for Street Improvements).

b. Payment will be made for the asphaltic concrete at the bid price per square yard for "Removal and Replacement of Asphaltic Concrete Street Pavement" for the area replaced, which shall not extend beyond two feet each side of the standard payline width of excavation for sewers, manholes and other structures, and shall exclude inlet sumps and curbing. Such payments shall include costs of labor, equipment, primer, saw cutting and asphaltic concrete required for removing and replacing the completed base and pavement surface.

5. Rigid Base Pavements:

a. Pavements of Portland cement concrete, pavements on Portland cement concrete base, pavements of asphaltic concrete surface course on existing pavements of Portland cement concrete, or pavements of asphaltic concrete surface course on old pavements of brick or cobblestone base shall be considered rigid base pavements. Excavation and compacted granular backfill of the trench will be made as described in Parts 3 and 4. The removed rigid base pavements shall be replaced as follows:

i. Pavements of Portland cement concrete shall be replaced with Class A concrete pavement not less than eight inches thick. It shall be reinforced with six by six inch, eight-gauge, welded wire mesh, meeting the requirements of ASTM A185 specifications, placed and held at two inches from the bottom of the concrete and extending six inches beyond each edge of the trench. The surfaces of the cut concrete shall be clean and free of loose particles. Immediately before any concrete is placed against the cut surfaces, they shall be thoroughly coated with cement grout. The completed pavement surfaces shall be finished to the same level and texture as the adjoining pavement, and shall be protected from damage, rapid drying or freezing. Any paving beyond the allowed payline limits for the pavement which may be damaged by the Contractor shall be replaced with no additional payment.

ii. Payment will be made for the concrete pavement removed and replaced at the bid price per square yard for "Removing and Replacing Concrete Pavement." The area for which payment will be made shall not extend beyond lines extending two feet beyond each payline for excavation for sewers, manholes and similar structures, and shall exclude inlet sumps and curbing.

b. Pavements of asphaltic concrete surface course on existing pavements of Portland cement concrete base or on brick and concrete or cobblestone and concrete or cobblestone base, the pavement shall be replaced with two inches of asphaltic concrete surface course on Class “A” concrete pavement base not less than eight inches thick, constructed as required for Portland cement concrete pavement except for the requirement of surface texture.

i. Payment will be made at the bid price per square yard for Removing and Replacing Asphaltic Concrete Surface Course and Pavement Base for the area removed within payline limits of two feet beyond each payline for excavation.

6. Sidewalks and Driveways:

a. Removal of sidewalks and driveways of concrete shall be made to the nearest joint or edge in the concrete pavement. Care shall be used to avoid damage to the adjacent pavement remaining in place. If the adjacent pavement is damaged or cracked by the operations of the Contractor, the pavement area enclosed between the payline limit as directed and a line parallel with such payline and including the damaged pavement shall be replaced at the expense of the Contractor. Excavation and compacted granular backfill of the trench will be made as described in Parts 3 and 4. The removed pavements shall be replaced as follows:

i. The removed concrete sidewalks and concrete driveways shall be replaced with similar pavements of Class “A” concrete to a thickness not less than four inches, nor less than the thickness required by the municipality of jurisdiction. It shall be reinforced with six by six inch, eight-gauge, welded wire mesh. The surfaces of the cut concrete shall be clean and free of loose particles. Immediately before any concrete is placed against the cut surfaces, they shall be thoroughly coated with cement grout. The pavement surfaces shall be finished to the same level, texture, and color as the adjoining pavements and shall be protected from damage, rapid drying, or freezing.

ii. Payment will be made at the bid price per square yard for Removal and Replacement of Concrete Sidewalks and Driveways. The area for which payment will be made shall not extend past the nearest joint or edge of the concrete pavement beyond the payline for excavation for sewers, manholes and similar structures. Cuts for trenches in asphaltic sidewalks and driveways shall be made by saw cut to straight true lines located on the payline limits of excavation for the trench or structure.

b. The removed or damaged asphaltic pavement shall be replaced with paving similar to that removed, but not less than two inches thick, nor less than the thickness required by the City (Standard Specifications for Street Improvements). Sidewalks passing through driveways and driveway approaches are considered driveways for the purpose of removal, replacement and payment.

i. Payment will be made at the bid price per square yard for Replacement of Asphalt Sidewalks and Driveways. The area for which payment will be made shall not extend beyond two feet each side of the standard payline for excavation for sewers, manholes, and similar structures.

c. Payment for unimproved drives of gravel or crushed rock surfacing shall be included in the payment made for site restoration, unless otherwise specified in the project specifications.

7. Curb and Gutter:

a. When necessary to remove concrete or asphaltic concrete curb and gutter, the cuts shall be made to straight true lines perpendicular to the alignment of the curb, and shall be located two feet beyond each payline of trench, or when so directed, to the nearest construction joint within an approximate distance of two feet beyond the trench payline. When granular fill compaction and settlement has been completed, the removed curb shall be replaced with similar matching curb and gutter in accordance with the specifications of the City (Standard Specifications for Street Improvements). Asphaltic concrete curb shall be machine laid, if in excess of 10 feet in length.

b. Payment will be made for removing and replacing concrete curb and gutter or asphaltic concrete curb and gutter at the respective bid price per lineal foot for the actual length required to be removed and replaced, exclusive of curb and gutter removed and replaced in inlet construction.

c. Curbs not requiring forms on the exposed surface as well as the unexposed surface will be considered pavement for the purpose of removal, replacement and payment.

8. ADA Access Ramps

a. When access ramps are required at street crossings or intersections due to removal of existing curbing or sidewalks the contractor shall comply with all jurisdictional requirements. Two ramps may be required if the inlet is in the rounding.

b. Payment for access ramps, removed and replaced or installed new shall be the same as for concrete sidewalks above. Payment will include any special detectable warning panels or other specials finishes required by the City or MoDOT.

Section E. ROCK BLANKET.

1. Construction Requirements:

    a. When required by the Project Plans or otherwise directed that banks are to be protected with rock blanket, the excavation or compacted fill shall be made to such surfaces and elevations that will permit placing of the surfacing without extending beyond or above the lines of the required channel cross section. No rock blanket shall be placed on any bank fill that has not been compacted. All rock blanket shall be placed on Type 1 filter fabric.

    b. The material to be used in the construction of a rock blanket shall be crushed limestone conforming to the requirements of Type 5 - Light or Type 6 - Heavy, as described in Part 2 of these specifications.

    c. The rock shall be neatly placed, and shall not be less than one foot thick for Type 5 – Light or not less than two feet thick for Type 6 - Heavy on the sides and on the bottom as shown on the “Typical Rock Blanket Detail”. The surface shall be reasonably regular and uniform.

2. Payment: Payment will be made at the unit bid price per square yard of rock blanket (light or heavy) and shall include as costs of material, labor, equipment, and filter fabric. The area for payment shall be computed from the exposed plane surface of the walls and bottom.

Section F. ABANDONMENT.

1. Sewers: Sewers and laterals to be abandoned shall be securely blocked at any points of intake or discharge with a bulkhead or pre-formed plug. When directed by the Project Plans and Specifications, they shall be completely filled with an approved material. The proposed method of filling and blocking the sewer shall be submitted to the City for approval. The Contractor will be allowed to remove that portion of the sewer to be abandoned in lieu of filling and blocking. If the Contractor elects the removal method, all costs for backfilling the excavation and all costs for surface restoration, in addition to removing and properly disposing of the pipe, shall be included in the unit bid price for Abandonment.

2. Manholes:

    a. After removing the manhole frame and cover, all incoming and outgoing pipes shall be bulkheaded. The walls shall be lowered to two feet below final grade if in earth or to below subgrade if in pavement.

    b. The structure shall then be filled with granular material. Selected earth shall be used to bring the surface to final grade or the subgrade and pavement shall be replaced in paved areas.

3. Septic Tanks:

    a. When the Plans call for the abandonment of a septic tank, the Contractor shall pump out and properly dispose of the contents within the tank.

b. The bottom of the tank shall be perforated to allow for drainage. If the top of the tank is concrete, it may be broken up and deposited in the tank. The sidewalls shall be lowered to at least two feet below final grade. The remainder of the tank shall be filled with granular material. Selected earth shall be used to bring the surface to final grade.

4. Pump Station Abandonment:

a. General: The Contractor shall contact the City seventy-two (72) hours prior to abandonment of the lift station to give the City time to salvage any equipment. The Contractor shall protect any equipment to be salvaged by the City. Any equipment not salvaged shall become the property of the Contractor, and shall be removed and disposed of in a proper manner.

b. The existing above grade wetwell and valve vault structures shall be removed to at least two feet below finished grade.

c. The bottom of the existing structures shall be perforated to allow for drainage.

d. The structures shall be filled with granular material.

e. Compacted select earth shall be used to bring the surface to final grade.

f. Terminate all utilities serving the site.

g. Equipment Removal and Disposal: Remove all mechanical and electrical equipment not salvaged by the City and dispose of the removed material in a proper manner.

5. Force Main Abandonment:

a. The existing force main shall be abandoned and filled in accordance with Section F. 1. Sewers of this Part.

b. All shut off valves, cleanouts, and air-release structures shall be removed. The ground surface around these structures shall be restored in a manner similar to the surrounding conditions.

c. If the contractor decides to remove the entire force main, additional conditions and permits may be required. No separate payment will be made for restoration, or additional conditions or permits.

6. Payment:

a. Payment for the abandonment of the pump station will be at the lump sum bid price for “Abandonment – Pump Station”, and shall include all costs for labor, equipment, and material for abandonment of the pump station and valve vault, removal and disposal of all mechanical and electrical equipment, abandonment and fill suction intakes between the wetwell and valve vault, filling the existing structures, and all site restoration.

b. Payments for the abandonment of the existing force mains shall be at the unit bid price for the Pay Item “Abandonment – Pipe Fill”, and shall include the cost for all labor, material, and equipment necessary for the abandonment in place and complete. The removal of all valves, blow-offs and cleanouts, as well as abandonment of vaults for these structures and associated site restoration shall be included in the unit bid price for “Abandonment – Pipe Fill”.

c. Payment for Abandonment: Payment for the work and materials required to abandon sewers, manholes, and septic tanks and pump stations in accordance to the methods described above, will normally be made by a respective bid item at a cost per cubic yard or cost per place. If no bid price is provided, abandonment will not be paid for separately

Section G. SIGNS.

When required by the Project Specifications, the Contractor shall furnish a sign at each of his major work locations to inform the public of the work under construction. The sign(s) shall be located as approved by the Director and maintained in a neat and orderly condition. The size and layout requirements of the sign will be provided by the Director. No additional payment will be made for the required signs.

Section H. OFFICE SPACE.

When required in the Project Specifications, the Contractor shall provide and maintain on or near the site or work an office or office space for the exclusive use of the City. Such office or space shall have a floor space not less than one hundred fifty square feet in area; have a tight floor, water-tight roof and sides, door and lock, sufficient windows for light and ventilation, screens for all openings; toilet facilities and lavatory connected to sewer and water supply. There shall be supplied a clothes locker with lock and key, a table suitable for use as a drafting board, a desk, at least 3 chairs, a plan rack, electric lights, and a telephone. The Contractor shall keep the office cleaned, lighted, heated, and shall furnish telephone service without cost until completion of the work for the project. Payment will be made for the costs of providing and removing office facilities at the lump sum bid price for Site Office Space.

PART 8 – PROTECTION AND RESTORATION OF SITE

Section A. CONTRACTOR RESPONSIBILITY.

1. The Contractor shall protect and avoid damage to all public and private property along the line of work. Damage due to the carelessness of the Contractor shall be repaired or restored at his expense. Particular attention shall be paid to avoid damage to trees, shrubs, bushes, and private property located in and adjacent to easements on private property. No trees may be removed outside the limits of sewer easements without the permission of the property owner. The removal of trees, shrubs and plants within the easement lines necessary to construct the project may be removed and not replaced, unless otherwise shown on the plans or provided in the Project Specifications. At the City's direction, specific trees, shrubs, or plants may be required to be removed and properly disposed of or left in place and protected. Reasonable lengths (250 lineal feet) of temporary fencing may be required as ordered by the City, the cost of which shall be included in "Protection and Restoration of Site".

2. In occupied residential lots, damaged shrubbery or trees outside the easement lines shall be replaced with new plants of equal type and quality. Finished lawn areas upon which earth has been deposited shall be cleared to the level of the existing sod, raked and watered. Areas where sod has been damaged, destroyed, or ruts have been filled in, shall be resodded. Areas where the sod is only slightly damaged may be lightly reseeded, if so permitted. After final restoration of the settled trench surfaces, trench areas shall be resodded, unless otherwise required in the Project Specifications

Section B. TEMPORARY EROSION AND SEDIMENT CONTROL.

1. If the sum of the total disturbed area (estimated working room width x length of project) exceeds one (1) acre, the Contractor will be required to submit to the City for acceptance his plan for control of runoff from the project site.

2. The Contractor's plan shall exercise best management practices (BMP) throughout the duration of the project in order to control water pollution and siltation from surface runoff. Such practices may include, but not limited to: (1) Minimizing the area disturbed and the duration of exposure at one time; (2) Stabilization of the exposed area as soon as practical by temporary seeding and mulching or sodding; (3) Retainage/management of site runoff by use of berm, slope drains, ditch checks, bales, or silt fences; (4) Retainage of silt and other debris. Pollutants such as chemicals, fuels, lubricants, bitumens, or other harmful materials shall not be discharged from the site.

3. In the event of conflict between these requirements and pollution control laws, rules, or regulations of other State, Federal or local agencies; the more restrictive laws, rules or regulations shall apply. It will be the responsibility of the Contractor to bring these to the attention of the City.

4. Payment shall include furnishing, installing, maintaining and removing all temporary control measures. Maintenance of control measures includes, but is not limited to periodic silt, debris and waste removal. Payment for this work will be included in the Pay Item "Protection and Restoration of Site".

Section C. AGREEMENTS WITH PROPERTY OWNERS.

The requirements of special arrangements made by the City with property owners at particular locations will be shown on the plans or specifications. Before entering upon any site, the Contractor shall provide the City with a signed copy of any agreement made between its owner and the Contractor for access, working space, and restoration of site. If, in special cases, fences, trees, shrubs, or plants are to be removed by the property owner and replaced at no expense to the Contractor, such cases will be stated in the Contract Specifications.

Section D. CLEANUP.

Debris and unused materials shall be removed from the working areas without unreasonable or unnecessary delay, and the working areas restored as nearly as practicable, as determined by the City, to their original conditions as soon as possible, in order to minimize damage, hazard, and inconvenience to the public and to the concerned property owners.

Section E. FENCES.

1. After construction is substantially complete fences shall be built or replaced after ground settlement due to construction. Fence replacement shall be in and constructed to equal or better condition of that removed. Fences elected to be removed by the Contractor to allow construction but in such poor condition as to not be reerected shall be replaced with new fence, the cost of which shall be included in protection and restoration.

2. Unless otherwise required in the Project Specifications or on the Project Plans, fence fabric shall be No. 11 gauge wire mesh, woven in a 2-inch mesh, and shall be 48 inches high. Fabric shall have a minimum 1.2 oz. galvanized coating per square foot of wire surface, and shall conform to ASTM A392 Specifications.

3. Metal line posts, corner posts, and top rails shall conform to ASTM A53 Specifications "Standard Weight" pipe (Schedule 40), with a galvanized coating not less than 1.8 oz. per square foot of total coated surface. Minimum pipe sizes shall be as follows:

    a. Line Posts; 1-½-inch nominal size (1.9" O.D.), 2.72 lb. per lin. ft.
    b. Corner Posts; 2-inch nominal size (2.375" O.D.), 3.65 lb. per lin. ft.
    c. Top Rails; 1-1/4-inch nominal size (1.66" O.D.), 2.27 lb. per lin. ft.

Section F. SODDING.

1. The project area shall be properly graded to insure that there are no ponding areas.

2. Unless otherwise required in the Project Specifications or on theo Project Plans, the prepared surface of trenches in lawns and turfed areas and in areas required to be regraded as a part of the construction, and turfed or lawn areas damaged by the Contractor, shall be restored by resodding.

3. After restoration of settled surfaces of the trench with earth, or the filling of rutted areas damaged by the Contractor’s equipment, all areas will be sodded. They shall be fine graded and raked to a smooth even surface, approximately one inch below the required finished surface with smooth transitions to adjacent undisturbed areas.

4. Commercial fertilizer shall be uniformly distributed and raked into the prepared surface at the rate of four pounds per one thousand square feet.

5. Unless otherwise specified, the fertilizer shall be a standard commercial product with a minimum composition of 8 percent available nitrogen, 4 percent available phosphates, and 24 percent potash with 40% slow release and sulphate of potash CSOP. No sod shall be placed when the temperature of the surrounding air reaches 90 degrees or above. The sod shall be laid with closely butted joints on the prepared, finished, fertilized moist subgrade. Within 2 hours after laying the sod and before rolling, the sod shall be watered lightly. After rolling, the newly sodded area shall be watered thoroughly to penetrate the subsoil a minimum of six (6) inches. The sod to be used shall be bluegrass, or as specified, free from weeds, leaves, debris and excessive amounts of decomposed vegetable matter. It shall be surface clipped in the field to a two-inch grass height; be in strips of uniform width cut with straight edges and ends; be approximately eighteen inches wide and three to five feet long; have an adequate root system not less than one inch thick; and be fresh cut, moist, and in good condition. Upon completion of sodding, it will be the Contractor’s responsibility to maintain the newly placed sod in a moist condition until fully rooted into the subgrade (minimum of four weeks) after the placement of the last section of sod.

6. Sodded areas outside of the payline limits for sodding described above and upon which earth has been deposited, and removed without leaving deposits of earth or damaging the sod, shall be raked smooth, fertilized at the rate of four pounds per one-thousand square feet, and thoroughly watered. Areas outside of payline limits which have been damaged shall be resodded. Areas of slightly damaged sod may be reseeded only with the approval of the Director.

7. Such sodded areas shall be raked and fertilized at the rate of four pounds per one-thousand square feet, and lightly seeded at the rate of two pounds per one-thousand square feet. Payment for the work of raking, watering, and light reseeding if required, is included in the lump sum payment made for restoration of site.

8. No sod shall be accepted until it has rooted into the subgrade.

9. Payment for accepted sodded areas will be made at the bid price per square yard and will include all costs of preparation, fine grading to finished grade, fertilizing, furnishing and placing sod, and watering, complete in place for the areas required to be sodded, but exclusive of sodding required at the Contractor's expense in restoration of areas damaged by the Contractor's equipment or operations. The width for which payment will be made for sod will be 20 feet wide. The 20 foot width shall be centered on the pipe. Areas of paved surfaces and obstacles shall be excluded from payment for sod. Sodding required beyond these limits will be paid for under the Pay Item "Protection & Restoration of Site."

Section G. SEEDING.

1. If required on the Project Plans or in the Project Specifications that seeding is to be used instead of resodding for specially designated areas, such areas shall be fine graded and raked to the required finished surfaces and grades, and fertilized at a rate of four (4) pounds per one-thousand square feet, with (13-25-12) fertilizer containing at least 30% slow release nitrogen..

2. Unless otherwise provided in the Project Specifications, seed to be used shall be a good grade of suitable mixed lawn grass, approved by the State of Missouri for viability and freedom from excessive amounts of weed seeds. Such approved seed mix shall consist of: 1) 80 percent Fiesta II Rye and 20 percent Touchdown Kentucky Blue Grass applied at the rate of six (6) pounds per one thousand square feet; or 2) Kentucky Blue Grass (not less than 65 percent), Red Fescue (15 percent), Red Top (5 percent), Annual Rye (15 percent) applied at the rate of seven (7) pounds per one-thousand square feet.

3. The seed shall be evenly sown on the prepared, moist, fertilized surface at the rate specified, lightly raked, and covered with pulverized straw, rolled, watered with a fine spray to avoid washing of the seed, and kept moist until acceptance of the work. When so provided in the Project Specifications, payment for such seeded areas will be made at the bid price per square yard, on the same basis as sod, and will include all costs of preparation, fine-grading to finished grade, fertilizing, furnishing and sowing seed, and watering, complete in place for the areas directed to be seeded.

4. Payment for seeding will be made at the bid price per square yard, measured as for sod, and will include all costs of preparation, fine-grading to finished grade, fertilizing, furnishing and sowing seed, mulching, and watering complete in place for the areas directed to be seeded. In case that no pay item is provided, all costs of seeding as described shall be included in the lump sum payment made for the pay item "Protection & Restoration of Site."

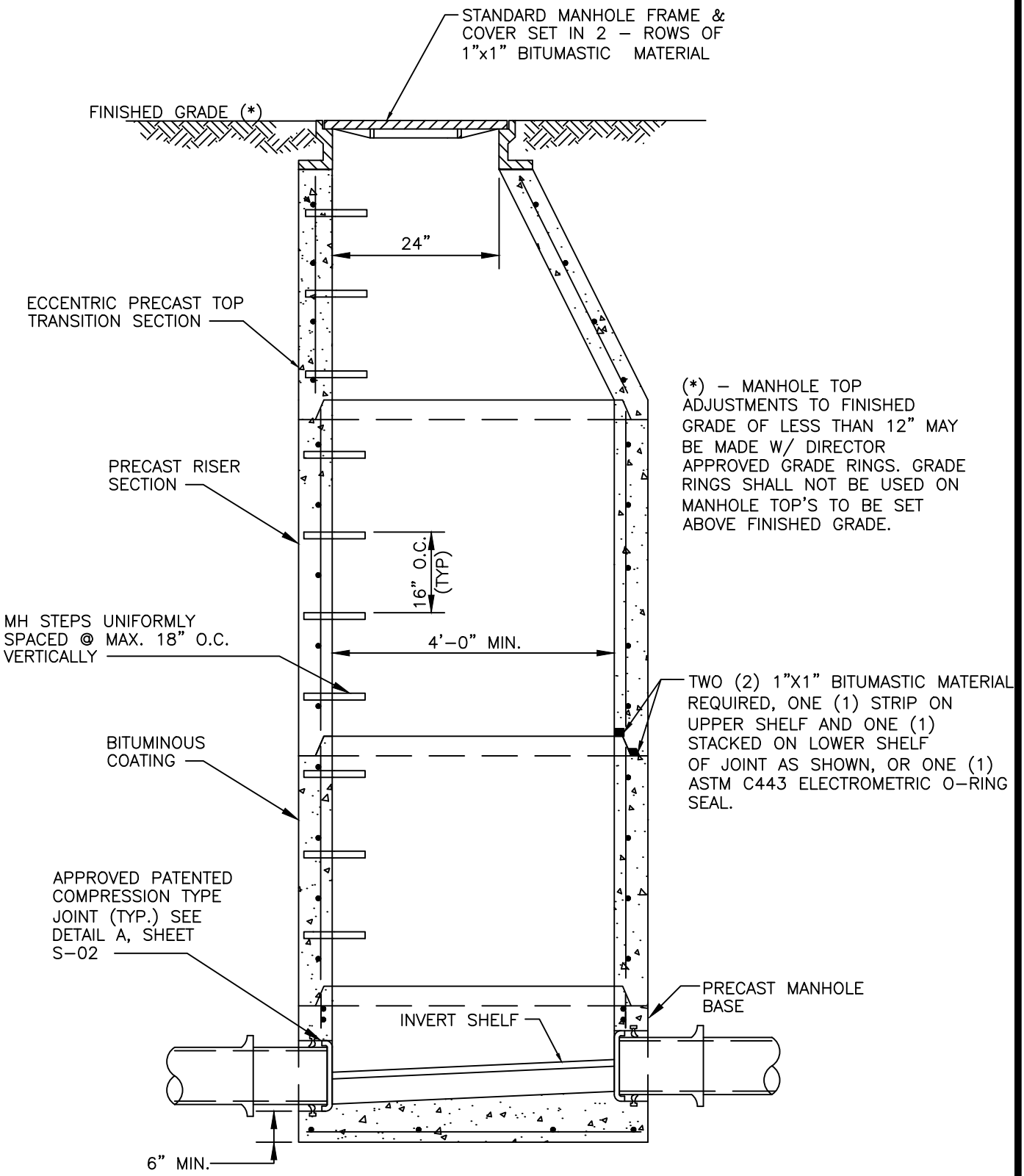
Section H. APPROVAL AND PAYMENT.

1. General:

   a. Before final approval of the project, a complete inspection will be made of the areas in which the Contractor has worked or has used for access to the work, in order to determine that damage has been repaired and the site restored as required by the specifications, and as agreed in any private agreements between the Contractor and the property owners, whether filed with the City as required or else not reported. Final approval for restoration of pavements, wearing surfaces, sidewalks, and drives will be given by the municipal or county authority of jurisdiction. Final approval will be withheld until the Contractor has repaired the damage and restored the site as required by the specifications and by any private agreement with a property owner.

   b. All costs of property protection, cleanup and restoration of site and working areas, except for pavement replacement, sodding, and for special items described in the Project Specifications, are included in the lump sum payment for Protection and Restoration of Site, unless otherwise provided in the Project Specifications.

END OF STANDARD SPECIFICATION

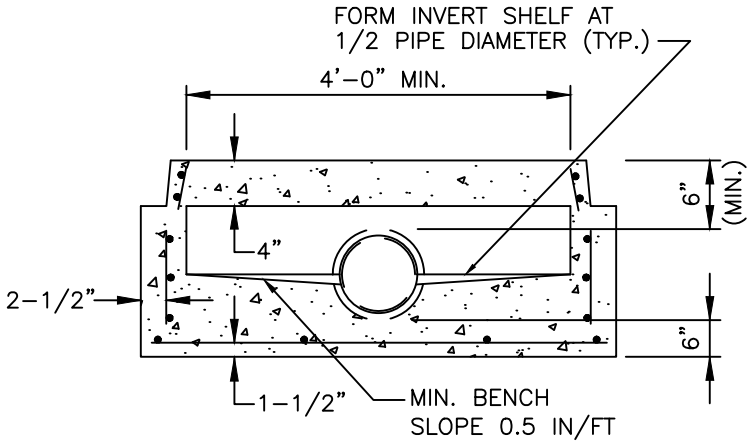


NOTES:

1. FLOWLINE ELEVATION OF INCOMING PIPES SHALL BE ONE (1) INCH HIGHER THAN THAT OF OUTGOING PIPE.
2. ALL PRECAST REINFORCED CONCRETE MANHOLES SHALL BE CONSTRUCTED IN ACCORDANCE WITH ASTM C–478 AND ASTM C–479. REFER TO ASTM C–478 FOR MINIMUM STEEL REQUIREMENTS.

Kent Peetz Approved Date Revisions	JACKSON, MO CITY OF BEAUTIFUL HOMES • PARKS • SCHOOLS AND CHURCHES 1814	# PRECAST MANHOLE SECTION

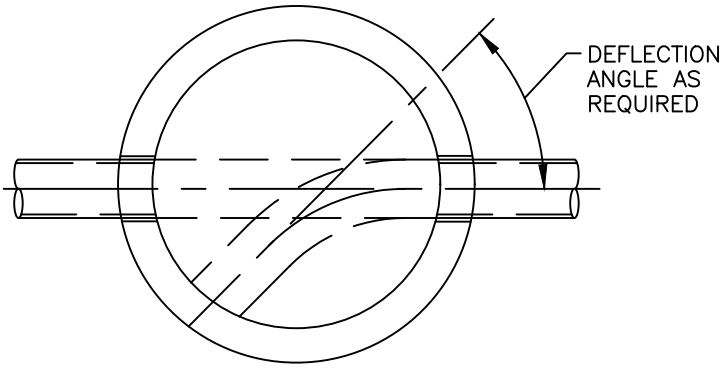
Sheet: S-01



NOTES:

1. FOR SEWERS ENTERING MANHOLES AT BETWEEN 0 TO 7 DEGREES, INSTALL A-LOK RUBBER GASKET BETWEEN PIPE AND MANHOLE WALL. INSTALL Z-LOK RUBBER GASKETS FOR ALL MANHOLE ENTRY APPROACHES GREATER THAN 7 DEGREES. SEWER CONNECTIONS TO MANHOLES SHALL BE LIMITED TO A MAXIMUM OF 25 DEGREES DEFLECTION UNLESS SPECIFICALLY DIRECTED OTHERWISE BY DIRECTOR. ALL GASKETS SHALL CONFORM TO ASTM C-478 AND ASTM C-923.
2. FOR CAST-IN PLACE STRUCTURES ON GROUTING APPLICATIONS FOR PIPE ENTRY, USE GASKET MATERIAL MEETING ASTM C-923, A-LOK WATERSTOP OR EQUAL.
3. USE NON-SHRINK GROUT SIKA CHEMICAL "KEMCO" OR APPROVED EQUAL.

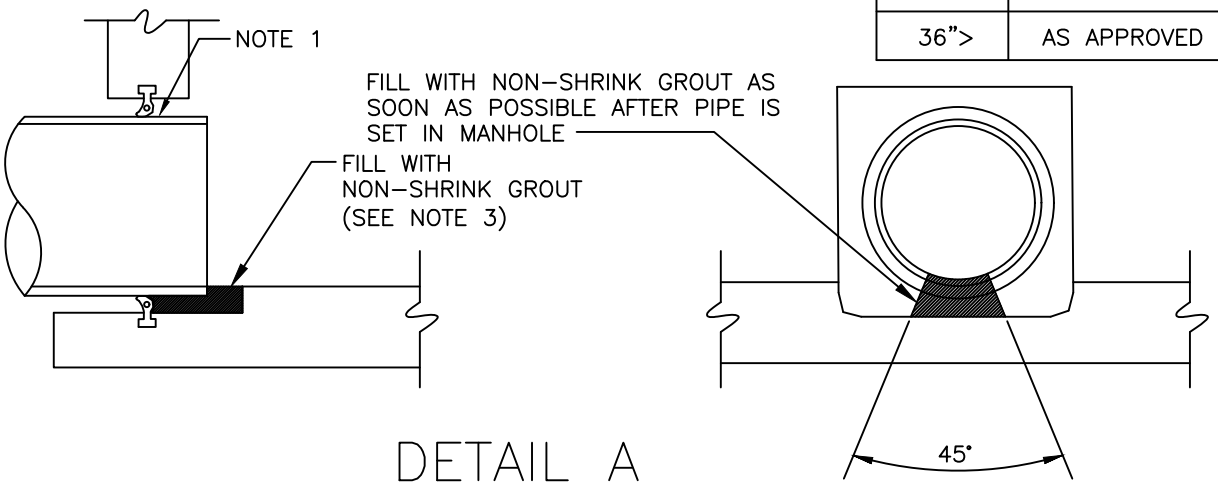
BASE SECTION



MINIMUM INSIDE DIAMETER OF BASE SECTION

PIPE ID NOMINAL INCHES	MINIMUM INSIDE DIAMETER INCHES
8"	48"
12"	48"
15"	48"
18"	48"
21"	48"
24"	48"
27"	60"
30"	60"
33"	60"
36">	AS APPROVED

MANHOLE BASE PLAN



DETAIL A

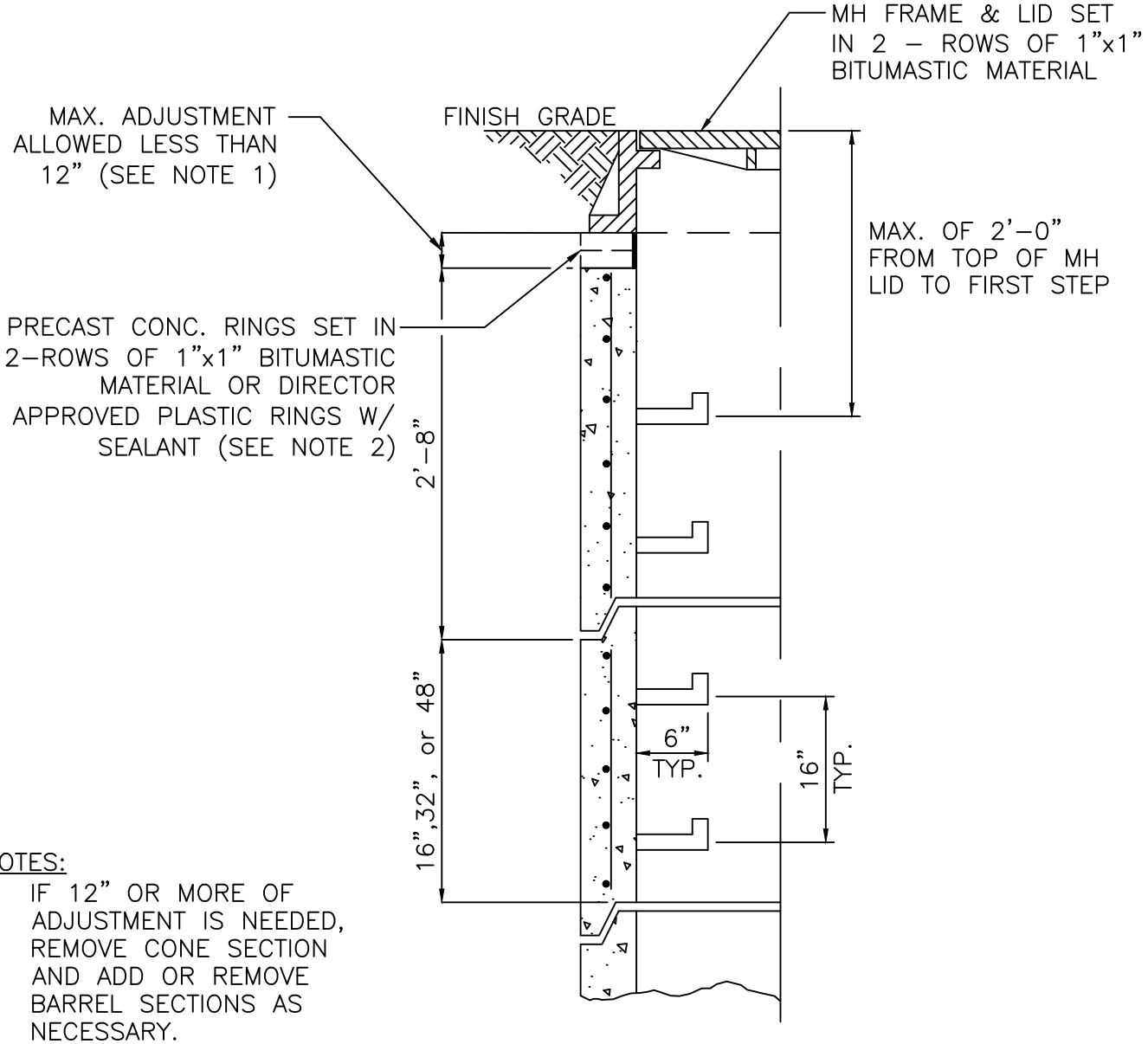
N.T.S.

Kent Peetz
Approved
Date

Revisions

PRECAST MANHOLE DETAILS & PLANS

Sheet:
S-02



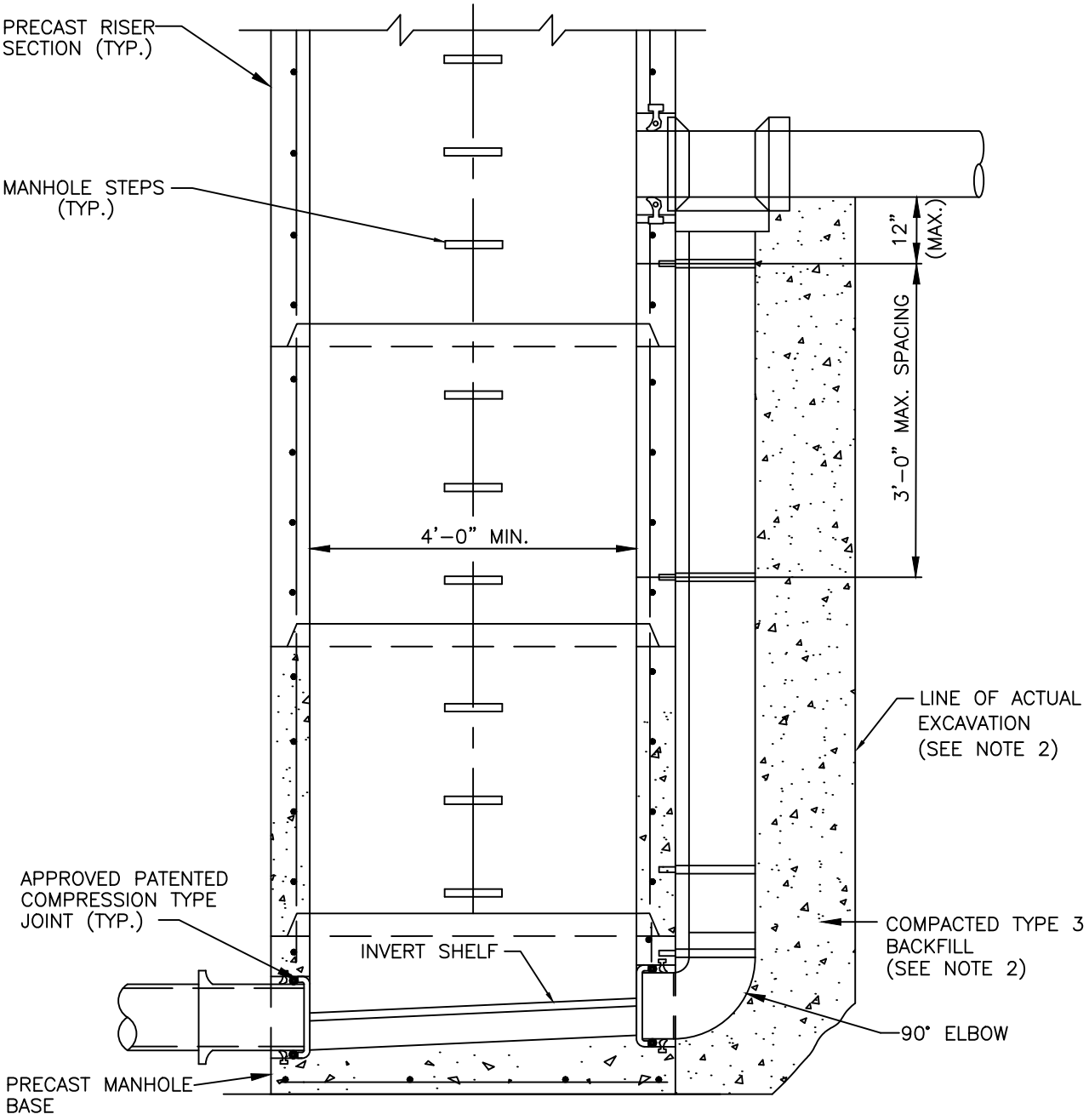
BARREL SECTION

NOTES:

1. IF 12" OR MORE OF ADJUSTMENT IS NEEDED, REMOVE CONE SECTION AND ADD OR REMOVE BARREL SECTIONS AS NECESSARY.

2. CONCRETE ADJUSTMENTS RINGS ARE REQUIRED IN PAVEMENTS LOCATED IN MODOT ROW AND CITY COLLECTOR AND ARTERIAL STREETS.

Kent Peetz Approved Date Revisions	JACKSON, MO CITY OF BEAUTIFUL HOMES • PARKS • SCHOOLS AND CHURCHES 1814	MANHOLE ADJUSTMENT	Sheet: S-03



NOTES:

1. DIAMETER OF DROP PIPE IS SAME AS INCOMING 8", 10" OR 12" PIPE SEWER UNLESS OTHERWISE SHOWN ON PROJECT PLANS. FOR SEWERS 15" THROUGH 24", A DROP IS NOT TO BE USED. RATHER, CONNECT TO MANHOLE AT OR WITHIN 24" ABOVE ITS FLOWLINE.

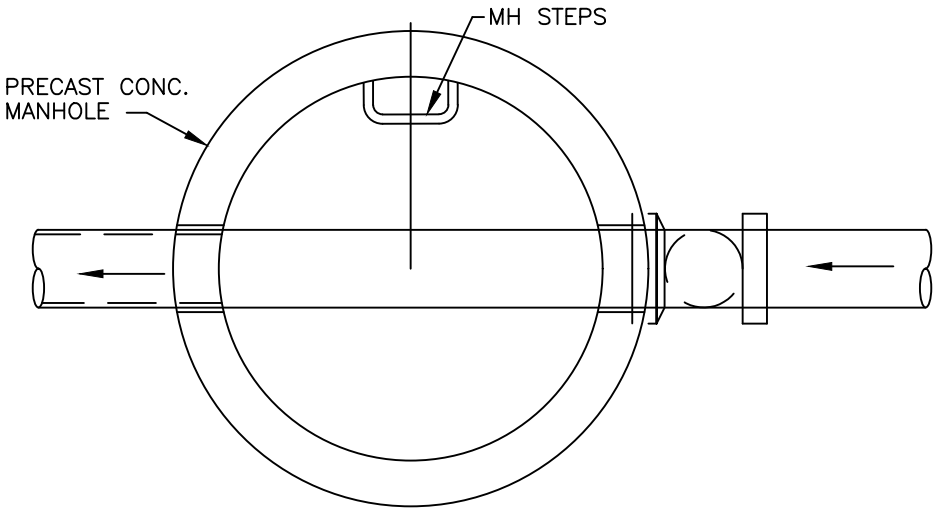
2. IF EXCAVATED SPACE OUTSIDE OF DROP PIPE EXCEEDS ONE(1) FT. PROVIDE 6" CLASS "A" CONCRETE ENCASEMENT ON INCOMING LINE FROM WALL OF MANHOLE TO A MIN. OF TWO FT. INTO UNDISTURBED EARTH WITH A MIN. OF 4-#4 REBARS FOR LENGTH OF ENCASEMENT OR INSTALL ONE (1) LENGTH OF D.I.P. FROM "TEE" FITTING INTO UNDISTURBED EARTH.

Kent Peetz
Approved
Date

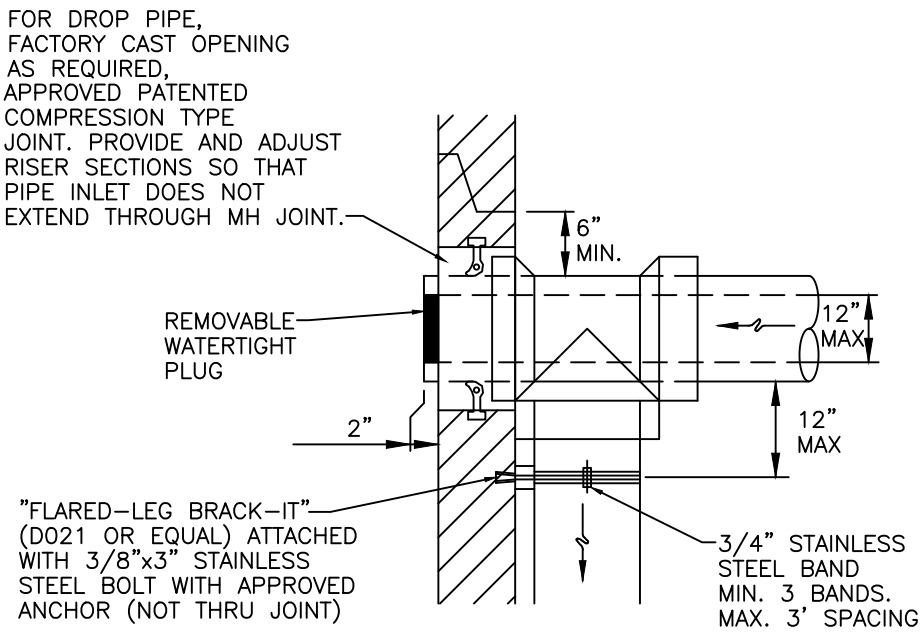
Revisions

OUTSIDE DROP MANHOLE SECTION VIEW

Sheet:
S-04



PLAN

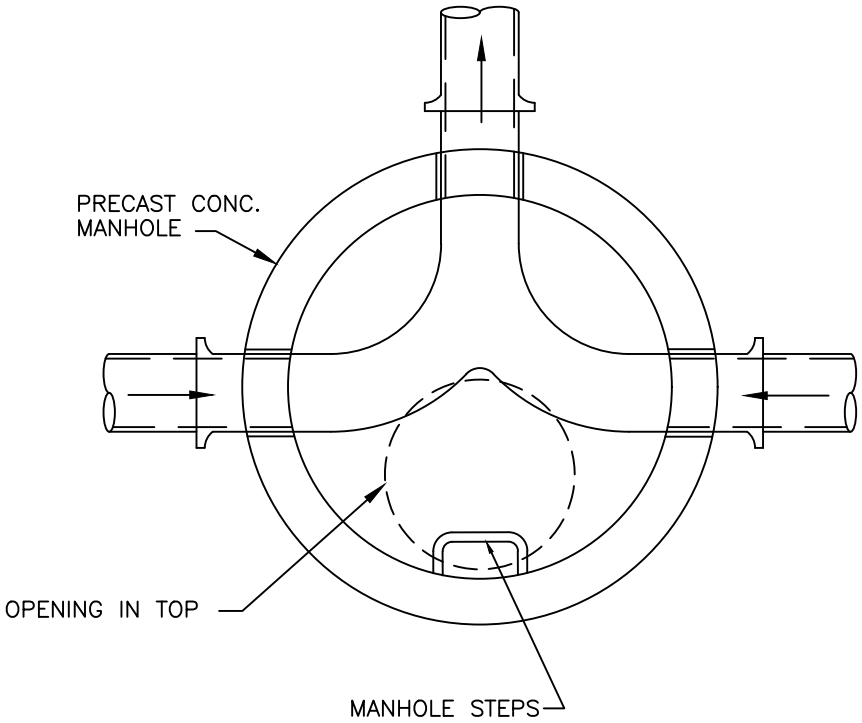


DETAIL "A"

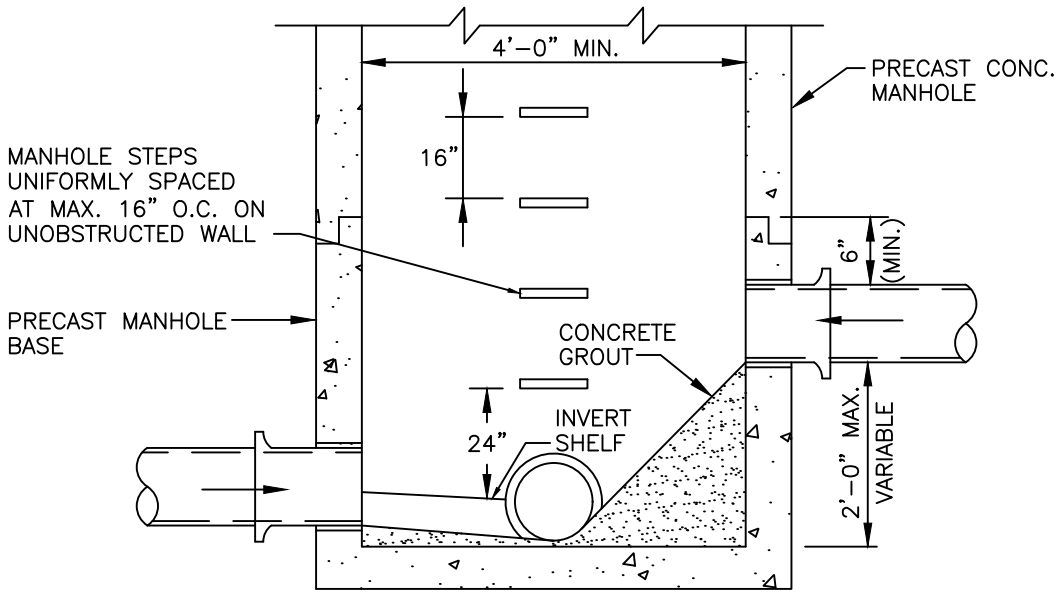
NOTES:

1. DIAMETER OF DROP PIPE IS SAME AS INCOMING 8", 10" OR 12" PIPE SEWER UNLESS OTHERWISE SHOWN ON PROJECT PLANS. FOR SEWERS 15" THROUGH 24", A DROP IS NOT TO BE USED. RATHER, CONNECT TO MANHOLE AT OR WITHIN 24" ABOVE ITS FLOWLINE.

Kent Peetz Approved Date Revisions	JACKSON, MO CITY OF BEAUTIFUL HOMES • PARKS • SCHOOLS AND CHURCHES 1814	OUTSIDE DROP MANHOLE PLAN VIEW & DETAIL	Sheet: S-05

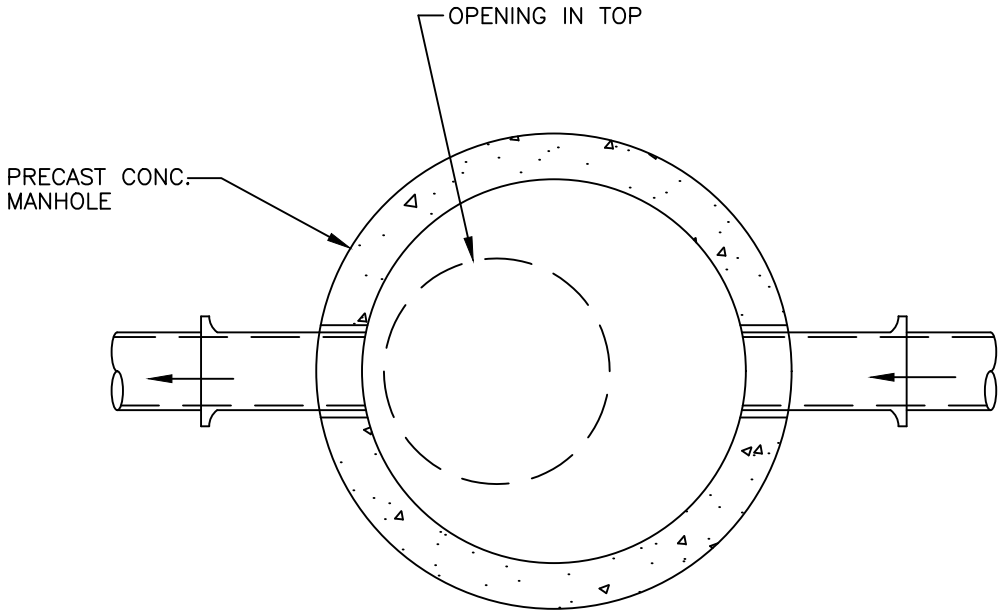


PLAN

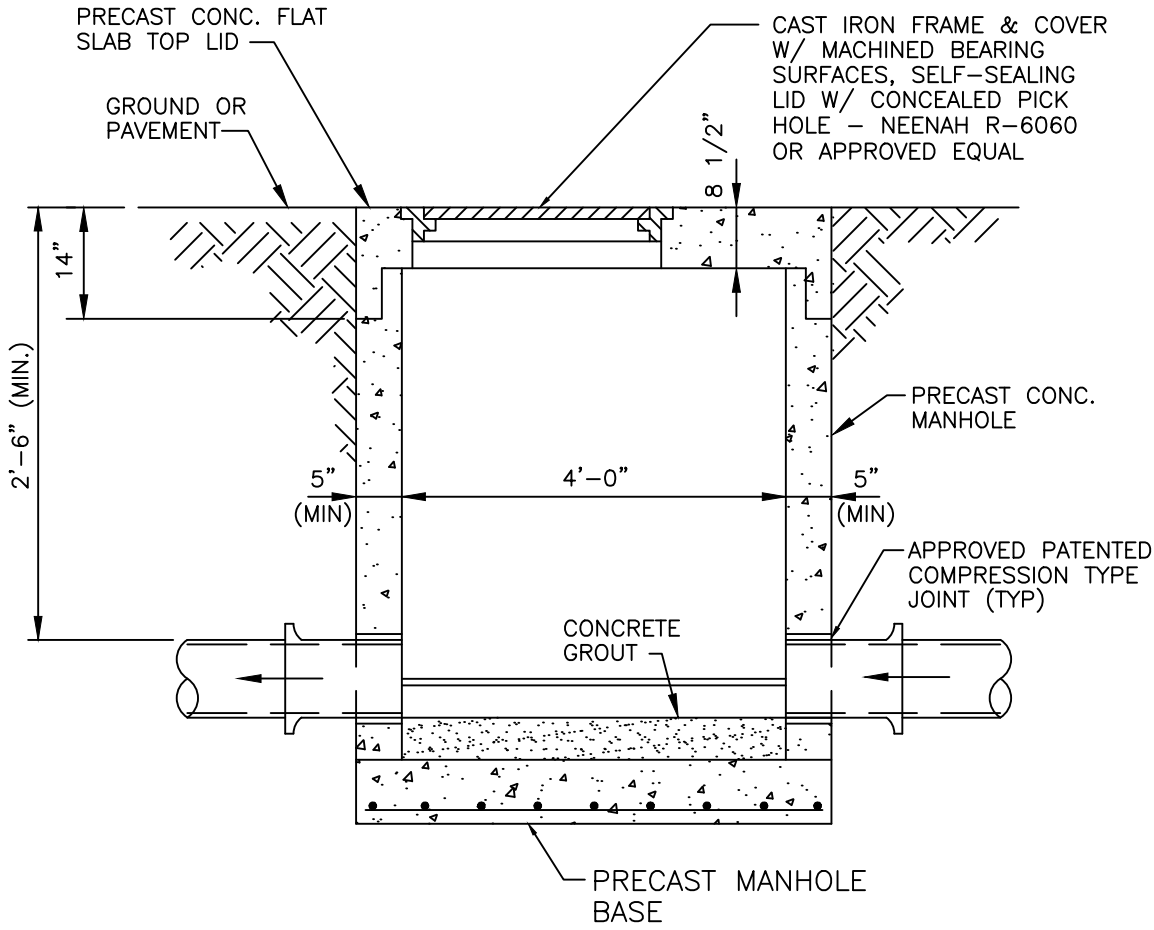


SECTION

Kent Peetz Approved Date Revisions	JACKSON, MO CITY OF BEAUTIFUL HOMES • PARKS • SCHOOLS AND CHURCHES 1814	INSIDE DROP MANHOLE	Sheet: S-06

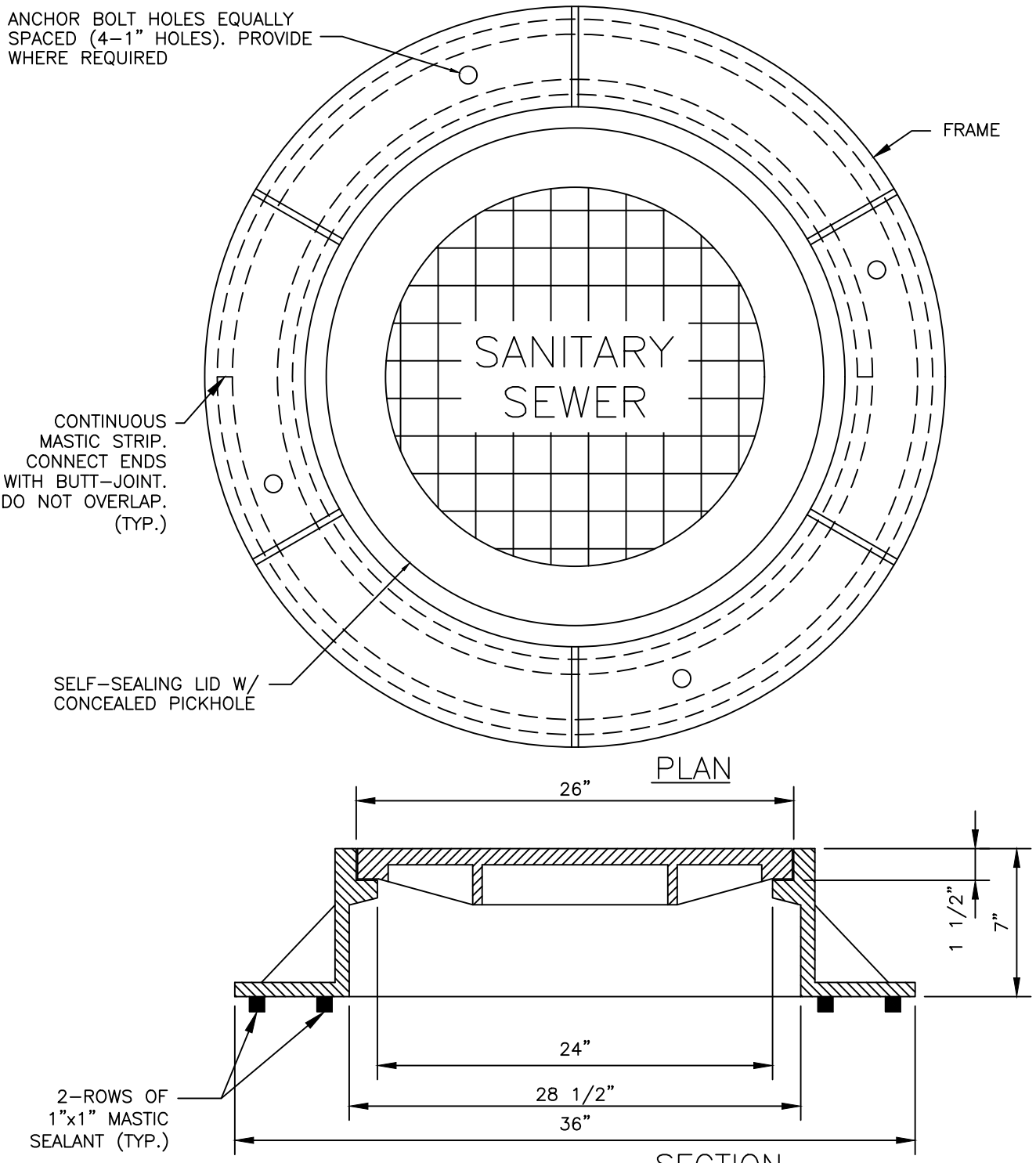


PLAN



SECTION

Kent Peetz Approved Date Revisions	JACKSON, MO CITY OF BEAUTIFUL HOMES • PARKS • SCHOOLS AND CHURCHES 1814	SHALLOW MANHOLE	Sheet: S-07



NOTES:

1. MACHINE–FINISH CONTACTING SURFACES FOR SEAT OF STANDARD MANHOLE FRAME AND COVER.
2. NEENAH R–1642 M.H. FRAME AND SOLID GASKETED SELF–SEALING LID WITH CONCEALED PICK HOLES, OR APPROVED EQUAL. TOTAL WEIGHT 380 LBS.
3. PROVIDE TWO (2) COMPLETE ROWS OF 1–INCH THICK FLEXIBLE RUBBER MASTIC SEALANT BETWEEN CAST IRON FRAME AND CONCRETE CONE OR GRADE RING.

Kent Peetz
Approved

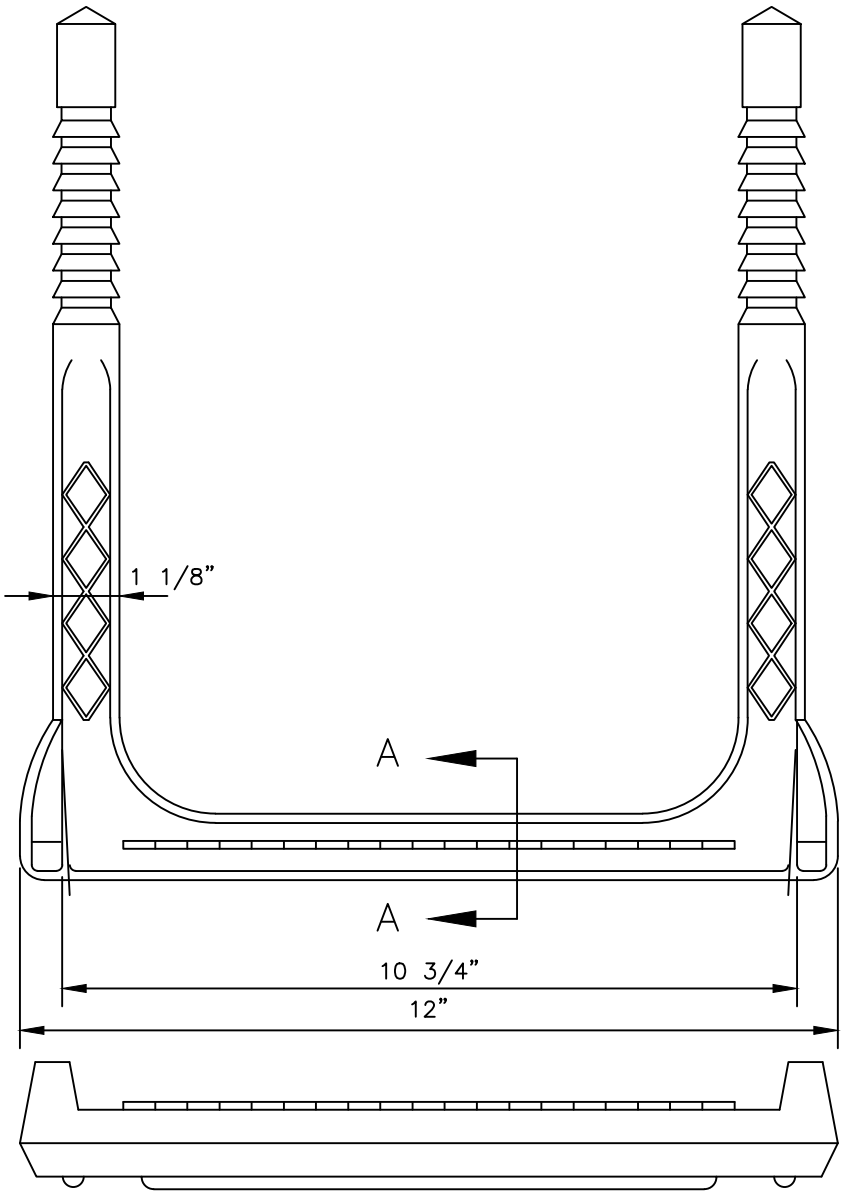
Date

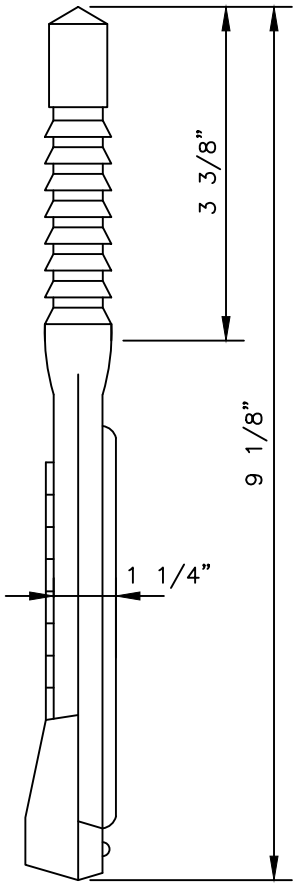
Revisions

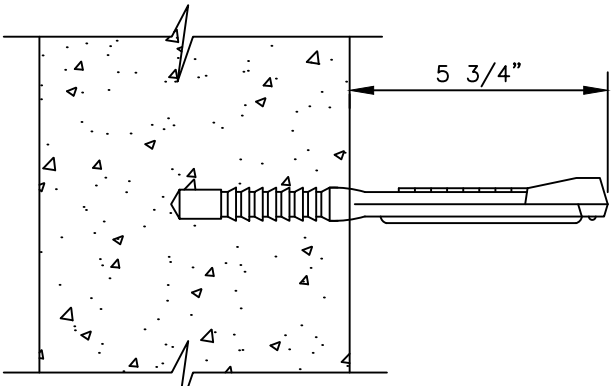
STANDARD CAST IRON MANHOLE FRAME & COVER

Sheet:

S-08







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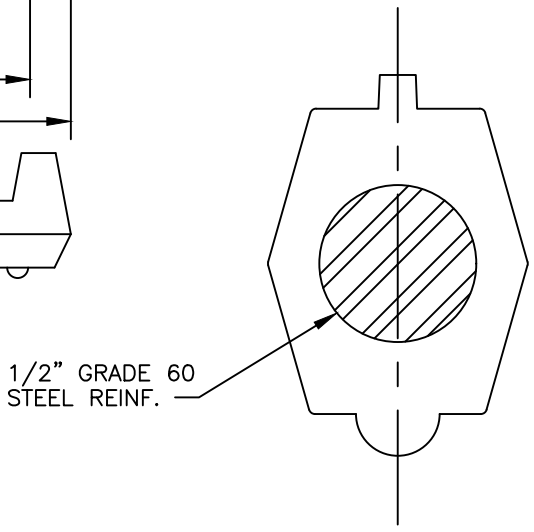
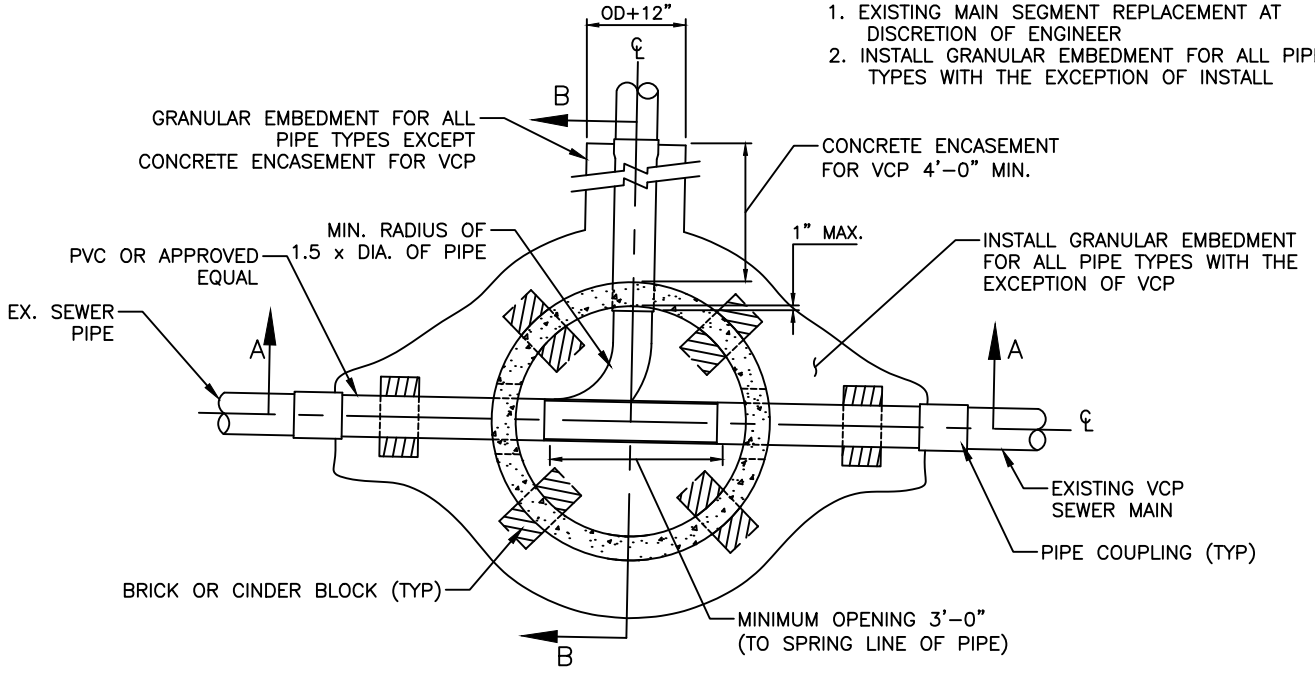


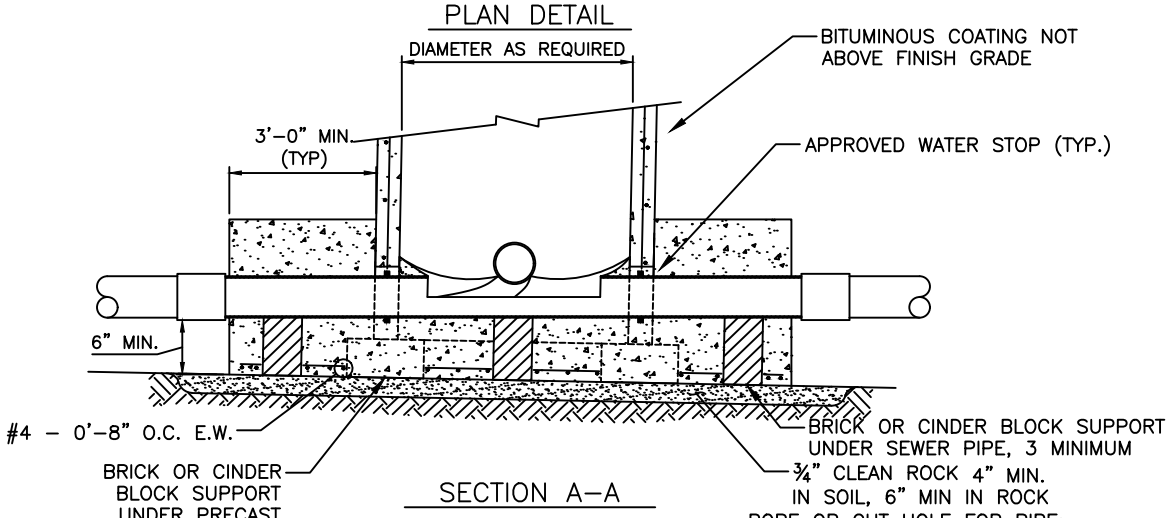
SECTION A–A

Kent Peetz Approved Date Revisions	JACKSON, MO CITY OF BEAUTIFUL HOMES • PARKS • SCHOOLS AND CHURCHES 1814	MANHOLE STEP FOR PRECAST MANHOLE	Sheet: S-09

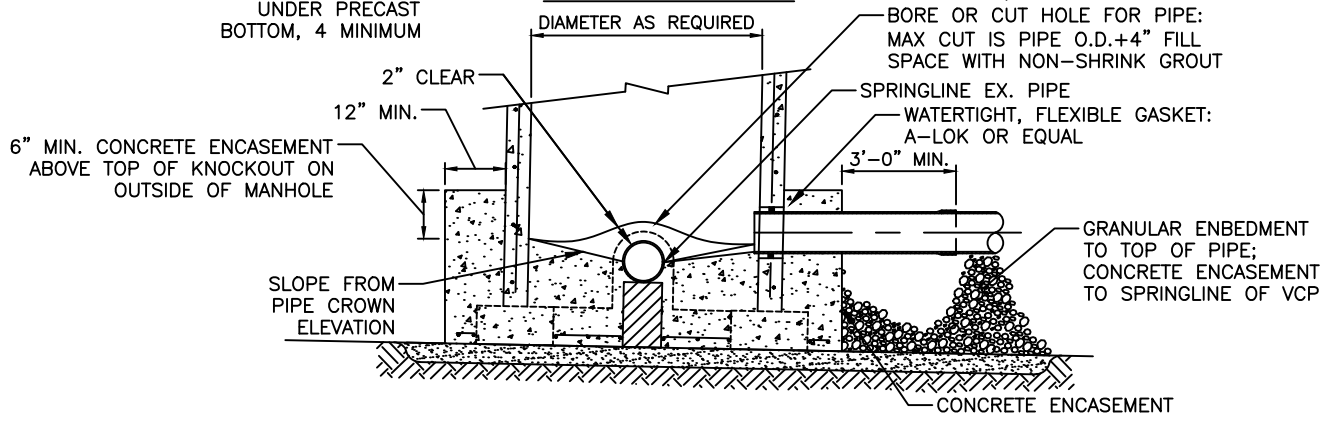
NOTE:
1. EXISTING MAIN SEGMENT REPLACEMENT AT DISCRETION OF ENGINEER
2. INSTALL GRANULAR EMBEDMENT FOR ALL PIPE TYPES WITH THE EXCEPTION OF INSTALL



PLAN DETAIL



SECTION A–A



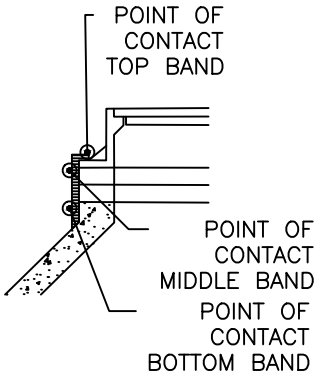
SECTION B–B

Kent Peetz Approved Date Revisions	JACKSON, MO CITY OF BEAUTIFUL HOMES • PARKS • SCHOOLS AND CHURCHES 1814	DOGHOUSE MANHOLE	Sheet: S-10

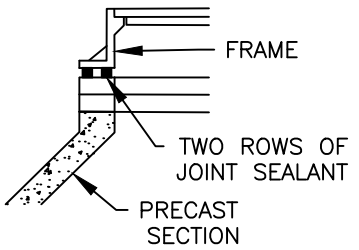
JOINT SEALANT AND AN EXTERIOR JOINT SEAL SHALL BE INSTALLED ON ALL SANITARY PRECAST CONCRETE MANHOLES AND PUMP STATIONS JOINTS AS DETAILED ON THIS SHEET TO PREVENT GROUNDWATER INFILTRATION.

1. JOINT SEALANT – CLEAN ALL JOINT SURFACES (REMOVE ALL DIRT, OIL, DEBRIS AND OTHER FOREIGN ITEMS) AND PROVIDE ADDITIONAL PRIMER IF RECOMMENDED BY JOINT SEALANT MANUFACTURER. THE APPROVED JOINT SEALANT MATERIAL AND MANHOLE SURFACES SHALL BE DRY DURING INSTALLATION. JOINT SEALANT SHALL BE APPLIED TO BOTH TOP AND BOTTOM JOINT SURFACES. THE JOINT SEALANT SHALL BE INSTALLED CONTINUOUSLY AROUND ALL JOINTS WITH THE ENDS PLACED BUTT TO BUTT (NOT OVERLAPPED AND NO OPEN GAPS BETWEEN SEALANTS). THE EXCESS JOINT SEALANT SHALL BE TRIMMED FLUSH TO BOTH INSIDE AND OUTSIDE SURFACES OF THE MANHOLE. TWO ROWS OF JOINT SEALANT SHALL BE APPLIED BETWEEN FRAME AND PRECAST SECTION. TWO ROWS OF JOINT SEALANT SHALL BE APPLIED BETWEEN FRAME AND PRECAST SECTION.
2. EXTERNAL JOINT SEAL – THE EXTERNAL JOINT SEALS SHALL BE MAC WRAP EXTERNAL JOINT SEALERS AS MANUFACTURED BY MARMAC CONSTRUCTION PRODUCTS, INC. OR APPROVED EQUAL. EXTERNAL JOINT SEALS SHALL CONSIST OF A COLLAR A MINIMUM 12" WIDE WITH AN OUTER LAYER OF POLYETHYLENE, WITH A MINIMUM TENSILE STRENGTH OF 4000 PSI AND A MINIMUM TEAR RESISTANCE OF 1,500 PSI, AND AN UNDER LAYER OF RUBBERIZED MASTIC THAT IS REINFORCED WITH A WOVEN POLYPROPYLENE FABRIC. TWO 5/8 INCH STEEL STRAPS WITH SELF–CONTAINED TENSIONING RATCHETS SHALL BE LOCATED WITHIN THE COLLAR ¾ INCHES FROM EACH EDGE. THE STRAPS SHALL BE CONFINED IN TUBES THAT ISOLATE THEM FROM THE MASTIC AND ALLOW THEM TO SLIP FREELY WHEN MECHANICALLY TIGHTENED AROUND MANHOLE. THE COLLAR SHALL BE FURNISHED WITH A MINIMUM 8 INCH OVERLAP AND A CLOSING FLAP TO COVER ANY REMAINING EXPOSED STRAP.
3. EXTERNAL CHIMNEY SEAL – THE EXTERNAL CHIMNEY SEAL SHALL BE MAR MAC CHIMNEY WRAP AS MANUFACTURED BY MAR MAC CONSTRUCTION PRODUCTS, INC. OR APPROVED EQUAL. CHIMNEY SEAL SHALL CONSIST OF A COLLAR A MINIMUM 14" WIDE WITH TWO LAYERS OF WOVEN POLYPROPYLENE FABRIC CONFORMING TO ASTM D–1682 AND RUBBERIZED MASTIC. THREE STAINLESS STEEL HOSE CLAMPS SHALL BE CONFINED IN TUBES THAT ISOLATE THEM FROM THE MASTIC AND ALLOW THEM TO SLIP FREELY WHEN MECHANICALLY TIGHTENED AROUND MANHOLE. A SECOND LAYER OF RUBBERIZED MASTIC SHALL COVER THE ENTIRE INTERNAL SURFACE OF COLLAR. THE COLLAR SHALL BE FURNISHED WITH A MINIMUM 6 INCH OVERLAP.
4. INTERNAL CHIMNEY SEAL (ALTERNATE) – TO BE USED WHEN EXTERNAL CHIMNEY SEAL IS LOCATED ABOVE GRADE OR WHEN PRECAST/FRAME CONFIGURATION DOES NOT ALLOW FOR PROPER INSTALLATION OF EXTERNAL CHIMNEY SEAL (I.E. FLAT TOP MANHOLE WHERE THE OUTSIDE DIAMETER DIFFERENCES EXCEED MANUFACTURE'S RECOMMENDED LIMITS.) OR AS APPROVED BY DISTRICT. THE INTERNAL CHIMNEY SEAL SHALL BE LSS INTERNAL CHIMNEY SEAL AS MANUFACTURED BY CRETEX SPECIALITY PRODUCTS OR APPROVED EQUAL. THE CHIMNEY SEAL SLEEVE SHALL BE MOLDED FROM HIGH GRADE RUBBER CONFORMING TO ASTM C–923, WITH A 1,500 PSI TENSILE STRENGTH. EXPANSION BANDS SHALL BE INTEGRALLY FORMED FROM 16 GA 304 STAINLESS STEEL WITH A LOCK MECHANISM TO SECURE BAND.

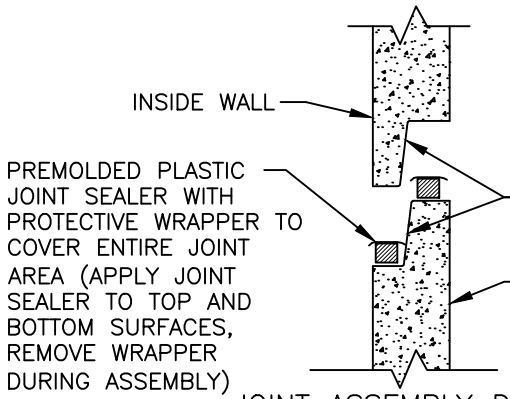
ALL SEALS SHALL BE SIZED SPECIFICALLY FOR STRUCTURES BY MANUFACTURER TO ENSURE COMPRESSION BANDS ARE PROPERLY PLACED TO MAKE A WATERTIGHT SEAL.



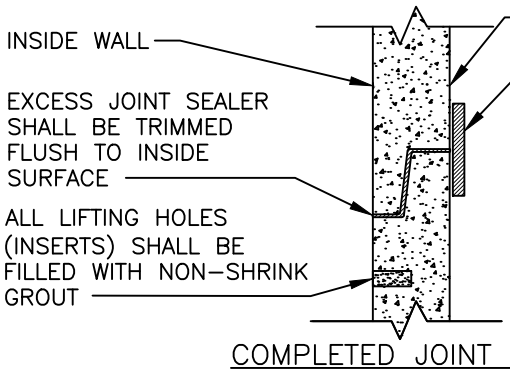
EXTERNAL CHIMNEY SEAL DETAIL



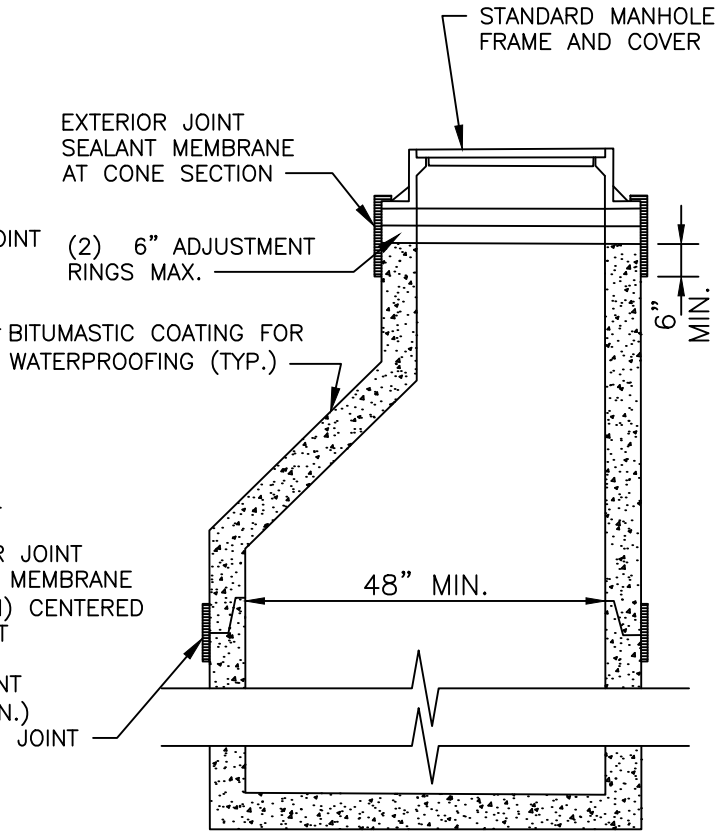
FRAME ASSEMBLY DETAIL



JOINT ASSEMBLY DETAIL



COMPLETED JOINT DETAIL

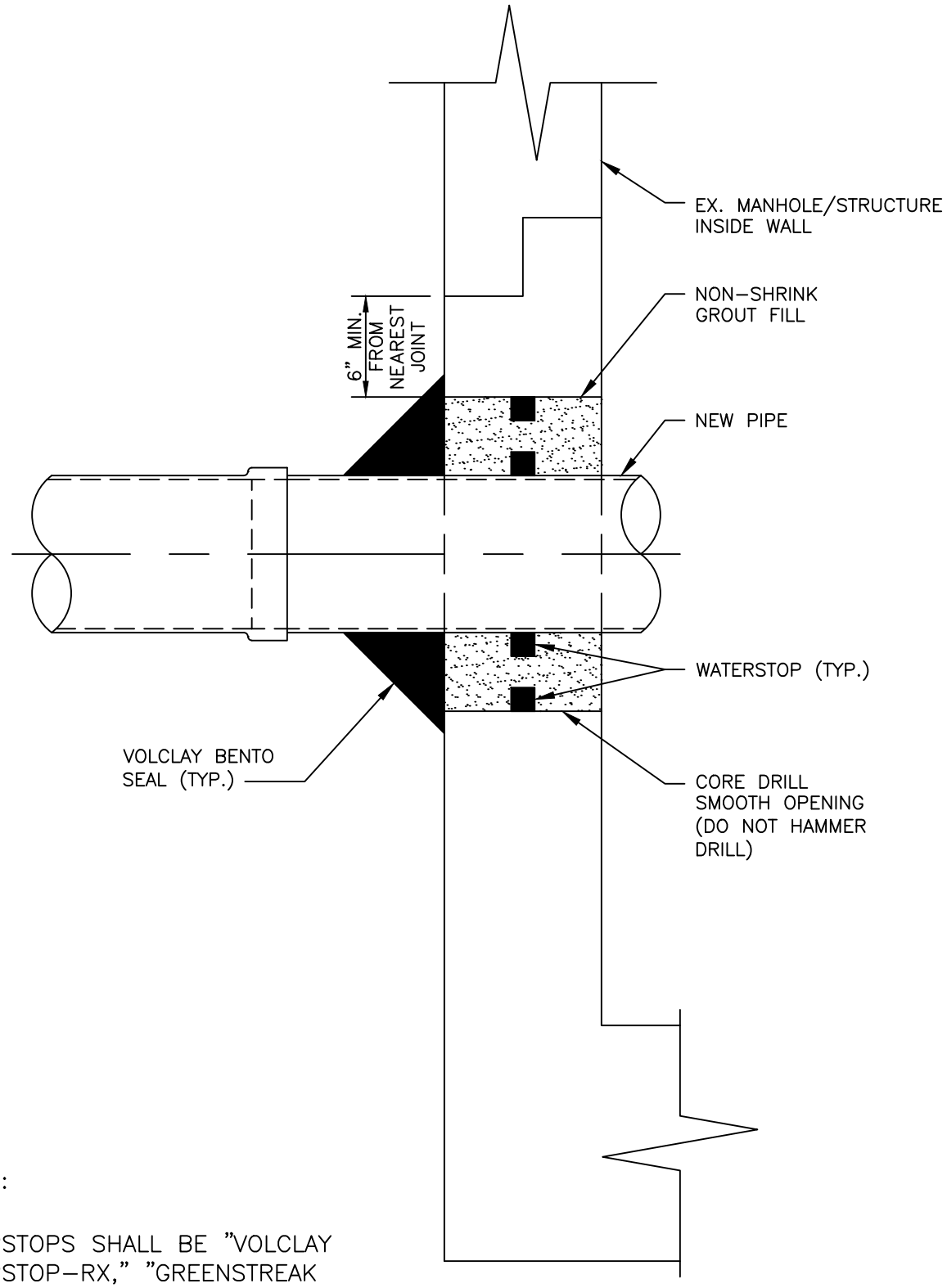


Kent Peetz — Approved — Date

Revisions

JOINT SEALANT AND EXTERIOR JOINT SEALANT MEMBRANE

Sheet: S-11



NOTES:

WATERSTOPS SHALL BE "VOLCLAY WATERSTOP–RX," "GREENSTREAK HYDROTITE," OR EQUAL PLACED IN CONTINUOUS STRIPS ALL AROUND PIPE/OPENING.

TYPICAL SECTION

Kent Peetz
Approved
Date

Revisions

NEW PIPE CONNECTION TO EXISTING MANHOLE / STRUCTURE

Sheet:
S-12

ROUND PIPE			
"D" INSIDE DIAMETER OF PIPE (INCHES)	"W" PAYLINE WIDTH OF TRENCH (INCHES)	"W" PAYLINE WIDTH OF TRENCH (FEET)	PAY VOLUMES CU. FT. PER FT. CONCRETE ENCASEMENT
4	30	2.50	3.28
6	30	2.50	3.59
8	30	2.50	3.87
10	30	2.50	4.09
12	30	2.50	4.25
15	36	3.00	5.55
18	36	3.00	5.77
21	39	3.25	6.61
24	42	3.50	7.39
27	45	3.75	8.18
30	49	4.08	9.30
33	53	4.42	10.53
36	56	4.67	11.43
39	D I S C O N T I N U E D		
42	63	5.25	13.38
48	70	5.83	15.67
54	77	6.42	18.15
60	84	7.00	20.73

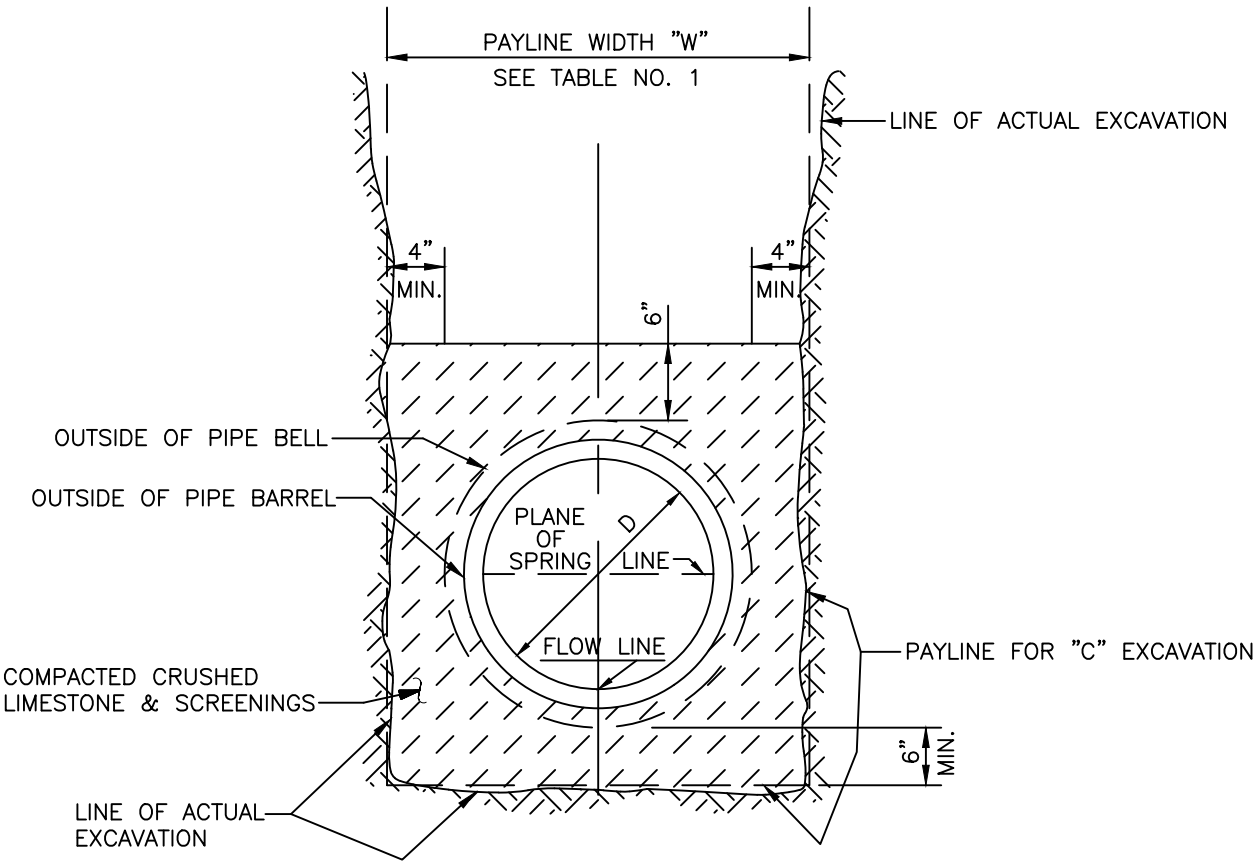
TABLE 1

Kent Peetz
Approved Date

Revisions

PAYLINE WIDTHS OF TRENCH & PAY-QUANTITIES OF CONCRETE

Sheet: S-13

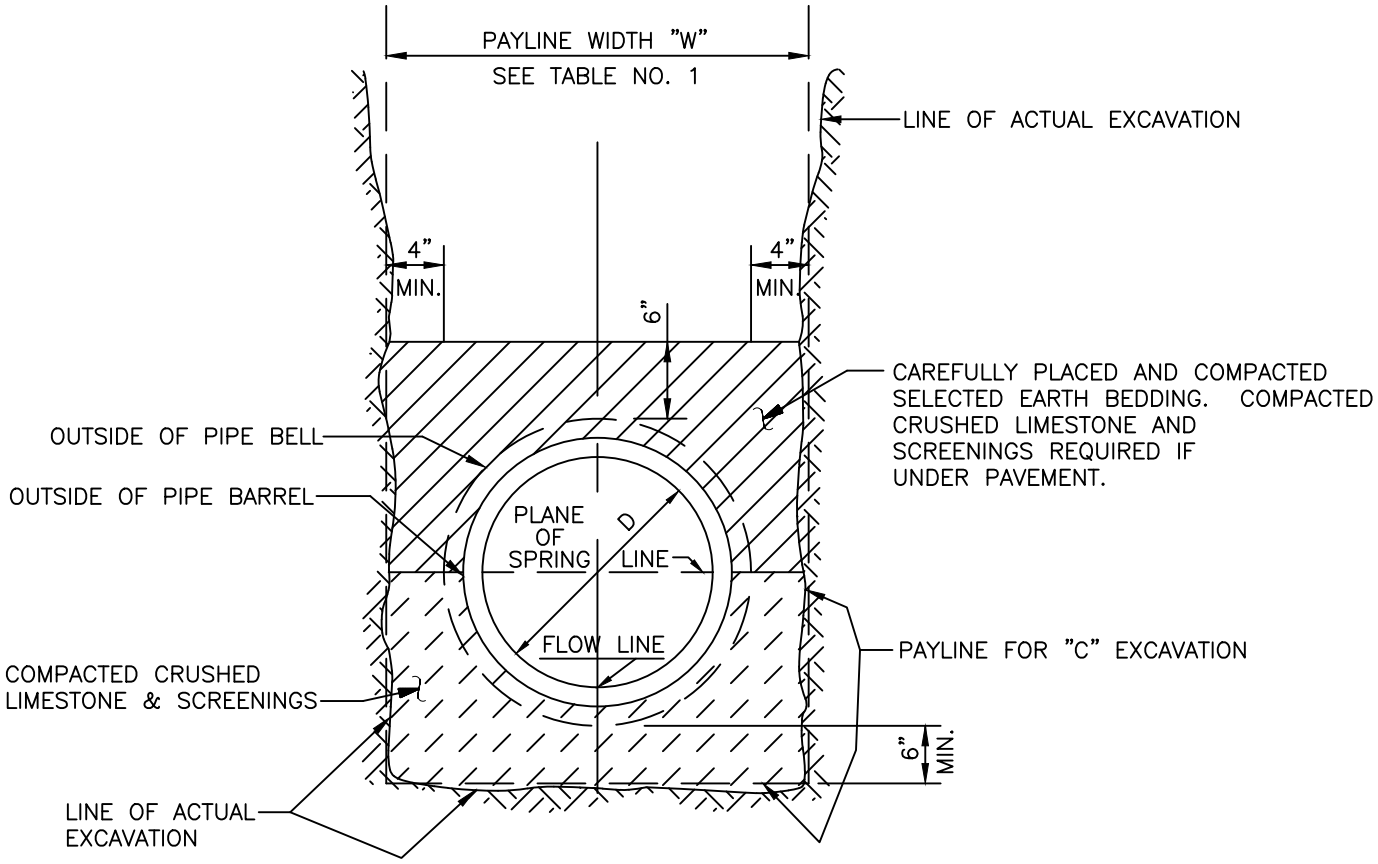


NOTE:

1. SDR–35 PIPE SHALL BE USED FOR COVER 0–15 FEET. FOR COVER GREATER THAN 15 FEET, C–900 PVC PIPE SHALL BE UTILIZED. ENGINEER MUST SPECIFY FOR COVER TYPE OTHER THAN SOIL.

(FOR ALL PIPE EXCEPT REINFORCED CONCRETE PIPE)

Kent Peetz Approved Date Revisions	JACKSON, MO CITY OF BEAUTIFUL HOMES • PARKS • SCHOOLS AND CHURCHES 1814	PIPE BEDDING CLASS "C"	Sheet: S-14



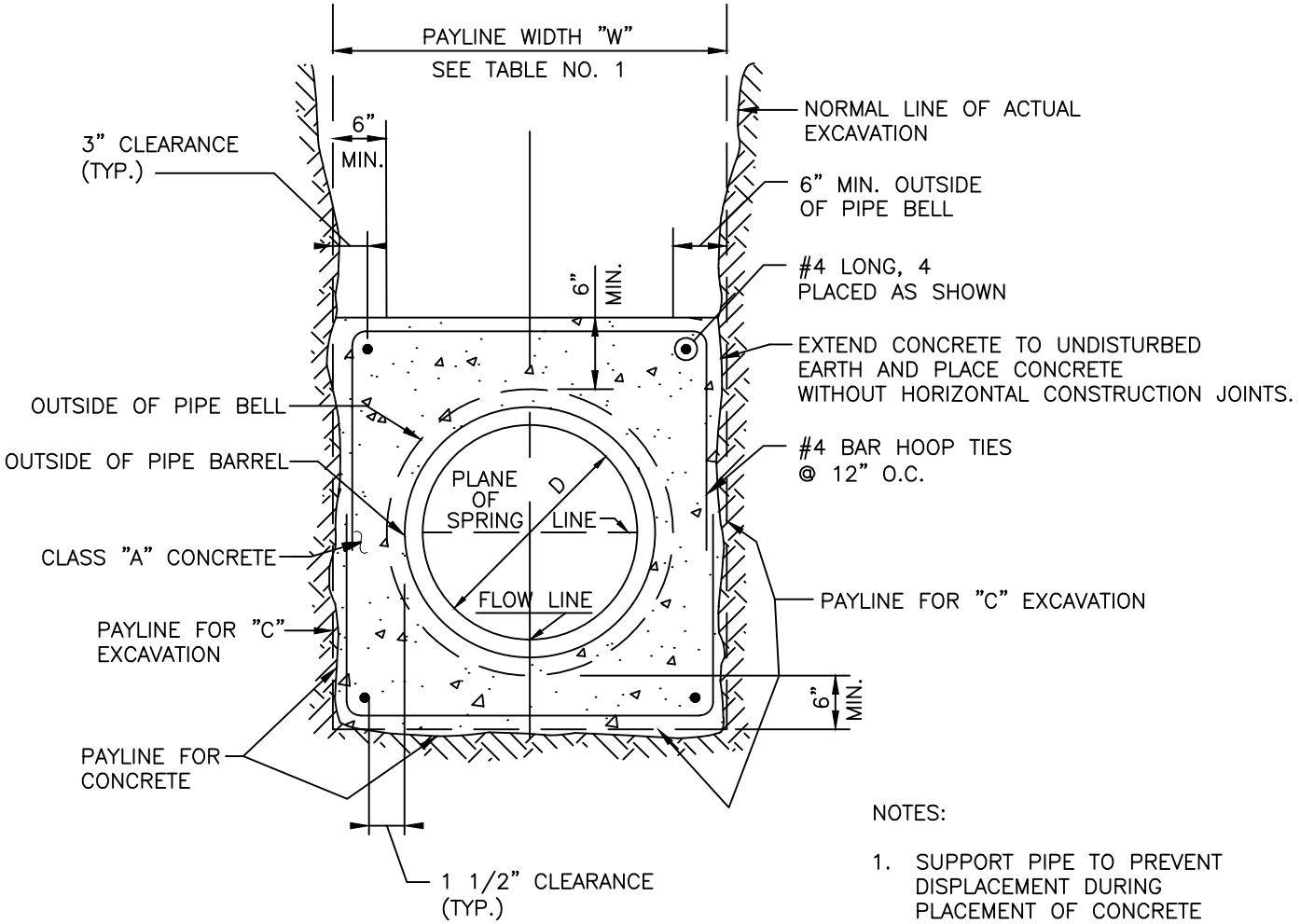
(MODIFIED FOR REINFORCED CONCRETE PIPE)

Kent Peetz
Approved
Date

Revisions

PIPE BEDDING CLASS "C"

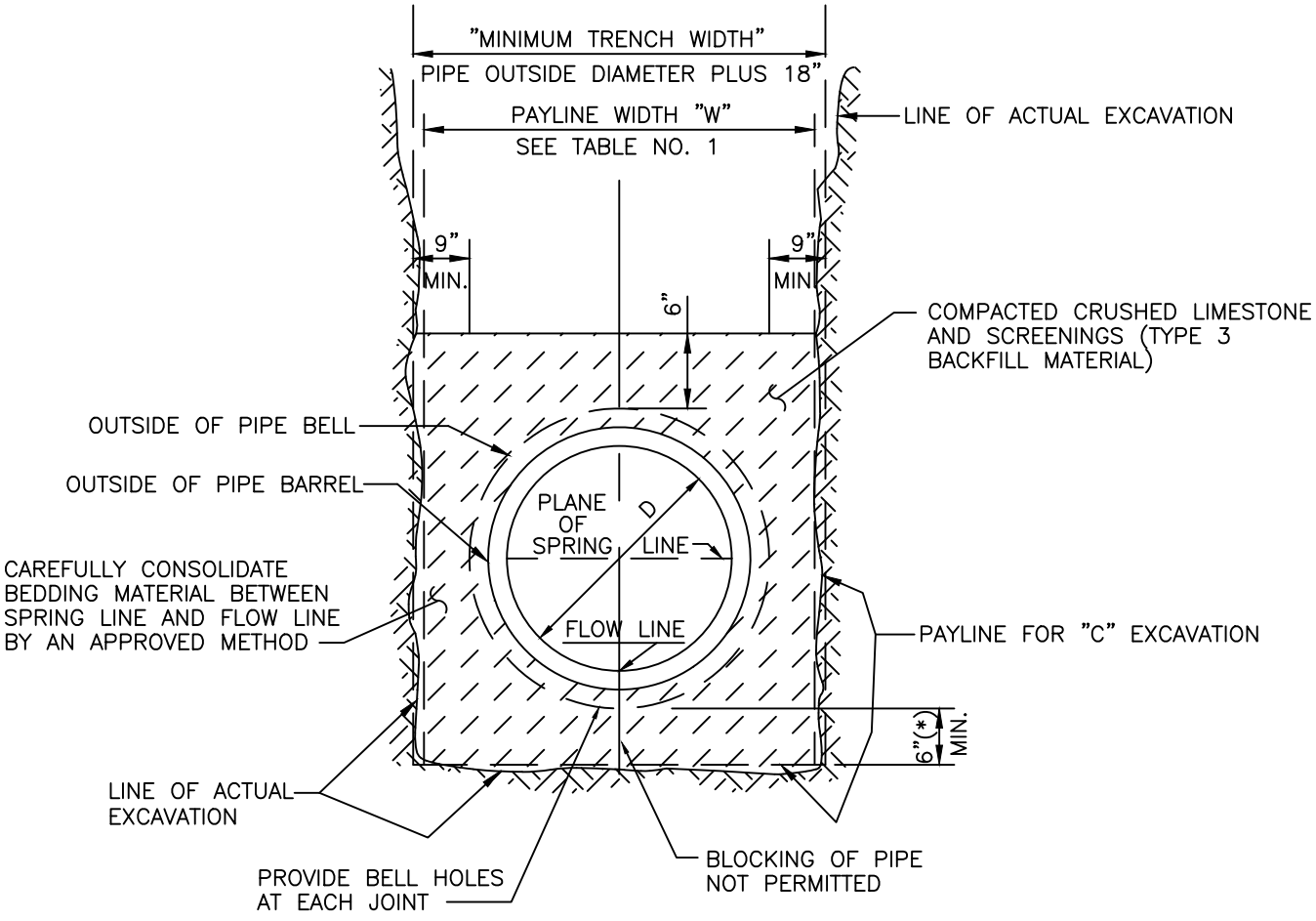
Sheet:
S-15



NOTES:

1. SUPPORT PIPE TO PREVENT DISPLACEMENT DURING PLACEMENT OF CONCRETE
2. PLACE CONCRETE AGAINST EITHER SOLID FORM WORK OR UNDISTURBED EARTH
3. ALL PIPE USED FOR CREEK AND DITCH CROSSINGS SHALL BE DUCTILE IRON PIPE CLASS 56 UNLESS OTHERWISE APPROVED BY THE CITY

Kent Peetz Approved Date Revisions	JACKSON, MO CITY OF BEAUTIFUL HOMES • PARKS • SCHOOLS AND CHURCHES 1814	CONCRETE ENCASEMENT	Sheet: S-16

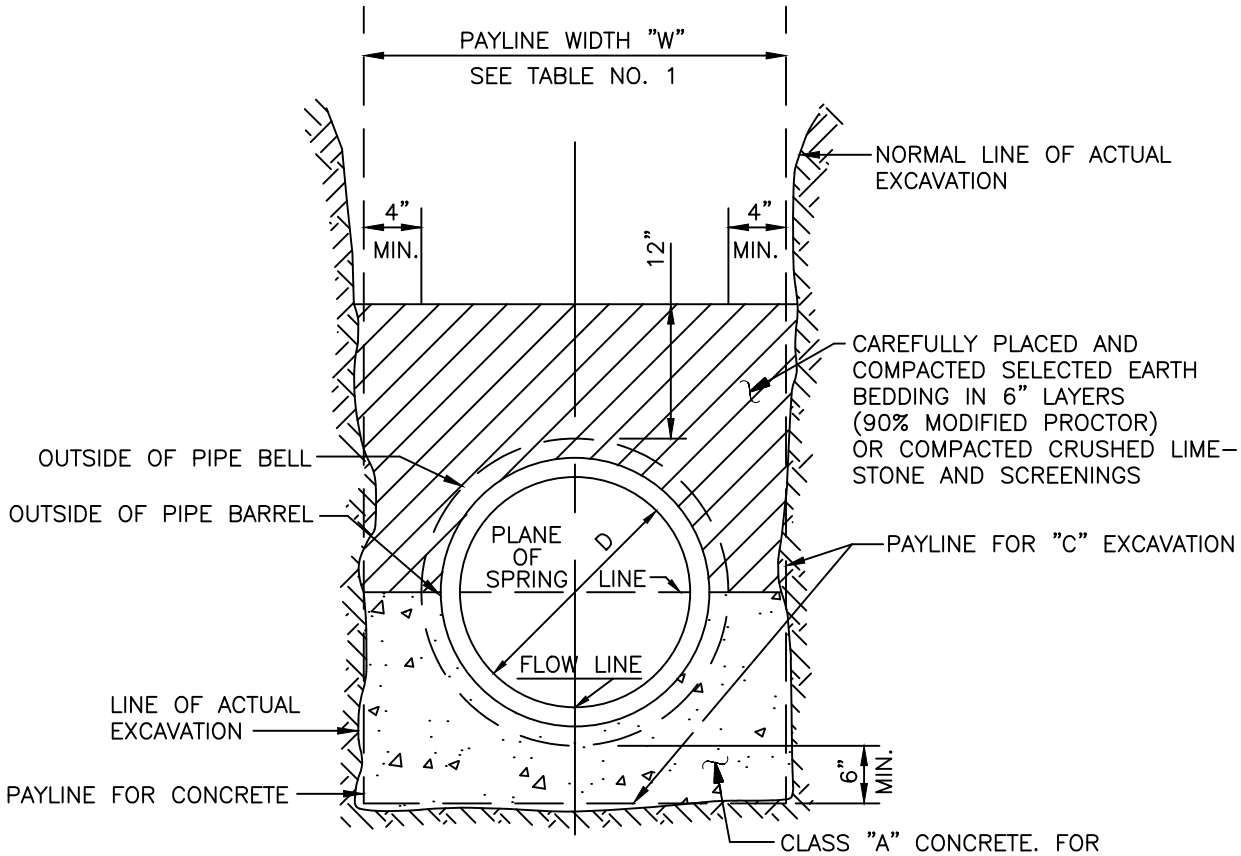


* IN HIGHLY ORGANIC OR OPENLY FLOWING SOILS, THIS DEPTH SHALL BE INCREASED AS REQUIRED BY THE DIRECTOR.

NOTES:

1. CHECK GRADE OF PIPE AFTER COMPACTION TO INSURE THE DESIRED FLOWLINE HAS NOT CHANGED.
2. ANY TRENCH BRACING USED BELOW THE TOP OF PIPE SHALL BE LEFT IN PLACE.
3. FOR INSTALLATIONS IN HIGHLY ORGANIC OR OPENLY FLOWING SOILS, THE ENTIRE PERIMETER OF THE PIPE BEDDING SHALL BE WRAPPED WITH AN APPROVED FILTER FABRIC OR THE "MINIMUM TRENCH WIDTH" SHALL BE EXPANDED BY INCREASING THE DISTANCE BETWEEN THE SIDE OF THE PIPE AND THE LINE OF ACTUAL EXCAVATION OR TRENCH BRACING TO A MINIMUM OF ONE PIPE DIAMETER.

Kent Peetz Approved Date Revisions	JACKSON, MO CITY OF BEAUTIFUL HOMES • PARKS • SCHOOLS AND CHURCHES 1814	PIPE BEDDING FOR FLEXIBLE PIPE (18" TO 48" DIAMETER)	Sheet: S-17



ALSO FOR PIPE SEWERS ON GRADES 25% TO 50% INCLUSIVE.

FOR GRADES EXCEEDING 50% SEE PROJECT SPECIFICATIONS.

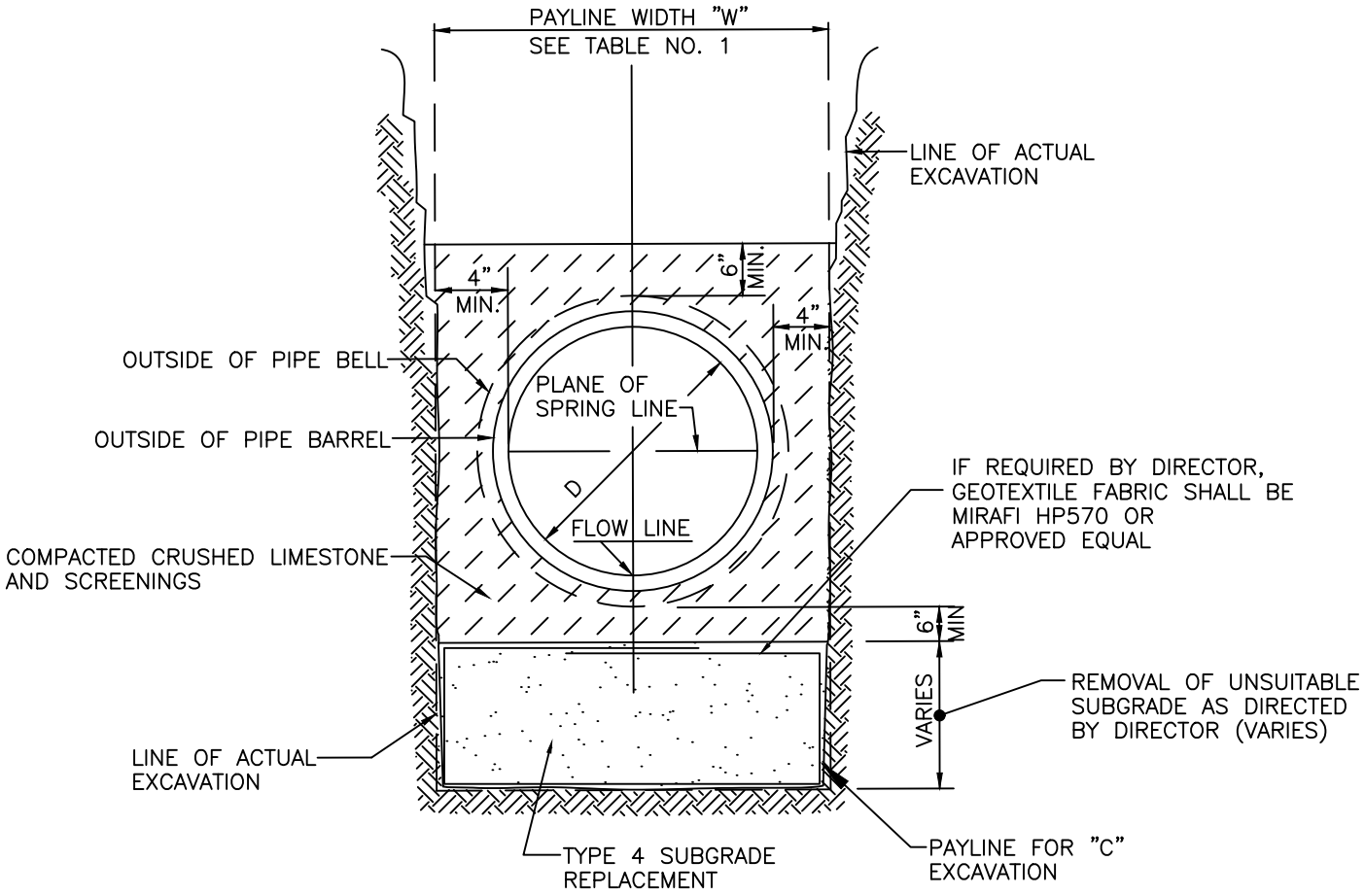
Kent Peetz
Approved
Date

Revisions

CONCRETE CRADLE (CLASS "A" BEDDING")

Sheet:

S-18

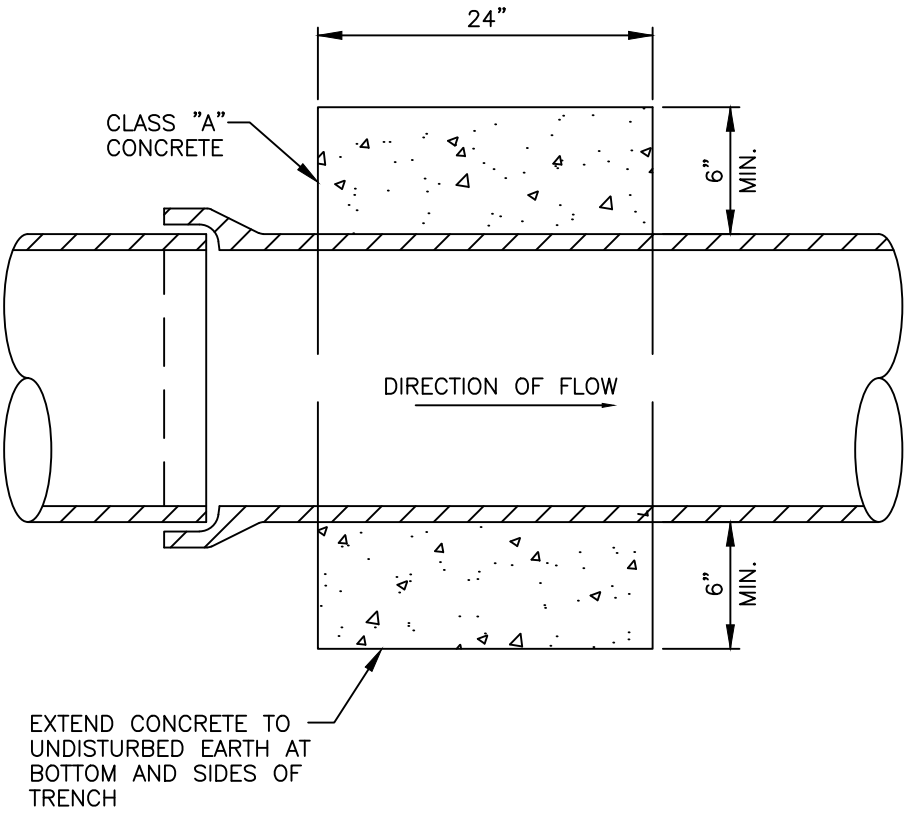


Kent Peetz
Approved Date

Revisions

BEDDING OF PIPE LAID ON UNSUITABLE SUBGRADE

Sheet:
S-19

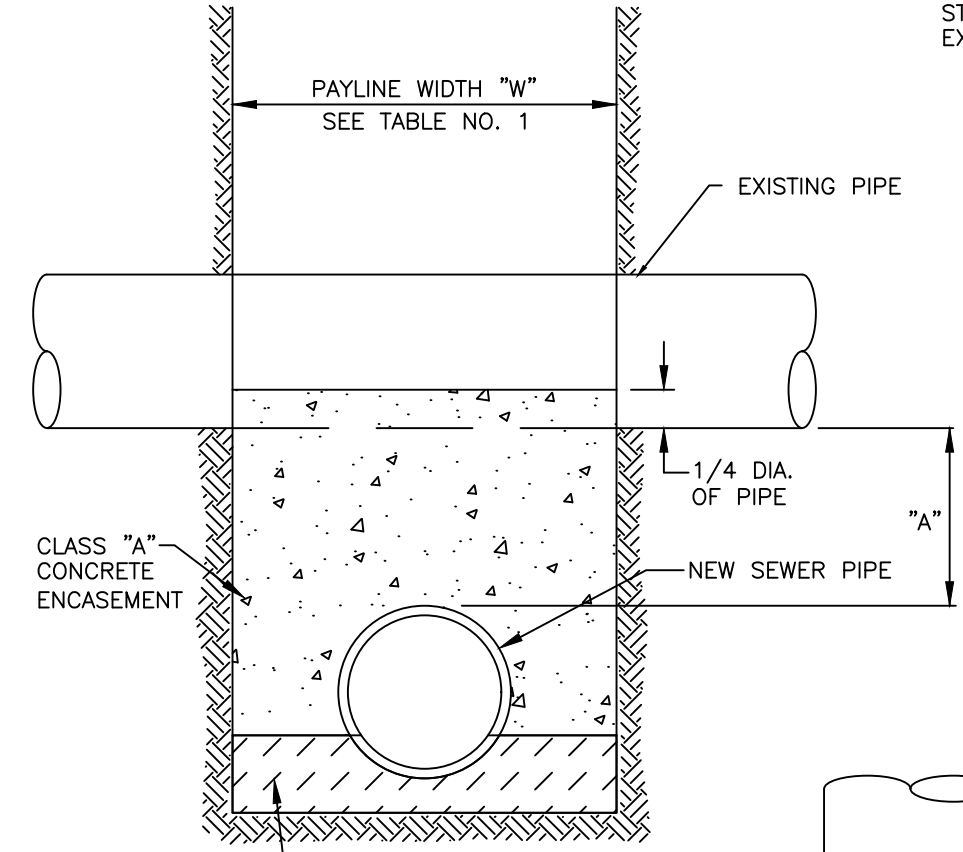


DETAIL OF CONCRETE COLLAR

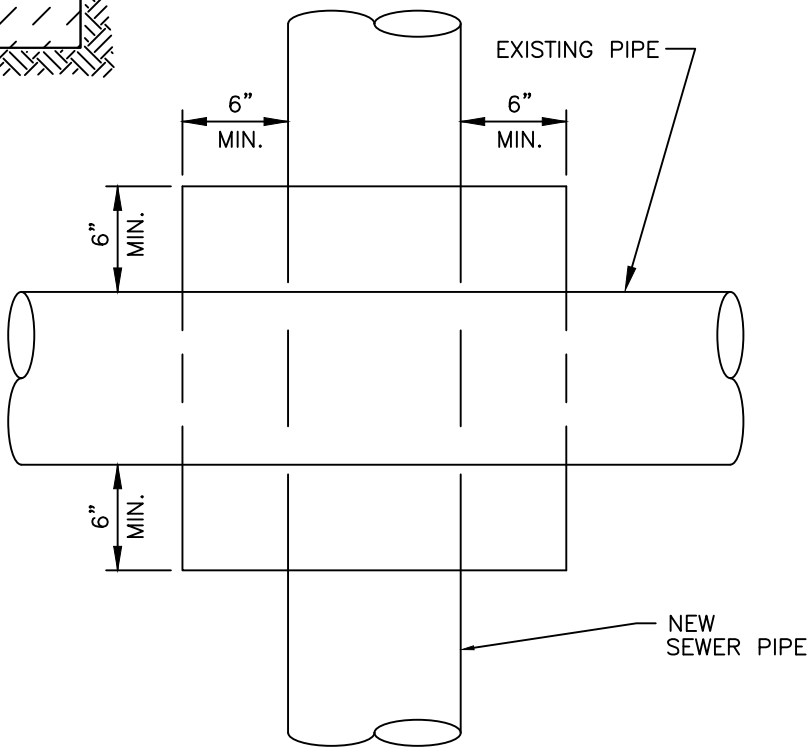
N.T.S.

Kent Peetz Approved Date Revisions	JACKSON, MO CITY OF BEAUTIFUL HOMES • PARKS • SCHOOLS AND CHURCHES 1814	CONCRETE COLLAR	Sheet: S-20

NOTE: WHERE "A" IS 12" OR GREATER, USE STANDARD CONCRETE CRADLE ON EXIST. SEWER PIPE



SECTION



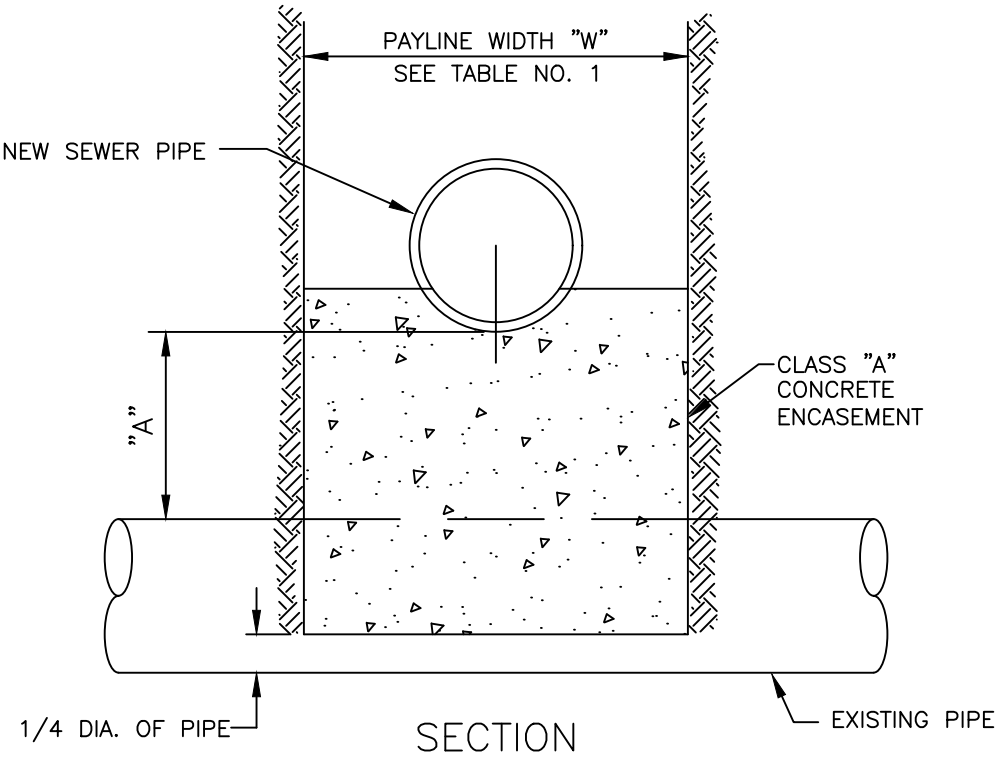
PLAN

Kent Peetz
Approved
Date

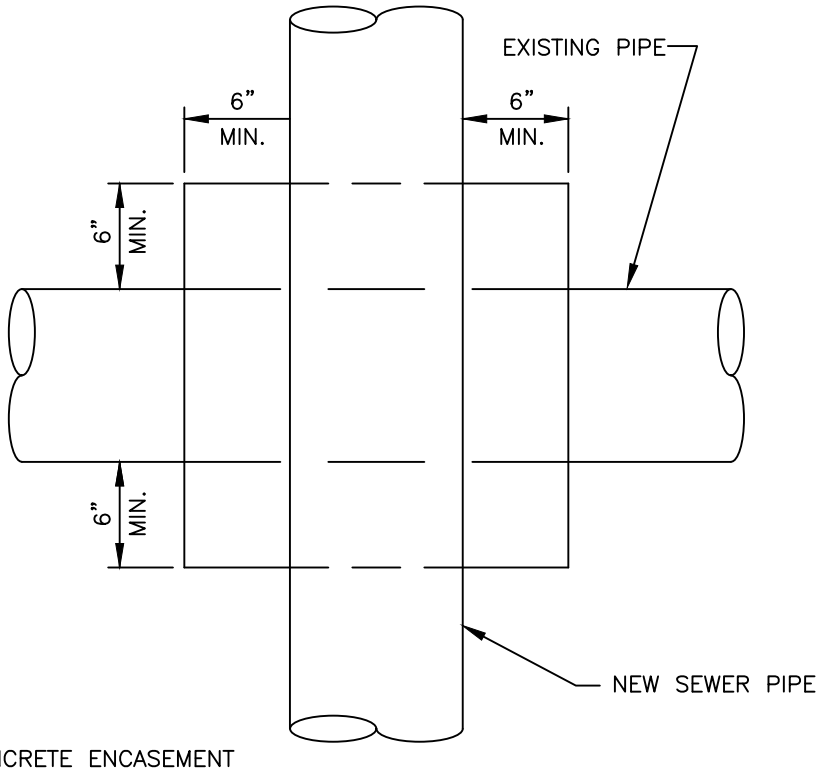
Revisions

PIPE ENCASEMENT FOR NEW SAN. PIPE UNDER EX. PIPE

Sheet: S-21



SECTION



PLAN

NOTES:

1) WHERE "A" IS GREATER THAN 12" NO CONCRETE ENCASEMENT IS REQUIRED.

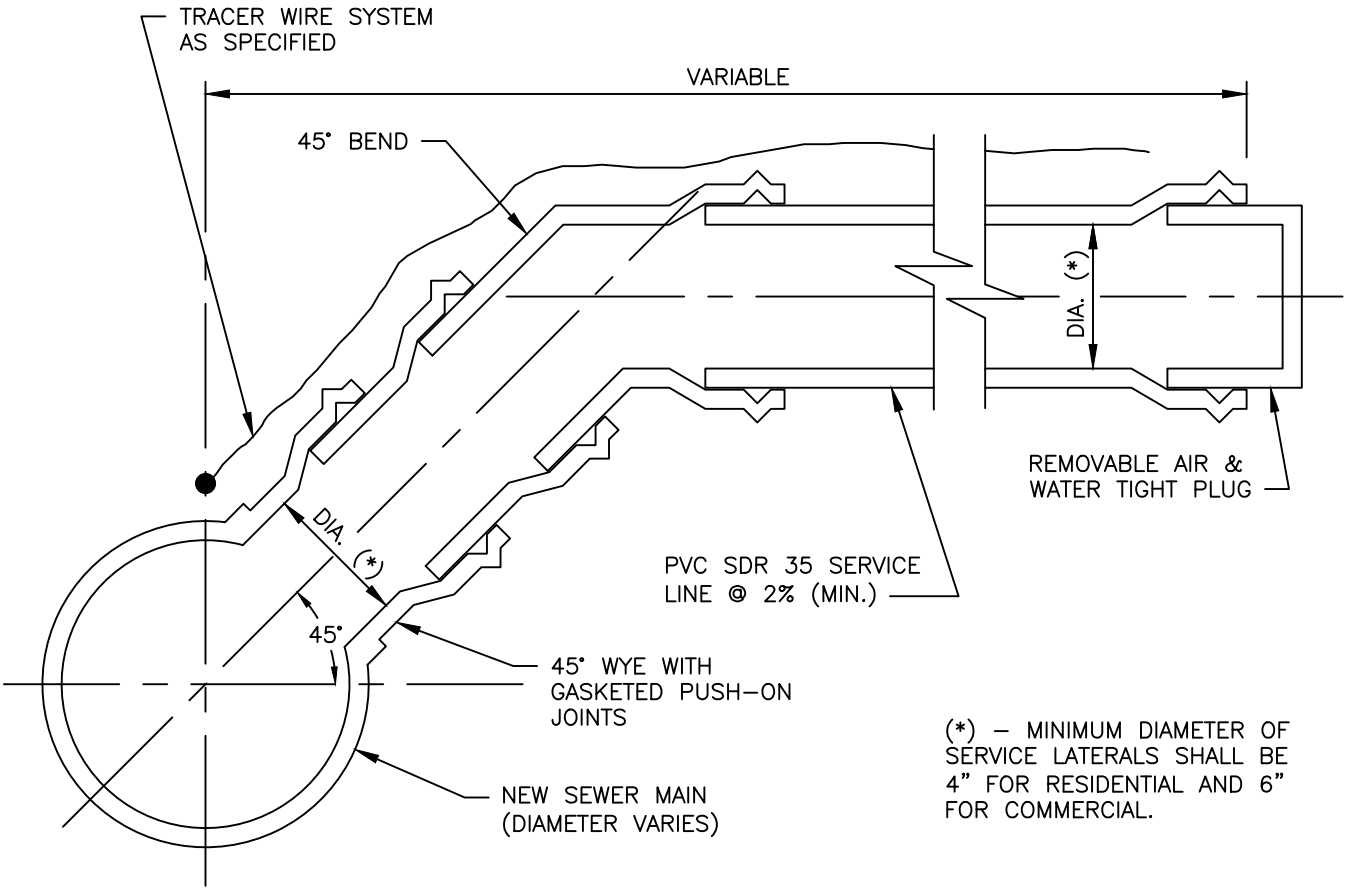
2) WHERE SANITARY SEWER AND POTABLE WATER CROSS, PIPE JOINTS SHALL BE THE MAXIMUM DISTANCE POSSIBLE FROM THE CROSSING.

Kent Peetz
Approved
Date

Revisions

PIPE ENCASEMENT FOR NEW SAN. PIPE OVER EX. PIPE

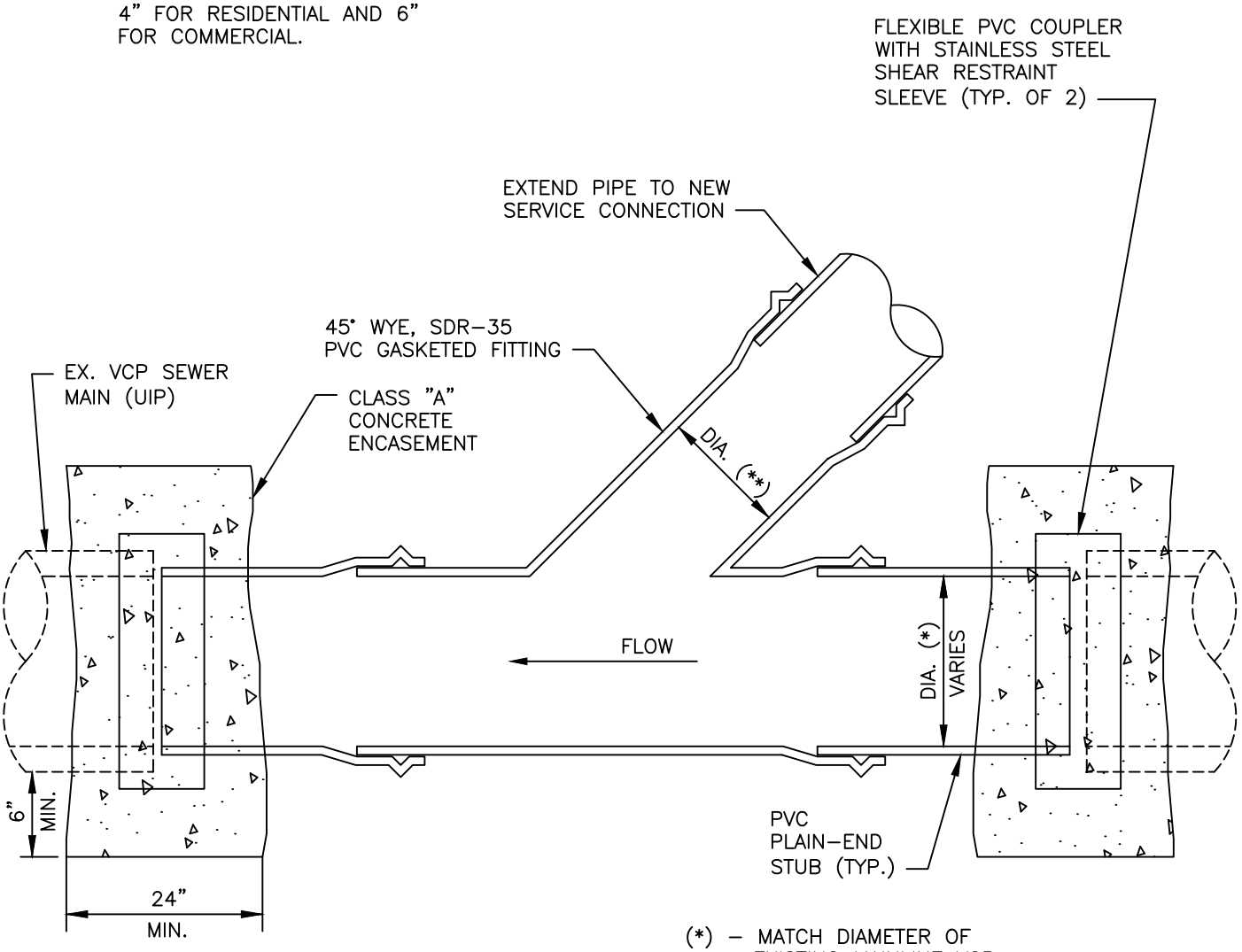
Sheet:
S-22



1. SDR–35 PVC WITH GASKETED PUSH–ON JOINT.
2. SEWER MAIN SHALL BE MIN 8" PVC SDR–35 UNLESS APPROVED BY DIRECTOR.
3. A CLEAN, DRY BEDDING MATERIAL IS REQUIRED AROUND THE COMPLETED CONNECTION BEFORE BACK FILLING. THE BEDDING MATERIAL FOR THE CONNECTION AND LATERAL PIPE SHALL BE TYPE 1 INSTALLED PER THE TYPE C TRENCH DETAIL.
4. LATERAL TAPS TO NEW CONSTRUCTION SHALL EXTEND 10 FEET BEYOND RIGHT OF WAY OR EASEMENT ONTO LOT TO BE SERVICED.
5. SERVICE WYE AND SERVICE LINE TO BE THE SAME MATERIAL AS MAIN UNLESS APPROVED BY DIRECTOR.
6. END OF SERVICE LINE SHALL HAVE A REMOVABLE AIR/WATER TIGHT PLUG.

Kent Peetz Approved Date Revisions	JACKSON, MO CITY OF BEAUTIFUL HOMES • PARKS • SCHOOLS AND CHURCHES 1814	NEW SEWER MAIN WITH LATERAL	Sheet: S-23

(**) – MINIMUM DIAMETER OF SERVICE LATERALS SHALL BE 4" FOR RESIDENTIAL AND 6" FOR COMMERCIAL.



(*) – MATCH DIAMETER OF EXISTING MAINLINE VCP SEWER

NOTES:

1. LATERAL CONNECTIONS TO EXISTING VCP SEWER MAIN SHALL BE MADE AS FOLLOWS: FLUSH CUT EXISTING VCP ON EITHER SIDE OF THE INTENDED CONNECTION, INSTALL SDR–35 COMPRESSION–JOINT PVC WYE WITH SDR–35 PVC STUBS BETWEEN BOTH ENDS OF THE VCP MAIN, ROTATED AXIALLY 45° FROM CENTER, CONNECT PVC STUBS TO EX. VCP WITH SHEAR–RESISTANT SHIELDED FLEXIBLE PVC COUPLER WITH STAINLESS STEEL SHEAR RESTRAINT.

2. COUPLING SHALL BE FERNCO 300 SERIES OR EQUAL. MATERIALS SHALL CONFORM TO ASTM C1173, ASTM C1460, AND ASTM 5926. ENCASE COUPLERS WITH CLASS "A" CONCRETE AS SHOWN.

3. WHEN A CONNECTION IS ALLOWED LARGER THAN 6" DIAMETER, OR WHEN APPROVED BY THE DIRECTOR, A SADDLE MAY BE USED IF THE I.D. OF THE CONNECTION PIPE IS NOT GREATER THAN ONE–HALF OF THE I.D. OF THE MAIN SEWER. SADDLE SHALL BE FERNCO TSPK–46 PRESSURE KIT, PIPECONX SADDLE WITH SHIELD, OR EQUAL. MATERIALS SHALL CONFORM TO ASTM C1173 AND ASTM C5926

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LATERAL CONNECTION TO EXISTING VCP SEWER MAIN

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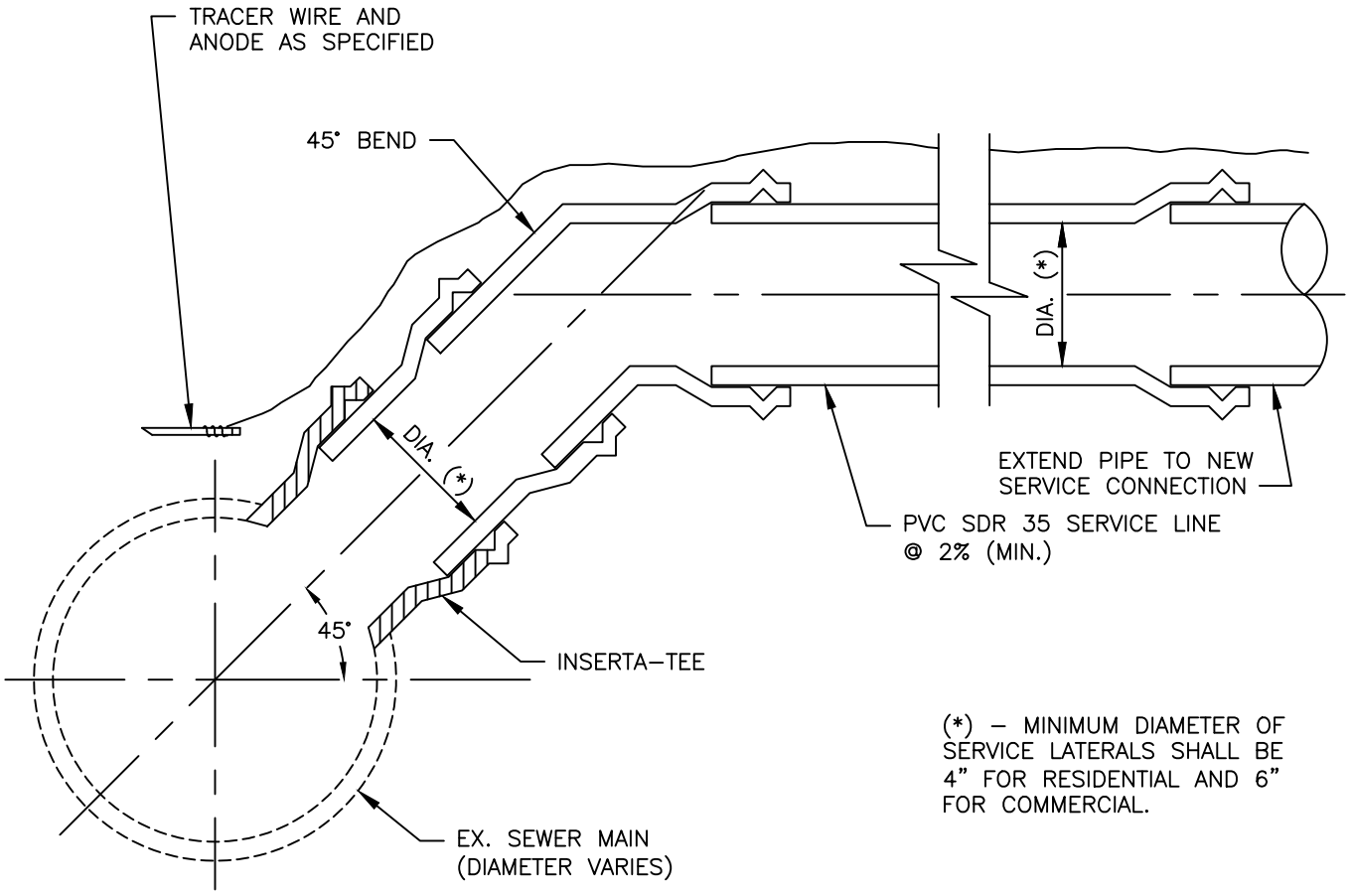

(*) – MINIMUM DIAMETER OF SERVICE LATERALS SHALL BE 4" FOR RESIDENTIAL AND 6" FOR COMMERCIAL.

NOTES:

1. A NEW LATERAL CONNECTION TO EXISTING PVC SEWER MAIN, OR OTHER DIRECTOR APPROVED PIPE MATERIAL, SHALL BE MADE WITH AN "INSERTA–TEE" FITTING. INSTALLATION OF THE INSERTA–TEE SHALL BE IN STRICT ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.

2. INSERTA–TEES SHALL NOT BE INSTALLED ON EXISTING VITRIFIED CLAY PIPE (VCP), UNLESS VCP HAS BEEN PREVIOUSLY LINED WITH CURED–IN–PLACE PIPE (CIPP) AND INSTALLATION IS APPROVED BY THE DIRECTOR.

3. NEW LATERAL PIPE AND FITTINGS SHALL BE PVC, SDR–35 WITH GASKETED JOINTS, UNLESS OTHERWISE APPROVED BY THE DIRECTOR. AN EXISTING 4" LATERAL PIPE MAY BE CONNECTED TO NEW 6" PVC PIPE USING A 4" X 6" PVC REDUCER. CONNECTION BETWEEN THE EXISTING PIPE AND NEW PIPE SHALL BE MADE WITH A DIRECTOR APPROVED FLEXIBLE PVC COUPLER WITH STAINLESS STEEL SHEAR RESTRAINT SLEEVE ENCASED IN CONCRETE.

4. A CLEAN DRY BEDDING IS REQUIRED AROUND THE COMPLETED CONNECTION BEFORE BACKFILLING. THE BEDDING MATERIAL FOR CONNECTION AND LATERAL PIPE SHALL BE TYPE 1 INSTALLED PER THE TYPE C TRENCH DETAIL.

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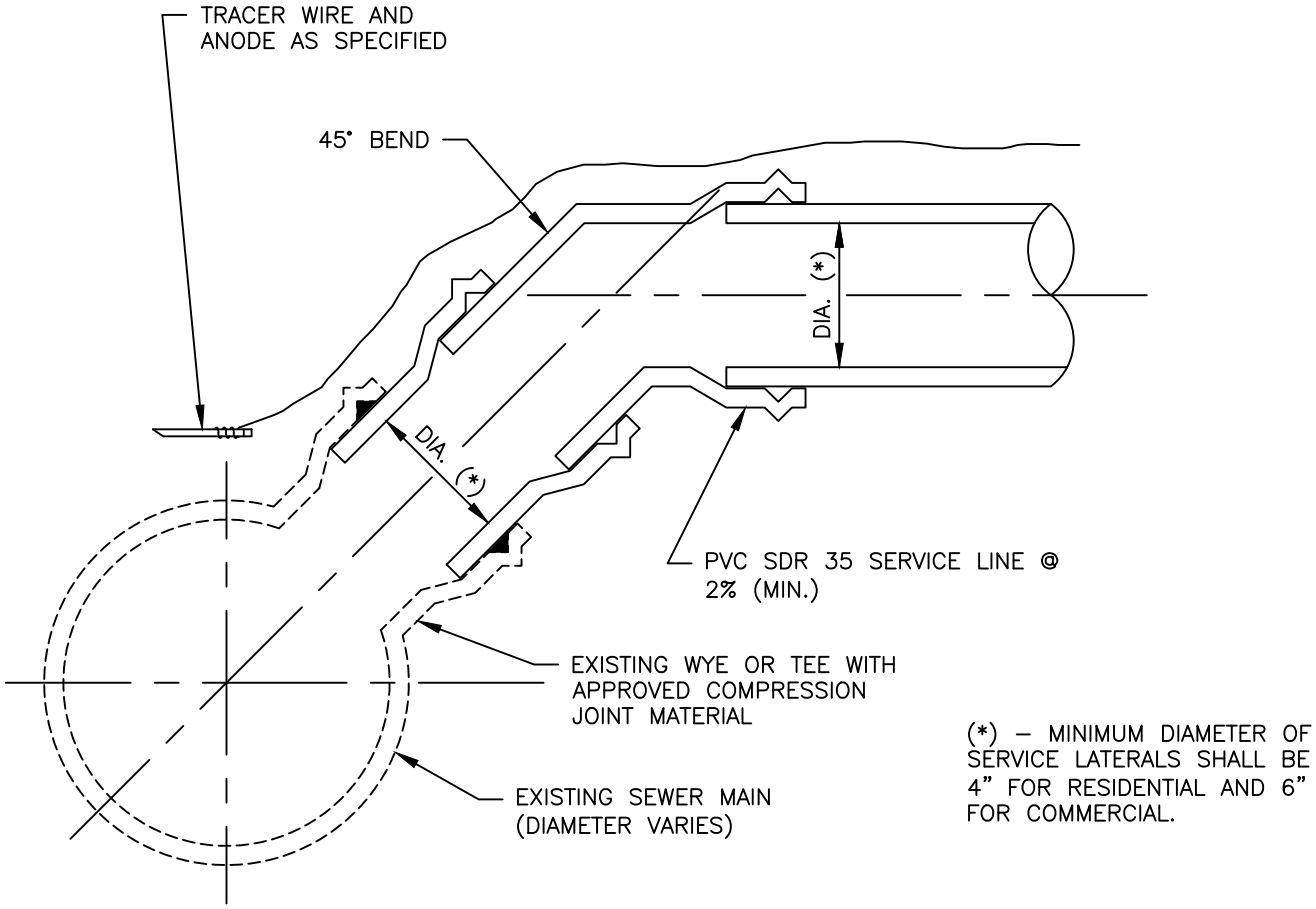
LATERAL CONNECTION TO EXISTING SEWER MAIN

Sheet: S-25



NOTES:

1. WHEN APPROVED BY THE DIRECTOR, EXISTING WYE OR TEE MAY BE UTILIZED TO CONNECT A NEW SERVICE LATERAL TO THE EXISTING SEWER MAIN.

2. CONNECTION TO EXISTING WYE OR TEE SHALL BE MADE WITH DIRECTOR APPROVED COMPRESSION JOINT MATERIAL THAT MATCHES THE SIZE AND MATERIAL OF THE EXISTING WYE OR TEE.

3. NEW LATERAL PIPE AND FITTINGS SHALL BE PVC, SDR–35 WITH GASKETED JOINTS, UNLESS OTHERWISE APPROVED BY THE DIRECTOR. AN EXISTING 4" LATERAL PIPE MAY BE CONNECTED TO THE NEW 6" PVC PIPE USING A 4" X 6" PVC REDUCER. CONNECTION BETWEEN THE EXISTING PIPE AND NEW PIPE SHALL BE MADE WITH A DIRECTOR APPROVED FLEXIBLE PVC COUPLER WITH STAINLESS STEEL SHEAR RESTRAINT SLEEVE ENCASED IN CONCRETE.

4. A CLEAN DRY BEDDING IS REQUIRED AROUND THE COMPLETED CONNECTION BEFORE BACKFILLING. THE BEDDING MATERIAL FOR CONNECTION AND LATERAL PIPE SHALL BE TYPE 1 INSTALLED PER THE TYPE C TRENCH DETAIL.

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MATERIALS

GENERAL

1. ALL TRACE WIRE AND TRACE WIRE PRODUCTS SHALL BE DOMESTICALLY MANUFACTURED IN THE U.S.A.

2. ALL TRACE WIRE SHALL HAVE HDPE INSULATION INTENDED FOR DIRECT BURY, GREEN COLOR COATED PER APWA STANDARD FOR SANITARY SEWER AND FORCE MAIN.

TRACE WIRE

1. OPEN TRENCH – TRACE WIRE SHALL BE #12 AWG COPPER CLAD STEEL, HIGH STRENGTH WITH MINIMUM 450 LB. BREAK LOAD, WITH MINIMUM 30 MIL HDPE INSULATION THICKNESS.
2. DIRECTIONAL DRILLING/BORING – TRACE WIRE SHALL BE #12 AWG COPPER CLAD STEEL, EXTRA HIGH STRENGTH WITH MINIMUM 1,150 LB. BREAK LOAD, WITH MINIMUM 30 MIL HDPE INSULATION THICKNESS.
3. TRACE WIRE – PIPE BURSTING/SLIP LINING – TRACE WIRE SHALL BE 7 X 7 STRANDED COPPER CLAD STEEL, EXTREME STRENGTH WITH 4,700 LB. BREAK LOAD, WITH MINIMUM 50 ML HDPE INSULATION THICKNESS.

CONNECTORS

1. ALL MAINLINE TRACE WIRES MUST BE INTERCONNECTED IN INTERSECTIONS, AT MAINLINE TEES AND MAINLINE CROSSES. AT TEES, THE THREE WIRES SHALL BE JOINED USING A SINGLE 3–WAY LOCKABLE CONNECTOR. AT CROSSES, THE FOUR WIRES SHALL BE JOINED USING A 4–WAY CONNECTOR. USE OF TWO 3–WAY CONNECTORS WITH A SHORT JUMPER WIRE BETWEEN THEM IS AN ACCEPTABLE ALTERNATIVE.
2. DIRECT BURY WIRE CONNECTORS – SHALL INCLUDE 3–WAY LOCKABLE CONNECTORS AND MAINLINE TO LATERAL LUG CONNECTORS SPECIFICALLY MANUFACTURED FOR USE IN UNDERGROUND TRACE WIRE INSTALLATION. CONNECTORS SHALL BE DIELECTRIC SILICON FILLED TO SEAL OUT MOISTURE AND CORROSION, AND SHALL BE INSTALLED IN A MANNER SO AS TO PREVENT ANY UNINSULATED WIRE EXPOSURE.
3. NON LOCKING FRICTION FIT, TWIST ON OR TAPED CONNECTORS ARE PROHIBITED.

TERMINATION/ACCESS

1. ALL TRACE WIRE TERMINATION POINTS MUST UTILIZE AN APPROVED TRACE WIRE ACCESS BOX (ABOVE GROUND ACCESS BOX OR GRADE LEVEL/IN–GROUND ACCESS BOX AS APPLICABLE), SPECIFICALLY MANUFACTURED FOR THIS PURPOSE.
2. ALL GRADE LEVEL/IN–GROUND ACCESS BOXES SHALL BE APPROPRIATELY IDENTIFIED WITH "SEWER" CAST INTO THE CAP AND BE COLOR CODED GREEN.
3. A MINIMUM OF 2 FT. OF EXCESS/SLACK WIRE IS REQUIRED IN ALL TRACE WIRE ACCESS BOXES AFTER MEETING FINAL ELEVATION.
4. ALL TRACE WIRE ACCESS BOXES MUST INCLUDE A MANUALLY INTERRUPTIBLE CONDUCTIVE/CONNECTIVE LINK BETWEEN THE TERMINAL(S) FOR THE TRACE WIRE CONNECTION AND THE TERMINAL FOR THE GROUNDING ANODE WIRE CONNECTION.
5. GROUNDING ANODE WIRE SHALL BE CONNECTED TO THE IDENTIFIED (OR BOTTOM) TERMINAL ON ALL ACCESS BOXES.
6. SERVICE LATERALS – TRACE WIRE MUST TERMINATE AT AN APPROVED ABOVE–GROUND TRACE WIRE ACCESS BOX, AFFIXED TO THE BUILDING EXTERIOR DIRECTLY ABOVE WHERE THE UTILITY ENTERS THE BUILDING, AT AN ELEVATION NOT GREATER THAN 5 VERTICAL FEET ABOVE FINISHED GRADE, OR TERMINATE AT AN APPROVED GRADE LEVEL/IN–GROUND TRACE WIRE ACCESS BOX, LOCATED WITHIN 2 LINEAR FEET OF THE BUILDING BEING SERVED BY THE DISTRICT.
7. LONG–RUNS, IN EXCESS OF 500 LINEAR FEET WITHOUT SERVICE LATERALS – TRACE WIRE ACCESS MUST BE PROVIDED UTILIZING AN APPROVED GRADE LEVEL/IN–GROUND TRACE WIRE ACCESS BOX, LOCATED AT THE EDGE OF THE ROAD RIGHT–OF–WAY, AND OUT OF THE ROADWAY. THE GRADE LEVEL/IN–GROUND TRACE WIRE ACCESS BOX SHALL BE DELINEATED USING A MINIMUM 48" POLYETHYLENE MARKER POST, COLOR CODED GREEN PER APWA STANDARD.

GROUNDING

1. TRACE WIRE MUST BE PROPERLY GROUNDED AT ALL DEAD ENDS/STUBS.
2. GROUNDING OF TRACE WIRE SHALL BE ACHIEVED BY USE OF A DRIVE–IN MAGNESIUM GROUNDING ANODE ROD WITH A MINIMUM OF 20FT OF #14 RED HDPE INSULATED COPPER CLAD STEEL WIRE CONNECTED TO ANODE (MINIMUM 1.5 LB.) SPECIFICALLY MANUFACTURED FOR THIS PURPOSE, AND BURIED AT THE SAME ELEVATION AS THE SEWER PIPE OR FORCE MAIN.
3. WHEN GROUNDING THE TRACE WIRE AT DEAD ENDS/STUBS, THE GROUNDING ANODE SHALL BE INSTALLED IN A DIRECTION 180 DEGREES OPPOSITE OF THE TRACE WIRE, AT THE MAXIMUM POSSIBLE DISTANCE.
4. WHEN GROUNDING THE TRACE WIRE IN AREAS WHERE THE TRACE WIRE IS CONTINUOUS AND NEITHER THE MAINLINE TRACE WIRE OR THE GROUNDING ANODE WIRE WILL BE TERMINATED AT/ABOVE GRADE, INSTALL GROUNDING ANODE DIRECTLY BENEATH AND IN–LINE WITH THE TRACE WIRE. DO NOT COIL EXCESS WIRE FROM GROUNDING ANODE. IN THIS INSTALLATION METHOD, THE GROUNDING ANODE WIRE SHALL BE TRIMMED TO AN APPROPRIATE LENGTH BEFORE CONNECTING TO TRACE WIRE WITH A MAINLINE TO LATERAL LUG CONNECTOR.
5. WHERE THE ANODE WIRE WILL BE CONNECTED TO A TRACE WIRE ACCESS BOX, A MINIMUM OF 2 FT. OF EXCESS/SLACK WIRE IS REQUIRED AFTER MEETING FINAL ELEVATION.

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INSTALLATION

GENERAL

1. TRACE WIRE INSTALLATION SHALL BE PERFORMED IN SUCH A MANNER THAT ALLOWS PROPER ACCESS FOR CONNECTION OF LINE TRACING EQUIPMENT, PROPER LOCATING OF WIRE WITHOUT LOSS OR DETERIORATION OF LOW FREQUENCY (512HZ) SIGNAL FOR DISTANCES IN EXCESS OF 1,000 LINEAR FEET, AND WITHOUT DISTORTION OF SIGNAL CAUSED BY MULTIPLE WIRES BEING INSTALLED IN CLOSE PROXIMITY TO ONE ANOTHER.
2. TRACE WIRE SYSTEMS MUST BE INSTALLED AS A SINGLE CONTINUOUS WIRE, EXCEPT WHERE USING APPROVED CONNECTORS. NO LOOPING OR COILING OF WIRE IS ALLOWED.
3. ANY DAMAGE OCCURRING DURING INSTALLATION OF THE TRACE WIRE MUST BE IMMEDIATELY REPAIRED BY REMOVING THE DAMAGED WIRE, AND INSTALLING A NEW SECTION OF WIRE WITH APPROVED CONNECTORS. TAPING AND/OR SPRAY COATING SHALL NOT BE ALLOWED.
4. TRACE WIRE SHALL BE INSTALLED AT THE BOTTOM HALF OF THE PIPE AND SECURED (TAPED/TIED) AT 5' INTERVALS.
5. TRACE WIRE MUST BE PROPERLY GROUNDED AS SPECIFIED.
6. TRACE WIRE ON ALL SERVICE LATERALS/STUBS MUST TERMINATE AT AN APPROVED TRACE WIRE ACCESS BOX LOCATED DIRECTLY ABOVE THE SEWER PIPE. (SEE TRACE WIRE TERMINATION/ACCESS)
7. AT ALL MAINLINE DEAD–ENDS, TRACE WIRE SHALL GO TO GROUND USING AN APPROVED CONNECTION TO A DRIVE–IN MAGNESIUM GROUNDING ANODE ROD, BURIED AT THE SAME DEPTH AS THE TRACE WIRE. (SEE GROUNDING)
8. MAINLINE TRACE WIRE SHALL NOT BE CONNECTED TO EXISTING CONDUCTIVE PIPES. TREAT AS A MAINLINE DEAD– END, GROUND USING AN APPROVED WATERPROOF CONNECTION TO A GROUNDING ANODE BURIED AT THE SAME DEPTH AS THE TRACE WIRE.
9. ALL SERVICE LATERAL TRACE WIRES SHALL BE A SINGLE WIRE, CONNECTED TO THE MAINLINE TRACE WIRE USING A MAINLINE TO LATERAL LUG CONNECTOR, INSTALLED WITHOUT CUTTING/SPLICING THE MAINLINE TRACE WIRE.
10. IN OCCURRENCES WHERE AN EXISTING TRACE WIRE IS ENCOUNTERED ON AN EXISTING UTILITY THAT IS BEING EXTENDED OR TIED INTO, THE NEW TRACE WIRE AND EXISTING TRACE WIRE SHALL BE CONNECTED USING APPROVED SPLICE CONNECTORS, AND SHALL BE PROPERLY GROUNDED AT THE SPLICE LOCATION AS SPECIFIED.
11. A MAINLINE TRACE WIRE MUST BE INSTALLED, WITH ALL SERVICE LATERAL TRACE WIRES PROPERLY CONNECTED TO THE MAINLINE TRACE WIRE, TO ENSURE FULL TRACING/LOCATING CAPABILITIES FROM A SINGLE CONNECTION POINT.
12. LAY MAINLINE TRACE WIRE CONTINUOUSLY, BY–PASSING AROUND THE OUTSIDE OF MANHOLES/STRUCTURES ON THE NORTH OR EAST SIDE.
13. TRACE WIRE ON ALL SANITARY SERVICE LATERALS MUST TERMINATE AT AN APPROVED TRACE WIRE ACCESS BOX COLOR CODED GREEN AND LOCATED DIRECTLY ABOVE THE SERVICE LATERAL.

PROHIBITED PRODUCTS AND METHODS

THE FOLLOWING PRODUCTS AND METHODS SHALL NOT BE ALLOWED OR ACCEPTABLE

1. UNINSULATED TRACE WIRE
2. TRACE WIRE INSULATIONS OTHER THAN HDPE
3. TRACE WIRES NOT DOMESTICALLY MANUFACTURED
4. NON LOCKING, FRICTION FIT, TWIST ON OR TAPED CONNECTORS
5. BRASS OR COPPER GROUND RODS
6. WIRE CONNECTIONS UTILIZING TAPING OR SPRAY–ON WATERPROOFING
7. LOOPED WIRE OR CONTINUOUS WIRE INSTALLATIONS, THAT HAS MULTIPLE WIRES LAID SIDE–BY–SIDE OR IN CLOSE PROXIMITY TO ONE ANOTHER
8. TRACE WIRE WRAPPED AROUND THE CORRESPONDING UTILITY
9. BRASS FITTINGS WITH TRACE WIRE CONNECTION LUGS
10. WIRE TERMINATIONS WITHIN THE ROADWAY, I.E. IN VALVE BOXES, CLEANOUTS, MANHOLES, ETC.
11. CONNECTING TRACE WIRE TO EXISTING CONDUCTIVE UTILITIES

TESTING

1. ALL NEW TRACE WIRE INSTALLATIONS SHALL BE LOCATED BY CONTRACTOR USING TYPICAL LOW FREQUENCY (512HZ) LINE TRACING EQUIPMENT AND WITNESSED BY THE DISTRICT PRIOR TO ACCEPTANCE OF OWNERSHIP.
2. THIS VERIFICATION SHALL BE PERFORMED UPON COMPLETION OF ROUGH GRADING AND AGAIN PRIOR TO FINAL ACCEPTANCE OF THE PROJECT.
3. CONTINUITY TESTING IN LIEU OF ACTUAL LINE TRACING SHALL NOT BE ACCEPTED.

ACCEPTABLE PRODUCTS

TRACE WIRE PRODUCTS SHALL BE AS FOLLOWS OR DIRECTOR APPROVED EQUAL:

COPPER CLAD STEEL (CCS) TRACE WIRE

1. OPEN TRENCH – COPPERHEAD #12 HIGH STRENGTH PART # 1230–HS
2. DIRECTIONAL DRILLING/BORING – COPPERHEAD EXTRA HIGH STRENGTH PART # 1245*EHS
3. PIPE BURSTING/SLIP LINING – COPPERHEAD SOLOSHOT EXTREME STRENGTH 7 X 7 STRANDED PART # PBX–50

CONNECTORS

1. COPPERHEAD 3–WAY LOCKING CONNECTOR PART # LSC1230*
2. DRYCONN 3– WAY DIRECT BURY LUG: COPPERHEAD PART # 3WB–01

TERMINATION/ACCESS

1. BOXES TO BE PROVIDED WITH 2–TERMINAL CONNECTION LID WHERE BOTH GROUND AND TRACE WIRES ARE PRESENT. COPPERHEAD PART # SP–LID–2
2. NON–ROADWAY ACCESS BOXES APPLICATIONS: TRACE WIRE ACCESS BOXES GRADE LEVEL COPPERHEAD ADJUSTABLE LITE DUTY PART # LD14*TP
3. CONCRETE / DRIVEWAY ACCESS BOX APPLICATIONS: TRACE WIRE ACCESS BOXES GRADE LEVEL COPPERHEAD PART # CD14*TP 14"
4. ROADWAY ACCESS BOX APPLICATIONS: TRACE WIRE ACCESS BOXES GRADE LEVEL COPPERHEAD PART # RB14*TP.

GROUNDING

1. ABOVE GRADE ACCESS BOX: COPPERHEAD PART # T2.
2. DRIVE IN MAGNESIUM ANODE: COPPERHEAD PART # ANO–1005 (1.5 LB)

Kent Peetz
Approved

Date

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JACKSON, MO
CITY OF BEAUTIFUL HOMES • PARKS • SCHOOLS AND CHURCHES
1814

TRACER WIRE SPECIFICATIONS (2)

Sheet:

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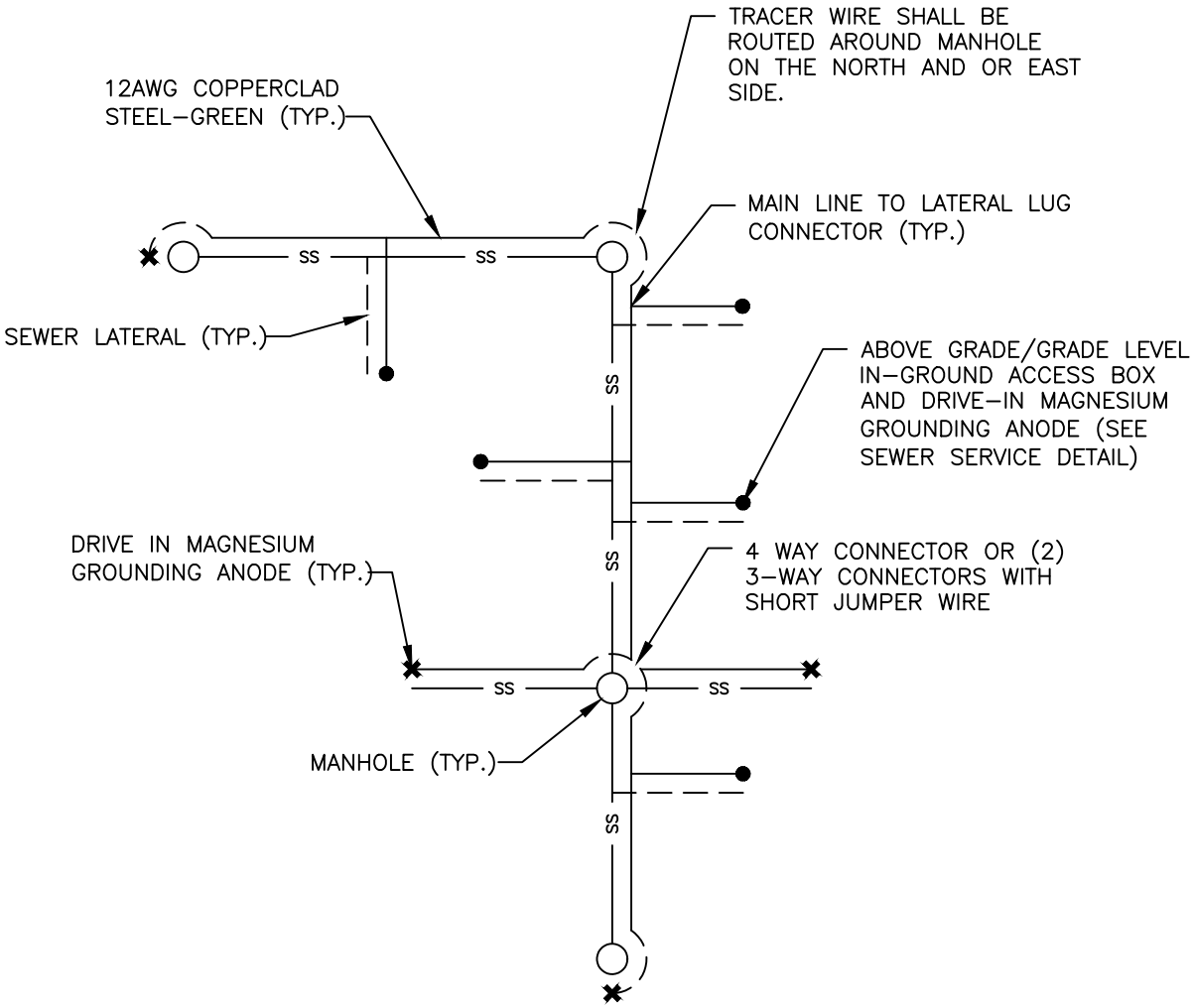

NOTES:

1. WIRE SHOWN AWAY FROM PIPE FOR CLARITY. WIRE SHALL BE INSTALLED ON HE BOTTOM SIDE OF THE PIPE BELOW THE SPRING LINE. THE WIRES SHALL BE FASTENED TO THE PIPE WITH TAPE OR PLASTIC TIES AT 5' INTEVALS.

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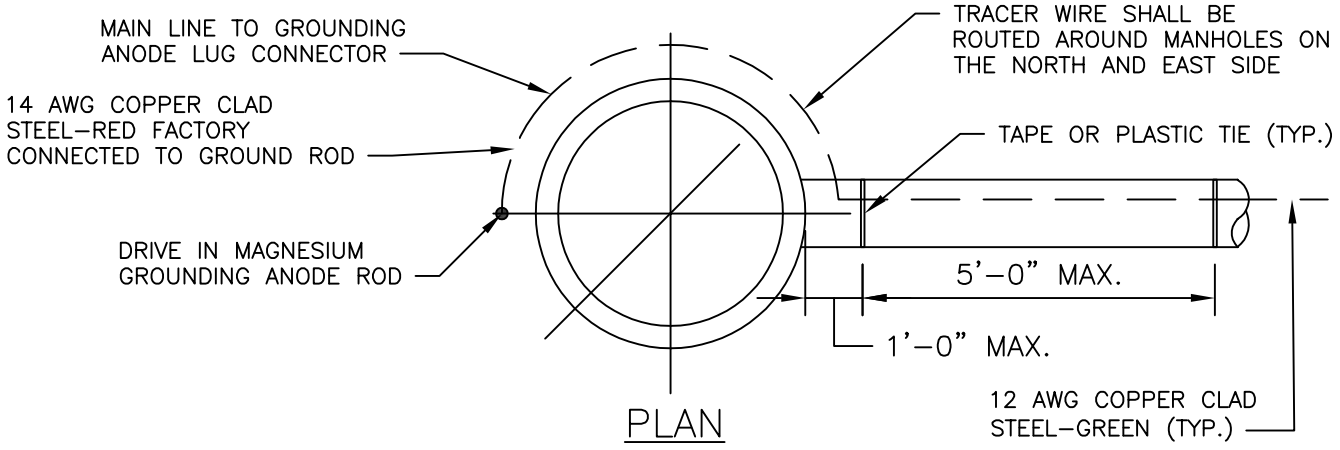
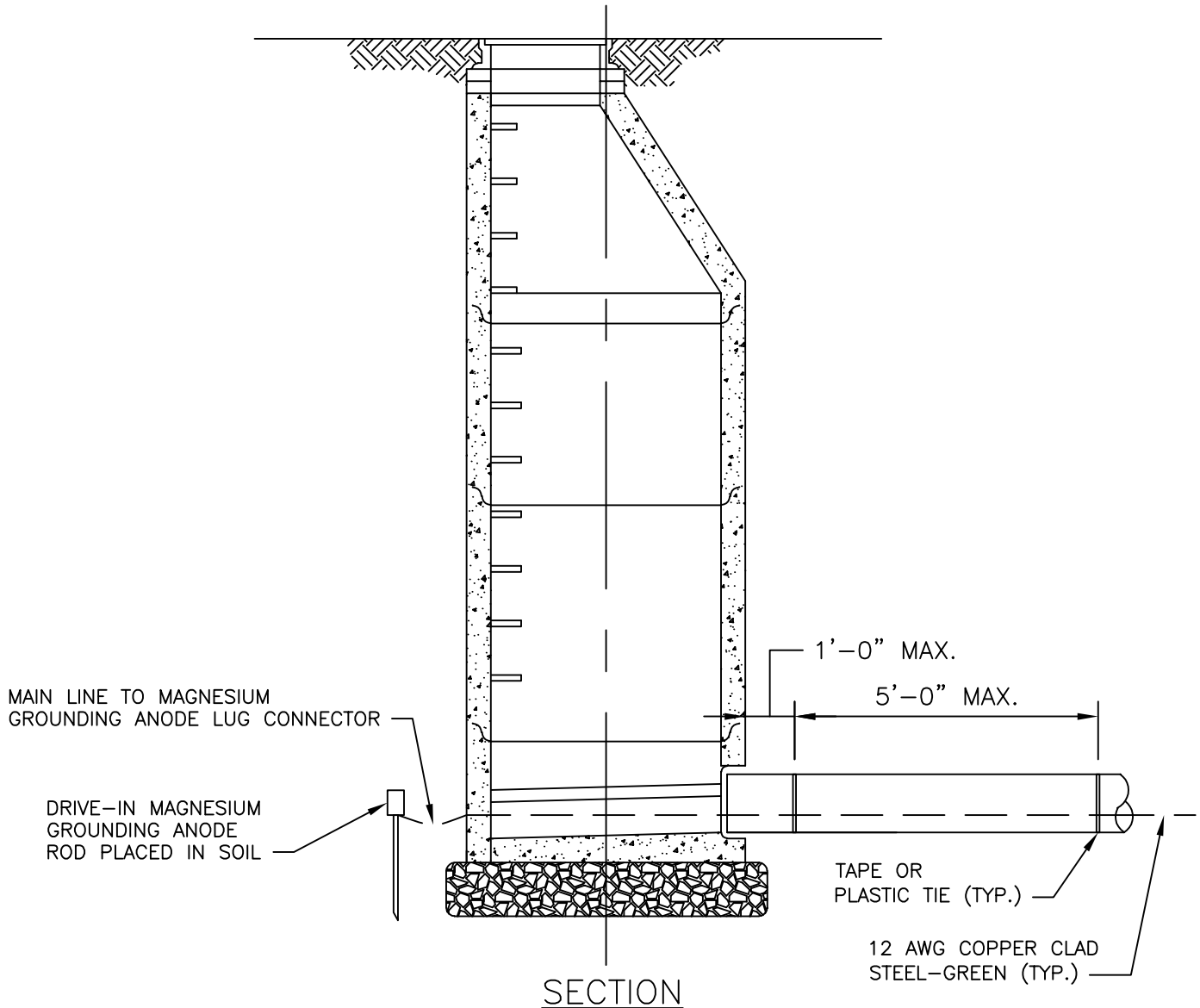
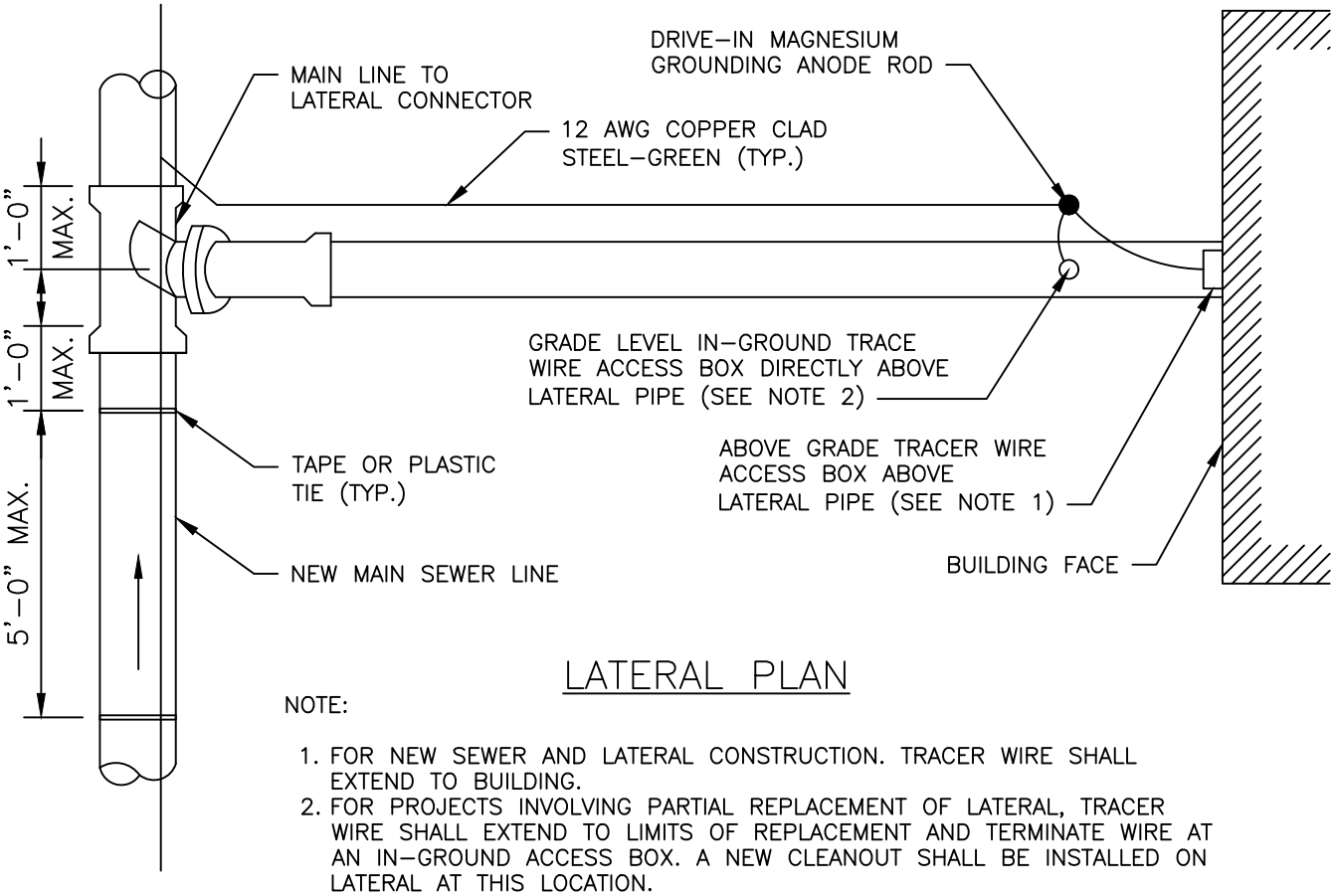


PLAN



SECTION

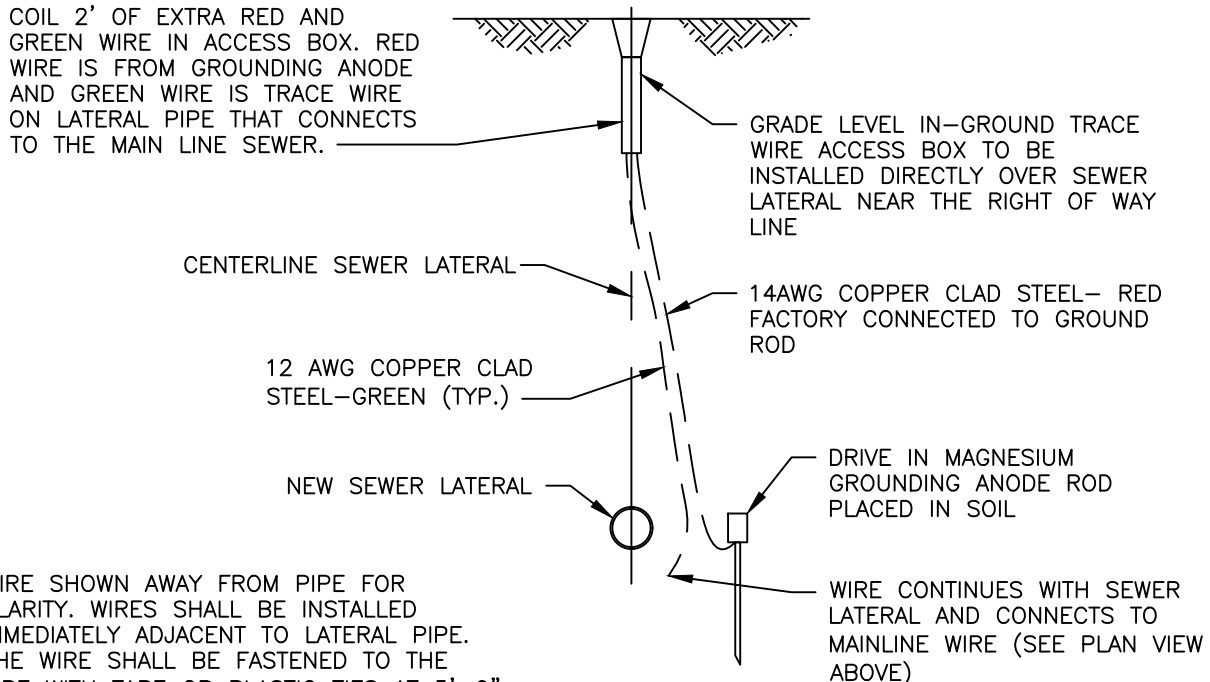
Kent Peetz Approved Date Revisions	JACKSON, MO CITY OF BEAUTIFUL HOMES • PARKS • SCHOOLS AND CHURCHES 1814	TRACER WIRE AT MANHOLE (NEW MAIN SEWER SYSTEM)	Sheet: S-30



LATERAL PLAN

NOTE:

1. FOR NEW SEWER AND LATERAL CONSTRUCTION. TRACER WIRE SHALL EXTEND TO BUILDING.
2. FOR PROJECTS INVOLVING PARTIAL REPLACEMENT OF LATERAL, TRACER WIRE SHALL EXTEND TO LIMITS OF REPLACEMENT AND TERMINATE WIRE AT AN IN–GROUND ACCESS BOX. A NEW CLEANOUT SHALL BE INSTALLED ON LATERAL AT THIS LOCATION.



NOTE:
1. WIRE SHOWN AWAY FROM PIPE FOR CLARITY. WIRES SHALL BE INSTALLED IMMEDIATELY ADJACENT TO LATERAL PIPE. THE WIRE SHALL BE FASTENED TO THE PIPE WITH TAPE OR PLASTIC TIES AT 5'–0" INTERVALS

SECTION

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TRACER WIRE AT LATERAL (NEW MAIN SEWER SYSTEM)

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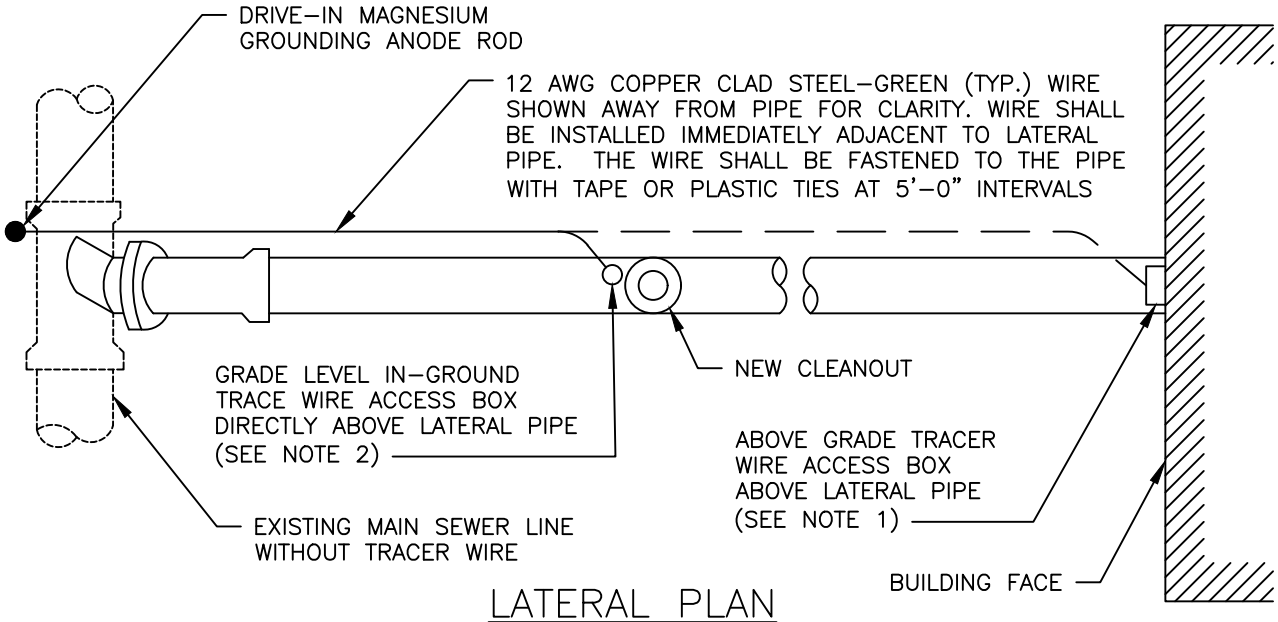
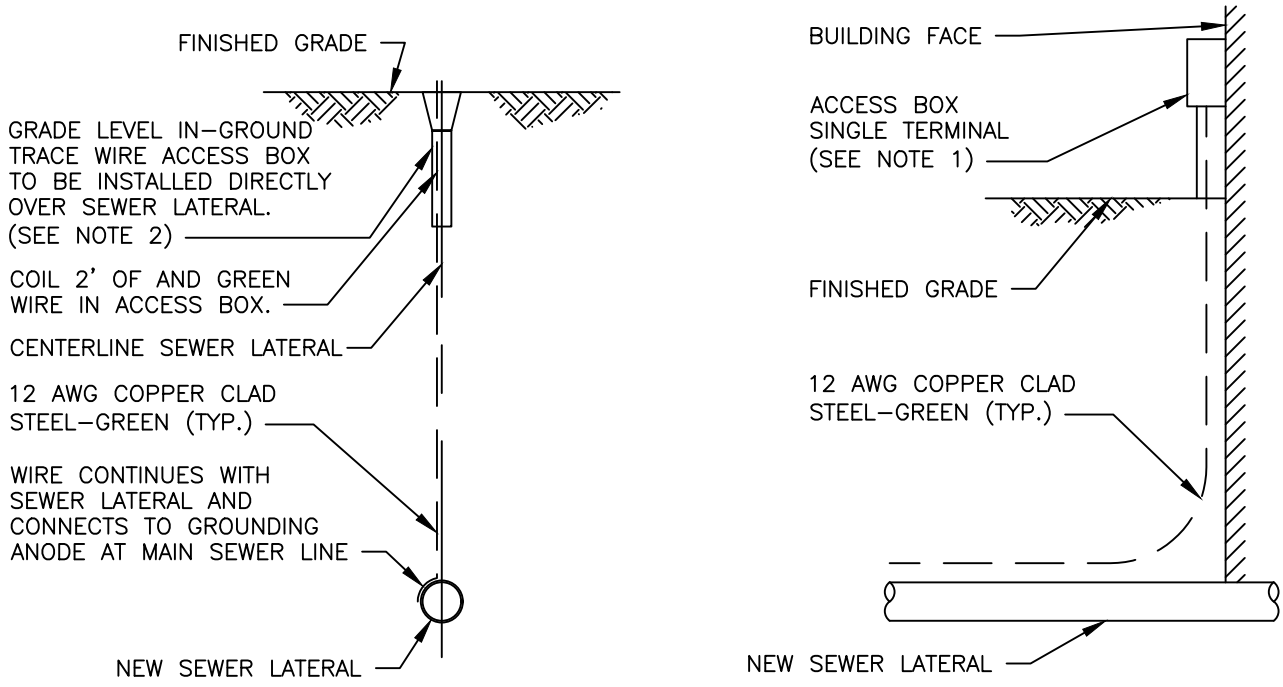


LATERAL PLAN

NOTES:

1. FOR NEW LATERAL CONSTRUCTION. TRACER WIRE SHALL EXTEND TO BUILDING.
2. FOR PROJECTS INVOLVING PARTIAL REPLACEMENT OF LATERAL, TRACER WIRE SHALL EXTEND TO LIMITS OF REPLACEMENT AND TERMINATE WIRE AT AN IN–GROUND ACCESS BOX. A NEW CLEANOUT SHALL BE INSTALLED ON LATERAL AT THIS LOCATION.



SECTIONS

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JACKSON, MO
CITY OF BEAUTIFUL HOMES • PARKS • SCHOOLS AND CHURCHES
1814

TRACER WIRE AT LATERAL (EX. MAIN SEWER LINE)

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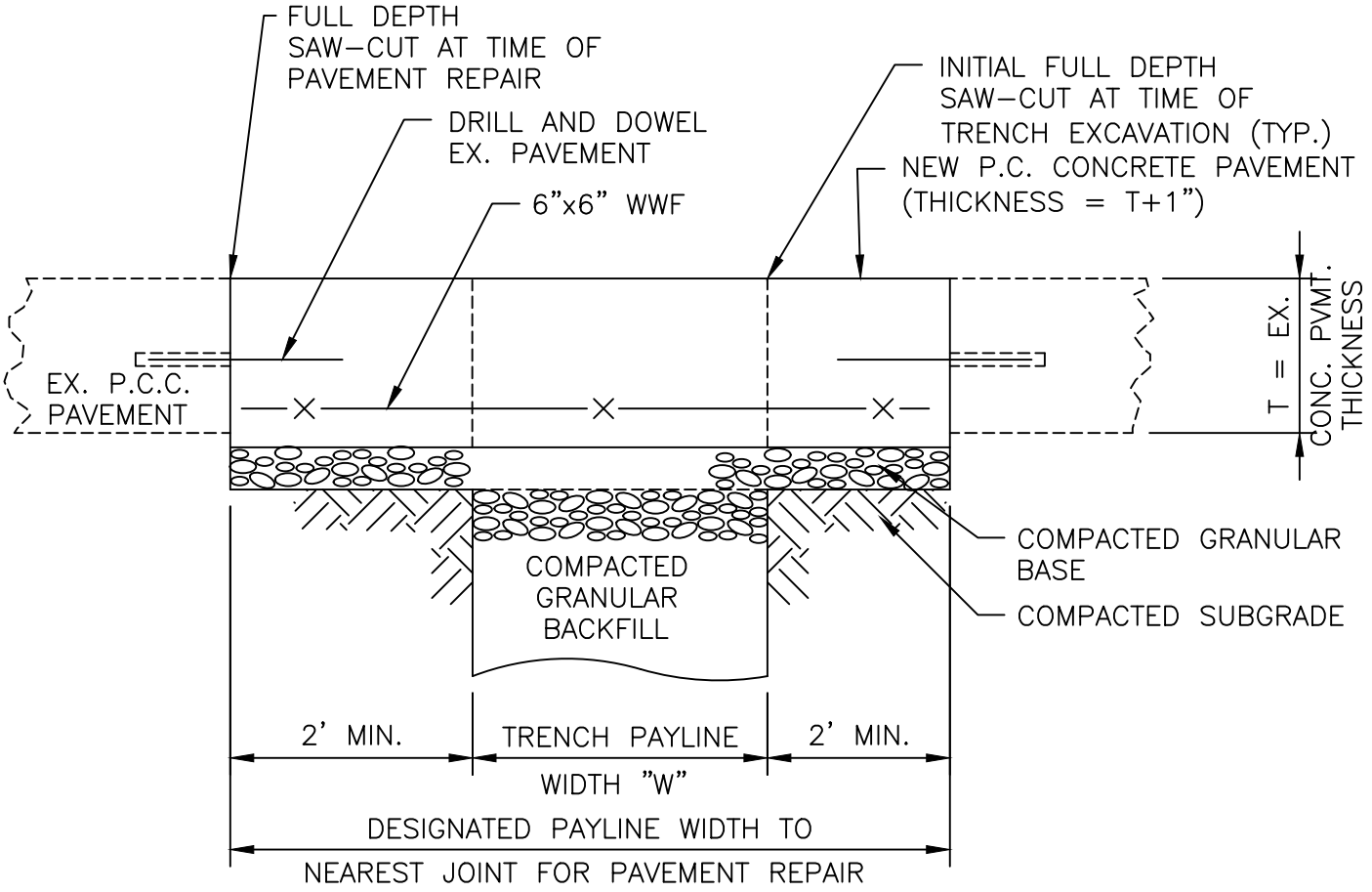

NOTES:

1. ALL PAVEMENT REPLACEMENT REPAIRS AND MATERIALS TO BE IN ACCORDANCE WITH THE CITY OF JACKSON STANDARD SPECIFICATIONS FOR STREET IMPROVEMENTS

Kent Peetz
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Date

Revisions

PAYLINE LIMITS FOR CONCRETE STREET PAVEMENT REPAIR

Sheet:

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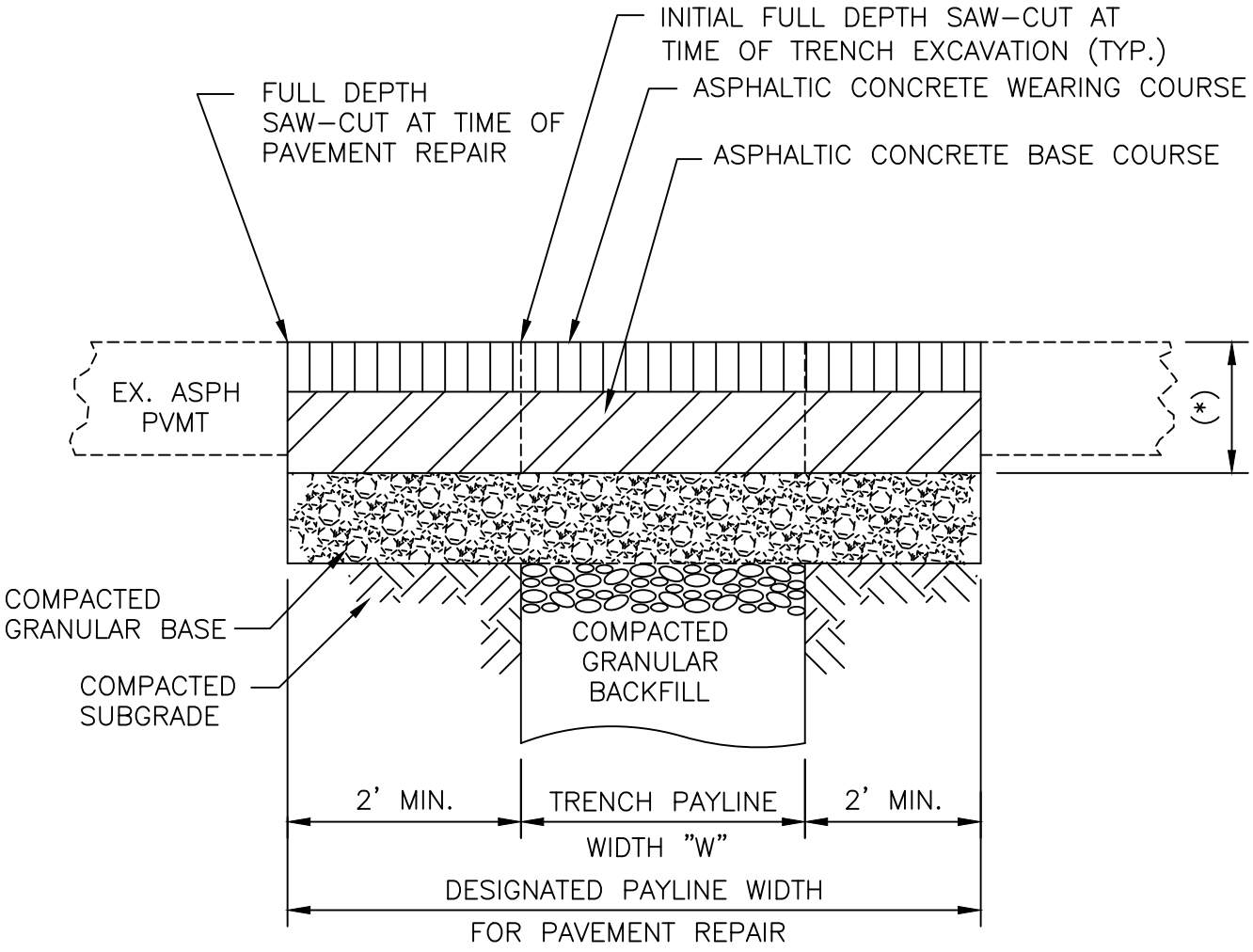
(*) – ASPHALTIC CONCRETE REPLACEMENT PAVEMENT SHALL BE AT LEAST 1–INCH THICKER THAN EXISTING PAVEMENT OR MINIMUM 9–INCHES THICK, WHICHEVER IS GREATER.



NOTES:

1. EXISTING ASHPALT PAVEMENT DAMAGED BY CONTRACTOR'S OPERATIONS, OUTSIDE THE DESIGNATED PAYLINE WIDTH, SHALL BE REMOVED AND REPLACED AS DETAILED AT NO ADDITIONAL COST TO OWNER.

2. ALL PAVEMENT REPLACEMENT, REPAIRS AND MATERIALS TO BE IN ACCORDANCE WITH THE CITY OF JACKSON STANDARD SPECIFICATIONS FOR STREET IMPROVEMENTS

Kent Peetz
Approved Date

Revisions

PAYLINE LIMITS FOR ASPHALT CONCRETE STREET PAVEMENT REPAIR

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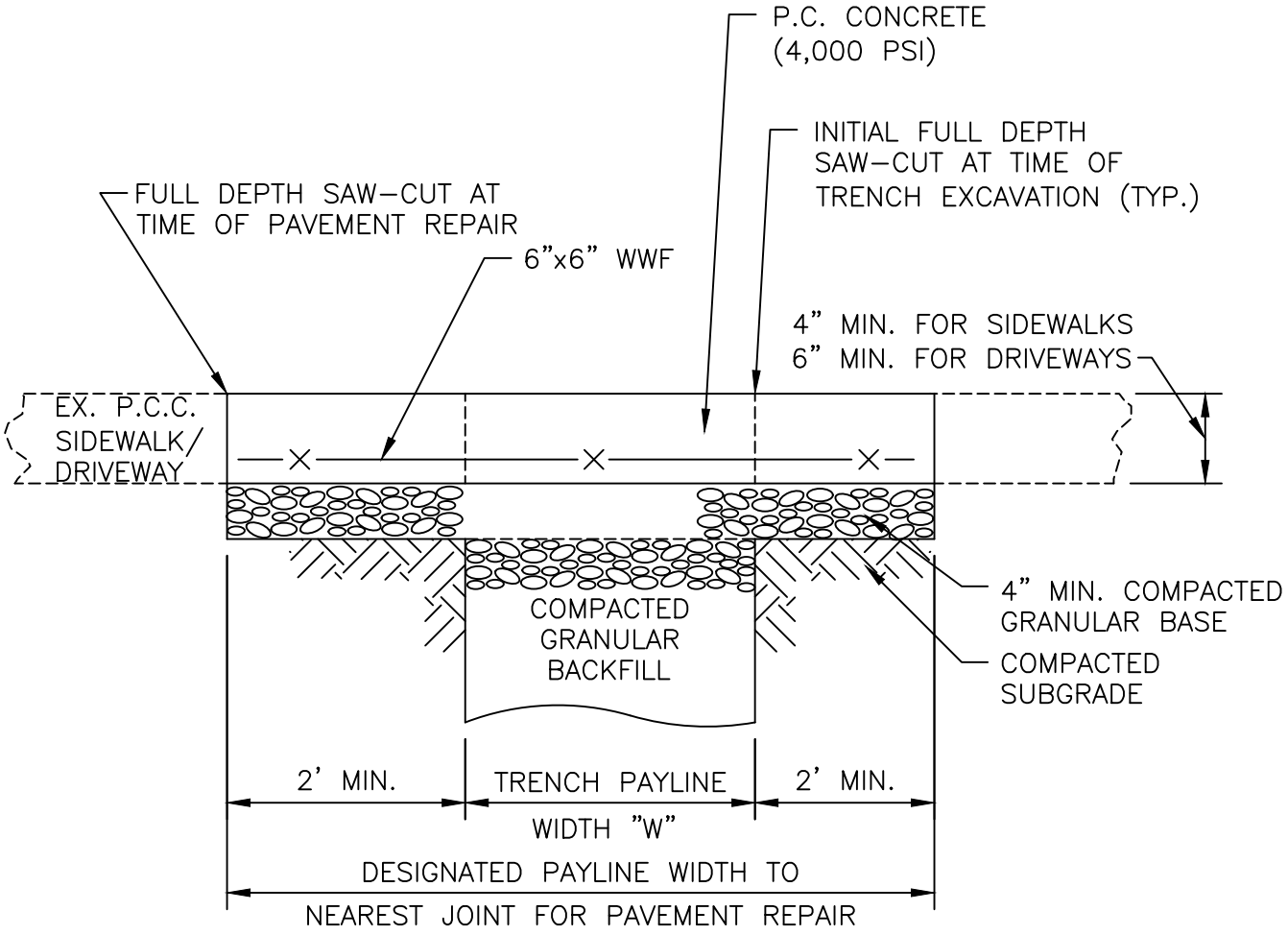

NOTES:

1. ALL PAVEMENT REPLACEMENT, REPAIRS AND MATERIALS TO BE IN ACCORDANCE WITH THE CITY OF JACKSON STANDARD SPECIFICATIONS FOR STREET IMPROVEMENTS

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PAYLINE LIMITS FOR CONCRETE SIDEWALK / DRIVEWAY REPAIR

Sheet:

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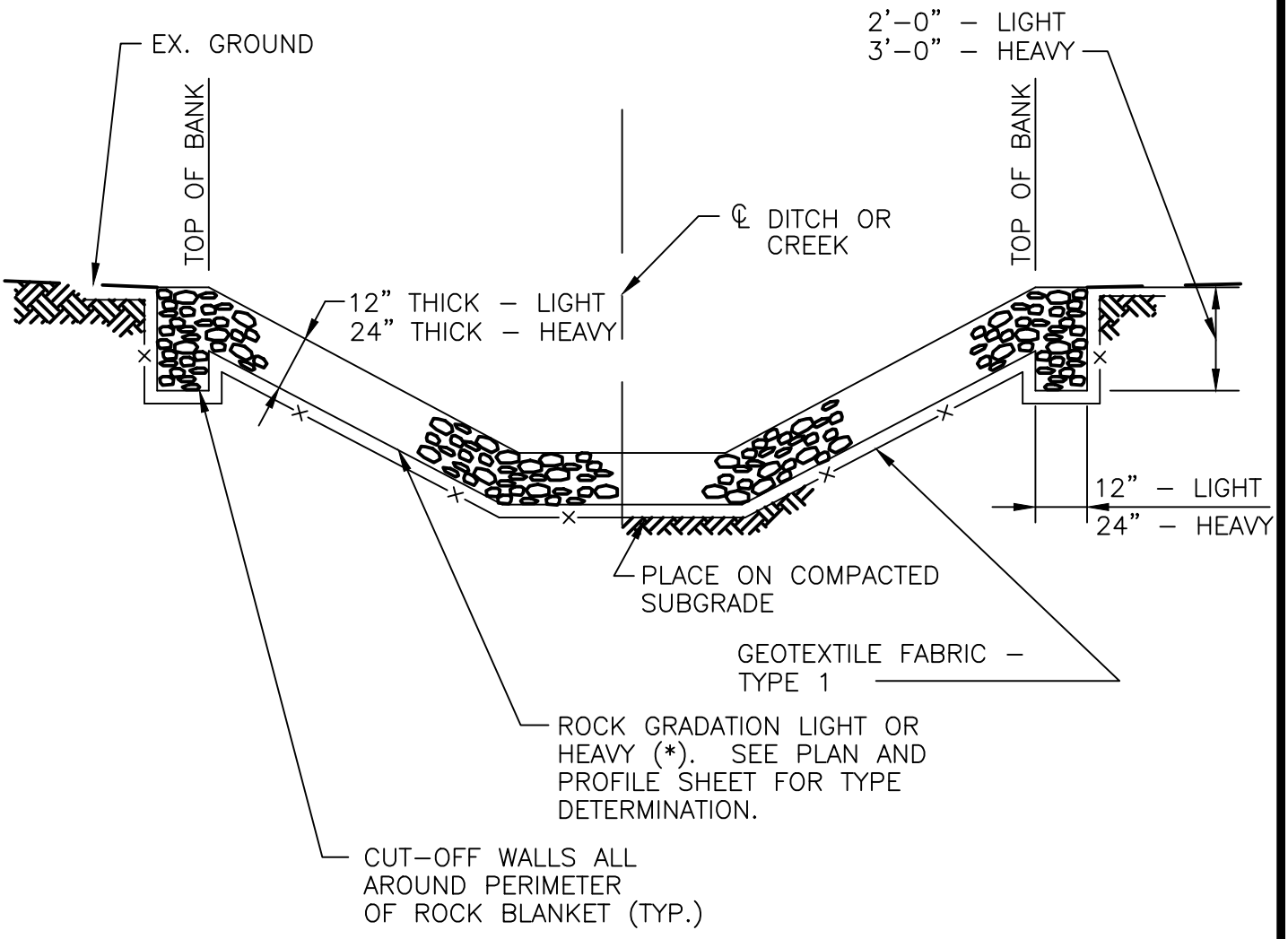


(*) SEE SPECIFICATIONS FOR LIGHT AND HEAVY GRADATIONS.

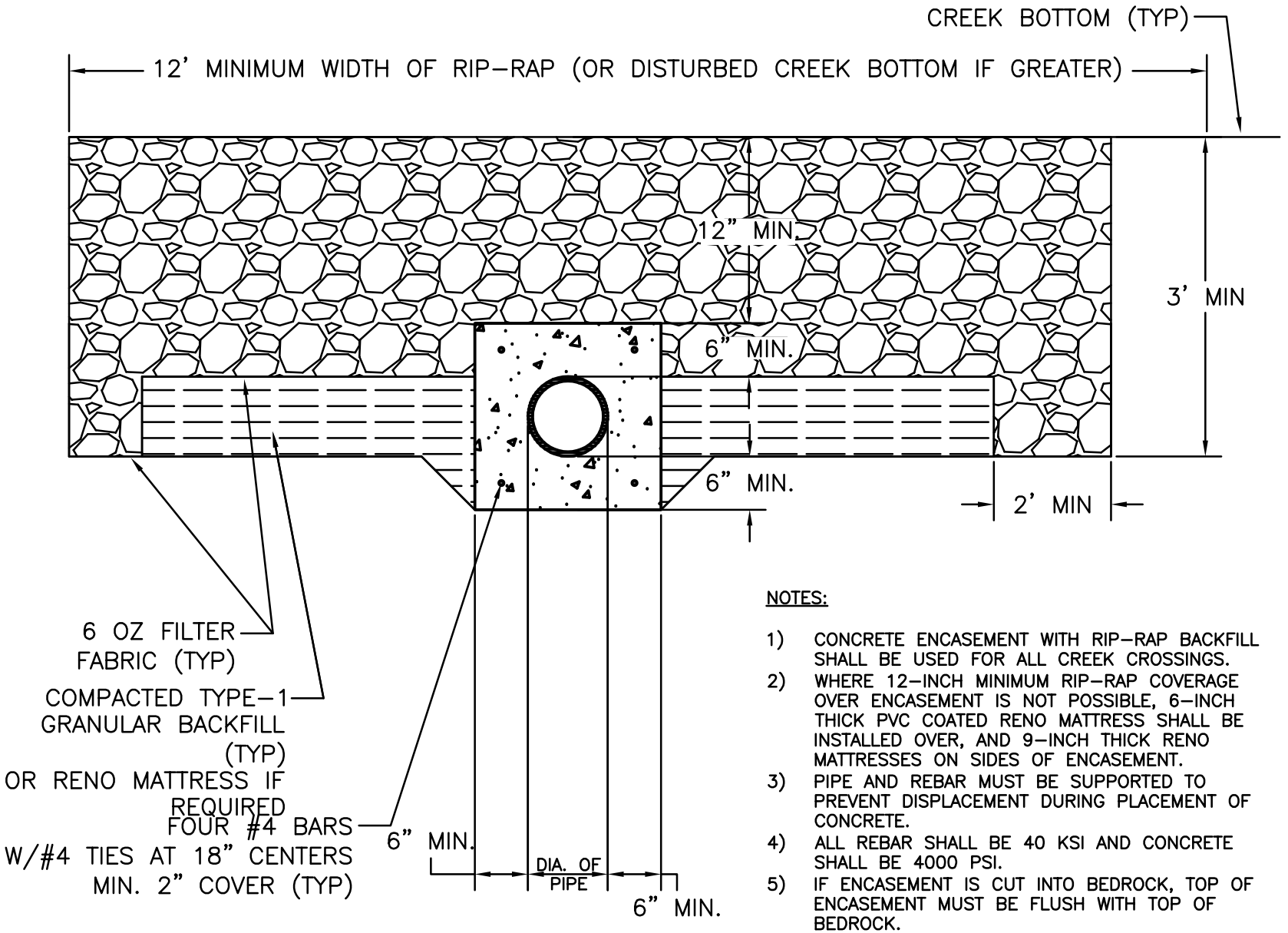
NOTE:
DO NOT PLACE ROCK BLANKET IN FLOWLINE OF LIMESTONE CREEK BOTTOMS.

Kent Peetz Approved Date Revisions	JACKSON, MO CITY OF BEAUTIFUL HOMES • PARKS • SCHOOLS AND CHURCHES 1814	TYPICAL ROCK BLANKET DETAIL	Sheet: S-36

Kent Peetz
Approved
Revisions
Date

CREEK CROSSING

Sheet: S-37



NOTES:

1) CONCRETE ENCASEMENT WITH RIP-RAP BACKFILL SHALL BE USED FOR ALL CREEK CROSSINGS.
2) WHERE 12-INCH MINIMUM RIP-RAP COVERAGE OVER ENCASEMENT IS NOT POSSIBLE, 6-INCH THICK PVC COATED RENO MATTRESS SHALL BE INSTALLED OVER, AND 9-INCH THICK RENO MATTRESSES ON SIDES OF ENCASEMENT.
3) PIPE AND REBAR MUST BE SUPPORTED TO PREVENT DISPLACEMENT DURING PLACEMENT OF CONCRETE.
4) ALL REBAR SHALL BE 40 KSI AND CONCRETE SHALL BE 4000 PSI.
5) IF ENCASEMENT IS CUT INTO BEDROCK, TOP OF ENCASEMENT MUST BE FLUSH WITH TOP OF BEDROCK.
6) ALL PIPE USED FOR CREEK AND DITCH CROSSINGS SHALL BE DUCTILE IRON PIPE CLASS 56 UNLESS OTHERWISE APPROVED BY THE CITY.

APPENDIX A TO THE SANITARY SEWERAGE FACILITIES STANDARD CONSTRUCTION SPECIFICATIONS

SANITARY SEWERAGE LIFT STATION

STANDARD DESIGN AND CONSTRUCTION REQUIREMENTS

FOR

THE CITY OF JACKSON, MISSOURI

CAPE GIRARDEAU COUNTY

March, 2021

Engineering Department
Kent A. Peetz, P.E.
Director of Public Works
101 Court Street
Jackson, MO 63755
Phone: (573) 243-2300 Fax: (573) 243-3322
Email: pw@jacksonmo.com
Website: www.jacksonmo.org

APPENDIX A TO THE SANITARY SEWERAGE FACILITIES STANDARD CONSTRUCTION SPECIFICATIONS

Sanitary Sewerage Lift Station
Standard Design and Construction Requirements
for
The City of Jackson, Missouri

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APPENDIX A – CITY OF JACKSON LIFT STATION AND FORCE MAIN STANDARD DETAILS

APPENDIX A (CONT'D) – CITY OF JACKSON LIFT STATION AND FORCE MAIN STANDARD DETAILS

END TABLE OF CONTENTS

1.0 GENERAL

The following are the standard specifications for pump stations and force mains to be installed and connected to the City of Jackson's sanitary sewer collection system. The purpose of these specifications is to provide a minimum standard for pump stations that complies with the guidelines set out by the Missouri Department of Natural Resources and incorporates the most cost effective and reliable design for maintenance and operation. The City of Jackson will make every attempt to standardize design and component selection so as to be compatible with existing units. Any deviation from these standards or alterations shall be approved by the City.

Sewage pump stations shall consist of a wet well, valve vault (for submersible pumps), sewage pumps, control systems, electrical systems (normal and emergency), superstructures, site security, grading and access. The contractor shall be responsible for extending all necessary utilities to the pump station site (electrical, phone, etc.).

Sanitary sewer pump stations will only be considered when the thorough study of all alternatives clearly indicates the impracticability of gravity collection and disposal and a cost effective analysis has been performed per Section 2.6.

All pump stations with an average daily flow of greater than 75,000 gallons per day shall be equipped with a minimum of 2 hours of emergency storage as well as a quick-connect terminal box and manual transfer switch for the connection of a mobile generator as a backup power supply. The 2 hour emergency storage volume shall be based upon a two (2) hour duration at peak inflows, as defined per section 2.3.F, with all pumps out of service. Pump stations with an average daily flow of 100,000 gallons per day or greater shall also have a permanently installed emergency generator. The Director reserves the right at all times both to require and/or waive emergency detention storage requirements for any lift station on a case-by-case basis to accommodate special conditions as necessary.

1.1 DEFINITIONS – For the purpose of this document, the following definitions shall apply:

A Discharge Piping: Pressure piping conveying untreated wastewater beginning at the pump station pump discharge flange out to 4'-0" beyond the exterior face of the most downstream pump station structure. When suction lift pumps are used, the term "Discharge Piping" shall also apply to the pump suction lift piping.

B. Force Main: Pressure piping conveying untreated wastewater beginning at 4'-0" from the exterior face of the most downstream pump station structure.

1.2 EASEMENTS - All sanitary sewer collection system piping and appurtenances shall be located in easements granted to the City of Jackson, and as shown on the approved set of improvement plans. Easements for pump stations and sanitary sewers installed as part of a development may be recorded on the record plat. All other easements will require easement documents.

1.3 SHOP DRAWINGS – Shop drawings shall be furnished by the design engineer for approval. The submittals shall include all materials, equipment, fittings, structures including reinforcement, complete, so as to show conformance with these specifications, the approved improvement plans, and the Lift Station Standard Construction Details. Equipment submittals shall have the specific model used for the project clearly marked on the cut sheets. Approval of the submittals in no way relieves the developer or contractor from the responsibility of providing a working system that complies with industry standards (ACI, ASTM, ANSI, AWWA, NEC, NFPA, UL, NEMA, etc…) nor from ensuring that all components are compatible with other components of the system.

1.4 AS-BUILT DRAWINGS – As-built plans and drawings shall be required for all new construction. Details shall include, but not be limited to, corrected plans showing final elevations and locations of all structures, pipes, and appurtenances. Any changes in components utilized for piping or control systems approved by the Director during construction shall be noted in an As-built set of shop drawings and/or equipment submittals. As-built drawings shall be provided to the City in the following quantity and format: (2) hard-copies, (1) AutoCAD .dwg file, and (1) .pdf file.

A The contractor shall provide the following as-built measurements of the completed structures/manholes:
   1 North and east coordinates of the center of the structure/manhole lid;
   2 Top and invert elevation of the structure/manhole cover;
   3 Sizes, materials, and invert elevations of all connecting pipes.

B All measurements shall be certified by either a land surveyor or engineer registered in the State of Missouri and submitted to the City in the following format:
   1 N, E, D (northing, easting, elevation, description).

C Submitted point files shall be digital Microsoft Excel or comma delineated value (.CSV) text file format.

D Horizontal and vertical accuracy shall be sub-centimeter using GPS or traditional survey methods.

E The City of Jackson's survey control system is established as follows:
   1 Horizontal Control: Missouri State Plane East-NAD 83 (feet);
   2 Vertical Datum: NAVD 88 (feet).

F As-built drawings shall be provided upon completion of construction. Two (2) sets of paper drawings shall be submitted. GPS coordinates shall be provided for each structure/manhole on the as-built plans. The drawings shall also be submitted electronically both as one (1) AutoCAD .dwg file and one (1) .pdf format file.

END OF SECTION

2.0 ENGINEERING REPORT

All pump station plans shall be accompanied by an Engineering Report. The following information shall be provided by the Developer and included in the report:

2.1 TITLE PAGE - Title page shall include the project name, date, Developer/Owner's name, name and location of the engineering firm preparing plans.

The Engineering Report shall be sealed by a Professional Engineer actively registered in the state of Missouri. The seal shall be displayed on the Title Page with the Engineer's name and registration number clearly visible. The seal shall be signed and dated by the Engineer.

2.2 SEWER SYSTEM INFORMATION

General: The following information shall be included in the Engineering Report submittal:

A Introduction

1 Type, location and size of development to be served by the proposed improvements.

2 Quantity of and range in size of lots or types of buildings to be serviced including residential or type of industrial/commercial.

B Existing Sewer System

1 Location and type of gravity system the force main will discharge into. For typical installations, force mains shall discharge into a gravity manhole as per the City of Jackson Lift Station and Force Main Standard Details; exception shall be made on a case-by-case basis subject to City approval. Provide details of connection to existing gravity system to include proposed manhole connection location, connection methods, and connection elevations.

C Future of Sanitary Sewer Service

1 State whether the entire development will be serviced by the proposed phase or if several phases will be involved.

2 State the number of lots this phase will encompass initially and finally if future phases are to be constructed.

3 State whether any other areas outside of the development within the watershed may be tributary to the pump station.

2.3 PUMP STATION AND FORCE MAIN DESIGN CALCULATIONS

Development of Pump Station Design Flows:

A Residential Development Area

Population Equivalent (PE)
Nb = Number of specified types of buildings
Np = Number of persons per unit = 3.7[1]
PE = Nb x Np

[1] Family population factors for the various areas are to be determined from the latest United States Census Tracts. An acceptable figure is 3.7 persons per household unit.

B Non-Residential Development Area

The average daily flow (excluding infiltration) for non-residential development areas shall be based on one of the following:

1 Actual water use records of similar facilities;

2 The current Rules of the Department of Natural Resources Division 20, Clean Water Commission, Chapter 8. Design Guides (10CSR 20-9.021,1.E.1);

3 Industry standards.

C Future Development

In designing all components of the pump station and discharge piping, consideration must be given to the potential need to expand or modify the facility to accommodate the future development of areas tributary to the station. As a minimum, the following items should be considered:

1 The valve chamber and wet well shall be sized to accommodate the ultimate pump and valve equipment requirements.

2 The ultimate flow should be considered in selection of the pumps.

3 The ultimate flow should be considered in sizing the discharge piping.

4 The ultimate storage requirement should be considered in the configuration of the detention pipes to allow for future expansion. Adequate area adjacent to the detention pipes must be provided to allow for this expansion.

D Infiltration

For proposed pump stations that will serve a combination of new construction sewers and existing sewers, the Average Daily Flow shall be modified to include an allowance for infiltration. The infiltration flow amount (I) shall be determined for the:

1 Gravity system, existing construction.

Where: I = Piping diameter (in.) x piping length (miles) x 200 (gal./in. dia./mi./day)

Depending on the extent and condition of the existing system served by new Pump Stations, the City may require an infiltration rate greater than 200 gal/dia/mi/day. The designing engineer should contact the City prior to submittal to determine if a greater rate will be required.

The calculated infiltration rate shall be accounted for in the computation of the Average Daily Flow.

E Average Daily Flow (ADF)

1 Average Daily Flow (GPD)

= Population Equivalent (PE) x 100 gal/person/day

2 Average Daily Flow (GPM) = Flow (GPD) / 1440 (Min/Day)

F. Peak Daily Flow (PDF)

1 Peaking Factor

$$Peaking\ Factor = \frac{18 + \sqrt{PE \div 1000}}{4 + \sqrt{PE \div 1000}}$$

2 Peak Daily Flow (GPD) = PF X ADF (GPD)

3 Peak Daily Flow (GPM) = PF X ADF (GPM)

The Design Engineer shall select from each of the approved manufacturers (Section 3.0), the most efficient pump capable of accommodating the station's Peak Daily Flow (PDF). Use the following procedure to make these determinations. Operating efficiency shall be the primary consideration when selecting the recommended pump.

G Total Dynamic Head (TDH)

1 Static Head (Hs)

Eh = Maximum force main elevation

E1 = Wet well low water elevation (shall be equivalent to the pump low-water cutoff elevation which shall be per the Pump Manufacturer's recommendations but in no cases less than the installed height of the pump). For suction-lift pumps, the low-water cutoff shall be per the Pump Manufacturer's recommendation but in no case less than 0'-6" above the invert of the suction pipe.

E2 = Wet well absolute highest water elevation (75% Detention Chamber Alarm). If the pump station is not equipped with detention storage, the absolute highest water elevation shall be equal to the maximum overflow elevation of the station. The goal is to avoid pump run-out on high water conditions.

Worst-case static head Hsw (feet) = Eh – E1

Best case static head Hsb (feet) = Eh - E2

Hs (feet) = Eh - E1

2 Loss (Lf) due to friction in force main

Length = Total equivalent length of force main

Lf (feet) = Length x Friction Factor/100

Where Friction Factor =Friction head loss (feet) per 100 feet of pipe:

$$=0.2083 \times [(100/C)^{1.85}] \times [(Q^{1.85}) / (d^{4.8655})]$$

Where Q=FLOW (GPM), d=inside pipe diameter in inches,

and C = Hazen-Williams C-factor (see below).

The following Hazen and Williams C-Factor shall be used for the computation of friction losses. The worst-case system design shall be used for determining the pump operating point, or Constant Speed Rating (CSR).

Hazen-Williams C-factor for computation of worst-case friction losses:

Unlined iron or steel pipe	C=100
All other pipe including plastic and lined DIP	C=120

To ensure that the pump motor does not overload after initial installation use the following C-value for the best case scenario evaluation.:

Plastic pipe	C=140
All other pipe (including steel and lined DIP)	C=150

3 Loss (Ls) from friction in the piping within the pump station using equivalent lengths (feet) for all fittings.

Ls (feet) = Length x Friction Factor/100

4 TDH (feet) = Hs + Lf + Ls

Plot a worst case TDH curve using the lower C Values above and the worst case static head (Hsw), and the best case TDH curve, using the higher C values above and the best case static head (Hsb), on a manufacturer's pump performance curve sheet.

Constant Speed Rating: The Constant Speed Rating (CSR), or the pump's operating point, is where the worst case TDH and the pump manufacturer's pump performance curve intersect.

Pump Overload Check: Find where the best case TDH and the pump manufacturer's pump performance curves intersect and check that the pump is not in an overload condition.

A minimum of four (4) flow rates shall be used to plot each curve.

2.4 Cycle Times

A Volume (Vr) of water in wet well needed to turn primary pump on

1 Elevation difference (E5) between primary pump on elevation (E3) and pump off elevation (E4)

E5 (ft.) = E3 (ft.) - E4 (ft.)

2 Volume (Vpf) of water per vertical foot in the wet well

A = the inside area of the wet well ($ft.^2$)

Vpf (gal/ft.) = A ($ft.^2$) x 7.481 ($gal/ft.^3$)

3 Vr = E5 (ft.) x Vpf (gal/ft.)

B Cycle Time for ADF

1 Time (Tf) required for volume in wet well to reach Vr

Tf (min.) = Vr (gal) /ADF (GPM)

2 Time (Tp) required for pump to return water level to the pump off elevation

Tp (min.) = Vr / (CSR – ADF) (GPM)

3 The pump is on for one pumping cycle of Tp and off for two (2) storage cycles of Tf plus one (1) pumping cycle of Tp because the pumps alternate in a duplex configuration. Where additional pumps are added the multiplier shall be the number of pumps or shall be adjusted to fit the pumping scheme.

4 Total Cycle Time (Tc) for one (1) pump:

Tc = 2 x (Tf + Tp)

C Cycle Time for PDF

1 Time (Tf) required for volume in wet well to reach Vr

Tf (min.) = Vr/PDF (GPM)

2 Time (Tp) required for pump to return water level to the pump off elevation

Tp (min.) = Vr / (CSR – PDF) (GPM)

3 Total Cycle Time (Tc) for one pump:

Tc = 2 x (Tf + Tp)

- Pump cycle times shall not exceed the pump's specified maximum starts per hour, starts per day, and minimum rest time between starts, as provided by the pump manufacturer.

D Force Main Design

1 Calculate and state the hydraulic retention time in the discharge force main (at initial flows and at design flows). Evaluate probability of developing septic conditions within the new force main due to excessive retention times.

2 Minimum velocity (V_{min}) at ADF shall be 2 feet per second (FPS).

3 Maximum velocity (V_{max}) with multiple pumps running shall be 8 feet per second (FPS).

3 Calculate and state the force main anticipated maximum operating pressures.

4 Size air / vacuum release valves (if applicable).

5 Volume, length, and design velocity of proposed new force main.

E Buoyancy Checks - A buoyancy check shall be performed for the pump station wet well, valve vault (if separate structure), detention pipe (when utilized), and all other sub-structures appurtenant to the pump station to ensure that floatation of these structures will not occur. The buoyancy calculations shall assume that the groundwater elevation is equal to that of the top of the wet well top slab. This assumption may be waived at the sole discretion of the City based on the availability of recent geotechnical data. The weight of water, piping, and/or appurtenant equipment within the envelope of the structures under evaluation may not be included in the total weight of the structure.

Ww = Weight of concrete wet well

Wf = Weight of concrete bottom slab where placed separately

Wb = Weight of backfill on footing

Wt = Ww + Wf + Wb (or determine detention chamber weight and overburden) = Total weight of structure

Ws = Weight of displaced water. Ws shall be modified by a safety factor specific to the conditions of the proposed installation.

W_t must be greater than Ws

2.5 LISTING OF RESULTS FROM THE DESIGN CALCULATIONS TO BE PRESENTED IN THE FOLLOWING ORDER:

A Number of Lots or Buildings

B Population Equivalent

C Average Daily Flow in GPM

D Peak Daily Flow in GPM

E The Volume of the Detention Chamber, where required (2-hour or minimum at PDF with all pumps out of service).

F Proposed wet well volume and aspect ratio

G Static Head, both worst and best case

H Proposed system curves for both single and parallel (duplex) pump operation at both the worst-case and best-case TDH conditions as defined in paragraph 2.3.G.4, herein (4 system curves total)

I Pump operating curves, superimposed on the calculated system curves as specified herein, to include pump efficiency at the constant speed rating (CSR) and at the best-case scenario.

J Total Dynamic Head, both worst and best case

K The Pump Selected (including type, manufacturer, model number, size, Hp, RPM, voltage, phase, impeller choice if other than standard, and GPM).

L Total Cycle Time for Average Daily Flow
Number of Minutes ON (Pumping Time)
Number of Minutes OFF (Fill Time)

M Total Cycle Time for Peak Daily Flow
Number of Minutes ON (Pumping Time)
Number of Minutes OFF (Fill Time)

N Size and Length of Force Main

O Minimum (one pump running) and Maximum (all pumps running) Velocities Maintained in Force Main.

P Force Main Hydraulic Retention Time (at initial flows and at design flows)

Q Air Release Valve Sizing Calculations (if required)

R Maximum Force Main Operating Pressure

S Discharge Piping Test Pressure – The test pressure shall be per the respective AWWA specification for the pipe material being tested. Pressure test requirements for SCH 80 PVC piping shall conform to those set forth in AWWA C900.

T Detention Pipe Design Calculations – Structural calculations shall be submitted verifying that the minimum pipe materials' standard specifications are adequate for the proposed installation.

U Pump Station site plan to include site perimeter, fenced perimeter, existing property lines and property easements, existing utility easements, proposed new temporary and/or permanent easements, location of all sub-surface improvements, and location/configuration of existing utilities.

V Include a pump station section detail identifying elevations of the top of the structure, bottom of structure, influent invert, detention pipe invert (if applicable), and float elevations for all floats specified herein.

W Provide proposed electrical schematics to include a pump station control panel schematic, control panel face configuration, ladder diagram, conduit and wire sizes, electrical site plan, and an electrical one-line diagram.

NOTE: The lowest development elevation must be above the elevation of the highest point of the detention chamber plus two (2) feet.

2.6 MANUFACTURER'S SPECIFICATIONS AND CUT SHEETS

1.) The manufacturer's standard specifications and cut-sheets for the pumps and equipment shall be included in the back of the engineering report.

2.) The manufacturer's cut sheets shall be marked to identify the applicable items selected.

3.) Specifications and performance curves shall be included for each pump proposed by the design engineer.

4.) The pump performance curves included with the pump information shall have the worst case and best case system TDH curves plotted on them.

2.7 FLOOD PLAIN STUDY

The pump station shall be designed to remain accessible and operational during a 100-year flood. Furthermore, the station shall be protected from damage during a 100-year flood event. A flood plain study will be required to determine these flood elevations.

2.8 COST EFFECTIVE ANALYSIS

Design engineer shall perform a cost effective analysis for all proposed pump stations and expansions of existing City-owned pump stations. Cost analysis shall compare the construction, operation and maintenance costs and any applicable salvage values over a 20-year period between proposed pump station and a reasonable gravity sewer alternative. Operation and maintenance costs that must be considered include: labor, electrical, equipment replacement and routine maintenance. Life cycle cost analysis shall assume an eight (8) year equipment life for all pumps.

Pump stations will only be considered a viable option if the cost analysis clearly shows that the gravity sewers are not economically feasible.

END OF SECTION

3.0 PUMP REQUIREMENTS

Minimum Standards:

The pumps shall be capable of handling raw, unscreened sewage. The discharge connection elbow shall be permanently installed in the wet well along with the discharge piping. The pumps shall be automatically connected to the discharge connection elbow when lowered into place, and shall be easily removed. There shall be no need for personnel to enter the pump well. Sealing of the pumping unit to the discharge connection elbow shall be accomplished by a simple linear downward motion of the pump. A sliding guide bracket shall be an integral part of the pump unit. No portion of the pump shall bear directly on the floor of the sump. The pump, with its appurtenances and cable, shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet.

At least two (2) pumps shall be provided in any pump station. Each pump shall be capable of handling the design average (ADF) and peak flows (PDF) so that each unit is a duplicate of the other. The pump installation shall be designed to handle, as a maximum, the greater of the following flows: the anticipated peak daily flow (PDF); or, four (4) times the average daily flow at anticipated system pressures. Once these criteria are met, the operating efficiency at the design ADF shall be the primary consideration when selecting the recommended pump. Where three (3) or more units are provided, they should be designed to accommodate average daily (ADF) and peak daily (PDF) flow conditions and must be of a capacity such that with any one (1) unit out of service, the remaining units will have the capacity, while running in parallel, to handle maximum flow requirements at the system pressure generated by these maximum flows. Maximum flow requirements shall be calculated in a method similar to that specified in Section 2.3 of these specifications with the wet well water surface elevation being equal to the lag float elevation, discharge flow equal to the calculated PDF, and the friction loss calculated with the worst-case C-factors. Pump supply power for all pumps greater than 7.5 hp must be 480V/3Ø/60Hz. Pumps greater than 7.5 hp may be provided with single phase power on a case-by-case basis, contingent upon the approval of the Director of Electrical Utilities prior to pump selection. Pumps lesser than 7.5 horsepower may be single-phase without a variance.

3.1 GENERAL

A Pumps shall be of the non-clog, solids handling, submersible type. Suction-lift pumps shall be allowed on a case-by-case basis following installation-specific approval by the City. When total suction lift exceeds 20 feet, only submersible-type pumps will be permitted.

B Only submersible-type grinder pumps will be acceptable for pump stations utilizing 7.5-horsepower pumps or smaller.

C All pumps, with the exception of grinder pumps, shall be capable of passing spheres of at least three inches in diameter.

D Pump suction and discharge piping shall be no less than the sizes specified in paragraph 3.1.G, with the exception of piping serving a grinder pump installation. Pump suction and discharge piping shall be no less than 2”Ø only when serving a grinder pump installation.

E Pumps less than 3-horse power will only be accepted with a variance from the Director.

F Pumps greater than 7.5 hp must be 3-phase 480 VAC power unless a variance is granted by the City for the specific installation. A request to provide single phase motors on pumps greater than 7.5 hp must be accompanied by an economic analysis submitted by the Design Engineer to show that bringing 3-phase power to the site is infeasible. Only pumps 7.5-horse power or less may be single phase without a variance.

G The pump discharge piping diameter shall be determined as follows (see following paragraph 3.1.H for exceptions specific to non-clog pumps):

Individual Pump Output	Pipe Diameter
50 GPM and Below	2"
51 to 80 GPM	3"
81 GPM and Above	4" Minimum

H Under no conditions shall non-clog pump piping be of a diameter less than 1” greater than the minimum solids passage capacity of the respective pump.

I The pump discharge piping diameter and material shall be uniform from the pump discharge base to the common header tee. Discharge piping materials shall conform to the specifications documented in Section 4.0 – PIPING AND VALVES.

J The common header and force main pipe diameter shall be sized to produce a minimum flow of 2 F.P.S. with one pump running and a maximum flow of 8 F.P.S. from the combined output of 2 or more pumps as programmed.

3.2 ACCEPTABLE MANUFACTURERS

A Submersible non-clog solids handling pumps shall be A.B.S Co., Flygt, or approved equal.

B Suction lift-type pumps shall be Smith & Loveless or Gorman-Rupp.

C Submersible grinder pumps shall be manufactured by the, A.B.S. Co., Flygt Co., or approved equal. All submersible grinder pumps shall have dual mechanical seals and high efficiency motors equal to or exceeding the A.B.S. PE series.

3.3 MATERIALS

A Major Components: Major pump components shall be of gray cast iron, Class 35B, with smooth surfaces devoid of blowholes and other irregularities. Where watertight sealing is required, O-rings made of nitrile rubber shall be used. All exposed nuts and bolts shall be of ASTM A167 304 stainless steel.

B Watertight Seals: All mating surfaces where watertight sealing is required shall be machined and fitted with nitrile O-rings. Fitting shall be such that sealing is accomplished by metal-to-metal contact between machined surfaces. This will result in compression of the nitrile rubber O-rings without requirement of a special torque limit. No secondary sealing compounds, rectangular gaskets, elliptical O-rings, grease, or other devices shall be used.

The cable entry water seal design shall preclude specific torque requirements to ensure a watertight and submersible seal. The cable entry shall be comprised of a single cylindrical elastomer grommet, flanked by washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter and compressed by the entry body containing a strain relief function, separate from the suction of the sealing cable.

The assembly shall bear against a shoulder in the pump top. The cable entry junction chamber and motor shall be separated by a stator lead sealing gland or terminal board, which shall isolate the motor interior from foreign materials gaining access through the pump top. Epoxies, silicones, or other secondary sealing systems shall not be considered acceptable.

The junction chamber, containing the terminal board, shall be sealed from the motor by elastomer compression seal (O-rings). Where a sealed junction chamber is not used, the motor chamber shall be fitted with a moisture detection probe. The probe shall be connected to and activate a warning light in the control panel.

Connection between the cable conductors and stator leads shall be made with threaded compressed type binding post permanently affixed to a terminal board and thus perfectly leak proof.

C Cooling System: Each unit shall be provided with an adequately designed cooling system. When thermal radiators (cooling fins) are used, they shall be integral to the stator housing and shall be adequate to provide the cooling required by the motor. When water jackets are used, the water jacket shall encircle the stator housing. The water jacket shall be provided with a separate, self-contained liquid cooling system. Regardless of the cooling system used, the motor must be capable of pumping under full load continuously with the water level only to the top of the volute. Motors with intermittent full load ratings or motors requiring oil for cooling will not be allowed.

D Impellers: The impeller shall be of gray cast iron, Class 35B, dynamically balanced, single or double shrouded non-clogging design having a long thrulet without acute turns. The impeller shall be capable of handling solids, fibrous materials, heavy sludge, and other matter found in normal sewage applications. The pump manufacturer shall, upon request, furnish mass moment of intertia data for the proposed impeller. The impeller shall be capable of passing a minimum 3-inch solid sphere. The fit between the impeller and shaft shall be a sliding fit with one (1) key.

When double shrouded impellers are used, a wear ring system shall be installed to provide efficient sealing between the volute and impeller. The wear ring shall consist of a stationary ring made of nitrile rubber molded with a steel ring insert which is drive fitted to the volute inlet and rotating stainless steel ring which is drive fitted to the impeller eye.

When single shrouded impellers are used, the volute shall be fitted with an adjustable replaceable front plat. The front plate shall be designed with a wave shaped inlet and an outward spiraling V-shaped groove on the side forcing the impeller to shed and force stringy solids outward from the impeller and through the pump discharge.

The volute shall be of single piece design and shall have smooth fluid passages large enough at all points to pass any size solid which can pass through the impeller.

Pump Motor: The pump motor shall be squirrel-cage, induction, and shell type design, housed in an air-filled watertight chamber. The stator winding and stator leads shall be insulated with moisture resistant Class H insulation that will resist a temperature of 180°C (356°F). The motor shall be designed for continuous duty and shall be capable of sustaining a minimum starts per hour as required by the pump station peak daily flow (PDF) and wet well geometry.

The pump motor cable, installed, shall be suitable for submersible pump application. Cable sizing shall conform to NEC specifications for pump motors.

The pump motor, motor cable, and control conductors shall be manufactured and installed in accordance with the NEC requirements for the area classification in which they are proposed to be installed.

Thermal Sensors: Thermal sensors shall be used to monitor stator temperatures. The stator shall be equipped with three (3) thermal switches, embedded in the end coils of the stator winding (one switch in each stator phase). These shall be used in conjunction with and supplemental to external motor overload protection and wired to the control panel.

Pump Shaft: Each pump shall be provided with an oil chamber for the shaft sealing system. The drain and inspection plug, with positive anti-leak seal, shall be accessible from the outside.

The pump shaft shall rotate on two (2) permanently lubricated bearings. The upper bearing shall be a single row deep groove ball bearing and the lower bearing two row angular contact ball bearing. The pump shaft shall be stainless steel or hard chrome plated carbon steel.

Each pump shall be provided with a tandem mechanical shaft seal system consisting of two (2) totally independent seal assemblies fabricated of silicon carbine or tungsten carbide. Seals shall run in an oil reservoir. Lapped seal faces must be hydro-dynamically lubricated at a constant rate. The lower seal unit, between the pump and oil chamber, shall contain one stationary and one positively driven rotating silicon carbide or tungsten carbide ring, or angled to the shaft lip type seal in grinder pump applications. Each interface shall be held in contact by its own spring

system. The seals shall require neither maintenance nor adjustment, but shall be easily inspected and replaceable. The following mechanical seal types shall not be considered acceptable: shaft seals without positively driven rotating members; conventional double mechanical seals containing either a common single or double spring acting between the upper and lower units. This conventional system requires a pressure differential to offset external pressure and to effect sealing.

END OF SECTION

4.0 PIPING AND VALVES

The following specifications shall be used for installation of the pump station piping and valves. Flanged and grooved end piping shall be acceptable means of connecting piping and valving within the Pump Station boundary.

All pipes must enter the structure walls with a one-foot minimum clearance from the outside face of the pipe to the face of the adjacent wall to allow for proper pipe gasket placement.

As used in this Specification Section, the term “discharge piping” and any of its derivatives shall be defined as the pressure piping from the individual pump discharge bases through the header tee to a point four feet (4’-0”) outside the exterior wall of the most downstream structure associated with the pump station. The term “force main” shall refer to the pressure piping beginning at a point four feet (4’-0”) from the exterior of the most downstream pump station structure to the receiving gravity manhole.

4.1 DISCHARGE PIPING

The piping from the individual pump discharge bases, through the valving assembly and out to the force main, shall be in accordance with the following:

A Four-inch Diameter Piping and Larger:

1 Grooved End Installation: Grooved end pipe barrels shall be ductile iron of Thickness Class 53 or greater as specified in A.N.S.I. A-21.51 (AWWA C151) with rigid radius grooves for end preparation in accordance with AWWA C606. Grooved-end fittings shall conform to the requirements of AWWA C110 or AWWA C153 for center to end dimensions, AWWA C153 or AWWA 21.10/AWWA C110 for wall thickness, and AWWA C606 rigid radius grooving dimensions for end preparation. Joint couplings shall be of ductile iron conforming to ASTM A-536, Grade S nitrile gasket compounded to conform to ductile iron pipe surfaces with 316 stainless steel nuts and bolts.

Flanged Installation: Flanged ductile iron pipe shall conform the standards set forth in AWWA/ANSI C115/A21.15. Ductile iron pipe barrels shall conform to the requirements of AWWA/ANSI C151/A21.51 and shall be a minimum of Thickness Class 53 or greater. Flanged ductile iron fittings shall conform to AWWA/ANSI C110/A21.10 or AWWA C153. All bolts and nuts for flange connections must be 316 stainless steel.

All flange gaskets must be full-face 1/8" thick red rubber and shall conform to standard AWWA/ANSI C111/A21.11.

Pipe Protection: All ductile iron pipe barrels and fittings installed within the pump station boundary (discharge boundary) shall be provided with an exterior fusion-bonded epoxy coating in accordance with AWWA C116. The interior of all ductile iron pipe installed within the pump station boundary (discharge piping) shall be lined with "Polybond-Plus" as manufactured by American Ductile Iron Pipe Company or the "Protecto 401" lining system by Tnemec.

Discharge piping that is contained within the pump station boundary and buried below-grade shall be encased in green polyethylene tubes meeting the requirements of ANSI A.21, AWWA C105, unless the pipe is encased in concrete or a variance is granted by the City.

2 Transition Fittings:

(a) Grooved to Flanged - The connection of grooved pipe and fittings to flanged pipe and fittings shall be facilitated with flange adapters as manufactured by Victaulic (style 341 Vic-Flange) or approved equal. The flange adapters shall be ductile iron conforming to ASTM A-536, Grade 65-45-12, with a universal primer coating. Gaskets shall have properties as designated by ASTM D-2000 and shall be suitable for the required service. Use 316 stainless steel bolts and nuts on all flange adapters and flanged components.

(b) Force Main Connection - The ductile iron pipe shall be extended to at least 4 feet from exterior wall of the most downstream pump station structure. The force main shall then be connected to the ductile iron pipe with a restrained mechanical coupling for joining and restraining plain end pipes of dissimilar materials. The coupling shall be a MEGALUG Series 3800 MEGA-COUPLING or approved equal.

B 2” – 3” Diameter Piping:

1 Piping - The discharge piping shall be ASTM 1785 schedule 80 with solvent-weld joints and fittings conforming to the following specifications.

(a) Compound: ASTM 1784

(b) Schedule 80 PVC Pipe: ASTM D1785

(c) Fittings: Schedule 80 PVC

(d) Socket Joints: ASTM D 2467

(e) Solvent Cement: ASTM D2564

(f) Primer: ASTM F656

2 Transition Fittings:

(a) Force Main Connection - The schedule 80 PVC pipe shall be extended at least 4 feet from the outside of the valve vault. The force main shall then be connected to the schedule 80 PVC pipe. The force main shall be connected to the schedule 80 pipe by means of a mechanical joint sleeve coupling as specified below: .

Material: Cast sleeve coupling for plain end D1785 and D2241 PVC pipe.

Compliances: Conforms to AWWA C219

Sleeve: Cast Ductile Iron 65-45-12 per ASTM A536

Follower: Cast Ductile Iron per ASTM A536

Coating: Fusion-bonded epoxy exterior coating per AWWA C213

Gasket: Nitrile (Buna-N) per ASTM D2000

Bolts & Nuts: High strength, low alloy steel per AWWA C111 / ANSI A21.11

Manufacturer: Coupling shall be OMNI^{TM} Cast Coupling Model 441 as Manufactured by Smith-Blair or approved equal.

Adequate thrust blocking must be installed to restrain movement at the force main connection joint. Refer to the City of Jackson Lift Station and Force Main Standard Details for thrust blocking requirements.

C Testing:

1 All pump station Discharge Piping including joints, fittings, valves, and appurtenances shall be subject to hydrostatic pressure testing prior to acceptance. Testing shall comply with section §4.3 Paragraph F herein.

2 Pressure testing of the pump station discharge risers between the pump discharge flange (Wet Well) and respective discharge valve (Valve Vault) shall be limited to visual inspection during equipment start-up. Upon request by the City, the Contractor shall, at no additional cost to the City, make provisions to operate each pump, briefly, against a closed discharge valve to allow for visual inspection of the discharge risers at the pump shut-off pressure. When performing this test, care shall be made to ensure the pump shut-off head does not exceed the pressure rating of the discharge riser piping.

4.2 DISCHARGE RISERS

A PVC - When plastic pipe is utilized for the pump discharge riser and the riser exceeds six (6) feet in length, a 316 stainless steel support brace must be installed between the riser and wet well wall. The brace shall be placed approximately in the middle of the riser but kept above the normal operating level of the well. When the discharge riser exceeds 12’-0” in length, multiple braces will be required to be installed on 6’-0” (maximum) centers above the normal operating level of the wet well.

B DIP - When ductile iron pipe is utilized for the pump discharge riser and the riser exceeds eight (8) feet in length a 316 stainless steel support brace must be installed between the riser and wet well wall. The brace shall be placed approximately in the middle of the riser but kept above the normal operating level of the well. When the discharge riser exceeds 16’-0” in length, multiple braces will be required to be installed on 8’-0” (maximum) centers above the normal operating level of the wet well.

C. Restrained Flange Coupling Adapter - One (1) each mechanically-restrained flanged coupling adapter shall be installed on each discharge pipe just downstream of where the pipe enters the valve vault to allow for

alignment adjustment during installation and future pipe disassembly. Restrained flange adapter shall be 2100 MEGAFLANGE as manufactured by EBAA Iron or approved equal.

4.3 FORCE MAIN REQUIREMENTS

Force mains shall meet the following criteria:

A Velocity - A cleaning velocity of at least 2 feet per second must be maintained when one pump is running and a maximum of 8 feet per second shall not be exceeded when both (all) pumps are running.

B Air Release Valve - An automatic release valve shall be placed at high points in the force main to prevent air pockets.

C Termination - Force mains shall discharge to the gravity sewer system at a manhole in a manner that smoothly directs the force main flow into the gravity sewer flow and minimizes turbulence. Connections to the gravity manhole shall be per the City of Jackson Lift Station and Force Main Standard Details.

D Joint Restraint-For standard force main installations, joint restraints shall be installed at all angle points to withstand the thrust developed under the test pressure plus 50 psig.

Mechanically Restrained Joints –The force main shall be fitted at all angle points with mechanically restrained joints designed to withstand the thrust developed under the test pressure plus 50 psig. The required number of mechanically restrained joints from the angle point shall be determined by the design engineer and shown in plan and profile.

Thrust Blocks - The force main shall be fitted with permanent thrust blocks at all bends, tees, plugs, fittings or other significant changes in direction. Thrust blocks shall be constructed as per the City of Jackson Lift Station and Force Main Standard Details. Thrust block locations shall be given on both plan and profile views on the construction plans.

E Clean-outs - The need for clean-outs on the force main shall be determined during plan review by the City of Jackson. As a general guideline, clean-outs will not be required on force mains under 1,800 feet in length. If clean-outs are required, refer to the City of

Jackson Sanitary Sewerage Lift Station and Force Main Standard Details.

F Force Main Pressure Test:

a.) All force main piping shall be subject to hydrostatic pressure testing prior to acceptance. Contractor shall bear all costs of pressure testing the piping to include, but not be limited to, the provision and cost of test and make-up water. Hydrostatic pressure testing shall be performed after the force main backfill has been placed and compacted.

b.) Unless otherwise specified, testing procedures shall conform to the applicable AWWA standards for the respective force main material. In the event of a conflict between the AWWA standard and the Specifications as defined herein, authority shall defer to these Specifications.

c.) Force Main Pressure Test (PVC) - Contractor shall fill and pressure test the force main in accordance with AWWA C605.

d.) Force Main Pressure Test (DIP) – Contractor shall fill and pressure test the force main in accordance with AWWA C600.

e.) The test pressure for all force main materials shall be 50 psig above the normal operating pressure, excluding friction losses, measured at the lowest elevation of the force main along the test section.

f.) The leakage shall be measured by pumping into the line with a pump capable of maintaining the required pressure and metering the amount of water necessary to sustain the pressure for a period of four (4) hours.

g.) The test when so conducted, shall indicate a leakage of not more than fifty (50) gallons per inch of pipe diameter per mile per day, and no leaks shall become apparent on the surface of the ground. Should surface leaks become apparent, or should the leakage exceed that specified, the leaks shall be located and repaired, and the line re-tested until it fulfills the above requirements.

h.) Pressure tests shall be witnessed by the City's authorized representative.

G Tracer Wire – Tracer wire shall be a #12 AWG HS-CCS high strength copper clad steel conductor (HS-CCS), insulated with a 30 mil, high density, high molecular weight polyethylene (HDPE) insulation, and rated for direct burial use at 30 volts. HDPE insulation shall be RoHS compliant and utilize virgin grade material. Insulation color shall meet the APWA color code standard for identification of buried utilities.

a.) Tracer wire shall have a minimum 380 lb break load.

All splices/connections shall be made with DryConn Direct Bury Lug, SnakeBite Connector by Copperhead Industries, TW Connector by Pro-Trace, or approved equal. Twist on wire nut style connectors or taped connectors are prohibited.

The tracer wire shall be installed the entire length of the force main as per the City of Jackson Sanitary Sewerage Lift Station and Force Main Standard Details. The tracer wire shall be placed along the top of the force main and taped in place with duct tape or electrical tape at a maximum of 5 foot intervals or three (3) places per length of 20'-0" pipe. The tracer wire shall be accessible from the surface at intervals not to exceed 1,000 feet. The tracer wire shall be extended into all valve vaults (pump station valve vault, air release vault, clean-out valves, etc.) a minimum of 5 feet, from each direction.

Grounding anode rods shall be installed at each end of all force mains, air-release valve pits and additional access points if required by manufacturer. Grounding rods shall be minimum 1.5 lb magnesium anode and installed according to manufacturer's recommendations.

Tracer wire access vaults shall be provided and installed as necessary to limit the spacing between tracer wire connection points to below 1,000 feet. The tracer wire access vaults shall be constructed as per the Standard Details. The wire shall be neatly rolled and placed on a stainless steel hook so that it does not interfere with normal operation. When suction lift pumps are utilized or when a pump station valve vault is not utilized, a tracer wire

access vault shall be provided within 10 feet of the pump station wet well.

All tracer wire installations shall be acceptance-tested after installation. The acceptance test shall include an actual field locate using typical (33 kHz) line tracing equipment, witnessed by the Contractor, Engineer, and Owner prior to acceptance of the project.

H Utility Marking Tape - A detectable underground utility marking tape shall be installed the entire length of the force main as per the City of Jackson Sanitary Sewerage Lift Station and Force Main Standard Details.

Property	**Method**	**Value**
Thickness	ASTM D2103	5.0 Mils (nominal)
Tensile Strength	ASTM D-882	22 lbs/in width (4400 psi)
Elongation	ASTM D-882	<50% at break
Printability	ASTM D2578	>40 dynes/cm^2

The tape shall consist of a 35 gauge (0.00035") solid aluminum foil core encased between 2 layers of plastic. The tape shall have an overall minimum thickness of 5.0 mil (0.005"). The aluminum foil must be visible from both sides. No inks or printing shall extend to the edges of the tape. All printing shall be encased to avoid ink rub off. Tape shall be green in color and conform to the requirements above.

I The following materials shall be used for the force main from a point four feet (4'-0") outside the chamber wall to the discharge manhole

1.) Four inch (4") diameter and above:

a.) AWWA C-900 for Polyvinyl Chloride (PVC) Pressure Pipe, or AWWA C909 for Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe 4-inch through 12-inch with approved joint, min. pressure class DR-18 (200 psi);

b.) AWWA C-905 PVC w/ C.I. O.D for 14-inch through 48-inch with approved joint, min. pressure class DR-18 (200 psi);

c.) AWWA C-151 DIP minimum Pressure Class 52.

d.) Joints for straight lengths of pipe shall be bell and spigot type in accordance with AWWA C900, AWWA C151, and AWWA C111.

f.) Joints at all inflection points in the force main alignment shall be made with mechanical joint fittings in accordance with AWWA C110 and AWWA C153.

2.) Three inch (3") diameter and above; less than four inch (4") diameter:

a.) PVC pipe meeting ASTM D2241 (SDR 21) with integral bell and gasket joint design meeting the requirements of ASTM D3139 and F477, minimum pressure class shall be DR-21 (200 psi) unless otherwise designated on the plans or specifications;

i.) Joints at inflection points along the alignment shall be solvent-welded SCH 80 PVC.

b.) Ductile iron pipe class 52 AWWA C-151.

i.) Joints for straight lengths of pipe shall be bell and spigot type in accordance with AWWA C900, AWWA C151, and AWWA C111.

ii.) Joints at all inflection points in the force main alignment shall be made with mechanical joint fittings in accordance with AWWA C110 and AWWA C153.

3.) The force main pipe shall have a pressure rating greater than the system's maximum operating pressure plus 50 psig.

4.) The project plans or specifications shall state the required SDR Ratio, Pressure Rating, Thickness Class, Pressure Class, and National Standards of the proposed force main material.

J Installation: When undefined in this specification or the associated Standard Details, the force main installation shall comply with the City of Jackson's standard gravity sewer installation specification titled "Sanitary Sewerage Facilities Standard Construction Specifications for the City of Jackson".

1.) The force main shall be provided with appropriate appurtenances where necessary, such as automatic air relief valves, thrust blocks, cleanouts, and cleanout manholes at low points in the force main.

2.) The force main shall be bedded in carefully-placed selected earth backfill unless otherwise shown on the Project Plans and Specifications.

3.) The force main shall be laid on a continuous rising grade form the lift station or cleanout manhole to the terminal manhole on the gravity sewer.

4.4 AIR RELEASE VALVES

An air release valve shall be installed on any high points or "knees" of the force main as required. The air release valves shall be the short-body style and specifically manufactured for wastewater applications. The body and cover of the valve shall be constructed of heavy-duty cast iron or plastic that has a pressure rating greater than or equal to the force main pipe material. Bolts, pipe, nipples and plugs shall be stainless steel. Street elbows shall be stainless steel or bronze. The valve shall be equipped with all isolation and backwash accessories as required. Isolation and flush valves shall be threaded ball valves with bronze bodies, stainless steel ball and operating lever, and nylon seats.

Air release valves shall be attached to the force main by means of a stainless steel pipe nipple (min. 4” long) threaded to a stainless steel tapping sleeve installed on a straight barrel of the force main. (Air release valves shall be supported to the wall of the structure by a 1-1/4” x 1-1/4” x 1/8” thick stainless steel angle bracket.)

Air release valves shall be placed in a vault as per the City of Jackson Lift Station and Force Main Standard Details.

Air valves shall be A.R.I. D-025-NS or approved equal.

4.5 PLUG AND CHECK VALVES

A Approved shut-off and check valves shall be placed on the discharge line of each pump. The check valves shall be located between the shut-off valve and the pump. Approved shut-off valves shall be placed on the force main as necessary. The shut-off and check valves shall be installed horizontally and located in accordance with the City of Jackson Lift Station and Force Main Standard Details. No pump discharge valve shall be vertically mounted or installed within the wet well.

B All valves shall be rated so as to withstand normal working pressure plus allowances for water hammer.

C Shut-off Valves - The valves shall be located so that each pump may be isolated from the common discharge header.

1 3 Inches and Larger - Shut-off valves 3 inches and larger shall be eccentric plug type valves with a resilient faced plug suitable for required service. Valves shall have self-lubricating stainless steel bearings and bearing grit seals. The port shall be circular, have a minimum flow area of 81% of the full pipe area, minimum 90% pipe diameter and be able to pass a cleaning pig when fully open. Flow direction shall be indicated on the valve body.

2 Body - The shut-off valves shall be cast iron body, ASTM A 126 Grade B or ductile iron per ASTM, Grade 65-45-12, and have a fusion-bonded epoxy coating per AWWA C213. The bonnet shall be ductile-iron material per ASTM A-536, Grade 65-45-12. Grooved and flanged valves shall comply with AWWA C-517 and AWWA C-606, AWWA C-115 requirements, respectively.

3 Plugs - Shut-off valve plugs shall be made of cast iron ASTM A 126 Class B or ductile iron ASTM A-536 covered with a Buna-N Rubber compound. The seats are to be a corrosion-resistant alloy such as 304 stainless steel. Flanged valves shall be in accordance with ANSI B 16.1 Class 125 standards. Grooved valves shall be in accordance with AWWA C606. Sleeve-type bearings shall be utilized in both the upper and lower trunnions. Bearings shall be corrosion resistant and have a low coefficient of friction.

4 Operators - 3-inch to 4-inch shut-off valves shall be provided with a 2- inch square operating nut and wrench head for overhead operation. Valves at the pump station and pump station valve vault that are larger than 4 inches shall be provided with a manual gear operator sized so that the maximum rim pull required is not more than 80 lbs. Valves installed on the force main that are larger than 4 inches shall be with a manual gear operator sized so that the maximum rim pull required is not more than 80 lbs. All valves, including valves provided with gear operator, shall be provided with a 2-inch square operating nut and wrench head. All valve operators shall be accessible from directly overhead and shall not require personnel entrance into the Lift Station Valve Vault. Valve wrenches shall be of sufficient length to allow personnel to operate valves from top of vault. Provide one (1) valve wrench at every new or rehabilitated Lift Station.

5 Sealing requirements - Shut-off valves 3 inches to 6 inches shall provide positive and reverse flow sealing up to 175 psi. Shut-off valves 8 inches to 12 inches shall provide sealing up to 175 psi and reverse sealing up to 50 psi. Shut-off valves larger than 12 inches shall provide positive sealing up to 150 psi and reverse sealing up to 50 psi. These valves have a preferred direction of shut off, and it is the responsibility of the contractor to see that they are properly installed. Acceptable manufacturers are Clow, Val-Matic, Dezurik, Victaulic Series 365 Vic-Plug or approved equal.

6 Smaller than 3 Inches - Shut-off valves smaller than 3 inches shall be ball- type shut-off valves. The valve body shall be ductile iron, ASTM A-395, Grade 65-45-12. The ball and stem shall be Type 316 stainless steel. The valve shall be a standard port, end-entry valve designed for 600 psi, minimum. The valve shall provide a drip free seal. The valves must be provided with a 2-inch square operating nut and wrench head or a concentric tee handle. Acceptable manufacturers are Victaulic, or approved equal.

E Check valves shall be of the swing check type including external lever arm and weight, with ASTM A-126 Class B cast-iron body. Check valve bodies and external appurtenant devices shall be fusion-bonded epoxy coating per AWWA C213. Check valves shall be either flanged or grooved end type. All fasteners shall be 316 stainless steel. Check valves shall be provided with an air cushion if required based on the anticipated severity of pipeline pressure surge.

2 inches to 3 inches check valve – Acceptable manufacturers are Victaulic (Series 712) Val-Matic (Series 7800LW) or approved equal.

3 inches and larger check valves – Acceptable manufacturers are Henry Pratt Series 9001, Val-Matic (Series 7800LW) or approved equal.

4.6 BYPASS PUMP PIPING

All pump stations shall be equipped with a bypass pump arrangement as per the City of Jackson Lift Station and Force Main Standard Details.

A Pump stations with a force main that is 4 inches or smaller shall be equipped with a 4-inch bypass arrangement.

B Pump stations with a force main that is 6 inches or larger shall be equipped with an 8-inch bypass arrangement.

4.7 VALVE CHAMBER DRAIN VALVE

A 4-inch drain pipe shall be installed from the valve vault to the pump vault. The drain pipe shall be ductile iron Class 53 or greater. An elastomeric “duckbill”back-water check valve shall be installed on the valve vault drain line as per City of Jackson Lift Station and Force Main Standard Details. The valve shall be a “Tide-Flex” series TF-2, 4-inch (slip on) check valve, by Red Valve Co. or equal. The check valve shall be attached to the drain pipe via two (2) stainless steel hose clamps.

4.8 WET WELL VENT

The wet well structure shall be vented with a 4-inch Class 53 AWWA C151 flanged pipe, provided with interior and exterior coating as specified for the Discharge Piping (refer to City of Jackson Lift Station and Force Main Standards). Vent pipe shall fully penetrate wet well top and shall be rigidly cast into or affixed to the top of the wet well. The wet well vent pipe shall have a mesh insect screen bolted to the bottom flange of the vent gooseneck. Bolting hardware shall be 304/316 and connection shall be ungasketed. Insect screen shall be 304/316 stainless steel No.2 mesh, intercrimp weave, with a 0.063” wire diameter (1/2” opening) and bare edges or approved equal. The use of hose clamps to attach the insect screen shall not be allowed.

A An odor filter may be required due to location. Odor filters and associated hardware shall be of 304/316 stainless steel construction and sized to match lift station capacity per manufacturer’s recommendations. Odor filtering media shall be serviceable and replaceable. The pressure drop across the odor control scrubber shall not exceed 4.2 in. w.c. across the vessel. The system shall be capable of removing foul air at a rate no lower than the rate of peak wastewater inflow to the Wet Well. Where required, Contractor shall furnish all labor, materials, equipment, and incidentals as required for operation of the odor control unit. The system shall be designed for continuous operation. Access port/s shall be provided to allow access to the internals of the system. The system shall be designed to withstand ambient temperatures up to 120 degrees F. The system and all accessories shall be factory mounted, piped and wired to the maximum extent possible. The system manufacturer and model shall be approved by the City of Jackson prior to purchasing.

4.9 POTABLE WATER SUPPLY

For lift stations with a minimum average daily flow of 50,000 gallons per day, or as required by the Director, a 1-inch metered water supply shall be installed per the City of Jackson Lift Station And Force Main Standard Details. A reduced-pressure zone (RPZ) backflow preventer shall be installed per the Missouri Public Drinking Water Regulation 10 CSR 60-11.010. The RPZ backflow preventer shall be located above-grade and installed within a lockable heated fiberglass enclosure. A lockable, freezeless yard hydrant shall be installed downstream of the RPZ. Water line shall maintain a minimum burial depth of 3'-6".

A Reduced Pressure Zone Backflow Preventer

- Watts LF009-QT-S;
- Approved Equal.

B. Non-Freeze Yard Hydrant

- Watts Drainage HY-800 with epoxy-coated cast-iron head, lift handle, and lock, galvanized casing, bronze internal working parts and valve housing, 1/8" NPT drain port;
- Approved Equal.

C. Enclosure

- Hot-Box Model HE012038028;
- Approved Equal.

4.10 GRAVITY LINES ENTERING THE STATION

A Ductile iron pipe shall be used on sections of gravity lines running from:

- The last manhole preceding the station up to the station.
- The outfall of the detention pipe to the station. This outfall line shall be a minimum of 12-inches in diameter and have a minimum 1% fall.

Concrete or PVC gravity pipes in these areas will not be acceptable.

B All incoming gravity lines and discharge piping in/out of the wet well and valve vault (if required) shall have a Z-lok type compression fitting cast-in-place where the piping passes through the structure walls. All piping outside diameters shall be located a minimum of one foot above or below structure joints. The maximum angle of deflection allowed for pipe gaskets is as follows:

- Z-lok = 25 degree

If construction constraints preclude precast pipe penetrations in and out of the pump station structures, these penetrations shall be core-drilled unless exception is granted by the City. In the event that the penetration is perpendicular to the structure face, install an A-Lok grout-in waterstop around the pipe and grout fill the annulus with non-shrink grout.

For installations where the pipe penetration is not perpendicular to the structure, the pipe connection shall be sealed by means of a swellable hydrophilic waterstop and grout fill annulus per City of Jackson Lift Station and Force Main Standard Details. Adhesive compound shall be installed to secure the waterstop to the exterior of the pipe and interior of the concrete wall core. Adhesive compound shall be per waterstop manufacturer's standard installation details. Swellable waterstop shall allow for limited angular pipe deflection after installation. Waterstop shall be Hydrotite as manufactured by SIKA U.S., or approved equal. Installation shall be per waterstop manufacturer's direction.

END OF SECTION

5.0 INTERIOR

5.1 SLIDE RAILS

All pump lifting slide rails shall be made of 316 SCH 40 stainless steel pipe. Slide rails shall be installed and sized per pump manufacturer's instructions. The slide rails shall be firmly braced to the wet well wall with stainless steel support brackets placed at a maximum spacing of 8 feet.

5.2 LIFTING CHAIN

Pump lifting chain, clevises and shackles shall be made of 316 stainless steel. The chain shall be sized to accommodate the installed pump weight, but shall not be sized smaller than 3/16-inch stainless steel diameter links.

5.3 BOLTS

All field installed bolts, nuts, and washers used inside either the pump or valve chamber shall be made of 316 stainless steel.

5.4 FASTENERS

All concrete fasteners used for installation of braces, brackets or boxes shall be stainless steel Wej-It type stud anchors, Hilti Quick Bolt Three or an approved equal.. Anchor holes shall be drilled to the manufacturer's recommended depth. Pump base anchor studs shall be sized as per pump manufacturer’s recommendation.

5.5 FLOATS AND SETTINGS

A Pump floats shall consist of a mechanical 24VDC SPDT switch sealed in a corrosion resistant IP68 polypropylene housing with a minimum of 18 gauge, 2-wire, SJOW/A jacketed cable. The floats shall be weighted to maintain bulb submersion during high water levels. The cable must be of sufficient length to reach the junction box with no splices and to allow removal of the float without entering the wet well. The level controls shall be suspended so that adjustment or replacement may be done without the use of any tools or without entering the wet well. The floats shall be UL/CSA listed. Mercury-style floats shall not be accepted.

B Floats shall not be located near the flow of the incoming sanitary lines.

C Sewage shall not rise to the level of the incoming gravity lines or the detention pipe during normal pump operation.

D All floats shall be located away from the turbulence of the incoming flow.

E The following levels shall guide the setting of float levels.

1 Off Float -The pump shall have water covering the top of the pump volute at the off level; the pump motor shall be completely submerged.

2 First Pump - No Less than one and a half feet above top of pump motor.

3 Lag Pump - No less than 2 feet above top of pump motor

4 High Level Alarm - No less than 2.5 feet above the top of pump motor and no more than one inch below the Detention Pipe invert.

5 24-hr Detention Alarm – Set to a level equivalent to 75% of the Detention Pipe capacity.

F Float leads and pump cords shall be suspended with stainless steel kellum grips from the bracket. The bracket shall be attached to the wet well hatch frame or firmly bolted to the concrete immediately below the hatch frame. Bracket shall be constructed of 316 stainless steel. Float bracket shall provide individual cable hooks of a quantity equal to that of the number of floats specified, on a common assembly. Float bracket shall be Model J6J as manufactured by Halliday Products or approved equal. The bracket shall be positioned so that float leads and pump cords are easily accessible without entering the wet well.

G Float wires shall be neatly routed away from the pump access hatch opening then through the wet well wall, without excessive wire strain or pull. Wire length on all float wires shall be such that each float may be adjusted to the bottom of the station wet well.

H Installed pump top and bottom elevations as well as the float elevations shall be shown on the pump station interior drawing.

I Floats shall be model ENM-10 as manufactured by Xylem Water Solutions or approved equal.

5.6 ACCESS HATCHES

All pump and valve chambers shall be provided with aluminum access hatches as follows:

A The access hatches shall be of aluminum construction rated for a 300 lbs. per square foot loading. Door size shall be as indicated on the drawings. The access frame and cover shall be flush with the top of the concrete with hinged and flush-locking mechanism, upper guide holder and level sensor cable holder. Frame shall be securely placed, mounted above the pumps. Hatches shall be equipped with form skirts, sized for the slab top thickness. Doors shall be provided with padlock lugs.

B Hatches shall be Bilco Type PCM or PDCM, or Halliday model S1S, S2S, or R1R or approved equal.

C All access hatch construction materials and appurtenances shall be manufactured from stainless steel, aluminum or brass.

D Access hatches shall be provided with orange powered-coated hinged aluminum I-bar safety grating. Load rating of safety grating shall be consistent with that specified for the hatch cover.

E Access hatches shall meet the following minimum size but in no case shall be sized less than deemed adequate, as determined by the City, to clear pump and valve removal from the respective structure. Size may vary due to manufacturer specification or pump configuration as approved by the Director:

Wet Well Diameter or Maximum Dimension	Minimum Hatch	Valve Vault	Minimum Hatch
4’	30” x 36”	4’	36” x 36”
5’	36” x 42”	5’	42” x 42”
6’	36” x 48”	6’	48” x 48”
7’	36” x 60”	7’	60” x 60”
8’	36” x 60”	8’	60” x 60”

F In lieu of a single hatch, the designer may propose a deduct to provide multiple hatches for both the wet well and the valve vault if a single hatch of adequate dimension is not available per the manufacturer’s standard catalog. Multiple-hatch designs shall adhere to the specifications as listed above.

5.7 PRESSURE SENSORS

Pressure sensors, if required, may be of the full-flange design with thru bolt holes or one piece wafer style with carbon steel flanges. Sensors shall clamp between standard ANSI pipeline flanges. All exposed surfaces to be epoxy painted or of a non-corrosive material. Sensor shall be flow thru design with flexible Buna-N elastomer sensing ring around the full circumference. Gauges to be 2 1/2-inch dial, Span Model 220 with 1/4-inch connection. Pressure switches shall have Nema-7 Housings with Single Pole Double Throw, snap-action switching elements. Switches shall be wired normally closed, with adjustable pressure settings. The pressure range shall be specified for each specific installation. Switches shall be, "NEO-DYN Model 132P4-8C6." Accessory piping to be 1/2-inch or 1/4-inch Parker Hex stainless steel with reducing fittings where necessary to connect instruments. Pressure sensors shall be "Red Valve" Series 40 flanged wafer sensors EVR type PES or approved equal.

5.8 PUMP CHAMBER INSPECTION

Following placement of the wet pit pumps and prior to allowing water in to the pump station, the pump station floor will need to be inspected by the City. The pit floor must be clean and dry for this inspection. The contractor/developer shall be responsible for arranging this inspection with the City per Section 10.2.

END OF SECTION

6.0 STRUCTURAL REQUIREMENTS

6.1 STRUCTURE DESIGN

The pump station structure shall consist of a wet well and a valve chamber, if required, constructed of either pre-cast or poured in place steel-reinforced concrete design as approved by the City.

- Precast sections, tops, and bases shall meet ASTM C-478.
- Poured-in-place steel-reinforced concrete shall be designed using LRFD method and meet the ACI-318 code for structural design and construction. Cast-in-place structures shall require structural details and calculations, signed and sealed by a professional engineer registered in the state of Missouri, for City review prior to acceptance.
- All cold joints shall include water-stop inserts. Water-stop inserts shall be dual-ribbed with a centerbulb and fabricated of flexible PVC.
- All structure top elevations shall be located a minimum of two feet above the 100-year flood elevation where applicable.

6.2 CONCRETE SPECIFICATIONS

All requirements on cast-in-place concrete shall be in accordance with the City of Jackson Sanitary Sewerage Facilities Standard Construction Specifications Part 5 – Concrete Construction.

6.3 REINFORCEMENT

Rebar placement and wall thickness shall be determined by design calculations but shall not less than minimum dimensions as indicated on the Standard Lift Station Details Sheet LS-12.

6.4 DETAIL DRAWINGS

A detailed plan and profile drawing of the pump station concrete structure shall be included in the submitted plans detailing, but not limited to, the following:

a.) The size, plan location, and elevation of all gravity lines, discharge pipes, drain piping, and electrical passage openings;

b.) Rebar details;

c.) Floor, top, and wall dimensions;

d.) Hatch casting details;

e.) All elevations of station piping and structural section joints;

f.) Structural joint details.

6.5 WET WELL DIMENSIONS

The wet well shall be sized and control setting shall be appropriate to avoid heat buildup in the pump motor due to frequent starting and to avoid septic conditions due to excessive detention time.

The wet well shall be designed and dimensioned such that the high water level in the wet well during normal operation shall be at least one foot (1'-0") below the invert of the incoming sewer.

6.6 CONSTRUCTION TOLERANCE OF WET WELL

The wet well shall be installed so that it is no more than 3 inches per 25 vertical feet out of plumb.

6.7 TOP OF WET WELL AND VALVE CHAMBER

The top elevation of Wet Well and Valve Chamber structures shall be 4 to 6-inches (4" to 6") higher than the surrounding ground elevation. Surrounding gravel pavement is to be sloped away from the structures for proper drainage.

6.8 ACCESS HATCHES

Access hatches shall be sized and positioned to allow vertical access to all pumps and valves. Access hatches shall be cast in the top sections of each chamber per Section 5.6.

6.9 PIPE & CONDUIT ENTRIES

"Z-lok" gaskets shall be embedded in the concrete castings per Section 4.10. Other methods may be allowed as approved by the Director

6.10 WET WELL FLOOR

A poured concrete invert shall be installed with sides at a 1 to 1 slope to a hopper bottom (sump) to minimize solids accumulation. The pump sump shall be no larger than required for pump installation and maintenance.

6.11 VALVE CHAMBER

A Valve chambers are required on all pump stations that utilize submersible pumps.

B The valve chamber floor shall be sloped with a 3-sided invert towards the 4-inch drain pipe using a 2-inch fillet.

1 Valve chamber shall be sized to allow 12-inches horizontal clearance around all fittings/valves and configured as per the Standard Details.

C No piping or electrical conduits may be run beneath the valve chamber floor.

6.12 PIPING DESIGN

A The standard pump station piping arrangements called out in this design book have proven themselves to be of sound design in typical pump station installations. Special bracing or water hammer protection devices have not been included or called for; however, when the surrounding terrain or station site is such that extreme hydraulic conditions may be created, it is the responsibility of the Design Engineer to anticipate such conditions and design for the probability of excessive pressure, stress and/or movement in the piping system. The Design Engineer shall be responsible for including whatever restraints, relief valves or surge protection, deemed necessary for the protection of the valve and piping system.

B Valve Chamber Piping Supports - After discharge piping and valves have been installed in the valve chamber, adjustable pipe cradle jacks shall be placed under the valves and tee, so that they have a 10-inch (10”) clearance between the floor and valve flanges. The supports shall be firmly bolted to the valve chamber floor. Supports shall be constructed of 316 stainless steel.

6.13 DETENTION CHAMBER

Where 2-hour sewerage detention must be provided, both the pump chamber and the incoming gravity system are not to be considered for the 2-hour calculations. Detention shall be installed below ground with an access manhole located at the both ends. The connection between the detention pipe and the wet well wall shall be made with a 12-inch ductile iron pipe. The detention pipe must be a dedicated system, it may not be used as part of the gravity system. The detention pipe and connecting line shall be laid with a minimum 1% slope. Typical detention pipe design shall be RCP per Part 2, Section G.3 of the Sanitary Sewer Standard Construction Specifications using rubber type gaskets. Bulk heading of the detention pipe shall be complete with a pre-cast bulkhead.

Under special circumstances, dual-wall polypropylene (PP) pipe may be substituted for reinforced concrete pipe. Any substitution of pipe materials for the detention pipe must be approved by the City prior to acceptance. Material substitution requests shall be accompanied by submittal information detailing, but not limited to, joint type, bulkheading, access points, and structural bearing capacity to demonstrate equivalence to RCP.

6.14 PROTECTIVE LINING OF CONCRETE SURFACES

A protective liner shall be installed on all interior exposed concrete surfaces of the wet well, first gravity manhole upstream of the wet well, detention pipe (if RCP construction), and the force main discharge manhole and one to five (1-5) manholes downstream, as required by flow conditions and as approved by the Director. The liner shall be a solventless, 100% solids, corrosion-resistant epoxy coating or a lining having multiple, structural fiberglass layers with a non-porous diaphragm bonded between the layers of fiberglass, and molded to the existing structure.

Acceptable Manufacturers: Raven Lining Systems AquataPoxy A-6, Terre Hill Composites Multiplex Liner THC-610-SL-68, or approved equal.

END OF SECTION

7.0 ELECTRICAL

7.1 UTILITY POWER

A The design engineer shall confirm power availability and available transformer configuration with the Director of Electric Utilities prior to design. Utility power to the control panel shall be 3 phase, 60hz where available. The supply voltage shall be determined prior to pump selection. See Sections 3.1 and 7.3 for additional information on pump electrical supply specifications. It is the responsibility of the contractor to bring the necessary utility power to the pump station site. Provide meter and safety switch rated for the electrical service entrance of the installation.

7.2 PUMP CONTROL PANEL

A GENERAL SPECIFICATIONS: The intent of this specification is to provide a complete, integrated Pump Control System as described herein. It shall be factory assembled, wired and tested. The panel manufacturer shall supply three (3) sets of complete As-Wired drawings upon completion of construction. One (1) copy of these drawings shall be provided inside the pump control panel and the other two (2) sets given to the City's representative. As-Wired (as-built) drawings shall be provided to the City in both CADD and .pdf formats upon completion of construction.

An equipment data tag shall be permanently affixed on the inside of the exterior door with the station designation, power source, pump horsepower, and pump full load amps. In addition to the label requirements of UL 508A, an engraved legend plate shall be permanently affixed on the inside of the exterior door with the name, address and telephone number of the service representative for the pumps and control panel.

Typical pump station sites contain both Class I, Division 1 and 2, Group D hazardous location classifications per NFPA Article 820. Refer to the detail on Sheet LS-08 "Wet Well Electrical Classification" on the City of Jackson Lift Station and Force Main Standard Details as well as NFPA Article 820: "Standard for Fire Protection in Wastewater Treatment and Collection Facilities" for the extent of classified areas. All applicable installation procedures shall be per NEC, ANSI, EPA, and all other codes and laws for this installation requirement shall be followed. Intrinsically safe barriers shall be provided for the float switches located in the wet well and for the pressure switches in the valve vault. All pump and control conduits

entering or exiting the pump control panel shall be installed with hazardous-location conduit seals in accordance with the applicable NFPA Article 820 area classifications (Class I, Division 1, Group D for the Wet Well; Class I, Division 2, Group D for the Valve Vault). These seals shall be provided and installed by the installing contractor.

1 Quality Assurance: The pump control panel shall be supplied by the pump supplier and fabricated by a current UL 508A Listed industrial control panel manufacturer. The panel manufacturer shall show its UL follow-up service procedure file number on submittals. All devices within the panel shall be UL listed and/or recognized where applicable and shall be mounted and wired in accordance with the most current edition of UL508 and NEC. The panel manufacturer shall have a minimum of 5 years experience manufacturing systems specifically for wastewater applications.

The pump control system(s) shall be fully tested by the factory prior to shipment. It shall include testing of both power and control devices as well as all control functions. A final inspection shall be performed prior to shipment and a copy of this form shall be provided with the panel.

The panel shall be designed with the following features to operate the specified pumps. The pumps, pump control panel and related accessories shall be supplied by the pump supplier to ensure compatibility and assure matching controls to pumps.

2 Basic Operation: The pumps shall be operated automatically or manually as a pump down, lead/lag, common off system. Each pump shall be controlled primarily through a “Hand-Off-Auto” 3-position maintained selector switch. Control function requirements are further defined in the control section of these specifications.

3. Position Commands:

(a) OFF - In this position the applicable pump will not run under any circumstance.

(b) HAND - In this position the applicable pump shall run without regard for the level sensing commands and will rely on operator discipline to run and stop.

(c) AUTO - In this position both pumps shall be controlled by an alternator based upon the status of the multiple level float switches installed in the wet well. As the float switches sense the appropriate level in the wet well, the alternator will initiate start and stop commands to the pumps based on the alternation sequence. All floats shall be interposed with intrinsically safe UL. Listed relays installed per NEC Article 504, ANSI/ISA-RP12.6 and all other applicable codes.

4 Pump Sequence: A total of 4 (5 if required) level floats shall be provided. The levels shall act as:

LEVEL 5 – 75% of Detention Pipe Alarm (as required)

LEVEL 4 - High Level Alarm

LEVEL 3 - Start Lag Pump; both pumps running

LEVEL 2 - Start Lead Pump; shall alternate on each call

LEVEL 1 - Off; all pumps stop

5 Wet Well: The wet well is classified as a Class I, Division 1, Group D hazardous location as per NFPA Article 820 recommendation. Refer to standard details for additional information regarding NFPA area classifications.

B. CONTROL PANEL ENCLOSURE

1 General: A UL Listed and NEMA Type 4X enclosure properly sized to contain the required components shall be used. The enclosure shall be constructed of 12 GA 304 stainless steel body and door(s) with a # 4 finish with continuous stainless steel piano hinge. Cabinet hinges shall be welded to the enclosure. A dripshield shall be welded on the top of the enclosure; screws to secure the dripshield shall not be allowed. Welded-on mounting brackets shall be provided; they shall be oversized to readily accommodate mounting the panel on 1 5/8-inch strut. All hardware shall be corrosion resistant stainless steel. A 3-point latch with nylon rollers and padlock provisions on handle shall be provided; handle and locking hardware shall be stainless steel. Oil-resistant door gasketing around all 4 sides of opening shall be applied. Door gaskets shall be self-gripping flange mounted EPDM with a wire-reinforced base.

A painted white enamel steel inner swing panel shall be provided for mounting of components. Voltage identification labels and comprehensive warning labels shall be provided. To maintain the environmental rating of the specified equipment and enclosure, install in the openings only certified or recognized devices with the same integrity as the enclosure, in compliance with the installation instructions of the device. The enclosure with the installed inner swing door shall be NEMA Type 4x and UL 4x. The enclosure shall be designed specifically for municipal waste water applications.

2 Enclosure Accessories: The enclosure shall also provide for and include the following mechanical and electrical facilities:

(a) Inner Swing Panel: Provision of a “dead front” feature shall be provided using a full size hinged inner door to mount all operator devices. Material shall be mild steel with turned down flanges on all 4 sides to form a 3/4" lip for added rigidity. The inner door shall be mounted on 3/8”-16 standoff studs per NEC and UL 508. The inner door shall be set back a minimum of 2” from the outer door, hinged from the left size, and secured with a single point latch knob (door screws are not acceptable). The inner door and components shall have a “dead back” feature in order to avoid accidental shock hazard. The inner door shall be large enough to fill the entire opening of the enclosure. The screws used to secure the inner swing door mounting hardware to the enclosure shall be UL and NEMA Type 4X rated/listed and shall not violate the environmental integrity of the enclosure. Mounting hardware which penetrates the enclosure and violates the environmental rating of the enclosure shall not be allowed. All hardware shall be corrosion resistant. Quarter-turn latches shall be provided for securing the inner door in the closed position; captive screws are not acceptable. In addition, an inner door handle shall be provided for operator convenience. All panel wiring and equipment layout shall be performed per NFPA, NEC, and UL-508A specifications. N.E.C gutter spacing shall be observed. A minimum of 12” additional D.I.N. rail shall be provided for future mounting expansion. All component mounting and wiring shall be completed per the given specifications.

(b) Condensation Heater: A 100 watt (minimum), 120 VAC heater shall be provided to protect the enclosure from the

harmful effects of condensation corrosion and low temperatures. The heater shall be complete with an adjustable thermostat. Individual branch protection shall be provided.

(c) Work Light: A 12-inch LED Light, bright white 5000K work light with a safety lens shall be mounted inside the top of the control panel without penetrating the panel outer skin with screws or fasteners. The light shall be operated with an on/off switch mounted on the inner door. Provide individual branch protection for work light.

(d) Wiring: All wires in the pump control panel shall be numbered with either clip sleeve, adhesive, or heat shrink type markers. Control panel schematic shall show wire and terminal numbers. All rungs shall be numbered with relay contacts referenced by these numbers. Relay contacts shall have socket terminals noted on the drawing. A final 11" x 17" as-built schematic shall be laminated to the inside of the control panel exterior door.

C. HIGH VOLTAGE SECTION

1 Main Lug Only: A power distribution block sized for the incoming power conductors shall be provided for the main power connection. A separate fused service entrance disconnect switch and meter shall be provided and installed by the contractor. The disconnect switch shall be have padlock provisions.

2 Magnetic Motor Starters: Magnetic across-the-line horsepower rated motor starters shall be supplied for each pump under 20 horsepower. Pumps 20 horsepower and larger shall be supplied with soft starters with bypass contactors.

Magnetic across-the-line starters shall be provided with under-voltage release and overload coils for each phase for each motor to give positive protection.

3 Soft Starters:

A. The solid state reduced voltage starter shall be UL and CSA listed and consist for an SCR based power section, logic board, and paralleling bypass contactor.

B. The overload protection shall be electronic and be based on an inverse time/current algorithm. Units using bimetal

overload relays are not acceptable. Over temperature protection (on heat sink) shall be standard.

C. The solid-state logic shall be phase sensitive, and shall inhibit starting on incorrect rotation. Improper phase rotation shall be indicated on the starter.

D. A normally open (NO) contact shall annunciate fault conditions. In addition, an LED display shall indicate the type of fault (current trip, phase loss, phase rotation, etc…).

2 Individual Branch Disconnect and Short Circuit Protection: Each pump motor shall be provided with a combination circuit breaker motor starter. Circuit breakers shall be thermal magnetic, “E” frame or better and rated for AIC available at the supply voltage. Contractor shall contact the utility company for the AIC available at the proposed service. Starters shall be NEMA rated. Starters smaller than Size 1 and half sizes will not be allowed. Coils and contacts shall be replaceable without removing the motor starter from the enclosure. Overloads shall be ambient compensated, quick trip (Class 10) type. Overload reset operators shall be provided to reset the overloads without opening the enclosure door.

3 Power Distribution System: Associated with this installation will require the individual branch disconnect and short circuit protection to have UL interrupting rating as determined by the utility .

4 Control Power: The 120 VAC, single-phase power shall be derived from a properly sized transformer. Individual 120 VAC circuit breakers shall be provided for each separate power requirement.

(a) Control power shall have an over current protection device suitable interrupting requirements of the system. Overcurrent protection devices shall be provided in accordance with NEC and the system requirements.

5 Lightning Arrester: The system shall be protected by a lightning arrester for the electrical service. It shall be parallel MOV design and provide protection for Category C Transient Surges as defined in ANS/IEEE C62.41 without degradation of components. The arrester shall provide protection between each phase line and the ground line.

The arrester shall be UL listed as a secondary surge arrester, UL category VZCA. The enclosure shall be molded UV resistant polycarbonate or equal material. All electrical connectors shall be sealed in a UL component recognized epoxy to exclude moisture, dirt and corrosion.

6 Ground Lugs: Ground lugs shall be provided for incoming service, all devices, equipment, and for each motor.

7 Three-Phase Power Monitor: A UL recognized 3-phase power monitor shall interrupt the control power in the event of phase loss, phase reversal, low voltage and phase unbalance. It shall have primary fuse protection. Contacts shall be rated for 15A resistive at 120 VAC. The 3-phase power monitor shall automatically reset when proper power is re-applied.

8 Components: Operator control devices shall be 30mm, NEMA and UL listed for Types 1, 12, 3R, or 4X to match or exceed the rating of the enclosure through which they are installed. Contact blocks shall be self-wiping and color- coded bridge type rated at 10A and must have a rated insulation of 600V. Terminal connections shall be suitable for two 14 AWG control wires. All control and time delay relays shall be DPDT rated 10A @ 120 VAC, 8-pin or 11-pin socket or octal base mount type. Sockets shall have pressure plate terminals that accept two 14 AWG wires and shall be rated a minimum of 300V. All terminal blocks supplied shall be box lug type rated at the proper voltage/amperage and shall accept two 14 AWG wires.

D CONTROL SECTION

1 General: All control wiring shall be minimum 16 AWG, MTW and shall be color-coded in accordance with all applicable codes and laws. Spiral wrap, tie wrap, fasteners and wire duct shall be provided as required for aesthetics and safety. All components mounted on the door shall be wired with insulated connectors (where “finger proof” terminals are not provided) to prevent accidental shock hazards. All components on the backpanel shall be mounted on DIN rail or fastened via drilled and tapped screws to facilitate easy component replacement. Pop rivets shall not be allowed. Ammeter loops shall be provided between the disconnect switch and combination starter for better heat dissipation and an easy means of meter reading. Wire markers shall be supplied at both ends of every wire.

All components on the backpanel shall be identified by a Brady BMX-C + System metallized polyester printed adhesive label or equivalent. These labels shall include all pertinent data applicable to ratings and sizes. Components on the door of the enclosure shall be identified with custom engraved plastic legend plates. Voltage identification labels and comprehensive warning labels shall also be provided.

2 Alternating Relay: An 8-pin socket mount DPDT alternating relay shall alternate each pump on each successive start command. It shall be complete with LED indicating lights showing the status of the internal relay and a lead selector toggle switch which will allow the alternation to be canceled and omit a disabled pump. Contacts shall be rated 10A at 120VAC.

3 Terminal Block DIN Rail: Mounting rail shall be constructed of aluminum and shall raise terminal blocks 30°from vertical to facilitate terminal access. DIN mounting rail shall be Entrelec XUS001737 or Equal.

4 Terminal Blocks: Terminal blocks shall be side-entry, non-fused, screw clamp blocks with UL/CSA/CE approvals. Terminal blocks shall be Entrelec Series M4/6 or Equal. Provide end stops on each end of terminal strips. End blocks shall be Entrelec BAM2 or Equal.

5 Mode Select: Method of operation shall be by a 3-position green illuminated maintained “Hand-Off-Auto” selector switch for each pump which shall provide for mode selection and run indication.

6 Pump Alarms:

A Pump Thermal Trip: A temperature monitoring relay shall be supplied for all pumps. One relay shall be provided for each pump. The relay shall monitor the stator temperature of the pump motor. Over temperature shall be detected by three (3) thermal switches, embedded in the end coils of the stator winding (one switch in each stator phase). An over temperature condition will cause immediate shutdown and the pump(s) shall remain locked out until manually reset. The over temperature function shall incorporate a bistable relay that retains its position during power failures. LED’s located on the relay shall indicate thermal trip. One (1) over-temperature pilot light shall be provided on the inner door for each pump.

B Seal Leakage Detection: Seal leakage detection shall be provided for all submersible pumps. Seal leakage shall be detected by a resistive float switch in the seal cavity. Detection of a seal leak occurring within the motor chamber shall not shutdown or lockout the pump. LED's located on these relays shall indicate a seal leak condition. One (1) seal failure pilot light shall be provided on the inner door for each pump.

C Pump Pressure Failure: To sense a failure to deliver normal flow for any reason, each pump shall be configured with a Pump Pressure Failure alarm which shall consist of an adjustable N.O. time-delay relay (OOX) energized by an interlock between a pump run demand and a normally-closed (N.C.) pressure switch installed on the individual pump discharge configured to open when the discharge pressure increases beyond a specific threshold. A Pump Pressure Failure alarm shall lock-out the offending pump and shall require a manual reset to be returned to service. Additionally, this alarm shall illuminate a red pilot light on the face of the interior panel. The Pump Pressure Failure alarm shall serve as a catch-all alarm and shall be representative of, but not limited to, the following modes of system failure: discharge valve closed, discharge check valve malfunction, discharge pipe leak, impeller failure, overload trip, and motor starter failure.

One (1) each amber pilot light shall be provided per pump to indicate the closure of the pump discharge pressure switch.

D Alarm Test: Provide an alarm test spring-return push-button to initiate a test of the audiovisual alarm system as well as the remote alarm dialer.

E Alarm Reset: A Pump Thermal Trip and Pump Pressure Failure alarm shall lock-out the offending pump from the automatic operation and shall require a manual reset. A single reset function shall reset all alarms for a single pump. Pump faults shall be reset by a spring-return push-button installed on the inner face of the control panel.

F Wet Well High Level. Provide one (1) red pilot light to indicate a wet well high level condition. The Wet Well High Level alarm shall automatically reset upon the removal of the high level condition.

G General Fault: Provide one (1) 120VAC relay to output a general fault condition for the entire pump station upon any of the following alarm conditions for any of the installed pumps: Pump Pressure Failure, loss of control power, and wet well high level.

7 Elapsed Time Meters(s) (ETM): A 6-digit non-resettable type hour meter shall be provided for each pump to record hours of operation. These shall be wired with insulated connectors to prevent accidental shock hazards. Provide “N-1” additional ETMs to record simultaneous run times for conditions when N-1, N-2, …, N+1 pumps are running simultaneously, where N = number of pumps installed. Simultaneous run-time ETMs are required to determine pump station flow for stations with constant speed pumps allowed to run in parallel.

7.1 Event Counter(s): Provide panel-mounted non-resettable event counters for each pump to monitor and record pump start cycles.

7.2 Pilot Light(s): Provide green pump running lights, red alarm lights, green lights for positive pressure, amber lights for seal failure, and one (1) green pilot light for control power. Pilot lights shall be 30mm full-voltage type or approved equal. Lights shall be push-to-test and shall be provided with removable lenses.

8 Intrinsically Safe Relay(s): ISR relays will be provided per Article 504 of the N.E.C. and ANSI/ISA-RP12.6. These relays shall be interfaced with all float and pressure switches. Intrinsically safe relays shall be UL 913 listed and shall be 8-pin socket mount style.

9 Convenience Outlet: One (1) 15A 120V GFCI duplex outlet shall be provided. It shall be mounted on the inner swing door. A dedicated 15A circuit breaker shall be provided for this outlet.

10 Start Delay: A time delay relay shall be provided to delay the start of the lag pump. This relay shall be adjustable from 1 to 10 seconds and shall be an 8-pin socket mount type with contact ratings as previously specified. The time delay relays shall be configured to inhibit simultaneous pump starts.

11 Horn & Strobe: A weatherproof red flashing LED alarm light and a horn rated 90dB at ten feet shall be provided to indicate a high level alarm condition. Alarm power shall be derived from the +24VDC control power and battery backup. They shall be mounted on the exterior of the pump control panel or fiberglass pump cover and

shall be UL recognized for NEMA 4X to maintain the environmental rating of the enclosure. The alarm shall be activated by the LEVEL-4 float (high water sensor), each respective Pump Pressure Failure alarm, and/or a power failure.

12 Dialer: An automatic phone dialer shall be provided and placed in a separate epoxy-coated carbon steel NEMA 4X enclosure in close proximity to the Pump Station control panel. The dialer shall be a solid state component capable of dialing from 1 to 8 phone numbers, each up to 30 digits in length. Unit shall have battery backup and be capable of utilizing standard pulse dialing or Touch Tone DTMF. If the control power fails, the dialer shall internally generate and automatically annunciate a power failure alarm. Unit shall be capable of being configured locally or remotely from a standard touch-tone phone Acceptable manufactures are RACO "Verbatim", Sensaphone model 1108 or approved equal.

(a) Phone Line: The dialer is to operate on a standard rotary pulse or Touch Tone "dial-up" phone line and is to be F.C.C. approved. A regular private line is to be provided by the contractor. Connection to the telephone is through an industry standard 4-pin modular jack (RJ-11). An additional empty RJ-11 jack shall be provided near the dialer for operator testing of the dialer alarm system.

(1) Install a splitter on the incoming phone line to provide two (2) RJ-11 4-pin jacks. One (1) jack shall be used for permanent connection of the autodialer. The second jack shall be reserved as a spare for future temporary telephone installation, by City, for testing of phone line.

(b) Power: Dialer shall be powered by a dedicated 15-amp circuit fed from the Pump Station control panel control circuit. Dialer shall be provided with a UL listed 12VAC power transformer.

(c) Battery Backup: The system shall have a built-in 12V sealed lead-acid rechargeable battery. The battery shall support approximately 12 hours of continued system operation in the absence of AC power.

(d) Environmental: The system shall function over an operating range of 32°F – 122°F at 0-90% RH, non-condensing.

(e) Alarm Channels

A minimum of eight (8) alarm channels shall be required.

(1) Channel 1 shall indicate pump #1 Pump Pressure Failure

(2) Channel 2 shall indicate pump #2 Pump Pressure Failure

(3) Channel 3 shall indicate high wet well level

(4) Channel 4 - Spare or pump 3 fail if needed

(5) Channel 5 shall indicate a loss of station power

(6) Channel 6 shall indicate 75% Detention Pipe level where required (spare if not used).

(7) Channel 7 shall indicate loss of 120 VAC control power

(8) Channel 8 shall indicate a Low Battery Detection

E CONTROL PANEL ACCESSORIES

1 Junction Boxes – General: The following shall apply to all junction boxes serving electrical conductors either entering or departing a Class I Division I or II environment. Junction boxes shall be constructed of fiber-reinforced polymer, 316 Stainless Steel, or a material providing equal protection against corrosion in a high humidity, H_2S saturated environment, per City approval. Each junction box shall contain tubular screw type terminal blocks for the connection of the respective wiring leads; wire splices shall not be allowed. All conduit exiting either junction box shall comply with the NEC requirements for conduit exiting a Class I Division I environment. Conduit seals shall be required for all conduits between the junction boxes specified herein and the Pump Station control panel. Conduit seals shall conform to the applicable NEC/NFPA codes.

2 Wet Well Pump Junction Box: One (1) UL Listed NEMA Type 7 IP68, Explosion Proof enclosure shall be provided for connection of all pump power and control feeders.

3 Wet Well ISB Junction Box: One (1) junction box shall be provided for all floats, pressure switches, and any device installed in the wet well that is protected by an intrinsically safe barrier in the pump station control panel. The junction box for the intrinsically safe

wiring shall be rated for intrinsically safe wiring within a Class I Div I environment per NEC (NFPA 70).The junction box for the intrinsically safe wiring shall conform to the intrinsically safe circuit provisions per NEC Article 504 and ANSI/ISA-RP12.6. .

4 Electrical Hand Hole: The Wet Well Pump Junction Box and the Wet Well ISB Junction Box shall be installed in a common HS20 rated electrical hand hole in close proximity to the wet well. Install junction boxes on brackets to separate from hand hole bottom. All penetrations to/from hand hole shall be water tight. Install one (1) SCH 80 PVC drain with P-trap from hand hole back to wet well. Cable sleeve and drain penetrations shall conform to the City of Jackson Lift Station and Force Main Standard Details. Install 3/4" minus bedding around hand hole drain line. Extend drain 6”±2” into wet well.

5 The appropriate conduit seal packing and compound shall be provided loose for the installing contractor. The conduits between the pump control panel and the junction boxes shall be sealed by the installing contractor AFTER start-up tests have been completed. The installing contractor must seal the conduit between the junction box and the Pump Station Control Panel in compliance with the applicable requirements set forth in the National Electric Code (NFPA 70) for conduits leaving a Class I Division I environment.

6 Low-voltage controls conductors protected by intrinsically safe barriers shall be permitted to be installed in a common conduit from the intrinsically safe junction box back to the pump station control panel. Wire and conduit sizing shall comply with NEC requirements.

7 The power feeders and control conductors for the overtemperature and seal failure circuitry shall be permitted to be installed in a common conduit; however, sets of conductors serving different pumps must be installed in separate conduits. Wire and conduit sizing shall comply with NEC requirements.

8 Transfer Switch: Pump stations where the largest pump is less than or equal to 15 horsepower, that are not equipped with back-up generators shall be provided with a thermal magnetic normal power main circuit breaker and emergency power main circuit breaker for transferring power between the utility and the portable generator. Install double throw safety switch for transfer of power from normal to generator.

The normal power circuit breaker shall be sized according to system load per the NEC. Generator size, generator receptacle size and system load shall be considered when sizing the emergency power main circuit breaker. Both circuit breakers shall be rated for based upon the rating of the connected service. Pump stations equipped with backup generators shall be provided with an automatic transfer switch to switch from utility power to generator power. The switch shall be properly sized for the load served as dictated by NEC and the manufacturer. The switch shall be certified to meet the latest adopted transfer switch standards as defined by UL Acceptable manufacturers are ASCO, Zenith, Russ Electric or approved equal.

9 Generator Receptacle: A generator receptacle shall be mounted on the side of the control panel. It shall have male contacts and include the required poles to properly interface with the generator system voltage requirements. The generator receptacle shall be suitable for connections in an outdoor environment. The generator receptacle shall be a model CROU AREA6425 RCPT ASSEM-S22 as manufactured by Crouse-Hinds.

7.3 THREE-PHASE MOTORS

All pumps will operate using 480 VAC three phase power, or as determined per Paragraph 7.1 – Utility Power.

Any station requiring pumps greater than 7.5 horsepower must be supplied with three phase power.

Any station requiring pumps 7.5 horsepower or less may use the single phase power source option upon City approval. Allowance of such a system will depend on the cost analysis presented by the designer/owner. Allowance will be determined on a case-by-case basis. Providing three phase power to the station is the preferred installation.

All pumps shall utilize 3-phase motors where 3-phase power is available. Single phase motors shall not be acceptable without approval by the Director per Section 3.1. Pump stations shall be served by utility supplied 3-phase power where available. For pump stations at which the largest pump is greater than 7.5 horsepower, the use of single phase power and a phase converter or VFDs will only be considered when the cost of having 3-phase power brought to the pump station exceeds twice the cost of single phase power and a phase converter for each pump served.

VFDs shall be supplied for each pump and correctly sized for the load. The VFD shall be set to run at 100% speed.

If phase conversion is to be used, submitted plans shall detail the converter installation. All phase converter installations shall meet the following requirements:

A Only converters using a static phase shift method of conversion will be acceptable. Rotary-type converters are unacceptable.

B All wiring ahead of the 3-phase panel shall be protected with single phase fusing sized to meet the total single phase amperage; conductors shall be sized based on single phase amperage and fusing.

C Converters shall be sized to operate the total installed pump station amperage with all pumps running.

D The converter shall be a Ronk "Add-a-phase", manufactured by Ronk Electrical Industries, Inc. (or approved equal). The converter shall be housed in a locking NEMA-4X rain-tight stainless steel enclosure.

E Cooling ventilation with fan and filter will be provide in the bottom of the control section and sized to ensure no failures due to over temperature of the converter unit. Cabinet cooling may be omitted on a case-by-case basis, depending on the size and type of equipment contained, at the sole discretion of City personnel.

7.4 STATION INTERIOR WIRING

The following electrical requirements shall be followed for wiring installed in the station interior:

A All pump power, control leads and level control float leads shall be hung with stainless steel kellum grips from the bracket supplied by the pump manufacturer. The bracket shall be bolted to the inside of the wet pit hatch frame or firmly bolted to the concrete immediately below the hatch frame, immediately below the hatch cover. The bracket shall be located so as not to interfere with the pump chamber entrance steps. All wires shall be neatly passed from the bracket to the raceway.

B All flexible cables shall be installed with separate strain relief.

C Passage of the pump and float wires from the pump chamber to the junction box shall be made through a length of conduit installed between the junction box and pump chamber. The power lead for each pump shall be placed in separate conduit. All of the float leads shall be placed in one conduit. A minimum of 12” separation shall be maintained between the control and power wiring.

D There shall be no electrical connections made in the pump chamber. All wiring shall run unbroken from the pump chamber to the junction box through the conduit and joined inside of the junction box.

7.5 PRESSURE SWITCH WIRING

Wiring from the pressure switches shall be 18 AWG S.T.O. portable cord T&B #25xx portable cord connectors shall be used on the switch end as well as the junction box end of the wire. The cord shall be neatly routed along the discharge pipe with ties and then run along the walls to the intrinsically-safe circuit junction box.

7.6 FIELD WIRING SPECIFICATIONS

Control panel wiring shall be as follows:

A All wiring installed on the line and load side of the electric meter shall be THHN copper wire.

B Electric service to the station shall be sized to provide the maximum total station amperage with all installed pumps running under a fully loaded condition.

C All pump station control panels shall be provided with a minimum 100-amp service.

7.7 CONDUIT SPECIFICATIONS

A In the event of specification contradictions, the conduit specifications for the Pump Station site shall conform to the more stringent of: the specifications as stated herein; the National Electric Code (NEC).

A.1 All conduit installed between the wet well to the junction box shall be sized per NEC requirements (minimum).

B One (1) dedicated conduit shall be provided for the power leads of each pump and one (1) dedicated conduit shall be provided for the control leads of each pump. One (1) dedicated conduit shall be provided for the float leads. One (1) dedicated conduit shall be provided for the pressure switch leads from the Valve Vault to the intrinsically-safe junction box.

C All conduit running to or from the control panel, should be run underground at a minimum depth of 18 inches below finished grade.

E All electrical conduit shall be PVC-coated rigid galvanized steel or PVC-coated intermediate metal conduit. Schedule 80 PVC conduit may be installed below-grade if encased in concrete per the requirements of NEC Section 501, contingent upon City approval on a case-by-case basis.

7.8 MOUNTING RACK

The station pump control panel and junction box shall be mounted on one prefabricated stainless steel structure. The panel shall be placed as follows:

A The control structure shall be set on a 4-inch concrete pad.

B Conduits shall be run into the pump station control cabinet from beneath the structure per the Standard Details.

C The panel shall be centered on the concrete pad and set 4-inches in from the rear edge of the pad.

7.9 EMERGENCY GENERATOR

A Pump stations with pumps equal to or greater than 20 hp, or flows of 100,000 GPD or more shall be equipped with a complete and operable emergency/standby electric generating system. The equipment shall be new, factory tested, and delivered ready for installation.

The packaged engine generating system shall include, but not limited to, diesel engine, generator, main circuit breaker, controls, fuel tank, exhaust piping, exhaust silencer, block heater batteries, battery charger and other miscellaneous items needed to provide a complete operational system that is capable of automatic start-stop operation. The generator shall be sized so that all the pumps and appurtenances contained in the pump station can run simultaneously. Provide 120 volt circuits as required for control, battery charger, and block heater; individual breakers must be supplied.

B Acceptable manufacturers are Caterpillar, Onan or approved equal.

7.10 DUSK-TO-DAWN LIGHT

A An LED dusk-to-dawn street light shall be provided for the lift station that is equal to or matching the street lighting provided for the surrounding area or subdivision as approved by the City of Jackson Electrical Utility.

END OF SECTION

8.0 FENCING

8.1 GENERAL

A galvanized chain-link fence surrounding the pump station site shall be provided as specified herein and as shown on the City of Jackson Lift Station Standard Details. The fence shall measure six foot (6'-0") from ground to the top rail (minimum) with one foot (1'-0") of barbed wire and one (1) twelve foot (12'-0") wide double-leaf gate. See standard details for additional clarification. Fencing shall be located such that:

A There is a four foot (4'-0") space between all pump station equipment (control panel, pump vault, valve vault, emergency storage, emergency generator, etc) and the fence perimeter.

B The access gate shall be located so that service vehicles have a direct and unobstructed path to the valve vault and pump chamber. Access gate shall not be placed in the direct path of a manhole.

8.2 MATERIAL SPECIFICATIONS

A Chain Link Fabric

1 Chain-link fabric shall be a 2-inch mesh woven from No. 9 gauge aluminum-coated steel or aluminum-zinc alloy-coated steel conforming to ASTM A491 or A392 The fabric shall have a height of 72 inches, 20-1/2 diamond count, with the bottom and top selvage twisted. Aluminum-coated steel fabric shall be given a clear organic coating after fabrication. Zinc coating on the steel fabric shall be not less than 0.47 ounce per square foot of uncoated wire surface.

B Fence Framework

1 General: Galvanized steel, ASTM F1083 Type I Regular Grade Pipe or ASTM F1043 Group IC Pipe with not less than 1.8 ounces of zinc per square foot of surface, or steel conforming to ASTM A569 externally triple-coated with hot-dip galvanizing at 1.0 ounce per square foot, chromatic conversion coating and clear acrylic polyurethane and coated internally with zinc-rich coating.

2 Fittings and Accessories: Unless otherwise noted, all fence fittings and accessories shall be galvanized according to ASTM A153, with zinc weights per Table I.

Top Rail Sleeves: 7" galvanized steel sleeve per ASTM F626.

Rail Ends: Galvanized pressed steel per ASTM F626, for connection of rails to post using a brace band.

Brace and Tension Bands: ASTM F626 galvanized 12 guage pressed steel by 3/4". Secure bands using min. 5/16” galvanized carriage bolt and nut.

3 Gate Posts: 2.875 inches O.D. at 5.79 lb/ft or 4.64 lb/ft.

4 End, Corner, Angle or Pull Post: 2.375 inches O.D. at 3.65 lb/ft or 3.12 lb/ft.

5 Line Post: 1.9 inches O.D. at 2.72 lb/ft or 2.28 lb/ft.

5 Gate Frame: 1.9 inches O.D. at 2.72 lb/ft or 2.28 lb/ft.

7 Top Rail: 1.66 inches O.D. at 2.27 lb/ft or 1.84 lb/ft.

8 Braces:

(a) HORIZONTAL BRACE: 1.66 inches O.D. at 2.27 lb/ft or 1.84 lb/ft.

(b) DIAGONAL BRACE: 3/8-inch diameter rod equipped with adjustable tightener

9 Tension Bar (Vertical): Galvanized Steel one piece length equal to 2 inches less than full height of the fabric with a minimum cross-section of 3/16” x 3/4" per ASTM F626. Provide tension bars where fabric is secured to terminal post.

C Fasteners

The chain-link fabric shall be securely fastened to all terminal posts by a 1/4" x 3/4" tension bars with heavy 11-gauge pressed steel bands at 14-inch maximum spacing, to line posts with 9-gauge wire clips at 14-inch maximum spacing, to the top rail with 9-gauge tie wires at 24-inch maximum spacing and to the bottom tension wire using 11-gauge galvanized hog rings at a 24-inch maximum spacing..

D Barbed Wire and Supporting Arms

1 Barbed Wire: Barbed wire shall consist of 3strands of 2-wire. Barbed wire shall be ASTM A121 design number 12-4-5-14R, 12 1/2 gauge, 0.099”, Type Z Class 2, 0.80 oz/ft^2 zinc coated double-strand twisted line wire with 14 gauge (0.080”) Type Z Class 3, 0.70 oz/ft^2 zinc coated 4 point barbs spaced an average of 5” on center.

2 Supporting Arms:

(a) One supporting arm shall be placed on each line and pull post.

(b) Single arm at 45 degrees with vertical, sloping to outside of fence.

(c) Integral with post top and designed as a weather-tight closure cap.

(d) Constructed for attaching 3 rows of barbed wire to each arm.

(e) Designed for 200 pound minimum pull-down load.

(f) Malleable iron or pressed steel.

E Bottom Tension Wire:

The bottom tension wire shall be a No. 7 gauge aluminum-coated steel conforming to ASTM A824, Type I. The tension wire shall placed at the bottom of the chain-link fabric and stretched tight with galvanized turnbuckles.

F Post Tops:

ASTM F626 galvanized pressed steel, malleable iron, or aluminum alloy weather-tight closure cap for each post. Provide line post loop tops to secure to top rail. G Gates:

1 Framing:

(a) Frames shall be assembled by welding or watertight galvanized steel rigid fittings.

(b) Provide with the same chain-link fabric as for fence. Install fabric with stretcher bars at vertical and top and bottom edges.

(c) Provide a diagonal brace on each gate leaf to ensure frame rigidity without sag or twist.

2 Hardware:

(a) Hinges of pressed or forged steel, or malleable iron, nonlift-off type, offset to permit 180 degree gate opening, 3 per leaf.

(b) Plunger-bar type latch with flush-type gate stop shall be provided. Latch bar shall extend to full gate height and be designed to easily engage gate stop.

(c) Locking device and padlock eyes shall be an integral part of the latch.

(d) An automatically engaging gate keeper shall be provided for each gate leaf which shall secure the free end of the gate in the open position.

G Protective Electrical Ground

Continuous fence shall be grounded at each corner post and at intervals not exceeding 500 feet, as per the Standard Details.

H Concrete: Minimum 28 day compressive strength of 3.000 psig (20MPa) minimum.

I Pump Station Sign

Each pump station shall be provided a sign in accordance with the Standard Details. The sign shall be securely fastened to the chain-link fence at a location clearly visible from the pump station access road and approved by the City.

J Driveway No Parking Sign

Lift stations located in developments, or that otherwise have a driveway that could be blocked by parked vehicles shall include a No Parking Any Time sign in accordance with the Standard Details.

8.3 INSTALLATION

A Fence

1 Follow general contour of ground and properly align.

2 Install chain link fencing system in accordance with ASTM F567 and manufacturer's instructions.

3 Posts

(a) Set in concrete bases as indicated on City of Jackson Lift Station Standard Details.

(b) Temporarily brace until concrete base has set.

(c) Install plumb and in straight alignment.

(d) Install pull posts every 300 feet if no corner posts are encountered in that distance.

(e) Install pull posts at changes in direction of 10 degrees to 30 degrees.

(f) Install corner posts at changes in direction of 30 degrees or more.

(g) Install pull posts at all abrupt changes in grade.

3 Post Bracing:

(a) Install braces for each end, pull and gate post and each side of each corner post.

(b) Install after concrete has set.

(c) Install so posts are plumb and in straight alignment when diagonal brace is under tension.

4 Tension Wire:

(a) Weave through the fabric and tie to each post with a minimum 9-gauge galvanized wire.

5 Chain-Link Fabric:

(a) Stretch taut with equal tension and each side of posts.

6 Stretcher Bars:

(a) Install at each pull, end and gate post and on each side of corner posts.

7 Barbed Wire:

(a) Attach 3 rows to each barbed wire supporting arm. Pull wire taut and fasten securely to each arm.

(b) Install 3 rows above the fabric and on extended gate end members of swing gates.

8 Fasteners:

(a) Install nuts for tension bands and hardware bolts on inside face of the fence and peen ends of bolts or score threads to prevent removal of nuts.

B Gates

1 Install plumb and level.

2 Install all hardware, framing, supports, and appurtenances as required for gate.

3 Install keepers, ground-set items, and flush plate in concrete for anchorage as shown on Standard Details.

4 Adjust and lubricate as necessary for smooth operation.

C Repairing Damaged Coatings

1 All damaged coatings shall be repaired in the shop or field by re-coating with compatible and similar coating as per manufacturer's recommendations.

END OF SECTION

9.0 PAVING

9.1 STATION AREA

The entire area inside the pump station fence shall be paved with crushed aggregate. Prior to placing the aggregate, the ground surface shall be sloped so as to permit surface water to drain away from the station. The crushed aggregate pavement for the station area shall be in accordance to Section 9.3 of this specification.

All pump and valve chambers shall have a paved concrete apron placed around the structures. The apron shall be a minimum of six inches (6") thick, reinforced with 8-gauge, 6x6 welded wire mesh. The concrete shall have a well-compacted twelve inches (12") thick stone base (minimum) with frost legs to resist heaving. The pavement shall be sloped to permit surface water to drain away from the station.

The remainder of the pump station area contained within the fenced perimeter shall be surfaced with an aggregate pavement. Extend the aggregate pavement to one foot (1'-0") beyond the fenced perimeter.

9.2 STATION ACCESS ROAD

Any pump station located farther than 10 feet from the center of the pump chamber to the edge of a public street or road shall have a 12-foot wide paved access road provided to the station. The access road shall.

A Be designed to limit the access road grade to a 10% maximum.

B The access road will be required to have a turn-around area as shown on the Standard Details when at least one of the following apply:

1 The access road exceeds 70 feet in length.

2 The access road exceeds a 3% grade.

3 The access road does not travel to the pump station in a straight line.

4 Access Road shall be constructed as per the Standard Details.

C Have a culvert installed where necessary to prevent erosion. Minimum driveway culvert size shall be 15-inches.

D Have a concrete apron installed within the Street Right of Way per the City of Jackson Standard Specifications for Street Improvements: Drawing No. 311, Driveway Plan and Driveway Curb and Gutter Section.

9.3 AGGREGATE

The pump station access road and the entire area inside the pump station fence shall be paved with 8 inches of crushed aggregate placed in 2 layers. The bottom 5 inches shall be crusher-run limestone screenings 2 1/2 inch maximum size (95% to 100% passing a 2 1/2 inch screen) graded to allow for satisfactory compaction. The top 3 inches shall be one-inch minus surface rock conforming to the Missouri Department of Transportation's specification for MoDOT Type 5 aggregate. The aggregate shall be composed of durable particles of rock and percentage of deleterious substances shall not exceed 12%.

Gradation of the 2-inch surface rock shall be per the discretion of the Director based upon material availability at the time of Construction.

9.4 ENTRANCE ROAD BARRIERS

When directed by the City, stations requiring entrance roads shall have 36-inch high barrier posts (bollards) installed at the road entrance. Post shall be constructed of 6" concrete filled steel or iron pipe. Posts shall be set 30" below grade in an 18"x36" poured concrete base. A 5/16" diameter galvanized chain locked on one end and firmly fastened to the other shall be run between the poles. For safety purposes, a 4" x 12" reflective plate shall be attached to the chain at the span center.

END OF SECTION

10.0 INSPECTION AND ACCEPTANCE PROCEDURES

10.1 GENERAL

While City personnel may make ongoing inspections during construction of pump station structures and appurtenances, there shall be two (2) specific inspections conducted prior to final approval of or acceptance of any pump station by the City of Jackson. Construction and Operations inspections must each be scheduled with a minimum of forty eight (48) hours' notice to insure that required City personnel are available by calling the Public Works Department at (573) 243-2300.

10.2 CONSTRUCTION INSPECTION

This inspection shall be performed upon completion of the wet well including pumps, pump bases, piping, and rails prior to allowing water or sewage into the pump station. The contractor shall be responsible for ensuring that the pump station floor is clean and dry for this inspection.

10.3 FINAL / OPERATIONS INSPECTION

This inspection shall be performed when 100% construction is complete, force main has been tested per Section §4.3 F, pavement, access road, fencing, and appurtenances are installed, and pumping equipment is ready to be tested. Prior to requesting this inspection the contractor shall submit the following documents to the Public Works Department:

- Two sets of as-built electrical schematics (one additional set shall be placed in the pump station control panel).
- As-built plans of the lift station and force main, stamped by a licensed engineer registered in Missouri, certifying that the pump station site, access drive, sewers and force main are located in existing easements and constructed per the approved plans including any changes or modifications accepted during construction.
- Manufacturer's pump test procedures including factory test readings for voltage, current and other significant parameters documented on standard forms, and blank forms for the field test.
- Control panel schematics, 11"x17" size, laminated to the inside of the control panel exterior door.

- Operating manuals and specification literature.
- Copy of electric and water bills to facilitate transfer of these accounts upon acceptance.

A Pump Tests

In the presence of City personnel, the contractor shall subject the pump equipment to such operating tests as may be required by the City to demonstrate that the equipment performs in accordance with the design requirements. As a minimum, the following two tests shall be performed:

- The insulation resistance of the each pump's windings and cables shall be tested per the manufacturer's recommendation or test equipment instructions. In the absence of a manufacturer specification the megohmmeter shall be set to 500V DC. The installed pumps shall not register less than 100 mega-ohms resistance from any lead to ground on a megohmmeter.
- The pumps shall be subjected to start-up tests with the voltage, current and other significant parameters being recorded on the standard forms provided by the manufacturer. The contractor shall arrange for an adequate supply of water for the tests. The minimum quantity of water to be provided shall be equivalent to 1.5 minutes of continuous pumping at the rated pump capacity for each pump operating alone. Each pump shall be tested a minimum of two times.

If tests do not demonstrate satisfactory performance of the equipment, deficiencies shall be corrected and equipment shall be retested.

10.4 FINAL GRADING AND SEEDING

All ground surrounding the pump station must be graded, seeded as per Part 7 – Protection and Restoration of Site, Standard Sewerage Facilities, Standard Construction Specifications for the City of Jackson, Missouri. Final acceptance of the pump station will not be given until grass cover has been established to provide sufficient erosion control

10.5 AUTODIALER ALARM SYSTEM TEST

The autodialer alarming system shall be tested to verify that it has been activated, programed, and is in proper working order.

10.6 CONSTRUCTION, OPERATION AND MAINTENANCE

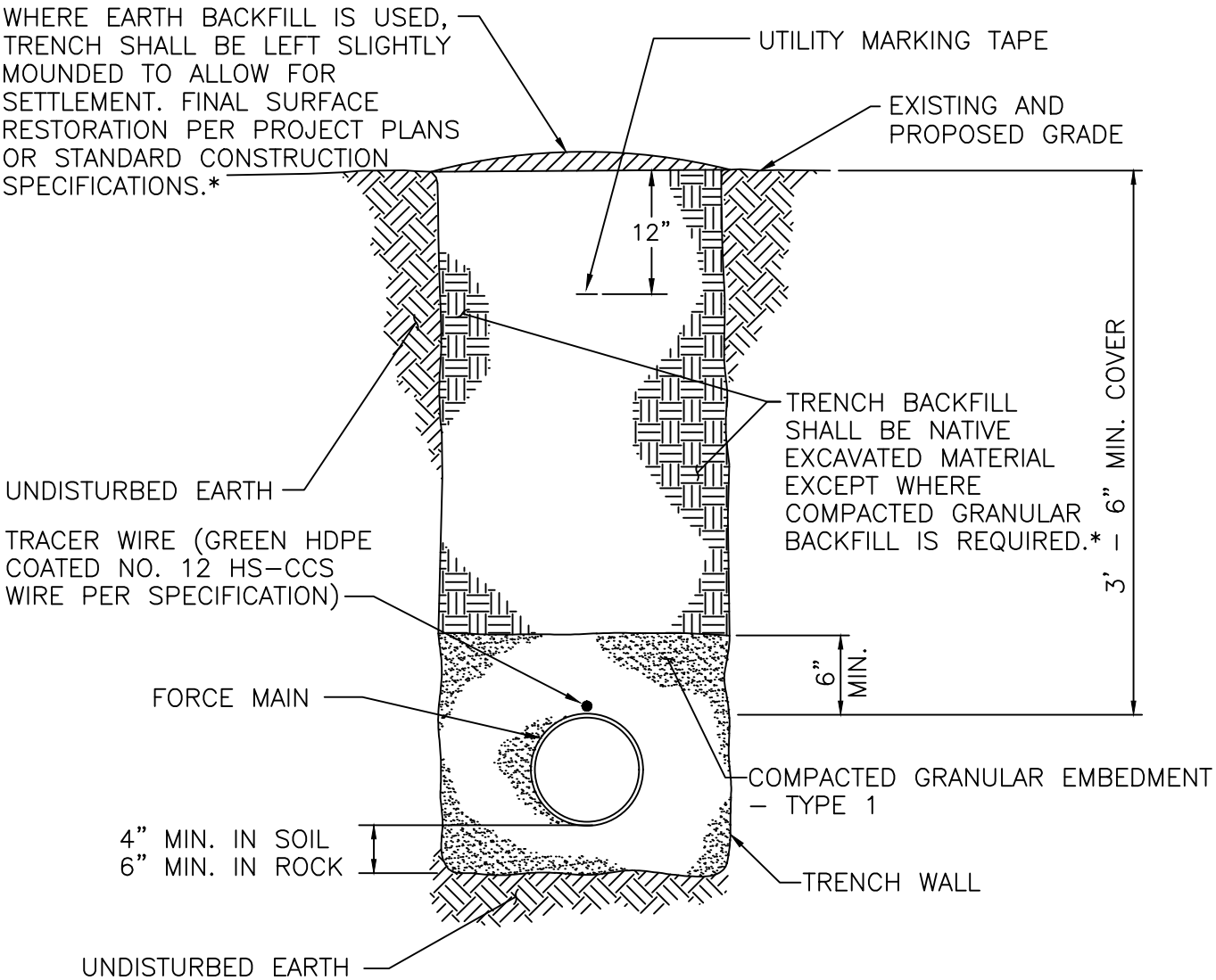
It is the responsibility of the developer to construct the pump station according to the approved construction plans. When the pump station and force main have received approval and all operation manuals, specification literature, and electrical diagrams have been received, the pump station and related appurtenances will be accepted by the City of Jackson for operation and maintenance.

10.7 WARRANTY

Where the pump station is part of a new development plan, a warranty of 2 years shall be provided by the developer similar to all new utility installations. Where the pump station is a standalone installation that will receive sufficient loading, in addition to the equipment manufacturer's general warranties, the contractor shall warrant the pump station and related appurtenances to be free from defects in materials and workmanship for a period of not less than one year from the date of the City of Jackson’s final written acceptance of said pump station.

END OF SECTION

* – REFER TO "CITY OF JACKSON SANITARY SEWERAGE FACILITIES STANDARD CONSTRUCTION SPECIFICATIONS" FOR TRENCH EXCAVATION/BACKFILL, PIPE BEDDING, AND SURFACE RESTORATION



KAP Approved Date Revisions	JACKSON, MO CITY OF BEAUTIFUL HOMES • PARKS • SCHOOLS AND CHURCHES 1814	FORCE MAIN INSTALLATION	Sheet: LS - 01

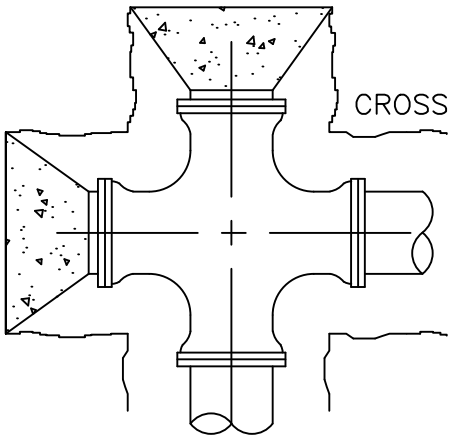
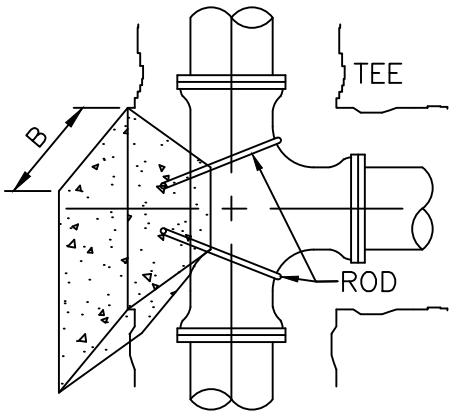


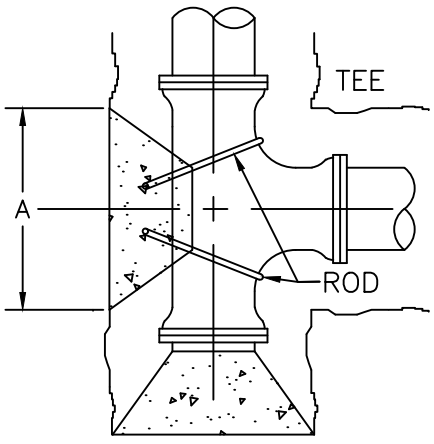
TABLE A

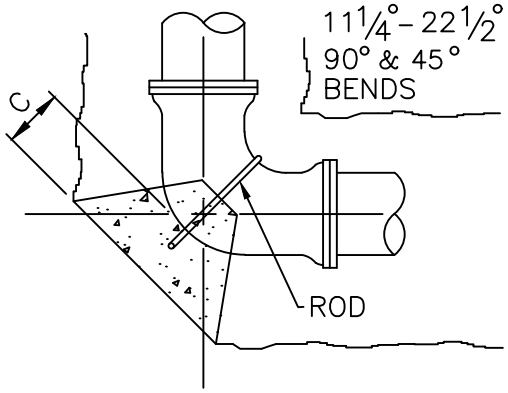
BEND		SIZE				
		4"& 6"	8"	10"	12"	16"
TEE OR PLUG	A	1'–8"	3'–2"	3'–6"	4'–2"	5'–5"
	B	1'–2"	1'–4"	1'–6"	1'–0"	2'–6"
	C	8"	9"	10"	1'–10"	1'–2"
11¼°	A	6"	7"	8"	8"	1'–3"
	B	1'–2"	1'–4"	1'–6"	1'–8"	2'–0"
	C	7"	8"	8"	8"	9"
22 ½°	A	8"	1'–4"	1'–5"	1'–10"	2'–8"
	B	1'–2"	1'–4"	1'–6"	1'–8"	2'–0"
	C	8"	9"	10"	11"	1'–2"
45°	A	1'–3"	2'–3"	2'–8"	3'–2"	4'–1"
	B	1'–2"	1'–4"	1'–6"	1'–10"	2'–6"
	C	8"	9"	10"	11"	1'–2"
90°	A	2'–3"	3'–7"	5'–0"	5'–10"	7'–7"
	B	1'–2"	1'–4"	1'–6"	1'–10"	2'–6"
	C	8"	9"	10"	1'–0"	1'–2"



NOTES:

1. ALL B&C DIMENSIONS TO BE AS REQUIRED TO REACH UNDISTURBED EARTH BUT NOT LESS THAN LISTED ON THRUST BLOCK TABLE.
2. CAST–IN–PLACE CONCRETE SHALL BE IN ACCORDANCE WITH THE "CITY OF JACKSON STANDARD CONSTRUCTION SPECIFICATIONS FOR SANITARY SEWERAGE FACILITIES," PART 5, CLASS "A" CONCRETE.
3. DIMENSIONS A, B, C, APPLY TO ALL BEND CONDITIONS SHOWN.
4. INSTALL PLUGS AT ALL RUNS OR BRANCHES DISCONTINUED FOR FUTURE SERVICES.
5. ALL BENDS, TEES, PLUGS, FITTINGS OR OTHER SIGNIFICANT CHANGES SHALL BE BRACED WITH POURED CONCRETE THRUST BLOCK AS SHOWN ON THIS DETAIL.
6. ALL PLUGS SHALL BE SEPARATED FROM THE CONCRETE THRUST BLOCK BY A 5 MIL LAYER OF PLASTIC SHEETING.





FOR HORIZONTAL ALIGNMENT

KAP
Approved Date

Revisions

HORIZONTAL THRUST BLOCK

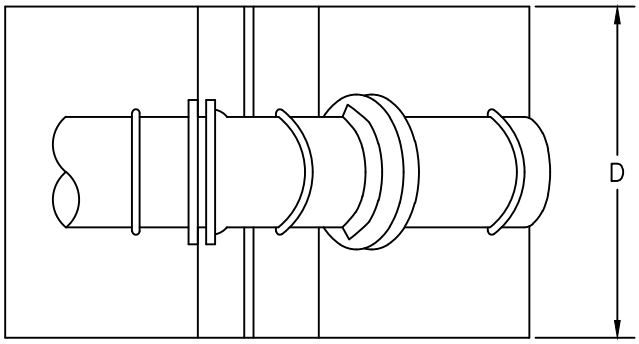
Sheet:

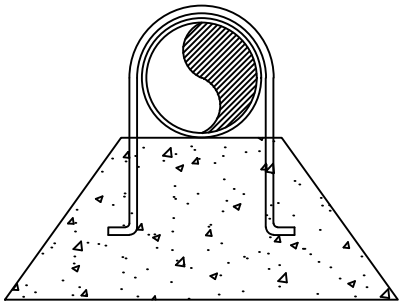
LS - 02

BEND		SIZE				
		4"& 6"	8"	10"	12"	16"
11¼°	D	1'–6"	1'–9"	2'–0"	3'–0"	3'–6"
	E	1'–3"	1'–6"	1'–9"	2'–0"	2'–3"
	F	2'–0"	2'–6"	2'–9"	3'–0"	4'–0"
22½°	D	2'–0"	3'–4"	3'–8"	4'–0"	4'–4"
	E	1'–9"	2'–3"	2'–6"	2'–6"	2'–6"
	F	2'–6"	2'–8"	3'–10"	4'–0"	5'–6"
45°	D	2'–6"	3'–0"	4'–0"	4'–6"	5'–2"
	E	2'–6"	2'–9"	3'–0"	3'–6"	4'–0"
	F	3'–0"	4'–0"	4'–6"	4'–9"	6'–6"

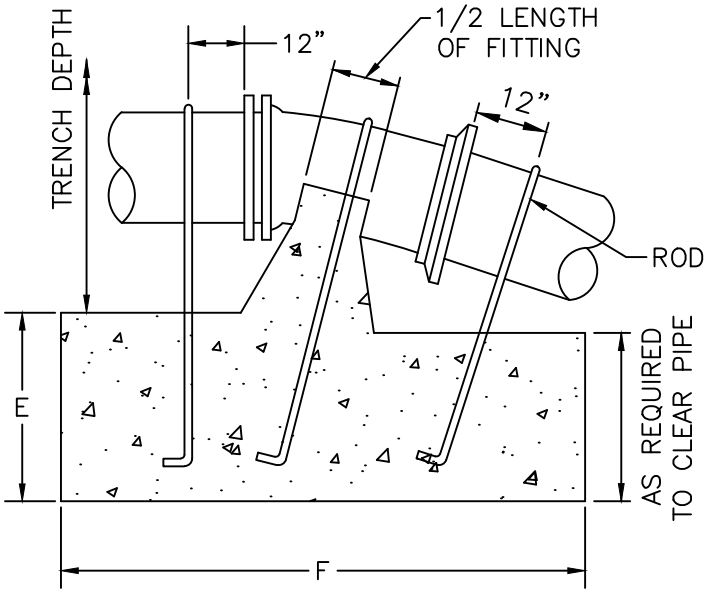
PIPE SIZE	ROD SIZE (IN)			NO. REQ'D.
	45°	22½°	11¼°	
4"& 6"	½	½	½	3
8"	½	½	½	3
10"	¾	¾	¾	3
12"	¾	¾	¾	3
16"	¾	¾	¾	3

THIS TABLE APPLIES TO VERTICAL & HORIZONTAL THRUST BLOCKS.





ROD DETAIL



NOTES:

1. ALL POURED CONCRETE SHALL BE PLACED ON UNDISTURBED EARTH AFTER EXCAVATION ACCORDING TO DIMENSIONS INDICATED ON THRUST BLOCK DIMENSION TABLE OR IT SHALL BE LAID THE FULL WIDTH OF TRENCH FROM UNDISTURBED WALL BUT NOT LESS THAN LISTED ON THRUST BLOCK TABLE.

2. ALL POURED CONCRETE SHALL BE IN ACCORDANCE WITH "CITY OF JACKSON STANDARD CONSTRUCTION SPECIFICATIONS FOR SANITARY SEWERAGE FACILITIES", PART 5, CLASS "A" CONCRETE.

3. TIE DOWNS
   4"–10" #4 REBAR
   12"–16" #5 REBAR

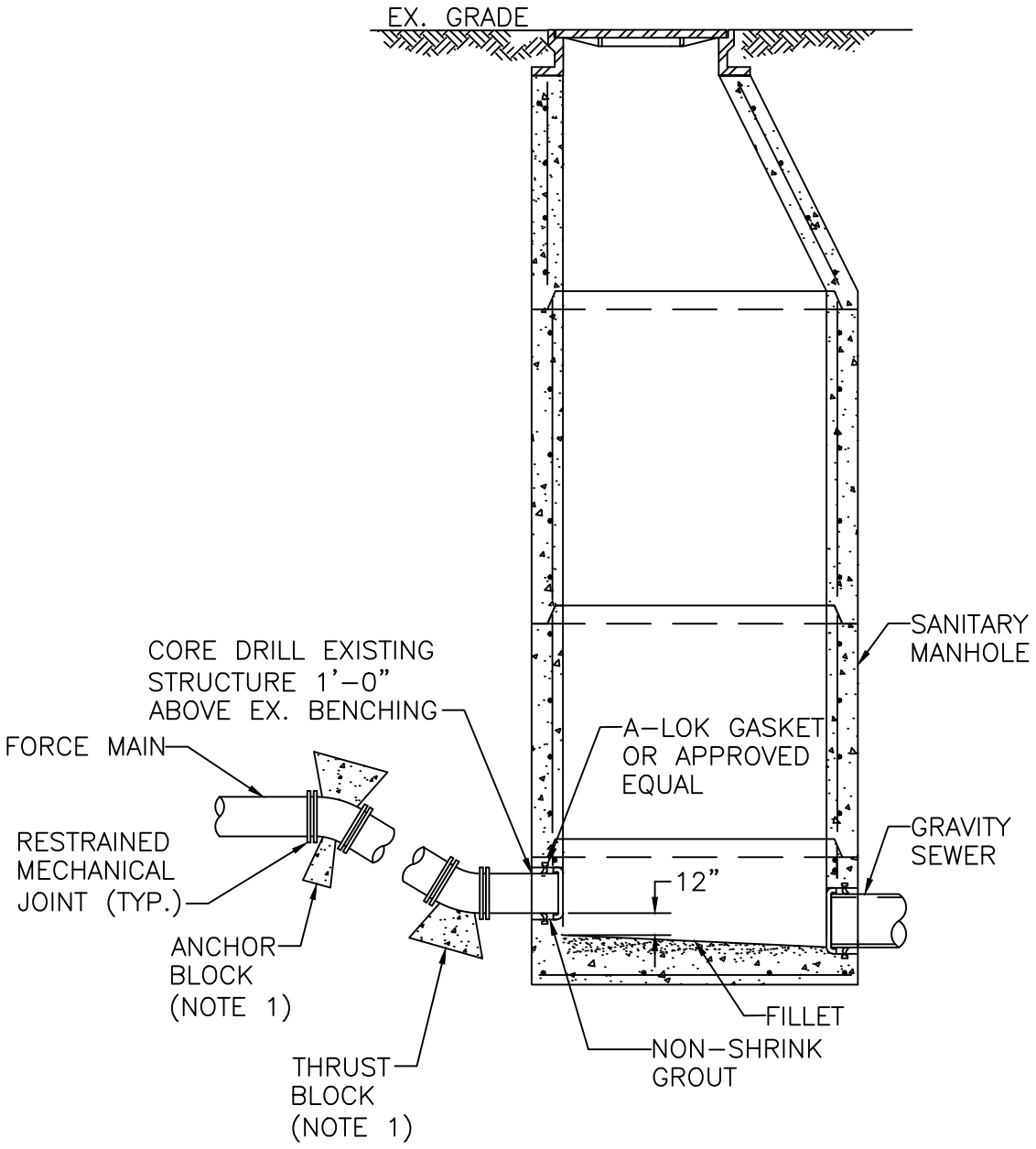
FOR VERTICAL ALIGNMENT

KAP
Approved Date

Revisions

VERTICAL THRUST BLOCK

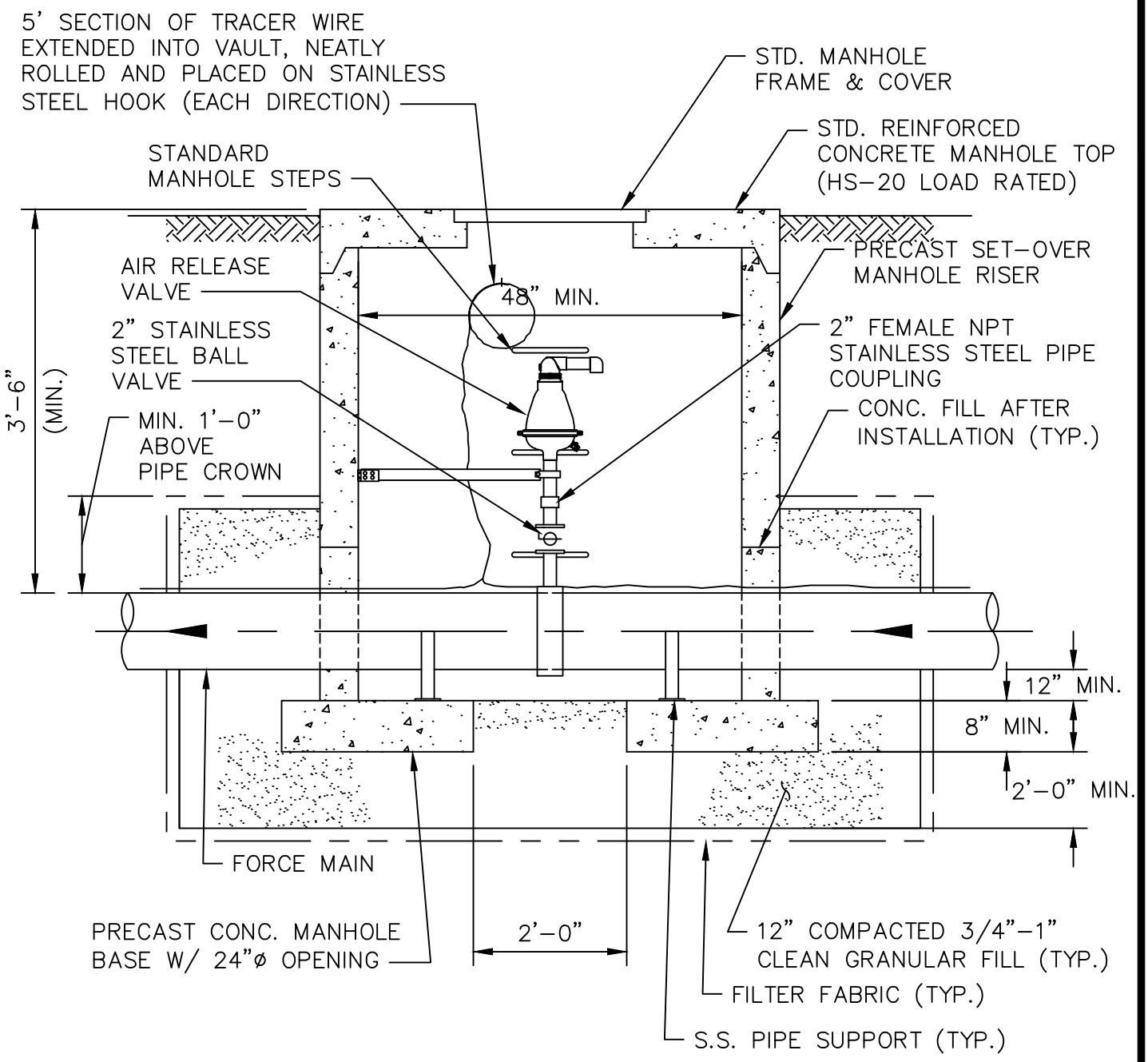
Sheet: LS - 03



NOTES:

1. REFER TO DETAIL LS-03 FOR APPROPRIATE THRUST BLOCKING OF FORCE MAIN

KAP Approved Date Revisions	JACKSON, MO 1814	FORCE MAIN TERMINATION	Sheet: LS-04

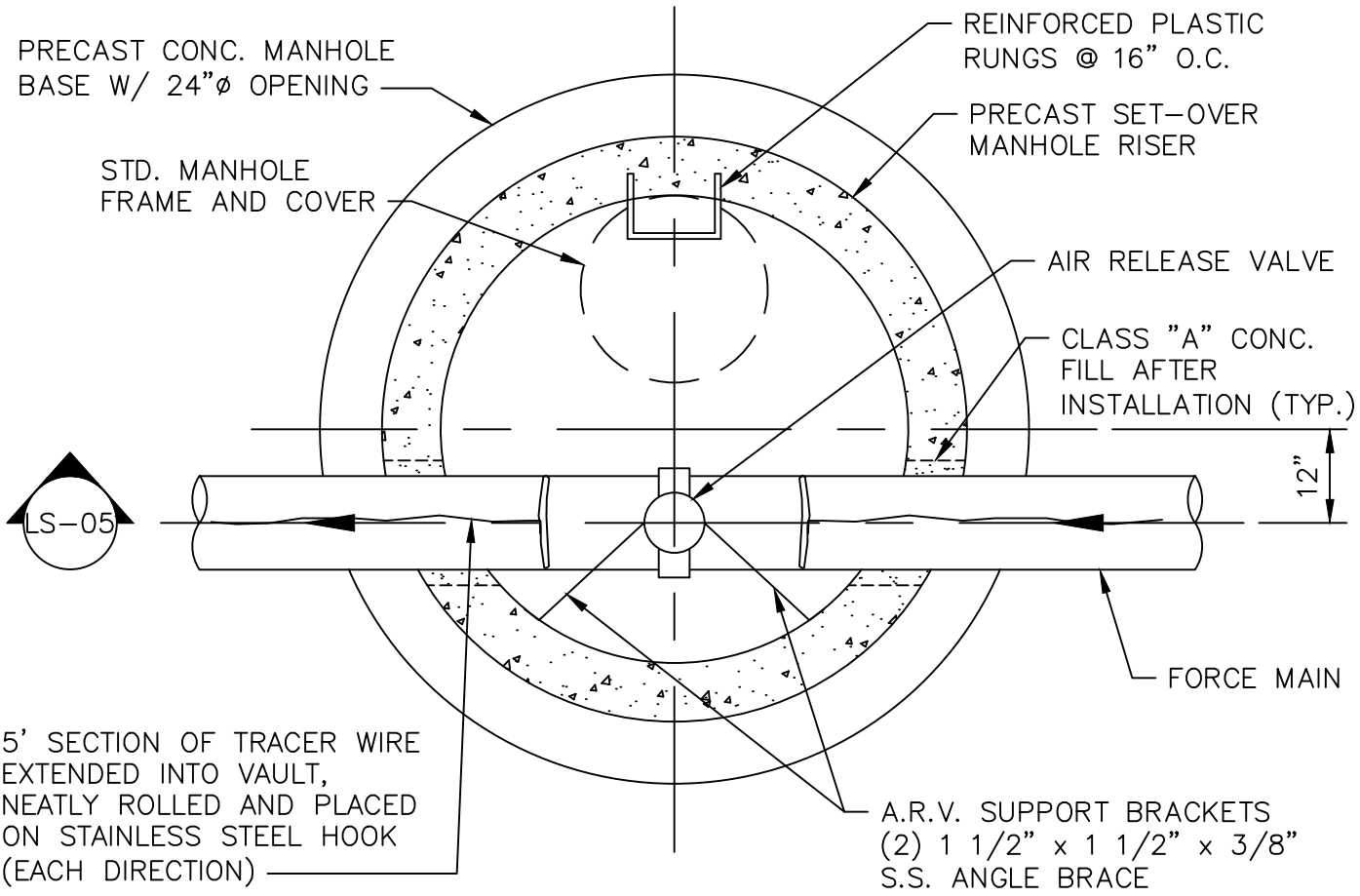


NOTES:

1. PROVIDE 2" ARI D-025 COMBINATION AIR RELIEF/VACUUM VALVE, OR APPROVED EQUAL. VALVE SHALL BE EQUIPPED WITH ALL BACKWASH ACCESSORIES.

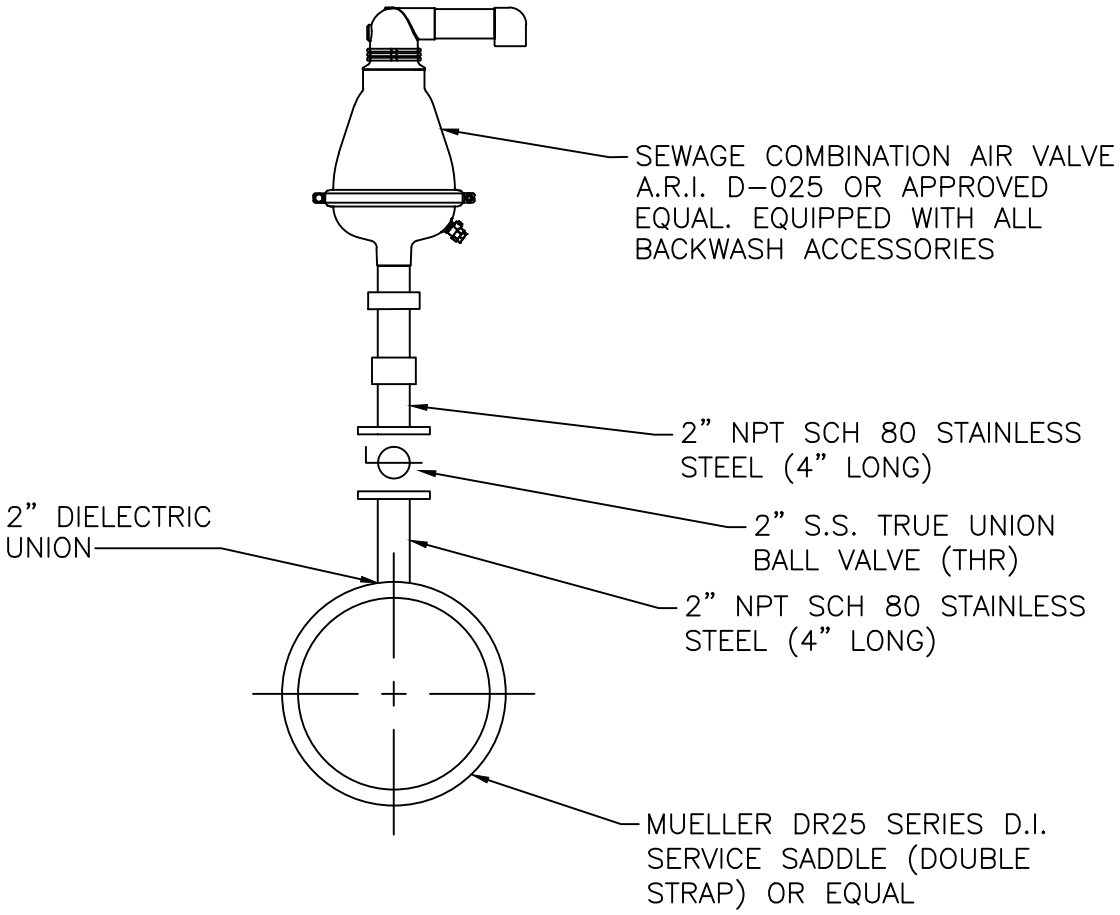
2. VALVE SHALL BE 2" DIAMETER MILWAUKEE BA260 BALL VALVE WITH STAINLESS STEEL BODY, BALL AND STEM, THREADED ENDS, LEVER HANDLE, TFE SEATS, OR APPROVED EQUAL.

KAP / Approved / Date	JACKSON, MO 1814	AIR RELEASE VALVE VAULT (SECTION VIEW)	Sheet: LS - 05
Revisions			

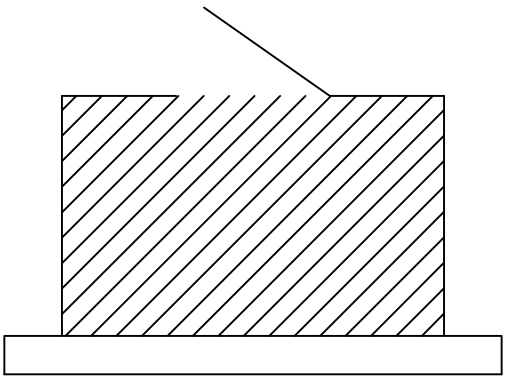


PLAN

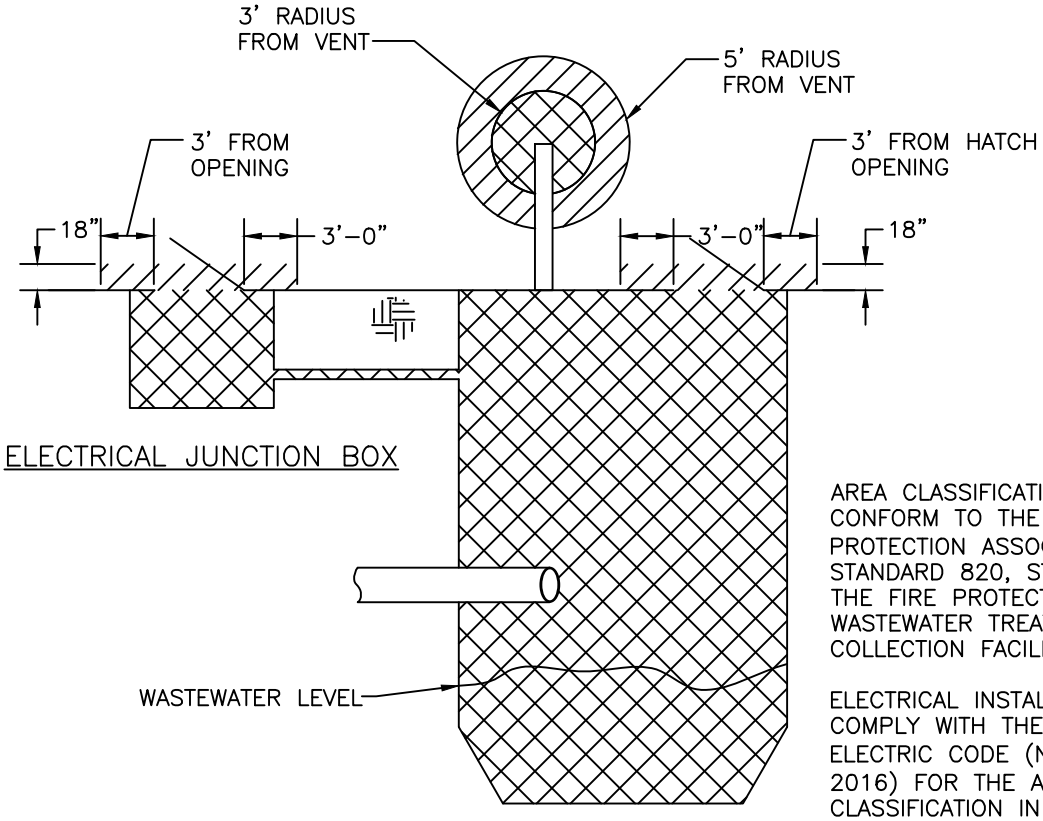
KAP Approved Date Revisions	JACKSON, MO CITY OF BEAUTIFUL HOMES · PARKS · SCHOOLS AND CHURCHES 1814	AIR RELEASE VALVE VAULT (PLAN VIEW)	Sheet: LS - 06



KAP Approved Date Revisions	JACKSON, MO CITY OF BEAUTIFUL HOMES • PARKS • SCHOOLS AND CHURCHES 1814	AIR RELEASE VALVE DETAIL	Sheet: LS - 07



VALVE VAULT



ELECTRICAL JUNCTION BOX

AREA CLASSIFICATIONS SHALL CONFORM TO THE NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) STANDARD 820, STANDARD FOR THE FIRE PROTECTION IN WASTEWATER TREATMENT AND COLLECTION FACILITIES, 2016.

ELECTRICAL INSTALLATIONS SHALL COMPLY WITH THE NATIONAL ELECTRIC CODE (NEC\NFPA 70, 2016) FOR THE AREA CLASSIFICATION IN WHICH THEY ARE INSTALLED.

WET WELL

CLASS 1, DIVISION 1, GROUP D CLASSIFIED AREA

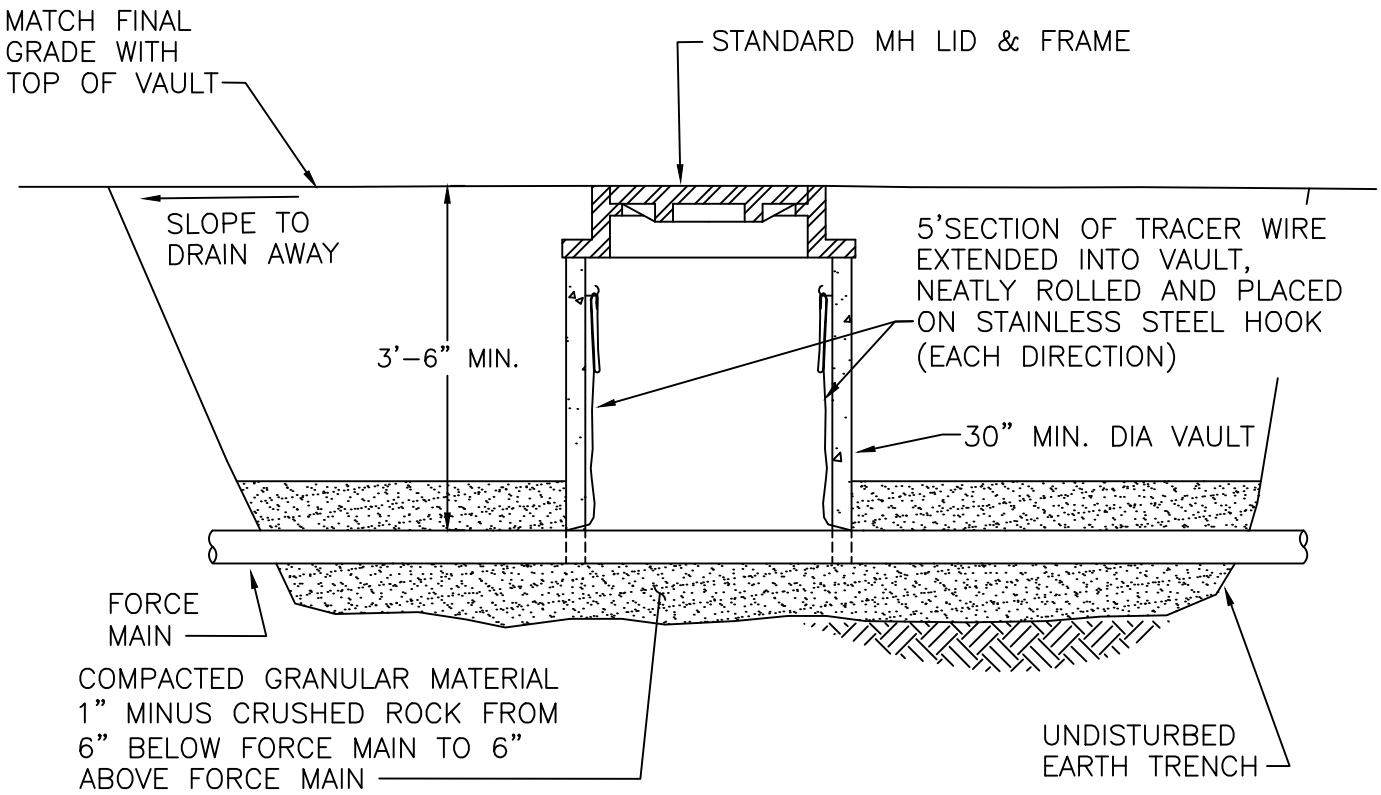
CLASS 1, DIVISION 2, GROUP D CLASSIFIED AREA

KAP
Approved
Date

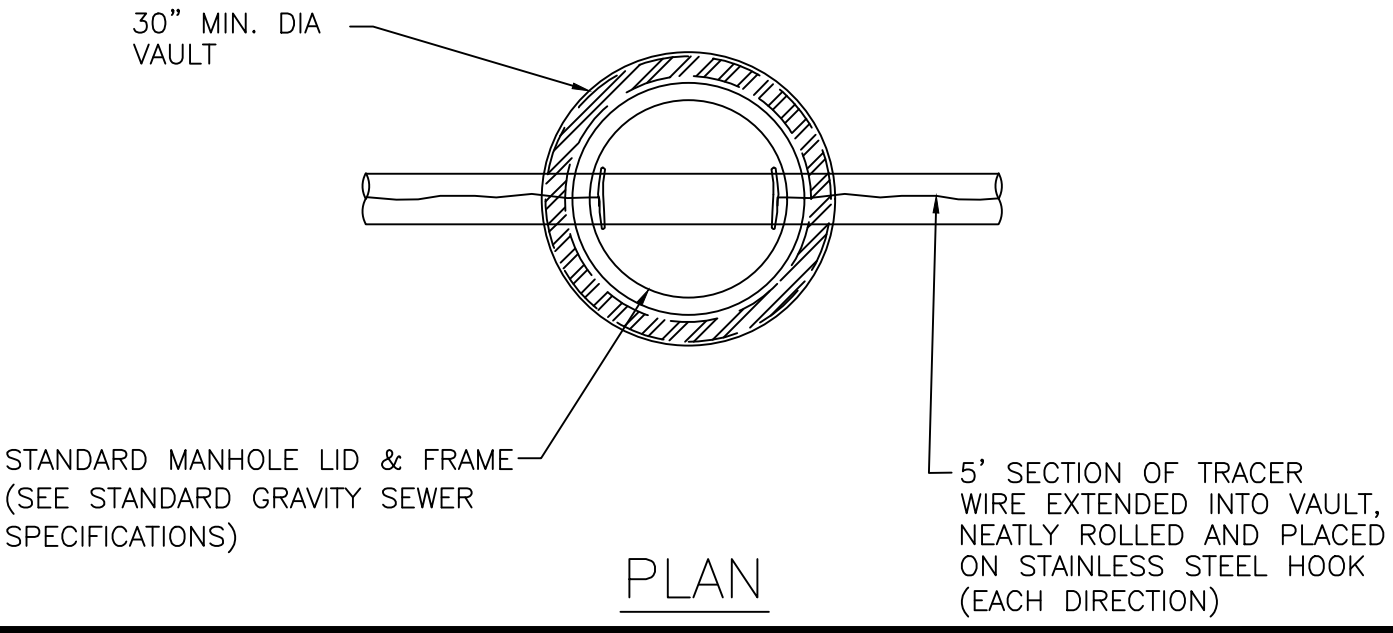
Revisions

WET WELL & VALVE VAULT ELECTRICAL CLASSIFICATION

Sheet:
LS - 08



SECTION



PLAN

KAP Approved Date Revisions	JACKSON, MO CITY OF BEAUTIFUL HOMES • PARKS • SCHOOLS AND CHURCHES 1814	TRACER WIRE ACCESS VAULT	Sheet: LS - 09

NOTES:

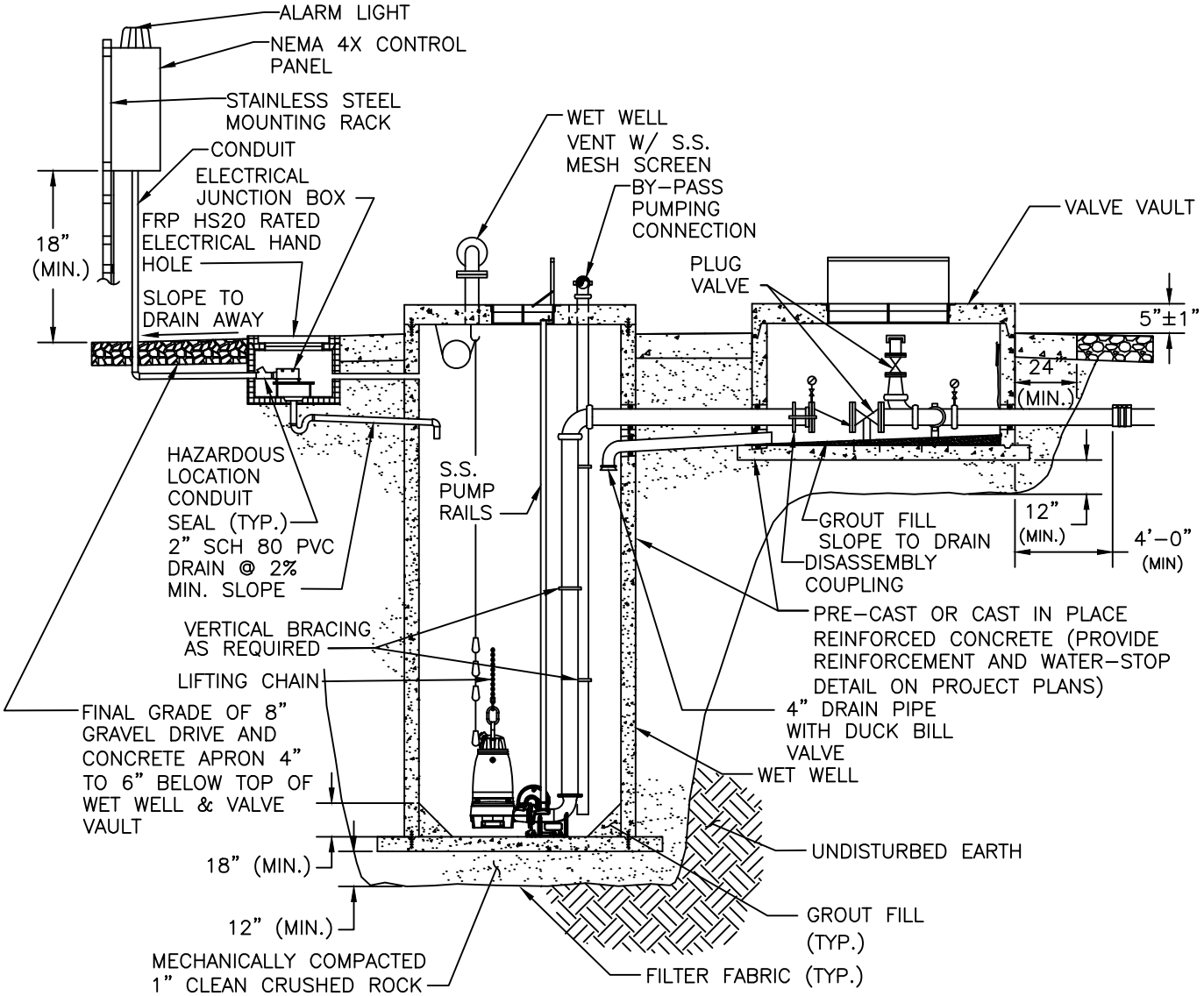
1. THE VALVE VAULT & WET WELL ARE TO BE EITHER REINFORCED PRECAST CONCRETE STRUCTURES OR CAST–IN–PLACE STRUCTURES. ALL STRUCTURAL DESIGN DATA AND DRAWINGS ARE TO BE SUBMITTED TO THE ENGINEER FOR APPROVAL AS PER SECTION 6.0 – STRUCTURAL REQUIREMENTS OF THE SPECIFICATIONS. STRUCTURES SHALL CONFORM TO THE CITY OF JACKSON PUMP STATION DESIGN REQUIREMENTS.

2. PRECAST JOINTS SHALL BE LOCATED A MINIMUM OF 6" FROM ALL PIPE PENETRATIONS. PRECAST SECTION SHOULD BE MINIMIZED TO REDUCE NUMBER OF JOINTS.

3. PROVIDE A MINIMUM OF 1'–0" CLEAR AROUND ALL FITTINGS AND VALVES WITH IN THE VALVE VAULT.

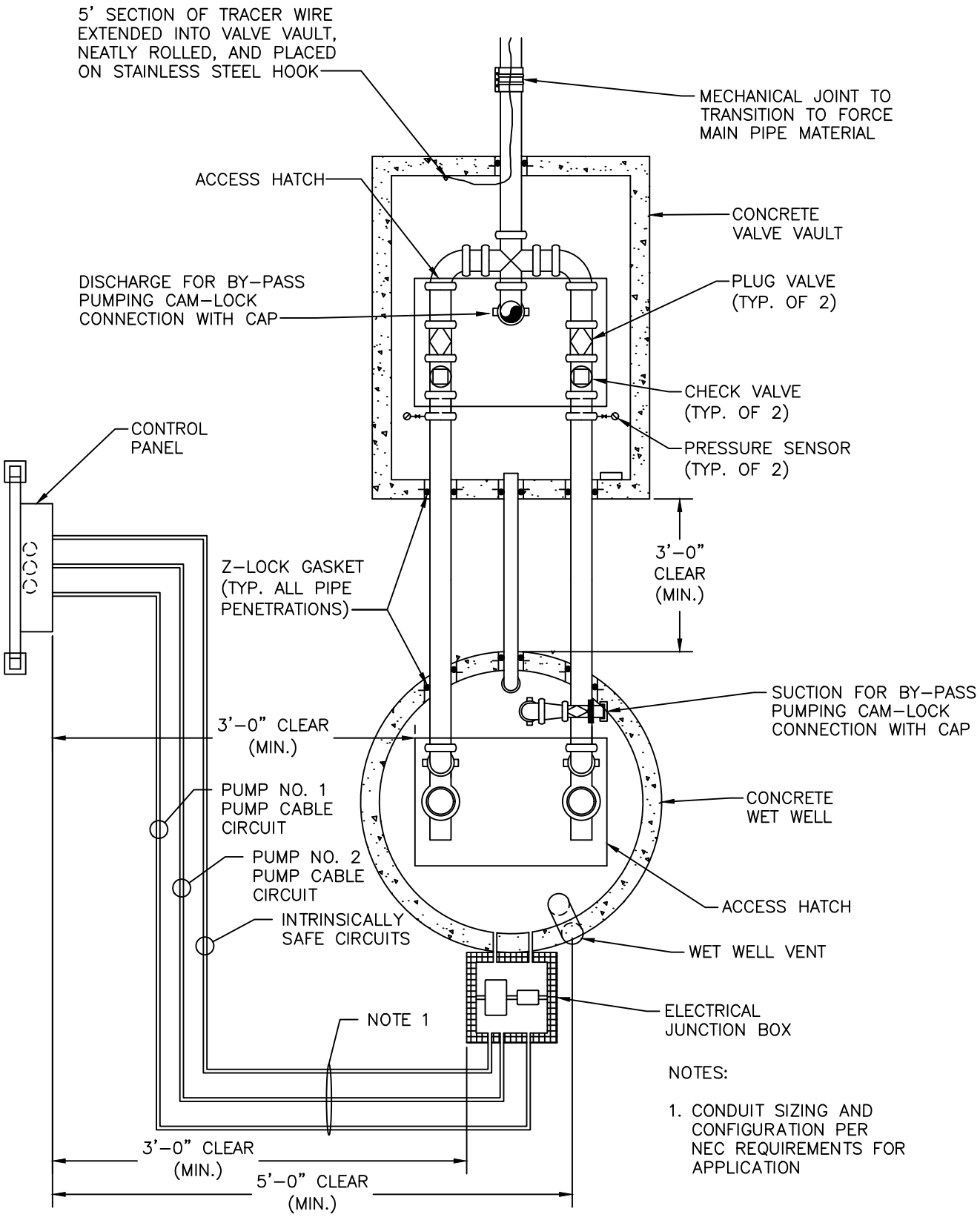
4. SECTION HAS BEEN EXPANDED FOR CLARITY. REFER TO PLAN DETAILS FOR TRUE POSITIONING OF PUMP CONTROL PANEL WITH RESPECT TO SITE. MAINTAIN MINIMUM CLEAR DISTANCES IN COMPLIANCE WITH NFPA 820 AND NEC 70 AS INDICATED ON DETAIL LS–12.

5. FROST LEGS ON CONCRETE MAINTENANCE APRON NOT SHOWN ON THIS SHEET FOR CLARITY. REFER TO STRUCTURAL DETAILS FOR TRUE POSITIONING OF FROST LEGS WITH RESPECT TO WET WELL AND VALVE VAULT.



NOTE: DETAILED DESIGN REQUIRED FOR SITE PLANS

KAP Approved Date Revisions	JACKSON, MO CITY OF BEAUTIFUL HOMES • PARKS • SCHOOLS AND CHURCHES 1814	SUBMERSIBLE LIFT STATION - SECTION	Sheet: LS - 10



NOTES:

1. CONDUIT SIZING AND CONFIGURATION PER NEC REQUIREMENTS FOR APPLICATION

KAP	
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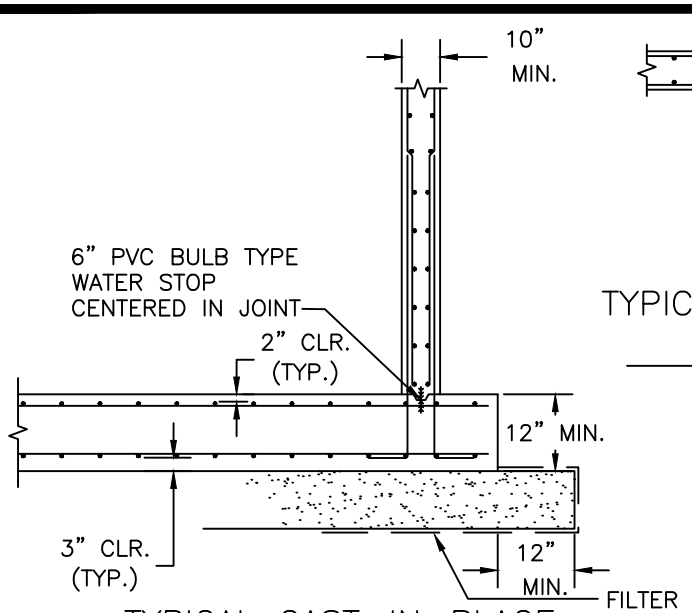
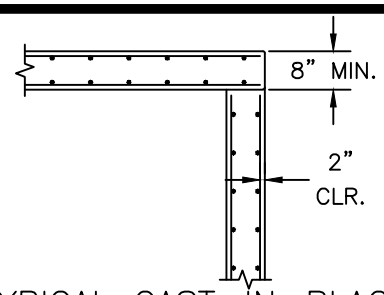
Revisions	

SUBMERSIBLE LIFT STATION - PLAN

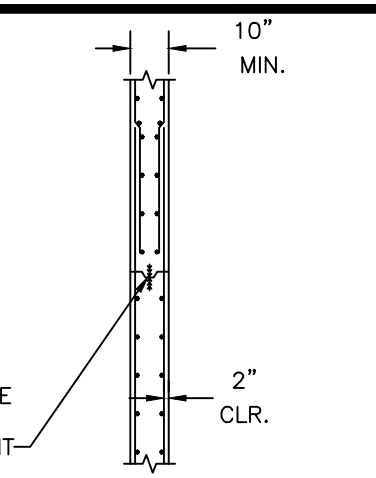
Sheet: LS - 11



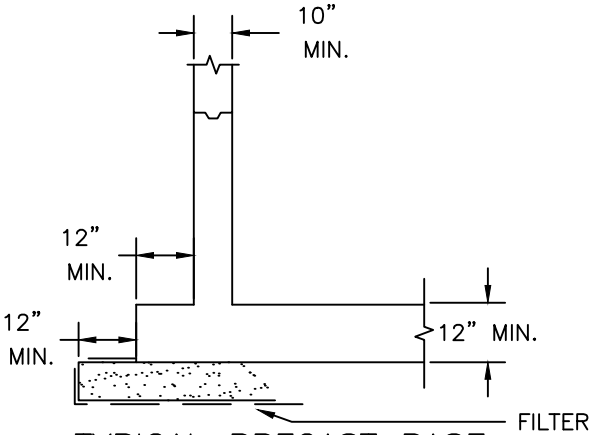
TYPICAL CAST-IN-PLACE BASE DETAIL



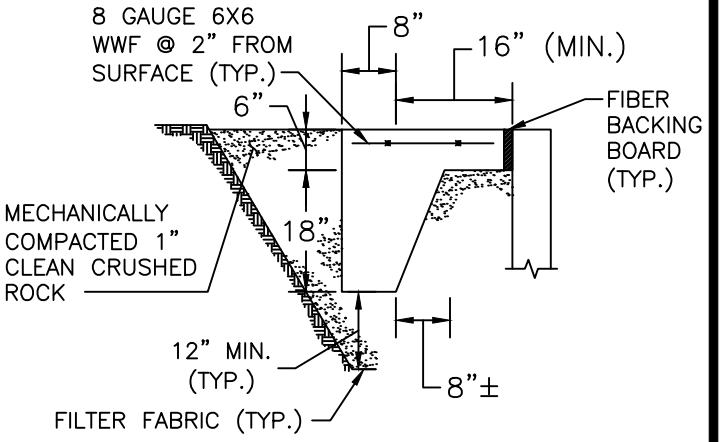
TYPICAL CAST-IN-PLACE TOP DETAIL



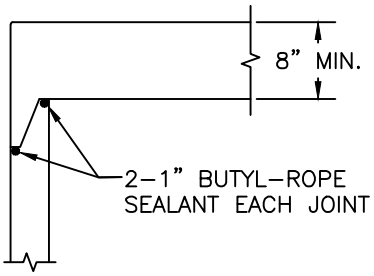
TYPICAL CAST-IN-PLACE WALL DETAIL



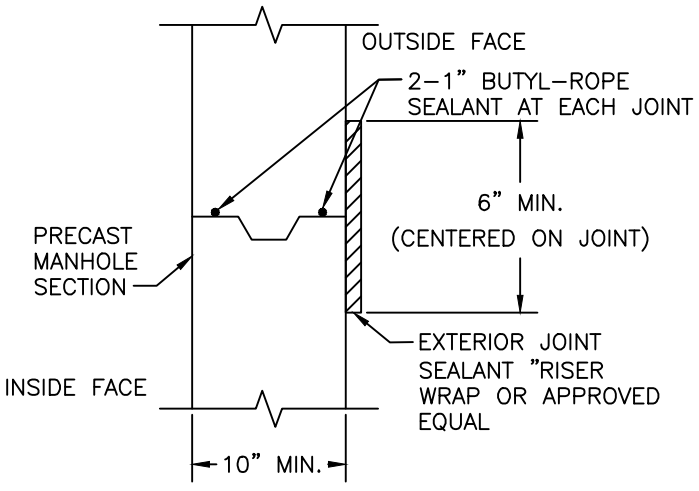
TYPICAL PRECAST BASE DETAIL



CONCRETE MAINTENANCE APRON DETAIL

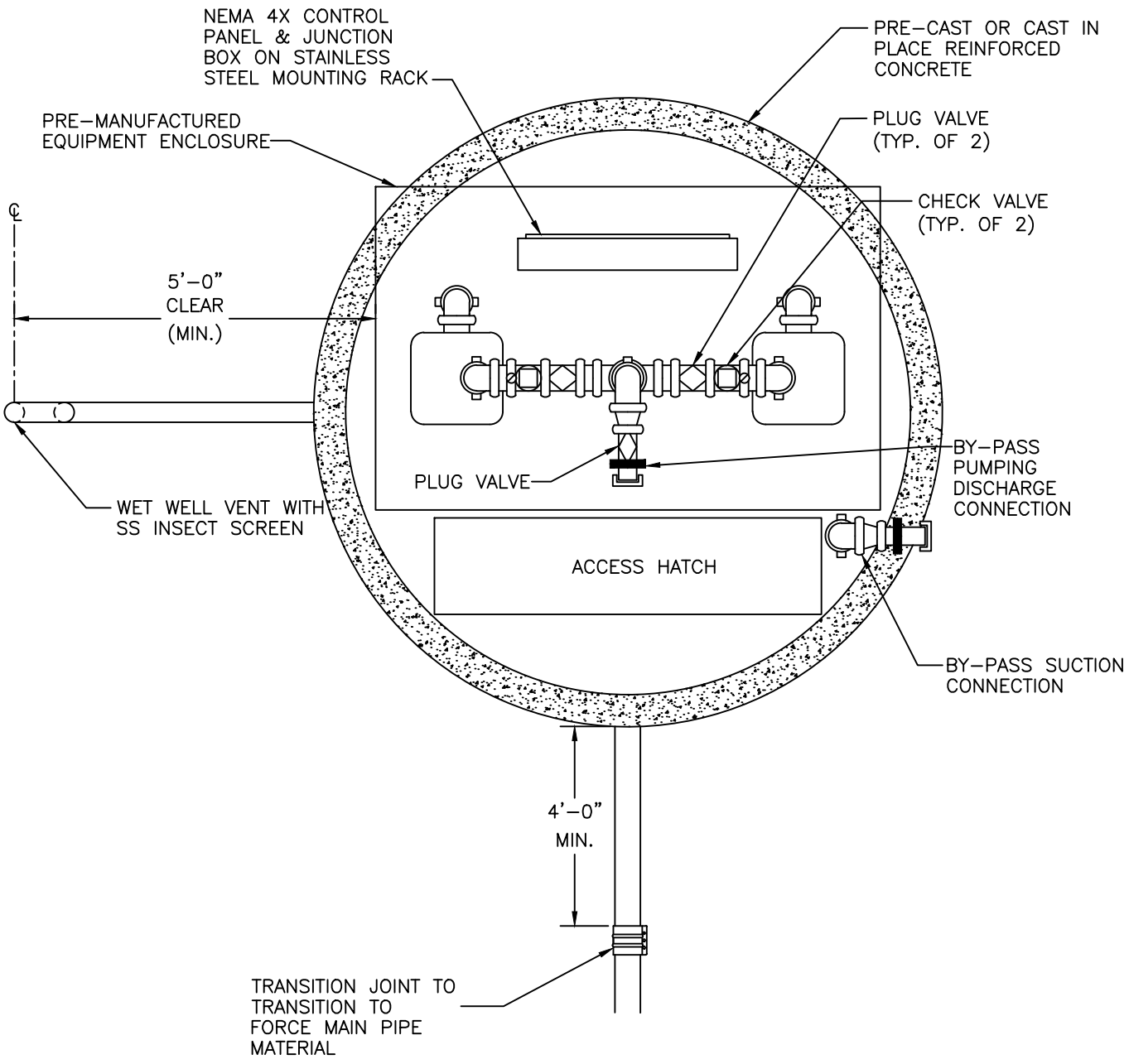


TYPICAL PRECAST TOP DETAIL



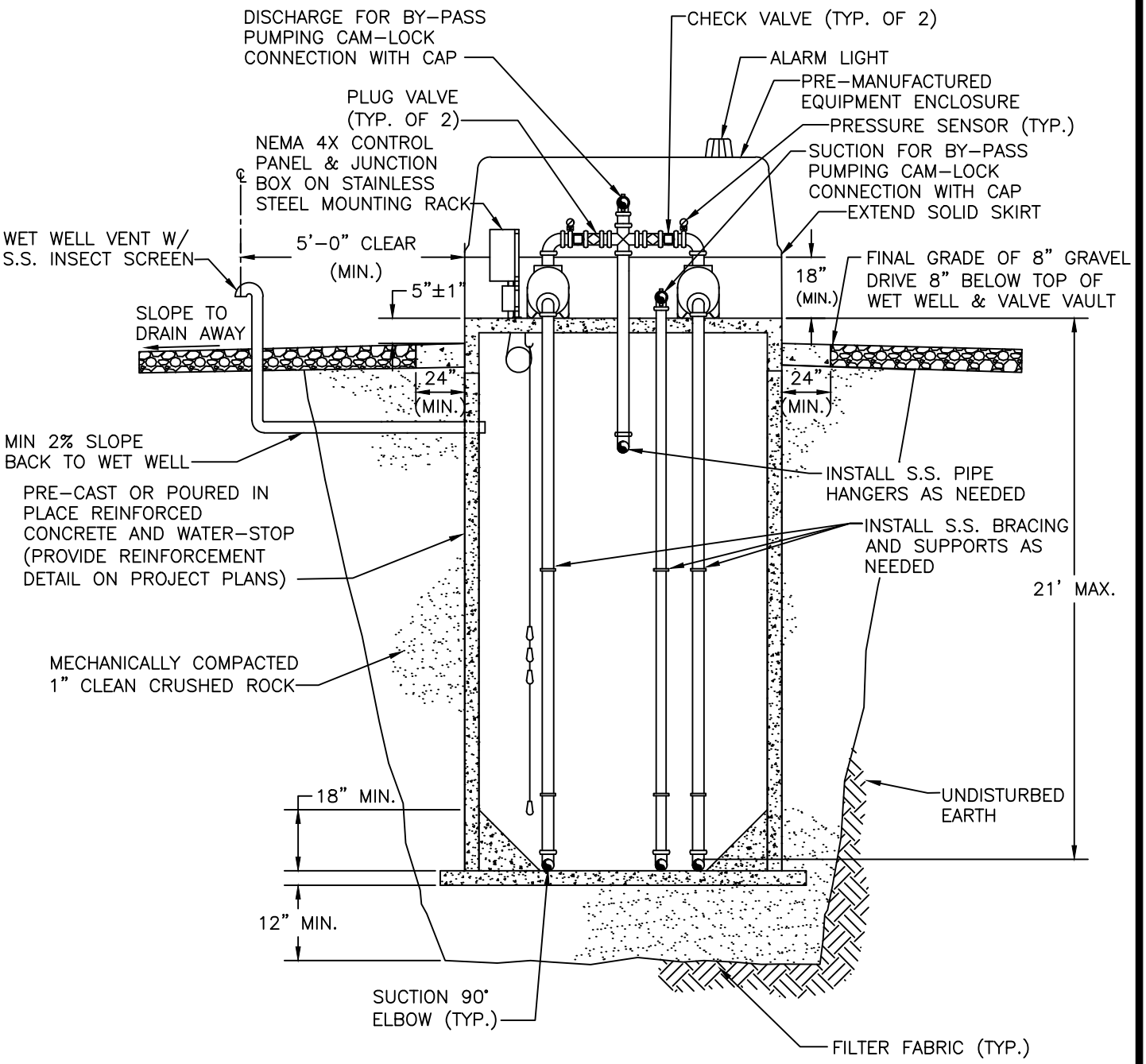
TYPICAL PRECAST JOINT SEALANT

KAP Approved Date Revisions	JACKSON, MO CITY OF BEAUTIFUL HOMES · PARKS · SCHOOLS AND CHURCHES 1814	TYPICAL LIFT STATION STRUCTURAL DETAILS	Sheet: LS - 12



NOTE: DETAILED DESIGN REQUIRED FOR SITE PLANS

KAP Approved / Date Revisions	JACKSON, MO 1814	ALTERNATE SUCTION-LIFT LIFT STATION - PLAN	Sheet: LS - 13



NOTE: DETAILED DESIGN REQUIRED FOR SITE PLANS

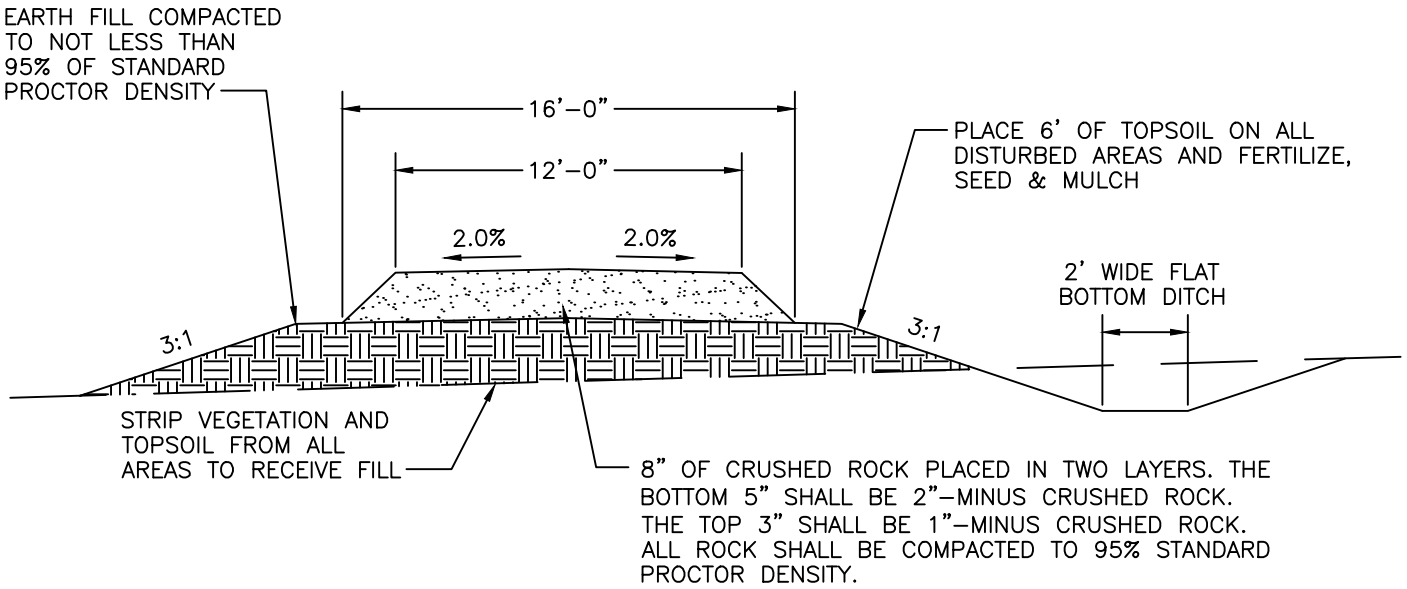
KAP
Approved Date

Revisions

ALTERNATE SUCTION-LIFT LIFT STATION - SECTION

Sheet:

LS - 14



NOTES:

1. CONSTRUCTION OF PUMP STATION ACCESS DRIVE SHALL COMPLY WITH ALL APPLICABLE SECTIONS OF THE CITY OF JACKSON STREET AND STORM WATER SPECIFICATIONS AND STANDARDS.

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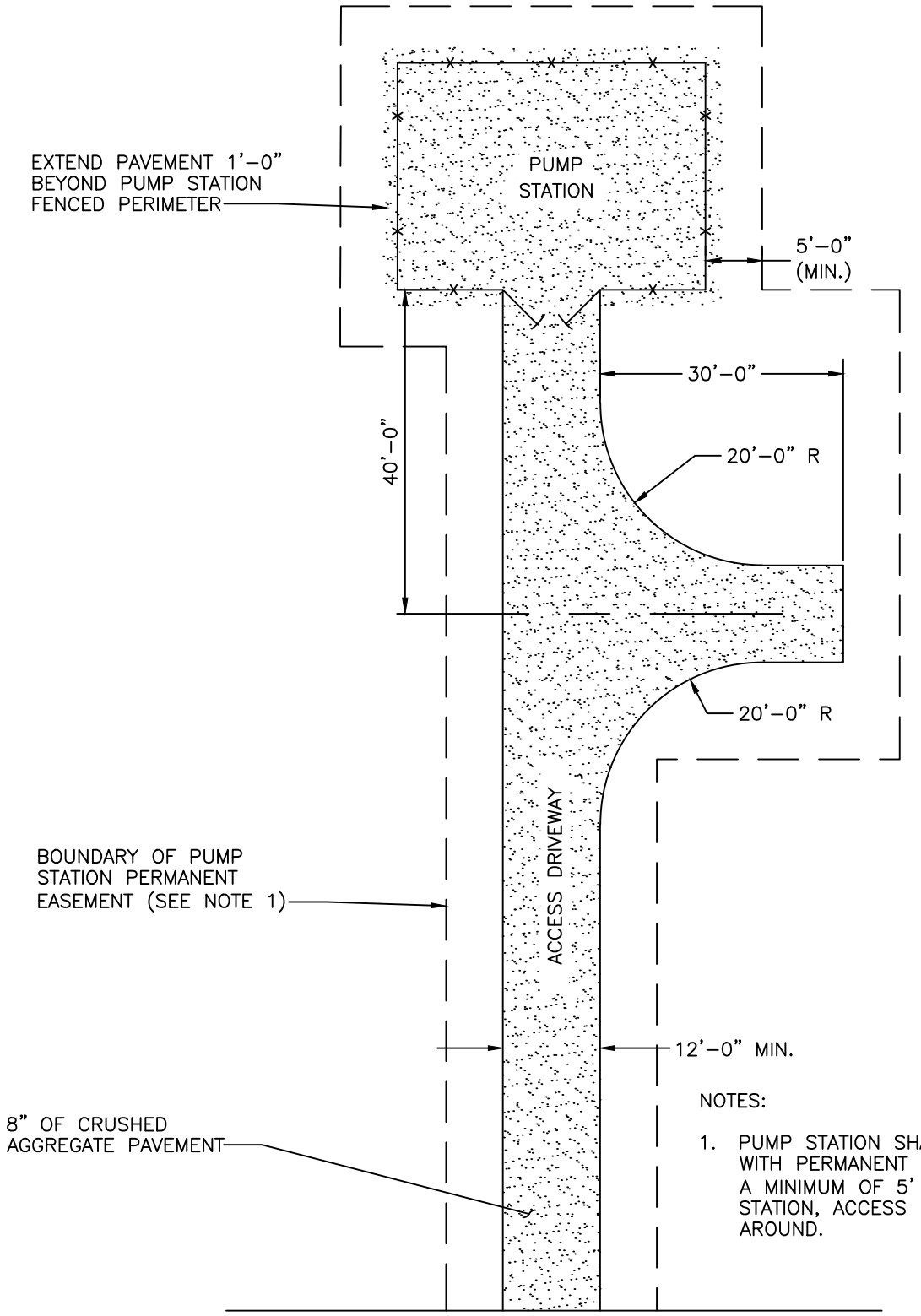
PUMP STATION ACCESS DRIVEWAY CROSS SECTION

Sheet: LS - 15



NOTES:

1. PUMP STATION SHALL BE CONSTRUCTED WITH PERMANENT EASEMENTS EXTENDING A MINIMUM OF 5' BEYOND THE PUMP STATION, ACCESS DRIVEWAY, AND TURN AROUND.

KAP	
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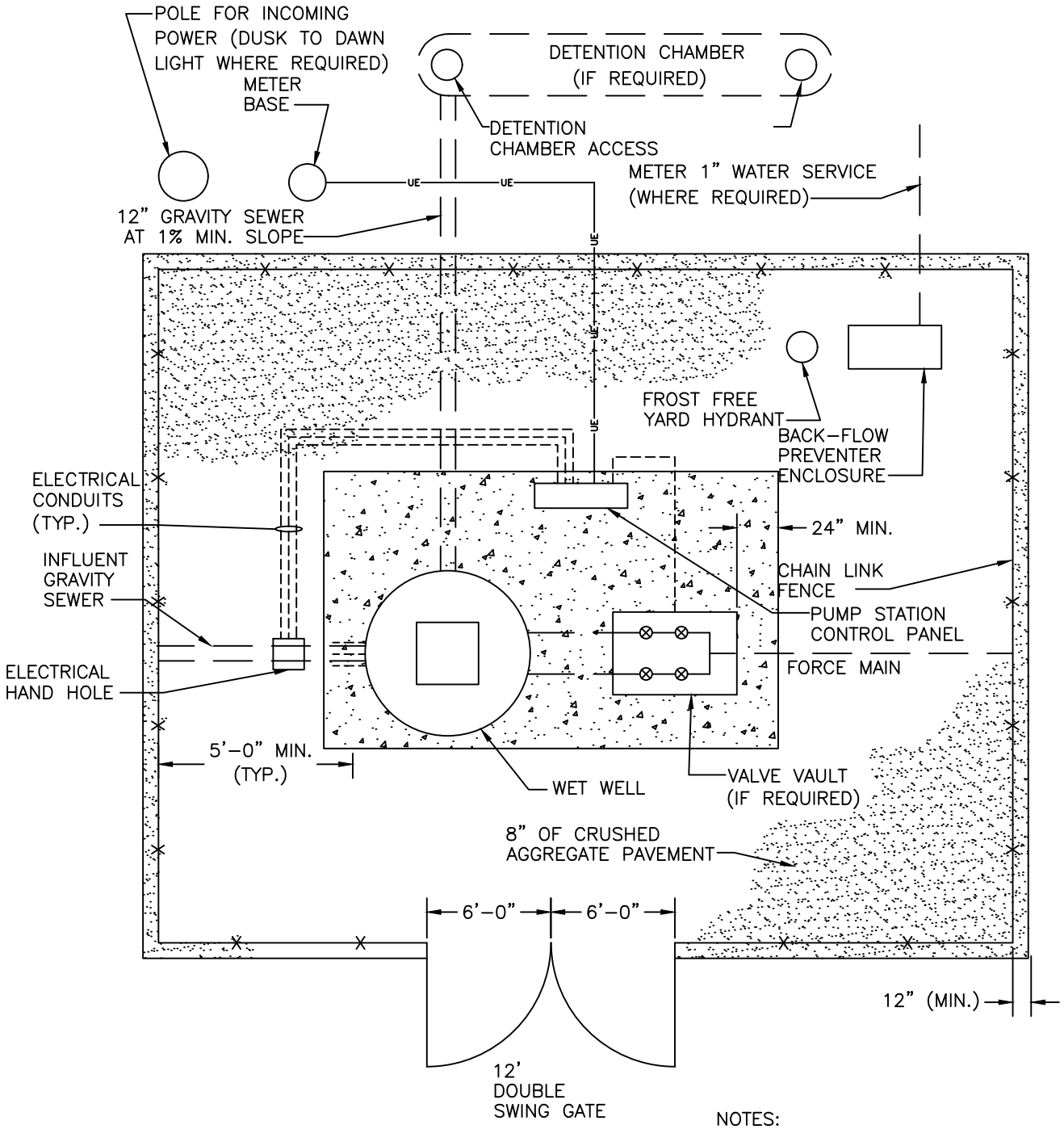
ACCESS DRIVEWAY & TURN AROUND AREA

Sheet: LS - 16



NOTES:

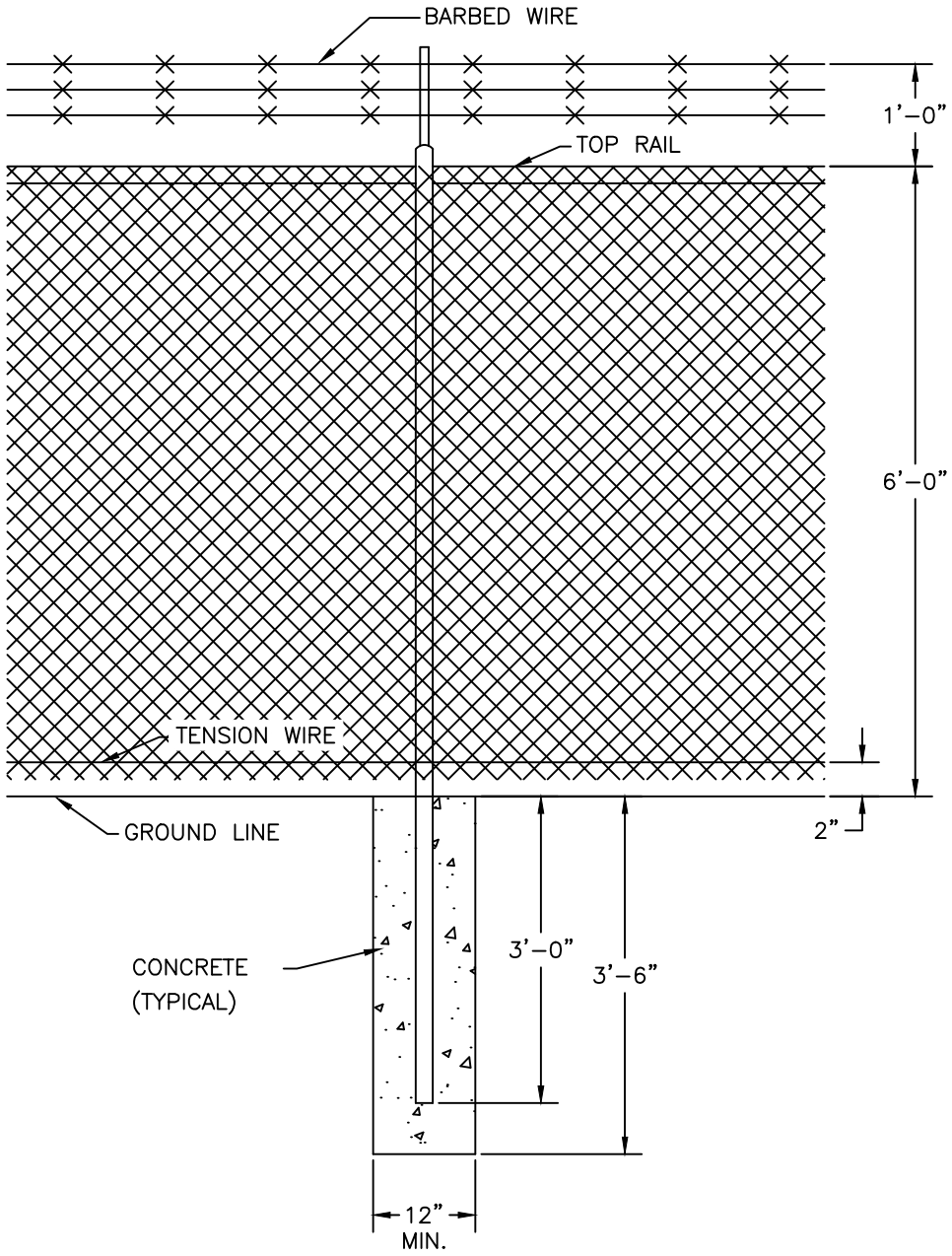
1. MAINTAIN A MINIMUM OF 5'-0" CLEAR BETWEEN PUMP STATION STRUCTURES AND FENCED PERIMETER

KAP
Approved
Date

Revisions

TYPICAL PUMP STATION SITE PLAN

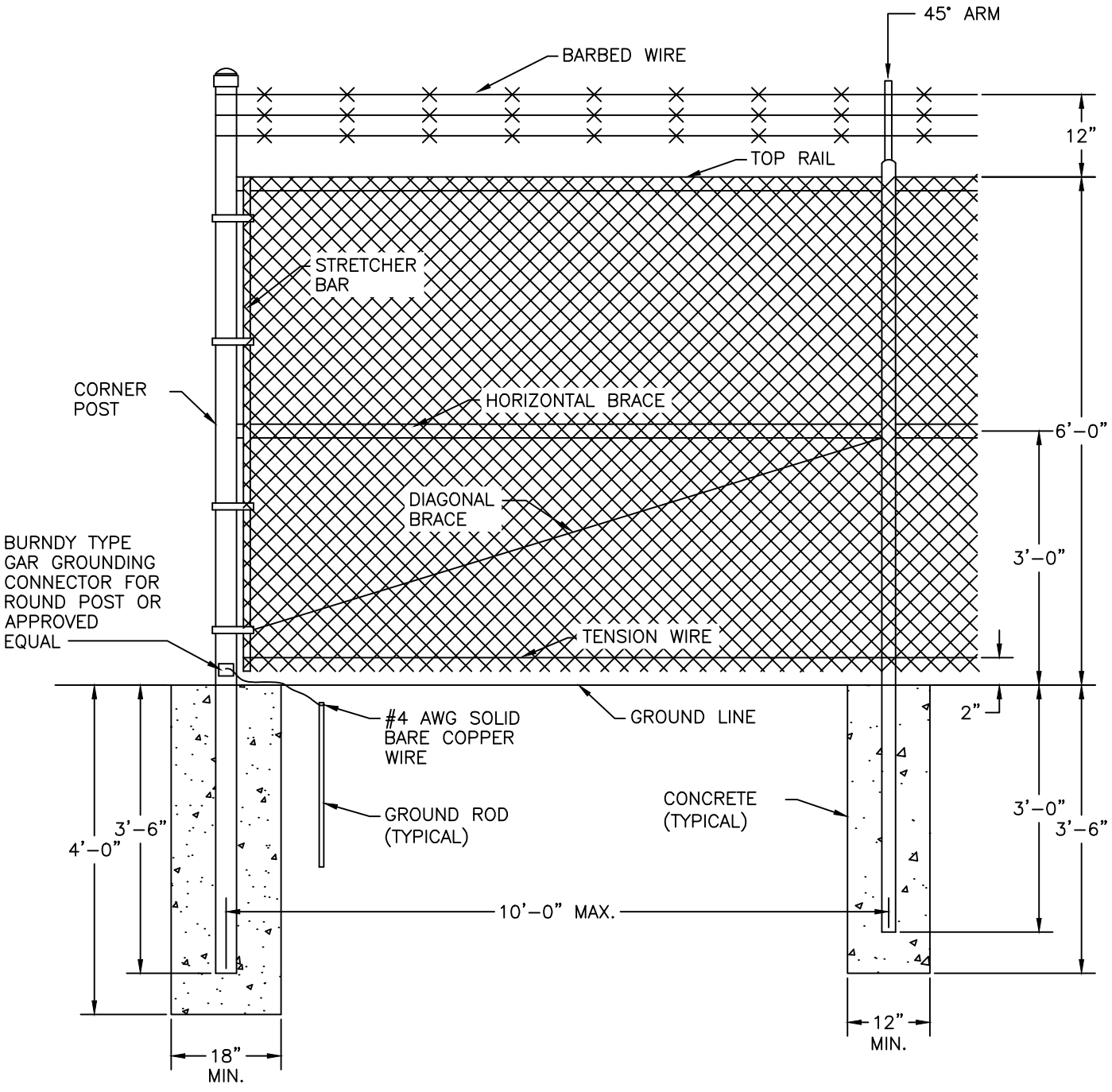
Sheet:
LS - 17



KAP	
Approved	Date
Revisions	

FENCING - STANDARD LINE POST

Sheet: LS - 18



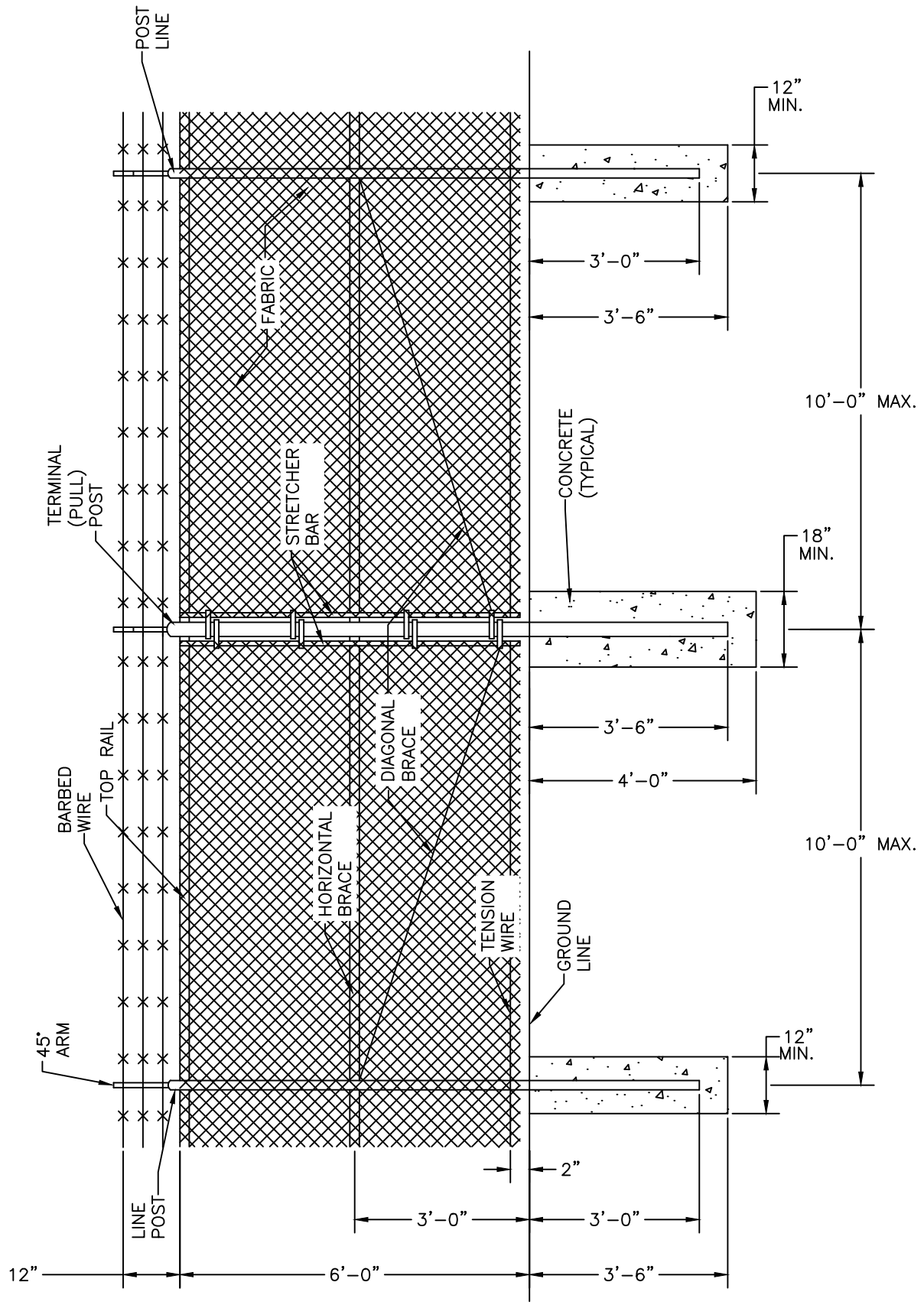
KAP
Approved Date

Revisions

FENCING - STANDARD CORNER

Sheet:

LS - 19



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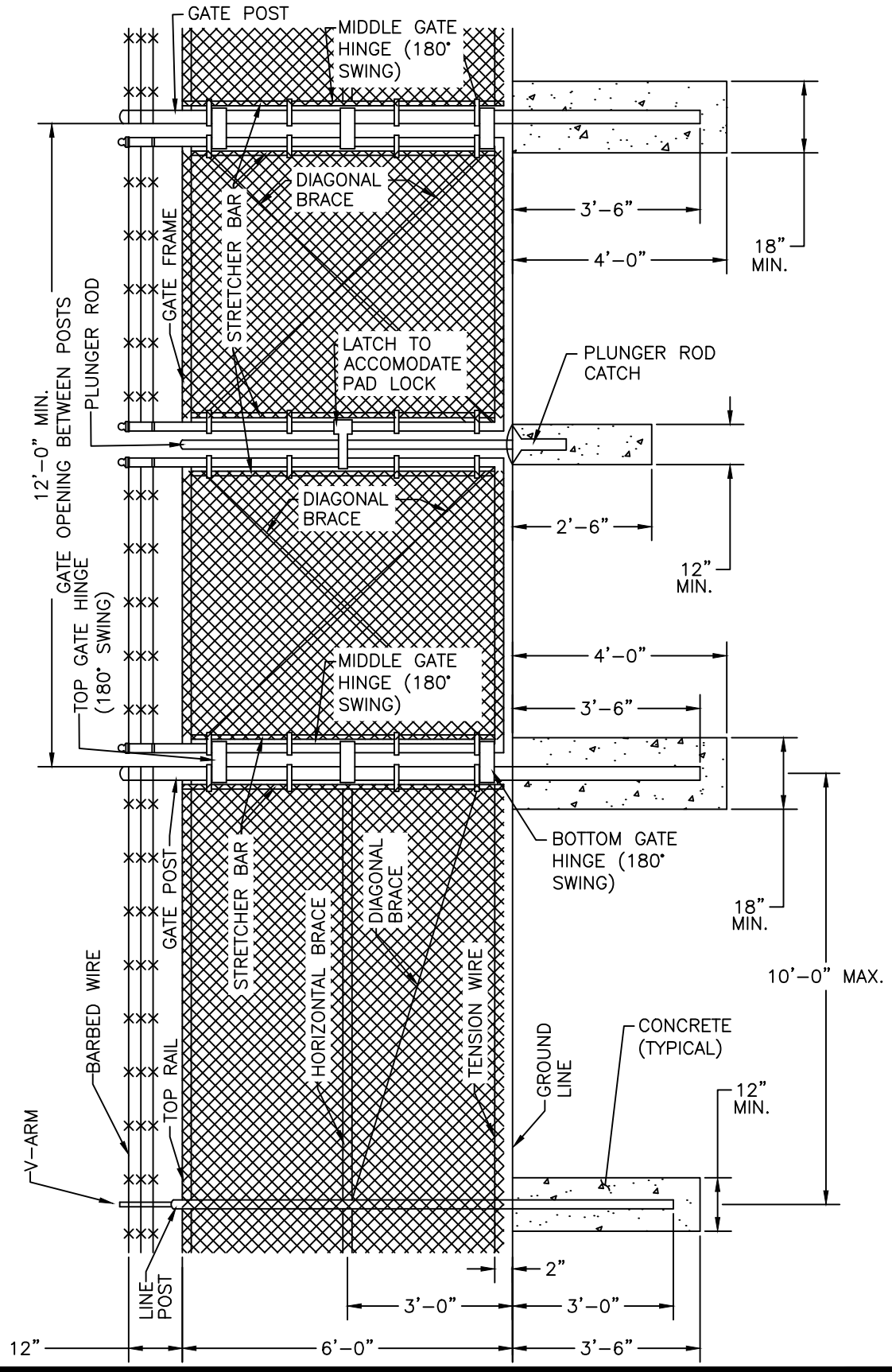
JACKSON, MO
CITY OF BEAUTIFUL HOMES • PARKS • SCHOOLS AND CHURCHES
1814

FENCING - STANDARD PULL POST

Sheet:

LS - 20

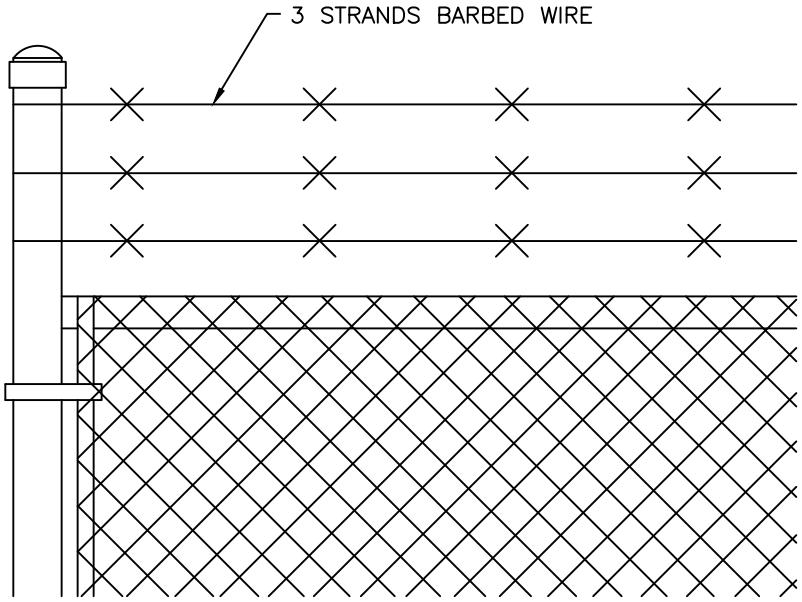


KAP
Approved Date

Revisions

FENCING - STANDARD GATE

Sheet: LS - 21



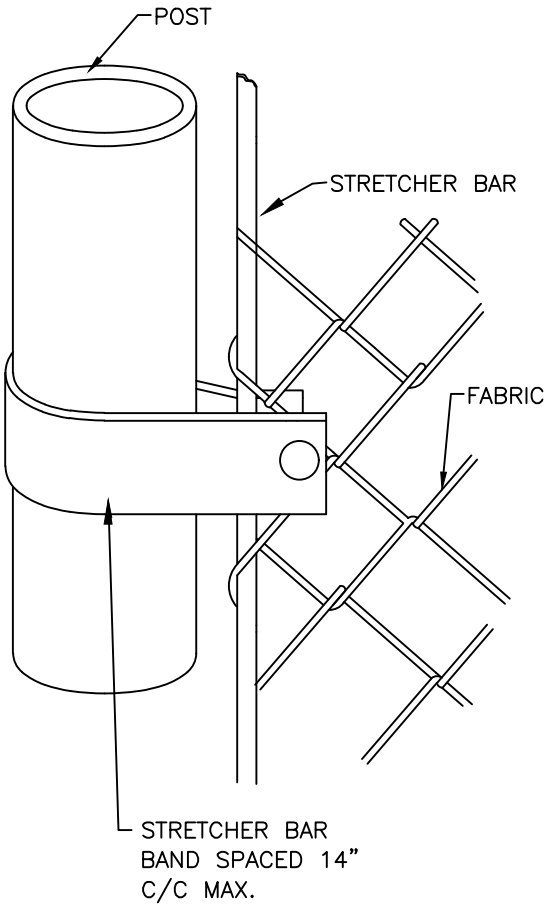
BARBED WIRE – 3 STRANDS, 12 1/2 GAUGE WIRE WITH 14 GAUGE 4 POINT BARBS SPACED APPROXIMATELY 6 INCHES APART. ALL WIRE SHALL BE ALUMINUM COATED WITH A MINIMUM COATING OF 0.25 OUNCES PER SQUARE FOOT OF SURFACE AREA.

BARBED WIRE SHALL BE DIRECTLY ATTACHED TO EACH CORNER AND GATE POST. BARBED WIRE SHALL BE ATTACHED TO EACH LINE POST AND PULL POST WITH A SUPPORTING ARM. SUPPORTING ARM SHALL SLOPE TO THE OUTSIDE OF THE FENCE AT A 45° ANGLE.

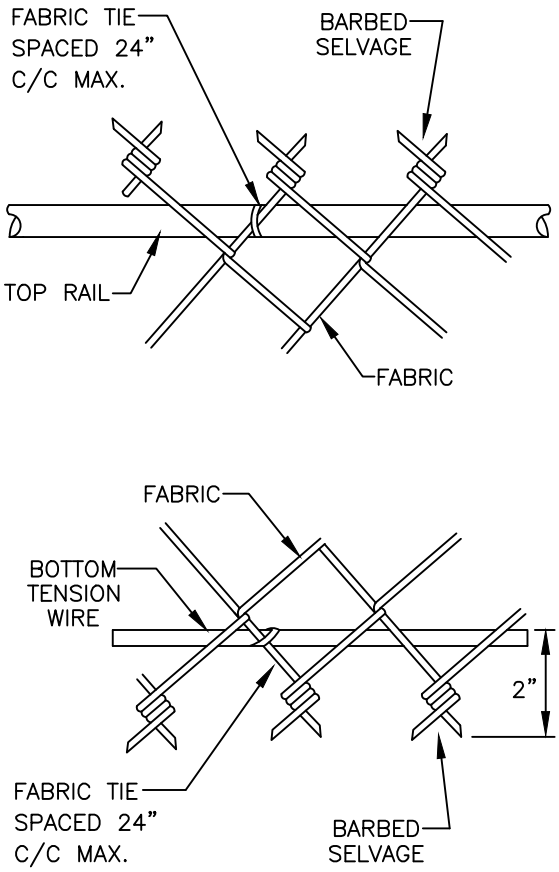
KAP	
Approved	Date
Revisions	

FENCING - BARBED WIRE

Sheet: LS - 22

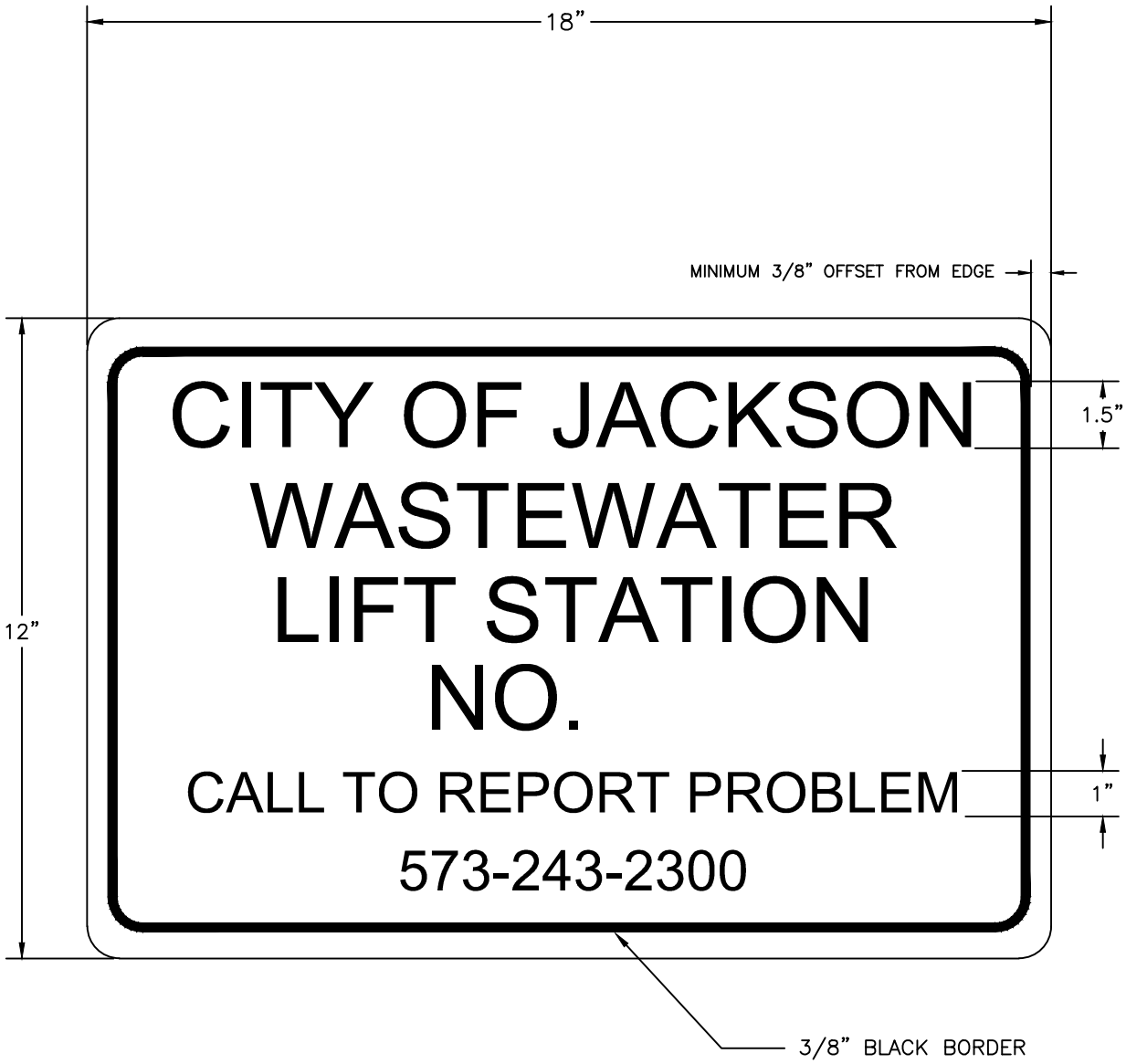


METHOD OF FASTENING
STRETCHER BAR TO POST



METHOD OF TYING
FABRIC TO TENSION WIRES

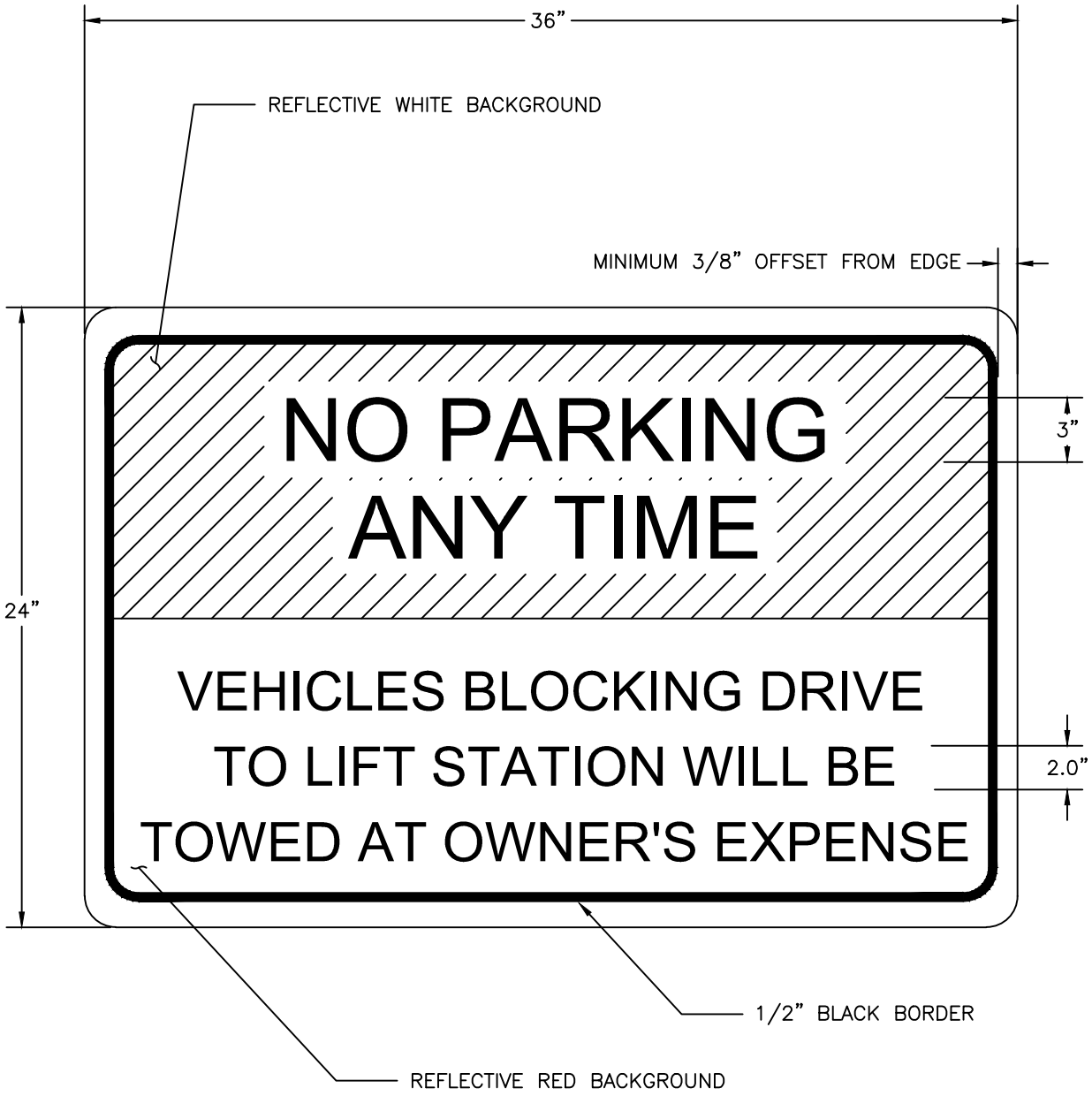
KAP Approved Date Revisions	JACKSON, MO CITY OF BEAUTIFUL HOMES • PARKS • SCHOOLS AND CHURCHES 1814	FENCING - FASTENING & TYING	Sheet: LS - 23



SIGN DATA:

- BLOCK BLACK LETTERS ON WHITE REFLECTIVE BACKGROUND.
- SIGN PANEL SHALL BE 1/8" THICK ALUMINUM SHEET.
- SIGN SHALL BE FIELD LOCATED ON GATE.

KAP Approved Date Revisions	JACKSON, MO 1814	LIFT STATION SIGN	Sheet: LS - 24



SIGN DATA:

- BLOCK WHITE LETTERS ON REFLECTIVE RED BACKGROUND TOP HALF OF SIGN.
- BLOCK BLACK LETTERS ON WHITE REFLECTIVE BACKGROUND BOTTOM HALF OF SIGN.
- SIGN PANEL SHALL BE 1/8" THICK ALUMINUM SHEET.
- SIGN SHALL BE FIELD LOCATED ON GATE.

KAP Approved Date Revisions	JACKSON, MO CITY OF BEAUTIFUL HOMES • PARKS • SCHOOLS AND CHURCHES 1814	NO PARKING SIGN	Sheet: LS - 25

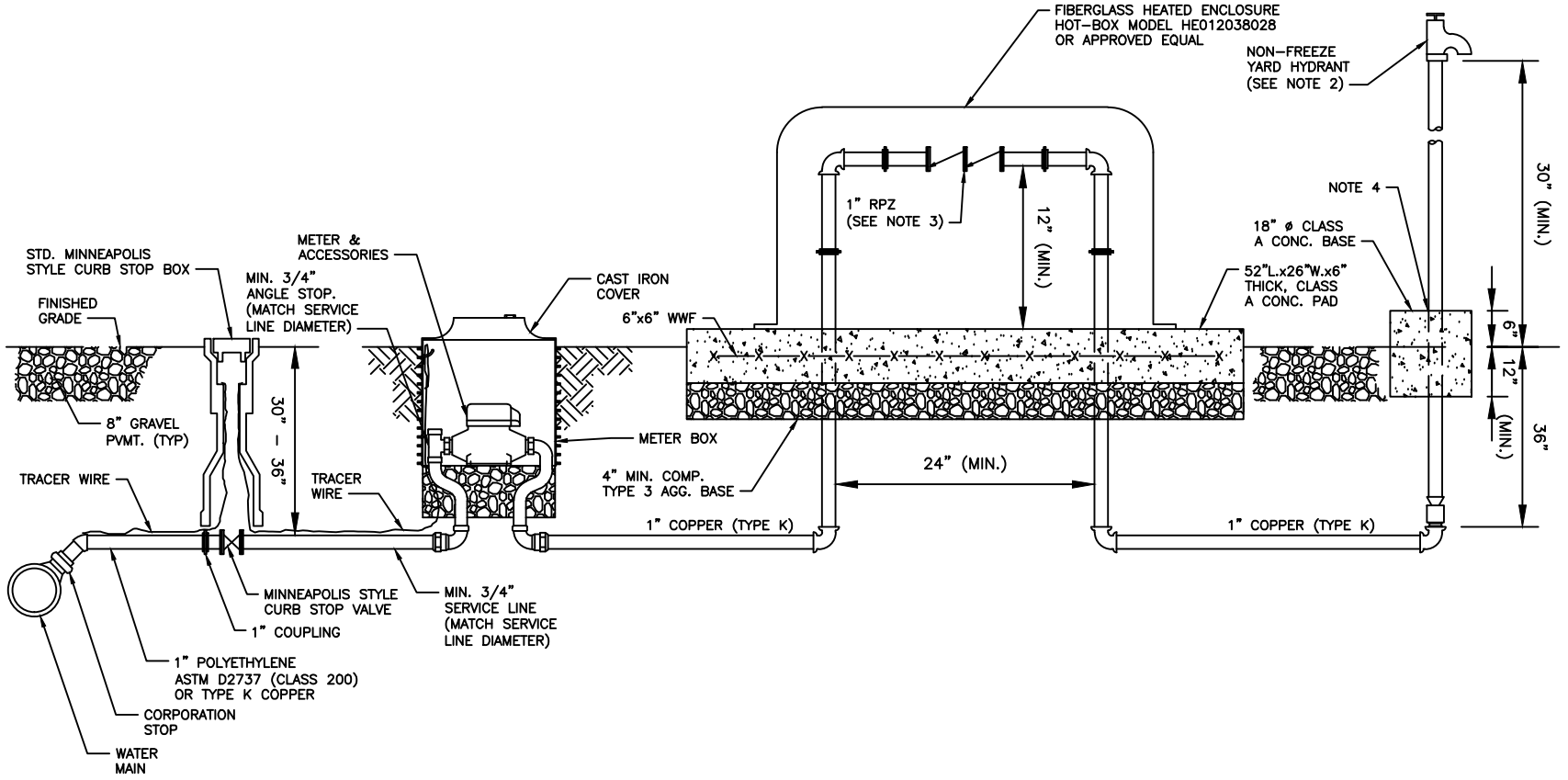
KAP

Approved

Date

Revisions

YARD HYDRANT DETAIL

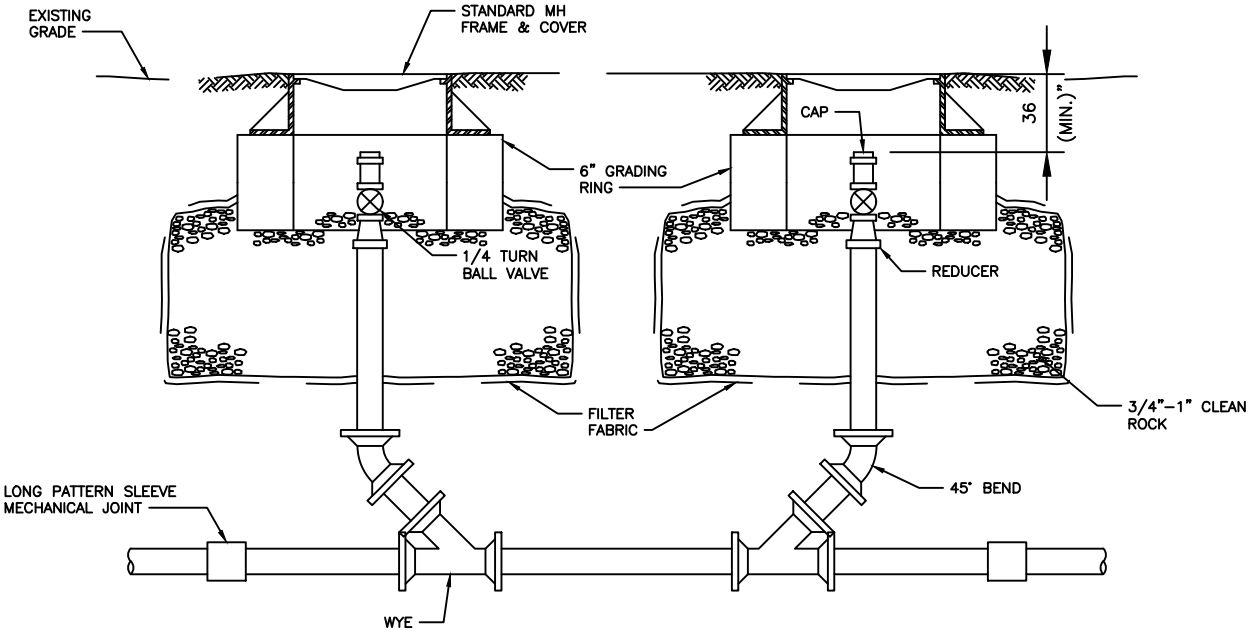


NOTE:

1. ALL MATERIAL AND INSTALLATION OF THE NEW 1" WATER SERVICE LINE, WATER METER, VALVES, BACK FLOW PREVENTER, AND YARD HYDRANT SHALL BE IN ACCORDANCE WITH THE "CITY OF JACKSON STANDARD SPECIFICATIONS FOR WATER MAIN EXTENSIONS /DEV. INSTALLATIONS."
2. WATTS DRAINAGE HY-800 WITH EPOXY COATED CAST IRON HEAD LIFT HANDLE AND LOCK OPTION, GALVANIZED CASING, BRONZE INTERNAL WORKING PARTS AND VALVE HOUSING, $\frac{1}{8}$" NPT DRAIN PORT, OR APPROVED EQUAL.
3. WATTS LF009-QT-S OR APPROVED EQUAL.
4. USE VINYL OR POLY PIPE WRAP TO ISOLATE GALVANIZED RISER FROM CONCRETE.

Sheet:

LS - 26



KAP Approved Date Revisions	JACKSON, MO CITY OF BEAUTIFUL HOMES • PARKS • SCHOOLS AND CHURCHES 1814	TYPICAL FORCE MAIN CLEAN OUTS	Sheet: LS-27