



THE TOWN OF SUPERIOR
DESIGN STANDARDS AND SPECIFICATIONS

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SECTION 100 – TITLE, SCOPE, AND GENERAL DESIGN CRITERIA

110.00 TITLE

These regulations shall be known as the *Town of Superior Design Standards and Specifications*, 2019 Edition, and may be cited as such. They shall be referenced herein as the DESIGN STANDARDS AND SPECIFICATIONS.

111.00 PURPOSE

The purpose of these DESIGN STANDARDS AND SPECIFICATIONS is to provide acceptable standards for design, construction, quality of materials, use, and location, as well as for the maintenance of public and private infrastructure and common facilities including, but not limited to, water-supply systems, sanitary-sewer systems, storm-drainage systems, roadways, landscaping, irrigation, open spaces, parking lots, and appurtenances.

120.00 SCOPE

The provisions of these DESIGN STANDARDS AND SPECIFICATIONS shall apply to the construction, enlargement, alteration, relocation, removal, conversion, demolition, repair, and excavation of public and private improvements or common facilities specifically regulated herein. The provisions of these DESIGN STANDARDS AND SPECIFICATIONS apply to Town contracts, Developer contracts and private contracts except where an approved Planned Development or Final Development Plan, and other planning documents, specifically state otherwise. Alterations, additions, or repairs to existing improvements shall comply with all requirements of these DESIGN STANDARDS AND SPECIFICATIONS unless specifically exempted by the Town Engineer.

120.01 Federal and State Laws and the Superior Municipal Code

The Contractor shall comply with all current and applicable federal and state laws and with the Superior Municipal Code. The Contractor shall obtain all necessary permits as required by these DESIGN STANDARDS AND SPECIFICATIONS prior to commencement of the work. The Contractor shall notify the Town Engineer twenty-four (24) hours before the start of the work or when work shall be resumed following a delay.

121.00 ALTERNATE MATERIALS AND METHODS OF CONSTRUCTION

The provisions of these DESIGN STANDARDS AND SPECIFICATIONS are not intended to prevent the use of any material or method of construction not specifically prescribed by these procedures. Alternate equivalent or superior materials or methods shall be submitted for approval by the Town Engineer. Sufficient evidence and proof of equivalency or superiority shall be submitted to substantiate the alternative method or material. Details of any approved alternative shall be recorded as a part of the project files.

122.00 MODIFICATIONS

In individual situations, the Town Engineer has the authority to grant modifications to these DESIGN STANDARDS AND SPECIFICATIONS or approve alternate designs, materials, and/or construction

methods. The applicant must demonstrate that conformance to the DESIGN STANDARDS AND SPECIFICATIONS is impractical in the specific situation, and that the modification conforms to the intent and purpose of the specified procedure, or that the proposed modification is superior or will provide a special benefit with its application. The requested modification shall not reduce any design requirement. The document(s) granting a modification shall be included in the project files.

123.00 TESTS

Whenever there is insufficient evidence of compliance with the provisions of these DESIGN STANDARDS AND SPECIFICATIONS or evidence that any material or construction does not conform to the requirements, the Town Engineer will require the Contractor to perform tests to demonstrate compliance. Test methods shall be as specified by the DESIGN STANDARDS AND SPECIFICATIONS or by other recognized test standards. If there are no recognized and approved test methods for the proposed alternate, the Town Engineer will determine the test procedures. All tests shall be made by an approved agency. The Town shall retain reports of such tests.

124.00 ORGANIZATION, ENFORCEMENT, AND INTERPRETATION

124.01 Authorization

The Town Engineer is authorized and directed to enforce all provisions of the DESIGN STANDARDS AND SPECIFICATIONS. The Town Engineer may designate a civil engineer, construction inspector, or other employee to act on their behalf.

124.02 Stop Work Order

If work is being done contrary to the provisions of these DESIGN STANDARDS AND SPECIFICATIONS, the Town Engineer may issue a written order to stop the work. The written “stop work order” may be served on any persons working or causing work to be done. Upon receipt of the stop work order, all work shall cease until the Town Engineer provides written notice authorizing the work to proceed.

124.03 Interpretation

These DESIGN STANDARDS AND SPECIFICATIONS are composed of written engineering standards, materials specifications, and detail drawings. When necessary, the Town Engineer shall interpret any section, or the difference between sections, and this interpretation shall be binding and controlling in its applications.

125.00 LIABILITY

The Town Engineer, or the authorized representatives charged with the enforcement of these DESIGN STANDARDS AND SPECIFICATIONS, acting in good faith and without malice in performing the duties, shall not be personally liable for any damage that may occur to persons or property as a result of any act or by reason of any act or omission in the discharge of the duties.

126.00 VIOLATIONS

It shall be unlawful for any person, firm, or corporation to construct, enlarge, alter, repair, move, improve,

remove, excavate, convert, demolish, or operate any public improvements or common facilities or permit the same to be done in violation of these DESIGN STANDARDS AND SPECIFICATIONS.

127.00 NO WAIVER OF TOWN'S RIGHT TO INSPECT WORK

The Town has the legal right to inspect work performed and materials furnished. No measurements, estimates, or certificates made either before or after the completion and acceptance of the work shall preclude this right or stop the Town from verifying the true amount and character of the work performed and materials furnished by the Contractor or from showing that any such measurement, estimate, or certificate is untrue or incorrectly made, or that the work or materials do not conform in fact to these DESIGN STANDARDS AND SPECIFICATIONS.

128.00 USE OF TOWN RIGHT-OF-WAY

128.01 Permission to Occupy Right-of-Way, Open Space, Dedicated Easements, Town-Owned Property, Town-Owned Open Space, Properties, and Easements

In accordance with Superior Municipal Code, all persons desiring to place facilities within the public right-of-way (R.O.W.), if not otherwise granted by the contract or written agreement, shall obtain permission from the Town and pay the required fees in order to occupy a Town R.O.W., open space, dedicated easement, town-owned property, town-owned open space, property, or easement.

For information about construction in the public R.O.W, please refer to Section 151.00 RIGHT-OF-WAY PERMIT, GRADING PERMIT, AND STORM WATER QUALITY PERMIT of these DESIGN STANDARDS AND SPECIFICATIONS.

128.02 Insurance and Indemnification

Insurance. Prior to the Town granting any permit, the Applicant shall file comprehensive general liability insurance policies or certificates with the Town, in the forms and amounts satisfactory to the Town. The Town, its officers, and employees shall be listed as “additional named insured” on all insurance policies and certificates. The Town’s departments shall be relieved of the obligation to submit certificates of insurance.

Indemnification. The Applicant and its related entities, agents, employees, and subcontractors, shall hold the Town harmless, defend, and indemnify the Town, its successors, assigns, officers, employees, agents, and appointed and elected officials from and against all liability or damage and all claims or demands whatsoever in nature and reimburse the Town for all its reasonable expenses, as incurred, arising out of the installation, maintenance, operation, or any other work or activity in the public right-of-way or by the Applicant related to its use thereof including, but not limited to, the actions of the Applicant, its related entities, agents, employees, subcontractors, and the agents and employees of said subcontractors, or the securing of and the exercise by the Applicant of the Permit rights granted in the Permit, including any third party claims, administrative hearings, and litigation; whether or not any act or omission complained of is authorized, allowed, or prohibited by this ordinance or other applicable law.

128.03 Performance Guarantee – (Letter of Credit)

If no formal agreement exists, such as a subdivision improvement agreement, metropolitan district, or capital improvement project construction agreement, and the total construction cost of the proposed

permit exceeds \$2,000.00, a performance guarantee (security) will be required of the permittee in the form of a letter of credit or a cash security deposit. No performance bonds will be accepted. The amount of security will be determined by the Town Engineer and shall be equal to the costs necessary for total restoration of the site and construction of all required storm drainage and stormwater quality improvements necessary for compliance with the Town's Municipal Separate Storm Sewer System (MS4) Permit. The security for storm drainage and stormwater quality improvements will be held until stormwater improvements are accepted as required in SECTION 200 – ACCEPTANCE PROCEDURES of these DESIGN STANDARDS AND SPECIFICATIONS. The security for work within a public right-of-way will be held for a period of two (2) years, or as otherwise specified.

The letter of credit shall be executed by the Applicant as principal and by at least one surety upon whom the service of process may be had in the state. The letter of credit shall be conditioned upon the Applicant fully complying with all provisions of the Town ordinances, rules, and regulations, and upon payment of all judgments and costs rendered against the Applicant for any material violation of the Town ordinances or state statutes that may be recovered against the Applicant by any person for damages arising out of any negligent or wrongful acts of the Applicant in the performance of work done pursuant to the Permit. The Town may bring an action on the letter of credit on its own behalf or on behalf of any person so aggrieved as beneficiary. The letter of credit shall be approved by the Town Attorney as to form and as to the responsibility of the surety thereon prior to the issuance of the Permit.

A letter of responsibility will be accepted in lieu of a letter of credit, or cash deposit from all public utilities, all franchised entities, and all metropolitan, water, and sanitation districts operating within the Town.

The letter of credit or cash deposit shall be waived for residential utility repairs and replacements, and residential sidewalk and driveway repairs and replacements.

The letter of credit, letter of responsibility, or cash deposit shall remain in force and effect for a minimum of two years.

128.04 Performance Guarantee Procedures

Any guarantee made hereunder shall serve as security for the performance of work necessary to repair the public R.O.W., and/or comply with all state and federal permits and requirements if the Applicant fails to:

- A. Complete the work in accordance with project schedule submitted to the Town Engineer as part of the permit;
- B. Complete the work in accordance with permit requirements; and/or
- C. Make the necessary maintenance and repairs during the warranty period.

The Applicant, by acceptance of the Permit, expressly warrants and guarantees to complete performance of the work in a manner acceptable to the Town and warrants and guarantees all work done for the warranty period. Refer to SECTION 200 – ACCEPTANCE PROCEDURES of these DESIGN STANDARDS AND SPECIFICATIONS. The Applicant agrees to make all necessary repairs during the warranty period in accordance with Table 200.01. This warranty shall include all repairs and actions needed as a result of:

- A. Defects in workmanship and use of substandard construction materials

- B. Settling of fills/backfill material or excavations
- C. Distress in the form of heaving/settling or cracking
- D. Any condition to impede, obstruct, and/or delay the intended full use of improvements;
- E. Any unauthorized deviations from the approved plans and specifications
- F. Failure to barricade
- G. Failure to clean up during and after performance of the work, and comply with Superior Municipal Code regarding control of construction materials and debris.
- H. Failure to replace pavement markings or otherwise comply with repaving or reconstruction schedule.
- I. Any other violation of this chapter or the ordinances of the Town.

The warranty period shall begin on the date of the Town's Issuance of a Construction Acceptance letter acknowledging the acceptance of construction into the warranty period.

If repairs and maintenance are required during the warranty period, a new R.O.W. Permit shall be required for those repairs. Warranty repair/maintenance work involving asphalt or concrete repairs is subject to an additional one- (1) year warranty.

At any time prior to completion of the warranty period, the Town Engineer may notify the Applicant of any needed repairs. Such repairs shall be completed within twenty-four (24) hours if the defects are determined by the Town to present imminent danger to the public health, safety, and welfare.

Should the Applicant fail to complete non-emergency warranty work in a timely manner, upon giving the Applicant (10) ten calendar days written notice, the Town may perform the work at the Applicant's expense.

If the cost of the warranty work performed by the Town exceeds the amount of the financial security, the Applicant shall be liable for the additional costs. If there is a dispute as to the amount owed, the Applicant may provide financial security to the Town to fully secure such payment until resolution of any appeal under this chapter.

130.00 SCOPE OF WORK

131.00 WORK CONDITIONS

131.01 Working Hours

All work shall be performed during regular working hours, 7:00 A.M. until 5:00 P.M., Monday through Friday. Restricted hours may be included as dictated by the Town Engineer. The Contractor shall not perform work outside of regular working hours, or on Saturday, Sunday, or any Town-observed holiday without receiving prior written consent from the Town Engineer. The Town's observed holidays include

New Year's Day, Martin Luther King Jr. Day, President's Day, Memorial Day, Independence Day, Labor Day, Veterans Day, Thanksgiving Day, the Friday following Thanksgiving, Christmas Eve, and Christmas Day. If the Contractor wishes to work outside regular working hours, a request to work shall be received by the Town two working days prior to the proposed date of the work. Refer to Section 150.00 PERMITS AND INSPECTIONS of these DESIGN STANDARDS AND SPECIFICATIONS.

131.02 Emergency Work

When, in the opinion of the Town, the Contractor has not taken sufficient precautions to ensure the safety of the public or the protection of the facilities being constructed or of adjacent structures or property that may be damaged by processes of construction on account of such neglect, and an emergency arises in which immediate action is considered necessary in order to protect public, private, or personal interests, the Town, with or without notice to the Contractor or the Developer, may provide suitable protection by causing such work to be done and material to be furnished and placed as the Town may consider necessary and adequate.

The cost and expense of such work and material so furnished shall be borne by the Contractor or developer and shall be paid upon presentation of the bills.

The performance of such emergency work under the direction of the Town shall in no way relieve the Contractor of responsibility for damages that may occur during or after such precaution has been taken. In an emergency threatening loss of life or extensive damage to the work or adjoining property, and where the Developer or Contractor is unable to obtain special instructions or authorization from the Town after diligent attempts to obtain such special instruction or authorization in sufficient time to take the necessary action, the Developer or Contractor is hereby permitted to act at his own discretion to prevent such threatening loss or damage.

131.03 Final Cleanup

Upon completion of the work, the Contractor shall remove from the project area all surplus and discarded materials, rubbish, and temporary structures, and leave the project area in a neat and presentable condition. The Contractor shall restore all work that has been damaged by his operations, to general conformity with the specifications for the item or items involved.

Final cleanup shall include inspection of the interior of all manholes, stormwater inlets, and facilities within the construction limits for construction materials, dirt, stones, or other debris deposited therein by the activities of the Contractor, and removal of the debris.

132.00 CONTROL OF WORK

132.01 Authority of the Town Engineer

The Town Engineer has the authority to stop the work whenever such stoppage may be deemed necessary and to resolve issues regarding the quality and acceptability of materials furnished, performance of the work, interpretation of the plans and specifications, and acceptable fulfillment of the requirements of these DESIGN STANDARDS AND SPECIFICATIONS.

The Town Engineer may define and the contractor will comply with the schedule and/or priority of the work to be completed on the project. Any revision to the schedule shall be authorized in writing by the Town Engineer.

132.02 Authority and Duties of the Town Construction Inspector

The Town Construction Inspector is authorized to observe and inspect all work and all material furnished. Observations and inspections may include all procedures and the preparation, fabrication, and installation of materials to be used. The Town Construction Inspector is not authorized to revoke, alter, or waive any requirements of these DESIGN STANDARDS AND SPECIFICATIONS. The Town Construction Inspector is authorized to call the attention of the Contractor to any failure of the work or materials to conform to these DESIGN STANDARDS AND SPECIFICATIONS. The Town Construction Inspector is also authorized to issue a "Correction Notice" when inspection of the project reveals violation(s) of these DESIGN STANDARDS AND SPECIFICATIONS or deviation from the Project Quality Control Plan and objectives. The Town Construction Inspector shall have the authority to reject substandard and nonconforming materials and faulty methods until any questions at issue can be resolved by the Town Engineer.

The Town Construction Inspector shall not act as foreman or perform other duties for the Contractor or interfere with the management of the work performed by the Contractor. Any "advice" that the Town Construction Inspector may give the Contractor shall not be construed as binding upon the Town in any way or release the Contractor from fulfilling all of the requirements of these DESIGN STANDARDS AND SPECIFICATIONS.

The presence or absence of the Town Construction Inspector shall not relieve the responsibility or the obligation of the Contractor.

The Town shall at all times have reasonable and safe access to the work whenever it is in preparation or progress, and the Contractor shall provide proper facilities for such access and inspection.

132.03 Suspension of Work

In case of suspension of work for any reason, the Contractor shall take precautions as necessary to prevent damage to the project, to provide for adequate drainage, and to install any necessary barricades, signs, or other facilities, at his expense, as directed by the Town Engineer and as required by these DESIGN STANDARDS AND SPECIFICATIONS. Necessary precautions shall be taken before the Contractor leaves the job site.

132.04 Removal of Unauthorized and Unacceptable Work

Work that does not conform to the approved plans and these DESIGN STANDARDS AND SPECIFICATIONS or that results in an inferior or unsatisfactory product shall be considered unacceptable work.

Unacceptable work, whether the result of poor workmanship, poor design, use of defective materials, damage through carelessness, or any other cause found to exist at any time prior to Final Acceptance/Release from Warranty of the work shall be immediately removed and replaced or corrected at the expense of the Developer in a manner acceptable to the Town. This expense includes the total and complete restoration of all disturbed surfaces to a condition acceptable to the Town.

132.05 Contractor's Responsibility; Character of Workers and Equipment

Contractor shall employ resources for bringing work to full completion in the manner and time required

by the contract. All workers shall have the skill and experience to perform the work assigned to them.

When workers are primarily conversing in a language other than English, each crew shall have at least one person who is fluent in both English and the primary language of the workers.

Any person employed by the Contractor or by any subcontractor who does not perform the work in a proper and skillful manner shall, at the written request of the Town Engineer, be removed by the Contractor or subcontractor and shall not be employed on the project without the approval of the Town Engineer.

The superintendent for the project shall either be on site, within 30 minutes of the site, or available by phone at all times. If the superintendent is not available, the superintendent shall designate an alternative contact.

All equipment used on the project shall be of the size and mechanical condition necessary to meet the requirements of the work and to produce a satisfactory quality product. Equipment that is used shall not cause injury to the roadway, adjacent property, or other roadways.

132.06 Situation Variances

Where any particular requirements contained in this Section of these DESIGN STANDARDS AND SPECIFICATIONS can be shown to be inappropriate when applied to an out of-the-ordinary situation, variances to said minimum requirements shall be considered and may be authorized by the Town Engineer. The proposed variance in the requirements shall result in a level of safety, service, and quality equal to or greater than that intended by the application of said requirements. These DESIGN STANDARDS AND SPECIFICATIONS shall govern when inconsistencies with approved construction plans occur, unless written permission is granted by the Town Engineer.

132.07 Town Capital Improvement Projects

It is recognized that the requirements contained in these DESIGN STANDARDS AND SPECIFICATIONS are not necessarily sufficient to be used as the sole guidance for plans, specifications, and contract administration of Town-managed capital improvement projects. Accordingly, the Town Engineer is authorized to develop and/or approve such additional requirements and procedures necessary for bidding, award, and construction administration of such projects. Said additional requirements and procedures shall be consistent with these DESIGN STANDARDS AND SPECIFICATIONS and all applicable provisions of other Town ordinances and resolutions.

132.08 Requirements of Other Jurisdictions

Where proposed street construction may affect other agencies such as the CDOT, UDFCD, adjacent cities, and counties or ditch companies, said construction shall be subject to the review of said agencies. Generally, where more than one requirement is imposed, the more restrictive requirement shall govern. Exceptions shall be authorized in writing by the Town Engineer.

133.00 CONTROL OF MATERIALS

133.01 Samples and Tests

To determine if materials comply with contract requirements and these DESIGN STANDARDS AND

SPECIFICATIONS, samples may be collected and/or tests performed at the source or job destination, at the discretion of the Town Engineer. Collection of samples and completion of tests shall be in accordance with relevant ASTM standard protocols, except where methods and procedures for sampling and testing materials are otherwise set forth in these DESIGN STANDARDS AND SPECIFICATIONS.

The Contractor shall furnish—at his expense—all samples, tests, and reports required by the Town Engineer and shall provide such facilities for collecting and forwarding them. When requested by the Town Engineer, a written statement providing the origin, composition and process of manufacture of a material shall be provided by the Contractor.

133.02 Storage of Materials

Materials shall be stored so as to assure the preservation of quality and suitability for the work. Stored materials shall be subject to inspection at any time prior to use in the work and shall meet all requirements of these DESIGN STANDARDS AND SPECIFICATIONS at the time they are used. Materials shall be stored in a manner that facilitates inspection. With the Town Engineer’s written approval, portions of the rights-of-way not required for public travel may be used to store materials and equipment. Any additional storage space required shall be provided by the Contractor at his expense.

133.03 Defective Materials

Materials that do not conform to contract requirements or these DESIGN STANDARDS AND SPECIFICATIONS shall be considered defective and shall be rejected. Rejected materials shall be removed from the work site within seventy-two (72) hours.

134.00 QUALITY ASSURANCE/QUALITY CONTROL

Quality assurance is the process followed by the Town Construction Inspector to assure compliance of each project to the Town’s DESIGN STANDARDS AND SPECIFICATIONS. Quality control is the process that shall be implemented by the contractor and the independent project inspectors provided by the Certified Materials Testing Agency (Independent Testing Agency) or the developer/builder performing the work.

The Contractor and the Independent Testing Agency shall prepare project specific documentation that will comprise the Quality Control Plan (QCP) as part of the overall project Quality Assurance Program prior to the preconstruction conference. The QCP shall include at a minimum:

1. A summary of the contractor’s methods and procedures to ensure quality control for all major aspects of the work. The summary should discuss roles, responsibilities, and qualifications of key project personnel, equipment to be used, project oversight, and any other project-specific strategies to ensure high-quality construction
2. The Certified Materials Testing Agency shall submit a testing plan that includes the work to be observed, required inspections, and required tests, including test type and frequency, on all major aspects of the work
3. The Qualifications of the materials tester, which should meet the minimum qualifications and have the required certifications listed in Section 311.01 QUALIFICATIONS FOR TESTING AGENCIES, of these DESIGN STANDARDS AND SPECIFICATIONS

4. A Worksheet or other form on which data will be recorded, which shall include, at a minimum, the location and date of the test taken, the testing standard used, a list of testing equipment, the test result, and information for failing tests. For pipe backfill operations, the test locations must also be shown on the approved utility profile plan
5. The name of the professional engineer responsible for review and approval of the test reports

The frequency of testing, as required in Section 311.02 MINIMUM TESTING REQUIREMENTS of these RULES AND REGULATIONS WITH DESIGN STANDARDS AND SPECIFICATIONS, shall be the minimum Quality Assurance requirements.

134.01 Quality Assurance Program - Non-Compliance

Provided that 90% or greater of all initial tests have passed, the Quality Assurance Program is considered satisfactory and no action will be required.

If less than 90% but greater than 75% of all initial tests have passed, the Town Construction Inspector will conduct a field meeting to be attended by:

- Town Construction Inspector
- Developer's Project Manager and field representative
- Developer's Testing Agency's Project Supervisor (P.E.) and Technician
- Contractor's Quality Control Manager, the Superintendent, and the Foreman of the crew doing the work

The purpose of the meeting will be to discuss and determine the cause of the test low passing rate and to determine a course of corrective action. Testing frequency shall be increased by 25% until 90% or more of the tests meet the specifications and requirements.

If less than 75% of all initial tests have passed, production will be suspended and the Town Construction Inspector will conduct a field meeting to be attended by:

- Town Construction Inspector
- Developer's Project Manager and field representative
- Developer's Testing Agency's Project Supervisor (P.E.) and Technician
- Contractor's Quality Control Manager, the Superintendent, and the Foreman of the crew doing the work

The purpose of the meeting will be to discuss and determine the cause of the low rate of passing tests and/or samples and to determine a course of corrective action. The contractor's foreman and crew doing the nonconforming work may be removed from the project. Production will remain suspended until the source of the problem is identified and corrected. Upon resuming production, the work testing and/or sampling frequency shall be increased by 50% until 90% or more of the tests/samples meet the specifications and requirements for at least three (3) working days.

140.00 GENERAL CONDITIONS

141.00 PROTECTION OF PUBLIC, PRIVATE, AND UTILITY INTERESTS

141.01 Operation of Existing Utility System Controls

Only the Town personnel shall operate control devices on all Town-owned existing utility systems.

141.02 Locates Required for Existing Utility Systems

Construction Drawings will not be approved and work will not be allowed in areas containing public utilities without potholing of utilities in accordance with Colorado Revised Statute §9-1.5-103.

Prior to any disturbance of soils, concrete, or asphalt materials, all utility line locations shall be marked on the ground with location equipment by a certified utility location agency. All utility locations shall be plainly marked by coded paint symbols on pavement or by marked stakes in the ground at the Contractor's expense. All potholing shall be completed prior to the approval of construction drawings. Potholing shall determine utility location, horizontal and vertical configuration, pipe material, and dimensions.

141.03 Permits Required by Other Agencies

Developers or Contractors proposing to place facilities in the vicinity of existing public, private, or utility infrastructure shall obtain a written agreement from the responsible managing agency. This written agreement shall include, but not be limited to, irrigation ditches, the CDOT, communication utilities, gas and electric utilities, and neighboring governmental entities.

141.04 Public Convenience and Safety

Fire hydrants shall be visible and accessible to the Fire District from the street at all times. No obstructions shall be placed within ten (10) feet of a fire hydrant. Unless otherwise specified, the Contractor shall give written notice to the proper authorities in charge of streets, water lines, gas lines, electric service, cable television, and other conduits, poles, manholes, catch basins, and all other property that may be affected by the Contractor's operations at least seventy-two (72) hours before breaking ground. The Contractor shall not hinder or interfere with any person in the protection of such property or the operation of utilities at any time. The Contractor shall obtain all necessary information—including field locations, which may include exploratory potholing. The contractor shall protect such utilities from injury, and shall avoid unnecessary exposure of utilities that could cause injury to the public. The Contractor shall obtain all necessary information in regard to the planned installation of new utilities, cables, conduits, and transformers. The Contractor shall make proper provisions and give proper notification so that new utilities and equipment can be installed without unnecessary inconvenience to the public. The Contractor shall give sufficient written notice to property owners adjacent to proposed work.

141.05 Interruption of Services

Before starting site work, the Contractor shall plan and coordinate the disconnection or interruption of all services; such as water, sewer, cable television, telephone, gas, electric power, and traffic. Disconnection and/or interruptions shall be made in accordance with the regulations of the utility that controls the supply of the service. Whenever the flow of traffic is affected, a Traffic Control Plan shall be provided in

accordance with Section 141.13 TRAFFIC CONTROL, BARRICADES, AND WARNING SIGNS, of these DESIGN STANDARDS AND SPECIFICATIONS.

The Town Public Works & Utilities Department shall provide a representative to be on site to observe and approve the Contractor's disconnection or interruption of the water and sewer services. Forty-eight (48) hours prior to the interruption of service, the Contractor shall notify all users whose service shall be interrupted in order for them to make provisions for necessary water storage. The notification shall, at a minimum, include the following information:

- Service type
- Area affected (location, street, and block)
- Date of shutdown
- Time of shutdown
- Duration of shutdown
- Contractor Contact Information (24-hour availability)
- Recommendations such as storing drinking water for consumption, cooking, or toilet flushing during the outage.

No line in service shall be shut down for more than a six- (6) hour period at one time. Prior approval by the Town Engineer is required for all shutdowns.

141.06 Protection of Paved Surfaces

Contractor shall be responsible for any damage to the street surface resulting from the Contractor's operation.

141.07 Protection of Storm Sewer Systems, Streams, Lakes, and Reservoirs

The Developer or Contractor shall take all necessary precautions to prevent pollution of streams, lakes, and reservoirs with fuel, oil, bitumen, calcium chloride, or other harmful materials.

They shall conduct and schedule their operations to avoid or minimize siltation of streams, lakes and reservoirs.

A storm water management plan shall be submitted to the Town Engineer for approval before starting work and shall conform to all local, state, and federal regulations.

A plan for erosion protection shall be submitted to the Town Engineer for approval before starting work and shall conform to all local, state, and federal regulations. Refer to Section 630 EROSION CONTROL of these DESIGN STANDARDS AND SPECIFICATIONS.

141.08 Protection of Public and Private Installations

The Contractor shall take proper precautions at all times for the protection of and replacement or restoration of driveway culverts, street intersection culverts or aprons, storm drains or inlets, fences, irrigation ditches, crossings and diversion boxes, mail boxes, shrubbery, flowers, ornamental trees, driveway approaches, and all other public and private installations that may be encountered during construction. The Contractor shall have the responsibility of providing each property with access to and from the property during the time of construction. Existing driveways shall be cut, filled, and graded as required and as directed by the Town Engineer to provide permanent access. Existing driveways shall be

resurfaced with the presently existing type of surfacing whenever the existing surface is destroyed.

141.08.01 Existing Structures and Utilities to Remain

All existing poles, wires, fences, property line markers and other structures which, in the opinion of the Town Engineer, shall be preserved in place without being temporarily or permanently relocated shall be carefully supported and protected from damage by the Contractor.

Underground utilities may exist within or immediately adjacent to areas of proposed construction. Where possible, locations of such utilities shall be indicated on the approved plans. The completeness and accuracy of the utility locate information presented is unverified and without guarantee. Utility locate information is supplied to provide the Contractor with approximate locations of utilities in and near proposed construction areas to anticipate probable or possible obstructions and the extent to which construction may be affected.

All utility services shall be supported by suitable means so that services do not fail during construction or if settling of soils occurs. Where any shallow pipe exists or is constructed that may have been distressed by the Contractor's construction operations, the Town may require the Contractor to submit video footage of the pipe for inspection. Developer and Contractor shall be responsible for the repair of underground pipes, wires, or conduits damaged by them or their subcontractors.

141.08.02 Relocation, Removal and Replacement of Existing Structures and Utilities

If the Contractor encounters structures and/or utilities in conflict with the proposed work, they shall be relocated or removed and replaced.

Abandonment or removal of the Town utilities shall be performed in accordance with Section 312.04 PIPE AND APPURTENANCES of these DESIGN STANDARDS AND SPECIFICATIONS.

141.08.03 Correcting Damage

In the case of damage, repairs and/or replacements shall be made at the Contractor's expense. The Contractor shall notify the property owner of the type and extent of the damage. The Contractor and property owner shall agree to a time schedule to repair the damage. If the property owners do not wish to make the repairs themselves, the Contractor shall repair the damage. If the damage is not repaired within the time frame to which the property owner and the Contractor agree, the Town may order repairs to be made at the Contractor's expense.

141.08.04 Tree Protection Zone

Construction activities located in or adjacent to any of the Town Park or right-of-way landscaping shall provide tree protection in the form of a six- (6) foot-high chain-link fence. Fencing shall be erected at the canopy dripline prior to any work on the site and shall remain in place until construction is complete. Protection requirements shall extend to neighboring trees overhanging the site. No storage of material, topsoil, vehicles, or equipment shall be permitted within the tree protection zone. The applicant shall be responsible for damage to protected trees during the course of construction.

141.09 Protection and Restoration of Property and Survey Monuments

The Developer and Contractor shall use every reasonable precaution to prevent the damage or destruction of public or private property, such as poles, trees, shrubbery, crops, fences, and survey monuments adjacent to or interfering with the work, and all overhead structures such as wires or cables within or outside of the rights-of-way.

Wherever necessary or directed by the Town Engineer, the Contractor shall erect and maintain a fence or railing around any excavation or work site. The Contractor will also place a sufficient number of amber lights about the work site and keep them burning from twilight until sunrise. The Contractor shall employ one (1) or more watchmen for additional security wherever they are needed or required by the Town.

The Contractor shall not prevent the flow of water in the gutters of the street and shall use proper means to permit the flow of surface water along the gutters while the work is progressing.

The Contractor shall protect and carefully preserve all land boundary and the Town survey control monuments. Any monument that may be disturbed shall be referenced and replaced by a Colorado Registered Professional Land Surveyor. All monuments disturbed or removed by the Contractor, through negligence or carelessness on his part or on the part of his employees or subcontractors, shall be replaced at the Contractor's expense. Replacement of any monument shall be completed in accordance with the requirements set forth in Section 141.11 Survey Monuments of these DESIGN STANDARDS AND SPECIFICATIONS.

Developer and Contractor shall be responsible for the damage or destruction of property resulting from neglect, misconduct, or omission in his manner or method of execution or nonexecution of the work, or that is caused by defective work or the use of unsatisfactory materials. Developer and Contractor shall restore such property to a condition similar or equal to that existing before such damage or injury occurred by repairing, rebuilding, or replacing it as may be directed, or they shall otherwise make good such damage or destruction in an acceptable manner.

Developer and Contractor shall be liable for all damage caused by storms and fire and shall, under no circumstances, start fires without first securing the necessary permits and approval of the authority having jurisdiction even though they may be ordered or required to conduct such burning. When burning brush, stumps, or rubbish, care shall be taken to avoid any damage to any standing trees, shrubs, or other property.

141.10 Surveys

Surveys shall conform to the latest edition of the Colorado Bylaws and Rules of Procedures and rules of Professional Conduct of the State Board of Registration for Professional Engineers and Profession Surveyors.

141.11 Survey Monuments

Permanent survey monuments, including the replacement of monuments, range points, and lot pins, shall be set in accordance with the requirements of Articles 51 and 53 of Title 38, *Colorado Revised Statutes*, and as required by the Bylaws and Rules of Procedure of the Colorado State Board of Registration for Professional Engineers and Professional Land Surveyors.

141.12 Dust Control

The Contractor shall take all necessary steps to control dust that arises from operations connected with the work. When ordered by the Town Engineer, the Contractor shall dust control the construction area by sprinkling the site with water, by constructing windrows, applying soil binders, or as otherwise directed by the Town Engineer.

141.13 Traffic Control, Barricades, and Warning Signs

All construction, maintenance, park or utility work being completed within the public rights-of-way shall have a Traffic Control Plan (TCP) approved by the Town Engineer. The TCP is a plan for guiding and handling traffic safely through the construction work zone. The TCP shall provide safe methods for movement of pedestrians, bicyclists, and motorists through the work zone, as well as a safe area for all workers engaged in the construction activity. The TCP shall show the location, spacing and scheduling of the advance warning signs, barricades, pavement markings, and other control devices. All traffic-control devices shall be installed and maintained in accordance with the *Manual on Uniform Traffic Control Devices (MUTCD)* and the *CDOT Work Zone Safety Handbook*, latest editions.

Requirements contained in these manuals shall be strictly enforced during the progress of the work.

The TCP shall be job-specific. For the Town Engineer to approve a TCP, it shall contain—at minimum—a scaled drawing showing the project area and the street(s) that are affected by the project. The drawing shall include the following information:

- A. Location and spacing of properly planned traffic-control devices
- B. The length of time that the construction shall be in progress.
- C. The name and phone number(s) of the Contractor's designated Traffic Control Supervisor
- D. Any special notes or information on how the traffic control operation is to be handled

The Contractor shall be responsible for the following:

- A. Obtaining a ROWP from the Town
- B. Providing timely notification to, and coordination with, all affected agencies, including the following:
 - 1. Rocky Mountain Fire District
 - 2. Boulder County Sheriff
 - 3. Town Engineer and Town Construction Inspector
 - 4. Town Public Works & Utilities Department
 - 5. Utility companies
 - 6. Regional Transportation District
- C. Informing occupants of abutting properties of access limitations due to the work
- D. Scheduling and expediting the work to cause the least inconvenience to the public. Construction or repair work shall not be permitted at or in the vicinity of signalized

intersections or on major streets or state highways without advance approval from the Town Engineer and CDOT, as applicable.

- E. Furnishing, installing, and maintaining required traffic-control devices and facilities, as required throughout the life of the contract, including periods when the work is not underway
- F. Providing flaggers when required
- G. Ensuring that survey crews and other employees working in or adjacent to a travel lane wear personal protection equipment, as required
- H. Providing adequate safeguards for workers and the general public
- I. Patrolling the construction site, as required, ensuring that all devices are in place and operating at all times
- J. Removing traffic-control devices when they are no longer needed.

Projects that affect traffic on arterial streets and/or collectors may require an off-duty police officer to direct traffic during peak hours of 7:00 to 9:00 a.m. and 4:00 to 6:00 p.m. Arrangements for officers can be made by contacting the Town Substation for the Boulder County Sheriff at (720)-564-2696 at least one (1) week in advance of the proposed work. Work shall be scheduled and expedited so as to cause the least inconvenience to the public.

Intersections and driveways shall be closed for the minimum amount of time. The Contractor shall coordinate driveway closures with property owners, and the Town Engineer shall provide final approval.

No work is allowed on Holiday-Restricted Streets (major shopping routes) between November 1 and January 1, unless approved by the Town Engineer.

Unless otherwise approved by the Town Engineer, construction operations are limited to half of the roadway at any time. Maintenance activities in arterial streets or collectors shall be planned and scheduled to minimize interference with traffic. Except for emergency situations, no maintenance work shall encroach on a moving traffic lane between the hours of 7:00 and 9:00 a.m. or 4:00 and 6:00 p.m., unless otherwise authorized by the Town Engineer.

All temporary traffic lanes shall be a minimum of ten (10) feet in width, unless otherwise authorized. In addition, lane clearance shall be a minimum of five (5) feet from an open excavation and two (2) feet from a curb or other vertical obstruction.

Suitable surfaces shall be provided for all temporary traffic lanes in work areas. When traffic is diverted from existing pavement, temporary surfaces shall be provided, as required by the Town Engineer.

Construction equipment not actively engaged in construction, employee vehicles, and official vehicles of the agency shall not be parked in the vicinity of the work if doing so further restricts traffic flow. Vehicles and equipment in continuous or frequent use may be operated or parked in the same traffic lane as the work obstruction. Construction spoils or materials may be similarly stored in this area or on the nearby roadway or sidewalk area, provided that four (4) feet of sidewalk is kept clear for pedestrian use. To

prevent the spoil bank from occupying too great a space at its base, toe boards may be used to keep it two (2) feet from the edge of the excavation on one side and two (2) feet from the edge of the traffic lane on the other.

Whenever necessary, trenches and excavations shall be bridged to permit unobstructed traffic flow.

- A. Bridging shall be secured against displacement by using adjustable cleats, angles, bolts, or other devices.
- B. Bridging shall be installed to operate with minimum noise.
- C. The trench shall be adequately shored, to support the bridging and traffic.
- D. Steel plates used for bridging shall extend a minimum of one (1) foot beyond the edges of the trench. Temporary paving materials shall be used to feather the edges of the plates to minimize wheel impact.
- E. Steel plates used for bridging shall be designed by a Colorado Registered Professional Engineer.

When the work area encroaches upon a sidewalk, bike lane, or walkway crosswalk area, special consideration shall be given to pedestrian and bicyclist safety. Effort shall be made to separate pedestrians and bicyclists from the work area.

All work shall be barricaded at all times. Between sunset and sunrise, the work area shall be properly lighted. The Contractor shall be responsible for all damage to the work due to the failure of barricades, signs, lights, flaggers, and/or watchers.

141.14 Use of Explosives

Detonation of explosives by Developers or Contractors shall only be by permit by the Town Manager.

The following information shall be submitted to the Town Manager (or a designee) at least thirty (30) days prior to the detonation of explosives:

- A. A graphic plan showing locations of proposed explosive use and improvements (including structures, wells, waterways, irrigation ditches, etc.) on the property, surrounding land uses, and improvements on adjacent properties within a distance equal to one thousand (1000) feet, plus the maximum distance of vibration, as specified in the report described below
- B. A geotechnical report prepared by a Colorado Registered Professional Engineer describing the geology of the area and the impacts of explosive use in the area, including wave attenuation and travel distance and potential impacts on improvements in the area
- C. An analysis of alternatives to explosives, including safety, time, and monetary comparisons of all alternatives

The Developer or Contractor shall use the utmost care to protect life and property when engaging in the detonation of explosives. Audible signals warning persons of danger shall be given before detonation of

explosives.

If the Town permits detonation of explosives within the Town, the Developer or Contractor shall submit to the Town Manager (or a designee) a Certificate of Insurance for coverage of detonation of explosives in the minimum following amounts: \$2,000,000 for property damage, per accident; and \$2,000,000 for public liability of bodily injury (single limit or equivalent), per accident. The Town shall be named as an additional insured on the insurance policy.

141.15 Storage of Explosives

In addition to the Town requirements for the use of explosives, the Developer or Contractor shall obtain a Fire District permit for the storage, handling, and use of explosives.

142.00 USE OF TOWN WATER

The Contractor may obtain permission to use the Town's water during construction, as follows:

- A. Requesting that the Public Works & Utility Department install a meter and appurtenances on a hydrant and agreeing to pay the applicable fees and deposits
- B. Agreeing to pay water-utility charges for installation, use, and removal of that meter, as well as for all damage (other than normal wear) to that meter
- C. Notifying the Public Works & Utility Department immediately when use of the meter is no longer required

143.00 PAVEMENT CUTS

Whenever possible, underground utility installations crossing arterials or streets that have been constructed, reconstructed, or overlaid within the past five (5) years shall be done by boring, except when emergency repairs are needed.

All street cuts shall be saw-cut prior to street patching. An approved asphaltic patch, roto milling, or base course trench surfacing shall be completed on the same day as the street cuts are made, unless the Town Engineer approves otherwise. The Contractor shall make every effort to install permanent hot-mix asphalt patches within twenty-four (24) hours of the utility installation completion. If permanent patches cannot be installed in this time frame, then the Contractor shall place temporary cold-mix asphalt patches in all street cuts immediately after completing backfill and compaction. Cold mix, roto milling, or base course shall be maintained free of surface ruts, and the street shall be cleaned of mud and dust until the permanent resurface is in place. Pavement cuts shall have permanent patching within five (5) working days, unless otherwise approved by the Town Engineer.

The applicant shall be responsible for maintenance of the permanent patch for a period of one (1) year.

When pavement cuts are required, the following conditions shall be met to avoid interfering with traffic:

- A. Pavement cuts in streets shall be open only between 9:00am and 4:00pm

- B. Two-way traffic shall be maintained at all times around the construction area. A TCP shall be prepared in accordance with Section 141.13 Traffic Control, Barricades, and Warning Signs of these DESIGN STANDARDS AND SPECIFICATIONS and shall be submitted to the Town Engineer for approval prior to the start of construction.

143.01 Pavement Cut-Repair Requirements

Pavement cut repairs shall be performed in accordance with the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS.

144.00 CABLE INSTALLATION

144.01 General

Unless otherwise approved in writing by the Town Engineer, all cable installation shall be within public rights-of-way or within a dedicated utility easement. All cables shall be installed at a minimum depth of twenty-four (24) inches, in accordance with the requirements of Article 300-5 of the NEC.

144.02 Underground Installation

All underground installations shall be in accordance with Article 300-5 of the NEC.

144.03 Overhead Installation

All overhead installations shall be in accordance with Article 230-24-(b) of the NEC.

150.00 PERMITS AND INSPECTIONS

151.00 RIGHT-OF-WAY PERMIT, GRADING PERMIT, AND STORM WATER QUALITY PERMIT

It shall be unlawful for any person, organization, firm, or corporation to construct, enlarge, alter, repair, relocate, improve, remove, excavate, convert, or demolish any public improvements or common facilities regulated by these DESIGN STANDARDS AND SPECIFICATIONS without first obtaining either a Right-of-way Permit, a Grading Permit, and/ or a Storm Water Quality Permit for such work from the Town.

151.01 Application for Permit

All the Town construction-related permits may be found online at the Town's website (www.SuperiorColorado.gov) or by visiting the Public Works & Utilities Department. Available permits include

- A. Right-of-way Permit
- B. Grading Permit
- C. Storm Water Quality Permit

An Applicant for a permit who is the owner or joint owner of the facilities involved shall complete and submit the application on the form furnished by the Public Works & Utilities Department at least five (5) working days prior to the anticipated starting date, except in case of emergency. Each application shall

- A. include the name, address, and telephone number of the developer, contractor, or subcontractor licensed to perform work in the public right-of-way, including the name and telephone number of an individual who will be available at all times during construction.
- B. identify and describe the work to be covered by the permit for which the application is made.
- C. describe the land on which the proposed work is to be done by legal description, street address, or similar description that shall readily identify and clearly locate the proposed work.
- D. indicate the type of work or improvement intended.
- E. be accompanied by plans, diagrams, computations and specifications, and other data as required in these DESIGN STANDARDS AND SPECIFICATIONS.
- F. be accompanied by a TCP, as defined in these DESIGN STANDARDS AND SPECIFICATIONS.
- G. state the valuation and the quantities of the work to be performed.
- H. be signed by the Applicant or an authorized agent, the latter of whom may be required to submit evidence to indicate such authority.
- I. submit starting and completion dates.
- J. provide other data and information that the Town requires.
- K. include all applicable fees.

151.02 Permit Issuance

The application, plans, specifications and other data filed by an Applicant for a permit shall be reviewed by the Town Engineer. If the Town Engineer finds that the work described in an application for a permit conforms to the requirements of these DESIGN STANDARDS AND SPECIFICATIONS, other pertinent laws and ordinances, and that all required fees have been paid, a permit may be issued.

Permitted plans require a signed Town Statement, per Section 161.02.01 DESIGN STANDARDS AND SPECIFICATIONS Compliance Statement of these DESIGN STANDARDS AND SPECIFICATIONS. The approved plans and specifications shall not be changed, modified, or altered without authorization from the Town Engineer, and all work shall be performed in conformance with the approved plans. One set of approved plans, specifications, and computations shall be retained by the Town, and the Contractor shall maintain one set shall be maintained at the work site at all times during the progress of the work.

A preconstruction conference may be required prior to the issuance of any construction permits. Attendance shall include the Town Engineer, the Town Construction Inspector, the Developer or Owner, the Design Engineer, the General Contractor, the Sub-Contractors, and others as appropriate. The Contractor will notify the Town two (2) working days before construction is to begin.

The issuance of a permit shall not be construed as a permit for, or approval of, any violation of the provisions in these DESIGN STANDARDS AND SPECIFICATIONS, or of any other regulations of this jurisdiction. No permit that presumes to give the Contractor authority to violate or cancel the provisions in these DESIGN STANDARDS AND SPECIFICATIONS shall be considered valid.

The issuance of a permit based on plans, specifications, or other data shall not prevent the Town from requiring the correction of errors in the plans, specifications, or other data, nor shall any such issuance prevent the Town from stopping construction operations that are in violation of these DESIGN STANDARDS AND SPECIFICATIONS or of any other regulations of this jurisdiction.

151.03 Permit Expiration

Every permit issued by the Town under the provisions of this section shall expire if the work authorized by the permit is not substantially completed by the date noted on the permit.

Any Applicant holding a valid permit may apply, in writing, for an extension of the completion date on the permit. Such requests shall be based on good cause, and the Town must find them to be acceptable. In such cases, the Town may extend the completion date for up to six months without an additional fee, provided that circumstances beyond the control of the Applicant have prevented completion of the work. If substantial changes have been made to the project, or if more than six (6) months have passed since the permit expiration date, the Applicant shall apply for a new permit. Permit fees will be assessed for the new application.

151.04 Permit Suspension or Revocation

The Town Engineer may suspend or revoke any permit issued under the provisions of these DESIGN STANDARDS AND SPECIFICATIONS. Suspension or revocation of a permit may occur when the permit is (a) issued in error, (b) based on incorrect information supplied by the Applicant, or (c) issued in violation of any ordinance or regulation, or in violation of any of the provisions of these DESIGN STANDARDS AND SPECIFICATIONS. No refund of permit fee shall be made for a revoked or a suspended permit.

152.00 PERMIT FEES

The permit fees shall be per the Town's approved fee schedule. Fees shall be calculated on a cumulative basis. The permit fee shall be paid in full at the time when the Town approves the plans and specifications and the permit is issued. The plan-review fee shall be paid in full at the time the plans and specifications are approved by the Town and the permit is issued. The plan-review fee shall be fifty percent (50%) of the permit fee.

A permit application shall expire if no permit is issued within one-hundred eighty (180) days of the date of application. Plans and other data submitted with the expired permit application may be returned to the Applicant or destroyed by the Town. The permit issuance period may be extended by the Town for a period up to one-hundred eighty (180) days. Such an extension shall be based upon a written request from

the Applicant showing that circumstances beyond the control of the Applicant have prevented action from being taken. In this case, a permit extension of one-hundred eighty (180) days from the expiration date noted on the permit may be granted without an additional fee. No application shall be extended more than once. To renew action on an expired application, the Applicant shall resubmit plans and pay a new plan-review fee.

The fees for the installation of certain public utilities (e.g., underground electrical lines, gas lines, telephone cables, and TV cables) and for the construction of the Town's Capital Improvement Projects may be reduced or waived by the Town.

153.00 INSPECTIONS

All construction work that requires a Right-of-way Permit or Grading Permit shall be subject to inspection by the Town Engineer or Town Construction Inspector.

It shall be the responsibility of the person performing the authorized work to notify the Town Engineer or Town Construction Inspector when such work is ready for inspection. Every request for inspection shall be filed at least two (2) working days before such inspection is desired unless otherwise stated in these DESIGN STANDARDS AND SPECIFICATIONS. An inspection request may be in writing or by telephone, at the option of the Town Engineer.

It shall be the responsibility of the person requesting an inspection required by these DESIGN STANDARDS AND SPECIFICATIONS to provide access to and means for proper inspection of all work. All work shall be inspected by the Town Engineer or Town Construction Inspector. The Town Engineer has the authority to halt construction when the Contractor is not following, in his opinion, these DESIGN STANDARDS AND SPECIFICATIONS and/or standard construction practices are not being followed, or the work is otherwise defective. Whenever any portion of these DESIGN STANDARDS AND SPECIFICATIONS are violated, the Town Engineer shall give the Contractor written notice listing deficiencies to be corrected and may order further construction stopped until all deficiencies are corrected. If the deficiencies are not corrected within the time limit specified in the notice, the Town Engineer may invoke enforcement options authorized by the *Superior Municipal Code* and/or draw upon the performance guarantees under which the work is being performed.

The procedure for final inspection and acceptance is specified in Section 200 ACCEPTANCE PROCEDURES of these DESIGN STANDARDS AND SPECIFICATIONS or the contract documents.

153.01 Additional Inspections and Reinspections

The Town Engineer or Town Construction Inspector may make or require additional inspections of any work, as deemed necessary to ascertain compliance with the provisions of these DESIGN STANDARDS AND SPECIFICATIONS and other provisions of the *Superior Municipal Code*. The Contractor shall be present, shall have approved plans available on site, and shall ensure that the work is accessible and ready for inspection. The Contractor shall not request an inspection if the work is incomplete, not ready for inspection, or when previously identified corrections have not been made.

160.00 PLANS AND SPECIFICATIONS

Plans, specifications, engineering calculations, diagrams, utility reports, drainage reports, traffic analysis reports, geotechnical studies, earthen cut/fill investigations, and other data shall be submitted in one or

more sets, as required by the Town Engineer, with each application for a permit. The Town shall require that plans, computations, and specifications be prepared and designed by a Colorado Registered Professional Engineer. Landscape plans shall be prepared and designed by a licensed landscape architect or Professional Engineer. Record Documents shall be prepared as required in Section 211.02 RECORD DOCUMENTS of these DESIGN STANDARDS AND SPECIFICATIONS. If the Design Engineer responsible for the original approved engineering construction drawings is replaced prior to preparing Record Documents, the replacement Design Engineer shall agree in writing to accept the responsibility for the final approval and the acceptance of the public improvements. The plans shall not be inspected for compliance with the DESIGN STANDARDS AND SPECIFICATIONS by the Design Engineer.

EXCEPTION: The Town Engineer may waive the submission of plans, calculations, etc., if the Town Engineer finds that the nature of the work is such that a review of plans is not necessary to ensure compliance with these DESIGN STANDARDS AND SPECIFICATIONS.

161.00 CONSTRUCTION PLAN REQUIREMENTS

Construction Plans shall be required for all

- A. Final Development Plans
- B. Projects involving infrastructure construction serving multiple lots
- C. Town projects involving roadways, water, sanitary sewers, or storm sewers improvements

All construction plans shall be checked for conformance with the DESIGN STANDARDS AND SPECIFICATIONS prior to approval by the Public Works & Utilities Department.

Engineering design shall remain the responsibility of the professional Design Engineer. Final plans shall be submitted to the Public Works & Utilities Department for review prior to approval. This set shall be returned marked with changes that are required or recommended.

161.01 Construction Plan Submittal Requirements

Upon final approval by the Town, submit the following:

- A. Five (5) sets of the construction plans, unbound, 22-inch x 34-inch white paper, with easy-to-read font size, signed and sealed by a Colorado Registered Professional Engineer. Landscape and irrigation plans shall be sealed by either a licensed Landscape Architect or a Professional Engineer. Each plan shall have a cover sheet with the Town Statement and signature line. See Section 161.02.01 DESIGN STANDARDS AND SPECIFICATIONS Compliance Statement of these DESIGN STANDARDS AND SPECIFICATIONS. The Developer or Engineer shall submit paper sets (22 inches x 34 inches”), signed and sealed by a Colorado Registered Professional Engineer for signature by the Town to be returned to the Developer.
- B. An AutoCAD digital copy of the construction plans. Confirm version acceptability with the Town’s GIS Division. Cross-referenced files shall be tied to the Town’s GPS network system.

- C. A PDF digital copy of the construction plans.

The Contractor shall keep a set of the signed approved plans on the job site for the duration of the project. Should circumstances warrant changes to the approved plans or specifications, written approval shall be obtained from the Town Engineer. Copies of approved revisions shall be given to the Developer or Contractor and the Design Engineer. It shall be the duty of the Design Engineer and the Contractor to record all changes on the Record Documents as they occur. Record Documents shall be submitted at the completion of the project, in compliance with Section 200 ACCEPTANCE PROCEDURES of these DESIGN STANDARDS AND SPECIFICATIONS.

161.02 General Requirements

Plans and specifications shall adhere to the following general requirements:

- A. be developed for a 22-inch x 34-inch format.
- B. have text with an easily read font size one-eighth (1/8) inch in height minimum.
- C. be drawn to scale, at a scale that is clear and easy to read.
- D. have sufficient clarity to indicate the location, nature and extent of the proposed work.
- E. provide sufficient detail to demonstrate conformance with the provisions of these DESIGN STANDARDS AND SPECIFICATIONS and relevant laws, ordinances, rules and regulations.

The following items shall be shown on all plans:
Title Block (lower right-hand corner preferred)

- A. Scale (for 22-inch x 34-inch drawings, 1 inch = 50 feet or 1 inch = 5 feet.)
- B. Date and revision
- C. Name of Professional Engineer or firm
- D. Professional Engineer's seal and signature
- E. Drawing number(s)
- F. DESIGN STANDARDS AND SPECIFICATIONS Compliance Statement

Each set of construction plans shall include:

- A. Cover or title sheet that identifies the project, Developer, and the design professionals and date of the documents
- B. General Notes supplied by the Town and contained in this section. Additional project specific information may be provided as Supplemental Notes.

- C. Material Lists identifying the type, size and quantity of materials to be installed
- D. Vicinity Map with sufficient detail to locate the project
- E. Overall summary drawings at a reasonable scale (1 inch = 100 feet, for example). The summary drawing(s) shall show all water, reuse-water, sanitary-sewer, storm-drainage and street facilities to be completed, and other pertinent information that would add to the overall understanding of the project.

161.02.01 DESIGN STANDARDS AND SPECIFICATIONS Compliance Statement

The following Town Statement shall be placed on the cover sheet of all drawings, including landscape and irrigation plans. The Town Statement shall be located in the lower right-hand corner, near the title block on the cover sheet. The following is the Town Statement:

“All work shall be constructed to Town of Superior DESIGN STANDARDS AND SPECIFICATIONS. These drawings have been reviewed and found to be in general compliance with these DESIGN STANDARDS AND SPECIFICATIONS and other Superior requirements. **THE ENGINEERING DESIGN AND CONCEPT REMAINS THE RESPONSIBILITY OF THE PROFESSIONAL ENGINEER WHOSE STAMP AND SIGNATURE APPEAR HEREON.**”

_____	_____
Public Works & Utilities Director (or Designee)	Date
_____	_____
Town Civil Engineer (or Designee)	Date
_____	_____
Utilities Superintendent (or Designee)	Date
_____	_____
Rocky Mountain Fire Chief (or Designee)	Date

The following Statement shall be placed on all landscape and irrigation plans:

“All work shall be constructed to Town of Superior DESIGN STANDARDS AND SPECIFICATIONS. This drawing has been reviewed and found to be in general compliance with these DESIGN STANDARDS AND SPECIFICATIONS and Superior requirements. **THE DESIGN AND CONCEPT REMAINS THE RESPONSIBILITY OF THE PROFESSIONAL LANDSCAPE AND IRRIGATION SYSTEM DESIGNER WHOSE SIGNATURE APPEARS HEREON.**”

_____	_____
Parks Maintenance Superintendent (or Designee)	Date

161.02.04 Variance Statement

Any proposed variance from these DESIGN STANDARDS AND SPECIFICATIONS shall be submitted as a written request to the Town.

The following is the Variance Statement (if necessary):

The Applicant is requesting a variance from the Town of Superior DESIGN STANDARDS AND SPECIFICATIONS for the following:

1. (List all applicable items)

_____	_____
Town (or Designee)	Date

161.03 Plan Details

- A. Vicinity map
- B. Key map and sheet index
- C. Legend containing all symbols used in the plans, usually located on a general or summary plan or sheet of the plan
- D. All proposed and existing buried infrastructure on a single plan. For areas where showing all proposed and existing infrastructure provides too much information for readability at 1 inch = 50 feet scale, provide blown-up details at reduced scale for clarity (1 inch = 20 feet or 1 inch = 10 feet, for example).
- E. North arrow
- F. Property lines; indicate lots to be served by solid lines; other property lines dotted, all consistent with the project legend
- G. Ownership or subdivision information
- H. Street names and easements, with width dimensions
- I. All other pertinent structures (including, but not limited to, houses, curbs, and water courses)
- J. Utility conflict areas
- K. Match lines
- L. References to detail sheets
- M. Pothole locations and data

161.04 Profile Details

- A. Vertical and horizontal grids with scales
- B. Ground surfaces, both existing (dotted) and proposed (solid)
- C. Existing utility lines crossing or in close proximity to the work. The intent is to provide sufficient information to avoid conflicts with (or damage to existing utilities. Use blown-up, reduced-scale details for clarity.
- D. Benchmarks, with all elevations referenced to one or more of the Town's GPS Monuments
- E. Existing manhole invert and rim elevations and identification number(s)
- F. Use blown-up, reduced-scale details for clarity

161.05 Water Supply Construction Details

In addition to the above general plan and profile details, all water-supply construction plans shall include the following items:

- A. Proposed water mains – general plan: including a summary table with all pipe sizes, material specification references (e.g., AWWA C900), pressure class, and approximate quantity by size and pressure class
- B. Proposed water mains (plans and profiles):
 - 1. Diameter
 - 2. Length
 - 3. Materials and types of joints
 - 4. Location dimensions, both existing and proposed
- C. Fittings:
 - 1. Tees
 - 2. Crosses
 - 3. Reducers
 - 4. Bends
 - 5. Plugs
 - 6. Blow-offs
 - 7. Air/vacuum valves
 - 8. Restraints
- D. Valves, including existing
- E. Fire hydrants
- F. Plan, profile and complete details for off-site transmission mains, pump stations, special valves, vaults, tanks, etc

- G. Complete material list for each plan and profile drawing
- H. Sequence of construction

161.06 Sanitary-Sewer Construction Details

In addition to the general plan and profile details, all sanitary-sewer construction plans shall include the following:

- A. Proposed sanitary-sewer mains – general plan: Provide a summary table with all pipe sizes, material specification references (e.g., ASTM C-76), strength class, and approximate quantity by size and strength class
- B. Proposed sanitary-sewer mains (plan and profile)
 - 1. Diameters
 - 2. Materials
 - 3. Gradients
 - 4. Flow direction arrows
 - 5. Lengths between manholes
 - 6. Underdrains
- C. Proposed manholes, cleanouts, and grease interceptors
 - 1. Stationing and other number designation
 - 2. Elevation of inverts, in and out of manholes
 - 3. Elevation of manhole rims
- D. Location control dimensions
- E. Manhole stub-outs
- F. Proposed future extensions
- G. Proposed wye and riser connections for services
- H. Proposed service connections or stub-ins
- I. Proposed underdrain system plan and profile
- J. Proposed concrete encasement
- K. Proposed cut-off walls
- L. Complete material list for each plan and profile drawing
- M. Sequence of construction

161.07 Storm Drainage Construction Details

The Storm Drainage Construction Plan shall be designed in accordance with any and all applicable Master Plans. In addition to the above general plan and profile details, all Storm Drainage Construction

Plans shall include the following:

- A. Proposed storm drainage – general plan: Provide a summary table with all pipe or conduit sizes, material specification reference (e.g., ASTM C-76), strength class, and approximate quantity by size and strength class.

- B. Overall drainage-area plan showing:
 - 1. North arrow
 - 2. Contours (maximum two (2) foot intervals)
 - 3. Location and elevation of the Town benchmarks
 - 4. Property lines
 - 5. Boundary lines (counties, districts, tributary areas, etc.)
 - 6. Streets, with street names and approximate grades
 - 7. Subdivision (name and location by section)
 - 8. Existing irrigation ditches, including ditch name(s) and ownership(s)
 - 9. Existing drainage ways, including gutter flow directions
 - 10. Drainage sub-area boundaries
 - 11. Easements required
 - 12. Proposed curbs and gutters, with gutter flow directions
 - 13. Proposed crosspans, with flow directions
 - 14. Proposed piping and open drainage ways
 - 15. Underdrain system connections to storm-sewer system
 - 16. Flow calculations for 2-, 5-, and 100-year storm runoff
 - 17. Path of 100-year storm runoff flows
 - 18. Critical minimum finished floor elevations for protection from 100-year runoff
 - 19. Proposed inlet locations and inlet sizes
 - 20. Roadway edge drain connections to storm sewer

- C. Proposed pipes:
 - 1. Plan showing stationing and flow direction arrows
 - 2. Profile
 - 3. Hydraulic Grade Line for 5-year and 100-year storm events
 - 4. Energy Grade Line for 5-year and 100-year storm events
 - 5. Pipe diameter, length, material, and strength class
 - 6. Grades
 - 7. Inlet and outlet details, including station number, structure designation, dimensions, and invert elevations
 - 8. Manhole details, including station number, manhole designation, diameter or dimensions, and invert elevations
 - 9. Typical bedding detail

- D. Proposed open channels:
 - 1. Plan showing stationing
 - 2. Profile
 - 3. Grades
 - 4. Typical cross-section(s), with major and minor storm event water surface elevations
 - 5. Lining details
 - 6. Water surface profile
 - 7. Energy grade line

- E. Proposed special structures (manholes, headwalls, open channel structures, trash gates, etc.):
 - 1. Plan
 - 2. Elevation
 - 3. Details of design and appurtenances

161.08 Street Construction Details

In addition to the above general plan and profile details, all Street Construction Plans shall include the following:

- A. Key map (sheet index)
- B. Overlot Grading Plan
- C. Typical sections of street construction, showing structure, dimensions, and pavement design(s)
- D. Existing irrigation ditches to be removed or piped
- E. Proposed curb, gutter, and sidewalk
- F. Proposed crosspans, including flow direction
- G. Stormwater drainage facilities
- H. Location and elevation of the Town GPS Monument bench marks.
- I. Horizontal curve data, with radii, tangents, points of curvature, (P.C.), intersection (P.I.) and tangency (P.T.)
- J. Stations and elevations of radius points (back of curb)
- K. Proposed profile of centerlines and curb flow lines, and property lines, with horizontal stationing and percent slope
- L. Proposed roadway lateral drains, edge drains, including depth, flow direction, discharge locations, cleanout locations, and cross-section details
- M. Stations, lengths, and elevations of vertical curve P.C., P.I. and P.T.
- N. Turning templates for all truck routes, docks, and intersections
- O. Percent slope of tangent lines
- P. Limits of construction
- Q. Sufficient information regarding existing or future construction to ensure continuity of construction

- R. Stations and elevations of drainage facilities and other structures
- S. Street light and underground service cable locations
- T. Street sign locations

161.09 Area Grading Plan Details

All construction plans shall include an Area Grading Plan that includes all pertinent information necessary to construct a structure on each lot. The Area Grading Plan shall follow the approved Drainage Plan. At a minimum, the following shall be included:

- A. Grading and drainage patterns of existing lots adjacent to subdivision
- B. Lot types (A, B, Transitional (T), Walkout (WO), Garden Level (GL), etc.)
- C. Lot corner elevations
- D. Building top of foundation (T.O.F.) elevations
- E. Lower limits of over-excavation elevations
- F. Elevations of ground outside of building to ensure proper drainage away from the foundation
- G. Elevations and grades of all drainage swales and side lot lines
- H. Elevations of all high points
- I. Drainage easements on and adjacent to subject property

161.10 Erosion Control Plan Details

All construction plans shall include an Erosion Control Plan, as specified in Section 630.00 EROSION CONTROL of these DESIGN STANDARDS AND SPECIFICATIONS. Erosion control plan drawings shall use the same base map as that for the Drainage Plan and shall include, at a minimum, the following information:

- A. A general location map with sufficient detail to identify drainage flows entering and leaving the development and general drainage patterns
- B. Major construction (e.g., development, irrigation ditches, existing detention facilities, culverts, and storm sewers) along the path of drainage
- C. Basins and divides, identified with topographic contours
- D. Specifications and details for erosion control measures
- E. A transition grading/drainage plan for construction activities that are phased or

sequenced. All residential developments shall require a transition Grading Plan.

- F. All information required by a Colorado Discharge Permit System (CDPS) stormwater construction permit

161.11 Landscape Details

In addition to the above general plan and profile details, all landscaping plans shall include the following items:

- A. Ownership/dedication, development responsibility, and maintenance responsibility information for each tract and outlot (on the cover sheet), with specified acreages
- B. Grading plans
- C. Property lines for tracts and outlots to be maintained by the Town. These property lines shall be staked, and the stakes shall be maintained by the Developer or Contractor until Construction Acceptance into the Warranty period for the public irrigation and landscaping improvements.
- D. Irrigation and landscaping to be maintained by the Town on separate plan sheets from irrigation and landscaping to be maintained by a private entity, (e.g., a homeowners association or a property management company. If irrigation and landscaping owned by the Town is to be maintained by a private entity, it shall be shown on the plans with red lines and text.
- E. A signature box on the cover sheet for approval by the Superintendent of Parks or designee.
- F. Mower access ramps for median islands.
- G. Provide engineering shop drawings for all park structures, including benches, trash cans, shelters, playgrounds, backstops, etc.
- H. Playground surface materials.
- I. Denotation of sidewalk radii.
- J. Flared sidewalks at intersections.
- K. All applicable Detail Drawings from these DESIGN STANDARDS AND SPECIFICATIONS.
- L. Plant ledger
- M. Plant counts
- N. Sightline triangles based on street speed limits
- O. Existing street lights, utility boxes, manholes, and street signs

- P. Bold line types to indicate landscaping and lightened line types to indicate irrigation
- Q. Delineated native areas and manicured areas
- R. Edger along bed areas adjacent to turf areas
- S. Mulch type (rock, cobble, wood mulch, etc.)
- T. No small, angular areas of turf
- U. Drought tolerant bluegrass in passive parks and R.O.W.
- V. Agronomic rates and percentage of turf
- W. Zone information, including clock letters; zone numbers; valve, head, and nozzle specifications; the number of heads per zone and precipitation rate in GPM/GPH per zone

If irrigation is not installed within one (1) year from the date plans are approved by the Town, the Developer or Contractor may be required to resubmit irrigation plans to the Town for approval.

161.12 Cut and Fill Plan

All subdivisions shall include a cut and fill plan. The cut and fill plan shall use the same base map as the Grading Plan. An Earthen Cut/Fill Investigation is required as part of the Preliminary and Final Geotechnical Reports, as described in Section 162.00 ENGINEERING REPORTS of these DESIGN STANDARDS AND SPECIFICATIONS. A Cut and Fill Plan shall be submitted for any project with proposed cuts and/or fills of more than three (3) vertical feet. The plan shall include the following information:

- A. Limits of cut and fill
- B. Depths of cut and fill (spot locations)
- C. Limits and depths of over-excavation and re-compaction areas
- D. Depth to groundwater at monitoring locations
- E. Slopes (percent)

161.13 Easement Widths

Water, sanitary sewer, reuse or irrigation mains, and storm sewers easements shall be a minimum of thirty (30) feet in width for buried utility lines up to ten (10) feet deep. For utility lines deeper than ten (10) feet, the easement widths shall be calculated according to the formula shown in Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS.

161.14 Specifications and Support Documentation

The following items shall also be included with submitted construction plans:

- A. Reference on plans to the Town of Superior DESIGN STANDARDS AND SPECIFICATIONS
- B. Reference on plans to other agency standards and specifications that are required or proposed
- C. Where reference to other commonly available standards and specifications shall not suffice, copies of specifications are to be provided
- D. Copies of written approval from other affected agencies as required
- E. Where work shall occur outside of the boundaries of the project (over lot grading, for example), copies of written approval from the adjoining private property owners shall be provided
- F. A preliminary pavement design shall be submitted as part of the Final Geotechnical Report, including final construction plans in accordance with requirements set forth in Section 162.02.04 Final Geotechnical Report of these DESIGN STANDARDS AND SPECIFICATIONS. This preliminary pavement design report is only for planning purposes and should not be used for construction. The Town's approval of this preliminary design is required prior to the start of overlot grading operation. Final Pavement Design Report shall be required after completion of utility construction and street grading operations. The requirements for the Final Pavement Design Report are summarized in Section 729.01 Subgrade Investigation of these DESIGN STANDARDS AND SPECIFICATIONS.
- G. Soils and other test data and design calculations for street structural sections, drainage facilities, and other appurtenances as required
- H. Digital copies of all reports, including graphics
- I. Written technical specifications

162.00 ENGINEERING REPORTS

All engineering reports shall include on the title page: (a) the type of report (preliminary or final); (b) the project name; (c) the preparer's name, date, and firm; and (d) Professional Engineer seal of preparer.

Preliminary and final engineering reports shall be organized according to the general outline of required topics presented in the following sections.

162.01 Preliminary Reports

The following preliminary reports shall accompany all Planned Development and preliminary plat applications:

- A. Utility Report (2 copies)
- B. Drainage Report (2 copies)

- C. Traffic Analysis Report (2 copies)
- D. Geotechnical Study and Earthen Cut/Fill Investigation (2 copies)
- E. Earthen Cut/Fill Investigation Report (2 copies)
- F. Additional reports, as required by the *Superior Municipal Code*
- G. A digital copy, in Acrobat Portable Document Format (PDF) that is identical to the hardcopy of all above reports and graphics.

162.01.01 Preliminary Utility Report Requirements

Preliminary utility reports shall include the following information and data as a minimum:

- A. Sanitary Sewer
 - 1. Layout and connection(s) to the Town sanitary-sewer system
 - 2. Average and peak flow rate calculations
- B. Water System
 - 1. Layout and connection(s) to the Town water system
 - 2. Potable water demand peak and average rate calculations
 - 3. Fire flow rate calculations

162.01.02 Preliminary Drainage Report

Drainage report calculations and supporting data, as set forth herein, shall be prepared in accordance with the UDFCD *Urban Storm Drainage Criteria Manual*. The Preliminary Drainage Report shall include as a minimum, the following:

- A. General Information:
 - 1. A drainage plan showing project location, description of the property, acreage, topography, identification of major drainage-ways involved, major drainage basin and sub-basin boundaries, runoff summary table for historic and developer flows, proposed type of development, access and maintenance responsibility, identification of wetlands and a reference to any flood hazard area delineation study, and Drainage Outfall System Master Plan applicable to the site
 - 2. A map of the tributary drainage basin determining the location and magnitude of flows from upstream of the site based on current development or zoning, whichever provides the highest runoff volumes
 - 3. A conceptual drainage plan that shows how intercepted and on-site flows shall be received and transported
 - 4. A discussion of the stormwater quality management approach and proposed water quality features
 - 5. Designated points of discharge from the site, accompanied by a general analysis of how existing downstream facilities shall handle this discharge
 - 6. Required rights-of-way for drainage easements and detention areas
 - 7. A discussion of how site characteristics (e.g., soils, vegetation, and erodibility) shall influence both wind and water erosion

8. A general discussion of the type of erosion control program necessary to prevent sediments from leaving the site
- B. Hydraulic Calculations:
1. Historic and proposed initial and major storm runoff quantities from the site under development. Evaluation of the historic drainage for the initial and major storm shall include:
 - a. Basin length, slope, time of concentration, intensity (show intensity duration curves used), and flow rates. The evaluation of proposed run-off quantities shall be based on the developer's plans for the site. An evaluation shall be performed for the same items listed for historic drainage to the extent that they are known or can be estimated.
 2. Stormwater Detention:
 - a. Stormwater storage volume required
 - b. Location of storage areas. The storage areas shall be shown and designated. If the ultimate land use of one or more parcels is not known, the storage volume required shall be numerically written with a statement that designates how the required storage is to be apportioned as parcels of the larger property are sold off for the ultimate development.

162.01.03 Preliminary Traffic Analysis Report

Required information for the Preliminary Traffic Analysis Report shall include, but not be limited to the following:

- A. Site location and study area boundaries
- B. Existing and proposed uses in vicinity of the site
- C. Existing and proposed roadways and intersections
- D. Existing traffic conditions
 1. a.m. and p.m. peak hour turning movement volumes at nearby intersections
 2. Average daily traffic (ADT) volumes at nearby roadway links
 3. Level of Service (LOS) analyses of nearby intersections
- E. Future background traffic (DRCOG 20-year planning horizon) projections
- F. Future background traffic LOS analyses
- G. Proposed Site Traffic
 1. Trip generation
 2. Trip distribution
 3. Trip assignment
- H. Projected traffic impacts
 4. Short-term
 - a. Existing plus Proposed Site Traffic
 - b. Intersection LOS analysis
 5. Long-term

- a. Future Background plus Proposed Site Traffic
- b. Intersection LOS analysis
- c. Roadway Segment Analysis: Site traffic ADT as an increment of total future ADT

162.01.04 Preliminary Geotechnical Report Requirements

Geotechnical and soils investigation studies are required for foundation design, pavement design, earthen cut/fill analysis, and over excavation and compaction for structures. A preliminary Geotechnical Report shall include the following information at a minimum:

- A. General Information
 - 1. Proposed development, including descriptions of development intensity, roadways, parks, golf courses, ponds, irrigated landscaped areas, utilities, and other structures and/or improvements
 - 2. Historic and present land use, including potential impacts to proposed development such as presence of landfills, open disposal areas, wetlands, leach-fields, mines, and mine waste, etc.
 - 3. Regional and local geological and hydrological description
 - 4. Surface water hydrology and drainage characteristics prior to development as well as groundwater characteristics
 - 5. Number and location of boreholes taken

- B. Site Condition Analysis and Impact Evaluation
 - 1. Analysis and evaluation of geological and hydrological site conditions and potential impacts to the proposed development, such as presences of faults, springs, unstable ground conditions, etc.
 - 2. Analysis and evaluation of site geotechnical engineering conditions and potential impacts to proposed development, such as presence of highly swelling soils, presence of collapsible and/or frost-susceptible soils, slope stability, mine subsidence, etc.
 - 3. Analysis and evaluation of the depth to groundwater prior to development and evaluation of impacts on the groundwater conditions resulting from proposed development;
 - 4. Analysis and evaluation of subgrade soils for support of structures, roadway pavement structures, sidewalks, driveways, curbs, and gutters
 - 5. Preliminary recommendations for subgrade soil stabilization

- C. Site Grading and Earthen Cut/Fill Investigation:
 - 1. Identification of all cut and fill areas exceeding three (3) feet in thickness within the proposed development;
 - 2. Depths to groundwater and bedrock, both prior to and after proposed grading
 - 3. Proposed goals of and reasons for modifying existing topographic conditions. The Town Master Plan requires sensitivity to the existing topographic conditions, and shall not allow artificial mounding to enhance views or create walkout lots
 - 4. Potential adverse conditions from the proposed cut and fill conditions, such as instability, settlement, heave, and the development of perched groundwater
 - 5. Potential impact from the pre-development and estimated post-development groundwater to proposed cut and fill areas
 - 6. Proposed goals, methods, and procedures for evaluating and minimizing risks to

foundations, slabs on grade, and other flatwork, as required by the International Building Code and as amended by the Town

- D. Recommendations for Final Geotechnical Report Scope of Work
1. Recommendations for soils investigations, including number of boreholes, depth of boreholes, sampling frequency, etc.
 2. Recommendations for installation of groundwater monitoring and piezometers in boreholes drilled as part of preliminary geotechnical investigation
 3. Recommendations for any additional studies such as, mine subsidence, geophysical survey, environmental investigation, etc.

E. Soil Sampling and Analyses

The preliminary geotechnical investigation shall include a minimum of two (2) boreholes for each project. The number of boreholes should be dependent on project size and the Geotechnical Engineer's recommendations. The borings shall meet the following requirements:

1. For preliminary pavement design; boreholes shall be advanced to a minimum depth of ten (10) feet below finished roadway grades.
2. For structures, the boreholes shall be extended to a minimum depth of ten (10) feet below the lowest foundation elevation recommended.
3. Borings shall extend deeper (if needed) to determine whether high bedrock or high groundwater levels are a design concern. Areas where the depth of bedrock is within five (5) feet of the lowest roadway structure final elevation should be delineated.
4. Soil samples may be combined to form soil groups consistent with the AASHTO classification, group index, and location for the area investigated. Groupings shall not mix samples with different AASHTO classifications. For example, soils with swell potential greater than two percent (2%) may not be grouped with other soils.
5. Composite samples may be obtained by mixing portions of each sample within a soil group to provide a uniform sample of the soil group. The composite samples shall be representative of the worst case soils for the project site, unless separate designs are proposed for each distinct soil groups and sufficient field sampling is conducted to determine the special limits of each soil unit identified. Composite samples used for determining R-values shall not be improved in R-value strength by mixing soils with a higher sand content with material of less strength.
6. Required soil tests for the preliminary geotechnical investigation include: AASHTO classification, Atterberg limits, groundwater level, bedrock level, natural moisture content, natural moisture density of soil sample recovered, Proctor test, R-value, swell consolidation, and percent passing the 200 sieve.

162.02 Final Engineering Reports

The following final reports shall accompany all site development plan and final plat applications:

- A. Utility Report (2 copies)
- B. Drainage Report (2 copies)
- C. Traffic Analysis Report (2 copies)

- D. Geotechnical Studies (2 copies)
- E. Construction Traffic Routing Plan (2 copies)
- F. Fire Sprinkler Report (2 copies)
- G. Additional reports as required by the *Superior Municipal Code* and CDPHE
- H. A digital copy, in Acrobat Portable Document Format (PDF), that is identical to the hard copy of all above reports and graphics shall be submitted.

162.02.01 Final Utility Report

The Final Utility Report shall include the following information and data as a minimum:

- A. Sanitary Sewer
 - 1. Layout and connection(s) to the Town sanitary sewer system
 - 2. Average and peak flow calculations
 - 3. Maximum and minimum slope and velocity
 - 4. Available existing downstream capacity
 - 5. Master plan map (11 inches x 17 inches and 22 inches x 34 inches), drawn to a standard engineering scale, showing existing and proposed facilities, as well as all pertinent geographic and infrastructure features for the area around, and including, the proposed development
 - 6. Underdrain outfall location

- B. Water
 - 1. Layout and connection(s) to the Town potable water system
 - 2. Potable water demand (peak and average)
 - 3. Fire flow demand
 - 4. Certified Fire Sprinkler Design Report
 - 5. Peak instantaneous demand and meter sizing
 - 6. Calculations of annual water consumption EQR's
 - 7. Available pressure and capacity
 - 8. User plan to comply with the irrigation water
 - 9. Irrigation water demand. Note whether potable or reclaimed water is proposed for irrigation use. If connection to the Town's reclaimed water system is proposed, provide a separate report containing all items listed for the potable system, except fire flow demand, regarding the use of the Town's reclaimed water for irrigation. Include information demonstrating that the reclaimed water system has sufficient capacity to include the proposed use.
 - 10. Network model of the system serving the development in both written format and digital format. The digital model shall be integrated with the Town's water model, and the written discussion shall detail the impacts to the existing Town system.
 - 11. Master plan map (11 inches x 17 inches and 22 inches x 34 inches), drawn to a standard engineering scale, showing existing and proposed facilities, as well as all pertinent geographic and infrastructure features for the area, around and including the proposed development

162.02.02 Final Drainage Report

The Drainage Report calculations and supporting data required as set forth herein, shall be prepared in accordance with the UDFCD *Urban Storm Drainage Criteria Manual*. The report shall include as a minimum, the following:

- A. Introduction:
 - 1. Site Location (include a map at a usable scale)
 - a. Town, county, and street grid
 - b. Adjacent development
 - 2. Site Description
 - a. Acreage
 - b. Existing topography, ground cover, and use
 - c. A discussion of how site characteristics (soils, vegetation, and erodibility) shall influence both wind and water erosion
 - 3. Existing drainage facilities, major channels, flood hazard zones, irrigation ditches, and locations of wetlands
 - 4. Proposed project description
 - 5. Flood hazard and drainage studies relevant to site

- B. Historic Drainage System:
 - 1. Major Basin:
 - a. Relationship to the major basin channel
 - b. Major basin drainage characteristics, topography, and runoff
 - 2. Sub-Basin and Site Drainage:
 - a. Initial and major storms
 - b. Offsite flows
 - c. Existing drainage patterns: (1) channelized or overland flow, (2) volumes, (3) points of discharge from the site, and (4) effect of historic flows upon adjacent properties

- C. Proposed (Developed) Drainage System:
 - 1. Criteria:
 - a. Size of basin and sub-basin
 - b. Hydrologic method
 - c. Design storm frequencies (initial and major)
 - 2. Runoff:
 - a. Developed flow rates and paths
 - b. Erosion control methods for both high and low flow conditions
 - 3. Detention:
 - a. Volumes required and provided for major and minor storm events
 - b. Release rates and method of release for major and minor storm events
 - c. Excess stormwater passage
 - d. Depths of ponding in parking areas
 - 4. Stormwater Quality Facilities
 - 5. Streets:
 - a. Depth and velocity of flow for initial and major storms
 - b. Storm drainage system
 - 6. Open channel flow:
 - a. Type of channel (lining)
 - b. Maximum depth and velocity

- c. Sediment control
 - d. Erosion control methods for both high and low flow conditions
- 7. Storm sewers and culverts
- D. Rights-of-way Requirements:
 - 1. Boundaries
 - 2. Present and future ownership
 - 3. Access and responsibility for maintenance
- E. Analysis of Upstream and Downstream Effects:
 - 1. Include changes in flow depth, stream velocity, and erosion rates to the next parcel of property under separate ownership, both upstream and downstream. Similar analysis shall be performed and reported for all parcel(s) between the subject property and a recognized channel that is capable of handling the flow from the site being analyzed.
- F. Conclusions:
 - 1. Discuss impact of proposed improvements. Discussion shall include benefits and adverse impacts, including solutions to mitigate impacts.
 - 2. Compliance with Federal Emergency Management Agency (FEMA) regulations are required for areas in the flood hazard zone.
- G. Detailed Calculations (Appendices):
 - 1. Runoff (historic and developed)
 - a. Separate time of concentration (T_c) for each design point (Rational Method)
 - b. Runoff coefficient or permeability coefficient from Table 400-2
 - c. Existing drainage facilities carrying flows shall include flow for entire tributary area for each design point
 - d. Irrigation ditch flows
 - 2. Detention:
 - a. Storage volumes (required and provided)
 - b. Peak inflow to detention ponds for initial and major storms
 - c. Peak discharge from detention pond based on outlet structure design for initial and major storms
 - d. Outlet structure (type/design)
 - e. Head at entrance
 - f. Emergency overflow release design
 - 3. Streets (refer to Section 6 of the Streets Chapter of the *Urban Drainage Criteria Manual*):
 - a. Depth and velocity of flow for both initial and major storms
 - b. Inlet capacities and depths at inlets
 - 4. Open Channel Flow:
 - a. Roughness coefficient
 - b. Trickle channel
 - c. Depth and velocity for initial and major storms
 - d. Channel protection
 - e. Minimum freeboard
 - f. Hydraulic grade line
 - 5. Hydraulic Structures (pipes, culverts, inlets, etc.):
 - a. Culvert capacity using standard nomographs

- b. Storm sewer capacity at each design section
 - c. Inlet capacity
 - d. Flow depth or headwater depth at inlet
 - e. Drops
 - f. Weirs
 - g. Streets, gutters, and crosspans
- H. Drainage Plan (Appendices):
- 1. A drainage plan (11 inches x 17 inches and 22 inches x 34 inches) showing project location, description of the property, acreage, topography, identification of major drainageways involved, major drainage basin and sub-basin boundaries, runoff summary table for historic and developer flows, proposed type of development, access and maintenance responsibility, identification of wetlands and a reference to any flood hazard area delineation study and Drainage Outfall System Master Plan applicable to the site.

162.02.03 Final Traffic Analysis Report

The final Traffic-Analysis Report shall include, but not be limited to the following:

- A. Site Location and study area boundaries
- B. Existing and proposed uses in vicinity of the site
- C. Existing and proposed roadways and intersections
- D. Existing traffic conditions
 - 1. a.m. and p.m. peak hour turning movement volumes at nearby intersections
 - 2. Average daily traffic (ADT) volumes at nearby roadway links
 - 3. Level of Service (LOS) Analyses of nearby intersections
- E. Future background traffic (DRCOG 20-year planning horizon) projections
- F. Future background traffic (LOS) Analyses
- G. Proposed Site Traffic
 - 4. Trip generation
 - 5. Trip distribution
 - 6. Trip assignment
- H. Projected traffic impacts
 - 7. Short-term
 - a. Existing plus Proposed Site Traffic
 - b. Intersection LOS Analysis
 - 8. Long-term
 - c. Future Background plus Proposed Site Traffic
 - d. Intersection LOS Analysis
 - e. Roadway Segment Analysis: Site traffic ADT as an increment of total future ADT
- I. Proposed Traffic Mitigation Measures

1. Traffic Signal Warrant Analysis
 2. Proposed off-site improvements
- J. Traffic Signage and Striping Plan
- K. Sight obstructions, visibility, and line of sight analysis
- L. Turn around design for dead-end streets and access drives
- M. Parking lot analysis and traffic circulation analysis, including Auto-Turn drawings for the design vehicle

162.02.04 Final Geotechnical Report

The Final Geotechnical Report shall include the information outlined below. A Final Pavement Design Report is required following utility installation, completion of grading operations, and prior to placement of base course or paving materials. Pavement design requirements are summarized in Section 729.01 Subgrade Investigation of these DESIGN STANDARDS AND SPECIFICATIONS. The final geotechnical report shall include the following information and data as a minimum:

- A. General Information
1. Proposed development, including descriptions of development intensity, roadways, parks, golf courses, ponds, irrigated landscaped areas, utilities, and other structures and/or improvements
 2. Historical and present land use and potential impacts to proposed development such as presence of landfills, open disposal areas, wetlands, leach fields, mines, and mine waste, etc.
 3. Regional and local geological and hydrological description
 4. Surface water hydrology and drainage characteristics from prior to development
 5. Groundwater characteristics
 6. Number and location of boreholes, graphically presented in relation to proposed roadway locations and elevations as shown on the Grading Plan
- B. Site Condition Analysis and Impact Evaluation
1. Analysis and evaluation of geological and hydrological site conditions and potential impacts to the proposed development, including the presence of faults, springs, unstable ground conditions, etc.
 2. Analysis and evaluation of site geotechnical engineering conditions and potential impacts to proposed development, including the presence of highly swelling soils, presence of collapsible and/or frost-susceptible soils, slope instability, mine subsidence, etc.
 3. Analysis and evaluation of the depth to groundwater prior to development and evaluation of impacts to the groundwater conditions resulting from proposed development
 4. Analysis and evaluation of subgrade soils for support of structures, roadway pavement structure, sidewalks, driveways, curb and gutter
 5. Recommendations for subgrade soil stabilization
 6. Recommendations for groundwater drainage systems such as underdrains, edge drains, foundation drains, interceptor trenches, cutoff walls, lateral drainage systems, roadway drainage systems, etc.
 7. Subsurface conditions along the utility trenches, stability during excavation,

- groundwater requirements for trenching, etc.
- 8. Suitability of subsurface conditions and in-situ soils for backfill below the proposed structures
- 9. Suitability of on-site soils for use as utility trench backfill

C. Site Grading and Earthen Cut/Fill Investigation:

- 1. Identification of all cut and fill areas that exceed three (3) feet in thickness within the proposed development, including a topographic map identifying cut and fill areas with color identification at three-foot increments
- 2. Depths to groundwater and bedrock prior to and after proposed grading
- 3. Proposed goals of and reasons for modifying existing topographic conditions. The Town Master Plan requires sensitivity to the existing topographic conditions, and shall not allow artificial mounding to enhance views or create walkout lots
- 4. Potential adverse conditions from the proposed cut and fill conditions, such as instability, settlement, heave, or the development of perched groundwater
- 5. Potential impacts from the pre-development and estimated post-development groundwater to proposed cut and fill areas
- 6. Identification of soil types, their density or consolidation state, ditches, and utilities, as well as any structural or morphological features such as fractures, slip planes, deformations, and/or hummocky topography, which indicate previous or potential landsliding, and any other potential unique conditions that could cause instability
- 7. Discussion of potential impacts to proposed improvements resulting from slope instability, anticipated settlement, and/or heave movement associated as result of cut or fill conditions

D. Soil Sampling and Analyses:

The final geotechnical investigation shall include a minimum of:

- 1. One (1) soil boring in each area that requires a cut of five thousand (5,000) cubic yards or greater
- 2. One (1) soil boring per two hundred and fifty (250) feet for each travel lane in a roadway, and a minimum of one (1) boring for each street

The borings shall meet the following requirements:

- 3. For preliminary pavement design, boreholes shall be advanced to a minimum depth of ten (10) feet below finished roadway grades.
- 4. For structures, the boreholes shall be extended to a minimum depth of ten (10) feet below the lowest recommended foundation elevation.
- 5. Borings shall extend deeper if that is necessary to determine if high bedrock or groundwater levels are a design concern. In areas that depth of bedrock is within five (5) feet of the lowest roadway structure final elevation shall be delineated.
- 6. Soil samples may be combined to form soil groups consistent with the AASHTO classification, group index, and location for the area investigated. Groupings shall not mix samples with different AASHTO classifications. For example, soils with swell potential greater than two percent (2%) shall not be grouped.
- 7. Composite samples may be obtained by mixing portions of each sample within a soil group so as to provide a uniform sample of the soil group. These composite samples shall be representative of the worst-case soils for the project site, unless separate designs are proposed for distinct soil groups and sufficient field sampling is conducted to determine the special limits of each soil unit identified.

Composite samples used for determining R-values shall not be improved in R-value strength by mixing soils with a higher sand content with materials of less strength.

8. Required soil tests for the final geotechnical investigation include AASHTO classification, Atterberg limits, groundwater level, bedrock level, natural moisture content, natural moisture density of soil sample recovered, Proctor test, R-value, swell consolidation, and percent passing the 200 sieve, sulfate ion content, corrosion potential, and resistivity.

E. Project Specifications and Testing Requirements

The final geotechnical report shall provide project specific requirements and recommendations for:

1. Excavation and embankment
2. Subgrade preparation and conditioning prior to fill placement
3. Utility trench and manhole construction, including trench shoring, stability, bedding, and backfilling requirements;
4. Analysis of suitability of on-site soils backfill material, or specifications for suitable backfill material for structures, trenches, embankments, and roadway subgrade
5. Roadway subgrade stabilization specifications
6. Moisture conditions and compaction requirements for fill material for structures, trenches, embankments, and roadway subgrade
7. The effect that ground water has on construction and methods to deal with any problems that may exist
8. Any special procedures that may pertain to construction

F. Building Foundation Analysis and Design

1. Natural moisture content of the soil strata, estimated depth of wetting and soil moisture changes after development. Calculate and provide an estimation of post construction depth of wetting, free field heave, and potential impacts to structures
2. Calculate and provide an estimation of post construction settlement, rate of such settlement, and potential impacts to structures. Calculations should be included as part of the report
3. Specific information including swell potential of the soil and the effect on foundations
4. Recommendations regarding foundation types and any special procedures that may pertain to construction
5. Recommendations regarding allowable soil bearing pressures and unconfined shearing strength
6. Methods of prevention of swell and shrinkage of expansive soils and minimizing their effects on structures
7. Compaction specifications, including moisture conditioning, compaction, and thickness of layer
8. Engineer's testing and requirements, and recommendations

162.02.05 Construction Traffic Routing Plan

Construction traffic within the Town shall proceed over a truck route or on such routes as are designated by the Town Manager at the time the development is approved. A construction traffic routing plan shall be provided along with the Final Engineering Reports at the time approval for the development is sought.

170.00 DEFINITIONS AND ABBREVIATIONS

171.00 DEFINITIONS

Whenever the following terms are used in these DESIGN STANDARDS AND SPECIFICATIONS, they shall be defined as follows:

- A. Approved by the Town of Superior – Approved by the Town Manager (or a designee)
- B. Bonds – Bond for performance, labor, or material payment, as well as irrevocable letters of credit and other instruments of security furnished by the Developer or Contractor in accordance with Subdivision Agreements or other Agreements with the Town
- C. Town – The Town of Superior, acting through the Town Manager (or an authorized designee)
- D. Town Code – The latest, officially adopted *Superior Municipal Code*
- E. Common Facilities – Facilities serving or held in common title by the owners or occupants of two or more dwelling units and/or commercial or industrial enterprises, as covered by these DESIGN STANDARDS AND SPECIFICATIONS
- F. Contractor – A person who seeks to construct, alter, move, demolish, repair, replace, excavate, or add to any public or private improvements or common facilities, as covered by these DESIGN STANDARDS AND SPECIFICATIONS
- G. Days – Calendar days unless otherwise specified
- H. Design Standards and Specifications – The body of directions, provisions, and requirements contained herein, describing the method or manner of construction, the qualities and quantities of the materials, and work to be furnished
- I. Developer – The person(s) who are legally responsible to the Town for construction of improvements. For Capital Improvement Projects, the Town is the Developer.
- J. Director of Public Works – The Town’s Director of Public Works or an authorized designee
- K. Engineer – The Town Engineer (or an authorized designee)
- L. Equipment – All machinery and equipment, including the necessary supplies for upkeep and maintenance, that are necessary for the proper construction and acceptable completion of the work
- M. Inspector – The authorized representative of the Town Engineer assigned to conduct detailed inspections of construction work to assure compliance with these DESIGN STANDARDS AND SPECIFICATIONS and the plans as approved by the Town
- N. Plans – Profiles, cross-sections, and drawings, including supplemental drawings, approved by the Town, which show the locations, character, dimensions, and details of the work
- O. Public Improvements – Improvements under the ownership or control of the Town, including but not limited to the components of the water system, sewer system, street system, park system, and storm drainage system, as covered by these DESIGN STANDARDS AND SPECIFICATIONS. This term also includes similar improvements that are built in connection with a subdivision that are intended to be dedicated to the Town
- T. PVC – Polyvinyl chloride, a strong, tough plastic based on resins made by the polymerization of vinyl chloride or copolymerization of vinyl chloride, with minor amounts (not over 50%) of other unsaturated compounds. This substance is then fashioned into sheets, tubing, pipe, conduit, containers, insulation, etc
- U. Work Hours – 7 A.M. until 5 P.M. of the same day, Monday through Friday
- V. Special provisions – Special directions, provisions, or requirements specific to the project

- and not otherwise detailed or set forth in the specifications
- W. Substantial Completion – That date, (as determined by the Town) when the construction project (or a specified part thereof) is sufficiently completed, in accordance with these DESIGN STANDARDS AND SPECIFICATIONS, so that the project or a specified part can be utilized for the purposes for which it is intended
- Y. Supplier – An individual, firm or corporation that has direct contract with a Developer, Contractor, or Subcontractor for the manufacture or furnishing of any part of the supplies and/or materials to be used at or incorporated in, work at the site

172.00 ABBREVIATIONS

- A. AASHTO – American Association of State Highway and Transportation Officials.
- B. ACI – American Concrete Institute
- C. ADT – Average Daily Traffic
- D. AISC – American Institute of Steel Construction
- E. ANSI – American National Standards Institute
- F. APWA – American Public Works Association
- G. ASA – American Standards Association
- H. ASTM – American Society for Testing and Materials
- I. AWG – American Wire Gauge
- J. AWWA – American Water Works Association
- K. BPR – Bureau of Public Roads
- L. CDOT – Colorado Department of Transportation
- M. CDPS – Colorado Discharge Permit System
- N. FCC – Federal Communications Commission
- O. gpcd – Gallons per capita per day
- P. gpm – Gallons per minute
- Q. GRC – Galvanized rigid conduit
- R. IBC – International Building Code
- S. IMSA – International Municipal Signal Association
- T. IPC – International Plumbing Code
- U. IPCEA – Insulated Power Cable Engineers Association
- V. ITE – Institute of Transportation Engineers
- W. LOS – Level of Service
- X. MGD – Millions of gallons per day
- Y. MS4 – Municipal Separate Storm Sewer System
- Z. MUTCD – Manual on Uniform Traffic Control Devices
- AA. NEC – National Electrical Code as approved by the American Standards Assoc.
- BB. NEMA – National Electrical Manufacturers Association
- CC. NFPA – National Fire Protection Association
- DD. PE – Professional Engineer
- EE. PSI – Pounds per square inch
- FF. QCP – Quality Control Plan
- GG. ROW – Right-of-way
- HH. ROWP – Right-of-way Permit
- II. TCP – Traffic Control Plan
- JJ. UDFCD – Urban Drainage and Flood Control District
- KK. UL – Underwriters Laboratories
- LL. USDA – United States Department of Agriculture

173.00 TERMS

Whenever, in these DESIGN STANDARDS AND SPECIFICATIONS, the words “ordered,” “directed,” “required,” “permitted,” or “allowed” – or other words or phrases of similar import – are used, it shall be understood that the intention is for these terms to refer to the Town’s order, direction, requirement, permission, or allowance. Similarly, the words “approved,” “reasonable,” “suitable,” “acceptable,” “properly,” and “satisfactory” – and other words of similar import – unless otherwise specified herein, shall refer to what the Town has approved reasonable, suitable, acceptable, proper, or satisfactory in the judgment of the Town. Whenever in these DESIGN STANDARDS AND SPECIFICATIONS, the words “Town Engineer” or “Public Works & Utilities Director” are used, it shall be understood that these refer to whichever Town employee the Town Manager has designated to fill that role, or to whoever may be the authorized designee of the Town Engineer or of the Public Works & Utilities Director.

174.00 SPECIFICATIONS BY REFERENCE

All specifications, including ASTM, ACI, etc. made a portion of these DESIGN STANDARDS AND SPECIFICATIONS by reference shall be the latest edition or as approved by Town Board and contained in the Superior Municipal Code.

Throughout these DESIGN STANDARDS AND SPECIFICATIONS, any section referenced shall be deemed to include all subsections of that section. Any portion of these DESIGN STANDARDS AND SPECIFICATIONS that may be applicable to any other section – whether referenced or not – shall apply.

SECTION 100

- 1 - STANDARD TOWN NOTES
- 2 - ENGINEERING REPORTS CHECKLIST
- 3 - CIVIL DEVELOPMENT CHECKLIST

GENERAL NOTES

1. DEFINITIONS:
OWNER: PROPERTY OWNER(S)
CONTRACTOR: THE PERSON OR GROUP COMPLETING THE WORK
ENGINEER: PROFESSIONAL ENGINEER OF RECORD
TOWN or SUPERIOR: AUTHORIZED REPRESENTATIVE(S) OF THE TOWN PUBLIC WORKS & UTILITIES DEPARTMENT; THE AGENCY OF JURISDICTION.
2. ALL WORK SHALL CONFORM TO THE LATEST REVISION OF CDOT STANDARDS AND SPECIFICATIONS, AND THE TOWN OF SUPERIOR DESIGN STANDARDS AND SPECIFICATIONS.
3. THE CONTRACTOR SHALL HAVE STAMPED AND SIGNED BY THE ENGINEER AND TOWN DRAWINGS, SPECIFICATIONS AND CURRENT TOWN OF SUPERIOR SPECIFICATIONS ON SITE AT ALL TIMES.
4. THE ENGINEERING CONCEPT REMAIN THE RESPONSIBILITY OF THE PROFESSIONAL ENGINEER WHOSE STAMP AND SIGNATURE APPEARS ON THE CONSTRUCTION DOCUMENTS. THE CONTRACTOR SHALL REPORT AND DISCREPANCIES TO THE ENGINEER AND THE TOWN IMMEDIATELY.
5. ALL WORK ON THE PROJECT SHALL BE PERFORMED DURING REGULAR WORK HOURS: 7AM TO 5PM, MONDAY THROUGH FRIDAY. RESTRICTED HOURS MAY BE DICTATED BY THE TOWN. ALL WORK ON THE PROJECT SHALL COMPLY WITH THE SUPERIOR MUNICIPAL CODE. NO WORK SHALL BE PERFORMED OUTSIDE REGULAR WORK HOURS OR ON SATURDAY OR SUNDAY, OR ANY OF THE TOWN OBSERVED HOLIDAYS WITHOUT RECEIVING PRIOR WRITTEN CONSENT FROM THE TOWN OR A DESIGNATED REPRESENTATIVE. TOWN OBSERVED HOLIDAYS INCLUDE NEW YEAR'S DAY, MARTIN LUTHER KING DAY, PRESIDENT'S DAY, MEMORIAL DAY, INDEPENDENCE DAY, LABOR DAY, VETERAN'S DAY, THANKSGIVING DAY, FRIDAY FOLLOWING THANKSGIVING, CHRISTMAS EVE, AND CHRISTMAS DAY. REQUEST FOR WORK OUTSIDE REGULAR WORK HOURS SHALL BE RECEIVED TWO (2) BUSINESS DAYS PRIOR TO THE PROPOSED DATE OF THE WORK. REFER TO SECTION 150.00 PERMITS AND INSPECTIONS OF THE TOWN DESIGN STANDARDS AND SPECIFICATIONS.
6. A PRE-CONSTRUCTION MEETING SHALL BE SCHEDULED BY THE OWNER WITH THE TOWN ENGINEERING STAFF AT LEAST THREE (3) BUSINESS DAYS PRIOR TO THE START OF CONSTRUCTION. THOSE IN ATTENDANCE SHALL INCLUDE: OWNER, ENGINEER, SUPERIOR, CONTRACTOR, GEOTECHNICAL ENGINEER, SURVEYOR, AND ANY OTHER AFFECTED AGENCIES. CONSTRUCTION DOCUMENTS WITH THE DESIGN STANDARD AND SPECIFICATIONS COMPLIANCE STATEMENT AND SIGNATURE SHALL BE DISTRIBUTED AT THE PRECONSTRUCTION MEETING
7. AN ON-SITE PRECONSTRUCTION CONFERENCE WITH TOWN PUBLIC WORKS STAFF SHALL OCCUR AT LEAST FORTY-EIGHT (48) HOURS PRIOR TO CONNECTING TO EXISTING TOWN UTILITIES.
8. THE CONTRACTOR SHALL PAY FOR AND OBTAIN THE REQUIRED RIGHT-OF-WAY CONSTRUCTION PERMIT AND ANY OTHER REQUIRED PERMIT FROM THE TOWN OF SUPERIOR PRIOR TO COMMENCING WORK ON THE PROJECT.
9. ALL OPERATIONS SHALL CONFORM TO THE APPLICABLE REGULATIONS SET FORTH BY THE ICC AND OSHA.
10. THE TOWN OF SUPERIOR PUBLIC WORKS AND UTILITIES DEPARTMENT, PHONE (393) 499-3675, SHALL BE NOTIFIED A MINIMUM OF 48 WORKING HOURS PRIOR TO COMMENCING ANY CONSTRUCTION ACTIVITIES.
11. ALL PHASES OF WORK PERFORMED ON DEDICATED PUBLIC INFRASTRUCTURE AND WORK IN THE RIGHT-OF-WAY SHALL BE INSPECTED AND APPROVED BY REPRESENTATIVE OF THE TOWN OF SUPERIOR. REQUESTS FOR INSPECTION SHALL BE MADE TO THE TOWN OF SUPERIOR, PHONE (303) 709-6726, OR (303) 499-3675 A MINIMUM OF 24 HOURS IN ADVANCE. OBSERVATION AND ONSITE VISITS ARE NOT TO BE CONSTRUED AS A GUARANTEE OR APPROVAL BY SUPERIOR STAFF OF CONTRACTOR'S WORK ON CONTRACTUAL COMMITMENT. IF WORK IS SUSPENDED FOR LONGER THAN 5 DAYS AFTER INITIAL START-UP, CONTRACTOR SHALL NOTIFY THE SUPERIOR CONSTRUCTION INSPECTION SUPERVISOR ONE (1) BUSINESS DAY PRIOR TO RESTART OF CONSTRUCTION.
12. IN THE EVENT OF AN EMERGENCY CONTACT SUPERIOR AT (303) 494-9477 DURING WORK HOURS OR (303) 438-6400 AFTER HOURS.
13. NOTIFY SUPERIOR AT (303) 499-3675 AND ROCKY MOUNTAIN FIRE DISTRICT AT (303) 494-3735 FOR ANY STREET CLOSURES AND EXISTING FIRE HYDRANTS TAKEN OUT OF SERVICE, AT LEAST TWO (2) BUSINESS DAYS PRIOR TO THE START OF CONSTRUCTION.
14. PRIOR TO ANY CONSTRUCTION ON THE PROJECT, THE CONTRACTOR SHALL SCHEDULE A PRE-CONSTRUCTION SITE VISIT WITH THE TOWN OF SUPERIOR REPRESENTATIVE TO VERIFY AND DOCUMENT THE EXISTING CONDITION OF ADJACENT PUBLIC IMPROVEMENTS.
15. THE CONTRACTOR SHALL VERIFY ACCURACY BETWEEN WORK SET FORT ON THESE CONSTRUCTION DOCUMENTS AND WORK REQUIRED IN THE FIELD. ANY DISCREPANCIES SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER AND THE TOWN PRIOR TO THE START OF CONSTRUCTION. THE ENGINEER SHALL COORDINATE ANY PROPOSED CHANGES WITH THE TOWN.
16. THE CONTRACTOR SHALL RESTRICT CONSTRUCTION ACTIVITY TO PUBLIC RIGHT-OF-WAY, AREAS DEFINED AS PERMANENT AND/OR TEMPORARY CONSTRUCTION EASEMENTS, AND AREAS UNDER OWNERSHIP OF OWNER, UNLESS OTHERWISE AUTHORIZED BY THE AFFECT PROPERTY OWNER AND ACKNOWLEDGED BY SUPERIOR. PRIOR TO BEGINNING CONSTRUCTION ACTIVITIES, CONTRACTOR SHALL OBTAIN WRITTEN AGREEMENTS FOR INGRESS AND EGRESS FROM THE WORKSITE FROM ADJACENT PRIVATE PROPWETY OWNERS. ACCESS TO ANY ADJACENT PRIVATE PROPERTY SHALL BE MAINTAINED THROUGHOUT THE CONSTRUCTION PERIOD.
17. CONTRACTOR SHALL OBTAIN, AT HIS OWN EXPENSE, ALL APPLICABLE CODES, LICENSES, STANDARDS, PERMITS, BONDS, ETC. WHICH ARE NECESSARY TO PERFORM THE WORK.
18. CONTRACTOR SHALL KEEP ONE RECORD COPY OF ALL SPECIFICATIONS, DRAWINGS, ADDENDA, MODIFICATIONS, AND SHOP DRAWINGS AT THE SITE IN GOOD ORDER AND ANNOTATED TO SHOW ALL CHANGES MADE DURING THE CONSTRUCTION PROCESS. THESE SHALL BE AVAILABLE TO THE ENGINEER AND SHALL BE DELIVERED TO HIM FOR TOWN RECORDS UPON COMPLETION OF THE PROJECT.
19. THE ENGINEER SHALL REVIEW ALL SUBMITTALS PRIOR TO SENDING THE SUBMITTALS TO THE TOWN FOR IT'S REVIEW.
20. THE PHYSICAL FEATURES SHOWN ON THIS PLAN ARE BASED ON THE BEST AVAILABLE INFORMATION. THE CONTRACTOR SHALL VERIFY AND BE RESPONSIBLE FOR ALL FEATURES, INCLUDING ALL UNDERGROUND AND ABOVE GROUND UTILITIES. PRIOR TO BEGINNING ANY WORK, THE CONTRACTOR SHALL CONTACT THE UTILITY NOTIFICATION CENTER OF COLORADO AT 811.
21. THE CONTRACTOR SHALL BE RESPONSIBLE FOR LOCATING ALL EXISTING UTILITIES AND PROTECTING THE SAME. LOCATIONS SHOWN ON THE PLANS ARE APPROXIMATE AND NOT ALL UTILITIES ARE NECESSARILY SHOWN. THE CONTRACTOR SHALL CONTACT TOWN, UNCC, AND APPROPRIATE ENTITIES TO LOCATE UNDERGROUND FACILITIES AT LEAST 48 HOURS PRIOR TO COMMENCEMENT OF CONSTRUCTION. THE EXACT LOCATION OF EACH UTILITY SHALL BE FIELD VERIFIED BEFORE COMMENCING WORK. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MAY OCCUR AS A RESULT OF THE CONTRACTOR'S FAILURE TO LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES.
22. CALL THE TOWN AT (303) 709-6727 FOR LOCATES OF EXISTING TOWN UTILITIES INCLUDING POTABLE AND NON-POTABLE WATER LINES, SANITARY SEWER LINES, STORM SEWER LINES, PUBLIC IRRIGATION LINES, AND TRAFFIC CONTROL DEVICES. CALL TWO (2) BUSINESS DAYS PRIOR, NOT INCLUDING THE DAY OF THE CALL, TO THE START OF CONSTRUCTION.
23. THE CONTRACTOR IS RESPONSIBLE FOR NOTIFICATION OF SUPERIOR UTILITY CUSTOMERS FOR POTENTIAL SERVICE OUTAGES AND TO COORDINATE WITH SUPERIOR PUBLIC WORKS FOR DETERMINATION OF MINIMUM TIME REQUIREMENTS. SUPERIOR PUBLIC WORKS SHALL BE NOTIFIED TWO (2) BUSINESS DAYS IN ADVANCE TO SCHEDULE AN OUTAGE
24. THE CONTRACTOR SHALL BE RESPONSIBLE FOR CONTACTING AND COORDINATING WITH THE APPROPRIATE UTILITY REPRESENTATIVES TO BE ON SITE DURING POTHOLING AND SHALL LIKEWISE BE RESPONSIBLE FOR DETERMINING THE TYPE AND LOCATION OF UNDERGROUND UTILITIES AS MAY BE NECESSARY TO AVOID DAMAGE THERETO.
25. LOCATIONS OF UTILITIES REPRESENT THE BEST KNOWN LOCATIONS AT THE TIME OF PREPARATION OF DRAWINGS. THE CONTRACTOR SHALL FIELD LOCATE ALL UTILITIES IN ADVANCE OF EXCAVATION. RELOCATION OF UTILITIES MAY OR MAY NOT BE NEEDED AFTER THEY ARE EXPOSED. WHEN THE CONTRACTOR DISCOVERS A DISCREPANCY IN LOCATIONS, THEY SHALL CONTACT THE ENGINEER IMMEDIATELY.
26. THE CONTRACTOR SHALL COOPERATE WITH COMPANIES TRYING TO COORDINATE WITH THE UTILITY ADJUSTMENT AND RELOCATION EFFORT. LINES NOT ADJUSTED OR RELOCATED SHALL BE PROTECTED BY THE CONTRACTOR IN PLACE. NO ADDITIONAL PAYMENT WILL BE ALLOWED FOR THE MINOR ADJUSTMENT OF STRUCTURES IN ORDER TO CLEAR A CONFLICTING UTILITY.
27. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROTECTING LIVE UTILITIES DURING CONSTRUCTION OPERATIONS AND SHALL HOLD TOWN OF SUPERIOR HARMLESS FOR ANY AND ALL DAMAGES TO LIVE UTILITIES ARISING FROM CONSTRUCTION OPERATIONS.
28. THE CONTRACTOR OBTAIN A CONSTRUCTION STORMWATER DISCHARGE PERMIT AND CONSTRUCTION DEWATERING PERMIT FROM THE COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENTAL (CDPHE). CDPHE MAY TAKE UP TO 30 DAYS TO RESPOND TO A PERMIT REQUEST.
29. THE CONTRACTOR SHALL MAINTAIN DRAINAGE DURING CONSTRUCTION. THE REPAIR OF DAMAGES RESULTING FROM DRAINAGE AND RUNOFF IS SOLELY THE RESPONSIBILITY OF THE CONTRACTOR.
30. THE CONTRACTOR SHALL PROTECT ALL WORK AREAS AND FACILITIES FROM WATER AT ALL TIMES. AREAS AND FACILITIES SUBJECTED TO FLOODING, REGARDLESS OF THE SOURCE OF WATER SHALL BE PROMPTLY DEWATERED AND RESTORED BY THE CONTRACTOR.
31. A CONSTRUCTION WATER PERMIT SHALL BE OBTAINED FROM THE TOWN OF SUPERIOR AND A HYDRANT METER WILL BE PROVIDED BY THE TOWN FOR A NOMINAL FEE AS A DEPOSIT. THE DEPOSIT WILL BE RETURNED ONCE THE CONTRACTOR RETURNS THE HYDRANT METER. ALL CONSTRUCTION WATER SHALL BE OBTAINED FROM THE TOWN AND MEASURED THROUGH A HYDRANT METER. THE TOWN WILL NOT CHARGE FOR THE CONSTRUCTION WATER.
32. ALL CONSTRUCTION ACTIVITIES MUST COMPLY WITH THE STATE OF COLORADO PERMITTING PROCESS FOR "STORMWATER DISCHARGES ASSOCIATED WITH CONSTRUCTION ACTIVITIES". FOR INFORMATION CONTACT CDPHE WATER QUALITY CONTROL DIVISION AT (303) 692-3150.
33. ANY CONSTRUCTION DEBRIS OR MUD TRACKED ONTO EXISTING ROADWAYS SHALL BE REMOVED IMMEDIATELY BY THE CONTRACTOR. IN NO CASE SHALL THE STREETS AND SIDEWALKS BE LEFT UNCLEAN AFTER COMPLETION OF THE DAY'S WORK. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO PROVIDE NECESSARY EQUIPMENT AND MATERIALS TO CLEAN THE STREETS AND SIDEWALKS.
34. ALL CONSTRUCTION ACTIVITIES MUST COMPLY WITH THE COLORADO PERMITTING PROCESS FOR "FUGITIVE DUST EMISSIONS ASSOCIATED WITH CONSTRUCTION ACTIVITIES". WATER SHALL BE USED AS A DUST PALLIATIVE AS LONG AS REQUIRED.
35. THE CONTRACTOR SHALL LIMIT CONSTRUCTION ACTIVITIES TO THOSE AREAS WITHIN THE LIMITS OF DISTURBANCE AND/OR TOES OF SLOPE AS SHOWN ON THE PLANS AND CROSS SECTIONS.
36. THE CONTRACTOR SHALL ALSO PERFORM CONSTRUCTION ACTIVITIES TO AVOID UNNECESSARY IMPACTS TO EXISTING VEGETATION. ANY DISTURBANCE BEYOND THESE LIMITS SHALL BE RESTORED TO ORIGINAL CONDITIONS BY THE CONTRACTOR AT HIS OWN EXPENSE.
37. CONSTRUCTION ACTIVITIES, IN ADDITION TO NORMAL CONSTRUCTION PROCEDURES SHALL INCLUDE THE PARKING OF VEHICLE OR EQUIPMENT, DISPOSAL OF LITTER AND ANY OTHER ACTION WHICH WOULD ALTER EXISTING CONDITIONS. DURING ALL CONSTRUCTION ACTIVITIES, THE CONTRACTOR SHALL KEEP ALL EQUIPMENT AND MATERIALS WITHIN THE LIMITS OF THE DISTURBANCE AREA.
38. THE CONTRACTOR SHALL PROTECT ALL EXISTING SURVEY MONUMENTS, BENCHMARKS, PROPERTY CORNERS, REFERENCE POINTS, STAKES, AND OTHER SURVEY REFERENCE MONUMENTS OR MARKERS DESIGNATED TO REMAIN IN PLACE FROM DAMAGE DURING CONSTRUCTION OPERATIONS. ANY MONUMENTS DISTURBED BY THE CONTRACTOR SHALL BE RESET AT THE CONTRACTOR'S OWN EXPENSE UNDER THE DIRECTION OF A COLORADO LICENSE PROFESSIONAL LAND SURVEYOR. THE CONTRACTOR SHALL DOCUMENT PRE-CONSTRUCTION CONDITIONS WITH PHOTOGRAPHY AND VIDEOGRAPHY.
39. THE CONTRACTOR SHALL COORDINATE WITH ADJACENT PROPERTY OWNERS TO ENSURE THEIR LANDSCAPING IS PROTECTED AND PROPERLY CARED FOR SHOULD THE PROJECT DISTURB OR INTERRUPT NORMAL MAINTENANCE.
40. NO OVERWEIGHT TRUCKS WILL BE ALLOWED ON TOWN OF SUPERIOR STREETS.
41. THE CONTRACTOR SHALL NOTIFY THE ENGINEER OF ANY PROBLEM IN CONFORMING TO THE APPROVED PLANS FOR ANY ELEMENTS OF THE IMPROVEMENTS PRIOR TO CONSTRUCTION.
42. THE CONTRACTOR SHALL BE SOLELY AND COMPLETELY RESPONSIBLE FOR THE CONDITIONS AT AND ADJACENT TO THE JOB SITE, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY DURING PERFORMANCE OF THE WORK. THE CONTRACTOR SHALL PROVIDE ALL LIGHTS, SIGNS, BARRICADES, FLAGGERS, OR OTHER DEVICES NECESSARY TO PROVIDE FOR PUBLIC SAFETY IN CONFORMANCE WITH THE MANUAL ON UNIFORM TRAFFIC CONTROL

DEVICES. THIS SHALL APPLY TO THE PROJECT DURING THE ENTIRE TIME FRAME DURING ALL HOURS AND NOT LIMITED TO WORKING HOURS.

43. TRAFFIC AND PEDESTRIAN CONTROL DEVICES SHALL BE IN CONFORMANCE WITH THE LATEST VERSION OF THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD) (INCLUDING ANY COLORADO SUPPLEMENT STANDARDS)
44. CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTENANCE AND CLEANING OF TRAFFIC CONTROL DEVICES. EXISTING PAVEMENT MARKINGS SHALL BE MAINTAINED DURING CONSTRUCTION OPERATIONS. IN CONFORMANCE WITH THE CONSTRUCTION DOCUMENTS AND THE DESIGN STANDARDS AND SPECIFICATIONS.
45. REMOVAL OF EXISTING PAVEMENT MARKINGS SHALL BE ACCOMPLISHED BY A METHOD THAT DOES NOT MATERIALLY DAMAGE THE SURFACE OR TEXTURE OF THE PAVEMENT OR EXISTING SURFACING. THE PAVEMENT MARKINGS SHALL BE REMOVED TO THE EXTENT THAT THEY ARE NOT VISIBLE UNDER DAY OR NIGHT CONDITIONS.
46. ALL REGULATORY, WARNING, GUIDE AND OTHER SIGNS ON THIS PROJECT SHALL BE FURNISHED AND INSTALLED BY THE CONTRACTOR. ALL SIGNS AND SIGN PLACEMENT SHALL CONFORM TO THE LATEST VERSION OF THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (M.U.T.C.D.) (INCLUDING ANY COLORADO SUPPLEMENT STANDARDS)
47. AT LEAST 5 WORKING DAYS PRIOR TO BEGINNING OF CONSTRUCTION ACTIVITIES THE TRAFFIC AND PEDESTRIAN CONTROL PLAN SHALL BE SUBMITTED TO THE TOWN OF SUPERIOR FOR REVIEW AND APPROVAL. THE PLAN SHALL BE PREPARED BY A CERTIFIED TRAFFIC CONTROL SUPERVISOR. NO WORK SHALL BEGIN UNTIL ALL TRAFFIC AND PEDESTRIAN CONTROL DEVICES HAVE BEEN PLACED IN ACCORDANCE WITH THE APPROVED PLAN. THE CONTRACTOR SHALL CONTINUOUSLY MAINTAIN THE TRAFFIC AND PEDESTRIAN CONTROL DEVICES FOR THE DURATION OF THE PROJECT.
48. STATIONS, ELEVATIONS AND DIMENSIONS CONTAINED IN THESE PLANS ARE CALCULATED FROM RECENT SURVEY. THE CONTRACTOR SHALL VERIFY CONSTRUCTION STAKING DEPENDENT DIMENSIONS IN THE FIELD BEFORE ORDERING OR FABRICATING MATERIAL.
49. IF A CONFLICT EXISTS OR A DESIGN MODIFICATION IS REQUIRED THE CONTRACTOR SHALL COORDINATE WITH THE ENGINEER TO MODIFY THE DESIGN. DESIGN MODIFICATIONS SHALL BE REVIEWED AND APPROVED BY THE TOWN OF SUPERIOR PRIOR TO BEGINNING CONSTRUCTION.
50. IN CASE EXISTING CONDITIONS OR DIMENSIONS VARY FROM THOSE SHOWN ON APPROVED DRAWINGS, CONTRACTOR SHALL NOTIFY THE ENGINEER SO PROPER ADJUSTMENTS CAN BE MADE.
51. PROOF-ROLL SUBGRADE BELOW ALL CONCRETE CURB AND GUTTER, SIDEWALK, PATH, CONCRETE AND ASPHALT PAVEMENTS WITH A PNEUMATIC-TIRED AND LOADED 10-WHEEL, TANDEM-AXLE DUMP TRUCK OR WATER TRUCK WEIGHING NOT LESS THAN 18 KIPS PER AXLE TO IDENTIFY SOFT POCKETS AND AREAS OF EXCESS YIELDING. DO NOT PROOF-ROLL WET OR SATURATED SUBGRADES. COMPLETELY PROOF-ROLL SUBGRADE WITH 2 PASSES IN ONE DIRECTION. LIMIT VEHICLE SPEED TO 3 MPH. EXCAVATE SOFT SPOTS, UNSATISFACTORY SOILS, AND AREAS OF EXCESSIVE PUMPING OR RUTTING, AS DETERMINED BY ENGINEER, AND REPLACE WITH COMPACTED BACKFILL OR FILL MEETING THE PROJECT SPECIFICATIONS.
52. ALL UTILITY EASEMENTS MUST REMAIN UNOBSTRUCTED AND FULLY ACCESSIBLE ALONG THE ENTIRE LENGTH FOR MAINTENANCE EQUIPMENT.
53. EMERGENCY ACCESS MUST BE MAINTAINED AT ALL TIMES.
54. WASTE MATERIALS SHALL BE DISPOSED OF BY THE CONTRACTOR. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO OBTAIN A DISPOSAL SITE FOR UNUSED MATERIAL, AND HAZARDOUS WASTE MATERIAL.
55. THE CONTRACTOR SHALL MAINTAIN A MANIFEST OF HAZARDOUS MATERIAL AND PROVIDE THE TOWN OF SUPERIOR WITH A COPY OF THE MANIFEST AT THE COMPLETION OF THE PROJECT.
56. ALL EXISTING UTILITIES AND IMPROVEMENTS INCLUDING BUT NOT LIMITED TO STREETS, UTILITY LINES, FENCES, STREET LIGHTS, SIGNS, CONCRETE CURB AND GUTTER, SIDEWALKS, BIKE PATHS, METER PITS, METER VAULTS, IRRIGATION SYSTEMS, LANDSCAPE SHALL BE REPAIRED OR REPLACED TO AN EQUAL OR BETTER CONDITION PRIOR TO ACCEPTANCE OF COMPLETED WORK.
57. OWNER SHALL SUBMIT A PAPER COPY OF REDLINED RECORD CONSTRUCTION DOCUMENTS TO SUPERIOR PRIOR TO THE CONSTRUCTION ACCEPTANCE INSPECTION. REFER TO SECTION 200 OF THE DESIGN STANDARDS AND SPECIFICATIONS FOR ADDITIONAL RECORD DOCUMENT SUBMITTAL REQUIREMENTS.
58. PRIOR TO CONSTRUCTION ACCEPTANCE, ENGINEER SHALL SUBMIT A PLAN OF PROPOSED LOCATIONS FOR INSTALLATION OF RANGE POINTS TO SUPERIOR FOR APPROVAL. RANGE POINTS SHALL BE SET IN ACCORDANCE WITH THE REQUIREMENTS OF ARTICLES 51 AND 53 OF TITLE 38 OF THE COLORADO REVISED STATUTES, AND AS REQUIRED BY THE BYLAWS AND RULES OF PROCEDURE OF THE COLORADO STATE BOARD OF REGISTRATION FOR PROFESSIONAL ENGINEERS AND PROFESSIONAL LAND SURVEYORS. RANGE POINTS SHALL BE SET IN VALVE BOXES THAT COMPLY WITH THE DESIGN STANDARDS AND SPECIFICATIONS WITH LIDS MARKED "SURVEY POINT" OR AS OTHERWISE APPROVED BY THE TOWN
59. ENGINEER SHALL SUBMIT ALL DETENTION POINTS TO THE CDOT COLORADO STORMWATER DETENTION AND INFILTRATION FACILITIES DATABASE THAT MEETS THE REQUIREMENTS OF STATE 37-92-602 (8) PRIOR TO OPERATION OF THE DETENTION FACILITY.
60. ALL DEDICATED PUBLIC IMPROVEMENTS ON THE PROJECT SHALL BE WARRANTED FOR A PERIOD OF 2 YEARS FROM THE DATE OF INITIAL ACCEPTANCE BY THE TOWN OF SUPERIOR.

WATER NOTES

1. ALL WATER MAIN MATERIALS AND CONSTRUCTION SHALL BE IN CONFORMANCE WITH THE TOWN OF SUPERIOR DESIGN STANDARDS AND SPECIFICATIONS.
2. WATER MAINS SHALL HAVE A MINIMUM COVER OF FOUR AND ONE-HALF FEET (4½'). WATER MAINS SHALL NOT BE PLACED DEEPER THAN TEN FEET (10') WITHOUT THE APPROVAL OF THE TOWN.
3. ALL WATER MAINS SHALL BE INSTALLED WITH INSULATED SOLID 10 AWG TYPE UF TRACER WIRE TAPED TO THE TOP OF THE PIPE. TRACER WIRE IS TO BE LOOPED UP TO EACH FIRE HYDRANT. A CATHODIC PROTECTION TEST BOX IS TO BE SET BEHIND EACH FIRE HYDRANT. THE BOX SHALL HAVE A CAST IRON LOCKING LID WITH A 3 ½ INCH DIAMETER, 18 INCH LONG PVC BODY. THE CAP WILL NEED A TWO WIRE CONNECTION POST AT A MINIMUM.

4. ALL SPLICES IN TRACER WIRE SHALL UTILIZE DBY-6 DIRECT BURY CONNECTORS.

5. ALL WATER MAINS SHALL BE PVC C900 DR 14 PIPE. FITTINGS SHALL BE MADE FROM DUCTILE IRON AND SHALL BE AT A PRESSURE RATING OF 250 PSI. ALL DIP PIPE, FITTINGS AND VALVE BOXES SHALL BE WRAPPED WITH 8 MIL MINIMUM THICKNESS POLYETHYLENE MATERIAL AND TAPED SECURE IN ACCORDANCE WITH AWWA STANDARDS C105.
6. CHLORINATION AGENT AND METHOD OF APPLICATION SHALL BE PROVIDED BY THE INSTALLING CONTRACTOR. TESTING, FLUSHING AND DISINFECTION OF WATER LINES SHALL BE IN ACCORDANCE WITH THE TOWN OF SUPERIOR DESIGN STANDARDS AND SPECIFICATIONS AND UNDER THE OBSERVATION OF THE TOWN OF SUPERIOR INSPECTOR. CHLORINATED WATER SHALL NOT BE DISCHARGED DIRECTLY INTO STREAMS, PONDS, OR STORM SEWERS.
7. FIRE HYDRANT ASSEMBLIES INCLUDES THE MAIN LINE VALVE, SWIVEL TEE, BRANCH VALVE, MECHANICAL JOINT RESTRAINTS, THRUST BLOCKS, DRAIN ROCK, SIX INCH PIPE AND FIRE HYDRANT ASSEMBLY. INSTALLATION SHALL BE IN ACCORDANCE WITH TOWN OF SUPERIOR DESIGN STANDARDS AND SPECIFICATIONS. ALL FIRE HYDRANTS SHALL OPEN LEFT (COUNTER-CLOCKWISE).
8. AIR RELIEF-VACUUM BREAKER VALVES SHALL BE INSTALLED AT EACH HIGH POINT ON ALL WATER MAINS AND AT ALL OTHER LOCATIONS AS DIRECTED BY THE TOWN OR ITS ENGINEER. AIR RELIEF-VACUUM BREAKER VALVES SHALL BE LOCATED IN PRE-CAST CONCRETE MANHOLES IN ACCORDANCE WITH THE TOWN'S DETAILS AND SHALL AUTOMATICALLY RELEASE AIR FROM THE LINES WHEN THE LINES ARE BEING FILLED WITH WATER, AND ADMIT AIR INTO THE LINES WHEN WATER IS BEING WITHDRAWN IN EXCESS OF THE INFLOW. THE VALVE AND BODY SHALL BE DESIGNED UNDER A MAXIMUM WORKING PRESSURE OF ONE HUNDRED AND FIFTY (150) POUNDS PER SQUARE INCH. VALVES SHALL HAVE AN IRON BODY WITH BRONZE TRIM, AND FLOATS SHALL BE STAINLESS STEEL. A TWO INCH (2") VALVE SHALL BE INSTALLED ON THE STEM BETWEEN THE PIPE AND THE RELIEF VALVE, OR AS SHOWN IN THE TOWN'S DETAILS.
9. PRESSURE REDUCING AND REGULATING VALVES SHALL BE OF A TYPE CAPABLE OF MAINTAINING PRE-ADJUSTED DOWNSTREAM PRESSURES, VARYING RATES OF FLOW, AND UPSTREAM PRESSURE, WITHOUT CAUSING WATER HAMMER. VALVES SHALL BE OF DIAPHRAGM TYPE, AND NOT SPRING-OPERATED, WITH FLANGED END CONNECTIONS, AND SHALL BE INSTALLED IN CONCRETE VALVE VAULTS OF SUFFICIENT SIZE SO AS TO ALLOW FOR ADEQUATE OPERATION AND MAINTENANCE. VALVES SHALL HAVE GATE VALVES AND PRESSURE GAUGES ON BOTH UPSTREAM AND DOWNSTREAM SIDES AND SHALL UTILIZE BYPASSES WITH SMALLER PRESSURE-REDUCING AND REGULATING VALVES TO HANDLE MINIMUM FLOWS, AS DETERMINED BY THE DISTRICT OR ITS ENGINEER. ALL GATE VALVES IN THE VAULTS SHALL BE CAPABLE OF BEING OPERATED FROM ABOVE THE GROUND BY THE USE OF TWO INCH (2") SQUARE VALVE KEYS. THE DISTRICT OR ITS ENGINEER WILL APPROVE THE MANUFACTURER OF ALL PRESSURE-REDUCING VALVES PRIOR TO INSTALLATION.
10. BLOW-OFF ASSEMBLIES SHALL BE INSTALLED AT EACH LOW POINT IN ALL WATER MAINS AND ON ALL MAJOR TRANSMISSION LINES. ALL WATER MAINS THAT HAVE DEAD ENDS WHERE STAGNANT WATER MIGHT COLLECT SHALL BE PROVIDED WITH BLOW-OFF DEVICES IN ACCORDANCE WITH THE TOWN'S DETAILS. IF THE WATER MAIN WILL BE TEMPORARILY DEADENED, A BLOW-OFF DEVICE MUST BE INSTALLED. IF A FIRE HYDRANT IS LOCATED AT THE WATER MAIN'S TEMPORARY END, THE FIRE HYDRANT CAN SERVE AS THE BLOW-OFF DEVICE.
11. CONTRACTOR SHALL LOCATE ALL EXISTING PLUGS AND THRUST BLOCKS PRIOR TO CONSTRUCTION.
12. INSTALL MECHANICAL JOINT RESTRAINTS AT ALL BENDS, STUBS, TEES, VALVES, BLOW-OFFS, PLUGS AND OTHER APPROPRIATE APPURTENANCES IN WATER LINES IN ACCORDANCE WITH MANUFACTURERS SPECIFICATIONS FOR WORKING PRESSURE, SOILS TYPE, AND PIPE TYPE.
13. ALL VALVES SHALL BE OPEN LEFT (COUNTER-CLOCKWISE). ALL GATE VALVES SHALL BE AWWA SPECIFICATION C-509 RESILIENT SEATED GATE VALVES. ALL VALVES SHALL BE MOUNTED DIRECTLY TO A TEE OR OTHER FITTING. VALVE MANUFACTURERS SHALL BE VALVES SHALL BE WATEROUS.
14. VALVE SHALL BE PROVIDED WITH A CAST IRON VALVE BOX AND ROUND COVER. THE VALVE BOX SHALL HAVE A MINIMUM INSIDE DIAMETER OF FIVE AND ONE-QUARTER INCHES (5¼") AND SHALL BE ADJUSTABLE IN LENGTH AND OF THE SCREW TYPE. THE WORD "WATER" SHALL BE CAST ON THE COVER. VALVE BOXES SHALL BE CASTINGS INC. C1-500 SERIES, THREADED, NO SUBSTITUTIONS. VALVE BOXES SHALL ALLOW FOR AT LEAST THREE INCHES (3") OF ADDITIONAL EXTENSION ABOVE THE LEVEL REQUIRED FOR FINAL GRADE AT THE TIME OF INSTALLATION. ALL VALVE BOXES SHALL BE WRAPPED WITH 8 MIL MINIMUM THICKNESS POLYETHYLENE MATERIAL AND TAPED SECURE IN ACCORDANCE WITH AWWA STANDARDS C105. A VALVE OPERATING NUT AT SIX (6) FEET OR GREATER BELOW FINAL GRADE SHALL HAVE AN EXTENSION STEM PROVIDED TO BRING THE OPERATING NUT TO A DEPTH OF FOUR (4) FEET BELOW FINAL GRADE.
15. WHEN IT IS NECESSARY TO LOWER WATER MAINS AT STORM SEWERS AND OTHER UTILITY CROSSINGS, A MINIMUM CLEARANCE OF 18 INCHES SHALL BE MAINTAINED BETWEEN PIPES.
16. NO PIPES SHALL BE BACKFILLED UNTIL INSPECTED BY THE TOWN OF SUPERIOR REPRESENTATIVE.
17. STANDARD PIPE LENGTHS SHALL BE 20 FEET ALL SIZES. RANDOM LENGTHS SHALL NOT BE PERMITTED.
18. ALL PIPE SHALL BE SUITABLE FOR USE AS A PRESSURE CONDUIT. PROVISIONS MUST BE MADE FOR EXPANSION AND CONTRACTION AT EACH JOINT WITH A RUBBER RING. THE BELL SHALL CONSIST OF INTEGRAL WALL SECTION WITH A SOLID CROSS SECTION RUBBER RING WHICH MEETS THE REQUIREMENTS OF AWWA SPECIFICATION C915.
19. EACH LENGTH OF PIPE SHALL BEAR THE DATE OF MANUFACTURER, TYPE, GRADE, LENGTH, MANUFACTURERS NAME, AND AN NSF SEAL OF APPROVAL.
20. PIPE JOINTS SHALL BE MADE USING INTEGRAL BELL WITH AN ELASTOMERIC GASKET PUSH ON TYPE JOINT OR USING MACHINED COUPLINGS OF A SLEEVE TYPE WITH RUBBER RING GASKETS AND MACHINED PIPE ENDS TO FORM PUSH ON TYPE JOINT.
21. THE MANUFACTURER SHALL FURNISH A CERTIFIED STATEMENT THAT ALL OF THE SPECIFIED TEST AND INSPECTIONS HAVE BEEN MADE AND THE RESULTS THEREOF COMPLY WITH THE REQUIREMENTS OF THE APPLICABLE STANDARDS HEREIN SPECIFIED. A COPY OF THE CERTIFICATION WILL BE SENT TO THE TOWN OF SUPERIOR UPON REQUEST.
22. CONTRACTOR SHALL VERIFY THE PIPE MATERIAL AND SIZE PRIOR TO CONSTRUCTION OF THE WATER LINE WHERE TAPS OR TIE-INS ARE TO BE MADE.
23. FIRE HYDRANTS SHALL BE OF THE DRY BARREL TYPE AND CONFORM WITH AWWA C502. FIRE HYDRANTS SHALL HAVE A FIVE AND ONE-QUARTER INCH (5¼") MAIN VALVE, TWO (2) TWO AND ONE-HALF INCH (2½") HOSE CONNECTIONS AND ONE (1) FOUR AND ONE-HALF INCH (4½") PUMPER CONNECTION. FIRE HYDRANTS SHALL HAVE SIX INCH (6") MECHANICAL JOINT CONNECTIONS AND SAFETY TRAFFIC FLANGE. FIRE HYDRANTS SHALL BE WATEROUS PACER WB-67 WITH BRONZE SEAT RING.



Standard Town Notes

Town of Superior

REVISIONS		Description	

No.	Date	By	Chk	Description

Job #	
Date	
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WATER NOTES (CONT.)

- 24.NO BENDING OF THE PIPE IS PERMITTED FOR INSTALLATIONS REQUIRED ALONG A RADIUS. HIGH DEFLECTION STOP COUPLINGS SHALL BE USED TO DEVELOP THE REQUIRED CURVATURE.
25.THE CONTRACTOR IS TO SCHEDULE WITH THE GEOTECHNICAL ENGINEER FOR SCHEDULED TESTING.
26.ALL WORK, INCLUDING CORRECTION WORK SHALL BE INSPECTED BY A TOWN OF SUPERIOR REPRESENTATIVE WHO SHALL HAVE THE AUTHORITY TO HALT CONSTRUCTION WHEN STANDARD CONSTRUCTION PRACTICES ARE NOT BEING ADHERED TO.
27.MAINTAIN A MINIMUM 10 FEET SEPARATION MEASURED HORIZONTALLY BETWEEN ALL STORM AND SANITARY AND WATER MAINS AND SERVICES.
28.LOCATION OF EXISTING UTILITIES SHALL BE VERIFIED BY CONTRACTOR PRIOR TO THE START OF CONSTRUCTION.
29.NO BEDDING MATERIAL SHALL BE PLACED ABOVE THE SPRINGLINE OF THE PIPE UNTIL A TOWN OF SUPERIOR REPRESENTATIVE HAS AUTHORIZED BACKFILLING. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO NOTIFY THE TOWN OF SUPERIOR 48 HOURS IN ADVANCE OF BACKFILL OPERATIONS SO A TOWN REPRESENTATIVE MAY INSPECT THE PIPE AND BALANCE OF BEDDING MATERIAL PLACEMENT PRIOR TO BACKFILLING. BEDDING MATERIAL SHALL BE PLACED ACROSS THE ENTIRE WITH OF THE TRENCH. STACKING OR PILING OF BEDDING WILL NOT BE ACCEPTED.
30.SEWER MAINS ABOVE OR LESS THAN 1.5 FEET MEASURED O.D. TO O.D. FROM WATER MAIN SHALL BE ENCASED IN CONCRETE.
31.ALL BURIED VALVES AND FITTINGS SHALL BE PROTECTED BY WAX TAPE PRIMER AND #1 WAX TAPE BY TRENTON CORPORATION, OR APPROVED EQUAL.
32.IN ADDITION TO THE REQUIRED WAX TAPE AND POLY WRAPPING OF ALL DIP, FITTINGS, ETC., ALL BOLTS FOR MECHANICAL JOINTS AND JOINT RESTRAINTS SHALL BE PROVIDED CATHODIC PROTECTION USING ZINC CAPS AS MANUFACTURED BY MARS COMPANY, OR APPROVED EQUAL.
33.NO TESTING OF WATER LINES SHALL OCCUR UNTIL ALL BACKFILL TEST REPORTS HAVE BEEN SUBMITTED TO THE TOWN OF SUPERIOR AND APPROVED.
34.ALL WATER MAINS SHALL BE DISINFECTED IN ACCORDANCE WITH AWWA C601 AFTER ALL CONSTRUCTION WORK HAS BEEN COMPLETED. CHLORINE SHALL BE ADDED TO THE WATER AT THE NECESSARY LOCATIONS IN THE AMOUNT TO FORM A FIFTY PARTS PER MILLION (50 PPM) FREE CHLORINE RESIDUAL. THE CHLORINE SOLUTION SHALL BE LEFT IN THE MAINS FOR NOT LESS THAN TWENTY-FOUR (24) HOURS, DURING WHICH TIME ALL VALVES AND FIRE HYDRANTS SHALL BE OPERATED IN ORDER TO DISINFECT THE APPURTENANCES. AFTER THAT LENGTH OF TIME, THE CHLORINE RESIDUAL OF THE SOLUTION, AT ANY PLACE IN THE WATER DISTRIBUTION SYSTEM, SHALL NOT BE LESS THAN TEN PARTS PER MILLION (10 PPM). ALL CHLORINATION WORK MUST BE DONE UNDER THE SUPERVISION OF THE INSPECTOR.
35.ALL FINISHED WATER MAINS, AFTER REACTION BLOCKING IS IN PLACE, SHALL BE PRESSURE AND LEAKAGE TESTED AT NOT LESS THAN ONE HUNDRED AND FIFTY (150) PSI.
36.BACTERIOLOGICAL TEST IS TO BE PERFORMED BY THE LOCAL HEALTH AUTHORITY TO INSURE ADEQUATE DISINFECTION.
37.ALL TREES ARE REQUIRED TO BE PLANTED A MINIMUM OF TEN FEET (10') FROM THE OUTSIDE OF ALL UTILITY LINES THAT ARE TO BE OWNED AND MAINTAINED BY THE DISTRICT.

SANITARY SEWER NOTES

- 1. ALL SANITARY SEWER MAINS AND SERVICES SHALL BE CONSTRUCTED AS SHOWN ON THE APPROVED DRAWINGS. SANITARY SEWER LINE MATERIALS AND CONSTRUCTION SHALL BE IN CONFORMANCE WITH THE TOWN OF SUPERIOR DESIGN STANDARDS AND SPECIFICATIONS.
2. SEWER MAINS AND FITTINGS SHALL BE PVC, SDR 26 MINIMUM THICKNESS CONFORMING TO ASTM D3034. JOINTS SHALL BE OF THE "SLIP ON" TYPE WITH INTEGRALLY CAST BELL HAVING AN ELASTOMERIC GASKET. SEWER MAINS SHALL BE GREEN IN COLOR.
3. MANHOLES SHALL BE LOCATED AT A MAXIMUM SPACING OF FOUR HUNDRED FEET (400') CENTER-TO-CENTER AND ALSO AT CHANGES IN SEWER MAIN ALIGNMENT AND/OR GRADE AND AT THE END OF EACH SEWER MAIN. SEWER MAINS SHALL BE LAID WITH UNIFORM SLOPE BETWEEN MANHOLES.
4. MANHOLES SHALL BE PRECAST CONCRETE UNITS CONFORMING WITH ASTM C-478. MANHOLES SHALL HAVE A MINIMUM INSIDE DIAMETER OF FOUR FEET (4').
5. MANHOLE FRAMES AND COVERS SHALL BE CAST IRON WITH THE WORD "SEWER" CAST ON THE COVER. THE FRAME SHALL PROVIDE A MINIMUM CLEAR OPENING OF TWENTY-FOUR INCHES (24").
6. THE SEWER COLLECTION SYSTEM SHALL BE INSTALLED IN A THOROUGH AND WORKMANLIKE MANNER IN ACCORDANCE WITH THE DESIGN DOCUMENTS THAT HAVE BEEN APPROVED BY THE DISTRICT. THE MINIMUM BEDDING AND BACKFILL REQUIREMENTS SHALL BE AS SHOWN IN THE TOWN'S DETAILS.
7. WHERE REQUIRED FOR STRUCTURAL REASONS OR TO PROTECT WATER MAINS LINES, THE SEWER MAIN SHALL BE ENCASED IN REINFORCED CONCRETE.
8. THE CONTRACTOR SHALL FLUSH THE SEWER MAIN, AS THE WORK PROGRESSES BY MEANS THAT ARE IN ACCORDANCE WITH GOOD PRACTICE, TO INSURE THAT EARTH, SAND, ROCKS OR OTHER FOREIGN MATERIALS ARE REMOVED FROM THE INTERIOR OF THE SEWER MAIN.
9. SEWER MAINS WILL BE CHECKED BY THE INSPECTOR TO DETERMINE WHETHER ANY DISPLACEMENT OF THE SEWER MAIN HAS OCCURRED AFTER THE TRENCH HAS BEEN BEDDED.
10.THE INSPECTOR SHALL WITNESS ALL TESTS AND VERIFY THE ACCURACY AND ACCEPTABILITY OF THE EQUIPMENT UTILIZED. THE ENGINEER WILL INFORM THE CONTRACTOR REGARDING ACCEPTABLE METHODS OF REPAIR IN THE EVENT ONE OR MORE SECTIONS FAIL TO PASS ANY TEST.
11. LAMP TEST: A LIGHT WILL BE FLASHED BETWEEN MANHOLES, OR IF THE MANHOLES HAVE NOT AS YET BEEN CONSTRUCTED, BETWEEN THE LOCATIONS OF THE MANHOLES, BY MEANS OF A FLASHLIGHT OR BY REFLECTING SUNLIGHT WITH A MIRROR. IF THE ILLUMINATED INTERIOR OF THE SEWER MAIN SHOWS POOR ALIGNMENT, DISPLACED PIPE, EARTH OR OTHER DEBRIS IN THE PIPE, OR ANY OTHER KINDS OF DEFECTS, THE DEFECTS, DETERMINED BY THE INSPECTOR, SHALL BE REMEDIED BY THE CONTRACTOR. THE TEST WILL BE REPEATED FOLLOWING COMPLETION OF BACKFILLING AND ANY POOR ALIGNMENT, DISPLACED PIPE OR OTHER DEFECTS, DETERMINED BY THE INSPECTOR, SHALL BE CORRECTED AT THE CONTRACTOR'S EXPENSE.
12. TESTS FOR WATER TIGHTNESS SHALL BE MADE BY THE CONTRACTOR IN THE PRESENCE OF THE INSPECTOR. THE CONTRACTOR SHALL PROVIDE ASSISTANCE TO THE INSPECTOR IN DEVELOPMENT OF A DETAILED RECORD OF THE TESTING PROGRAM. THE SEWER MAIN AND CONNECTIONS SHALL NOT LEAK IN EXCESS OF THE IDENTIFIED RATE IN THE TOWN

- OF SUPERIOR DESIGN STANDARDS AND SPECIFICATIONS FOR A TWENTY-FOUR (24) HOUR TEST PERIOD. EACH REACH OF SEWER MAIN BETWEEN MANHOLES SHALL BE TESTED INDIVIDUALLY. ANY INDIVIDUAL REACH THAT LEAKS IN EXCESS OF THE AMOUNT ALLOWED SHALL BE CONSIDERED AS FAILING, AND SHALL BE REPAIRED AND RETESTED. AT THE DISCRETION OF THE INSPECTOR, THE TIME FOR LEAKAGE RATE TEST MAY BE SHORTENED TO FOUR (4) HOURS.
13. AT THE OPTION OF THE CONTRACTOR, LOW-PRESSURE AIR TESTING OF THE INSTALLED SEWER MAIN MAY BE USED INSTEAD OF THE LEAKAGE EXFILTRATION TEST. TESTING SHALL BE IN ACCORDANCE WITH THE TOWN OF SUPERIOR DESIGN SPECIFICATIONS AND STANDARDS.
14. ALL PVC SEWER MAINS SHALL BE TESTED FOR VERTICAL DEFLECTION AFTER PLACEMENT AND COMPACTION OF BACKFILL, UNLESS TESTING IS SPECIFICALLY EXCEPTED BY THE INSPECTOR. METHOD OF TESTING SHALL BE BY DEFLECTOMETER OF THE RIGID GO/NO-GO TYPE DEVICE. AN ALTERNATIVE METHOD WILL BE PERMITTED ONLY BY WRITTEN PERMISSION OF THE INSPECTOR. MAXIMUM ALLOWABLE DEFLECTION SHALL BE FIVE PERCENT (5%) OF THE SEWER MAIN DIAMETER. ANY AND ALL SEWER MAIN WITH VERTICAL DEFLECTION GREATER THAN THE ALLOWABLE SHALL BE EXCAVATED, REMOVED FROM THE SEWER MAIN, REPLACED, BACKFILLED AND COMPACTED AS SPECIFIED AND RETESTED.
15. ALL MANHOLES SHALL BE TESTED FOR LEAKAGE AND ALL TESTS SHALL BE WITNESSED BY THE INSPECTOR. THE LEAKAGE TEST SHALL BE CONDUCTED PRIOR TO BACKFILLING AROUND THE MANHOLE AND SHALL BE CARRIED OUT IN ACCORDANCE WITH THE TOWN OF SUPERIOR DESIGN S. AT THE OPTION OF THE CONTRACTOR, VACUUM TESTING OF THE INSTALLED MANHOLES MAY BE USED INSTEAD OF THE LEAKAGE TEST. ALL VACUUM TESTS SHALL BE WITNESSED BY THE INSPECTOR.
16. ALL TREES ARE REQUIRED TO BE PLANTED A MINIMUM OF TEN FEET (10') FROM THE OUTSIDE OF ALL UTILITY LINES THAT ARE TO BE OWNED AND MAINTAINED BY THE DISTRICT.

STORM SEWER NOTES

- 1. STORM WATER MAINS, CULVERTS AND FITTINGS SHALL BE REINFORCED CONCRETE CONFORMING TO ASTM C-76. TYPE II OR TYPE V CONCRETE SHALL BE USED DEPENDING UPON THE SULFATE CONTENT OF THE SOIL. CSP, CMP AND PLASTIC PIPE, IF PROPOSED FOR STORM SEWER MATERIALS, SHALL REQUIRE THE REVIEW AND PRIOR WRITTEN APPROVAL OF THE DISTRICT'S ENGINEER. JOINTS SHALL BE TONGUE AND GROOVE AND BE SEALED WITH RUB'R-NEK BY K.T. SNYDER CO. OR APPROVED EQUIVALENT MATERIAL. ALL STREET AND ROAD CULVERTS SHALL BE EQUIPPED WITH END SECTIONS.
2. THE MINIMUM DIAMETER OF A TRUNK STORM WATER LINE SHALL BE EIGHTEEN INCHES (18"). THE MINIMUM DIAMETER OF A LATERAL STORM WATER LINE FROM INLETS SHALL BE FIFTEEN INCHES (15").
3. MANHOLES SHALL BE PRECAST CONCRETE CONFORMING WITH ASTM C-478. MANHOLES SHALL HAVE A MINIMUM INSIDE DIAMETER OF FOUR FEET (4') AND SHALL BE CONSTRUCTED AND INSTALLED IN ACCORDANCE WITH THE TOWN'S DETAILS.
4. AT DROP MANHOLES, IF THE DROP HEIGHT EXCEEDS SIX FEET (6'), THEN SIX THOUSAND (6,000) PSI CONCRETE IS REQUIRED FOR THE MANHOLE STRUCTURE.
5. FOR STORM WATER MANHOLES THAT EXCEED A DEPTH OF TWENTY FEET (20"), WE MAY REQUIRE AN INTERMEDIATE PLATFORM AND SIXTY INCH (60"), MINIMUM, DIAMETER MANHOLE RISERS.
6. LOCAL FACILITIES OF THE STORM WATER SYSTEM SHALL BE INSTALLED IN A THOROUGH AND WORKMANLIKE MANNER AND IN ACCORDANCE WITH THE DESIGN DOCUMENTS THAT HAVE BEEN APPROVED BY THE ENGINEER. THE MINIMUM BEDDING AND BACKFILL REQUIREMENTS FOR STORM WATER LINES SHALL BE AS SHOWN IN THE TOWN'S DETAILS.
7. EXPOSED RIPRAP IS REQUIRED TO BE TYPE M OR LARGER.
8. AT THE OUTLET OF STORM WATER LINES AND AT CURB CUTS, EROSION PROTECTION IS REQUIRED TO BE EXTENDED TO THE POND BOTTOM, OR TO THE TOE OF THE SLOPE IN A CHANNEL, WHICHEVER THE CASE MAY BE.
9. AT THE OUTLET OF STORM WATER LINES INTO A DRY DETENTION BASIN, A HARD BOTTOMED TRICKLE CHANNEL (EITHER CONCRETE OR GROUTED ROCK) IS REQUIRED THROUGH THE EROSION PROTECTION BASIN.
10.LAMP TEST: A LIGHT WILL BE FLASHED BETWEEN MANHOLES, OR IF THE MANHOLES HAVE NOT AS YET BEEN CONSTRUCTED, BETWEEN THE LOCATIONS OF THE MANHOLES, BY MEANS OF A FLASHLIGHT OR BY REFLECTING SUNLIGHT WITH A MIRROR. IF THE ILLUMINATED INTERIOR OF THE STORM SEWER MAIN SHOWS POOR ALIGNMENT, DISPLACED PIPE, EARTH OR OTHER DEBRIS IN THE PIPE, OR ANY OTHER KINDS OF DEFECTS, THE DEFECTS, DETERMINED BY THE INSPECTOR, SHALL BE REMEDIED BY THE CONTRACTOR. THE TEST WILL BE REPEATED FOLLOWING COMPLETION OF BACKFILLING AND ANY POOR ALIGNMENT, DISPLACED PIPE OR OTHER DEFECTS, DETERMINED BY THE INSPECTOR, SHALL BE CORRECTED AT THE CONTRACTOR'S EXPENSE.

- 11. ALL TREES ARE REQUIRED TO BE PLANTED A MINIMUM OF TEN FEET (10') FROM THE OUTSIDE OF ALL UTILITY LINES THAT ARE TO BE OWNED AND MAINTAINED BY THE DISTRICT.

EROSION CONTROL NOTES

- 1. THE CONTRACTOR SHALL BE RESPONSIBLE FOR SEDIMENT AND EROSION CONTROL AT THE SITE THROUGHOUT CONSTRUCTION.
2. PERIMETER SILT FENCING SHALL BE INSTALLED PRIOR TO ANY LAND DISTURBING ACTIVITY (STOCKPILING, STRIPPING, GRADING, ETC.)
3. BEST MANAGEMENT PRACTICES (BMP'S) SHALL BE USED AS NECESSARY TO ADDRESS SEDIMENT AND DUST FROM SITE DISTURBANCE. ADDITIONAL MEASURES MAY BE REQUIRED AT THE DIRECTION OF THE ENGINEER.
4. BMP'S MAY INCLUDE, BUT ARE NOT LIMITED TO:
a.MINIMAL DISTURBANCE FOR MINIMAL TIME PERIODS.
b.GRAVEL CONSTRUCTION ACCESS.
c.SILT FENCE, STRAW BALE OR SAND BAG BARRIERS, ROCK CHECK DAMS.
d.STORM SEWER INLET PROTECTION.
e.SEDIMENT CAPTURE PONDS.
f.SITE WATERING FOR DUST SUPPRESSION.
5. BMP'S SHALL BE MAINTAINED AND KEPT IN GOOD REPAIR FOR THE DURATION OF THE PROJECT. THE CONTRACTOR SHALL INSPECT BMP'S WEEKLY AND AFTER SIGNIFICANT (GREATER THAN 0.1" PRECIPITATION) STORM EVENTS. THE MAINTENANCE AND REPAIR SHALL BE COMPLETED IN A TIMELY MANNER. SEDIMENT AND DEBRIS SHALL BE REMOVED WHEN THEY REACH HALF THE BMP HEIGHT OR IMPACT THE FUNCTION OF THE BMP.
6. SOIL STOCKPILES SHALL BE PROTECTED FROM SEDIMENT TRANSPORT BY SURFACE ROUGHENING, WATERING AND PERIMETER SILT FENCING. SOILS THAT WILL BE STOCKPILED FOR MORE THAN 30 DAYS SHALL BE MULCHED AND SEEDED WITH A GRASS COVER

WITHIN 14 DAYS OF STOCKPILE CONSTRUCTION.

- 7. THE CONTRACTOR SHALL INSURE ALL LOADS OF CUT AND FILL SOILS IMPORTED TO OR EXPORTED FROM THE SITE ARE PROPERLY LOADED AND COVERED TO PREVENT LOSS DURING TRANSPORT.
8. THE CONTRACTOR SHALL REMOVE SEDIMENT, MUD, AND CONSTRUCTION DEBRIS RESULTING FROM THIS PROJECT FROM FLOW LINES AND PAVEMENT OF PUBLIC STREETS IN A TIMELY MANNER.
9. SOILS EXPOSED DURING LAND DISTURBING ACTIVITY SHALL BE KEPT IN A ROUGHENED CONDITION BY RIPPING OR DISCING ALONG LAND CONTOURS UNTIL MULCH, VEGETATION OR OTHER PERMANENT EROSION CONTROL IS IN PLACE. NO SOILS SHALL REMAIN EXPOSED BY LAND DISTURBING ACTIVITY FOR MORE THAN THIRTY (30) DAYS BEFORE REQUIRED TEMPORARY OR PERMANENT EROSION CONTROL IS INSTALLED UNLESS OTHERWISE APPROVED.
10.VEHICLE TRACKING CONTROL, INLET/OUTLET, ROCK SOCK, AND SILT FENCE PROTECTION WILL BE USED TO CONTROL EROSION DURING CONSTRUCTION.
11.ALL TEMPORARY SEDIMENT CONTROLS WILL BE REMOVED WITHIN 30 DAYS AFTER THE FINAL STABILIZATION IS ACHIEVED OR AFTER THE TEMPORARY MEASURES ARE NO LONGER NEEDED, WHICHEVER COMES FIRST.
12.NATURAL VEGETATION SHALL BE RETAINED AND PROTECTED WHENEVER POSSIBLE. EXPOSURE OF SOIL TO EROSION FROM REMOVAL OR DISTURBANCE OF VEGETATION SHALL BE LIMITED TO THE AREA REQUIRED FOR IMMEDIATE CONSTRUCTION OPERATIONS AND FOR THE SHORTEST PRACTICAL PERIOD OF TIME.
13.USE CURRENT CDOT/UDFCD STANDARD DETAILS.

STREET EXCAVATION NOTES

- 1. WHERE IT IS REQUIRED TO CUT EXISTING PAVEMENT, THE CUTTING SHALL BE DONE TO A NEAT WORK LINE FULL DEPTH WITH A CONCRETE-CUTTING SAW OR OTHER METHOD AS APPROVED BY THE TOWN. PAVEMENT SHALL ONLY BE OPEN CUT WHEN APPROVED BY THE TOWN. ALL SAW WATER SLURRY SHALL BE PROPERLY CONTAINED USING APPROPRIATE BMP'S, AND IS PROHIBITED FROM ENTERING ANY STORM DRAINS. SAW WATER SLURRY SHALL BE REMOVED FROM IMPERVIOUS SURFACES AS WORK PROGRESSES.
2. ALL PAVEMENT CUTS AND EXPLORATORY POTHoles SHALL BE REPAIRED AS REQUIRED BY THE TOWN.
3. EXISTING ASPHALT PAVEMENT SHALL BE REMOVED AS INDICATED IN THE PLANS OR DESIGNATED BY THE ENGINEER.
4. ALL REMOVALS THAT ARE NOT SALVAGEABLE SHALL BECOME THE PROPERTY OF THE CONTRACTOR UNLESS OTHERWISE INDICATED ON THE PLANS AND PROJECT SPECIFICATIONS. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL DISPOSAL COSTS.
5. ALL TRENCHES SHALL BE ADEQUATELY SUPPORTED AND THE SAFETY OF THE WORKERS AND PUBLIC PROVIDED FOR AS REQUIRED BY THE MOST RECENT OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) "SAFETY AND HEALTH REGULATIONS FOR CONSTRUCTION".
6. ALL EXCAVATIONS IN EXISTING STREETS SHALL BE BACKFILLED WITH APPROVED CDOT FLOWABLE FILL FROM BEDDING MATERIAL TO FINISH SUBGRADE ELEVATION.
7. APPROPRIATE STREET PLATES SHALL BE USED OVER FLOW FILLED TRENCH EXCAVATIONS UNTIL THE FLOW FILL HAS ADEQUATELY CURED TO SUPPORT TRAFFIC LOADING AND PATCHING.
8. THE CONTRACTOR SHALL REPAIR ANY EXCAVATIONS OR PAVEMENT FAILURES CAUSED BY HIS CONSTRUCTION AS DIRECTED BY THE ENGINEER. THE CONTRACTOR SHALL PROPERLY BARRICADE THE CONSTRUCTION SITE UNTIL CONSTRUCTION IS COMPLETE.
9. ALL CONCRETE AND ASPHALT MIXTURE DESIGNS SHALL BE APPROVED BY SUPERIOR PRIOR TO PLACEMENT OF CONCRETE AND ASPHALT.
10.PATCHING SHALL BE TO THE DEPTH OF THE SURROUNDING EXISTING PAVEMENT PLUS 1 INCH, OR TO THE DEPTH SHOWN IN THE LIFT DETAIL AS DIRECTED BY THE ENGINEER. THE TOP LIFT MUST UTILIZE HMA (GRADING SX)(75)(PG 64-22) OR APPROVED ALTERNATE. THE THICKNESS OF SUBSEQUENT LIFTS MUST BE EQUAL TO OR GREATER THAN THE LIFT DIRECTLY ABOVE. THE LOWER LIFTS MAY UTILIZE HMA (GRADING S OR SG)(75)(PG 64-22) OR APPROVED ALTERNATE.
11.A TACK COAT SHALL BE PLACED TO THE VERTICAL EDGES OF EXISTING ASPHALT PRIOR TO THE PLACEMENT OF LIFTS OF HMA.
12.BEFORE PLACEMENT OF THE TACK COAT, THE CONTRACTOR SHALL CLEAN THE ROADWAY AS DIRECTED BY THE ENGINEER.
13.FINISH TOP LIFT SHALL MEET SURFACE TOLERANCE REQUIREMENTS OF 3/16 INCH AS MEASURED WITH A 10 FOOT STRAIGHT EDGE. SURFACE EXCEEDING 3/16 INCH SHALL BE CORRECTED PRIOR TO FINAL COMPACTION.
14.IMMEDIATELY AFTER FINISH ROLLING THE HMA PATCH, THE EDGES SHALL RECEIVE AN APPLICATION OF CSS1-H TACK EXTENDING A MINIMUM OF 6 INCHES EITHER SIDE OF THE JOINT (PICTURE FRAME). APPLICATION OF CSS1-H SHALL OCCUR BEFORE THE HMA TEMPERATURE DROPS BELOW 175 DEGREES.
15.THE CONTRACTOR SHALL BE RESPONSIBLE FOR ADJUSTMENT OF ALL VALVES AND MANHOLE RIMS THAT ARE NOT SPECIFIED TO BE ADJUSTED BY THE INDIVIDUAL UTILITY COMPANY, TO FINAL STREET GRADE.

REUSE IRRIGATION NOTES

- 1. IRRIGATION MAINS SHALL BE PURPLE AND SHALL CONFORM WITH AWWA C900, ONE HUNDRED AND FIFTY (150) MINIMUM PRESSURE CLASS (FOR TWELVE INCH (12") AND SMALLER PVC IRRIGATION MAINS). THE PURPLE COLOR SHALL BE A FACTORY PIGMENT OF THE PVC MATERIAL, AND PAINTING OF THE PIPE MATERIAL IS NOT ACCEPTABLE.
2. ALL IRRIGATION MAINS SHALL BE INSTALLED WITH WARNING TAPES OR WITH THE WARNING PRINTED DIRECTLY ONTO THE IRRIGATION MAIN AND 10GA COATED COPPER TRACER WIRE. ALL SPLICES IN TRACER WIRE SHALL UTILIZE DBY-6 DIRECT BURY CONNECTORS. WARNING TAPES SHALL BE INSTALLED DIRECTLY ON TOP OF THE IRRIGATION MAIN LONGITUDINALLY AND SHALL BE CENTERED. THE TRACER WIRE SHALL BE TAPED TO THE PVC LINE. ACCEPTABLE TAPE OR PRINTING DIRECTLY ON THE IRRIGATION MAIN SHALL STATE: "NON-POTABLE LINE - DO NOT DRINK."

- 3. STANDARD PIPE LENGTHS SHALL BE 20 FEET ALL SIZES. RANDOM LENGTHS SHALL NOT BE PERMITTED.
4. INSTALL MECHANICAL JOINT RESTRAINTS AT ALL BENDS, STUBS, TEES, VALVES, BLOW-OFFS, PLUGS AND OTHER APPROPRIATE APPURTENANCES IN WATER LINES IN ACCORDANCE WITH MANUFACTURERS SPECIFICATIONS FOR WORKING PRESSURE, SOILS TYPE, AND PIPE TYPE.
5. ALL PIPE SHALL BE SUITABLE FOR USE AS A PRESSURE CONDUIT. PROVISIONS MUST BE MADE FOR EXPANSION AND CONTRACTION AT EACH JOINT WITH A RUBBER RING. THE BELL SHALL CONSIST OF INTEGRAL WALL SECTION WITH A SOLID CROSS SECTION RUBBER RING WHICH MEETS THE REQUIREMENTS OF AWWA SPECIFICATION C915.
6. EACH LENGTH OF PIPE SHALL BEAR THE DATE OF MANUFACTURER, TYPE, GRADE, LENGTH, MANUFACTURERS NAME, AND AN NSF SEAL OF APPROVAL.
7. PIPE JOINS SHALL BE MADE USING INTEGRAL BELL WITH AN ELASTOMERIC GASKET PUSH ON TYPE JOINT OR USING MACHINED COUPLINGS OF A SLEEVE TYPE WITH RUBBER RING GASKETS AND MACHINED PIPE ENDS TO FORM PUSH ON TYPE JOINT.
8. THE MANUFACTURER SHALL FURNISH A CERTIFIED STATEMENT THAT ALL OF THE SPECIFIED TEST AND INSPECTIONS HAVE BEEN MADE AND THE RESULTS THEREOF COMPLY WITH THE REQUIREMENTS OF THE APPLICABLE STANDARDS HEREIN SPECIFIED. A COPY OF THE CERTIFICATION WILL BE SENT TO THE TOWN OF SUPERIOR UPON REQUEST.
9. CONTRACTOR SHALL VERIFY THE PIPE MATERIAL AND SIZE PRIOR TO CONSTRUCTION OF THE WATER LINE WHERE TAPS OR TIE-INS ARE TO BE MADE.
10.VALVE SHALL BE PROVIDED WITH A CAST IRON VALVE BOX AND TRIANGULAR COVER (CASTINGS INC. MODEL 4TCI-17-S). VALVE BOXES SHALL ALLOW FOR AT LEAST THREE INCHES (3") OF ADDITIONAL EXTENSION ABOVE THE LEVEL REQUIRED FOR FINAL GRADE AT THE TIME OF INSTALLATION. ALL VALVE BOXES SHALL BE WRAPPED WITH 8 MIL MINIMUM THICKNESS POLYETHYLENE MATERIAL AND TAPED SECURE IN ACCORDANCE WITH AWWA STANDARDS C105.
11.NO BENDING OF THE PIPE IS PERMITTED FOR INSTALLATIONS REQUIRED ALONG A RADIUS. HIGH DEFLECTION STOP COUPLINGS SHALL BE USED TO DEVELOP THE REQUIRED CURVATURE.
12.THE CONTRACTOR IS TO SCHEDULE WITH THE GEOTECHNICAL ENGINEER FOR SCHEDULED TESTING.
13.ALL WORK, INCLUDING CORRECTION WORK SHALL BE INSPECTED BY A TOWN OF SUPERIOR REPRESENTATIVE WHO SHALL HAVE THE AUTHORITY TO HALT CONSTRUCTION WHEN STANDARD CONSTRUCTION PRACTICES ARE NOT BEING ADHERED TO.
14.LOCATION OF EXISTING UTILITIES SHALL BE VERIFIED BY CONTRACTOR PRIOR TO THE START OF CONSTRUCTION.
15.NO BEDDING MATERIAL SHALL BE PLACED ABOVE THE SPRINGLINE OF THE PIPE UNTIL A TOWN OF SUPERIOR REPRESENTATIVE HAS AUTHORIZED BACKFILLING. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO NOTIFY THE TOWN OF SUPERIOR 48 HOURS IN ADVANCE OF BACKFILL OPERATIONS SO A TOWN REPRESENTATIVE MAY INSPECT THE PIPE AND BALANCE OF BEDDING MATERIAL PLACEMENT PRIOR TO BACKFILLING. BEDDING MATERIAL SHALL BE PLACED ACROSS THE ENTIRE WITH OF THE TRENCH. STACKING OR PILING OF BEDDING WILL NOT BE ACCEPTED.
16.SEWER MAINS ABOVE OR LESS THAN 1.5 FEET MEASURED O.D. TO O.D. FROM WATER MAIN SHALL BE ENCASED IN CONCRETE.
17.ALL BURIED VALVES AND FITTINGS SHALL BE PROTECTED BY WAX TAPE PRIMER AND #1 WAX TAPE BY TRENTON CORPORATION, OR APPROVED EQUAL.
18.IN ADDITION TO THE REQUIRED WAX TAPE AND POLY WRAPPING OF ALL DIP, FITTINGS, ETC., ALL BOLTS FOR MECHANICAL JOINTS AND JOINT RESTRAINTS SHALL BE PROVIDED CATHODIC PROTECTION USING ZINC CAPS AS MANUFACTURED BY MARS COMPANY, OR APPROVED EQUAL.
19.NO TESTING OF WATER LINES SHALL OCCUR UNTIL ALL BACKFILL TEST REPORTS HAVE BEEN SUBMITTED TO THE TOWN OF SUPERIOR AND APPROVED.
20.ALL FINISHED WATER MAINS, AFTER REACTION BLOCKING IS IN PLACE, SHALL BE PRESSURE AND LEAKAGE TESTED AT NOT LESS THAN ONE HUNDRED AND FIFTY (150) PSI.

UTILITY MAINTENANCE STATEMENT:

ALL PUBLIC WATER, REUSE WATER, STORM SEWER AND SANITARY SEWER MAINS AND APPURTENANCES LOCATED IN PUBLIC ROW SHALL BE MAINTAINED BY THE TOWN OF SUPERIOR PUBLIC WORKS DEPARTMENT. ALL PUBLIC WATER, REUSE WATER, STORM SEWER, SANITARY SEWER MAINS AND APPURTENANCES UNDER PRIVATE DRIVES ARE LOCATED IN UTILITY EASEMENTS. THE TOWN IS RESPONSIBLE FOR MAINTENANCE OF THESE WATER, REUSE WATER, STORM AND SANITARY SEWER FACILITIES. THE TOWN IS NOT RESPONSIBLE FOR REPAIR OR REPLACEMENT OF PRIVATE DRIVE, CURB AND GUTTER OR LANDSCAPING DAMAGED DURING UTILITY REPAIR OR MAINTENANCE.



Standard Town Notes

Town of Superior

Table with 3 columns: No, Date, By, Chk, Description. It is a grid for tracking revisions.

Job #
Date
Drawn By
Designed By
Checked By
File Superior Notes
Scale



Town of Superior Engineering Reports

Project Name: _____

Project Location: _____

Review Date: _____

This checklist is intended to assist the project architect/engineer develop a complete set of engineering reports. The checklist should not be considered to be all inclusive. Additional information, as may be necessary for a project, should be incorporated.

1. PRELIMINARY REPORTS	
	INCLUDED
The following will accompany PDP and Preliminary Construction Drawings:	
Utility Demand Report - 2 hard copies and 1 electronic copy	
Drainage Report - 2 hard copies and 1 electronic copy	
Traffic Analysis Report - 3 hard copies and 1 electronic copy	
Geotechnical Study and Earthen Cut/Fill Investigation - 2 hard copies and 1 electronic copy	
Earthen Cut/Fill Investigation Report - 2 hard copies and 1 electronic copy	
Additional Report as required by the Superior Municipal Code	
Preliminary Utility Demand Report Requirements	
A. Sanitary Sewer	
1. Layout and connection(s) to the Superior sanitary sewer system	
2. Average and peak flow rate calculations	
B. Potable Water System	
1. Layout and connection(s) to the Superior water system	
2. Potable water demand peak and average rate calculations	
3. Fire flow rate calculations	
C. Reuse Water System	
1. Layout and connection(s) to the Superior water system	
2. Demand Peak and average rate calculations	
Preliminary Drainage Report Requirements	
A. General Information	
1. Drainage plan showing:	

	INCLUDED
a. Project location	
b. Description of property	
c. Acreage	
d. Topography	
e. Identification of major drainage ways	
f. Major drainage basin and sub-basin boundaries	
g. Runoff summary table for historic and developed flows	
h. Proposed type of development	
i. Access and maintenance responsibility	
j. Identification of wetlands	
k. Reference to any applicable flood hazard area delineation study and Drainage Outfall System Master Plan	
2. Map of tributary drainage basin showing the location and magnitude of flows upstream of the site based on current development or zoning, which ever provides a higher runoff volume	
3. Conceptual drainage plan showing how intercepted and on-site flows shall be received and transported	
4. Discussion of storm water quality management approach and proposed water quality features	
5. Designed points of discharge from the site, accompanied by a general analysis of how existing downstream facilities shall handle discharge	
6. Required right-of-way for drainage easements and detention areas	
7. Discussion of how site characteristics (soil, vegetation, erodibility) shall influence both wind and water erosion	
8. General discussion of type of erosion control program necessary to prevent sediments from leaving site	
B. Hydraulic Calculations	
1. Historic and proposed initial and major storm runoff quantities from the site under development. Evaluation of historic and proposed drainage for initial and major storm shall include:	
a. Basin length	
b. Slope	
c. Time of concentration	
d. Intensity (show intensity duration curves used)	
e. Flow rates	

	INCLUDED
2. Storm Water Detention	
a. Storm water storage volume required	
b. Location of storage area. It shall be known and designated accordingly. If ultimate parcel use is unknown, storage volume required shall be numerically written with a statement designating how it is to be apportioned as parcels or property are sold off for ultimate development	
Preliminary Traffic Impact Analysis Report Requirements	
INCLUDED	
A. Site location, land use, site, and study area boundaries	
B. Existing and proposed uses in vicinity of site	
C. Existing and proposed roadways and intersections	
D. Existing traffic conditions	
1. AM and PM peak hour turning movement volumes at nearby intersections	
2. Average daily traffic volumes (ADT) at nearby intersections	
3. Level of Service (LOS) analyses of nearby intersections	
E. Future background traffic (DRCOG 20-year planning horizon projections)	
F. Future background traffic LOS analyses	
G. Proposed site traffic	
1. Trip generation and design hour volumes	
2. Trip distribution	
3. Trip assignments	
H. Projected traffic impacts	
1. Short-term	
a. Existing plus site traffic	
b. Intersection Level of Service analysis	
2. Long-term	
a. Future background plus site traffic	
b. Intersection Level of Service	

	INCLUDED
c. Roadway segment analysis: site traffic ADT as increment of total future ADT	
Preliminary Geotechnical Report Requirements	
A. Required for: foundation design, pavement design, earthen cut/fill analysis, and over excavation and compaction for structures	INCLUDED
B. General Information	
1. Proposed development including descriptions of development intensity, roadways, parks, golf course, ponds, irrigation landscaped areas, utilities, and other structures and or improvements	
2. Historical and present land use and potential impacts to proposed development such as presences of landfills, open disposal areas, wetlands, leach-fields, mines, and mine waste, etc.	
3. Regional and local geological and hydrological description	
4. Surface water hydrology and drainage characteristics prior to development and groundwater characteristics	
5. Number and location of bore holes taken	
C. Site Condition Analysis and Impact Evaluation	
1. Analysis and evaluation of geological and hydrological site conditions and potential impacts to the proposed development such as presences of faults, springs, unstable ground conditions, etc.	
2. Analysis and evaluation of site geotechnical engineering conditions And potential impacts to proposed development such as presence of highly swelling soils, presence of collapsible and/or frost-susceptible soils, slope stability, mine subsidence, etc.	
3. Analysis and evaluation of the depth to groundwater prior to development and evaluation of impacts to the ground water conditions resulting from proposed development	
4. Analysis and evaluation of subgrade soils for support of structures, roadway pavement structure, sidewalks, driveways, and curb and gutter	
5. Preliminary recommendations for subgrade soil stabilization	
D. Site Grading and Earthen Cut/Fill Investigation	
1. Identification of all cut and fill areas exceeding 3 feet in thickness within proposed development	
2. Depths to groundwater and bedrock prior to and after proposed grading	
3. Proposed goals and reasons to modify existing topographic conditions	
4. Potential adverse conditions from the proposed cut and fill conditions such as stability, settlement, heave, and development of perched groundwater	
5. Potential impacts from the pre-development and estimated post-development groundwater to proposed cut and fill areas	
6. Proposed goals, methods, and procedures for evaluating and minimizing risks to foundations, slabs on grade, and other flatwork required by International Building Code and as amended by the Town of Superior	

	INCLUDED
E. Recommendations for Final Geotechnical Report Scope of Work	
1. Recommendations for soil investigations such as number and depth of boreholes, sampling frequency, etc	
2. Recommendations for installation of groundwater monitoring and piezometers in boreholes as part of preliminary geotechnical investigation	
3. Recommendations for additional studies such as mine subsidence, geophysical survey, environmental investigation, etc	
F. Soil Sampling and Analysis	
a. Preliminary pavement design: boreholes to be advanced to a minimum depth 10 feet below finished roadway grade	
b. Structures: boreholes shall be advanced to a minimum depth of 10 feet below the lowest foundation elevation recommended	
c. Borings shall extend deeper, as needed, to determine bedrock if high groundwater is a design concern	
d. If bedrock is within 5 feet of lowest roadway structure final elevation, it shall be delineated	
e. Soil samples may be combined to form soil groups consistent with AASTHO classification, group index, and location for area investigated. Groupings shall not mix samples with different AASTHO classifications	
f. Composite samples may be obtained by mixing portions of each sample within a soil group to provide uniform sample. It shall represent worst case soil for project site.	
g. Composite samples used for determining R-values shall not be improved in R-value strength by mixing soils with a higher sand content with material of less strength	
h. Required soil tests for preliminary geotechnical investigation include:	
1) AASTHO classification	
2) Atterberg Limits	
3) Groundwater level	
4) Bedrock level	
5) Natural moisture content	
6) Natural moisture density of soil sample recovered	
7) Proctor test	
8) R-value	
9) Swell consolidation	
10) Percent passing 200 sieve	

2. FINAL REPORTS	
	INCLUDED
The following will accompany FDP and Progress Construction Drawings:	
Utility Report - 2 hard copies and 1 electronic copy	
Drainage Report - 2 hard copies and 1 electronic copy	
Traffic Analysis Report - 3 hard copies and 1 electronic copy	
Geotechnical Study - 2 hard copies and 1 electronic copy	
Construction Traffic Routing Plan - 2 hard copies and 1 electronic copy	
Additional Report as required by the Superior Municipal Code	
Final Utility Demand Report Requirements	
	INCLUDED
A. Sanitary Sewer	
1. Layout and connection(s) to Superior sanitary sewer system	
2. Average and peak flow calculations	
3. Maximum and minimum slope and velocity	
4. Available existing downstream capacity	
5. Master plan map (11"x17" and 22"x34"), drawn to scale, showing existing and proposed facilities, as well as all pertinent geographic and infrastructure features for the area around, and including, the proposed	
6. Underdrain outfall location	
B. Potable Water	
1. Layout and connection(s) to the Superior potable water system	
3. Fire flow demand	
4. Peak instantaneous demand and meter sizing	
5. Estimate of equivalent residential units (EQR's) as defined in Section 6 of the Town Standards	
6. Available pressure and capacity: Pressure drop calculations in service lines from watermain tap to building connection	
7. Irrigation water demand	
8. Network model of system serving development in both written and digital format. Digital model shall be integrated with Superior's water model and written discussion shall detail impacts to the existing system	
9. Master plan map (11"x17" and 22"x34"), drawn to scale, showing existing and proposed facilities, as well as all pertinent geographic and infrastructure features for the area around, and including, the proposed development	
C. Reuse Water	
1. Layout and connection(s) to the Superior water system	
2. Available pressure and capacity	

	INCLUDED
3. Irrigation water demand	
4. Network model of system serving development in both written and digital format. Digital model shall be integrated with Superior's water model and written discussion shall detail impacts to the existing system	
5. Master plan map (11"x17" and 22"x34"), drawn to scale, showing existing and proposed facilities, as well as all pertinent geographic and infrastructure features for the area around, and including, the proposed development	
Final Drainage Report Requirements	INCLUDED
Report shall be prepared in accordance with UDFCD Urban Storm Drainage Criteria Manual. It shall include:	
1. Introduction	
a. Site Location (include map at useable scale)	
1) City, County, Street grid	
2) Adjacent development	
b. Site Description	
1) Acreage	
2) Existing topography, ground cover, and use	
3) Discussion of how site characteristics (soils, vegetation, erodibility) shall influence wind and water erosion	
c. Existing drainage facilities, major channels, flood hazard zones, irrigation ditches, location of wetlands	
d. Proposed project description	
e. Flood hazard and drainage studies relevant to site	
2. Historic Drainage System	
a. Major Basin	
1) Relationship to major basin channel	
2) Major basin drainage characteristics, topography, runoff	
b. Sub-Basin and Site Drainage	
1) Initial and major storm	
2) Offsite flows	
3) Existing drainage patterns	

	INCLUDED
a) Channelized or overland flow	
c) Point of discharge from site	
d) Effect of historic flows upon adjacent properties	
3. Proposed Drainage System	
a. Criteria	
1) Size of basin and sub-basin	
2) Hydrologic method	
3) Design storm frequency (initial and major)	
b. Runoff	
1) Developed flow rates and paths	
2) Erosion control methods for both high and low flow conditions	
c. Detention	
1) Volumes required and provided for major and minor storm events	
2) Release rates and method of release for major and minor storm events	
3) Excess storm water passage	
4) Depth of ponding in parking areas	
d. Stormwater Quality Facilities	
e. Streets	
1) Depth and velocity of flow for initial and major storms	
2) Storm drainage system	
f. Open channel flow	
1) Type of channel (lining)	
2) Maximum depth and velocity	
3) Sediment control	
4) Erosion control methods for both high and low flow conditions	

	INCLUDED
4. Right-of-way Requirements	
a. Boundaries	
b. Present and future ownership	
c. Access and responsibility for maintenance	
5. Analysis of Upstream and Downstream Effect	
a. Include changes in flow depth, stream velocity, and erosion rates to the next parcel of property under separate ownership, upstream and downstream. Similar analysis shall be performed and reported for all parcel(s) between the subject property and recognized channel capable of handling the flow from the site being analyzed.	
6. Conclusions	
a. Discuss impact of proposed improvements, including benefits and adverse impacts with solutions to mitigate impacts	
b. Compliance with FEMA regulations for areas in the flood hazard zone	
7. Detailed Calculations (Appendices)	
a. Runoff (historic and developed)	
1) Separate time of concentration for each design point (rational method)	
2) Runoff coefficient or permeability coefficient	
3) Existing drainage facilities carrying flows, including flow for entire tributary area for each design point	
4) Irrigation ditch flows	
b. Detention	
2) Peak inflow to detention ponds for initial and major storms	
3) Peak discharge from detention pond based on outlet structure design for initial and major storms	
4) Outlet structure type/ design	
5) Head at entrance	
6) Emergency overflow release design	
c. Streets (refer to Urban Drainage Criteria Manual Volume 1, Chapter 7 on Streets, Section 6)	
1) Depth and velocity of flow for initial and major storms	

	INCLUDED
2) Inlet capacities and depths at inlets	
d. Open Channel Flow	
1) Roughness coefficient	
2) Trickle channel	
3) Depth and velocity for initial and major storms	
4) Channel protection	
5) Minimum freeboard	
6) Hydraulic grade line	
e. Hydraulic Structures (pipe, culvert, inlet, etc)	
1) Culvert capacity using standard nomographs	
2) Storm sewer capacity at each design section	
3) Inlet capacity	
4) Flow depth or headwater depth at inlet	
5) Drops	
6) Weirs	
7) Streets, gutters, and crosspans	
8. Drainage Plan (Appendices)	
a. Drainage plan (11"x17" and 22"x34") showing project location, description of the property, acreage, topography, identification of major drainageways involved, major drainage basin and sub-basin boundaries, runoff summary table for historic and developed flows, proposed type of development, access and maintenance responsibility, identification of wetlands and a reference to any flood hazard area delineation study and Drainage Outfall System Master Plan applicable to the site	
Final Traffic Analysis Report Requirements	INCLUDED
A. Site location and study area boundaries	
B. Existing and proposed uses in vicinity of site	
C. Existing and proposed roadways and intersections	

	INCLUDED
D. Existing traffic conditions	
1. AM and PM peak hour turning movement volumes at nearby intersections	
2. Average daily traffic volumes (ADT) at nearby roadway links	
3. Level of Service (LOS) analyses of nearby intersections	
E. Future background traffic (DRCOG 20-year planning horizon) projections	
F. Future background traffic LOS analyses	
G. Proposed site traffic	
1. Trip generation	
2. Trip distribution	
3. Trip assignment	
H. Projected traffic impacts	
1. Short-term	
a. Existing plus site traffic	
b. Intersection Level of Service analysis	
2. Long-term	
c. Future background plus site traffic	
d. Intersection Level of Service	
e. Roadway segment analysis: site traffic ADT as increment of total future ADT	
I. Proposed traffic mitigation measures	
1. traffic signal warrant analysis	
2. proposed off-site improvements	
J. Traffic signage and striping plan	
K. Sight obstructions, visibility, and line of sight analysis	
L. Parking lot analysis and traffic circulation analysis including Auto-Turn drawings for the design vehicle	

Final Geotechnical Report Requirements	INCLUDED
<p>Final Pavement Design Report is required following utility installation, completion of grading operations, and prior to placement of base course or paving materials. Pavement design requirements are summarized in Town Standards and Specifications, Section 729. Final Geotechnical report shall include the following information and data as a minimum:</p>	
<p>1. General Information</p>	
<p>a. Proposed development including descriptions of development intensity, roadways, parks, golf courses, ponds, irrigated landscaped areas, utilities, and other structures and/or improvements</p>	
<p>b. Historical and present land use and potential impacts to proposed development such as presence of landfills, open disposal areas, wetlands, leach-fields, mines and mine waste, etc</p>	
<p>c. Regional and local geological and hydrological descriptions</p>	
<p>d. Surface water hydrology and drainage characteristics prior to development</p>	
<p>e. Groundwater characteristics</p>	
<p>f. Number and location of boreholes graphically presented in relation to proposed roadway locations and elevations as shown on the grading plan</p>	
<p>2. Site Condition Analysis and Impact Evaluation</p>	
<p>a. Analysis and evaluation of geological and hydrological site conditions and potential impacts to the proposed development, such as presences of faults, springs, unstable ground conditions, etc</p>	
<p>b. Analysis and evaluation of site geotechnical engineering conditions and potential impacts to proposed development, such as presence of highly swelling soils, presence of collapsible and/or frost-susceptible soils, slope stability, mine subsidence, etc</p>	
<p>c. Analysis and evaluation of the depth to groundwater prior to development and evaluation of impacts to the groundwater conditions resulting from proposed development</p>	
<p>d. Analysis and evaluation of subgrade soils for support of structures, roadway pavement structure, sidewalks, driveways, curb and gutter, etc.</p>	
<p>e. Recommendations for subgrade soil stabilization</p>	
<p>f. Recommendations for groundwater drainage system such as underdrains, edge drains, foundation drains, interceptor trenches, cut-off walls, lateral drainage systems, roadway drainage systems, etc</p>	
<p>g. Subsurface conditions along the utility trenches, stability during excavation, groundwater requirements for trenching, etc</p>	
<p>h. Suitability of subsurface conditions and in-situ soils for backfill below proposed structures</p>	
<p>i. Suitability of on-site soils for use as utility trench backfill</p>	
<p>3. Site Grading and Earthen Cut/Fill Investigation</p>	
<p>a. Identification of all cut/fill areas exceeding 3 feet thick within proposed development including topographic map identifying cut/fill areas with identification at 3-foot increments</p>	

	INCLUDED
b. Depths to ground water and bedrock prior to and after proposed grading	
c. Proposed goals and reasons to modify existing topographic conditions. Town of Superior Master Plan requires sensitivity to existing topographic conditions and shall not allow artificial mounding.	
d. Potential adverse conditions from the proposed cut/fill conditions such as stability, settlement, heave, and development of perched ground water	
e. Potential impacts from the pre-development and estimated post-development groundwater to proposed cut/fill areas	
f. Identification of soil types, their density of consolidation state, ditches, utilities, and structural and morphological features such as fractures, slip planes, deformations, and/or hummocky topography, which indicate previous or potential land sliding, and any other potential unique conditions that could cause instability	
g. Discussion of potential impacts to proposed improvements resulting from slope instability, anticipated settlement, and/or heave movement associated as result of cut/fill conditions	
4. Soil Sampling Analysis	
a. Final geotechnical investigation shall include a minimum:	
1) 1 soil boring in any area requiring a cut of 5,000 CY or greater	
2) 1 soil boring per 250 feet for each travel lane in a roadway, and minimum 1 boring for each street	
b. Borings shall meet the following requirements:	
1) Preliminary pavement design: boreholes shall be advanced to a minimum depth of 10 feet below finished roadway grades	
2) Structures for boreholes shall be extended to a minimum depth of 10 feet below the lowest foundation elevation recommended	
3) Borings shall extend deeper, if needed, to determine if bedrock height or groundwater levels are a design concern. In areas that depth of bedrock is within 5 feet of lowest roadway structure final elevation, it shall be delineated.	
4) Soil samples may be combined to form soil groups consistent with the AASHTO classification, group index, and location for the area investigated. Groupings shall not mix samples with different AASHTO classifications. For example, soils with swell potential greater than 2 percent may not be grouped.	
5) Composite samples may be obtained by mixing portions of each sample within a soil group to provide a uniform sample of the soil group. The composite samples shall be representative of the worst case soils for the project site, unless separate designs are proposed for distinct soil groups and sufficient field sampling is conducted to determine the special limits of each soil unit identified. Composite samples used for determining R-values shall not be improved in R-value strength by mixing soils with a higher sand content with material of less strength.	
6) Required soil tests for the final geotechnical investigation include:	
a) AASHTO classification	

	INCLUDED
b) Atterberg Limits	
c) Groundwater level	
d) Bedrock level	
e) Natural moisture content	
f) Natural moisture density of soil sample recovered	
g) Proctor test	
h) R-value	
i) Swell consolidation	
j) Percent passing 200 sieve	
k) Sulfate ion content	
l) Corrosion potential	
m) Resistivity	
5. Project Specifications and Testing Requirements	
a. Final geotechnical report shall provide project specific requirements and recommendations for:	
1) Excavation and embankment	
2) Subgrade preparation and conditioning prior to fill placement	
3) Utility trench and manhole construction, including trench shoring, stability, bedding, and backfilling requirements	
4) Analysis of suitability of on-site soils for backfill material or specifications for suitable backfill material for structures, trenches, embankments, and roadway subgrade	
5) Roadway subgrade stabilization specifications	
6) Moisture conditions and compaction requirements for fill material for structures, trenches, embankments, and roadway subgrade	
7) Effect of groundwater on construction and methods to deal with any problems that may exist	
8) Any special procedures that may pertain to construction	
b. Building Foundation Analysis and Design	

	INCLUDED
1) Natural moisture content of the soil strata, estimated depth of wetting and soil moisture changes after development. Calculate and provide an estimation of post construction depth of wetting, free field heave and potential impacts to structures.	
2) Calculate and provide an estimation of post construction settlement, rate of such settlement, and potential impacts to structures. Calculations should be included as part of the report.	
3) Specific information including swell potential of the soil and the effect on foundations	
4) Recommendations regarding foundation types and any special procedures that may pertain to construction	
5) Recommendations regarding allowable soil bearing pressures and unconfined shearing strength	
6) Methods of prevention of swell and shrinkage of expansive soils and minimizing their effect on structures	
7) Compaction specification including moisture conditioning, compaction, and thickness of layer	
8) Engineer's testing and requirements and recommendations	
Construction Traffic Routing Plan	INCLUDED
Construction traffic within Superior shall proceed over a truck route or on such roads as are designated by the Town Board at the time the development is approved. Construction traffic routing plan shall be provided along with the Final Engineering Reports at the time approval for the development is sought.	



Town of Superior Civil Development Review

Project Name: _____

Project Location: _____

Design Stage: PRELIMINARY or FINAL

Review Date: _____

This checklist is intended to assist the project architect/engineer develop a complete set of construction documents. The checklist should not be considered to be all inclusive. Additional information, as may be necessary for a project, should be incorporated. The Town may waive any requirements listed below as it deems appropriate. Applicant is to complete the checklist.

1.0 GENERAL PLAN REQUIREMENTS	YES	NO	N/A	Sheet #	COMMENTS	PRELIMINARY CONSTRUCTION DRAWINGS	FINAL CONSTRUCTION DRAWINGS
1.01 Submitted on 22"x34" paper sheets (applies to all pages of plan set or electronically)						X	X
1.02 Each sheet title block includes correct project name.						X	X
1.03 Each sheet title block includes correct drawing number						X	X
1.04 Each sheet title block includes correct Designed By, Drafted By, and Checked By initials and dates						X	X
1.05 Designer and Checker are not same person							X
1.06 Each sheet title block includes appropriate engineer's seal							X
1.07 Each sheet title block includes name of Engineer or firm							X
1.08 Each sheet showing plan view includes north arrow and is shown with correct orientation						X	X
1.09 Each sheet showing plan/elevation/details includes correct scale bar						X	X
1.10 Each sheet showing horizontal and vertical control includes appropriate datum reference							X

	YES	NO	N/A	Sheet #	COMMENTS	PRELIMINARY CONSTRUCTION DRAWINGS	FINAL CONSTRUCTION DRAWINGS
1.11 Cover sheet includes Town Engineer Statement						X	X
1.12 All legend symbols and abbreviations correspond with those shown in the plans						X	X
1.13 All general notes correspond with the work of the plans						X	X
1.14 Line weights and types are used properly and in accordance with Town Standards to represent the work						X	X
1.15 Scale is used properly to present the work						X	X
1.16 All text is in an easily read font size, minimum 1/8" tall						X	X
1.17 Bench marks referencing Town's GPS monuments							X
1.18 All details and sections are correct for sheet reference numbers, limits, aspects, and orientation						X	X
1.19 Cover sheet shall have project location with streets labeled to navigate to site, and includes key map with site location						X	X
1.20 Cover sheet shall have sheet index. Sheet order of precedence matches plan sequence, in a logical order that is consistent						X	X
1.21 Sheet index included with titles of each sheet. Sheet number is consistent with actual sheet						X	X
1.22 Cover sheet shall show revisions and dates in sheet title block							X
1.23 Each plan sheet is included and sheet number, drawing number, and title are consistent with the plans							X
1.24 Summary of quantities - all items are included, and quantities and units are consistent with estimate							X

	YES	NO	N/A	Sheet #	COMMENTS	PRELIMINARY CONSTRUCTION DRAWINGS	FINAL CONSTRUCTION DRAWINGS
1.25 At a minimum, each submittal shall include the following plans: Existing Conditions/Demolition, Site Plan, Civil Plans, Roadway & Transportation, Grading and Storm Water Management, Erosion Control, Potable Water, Reuse Water, Sanitary Sewer, Traffic Signage, Traffic Markings, Street Lighting, Irrigation, and Landscape						X	X
1.26 Plan set shall include an overall utility plan showing all existing and proposed utilities with clearances to other utilities and landscaping							X
2.0 EXISTING CONDITIONS/ DEMOLITION PLAN	YES	NO	N/A	Sheet #	COMMENTS	PRELIMINARY CONSTRUCTION DRAWINGS	FINAL CONSTRUCTION DRAWINGS
2.01 Topography is shown with appropriate line weight and accuracy						X	X
2.02 Boring locations are shown, identified and accurate in their location							X
2.03 Right of Way, easements, and other property lines are shown and consistent						X	X
2.04 All existing features and elements are clearly identified						X	X
2.05 Horizontal and vertical control is established						X	X
2.06 Horizontal and vertical datum is identified						X	X
2.07 Survey monument identification is correct						X	X
2.08 All utilities potholed							
2.09 Underground utilities are shown using appropriate symbols, line types, line weights, and scale; utilities are complete						X	X
2.10 All utilities and elements clearly identified						X	X
2.11 All demolition work of project is identified and appropriately referenced						X	X
2.12 Demolition callouts accurately describe the nature and limits of the work						X	X

	YES	NO	N/A	Sheet #	COMMENTS	PRELIMINARY CONSTRUCTION DRAWINGS	FINAL CONSTRUCTION DRAWINGS
2.13 All salvage and relocation items are clearly identified							X
2.14 All utility demolition is identified by cross-hatching							X
2.15 Pavement removal limits are clearly shown and dimensioned						X	X
3.0 SITE PLAN	YES	NO	N/A	Sheet #	COMMENTS	PRELIMINARY CONSTRUCTION DRAWINGS	FINAL CONSTRUCTION DRAWINGS
3.01 Topography is consistent with existing conditions sheets						X	X
3.02 Topography is consistent with proposed new contours shown						X	X
3.03 Right of Way, easements, and other property lines are shown and are consistent with existing conditions sheet						X	X
3.04 Existing utilities consistent with existing utilities sheets						X	X
3.05 All applicable features and elements are clearly identified						X	X
3.06 Surveying information and applicable datum shown						X	X
3.07 All new work on project is identified and appropriately referenced to discipline plan sheets (e.g. see Civil, Structural, Mechanical, Electrical, etc. sheets)						X	X
3.08 All new project work is coordinated between discipline plan sheets						X	X
3.09 All new work is clearly delineated from existing conditions						X	X
3.10 Only new work is shown (e.g. all existing work replaced by new work is removed from plan sheets)						X	X
3.11 New work callouts accurately describe the nature and limits of the work							X
3.12 All buildings shall be shown with proposed and existing setbacks.							X
3.13 Locations of ADA ramps, curb and gutter, and sidewalk are shown						X	X

	YES	NO	N/A	Sheet #	COMMENTS	PRELIMINARY CONSTRUCTION DRAWINGS	FINAL CONSTRUCTION DRAWINGS
3.14 Typical street cross-sections are provided						X	X
3.15 New and existing utilities are shown and complete						X	X
3.16 Site lighting shall be shown							X
3.17 Show all street names and widths						X	X
3.18 Note Stating: "Site Plan is based on Title Commitment dated _____"							X
4.0 CIVIL PLANS/ ROADWAY & TRANSPORTATION	YES	NO	N/A	Sheet #	COMMENTS	PRELIMINARY CONSTRUCTION DRAWINGS	FINAL CONSTRUCTION DRAWINGS
4.01 Topography is consistent with existing condition sheets						X	X
4.02 Right of Way, easements, and other property lines are shown and consistent with existing conditions sheets						X	X
4.03 All applicable features and elements are clearly identified							X
4.04 Civil work clearly identified and dimensioned in appropriate units/coordinates						X	X
4.05 Reference dimensions are indicated as appropriate						X	X
4.06 Distances to any other access and/ or intersection are shown to ensure distances are acceptable.						X	X
4.07 ROW limits are clearly shown and dimensioned						X	X
4.08 Construction phasing plans are included							X
4.09 Construction staging area clearly identified							X
4.10 Slopes for drainage are shown and clear						X	X
4.11 Pavement sections are shown and detailed						X	X

	YES	NO	N/A	Sheet #	COMMENTS	PRELIMINARY CONSTRUCTION DRAWINGS	FINAL CONSTRUCTION DRAWINGS
4.12 Signage and striping is shown and complete						X	X
4.13 ADA parking and access are shown and have been coordinated with others						X	X
4.14 Traffic control is shown and complete						X	X
4.15 Existing irrigation ditches to be removed or piped						X	X
4.16 Proposed curb & gutter, sidewalk, crosspans, and flow direction						X	X
4.17 Horizontal curve data with radii, tangents, PC, PI, and PT							X
4.18 Vertical curve data with PC, PT, and PT with stations and lengths of street							X
4.19 Curb return profiles for any intersection that exceeds a 2% grade difference						X	X
4.20 Show truck turning templates for all truck routes, docks, and intersections						X	X
4.18 Station and elevation of radius points (back of curb)							X
4.19 Profile of street centerline and flow line of curb, and property line with horizontal stationing and percent slope						X	X
4.20 Percent of slope with tangent lines						X	X
4.21 Proposed roadway lateral drains and edge drains, including depth, flow direction, discharge location, clean out location, and cross-section details						X	X
4.22 Limits of construction						X	X
4.23 Street light and underground service cable location						X	X
4.24 Street sign location						X	X
4.25 Show sufficient existing and/or future construction to assure continuity						X	X

5.0 GRADING PLAN/ STORM WATER MANAGEMENT PLAN	YES	NO	N/A	Sheet #	COMMENTS	PRELIMINARY CONSTRUCTION DRAWINGS	FINAL CONSTRUCTION DRAWINGS
5.01 Provide summary table of pipe size, specification references, strength class, and approximate quantity by size and class							X
5.02 Topography contours (maximum 2 foot contours)						X	X
5.03 Topography is consistent with existing condition sheets						X	X
5.04 Topography is consistent with proposed new contours shown						X	X
5.05 Grading and drainage pattern for existing lots adjacent to subdivision						X	X
5.06 Show Lot type (A, B, Transitional (T), Walkout (WO), Garden Level (GL), etc.)						X	X
5.07 Show elevations at lot corners, top of foundation, and high points							X
5.08 Show elevation for bottom limit of over-excavation							X
5.09 Show elevation of ground outside of building							X
5.10 Show elevation and grade of drainage swales and side lot lines							X
5.11 Show drainage easements on and adjacent to subject property						X	X
5.12 Grading limits are clearly shown and dimensioned						X	X
5.13 Trenching, cut/fill limits, and depths are shown						X	X
5.14 Limit and depth of over-excavation and re-compaction						X	X
5.15 Depth to groundwater at monitoring locations							X
5.16 Drainage structures grate and invert elevations are shown						X	X
5.17 Town of Superior standard erosion control notes included						X	X

	YES	NO	N/A	Sheet #	COMMENTS	PRELIMINARY CONSTRUCTION DRAWINGS	FINAL CONSTRUCTION DRAWINGS
5.18 Storm sewer utility to include plan and profile						X	X
5.19 Storm sewer manholes and inlets include stationing, designation, dimensions and invert elevations						X	X
5.20 Storm sewer profiles to include HGL and EGL for 5- and 100-year storm							X
5.21 BMPs to be selected based on appropriate use (refer to Town standards for use requirements)							X
5.22 Side slopes greater than 3:1 may require terracing or structural retaining walls, retaining walls greater than 3 ft must have structural design							X
5.23 All existing curb, gutter and sidewalk, and proposed curb, gutter, and sidewalk						X	X
5.24 All proposed curb & gutter, cross pans, piping, and open drainageways with flow directions						X	X
5.25 Show open channel in plan and with stationing						X	X
5.26 Show open channel in profile with water surface profile and energy grade line							X
5.27 Show typical cross section with major and minor storm event water surface elevation						X	X
5.28 Lining details for open channel						X	X
5.29 Special structures detail of design and appurtenances							X
5.30 Show existing drainageways with flow direction						X	X
5.31 Label all streets with approximate grades						X	X
5.32 Label all irrigation ditches with names and owners						X	X
5.33 Shows drainage sub-area boundaries						X	X
5.34 Show flow calculations for 2-, 5-, and 100-year storm runoff						X	X

	YES	NO	N/A	Sheet #	COMMENTS	PRELIMINARY CONSTRUCTION DRAWINGS	FINAL CONSTRUCTION DRAWINGS
5.35 Show path of 100-year storm runoff flow						X	X
5.36 Show that adjoining property will not be affected and grading is compatible						X	X
5.37 Label critical minimum finished floor elevation for 100-year runoff							X
5.38 Detention pond details including outlet structure shown						X	X
6.0 EROSION CONTROL PLAN	YES	NO	N/A	Sheet #	COMMENTS	PRELIMINARY CONSTRUCTION DRAWINGS	FINAL CONSTRUCTION DRAWINGS
6.01 General location map with detail to identify flow direction entering and leaving development and general flow path						X	X
6.02 Major construction along drainage path						X	X
6.03 Basins and divides identified with topographic contours						X	X
6.04 Specifications and details for erosion control measures							X
6.05 Transition grading/drainage plan for phased or sequenced projects							X
6.06 All information for CDPHE stormwater construction permit							X
7.0 POTABLE WATER UTILITY PLAN	YES	NO	N/A	Sheet #	COMMENTS	PRELIMINARY CONSTRUCTION DRAWINGS	FINAL CONSTRUCTION DRAWINGS
7.01 Site map with north arrow and scale						X	X
7.02 Vicinity map with north arrow and scale						X	X
7.03 Title of project (list phases as applicable)						X	X
7.04 Label whether detached home, town homes, apartments, duplexes, condominiums, commercial, or industrial						X	X
7.05 Typical street cross sections showing all existing and proposed utilities with required separations						X	X

	YES	NO	N/A	Sheet #	COMMENTS	PRELIMINARY CONSTRUCTION DRAWINGS	FINAL CONSTRUCTION DRAWINGS
7.06 Town of Superior standard water plan notes							X
7.07 Signature blocks							X
7.08 Fire flow information (max static pressure, residual pressure)							X
7.09 Bar scale of sufficient size to properly show detail						X	X
7.10 Valves must be installed a maximum of every 600 feet or no more than 15 residential units out of service and 1 hydrant							X
7.11 System must be looped if more than 12 single family services are on a single feed water line						X	X
7.12 Permanent and temporary dead end mains require a hydrant or blow off per the Town standards						X	X
7.13 Show public water mains, stub-outs, and hydrants in public ROW or utility easement						X	X
7.14 Ensure utility easements meet Town standards						X	X
7.15 Outage modeling is required for shutdown of water mains greater than 12 inch diameter							X
7.16 30" minimum between fittings							X
7.17 Minimum of 4.5' of cover to top of pipe						X	X
7.18 Water lines shall be located 10 feet north or east of street centerline or 5 feet north or east of curb median						X	X
7.19 Provide calculations for all concrete thrust blocks for water mains greater than 16 inches and label volume							X
7.20 Show and label all existing and proposed utilities including fiber, gas, and electric. Size and material must be shown.						X	X
7.21 Label all existing and proposed water lines as public or private						X	X
7.22 Label match lines with stations and corresponding sheet numbers							X

	YES	NO	N/A	Sheet #	COMMENTS	PRELIMINARY CONSTRUCTION DRAWINGS	FINAL CONSTRUCTION DRAWINGS
7.23 Label all horizontal and vertical bends and size (45 degree max bend) Use standard pipe sizes.							X
7.24 Label street names (note if private)						X	X
7.25 Label all existing valves and fire hydrants						X	X
7.26 Show anode size, test station, and locations on DIP/steel mains							X
7.27 Label property lines						X	X
7.28 Label subdivision boundaries and adjacent filings						X	X
7.29 Label curb and gutter						X	X
7.30 Label sizes of all reducers							X
7.31 Label curve data (including PCs and PTs) with stations and label radius number and widths							X
7.32 Provide addresses and lot numbers for all lots/buildings							X
7.33 Label diameters and lengths of pipes in plan and profile						X	X
7.34 Label pipe material						X	X
7.35 Show stations for all fittings							X
7.36 Show stations for all crossings						X	X
7.37 Show stations for all service connections (4" and larger)							X
7.38 Label all concrete thrust blocks and show volumes							X
7.39 Label pipe as abandoned or removed per Town standards						X	X

	YES	NO	N/A	Sheet #	COMMENTS	PRELIMINARY CONSTRUCTION DRAWINGS	FINAL CONSTRUCTION DRAWINGS
7.40 Label length of main to be abandoned						X	X
7.41 Stub-outs must have temporary blow-off assemblies with thrust blocks						X	X
7.42 Label horizontal distance from proposed water line to other utilities where it deviates from typical cross section						X	X
7.43 Verify that water meter has minimum 3 ft radius of clearance and service lines have minimum 5 feet separation							X
7.44 Verify that water main is located in roadways, in drive aisles of parking areas, or at minimum 5 ft from edge of easement within the easement						X	X
7.45 Verify that water main is located minimum 10 ft away from any tree, structure, or building						X	X
7.46 Crossings underneath utilities shall have plan and profile and maintain a minimum of 18" separation							X
7.47 Show pipe elevations and vertical separations for all sanitary sewer, storm sewer, and electrical duct banks							X
7.48 If vertical separation is not met, flow-fill shall be used to achieve compaction							X
7.49 Show secondary containment (casing pipe, encased in concrete, flow-fill or HDPE/welded steel) which is required for water						X	X
7.50 Add concrete restraints at top and bottom of slope on grades greater than 10%							X
7.51 Install MJ restrained pipe on grade greater than 10%							X
7.52 Steel casing shall not be at a greater than 5% slope							X
7.53 Steel casing needs to be approximately 2 times the diameter of the encased water pipe						X	X
7.54 Ensure no taps or tees are proposed at casing locations or within a pipe lowering						X	X
7.55 Show casing pipe if water main is under another utility greater than 30" in diameter						X	X

	YES	NO	N/A	Sheet #	COMMENTS	PRELIMINARY CONSTRUCTION DRAWINGS	FINAL CONSTRUCTION DRAWINGS
7.56						X	X
7.57							X
7.58							X
7.59							X
7.60							X
7.61							X
7.62							X
7.63							X
7.64						X	X
7.65							X
7.66						X	X
7.67						X	X
7.68						X	X
7.69						X	X
7.70							X
7.71							X
7.72						X	X

	YES	NO	N/A	Sheet #	COMMENTS	PRELIMINARY CONSTRUCTION DRAWINGS	FINAL CONSTRUCTION DRAWINGS
7.73 Show profile grid elevations						X	X
7.74 All utility conflict areas are shown						X	X
7.75 Show existing and proposed water meters and easements							X
7.76 Show landscaping to ensure proper clearance at meter and distance to pipes							X
7.77 Show sequence of construction							X
8.0 REUSE WATER UTILITY PLAN	YES	NO	N/A	Sheet #	COMMENTS	PRELIMINARY CONSTRUCTION DRAWINGS	FINAL CONSTRUCTION DRAWINGS
8.01 Site map with north arrow and scale						X	X
8.02 Vicinity map with north arrow and scale						X	X
8.03 Title of project (list phases as applicable)						X	X
8.04 Label whether detached home, town homes, apartments, duplexes, condominiums, commercial, or industrial						X	X
8.05 Typical street cross sections showing all existing and proposed utilities with required separations						X	X
8.06 Town of Superior standard reuse water plan notes							X
8.07 Signature blocks							X
8.08 Bar scale of sufficient size to properly show detail						X	X
8.09 Permanent and temporary dead end mains require a blow off per the Town standards						X	X
8.10 Show public reuse water mains and stub-outs in public ROW or utility easement						X	X
8.11 Ensure utility easements meet Town standards						X	X

	YES	NO	N/A	Sheet #	COMMENTS	PRELIMINARY CONSTRUCTION DRAWINGS	FINAL CONSTRUCTION DRAWINGS
8.12 30" minimum between fittings						X	X
8.13 Minimum of 4.5' of cover to top of pipe						X	X
8.14 Provide calculations for all concrete thrust blocks for reuse water mains greater than 16 inches and label volume							X
8.15 Show and label all existing and proposed utilities including fiber, gas, and electric. Size and material must be shown.						X	X
8.16 Label all existing and proposed reuse water lines as public or private						X	X
8.17 Label match lines with stations and corresponding sheet numbers							X
8.18 Label all horizontal and vertical bends and size (45 degree max bend) Use standard pipe sizes.							X
8.19 Label street names (note if private)						X	X
8.20 Label all existing valves						X	X
8.21 Show anode size, test station, and locations on DIP/steel mains							X
8.22 Label property lines						X	X
8.23 Label subdivision boundaries and adjacent filings						X	X
8.24 Label curb and gutter						X	X
8.25 Label sizes of all reducers						X	X
8.26 Label curve data (including PCs and PTs) with stations and label radius number and widths							X
8.27 Provide addresses and lot numbers for all lots/buildings							X
8.28 Label diameters and lengths of pipes in plan and profile						X	X

	YES	NO	N/A	Sheet #	COMMENTS	PRELIMINARY CONSTRUCTION DRAWINGS	FINAL CONSTRUCTION DRAWINGS
8.29 Label pipe material						X	X
8.30 Show stations for all fittings							X
8.31 Show stations for all crossings							X
8.32 Label all concrete thrust blocks and show volumes							X
8.33 Label pipe as abandoned or removed per Town standards						X	X
8.34 Label length of main to be abandoned						X	X
8.35 Stub-outs must have temporary blow-off assemblies with thrust blocks						X	X
8.36 Label horizontal distance from proposed reuse water line to other utilities where it deviates from typical cross section						X	X
8.37 Verify that water meter has minimum 3 ft radius of clearance							X
8.38 Verify that reuse water main is located in roadways, in drive aisles of parking areas, or at minimum 5 ft from edge of						X	X
8.39 Verify that reuse water main is located minimum 10 ft away from any tree, structure, or building						X	X
8.40 Crossings underneath utilities shall have plan and profile and maintain a minimum of 18" separation							X
8.41 Show pipe elevations and vertical separations for all potable water, sanitary sewer, storm sewer, and electrical duct banks							X
8.42 If vertical separation is not met, flow-fill shall be used to achieve compaction							X
8.43 Add concrete restraints at top and bottom of slope on grades greater than 10%							X
8.44 Install MJ restrained pipe on grade greater than 10%							X
8.45 Steel casing shall not be at a greater than 5% slope							X

	YES	NO	N/A	Sheet #	COMMENTS	PRELIMINARY CONSTRUCTION DRAWINGS	FINAL CONSTRUCTION DRAWINGS
8.46 Steel casing needs to be approximately 2 times the diameter of the encased water pipe						X	X
8.47 Ensure no taps or tees are proposed at casing locations or within a pipe lowering						X	X
8.48 Show casing pipe if reuse water main is under another utility greater than 30" in diameter						X	X
8.49 If crossing pressure zones, a pressure reducing station is required						X	X
8.50 Show detail drawings for all pressure reducing stations on construction drawings. Show vents on plan view							X
8.51 Profile all pressure reducing stations							X
8.52 Profile all air and vacuum valve stations. Show vents on plan view.							X
8.53 Profiles required for all mains at scale of 1"=50' horizontal and 1"=5' vertical						X	X
8.54 Profiles include ground surface existing (dotted) and proposed (solid)						X	X
8.55 Stations on profile match plan view						X	X
8.56 Label existing and proposed grades						X	X
8.57 Label all proposed horizontal and vertical bends with elevations							X
8.58 Label percent grade on all profile pipes							X
8.59 Label all valves and show butterfly valves on 16" and larger waterlines						X	X
8.60 Show profile grid elevations						X	X
8.61 All utility conflict areas are shown						X	X
8.62 Show sequence of construction							X

9.0 SANITARY SEWER UTILITY PLAN	YES	NO	N/A	Sheet #	COMMENTS	PRELIMINARY CONSTRUCTION DRAWINGS	FINAL CONSTRUCTION DRAWINGS
9.01 Town of Superior standard wastewater general notes included						X	X
9.02 Sanitary sewer plan and profile at a scale of minimum 1"=50' horizontal and 1"=5' vertical						X	X
9.03 Provide summary table of pipe sizes, specification references, strength class, and approximate quantity by size and class							X
9.04 Profiles include ground surface existing (dotted) and proposed (solid)						X	X
9.05 Sanitary sewer lines to be located five feet south or east of street centerline						X	X
9.06 Label street width FL-FL and horizontal separation between utilities						X	X
9.07 When connecting to existing manholes or mains show and label all design information for such facilities including size, material, slope, etc.						X	X
9.08 Label manholes with stations (offset as required)							X
9.09 Provide reference stations and horizontal control for intersecting manholes							X
9.10 Show manhole stub-outs, wye and riser connections for services, service connections, and proposed future extensions							X
9.11 Show proposed underdrain system plan & profile						X	X
9.12 Show concrete encasement & cut-off walls							X
9.13 Label interval stationing and distinguish between centerline and sanitary sewer stationing							X
9.14 Label curve data including PCs and PTs with stations and label radius number and widths							X
9.15 Label service line locations with stations (commercial projects)							X
9.16 Label sleeves with beginning and ending station and include pipe size and material of sleeve							X

	YES	NO	N/A	Sheet #	COMMENTS	PRELIMINARY CONSTRUCTION DRAWINGS	FINAL CONSTRUCTION DRAWINGS
9.17 Label length, slope, and flow direction of pipes - must match stationing						X	X
9.18 Label manholes with stations , diameter, rim elevations, and all inverts (existing and proposed)						X	X
9.19 Label underdrain including type (passive or active), material, cleanouts, trench dams, and discharge points							X
9.20 Label existing and proposed grades						X	X
9.21 Label grid stations and elevations						X	X
9.22 Verify diameter of manholes and pipes						X	X
9.23 Label if manhole has locking lid and type							X
9.24 Manhole assessment must be completed when modifications or connections to existing manholes are proposed						X	X
9.25 Confirm maximum spacing between manholes is 400 feet						X	X
9.26 Show hydraulic grade and energy grade lines. Note locations where flow changes from sub to super critical flow.							X
9.27 No services allowed on stub for future main extensions							X
9.28 Show complete material list for each plan and profile drawing							X
10.0 TRAFFIC SIGNAGE, MARKINGS, & LIGHTING	YES	NO	N/A	Sheet #	COMMENTS	PRELIMINARY CONSTRUCTION DRAWINGS	FINAL CONSTRUCTION DRAWINGS
10.01 All signage and markings follow MUTCD standards and as designated by the Town							X
10.02 Signs are designed in accordance with Section 700							X
10.03 Stop signs shown at intersection approaches designated as through streets						X	X
10.04 Traffic signal complies with CDOT <i>Standard Specifications for Road and Bridge Construction</i>						X	X

	YES	NO	N/A	Sheet #	COMMENTS	PRELIMINARY CONSTRUCTION DRAWINGS	FINAL CONSTRUCTION DRAWINGS
10.05 All conduit is shown							X
10.06 Traffic signal cabinet location is approved by Town							X
10.07 Street Light spacing meets standard in Section 751.02 for the roadway type						X	X
10.08 Provide lighting plan showing existing and proposed lighting levels on and off site that will affect lighting levels on site							X
10.09 Provide details of lighting fixtures							X
10.10 Provide widths and materials of proposed striping							X
11.0 IRRIGATION AND LANDSCAPE PLAN	YES	NO	N/A	Sheet #	COMMENTS	PRELIMINARY CONSTRUCTION DRAWINGS	FINAL CONSTRUCTION DRAWINGS
11.01 Ownership/dedication, development responsibility and maintenance responsibility for each tract and outlot on cover sheet with acreage							X
11.02 Grading plans							X
11.03 Show property lines						X	X
11.04 Show irrigation and landscaping to be maintained by private entity							X
11.05 Show irrigation and landscaping to be maintained by the Town							X
11.06 Show proposed and existing sidewalk, fire hydrants, and underground utilities for proper clearances							
11.07 Signature box for Superintendent of Parks							X
11.08 Show mower access ramps						X	X
11.09 Shop drawings for all structures						X	X
11.10 Specify playground surfaces						X	X

	YES	NO	N/A	Sheet #	COMMENTS	PRELIMINARY CONSTRUCTION DRAWINGS	FINAL CONSTRUCTION DRAWINGS
11.11 Show sidewalk radii						X	X
11.12 Sidewalks to be flared at intersections						X	X
11.13 Plant ledger with count							X
11.14 Sightline triangles based on street speed limits						X	X
11.15 Show existing street lights, utility boxes, manholes, and street signs						X	X
11.16 Bold linetype for landscaping, lightened linetype for irrigation						X	X
11.17 Subdrain shown in areas with non-conforming irrigation according to geotechnical recommendations							X
11.18 Delineated native and manicured areas						X	X
11.19 Edger along bed areas adjacent to turf areas						X	X
11.20 No small, angular areas of turf						X	X
11.19 Drought tolerant bluegrasses in passive parks and ROW						X	X
11.20 Provide estimate of agronomic rates for grasses, bushes, trees, and turf						X	X
11.21 Provide "User Plan to Comply" (UPC) as required per regulation 84.						X	X

SECTION 200 – ACCEPTANCE PROCEDURES

201.00 GENERAL CONDITIONS

Refer to Section 100 TITLE, SCOPE AND GENERAL CONDITIONS of these DESIGN STANDARDS AND SPECIFICATIONS for additional requirements that apply to all projects within the Town.

210.00 SCOPE

The Town shall issue two types of acceptances for public improvements: (1) Probationary Acceptance into Warranty, which begins the warranty period, and (2) Final Acceptance, which ends the warranty period.

Stormwater detention ponds and permanent water quality structures or features (BMPs), which will be privately owned and maintained, shall be accepted by the Town without a warranty period. The requirements of the Probationary Acceptance into Warranty process shall apply to all stormwater detention ponds and permanent water quality systems.

Private improvements, such as parking lots or landscaping owned and maintained by a Homeowners Association or property management group, shall be constructed to comply with all applicable DESIGN STANDARDS AND SPECIFICATIONS. Private improvements shall not be accepted by the Town.

211.00 PROBATIONARY ACCEPTANCE INTO WARRANTY PERIOD

Letters of Probationary Acceptance into Warranty are issued by the Town Engineer.

211.01 Probationary Acceptance Inspection

Upon completion of construction of public improvements associated with utilities, roadways, landscaping and/or irrigation, and prior to requesting a Probationary Acceptance Inspection from the Town, the Developer shall conduct an inspection, make all necessary corrections and ensure that all temporary structures, debris, and mud have been removed.

When public improvements are complete and ready for inspection by the Town Construction Inspector, the Developer shall submit a written request to the Town. The request shall clearly state which public improvements are ready for inspection and shall include a complete draft set of Record Documents. Refer to Section 211.02 RECORD DOCUMENTS of these DESIGN STANDARDS AND SPECIFICATIONS.

Prior to inspection for Probationary Acceptance into Warranty for roadways, nondestructive deflection testing that complies with Section 938.00 PAVEMENT DEFLECTION TESTING of these DESIGN STANDARDS AND SPECIFICATIONS shall be performed to ensure structural integrity of the roadway. A Colorado Registered Professional Engineer shall submit a stamped and sealed copy of the nondestructive deflection testing report to the Town Engineer.

All variances from the approved construction plans shall be supported by documentation. All related testing certifications and other supporting documentation shall be submitted to the Town Engineer. All required certifications shall contain the signature and seal of a Colorado Registered Professional Engineer. The Town Engineer shall schedule a date and time for the inspection within five business (5) days of the Developer's request. Within five (5) business days after the Probationary Acceptance into

Warranty inspection, a list of deficiencies (punch list) shall be prepared by the Town Construction Inspector and presented to the Developer. Within ten (10) calendar days of receipt of this punch list, the Developer shall begin making corrections. All deficiencies shall be corrected by the Developer within thirty (30) calendar days of receipt of the punch list. After the Developer has corrected the deficiencies, the Developer shall request a follow-up inspection from the Town. When the public improvements pass the Probationary Acceptance into Warranty inspection, the Developer and the Town Construction Inspector shall sign the punch list to indicate completion.

The above time schedule may be extended only under special circumstances and with the written approval of the Town Engineer. If all deficiencies are not corrected in the time period outlined herein, the Town has the right to draw upon the performance guarantee, as specified in the Subdivision Improvement Agreement.

211.02 Record Documents

The Record Documents shall represent the “as-built” condition of all site improvements and shall be based upon the addenda, change orders and other data furnished. Every sheet of the Record Documents shall be attested to and sealed by a Colorado Registered Professional Engineer and/or Registered Professional Land Surveyor, and every sheet shall be stamped “RECORD DOCUMENT.”

The following information shall be included in the Record Documents:

- A. All approved plan revisions that have occurred since the Town Engineer approved the plans.
- B. For Roadways:
 - 1. Elevation check at a maximum of 150-foot intervals in each flow line along the street or at each elevation breakpoint, at the PCR of each radius, at the center and ends of each crossspan and at each grade break.
 - 2. Elevation at the flow line on each side of storm inlets.
 - 3. Elevations at all design points shown on the cul-de-sac plans.
 - 4. All locations of pavement markings.
 - 5. Location of all patched areas.
- C. For Sanitary Sewers and Storm Sewers:
 - 1. Any changes from the approved plans in materials or pipe sizes.
 - 2. Elevation of all in and out inverts at manholes, inlets and outlets.
 - 3. Distances between manholes and between manholes and inlets or outlets.
 - 4. Location of all sanitary sewer service connections.
 - 4. Rim elevations on all manholes and drainage inlet structures and number of rings added during paving operations.
 - 5. Elevation checks every 100 feet in the flow line of all drainage channels.
- D. For Detention Ponds and Water Quality Improvements
 - 1. Professional Engineer certification regarding final detention pond volume and the final release rate per drainage criteria.
 - 2. Professional Engineer certification that all water quality features (Permanent BMP's) were installed per the approved design documents.
- E. For Water Mains:
 - 1. Any changes from the approved plans in materials or pipe sizes.

2. Horizontal verification of water valves, tees, crosses and fire hydrants if changed from the approved plans.
 3. Location(s) and type of restraint installed.
 4. Location of all water service connections.
- F. For Public Landscaping and Irrigation Improvements:
1. List of all plant material installed, including size and quantities (as certified by a Landscape Architect).
 2. List area of turf in acres and percent of total area.
 3. Horizontal verification of all structures. Show pertinent physical features, such as sidewalks, bike paths, fences, ponds, buildings, parking lots and athletic fields.
 3. Horizontal verification of all irrigation pipes, irrigation heads, valve boxes, wiring, electrical boxes, controllers, meters and backflow protection devices. Noted information shall include all pipe sizes, zone numbers, valve locations, head types, valve types and model numbers as well as controller types and model numbers.

211.03 Application for Probationary Acceptance into Warranty

After the public improvements have passed the Probationary Acceptance into Warranty inspection, the Developer shall complete an Application for Probationary Acceptance into Warranty of Public Improvements. It shall be submitted to the Town Engineer with a signed copy of the completed Probationary Acceptance into Warranty inspection list within seven (7) business days. The following items shall be submitted with the application prior to the Town Engineer's consideration for Probationary Acceptance into Warranty:

- A. General Contractor of Record information.
- B. Two complete sets of 22-inch by 34-inch Record Documents.
- C. A PDF set of Record Documents.
- D. A complete GIS-compatible digital copy of documents, in compliance with the Town of Superior GIS Data Dictionary, accurately representing the completed project as constructed.
- E. Field Inspection Reports as required in Section 160.00 PLANS AND SPECIFICATIONS of these DESIGN STANDARDS AND SPECIFICATIONS.
- F. A complete set of geotechnical engineering reports stamped and sealed by a Colorado Registered Professional Engineer.
- G. A Final Sworn Affidavit of Construction Cost.
- H. Date of installation of all piping and appurtenances.
- I. Any other items or Special Provisions required by the Subdivision Improvement Agreement.

The Town Engineer will review the Application for Probationary Acceptance into Warranty of Public

Improvements for accuracy and completeness.

211.04 Letter of Probationary Acceptance into Warranty

Upon approval of the Record Documents and the Application for Probationary Acceptance into Warranty of Public Improvements, the Town Engineer will prepare and issue a Letter of Probationary Acceptance into Warranty to the Developer that states which improvements are accepted. The warranty period shall begin on the date indicated in the Letter of Probationary Acceptance. Upon issuance of the Letter of Probationary Acceptance, maintenance of the new public improvements and facilities shall become the responsibility of the Town, except for repairs and replacements that—in the opinion of the Town—become necessary during the warranty period. Maintenance of privately owned stormwater drainage systems, detention ponds and water quality improvements shall remain the responsibility of the property owner or party designated on the approved plat or Final Development Plan.

At the time of the issuance of the Letter of Probationary Acceptance into Warranty (Irrigation and Landscaping), the developer shall make a formal request to the Town to transfer the water and electrical bill from the developer to the Town.

During the warranty period, the Town may issue the developer written notice requesting warranty repairs and/or replacements. The Developer shall begin and complete repairs and/or replacements within the time period specified on the written notice. The Town may make the repairs and replacements and/or draw upon the Developer’s warranty performance guarantee as specified in Subdivision/Improvement Agreement.

211.05 Duration of Warranty Period for Public Improvements and Facilities

TABLE 200.01 WARRANTY PERIOD FOR PUBLIC IMPROVEMENTS AND FACILITIES

	DEVELOPMENT PROJECTS	CAPITAL IMPROVEMENT PROJECTS
Utilities	2 years	Per Contract
Roadways	2 years minimum. See additional warranty duration requirements below.	Per Contract. See additional warranty duration requirements below.
Irrigation/ Landscaping	2 years	2 years

All repairs done during the warranty period will be warrantied for an additional year.

Note that an additional manufacturer warranty may be required for specific equipment. See equipment specifications.

211.06 Warranty Performance Guarantee

Upon issuance of the Letter of Probationary Acceptance, the Town may release a portion of the performance guarantee, provided that the balance of the performance guarantee is sufficient to fund incomplete improvements and possible warranty replacements and repairs. A minimum of twenty-five (25) percent of the certified public improvements cost shall be held by the Town throughout the

warranty period, unless otherwise stated in the Subdivision Improvement Agreement or as required by the Town Engineer. Performance guarantee for privately owned storm drainage systems, detention ponds and water quality improvements will be released in full upon issuance of the Letter of Probationary Acceptance unless otherwise stated in the Subdivision Improvement Agreement or as required by the Town.

211.07 Probationary Acceptance into Warranty Maintenance Responsibility for Public Improvements and Facilities

TABLE 200.02 RESPONSIBILITY FOR PUBLIC IMPROVEMENTS AND FACILITIES DURING WARRANTY

	RESPONSIBILITIES	
Utilities	Town of Superior	Maintenance and Operation
	Developer/Contractor	Repairs and Replacement
Roadways	Town of Superior	Maintenance*
	Developer/Contractor	Repairs and Replacement*
Irrigation	Town of Superior	Maintenance Except for First Winterization and Spring Turn-on
	Developer/Contractor	Repairs and Replacement Plus First Winterization and Spring Turn-on
Landscaping	Town of Superior	Maintenance
	Developer/Contractor	Repairs and Replacement

*Roadway maintenance during the warranty period is generally limited to street sweeping, sign maintenance and snow plowing. Pavement preservation operations including crack sealing, patching or asphalt surface sealing during the warranty period are considered repair operations and are the responsibility of the Developer and/or Contractor.

212.00 FINAL ACCEPTANCE AND RELEASE FROM WARRANTY BY THE TOWN

The warranty period does not expire until all warranty repairs and replacements have been made and approved by the Town.

212.01 Final Acceptance/Release from Warranty Inspection

Approximately two (2) months before the end of the warranty period, the Developer shall submit a written request for a Final Acceptance/Release from Warranty inspection from the Town. The request shall clearly state which public improvements are ready for inspection. The Town Engineer shall schedule a date and time for the inspection within five (5) business days of the Developer’s request. Within five (5) business days after the Final Acceptance/Release from Warranty inspection, a punch list shall be prepared by the Town Construction Inspector and presented to the Developer. Within ten (10) calendar days of receipt of this punch list, the Developer shall begin making corrections. All deficiencies shall be corrected

by the Developer within thirty (30) calendar days of receipt of the punch list.

After the Developer has corrected the deficiencies, the Developer shall request a follow-up inspection from the Town. When the public improvements pass the Final Acceptance/Release from Warranty inspection, the Developer and the Town Construction Inspector shall sign the punch list to indicate completion.

The above-mentioned schedules may be extended only under special circumstances and with the written approval of the Town.

212.02 Final Acceptance/Release from Warranty Work for Roadways

At the end of the two-year warranty period, roadways shall have a minimum Remaining Service Life (RSL) of 20 minus the warranty period in years (typically an RSL 18). Final Acceptance/Release from Warranty work for roadways includes pavement testing of areas of visual distress, repairs and/or replacements to concrete and asphalt and the final asphalt surface treatment if required. The final asphalt surface treatment will depend on the condition/RSL of the roadway at the end of the warranty period.

The necessary surface treatment may range from nothing to edge milling and a 2-inch asphalt overlay, depending on the Remaining Service Life (RSL) of the roadway.

After all concrete and asphalt repairs have been made and re-inspected by the Town, the asphalt surface treatment shall be installed and the Developer shall request a follow-up Final Acceptance/Release from Warranty inspection. The Developer shall begin and complete Final Acceptance/Release from Warranty work within 90 days. The time period may be extended during cold weather months or under special circumstances and with the written approval of the Town Engineer. If the Developer does not begin and complete all Final Acceptance/Release from Warranty work within this time period, the Town may draw upon the warranty performance guarantee as specified in the Subdivision/Improvement Agreement.

212.02.01 Final Acceptance and Release from Warranty of Roadways in Developments Where Less Than eight percent of the buildings have Certificates of Occupancy

If less than eighty percent of the number of homes or commercial buildings along a roadway within the Development have been issued Certificates of Occupancy at the end of the two-year warranty period, the Developer shall repair all areas of visual pavement distress on the roadway as directed by the Town. The Town will prepare a cost estimate to edge mill and add a two-inch asphalt overlay. The cost estimate will be based on current year average bids of comparable projects for edge milling and SX asphalt. The Developer shall pay the Town the amount of the estimated cost within 90 days, or the Town shall draw upon the performance guarantee (Letter of Credit or escrow) as specified in the Subdivision Improvement Agreement. At that time, the developer shall be released from Warranty obligations, and it shall become the responsibility of the Town to complete the edge milling and final overlay at an appropriate time.

212.03 Final Acceptance and Release from Warranty

After the public improvements have passed the Final Acceptance/ Release from Warranty inspection or the Town has drawn upon the warranty performance guarantee and completed the public improvements, the Town Engineer shall prepare a Letter of Final Acceptance/ Release from Warranty. Final Acceptance shall be issued, the warranty period shall expire, and the Town Engineer will release the balance of the warranty performance guarantee.

SECTION 300 – SOILS AND EARTHWORK

301.00 GENERAL CONDITIONS

Refer to Section 100 TITLE, SCOPE AND GENERAL CONDITIONS of these DESIGN STANDARDS AND SPECIFICATIONS for additional requirements that apply to all projects within the Town.

310.00 SCOPE

All site work and earthwork shall comply with the requirements of these DESIGN STANDARDS AND SPECIFICATIONS and any special criteria established by the Town. Site work shall be completed as shown on the approved engineering plans. Site work may consist of demolition, removal, and abandonment; clearing and grubbing; overlot grading; removal of topsoil; site preparation; embankment subgrade preparation; embankment fill; excavation, trenching, bedding and backfill of pipelines and service lines; excess excavation; structure backfill; roadway excavation, backfill and compaction; borrow; and restoration and cleanup. All workmanship and materials shall be in accordance with the requirements of these DESIGN STANDARDS AND SPECIFICATIONS and shall conform to the lines, grades, quantities, and the typical cross-sections shown on the approved plans, or as directed by the Town.

311.00 INSPECTIONS, OBSERVATION, AND TESTING

The Contractor shall provide site access to all Town Construction Inspectors, and all other project quality control (QC) and/or quality assurance (QA) personnel, throughout the earthwork process, for observation and testing purposes. **The Developer shall provide for full time observation of all embankment fill, over-excavation and re-compaction, and backfill placement by a certified materials testing agency.** The Contractor shall not proceed with work until a certified materials testing agency is on site for observation and testing, unless approved by the Town.

Test agency shall provide written field draft copies of all test results to the Town Construction Inspector daily.

All testing and retesting to meet requirements and specifications shall be at the Contractor's expense.

311.01 Qualifications for Testing Agencies

Testing Agencies working in the Town shall certify to the Town Public Works & Utilities Department that they comply, as requested and appropriate, with the current requirements of:

American Society for Testing and Materials (ASTM), *Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation*, Designation C 1077

American Society for Testing and Materials (ASTM), *Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection Road and Paving Materials*, Designation D 3666

American Society for Testing and Materials (ASTM), *Standard Practice for Minimum Requirements for Agencies Engaged in the Test and/or Inspection of Soil and Rocks used in Engineering Design and Construction*, Designation D 3740

American Society for Testing and Materials (ASTM), *Standard Practice for Certification of Personnel Engaged in the Testing of Soil and Rock*, Designation D 5255

American Society for Testing and Materials (ASTM), *Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection*, Designation E329

The Testing Agency's submittal shall include, at a minimum, the inspection certificate of the Testing Agency, issued within the last two years, by a third party such as the American Association for Laboratory Accreditation, the National Voluntary Laboratory Accreditation Program, AASHTO Accreditation Program, or the Cement and Concrete Reference Laboratory, as appropriate; and a copy of the Testing Agency's Quality Assurance Program.

The Person responsible for and in direct supervision of all Quality Control testing shall be a Registered Professional Engineer in the State of Colorado and practicing in a related field. The technician conducting inspections, taking samples, and performing tests must possess one or more of the following qualifications:

- Technicians conducting soil and material testing inspection, compaction testing, or collecting samples for laboratory testing must have a WAQTC, ACI Aggregate Base Course, or NICET Level II certificate, or higher in each area.
- Technicians conducting pavement inspections, taking asphalt samples, conducting asphalt content tests, conducting gradation tests or asphalt compaction tests, and determining asphalt volumetric and strength characteristics must have the following certifications from LabCAT or equivalent.
 - Certification A – Laydown Operations (Field Control)
 - Certification B - Plant Materials Control (Field Control/ Laboratory)
 - Certification C - Volumetric & Stability (Laboratory)
 - Certification E – Aggregate (Field Control/ Laboratory)
 - Certification I - Asphalt Paving Materials Inspector (Field Control)
- Technicians taking Portland Cement Concrete samples and conducting field tests must have an ACI Field certification.
- Technicians conducting tests of Portland Cement Concrete for compressive and flexural strength shall be an ACI Strength certified technician.
- Technicians determining mixture design characteristics shall be an ACI Level I/II.

311.02 Minimum Testing Requirements

TABLE 300.01

MATERIALS	ASSHTO	ASTM	MINIMUM FREQUENCY OF TESTS
IN PLACE DENSITY			
NUCLEAR	T310	D6938	EMBANKMENT (NON ROADWAY) ONE TEST PER EVERY 1,000 CUBIC YARDS FOR OPEN SPACE AND PARK AREAS; OTHERWISE, ONE TEST PER EVERY 250 CUBIC YARDS (MINIMUM OF 1 TEST PER LIFT AND 3 TESTS PER DAY)
			ROADWAY / SUBGRADE (INCLUDING SIDEWALK AND CURB & GUTTER) - ONE TEST PER EVERY 200 LANE FEET PER 8" LAYER, MINIMUM OF 3 TEST PER DAY
			UTILITY TRENCHES - ONE TEST PER 150 LINEAL FEET PER 8" VERTICAL LIFT - TEST POINTS STAGGERED SO AS TO NOT ALIGN ON TOP OF THE TEST BELOW. MINIMUM OF 3 TESTS PER DAY. MINIMUM 1 TEST PER 8" VERTICAL LIFT PER SERVICE LINE.
			VERTICAL STRUCTURES - MANHOLES, INLETS, FIRE HYDRANTS & VALVE BOXES - 1 TEST PER 4" VERTICAL LIFT - TEST POINTS STAGGERED SO AS TO NOT ALIGN ON TOP OF THE TEST BELOW - TEST TAKEN WITHIN 2' OF THE STRUCTURE
PROOF ROLLING			ALL SUBGRADE AND BASE COURSES
AGGREGATE BASE COURSE			
GRADATION	T27 & T11	C136	ONE TEST PER EVERY 500 TONS OR FRACTION THEREOF
IN PLACE DENSITY	T310	N/A	ONE TEST PER EVERY 200 LANE FEET PER LAYER
THICKNESS	N/A	N/A	ONE TEST PER EVERY 200 LANE FEET PER 6" LIFT

TABLE 300.01 (cont.)

MATERIALS	ASSHTO	ASTM	MINIMUM FREQUENCY OF TESTS
HOT MIX ASPHALT (HMA)			
SAMPLING	R66	D979 / D3665	ONE TEST PER EVERY 500 TONS OR FRACTION THEREOF PER DAY (NOT LESS THAN ONE TEST PER DAY)
MARSHALL	T245/ T166	D6926/D6927	ONE TEST PER EVERY 500 TONS OR FRACTION THEREOF PER DAY (NOT LESS THAN ONE TEST PER DAY)
HVEEN PROPERTIES	T246/ CDOT 5106 T247 CP-L	D1560	ONE TEST PER EVERY 500 TONS OR FRACTION THEREOF PER DAY (NOT LESS THAN ONE TEST PER DAY)
SUPERPAVE GYRATORY COMPACTOR	T312	D6925	ONE TEST PER EVERY 500 TONS OR FRACTION THEREOF PER DAY (NOT LESS THAN ONE TEST PER DAY)
IN PLACE DENSITY	T310-01	D2950	NUCLEAR, ONE TEST EVERY 200 LINEAL LANE FEET PER LIFT OF IN PLACE HOT BITUMINOUS PAVING MIXTURES. MINIMUM 4 TESTS PER INTERSECTION.
JOINT DENSITY	T166	D2926	ONE TEST PER 200 LINEAL FEET (OR FRACTION THEREOF) PER LIFT
ASPHALT CONTENT AND GRADATION	T164 / T308	D2172/ D6307 D5444	ONE TEST PER EVERY 500 TONS OR FRACTION THEREOF PER DAY (NOT LESS THAN ONE TEST PER DAY)
MAXIMUM SPECIFIC GRAVITY OF HBP	T209	D2041	ONE TEST PER EVERY 500 TONS OR FRACTION THEREOF PER DAY (NOT LESS THAN ONE TEST PER DAY)
BULK SPECIFIC GRAVITY (LABORATORY)	T166	D2726	ONE TEST PER EVERY 500 TONS OR FRACTION THEREOF PER DAY (NOT LESS THAN ONE TEST PER DAY)
AIR VOIDS AND VMA	T269	D3203	ONE TEST PER EVERY 500 TONS OR FRACTION THEREOF PER DAY (NOT LESS THAN ONE TEST PER DAY)
BULK SPECIFIC GRAVITY (CORES)	T166	D2726 / D3549	WHEN DIRECTED BY TOWN ONE TEST PER EVERY 200 LINEAL LANE FEET PER LAYER OF IN PLACE HOT BITUMINOUS PAVING MIXTURES
AGGREGATE GRADATION	T27	C136	ONE TEST PER EVERY 1,000 TONS OR FRACTION THEREOF (NOT LESS THAN ONE TEST PER DAY)

TABLE 300.01 (cont.)

MATERIALS	ASSHTO	ASTM	MINIMUM FREQUENCY OF TESTS
CONCRETE			
SAMPLING	T60	C172	ONE TEST, FIRST LOAD OF THE DAY, THEN EVERY 50 CUBIC YARDS OR PORTION THEREOF PER DAY (NOT LESS THAN ONE TEST PER DAY)
COMPRESSIVE STRENGTH	T22	C39	ONE SET OF 5 CYLINDERS,* FIRST LOAD OF THE DAY, THEN EVERY 50 CUBIC YARDS OR PORTION THEREOF PER DAY (NOT LESS THAN ONE TEST OF 5 CYLINDERS PER DAY)
TEMPERATURE	T309	C1064	ONE TEST, FIRST LOAD OF THE DAY, THEN EVERY 50 CUBIC YARDS OR PORTION THEREOF PER DAY (NOT LESS THAN ONE TEST PER DAY)
SLUMP	T119	C143	ONE SET, FIRST LOAD OF THE DAY, THEN EVERY 50 CUBIC YARDS OR PORTION THEREOF PER DAY (NOT LESS THAN ONE TEST PER DAY)
UNIT WEIGHT/ DENSITY AND AIR CONTENT	T196 / T121 / T152	C173 / C138 / C231	ONE SET, FIRST LOAD OF THE DAY, THEN EVERY 50 CUBIC YARDS OR PORTION THEREOF PER DAY (NOT LESS THAN ONE TEST PER DAY) IF FAILING AIR CONTENT TEST, THE NEXT 3 TRUCKS SHALL BE TESTED FOR AIR CONTENT.
THICKNESS (CORING)	T24	C174 / C42	WHEN DIRECTED BY TOWN ONE TEST PER 500 LINEAL FEET

Concrete paving, when approved, shall meet all applicable CDOT testing requirements.

* 5 compressive strength cylinders required: 1 at 7 day, 1 at 14 day, 2 at 28 day, 1 for hold.

312.00 DEMOLITION, REMOVAL, AND ABANDONMENT

The Contractor shall remove, wholly or in part, and satisfactorily dispose of all foundations, signs, structures, fences, old pavements, abandoned pipelines, traffic control device materials, and any other obstructions which are not designated on the approved plans or allowed to remain. Utilities and other items for which alternative provisions have been made for removal shall follow demolition, removal, and abandonment procedures shown on the approved plans or as otherwise approved by the Town. Removal of sign panels shall include all work necessary to remove the panel and attachment hardware from the existing installation. Concrete sign post bases shall be removed. Pedestals and bases shall be removed to one (1) foot below the surrounding ground or subgrade, and backfilled with suitable material.

Where portions of structures are to be removed, the remaining parts shall be prepared to accommodate the new construction. The work shall be performed in such a manner that materials left in place shall be protected from damage. All damage to portions of structures to remain shall be repaired at the Contractor's expense. Reinforcing steel that projects from a structure to remain shall be cleaned and aligned to provide an adequate bond with new construction. Dowels shall be securely grouted with an approved grout. Depressions that result from removal of structures, footings, and other obstructions shall be filled and compacted with clean structural fill materials or an approved controlled low-strength material (CLSM or "flowable fill") mixture, so as to eliminate hazards, such as cave-in or accumulation and ponding of water.

Materials used for traffic detour structures supplied by the Contractor shall be the property of the Contractor. After the detour is abandoned, the Contractor shall completely remove the traffic detour structure materials. Disposal of materials shall comply with Section 312.01 DISPOSAL of these DESIGN STANDARDS AND SPECIFICATIONS.

After all demolition, removal, and abandonment work is complete, the Contractor shall grade the entire contract area by properly filling, compacting, and leveling the site to existing adjacent grades or to lines and grades shown on the approved plans.

312.01 Disposal

The Contractor shall make all necessary arrangements to obtain suitable disposal locations. If disposal shall be at locations other than established dumpsites, the Town may require the Contractor to furnish written permission from the property owner, on whose property the materials and debris are proposed to be placed. Materials and debris shall be disposed of in a manner approved by the Town. Burning shall not be allowed without prior written approval of the Town, the Boulder County Health Department, and the Rocky Mountain Fire District.

312.02 Salvage

All salvageable material indicated on the approved plans and any additional salvageable material marked by the Town shall be removed, without unnecessary damage, in sections or pieces which may be readily transported and shall be stored by the Contractor in locations approved by the Town. The Contractor shall be required to replace any materials lost due to improper storage methods or damaged by negligence. These materials include, but shall not be limited to, the following: manhole frames and covers; inlet grates; valves and fire hydrants; landscape plant materials; fence materials; handrails; culverts; guardrails; walkways; roadway and traffic appurtenances (traffic signals and attached hardware, including mast arms and span wire); and irrigation systems and appurtenances.

312.03 Bridges, Culverts, and Other Drainage Structures

Bridges, culverts, and other drainage structures in use by traffic shall not be removed until a Traffic Control Plan has been approved by the Town. Refer to Section 141.13 TRAFFIC CONTROL, BARRICADES, AND WARNING SIGNS of these DESIGN STANDARDS AND SPECIFICATIONS.

Unless otherwise directed, the foundations or substructures of existing structures shall be removed down to one (1) foot below natural ground surface or bottom of drainage way. Where such portions of existing structures lie, wholly or in part, within the limits of a new structure, they shall be removed, as necessary, to accommodate construction of the proposed structure. Steel, concrete, and wood bridges shall be dismantled. Steel members to be salvaged shall be match-marked by the Town or the Contractor with waterproof paint.

312.04 Pipe and Appurtenances

All pipe and appurtenances to be taken out of service shall be completely removed or may be abandoned in place by approval of the Town as specified below.

Water Service – The tapping saddle (if used) and corporation stop shall be removed and the hole covered with a main line-size by 24-inch long stainless steel repair clamp. The repair clamp shall be a Ford[®], all stainless steel repair clamp style FS1, single section, or approved equal.

Fire Service (main line tee or swivel tee) – The valve on the tee shall be removed and the tee shall be capped or plugged as needed. Pipe greater than eight (8) inches in diameter shall be either removed or abandoned in place by filling with CLSM. Pipe eight (8) inches or less in diameter may be left in place, but shall be capped or plugged at each end. A thrust block shall be placed at cap or plug.

Main Lines – Pipe greater than eight (8) inch diameter shall either be removed or abandoned in place, by filling with CLSM. Pipe eight (8) inches or less in diameter may be left in place, but shall be capped or plugged at each end.

Sanitary Sewer Service – The service saddle or wye/tee fitting shall be removed, and a new piece of main line pipe shall be installed, using a Fernco[®] Strong Back RC Series repair coupling or an Indiana Seal[®] shear guard repair coupling. For sanitary sewer stubs out of manholes, the pipe shall be cut off on the outside of the manhole. A new invert base shall be poured and the abandoned pipe shall be filled with concrete and encapsulate the pipe. Otherwise, the pipe shall be either removed or abandoned in place by filling with CLSM.

Pipe designated to be reused by the Town shall be removed and stored, when necessary, to prevent loss or damage before transfer.

Excavation required to remove pipe or appurtenances shall be backfilled and compacted, in accordance with Section 340.00 TRENCHING, BACKFILLING AND COMPACTING of these DESIGN STANDARDS AND SPECIFICATIONS.

When pipe is to be abandoned in place, it shall be completely filled with flashfill, composed of 1600 to 1800 lbs. of Boral fly ash type F, 200 to 400 lbs. of Boral fly ash Type C, and 800 to 1200 lbs. of water per CY unless otherwise approved by the Town. Each end of the pipe shall be capped with concrete.

When removing appurtenances such as manholes, catch basins, inlets etc., any live lines connected to

these appurtenances shall be properly bypassed and shall remain in operation until abandonment is complete.

When appurtenances are to be abandoned in place, the remaining structure shall be lowered to a minimum of three (3) feet below finished grade, and shall be filled with concrete, with a minimum compressive strength of 3000 psi (at 28 days), to the top of the remaining structure, and then backfilled and compacted to the required grades.

312.05 Pavement and Concrete Flatwork

All concrete or asphalt to remain shall have a straight, true break line and a vertical face. Concrete or asphalt shall be cut with a saw. Concrete replacements shall be from control joint to control joint, provided that the stone is a minimum of five (5) feet. Asphalt cuts shall be parallel and perpendicular to the roadway. Asphalt and concrete patches shall not have more than four sides to the cut. Any damage to adjacent concrete or asphalt intended to remain in place shall be repaired at the Contractor's expense. The minimum depth of saw cuts for repair in concrete shall be six (6) inches.

If areas cut for future placement of concrete or asphalt adjacent to existing asphalt or concrete are left exposed for longer than thirty (30) days or subjected to inclement weather, the areas shall be evaluated by a Geotechnical Engineer and a recommendation shall be provided to the Town. An additional cut of at least six (6) inches behind and/or below the existing structure, or until competent subgrade is encountered, may be required by the Town.

The Contractor shall be responsible for the cost of removal and replacement of all excess concrete placement, as determined by the Town.

320.00 SITE PREPARATION

The Contractor shall complete all work necessary to properly prepare the site, as shown on the approved plans and as specified herein. The site shall be prepared in such a manner that facilitates subsequent soils or earthwork operations. Site preparation includes clearing, grubbing, grading, tree and shrub removal, native grass stripping, and removing and disposing of all debris within the limits of the project and other such areas as may be indicated on the plans or required by the work. Site preparation procedures shall be performed to comply with the approved plans or as designated by the Town. Adjacent vegetation and other items to remain shall be adequately preserved from injury.

321.00 CLEARING

All sites to receive fill shall be cleared of organic materials, including root structures, at the Contractor's expense. Vegetation shall be pulled or grubbed in such a manner as to assure complete and permanent removal. Branches of trees extending over the roadbed shall be trimmed to give a clear height of twenty (20) feet above the road bed surface. All surface objects and trees, stumps, roots and other protruding obstructions not designated to remain shall be cleared and/or grubbed as required by the Geotechnical Engineer. Non-biodegradable, solid objects located at least two (2) feet below the final subgrade surface may remain, at the discretion of the Town.

The Town may establish clearing lines and designate items and materials to remain. The Contractor shall preserve all materials and items to remain. Paint used for cut or scarred surfaces of trees or shrubs to remain shall be an approved asphalt base paint formulated especially for tree surgery.

Except in areas to be excavated, stump holes and other holes from which obstructions are removed shall be backfilled with suitable material and compacted in accordance with these DESIGN STANDARDS AND SPECIFICATIONS.

The Contractor shall clear and grub areas where excavation or embankment shall be made. Clearing and grubbing shall include the removal of organic material, such as brush, roots, sod, grass, agricultural crop residue, sawdust, and vegetable matter from the surface of the ground.

Clearing shall be performed with due consideration for and protection of the general public and public and private property. Any damage to streets, parking lots, utilities, plants, trees, buildings or structures on public or private property, or to bench marks and construction staking due to the negligence of the Contractor, shall be repaired and restored to its original condition at the Contractor's expense. Areas proposed to be preserved shall be clearly staked or fenced off by the Contractor. It shall be the Contractor's responsibility to ensure that these areas are not damaged during the construction process. Any damaged areas shall be repaired or replaced at the Contractor's expense.

322.00 STAKING AND GRADE CONTROL

Control and construction stakes shall be set by field parties, under the supervision of a Colorado Registered Professional Engineer or a Colorado Registered Land Surveyor, who shall be paid by the Contractor. These field parties shall be available to check field control and to provide assistance to the Contractor. A set of approved plans shall be kept on the job site at all times by the Contractor.

It shall be the responsibility of the Contractor to maintain the alignment and grade shown on the approved plans. The alignment and grade elevation of forms shall be checked, and any necessary corrections shall be made before placing the concrete. When any form has been disturbed or any subgrade thereunder has become unstable, the subgrade shall be reconditioned or replaced in accordance with these DESIGN STANDARDS AND SPECIFICATIONS.

323.0 GRADING REQUIREMENTS

323.01 Grading Permit

Grading Permit shall be required, as specified in Section 151.00 Right-of-way Permit, Grading Permit, and Storm Water Quality Permit of these DESIGN STANDARDS AND SPECIFICATIONS.

323.02 Grading Methods

All areas disturbed during grading operations shall have the final graded area hydro-seeded or revegetated with native grasses, in accordance with the requirements of Section 1000 PARKS AND RECREATION CONSTRUCTION of these DESIGN STANDARDS AND SPECIFICATIONS. Seeding shall be completed within thirty (30) days of the grading completion and no longer than ninety (90) days of the commencement of grading operations at the site.

The Contractor shall comply with all dust control requirements of Section 141.12 Dust Control of these DESIGN STANDARDS AND SPECIFICATIONS for the duration of the project.

Areas adjacent to structures and other areas inaccessible to heavy grading equipment shall be graded by approved manual methods. Grading of filled and unfilled areas shall be to the lines and grades indicated on the approved plans. Grading shall be performed in conjunction with all necessary clearing, grubbing,

stripping, filling, and compacting operations.

Final grading shall be performed to provide proper drainage for the overall site and away from site improvements that may be sensitive to moisture infiltration. In no case shall drainage from the project site be altered or controlled in a manner that may result in damage, or the potential for damage, to adjacent property or to any portion of the work from erosion or flooding.

323.03 Cut and Fill Requirements

All areas with slopes greater than four to one (4:1) shall be benched or modified by an approved method prior to receiving fill. Benching dimensions shall be determined by the project Geotechnical Engineer.

All fill shall be placed in a controlled state, tested for moisture and density, in locations designated in the approved plans and reports and in accordance with these DESIGN STANDARDS AND SPECIFICATIONS, unless otherwise approved by the Town. Fill materials shall not be placed, stockpiled or stored in an area that is not designated on the plans or approved by the Town.

The Contractor shall comply with all federal and state environmental laws, such as the Endangered Species Act, Federal Emergency Management Act, Army Corps of Engineers Wetlands Regulations, Division of Wildlife Regulations, and CDPHE. Contractor shall make every effort to relocate wildlife prior to grading. Relocation plans shall be approved by the Town. All wetlands shall be protected by silt fencing and other required Best Management Practices (BMP's), during grading operations, and until disturbed areas are fully re-vegetated.

Upon completion of work in which a Grading Permit is required, the Contractor shall provide the following information, certified and sealed by a Colorado Registered Professional Engineer:

- A. An "as-built" area grading plan, which shows original ground surface elevations, as-constructed ground surface elevations, limits and depths of over-excavation, lot drainage patterns and locations and elevations of all surface and subsurface drainage facilities.
- B. An overlot grading summary report prepared, by the project Geotechnical Engineer which states that fill placement is in conformance to approved plans and reports, and includes locations and elevations of field density tests (referenced from a permanent landmark or permanent control point), summaries of field and laboratory tests and any other substantiating data and comments regarding deviations from the approved plans and reports and how they relate to or affect recommendations in the approved Geotechnical Engineering Report and grading plan.

323.04 Topsoil

The Contractor shall salvage within the project limits, or acquire when needed, loose friable loam ("topsoil") free of admixtures of subsoil, refuse, stumps, roots, rocks, brush, weeds, heavy clay, toxic substances or other material which would be detrimental to the proper development of vegetative growth. Topsoil shall not be placed until the areas to be covered have been properly prepared and grading operations in the area have been completed. Topsoil shall be placed, spread, and keyed to the underlying material at locations and to the thickness shown on the approved plans.

Topsoil shall not be incorporated into any embankment fill or backfill material without prior approval of the project Geotechnical Engineer and the Town.

330.00 EARTHWORK

Earthwork shall consist of excavation, disposal, shaping, moisture conditioning, and compaction of all material encountered within the limits of the project, including but not limited to excavation of ditches and channels, surface boulders, muck, rock, concrete foundations, slabs, stripping, etc. Excavation shall be performed to the line and grade and typical cross-sections shown on the approved plans or as required by the Town Engineer.

Excavation, dewatering, sheeting, and bracing shall be performed so as to eliminate any possibility of undermining or disturbing the foundation of any existing structures, utilities, pavement and concrete flatwork.

Free-running water shall be drained from all earthwork materials, prior to construction of structures, utilities, or concrete flatwork..

The Town may require the Contractor to submit a proposed earthmoving diagram and map of proposed haul routes for approval.

330.01 Definitions

- A. Unclassified Excavation – Any and all earthen materials encountered, including rocks and boulders, during construction. Rock formations that can be removed by ripping, with a D-9 tractor in good repair with a single hydraulic ripper, are considered as unclassified excavation.
- B. Embankment Construction – Earthwork, including preparation of the subgrade upon which embankment material shall be placed; dikes within or outside right-of-way; placement and compaction of approved material within areas where unsuitable materials have been removed; and placement and compaction of embankment materials in holes, pits, and other depressions to lines and grades shown on the approved plans. Only suitable materials, approved by the project Geotechnical Engineer, shall be used in construction of embankments and backfills
- C. Suitable Material/Backfill - Any earthen material that consists of non-organic sands, gravels, clays, silts, and mixtures thereof. Rock, with a maximum size of six (6) inches, is allowable for embankment. Rock, with a maximum size of two (2) inches, is allowable for trench backfill. Claystone fragments, exceeding two (2) inches in particle size, are not to be incorporated in embankment material, unless specifically approved by the project Geotechnical Engineer and the Town. Bedrock that breaks down to specified soil types and sizes during excavation, hauling, and placement may be considered suitable material, if they are excavated, and moisture conditioned, and aged for a period of time to achieve a uniform, homogenous material.
- D. Unsuitable Material - Any earthen material that contains vegetable or organic silt, topsoil, any soils with organic contents exceeding 2%, wet and over saturated soils, frozen materials, trees, stumps, certain man made deposits, or industrial waste, sludge or landfill, lignite, or other undesirable materials.
- E. Structure Excavation - Excavation of any and all materials over an area extending three

(3) feet out from the outer most bottom edge of a proposed structure, up to existing grade or top of proposed grade (whichever comes first) at a one to one (1:1) slope. Rock formations within this area that can be removed by ripping with a D-9 tractor in good repair with a single hydraulic ripper, shall be considered structure excavation.

- F. Structure Backfill - Earthen material that is installed around and over any structure shown on the approved plans. Imported structure backfill (Class I) shall meet the general gradation of "Class 1 Structure Backfill Material" or Controlled Low Strength Material (CLSM) "flowable fill," as specified in Section 703.08 of the CDOT *Standard Specifications for Road and Bridge Construction*.
- G. Rock Excavation - Igneous, metamorphic, or sedimentary rock formations that cannot be excavated with a D-9 tractor in good repair with a single hydraulic ripper.
- H. Borrow - Backfill or embankment material, which shall be acquired from designated borrow areas to make up the deficient areas, which cannot be completed from excavation within work limits. All sources of borrow material shall be approved prior to use by the project Geotechnical Engineer and the Town.
- I. Proof-Rolling - The application of test loads over a subgrade surface, by means of a heavy_pneumatic-tired tandem axle vehicle, to locate weak areas in subgrade. Refer to Section 350.04 PROOF-ROLL OBSERVATION AND TESTING of these DESIGN STANDARDS AND SPECIFICATIONS.
- J. Bedding Material - Material that is installed under and around pipelines, rip-rap, low flow channels, and any other locations required by the Town. The thickness and gradation of bedding materials shall comply with Section 343.01 BEDDING FOR PIPELINES AND SERVICE LINES of these DESIGN STANDARDS AND SPECIFICATIONS.
- K. Stabilization Material - Material that shall be placed in over-excavation areas, areas_with unsuitable in situ material, or areas with a high water table in order to stabilize the existing material. Thickness of stabilization material shall be determined and installed in the field, on a case by case basis. Gradation of stabilization material shall comply, at a minimum, with the "No. 4 Coarse Aggregate" specified in Section 703.02 of the CDOT *Standard Specifications for Road and Bridge Construction* or other materials, such as lime or flyash, specified on the approved plans and approved by the project Geotechnical Engineer.

330.02 Grading Tolerances

All earthwork shall be performed in such a manner that final grades after excavation, compaction of backfill, placement of rip-rap, construction of channel lining, etc. shall conform to the cross-sections shown on the approved plans. The final earthwork shall comply with the design elevations, with the following allowable tolerances:

- A. 0.03 feet within main drainage channel bottom limits.
- B. 0.3 feet at the top of any embankment where a cut side slope intersects the existing grade.

- C. 0.5 feet in all portions of the site not included in items A. or B. above.
- D. In addition to the above tolerances, positive surface drainage shall be provided on the entire site so that no depressions or ponds are formed, regardless of depth.

It shall be the Contractor's responsibility to ensure that all portions of the site drain as shown on the approved plans.

330.03 Borrow

It shall be the Contractor's responsibility to stockpile suitable materials for use in the project. Only after the Contractor estimates that sufficient suitable backfill material is stockpiled to complete all earthwork operations of the project, shall excavated material be removed from the project site.

If the Contractor fails to preserve onsite, sufficient suitable material, and removes or disposes of suitable material, suitable material shall be recovered at the Contractor's expense.

If there is an insufficient quantity of suitable material available onsite, the Contractor shall provide additional suitable material, as defined in Section 330.01 DEFINITION of these DESIGN STANDARDS AND SPECIFICATIONS.

331.00 EMBANKMENT CONSTRUCTION

Embankment construction shall include placement, processing, and compaction of all embankment material, and all related work required to ensure proper bond of materials with previously placed embankment material. All embankment construction shall be conducted in accordance with specification and procedures provided and under direct supervision of by project Geotechnical Engineer.

331.01 Preparation of Embankment Subgrade

No excavation shall be performed, in any area, until the proposed work has been staked by the Contractor, cross-sections of existing ground are determined and plotted, and all survey elevations and cross-sections shown on the approved plans are reviewed and approved by the Town. Excavation shall be performed to the lines and grades shown on the approved plans. Prior to placement of street subgrade, utilities shall be installed, utility service lines shall be stubbed to the edge of the R.O.W., and all trenches shall be backfilled and properly compacted.

Fill shall be placed on competent subgrade, as determined by the project Geotechnical Engineer. The Contractor shall excavate soft, yielding, oversaturated, or otherwise unsuitable soils prior to the placement of fill.

The grade shall be maintained to ensure that the surface is well drained at all times. When necessary, temporary drain systems shall be installed to intercept or divert surface water that may affect the work.

Where an embankment shall be constructed, unsuitable material shall be removed from the surface. The cleared surface shall be plowed or scarified to a minimum depth of six (6) inches. The embankment area shall adhere to the density and moisture content requirements shown in the following table, unless otherwise approved by the project Geotechnical Engineer:

TABLE 300.02

Soil Classification AASHTO M145	Relative Compaction By <u>Standard</u> Proctor AASHTO T99 (ASTM D698) (percent compaction)	Relative Compaction By <u>Modified</u> Proctor AASHTO T180 (ASTM D1557) (percent compaction)	Moisture Content Range (with respect to Optimum Moisture Content)
A-1 through A-5	-	95	-2 to +2 (based on AASHTO T180)
A-6 and A-7	95	-	0 to +2 (based on AASHTO T99)

Where embankments shall be placed on slopes steeper than 4:1 (horizontal to vertical), benches shall be excavated into the slope by a method approved by the project Geotechnical Engineer. Such slopes include natural and previously constructed embankments. The benches shall be cut ten (10) feet horizontally into the existing slope to create a stepped bench condition, and the vertical step shall not exceed four (4) feet, unless otherwise approved by the project Geotechnical Engineer. All surfaces to receive embankment material shall be inspected and approved by the project Geotechnical Engineer immediately prior to embankment material placement.

331.02 Embankment Material Placement

No embankment material shall be placed until an approved Grading Permit is issued.

Earthmoving equipment, watering equipment, processing equipment and compaction equipment are the responsibility of the Contractor. Equipment shall be suitable for performing excavation and embankment work, in accordance with these DESIGN STANDARDS AND SPECIFICATIONS and the Contract schedule.

After subgrade is properly prepared, the embankment filling operation shall begin, in the deepest section of the area to be filled. Embankment material shall be placed, uniformly moisture conditioned, and compacted in parallel layers until the finished rough grade is reached. Temporary gaps through the embankment shall not be allowed without approval of the Geotechnical Engineer. All temporary slopes shall not be steeper than 4:1 (horizontal:vertical).

The thickness of each layer shall not exceed eight (8) inches before compacting.

Embankment material shall be a homogenous mixture of Suitable Material as defined in Section 330.01 DEFINITIONS of these DESIGN STANDARDS AND SPECIFICATIONS. The full depth of each layer shall be processed, to ensure a satisfactory bonding surface for the next layer of embankment material. If more than 24 hours have elapsed between the time of compaction testing and placement of the next layer of roadway embankment, the area shall be retested.

In order to achieve uniform moisture content throughout the materials in the layer, wetting or drying of the material and manipulation shall be performed. Placement of material shall not proceed until excessively wet material has been dried and overly dry material has been wetted with methods approved by the project Geotechnical Engineer. Each layer of embankment shall be properly processed by disking or by other approved methods so that the water is distributed uniformly throughout the layer prior to rolling and after compaction. In no case shall additional embankment material be placed until the

underlying layer has been properly processed, in accordance with these DESIGN STANDARDS AND SPECIFICATIONS. Materials placed that do not comply with moisture and/or density specifications are subject to removal and replacement and/or reprocessing at the Contractor's expense.

The surfaces of previously placed embankment material, which have not had material placed on them for a period of time, shall be reprocessed to comply with the moisture and density requirements, prior to placement of additional material.

Proof rolling shall be performed after specified compaction has been obtained for the final lift of roadway embankment/subgrade. Areas identified as weak, areas with vertical deflection of more than ½ inch, areas exhibiting "pumping conditions," and those areas which fail a proof roll, as indicated by the inspector, shall be ripped, scarified, wetted or dried if necessary, and re-compacted to the requirements for density and moisture.

Rock Material in Common Embankment Excavated material that contains solid rock, consisting of cobbles, boulders, or rock fragments ("rock material") less than one cubic yard in volume; a maximum thickness of one and one-half (1½) feet; and a maximum dimension of six (6) feet that cannot be processed by crushing, breaking, or pulverizing, may be placed in embankments below ten (10) feet from the rough subgrade elevation, with approval from the project Geotechnical Engineer and the Town. In no case shall claystone fragments larger than three (3) inches in any dimension be incorporated into the embankment layers. Rock material does not include the claystone bedrock formations common throughout the Town. If placed, rock material shall be incorporated in layers no thicker than the thickness of the largest pieces. The rock material shall be carefully dispersed throughout the layers and throughout the embankment to avoid nesting. Rock fragments shall be spaced far enough apart to allow the Contractor's equipment to operate between the rock pieces. All voids shall be filled with fines material to obtain the required uniform density around the rock fragments.

Embankment areas that contain rock material shall be compacted with adequate equipment and sufficient passes to ensure that the embankments meet all specified moisture and density requirements for common embankment before the next lift is placed.

332.00 EXCAVATION

All excavated areas shall be graded in a manner that allows adequate drainage and does not disturb material outside the limits of slopes. Excavated areas shall be within the tolerances noted in Section 330.02 GRADING TOLERANCES of these DESIGN STANDARDS AND SPECIFICATIONS. When practical, all suitable material removed from the excavation shall be used in the formation of embankments, for backfilling, and for other purposes. Materials that are considered unsuitable material (including rock) or surplus by the Town will be disposed of at the Contractor's expense in accordance with Section 312.01 DISPOSAL of these DESIGN STANDARDS AND SPECIFICATIONS.

All water pumped or drained from the work shall be disposed of according to provisions of the Stormwater Discharge Permit through the National Pollutant Discharge Elimination System (NPDES) in a manner satisfactory to the Town, without undue interference with other work or damage to pavements, other surfaces, or property.

332.01 Excavated Material

Excavated material shall be placed so as to minimize the inconvenience to occupants traveling on streets and driveways or adjoining properties. Excavated material shall not be deposited on private property unless written consent of the property owner(s) has been filed with the Town.

Suitable excavated material shall be used as backfill, fill for embankments, or other parts of the work, in accordance with the appropriate sections of these DESIGN STANDARDS AND SPECIFICATIONS.

Disposal of surplus material shall be in accordance with Section 312.01 DISPOSAL of these DESIGN STANDARDS AND SPECIFICATIONS.

332.02 Excess Excavation

If, in the opinion of the project Geotechnical Engineer, the material at or below the depth to which excavation for structures would normally be carried is unsuitable for the required installation, it shall be removed to such widths and depths, as directed by the project Geotechnical Engineer and shall be replaced to provide a stable, non-yielding surface that is approved by the project Geotechnical Engineer.

It is the sole responsibility of the Contractor to become familiar with the existing conditions and potential excess excavation at each project site. Geotechnical reports or other data provided by the Town may be used to assist in determining general site and soil characteristics.

If, through failure or neglect of the Contractor to conduct the excavation work in a proper manner, the surface of the subgrade is in an unsuitable condition to proceeding with construction, the unstable material shall be removed and replaced with recycled concrete, structure backfill, or other approved material at the Contractor's expense. The condition of the subgrade shall be approved by the project Geotechnical Engineer before any additional materials are placed.

333.00 OVER-EXCAVATION AND RE-COMPACTION FOR STRUCTURES

All over-excavation and re-compaction operations for structures shall be performed in accordance with the construction and testing procedures provided in the Final Geotechnical Report. Excavation shall extend at least twenty (20) feet outside the proposed building on all sides to protect the structure and concrete flatwork.

340.00 TRENCHING, BACKFILLING, AND COMPACTING

This work shall consist of furnishing all labor, materials, tools, and equipment for trenching, bedding, backfill, and compaction for all underground utilities, located under roadways or within right-of-ways (as specified herein) and shown on the approved plans. The excavation shall be made to lines and grades shown on the approved plans, and as established by the Town. Except where shown otherwise on the approved plans and except where the Town gives written permission to do otherwise, all trench excavation shall be made by open cut to the depth required to construct the pipelines, as shown on the approved plans. All excavation shall be 'unclassified,' as defined in Section 330.01 DEFINITIONS of these DESIGN STANDARDS AND SPECIFICATIONS. All trenching shall be performed in accordance with all Occupational Safety and Health Administration (OSHA) requirements. These regulations are described in Subpart P, Part 1926 of the Code of Federal Regulations. All excavated material which meets the requirements for backfill materials shall be stockpiled in a manner which shall not contaminate the excavated material, and shall be located a sufficient distance from the trench to avoid overloading, to avoid obstructing sidewalks, driveways, or streets, and to provide the least possible interference with traffic.

At no time shall there be more than three hundred (300) lineal feet of trench open at a time. No trenches shall be left open overnight in neighborhoods.

340.01 Special Conditions

- A. Subsurface Investigation - Prior to the connection of any planned utility line to an existing line, the Contractor shall expose the existing utility at the points of connection in order to verify the elevations and materials of construction. The Town will be notified a minimum of two (2) working days before such an investigation is performed. The Contractor shall also expose utilities as they cross each other to allow for verification of elevation and materials of construction.
- B. Underground Wire, Cable, Fiber Optic, or Similar Lines - Where underground wire, cable, fiber optic or similar lines are encountered, they shall be relocated as directed by the service provider and in accordance with their specifications. The Contractor shall coordinate this work with all other phases of construction to avoid further conflicts.
- C. Gas and Electric Lines - Where underground gas and electric lines are encountered, they shall be relocated as directed by the gas and electric service provider and in accordance with their specifications. The Contractor shall coordinate this work with all other phases of construction to avoid further conflicts.

340.02 Removal of Water

The Contractor shall provide and maintain adequate equipment to properly remove and dispose of all surface or ground water that enters the trench. Water shall be disposed of without damage to adjacent property and without being a nuisance to public health and convenience. The use of any sanitary sewer to dispose of trench water shall not be allowed. The trench shall be dry at all times during pipe installation. Dewatering shall be accomplished by well points, sumping, or any other method approved by the Town. A Colorado Discharge Permit System (CDPS) Construction Dewatering Permit shall be required prior to construction dewatering activities.

341.00 TRENCH EXCAVATION FOR ROADWAYS

When excavating in concrete or asphalt areas, the limits of the trench shall be string lined and the surface cut in a vertical plane by sawing, cutting wheel, or jackhammering. If the vertical edges of a trench in a roadway ravel during construction, they shall be trued to a vertical plane to a point twelve (12) inches outside the limits of excavation, prior to milling and placing the resurfacing material, in accordance with the Detail Drawings of these DESIGN STANDARDS AND SPECIFICATIONS.

At no time shall there be more than three hundred (300) lineal feet of trench open at a time. No trenches shall be left open overnight in neighborhoods.

Surface materials such as concrete and asphalt shall be disposed of independently of the underlying soil. Unsuitable materials shall be disposed of by the Contractor, in accordance with Section 312.01 DISPOSAL of these DESIGN STANDARDS AND SPECIFICATIONS.

342.00 TRENCH EXCAVATION FOR PIPELINES AND SERVICE LINES

The width of the trench shall comply with the requirements set forth in these DESIGN STANDARDS AND SPECIFICATIONS and shall be sufficient to allow pipe to be installed and backfill placed and compacted, as shown in the detail drawings found in these DESIGN STANDARDS AND

SPECIFICATIONS.

At no time shall there be more than three hundred (300) lineal feet of trench open at a time. No trenches shall be left open overnight in neighborhoods.

342.01 Preparation of Foundation for Pipe Laying

When the excavation is in firm earth, care shall be taken to avoid excavation below the established grade plus the required specified over depth to accommodate the pipe bedding material.

In case soft or otherwise unsuitable foundation material is encountered in the bottom of the trench, the project Geotechnical Engineer and/or the Town may require removal and replacement with stabilization material to provide a suitable foundation for the pipe. If the trench bottom is wet, the project Geotechnical Engineer shall determine whether it is stable. The bottom of sumps utilized for dewatering shall be two (2) inches minimum below the bottom of the trench excavation to prevent the upward flow of water into the excavation, which may result in unstable bottom conditions.

343.00 BACKFILL FOR PIPELINES AND SERVICE LINES

Suitable backfill shall be as defined in Section 330.01 DEFINITIONS of these DESIGN STANDARDS AND SPECIFICATIONS.

The following special trench backfill requirements shall apply for utilities located in existing or planned road rights-of-way.

- 1) Isolated Street Cuts– Service line cuts and other isolated utility repairs or modifications in a paved street area shall be backfilled with Controlled Low Strength Material (CLSM) “flowable fill,” per CDOT Standards and Specifications Section 206.02.
- 2) Constrained Areas - Areas in which proper backfill compaction cannot be achieved, such as utility crossing, under curb and gutter, or any area identified by the Certified Materials Tester or Town Construction Inspector, shall be backfilled with Controlled Low Strength Material (CLSM) “flowable fill.”

Materials used above the subgrade level shall comply with the requirements for subbase and base course materials, as defined in Section 900 ASPHALT MIX DESIGN AND CONSTRUCTION of these DESIGN STANDARDS AND SPECIFICATIONS.

Bracing installed to prevent cave-ins shall be withdrawn in a manner that shall maintain the desired support during the backfill operations. Driven sheet pilings shall be cut off at or above the top of pipe, and the portion below the cut-off line shall be left in the ground.

343.01 Bedding for Pipelines and Service Lines

All pipe shall be installed with sufficient bedding material to provide a minimum of six (6) inches of separation between the subsoil and the barrel of the pipe, and a minimum of twelve (12) inches above the top of the barrel of the pipe. The bedding material shall be tamped under the haunches for the full length of the pipe barrel to ensure support for entire length of pipe. The pipe barrel shall be uniformly supported along the entire length of the pipe.

Bedding material for all PVC, HDPE, CPP and DIP water and reuse water (“flexible pipe”) shall be squeegee sand which complies with the following:

TABLE 300.03 SQUEEGEE SAND

Sieve size	Total Percent Passing by Weight
3/8 inch	100
No. 200	0-5

Bedding material for all PVC sanitary sewer, PVC and HDPE under drain pipe, and RCP storm pipe shall consist of materials that meet the gradation of “No. 67 Coarse Aggregate” as specified in Section 703.01 of the CDOT Standard Specifications for Road and Bridge Construction, unless otherwise recommended by the Geotechnical Engineer and approved by the City Engineer.

TABLE 300.04 #67 AGGREGATE

Sieve size	Total Percent Passing by Weight
1 inch	100
3/4 inch	90-100
3/8 inch	20-55
No. 4	0-10
No. 8	0-5

Bedding material shall be placed to a depth of twelve (12) inches above the barrel section of all flexible pipe and shall be level in all directions across the width and length of the trench. RCP shall be bedded to springline at a minimum. Bedding material shall be worked under pipe to provide uniform haunch support. Pipe shall be installed in accordance with these STANDARDS AND SPECIFICATIONS.

343.21 Backfill Compaction

Trench backfill shall be placed in loose eight (8) inch lifts, processed, and uniformly moisture-conditioned, and each lift thoroughly consolidated by tamping, vibrating, or a combination thereof, until the moisture content and the relative compaction complies with the values shown in the Moisture and Density Requirements for Embankment Materials table in Section 331.00 EMBANKMENT CONSTRUCTION of these DESIGN STANDARDS AND SPECIFICATIONS for the various soil classifications and relative compaction.

The use of hydro-hammer type compaction equipment is prohibited.

For new landscape areas, compaction shall be between eighty (80) and eighty five (85) percent of the maximum Standard Proctor dry density, in the top two (2) feet of soils below finished grade. Where sidewalk or concrete trail will be constructed, soils shall be scarified for a minimum depth of 12 inches, uniformly moisture-treated and re-compacted two (2) feet wider than the footprint of the sidewalk or trail, until the moisture content and the relative compaction complies with the values shown in the Moisture and Density Requirements for Embankment Materials table in Section 331.00 EMBANKMENT CONSTRUCTION of these DESIGN STANDARDS AND SPECIFICATIONS.

344.00 BACKFILL OF STRUCTURES IN THE RIGHT OF WAY

Areas adjacent to structures located within the rights-of-way, such as bridge abutments, box culverts, vaults, manholes, and storm inlets, and other areas inaccessible to mobile compaction equipment shall be compacted with suitable power-driven hand tampers or other approved devices. Backfilling shall consist of placing materials in horizontal, uniform layers brought up uniformly on all sides of the structure. The thickness of each layer of backfill shall not exceed four (4) inches before compacting to the required density. The Contractor shall uniformly process, maintain proper moisture in, and properly compact each lift throughout the backfilling process.

Backfill material shall not be deposited against the back of concrete abutments, concrete retaining walls, or the outside of cast-in-place concrete structures until the concrete has developed a strength of not less than eighty (80) percent of the required design strength. Backfill placed within two (2) feet of any structure shall be placed evenly on all sides to avoid unequal lateral pressures.

Compaction equipment or methods that produce horizontal or vertical earth pressures, which may cause excessive displacement, a loss of compaction in backfill zone, or may damage structures, shall not be used.

Unless otherwise shown on the approved plans or directed by the Town, all sheeting and bracing used for structure excavation shall be removed by the Contractor prior to backfilling.

In the event that suitable backfill material is not available on the site, the Contractor shall import suitable backfill as defined in Section 330.01 DEFINITIONS of these DESIGN STANDARDS AND SPECIFICATIONS

Where pipe is connected to a structure to be backfilled, bedding and backfilling procedures shall comply with Section 343.01 BEDDING FOR PIPELINES AND SERVICE LINES of these DESIGN STANDARDS AND SPECIFICATIONS.

In constrained areas where proper compaction of backfill cannot be achieved around structures, CLSM “flowable fill” shall be used, as defined in Section 330.01 DEFINITIONS of these DESIGN STANDARDS AND SPECIFICATIONS.

350.00 ROADWAY EXCAVATION, BACKFILL, AND COMPACTION

Prior to placement of street subgrade, base, paving and concrete materials, utilities shall be installed, utility service lines shall be stubbed to the edge of the R.O.W., and all trenches shall be backfilled and properly compacted.

The use of hydro-hammer type compaction equipment is prohibited.

Roadway embankments shall be constructed in accordance with Section 331.00 EMBANKMENT CONSTRUCTION of these DESIGN STANDARDS AND SPECIFICATIONS.

350.01 Base Course (For Composite Sections)

3051.01.01 Materials

Base course shall consist of a foundation course, composed of recycled concrete aggregate base course, constructed on the prepared subgrade. Material composed of uniform size particles, or which contains pockets of excessively fine or excessively coarse material, shall not be approved for use. Materials and construction shall be in accordance with the requirements of Section 304 of the CDOT *Standard Specifications for Road and Bridge Construction*. Gradation shall be Class 6 (¾" maximum), in accordance with Table 7032-of CDOT *Standard Specifications for Road and Bridge Construction*.

350.01.02 Construction

All work shall be observed and tested by the project Geotechnical Engineer. The CDOT Class 6 recycled concrete aggregate base course shall be placed on the previously prepared subgrade at the locations and in the proper quantities, to conform to the cross-sections shown on the approved plans and as directed by the Town. Geotextile fabric shall be installed if required on the approved plans or final pavement design report. The material shall be placed without segregation. Any segregated areas shall be removed and replaced with uniformly graded material at the Contractor's expense.

The thickness of each base course layer shall not exceed six (6) inches before compaction. If the required depth exceeds six (6) inches, and is less than twelve (12) inches, material shall be placed in two (2) or more lifts of approximately equal thickness. If uniform density cannot be obtained by six (6) inch lifts, the maximum lift thickness shall not exceed four (4) inches.

Base course material shall not be placed on a dry or dusty soil foundation, which could cause rapid dissipation of moisture from the base course material and hinder or preclude proper compaction.

Excessively dry soil foundations shall have water applied to them and shall be reprocessed and recompacted. If, at any time, the subgrade construction is subjected to rain, snow or other significant events, the project Geotechnical Engineer shall evaluate the affected areas prior to continuing with subgrade preparation and shall make a recommendation to the Contractor and to the Town.

The prepared base course surface shall be smooth and free of ruts and irregularities, true to the line and grade shown on the approved plans, and consistent with direction provided by the Town. The base course shall be maintained in this condition by watering, drying, rolling, and/or blading until the asphalt or concrete flatwork is placed. The surface tolerance of the base course shall be in accordance with Section 304.06 of the CDOT *Standard Specifications for Road and Bridge Construction*.

350.03 Lime-Treated (Fly Ash or Cement-Treated) Subgrade

When required, lime-treated subgrade shall comply with Section 307 of the CDOT *Standard Specifications for Road and Bridge Construction*. Lime-treated subgrade shall extend to the back of the sidewalk for streets with attached sidewalks, and one (1) foot behind the back of the curb for streets with detached sidewalks, as shown in the Detail Drawings of these DESIGN STANDARDS AND SPECIFICATIONS.

Lime treatment of subgrade is disallowed during the winter months, when ambient temperatures are below 40 degrees Fahrenheit. Alternative methods of soil stabilization may be allowed with approval of the Town. Soil mix design procedures shall comply with the CDOT *Standard Specifications for Road and Bridge Construction*.

350.04 Proof-Roll Observation and Testing

After passing compaction tests, the Contractor and/or the Town's representative shall proof-roll the areas. No proof-roll inspections shall be performed until all underground utility testing is complete. Subgrade areas failing compaction testing or proof-rolling shall be delineated and reprocessed and/or removed and replaced in a manner approved by the project Geotechnical Engineer and the Town. Such procedures may include over-excavation, scarification, moisture-conditioning, re-compaction, and/or replacement with suitable materials that comply with the moisture and density requirements. In addition to complying with moisture and density requirements, all subgrade materials shall exhibit stability during proof-rolling. Additional compaction testing and proof-rolling may be required, at the discretion of the Town. All proof-rolling operations shall be at the Contractor's expense.

Within the twenty-four (24) hour time period prior to paving, subgrade compaction testing and proof-roll observation and testing (proof-rolling) with a water truck shall be required. Proof-rolling shall be performed as designated, with a tandem axle water truck, or tandem axle dump truck, loaded to a minimum of 18 KIPS per axle, minimum 54,000 lb. Tires shall be inflated to a minimum pressure of seventy (70) pounds per square inch and a maximum pressure of ninety (90) pounds per square inch. Air pressure in the tires shall be maintained within a tolerance of five (5) pounds per square inch.

360.00 RESTORATION AND CLEAN UP

At all times during construction, the Contractor shall maintain the site, including partially finished structures, material stockpiles, and other like areas, in a reasonable state of order and cleanliness.

The grade and condition of all unsurfaced areas shall be restored to a condition equal to or better than the grade and condition immediately prior to construction, unless otherwise shown in the approved plans and to the satisfaction of the Town. The Contractor shall restore or replace all seeded areas, sod, trees, landscaping materials, landscape irrigation systems, fences, and any other items, to a condition equal to or better than before the work began and to the satisfaction of the Town. All grassed areas shall be reseeded or re-sodded, in accordance with Section 1000 PARKS AND RECREATION CONSTRUCTION of these DESIGN STANDARDS AND SPECIFICATIONS, and the Contractor shall be responsible for maintaining these areas until substantial growth occurs and until the Construction is accepted into Warranty. Refer to Section 200 - ACCEPTANCE PROCEDURES of these DESIGN STANDARDS AND SPECIFICATIONS.

All pavement and concrete flatwork shall be restored or replaced to a condition equal to or better than before the work began and to the satisfaction of the Town.

In the event of failure of the Developer or Contractor to complete work, correct deficiencies, or clean up a project site within a reasonable time period, the Town has the right to draw upon the performance guarantee.

SECTION 400 – WATER SUPPLY FACILITIES

401.00 GENERAL CONDITIONS

Refer to Section 100 TITLE, SCOPE, AND GENERAL CONDITIONS of these DESIGN STANDARDS AND SPECIFICATIONS for additional requirements that apply to all projects within the Town and Service Areas.

401.01 Cross Connections

Cross connections shall not be allowed. For enforcement provisions, refer to the *Superior Municipal Code* regarding cross connection and backflow connection controls for the treated water system.

410.00 DESIGN CRITERIA

410.01 General

All potable water distribution systems shall comply with the requirements of the DESIGN STANDARDS AND SPECIFICATIONS for water main and service line construction and may include special criteria established by the Town Engineer for the overall hydraulics of the water utility system. Special criteria shall be outlined at pre-design meetings, as determined necessary by the Town Engineer. The requirements set forth in the latest edition of the *Denver Water Board Engineering Standards* shall apply for information omitted in these DESIGN STANDARDS AND SPECIFICATIONS. The requirements set forth in the latest edition of the *American Water Works Association Standards* shall apply for information omitted from both these DESIGN STANDARDS AND SPECIFICATIONS and the *Denver Water Board Engineering Standards*. The order of precedence is 1) these DESIGN STANDARDS AND SPECIFICATIONS, 2) the *Denver Water Board Engineering Standards*, 3) the *American Water Works Association Standards*, and 4) Colorado Department of Public Health and Environment

These DESIGN STANDARDS AND SPECIFICATIONS also cover design and construction of waterlines for the transmission and distribution of reuse water (tertiary treated effluent) and for the supply of raw water (water in its natural state, prior to any treatment and taken from a natural or impounded body of water) to maintain ponds as visual amenities. The area wetted with reuse water shall be designed to avoid picnic tables, drinking fountains, and playground equipment. Reuse and raw water are intended for potable uses, such as landscape irrigation, and are not intended for use on residential property and other areas with a potable water supply.

These DESIGN STANDARDS AND SPECIFICATIONS shall apply to all reuse waterlines from the connection to the Town's tertiary treated effluent transmission main or existing reuse lateral to the points of use or application. Design of irrigation systems connected to the reuse water distribution system shall be in accordance with the applicable subsections of Section 1000 PARKS AND RECREATION CONSTRUCTION of these DESIGN STANDARDS AND SPECIFICATIONS and shall include backflow prevention. Unless otherwise specified, the provisions of Section 360.00 RESTORATION AND CLEAN UP of these DESIGN STANDARDS AND SPECIFICATIONS shall apply to reuse and raw waterline installation.

411.00 DESIGN FLOW REQUIRMENTS

411.01 Potable Water Distribution System

The design of the potable water distribution system shall be based on the following:

TABLE 400.01 UNIT WATER DEMANDS FOR FUTURE LAND USE

Land Type	Avg. Demand	Max. Day/Avg. Day	Max. Hr./Max. Day
Residential	145 GPC/D*	3.05	1.9
Commercial	1650 GPD/acre	2.00	1.9
Industrial	1651 GPD/acre	1.32	1.9
Park	3060 GPD/acre	3.90	1.9

*Gallons Per Capita/Day

Minimum residential population density, household density, and land usage shall be, as noted, on the approved PUD and/or Plat or as determined by the Town Utilities Superintendent. Fire flows may be calculated from more than one (1) hydrant, providing the hydrants used are directly accessible to all possible fire locations in the area served and not at the end of cul-de-sacs. Fire flows required by the Rocky Mountain Fire District shall be:

- A. Available fire flow shall be twenty (20) psi residual minimum.
- B. Minimum fire flow (two- [2-] hour duration) for any newly developed areas:

Single-family detached dwellings and duplexes	1,500 gpm
All other buildings	3,500 gpm

Note: Above fire flow requirements may be increased due to type of construction and size of building, per direction of the Fire Marshall.

- C. The Developer is responsible for obtaining fire flow tests. Tests shall be scheduled and coordinated by the Town Utilities Superintendent. The Design Engineer is responsible for obtaining pressure test data, including supplying pressure measuring equipment. The Design Engineer is also responsible for arranging water valve and hydrant operation with the Town Utilities Superintendent. Town staff shall be present for the fire flow testing, but will not perform or report flows to the Developer or Contractor.

411.02 Non-Potable Water Distribution System

The reuse water system shall be sized to deliver no less than forty (40) psi dynamic pressure during peak flow rate conditions. It shall not be designed to provide any fire protection flows.

412.00 OPERATING PRESSURE REQUIREMENTS

All areas shall be designed to provide a maximum static head of two hundred ninety (290) feet or one hundred twenty-five (125) psi and a minimum static head of one hundred (100) feet or forty-three (43) psi. Distribution systems shall also be designed to maintain a twenty (20) psi residual pressure during the

required fire flow and a forty (40) psi residential residual during peak residential flows. The maximum pressure drop from static head to either fire flow or peak residential flow shall not exceed thirty (30) psi.

The Town does not guarantee any minimum dynamic pressure at any point on the reuse system. The Developer shall perform the necessary hydraulic analysis to determine design pressure for the project.

The determination of the need for and the installation of a PRV shall be the responsibility of the Town.

413.00 DISTRIBUTION SYSTEM LAYOUT

Distribution mains and lateral lines shall be located as shown on the approved plans and shall be a minimum of eight (8) inch diameter pipe.

Lines at the ends of long cul-de-sacs shall be looped along lot lines to adjacent streets or in outlots whenever possible. If a utility easement is required, it shall be a minimum of thirty (30) feet wide. The Developer shall be responsible for obtaining easements required for the construction, maintenance, and operation of the main and lateral lines. Dead ends shall be provided with a fire hydrant. Mains and laterals shall be extended to the boundaries of Filings or Phases and completely across the frontage of individual lots.

When the water main passes under a highway or waterway, there shall be a minimum of five (5) feet of cover, and a steel casing shall be installed in accordance with the Detail Drawings. The steel casing shall extend the entire width of the right-of-way or easement of the crossing structure or as directed by the Town Engineer. In all cases, valves shall be located such that the water main at such crossings can be completely isolated without interruption of any services.

413.01 Waterline Crossing Over A Sanitary Sewer Line

When there is less than eighteen (18) inches of vertical clearance between the water main and the sanitary sewer, the sanitary sewer shall be encased in concrete a minimum of ten (10) feet on each side of the centerline of the crossing or polyvinyl chloride pressure pipe in accordance with American Water Works Association C900 DR 14 may be used.

413.02 Waterline Crossing Over A Storm Sewer Line

When there is less than eighteen (18) inches of vertical clearance between the water main and the storm sewer, each joint of the storm sewer within ten (10) feet of the centerline of the crossing shall be encased in concrete.

413.03 Sanitary Sewer Line Crossing Over A Waterline

In all cases, regardless of vertical clearance, the sanitary sewer shall be encased in concrete a minimum of ten (10) feet on each side of the centerline of the crossing. Polyvinyl chloride pressure pipe in accordance with American Water Works Association C900 DR 14 may be used instead.

413.04 Storm Sewer Line Crossing Over A Waterline

In all cases, regardless of vertical clearance, the joints of the storm sewer shall be encased in concrete a minimum of ten (10) feet on each side of the centerline of the crossing.

413.05 Limits On Vertical Separation

Under no circumstances shall the vertical clearance between any lines involving a waterline, sanitary sewer line, or storm sewer be less than eighteen (18) inches without written approval from the Town Engineer.

413.06 Easements

All mains shall be in an easement which has a width of at least two times the depth to the pipe invert. The minimum easement shall be twenty-four (24) feet in width for water utility, thirty (30) feet in width for sewer, thirty-seven (37) feet in width for two utilities, and forty (40) feet for three (3) utilities. Site specific circumstances may dictate the need for wider easements. The main shall be located a minimum of ten (10) feet from and parallel to the edge of the easement. Meters and fire hydrants not installed within the right-of-way will require an easement dedication ten (10) feet wide and extending three (3) feet behind the meter or fire hydrant. If the meter or fire hydrant easement is longer than ten (10) feet, then the width of the easement shall be a minimum of twenty (20) feet. The fire hydrant shall be centered in such easements. All easements shall be for the exclusive use of the Town. No landscaping (except grass and private irrigation systems) or permanent structures (mailboxes, sheds, buildings, etc.) shall be placed in the easement.

The easement agreement (provided by the Town) shall state that any temporary structures (including paving and fencing) placed in the easement shall be removed and replaced by the owner of the land when requested by the Town so that maintenance can be performed. The Town shall be held without liability by the Owner for the replacement of any structures removed from the easement.

The following statement shall appear on all official development plans, construction documents, and all final plats.

UTILITY MAINTENANCE STATEMENT

All public water, reuse water, storm sewer, and sanitary sewer mains and appurtenances located in public ROW shall be maintained by the Town's Public Works and Utilities Department. All public water, reuse water, storm sewer, sanitary sewer mains, and appurtenances under private drives are located in utility easements. The Town is responsible for maintenance of these facilities. The Town is not responsible for repair or replacement of private drive, curb and gutter, or landscaping damaged during utility repair or maintenance.

414.00 FUTURE CONNECTIONS

A blow-off, in accordance with the detail drawing in these DESIGN STANDARDS AND SPECIFICATIONS, is required at the end of any water main which terminates and is anticipated to be extended in the future. When a future main extension is anticipated, the main shall be valved so that only one (1) valve will have to be closed when the main is extended. The valve shall be restrained so when the one (1) valve is closed and the line to be extended is exposed, the valve will not blow off from the pipe. Restraint shall be made by the use of a mechanical joint anchoring tee (swivel tee), a cross, or by installing a minimum of two (2) full lengths of pipe on the extension side of the valve. No service taps shall be allowed on a main which can be extended in the future between the single valve to be closed and the dead end.

415.00 SERVICES

Each separated structure shall be served by a separate service line and meter. All non-residential developments with any irrigated areas are required to have separate irrigation taps and meters from the reuse water main. Utility easements shall be required for service lines up to and including the meter pit. No pressure booster facility of any kind shall be allowed on any service line between the public main and the meter. All service line pressure booster facilities shall be privately owned and maintained. Water service lines shall be located a minimum of ten (10) feet away from all sewer services (measured horizontally). All service lines shall be constructed perpendicular to the front property line or rear alley of the property they are going to serve and not more than three (3) feet from the side of a front property line. All service lines and meters connected to these will be the same size as the tap, unless otherwise approved and/or required by the Town. If the tap and meter are of different sizes, the fee shall be paid for the larger, unless a larger tap is approved and/or required by the Town, in which case the fee for the meter size shall be paid. Each platted lot shall have its own service. Each unit in a duplex building shall have its own service.

All service lines three-quarters ($\frac{3}{4}$) of an inch through two (2) inches shall be copper and shall be installed continuously without joints between the corporation stop at the water main and the meter or curb stop.

Services shall have a minimum of five (5) feet of cover and be laid as shown on the Detail Drawing in these DESIGN STANDARDS AND SPECIFICATIONS. Service connections (three [3] inch, four [4] inch, six [6] inch, or eight [8] inch) to new lines shall be made with mechanical joint anchoring tees (swivel tees) or reducing mechanical joint anchoring tees (swivel tees) if installed at the time of main line construction. Connections shall be approved by the Town Engineer.

Water meters shall have the lay lengths as listed in Table 400.02.

Size (in.)	Use	Lay Length (in.)
5/8"x3/4"	Domestic	7 1/2"
3/4"	Domestic	9"
1"	Domestic	11"
1 1/2"	Domestic	13"
2"	Domestic	15 1/2" or 17"
3"	Domestic	17"
4"	Domestic	19"
3/4"	Reuse Irrigation	9"
1"	Reuse Irrigation	11"
1 1/2"	Reuse Irrigation	13"
2"	Reuse Irrigation	10" or 17"
3"	Reuse Irrigation	19"
4"	Reuse Irrigation	21"

416.00 UNLAWFUL CONNECTIONS

No installation of potable water supply piping or part thereof shall be made in such a manner that it will be possible for used, unclean, polluted, or contaminated water, mixtures, or substances to enter any portion of such piping from any tank, receptacle, equipment, or plumbing fixture by reason of back siphonage, suction, back pressure, or any other cause, either during normal use and operation or when any

such tank receptacle, equipment, or plumbing fixture is flooded or subject to pressure in excess of the main line operating pressure. No person shall make a connection or allow one to exist between pipes or conduits carrying domestic water supplied by the Town and any pipes, conduits, or fixtures containing or carrying water, chemicals, liquids, gases, or any other substances from any other source.

417.00 FIRE CONTROL

417.01 Fire Hydrant Spacing

In single-family residential areas, fire hydrants shall be spaced a maximum of five hundred (500) feet apart, as measured along street curb line, and at an overall spacing that shall average not less than one (1) hydrant to two-hundred thousand (200,000) square feet accessible to the fire hydrant throughout an individual subdivision. A hydrant shall be placed at the end of each cul-de-sac. Fire hydrants at the end of cul-de-sacs shall not be considered available for fire-fighting purposes. In business, industrial, and high-density residential areas, hydrants shall be spaced not greater than three hundred (300) feet apart or as approved by Rocky Mountain Fire District.

Hydrants shall be spaced not greater than one thousand (1,000) feet along connector and arterial roadways without domestic water service lines.

All fire hydrant locations and spacing shall be reviewed and approved by Rocky Mountain Fire District.

417.02 Fire Hydrant Placement

Fire hydrants shall be placed with the pumper nozzle facing the street. In single family residential areas, the fire hydrants shall be a minimum of two (2) feet behind the back of the curb for detached walks and two (2) feet behind the back of walk for attached walks. In no case shall a hydrant be located closer than five (5) feet to obstructions, driveways, etc. The fire hydrant shall be located within the right-of-way or easement and on the same side of the street as the water main unless otherwise approved by the Town Engineer. Fences, landscaping, etc., shall in no way hinder the operation of the fire hydrant. In addition, clear distances to the fire hydrant shall be in accordance with these DESIGN STANDARDS AND SPECIFICATIONS. The fire hydrant lateral lines shall be set at ninety degrees (90°) to mains. The fire hydrant lateral line shall be no more than seventy (70) feet in length from the main. No horizontal bends or offsets shall be used in fire hydrant lateral lines. Under no circumstances shall any tap be made on a fire hydrant lateral line.

417.03 Fire Lines

The property owner shall maintain all fire lines extending from the valve on the Town water main. Valves on newly constructed fire lines shall be located on and/or restrained to the tee at the main line. The entire fire line shall be ductile iron pipe with a minimum of Class 250 and have restrained joints from the tee and valve to the end of the fire line. The line shall be sized for building sprinkler requirements. Fire lines are to be used exclusively for fire protection. Domestic water taps and irrigation taps shall not be allowed on the fire line. A property requiring a domestic service line and a fire protection service line will have separate taps for each.

Residential fire sprinkler systems are required in all residences. The system shall be designed to conform to the provisions of NFPA 13D or IRC P2904. The Town shall not conduct fire sprinkler system design reviews.

418.00 VALVES

418.01 Valve Spacing and Marking

Valves shall be placed with a maximum spacing of five hundred (500) feet in all distribution mains and lateral lines. Spacing of valves in transmission mains may be greater than six hundred (600) feet with the approval of the Town Engineer. Two (2) valves shall also be placed at each fire hydrant swivel tee and branch line.

All waterline tees shall have a minimum of three (3) valves, and all waterline crosses shall have a minimum of four (4) valves, as shown in the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS. Valves for residential areas shall be located throughout the distribution mainline such that no more than fifteen (15) customers are without service during a shutdown. For a succession of short blocks perpendicular to the direction of the distribution main and without residential or commercial services between them, one (1) or more intersection(s) may have the valve in that direction omitted, but the six hundred (600) foot maximum spacing requirement shall be maintained.

Valves shall also be placed at each end of a waterline running through an easement on private property, on each side of a major creek or channel crossing, and on each side property line (at lines extended) of a distribution line that provides service to a hospital, school, or large industrial user. Any valve located outside a paved area shall have a twenty-four (24) inch wide by twenty-four (24) inch wide by six (6) inch thick square, finished, concrete collar around the valve box. Marker posts shall be required for valves located outside the pavement in accordance with these DESIGN STANDARDS AND SPECIFICATIONS.

418.02 Air Release and Vacuum Relief Valves

Combination air and vacuum relief valves shall be installed at each high point, at abrupt changes in slope, and at line valves when the line slopes away from the valve in all distribution mains and at high points of lateral lines, as required by the Town Engineer.

Air and vacuum relief valves shall be installed in precast manholes or vaults fitted with air vents open to the atmosphere and in accordance with the Detail Drawings of these DESIGN STANDARDS AND SPECIFICATIONS for all lines twelve (12) inches or larger or as required by the Town Engineer.

418.03 Blow-off Valves and Drains

418.03.01 Blow-off Valves

Provisions shall be included in the design to allow for the flushing of distribution mains and lateral lines at all low points in the system. Fire hydrants may be used for permanent blow-offs. All dead ends shall be provided with fire hydrants.

For temporary dead end waterlines, a temporary blow-off valve may be permitted. The blow-off assembly shall be installed perpendicular to and on the downhill side of the waterline and shall drain to the nearest street gutter line or drainage channel. The blow-off assembly standpipe shall have a threaded end to accept a fire hose coupling. The top of the standpipe shall be between four (4) and six (6) inches below grade, in accordance with the Detail Drawings of these DESIGN STANDARDS AND SPECIFICATIONS.

418.03.02 Drains

Transmission line drains may be required as directed by the Town Engineer. These should be installed as shown in the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS.

419.00 PIPE

All pipe used for distribution mains and lateral lines, having a diameter of twelve (12) inches or less, not including fire lines to buildings and fire hydrant laterals, shall be AWWA C900 DR14 PVC or AWWA C151 Class 250 DIP pipe, unless otherwise approved in writing by the Town Engineer. The Town Engineer may require pipelines twelve (12) inches or smaller to be designed on a case-by-case basis. Fire lines to buildings and fire hydrant laterals shall be ductile iron pipe. Distribution mains in excess of twelve (12) inches in diameter shall be subject to approval as directed by the Town Engineer. Pipe shall be minimum Class 350 DIP or AWWA C905 DR18 Class 235. The Town requires all pipes larger than twelve (12) inches to be designed and appropriate calculations to be submitted.

The normal minimum size distribution main is eight (8) inch or six (6) inch for short, looped lines in single-family residential areas if approved by the Town Engineer. Smaller distribution mains may be individually approved by the Town Engineer for dead-end mains without fire hydrants or the possibility of future tie-ins.

419.01 Hydraulic Design

All pipes shall be designed to provide a maximum velocity of ten (10) feet per second at fire flow. Distribution mains and lateral lines shall be designed using the Hazen-Williams friction coefficients and maximum head losses noted below:

TABLE 400.03

Pipe Size (in.)	Hazen-Williams Friction Coeff.	Max. Head Loss
8" - 12"	C-100	2' per 1,000'
14" - 16"	C-110	2' per 1,000'
20"	C-130	1.5' per 1,000'
Over 20"	As directed by the Town Engineer	

419.02 Location (Typical)

Water mains shall typically be located ten (10) feet north or east and parallel of the centerline of the street, unless otherwise approved by the Town Engineer.

At street intersections, valves shall be located at the extension of property lines. Fire hydrant gate valves shall be placed near the main. All fire hydrants shall have a restrained connection directly to the tee off the main.

In all instances, water mains shall extend to the boundary line of the property or subdivision served, to the center of boundary streets, or to the outside of paved areas, as noted on the approved plans. A water main serving one (1) lot shall extend the entire length across the frontage of that lot.

Where parallel or approximately parallel to a structural wall, the service line shall be at least five (5) feet from the wall. Penetrations through structures shall be approximately at right angles and shall provide flexibility such that the service line will not be damaged by settlement of the structures.

419.03 Horizontal and Vertical Alignment

PVC pipe shall only be deflected in barrel. Ductile iron pipe may be deflected at the joints. For horizontal alignment changes, pipe may be deflected up to a maximum of one degree (1°). Fittings are required for deflections to cross under utilities, but the Contractor may request a variance from the Town to vertically deflect pipe per the following table.

TABLE 400.04 ALLOWABLE DEFLECTION: PVC

Pipe Size (in.)	Radius (ft.)
4	100
6	150
8	200
10	250
12	300

Ductile iron pipe may be deflected in joints per manufacturers’ specifications with a safety factor per the Town Engineer.

Changes in direction of water lines may require fittings. For a waterline lowering that is greater than ten (10) feet deep, construct a parallel line up to - but not including - the top forty-five degree (45°) bends. The parallel line shall be filled with water to prevent gaskets from drying out. Extra lubricant shall be used with the gaskets, and each end shall be sealed with a gasketed plug. Vents shall be used to ensure the entire parallel line is filled with water. If the pipe material is ductile iron, it shall be required to be cathodically protected. Install a valve at each end of the lowering. A hydrant shall be installed between one (1) of the valves and the adjacent forty-five degree (45°) bend to facilitate flushing of the lowered section. Sleeves shall not be used for waterline lowering. Refer to the Detail Drawings of these DESIGN STANDARDS AND SPECIFICATIONS.

419.04 Pipe Depths

All water main pipe shall be installed with a minimum of five (5) feet of cover from finished grade of street to the top of the pipe barrel. Proposed installations greater than ten (10) feet from finished grade require Town’s approval.

419.05 Relation to Other Utilities

Refer to Section 517.01 RELATION TO WATERLINES of these DESIGN STANDARDS AND SPECIFICATIONS for additional requirements.

420.00 GENERAL PROVISIONS

421.00 GENERAL

Construction of all water mains within the Town and all water service lines that connect to water mains within the Town shall be in accordance with these DESIGN STANDARDS AND SPECIFICATIONS and the approved plans. These DESIGN STANDARDS AND SPECIFICATIONS shall apply to new water system construction as well as to repairs to existing facilities.

When special conditions are encountered or deviations from these DESIGN STANDARDS AND SPECIFICATIONS are required by the Town, and such changes are in the best interests of the Town, the decision of the Town will be final.

422.00 PERMITS REQUIRED

A Right-of-way Permit shall not be issued until the Town has approved the water system plans. A pre-construction meeting with the Town Construction Inspector and the Project Engineer shall be scheduled and completed prior to the commencement of any construction.

423.00 MAINTENANCE OF TRAFFIC

When street cuts are required for water system construction or repairs to existing facilities, the following conditions shall be met to avoid interference with traffic:

Street service cuts shall only be open between 9:00 a.m. and 4:00 p.m. Two-way traffic shall be maintained at all times around the construction area. A Traffic Control Plan shall be prepared in accordance with Section 141.13 TRAFFIC CONTROL, BARRICADES, AND WARNING SIGNS of these DESIGN STANDARDS AND SPECIFICATIONS and submitted to the Town for approval prior to the commencement of construction.

430.00 POTABLE, RAW, AND REUSE WATER MAIN CONSTRUCTION

431.00 SITE WORK AND EARTHWORK

Refer to Section 330.00 EARTHWORK of these DESIGN STANDARDS AND SPECIFICATIONS.

431.01 Trenching, Backfilling, and Compacting

Refer to Section 340.00 TRENCHING, BACKFILLING, AND COMPACTING of these DESIGN STANDARDS AND SPECIFICATIONS.

431.02 Preservation of Monuments

Refer to Section 141.00 PROTECTION OF PUBLIC, PRIVATE, AND UTILITY INTERESTS of these DESIGN STANDARDS AND SPECIFICATIONS.

432.00 MATERIALS

432.01 General

All references to the *Denver Water Board Engineering Standards* cited in these DESIGN STANDARDS AND SPECIFICATIONS shall mean the latest edition of the Engineering Standards of the Board of Water Commissioners of Denver, Colorado. All references to the *America Water Works Association Standards* cited in these DESIGN STANDARDS AND SPECIFICATIONS shall mean the latest edition of the AWWA Standards.

Pressure classes or ratings specified for materials in this section are minimums. The pressure class or rating for all materials used in a water supply system design shall be adequate for the water system pressure requirements.

432.02 Pipe

All pipe for water main construction shall be as described in Section 419.00 PIPE of these DESIGN STANDARDS AND SPECIFICATIONS. Each pipe shall be marked with the class designation and size. A six (6) inch wide detectable warning tape shall be installed twelve (12) inches to eighteen (18) inches above all pipe for the purpose of warning of location of buried pipeline, in accordance with the Detail Drawings of these DESIGN STANDARDS AND SPECIFICATIONS. A No. 10 AWG solid, insulated copper wire shall be attached to all pipe for the purpose of future location, in accordance with the Detail Drawings of these DESIGN STANDARDS AND SPECIFICATIONS. Installation of all pipe shall be in accordance with the manufacturers' recommendations and these DESIGN STANDARDS AND SPECIFICATIONS.

PVC Pipe: All PVC pressure pipe for potable waterlines in sizes up through twelve (12) inch diameter shall comply with AWWA C900 DR-14 Class 305 and shall be blue in color.

PVC pipe for non-potable waterlines in sizes up through twelve (12) inches in diameter shall comply with AWWA C900, pressure class 200 psi (DR-14) and shall be purple in color. The purple color shall be a factory pigment of the PVC material. Painting of the pipe material is not acceptable.

PVC pressure pipe for potable waterlines in twelve (12) inch through thirty-six (36) inch diameter shall comply with AWWA C905, pressure rating 235 (DR-18) minimum. All pipes larger than twelve (12) inches must be designed with all appropriate design calculations submitted, including pipe-soil stiffness (E') to ensure it is greater than the pressures generated by the surrounding expansive soils or bedrock.

PVC pressure pipe for non-potable waterlines in twelve (12) inch through thirty-six (36) inch diameter shall comply with AWWA C905, pressure rating 235 psi (DR-18).

Ductile Iron Pipe: All ductile iron pipe shall comply with AWWA C151 and be Class 250. Class designation shall be as shown on the approved plans or as designated by the Town for each individual project. Joints shall be mechanical or push-on and shall comply with AWWA C111. Ductile iron pipe shall have a standard cement mortar lining that complies with AWWA C104 and a bituminous outside coating approximately one (1) mil thick.

Ductile iron pipe used in construction of hydrant laterals and fire lines shall be thickness Class 250.

Ductile iron pipe used in construction of non-potable waterlines shall be Class 350. Ductile iron pipe may be required for non-potable waterlines that have higher pressures and that are twelve (12) inches in diameter or less.

Ductile iron, copper, steel, or other non-potable pipe material not readily available in purple shall be

encased in purple polyethylene (poly-wrapped).

432.03 Polyethylene Wrap for Ductile Iron Pipe and Fittings

The polyethylene encasement material shall be in accordance with the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS. All DIP, valves, and fittings shall be wrapped in eight (8) mil minimum thickness polyethylene in accordance with ANSI A21.5 and AWWA C105.

432.04 Fittings

Ductile iron fittings shall comply with AWWA C110 and/or C153. Class designation shall be 250. Joints shall be mechanically restrained. Integral restrained joints that comply with AWWA C111 may be used with approval of the Town Engineer. Rubber gasket joints shall comply with AWWA C111. A standard thickness cement mortar lining shall be applied to comply with AWWA C104. All fittings shall be epoxy coated.

Mechanical joint restraint shall be wedge action and self-actuating, such as Megalugs. Restraints shall be protected from corrosion in accordance with Section 432.18 CORROSION PROTECTION SYSTEMS of these DESIGN STANDARDS AND SPECIFICATIONS. **No all-thread shall be used.**

All pipe and fittings must be manufactured in the USA.

432.05 Gate Valves

All gate valves for potable and raw water lines shall open left (counterclockwise), and all gate valves for reuse waterlines shall open left (counterclockwise). Gate valves in sizes four (4) inches to twelve (12) inches shall be non-rising stem, bronze mounted, open left for potable water and open left for non-potable water, resilient-seated type, with an AWWA standard two (2) inch-square operating nut, manufactured in accordance with AWWA C509 or AWWA C515. It shall have mechanical joint ends conforming to AWWA 500. Class designation shall be compatible with the pipe class designated for the project. Gate valves shall be Waterous American Flow Control Series 2500-1 Resilient Wedge MJ x MJ or approved equal.

All bolting shall be stainless steel AISI grade 304. If nuts are used on the bolts, the nuts shall be 304 stainless steel, and the bolt threads shall be coated with an anti-galling compound.

Valves shall comply with the ANSI/NSF 61 requirements.

Resilient gate:

The valve gate shall be ductile iron, fully encapsulated with EDPM rubber, and shall be capable of a drip-tight shutoff with flow in either direction. The EDPM shall be permanently vulcanized to the gate.

Stems:

Valve stems shall be made of stainless steel or bronze with minimum yield strength of forty thousand (40,000) psi. Stems shall be provided with separate or integral bronze thrust collars. Bronze valve stems shall contain no more than five percent (5%) zinc, no more than two percent (2%) aluminum, and no more than one percent (1%) lead. Stainless steel stems shall contain a minimum of sixteen percent (16%) chrome.

Seals and Gaskets:

Valve stem seals shall be an O-ring type, with not less than one (1) O-ring below the thrust collars and two (2) O-rings above the thrust collars. If an O-ring groove is cut into the stem, the diameter of the groove shall not be less than the root diameter of the stem threads. O-rings and gaskets shall be made of an NBR rubber to help prevent the effects of permeation. Bonnet gaskets shall be an O-ring type that completely encircles each individual bonnet bolt so that the bolts are isolated from internal or external water sources.

Protective Coatings:

The exposed ferrous surface shall be coated with a fusion bonded epoxy in accordance with AWWA C550.

432.06 Butterfly Valves

All butterfly valves for potable and raw waterlines shall open left (counterclockwise), and all butterfly valves for reuse waterlines shall open left (counterclockwise). All valves having a nominal diameter of fourteen (14) inches or greater shall be geared butterfly valves designed for direct burial and shall comply with AWWA C504, Class 150-B. Class designation shall be compatible with the pipe class designated for the project.

Valves shall be of the tight-closing, rubber seat type with rubber seats which are bonded to the valve body. No metal-to-metal sealing surfaces shall be permitted. Valves shall provide zero leakage at the pressure rating of the pipe in either direction. Valve discs shall rotate ninety degrees (90°) from the full open position to the tight shut position. Coatings shall be equal to or exceed AWWA C550. Valve bearings shall be sleeve-type, corrosion-resistant, and self-lubricating, with the load not to exceed twenty-five hundred (2,500) psi.

Valve operators shall be the traveling nut type designed to withstand three hundred (300) foot-pounds of input torque at full open or closed positions without damage to the valve or operator. Valve operators shall be fully gasketed, grease packed, designed to withstand submersion in water to ten (10) psi, and operate with a two (2) inch square nut.

432.07 Pressure Reducing Valves

All pressure reducing valves shall be Class 150 suitable for a working pressure of 250 psi. Distribution main and lateral line pressure reducing valves shall be installed in a vault and contain parallel valves for high and low flow ranges. Piping shall be ductile iron through the vault walls and extend three (3) feet past the vault walls in accordance with the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS. Oil filled differential gauges shall be installed with brass or stainless steel ball valves.

Pressure reducing valves shall be installed at location(s) noted on the approved plans. The valve shall be capable of maintaining a constant downstream pressure, regardless of varying inlet pressure and rate of flow, and shall be hydraulically operated and diaphragm-actuated with a globe or angle pattern. It shall contain a resilient, synthetic rubber disc having a rectangular cross-section contained on three and one-half (3 ½) sides by a disc retainer, forming a tight seal against a single removable seat insert. The diaphragm assembly, containing a valve stem, shall be fully guided at both ends by a bearing in the valve cover and an integral bearing in the valve seat. This diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating operating pressure from line

pressure. The diaphragm shall consist of nylon fabric with synthetic rubber and shall not be used as a seating surface. Packing glands and/or stuffing boxes are not permitted, and there shall be no pistons operating the valve or pilot controls. There shall be flared end connections. All necessary repairs shall be possible without removing the valve from the line. The valve shall be furnished with an indicator rod to show valve position.

There shall be gate valves and pressure gauges on both upstream and downstream side of the valve. All gate valves in the vaults shall be capable of being operated from above ground by the use of two (2) inch square valve keys. The Town Engineer shall approve the manufacturer of all pressure-reducing valves prior to installation.

432.08 Fire Hydrants

Fire hydrants shall comply with AWWA C502 for dry-barrel fire hydrants and shall be listed by Underwriters Laboratories and Factory Mutual Research Corporation. Casting or other permanent marks shall be used to confirm that fire hydrants comply with these standards.

Fire hydrants shall also comply with the following supplementary specifications:

- A. Fire hydrants shall be Waterous Pacer WB-67-250. No Alternate.
- B. Hydrants shall be rated at two hundred fifty (250) psi operating pressure and tested at five hundred (500) psi per Section 5.1 of AWWA C502. Production testing of each hydrant shall be pre-formed performed at five hundred (500) psi to ensure proper assembly and operation and detection of any imperfections. All iron parts, as designated in Section 3.1.2 of AWWA C502, shall be ductile iron.
- C. Hydrants shall be designed for five (5) foot pipe bury and shall not be buried below the first flange. The first flange shall be two (2) to four (4) inches above grade. A maximum of one (1) riser shall be used, and if a riser is required, a breakaway coupling shall be installed two (2) to four (4) inches above grade. **Installation of hydrant riser requires a separate, specific inspection. Installation of a hydrant riser requires the installation of a new bury depth tag on the fire hydrant.**
- D. Nozzles shall be two - 2½” hose connections one hundred eighty degrees (180°) apart and one - 4½” pumper connection. All nozzles shall be at the same elevation. Nozzle threads shall be National Standard Fire Hose coupling screw threads, as described in Appendix A of AWWA C502, unless otherwise specified. Nozzle caps shall be provided with chains and gaskets. Nozzle caps shall have the same nut configuration as the hydrant-operating nut. Nozzles shall be reverse threaded into the upper barrel and mechanically locked in place.
- E. Hydrant main valves shall be five and a quarter (5¼) inches and shall be of the full compression design, opening against and closing with the pressure. The main valve seat ring shall thread into a bronze sub-seat, and all gaskets sealing the seat ring shall be on a bronze-to-bronze seating surface. The seat ring threads shall not serve as pressure seal. The entire valve and rod assembly shall be removable by use of a small, lightweight seat removal wrench.
- F. The drain valves shall allow complete drainage of all residual water in the hydrant. The circumferential drain passage inside the hydrant shall be bronze on all surfaces. The

draining system of the hydrant shall be bronze with a sliding bronze drain valve. Sliding drain valves made of rubber, plastic, or leather shall not be allowed.

- G. Hydrant runs shall not contain bends unless approved by the Town.
- H. Hydrant tee shall not be installed in a lowering.
- I. Hydrants shall be the breakaway types with a frangible ground line and rod coupling designed to break upon traffic impact to prevent further damage to the hydrant and connecting pipe. The frangible coupling shall allow the upper section to be rotated to any desired position. Couplings which employ lug devices or a breakaway barrel are not acceptable. Frangible bolts are not allowed.
- J. Hydrant operating nuts shall be ductile iron and shall be pentagonal in shape, one and a half (1½) inches from point to flat. The operating nut shall also function as a weather shield. **Hydrants shall open left (counterclockwise).**
- K. The operating mechanism shall utilize two (2) O-ring seals between the revolving nut and bronze-sheathed upper section of the valve rod. The top of the rod shall also be fitted with a travel stop nut to limit downward travel on the rod. All-weather grease shall be used to provide permanent lubrication. A thermoplastic or Teflon thrust ring shall be used to reduce friction while opening the hydrant.
- L. The hydrant inlet shall have six (6) inch mechanical joint restraint connections which shall be accomplished by use of wedge action, self-actuating fittings.
- K. The buried portion of the hydrant shall have a bituminous coating to comply with AWWA C116. All ferrous metal parts shall be coated to comply with AWWA C500. The bonnet and nozzle cap shall be given one (1) shop coat of safety red color heavy-duty alkyd enamel paint that complies with Federal Color No. 13538 Specifications. A final coat of industrial enamel VOC complying, Industrial & Marine coating paint shall be applied in the field. This paint shall be safety red.

432.09 Valve Boxes

All potable buried valves and blow-offs shall be provided with a valve box. Valve boxes shall be cast iron with round cover and oval base. The valve box shall have a minimum inside diameter of five and one-quarter (5¼) inches and shall be adjustable in length and of the screw type. Box lids shall be marked "WATER." Valve boxes shall be Castings, Inc., CI-550 with 160 Oval Base. No Alternate. Valve boxes shall have a minimum of three (3) inches of additional extension above the level required for final grade at the time of installation. All valve boxes, bases, and lids shall be Class 35B. **All valve boxes shall be installed centered and plumb.**

Coatings shall comply with AWWA C116.

Reuse valve boxes shall be Castings, Inc., CI-550 with 160 oval base. No Alternate. The top section shall be Castings, Inc., 4TCI-17S threaded riser with Rite-Hite triangle lid marked "Irrigation." All valve boxes, bases, and lids shall be Class 35B. **All valve boxes shall be installed centered and plumb.**

432.10 Air Release and Vacuum Relief Valves

All combination air release and vacuum relief valves shall comply with AWWA C512. The large orifice of combination air valves shall allow air to escape during pipeline filling and to enter during drainage of the pipeline.

The valve shall consist of a body, cover, baffle, float, and seat. The float shall be stainless steel designed to withstand a maximum pressure of one thousand (1,000) psi. The body and valve shall be designed to operate under a maximum working pressure of one hundred fifty (150) psi. All materials shall comply with ASTM A126 and ASTM A240. Valves shall have an iron body with bronze trim, and floats shall be stainless steel. A two (2) inch valve shall be installed on the stem between the pipe and the relief valve or as shown in the Town's details.

Air release and vacuum relief valves shall be installed in a vault in accordance with the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS. Galvanized piping or fittings shall not be allowed.

432.11 Irrigation Flow Control Valves

Reuse water service lines shall be equipped with a flow control valve to limit flow to the maximum rate approved by the Town. Flow control valves shall be OCV Control Valves, Rate of Flow Valve Series 120 G or Cla-Val Co Model 49-01. If the design rate of flow exceeds a max:min ratio of 4:1, an OCV Series 120 G-4 flow control valve shall be used.

Upon the Developer's payment to the Town for the actual cost of the valve, the flow control valve shall be ordered and purchased by the Town and factory preset to the approved maximum flow rate. The preset flow rate shall not be field adjusted.

The flow control valve shall be installed with the meter in a common vault in accordance with the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS.

432.12 Blow-off and Drain Assemblies

The temporary blow-off shall be through a two (2) inch ball valve with a two (2) inch gate valve operating nut, box, piping, and cover. Unless otherwise approved in writing by the Town Engineer, all piping shall be threaded copper, and valves shall be bronze. Galvanized piping and fittings are not allowed. Refer to the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS. Valve boxes for blow-off assemblies and standpipes shall be Castings, Inc., CI-550 with 160 Oval Base. No Alternate. **All valve boxes shall be installed centered and plumb.**

Permanent six (6) inch drains for potable waterlines shall be approved in writing by the Town and shall be constructed in accordance with the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS. Six (6) inch blow-offs for non-potable waterline flushing shall be constructed at all dead-ends and at other points deemed necessary by the Town.

432.13 Vaults

Vaults shall be cast-in-place and shall be constructed in accordance with these DESIGN STANDARDS AND SPECIFICATIONS. Precast vaults shall be designed so that all joints and corners are waterproof. Precast and cast-in-place vaults shall be made waterproof after construction by use of sealants, epoxies, or other approved methods.

The vault roof shall be designed to support the overhead fill, any surcharge, and an H-20 traffic loading.

Where the cover over the roof is less than two and one-half (2½) feet or more than five (5) feet, a cast-in-place vault is required.

Cast-in-place meter vaults shall be in accordance with the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS and shall be constructed of CDOT Class B/D, CDOT Class 2 concrete with steel reinforcement in accordance with the CDOT M&S STANDARDS.

432.14 Manholes

Refer to Section 532.05 MANHOLES and Section 532.08 CAST AND DUCTILE IRON FITTINGS of these DESIGN STANDARDS AND SPECIFICATIONS. Lids shall be furnished with the word “WATER” cast on top.

432.15 Manhole Base Slabs and Base Beams

Refer to Section 532.06 MANHOLE BASES of these DESIGN STANDARDS AND SPECIFICATIONS.

432.16 Sump Pits for Vaults and Manholes

Sumps with a sump pump are required for vaults or manholes in areas where there is groundwater present and in all telemetry equipment and pressure regulating valve manholes and vault installations. All sumps shall have a sump pump. Refer to the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS.

432.17 Vent Pipes

Vent pipes shall be used in all vaults and manholes to allow gases to escape. Installations that contain electrical equipment shall have a blower attached to the vent system. Vent pipes shall be field located, as approved by the Town Engineer, at the nearest intersection of the street property line and the side lot line. Refer to the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS.

Above ground vent pipe shall be six and five-eighths (6⁵/₈-) inch O.D. galvanized steel pipe, Grade 40 that complies with ASTM A53. The vent screen shall be three-fourths (¾) inch No. 119 flattened, expanded, galvanized metal screen. Below ground vent pipe shall be six (6) inch, schedule 80 PVC with glued joints. A PVC glued joint by standard pipe thread female adapter shall be used to connect the steel pipe to the PVC pipe at ground level. A breakaway coupling shall be installed between the steel and PVC pipe.

432.18 Corrosion Protection Systems

When soil resistivity is less than two thousand five hundred (2,500) ohm-centimeters (OHM-CM), but greater than one thousand (1,000) OHM-CM, ductile iron pipe and fittings may be used, but the ductile iron materials shall be protected against corrosion.

Methods to provide corrosion protection for integral metallic parts of the water transmission system are as follows:

- A. Corrosion Resistant T-head Bolts and Nuts shall be 45,000 psi minimum steel with a fluoropolymer coating and shall be either “TriPac 2000,” “Cor-Blue” by NSS Industries, or “Blue Bolt” by Birmingham Fasteners. Bolts shall have zinc anode cap screwed to each bolt. Fittings, bolts, and zinc anode caps shall be inspected by a Town Construction Inspector.

- B. Ductile Iron Pipe shall be furnished from manufacturer with cement mortar lining and bituminous coating. Pipe shall be double wrapped with polyethylene wrap and taped at each end.
- C. Butterfly and Gate Valves shall be furnished from manufacturer with a coating equal to or exceeding AWWA C550. Bolts and nuts shall either be epoxy or fluoropolymer coated. Valves shall be double wrapped with polyethylene and taped at each end.
- D. Mechanical Joint Tees, Bends, Caps, Plugs, and all other fittings shall be furnished from manufacturer with cement mortar lining and bituminous coating. Thread-bolts and nuts shall be corrosion resistant “Cor-Blue” by NSS Industries or “Blue Bolt” by Birmingham Fasteners. Bolts shall have zinc anode cap screwed to each bolt. Fittings shall be double wrapped with polyethylene and taped at each end. Fittings, bolts, and zinc anode caps shall be inspected by a Town Construction Inspector prior to wrapping with polyethylene.
- E. Mechanical Joint Restraint (Wedge action, self-actuating, such as Megalugs) for ductile iron pipe shall be furnished from manufacturer with a bituminous coating. Mechanical joint restraint for PVC pipe shall be furnished from the manufacturer with red primer coat. Buried pipelines shall use retainer glands as manufactured by EBAA Iron, Inc., or approved equal. T-head bolts and nuts and restraint rods shall be corrosion resistant “Cor-Blue” by NSS Industries or “Blue Bolt” by Birmingham Fasteners. Bolts shall have zinc anode cap screwed to each bolt. Mechanical joint restraint shall be double wrapped with polyethylene and taped at each end. Joint restraints, bolts, rods, and zinc anode caps shall be inspected by the Town Construction Inspector prior to wrapping with polyethylene.
- F. Polyethylene Wrap shall be eight (8) mil, minimum, close-laminated wrap and shall comply with the *Denver Water Board Engineering Standards* Section MS-13.
- G. Damage to Epoxy and/or Other Material Coatings shall be repaired and inspected prior to installation.
- H. Polyethylene Wrapping and Taping shall be inspected by the Town Construction Inspector prior to backfilling.
- I. Record Documents shall provide pipe lengths, material, diameter, type, depth, and coordinate locations of all metallic items, including but not limited to pipe, valves, bends, and fittings, to “GPS backpack” accuracy. Refer to Section 200 ACCEPTANCE PROCEDURES of these DESIGN STANDARDS AND SPECIFICATIONS for more information.
- J. Cathodic Protection for Steel Casings shall be protected from corrosion by a galvanic anode cathodic protection system when directed by the Town Engineer. The galvanic anode cathodic protection system shall be comprised of two test stations placed at each end of each steel sleeve that shall connect galvanic anodes to the sleeve.
- M. Fire Hydrant Anodes shall be two (2) seventeen (17) pound anode bags.

The cathodic protection system shall be designed by a Colorado Licensed Professional Engineer accredited by the National Association of Corrosion Engineers. Installation shall be performed under the direction of a licensed Professional Engineer who is accredited by the National Association of Corrosion

Engineers.

Metallic reuse pipe shall be electrically insulated at its connection to the transmission main. New runs of metallic pipe shall be designed for electrical continuity throughout the run, but shall be electrically insulated at connections with other pipelines. Bonding of joints shall be required. Ductile iron and steel pipelines shall be cathodically protected using the passive anode system.

Cathodic protection test stations shall be provided and shall be shown on the approved construction drawings.

432.18.01 Insulators

For metallic pipe, insulators shall be installed at the outlet end of the corporation stop. Insulators shall be Ford Service Insulators or an approved equal for water service lines and shall be installed in accordance with the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS.

Refer to *Denver Water Board Engineering Standards* Sections MS-21 and MS-22 for other insulators that may be required. Refer to Sections MS-27 and DD-9 for insulators for mechanical joint systems. Refer to the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS.

432.18.02 Tape

The polyethylene seams and overlaps shall be wrapped and held in place by means of two (2) inch wide plastic-backed adhesive tape. The tape shall be Polyken #900 (polyethylene), Scotchrap #50 (polyvinyl), or equal. The tape shall have adhesive that shall bond securely to both metal surfaces and polyethylene film.

432.18.03 Tests and Measurements

Each cathodic protection system shall be tested under the direction of a Colorado Licensed Professional Engineer who is accredited by the National Association of Corrosion Engineers. A final continuity report on the installation and testing/monitoring procedures shall be prepared by a Colorado Licensed Professional Engineer who is accredited by the National Association of Corrosion Engineers and submitted to the Town.

- A. Upon completion of the Cathodic protection system installation work, the Contractor shall perform testing to ensure proper operation of the system.
- B. All Cathodic protection system tests shall be conducted by the Contractor's Corrosion Specialist, Cathodic Protection Specialist, or Corrosion Engineer. All testing shall be conducted in the presence of the Town.
- C. Electrical continuity of pipe joints shall be verified by field testing after completion of the pipeline installation. The Contractor shall submit a written procedure for such testing prior to the start of construction.
- D. After the installation of all specified test stations, anodes, and electrical isolation fittings, the Contractor shall obtain pipe-to-soil and anode-to-soil potential measurements using a saturated copper/copper sulfate reference electrode and a voltmeter with a minimum input impedance of ten (10) meg-ohms. Measurements shall be obtained before (native state potentials) and after connection of the anode wires in the test stations.

- E. Measurements shall be obtained at all test stations and any other locations deemed appropriate by the Contractor's Corrosion Specialist or Corrosion Engineer.
- F. The reference electrode shall be positioned in the soil directly over the pipe or structure where possible.
- G. Current output of the sacrificial anodes shall be obtained after connecting the anode wire in the test station boxes and utilizing the shunt provided in each test stations.
- H. All anode current output and pipe-to-soil and anode-to-soil potential measurements shall be recorded, including the test date in tabular form. The test data shall be included in the Operations & Maintenance Manual to be submitted at the completion of the Project.

432.19 Tracer Wire and Warning Tape

A No. 10 AWG solid, insulated copper wire shall be attached to all pipes, including at least one carrier pipe inside a casing pipe, for the purpose of future location. If tracer wire is not attached to a carrier pipe, it may be cad-welded to both ends of a casing pipe and terminated in test stations within ten (10) horizontal feet from the ends of the casing pipe. DBY-6 copper split connectors, or equal, shall be used.

For non-metallic domestic water lines, tracer wire shall be run along each fire hydrant assembly and brought to the surface in a test station located behind the fire hydrant. No tracer wire shall be allowed in valve boxes. Test stations shall be CP Test Services, Glenn Series Glenn-4 with locking lid, three-and-a-half (3½) inches by four (4) inches, or approved equal. For reuse water lines, the tracer wire shall be brought to the surface in a test station located behind the curb and gutter. Test stations for non-potable water lines shall not exceed a distance of five hundred (500) lineal feet. The test station shall be cast within a two (2) foot by two (2) foot by six (6) inch thick concrete collar.

In all air-vac manholes, tracer wire shall run up the stairs to the surface.

A qualified tester shall verify continuity of tracer wire, and a report shall be submitted to the Town with other Record Documents. Uninterrupted continuity is a requirement for Construction Acceptance into Warranty.

All pipelines shall have a six (6) inch wide, detectable, magnetic warning tape installed twelve (12) to eighteen (18) inches above all pipes, on top of the bedding, for purpose of the warning of location of buried pipeline. For potable water, the marker tape shall be blue in color with black lettering in a continuously repeating pattern with the words "CAUTION WATER LINE BELOW." For non-potable (raw and reuse) waterlines, the marker tape shall be purple in color with black lettering in a continuously repeating pattern with the words "NON-POTABLE WATER LINE – DO NOT DRINK."

Tracer while shall be tested by the Developer/ Contractor in the presence of the Town Construction Inspector. It shall be tested with a minimum of three (3) feet of backfill completed above the tracer wire. Testing of the tracer wire shall be completed prior to paving.

432.20 Bedding Materials

Bedding materials shall comply with Section 343.01 BEDDING FOR PIPELINES AND SERVICE LINES of these DESIGN STANDARDS AND SPECIFICATIONS.

432.21 Concrete

All concrete shall comply with Section 800 CONCRETE MIX DESIGN AND CONSTRUCTION of these DESIGN STANDARDS AND SPECIFICATIONS for Portland cement concrete construction.

432.22 Plastic Liner Pipe (Slip lining)

Water main slip lining materials shall comply with Section 532.10 IN-PLACE REHABILITATION OF EXISTING PIPELINES of these DESIGN STANDARDS AND SPECIFICATIONS.

432.23 Steel Casings for Bores

Steel casing pipe shall comply with Section 532.11 STEEL CASINGS FOR BORES of these DESIGN STANDARDS AND SPECIFICATIONS.

432.24 Gasket Pipe Lubricant

Gasket pipe lubricant shall be Whitlam Plumb-Pro “Blue Lube” or approved equal.

432.25 Pipe Insulation

Pipe insulation shall be Specialty Products and Insulation Co. “Foamglass Pipe Insulation” or approved equal.

433.00 INSTALLATION

433.01 General

All work shall comply with AWWA C600, AWWA C605, and to the pipe manufacturer’s installation instructions, except as modified by these specifications.

433.02 Alignment and Grade

Field parties, under the supervision of a Colorado Licensed Professional Land Surveyor or Professional Engineer, shall determine alignment and grade of the pipe and the location of fittings, valves, and hydrants. The required minimum depth of cover between the top of the pipe barrel and the finished street grade is four (4) feet, six (6) inches. The waterline shall be installed to the required lines and grades with fittings, valves, and hydrants at the required locations. Record Documents of waterline alignment, verified by a Professional Licensed Surveyor or a Professional Engineer, shall be furnished to the Town to comply with Section 200 ACCEPTANCE PROCEDURES of these DESIGN STANDARDS AND SPECIFICATIONS. Refer to Section 517.01 RELATION TO WATERLINES of these DESIGN STANDARDS AND SPECIFICATIONS for additional requirements.

433.03 Protection of Existing Underground Utilities

The Contractor shall be held responsible for the protection of public improvements, as stated in Section 141.00 PROTECTION OF PUBLIC, PRIVATE, AND UTILITY INTERESTS of these DESIGN STANDARDS AND SPECIFICATIONS. It shall be the Contractor’s responsibility to replace all damaged public improvements at his own expense.

433.04 Interruption of Services

Interruption of services shall comply with Section 141.05 INTERRUPTION OF SERVICES of these DESIGN STANDARDS AND SPECIFICATIONS.

433.05 Pipe Installation

No pipe installation may begin until adequate backfill and compaction equipment is on site.

Proper equipment, tools, and facilities shall be provided and used by the Contractor for safe and efficient performance of the work. All pipe, fittings, valves, and hydrants shall be carefully lowered into the trench in such a manner as to prevent damage to pipe materials and to protect coatings and linings. **Under no circumstances shall pipe or fittings be dropped or dumped into the trench.** Any pipe or fittings that are dropped or dumped shall be removed from the work site and shall not be used.

Immediately before joining two lengths of pipe, the inside of the bell and the outside of the spigot end and the gasket shall be thoroughly cleaned. Caution shall be exercised to ensure that the correct type of gasket is used. A thin film of gasket lubricant shall be applied to the inside face of the gasket and the spigot end of the pipe. The spigot end of the pipe shall be placed in the bell with care to prevent the joint from contacting the ground. The joint shall be completed by pushing the pipe home with a slow, steady pressure, without jerky or jolting movements. Pipe furnished without a depth mark shall be marked before assembly to ensure insertion to the full depth of the joint. The pipe shall then be properly set and brought to correct line and grade. After installation of the polyethylene protective wrap, the pipe shall be secured in place by installation of bedding material and backfill in accordance with these DESIGN STANDARDS AND SPECIFICATIONS.

At times when installation is not in progress, the open ends of the pipe shall be closed with a watertight plug. Cutting of pipe for inserting valves, fittings, or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe or lining, leaving a smooth end at right angles to the axis of the pipe. Pipe ends shall be smooth and beveled with a file or other tools according to the pipe manufacturer's recommendations.

Extra care should be used in handling PVC pipe during cold weather due to the reduced flexibility and impact resistance as temperatures approach and drop below freezing. PVC pipe to be stored outside and exposed to sunlight shall be covered with an opaque material, such as canvas. Clear plastic sheets shall not be used to cover the pipe. Air circulation shall be provided under the covering. Any over-exposed pipe, as determined by the Town, will not be permitted for installation.

Pipeline installation shall be performed within one hundred (100) linear feet of trench excavation. If construction is occurring in an open field, this distance may be increased at the Town's discretion. Trench backfill shall be performed within fifty (50) linear feet of pipeline installation. If construction is occurring in an open field, this distance may be increased at the Town discretion.

At no time shall there be more than three hundred (300) lineal feet of trench open at a time. No trenches shall be left open overnight in neighborhoods.

When buried, all ductile iron pipe fittings and appurtenances shall be protected with eight (8) mil thick polyethylene wrap. Miscellaneous steel or other ferrous pipe for blow-offs, valve boxes, etc., shall be similarly protected. Refer to Section 340.00 TRENCHING, BACKFILLING, AND COMPACTING of these DESIGN STANDARDS AND SPECIFICATIONS for trenching, backfilling, and compaction requirements. Refer to Section 200 ACCEPTANCE PROCEDURES of these DESIGN STANDARDS

AND SPECIFICATIONS for survey requirements for Record Documents of waterlines.

The Town Construction Inspector shall be notified at least one (1) working day (twenty-four [24] hours) in advance of when pipe is to be installed in any trench. No pipe shall be covered until a Town Construction Inspector has inspected the installation.

433.06 Thrust Blocking, Restrained Joints, and Fittings

Thrust blocks and mechanical joint restraints shall be used at all valves, bends, fittings with mechanical connections, and dead ends in accordance with the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS. For high pressure or special circumstances, alternative restraint systems, such as fused pipe, may be considered. Alternative restraint systems shall be approved by the Town Engineer.

All joints shall be restrained. Mechanical joint restraint (wedge action, self-actuating, such as Megalugs) shall be used at all valves, bends, fittings with mechanical connections, and dead ends. Tie rods shall not be used. The table shall also be used for the length of mechanical joint restraint. Restraints shall be protected to comply with Section 432.18 CORROSION PROTECTION SYSTEMS of these DESIGN STANDARDS AND SPECIFICATIONS. Crosses shall be restrained in all applicable directions, and twelve (12) inch and smaller-line valves and tees shall have mechanical joint restraint on each side of the fitting or valve.

Thrust blocking shall be in accordance with the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS. Care shall be taken to not block outlets, cover bolts, nuts, clamps, or other fittings and to ensure they are accessible. A bond breaker shall be placed between the pipe and the thrust block to aid in future removal. The thrust block shall bear against undisturbed earth.

Thrust blocks shall be cast-in-place from concrete having a minimum compressive strength of three thousand (3,000) psi. **The use of hand mixed concrete for thrust blocks is prohibited.**

Newly placed thrust blocks shall be allowed to set, undisturbed, for a minimum of twenty-four (24) hours prior to any backfilling, tamping, or compaction, unless otherwise approved by the Town. During cold weather conditions, the thrust blocks shall be protected from freezing.

433.07 Setting Valves and Fire Hydrants

Valve boxes shall not be installed in curb and gutter, sidewalk or crosspans.

Each hydrant shall have a six (6) inch gate valve on the hydrant run and shall be connected to the main by a six (6) inch ductile iron, polyethylene wrapped pipe. The valve shall be anchored to the swivel tee.

Hydrants shall be set with the bury line at the established finished grade. Hose nozzles shall be set parallel to the curb with the pumper nozzle facing the curb. Hydrant height is eighteen (18) inches, minimum, from center of nut on cap to finish grade. Hydrants shall be located at least eighteen (18) inches from center of hydrant to back of curb or sidewalk. All fire hydrant extensions shall be a single piece with a maximum length of four (4) feet. Only one (1) extension shall be permitted with revision to the bury depth tag.

Valves shall be provided with valve boxes centered and plumb over the operating nut of the valve. Valve boxes and bases shall be wrapped with eight (8) mil polyethylene secured with tape. The boxes shall be supported to prevent any shock or stress from being transmitted to the valve. All valves shall be installed

using a valve box adaptor to ensure proper centering of the valve box during backfill and to maintain valve box location. Valve boxes shall be maintained in this position during backfill. Valve box covers shall be set below the subgrade level to prevent damage during street construction and later adjusted to grade at the time of paving.

Hydrants shall include a drainage pit with nine (9) square feet of surface area and two (2) feet of depth below the barrel of the inlet. Pits shall be backfilled with one and one half- (1½-) inch, washed, crushed rock to a level six (6) inches above the barrel drain hole, and the rock covered with eight (8) mil polyethylene to prevent dirt from filling the rock. A concrete thrust block shall be placed at the bowl of each hydrant in accordance with Detail the Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS to prevent obstruction of the barrel drain hole.

Depending upon hydrant location, the use of bollards may be required for protection, as specified by the Town.

433.08 Plastic Liner Pipe (Slip lining)

Installation of plastic liner pipe shall comply with Section 533.10 IN-PLACE REHABILITATION OF EXISTING PIPELINES of these DESIGN STANDARDS AND SPECIFICATIONS.

433.09 Steel Casing and Carrier Pipe Installation

Installation of steel casing and carrier pipe shall comply with Section 533.11 STEEL CASING AND CARRIER PIPE INSTALLATION of these DESIGN STANDARDS AND SPECIFICATIONS.

Tracer wire shall be taped to the carrier pipe before installation of carrier pipe supports and installed in the steel casing along with the carrier pipe. A test station, similar to those required at fire hydrants, shall be installed for the tracer wire in Town R.O.W. near each end of the steel casing pipe. Tracer wire shall be welded to each end of the casing. Uninterrupted continuity shall be tested in accordance with the requirements of Section 432.19 TRACER WIRE AND WARNING TAPE of these DESIGN STANDARDS AND SPECIFICATIONS.

433.10 Cathodic Protection Test Stations

Underground pipeline test stations shall be installed at locations shown on the approved plans and in accordance with the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS.

433.11 Plugging of Dead Ends

Temporary dead ends shall be installed with standard plugs or caps and thrust blocks. Temporary dead ends shall be provided with blow-offs or fire hydrants, as required by the Town. Permanent dead ends shall be provided with fire hydrants and valves. All temporary dead ends in undeveloped lots and open lands shall be marked with a blue post.

433.12 Filling and Venting the Line

Only the Town's Public Works Department shall operate valves.

The line shall be slowly filled with water and all air expelled from the pipe. Care shall be taken that all available hydrants (including hydrant gate valves), air relief valves, and other vents are open while filling the line. Where hydrants or other vents are not available in the line, the Contractor shall use a temporary

two (2) inch blow-off for venting purposes. Once construction is complete, the taps shall be removed and the main repaired by the use of an approved stainless steel repair clamp. The line shall not be filled at a rate that exceeds the venting capacity.

433.13 Disinfection and Flushing of Water Lines

Testing sequence shall be as follows:

1. High Chlorine Testing
2. Line Flushing
3. Hydrostatic Pressure Testing
4. Bacteriological Testing

Disinfection and flushing shall be performed in accordance with the requirements of the Colorado Department of Public Health and Environment and shall comply with AWWA C651.

Chlorine shall be added to the water at the necessary locations in such an amount that a fifty (50) parts per million (ppm) free chlorine residual is formed. This chlorine solution shall be retained in the water line for at least twenty-four (24) hours. After twenty-four (24) hours, all valves and fire hydrants shall be operated to disinfect the appurtenances. A free chlorine residual at all hydrants and blow-offs shall be at least ten (10) parts per million (ppm) at the end of the twenty-four (24) hour period. If the test is unsatisfactory, disinfection shall be repeated until a ten (10) ppm free chlorine residual is obtained. The chlorination work must be done under the supervision of the Engineer of Record and Town representative.

When cutting into or repairing an existing water line, disinfection and flushing shall comply with AWWA C651. Following chlorination, the water line shall be flushed through all hydrants and blow-offs until the water runs clear with no chlorine residual in excess of that carried in the existing system. As a minimum, the total volume of the water line being tested shall be flushed. The Contractor shall be responsible for metering and paying the Town for water used for flushing.

The Contractor shall take all necessary precautions to prevent the flow of strong chlorine solution into existing water facilities and shall be responsible for damages done by heavily chlorinated water. No water lines shall be placed in service or tapped until a written release is obtained from the Town. Sodium thiosulfate shall be used when flushing water on the ground and to waterways that do not contain fish. Vita-D-Chlor Neutral or approved equal shall be used when flushing to waterways with fish. Flushing to the sanitary sewer shall only be allowed with permission from the Town Utilities Superintendent.

The line shall be visually inspected for turbidity. If the inspection is unsatisfactory, the line shall be flushed again. If the turbidity test fails a second time, the line shall be re-chlorinated and then re-flushed.

A twenty-four (24) hour bacteriological test for total coliform bacteria shall be performed by the Town. Bacterial testing is complete on Monday through Thursday only. If the test is unsatisfactory, the line shall be flushed again. If the bacteriological test fails a second time, the line shall be re-chlorinated, re-flushed and re-tested.

433.14 Leakage

Pressure and leakage tests shall be conducted to comply with AWWA C600 to a pressure of one hundred and fifty (150) pounds per square inch (psi) at the low point of the section being tested for the duration of

two (2) hours. The maximum length of line to be tested shall be one thousand (1,000) feet. All joints shall be watertight within tolerances allowed by AWWA C600. Leakage in excess of tolerances shall be located and made watertight by the Contractor. Pressure and leakage tests shall not be conducted until the line has passed all required disinfection tests. The following formula computes the acceptable leakage:

$$L = \frac{SD \sqrt{P}}{148,000}$$

- L = Allowable leakage in gallons per hour
- S = Tested length of pipe in feet
- D = Nominal diameter of pipe in inches
- P = Average test pressure during the test in psi

When testing against existing closed valves, an additional leakage per closed valve of 0.0078 gallons per hour per inch of nominal valve size may be allowed at the discretion of the Town. Each valved section of pipe shall be slowly filled with water and the specified test pressure (measured at the lowest point of elevation) shall be applied by means of a pump connected to the pipe in a satisfactory manner. The pump, pipe connection, gauges, water meter, and all necessary apparatus and labor shall be furnished by the Contractor. Gauges and measuring devices shall be approved by the Town Construction Inspector. Pressure gauge will be minimum three (3) inch diameter with readings from 0-160 pounds, with maximum of two (2) pound increments. Water meter shall be capable of recording to 0.01 of a gallon. Before applying the specified test pressure, all air shall be expelled from the pipe. Any cracked or defective pipes, fittings, valves or hydrants discovered in the pressure test shall be removed and replaced by the Contractor with sound material, including any existing pipe or appurtenances that are leaking and included in the test section. After all visible leaks have been repaired, the pressure test shall be conducted again. Should testing show a leakage rate in excess of the rates above, the pipeline shall not be accepted. The pipeline shall be repaired, rechlorinated to meet the criteria in these DESIGN STANDARDS AND SPECIFICATIONS, and retested as described in this section until it meets the test requirements and is accepted by the Town.

Reuse water systems with pressures greater than one hundred and fifty (150) pounds per square inch (psi) shall be tested to a pressure of two hundred (200) pounds per square inch (psi) at the low point of the section being tested for the duration of two (2) hours.

433.15 Concrete Vaults

Refer to *Denver Water Board Engineering Standards* Section MS-28.

434.00 INSPECTIONS

Refer to Section 153.00 INSPECTIONS of these DESIGN STANDARDS AND SPECIFICATIONS.

Adequate inspections assure compliance to the Town requirements and are the basis for Town's recommendation that said improvements be accepted for maintenance and for release of performance guarantees. It is the responsibility of the Contractor to contact the Town Construction Inspector a minimum of one (1) full working day (twenty-four [24] hours) in advance of the required inspections. Required inspections shall include:

- A. Stockpiled Materials – Verify that materials meet DESIGN STANDARDS SPECIFICATIONS and approved submittals, including but not limited to: bedding

material, pipe, fittings, valves, valve boxes, and fire hydrants. All stockpiled materials shall be protected from the elements.

- B. Excavation – Verify proper trench depths, shoring, spoil pile location, dewatering, and location and protection of existing utilities.
- C. Installation – Verify proper bedding depth, alignment and grade, clean pipe, and lubricants. Check that chlorine tablets are affixed to the inside of pipe and verify “slicing in” of bedding at haunches. Tracer wire is securely attached to the top of pipe, metallic fittings are wrapped with polyethylene, fittings have corrosion-resistant bolts and nuts, and fire hydrants have proper drainage rock. Reuse waterlines shall be purple in color and have purple tracer wire, purple plastic wrap, and purple warning tape.
- D. Thrust Blocks and Restraints – Verify proper size of concrete thrust blocks and adequate bond breaker, and proper torque of bolts for mechanical restraints.
- E. Backfill and Compaction – Verify proper methods of backfill and compaction, depths of lifts, moisture control, and backfill material free of large rock, organic, or frozen material.
- F. Loading and Testing – Verify that loading and testing methods adhere to these DESIGN STANDARDS AND SPECIFICATIONS. Load line, wait at least twenty-four (24) hours, test for high chlorine residual, flush, test for reduced chlorine residual, and wait at least twenty-four (24) hours. The bacteriological (“clear water”) sample shall pass prior to pressure testing in accordance with these DESIGN STANDARDS AND SPECIFICATIONS.
- G. Tie In – After successful testing, tie in dead end to loop the system.
- H. Service Taps – Verify proper tapping procedures. For saddle taps, torque on the saddle is checked. Verify that there are no leaks at the corporation stop and the coupon has been removed. Verify copper service line has proper goose neck, the service line runs correctly to the yoke at the meter pit, there are no joints between the corporation stop and the curb stop valve, and the water is on at the meter pit. The Contractor shall notify the Town when a service line is ready for connection to the main. The connection to the main shall not be made until after it has been inspected and approved. The connection to the main shall be made in the presence of the Inspector. Connections shall not be made on Fridays or within five (5) business days of Thanksgiving or Christmas.
- I. Construction Acceptance into Warranty – Refer to Section 200 ACCEPTANCE PROCEDURES of these DESIGN STANDARDS AND SPECIFICATIONS. General items include:
 - 1. All temporary structures, debris, mud, and waste materials shall be removed from public property.
 - 2. All relative testing certifications and documentation shall be submitted to the Town. All compaction tests should be submitted. Copies of original test documentation is acceptable.
 - 3. All curb stop boxes are centered and plumb and have been raised to grade and checked for valve accessibility.
 - 4. All water services shall be marked with a four (4) inch-tall “W” by wet stamp in the curb face or saw cutting into the face of the curb where the service extends into the property.

5. All water valve boxes, centered and plumb, are at construction grade, straight, and cleaned out to check for access to valve nut and ability to get a valve key on the nut and operate the valve. Verify that all valves that should be open are open. Tracer wire test stations shall be accessible and at proper grade.
 6. All fire hydrants shall be checked for ability to be pressurized.
- J. Final Acceptance/Release from Warranty – Refer to Section 200 ACCEPTANCE PROCEDURES of these DESIGN STANDARDS AND SPECIFICATIONS. General items include:
1. All curb stop boxes, centered and plumb, are raised to grade and checked for valve accessibility.
 2. Each water valve box shall be cleaned out to check for access to valve nut and the ability to get a valve key on the nut and operate the valve. All valves that should be open are open. Tracer wire test stations shall be accessible.
 3. All fire hydrants shall be checked for ability to be pressurized.

440.00 WATER SERVICE LINE CONSTRUCTION

441.00 GENERAL

Water service lines and meter pits/ vaults shall be installed after curb and gutter, or combination curb and gutter are constructed. All water service line locations shall be marked on the face of the curb by wet stamp in the curb face, or neatly saw cutting, a four (4) inch-tall “W” symbol where services cross under the curb. Where no curb exists, an aluminum tag, blue in color one and three quarter (1¾) inches in diameter shall be fastened to the asphalt where the service crosses two (2) feet from the edge of pavement with a two (2) inch-long PK nail. Water service lines shall be in a separate trench, except as approved by the Town Engineer, and shall be a minimum of ten (10) horizontal feet from sewer service lines. Water service lines shall be a minimum of eighteen (18) vertical inches above any sanitary sewer crossing. All water service lines shall be stubbed into the lot either ten (10) feet beyond the back of the sidewalk or curb or five (5) feet beyond any utility easement, whichever is greater, and shall be marked at the end of the water service with a wood 2x4 painted blue. Water service line shall connect to the system in a public street or similar place where the Town has a free right of access and which is otherwise suitable.

The water service line at the curb stop shall be no deeper than four (4) feet six (6) inches. Water service lines shall be a minimum of two (2) feet inside the property line.

441.01 Excavation

All excavation shall comply with Section 332.00 EXCAVATION of these DESIGN STANDARDS AND SPECIFICATIONS.

All excavations for water service line and Town water service line installations shall be adequately guarded with barricades and lights so as to protect the public from hazard. Street, sidewalks, parkways, and other public or private property disturbed in the course of work shall be restored to their original condition in a manner satisfactory to the Town.

442.00 EQUIPMENT AND MATERIALS

442.01 Water Service Lines

Water service lines shall be sized in general conformance with AWWA Manual M-22, "Sizing Water Service Lines and Meters." Completed M-22 form shall be submitted to the Utility Engineer at design phase. Partial installation of water service lines is prohibited. The pressure drop from the main to the building connection shall be provided. The maximum allowable pressure drop shall be fifteen (15) pounds per square inch (psi) unless available supply pressures do not provide fifty (50) pounds per square inch (psi) at the building. Minimum supply pressure at the building shall be fifty (50) pounds per square inch (psi).

Service lines shall be seamless copper tube designated as "Type K" (soft) and conforming to ASTM B88 shall be used for service lines unless otherwise specifically approved by the Town Engineer. No joints or connections permitted between the corporation stop and the curb stop valve or meter.

Water service lines shall be of the same type of material from beginning to end unless the appropriate insulator is installed at the junctions of dissimilar metals and unless approved by the Town Engineer.

Reuse water service line outside the meter pit shall be made of plastic materials, as follows:

Three-quarter- ($\frac{3}{4}$ -) inch through two (2) inch size reuse service lines shall be polyethylene, non-jointed, conforming to AWWA C901, minimum Class 160, using PE 2306, 3306, and 3406 material. All PE service lines shall conform to Iron Pipe Size (IPS) sharing same O.D. as schedule 80 PVC. Reuse lines three (3) inch or larger shall be ASTM D2241 DR 21, Class 200.

Irrigation service lines four (4) inch diameter and larger shall conform with AWWA C900, one hundred and fifty (150) psi minimum pressure class for twelve (12) inch and smaller PVC irrigation mains.

Reuse service line shall be installed with warning tapes or with the warning printed directly onto the pipe. Warning tape shall be installed directly on top of the Irrigation Service Line longitudinally and shall be centered. Acceptable tape or printing directly on the Irrigation Service Line shall state: "NON-POTABLE WATER LINE - DO NOT DRINK."

442.02 Water Service Saddles

Water service saddles shall be used for all water taps on any kind of pipe other than DIP. For DIP, three-quarter- ($\frac{3}{4}$ -) inch taps may be made without using a service saddle on six (6) inch pipe; three-quarter- ($\frac{3}{4}$ -) inch and one (1) inch taps may be made without service saddle on pipe eight (8) inch or larger. All other taps shall be made with a double strap bronze saddle, Ford 202B, or approved equal.

442.03 Meters

Unless otherwise approved, water meters shall be housed in an exterior meter pit in accordance with the standard drawings. If an interior meter is approved, interior meters shall have a water service shut off outside of the building at the property line or at least twenty (20) feet from the building.

All one (1) inch and smaller meters for potable water shall be bronze case Sensus iPERL (magnetic three-quarter to one-and-one-half [$\frac{3}{4}$ -1 $\frac{1}{2}$] inch) with sealed register, dual feed chambers, and positive displacement magnetic drive meters, including touch read/pit lid adapters and Sensus 520-M single port radio transmitters for meter pit installation. Meters shall meet the no lead requirements of NSF 372. Meters two (2) inches and larger in size shall be as approved by the Town; normally, Sensus compound type meters will be selected. All meters and transmitters shall be supplied and installed by the Town at the Contractor's expense.

442.04 Potable Water Sampling Stations

Multifamily residential housing units shall provide a suitable location for Town employees to access the potable water system for monitoring water quality. Townhomes, condominiums, apartments, and mobile home parks shall provide an acceptable potable water sampling locations, such as (1) a metal faucet in a maintenance room or kitchen area, (2) a frost-free outdoor spigot with a lockable cover, or (3) an outdoor sampling station. Potable water outlets that are not acceptable sampling locations include bathroom sinks, drinking water fountains, faucets with attached hoses, and any faucet connected to a water treatment system such as a water softener or filtration device.

If the outdoor sampling station is selected, details of its location and connection to the distribution system shall be as determined by the Town Engineer. The outdoor sampling station shall be 52" bury depth, with three-quarter ($\frac{3}{4}$) inch FIP inlet, and three-quarter ($\frac{3}{4}$) inch hose nozzle. The station shall be enclosed in a lockable, non-removable, aluminum-cast housing. When opened, the station shall require no key for operation, and the water will flow in an all brass waterway. All working parts will also be of brass and be removable from above ground without digging. Exterior piping shall be galvanized steel. A copper vent tube with shutoff valve will enable each station to be pumped free of standing water to prevent freezing and to minimize bacterial growth. Sampling station shall be Kupferle Foundry Eclipse No. 88 or approved equal.

The outdoor sampling station shall be installed with a curb stop (Ford Ball Valve Curb Stop B11-333W or approved equal) to isolate it from the distribution main. Requirements of the Cross-Connect and Backflow Control Program will apply. Installation shall be in a publicly accessible area such as a park, lawn, or landscaped border.

442.05 Outside Meter Settings

All three-quarter ($\frac{3}{4}$) inch and one (1) inch meters shall be set with a copper setter having an internal angle curb valve on the inlet side. Copper setters shall be Ford 80 Series or Town approved equal. Meters larger than one (1) inch shall have sealed valved bypasses and be set in accordance with the detail given or as approved by the Town.

All outside meters shall be installed in a horizontal position and housed in a meter pit in accordance with the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS. The installation of the water meter shall comply with the following unless otherwise approved by the Town:

- A. All meters not installed within the right-of-way shall require an easement dedication ten (10) feet wide and extending three (3) feet behind the meter.
- B. The meter shall be installed in a pit, manhole, or vault which shall allow free and easy access and adequate room for installation, inspection, and maintenance and shall provide protection from freezing.
- C. All fittings shall be brass or copper.
- D. A ball or gate valve shall be installed where the water service line enters the building and the meter is installed.
- E. Water meters are not to be installed in roadways, driveways, or parking areas.

442.06 Inside Meter Settings

Inside meters shall only be used with special approval by the Town. All inside meter settings shall be installed in a manner which shall allow free and easy access and adequate room for installation, inspection, and maintenance and shall provide protection from freezing. Meters installed inside buildings shall not be more than eighteen (18) inches from the wall through which the water service line enters the building unless otherwise approved in writing by the Town. There shall be no reasonable means for water to be taken from the service line without passing through the meter. The Town may require a remote meter reading device may be installed.

Inside meter settings shall not be allowed in crawl spaces, closets, or other places where free and easy access is not provided. Meter sizes one and one-half (1½) inch and two (2) inch installed inside buildings shall be provided with a floor drain. Refer to the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS. Installation shall conform to the following:

- A. The meter setting shall be installed in the basement, a utility closet, or similar area, which shall allow free and easy access and adequate room for installation, inspection, and maintenance.
- B. The meter yoke shall be a minimum of twelve (12) inches and a maximum of four (4) feet above floor level in a horizontal position and have a minimum of twelve (12) inches clearance from all surrounding obstructions.
- C. A ball or gate valve shall be installed on both the upstream and downstream side of the water meter.
- D. A pressure regulator, adjustable from twenty-five (25) to seventy-five (75) psi shall be installed between the meter yoke and downstream valve. The regulator shall be a Watts Model 25AUB or equivalent unless otherwise approved in writing by the Town Engineer.
- E. All fittings shall be brass or copper.

442.07 Commercial Above Grade Meters

Upon written request, the Town may approve the installation of a water meter above grade in a commercial building. The request for approval must include an explanation for the request along with plan(s) showing the location of the meter in the building. The meter must be located in such a manner that the meter can be accessed easily from an entrance to the building and without the necessity of walking through the building. The required interior room for the meter will be supplied and constructed at the applicant's expense. The Town will supply a lock box for the key to access the meter. Detail Drawings suggest installation details, which shall be done in a manner such that all piping, valves, and meter are easily accessible for maintenance and operation and are protected from the elements. All supports must be mounted on the wall(s).

442.08 Meter Bypass Line

A bypass line shall be required for all domestic use one and one-half (1½-) inch and larger meters unless otherwise approved by the Town Engineer, whether installed in an outside or inside setting. Bypass lines shall contain an independent control valve and shall not contain tees, plugs, or other outlets, and shall be in accordance with the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS. A bypass line may be required on services smaller than one and one-half (1½) inch if deemed necessary by the Town Engineer.

442.09 Valves for Use with Meters

Valves three (3) inches or larger for use with ductile iron water service line shall be gate valves with cast iron bodies. All gate valves three (3) inches or larger shall be supported by adjustable steel valve supports.

442.10 Meter Couplings

All meters one and one-half (1½) inch and larger shall be installed with a coupling to allow for the removal of the meter without disturbing the pipe. Couplings shall comply with *Denver Water Board Engineering Standards* Section MS-22.

442.11 Meter Yokes (Copper Setters)

Meter Yokes (Copper Setters) shall be Ford Series 80 or approved equal. Water service connections shall be flare type.

442.12 Meter Pits and Covers

Meter pits for three-quarter (¾) inch and one (1) inch meters shall have a circular reinforced concrete barrel. Barrel sections shall be of five thousand (5,000) psi minimum strength concrete, meeting CDOT Class 2 sulfate resistance, with a wall thickness of not less than two (2) inches. Reinforcement shall not be less than No. 9 circular wire six (6) inches on center. Setting shall consist of a lower bell section with opening at the bottom to allow for entrance/exit of the Service Line. Barrel sections shall fit together allowing no visible gaps, and the top section shall be shaped for placement of the meter pit cover. Adjustable grade rings shall be of reinforced concrete or cast iron. As an alternate, pre-cast polyethylene meter pits are acceptable. The polyethylene meter pits shall have a minimum nominal wall thickness of fifty-five one hundredths (0.55) inch, vertical crush strength exceeding twenty thousand (20,000) pounds, white interior color and black exterior color manufactured by Mid-States Plastics, Inc. or Town approved equal. Meter pits for three-quarter (¾) inch and one (1) inch meters shall be installed on two (2)- six (6) inch by six (6) inch by six (6) inch 5,000 psi concrete reinforced base beams or approved equal.

For one and one-half (1½) inch and two (2) inch meters, precast concrete vaults (conforming to ASTM C478) shall be used. Larger size meter pits shall be as approved by the Engineer.

Meter pit covers for three-quarter (¾) inch and one (1) inch meters shall be constructed of cast iron with cast iron inner frost lid. The top lid shall be of cast iron with a worm type lock operated by a pentagon head. The lid and cover shall be Castings, Inc. W-32-16-CI Recessed Lid or Town approved equal. The top lid shall be tapped with a one and seven-eighths (1⅞) inch hole for mounting the touch read pad and marked with "Water." Reuse meter pit covers shall be marked with "Irrigation." For larger meter installations, the meter cover shall be Ford No. 24 with inner cover, except when located in street paving.

Reuse water meter pits shall have polyethylene by copper compression couplings provided at the meter pit and outlet, the meter color shall be purple, if a pre-cast polyethylene meter pit is utilized, the interior color shall be purple and by-pass piping is not needed.

442.13 Corporation Stops

Corporation stops provide the connection for the water service line to the waterline. Corporation stops are also required in air and vacuum valve and large butterfly valve installations. Corporation stops shall be

used for connection of services two (2) inches and smaller. Corporation stops shall be brass and conform to AWWA C800. The inlet shall be standard AWWA corporation stop inlet thread and the outlet shall be for flared type “K” copper service pipe. Corporation stops shall be A.Y. McDonald 74701, Cambridge Brass 302NL Series, Ford FB-600-x-NL, Mueller B25000N, or Town approved equal, provided with an insulating coupling. Refer to the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS and *Denver Water Board Engineering Standards* Section MS-21.

442.14 Curb Stops

Curb stops shall be placed on the inlet side of the meter pit for all services two (2) inches and smaller. Placement of the curb stop and stop box can vary from a maximum of five (5) feet outside the front property line to a maximum of five (5) feet inside the front property line. Curb stops shall be buried a minimum of four (4) feet six (6) inches and a maximum of five (5) feet six (6) inches. The curb stop shall be located a minimum of six (6) inches and a maximum of twelve (12) inches upstream from the meter pit. Placement of the curb stop and stop box outside the front property line is preferred. Refer to the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS and *Denver Water Board Engineering Standards* Sections MS-21 and MS-23. Curb stops shall be brass and conform to AWWA C800. Connections shall be for flared type “K” copper service pipe. Curb stops shall be Mueller J-15204, Ford B-22, or Town approved equal. Curb stops shall not be installed in concrete or asphalt unless approved by the Town and shall have a traffic approved curb box.

442.15 Curb Stop Service Boxes

Curb stop service boxes, centered and plumb, shall be cast iron, Buffalo type. The bottom part shaped like an inverted “U” straddling the service line shall have a flanged bottom so as to support itself. Curb stop service boxes shall comply with *Denver Water Board Engineering Standards* Section MS-22. Curb stop boxes shall be set to one-half (½) inch above finish grade and be accessible at the time of meter installation. Water service curb stop box lids shall be marked with “Water.” Reuse water service curb stop box lids shall be marked with “Irrigation.”

442.16 Brass or Copper Fitting Couplings

Fittings shall be brass or copper alloy. Connections shall be by flared joints and no joints shall be permitted underground.

442.17 Backflow Preventers

Backflow preventers shall be installed on all commercial water service lines and on all residential water service lines that serve more than two (2) units. The backflow prevention shall have a reduced pressure zone valve assembly. All backflow preventer installations shall comply with Superior Metropolitan District #1 and CDPHE policy and regulation.

442.18 Pressure Regulating Valve

Pressure regulating valve (PRV) shall be installed on all service lines except where specifically exempted by the Town and shall be upstream of all uses. Installation of PRV in the meter pit is acceptable to the Town if the meter pit and service line are so designed as to permit convenient servicing of the meter. The PRV shall be set for a downstream pressure not exceeding eighty 80 psi.

443.00 TAPPING THE MAIN

All taps shall be wet taps. Shut down of any portion of the water system shall only be allowed when uncontrolled circumstances do not permit a wet tap. Any shut down of the water system must be approved in writing by the Town.

Tapping of the pipe shall be completed with a tapping saddle.

All service taps shall be performed by the Contractor. Taps shall be made using an approved tapping machine. All necessary materials for said taps, including corporations stops, copper line, meter pits, copper setters, curb stops, etc., shall be supplied by the Contractor. Said materials shall conform to these DESIGN STANDARDS AND SPECIFICATIONS.

Taps on water or reuse water mains shall only be made when the air temperature is 40 degrees Fahrenheit and rising.

All taps into the water main shall be at an angle of not more than 45 degrees Fahrenheit from the horizontal, and corporation stops shall be installed. Taps shall not be made on a water main until all tests have been performed, the main has passed the pressure tests and clear water tests, and a "Release For Service" letter has been issued by the Town. Care shall be taken to properly install water service lines so that a minimum of twelve (12) inches of slack is in the service line gooseneck at the main to protect against pull-out. The Town Construction Inspector will inspect each tap for leaks prior to polywrap, bedding, and backfilling. Tapping mains may require digging out bedding material and cutting or removing part of the corrosion protective wrapping. After the taps are made, the wrap shall be repaired or replaced by the Contractor to protect both the service line and the main.

Service taps shall maintain a minimum spacing of twenty-four (24) inches between taps and twenty-four (24) inches of separation from all pipe joints, bells, fittings, and valves. Under no circumstances shall a water service connection be made directly to a transmission main.

The Town shall be responsible for maintain that portion of the water service line, corporation stop, and meter as shown on the detail drawings and as set forth in the DESIGN STANDARDS AND SPECIFICATIONS.

450.00 PUMPING FACILITIES

451.00 GENERAL

In locations where the Town's water distribution system may not be capable of providing adequate water pressure, the Town may require the construction of a pumping facility to provide proper service. The Town may not approve the installation of a pumping facility where, in the opinion of the Town, such installation would be injurious to the operation, or future operation of the Town's water system. The Developer shall provide the Town with a set of design calculations and drawings for review and approval as required under Section 160.00 PLANS AND SPECIFICATIONS of these DESIGN STANDARDS AND SPECIFICATIONS.

The pumping facility shall comply with all requirements of the Colorado Department of Public Health and Environment and of these DESIGN STANDARDS AND SPECIFICATIONS. The Town shall require that the Developer prepare record document drawings and an electronic (AutoCAD) file of the pumping facility in accordance with Section 200 ACCEPTANCE PROCEDURES of these DESIGN STANDARDS AND SPECIFICATIONS. Upon completion of the pumping facility, the Contractor shall

also provide the Town with two (2) copies of an Operation & Maintenance Manual for the facility.

452.00 DESIGN CRITERIA

452.01 Pumps and Pump Station

All pertinent portions of *Denver Water Board Engineering Standards* Section 5.10 shall apply. Applicable portions of *Denver Water Board Engineering Standards* Section 6 shall also be followed.

A standby generator capable of operating the entire station shall be provided. The generator may be housed inside a separate, all-weather enclosure.

452.02 Controls and Supervisory Control and Data Acquisition (SCADA)

All new controls, telemetry equipment, and security equipment shall be compatible with and easily integrated into the Town's system. All pertinent portions of *Denver Water Board Engineering Standards* Section 5.12 shall apply. Controls and SCADA systems are subject to review and approval by the Town prior to installation.

460.00 TRENCHING, BACKFILLING, AND COMPACTING

Trenching, backfilling, and compacting shall comply with Section 340.00 TRENCHING, BACKFILLING, AND COMPACTING of these DESIGN STANDARDS AND SPECIFICATIONS.

470.00 HEALTH AND SAFETY SIGNAGE

A sign reading "NON-POTABLE RECLAIMED WATER—NOT FOR DRINKING" shall be posted at all points where consumption of the water may be attractive to the public, in areas of public use which receive reclaimed water, and at all valves, control boxes, and similar features.

This requirement shall not apply to sprinkler heads. Signs reading "ATTENTION: IRRIGATED WITH RECLAIMED WATER. DO NOT DRINK FROM SPRINKLERS" shall be posted by the Developer at conspicuous locations in areas irrigated with reuse water. Where signage is not feasible (such as a valve box in a street), the above wording shall be engraved on brass tags riveted to the outside and inside of the component. A permit from CDPHE shall be procured prior to connecting to the Town's reuse system. A signage plan shall be submitted to the Town and approved before connecting to the Town's reuse or raw water system. These signage provisions apply to both new construction and cases where an existing irrigation waterline is connected to the Town's reuse or raw water system.

To the extent possible, reuse components, such as valve box lids, valves, valve operators, meters, control boxes, etc. shall be purple.

Hose bibs and yard hydrant connections shall be coupling-type (not threaded) to prevent use of common "garden" hose and possible cross-connections.

480.00 RESTORATION AND CLEAN UP

Restoration and cleanup shall be completed in accordance with Section 360.00 RESTORATION AND CLEAN UP of these DESIGN STANDARDS AND SPECIFICATIONS.

GENERAL WATER DISTRIBUTION PIPELINE NOTES

1. WATER DISTRIBUTION PIPELINES SHALL BE EITHER POLYVINYL CHLORIDE (PVC) PRESSURE PIPE OR DUCTILE IRON PIPE (DIP).
2. PIPES 12 INCHES OR SMALLER SHALL BE MINIMUM AWWA C900 DR 14 CLASS 305 PVC OR AWWA C151 CLASS 250 DIP. THE TOWN MAY REQUIRE PIPELINES 12 INCHES OR SMALLER TO BE DESIGNED ON A CASE BY CASE BASIS.
3. PIPES LARGER THAN 12 INCHES SHALL BE MINIMUM CLASS 250 DIP OR AWWA C905 DR18 CLASS 235. THE TOWN REQUIRES ALL PIPES LARGER THAN 12 INCHES BE DESIGNED AND APPROPRIATE DESIGN CALCULATIONS TO BE SUBMITTED.

DUCTILE IRON PIPE

1. DUCTILE IRON PIPE SHALL BE MANUFACTURED IN ACCORDANCE WITH AWWA C151.
2. PIPE JOINTS SHALL BE PUSH-ON SINGLE GASKET THAT CONFORM TO THE APPLICABLE REQUIREMENTS OF AWWA C111. OTHER JOINT TYPES MAY BE ACCEPTABLE IF THEY ARE SPECIFICALLY APPROVED BY THE TOWN.
3. PIPE SHALL HAVE A NOMINAL LAYING OF LENGTH OF 20 FEET. RANDOM LENGTHS ARE NOT ACCEPTABLE.
4. THE GRADE OF IRON SHALL BE 60/42/10.
5. PIPE SHALL HAVE STANDARD THICKNESS CEMENT-MORTAR LINING OR BE EPOXY LINED IN ACCORDANCE WITH AWWA STANDARDS AND SHALL BE GIVEN A SEAL COAT OF ASPHALTIC MATERIAL.
6. THE MANUFACTURER SHALL FURNISH A SWORN STATEMENT THAT THE INSPECTION AND ALL OF THE SPECIFIED TESTS HAVE BEEN COMPLETED AND THAT THE RESULTS COMPLY WITH THE REQUIREMENTS OF THESE STANDARDS. A COPY OF THE CERTIFICATION, INCLUDING COMPLIANCE WITH ANSI/NSF 61, SHALL BE SENT TO THE TOWN.
7. ACCEPTABLE MANUFACTURERS INCLUDE AMERICAN CAST IRON PIPE COMPANY, GRIFFIN PIPE PRODUCTS COMPANY, PACIFIC STATES CAST IRON PIPE COMPANY, AND UNITED STATES PIPE AND FOUNDRY COMPANY.
8. DUCTILE IRON PIPE THAT IS TO BE INSTALLED IN THE TOWN SHALL BE MANUFACTURED DOMESTICALLY.
9. ALL JOINTS SHALL BE MECHANICALLY RESTRAINED.

POLYVINYL CHLORIDE PRESSURE PIPE

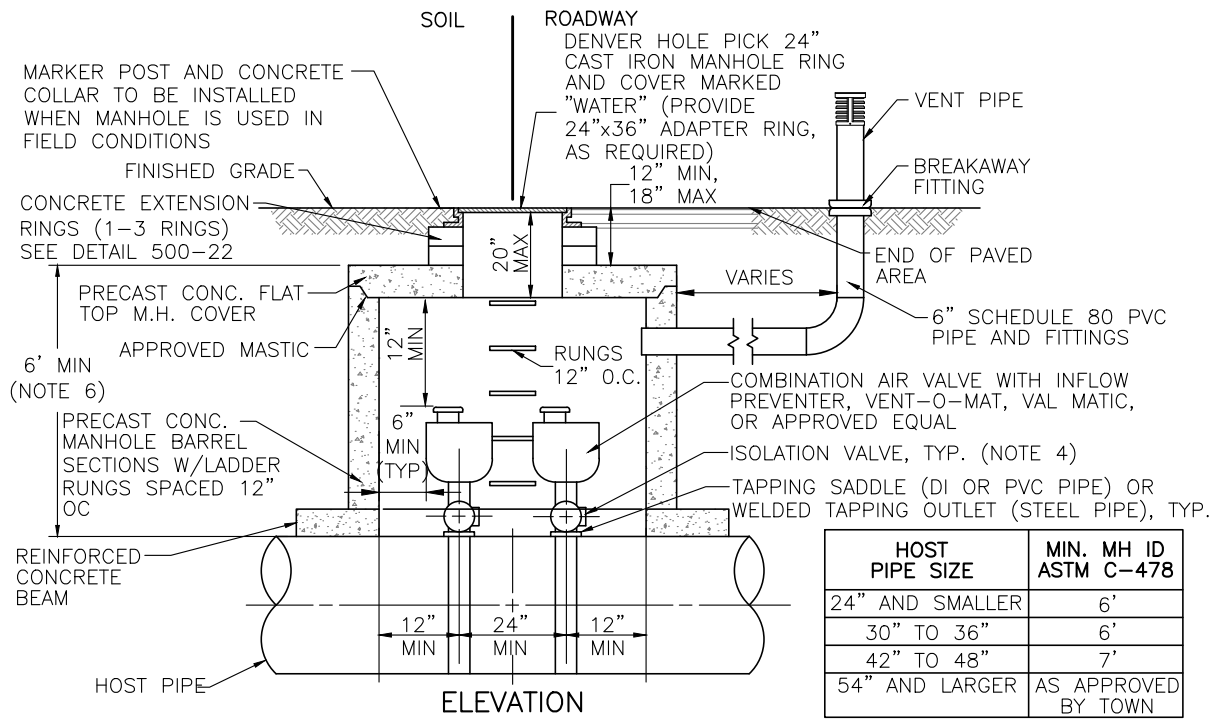
1. PVC PIPE SHALL BE MANUFACTURED IN ACCORDANCE WITH AWWA C900, OR AWWA C905 AS APPLICABLE.
2. PIPE JOINTS SHALL BE MADE USING AN INTEGRAL BELL WITH AN ELASTOMERIC GASKET PUSH-ON TYPE JOINT.
3. PVC PIPE 12 INCHES AND SMALLER SHALL BE DR 14 CLASS 305. PVC PIPE LARGER THAN 12 INCHES SHALL BE DR 18 CLASS 235.
4. PIPE SHALL HAVE A NOMINAL LAYING LENGTH OF 20 FEET. RANDOM LENGTHS ARE NOT ACCEPTABLE.
5. PVC PIPE UTILIZING FUSED BUTT-JOINTS MAY BE ALLOWED IF APPROVED BY THE TOWN.
6. THE MANUFACTURER SHALL FURNISH A SWORN STATEMENT THAT THE INSPECTION AND ALL OF THE SPECIFIED TESTS HAVE BEEN COMPLETED AND THAT THE RESULTS COMPLY WITH THE REQUIREMENTS OF THESE STANDARDS. A COPY OF THE CERTIFICATION, INCLUDING COMPLIANCE WITH ANSI/NSF 61, SHALL BE SENT TO THE TOWN.
7. ACCEPTABLE MANUFACTURERS INCLUDE CERTAINTEED CORPORATION, JM EAGLE, IPEX, DIAMOND PLASTIC CORPORATION, NORTH AMERICAN PIPE CORPORATION, AND VINYLTECH CORPORATION.
8. ALL JOINTS SHALL BE MECHANICALLY RESTRAINED.



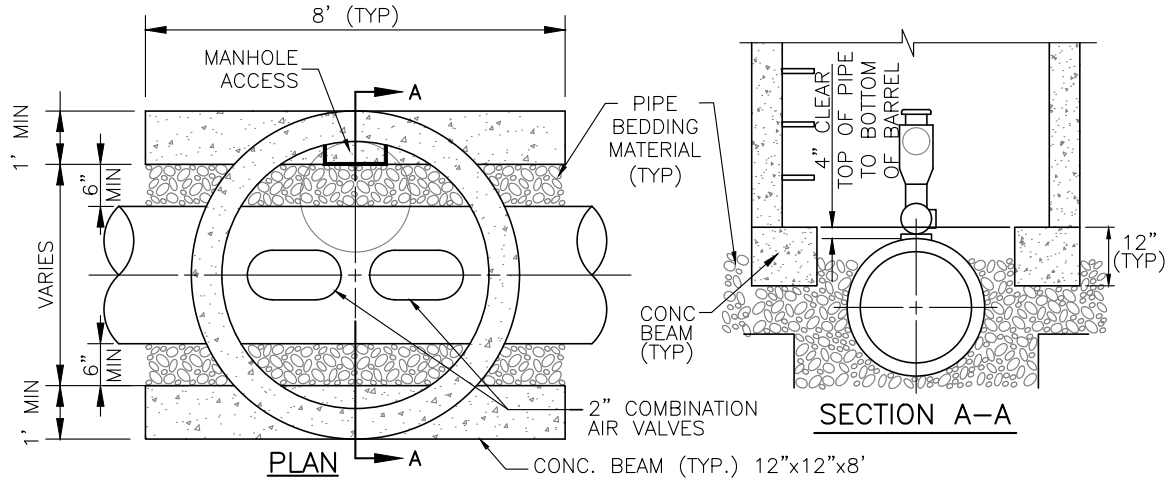
GENERAL WATER DISTRIBUTION PIPELINE NOTES

DATE: JANUARY 2019

SHEET 400-1



HOST PIPE SIZE	MIN. MH ID ASTM C-478
24" AND SMALLER	6'
30" TO 36"	6'
42" TO 48"	7'
54" AND LARGER	AS APPROVED BY TOWN



NOTES:

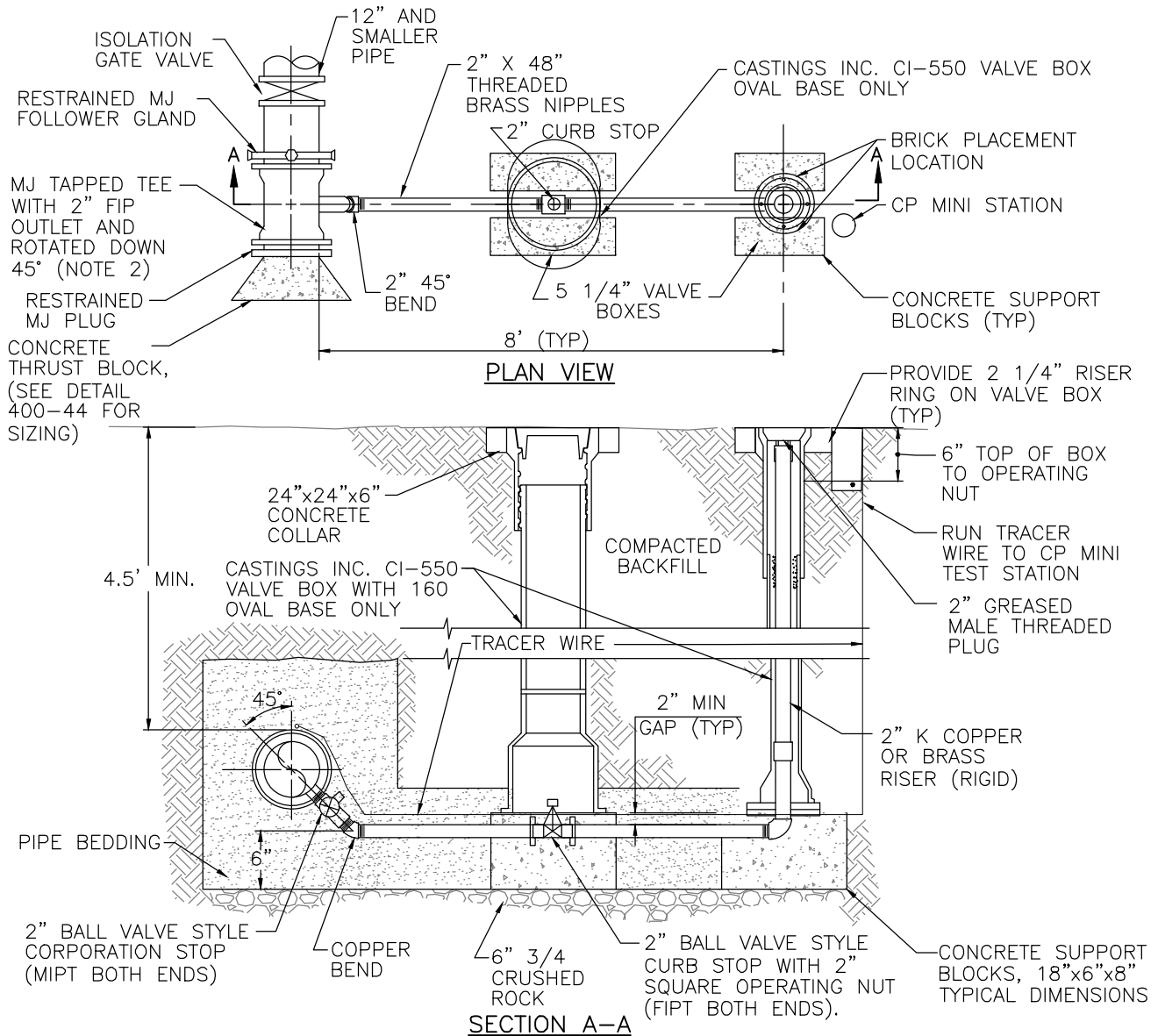
1. CONTRACTOR SHALL SUBMIT SHOP DRAWINGS OF VAULT LAYOUT AND FITTINGS FOR APPROVAL BY THE TOWN.
2. AIR VALVES SHALL BE SIZED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.
3. FOR APPROVED MANUFACTURERS AND MODEL NUMBERS OF FITTINGS, REFER TO THE ENGINEERING STANDARDS.
4. ISOLATION VALVES SHALL BE FULL PORT BRONZE BALL STYLE WITH HAND LEVER. 2" VALVES SHALL BE CORPORATION TYPE AND THREE INCH AND LARGER VALVES SHALL INCORPORATE FLANGE FITTINGS TO MATE WITH FLANGED AIR VALVES.
5. ALL COMPONENTS OF MANHOLE STRUCTURE SHALL MEET AASHTO H20 LOAD RATING.
6. CHECK HEIGHT OF AIR VALVE AND ASSOC. PLUMBING AND ENSURE PROPER CLEARANCES FROM VAULT PRIOR TO ESTABLISHING HOST PIPE DEPTH.
7. REFER TO STANDARD MANHOLE DETAIL. VENT-O-MATIC RGX FOR SEWAGE APPLICATIONS OR APPROVED EQUAL.

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS. N.T.S.



COMBINATION AIR VALVE INSTALLATION

DATE: JANUARY 2019 SHEET 400-2



NOTES:

1. MJ TAPPED TEE CAN BE SUBSTITUTED WITH A 2" TAPPING SADDLE. PROVIDE A MINIMUM OF 24" BETWEEN THE TAP LOCATION AND THE HOST PIPE PLUG.
2. ALL 2" FITTINGS AND PIPE SHALL BE COPPER.
3. ALL PIPE AND FITTINGS SHALL BE WRAPPED IN POLYETHYLENE AND SECURELY TAPED PRIOR TO PLACING THRUST BLOCKS.

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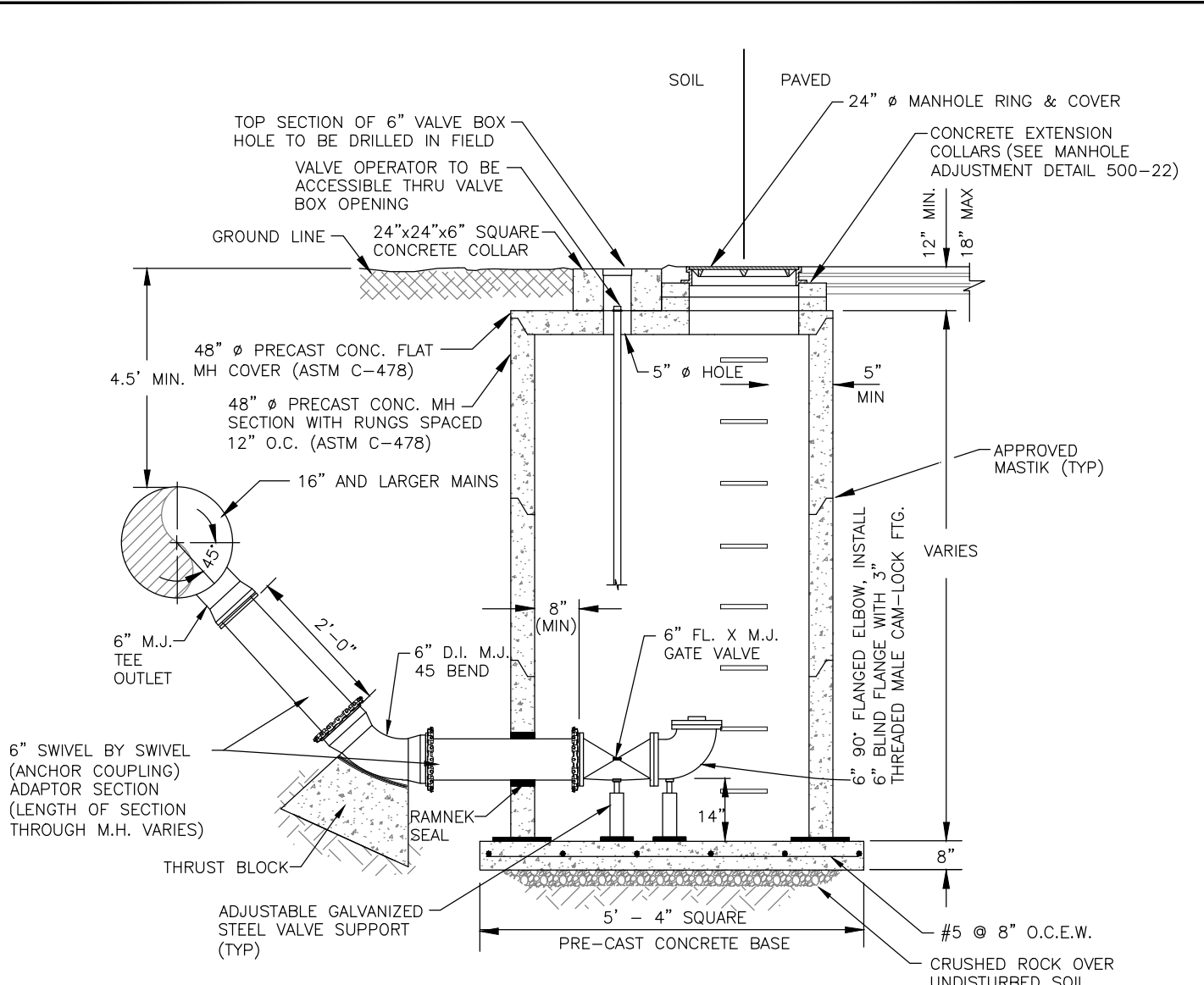
N.T.S.



**STANDARD BLOWOFF ASSEMBLY
12" AND SMALLER WATERLINES**

DATE: JANUARY 2019

SHEET 400-3



NOTES:

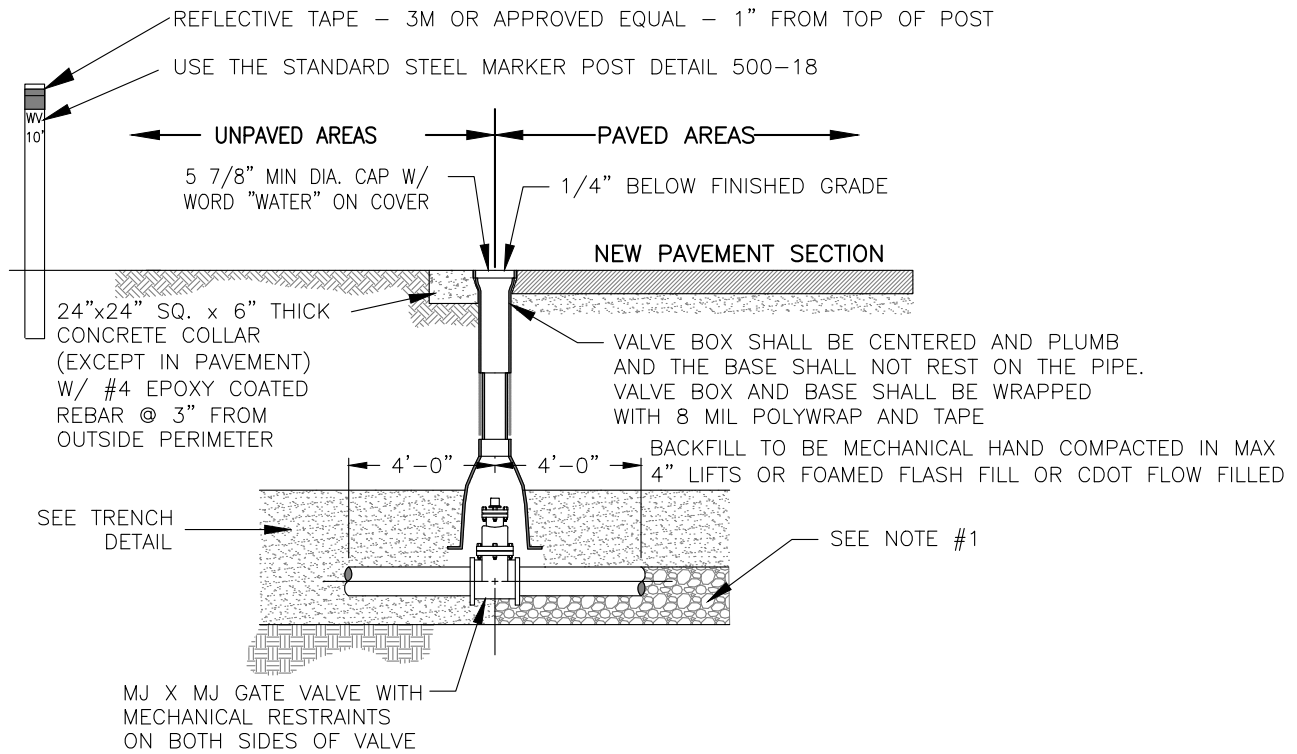
1. ALL COMPONENTS OF THE MANHOLE STRUCTURE SHALL MEET AASHTO HS20 LOAD RATING.
2. PIPE PENETRATIONS SHALL BE SEALED WITH MECHANICAL SEAL AND MANHOLE JOINTS SHALL BE SEALED WITH RAM-NEK RN101 OR APPROVED EQUAL.
3. COAT THE EXTERIOR OF THE STRUCTURE WITH BITUMASTIC 300M DAMP PROOFING OR APPROVED EQUAL.
4. THIS BLOW-OFF INSTALLATION SHALL BE REPLACED WITH A FIRE HYDRANT WHEN DIRECTED BY THE TOWN, SUCH AS IN AREAS OF HIGH GROUNDWATER.
5. FLOWFILL CUTOFF WALLS SHALL BE INSTALLED ON BOTH SIDES OF THE MAINLINE TEE TO PREVENT INFILTRATION INTO THE VAULT.

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS. N.T.S.



**16" AND LARGER TRANSMISSION
MAIN BLOW-OFF INSTALLATION**

DATE: JANUARY 2019	SHEET 400-4
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NOTES:

1. CARE SHALL BE TAKEN WHEN INSTALLING VALVES TO ASSURE PROPER SUPPORT OF THE VALVE. THE TOWN REQUIRES 6" MIN. OF 3/4" CRUSHED ROCK TO BE INSTALLED UNDER THE VALVE TO PROVIDE PROPER SUPPORT.
2. VALVES SHALL NOT BE PLACED IN CONCRETE SIDEWALKS, CROSS PANS, GUTTERS, OR OTHER DRAINAGE WAYS.
3. OPERATING NUTS SHALL NOT BE SET CLOSER THAN TWO (2) FEET FROM FINAL GRADE.
4. GATE VALVE SHALL BE POLYETHYLENE WRAPPED (8 MIL).
5. CONCRETE COLLARS & MARKER POSTS ARE REQUIRED WHEN VALVE IS LOCATED IN AN UNPAVED AREA.
6. VALVE BOXES ARE TO BE BROUGHT UP TO GRADE AT THE TIME OF PAVEMENT PLACEMENT OR OVERLAY. VALVE BOX ADJUSTING RINGS ARE NOT ALLOWED.
7. VALVE BOXES TO BE CASTING, INC. W CI-550 WITH 160 OVAL BASE, NO ALTERNATE. FOR REUSE IRRIGATION TOP SHALL BE CASTINGS, INC. 4TCI-17-S TRIANGLE RITE HITE TOP.
8. HEAT ASPHALT PRIOR TO ADJUSTING BOX.
9. SEE TOWN OF SUPERIOR STANDARDS AND SPECIFICATIONS SECTION 343.00 FOR BEDDING REQUIREMENTS.

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

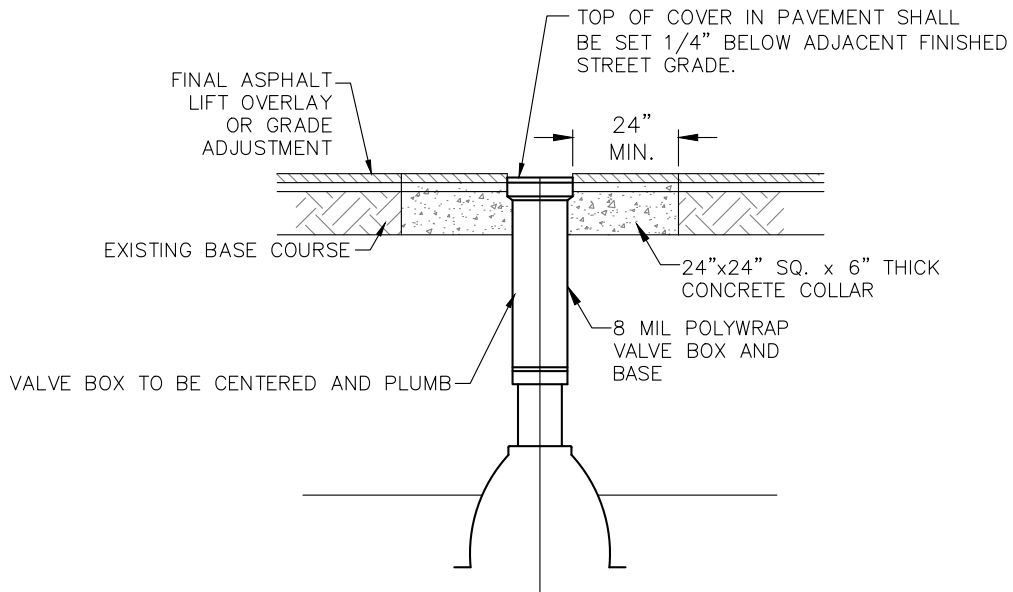
N.T.S.



VALVE BOX

DATE: JANUARY 2019

SHEET 400-5



THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

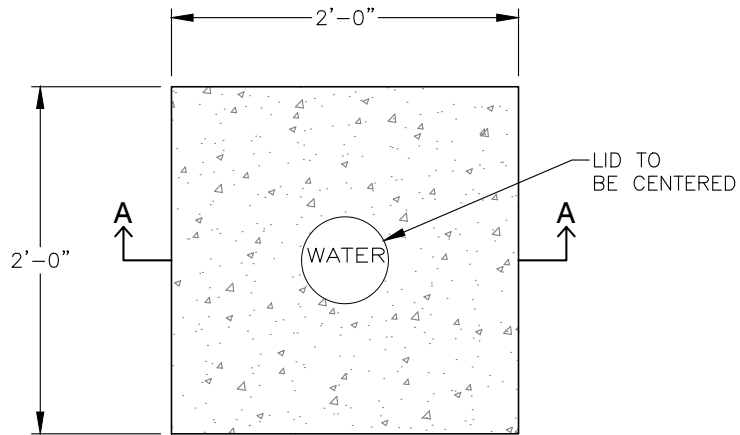
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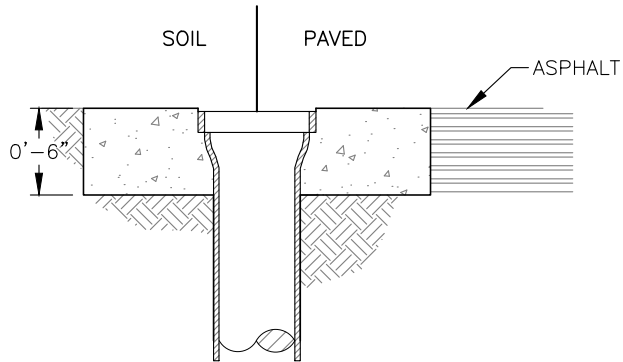
VALVE BOX ADJUSTMENT

DATE: JANUARY 2019

SHEET 400-6



PLAN



SECTION A-A

NOTES:

1. HAND MIXED CONCRETE IS PROHIBITED
2. CONCRETE TO BE EDGED AND BROOM FINISHED
3. COLLAR TO BE SQUARE AND LEVEL

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

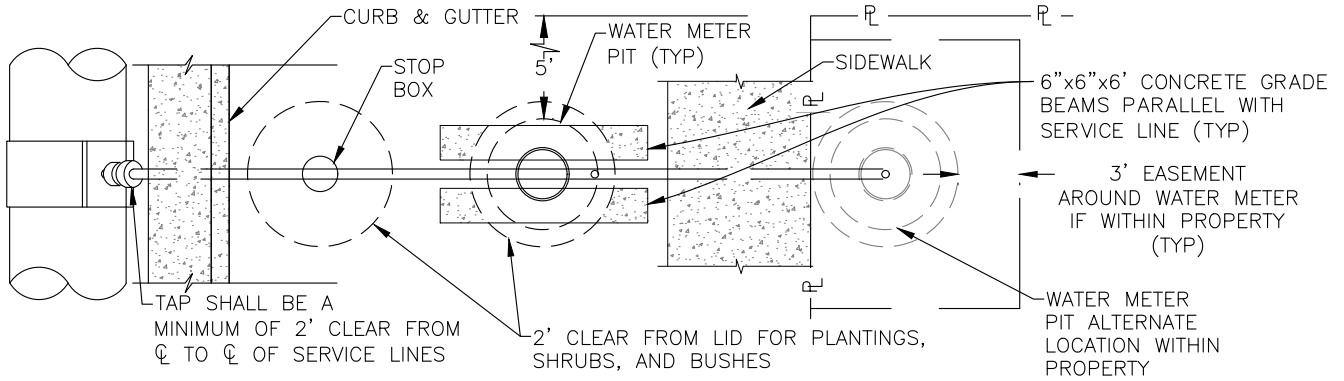
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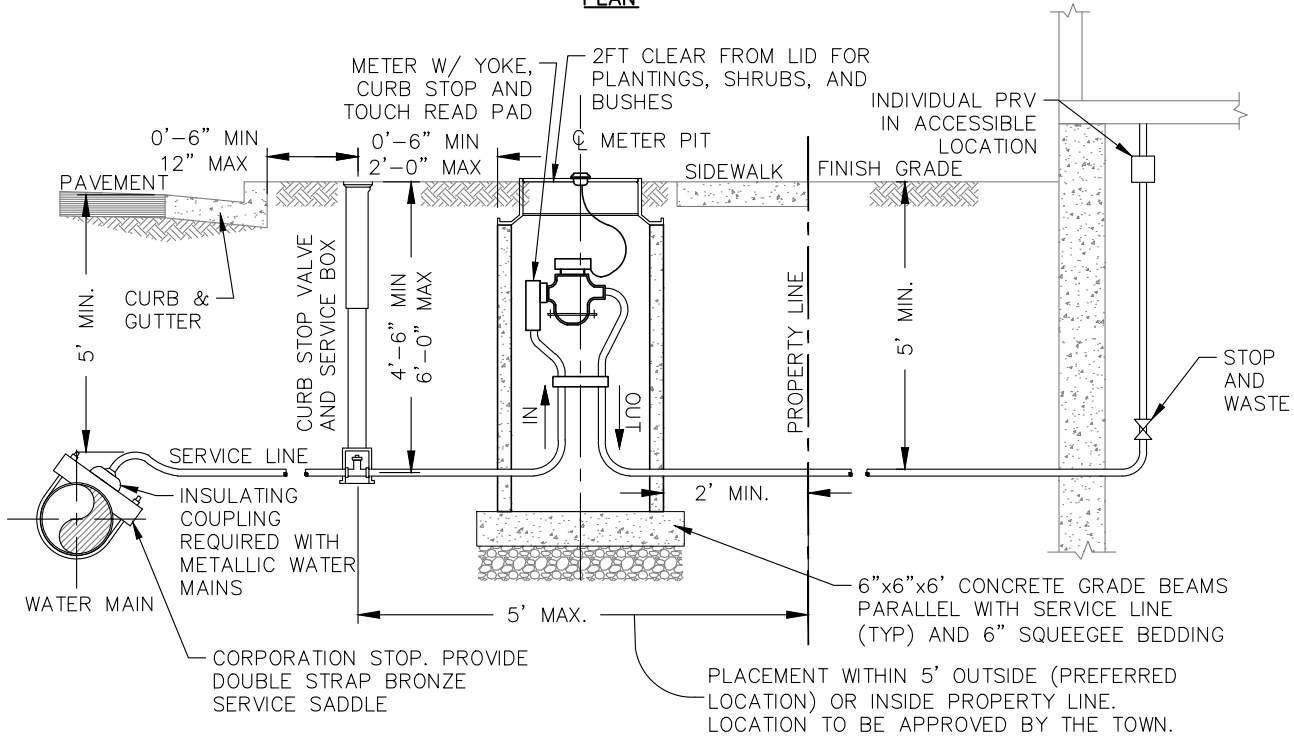
VALVE BOX AND CONCRETE
COLLAR FOR TEST STATION

DATE: JANUARY 2019

SHEET 400-7



PLAN



ELEVATION

NOTES:

1. SERVICE LINE TO BE TYPE "K" COPPER.
2. SERVICE LINE AND METER PIT TO BE INSPECTED BY THE TOWN.
3. INSTALL INDIVIDUAL PRESSURE REDUCING VALVE (PRV) UNLESS SPECIFICALLY NOT REQUIRED BY THE ENGINEER. ALTERNATE LOCATION FOR PRV IN METER PIT.
4. CORP STOP TO BE MUELLER H-15000 OR FORD F-600, OR APPROVED TOWN EQUAL.
5. NO BENDS, FITTINGS, CONNECTIONS, OR CHANGES IN PIPE SIZE FROM THE WATER MAIN TO 5' PAST THE OUTSIDE WALL OF THE METER PIT ON THE CUSTOMER SIDE. SERVICE LINE MAY BE INCREASED ONE PIPE SIZE AFTER THIS POINT.
6. SEE TOWN OF SUPERIOR STANDARDS AND SPECIFICATIONS SECTION 343.00 FOR BEDDING.

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

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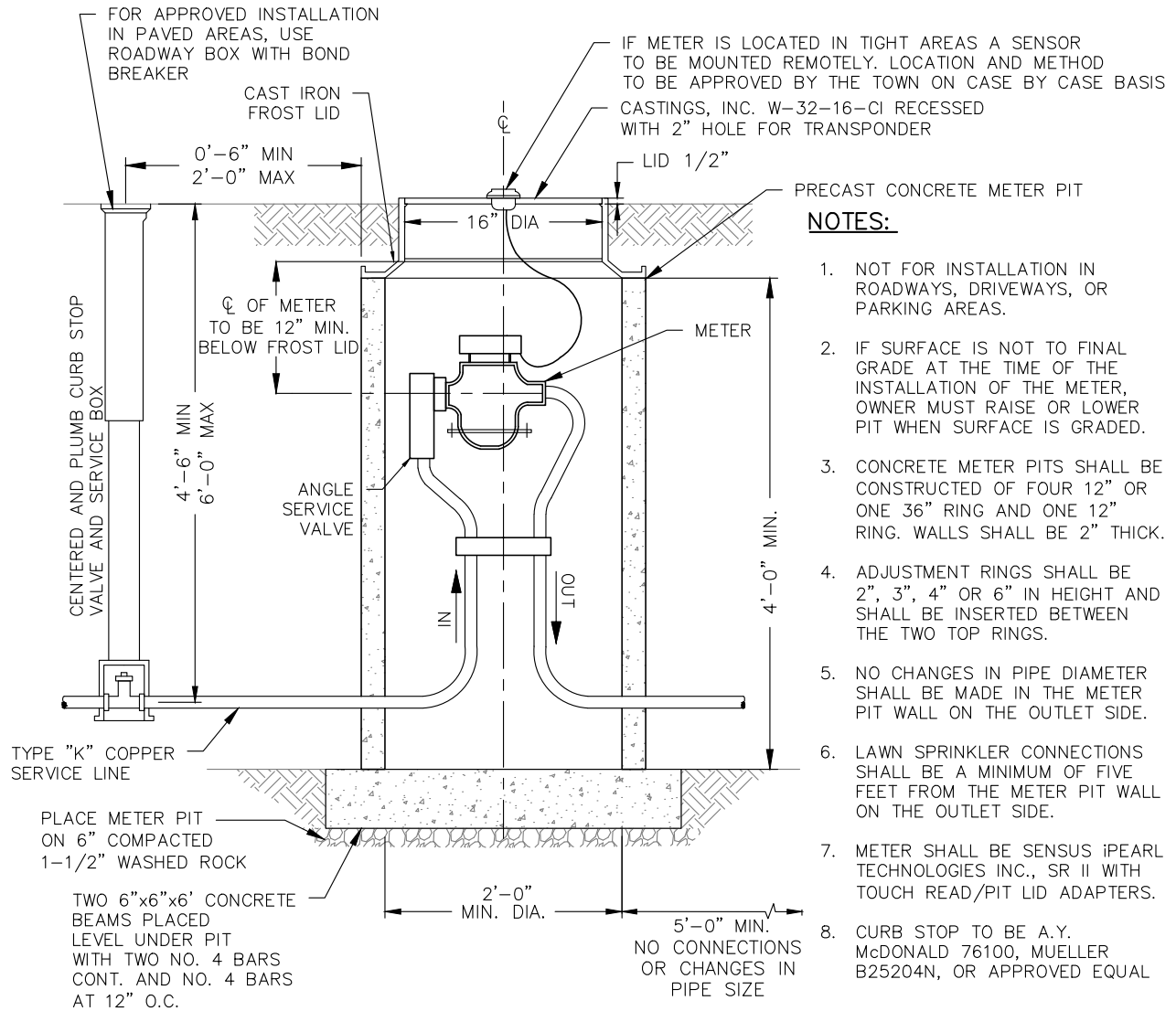


Gateway to Boulder Valley®

TYPICAL POTABLE WATER SERVICE DETAIL

DATE: JANUARY 2019

SHEET 400-8



9. WATER SERVICES SHALL BE INSTALLED ONLY AFTER CURB AND GUTTER/COMBINATION CURB, GUTTER, SIDEWALK CONSTRUCTED.
10. WATER SERVICES SHALL BE CONSTRUCTED AND INSPECTED FROM THE WATER MAIN TO THE END OF THE PIGTAIL OUTSIDE THE METER PIT. INSTALLATION IN SEGMENTS IS PROHIBITED.
11. CONTINUOUS K COPPER FROM THE CORP STOP TO THE CURB STOP.
12. NO TAPS PERMITTED UNTIL AMBIENT AIR TEMPERATURE IS 40 DEGREES AND RISING.
13. NO PLASTIC FITTINGS SHALL BE ALLOWED.
14. SEE TOWN OF SUPERIOR STANDARDS AND SPECIFICATIONS SECTION 343.00 FOR BEDDING REQUIREMENTS.

WATER METER LAY LENGTH TABLE

5/8"x3/4"	DOMESTIC	7-1/2"
3/4"	DOMESTIC	9"
1"	DOMESTIC	11"

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N.T.S.

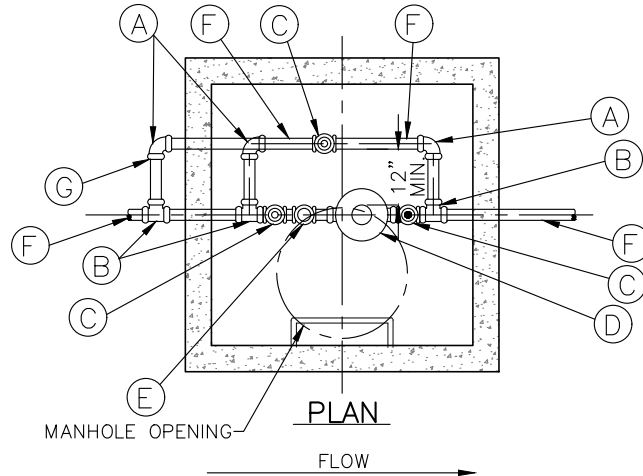


3/4" & 1" DOMESTIC
METER SETS

DATE: JANUARY 2019

SHEET 400-9

- (A) 90° BEND
- (B) TEE
- (C) CURB STOP
- (D) METER
- (E) CHECK VALVE
- (F) TYPE "K" COPPER PIPE
- (G) PIPING CHANGE REQ'D ON 2" METERS, OPTIONAL FOR 1-1/2" METERS

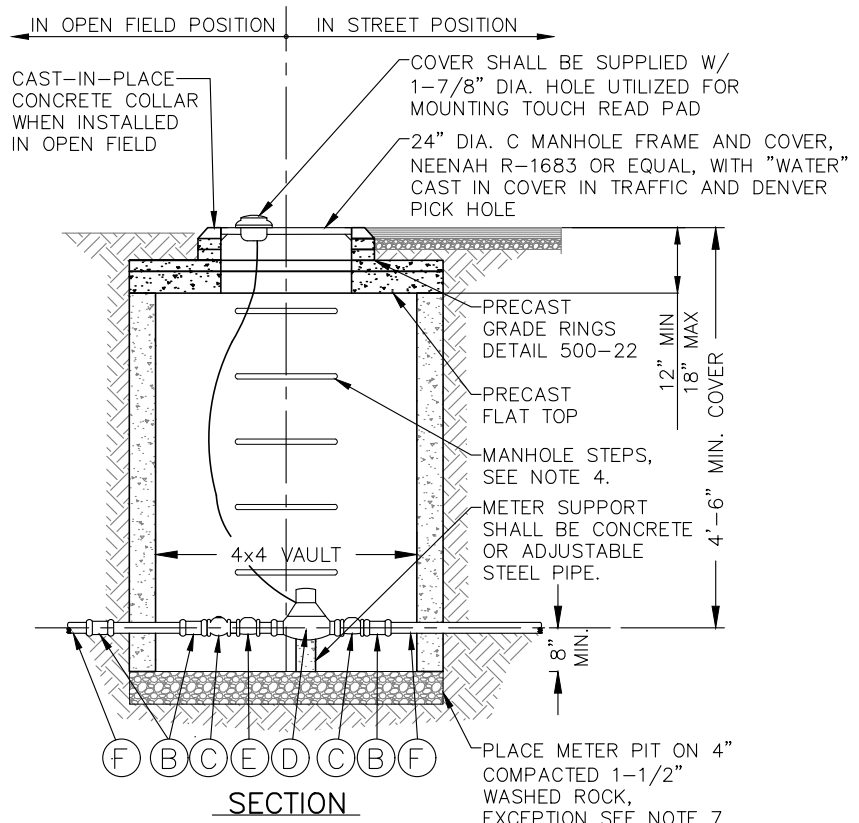


NOTES:

1. JOINTS INSIDE METER VAULT SHALL BE EITHER THREADED OR SOLDERED WITH 95/5% TIN/ANTIMONY SOLDER.
2. METER SHALL BE SENSUS TYPE SR W/ TOUCH READ/PIT LID ADAPTER. METERS SHALL BE FLANGED WITH BRASS COMPANION FLANGES.
3. NO CHANGES IN PIPE DIAMETER SHALL BE MADE IN THE METER PIT OR BEYOND THE METER PIT ON THE OUTLET SIDE.
4. MANHOLE STEPS SHALL BE PLACED ON THE OPPOSITE SIDE OF THE BYPASS AT 16" O.C. STEPS TO BE M.A. INDUSTRIES PS-2-PF-DF OR EQUAL..
5. LAWN SPRINKLER CONNECTIONS SHALL BE A MINIMUM OF FIVE FEET FROM THE METER PIT WALL ON THE OUTLET SIDE.
6. IF SURFACE IS NOT TO FINAL GRADE AT THE TIME OF THE INSTALLATION OF THE METER, OWNER MUST RAISE OR LOWER PIT WHEN SURFACE IS GRADED.
7. IN AREAS OF GROUNDWATER, USE A CAST-IN-PLACE 6" THICK CONCRETE BASE, 6'-0" DIA., WITH NO. 4 BARS AT 12" O.C. EACH WAY. INSTALL 4" PVC DRAIN TO DAYLIGHT. PLACE BASE ON 1-1/2" COMPACTED WASHED ROCK FOR STABILIZATION.
8. VAULT SHALL BE PLUMB AND CENTERED.

WATER METER LAY LENGTH TABLE

1-1/2"	DOMESTIC	13"
2"	DOMESTIC	15/1/2' OR 17"



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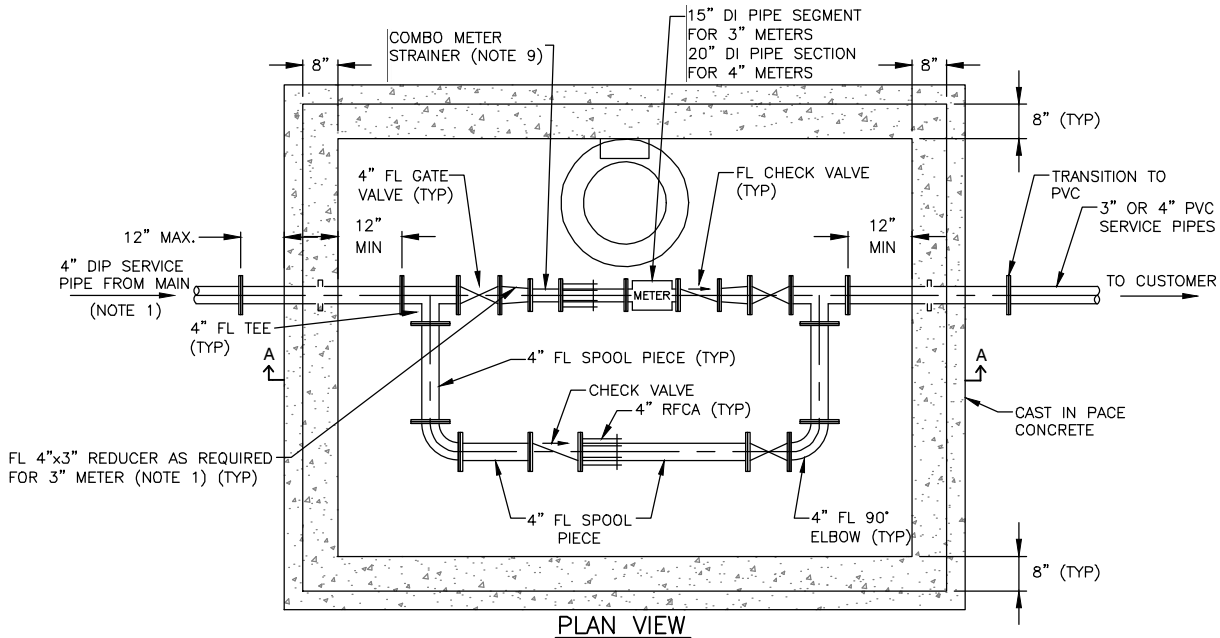
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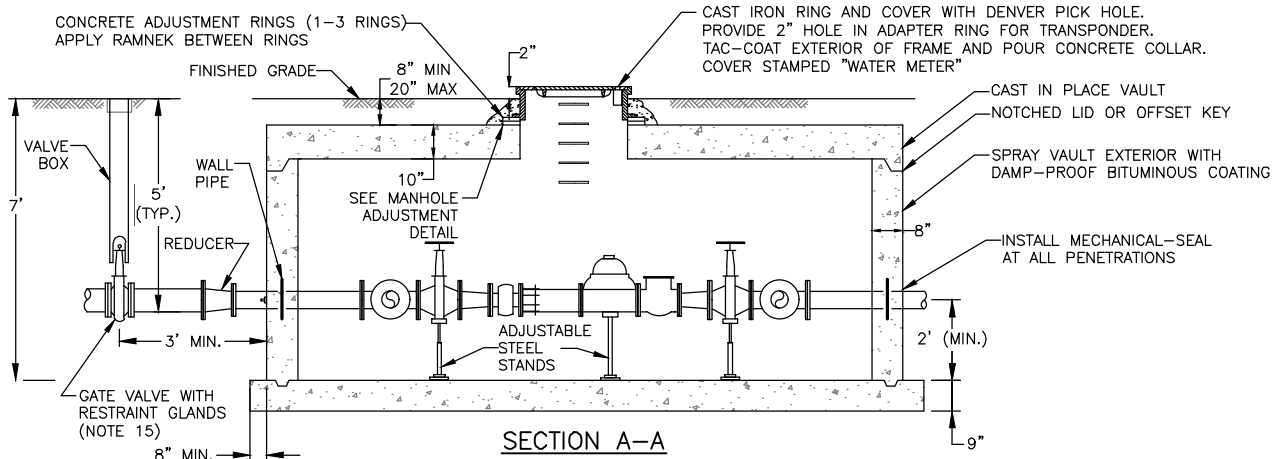
1-1/2" AND 2" DOMESTIC METER SETS

DATE: JANUARY 2019

SHEET 400-10



PLAN VIEW



SECTION A-A

WATER METER LAY LENGTH TABLE

3"	DOMESTIC	17"
4"	DOMESTIC	19"

NOTES:

- FOR ALL 3" AND 4" METER SETTINGS, 4" CLASS 52 DIP PIPE SHALL BE REQUIRED FROM THE MAIN TO THE VAULT AS SHOWN ON THIS DETAIL. FOR 3" METER SETTINGS, A REDUCER SHALL BE REQUIRED BEFORE THE METER AND ALSO ON THE BYPASS AS SHOWN (SEE NOTE 2 FOR EXCEPTION).
- UPSIZING OF THE SERVICE PIPE AFTER THE METER REQUIRES THE APPROVAL OF THE TOWN FOR A SERVICE PIPE UPSIZED FROM 3" TO 4", A REDUCER SHALL BE INSTALLED AFTER THE METER AS SHOWN (REDUCER IS NOT REQUIRED ON BYPASS IN THIS CASE).
- IN GENERAL, PVC PIPE SHALL BE USED ON THE SERVICE LINE OUTSIDE THE VAULT, EXCEPT WHERE THE DI PIPE STUBS THROUGH THE VAULT WALLS, AND DI PIPE SHALL BE USED INSIDE THE VAULT. FITTINGS INSIDE THE VAULT SHALL BE FLANGED, UNLESS OTHERWISE NOTED. FITTINGS OUTSIDE THE VAULT SHALL BE MECHANICAL JOINT.
- FOR APPROVED MANUFACTURERS AND MODEL NUMBERS OF FITTINGS, REFER TO CHAPTER 4 OF THESE STANDARDS AND SPECIFICATIONS.
- METER VAULT SHALL BE SURVEYED SO THAT THE COVER CAN BE PROPERLY LOCATED 2" ABOVE FINISHED GRADE PRIOR TO BACKFILLING.
- A BYPASS IS REQUIRED TO BE INSTALLED ON ALL POTABLE WATER SETTINGS.
- MANHOLE STEPS SHALL BE PLACED 12" ON CENTER AND 18" MAX. FROM FINISHED GRADE TO THE FIRST STEP.
- SERVICE PIPES WILL REQUIRE SHOP DRAWING SUBMITTAL AND APPROVAL BY THE TOWN.
- COMPOUND METERS SHALL HAVE STRAINERS UPSTREAM OF THE 15" PIPE SEGMENT. TURBO METERS SHALL HAVE INTEGRAL STRAINERS.
- STEEL PIPE STANDS SHALL BE REQUIRED: 4 FOR MAIN LINE AND 4 FOR BYPASS LINE (MINIMUM).
- METER VAULT AND CURB STOP SHALL BE LOCATED IN A SOD OR MULCH AREA WITH A 10' MIN. WIDTH UTILITY EASEMENT. NO TREES, SHRUBS OR STRUCTURES SHALL BE LOCATED IN THE EASEMENT.
- THIS VAULT IS NOT INTENDED FOR INSTALLATION IN STREETS, DRIVEWAYS OR CONCRETE AREAS.
- VAULT RODDING, NUTS AND WALL PLATES MUST BE STAINLESS STEEL.
- ALL SERVICE PIPE AND FITTINGS OUTSIDE OF THE VAULT SHALL BE MECHANICALLY RESTRAINED.
- STAINLESS STEEL NUTS & BOLTS ON ALL FITTINGS WITH ANTI-SEIZE.
- ADD DRAIN PIPE, SUMP, AND PUMP IF CANNOT DISCHARGE BY GRAVITY.

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

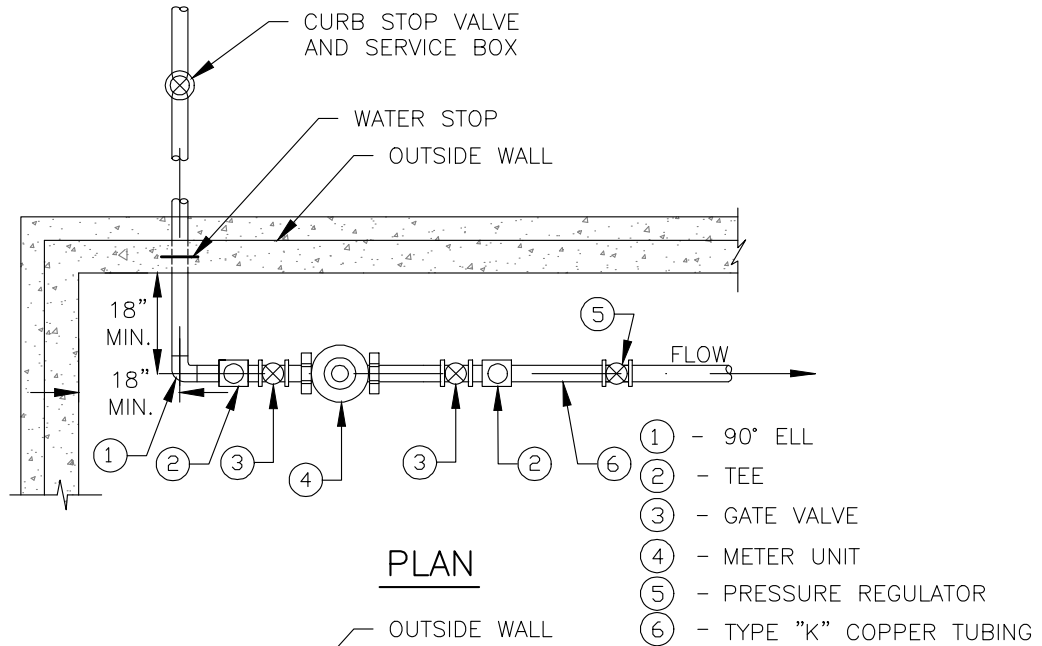
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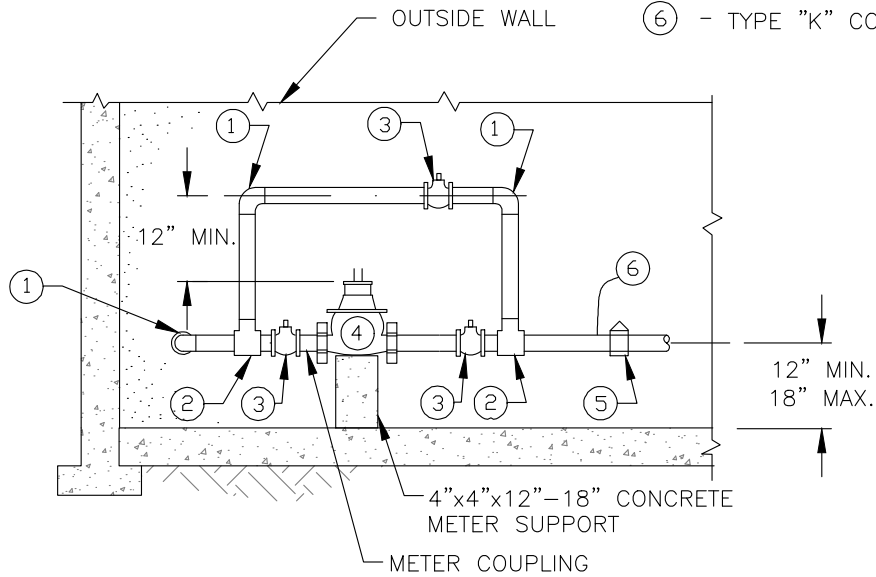
3" TO 4" DOMESTIC METER SETS

DATE: JANUARY 2019

SHEET 400-11



PLAN



ELEVATION

NOTES:

1. PIPE JOINTS SHALL BE THREADED OR SOLDERED WITH 95-5 TINANTOMONY SOLDER.
2. INSTALLATION MUST ALLOW ACCESS FOR MAINTENANCE AND BE PROTECTED FROM FREEZING.
3. COMPANION FLANGES SHALL BE BRONZE.
4. A FLOOR DRAIN SHALL BE PLACED NEAR THE METER INSTALLATION.

**REQUIRES
SPECIAL
APPROVAL**

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

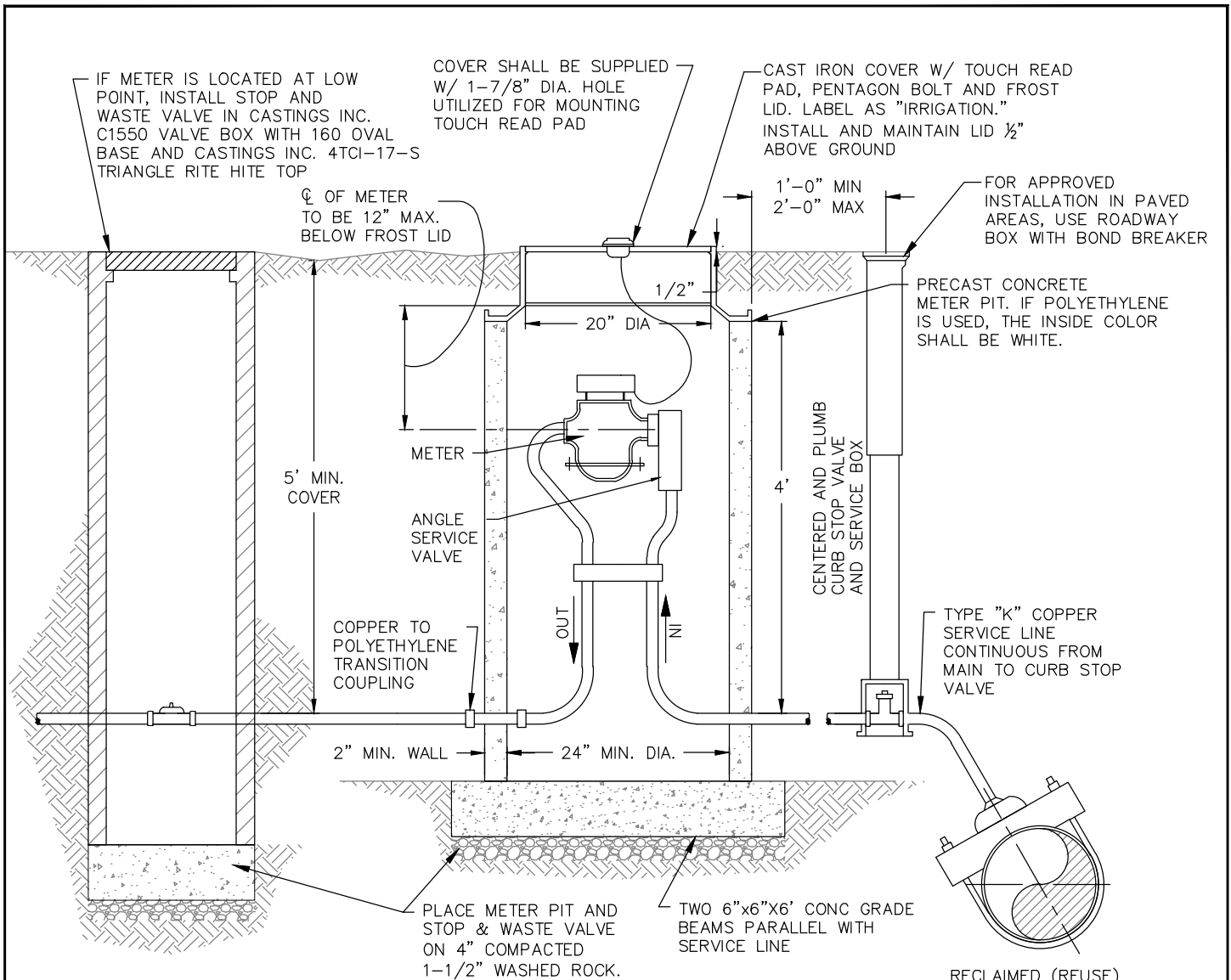
N.T.S.



INSIDE METER SETTINGS
1" TO 2"

DATE: JANUARY 2019

SHEET 400-12



NOTES:

1. NOT FOR INSTALLATION IN ROADWAYS, DRIVEWAYS, OR PARKING AREAS.
2. IF SURFACE IS NOT TO FINAL GRADE AT THE TIME OF THE INSTALLATION OF THE METER, OWNER MUST RAISE OR LOWER PIT WHEN SURFACE IS GRADED.
3. METER SHALL BE SENSUS TECHNOLOGIES INC., SR II (PURPLE IN COLOR) WITH TOUCH READ/PIT LID ADAPTERS.
4. CURB STOP TO BE A.Y. McDONALD 76100, MUELLER B25204N, OR APPROVED EQUAL.
5. NO BENDS, FITTINGS, CONNECTION, OR CHANGES IN PIPE SIZE FROM THE MAIN TO 5' PAST THE OUTSIDE WALL OF METER PIT ON THE CUSTOMER SIDE. SERVICE LINE MAY BE INCREASED ONE PIPE SIZE AFTER THIS POINT.

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N.T.S.



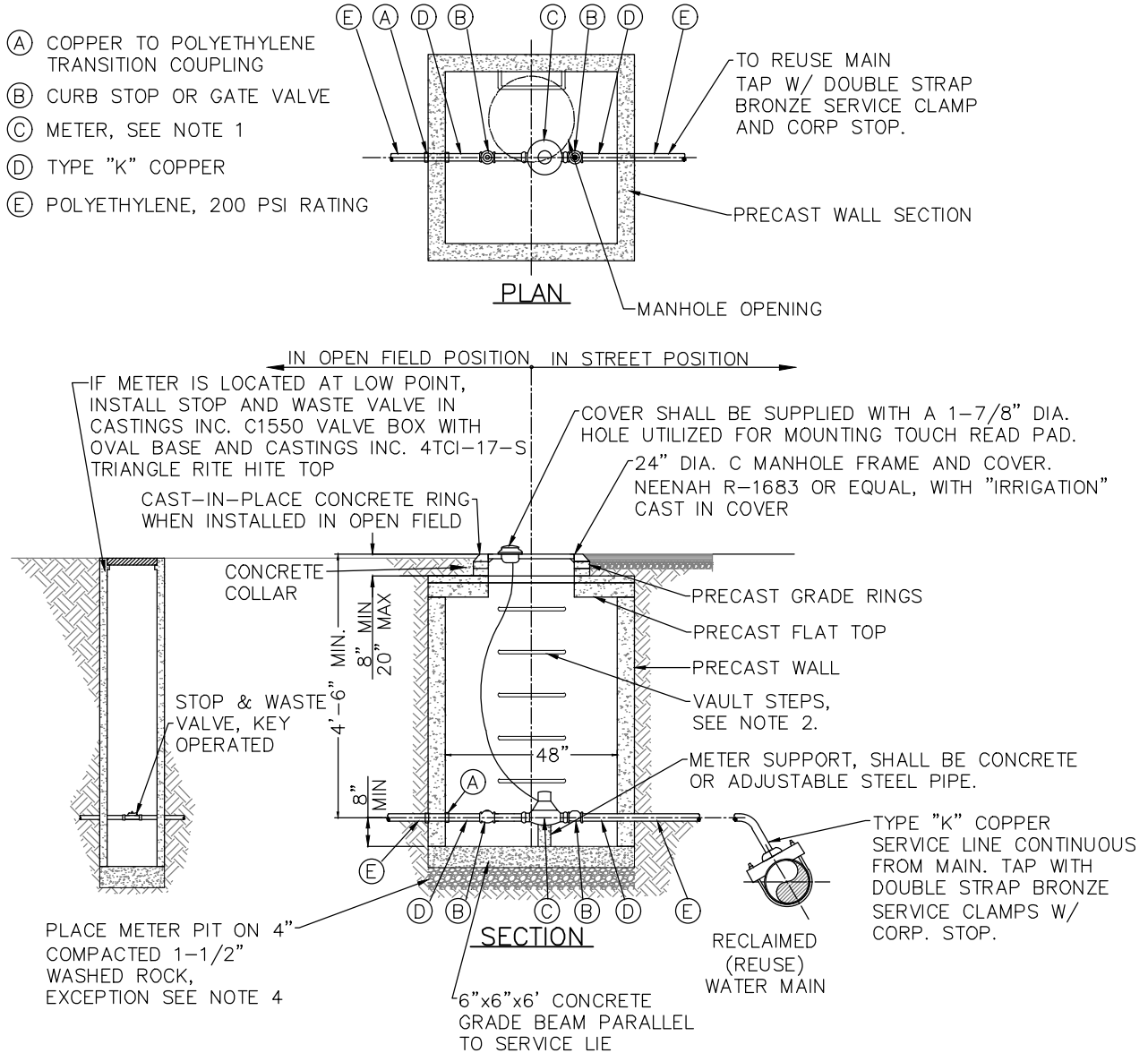
COMMERCIAL IRRIGATION SERVICE
LINES METER 3/4" AND 1"

DATE: JANUARY 2019

SHEET 400-13

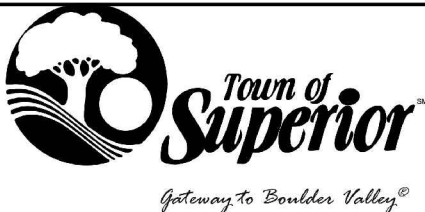
NOTES:

1. METER SHALL BE SENSUS OMNI T2 (PURPLE IN COLOR) AND SHALL BE FLANGED WITH BRASS COMPANION FLANGES.
2. VAULT STEPS SHALL BE PLACED AT 16" O.C. STEPS TO BE NEENAH R-1982-W OR EQUAL.
3. IF SURFACE IS NOT TO FINAL GRADE AT THE TIME OF INSTALLATION OF THE METER, OWNER MUST RAISE OR LOWER PIT WHEN SURFACE IS GRADED.
4. IN AREAS OF GROUND WATER, USE A CAST-IN-PLACE 6" THICK BASE
5. CONCRETE BASE, 6'-0" WITH NO. 4 BARS AT 12" O.C. EACH WAY. INSTALL 4" PVC DRAIN TO DAYLIGHT. PLACE BASE ON 1-1/2" COMPACTED WASHED ROCK FOR STABILIZATION.



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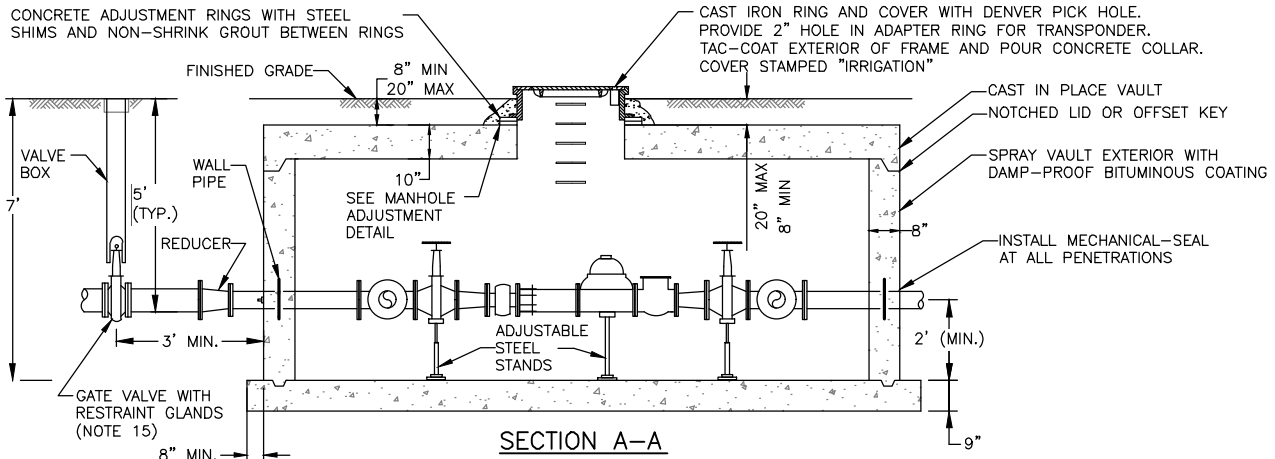
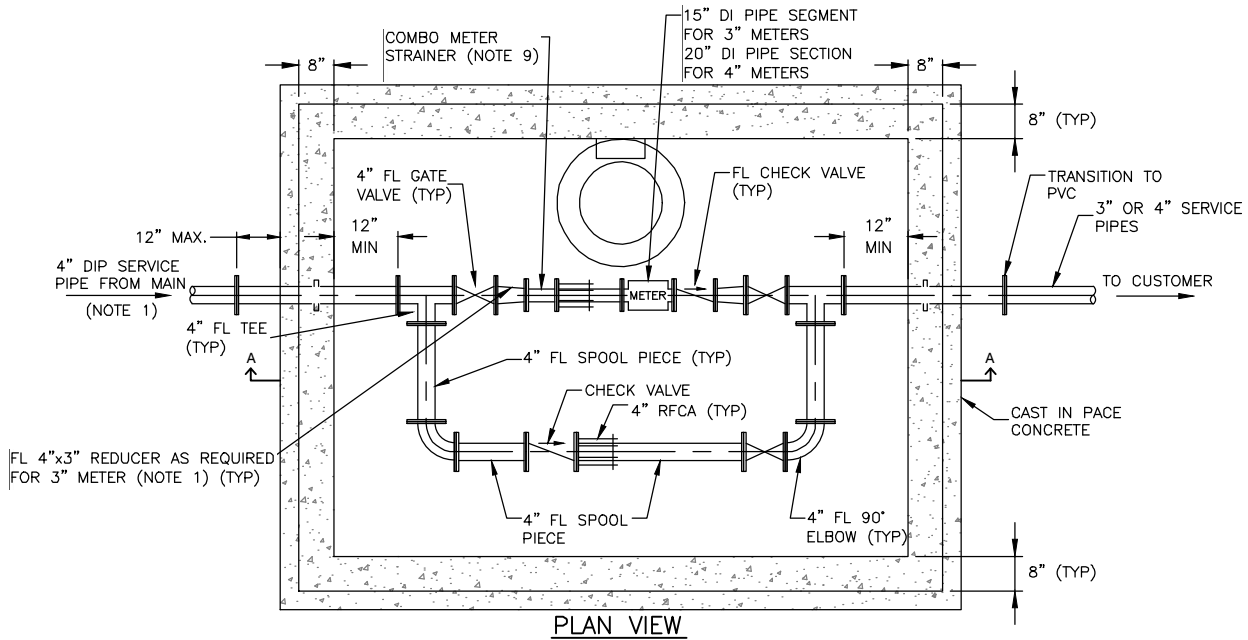
N.T.S.



COMMERCIAL IRRIGATION METER
1-1/2" AND 2"

DATE: JANUARY 2019

SHEET 400-14



WATER METER LAY LENGTH TABLE

3"	DOMESTIC	17"
4"	DOMESTIC	19"

NOTES:

1. FOR ALL 3" AND 4" METER SETTINGS, 4" CLASS 52 DIP PIPE SHALL BE REQUIRED FROM THE MAIN TO THE VAULT AS SHOWN ON THIS DETAIL. FOR 3" METER SETTINGS, A REDUCER SHALL BE REQUIRED BEFORE THE METER AND ALSO ON THE BYPASS AS SHOWN (SEE NOTE 2 FOR EXCEPTION).
2. UPSIZING OF THE SERVICE PIPE AFTER THE METER REQUIRES THE APPROVAL OF THE TOWN FOR A SERVICE PIPE UPSIZED FROM 3" TO 4", A REDUCER SHALL BE INSTALLED AFTER THE METER AS SHOWN (REDUCER IS NOT REQUIRED ON BYPASS IN THIS CASE).
3. IN GENERAL, PVC PIPE SHALL BE USED ON THE SERVICE LINE OUTSIDE THE VAULT, EXCEPT WHERE THE DI PIPE STUBS THROUGH THE VAULT WALLS, AND DI PIPE SHALL BE USED INSIDE THE VAULT. FITTINGS INSIDE THE VAULT SHALL BE FLANGED, UNLESS OTHERWISE NOTED. FITTINGS OUTSIDE THE VAULT SHALL BE MECHANICAL JOINT.
4. FOR APPROVED MANUFACTURERS AND MODEL NUMBERS OF FITTINGS, REFER TO CHAPTER 4 OF THESE STANDARDS AND SPECIFICATIONS.
5. METER VAULT SHALL BE SURVEYED SO THAT THE COVER CAN BE PROPERLY LOCATED 2" ABOVE FINISHED GRADE PRIOR TO BACKFILLING.
6. A BYPASS IS REQUIRED TO BE INSTALLED ON ALL POTABLE WATER SETTINGS.
7. MANHOLE STEPS SHALL BE PLACED 12" ON CENTER AND 18" MAX. FROM FINISHED GRADE TO THE FIRST STEP.
8. SERVICE PIPES WILL REQUIRE SHOP DRAWING SUBMITTAL AND APPROVAL BY THE TOWN.
9. COMPOUND METERS SHALL HAVE STRAINERS UPSTREAM OF THE 15" PIPE SEGMENT. TURBO METERS SHALL HAVE INTEGRAL STRAINERS.
10. STEEL PIPE STANDS SHALL BE REQUIRED: 4 FOR MAIN LINE AND 4 FOR BYPASS LINE (MINIMUM).
11. METER VAULT AND CURB STOP SHALL BE LOCATED IN A SOD OR MULCH AREA WITH A 10' MIN. WIDTH UTILITY EASEMENT. NO TREES, SHRUBS OR STRUCTURES SHALL BE LOCATED IN THE EASEMENT.
12. THIS VAULT IS NOT INTENDED FOR INSTALLATION IN STREETS, DRIVEWAYS OR CONCRETE AREAS.
13. VAULT RODDING, NUTS AND WALL PLATES MUST BE STAINLESS STEEL.
14. ALL SERVICE PIPE AND FITTINGS OUTSIDE OF THE VAULT SHALL BE MECHANICALLY RESTRAINED.
15. STAINLESS STEEL NUTS & BOLTS ON ALL FITTINGS WITH ANTI-SEIZE.
16. ADD DRAIN PIPE, SUMP, AND PUMP IF CANNOT DISCHARGE BY GRAVITY.

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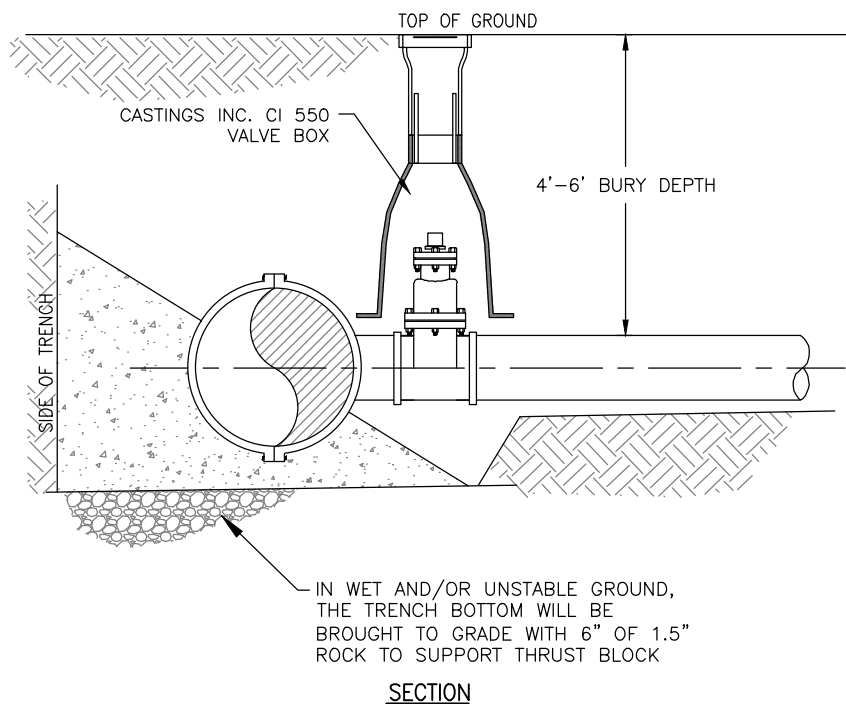
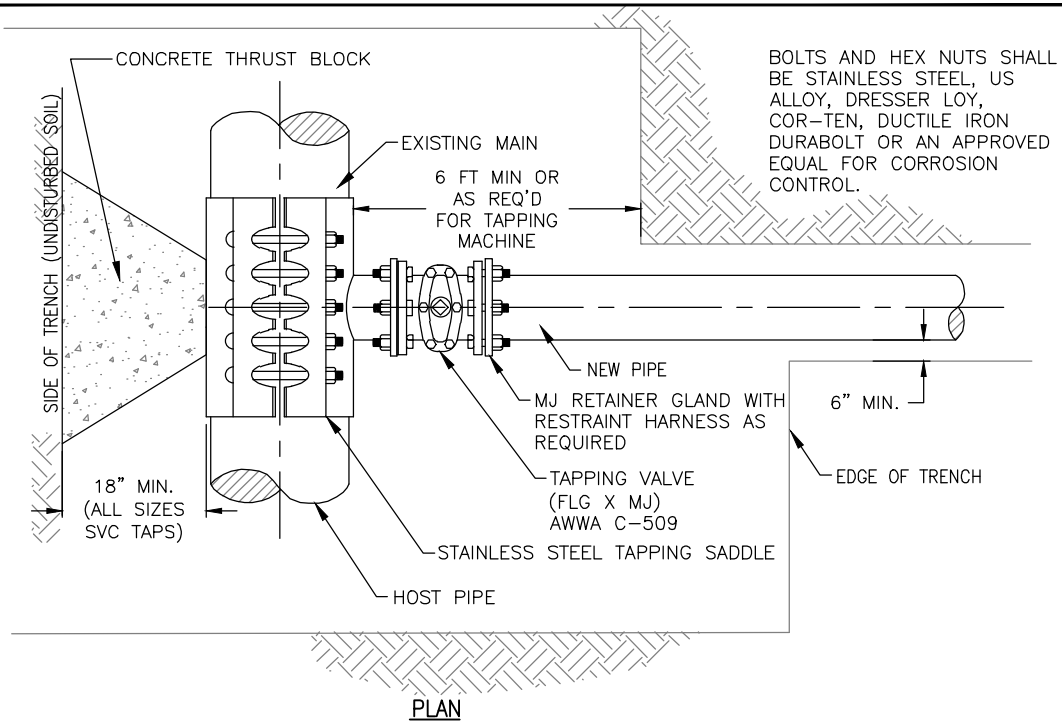
N.T.S.



**IRRIGATION 3" TO 4"
METER SETS**

DATE: JANUARY 2019

SHEET 400-15



NOTES:

1. THE TOWN SHALL BE NOTIFIED AT LEAST 48 HOURS PRIOR TO TAPPING. THE TOWN'S REPRESENTATIVE SHALL BE ON SITE DURING TAPPING.
2. ALL FITTINGS TO RECEIVE DOUBLE POLYWRAP PRIOR TO BACKFILL OR POURING OF CONCRETE THRUST BLOCKS.

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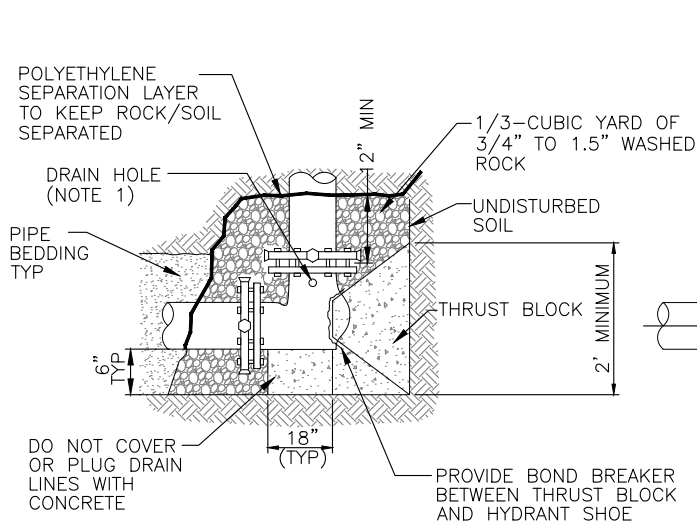
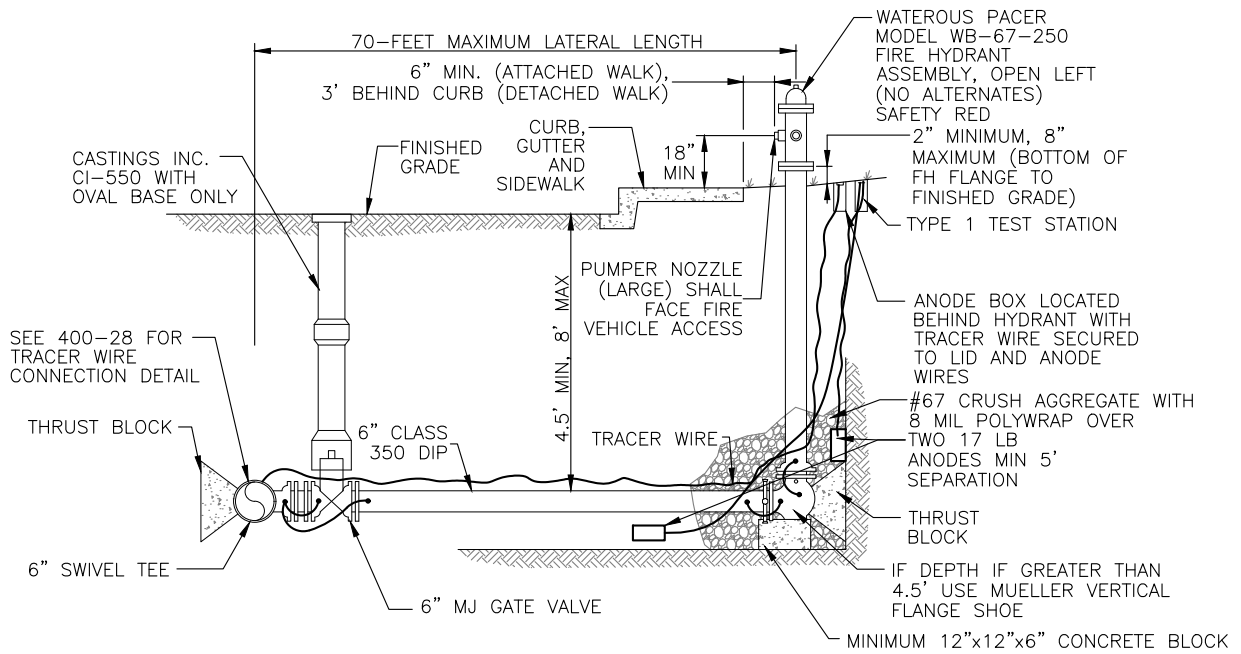
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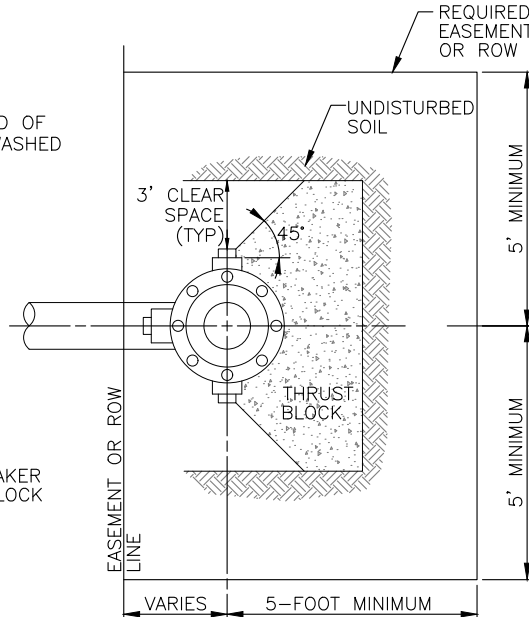
**WET TAP CONNECTION
4" & LARGER TAP**

DATE: JANUARY 2019

SHEET 400-16



SHOE SIDE DETAIL



TOP VIEW

NOTES:

1. ALL FITTINGS, DI PIPE, AND HYDRANT BARREL SHALL BE POLYETHYLENE WRAPPED PER AWWA C-105. PROVIDE PERFORATION AT HYDRANT DRAIN HOLES.
2. TREES, SHRUBS, AND STRUCTURES SHALL NOT BE LOCATED WITHIN THE UTILITY EASEMENT OR RIGHT-OF-WAY FOR THE HYDRANT. HYDRANT UTILITY EASEMENTS AND RIGHTS-OF-WAY SHALL BE 10-FOOT WIDE (MIN), AND EXTEND 5- FEET BEHIND THE HYDRANT. VARIANCES FROM THIS ENCROACHMENT CRITERIA WILL REQUIRE THE WRITTEN APPROVAL OF THE FIRE MARSHALL.
3. PRIOR TO PUTTING THE HYDRANT INTO SERVICE THE FOLLOWING SHALL BE PERFORMED: NOZZLE THREADS SHALL BE GREASED, OIL RESERVOIR SHALL BE FILLED, AND HYDRANTS SHALL BE PAINTED "RUSTOLEUM" HIGH PERFORMANCE ENAMEL (#7564, SAFETY RED).
4. THE ENTIRE PIPING ASSEMBLY (HYDRANT SHOE TO CONNECTION AT MAIN) SHALL BE RESTRAINED.
5. THE VALVE NUT SHALL HAVE A MAXIMUM BURIED DEPTH OF 4'-6" FROM FINISHED GRADE.

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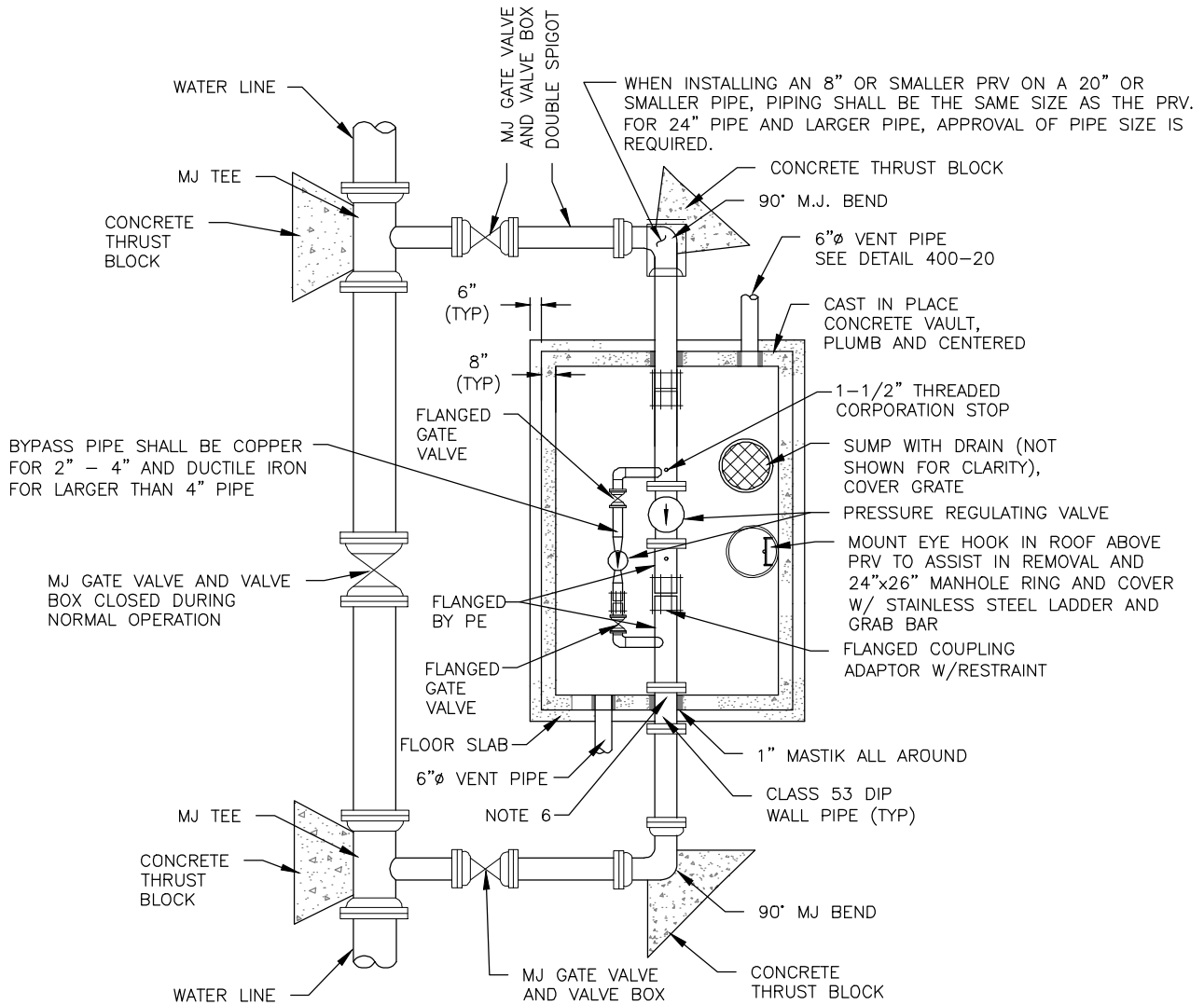
N.T.S.



**FIRE HYDRANT INSTALLATION
 DETAIL**

DATE: JANUARY 2019

SHEET 400-17



NOTES:

1. ALL CAST IN PLACE CONCRETE PRODUCTS SHALL MEET CDOT CLASS 2 SULFATE RESISTANCE. VAULT TO MIN. 7' X 6' INSIDE DIMENSIONS.
2. ACCESS STAIRS WITH DOOR OUTSIDE OF PAVEMENT MAY BE REQUIRED ON STREETS WITH HEAVY TRAFFIC.
3. FOR ELEVATION VIEW SEE CROSS-SECTION DRAWING 400-19.
4. SUMP PUMP AND VENT FAN REQUIRED IN VAULTS WITH ELECTRICAL TELEMETRY EQUIPMENT.
5. ALL PIPE THROUGH VAULT WALLS AND INSIDE VAULT SHALL BE CLASS 53 D.I.P. WALL PIPE.
6. DIMENSIONS OF VAULT TO BE DETERMINED BY EQUIPMENT PLUS 2' MIN. CLEARANCE TO WALLS. SHOP DRAWINGS REQUIRED.
7. ALL FITTINGS OUTSIDE VAULT SHALL HAVE MECHANICAL JOINT RESTRAINT.

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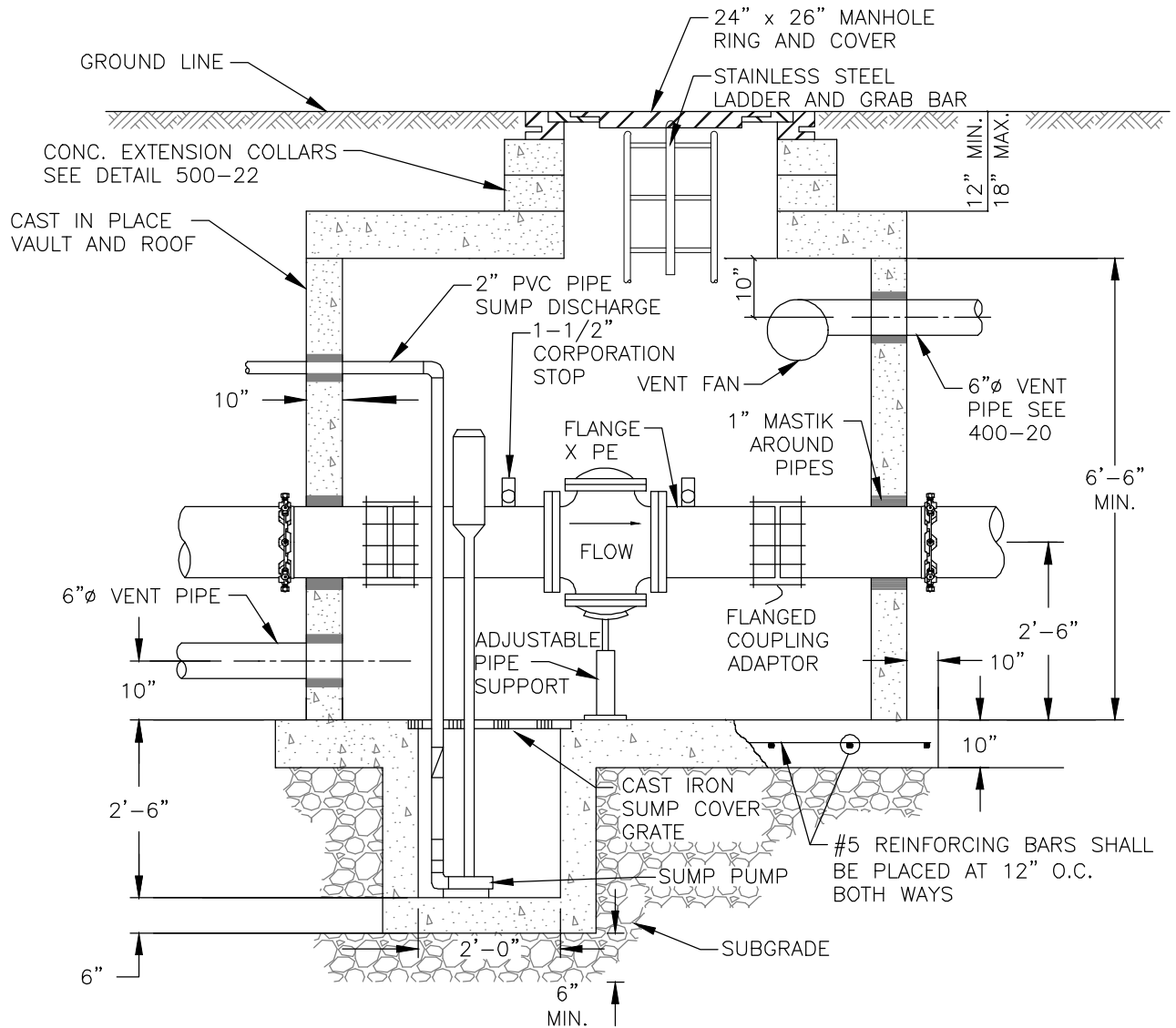
N.T.S.



PRV IN A VAULT
PLAN VIEW

DATE: JANUARY 2019

SHEET 400-18



NOTES:

1. SHOP DRAWINGS OF CONCRETE VAULTS SHALL BE SUBMITTED FOR APPROVAL.
2. SEE DRAWING 400-18 FOR PLAN VIEW AND ADDITIONAL NOTES.
3. ROUND VAULTS ARE PROHIBITED.

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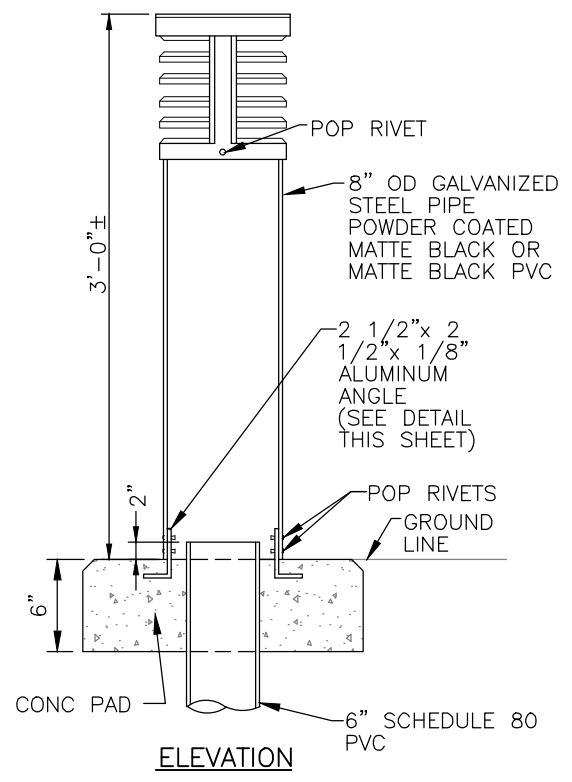
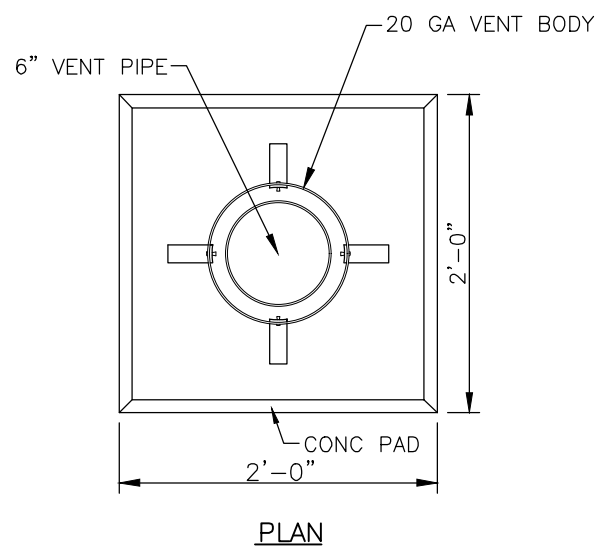
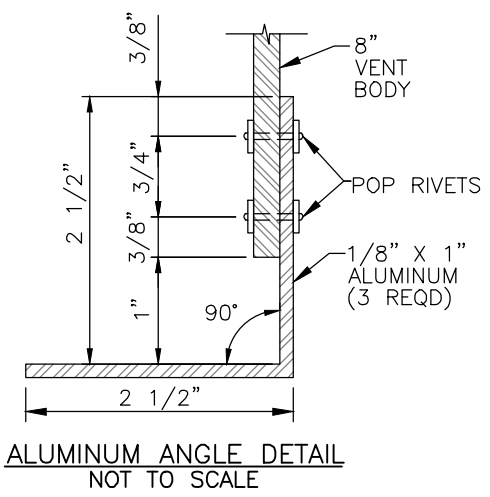
N.T.S.



PRV IN A VAULT
SECTION VIEW

DATE: JANUARY 2019

SHEET 400-19



NOTES:

1. LOCATE VENT OUT OF TRAFFIC AREAS AND AS APPROVED BY THE TOWN.
2. VENTS SHALL HAVE FINE MESH SCREEN INSTALLED IN INTERIOR TO PREVENT INSECTS ENTERING THE VENT PIPE.

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N.T.S.



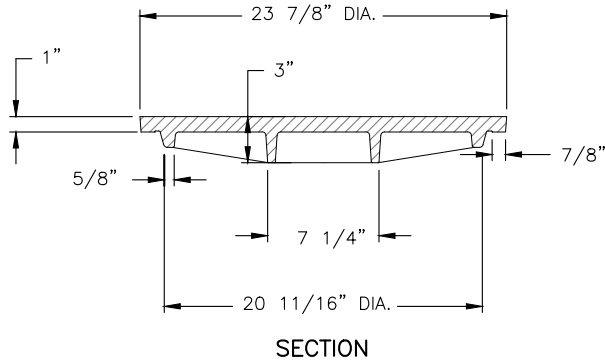
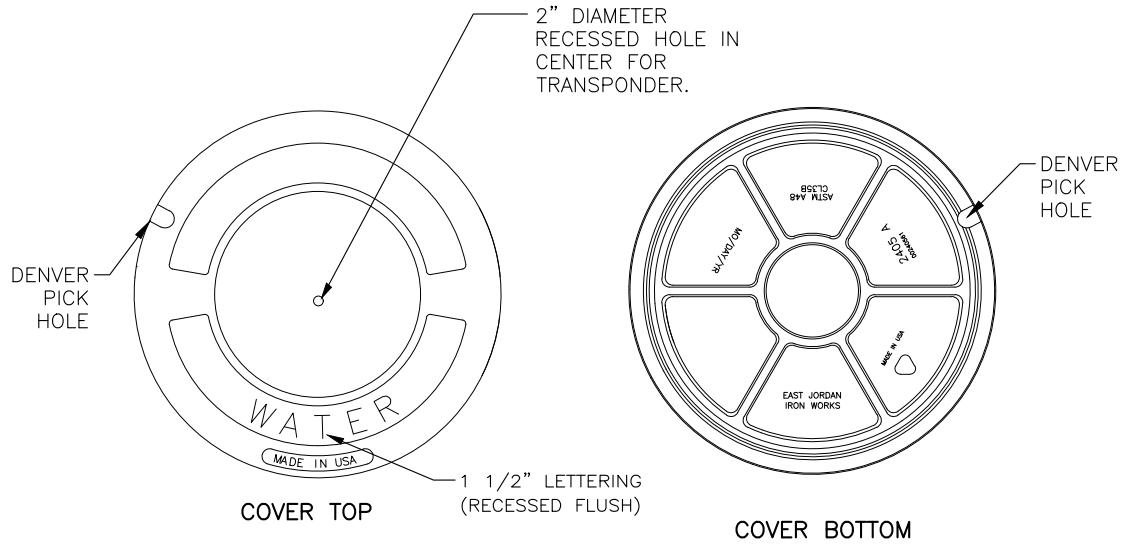
VAULT VENT DETAIL

DATE: JANUARY 2019

SHEET 400-20

NOTE:

FOR REUSE APPLICATIONS SUBSTITUTE "WATER" WITH "IRRIGATION"



THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

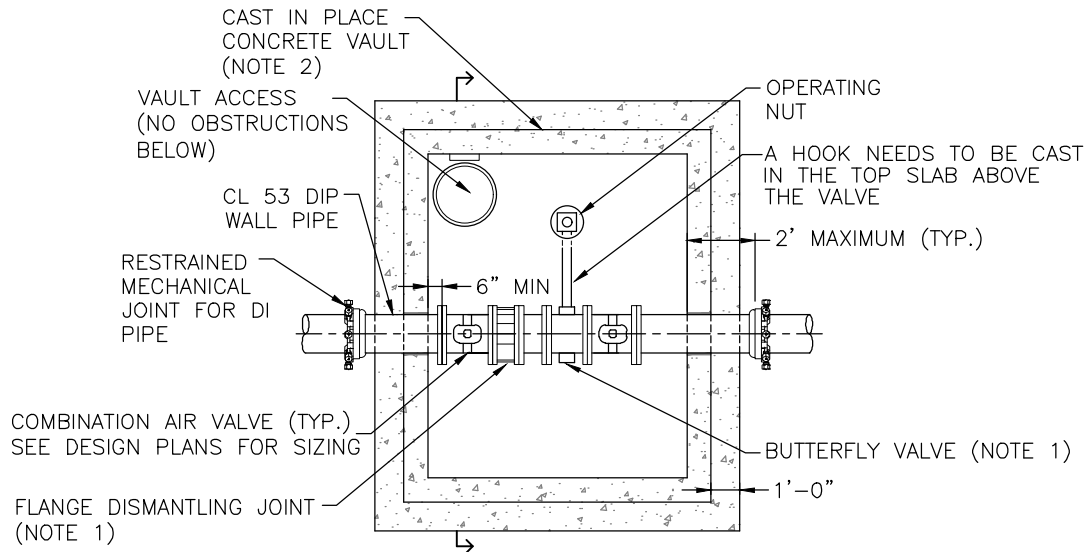
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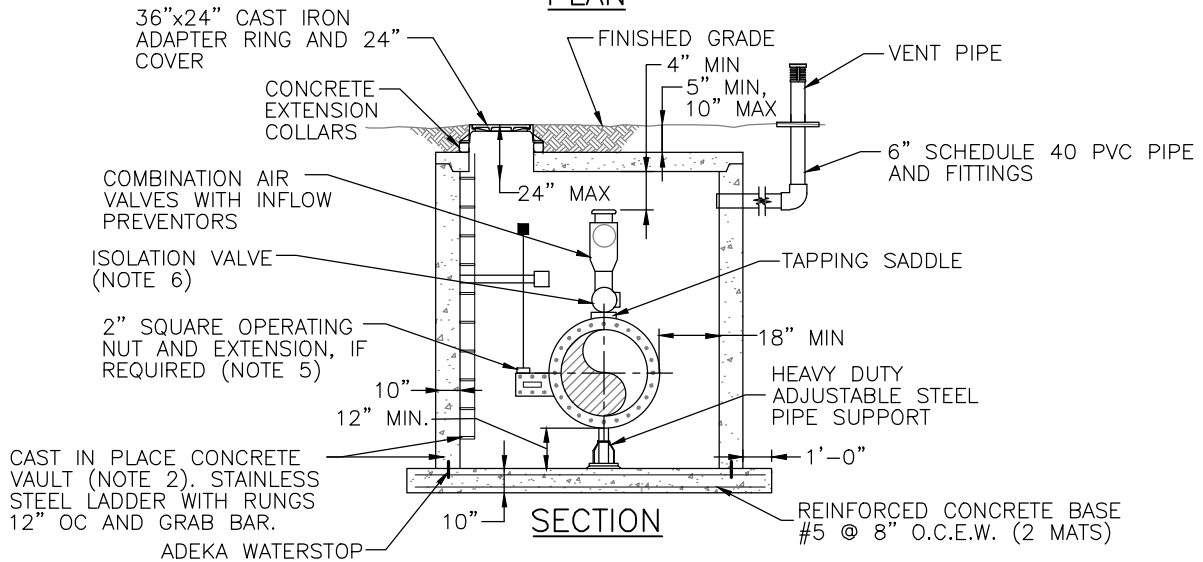
CAST IRON WATER VAULT LID

DATE: JANUARY 2019

SHEET 400-21



PLAN



SECTION

NOTES:

- | | | |
|---|---|--|
| <p>1. ENGINEER SHALL SUBMIT PIPE LAYOUT DRAWINGS AND DIMENSIONING IN VAULT FOR APPROVAL BY THE TOWN. BFV SHALL BE FLANGED WITH A DISMANTLING JOINT (FLANGED COUPLING ADAPTOR).</p> <p>2. THE VAULT, PLUMB AND CENTERED, STRUCTURE SHALL BE DESIGNED FOR HS20 LOADING CRITERIA. STRUCTURE REINFORCEMENT TO BE DESIGNED BY ENGINEER.</p> <p>3. ALL AIR VALVE PIPING AND</p> | <p>FITTINGS SHALL BE COPPER.</p> <p>4. COAT THE EXTERIOR OF THE VAULT WITH BITUMASTIC 300M DAMP PROOFING OR APPROVED EQUAL.</p> <p>5. ISOLATION VALVES SHALL BE FULL PORT BRONZE BALL STYLE WITH HAND LEVER. 2" VALVES SHALL BE CORPORATION TYPE AND 3" AND LARGER VALVES SHALL HAVE A FLANGE ADAPTOR ON THE OUTLET SIDE TO MATE WITH FLANGED AIR VALVES.</p> | <p>6. VAULT TO BE 7' x 6' MINIMUM INSIDE DIMENSIONS.</p> |
|---|---|--|

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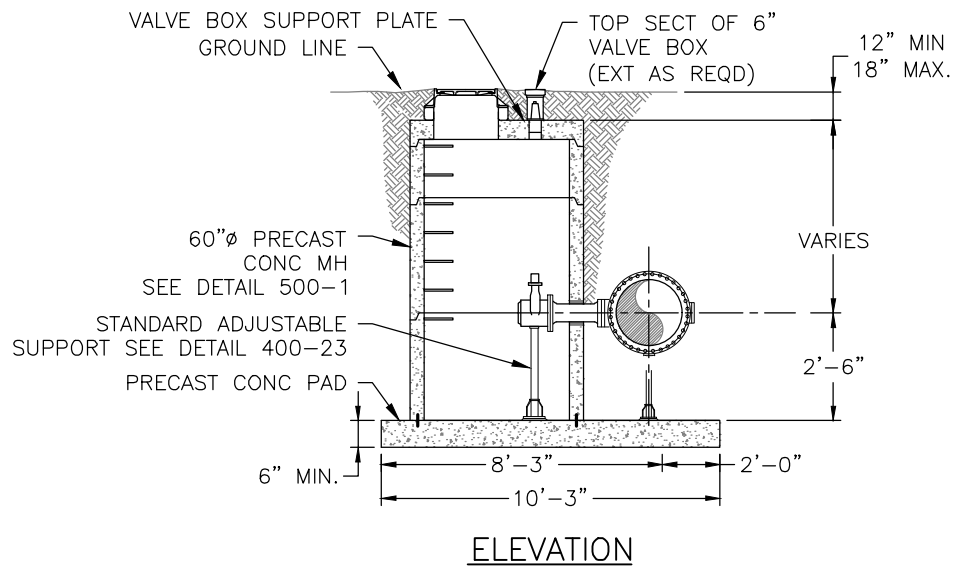
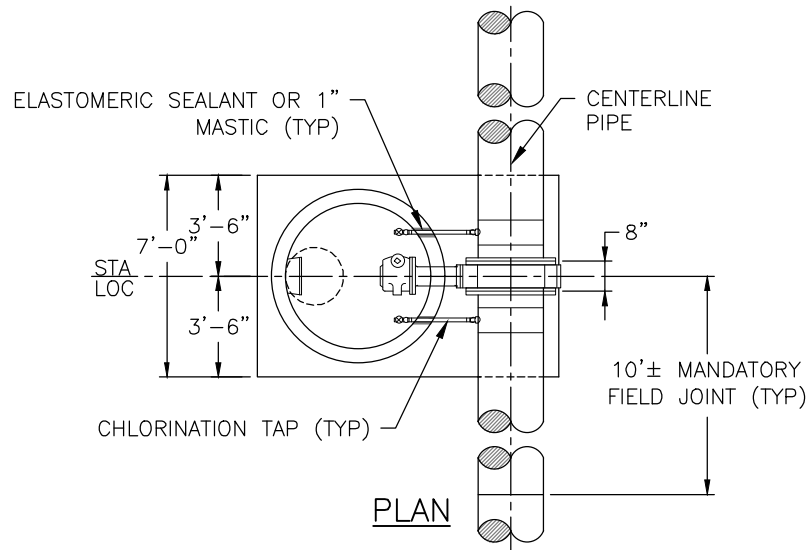
N.T.S.



**BUTTERFLY VALVE INSTALLATION
IN WATERLINES LARGER
THAN 16" (1 OF 2)**

DATE: JANUARY 2019

SHEET 400-22



THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

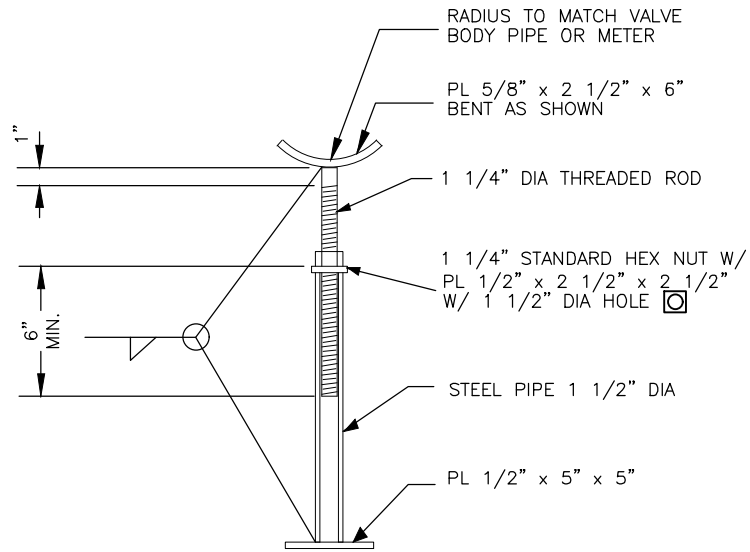
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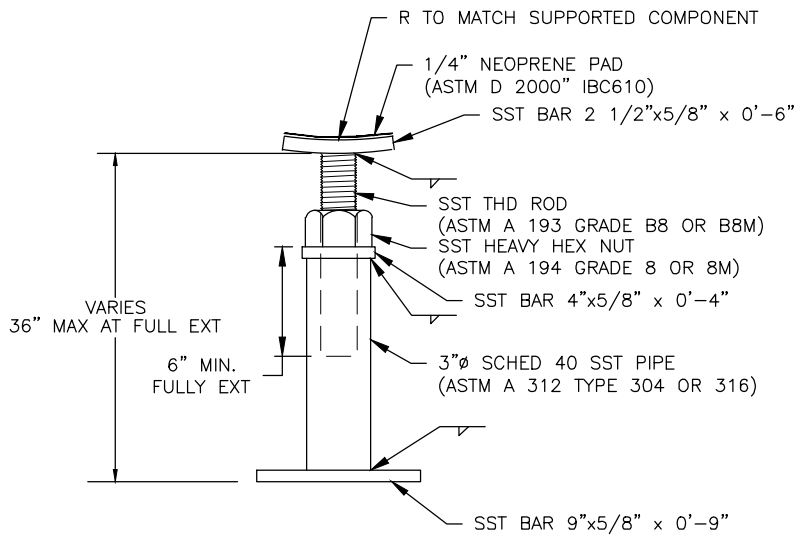
BUTTERFLY VALVE INSTALLATION
IN WATERLINES LARGER
THAN 16" (2 OF 2)

DATE: JANUARY 2019

SHEET 400-22α



TYPICAL ADJUSTABLE PIPE SUPPORT



BAR MATERIAL TO BE ASTM A 240 TYPE 304 OR 316

TYPICAL HEAVY DUTY ADJUSTABLE PIPE SUPPORT

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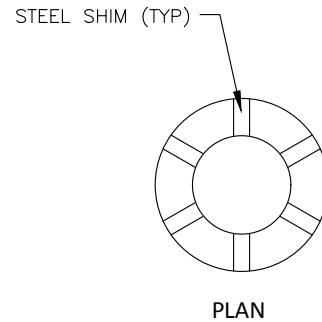
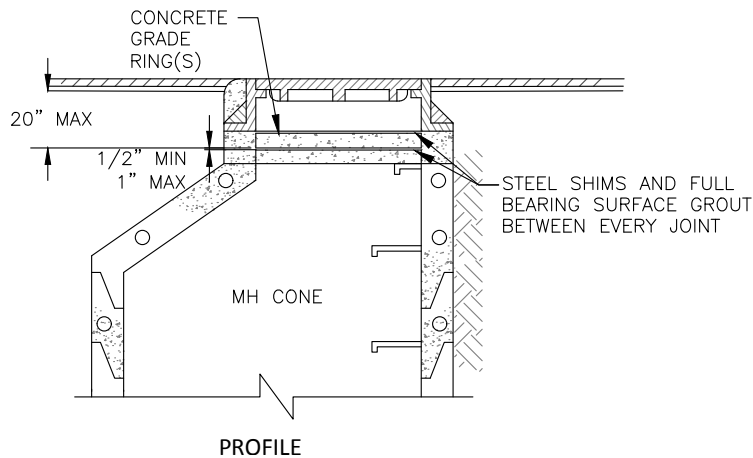
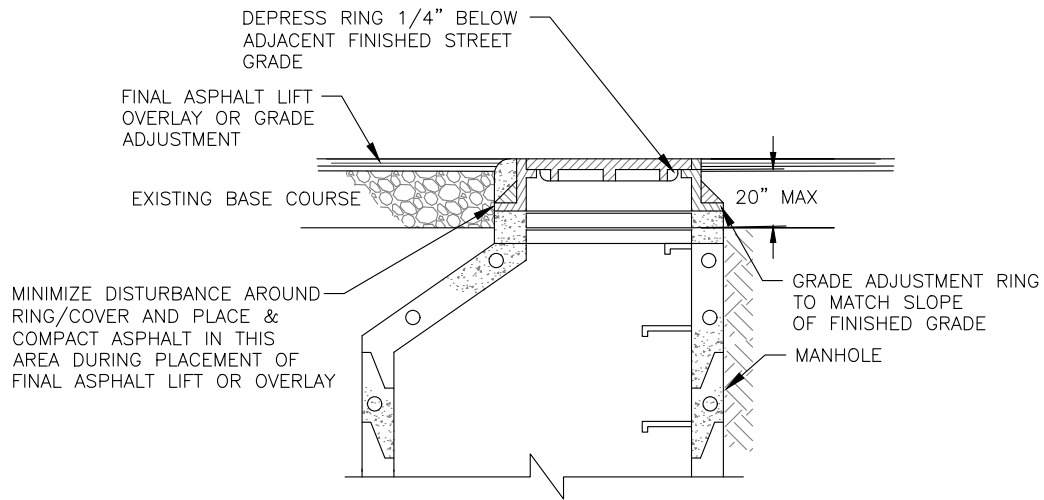
N.T.S.



METAL PIPE SUPPORTS

DATE: JANUARY 2019

SHEET 400-23



NOTES:

1. FULL BEARING SURFACE SHALL BE GROUTED WITH STEEL SHIMS, MINIMUM 6 LOCATIONS AROUND MANHOLE TO MATCH PROFILE OF ADJACENT SURFACES.
2. SMOOTH CHIMNEY INSIDE AND OUTSIDE WITH GROUT

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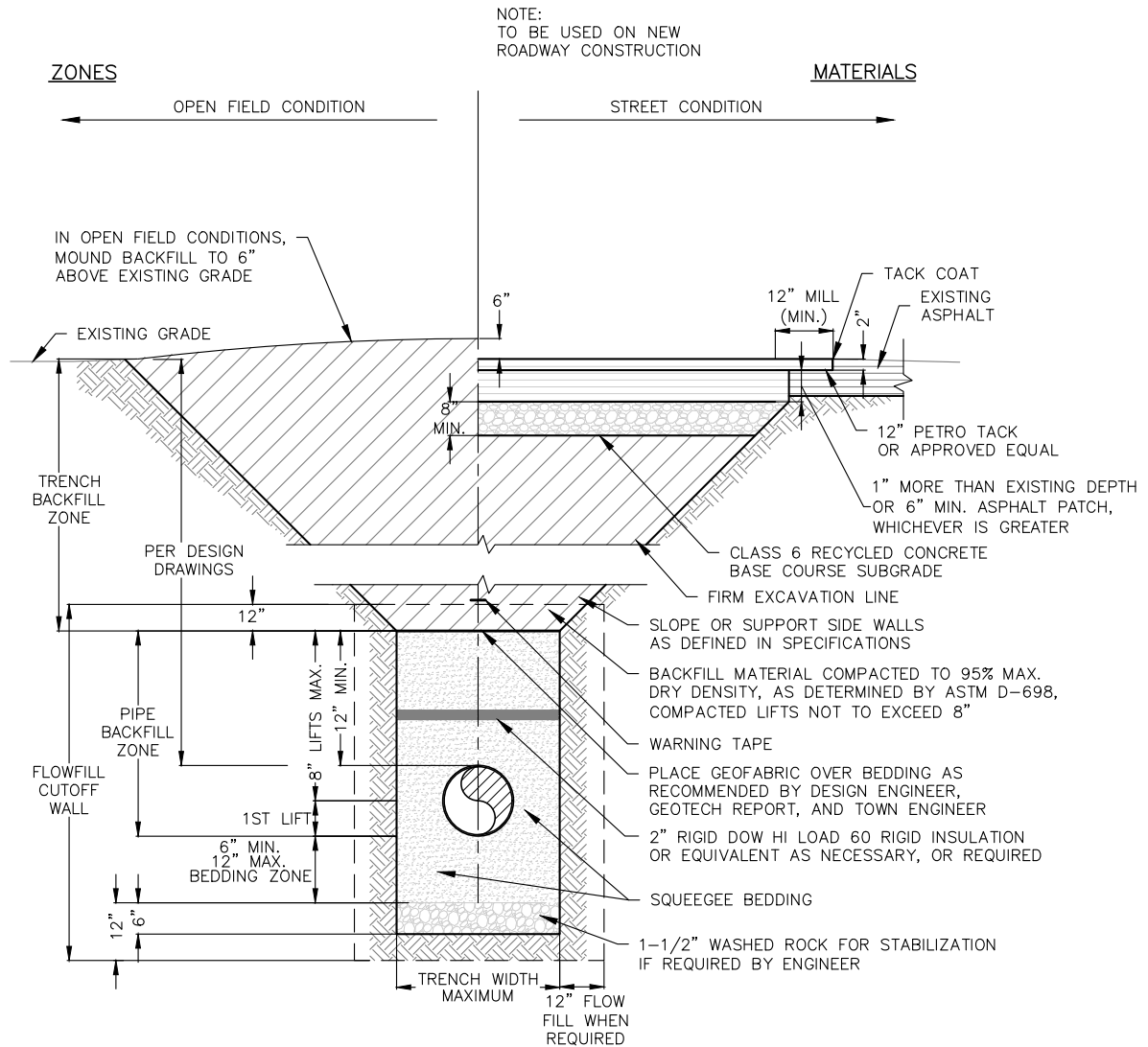
N.T.S.



**MANHOLE RING AND COVER
ADJUSTMENT DETAIL**

DATE: JANUARY 2019

SHEET 400-24

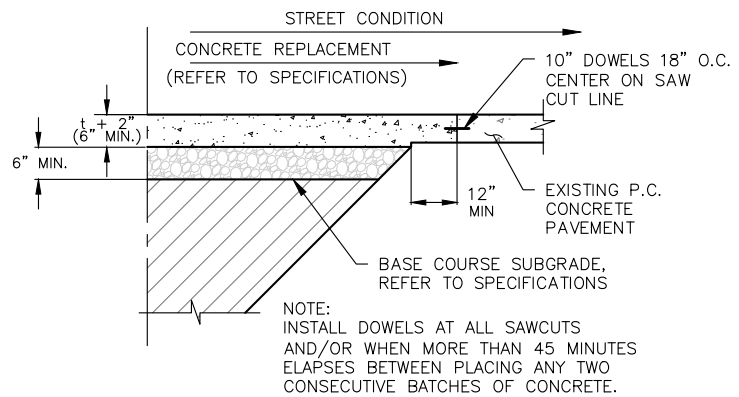


PIPE DIAMETER (INCHES)	MAXIMUM TRENCH WIDTH (INCHES)
4 and smaller	22
6	24
8	26
10	28
12	30
14	32
16	34
18	36
20	38
24	42
30	48
36	54

SQUEEGEE SAND

SIEVE SIZE	% PASSING
3/8"	100
NO. 200	0-5

% PASSING IS TOTAL PERCENT PASSING BY WEIGHT



THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

N.T.S.



**TYPICAL WATER MAIN, REUSE,
AND SERVICE LINE BEDDING
AND BACKFILL DETAIL**

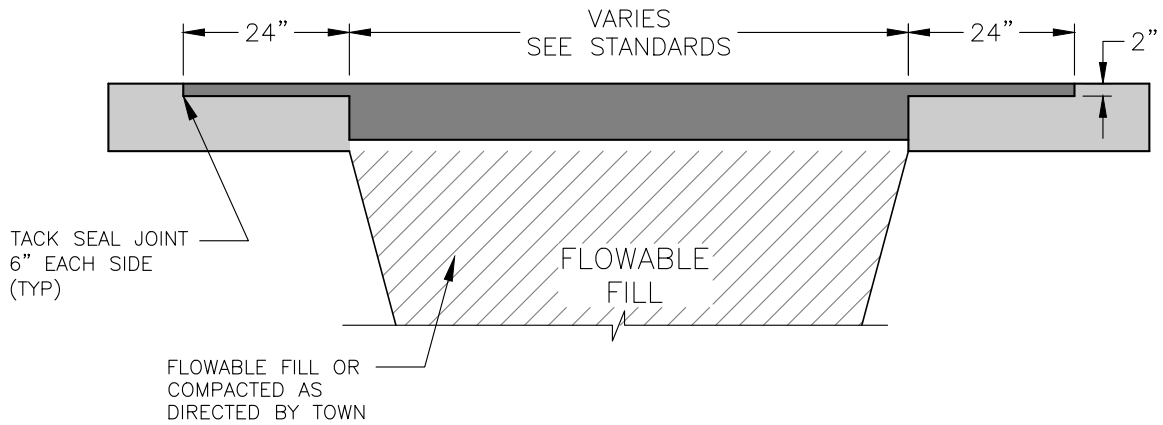
DATE: JANUARY 2019

SHEET 400-25

MINIMUM ASPHALT PATCH THICKNESS				
ZONING				
STREET CLASSIFICATION	INDUSTRIAL		ALL OTHER	
	THICKNESS	LIFTS	THICKNESS	LIFTS
ARTERIAL	11"	3	11"	3
COLLECTOR	7"	2	7"	2
LOCAL	6"	2	6"	2

Asphalt Patch

HMA OVER CDOT FLOW FILL, OR FOAMED FLASH FILL WITH 2" MILL AND OVERLAY 2' WIDER THAN FULL DEPTH PATCH ON BOTH SIDES



NOTES:

1. CDOT FLOW FILL, OR FOAM FLASH FILL FOR TRENCH BACKFILL.
2. PAVEMENT CUTS WILL NOT BE ALLOWED WITHOUT TOWN ENGINEER APPROVAL WITHIN SEVEN (7) YEARS AFTER A STREET HAS BEEN CONSTRUCTED, RECONSTRUCTED, OR OVERLAID. EMERGENCY REPAIRS ARE EXEMPT.
3. SEE ALSO STANDARD STREET SECTION DETAIL.

MAXIMUM LIFT DEPTH - 5"

MINIMUM LIFT DEPTH - 2"

THICKNESS OF EACH LIFT BELOW THE TOP SHALL NOT VARY MORE THAN 3/8", TOP LIFT SHALL BE GRADE SX HOT BITUMINOUS PAVEMENT

FINISH SURFACE TOLERANCE SHALL NOT EXCEED 3/16" IN ANY DIRECTION WHEN CHECKED WITH 10 FOOT STRAIGHT EDGE. FINISHED SURFACE SHALL BE RAKED FREE OF AGGREGATE PRIOR TO COMPACTION EQUIPMENT BEING USED

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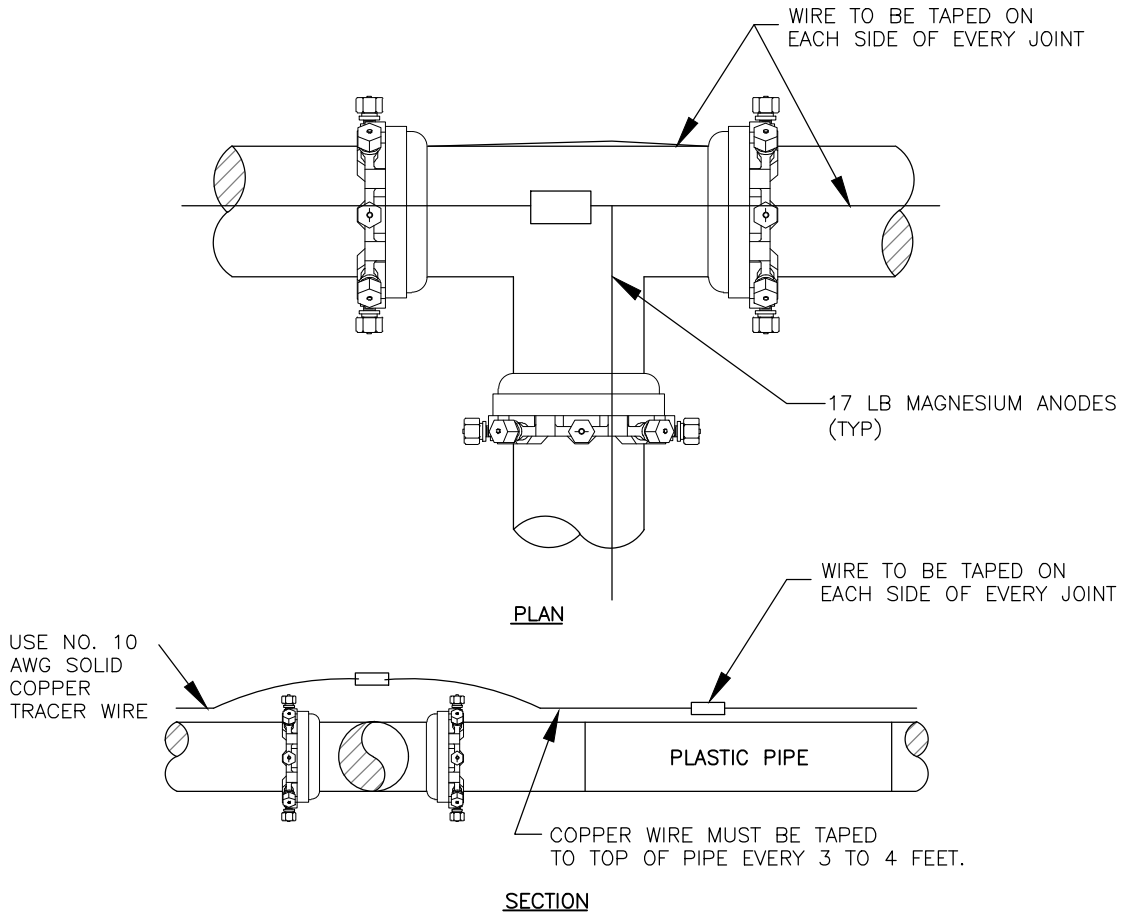
N.T.S.



TRENCH PATCHBACK DETAIL

DATE: JANUARY 2019

SHEET 400-26



NOTES:

1. ALL TRACER WIRES TERMINATE IN A TEST STATION (CP MINI).
2. BLUE TRACER WIRE REQUIRED ON DOMESTIC WATER LINE.
3. PURPLE TRACER WIRE REQUIRED ON REUSE WATER LINE.
4. GREEN TRACER WIRE REQUIRED ON FORCE MAIN.

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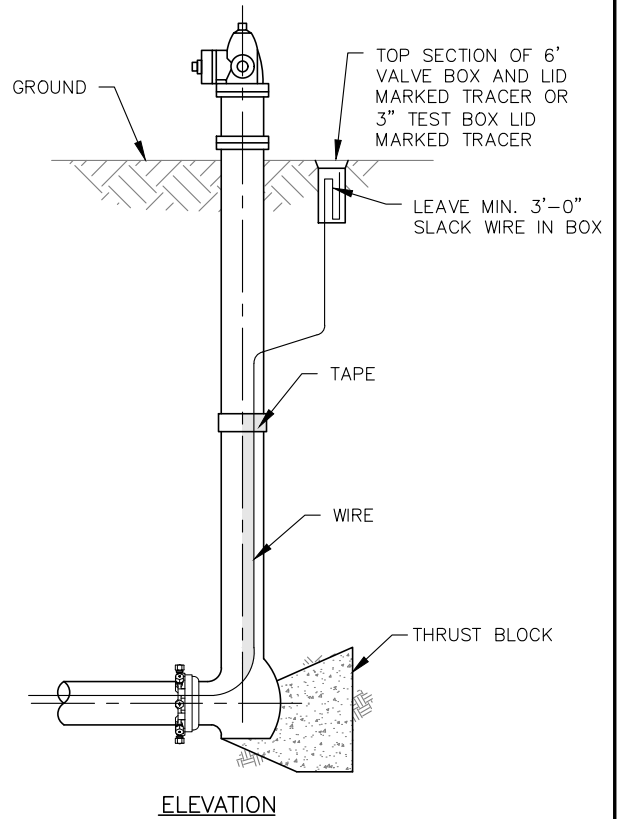
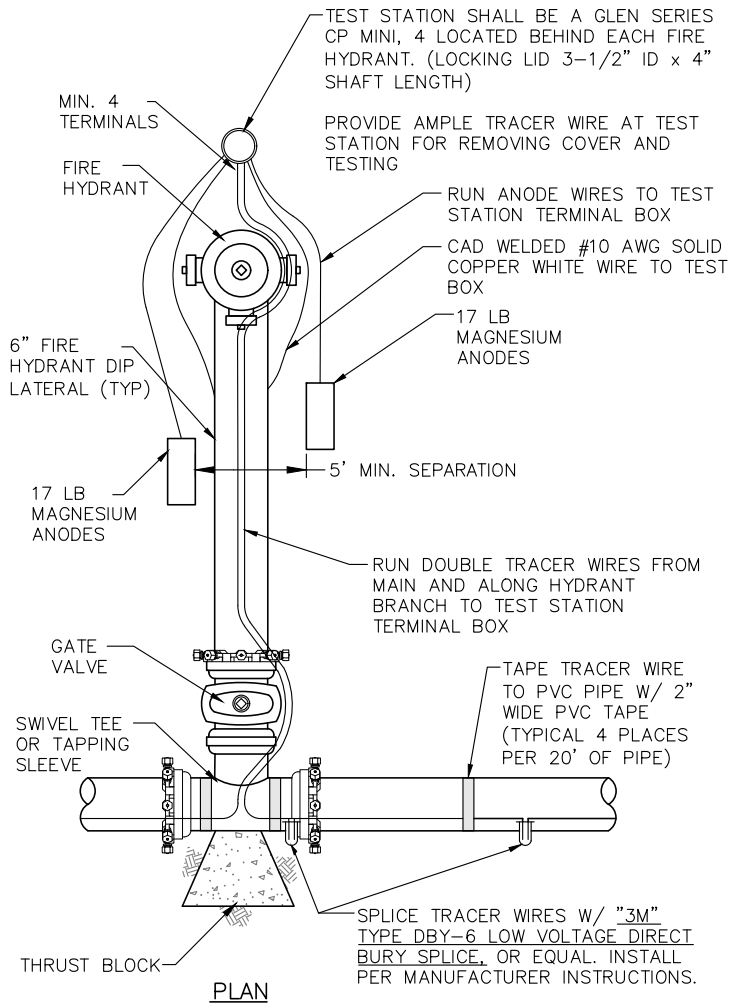
N.T.S.



TRACER WIRE
ON PLASTIC PIPE

DATE: JANUARY 2019

SHEET 400-27



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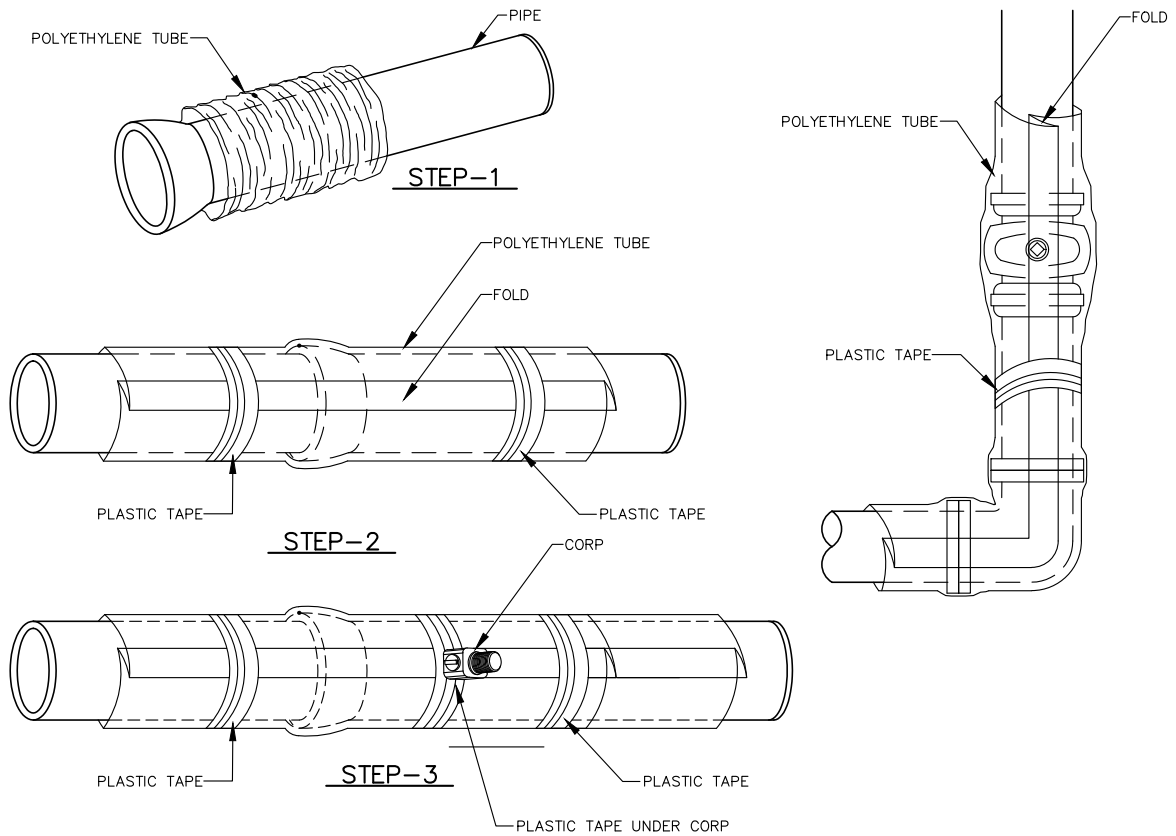
N.T.S.



TRACER WIRE AT FIRE HYDRANT

DATE: JANUARY 2019

SHEET 400-28



FIELD INSTALLATION—POLYETHYLENE WRAP

- STEP-1 PLACE TUBE OF POLYETHYLENE MATERIAL AROUND PIPE PRIOR TO LOWERING PIPE INTO TRENCH.
- STEP-2 PULL THE TUBE OVER THE LENGTH OF THE PIPE. TAPE TUBE TO PIPE AT JOINT. FOLD MATERIAL AROUND THE ADJACENT SPIGOT END AND WRAP WITH TAPE TO HOLD THE PLASTIC TUBE IN PLACE.
- STEP-3 OVERLAP FIRST TUBE WITH ADJACENT TUBE AND SECURE WITH PLASTIC ADHESIVE TAPE. THE POLYETHYLENE TUBE MATERIAL COVERING THE PIPE SHALL BE LOOSE. EXCESS MATERIAL SHALL BE NEATLY DRAWN UP AROUND THE PIPE BARREL, FOLDED ON TOP OF THE PIPE AND TAPED IN PLACE.

NOTE:

1. POLYETHYLENE SHALL BE MINIMUM 8-MIL THICKNESS
 WATER PIPE SHALL BE WRAPPED IN BLUE.
 REUSE WATER PIPE SHALL BE WRAPPED IN PURPLE.
 FORCE MAIN IN GREEN.

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

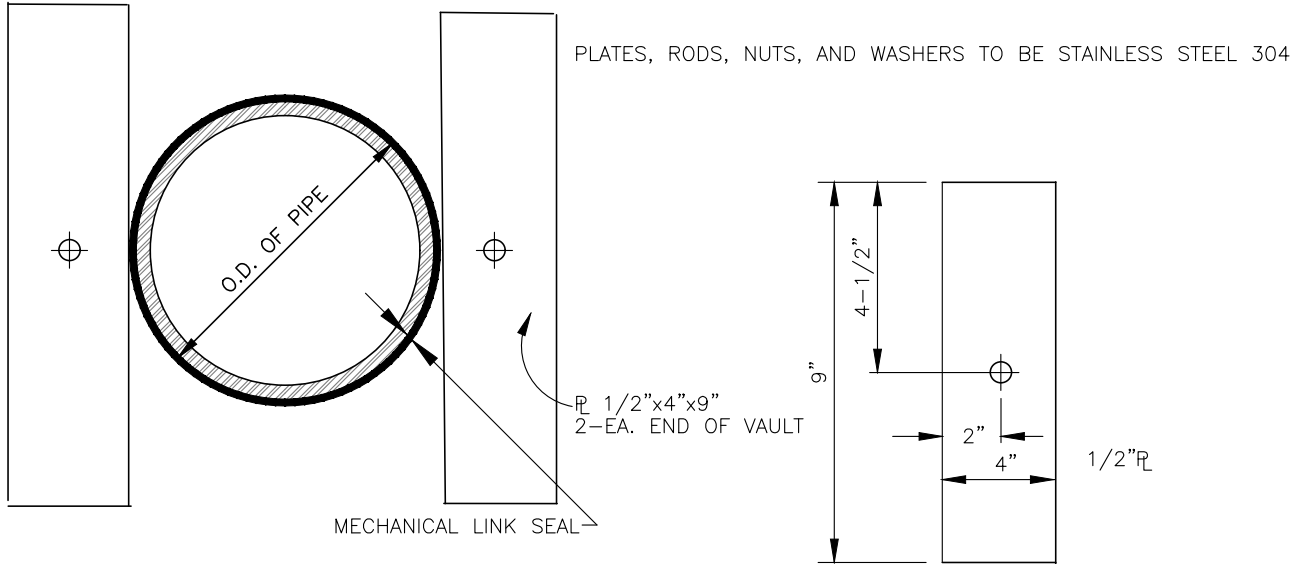
N.T.S.



**POLYETHYLENE WRAP FOR
IRON PIPE & FITTINGS**

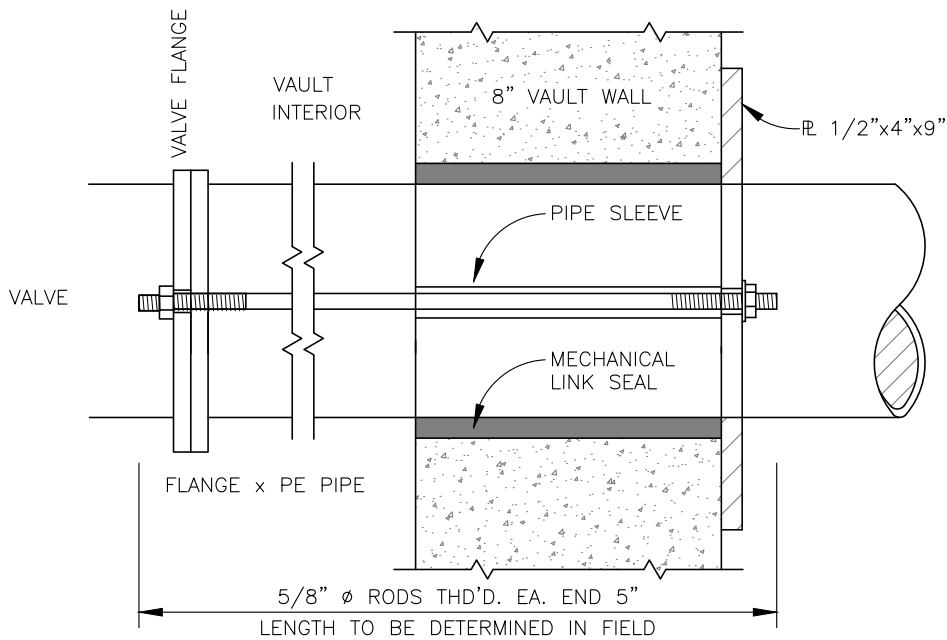
DATE: JANUARY 2019

SHEET 400-29



EXTERIOR VIEW

WALL PLATE



SECTION

NOTE:

WALL CLAMP SUITABLE FOR PRE-CAST WALLS.
CAST-IN-PLACE WALLS REQUIRE WALL PIPE.

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

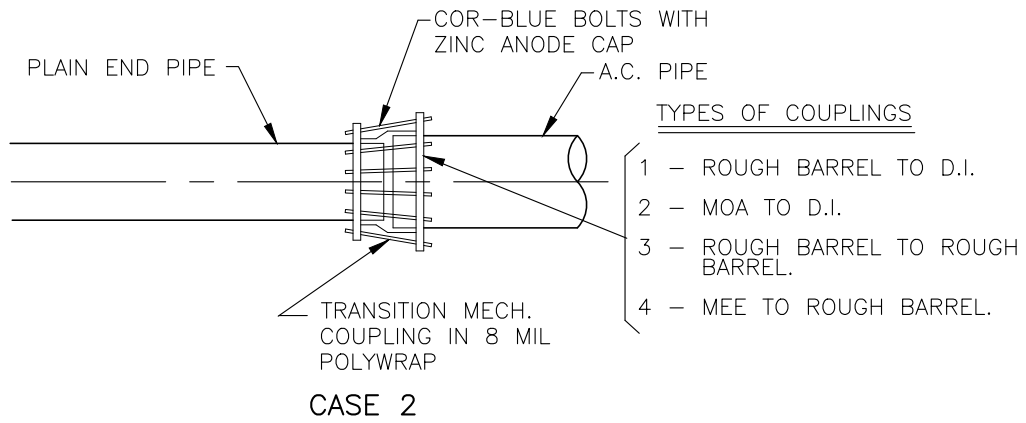
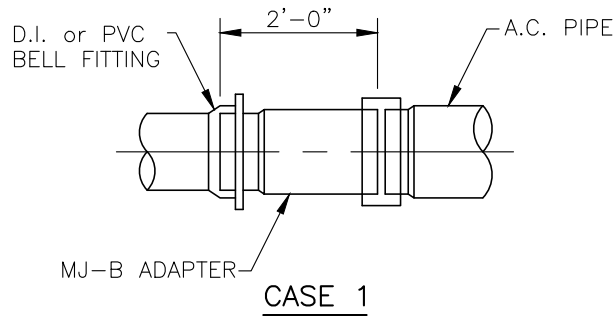
N.T.S.



STAINLESS STEEL
WALL CLAMP

DATE: JANUARY 2019

SHEET 400-30



- MOA = MACHINED OVER ALL.
- MEE = MACHINED EACH END.
- MJ = MECHANICAL JOINT.
- MJ-B = MECHANICAL JOINT-BELL ADAPTER.
- D.I. = DUCTILE IRON PIPE
- A.C. = ASBESTOS CEMENT PIPE

NOTE:

THE CONTRACTOR SHALL POTHOLE THE HOST PIPE AND MEASURE THE OUTSIDE DIAMETER PRIOR TO ORDERING PARTS OR CUTTING THE PIPE.

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

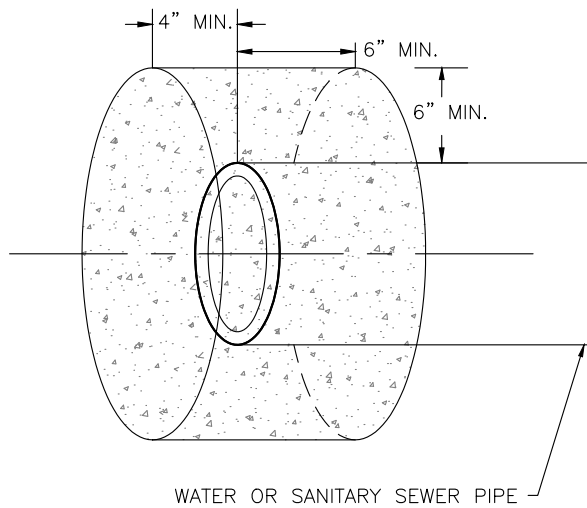
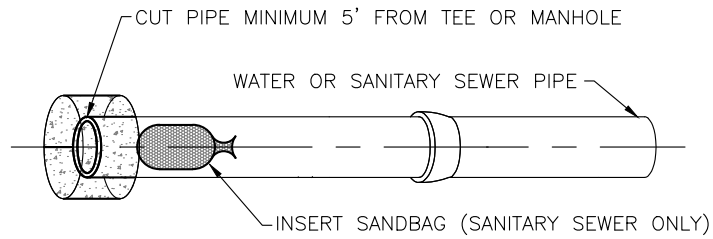
N.T.S.



**ASBESTOS CEMENT PIPE
ADAPTER DETAILS**

DATE: JANUARY 2019

SHEET 400-31



FIELD INSTALLATION—CONCRETE PIPE CAP

1. CUT PIPE A MINIMUM OF 5' FROM THE TEE.
2. INSTALL CONCRETE CAP ENCASING A MINIMUM 6" OF REMAINING PIPE AND EXTENDING A MINIMUM 4" FROM THE END OF PIPE WITH A MINIMUM RADIAL THICKNESS OF 6" AROUND THE EXISTING PIPE.
3. INSERT SANDBAG INTO PIPE INVERT OF MANHOLE (FOR SANITARY SEWER ONLY).
4. TO BE INSTALLED AT BOTH ENDS OF ABANDONED PIPE.

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

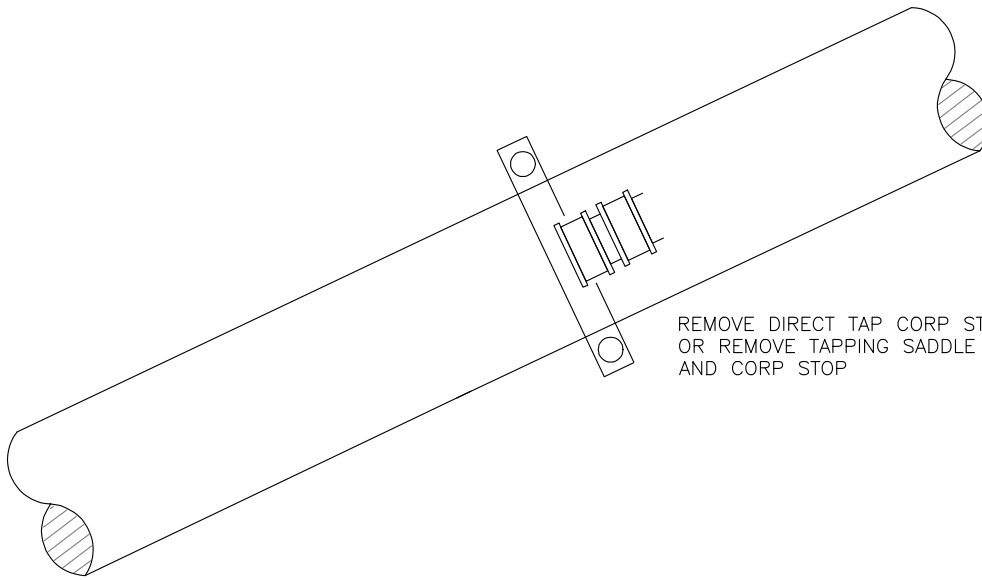
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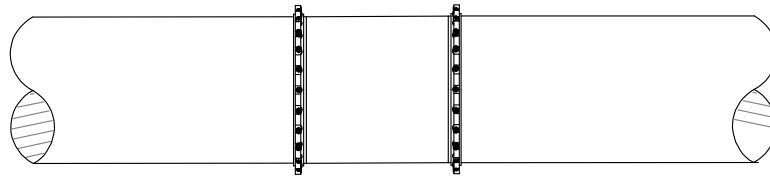
ABANDONMENT OF WATERLINE

DATE: JANUARY 2019

SHEET 400-32



REMOVE DIRECT TAP CORP STOP
OR REMOVE TAPPING SADDLE
AND CORP STOP



INSTALL SOLID SLEEVE AND NEW SECTION OF PIPE, 4' MINIMUM

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

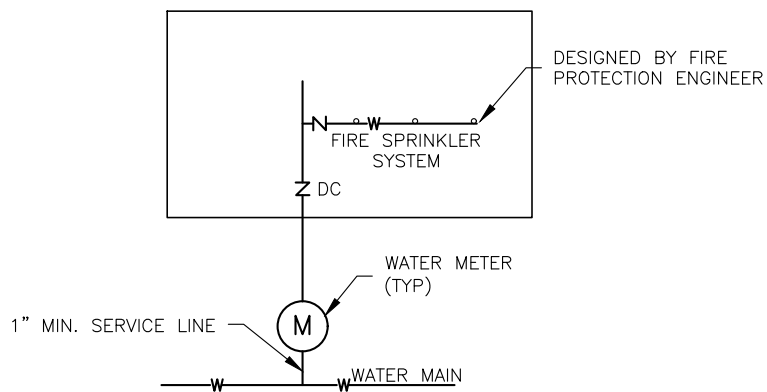
N.T.S.



ABANDONMENT OF WATER SERVICE TAPS

DATE: JANUARY 2019

SHEET 400-33



THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

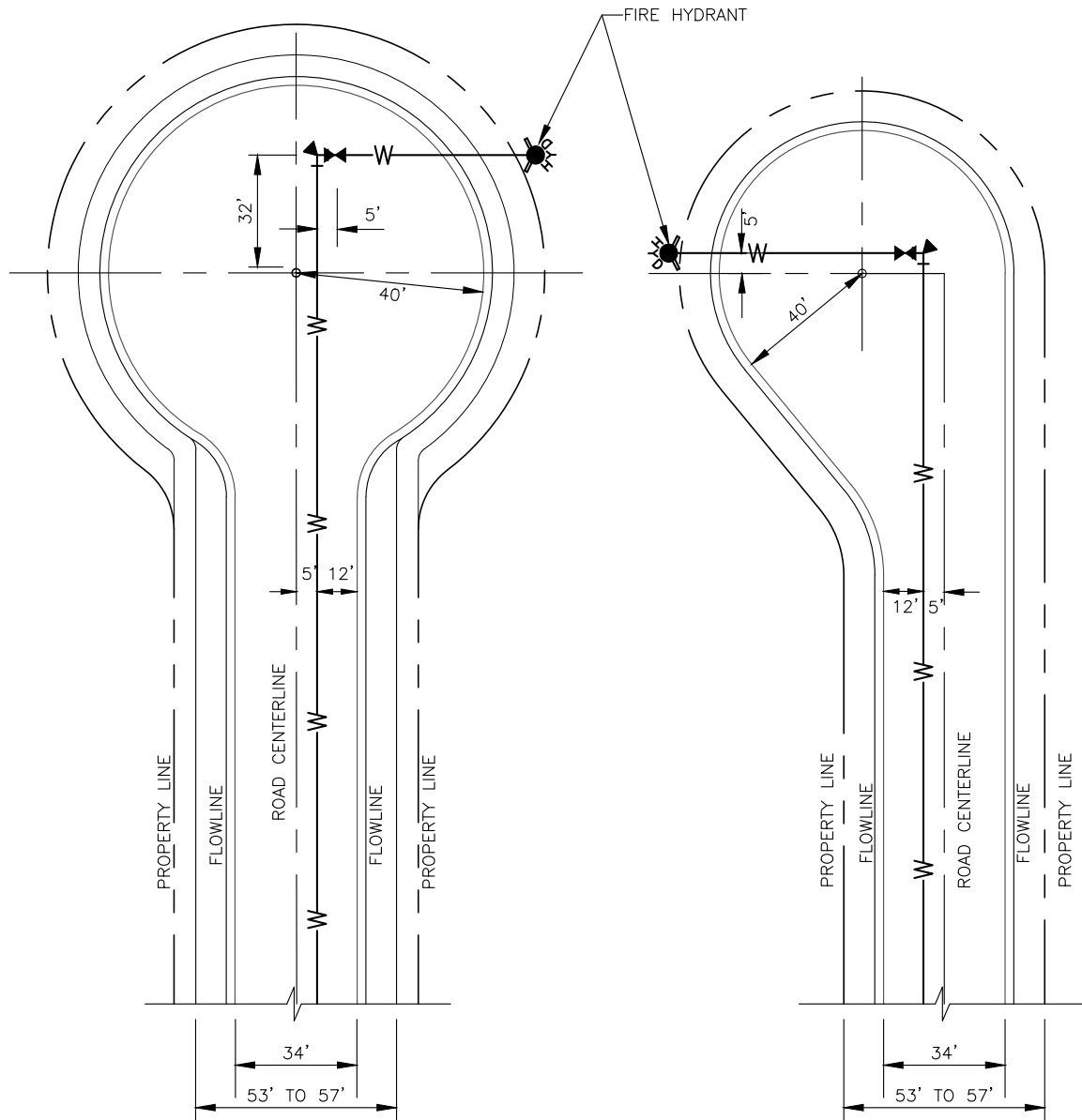
N.T.S.



RESIDENTIAL FIRE PROTECTION LINE SYSTEM

DATE: JANUARY 2019

SHEET 400-34



"A"
"A" – STRAIGHT LINE
 CUL-DE-SAC:
 LAY PIPE TO 32' BEYOND
 THE CENTER (RADIUS
 POINT) OF CUL-DE-SAC

"B"
"B" – OFFSET CUL-
 DE-SAC:
 LAY PIPE TO 5' BEYOND
 CENTER (RADIUS POINT)
 OF CUL-DE-SAC.

NOTE:

BLOW OFF ASSEMBLY MAY ONLY BE USED WITH WRITTEN AUTHORIZATION FROM THE TOWN ENGINEER

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

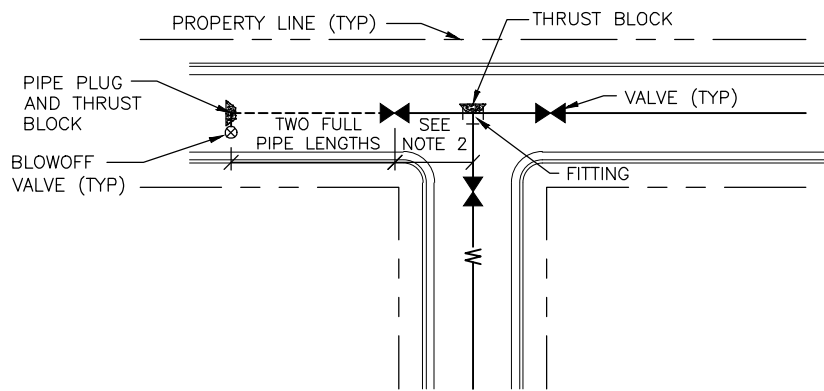
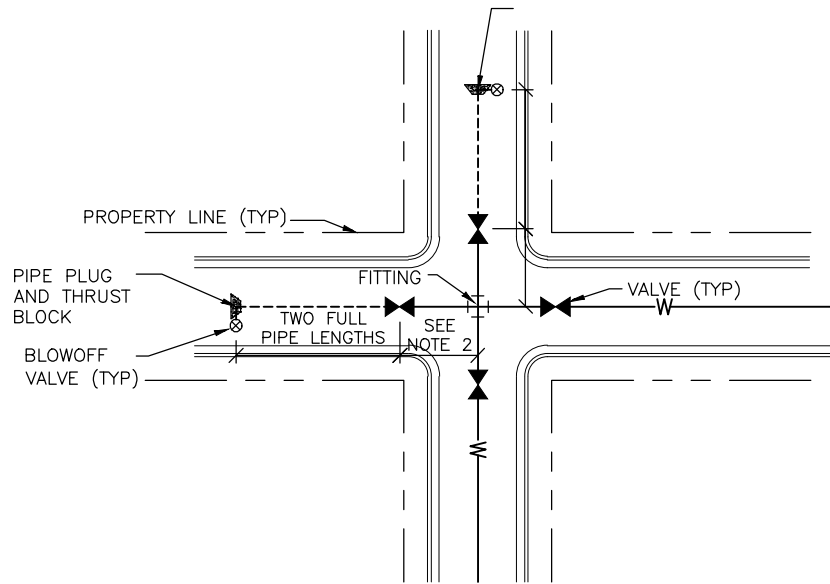
N.T.S.



WATER DISTRIBUTION SYSTEM
 TYPICAL PLAN FOR CUL-DE SACS

DATE: JANUARY 2019

SHEET 400-35



NOTES:

1. INSTALL VALVE AT PROPERTY LINE
2. STUB OUT TWO FULL PIPE LENGTHS FROM VALVE, PLUG END OF PIPE. INSTALL BLOWOFF AND THRUST BLOCK.
3. 3 VALVES ADJACENT TO EVERY TEE.
4. 4 VALVES ADJACENT TO EVERY CROSS.
5. INSTALL GATE VALVE AT END OF EVERY STUB OUT.

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

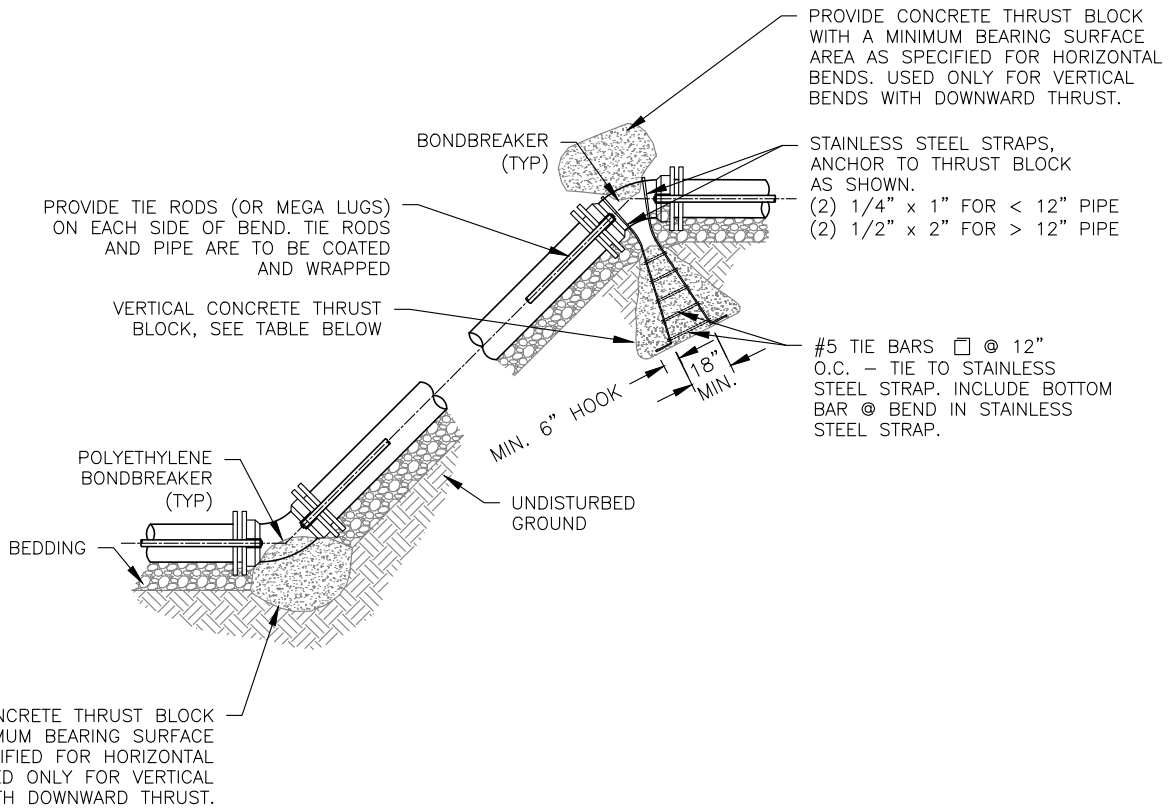
N.T.S.



FUTURE WATER LINE CONNECTIONS AT INTERSECTIONS

DATE: JANUARY 2019

SHEET 400-36



MINIMUM VOLUME OF CONCRETE FOR UPPER FITTING VERTICAL THRUST BLOCK IN CU. FT.			
PIPE SIZE	11-1/4" BEND	22-1/2" BEND	45" BEND
4"	4	8	15
6"	9	18	33
8"	16	31	58
10"	25	49	90
12"	36	70	129

NOTE:

1. JOINTS AND BOLTS SHALL BE ACCESSIBLE FOR REPAIRS AFTER THRUST BLOCK IS PLACED

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

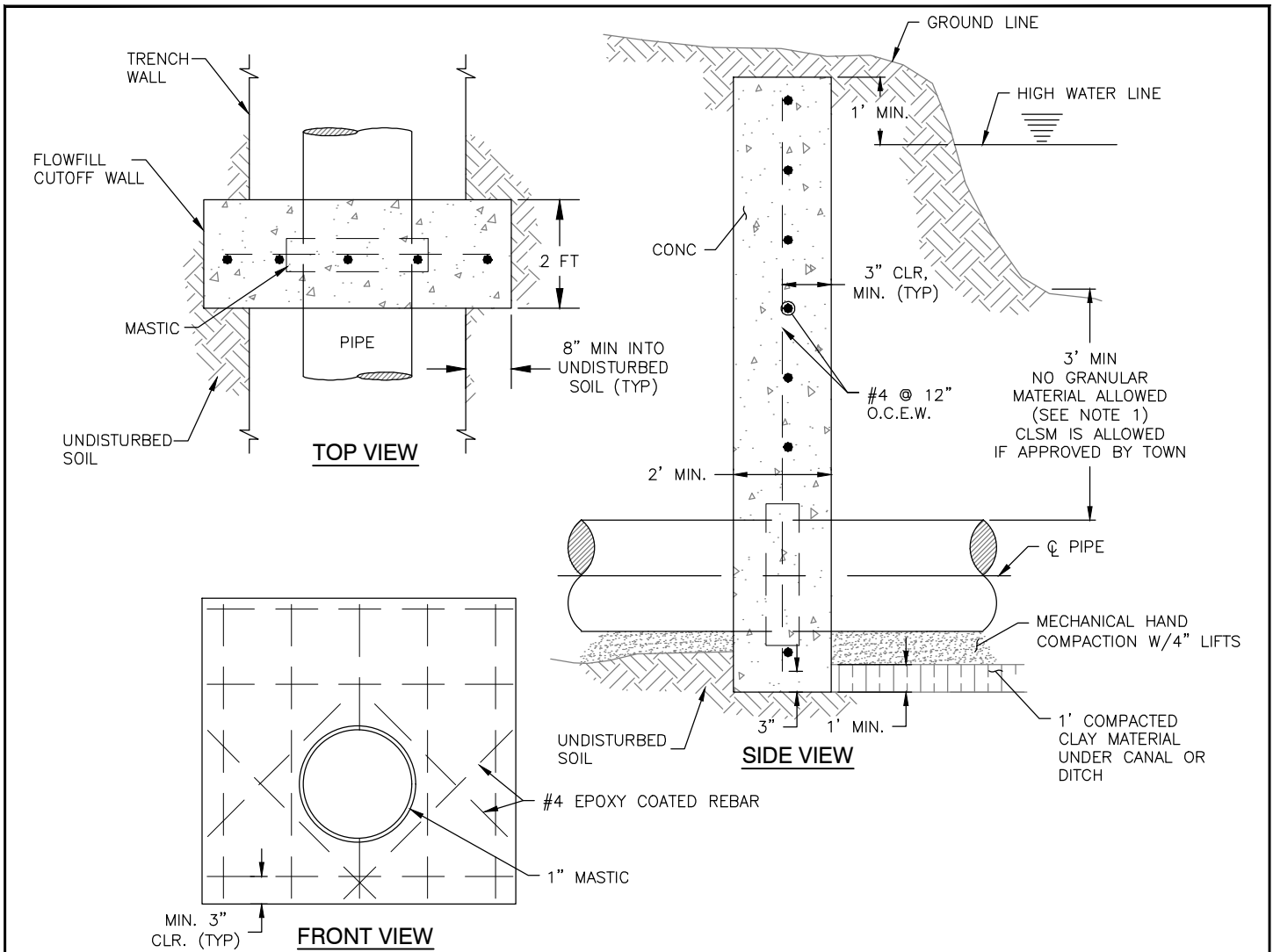
N.T.S.



LOWERING FOR UTILITY CROSSING

DATE: JANUARY 2019

SHEET 400-37



NOTES:

1. BACKFILL SPECIFICATIONS:

- A. MATERIAL
PLASTICITY INDEX: GREATER THAN 7

GRADATION: 100% PASSING NUMBER 4 SIEVE
50% MINIMUM PASSING NUMBER 200 SIEVE:

- B. COMPACTION
- 95% MAXIMUM DRY DENSITY AS DETERMINED BY ASTM D 698 WITH MOISTURE CONTENT FROM OPTIMUM TO 2% ABOVE OPTIMUM.
 - WRITTEN CONFIRMATION FROM A CERTIFIED SOILS LAB IS REQUIRED PRIOR TO ANY MATERIAL INSTALLATION AT THE SITE
 - NO ORGANIC FILL IS ALLOWED
 - CLAY MATERIAL MUST ADHERE TO THE ABOVE REFERENCED SPECIFICATIONS AND MUST BE INSTALLED THE ENTIRE LENGTH AND WIDTH OF EXCAVATION
 - 1' MINIMUM CLAY MATERIAL WILL BE PLACED AND COMPACTED UNDER THE INSTALLATION

2. MAX CROSSING 20' AT SURFACE.

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

N.T.S.



DITCH OR CANAL CROSSING

DATE: JANUARY 2019

SHEET 400-38

THE NUMBER OF RUNNERS ON EACH SPACER DEPENDS ON THE PIPE DIAMETER. THE GAP ON THE TOP SPACERS SHALL NOT EXCEED $\frac{3}{4}$ "

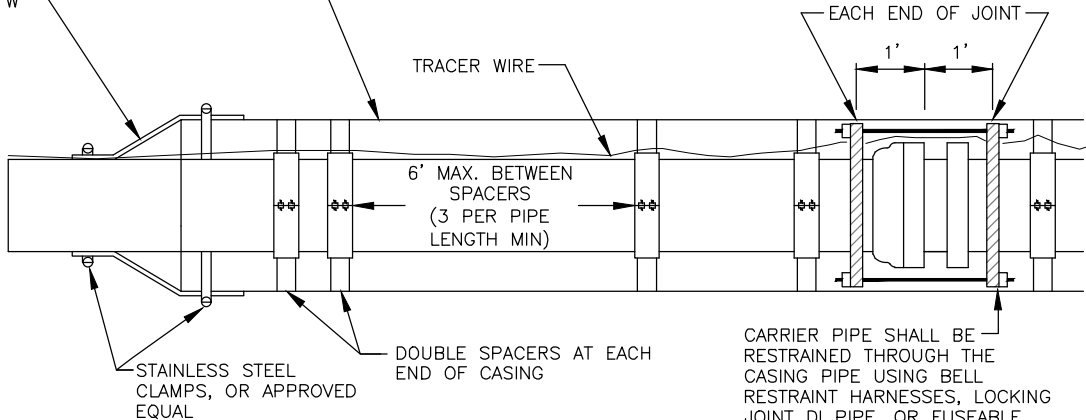
CARRIER PIPE

NEOPRENE, EPDM RUBBER OR PVC SPACERS SHALL BE ELECTRICALLY ISOLATED FROM THE CASING PIPE

STEEL CASING PIPE (SEE TABLE FOR WALL THICKNESS)

SECTION VIEW

WATERTIGHT TYPE C PULL-ON OR TYPE W WRAP AROUND END SEAL (TYP.)



SIDE VIEW

CARRIER PIPE SHALL BE RESTRAINED THROUGH THE CASING PIPE USING BELL RESTRAINT HARNESSSES, LOCKING JOINT DI PIPE, OR FUSEABLE PVC PIPE, AS APPROVED

CARRIER PIPE NOMINAL ϕ	CASING PIPE	
	MIN OD	MIN WALL THICKNESS
4"	12"	0.188"
6"	16"	0.25"
8"	18"	0.282"
12"	24"	0.344"
16"	30"	0.438"
20"	36"	0.438"

NOTE:

THE ANNULAR SPACE BETWEEN THE CASING AND CARRIER PIPES SHALL NOT BE FILLED WITH ANY MATERIAL.

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

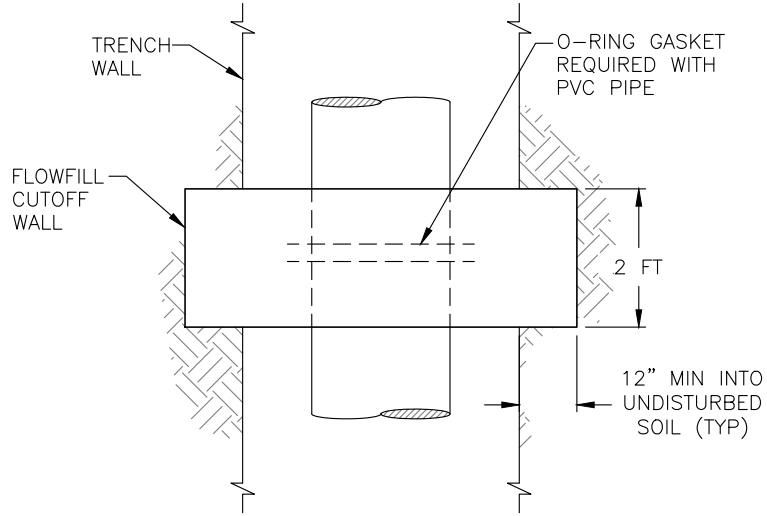
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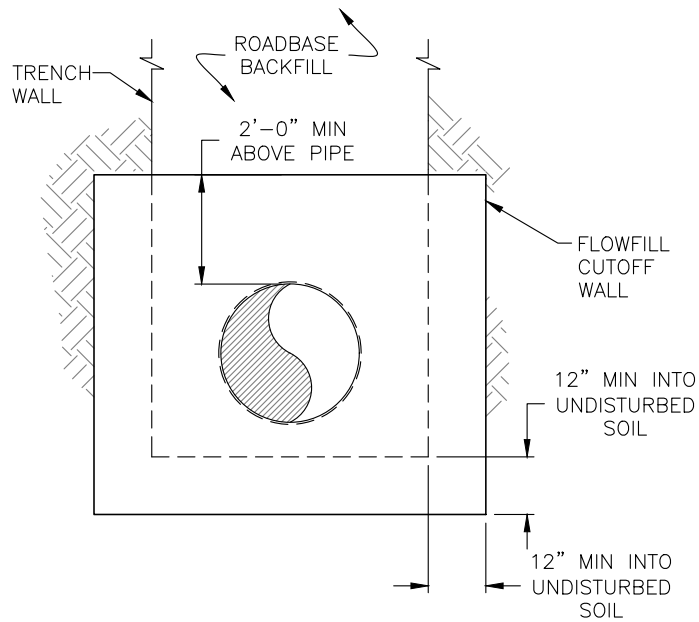
JACKING DETAIL

DATE: JANUARY 2019

SHEET 400-39



PLAN VIEW



SECTION VIEW

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

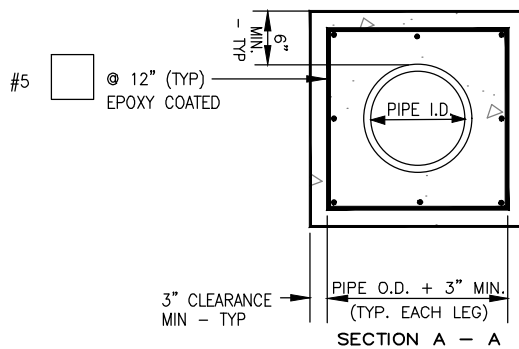
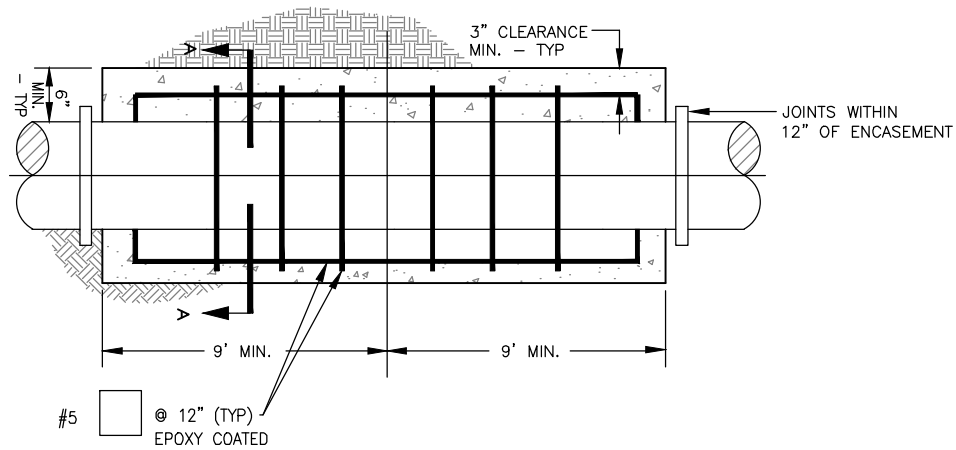
N.T.S.



FLOWFILL CUT OFF WALL DETAIL

DATE: JANUARY 2019

SHEET 400-40



PIPE I.D.	NO. OF LONGITUDINAL BARS & LOCATION	
6" TO 8"	4 - #5 BARS	1 EACH CORNER
10" TO 18"	8 - #5 BARS	3 EACH SIDE
20" TO 30"	12 - #5 BARS	4 EACH SIDE
36"	16 - #5 BARS	5 EACH SIDE

NOTES:

1. THIS DETAIL IS TO BE USED UNDER NORMAL CONDITIONS. WHERE EXCESSIVE GROUNDWATER IS PRESENT AN ALTERNATE DESIGN WILL BE REQUIRED.
2. ALL REBAR TO BE GRADE 60 AND EPOXY COATED.
3. 4,500 PSI CDOT CLASS B/D CONCRETE.
4. PLACE CONCRETE AGAINST EITHER SOLID FORMWORK OR UNDISTURBED SOIL.

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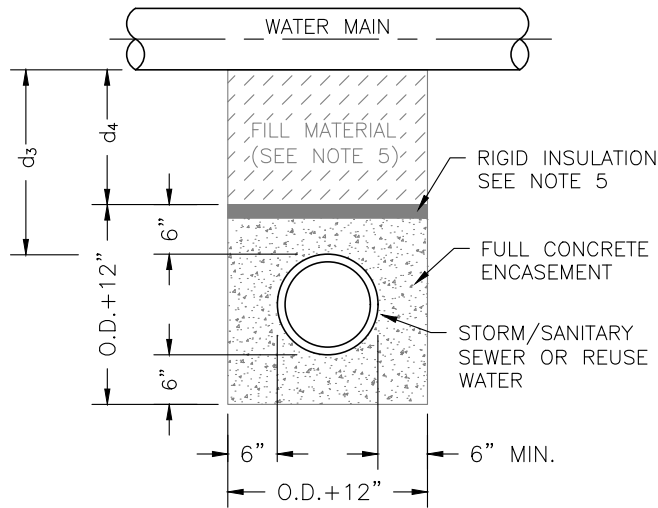
N.T.S.



CONCRETE ENCASEMENT
REINFORCEMENT DETAIL

DATE: JANUARY 2019

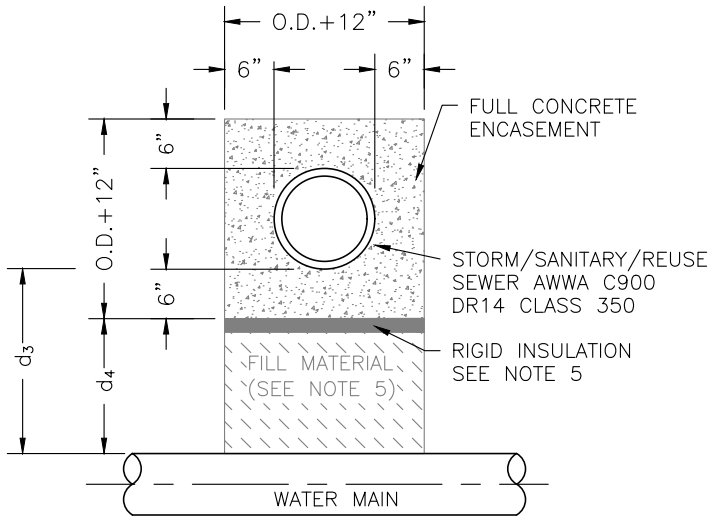
SHEET 400-41



STORM, SANITARY SEWER, OR REUSE CROSSING UNDER WATER MAIN
 IF $d_3 > 18"$, ENCASEMENT NOT REQUIRED

NOTES:

1. CONCRETE COLLAR AROUND STORM SEWER JOINTS MAY BE ACCEPTED WITH WRITTEN APPROVAL BY THE TOWN ENGINEER AND ONLY FOR PIPE 30" OR LARGER.
2. CONCRETE TO BE CAST AGAINST UNDISTURBED SOIL OR SHORING.
3. LENGTH OF ENCASEMENT SHALL EXTEND AT LEAST 10- FEET EACH SIDE OF WATER MAIN.
4. UNLESS OTHERWISE NOTED ON PLAN/PROFILE DRAWINGS, ENCASEMENTS NEED NOT BE REINFORCED.
5. FILLER MATERIAL BETWEEN CONDUITS TO BE:
 - a) APPROVED DOW HI LOAD 60 RIGID INSULATION IF $d_4 \leq 6"$.
 - b) COMPACTED BACKFILL, IF $d_4 > 6"$.
6. SHORING OR SHEETING, IF USED, TO BE CUT OFF AT TOP OF ENCASEMENT



STORM, SANITARY SEWER, OR REUSE CROSSING OVER TOP OF WATER MAIN
 ENCASEMENT REQUIRED REGARDLESS OF DIMENSION d_3
 (SEE NOTE 1 FOR SPECIAL CASES)

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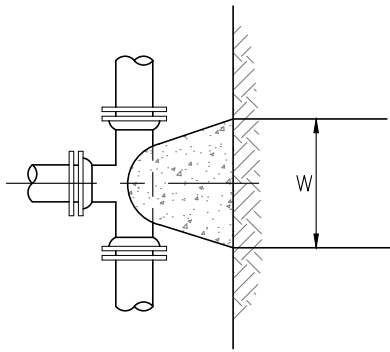
N.T.S.



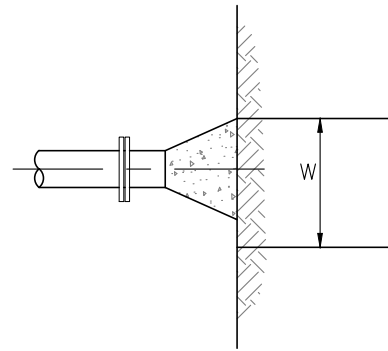
ENCASEMENT FOR CONDUIT
CROSSING

DATE: JANUARY 2019

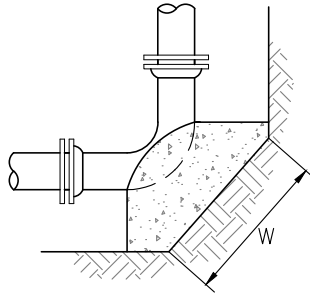
SHEET 400-42



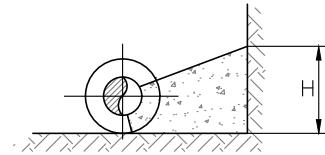
TEE



CAP OR PLUG



BEND



SECTION

MINIMUM THRUST AREA IN SQUARE FEET

PIPE SIZE	11-1/4" BEND	22-1/2" BEND	45° BEND	90° BEND	TEE (BRANCH SIZE OR CAP)
6"	3.0	4.0	7.0	13.0	9.0
8"	3.0	6.0	12.0	21.0	16.0
12"	7.0	14.0	26.5	45.0	34.0
16"	11.5	23.0	43.5	62.0	57.0

NOTES:

1. PLACE CONCRETE AGAINST UNDISTURBED SOIL.
2. JOINTS AND BOLTS SHALL BE ACCESSIBLE FOR REPAIRS AFTER THRUST BLOCK IS PLACED.
3. PROVIDE POLYETHYLENE BOND BREAKER.
4. CONCRETE TO BE CDOT 4,500 psi CLASS B/D. HAND MIXED CONCRETE PROHIBITED.

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N.T.S.



CONCRETE THRUST BLOCKS
BEARING SURFACES AND
INSTALLATION – SHEET 1 OF 2

DATE: JANUARY 2019

SHEET 400-43

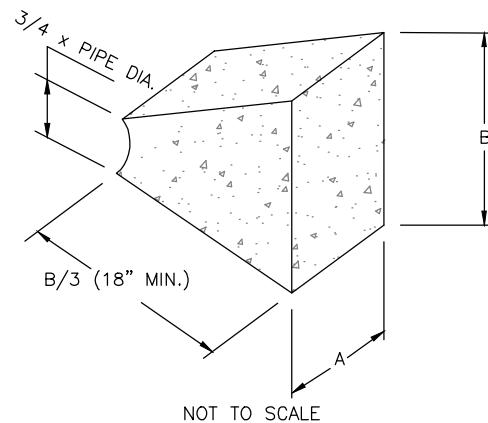
MINIMUM DIMENSIONS FOR THRUST BLOCKS

FITTING SIZE	TEES & PLUGS		90° BEND		45° BENDS & WYES	
	A	B	A	B	A	B
4"	1'-7"	1'-2"	1'-9"	1'-6"	1'-8"	0'-10"
6"	2'-0"	1'-11"	2'-5"	2'-2"	1'-10"	1'-7"
8"	2'-8"	2'-6"	3'-2"	3'-0"	2'-5"	2'-1"
10"	3'-4"	3'-3"	4'-0"	3'-10"	3'-0"	2'-9"
12"	4'-0"	3'-10"	4'-8"	4'-8"	3'-8"	3'-3"
14"	5'-5"	3'-10"	6'-6"	4'-11"	4'-9"	3'-5"
20"	5'-0"	5'-0"	6'-0"	6'-0"	5'-0"	4'-0"
24"	6'-0"	6'-0"	7'-0"	7'-0"	5'-0"	5'-0"
30"	7'-6"	7'-6"	8'-0"	8'-0"	6'-3"	6'-3"

FITTING SIZE	REDUCERS & 22 1/2° BENDS		11 1/4° BENDS	
	A	B	A	B
4"	1'-7"	0'-6"	0'-6"	0'-6"
6"	1'-9"	0'-10"	1'-0"	0'-6"
8"	1'-9"	1'-6"	1'-0"	1'-0"
10"	2'-2"	1'-11"	1'-6"	1'-0"
12"	2'-7"	2'-3"	2'-0"	1'-0"
14"	3'-5"	2'-5"	2'-0"	1'-6"
20"	3'-6"	3'-0"	3'-0"	2'-0"
24"	4'-6"	3'-0"	3'-0"	3'-0"
30"	4'-9"	4'-6"	3'-3"	3'-3"

GENERAL NOTES:

1. BEARING SURFACE AREAS SHOWN IN CHART ARE MINIMUM.
2. BASED ON 150 P.S.I. INTERNAL PIPE OPERATING PRESSURE.
3. SOIL BEARING CAPACITY = 1000 LB./SQ. FT.
4. ALL FITTINGS TO BE WRAPPED WITH POLYETHYLENE (MINIMUM 8 MIL.).
5. 4500 psi CONCRETE. SEE SECTION 800.



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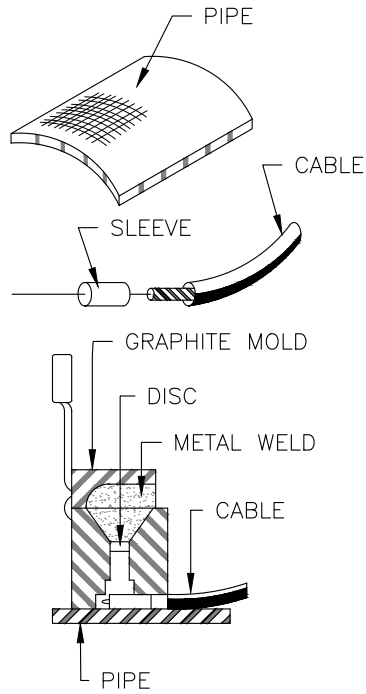
N.T.S.



TYPICAL THRUST BLOCK
DIMENSIONS
SHEET 2 OF 2

DATE: JANUARY 2019

SHEET 400-44

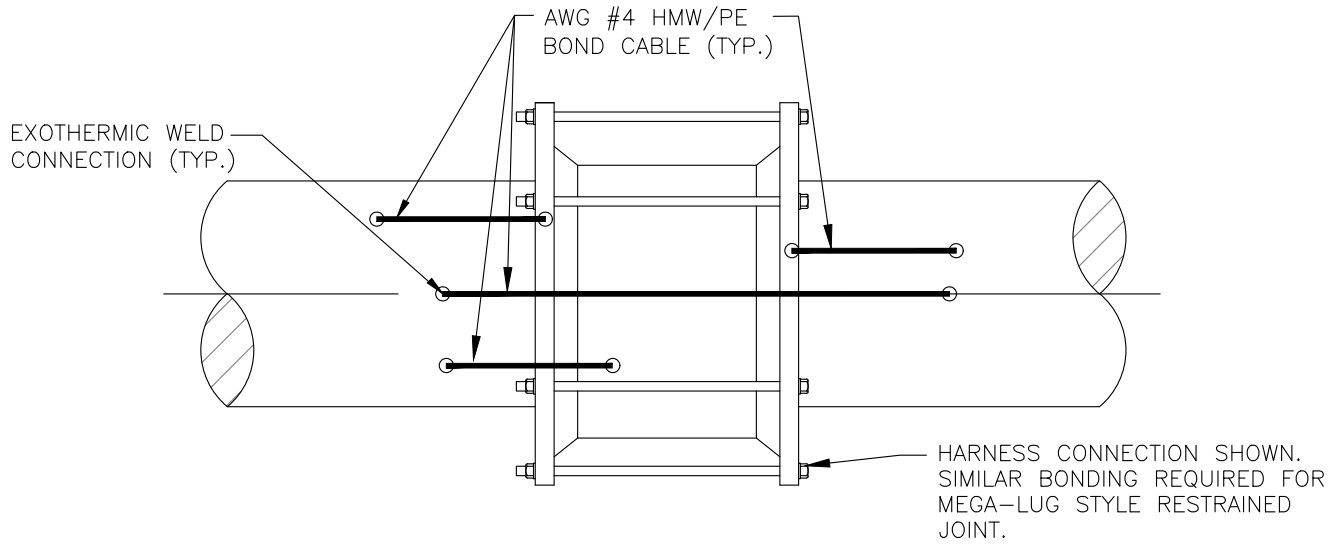


PROCEDURE:

1. FILE STRUCTURE TO BARE METAL AND CLEAN SURFACE.
2. STRIP INSULATION FROM WIRE AND ATTACH SLEEVE.
3. HOLD MOLD FIRMLY WITH OPENING AWAY FROM OPERATOR. IGNITE WITH FLINT GUN.
4. REMOVE SLAG FROM CONNECTION WITH CHIPPING HAMMER.
5. REPLACE/REPAIR EPOXY COATING. COVER WITH WELD CAP. COVER CONNECTION WITH BITUMASTIC COATING OVER ALL EXPOSED METAL.

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

N.T.S.



NOTES:

1. BONDING NOT REQUIRED ON INSULATING COUPLINGS.
2. INSTALL POLYETHYLENE WRAP.

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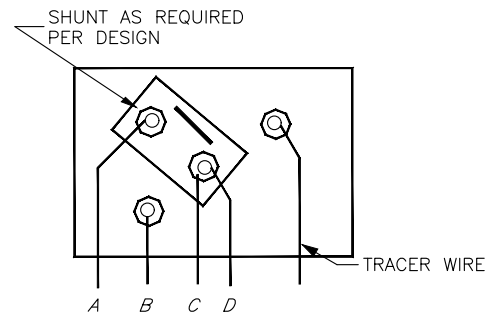
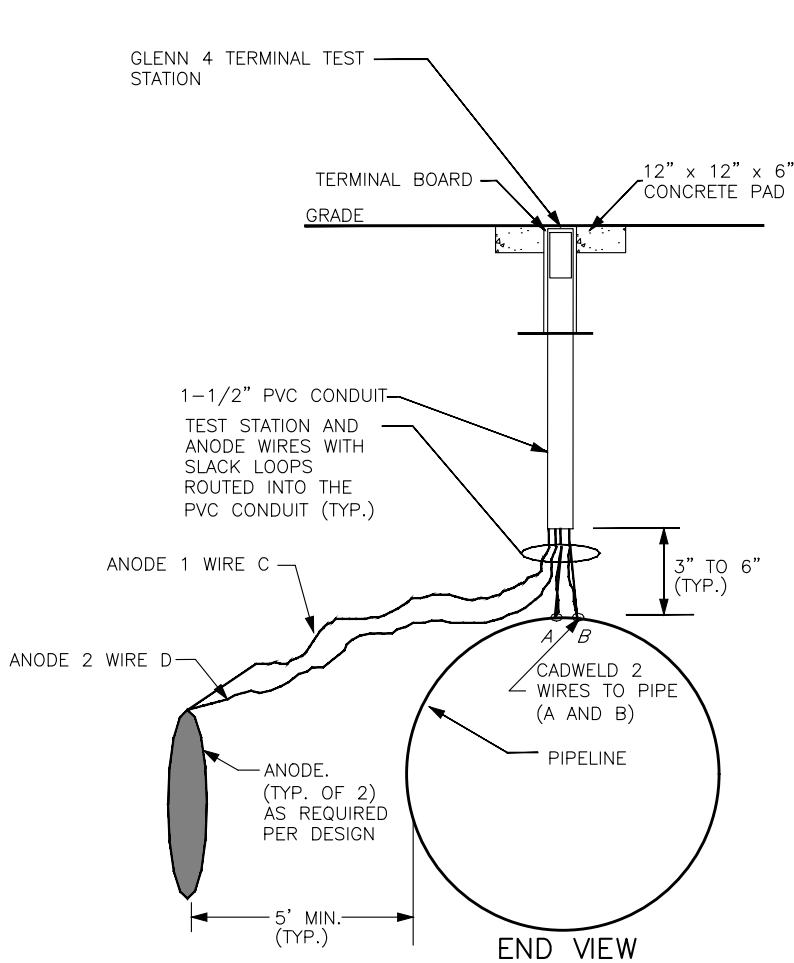
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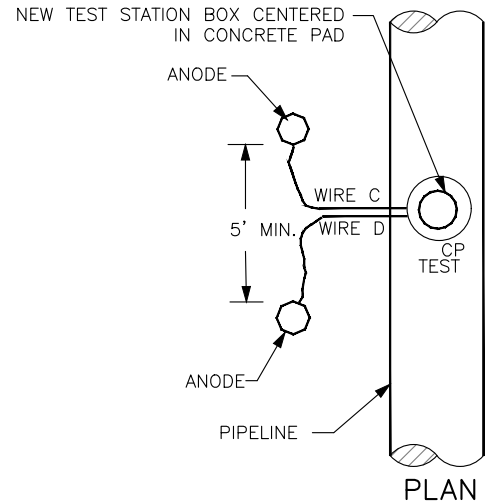
JOINT BONDING—RESTRAINED
DIP JOINT DETAIL

DATE: JANUARY 2019

SHEET 400-46



TERMINAL BOARD WIRING DETAIL



PLAN

NOTES:

1. A MINIMUM OF 3 FEET OF SLACK SHALL BE PROVIDED FOR ALL WIRES INSIDE THE TEST STATION BOX.
2. A MINIMUM OF 6 INCHES OF SLACK SHALL BE PROVIDED FOR ALL WIRES AT THE BOTTOM OF THE 2" PVC CONDUIT.
3. THE 2" PVC CONDUIT SHALL EXTEND APPROXIMATELY 3 INCHES INTO THE TEST STATION BOX.
4. TWO ANODES SHALL BE PROVIDED. ANODES MAY BE INSTALLED VERTICALLY OR HORIZONTALLY IN NATIVE SOILS (NOT IMPORTED OR SELECT BACKFILL SUCH AS SQUEEGEE OR SAND).
5. WIRES A, B = #12 AWG TYPE RHW, COPPER (RED)
 WIRES C, D = #10 AWG SOLID TYPE RHW OR TYPE USE, COPPER (BLACK)

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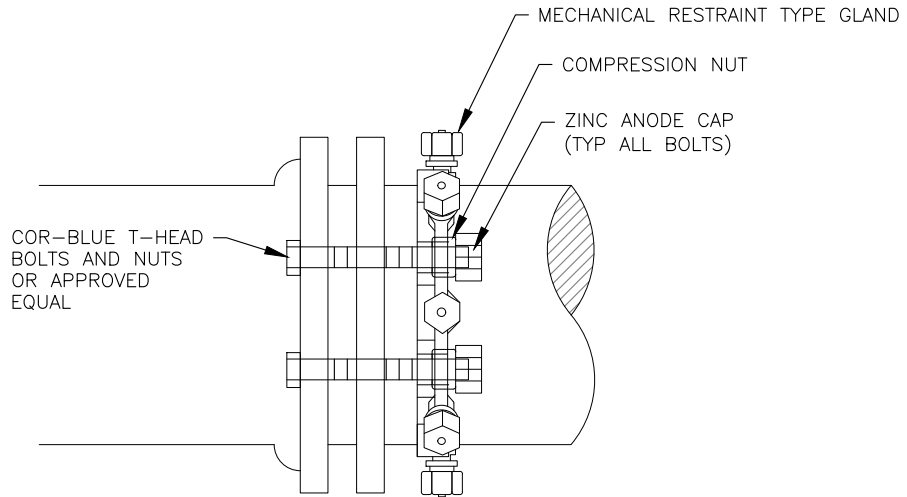
N.T.S.



TYPE 1 – TEST STATION WITH 2 ANODES

DATE: JANUARY 2019

SHEET 400-47



NOTES:

- COR-BLUE (OR APPROVED EQUAL) BOLTS AND NUTS ON ALL FITTINGS, MEGALUGS, HARNESS RESTRAINTS, ETC.
- CORE-BLUE RODS AND NUTS ARE REQUIRED ON ALL RESTRAINTS
- SPECIFY NUMBER OF POINTS OF RESTRAINT
- MEGA LUG BY EBAA IRON OR APPROVED EQUAL

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

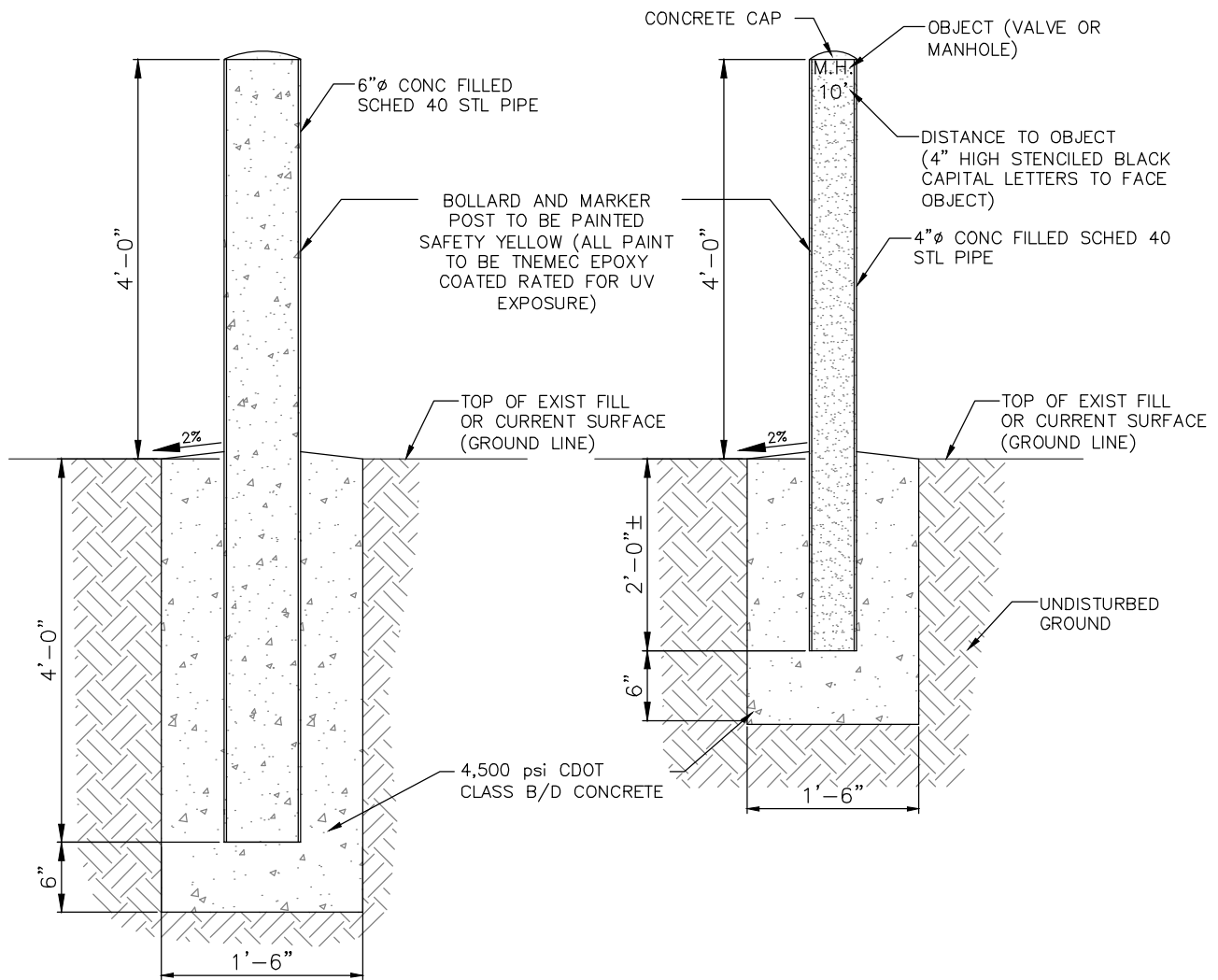
N.T.S.



CONNECTION BOLTS &
ZINC ANODE CAP

DATE: JANUARY 2019

SHEET 400-48



NOTES:

1. BOLLARD DETAIL USED TO PROTECT OBJECTS SUCH AS FIRE HYDRANTS, SAMPLING STATIONS, ETC.
2. MARKER POST DETAIL USED FOR LOCATING MANHOLES, VALVE BOXES NOT INSTALLED IN CONCRETE OR ASPHALT.

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

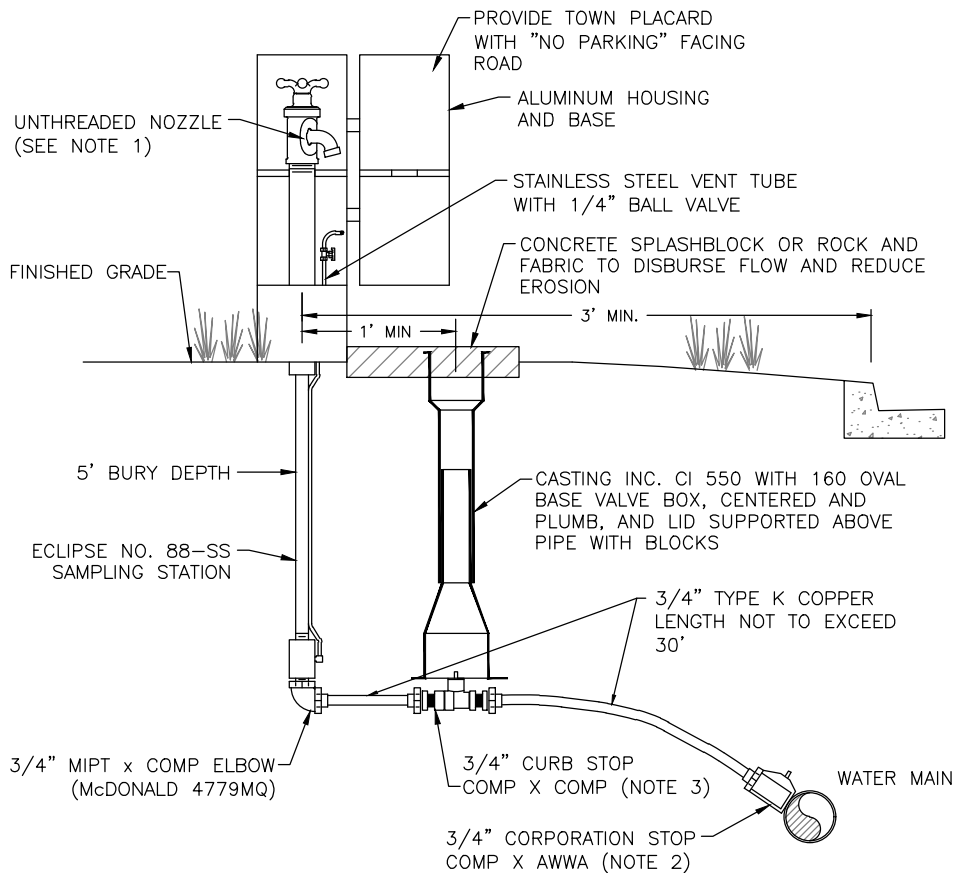
N.T.S.



BOLLARD DETAIL

DATE: JANUARY 2019

SHEET 400-49



NOTES:

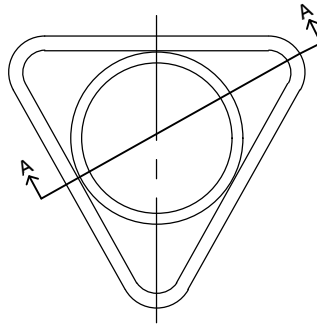
1. SAMPLING STATIONS SHALL BE ECLIPSE NO. 88-SS (MANUFACTURED BY KUPFERLE FOUNDRY) WITH 5' BURY DEPTH, 3/4" FIPT INLET AND 3/4" UNTHREADED NOZZLE. STATIONS SHALL BE ENCLOSED IN A LOCKABLE, NON-REMOVABLE ALUMINUM-CAST HOUSING.
2. ACCEPTABLE CORPORATION STOPS INCLUDE: FORD F-600; MUELLER J-15000 OR APPROVED EQUAL.
3. ACCEPTABLE CURB STOPS INCLUDE: FORD BALL VALVE B11-333W OR APPROVED EQUAL.
4. STATION, INCLUDING ELBOW, SHALL BE SUPPLIED BY THE CONTRACTOR. CONTRACTOR SHALL PROVIDE AND INSTALL ALL MATERIAL AND RESTORE SITE TO ITS ORIGINAL CONDITION.
5. ALL COPPER CONNECTIONS TO BE COMPRESSION ONLY, WITH STAINLESS STEEL GRIPPER RING.
6. WITH THE TOWN'S APPROVAL, A BOLLARD SHALL BE LOCATED 30" CLEAR AND IN FRONT OF THE SAMPLE STATION AT A 45 DEGREE ANGLE FROM A LINE DRAWN FROM THE STREET TO THE STATION. BOLLARDS SHALL NOT RESTRICT ACCESS TO THE STATION. SEE DETAIL 400-49.



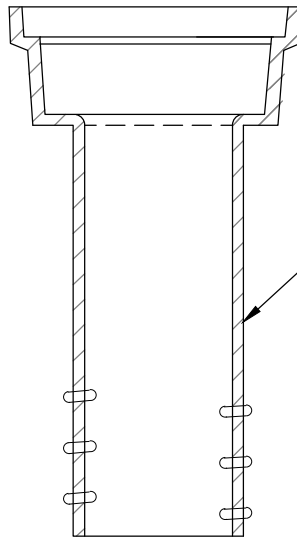
WATER SAMPLING STATION

DATE: JANUARY 2019

SHEET 400-50



PLAN



CASTINGS INC. CLASS 35B
MODEL 4TCI-17-S

SECTION A-A

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

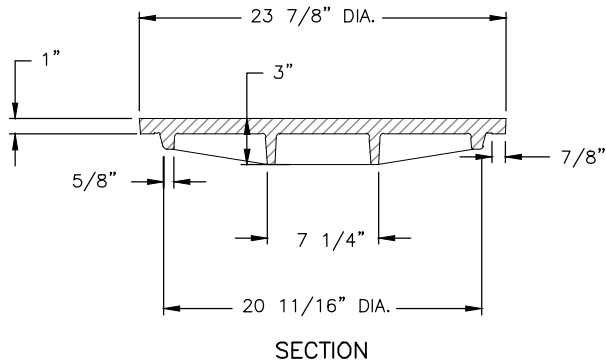
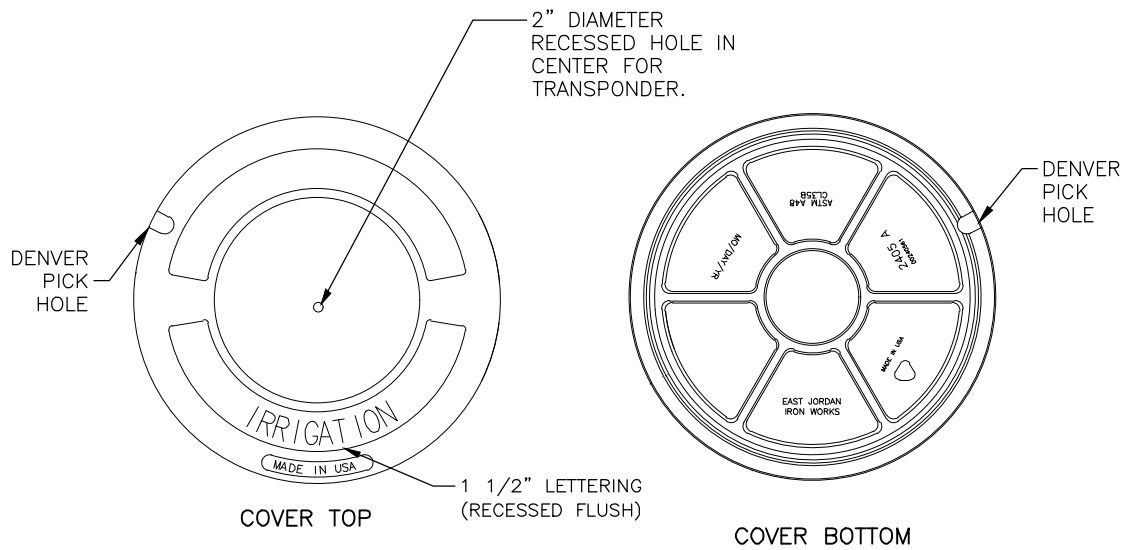
N.T.S.



TRIANGLE TOP FOR REUSE
WATER VALVE

DATE: JANUARY 2019

SHEET 400-51



THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

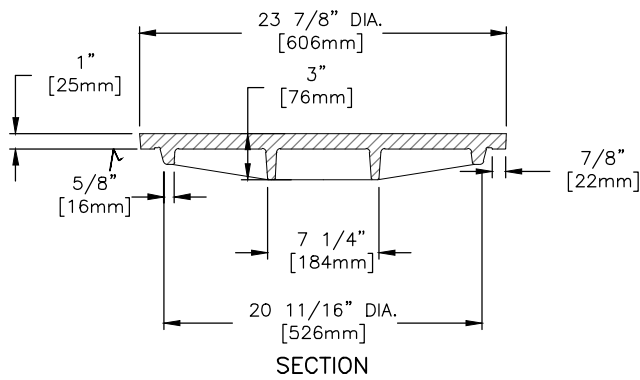
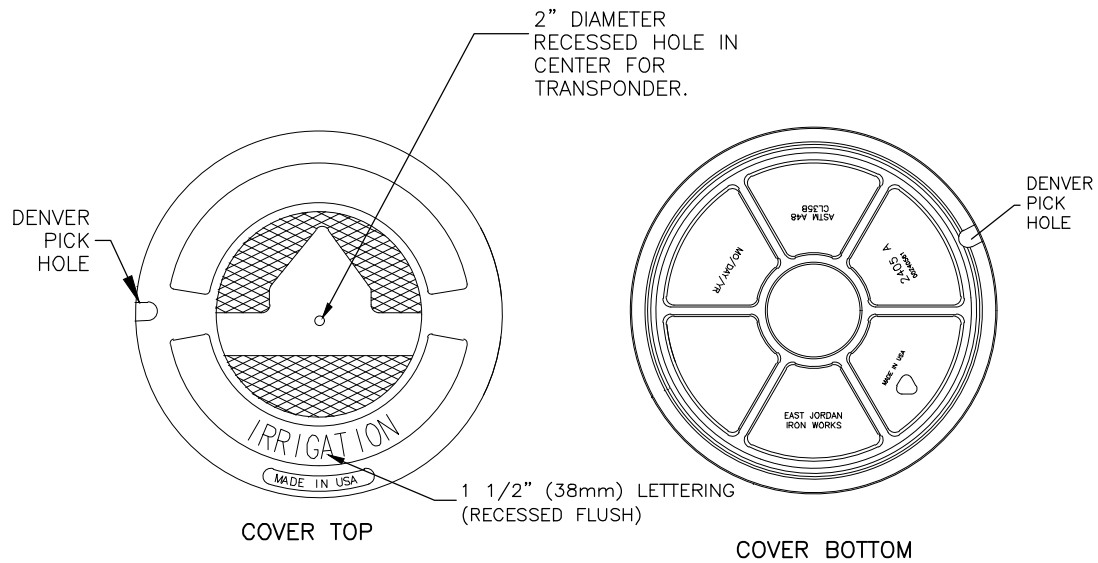
N.T.S.



REUSE IRRIGATION VAULT LID

DATE: JANUARY 2019

SHEET 400-52



THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

N.T.S.



WATER IRRIGATION VAULT LID

DATE: JANUARY 2019

SHEET 400-53

SECTION 500 – SANITARY SEWER FACILITIES

501.00 GENERAL CONDITIONS

Refer to Section 100 TITLE, SCOPE AND GENERAL CONDITIONS of these DESIGN STANDARDS AND SPECIFICATIONS for additional requirements that apply to all projects within the Town and service areas.

510.00 DESIGN CRITERIA

511.00 SCOPE

It is the intent of this “design criteria” section to provide sufficient detailed information to enable the Engineer for the Owner/Developer to correctly and efficiently design the overall sanitary sewer system for a particular development. If there is a question or a concern regarding the design of any portion of the sanitary sewer system that is not adequately answered within this chapter, the Owner/Developer or a designated representative shall contact the Town Engineer to get all issues resolved prior to design. Any deviation from these DESIGN STANDARDS AND SPECIFICATIONS must be approved in writing by the Town.

Outfall sewers, pumping stations, interceptors, and appurtenances are included under the definition of “domestic wastewater works” in the State Water Quality Control Act. Section 25-8-702 of the State Water Quality Control Act states: “No person shall commence the construction of any domestic wastewater treatment works or the enlargement of the capacity of an existing domestic wastewater treatment works, unless the site location and the design for the construction or expansion have been approved by the division (Colorado Department of Public Health and Environment, CDPHE).” Section 25-8-103 (5) of the State Water Quality Control Act states: “Domestic wastewater treatment works means a system or facility for treating, neutralizing, stabilizing, or disposing of domestic wastewater which system or facility has a designed capacity to receive more than two thousand gallons of domestic wastewater per day.” Therefore, all plans falling under this criteria shall be submitted to the CDPHE for approval prior to construction of any domestic wastewater treatment works, including wastewater treatment plants, individual sewage disposal systems, lift (pumping) stations, and certain interceptor sewers with a capacity of two-thousand (2,000) gallons per day or greater, as well as certain facilities that produce reclaimed domestic wastewater.

512.00 GENERAL

The sanitary sewer system shall be designed by a Registered Colorado Professional Engineer utilizing the most current technical standards along with good, sound engineering judgment throughout the design process. The design process includes the submittal of a utility study and construction drawings for review and approval by the Town. The following note shall be incorporated into the utility study:

“We acknowledge that the Town’s review of this study is only for general conformance with submittal requirements, current design criteria, and standard engineering principles and practices.”

512.01 Study

The study shall include, as a minimum, the following information and shall be typed and bound in an 8-1/2-inch x 11-inch report binder:

- A. Text, which addresses a minimum of project location and description, project concept, discussion of any information that would affect the Town's ability to serve the new area, and any recommendations and conclusions of the analysis.
- B. The area (in acres) which could be served by gravity by the new sewer, shown on a topographic map which delineates the basin boundaries as stated in (G) below.
- C. The estimated population densities and total population based on land use projections to be served by the new sewer.
- D. The estimated quantity and quality of any industrial wastes to be discharged to the system.
- E. Design flow rates, minimum and maximum flow velocities, minimum and maximum pipe slopes, and infiltration allowances.
- F. The impact of the additional flows on the existing sanitary sewer system at all critical points between the proposed site and the major interceptor.
- G. A utility map which includes a minimum of the following information:
 - 1. Location of all proposed and existing easements and/or right-of-ways.
 - 2. Existing and proposed sanitary sewer lines and appurtenances with sizes and slopes shown.
 - 3. Basin delineation
 - 4. All other existing and proposed utilities.
- H. All other requirements for the CDPHE approval when applicable.

513.00 DESIGN FLOW

The design flow shall include the entire area tributary to the outfall point. The following wastewater flow rates, which include infiltration, shall be used:

TABLE 500.01

User Type	Unit Wastewater Flow Rate
Residential	100 gallons/capita/day
Industrial	1,500 gallons/acre/day
Commercial	1,000 gallons/acre/day
Park/Recreation	50 gallons/acre/day
Elementary Schools	13 gallons/student/day
Jr. & Sr. High Schools	20 gallons/student/day

Maximum residential population density, household density, and land usage shall be as noted on an approved PUD and/or Plat, or as determined by the Town Superintendent.

Wastewater flow peaking factors shall be computed using the following equation:

$$PF = 3.8 / (AADF)^{0.17}$$

Where AADF = annual average daily flow, MGD.

The peaking factor shall not be less than two and one-half (2.5) or greater than five (5).

514.00 HYDRAULIC DESIGN

Sewer main shall carry the peak design flow at a maximum flow depth of fifty (50) percent of the pipe diameter.

The minimum velocity at the peak design flow rate shall be two (2) feet per second. Where actual flow shall be considerably below the design flow for several years, the Town may require that the minimum velocity be attained by suitable grades at the partial peak design flow rate. Maximum allowable velocity shall not exceed ten (10) feet per second.

Care shall be taken to design invert elevations at manholes in such a manner that the energy gradient is consistently falling in the direction of flow. In addition, when the velocity of an upstream sewer entering a manhole at peak flow is above critical velocity, the hydraulic gradient shall be computed to insure that a surcharge shall not occur at a service connection and that the energy gradient shall remain level across the manhole.

515.00 DESIGN DETAILS

515.01 Sewer Mains

Sanitary sewer mains shall be eight (8) inch diameter or larger. Service connections shall be four (4) inch diameter or larger. The following minimum grades (based on a Manning's formula; n = 0.013) shall apply:

TABLE 500.02

Sewer Diameter (Inch)	Minimum Grade (Percent)	Maximum Grade (Percent)
8	0.6	7.5
10	0.25	5.5
12	0.20	4.5
15	0.15	3.5
18	0.11	2.5
21	0.09	2.0
24	0.08	1.8
27	0.07	1.5
30	0.06	1.3
33	0.05	1.2
36	0.05	1.0
42	0.04	0.8
48	0.03	0.7

Sewer mains shall ordinarily have a minimum of six (6) feet of cover to finished ground surface. Sewer lines shall be designed to ensure a two (2) percent minimum slope from one (1) foot below the bottom of the lowest foundation to the sewer service connection.

Sewer mains shall be extended at least ten (10) feet uphill from the lowest lot corner of the uppermost lot to be served adjacent to the sewer main. Sewer mains shall terminate in a manhole. Service connections shall not be made at manholes, unless otherwise approved by the Town. All stub-outs for future extension of the sanitary sewer shall be terminated in a manhole base.

Where trunk or interceptor sewers are fifteen (15) feet or more deep, a shallow, local sewer shall be designed for house service connections, unless otherwise approved by the Town.

Sewage flows shall be directed to the Trunk Sewer having designed capacity as indicated by the Town's Master Plan. The sewer main shall be designed to carry not less than the projected peak flow rate flowing half full.

515.02 Manholes

Manholes shall be a minimum of forty-eight (48) inches diameter and shall be provided at every change in direction, grade, and connection to other sewer mains. The maximum spacing shall be four hundred (400) feet. Where two (2) or more pipes enter a manhole, the Town will approve the manhole design size. Sewer lines shall not be deflected between manholes, in line, or grade.

Manholes shall be sized accordingly: forty-eight (48) inches diameter for lines sized eight (8) inches to fifteen (15) inches in diameter; sixty (60) inches for lines sized eighteen (18) inches to twenty-one (21) inches in diameter; and seventy-two (72) inches for lines sized twenty-four (24) inches to thirty (30) inches in diameter. Special designed vaults are required for pipes greater than (>) thirty (30) inches in diameter.

Manholes that are up to ten (10) feet deep shall follow the listed sizing above. All manholes ten (10) feet or deeper shall be increased in diameter by twelve (12) inches from the outlined size above.

Where pipe slope is less than five (5) percent, the flow channel of the manhole shall have two-tenths (0.2) of a foot elevation drop from the entering pipe invert to the existing pipe invert. Where pipe slope is greater than five (5) percent, the manhole flow channel shall match pipe slope.

Chemical and gas resistant manhole interior linings shall be required on all newly constructed sewers or other manholes downstream of a discharge source that are determined by the Town to be at risk of deterioration. High levels of hydrogen sulfide (H₂S) gases and other corrosive discharges (e.g., those coming from breweries and downstream of sewer force mains) contribute to the degradation of manholes, and shall require interior lining. Manholes having pipes up to twelve (12) inches in diameter shall be lined with Raven Lining Systems. Manholes having one (1) or more pipes fifteen (15) inches in diameter or greater shall be lined with SpectraShield.

Bituminous coatings shall be required on manhole exteriors on all newly constructed sewers in order to waterproof manholes and reduce infiltration. MacWrap shall be placed on the exterior of all joints.

When design and function dictate a drop manhole, written permission shall be obtained from the Town. The design and proposed materials shall be approved by the Town Engineer.

All-weather access shall be provided to all sanitary sewer manholes or other sewer appurtenances. All-

weather access is defined as a paved road, concrete path, or crushed rock surface with width of ten (10) feet and a depth capable of supporting maintenance machinery weighing up to ten (10) tons.

Sewer manholes shall be located such that storm water will not pond or infiltrate into manhole lids. Sewers shall not be placed within detention or retention ponds.

515.03 Sewer Service Line

Each structure shall be served by a separate service line. Sizing and Capacity of the building sewer service line shall be subject to the approval of the Town, but in no event shall the diameter be less than four (4) inches. Minimum grade and slopes shall be as follows:

TABLE 500.03

Service Line Size	Slope
4"	2.00% Normal
6"	1.00%
8"	0.60%

Sanitary sewer service lines shall be located a minimum of ten (10) feet away from all water services (measured horizontally from edge of pipe to edge of pipe). All service lines shall be constructed perpendicular to the property line of the property they are going to serve and not less than five (5) feet from the side property line. Typical installations should locate the sanitary sewer service line five (5) feet downstream of the centerline of the lot.

Pressure line must be connected to a manhole prior to entering the Town's sanitary sewer line.

The Town shall not be responsible for locating sewer service lateral stub-outs for future connections.

515.04 Service Connections

No connection between the Sewer Collection System and the sewer service line of the Owner may be made except in a public street adequate to accommodate sewer facilities or in a similar place to which the Town has as a free right of access as it would have in a public street.

The applicant for sewer service shall notify the Town when the sewer service line is ready for connection to the sewer main, and the connection to said sewer main shall not be made until after inspection and approval by the Town. The connection to the sewer main shall be made in the presence of and approved by the Town Construction Inspector.

For new construction, pre-installed wye fittings shall be used for the connections. When the diameter of the sewer service is six (6) inches or larger, a manhole shall be constructed at the sewer main in place of a wye fitting. A sewer service tying into a manhole must be a minimum of six (6) inches in diameter. Sewer service lines of four (4) inches in diameter are not allowed to discharge into public manholes.

Connection to the existing sewer main shall be made as follows: 1) if the sewer main is twelve (12) inches or less in diameter, a saddle on up to eight (8) inch branches shall be installed, or 2) where the sewer main is greater than twelve (12) inches in diameter, a neat hole may be cut into the sewer main, with entry in the downstream direction at an angle of forty-five (45) degrees. The use of an approved saddle is mandatory.

Any sewer service line tying into a main line larger than eight (8) inch shall also be made in a manhole. Benches shall be constructed in manholes to accommodate sewer service flow such that the flow transitions smoothly into the flow of the main.

Wye fittings shall be provided on the sewer main for service connections at each lot or building site shown on the plans. Fittings shall be angled upward so that the upper invert of one-eighth ($\frac{1}{8}$) bend connected to the fitting shall have an elevation equal to or higher than the inside crown of the sewer main.

All sanitary sewer service line locations shall be marked on the face of the curb by wet stamp in the curb face, or neatly saw cutting a four (4) inch tall "S" symbol where services cross under the curb. Where no curb exists, an aluminum tag, green in color and one and three-quarter ($1\frac{3}{4}$) inch diameter, shall be fastened to the asphalt where the service crosses two (2) feet from the edge of pavement with a 2-inch long PK nail.

6-inch double sweep clean-outs shall be installed at no more than one hundred (100) foot intervals on all sanitary sewer services and at any significant change in direction. Refer to Section 543.04 SERVICE STUB-INS TO PROPERTY LINE of these DESIGN STANDARDS AND SPECIFICATIONS.

All excavations required for the installation of sewer service lines shall be open-trench work unless otherwise approved by the Town.

515.05 Unlawful Connections

It shall be unlawful to discharge roof drainage, foundation drainage, elevator sumps, sump pumps, surface drainage, or any other nonacceptable wastes to the sanitary sewer, which would violate any of the provisions of the Municipal Code.

516.00 SANITARY SEWER PRETREATMENT SEWER-MONITORING FACILITY

Any new building to be constructed in an industrially zoned area with a floor space greater than five thousand (5,000) square feet or with a water meter size greater than three-quarter ($\frac{3}{4}$) inch or if otherwise required by the Town shall install a sewer-monitoring facility in accordance with these DESIGN STANDARDS AND SPECIFICATIONS prior to final building inspection approval. The monitoring facility shall be situated outside of the building on the user's premises. If the industrial user's service line ties into an existing Town manhole and such manhole allows for safe sampling and isolation of the industrial user's discharge, the Town may allow said manhole to serve as the industrial user's monitoring facility. Buildings with multiple tenants will be required to have multiple sewer-monitoring facilities.

517.00 LOCATION DETAILS

Sanitary sewer lines, including manholes, shall be located a minimum of three (3) feet from the edge of gutter pans. Sanitary sewer mains installed in local or connector streets shall typically be located on the centerline of the streets, unless otherwise approved by the Town. Service connections shall not be permitted to cross an arterial street. Sanitary sewer service shall connect to the system in a public street or similar place where the Town has a free right of access and which is otherwise suitable.

Where sanitary sewer mains are installed in easements, they shall ordinarily be located in the center of the easement, provided that manholes can be located to provide reasonable access for maintenance crews.

The maximum spacing between manholes shall be 400 feet. Manholes shall not be located in areas which are subject to flooding from surface runoff.

517.01 Relation to Waterlines

Sanitary sewer lines shall be located a minimum of ten (10) feet horizontally from existing or proposed waterlines (clear separation). Where sewer lines cross waterlines, the sewer line shall have a minimum of eighteen (18) inches clear separation below the waterline. If this clearance is not feasible, the crossing shall be designed and constructed so as to protect the waterline.

When minimum clearance is not feasible, minimum protection shall consist of the installation of an impervious and structural sewer. Sewer pipe shall be encased in reinforced concrete. The encasement shall be at least six (6) inches thick around the entire pipe and shall extend a minimum distance of ten (10) feet on either side of the waterline and to a sewer pipe joint. The Contractor shall ensure that encasement concrete does not prevent deflection at the pipe joint. In all cases, suitable backfill or other structural protection shall be provided to preclude settling and/or failure of the higher pipe. When minimum clearance is not feasible, the sanitary sewer pipe may be installed in a steel casing in accordance with these DESIGN STANDARDS AND SPECIFICATIONS if approved by the Town Engineer. The Town will approve the crossing design.

518.00 UNDERDRAIN PIPE

Underdrain pipe shall be installed at locations shown on the approved plans. Underdrain pipe shall be installed for all single family residential developments and shall connect to the peripheral drain systems for house foundations. Underdrain pipe shall be installed for commercial and industrial buildings where it is recommended by the Geotechnical Engineer. The preferred underdrain outfall is via connection into either a storm sewer catch basin or a storm manhole, located three-fourths ($\frac{3}{4}$) of the pipe diameter above the flowline.

An outfall that daylight into a drainage way or other open structure must be constructed with a concrete headwall and include a hinged grate with no larger than a one (1) inch by one (1) inch mesh grid as shown in Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS.

Underdrain pipes shall be provided with clean-outs in each manhole. 6-inch clean-outs shall be installed on underdrain services at two hundred fifty (250) foot intervals and at all changes in pipe size and direction. Underdrain pipe shall be continued under manholes by use of suitable bends, other fittings, and solid, un-perforated pipe.

Underdrain pipe shall be installed with tracer wire as shown in the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS whenever the underdrain pipe alignment diverges from the sanitary sewer alignment.

519.00 GREASE, OIL, AND GRIT INTERCEPTOR DESIGN AND INSTALLATION

Oil, sand, and grease interceptors shall be provided when, in the judgment of the Town, an interceptor is necessary for the proper handling of liquid wastes containing grease or solids which may be harmful to, cause obstruction of, or interfere with the operation of the wastewater treatment facility. All interceptors shall be constructed in accordance with the latest edition of the International Plumbing Code.

All service drains from kitchen, food preparation, and dishwashing areas shall be connected to an interceptor. Fixtures that must be connected include, but are not limited to, scullery sinks, pot and pan sinks, dishwashing machines, soup kettles, and floor drains located in areas where materials containing grease may exist. Garbage disposals (garbage grinders) will also be required to be connected to an approved interceptor.

All waste shall enter the interceptor through the inlet pipe only. Toilets, urinals, and similar fixtures shall not be connected to the interceptor.

Upon prior approval by the Town, installation of an interceptor will not be required for facilities where food is served but not cooked and/or no equipment or utensils associated with preparation or service of the food are washed at the facility.

All facilities shall have a pretreatment plan in compliance with the Colorado Department of Public Health and Environment.

519.01 Grease Interceptors

Approval: The size, type, and location of each interceptor shall be approved and inspected by the Town Engineer. Except where otherwise specifically permitted, no wastes other than those requiring separation shall be discharged into any interceptor. Four (4) sets of plans, including complete mechanical and plumbing sections, shall be submitted to the Town for approval prior to construction. Such plans shall include the size, type, and location of each interceptor.

Design: All interceptors for grease and heavy solids shall be designed and located so that they are readily accessible for cleaning and shall have a water seal of not less than six (6) inches. Interceptors shall be constructed in accordance with the specifications contained in these DESIGN STANDARDS AND SPECIFICATIONS, shall be approved by the Town, and shall have a minimum of two (2) compartments with fittings designed for grease retention. There shall be at least two (2) manholes for each interceptor to provide access for cleaning and inspection of all fixtures and compartments, at a minimum of one (1) manhole per ten (10) feet of interceptor length. In the case of smaller or circular interceptors, where it is not practical to install two (2) manholes, a single manhole shall be located so as to permit entrance to the first compartment and inspection of the second. All areas of the second compartment shall be accessible for cleaning.

Location: All interceptors shall be readily accessible for inspection and servicing and shall be maintained in proper working condition. If a ladder must be used or heavy equipment moved out of the way in order for the Town Engineer to inspect or service interceptors, the interceptors will not be considered to be readily accessible. All interceptors shall be located outside of the facility served. Interceptors may not be installed in any part of a building where food is handled. **Interceptors will not be allowed in drive-through driveways or next to main entrance ways.** Location of all interceptors shall be approved by the Town Engineer and shall be shown on the approved final development plan.

Sizing Criteria: When determining the minimum size of the interceptor required, the following will be considered:

The minimum acceptable volume shall be not less than 1,190 gallons.

The size of the interceptor shall be based on the maximum number of meals served at the maximum periods of the day (either breakfast, lunch, or dinner):

Method 1: The volume of the interceptor shall be two and one-half (2½) gallons multiplied by the maximum number of meals served during the busiest period of the day.

Method 2: An alternate method of determining the size of a grease interceptor is to multiply seating capacity times a turnover constant of 1.6 times two and one-half (2½) gallons. Seating capacity can be approximated using ten (10) square feet of dining area per person (VOLUME = Seating Capacity x 1.6 x 2.5 gallons).

Method 3: When the above methods are not feasible, an appropriate volume may be determined by multiplying the total rate of flow in gallons per minute from each fixture required to be connected to the interceptor times a minimum retention time of not less than 15 minutes, the resulting volume expressed in gallons.

TYPE OF FIXTURE	RATE OF FLOW (GPM.)
Floor drain/sink	10
Restaurant kitchen sink	15
Single compartment scullery sink	20
3 compartment sinks	35
2 single compartment sinks	25
2 double compartment sinks	35
Restaurant dishwasher:	
Up to 30 gallon water capacity	15
30 to 50 gallon water capacity	25
50 to 100 gallon water capacity	40
Garbage disposal/grinder	35

Shoppette/Strip Mall Buildings: Each shoppette/strip mall shall have a common kitchen grease waste drain which is sized to collect future potential flows from fixtures that can be expected to introduce grease from food preparation and/or dishwashing into the sanitary sewer system. These fixtures shall include, but are not limited to, garbage disposals, food preparation sinks, floor sinks, dishwashers, scullery sinks, soup kettles, and other fixtures of these types.

The common kitchen grease waste drain shall be routed to the exterior building to a grease interceptor. Sanitary sewage flows will not be allowed into the kitchen grease waste drain.

The grease interceptor shall be constructed in accordance with Chapter 10 of the latest edition of the International Plumbing Code. The grease interceptor shall be vented, and access covers shall be gas tight with a minimum opening dimension of twenty four (24) inches.

Sizing criteria for the common grease interceptor will be as follows: The number of potential seats in any shoppette/strip mall shall be determined by dividing twenty-five (25) percent of the interior building square footage by the occupant load factor of fifteen (15) SF/person.

$$\frac{0.25 \times \text{Total Building Square Footage}}{15 \text{ SF}} = \text{Potential Restaurant Seating}$$

To size the common grease interceptor, the following formula will be used: Volume = # Seats x 6 (Waste Flow Rate) x 2.5 (Retention Time) x Storage Factor. The Storage Factors are as follows:

TABLE 500.04

Hours of Operation	Storage Factor
8	1
16	2
24	3

In no case will any grease interceptor for a shoppette/strip mall be less than 1,500 gallons.

Any establishment which will produce an overload on this design will be required to make any necessary corrections/alterations to assure compliance with Chapter 10 of the latest edition of *International Plumbing Code*.

519.02 Oil Separators and Sand/Grit Interceptors

At parking garages, repair garages, car-washing facilities with engine or undercarriage cleaning capability, and at warehouses and factories where oily and flammable liquid waste are produced, all oil-bearing, grease-bearing, and flammable wastes shall be discharged to a separator before emptying in the building drainage system or other point of disposal.

Parking Garage	45 gallons + 8 gallons per 10 vehicles
Repair Garage	45 gallons + 8 gallons per 100 square feet of building space
Car Washing Facility	45 gallons + 8 gallons per 100 square feet of building space
Warehouse/ Factory	45 gallons + 8 gallons per 100 square feet of building space

Commercial laundries shall be equipped with an interceptor with a wire basket or similar device (removable for cleaning) that prevents passage into the drainage system of solids one-half (1/2) inch or larger in size (e.g., string, rags, buttons, or other materials detrimental to the public sewage system).

Bottling plants shall discharge process wastes into an interceptor that shall provide for the separation of broken glass or other solids before discharging waste into the drainage system.

Maintenance: The responsibility of cleaning and maintaining the interceptor in efficient operating condition shall be the Owner's responsibility. Oil and sand interceptors shall be readily accessible and shall be inspected on a periodic basis by the Town Engineer. The Owner will make any repairs and improvements deemed necessary by the Town Engineer during the inspection, and the Owner will be responsible for all costs of such repairs and improvements.

All sand, oil, and grease interceptors must be pumped out at a maximum interval of every quarter year. Cost of pump-out shall be at Owner's expense.

The Town retains the right to inspect all interceptors during regular business hours, without prior notice, to determine whether the interceptor is operating properly and is being adequately maintained on a regular basis. Records of maintenance shall be kept on the premises. No chemical, thermal, or bacterial agents may be used to alter the contents of the interceptor without prior written approval of the Town.

520.00 GENERAL PROVISIONS

521.00 GENERAL

All sanitary sewer main construction within the Town's system and all sanitary sewer service line construction connecting to the Town's sewer mains shall comply with these DESIGN STANDARDS AND SPECIFICATIONS and the approved plans. These DESIGN STANDARDS AND SPECIFICATIONS govern new sanitary sewer service line construction and repairs to existing facilities within the Town.

522.00 PERMITS REQUIRED

A Right-of-way Permit (ROWP) shall not be issued until the Town has approved the sanitary sewer line plans.

523.00 MAINTENANCE OF TRAFFIC

When street cuts are required for sanitary sewer facilities construction, maintenance of traffic shall comply with Section 141.13 TRAFFIC CONTROL, BARRICADES, AND WARNING SIGNS of these DESIGN STANDARDS AND SPECIFICATIONS.

530.00 SANITARY SEWER MAIN CONSTRUCTION

531.00 SITE WORK AND EARTHWORK

531.01 General

Site work and earthwork shall comply with SECTION 300 SOILS AND EARTHWORK of these DESIGN STANDARDS AND SPECIFICATIONS.

531.02 Trenching, Backfilling, and Compacting

Except where otherwise approved in writing by the Town, all existing arterial and collector streets shall have pipe installed by pushing or boring. Directional boring may be approved at the discretion of the Town.

Trenching, backfilling, and compacting shall comply with Section 340.00 TRENCHING, BACKFILLING, AND COMPACTING of these DESIGN STANDARDS AND SPECIFICATIONS.

531.03 Preservation of Monuments

Refer to Section 141.00 PROTECTION OF PUBLIC, PRIVATE, AND UTILITY INTERESTS of these DESIGN STANDARDS AND SPECIFICATIONS.

532.00 MATERIALS

532.01 Sewer Pipe

Unless otherwise approved by the Town, all sewer pipe and fittings shall be polyvinyl chloride (PVC) and

shall comply with ASTM D3034 and be SDR 26 minimum thickness. All pipe and fittings shall be subject to inspection by the Town Construction Inspector. All joints shall be factory prepared compression type (elastomeric gasket joint), providing a watertight seal. Solvent cement joints shall not be used. Sewer mains and services shall be green in color.

All pipe materials to be incorporated in the construction of sanitary sewers shall conform to the requirements specified herein or as modified elsewhere in these DESIGN STANDARDS AND SPECIFICATIONS. All materials furnished shall be new and undamaged. Everything necessary to complete all installations shall be furnished and installed whether shown on the approved drawings or not, and all installations shall be completed and fully operational. Acceptance of materials or the waiving of inspections thereof shall in no way relieve the developer of the responsibility of furnishing materials meeting the requirements of these DESIGN STANDARDS AND SPECIFICATIONS.

All materials delivered to the job site shall be adequately housed and protected to ensure the preservation of their quality and fitness for the work.

For all pipe installation depths, pipe material and bedding conditions shall be determined by engineering design calculations, including pipe-soil stiffness (E') to ensure it is greater than the pressures generated by the surrounding expansive soils or bedrock. These calculations shall be submitted to the Town for approval.

Sewer pipe for force mains shall be C900 PVC DR 14. The pipe shall be green in color and clearly labeled as a force main. Warning tape above the pipe shall also be green. Isolation valves for force mains shall be plug valves and shall open left.

532.01.01 Defects

Defects in an individual pipe or in a shipment of pipe may constitute sufficient cause for rejection of the pipe. Rejected materials shall be removed from the work site within 24 hours unless otherwise permitted by the Town. The presence of any of the following defects may be cause to reject the material:

- A. Pipe length varying more than two inches from the specified length. Pipe shall not be ordered in random lengths.
- B. Pipe having a deviation from straight which exceeds the following: $(\text{Length of Pipe in Feet}) / (32) = \text{Maximum Deviation in Inches}$
- C. Porous areas on either the inside or the outside surface of a concrete pipe having an area of more than five square inches and a depth of more than one-half inch.
- D. Pipe which has been patched or repaired without written approval of the Town.
- E. Exposure of the reinforcement.
- F. Pipe damaged during shipment or construction.
- G. Any deficiencies noted in applicable ASTM Specifications

532.01.02 Certification

A manufacturer's certification that material was manufactured and tested in accordance with applicable

ASTM designations, together with a report of all test results, may be required by the Town prior to final acceptance of the work.

532.02 Underdrain Pipe

Unless otherwise approved by the Town, all underdrain pipe and fittings shall be white SDR 26 PVC and shall comply with ASTM F2648. Underdrain pipe shall be perforated in the lower quadrant at 4 and 8 o'clock and shall be wrapped with a geotextile fabric to keep soil fines from entering the pipe. All underdrain service pipe shall also be perforated and wrapped as previously noted. Where underdrain is to be constructed under sewer mains, a clean out shall be provided at each manhole for the underdrain as shown in the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS. Suitable fittings shall be provided for construction of the six (6) inch clean-outs and bends at manholes. Underdrain pipe shall be stubbed out for residential lot connection and shall be white in color, three (3) inch diameter, and shall comply with ASTM F2648.

The Underdrain shall be customer owned up to the wye connection.

532.03 Plugs

A gasketed plug, as recommended by the pipe manufacturer, shall be provided to seal the end of a wye connection or a dead-end stub. Plug locations shall be marked below ground with a wood two (2) by four (4) post and above ground with a steel T-post with green flagging.

532.04 Sanitary Sewer Wye Tapping Saddle

Wye tapping saddles shall only be used on existing sanitary sewer mains with the approval of the Town. Wye tapping saddle shall be Genco Sealtite Wye Gravity Sewer Saddle, Type E, Model 26 with two and a half (2.5) inch stainless steel band and bolts, or approved equal.

532.05 Manholes

Manhole bases shall be constructed of cast-in-place concrete. Pre-cast reinforced concrete risers (barrel sections) and tops shall comply with ASTM C478. Manholes shall be in accordance with the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS.

Manholes shall have a minimum inside diameter of four (4) feet. Manholes ten (10) feet or deeper shall have a minimum inside diameter of five (5) feet.

The top of the manhole vault shall be a minimum of twelve (12) inches and a maximum of twenty (20) inches below the finished street or ground surface elevation. Concrete extension risers or collars shall be used to bring the manhole ring and cover up to finished street or ground surface elevation. Manholes five (5) feet deep or less shall be constructed as shallow manholes and shall be in accordance with the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS. Cones shall be of the eccentric type.

Steps shall have a minimum tensile strength of 38,000 psi, minimum yield strength of 35,000 psi, and an elongation of not less than ten (10) percent in two (2) inches. Steps shall carry a load of one thousand (1,000) pounds when projected six (6) inches from the wall and fifteen hundred (1,500) pounds when projected four (4) inches from the wall without permanent deformation. Steps shall be one-half (1/2) inch diameter steel-reinforcing rods completely encapsulated in copolymer polypropylene as manufactured by M.A. Industries, Inc., or an approved equal. Steps shall be spaced in accordance with the Detail Drawings

found in these DESIGN STANDARDS AND SPECIFICATIONS. The minimum distance from the finished ground (street) surface to the first step shall be twenty-four (24) inches, and the maximum shall be thirty (30) inches.

Mortar for manholes shall be mixed in the following proportions by volume: One (1) part Portland cement; one-half (1/2) part hydrated lime; and three (3) parts sand or masonry cement. The cement, lime, and sand shall be thoroughly mixed dry and only enough water added to form a mortar of proper consistency. Mortar shall be used within one (1) hour after mixing with no retampering permitted. Mortar that has taken a partial set is prohibited from use.

532.06 Manhole Bases

The minimum slab thickness shall be six (6) inches. The minimum reinforcement shall be epoxy coated #4 reinforcing steel at eight (8) inches on center each direction. The placing, fastening, splicing, and supporting of reinforcing steel or bar mat reinforcement shall be in accordance with the approved plans, the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS, and the latest edition of “CRSI Recommended Practice for Placing Reinforcing Bars.”

532.07 Concrete

Concrete shall comply with SECTION 800 CONCRETE MIX DESIGN AND CONSTRUCTION of these DESIGN STANDARDS AND SPECIFICATIONS. Type II Portland cement shall be used, unless otherwise recommended by the Geotechnical Engineer. Concrete encasement of sewer pipe shall comply with Section 517.01 RELATION TO WATERLINES of these DESIGN STANDARDS AND SPECIFICATIONS.

532.08 Cast and Ductile Iron Fittings

All cast iron manhole rings and covers and other iron castings shall comply with ASTM A48. Fittings shall be in accordance with the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS. Ductile iron rings and covers shall comply with ISO 1083. All metal bearing surfaces between the ring and cover shall be machined or fabricated to insure good seating. Manhole lids shall be provided with a non-slip pattern in the surface that lies flush with the elevation of the ring. Lids shall be furnished with the words “SEWER” cast on top. Lids shall have Denver pick holes. They shall also provide a clear opening of minimum of twenty-four (24) inches.

532.09 Bedding Materials

Bedding materials shall comply with Section 343.01 BEDDING FOR PIPELINES AND SERVICE LINES of these DESIGN STANDARDS AND SPECIFICATIONS.

532.10 In-Place Rehabilitation of Existing Pipelines

In-place rehabilitation of existing pipelines may be by slip lining, pipe bursting, or heat activated resin lining in accordance with plans approved by a Colorado licensed Professional Engineer.

Sewer liner pipe and fittings shall be made of a polyethylene pipe compound that meets the requirements for Type III, Grade P34 polyethylene and complies with ASTM D1248 and D3350. Both resin and manufacturing plant shall be approved by the National Sanitation Foundation. Horizontal and vertical alignment tolerances shall be specified by the design engineer.

532.11 Steel Casings for Bores

All carrier pipe through casings shall comply with ASTM C900, C905, or C909. Steel casing pipe for bores shall be seamless welded steel tubing having an inside diameter of at least four (4) inches greater than the outside diameter of the bell or joint or mechanical restraint of the carrier pipe or mechanical restraint to be installed therein. The minimum wall thickness of the tubing shall be:

TABLE 500.05

Casing O.D.	Min. Wall Thickness
>24"	3/16"
27"	1/4"
30"-36"	5/16"
42"	3/8"

All carrier pipe joints shall have mechanical restraint inside the casing. Cathodic protection and casing end seals shall be specified per design engineer recommendations. Carrier pipe supports shall be glass reinforced polymer runners similar to the system shown in the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS. The spacers system shall be designed and fabricated for the specific project and application for which they are furnished. The stainless steel casing spacer system shall be from Cascade Waterworks Manufacturing Company, or approved equal.

Steel pipe may be re-used for a casing if it can be certified to meet these DESIGN STANDARDS AND SPECIFICATIONS and is approved by the Town.

533.00 INSTALLATION

533.01 General

Installation of PVC sewer main shall comply with ASTM D2321.

533.02 Alignment and Grade

Field parties, under the supervision of a Registered Professional Land Surveyor or Professional Engineer licensed to practice in the State of Colorado, shall determine alignment and grade of the pipe and the location of sanitary sewer system appurtenances. The sewer line shall be installed to the required lines and grades with appurtenances at the required locations. Record Documents of sanitary sewer system alignment, verified by a Professional Licensed Surveyor or a Professional Engineer, shall be furnished to the Town to comply with SECTION 200 ACCEPTANCE PROCEDURES of these DESIGN STANDARDS AND SPECIFICATIONS.

533.03 Protection of Existing Underground Utilities

The Contractor shall be held responsible for the protection of public improvements as stated in Section 141.00 PROTECTION OF PUBLIC, PRIVATE, AND UTILITY INTERESTS of these DESIGN STANDARDS AND SPECIFICATIONS. It shall be the Contractor's responsibility to replace all public improvements damaged at the Contractor's expense.

533.04 Underdrain Pipe

Underdrains shall be installed where shown on the approved plans and as required by Section 518.00 UNDERDRAIN PIPE of these DESIGN STANDARDS AND SPECIFICATIONS. The underdrain pipe shall be installed to a true line and grade and held in place with underdrain bedding material as shown on the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS.

533.05 Sewer Pipe Installation

Proper equipment, tools, and facilities shall be provided and used by the Contractor for safe and efficient performance of the work. All pipe and sanitary sewer appurtenances shall be carefully lowered into the trench in such a manner as to prevent damage to pipe materials and to protect coatings and linings. Under no circumstances shall pipes or fittings be dropped or dumped into the trench. Any pipes or fittings that are dropped or dumped shall be removed from the work site and shall not be used.

When buried, all ductile iron pipe fittings and appurtenances shall be protected with polyethylene wrap in accordance with the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS. Miscellaneous steel or other ferrous pipe shall be similarly protected. Refer to SECTION 200 ACCEPTANCE PROCEDURES of these DESIGN STANDARDS AND SPECIFICATIONS for the survey and record document requirements of sanitary sewer lines.

The Town Construction Inspector shall be notified at least one (1) working day (twenty-four [24] hours) in advance of when pipe is to be installed in any trench. No pipe shall be covered until a Town Construction Inspector has inspected the installation.

Sewer lines shall be constructed continuously upgrade from an existing sanitary sewer except when otherwise approved by the Town. Special care shall be taken to lay sewer pipe to exact line and grade with spigot ends pointing in the direction of flow. All foreign matter or dirt shall be removed from the interior and ends of the pipe before they are lowered into position in the trench and prior to connection. Every precaution shall be taken to prevent foreign material and trench water from entering the pipe and fittings. During construction, the Contractor shall provide and maintain adequate equipment to properly remove and dispose of all water entering the trench and any other part of the work.

Pipe shall be laid from downstream to upstream with spigot ends pointing downstream. All pipe shall be placed true to line and grade and carefully centered and with a smooth invert at the joint. The joint shall be made in a workmanlike manner and shall be watertight. Immediately before joining two lengths of pipe, the inside of the bell and the outside of the spigot end and the gasket shall be thoroughly cleaned. Caution shall be exercised to ensure that the correct type of gasket is used. A thin film of gasket lubricant shall be applied to the inside face of the gasket and the spigot end of the pipe. The spigot end of the pipe shall be placed in the bell with care to prevent the joint from contacting the ground. The joint shall be completed by pushing the pipe home with a slow steady pressure, without jerky or jolting movements. Pipe furnished without a depth mark shall be marked before assembly to ensure insertion to the full depth of the joint. The pipe shall then be properly set and brought to correct line and grade.

Cutting of pipe for inserting closure pieces shall be done in a neat and workmanlike manner without damage to the pipe or lining, leaving a smooth end at right angles to the axis of the pipe. Pipe ends shall be smooth and beveled with a file or other tools according to the pipe manufacturer's recommendations.

Extra care should be used in handling PVC pipe during cold weather due to the reduced flexibility and impact resistance as temperatures approach and drop below freezing. PVC pipe to be stored outside shall be covered with an opaque material such as canvas. Clear plastic sheets shall not be used to cover the

pipe. Air circulation shall be provided under the covering. Any over-exposed pipe, as determined by the Town, will not be permitted for installation.

No pipe or appurtenant structure shall be installed upon a foundation in which frost has penetrated or at any time when the Town deems there is a danger of ice formation or frost penetrations at the bottom of the excavation. No pipe or appurtenant structure shall be installed unless backfilling can be completed before the formation of ice and frost.

Sewer pipe shall be secured in place by installation of bedding material tamped under and along it up to a level of twelve (12) inches over the top of the pipe to comply with Section 343.01 BEDDING FOR PIPELINES AND SERVICE LINES of these DESIGN STANDARDS AND SPECIFICATIONS. Backfill material shall be installed and compacted to comply with Section 344.00 BACKFILL FOR STRUCTURES IN THE RIGHT OF WAY of these DESIGN STANDARDS AND SPECIFICATIONS.

All sewers shall be kept thoroughly clean and free of gravel, dirt, and debris. The Contractor shall flush the sewer main as the work progresses, by means that are in accordance with good practice, to insure that all foreign materials are removed from the interior of the sewer main. Whenever work ceases for any reason, the unfinished end of the pipe shall be securely closed with a temporary tight-fitting plug.

At no time shall there be more than three hundred (300) feet of trench open at a time on the project.

533.06 Connections to Existing Manholes

Modifications to existing manholes shall not jeopardize the structural integrity. Sewer pipe connections to existing manholes, where there is no pipe stubbed out, shall be made in accordance with the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS. The Contractor shall core drill as small an opening in the existing manhole as necessary to insert the new sewer pipe. The existing concrete flow channel shall be chipped to the cross-section of the new pipe in order to form a smooth continuous flow channel similar to what would be formed in a new concrete base. Non-shrink grout shall be used to finish the new channel and invert and to seal the new sewer line so the junction is watertight. The Contractor shall protect and repair all damage to the lining of the manhole. A vacuum test shall be completed after the connection is completed.

533.07 Construction of Manholes and Clean-outs

Manholes shall be constructed in accordance with the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS. Concrete bases shall extend at least eight (8) inches below the bottom of the pipe and at least two (2) inches over the top of the pipe. The concrete manhole bench shall slope upward at least two (2) inches per foot from the top of the pipe. Epoxy coated reinforcement shall be required in all manhole bases in accordance with these DESIGN STANDARDS AND SPECIFICATIONS. A bell section of pipe shall be installed five (5) feet outside the manhole on each leg of the flow in accordance with these DESIGN STANDARDS AND SPECIFICATIONS.

Pipes connecting to cast-in-place manhole bases shall have a water stop in accordance with the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS. A water stop gasket shall also be used for new connections to existing manholes.

The manhole flow channel shall be made of concrete and shall conform exactly to the lower half of the pipe it connects. Changes in flow direction shall be constructed with as large a radius of curvature as possible. Flow channels shall be finished and left smooth and clean.

Pre-cast barrel sections shall not be placed on the base until after it has reached seventy-five (75) percent of concrete design strength to provide support without damage. Asphaltic mastic (Ram-Neck) shall be applied between each precast-section bearing seat. All lifting holes and other imperfections in the interior manhole wall shall be filled with cement mortar. Manhole barrel joints shall be sealed with a double bead of asphaltic mastic and joint tape on the outside. Adjustment rings shall be sealed with non-shrink grout.

All sewer clean-outs that are not contained in manholes shall be provided with an approved cleanout box and a “sewer” lid in accordance with these DESIGN STANDARDS AND SPECIFICATIONS.

533.08 Manhole Grouting Treatment

The horizontal joints between precast manhole sections shall be plastered and troweled smooth, inside and out, with cement mortar. The mortar shall be not less than five-eighths ($\frac{5}{8}$) inch in thickness over the joint and shall extend at least four (4) inches on either side of the joint.

All smooth surface pipes (e.g., PVC) shall have a manhole water-stop gasket, to be furnished by the Contractor, firmly attached to the pipe prior to grouting into the manhole. The opening in the manhole wall where a pipe enters or leaves shall be sealed and patched in a neat workmanlike manner, both inside and out, with cement mortar. All lifting holes and other imperfections in the interior manhole wall shall be filled with cement mortar.

533.09 Adjustment Rings

Precast concrete adjustment rings shall be used on top of the cone to support and adjust the manhole frame to the required final grade. The maximum depth of the adjustment rings shall be six (6) inches, and the maximum depth from top of cone to final grade shall be twenty (20) inches. Steel shims and full bearing surface non-shrink grout shall be used between each adjustment ring, between the top of cone and adjustment ring, and between top adjustment ring and the ring and cover. Steel shims shall be equally spaced in a minimum of six (6) locations around the opening to support the adjustment rings at the appropriate grade and cross slope. The concrete surface shall be thoroughly cleaned and wetted prior to placing non-shrink grout. The inside and outside of the chimney shall be smoothed in a neat workmanlike manner using non-shrink grout.

The top elevation of the manhole shall be adjusted to match final street grade. If manholes are located in open fields, they shall be left at least eighteen (18) inches above grade a locking ring and cover shall be installed, and a smoothed and neat workmanlike tapered concrete collar placed around the manhole frame to the cone section or as directed by the Town. In all areas outside the pavement, manholes shall be properly marked by a steel marker post in accordance with these DESIGN STANDARDS AND SPECIFICATIONS.

533.10 In-Place Rehabilitation of Existing Pipelines

Refer to Section 532.10 IN-PLACE REHABILITATION OF EXISTING PIPELINES of these DESIGN STANDARDS AND SPECIFICATIONS.

533.11 Steel Casing and Carrier Pipe Installation

Tunneling and boring operation methods shall be approved by the Town. Excavation and casing installation shall be performed simultaneously. At no time shall the advancing edge of the casing trail the excavation by more than twelve (12) inches.

The casing pipe shall be installed by boring or jacking upgrade from the outlet end. When excavation exceeds the advancing edge of the casing by more than twelve (12) inches or sloughing of the hanging wall occurs such that voids are created along or above the casing, external grouting of the casing shall be required. Grouting shall be accomplished by pumping at between five (5) and ten (10) psi equal parts of Portland Cement and mortar sand mixed with sufficient water to provide a slump of less than two (2) inches through grout holes in the casing until all voids are filled. Grout holes, one (1) inch to two (2) inches in diameter, shall be provided or drilled in the casing on four (4) foot centers along the pipe arch and at eight (8) foot centers along each spring line. As grouting advances, each of the completed grout holes shall be plugged to a watertight condition.

Following installation of carrier pipe in casing pipe, tracer wire shall be taped to the main and welded to each end of the casing. Uninterrupted continuity shall be tested in accordance with the requirements of Section 432.19 TRACER WIRE AND WARNING TAPE of these DESIGN STANDARDS AND SPECIFICATIONS.

533.12 Wyes for Service Connections

All wyes and fittings shall be SDR 26. Wyes shall be angled upwards so that the flow line of a forty-five (45) degree bend connected to the fitting shall have an elevation equal to or higher than the inside crown of the sewer main. Watertight plugs shall be installed in each service connection stub. Record Document measurements shall be made to reference the wye to the nearest downstream manhole before backfill. Record Documents shall comply with SECTION 200 ACCEPTANCE PROCEDURES of these DESIGN STANDARDS AND SPECIFICATIONS.

The Customer for a service connection shall notify the Town when the service line is ready for connection to the main. The connection to the Main shall not be made until after the Town's inspection and approval of the service line. The actual connection to the main shall be made in the presence of the Town Construction Inspector.

534.00 TESTING AND INSPECTION

Refer to Section 153.00 INSPECTIONS of these DESIGN STANDARDS AND SPECIFICATIONS.

Adequate inspections assure compliance to the Town requirements and are the basis for the Town's recommendation that said improvements be accepted for maintenance and for release of performance guarantees. It is the responsibility of the Contractor to contact the Town Construction Inspector a minimum of two (2) full working day (forty-eight [48] hours) in advance of the required inspections. Required inspections shall include the following:

- A. Stockpiled Materials – Verify that materials meet DESIGN STANDARDS AND SPECIFICATIONS and approved submittals, including but not limited to bedding material, pipe, fittings, concrete mix designs, reinforcing steel, seals, valves, valve boxes.
- B. Excavation – Verify proper trench depths, shoring, spoil pile location, dewatering, and location and protection of existing utilities.
- C. Installation – Verify proper bedding depth, alignment and grade, clean pipe and lubricants. Verify “slicing in” of bedding at haunches.
- D. Backfill and Compaction – Verify proper methods of backfill and compaction, depths of

lifts, uniform moisture control, backfill material free of large rock and organic or frozen material, snow, ice, water, and proper compaction effort and passing tests. Verify that sewer force main has warning tape. Verify that tracer wire has been installed on all carrier pipe contained in a casing and that it has a passing continuity test.

- E. Testing – Verify that testing methods comply with these DESIGN STANDARDS AND SPECIFICATIONS. The testing procedures are intended to determine if the sewer main meets the Town’s minimum quality standards. Alternative procedures meeting or exceeding the intent of these procedures, as determined by the Town, are acceptable. In any case, however, alternative testing procedures must be included in the design plans and specifications. All testing shall take place in the field and shall be conducted on the installed product.

Verify that the Town Construction Inspector has witnessed all flushing, video inspection, lamp test, low pressure air tests of pipe, vacuum testing of manholes, and deflection testing. Mandrel testing for flexible pipe must be witnessed by the Town Construction Inspector. Mandrel testing shall be performed by a certified third party.

Prior to Construction Acceptance into Warranty, the Contractor shall conduct tests for water-tightness. Tests shall be completed under the observation of the Town Construction Inspector. Low pressure air testing of the sewer lines (including services) shall be used. Vacuum testing of all manholes shall be required by the Town. The Contractor shall provide all equipment and personnel necessary to perform the required tests. The Town Construction Inspector shall record times and pressure and vacuum readings during the test period. A test section shall not be any longer than the length of pipe between adjacent manholes.

The Town may require that the first two (2) manholes, including the main between them, of all sewer projects be tested before further construction. This is to permit initial observation of the quality of construction and workmanship. The Town may require additional testing during the course of construction if infiltration appears to be excessive or the quality of workmanship is questionable.

- F. Construction Acceptance into Warranty – Refer to SECTION 200 ACCEPTANCE PROCEDURES of these DESIGN STANDARDS AND SPECIFICATIONS. General items include:

1. All temporary structures, debris, mud, and waste materials shall be removed from public property.
2. All relative testing certifications and documentation shall be submitted to the Town, including all compaction tests. Copies of originals are acceptable.
3. All sanitary sewer service locations shall be marked by saw cutting an “X” or “S” into the face of the curb where the service extends into the property.
4. All sanitary sewer manholes are at construction grade, clean, and grouted with ladders straight. Verify that underdrain clean-outs are clear and capped and that all sanitary sewer lines have been jetted.

Prior to requesting a Construction Acceptance into Warranty inspection, the Contractor shall clean sanitary sewer mains and shall have the lines inspected with video equipment. A copy of the videotape and written report shall be submitted to the Town for review. Video shall also include an audio description of pipe and manhole deficiencies and

camera location during the inspection. Any sections that contain debris or obstructions shall be cleaned and re-videtaped. Video shall be continuous from manhole to manhole, and all notations shall correspond to the approved construction plans. If after visual inspection of the sanitary sewer lines the Town suspects that there is a problem, alignment and/or deflection tests may be required at the Contractor's expense.

G. Final Acceptance/Release from Warranty – Refer to Section 212.00 FINAL ACCEPTANCE AND RELEASE FROM WARRANTY BY THE TOWN of these DESIGN STANDARDS AND SPECIFICATIONS.

1. Verify that all temporary structures, debris, mud, and waste materials are removed from public property.
2. Verify that all sanitary sewer manholes are clean.

Prior to Construction Acceptance into Warranty, the Contractor shall jet rod the sewer lines, and a video inspection and written log shall be performed, recorded, and submitted to the Town. The Town Construction Inspector shall review the recorded video and log for inadequacies in the system. If inadequacies are noted, the Contractor shall make repairs deemed necessary by the Town Construction Inspector.

534.01 Visual Examination

The Town Construction Inspector shall visually check each manhole, both exterior and interior, for flaws, cracks, holes, or other inadequacies which might affect the operation or watertight integrity of the manhole. Should any inadequacies be found, the Contractor shall make any repairs deemed necessary by the Town Construction Inspector.

534.02 Leakage Testing

The sewer main and connections shall not leak in excess of the following rate for a twenty-four (24) hour test period:

TABLE 500.06 MAXIMUM ALLOWABLE SEWER LEAKAGE

Pipe Size (inches)	Leakage (gal/foot/24 hour)
18	0.68
15	0.57
12	0.45
10	0.38
8	0.30
6	0.23

Each reach of sewer main between manholes shall be tested individually. Any individual reach that leaks in excess of the amount allowed shall be considered as failing and shall be repaired and retested.

534.03 Vacuum Testing Manholes

Leakage Testing may be used instead of the vacuum testing if approved by the Town. Manholes shall be tested before the ring and cover and grade adjustment rings have been installed. All pipes entering the

manhole shall be plugged and braced, and a vacuum of ten (10) inches of mercury shall be drawn. The vacuum pump shall be turned off and the time monitored as the vacuum drops one (1) inch. The vacuum shall not drop more than one (1) inch for the duration of the time indicated in the following table:

TABLE 500.07 VACUUM TEST DURATION FOR DIAMETER OF MANHOLE

Depth (feet) (vertical length of manhole)	Time (sec)		
	48-inch Diameter	60-inch Diameter	72-inch Diameter
8	20	26	33
10	25	33	41
12	30	39	49
14	35	46	57
16	40	52	67
18	45	59	73
20	50	65	81
22	55	72	89
24	59	78	97
26	64	85	105
28	69	91	113
30	74	98	121

Manholes that fail the vacuum test shall be replaced or shall have a second chemical and gas resistant manhole interior lining applied, per the Town’s instructions prior to being retested. Lining material shall be in accordance with these DESIGN STANDARDS AND SPECIFICATIONS.

534.04 Deflection Testing Pipe

Alignment and grade shall be checked. A light will be flashed between manholes, or if the manholes have not as yet been constructed, between the locations of the manholes, by means of a flashlight or by reflecting sunlight with a mirror. If the illuminated interior of the sewer main shows poor alignment, displaced pipe, earth, or other debris in the pipe, or any other kinds of defects, as determined by the Town Construction Inspector, these defects shall be remedied by the Contractor. The pipe shall have 100% open/ visibility. The test will be repeated following completion of backfilling and any poor alignment, displaced pipe, or other defect, determined by the Town Construction Inspector, shall be corrected at the Contractor’s expense.

All PVC sewer mains shall be tested for vertical deflection after placement and compaction of backfill prior to construction continuing. Method of testing shall be by deflectometer of the rigid GO/No-GO type device or an alternative method permitted by the Town.

Testing by the described deflectometer shall be completed a second time no earlier than 30 days and no later than 45 days after backfill over the pipe has been placed and compacted. The second test may be waived by the Town.

Maximum allowable vertical deflection shall be five (5) percent of the pipe diameter. Any and all pipe with vertical deflection greater than the allowable shall be excavated, removed from the pipeline, replaced, backfilled, and compacted and retested until the testing requirements are met.

Pipe Laying: No deflection in the joints shall be allowed. All pipe shall be fully supported by the full length of pipe barrel without support by the bell mounding.

534.05 Low-Pressure Air Testing

The following criteria and procedure shall be utilized for low-pressure testing, unless otherwise approved by the Town Construction Inspector.

Plug Restraint: It is important and essential that all plugs be installed and braced in such a way that blowouts are prevented. It is recommended that every plug be positively braced and that no one be allowed in the manhole adjoining a sewer main being tested so long as pressure is maintained in the sewer main.

Relief Valve: All pressurizing equipment used for low-pressure air testing shall include a regulator or relief valve set no higher than nine (9) psig to avoid over-pressurizing and displacing temporary or permanent plugs. As an added safety precaution, the pressure in the test section should be continuously monitored to make certain that it does not at any time exceed nine (9) psig.

Plug Design: Either mechanical or pneumatic plugs may be used. All plugs shall be designed to resist internal testing pressures without the aid of external bracing or blocking. However, the Contractor should internally restrain or externally brace the plugs to the manhole wall as an added safety precaution throughout the test.

Singular Control Panel: To facilitate test verification by the Town Construction Inspector, all air used shall pass through a single, above ground control panel.

Equipment Controls: The above ground air control equipment shall include a shut-off valve, pressure regulating valve, pressure relief valve, input pressure gauge, and a continuous monitoring pressure gauge having a pressure range from zero (0) to ten (10) psi (max), marked with one-half (½) pound increments. The continuous monitoring gauge shall be no less than four (4) inches in diameter with minimum divisions of one-tenth (0.10) psi and an accuracy of +/- 0.04 psi.

Separate Hoses: Two separate hoses shall be used to connect (1) the control panel to the sealed sewer main for introducing low-pressure air and (2) a separate hose connection for constant monitoring of air pressure build-up in the sewer main. This requirement greatly diminishes any chances for over-pressurizing the sewer main.

Pneumatic Plugs: If pneumatic plugs are utilized, a separate hose shall also be required to inflate the pneumatic plugs from the above ground control panel.

Laterals, Stubs, and Fittings: During sewer construction, all service laterals, stubs, and fittings in the sewer main test section shall be properly capped or plugged so as not to allow for air loss that could cause an erroneous air test result. It may be necessary and is always advisable to restrain gasketed caps, plugs, or short pipe lengths with bracing stakes, clamps, and tie-rods, or wire harnesses over the pipe bells.

Plug Installation and Testing: After manholes have been tested for alignment and grade, and a manhole-to-manhole reach of sewer main has been backfilled to final grade and prepared for testing, the plugs shall be placed in the sewer main at both manholes and secured.

It is advisable to seal test all plugs before use. Seal testing may be accomplished by laying one length of sewer main on the ground and sealing it at both ends with the plugs to be checked. The sealed sewer main should be pressurized to nine (9) psig. The plugs shall hold against this pressure without bracing and without any movement of the plugs out of the sewer main. No persons shall be allowed in the alignment

of the sewer main during plug testing. The upstream end of the sewer main shall be plugged first to prevent any upstream water from collecting in the test sewer main.

Line Pressurization: Low pressure air shall be slowly introduced into the sealed sewer main until the internal air pressure reaches four (4.0) psig.

Pressure Stabilization: After a constant pressure of four (4.0) psig is reached, the air supply shall be throttled to maintain that internal pressure for at least two (2) minutes. This time permits the temperature of the entering air to equalize with the temperature of the sewer main wall.

Timing Pressure Loss: When temperatures have been equalized and the pressure stabilized at four (4.0) psig, the air hose from the control panel to the air supply shall be shut off or disconnected. The continuous monitoring pressure gauge shall then be observed while the pressure is decreased to no less than three and a half (3.5) psig. The timing pressure loss test shall then commence at a pressure reading of three and a half (3.5) psig, or any convenient observed pressure reading between three and a half (3.5) psig and four (4.0) psig (except as adjusted for groundwater as follows).

Air Pressure Adjustment: An air pressure correction, which must be added to the three and a half (3.5) psig normal test starting pressure, shall be calculated by dividing the average vertical height (in feet) of groundwater above the invert of the sewer main to be tested by 2.31. The result gives the air pressure correction in pounds per square inch to be added. (For example, if the average vertical height of groundwater above the pipe invert is 2.8 feet, the additional air pressure above the pipe invert is 2.8 divided by 2.31 or 1.2 psig. This would require a minimum starting pressure of 3.5 plus 1.2 or 4.7 psig.) The allowable pressure drop of one (1.0) psig and the timing in Table 500.08 are not affected and shall remain the same. However, in no case should the starting test pressure exceed nine (9.0) psig.

Determination of Line Acceptance: If the time shown in the Vacuum Test for the designated sewer main size and length elapses before the air pressure drops one (1.0) psig, then the section undergoing the test shall have passed.

TABLE 500.08 SPECIFICATION TIME REQUIRED FOR A 1.0 PSIG PRESSURE DROP FOR SIZE AND LENGTH OF PIPE INDICATED FOR Q = 0.0015

Pipe Diameter (inch)	Min Time (min:sec)	Length for Min Time (ft)	Time for Longer Length (sec)	Specification Time for Length (L) shown (min:sec)								
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft	
4	3:46	597	0.380 L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	0.854 L	5:40	5:40	5:40	5:40	5:40	5:40	5:40	5:42	5:42
8	7:34	298	1.520 L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24	
10	9:26	239	2.374 L	9:26	9:26	9:26	9:53	11:54	13:51	15:49	17:48	
12	11:20	199	3.418 L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38	
15	14:10	159	5.342 L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04	
18	17:00	133	7.692 L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41	

534.06 Video Inspection

Following completion of sewer line work, the Contractor shall perform and supply the Town with a copy of the PACP video inspection. Video inspections shall be performed by a PACP certified inspector that is approved by the Town and use an approved PACP scoring version.

Prior to performing the video inspection, the sewer improvements must be complete, accessible, and cleaned using pressurized water sufficient to allow for a detailed inspection. The Town will not accept inspections for lines that have not been cleaned.

Following video inspections and any necessary repairs that the Contractor may have identified, the Town will review video inspections. If video inspections are determined to be acceptable by the Town, the work will be eligible for acceptance.

Prior to expiration of the Contractor's two- (2-) year warranty, the Contractor shall perform a follow-up video inspection of the sewer system. Any defects found during the Contractor's warranty video inspection shall be corrected by the Contractor.

534.07 Pipe Cleaning Prior to Inspections

Sewer cleaning shall be by high-pressure jet cleaning to remove foreign materials from lines. The jet cleaning machine shall be capable of removing stones, grit, grease, sludge, and other debris from the sanitary lines by the scouring action of high pressure water. Dumping of large volumes of water from hydrants or tankers into the sanitary sewer system is expressly prohibited.

The jet cleaning machine must be capable of providing a continuous flow of water at a minimum of forty (40) GPM and two thousand (2,000) psi. At a minimum, the cleaner shall use a ninety (90) percent interior pipe diameter proofer skid at all times. Cleaning shall begin at the upper end of the system and proceed downstream to the outfall. The hose should be brought back at a proper yet steady speed for appropriate and satisfactory cleaning. If necessary, repeat the process to remove all debris. All debris removed from the cleaning process shall be captured and disposed of as approved by the Town such that it does not enter the downstream portion of the collection system.

Sewers found to be improperly cleaned shall be cleaned and re-inspected at the Contractor's expense.

535.00 CONNECTION TO THE TOWN'S SEWER SYSTEM

Flow of any kind into the existing sewer system shall not be allowed until the sewer has been satisfactorily completed and approved for use by the Town.

540.00 SANITARY SEWER SERVICE LINE CONSTRUCTION

541.00 TRENCHING, BACKFILLING, AND COMPACTING

Trenching, backfilling, and compacting shall be completed and shall comply with Section 340.00 TRENCHING, BACKFILLING, AND COMPACTING of these DESIGN STANDARDS AND SPECIFICATIONS.

542.00 MATERIALS

542.01 Polyvinyl Chloride (PVC)

Pipe and fittings shall comply with ASTM D3034. All sanitary sewer pipe shall be SDR 26. All joints shall be factory prepared compression type (elastomeric gasket joint), providing a watertight seal. A compression stop, as recommended by the pipe joint manufacturer, shall be provided to seal the end joint

of dead-end stubs.

543.00 INSTALLATION

543.01 General

Installation of PVC sanitary sewer services shall comply with ASTM D2321 and to the pipe manufacturer's installation instructions.

543.02 Location and Alignment of Service

At no time shall the service line be closer than three (3) feet to a side property line, and no service line may be constructed through or in front of an adjoining property. Sewer service lines shall typically be located a minimum of ten (10) feet to the low side of the water service or as shown on the approved plans. Sewer service lines shall be laid with a constant and straight line with no bends.

Where parallel to a structural wall, the service line shall be at least five (5) feet from the wall. Penetrations through structures shall be at right angles and shall provide flexibility such that the service line will not be damaged by settlement of the structures.

Clean-outs shall be installed to comply with the International Residential Code (IRC), the International Plumbing Code (IPC), and as described herein. Unless specific approval is obtained in writing from the Town, all sanitary sewer service lines shall have a minimum depth of four (4) feet.

543.03 Crossing Sidewalk or Curb (Existing or Proposed)

In no instance shall a trench extend beneath an existing sidewalk or curb. The pipe shall be bored, jacked, or tunneled through the earth under the sidewalk or curb. If the service line is installed prior to the placement of the sidewalk or curb, the trench shall be backfilled in accordance with Section 344.00 BACKFILL FOR STRUCTURES IN THE RIGHT OF WAY of these DESIGN STANDARDS AND SPECIFICATIONS.

543.04 Service Stub-ins to Property Line

Sanitary sewer service line locations shall be marked on the curb with an "X" or "S." All service stub-ins shall be stubbed into the lots, ten (10) feet minimum beyond the R.O.W. or utility easement. All service stub-ins shall be plugged and marked in accordance with Section 532.03 PLUGS of these DESIGN STANDARDS AND SPECIFICATIONS.

The Town shall be responsible for maintaining the portion of the service line as shown in the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS.

543.05 Tapping the Main

Wyes shall be installed on all new main line for connections. Where wyes have not been installed in the sewer main, sanitary sewer tapping saddles shall be used. Genco Sealite Wye Gravity Sewer Saddle, Type E, Model 26 with two and a half (2.5) inch stainless steel band and bolts, or approved equal shall be used.

543.06 Pipe Installation

In cases where the sewer service cannot be installed a minimum of ten (10) feet horizontally from a water service or it is deemed required for structural reasons, concrete encasement of the sewer line shall be required. Installation of sanitary sewer lines shall comply with Section 533.00 INSTALLATION of these DESIGN STANDARDS AND SPECIFICATIONS.

In cases where the water and sewer service lines shall cross one another, installation shall comply with Section 517.01 RELATION TO WATERLINES of these DESIGN STANDARDS AND SPECIFICATIONS. Ferncos shall not be allowed.

543.07 Industrial

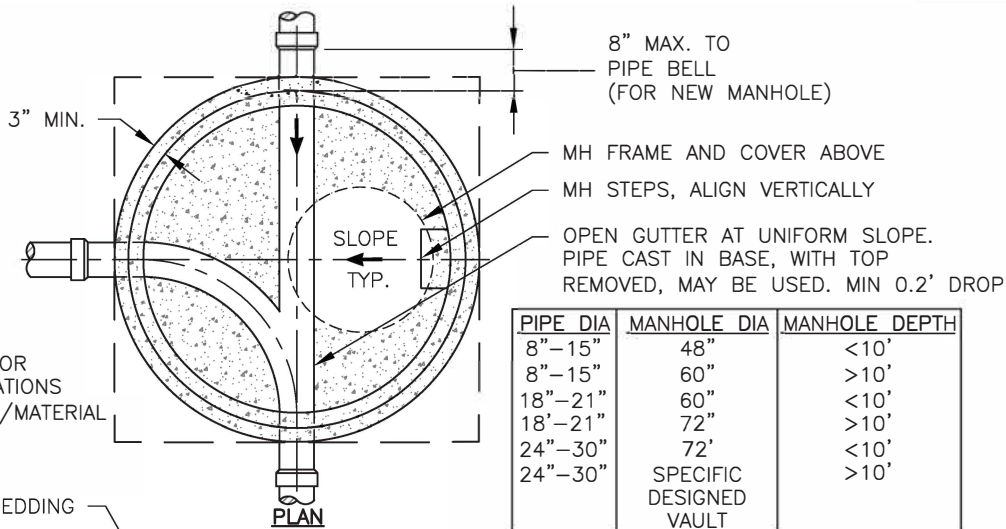
All buildings (warehouses, etc.) constructed as a shell with the intention of only being used for subdivided suites for commercial purposes shall be required to install service connections extending a minimum of six (6) feet outside of the building with a clean-out for each set of proposed bathrooms or suites. All commercial and industrial facilities shall have a clean out on the outside of the building, located a minimum of three (3) feet from the building, on the service connection.

543.08 Other Requirements

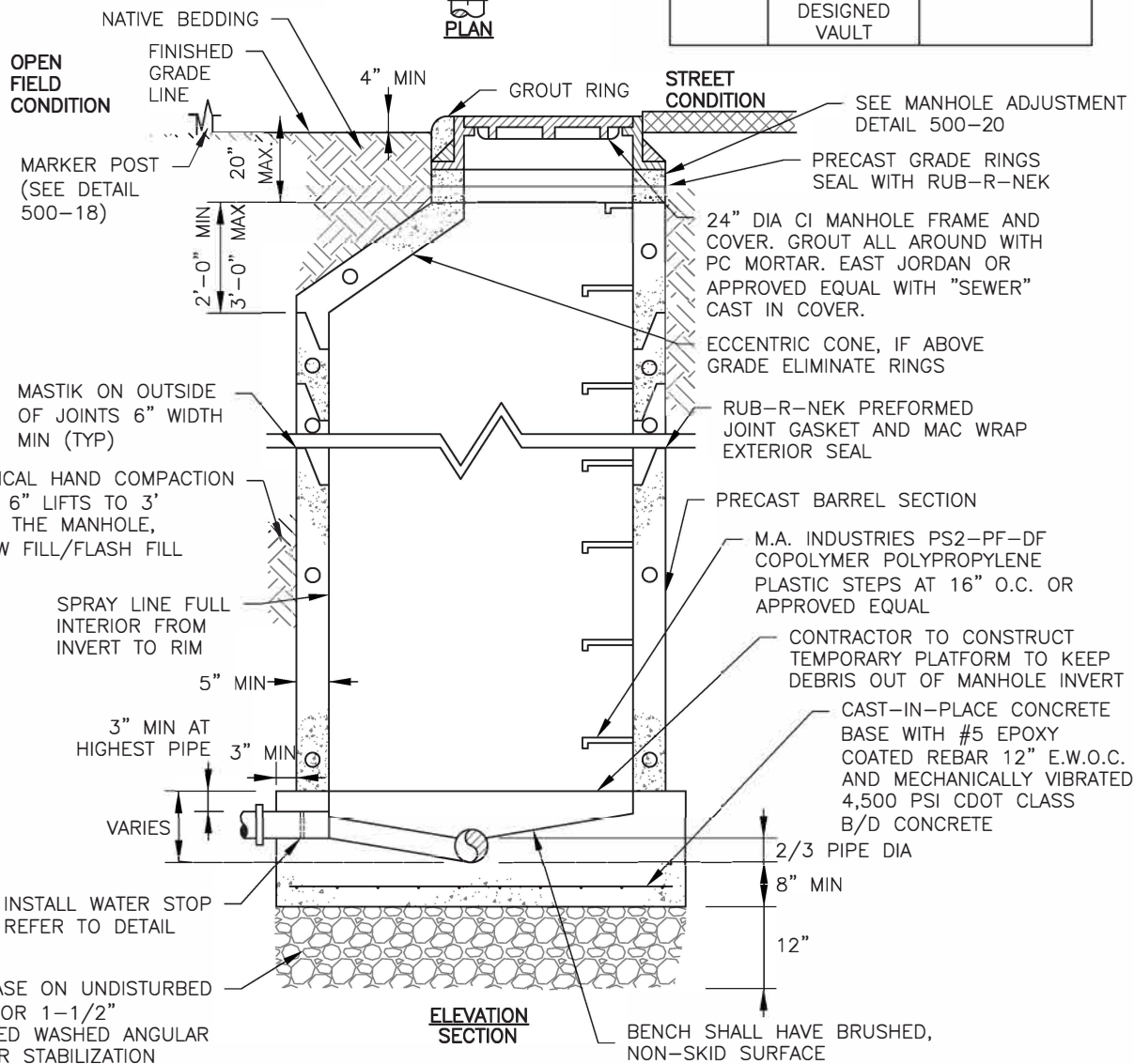
Rainwater leaders, roof drains, surface drains, or groundwater drains shall not be connected to the sanitary sewer system. Each sanitary sewer service system shall be separate from the drainage system. Grease, oil, and grit traps shall be designed and installed where required by the provisions of the IRC.

550.00 RESTORATION AND CLEAN UP

Restoration and cleanup shall be completed and shall comply with Section 360.00 RESTORATION AND CLEAN UP of these DESIGN STANDARDS AND SPECIFICATIONS.



*SEE TOWN OF SUPERIOR STANDARDS AND SPECIFICATIONS SECTION 343.00 FOR BEDDING/MATERIAL



THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

N.T.S.



Gateway to Boulder Valley®

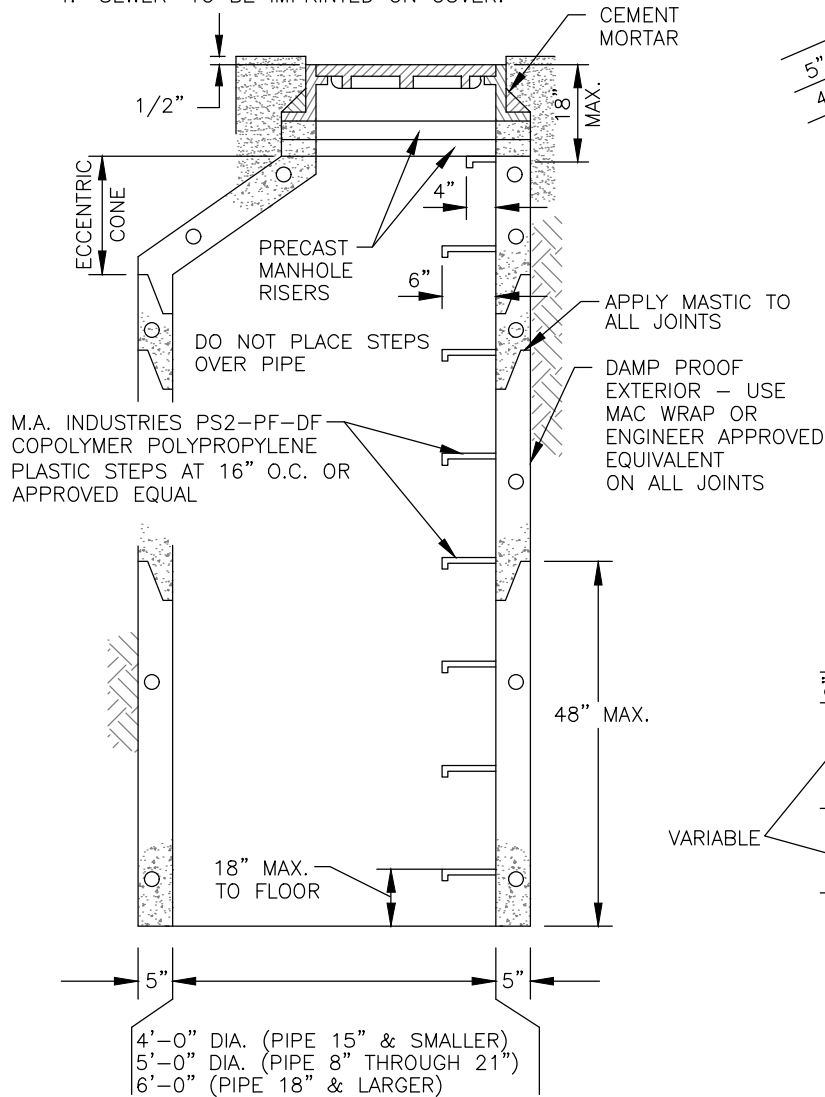
STANDARD PRECAST CONCRETE MANHOLE WITH CAST IN PLACE MANHOLE BASE

DATE: JANUARY 2019

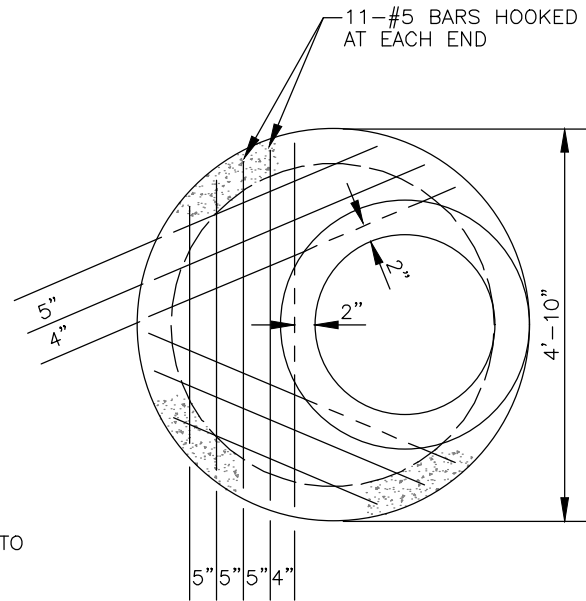
SHEET 500-1

NOTES:

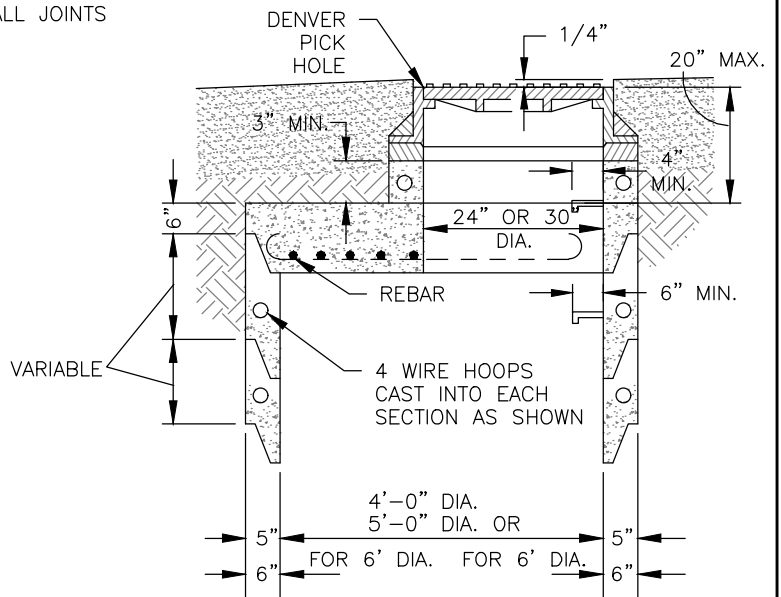
1. ALL JOINTS TO BE SET IN FLEXIBLE BUTYL RESIN SEALING COMPOUND AND PLASTERED WITH MORTAR 5/8" THICK AND EXTENDING 4" EACH SIDE OF JOINT INSIDE AND OUTSIDE.
2. MORTAR ON RISER RINGS IS ACCEPTABLE.
3. MANHOLES INSTALLED OUTSIDE OF STREET RIGHT-OF-WAY SHALL HAVE LOCKING COVERS.
4. "SEWER" TO BE IMPRINTED ON COVER.



TYPICAL MANHOLE SECTION WITH ECCENTRIC CONE



PLAN



ALTERNATE FLAT TOP

*SEE TOWN OF SUPERIOR STANDARDS AND SPECIFICATIONS SECTION 343.00 FOR BEDDING/MATERIAL

BACKFILL TO BE HAND COMPACTED WITHIN 4'-0" OF MANHOLE

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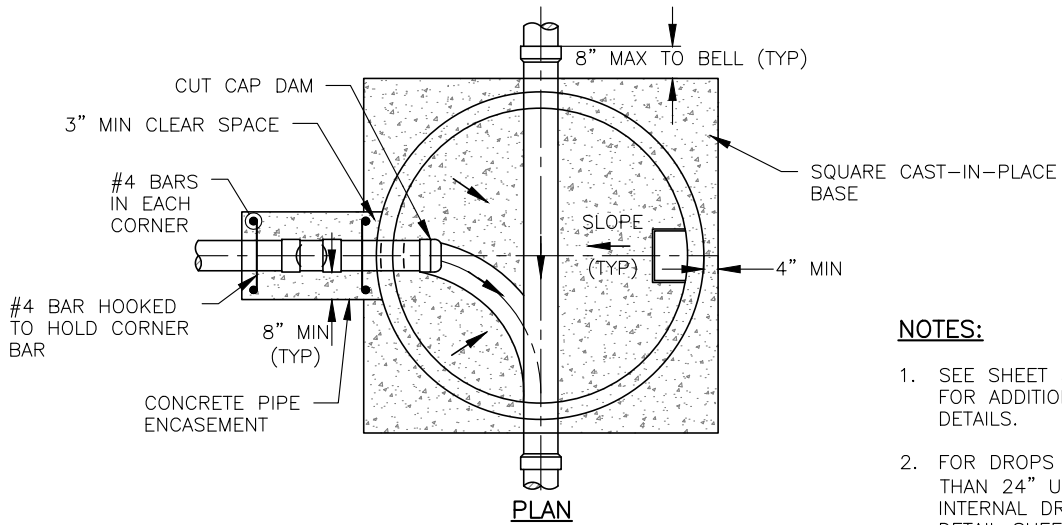
N.T.S.



MANHOLE BARRELS AND ALTERNATE TOPS

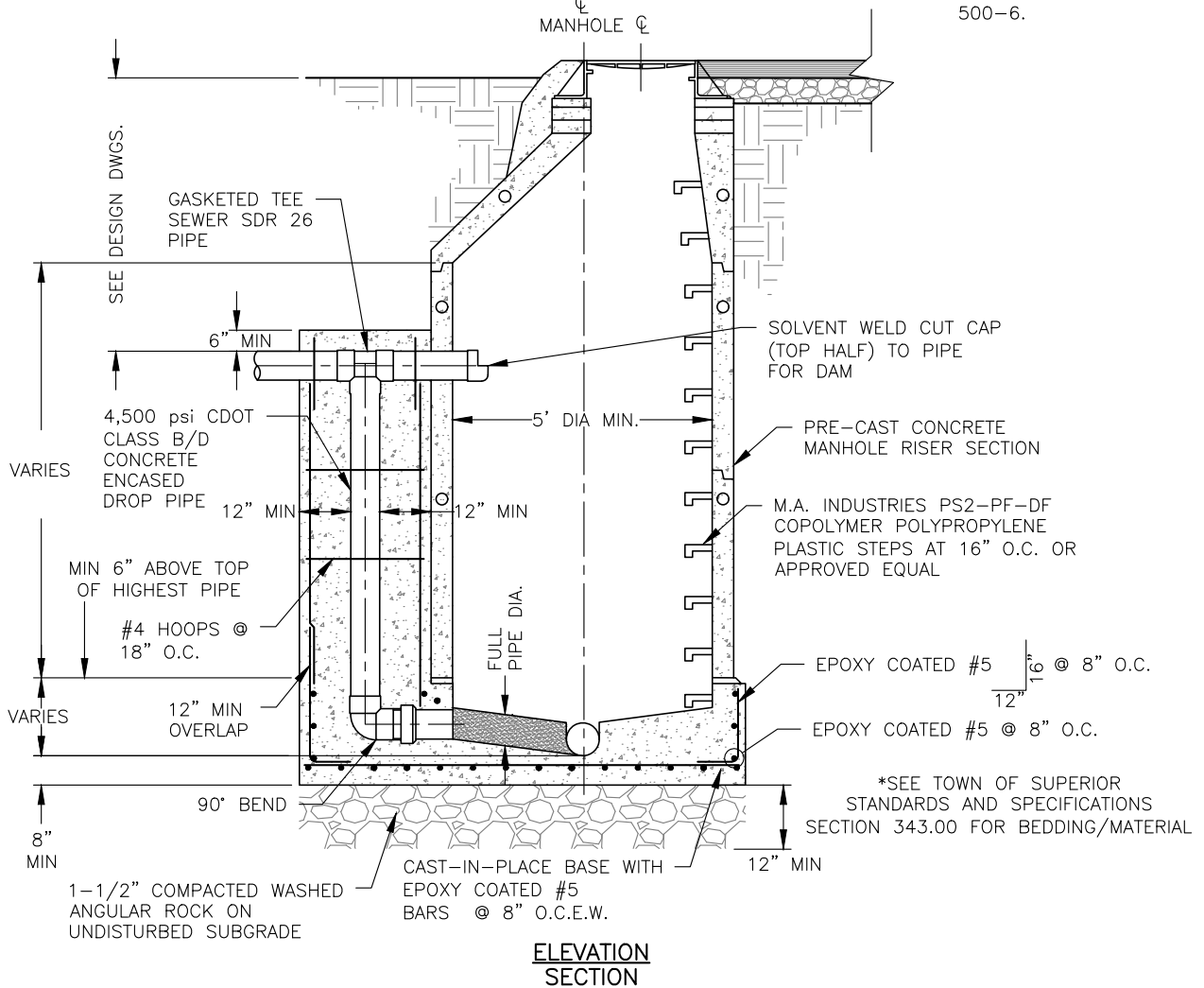
DATE: JANUARY 2019

SHEET 500-2



NOTES:

1. SEE SHEET 500-1 FOR ADDITIONAL DETAILS.
2. FOR DROPS LESS THAN 24" USE INTERNAL DROP, PER DETAIL SHEET 500-6.



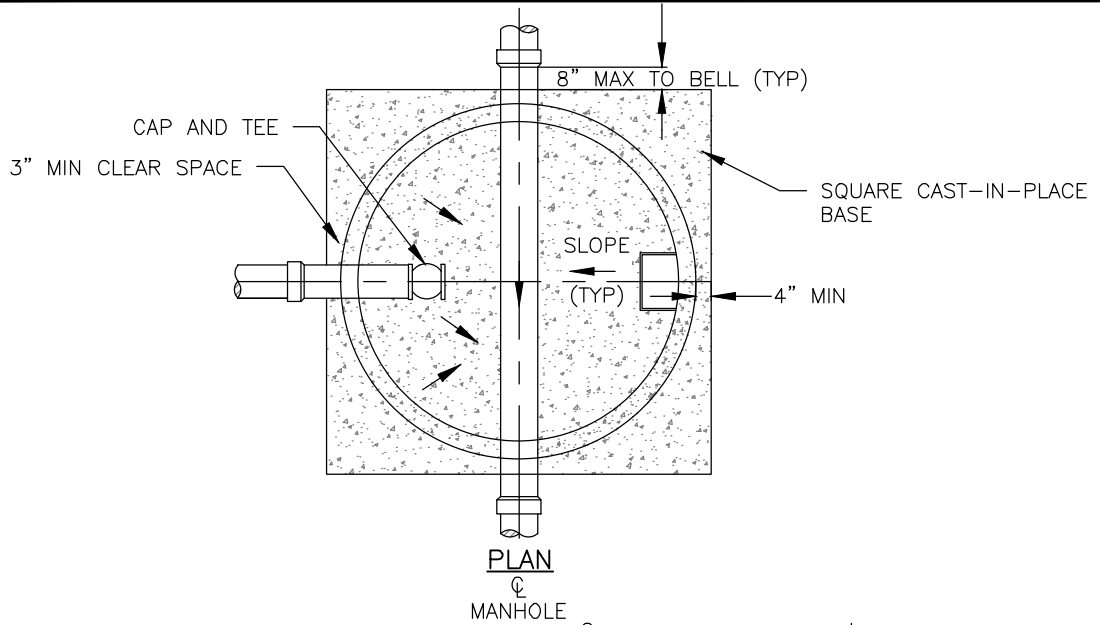
*SEE TOWN OF SUPERIOR STANDARDS AND SPECIFICATIONS SECTION 343.00 FOR BEDDING/MATERIAL



**DROP MANHOLE
DETAIL**

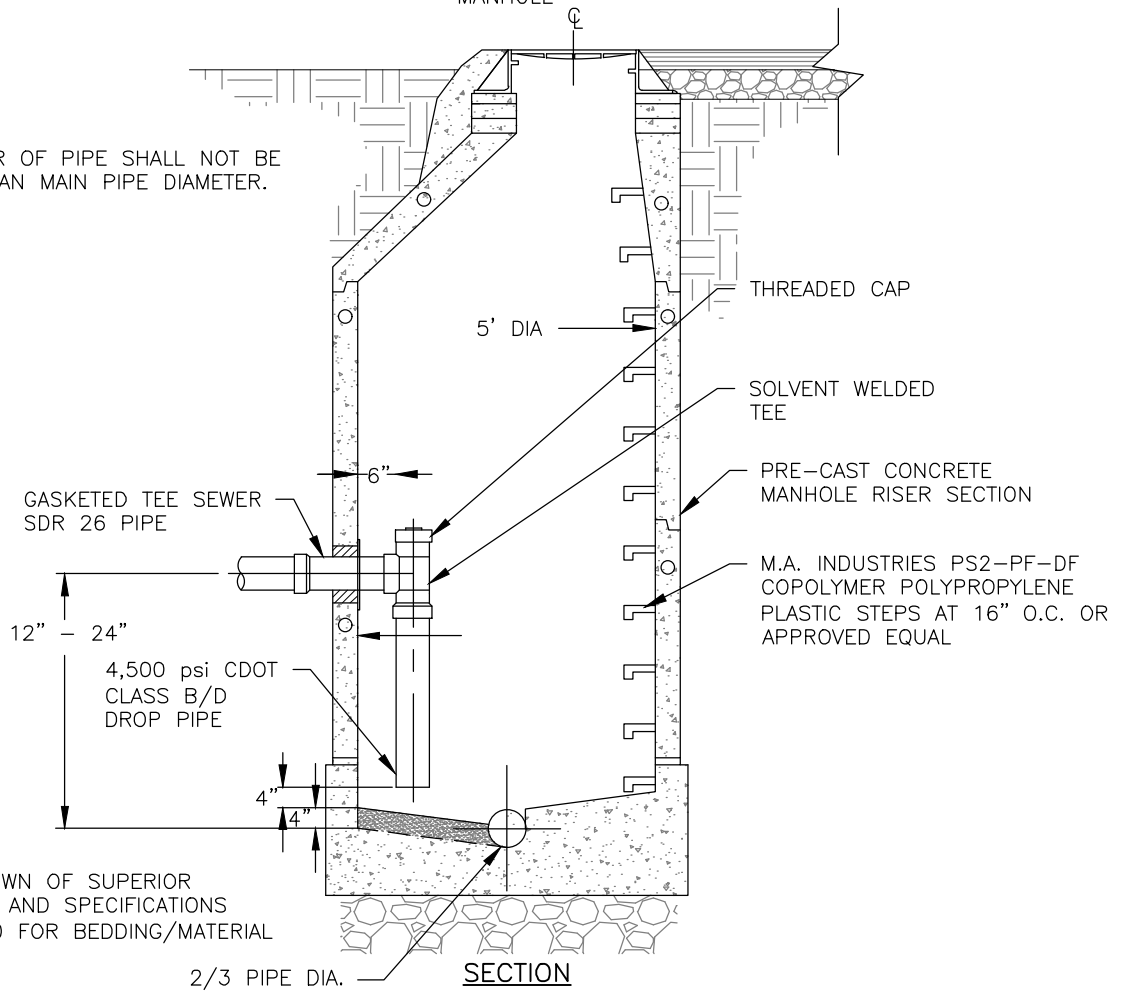
DATE: JANUARY 2019

SHEET 500-3



NOTE:

1. DIAMETER OF PIPE SHALL NOT BE LESS THAN MAIN PIPE DIAMETER.



*SEE TOWN OF SUPERIOR STANDARDS AND SPECIFICATIONS SECTION 343.00 FOR BEDDING/MATERIAL

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

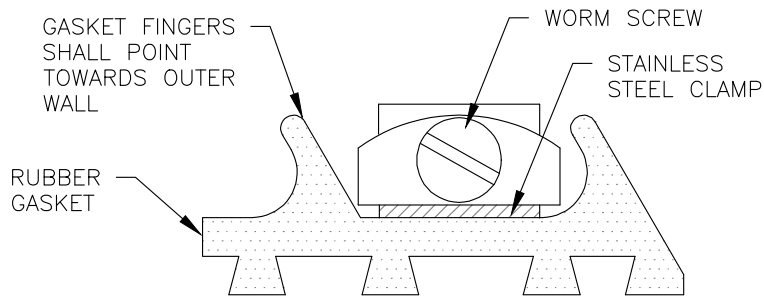
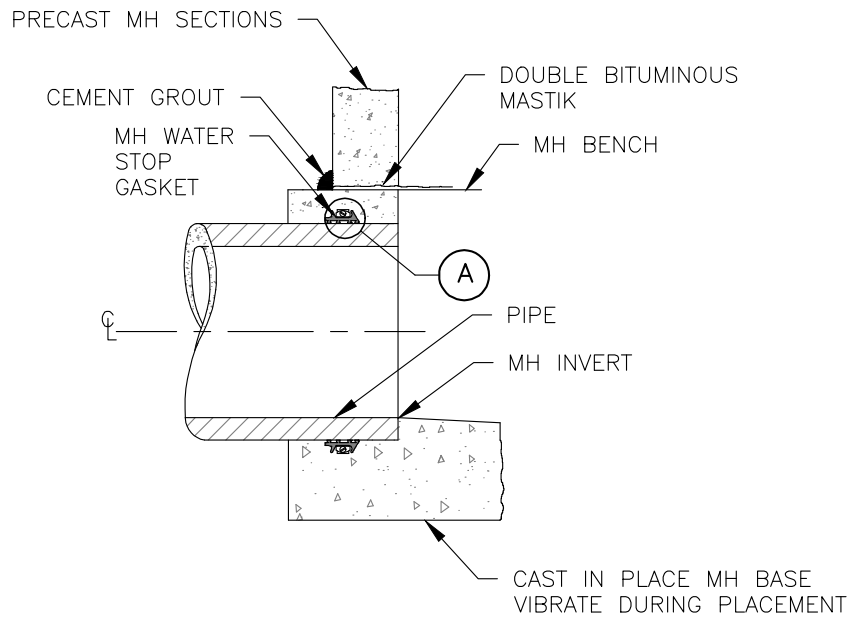
N.T.S.



INTERNAL DROP MANHOLE
DETAIL

DATE: JANUARY 2019

SHEET 500-4



A MH WATER STOP GASKET DETAIL

NOTES:

1. PLACE STOP ON PIPE NEAR CENTER OF MANHOLE WALL.
2. TIGHTEN STEEL BAND TO ASSURE POSITIVE SEAL AGAINST PIPE OUTSIDE.

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

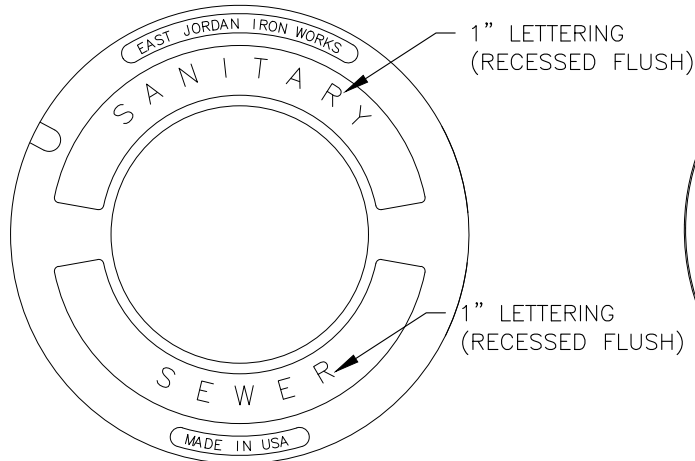
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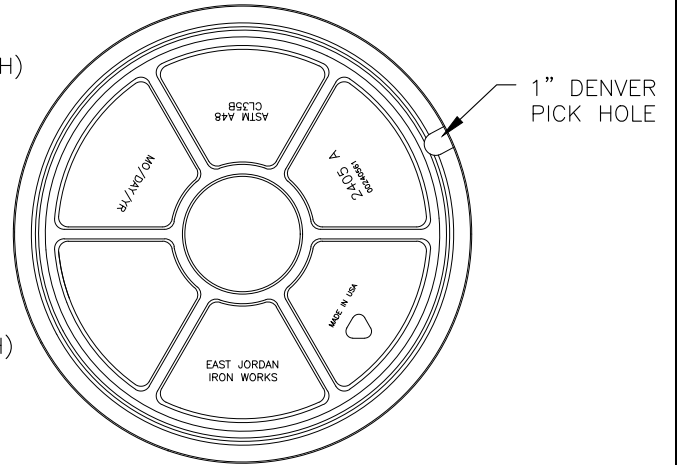
MANHOLE PIPE WATER STOP GASKET

DATE: JANUARY 2019

SHEET 500-5



TOP OF COVER

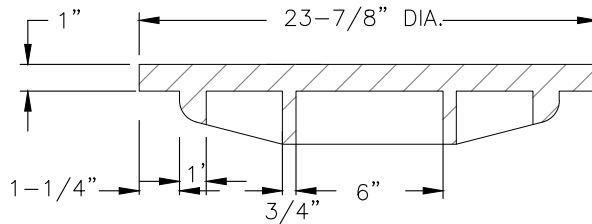


BOTTOM OF COVER

NOTES:

COVER: GRAY IRON ASTM A48 CL35 B
 LOAD RATING: H-20
 COVER: 135 LBS 61kg
 PRODUCT NUMBER 00240561
 MACHINED SURFACE

EAST JORDAN IRON WORKS #2405A
 PRODUCT #240562 OR APPROVED
 EQUAL



SECTION OF COVER

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

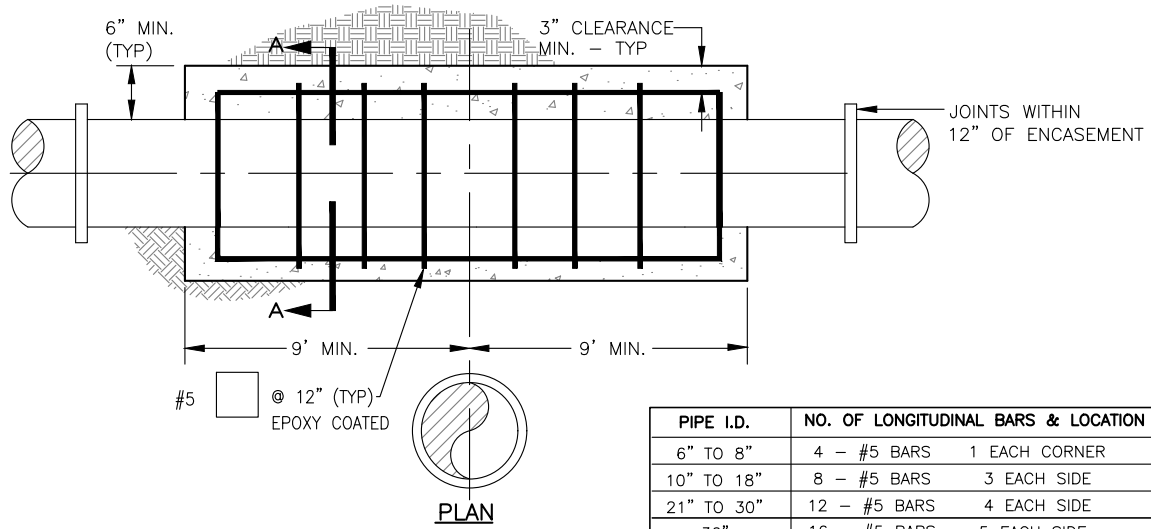
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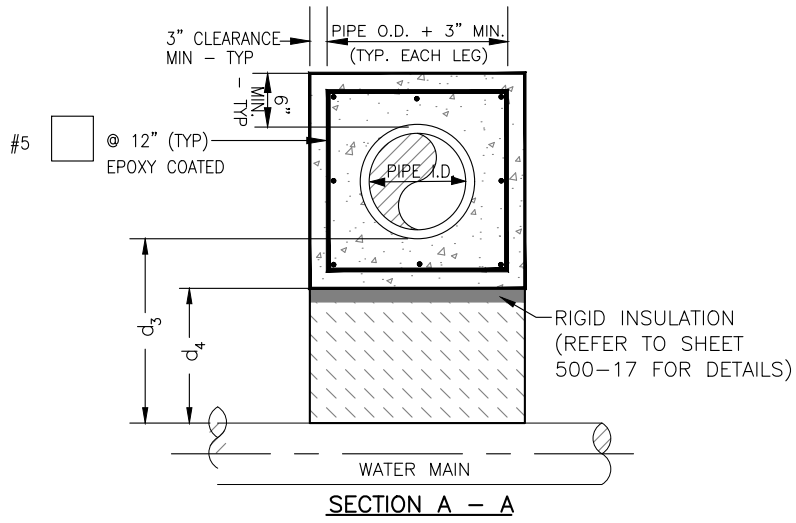
SANITARY SEWER
 MANHOLE LID

DATE: JANUARY 2019

SHEET 500-6



PIPE I.D.	NO. OF LONGITUDINAL BARS & LOCATION	
6" TO 8"	4 - #5 BARS	1 EACH CORNER
10" TO 18"	8 - #5 BARS	3 EACH SIDE
21" TO 30"	12 - #5 BARS	4 EACH SIDE
36"	16 - #5 BARS	5 EACH SIDE



NOTES:

1. THIS DETAIL IS TO BE USED UNDER NORMAL CONDITIONS. WHERE EXCESSIVE GROUNDWATER IS PRESENT AN ALTERNATE DESIGN WILL BE REQUIRED.
2. ALL REBAR TO BE GRADE 60 AND EPOXY COATED.
3. 4,500 PSI CDOT CLASS B/D CONCRETE.
4. PLACE CONCRETE AGAINST EITHER SOLID FORMWORK OR UNDISTURBED SOIL.
5. REFER TO SHEET 500-17 FOR BEDDING DETAILS.

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

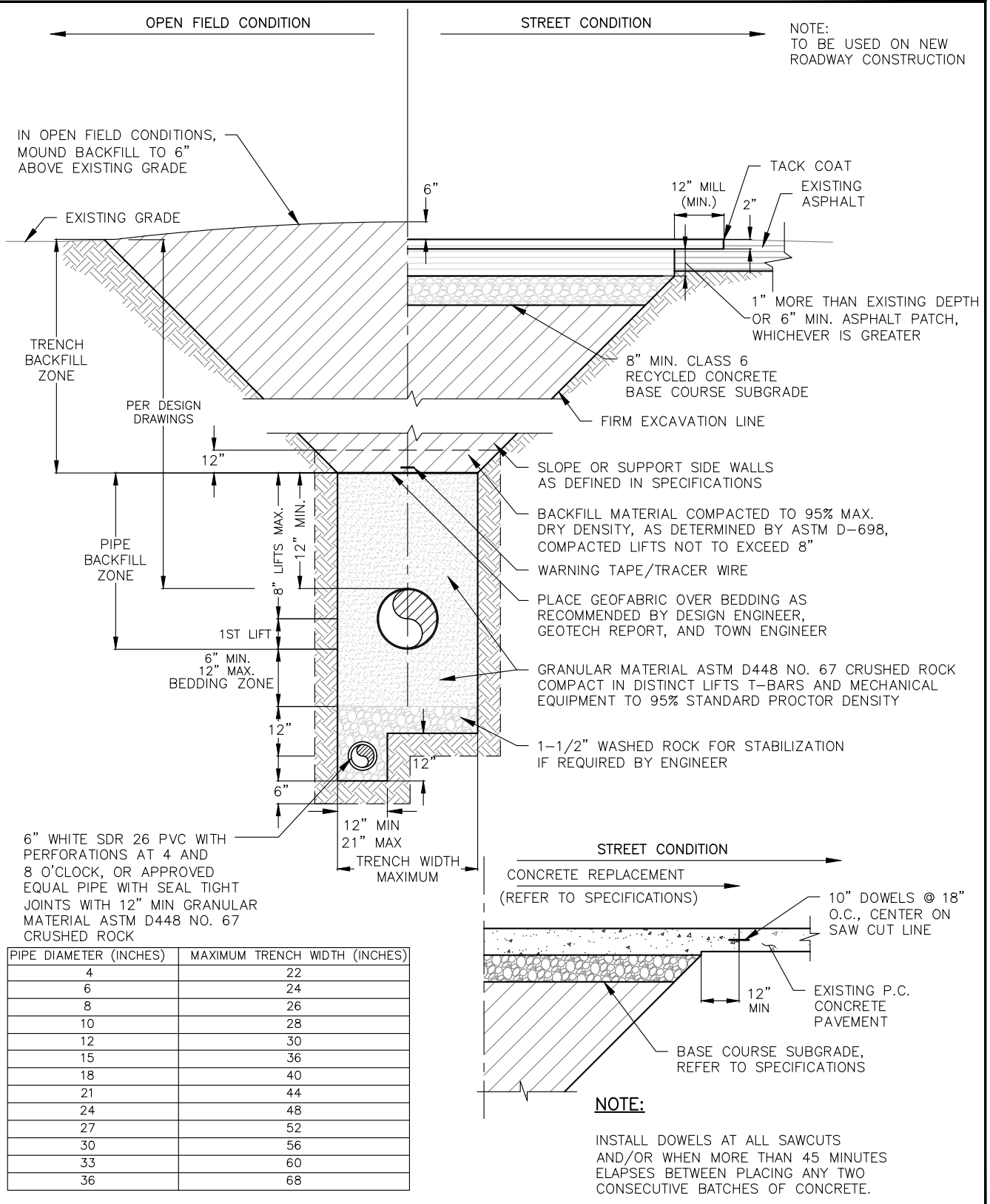
N.T.S.



TYPICAL PIPE
ENCASEMENT REBAR SCHEDULE

DATE: JANUARY 2019

SHEET 500-7



NOTE:
TO BE USED ON NEW
ROADWAY CONSTRUCTION

IN OPEN FIELD CONDITIONS,
MOUND BACKFILL TO 6"
ABOVE EXISTING GRADE

EXISTING GRADE

TRENCH
BACKFILL
ZONE

PER DESIGN
DRAWINGS

12"

PIPE
BACKFILL
ZONE

8" LIFTS MAX.
12" MIN.

1ST LIFT

6" MIN.
12" MAX.
BEDDING ZONE

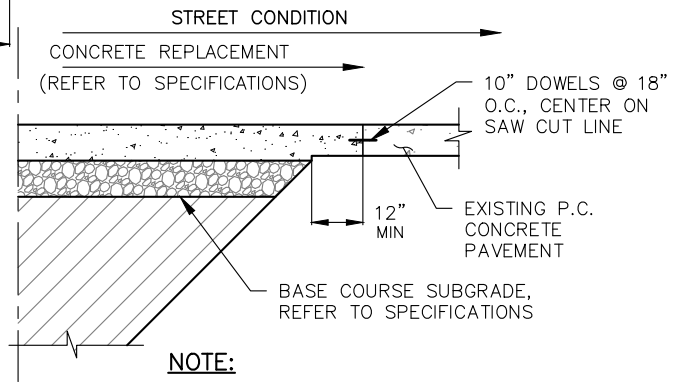
12"

6"

12" MIN
21" MAX
TRENCH WIDTH
MAXIMUM

6" WHITE SDR 26 PVC WITH
PERFORATIONS AT 4 AND
8 O'CLOCK, OR APPROVED
EQUAL PIPE WITH SEAL TIGHT
JOINTS WITH 12" MIN GRANULAR
MATERIAL ASTM D448 NO. 67
CRUSHED ROCK

PIPE DIAMETER (INCHES)	MAXIMUM TRENCH WIDTH (INCHES)
4	22
6	24
8	26
10	28
12	30
15	36
18	40
21	44
24	48
27	52
30	56
33	60
36	68



NOTE:
INSTALL DOWELS AT ALL SAWCUTS
AND/OR WHEN MORE THAN 45 MINUTES
ELAPSES BETWEEN PLACING ANY TWO
CONSECUTIVE BATCHES OF CONCRETE.

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS
MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

N.T.S.



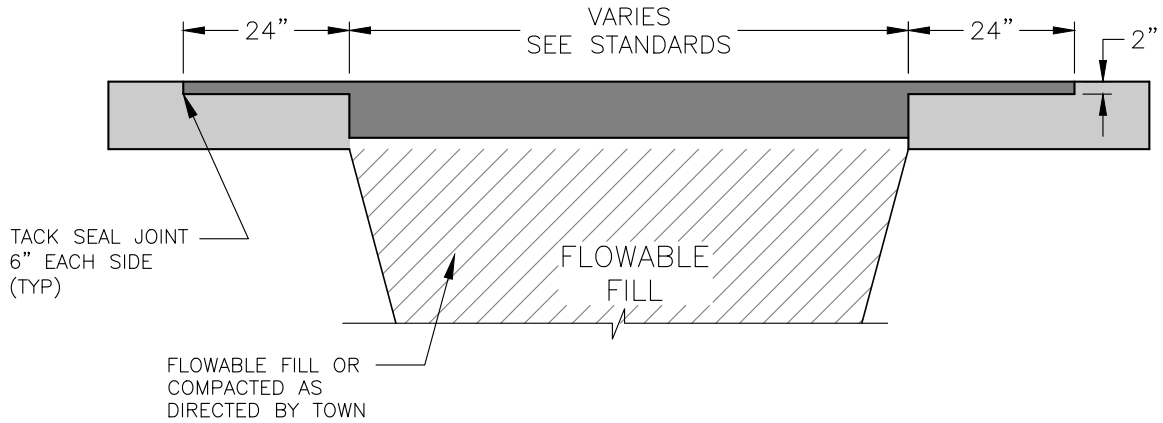
TYPICAL SANITARY SEWER
TRENCH PIPE BEDDING

DATE: AUGUST 2019 SHEET 500-8

MINIMUM ASPHALT PATCH THICKNESS				
ZONING				
STREET CLASSIFICATION	INDUSTRIAL		ALL OTHER	
	THICKNESS	LIFTS	THICKNESS	LIFTS
ARTERIAL	11"	3	11"	3
COLLECTOR	7"	2	7"	2
LOCAL	6"	2	6"	2

Asphalt Patch

HMA OVER CDOT FLOW FILL, OR FOAMED FLASH FILL WITH 2" MILL AND OVERLAY 2' WIDER THAN FULL DEPTH PATCH ON BOTH SIDES



NOTES:

1. PATCHBACK IS TO BE USED ON EXISTING ROADWAYS.
2. CDOT FLOW FILL, OR FOAM FLASH FILL FOR TRENCH BACKFILL.
3. PAVEMENT CUTS WILL NOT BE ALLOWED WITHOUT TOWN ENGINEER APPROVAL WITHIN SEVEN (7) YEARS AFTER A STREET HAS BEEN CONSTRUCTED, RECONSTRUCTED, OR OVERLAID. EMERGENCY REPAIRS ARE EXEMPT.
4. SEE ALSO STANDARD STREET SECTION DETAIL.

MAXIMUM LIFT DEPTH - 5"
MINIMUM LIFT DEPTH - 2"

THICKNESS OF EACH LIFT BELOW THE TOP SHALL NOT VARY MORE THAN 3/8", TOP LIFT SHALL BE GRADE SX HOT BITUMINOUS PAVEMENT.

FINISH SURFACE TOLERANCE SHALL NOT EXCEED 3/16" IN ANY DIRECTION WHEN CHECKED WITH 10 FOOT STRAIGHT EDGE. FINISHED SURFACE SHALL BE RAKED FREE OF AGGREGATE PRIOR TO COMPACTION EQUIPMENT BEING USED

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N.T.S.

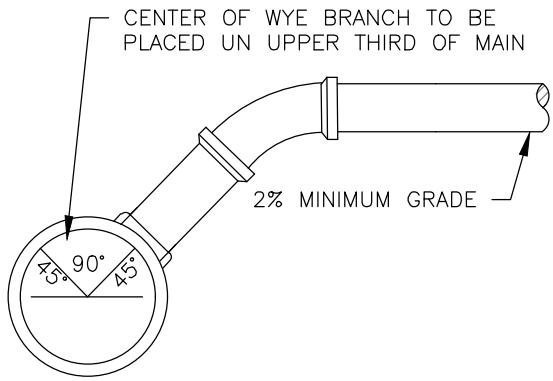


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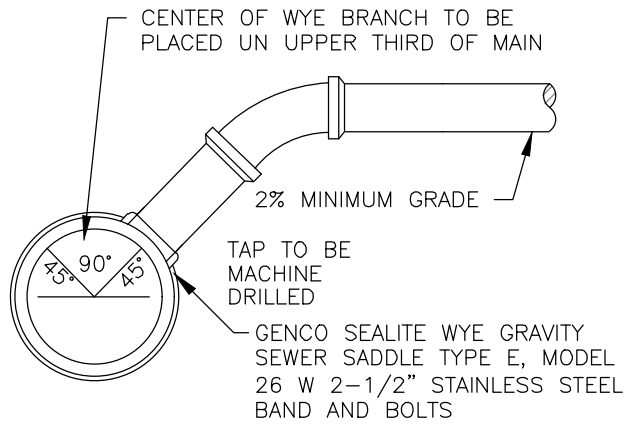
SANITARY SEWER TRENCH PATCHBACK DETAIL

DATE: JANUARY 2019

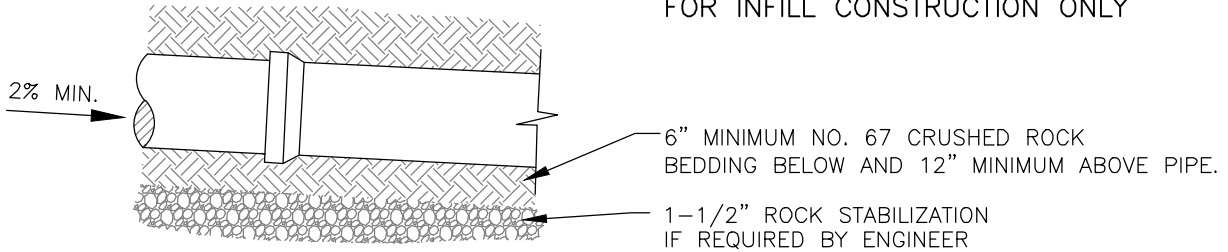
SHEET 500-8a



WYE CONNECTION TO TEE



BEND & SADDLE CONNECTION
FOR INFILL CONSTRUCTION ONLY



FACTORY PREPARED A.S.T.M. C-425 COMPRESSION TYPE JOINTS ONLY OR APPROVED EQUIVALENT.

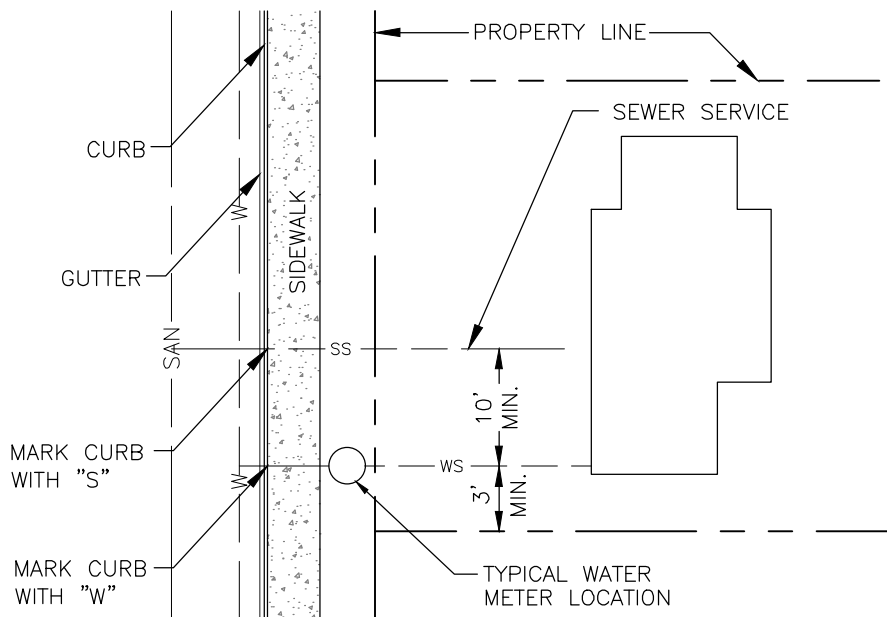
BELL SHOULD NOT TOUCH SIDES OR BOTTOM OF BELL HOLE.

ACCEPTABLE BEDDING

#67 CRUSHED ROCK

NOTES:

1. ALL EXCAVATION UNDER PIPELINES AND FITTINGS SHALL BE BACKFILLED WITH COMPACTED ROCK. SEE TRENCH DETAIL.
2. INSTALL MANHOLE FOR SERVICE LINE CONNECTIONS 6" AND LARGER.
3. 4" MINIMUM SERVICE SIZE.
4. NEW CONSTRUCTION USE WYE CONNECTION.
5. INFILL USE GENCO TAPPING SADDLE
6. REFER TO TOWN OF SUPERIOR STANDARDS AND SPECIFICATIONS SECTION 343.00 FOR BEDDING MATERIALS.



THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

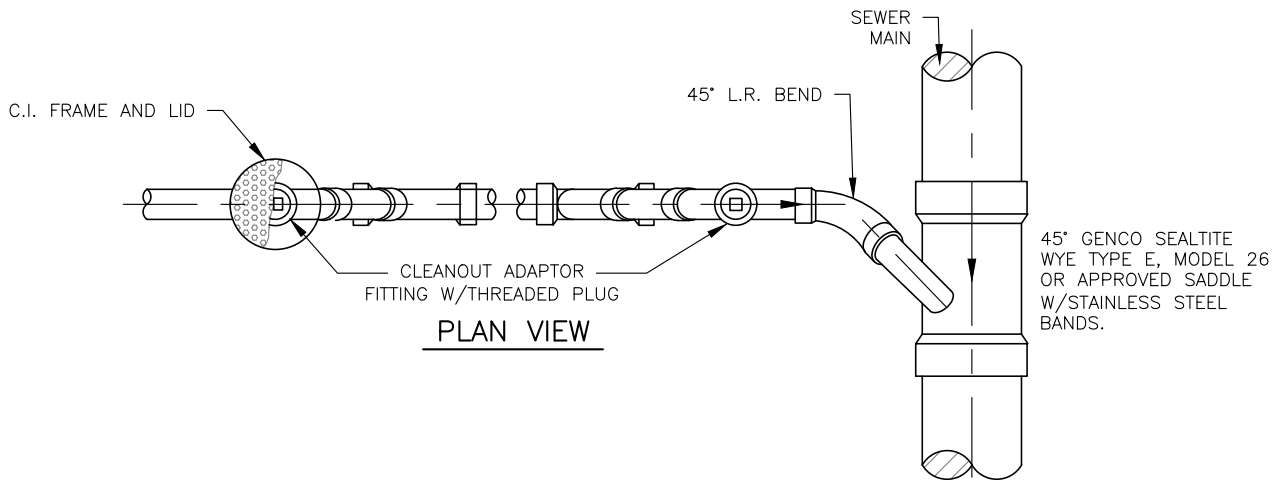
N.T.S.



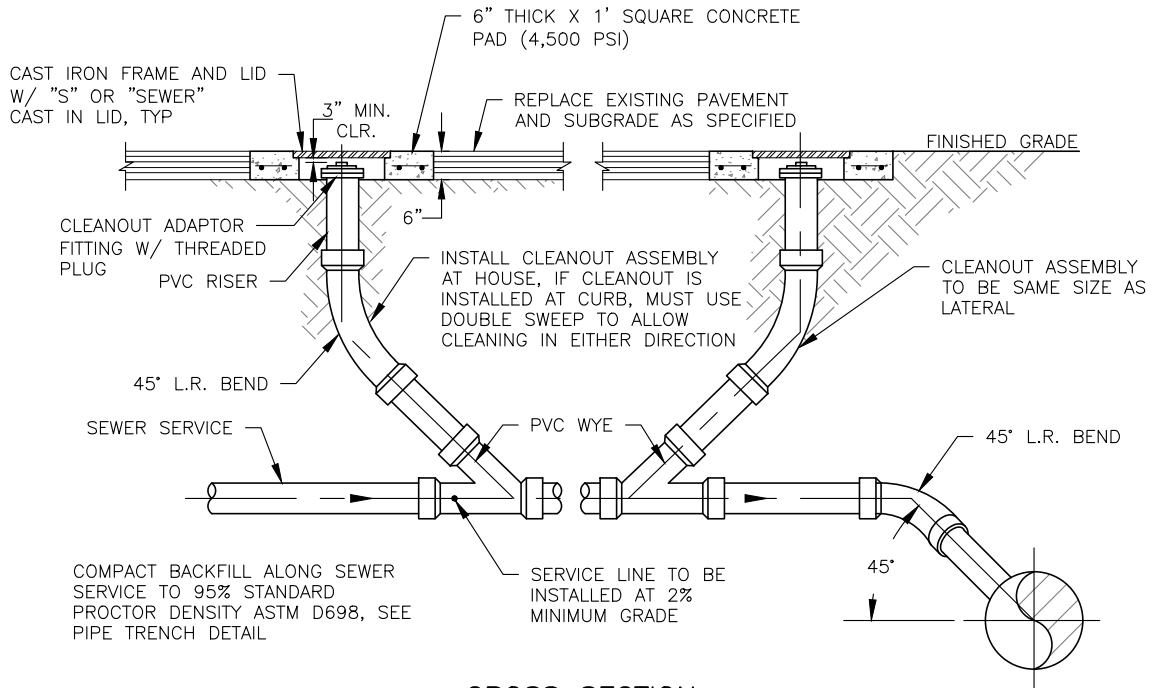
TYPICAL SANITARY SERVICE LOCATION

DATE: JANUARY 2019

SHEET 500-9



PLAN VIEW



CROSS SECTION

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

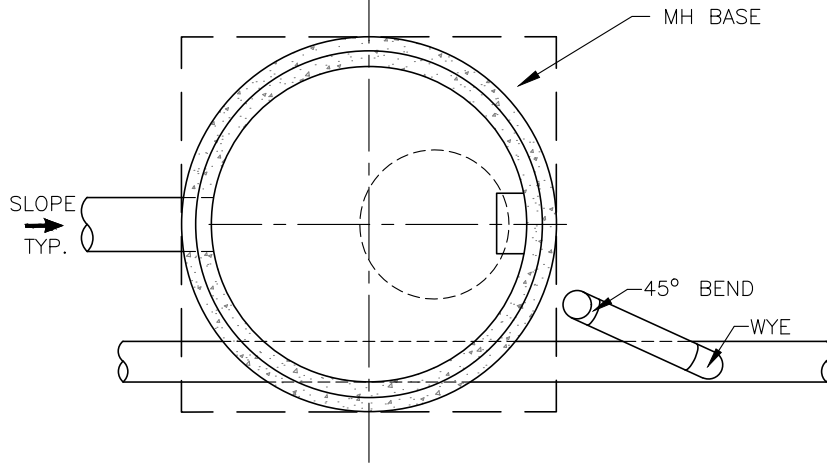
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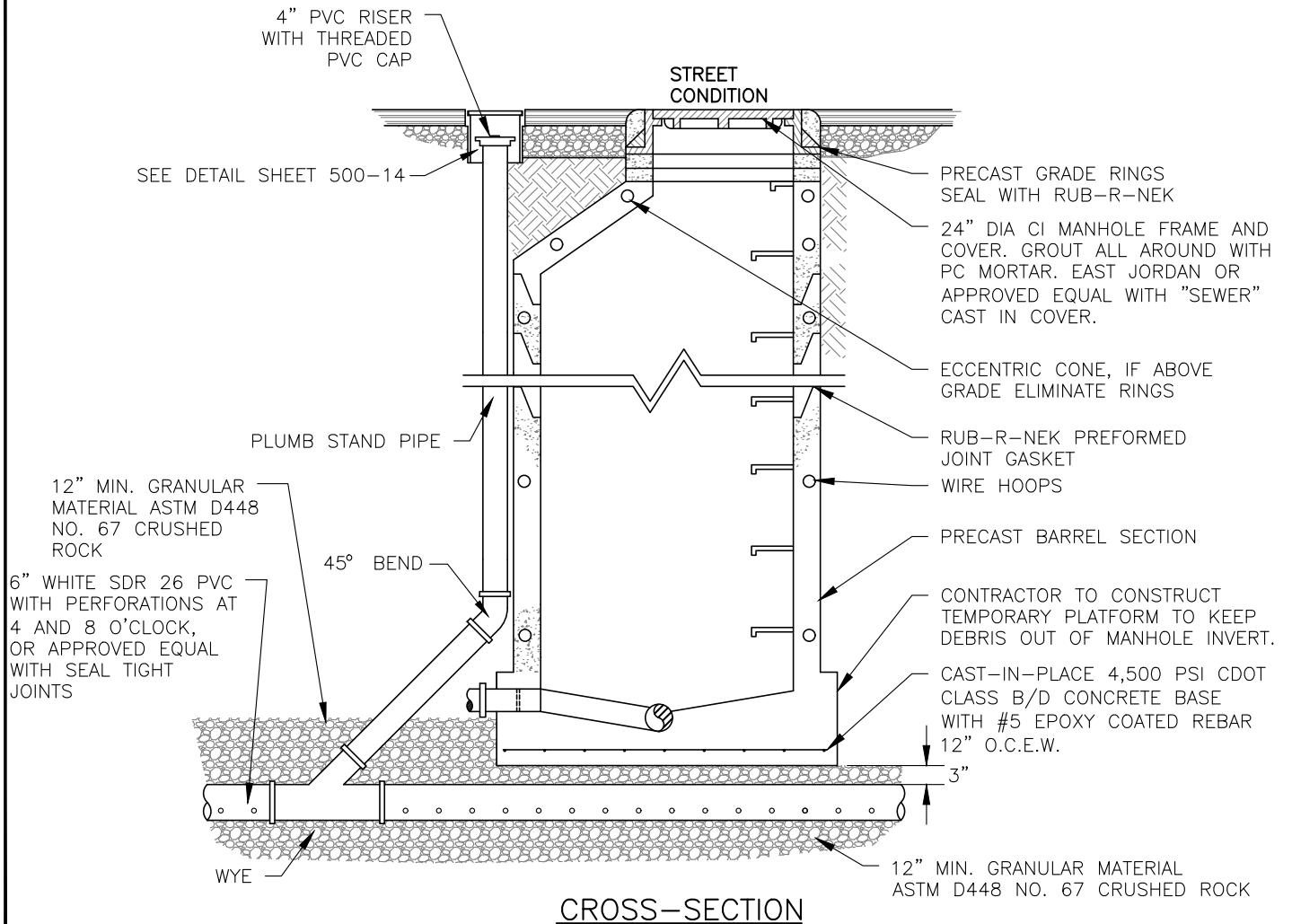
STANDARD CLEAN-OUT
SERVICE LINE DETAIL

DATE: MAY 2023

SHEET 500-10



PLAN VIEW



CROSS-SECTION

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

N.T.S.



TYPICAL UNDERDRAIN CLEANOUT
DETAIL

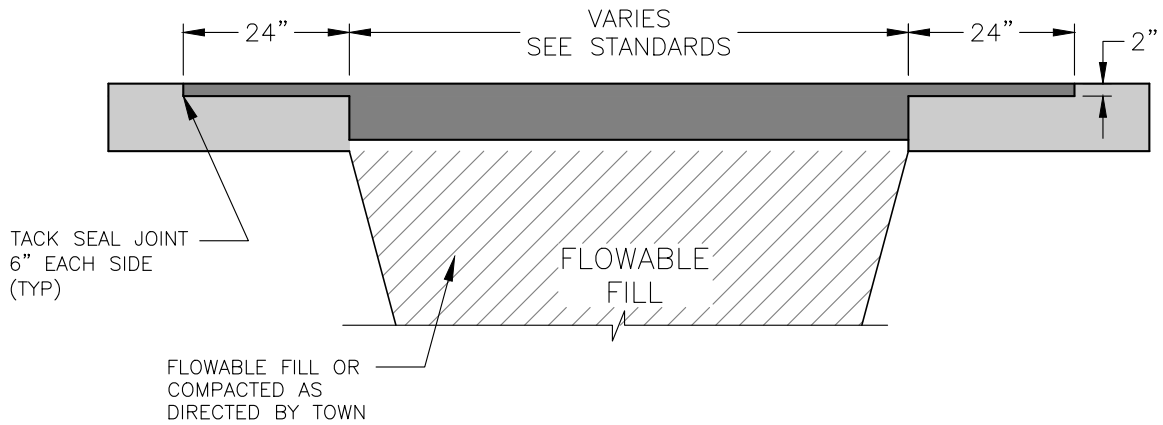
DATE: AUGUST 2019

SHEET 500-11

MINIMUM ASPHALT PATCH THICKNESS				
ZONING				
STREET CLASSIFICATION	INDUSTRIAL		ALL OTHER	
	THICKNESS	LIFTS	THICKNESS	LIFTS
ARTERIAL	11"	3	11"	3
COLLECTOR	7"	2	7"	2
LOCAL	6"	2	6"	2

Asphalt Patch

HMA OVER CDOT FLOW FILL, OR FOAMED FLASH FILL WITH 2" MILL AND OVERLAY 2' WIDER THAN FULL DEPTH PATCH ON BOTH SIDES



NOTES:

1. PATCHBACK IS TO BE USED ON EXISTING ROADWAYS.
2. CDOT FLOW FILL, OR FOAM FLASH FILL FOR TRENCH BACKFILL.
3. PAVEMENT CUTS WILL NOT BE ALLOWED WITHOUT TOWN ENGINEER APPROVAL WITHIN SEVEN (7) YEARS AFTER A STREET HAS BEEN CONSTRUCTED, RECONSTRUCTED, OR OVERLAID. EMERGENCY REPAIRS ARE EXEMPT.
4. SEE ALSO STANDARD STREET SECTION DETAIL.

MAXIMUM LIFT DEPTH - 5"
MINIMUM LIFT DEPTH - 2"

THICKNESS OF EACH LIFT BELOW THE TOP SHALL NOT VARY MORE THAN 3/8", TOP LIFT SHALL BE GRADE SX HOT BITUMINOUS PAVEMENT.

FINISH SURFACE TOLERANCE SHALL NOT EXCEED 3/16" IN ANY DIRECTION WHEN CHECKED WITH 10 FOOT STRAIGHT EDGE. FINISHED SURFACE SHALL BE RAKED FREE OF AGGREGATE PRIOR TO COMPACTION EQUIPMENT BEING USED

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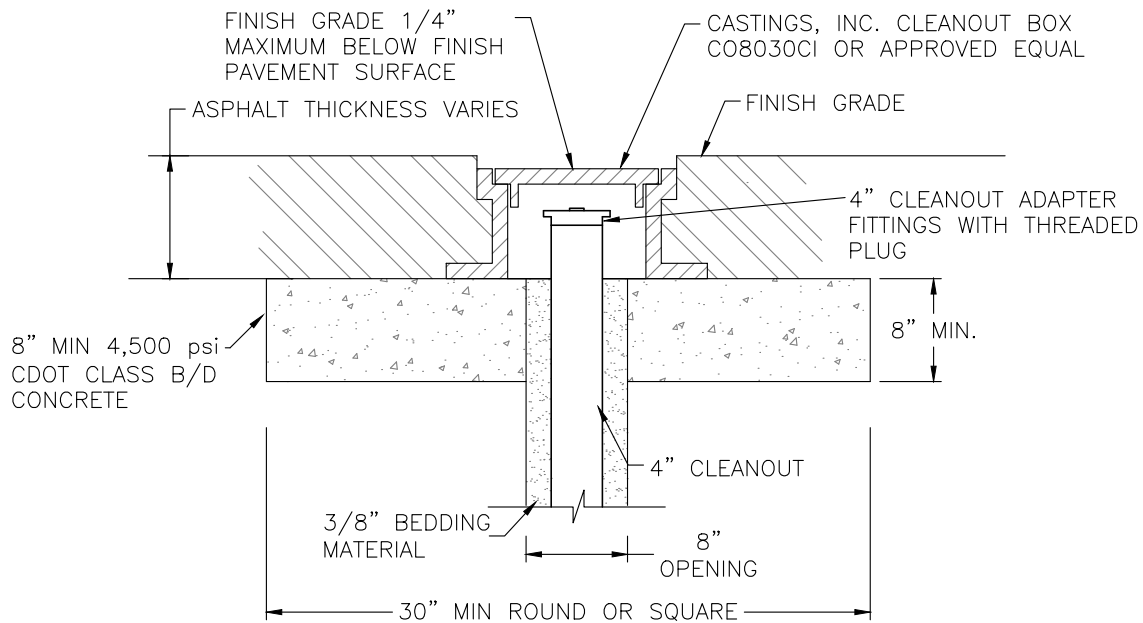
N.T.S.



TRENCH PATCHBACK DETAIL

DATE: JANUARY 2019

SHEET 500-11a



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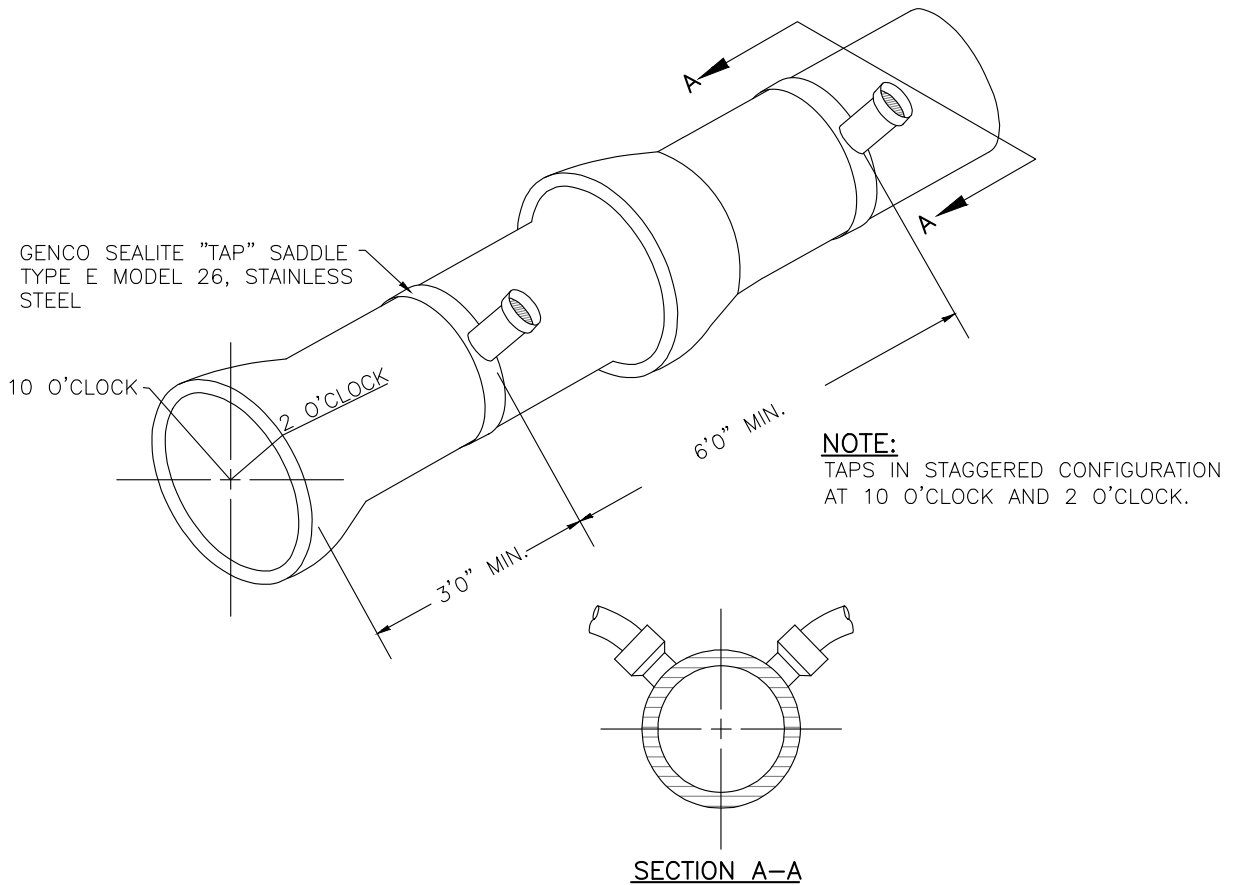
N.T.S.



STANDARD SANITARY SEWER UNDERDRAIN CLEANOUT

DATE: JANUARY 2019

SHEET 500-12



NOTES:

1. SEWER SERVICE CONNECTIONS SHALL BE POSITIONED AT EITHER THE 2 O'CLOCK OR THE 10 O'CLOCK POSITION ON THE CIRCUMFERENCE OF THE SEWER MAIN.
2. ON NEW INSTALLATIONS, THE WYE FITTING SHALL BE USED. WHEN TAPPING INTO AN EXISTING SEWER MAIN, A GENCO SEALTITE WYE TYPE E, MODEL 26 SADDLE CONNECTION AND APPROVED CORING METHOD SHALL BE USED.
3. THE MINIMUM DISTANCE BETWEEN SERVICE CONNECTIONS MADE ALONG THE PIPE SHALL BE 3-FEET. THE MINIMUM DISTANCE FROM EITHER THE BELL OR SPIGOT END OF A PIPE SHALL BE 3-FEET. THE MINIMUM DISTANCE FROM THE EDGE OF A MANHOLE TO A SERVICE CONNECTION SHALL BE EITHER 5-FEET OR PAST THE TRANSITION POINT FROM THE MANHOLE TRENCH, WHICHEVER IS GREATER.
4. A MAXIMUM OF 4 SEWER SERVICE CONNECTIONS SHALL BE ALLOWED PER 20-FEET LENGTH OF PIPE. A SPECIFIC SOILS INVESTIGATION SHOULD BE CONDUCTED TO ASSURE THAT THE EXTERNAL LOADING ON THE TAPPED SEWER WILL BE WITHIN ALLOWANCE LIMITS REGARDLESS OF THE NUMBER IF TAPS INVOLVED.

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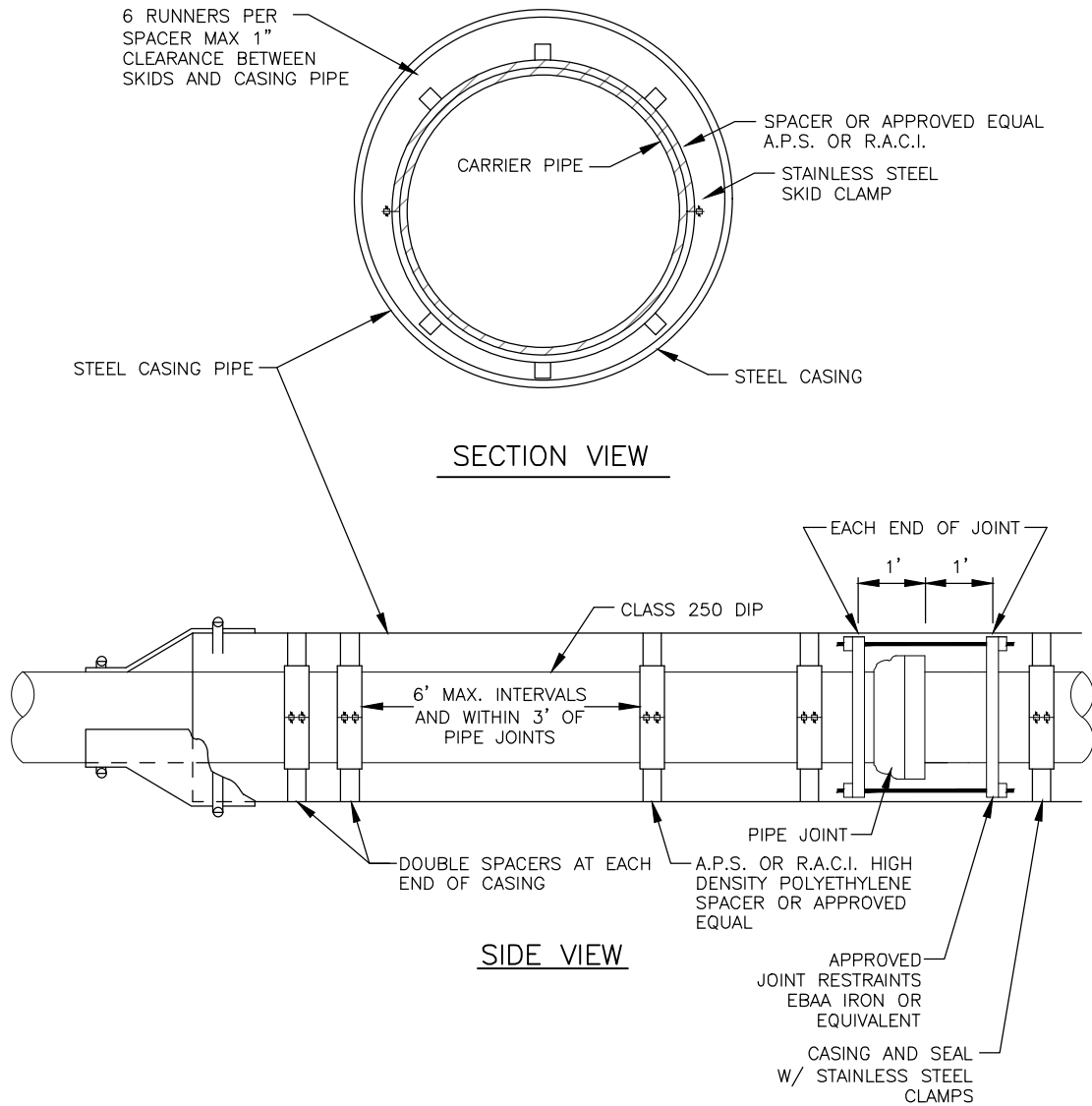
N.T.S.



SANITARY SEWER TAPPING

DATE: JANUARY 2019

SHEET 500-13



THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

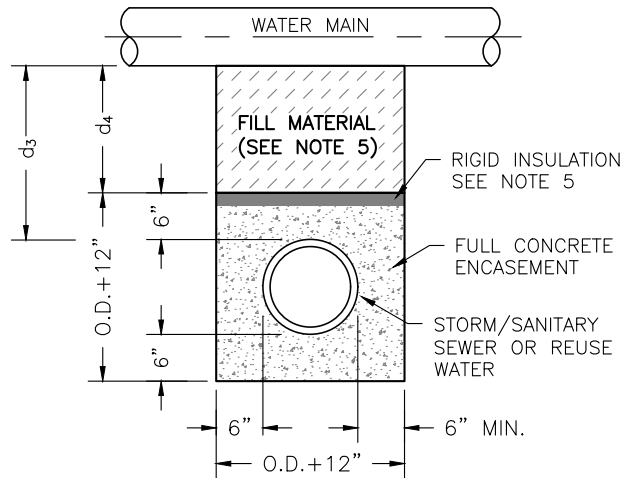
N.T.S.



JACKING DETAIL

DATE: JANUARY 2019

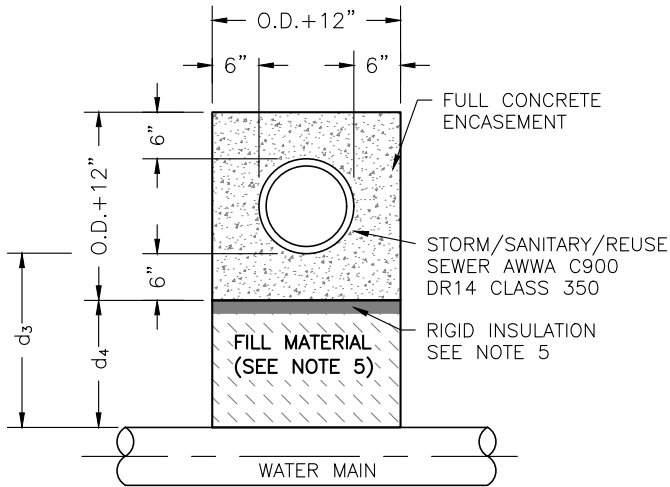
SHEET 500-14



STORM, SANITARY SEWER, OR REUSE CROSSING UNDER WATER MAIN
 IF $d_3 > 18"$, ENCASEMENT NOT REQUIRED

NOTES:

1. CONCRETE COLLAR AROUND STORM SEWER JOINTS MAY BE ACCEPTED WITH WRITTEN APPROVAL BY THE TOWN ENGINEER AND ONLY FOR PIPE 30" OR LARGER.
2. CONCRETE TO BE CAST AGAINST UNDISTURBED SOIL OR SHORING.
3. LENGTH OF ENCASEMENT SHALL EXTEND AT LEAST 10- FEET EACH SIDE OF WATER MAIN.
4. UNLESS OTHERWISE NOTED ON PLAN/PROFILE DRAWINGS, ENCASEMENTS NEED NOT BE REINFORCED.
5. FILLER MATERIAL BETWEEN CONDUITS TO BE:
 - a) APPROVED DOW HI LOAD 60 RIGID INSULATION IF $d_4 \leq 6"$.
 - b) COMPACTED BACKFILL, IF $d_4 > 6"$.
6. SHORING OR SHEETING, IF USED, TO BE CUT OFF AT TOP OF ENCASEMENT



STORM, SANITARY SEWER, OR REUSE CROSSING OVER TOP OF WATER MAIN
 ENCASEMENT REQUIRED REGARDLESS OF DIMENSION d_3
 (SEE NOTE 1 FOR SPECIAL CASES)

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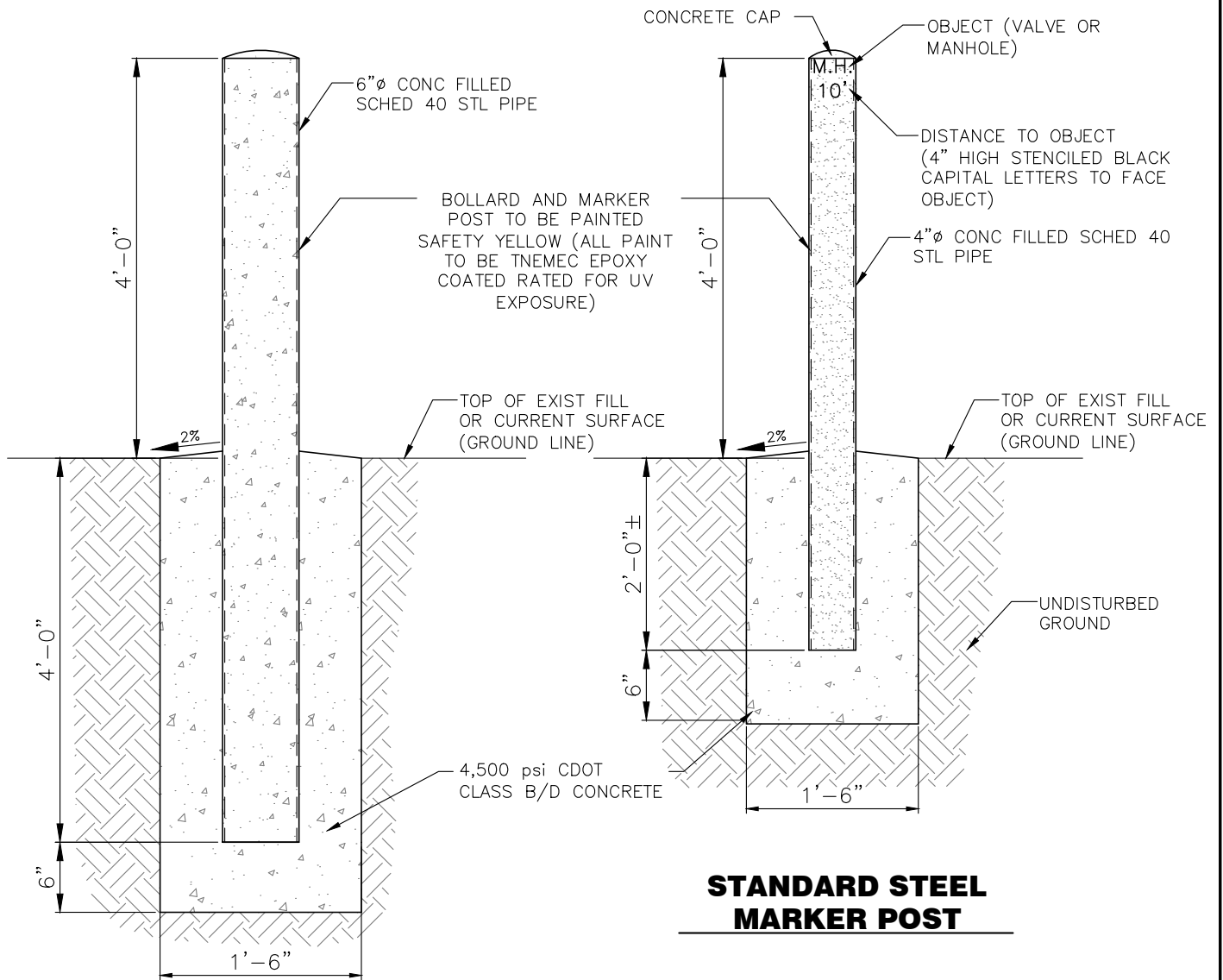
N.T.S.



**ENCASEMENT FOR
CONDUIT CROSSINGS**

DATE: JANUARY 2019

SHEET 500-15



BOLLARD DETAIL

NOTES:

1. BOLLARD DETAIL USED TO PROTECT OBJECTS SUCH AS FIRE HYDRANTS, SAMPLING STATIONS, ETC.
2. MARKER POST DETAIL USED FOR LOCATING MANHOLES, VALVE BOXES NOT INSTALLED IN CONCRETE OR ASPHALT.

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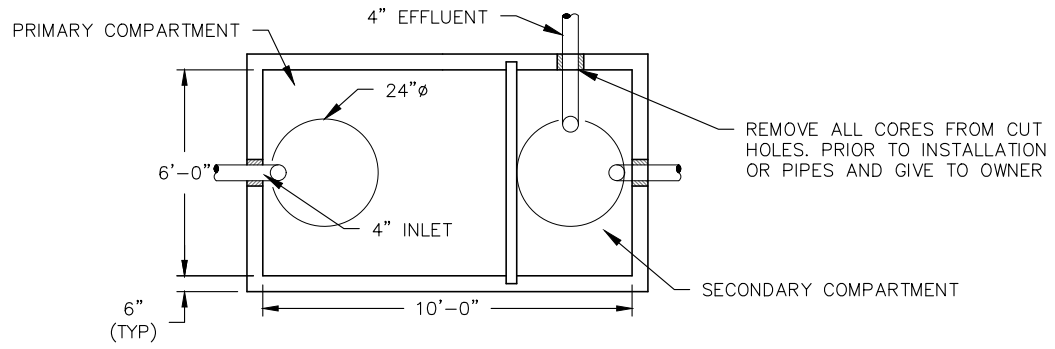
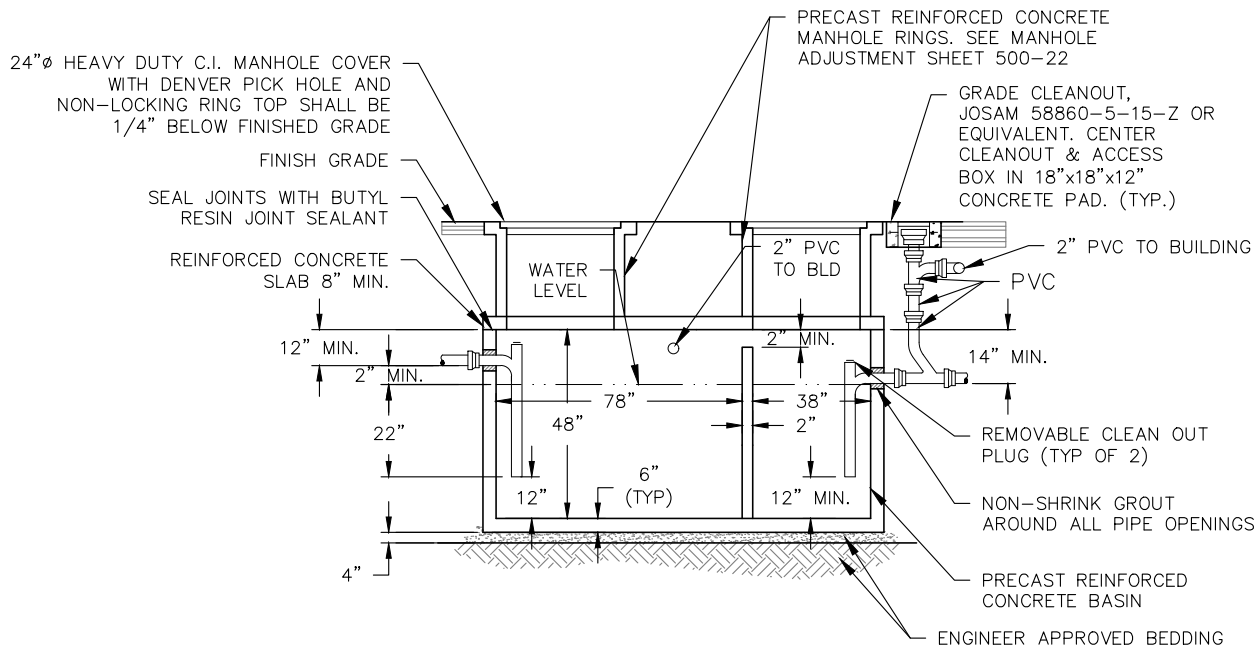
N.T.S.



BOLLARD & STANDARD STEEL MARKER POST DETAIL

DATE: JANUARY 2019

SHEET 500-16



NOTES:

1. SEAL ALL PIPE PENETRATIONS WATER TIGHT.
2. SEE PLANS FOR PIPE SIZES.
3. SECONDARY COMPARTMENT HOLDS 1/3 OF TOTAL CAPACITY.
4. ALL PIPE FITTINGS TO BE CAST IRON.
5. FOR SIZE AND CAPACITY SEE RULES AND REGULATIONS WITH DESIGN STANDARDS AND SPECIFICATIONS 519.00.
6. FOR BEDDING MATERIALS SEE TOWN OF SUPERIOR STANDARDS AND SPECIFICATIONS 343.00.

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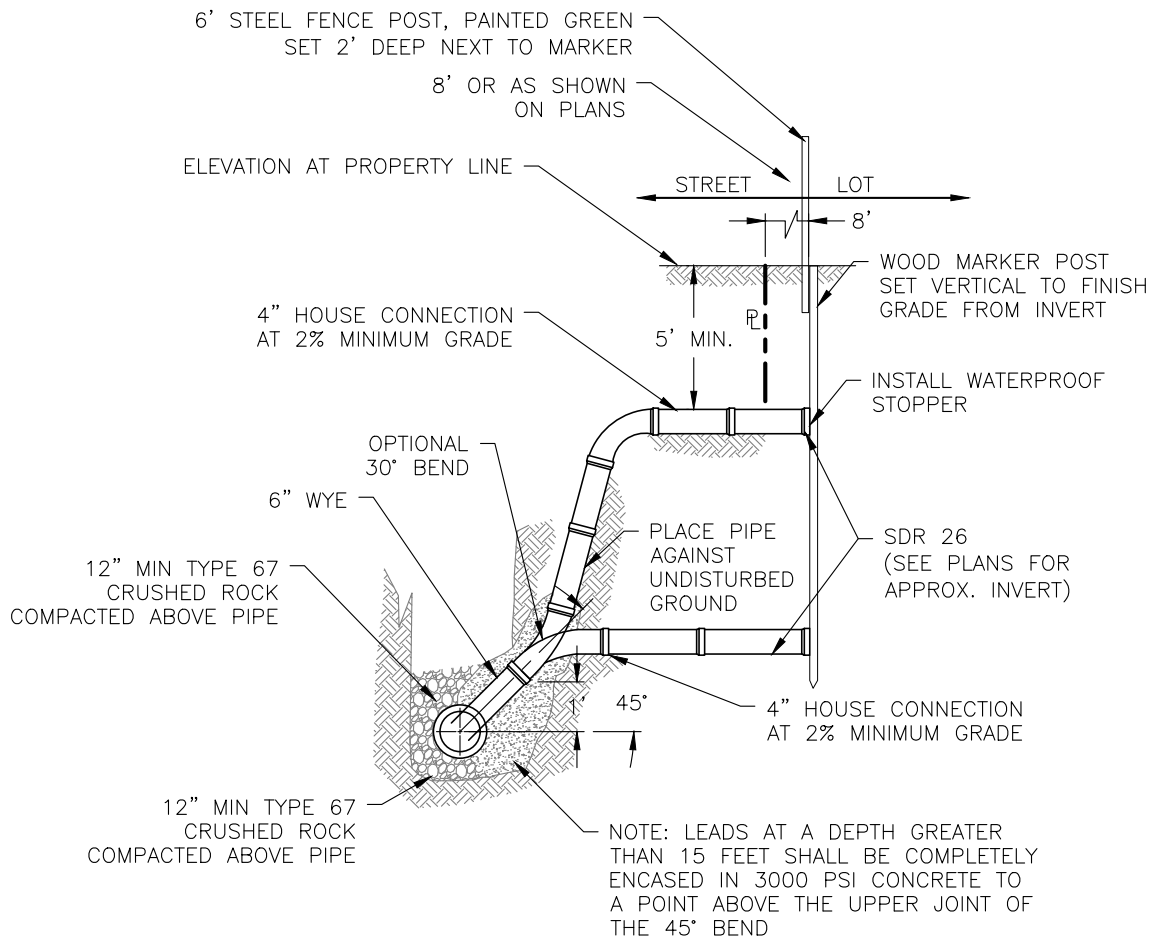
N.T.S.



SAND/OIL/GREASE INTERCEPTOR

DATE: JANUARY 2019

SHEET 500-17



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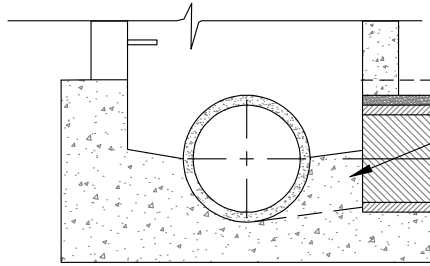
N.T.S.



SANITARY SEWER SERVICE
& RISER CONNECTION DETAIL

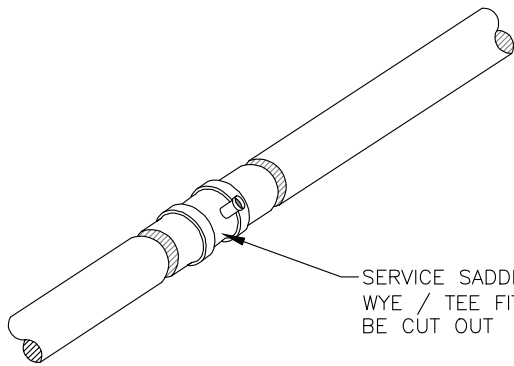
DATE: JANUARY 2019

SHEET 500-18

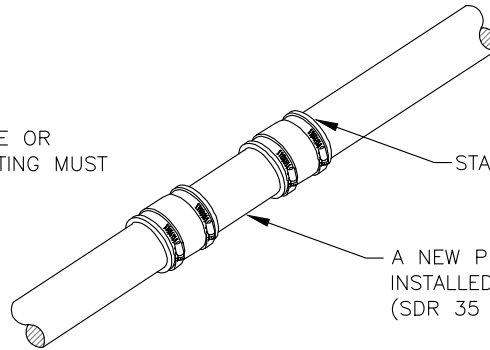


CUT OFF STUBBED OUT PIPE
FLUSH WITH OUTSIDE OF MANHOLE.
NEW INVERT TO BE POURED
INSIDE MANHOLE AND PIPE TO BE
FILLED WITH CONCRETE.

STUB-OUT



SERVICE SADDLE OR
WYE / TEE FITTING MUST
BE CUT OUT



STAINLESS STEEL BANDS

A NEW PIECE OF PIPE TO BE
INSTALLED WITH 2 SDR 26" SOLID SLEEVES
(SDR 35 IF EXISTING MAIN IS SDR 35)

MAIN

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS
MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

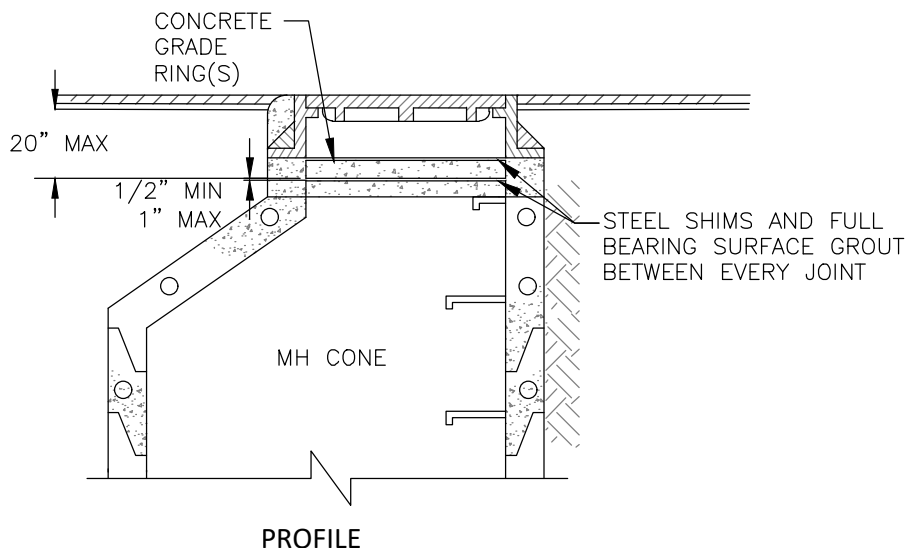
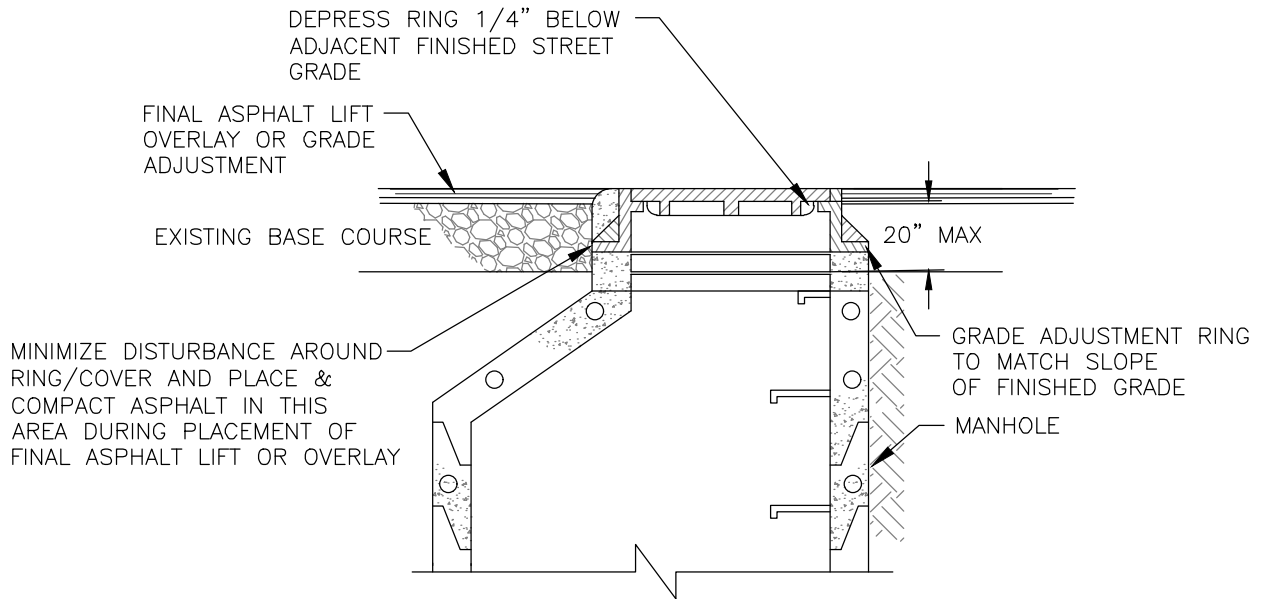
N.T.S.



ABANDONMENT OF SANITARY
SEWER LINE STUB-OUT
OR SERVICE

DATE: JANUARY 2019

SHEET 500-19



NOTES:

1. FULL BEARING SURFACE SHALL BE GROUTED WITH STEEL SHIMS, MINIMUM 6 LOCATIONS AROUND MANHOLE TO MATCH PROFILE OF ADJACENT SURFACES.
2. SMOOTH CHIMNEY INSIDE AND OUTSIDE WITH GROUT

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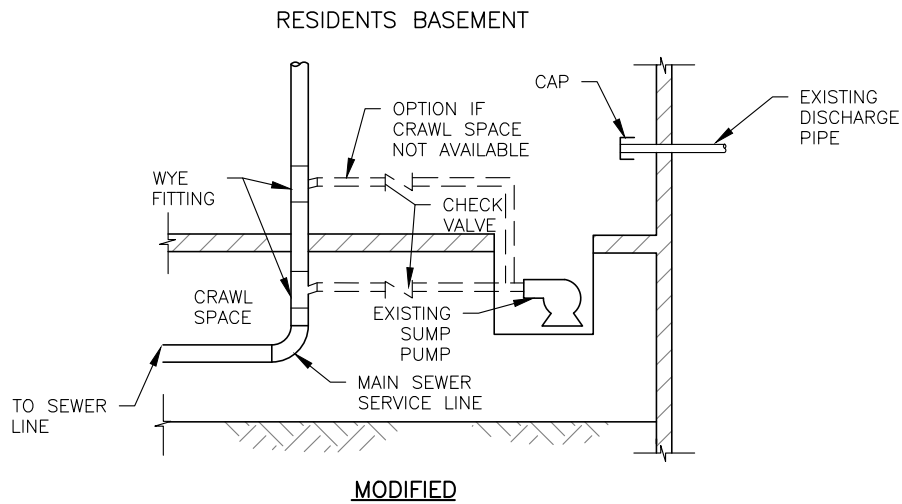
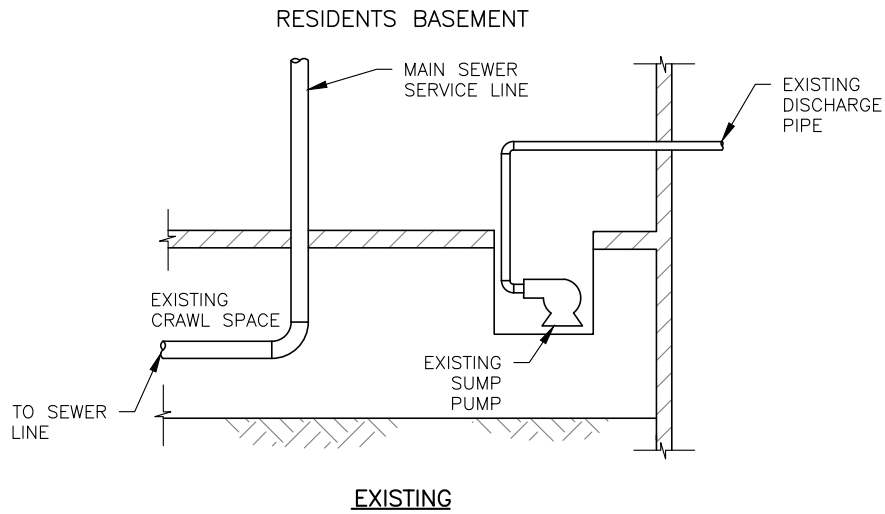
N.T.S.



SANITARY SEWER MANHOLE RING AND COVER ADJUSTMENT DETAIL

DATE: JANUARY 2019

SHEET 500-20



NOTE:
LICENSED PLUMBER TO INSTALL

**REQUIRES
SPECIAL
APPROVAL**

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N.T.S.



SUMP PUMP CONNECTION

DATE: JANUARY 2019

SHEET 500-21

SECTION 600 STORM DRAINAGE FACILITIES

601.00 GENERAL CONDITIONS

Refer to Section 100 TITLE, SCOPE, AND GENERAL CONDITIONS of these DESIGN STANDARDS AND SPECIFICATIONS for additional requirements that apply to all projects within the Town.

610.00 STORM DRAINAGE DESIGN AND TECHNICAL CRITERIA

All proposed construction plans and submittals shall be accompanied by a storm drainage analysis. Appropriate drainage system design shall be submitted for approval by the Town for each phase of construction. Approval of the analysis and design is subject to the following conditions:

- A. Construction of the system shall commence within three hundred sixty-five (365) days of the date of the approval.
- B. No construction has been completed on any adjacent property that may have affected the drainage pattern within the basin.

New submittals may be required by the Town.

The proposed construction shall not damage upstream or downstream properties. The planning and design of the drainage system shall not transfer the problem from one location to another.

The standards contained within this section shall supersede all other drainage criteria manuals, including but not limited to the Urban Drainage and Flood Control District (UDFCD) *Urban Storm Drainage Criteria Manual (Volumes 1-3)* and the Boulder County Storm Drainage Criteria Manual. If the Design Standards are silent in regard to a particular aspect of drainage, then the Engineer shall consult and apply the strictest standard found in either the UDFCD *Urban Storm Drainage Criteria Manual (Volumes 1-3)* or the Boulder County Storm Drainage Criteria Manual.

The runoff analysis for a particular area shall be based on the natural, undisturbed land for that area. Any contributing runoff from upstream areas shall be based on the existing land use topography and characteristics of those areas.

Where a master drainage plan for a given area of the Town is available, proposed drainage systems shall conform to that plan. Consideration shall be given as to how the proposed plan drainage systems shall tie into the existing upstream and downstream drainage systems.

In areas where a master plan is not available, major drainage ways and easements shall be located to provide continuity with existing drainage conditions. These drainage ways and easements shall be shown on all drainage plans.

Permanent stormwater quality facilities shall be designed and constructed in accordance with the UDFCD *Urban Storm Drainage Criteria Manual (Volume 3.)*

The Federal Emergency Management Agency (FEMA) floodplain boundaries are available from the Town and shall be shown on all preliminary and final drainage plans. Refer to the Superior Municipal Code for permitted uses in the floodplain.

All ponding facilities shall be of the detention type. Retention facilities shall only be allowed with the written approval of the Town.

Construction that shall impair surface or subsurface drainage shall not be approved. The Town reserves the right to issue and enforce more stringent criteria should adverse conditions exist. Designs that vary from these criteria shall require written approval of a variance by the Town prior to final approval of the plans.

Natural topographic features shall be the basis of location for easements and future runoff calculations. Where defined, existing drainage patterns and slopes shall be used. The drainage facilities shall be able to handle the design flows with no erosion damage to the system.

Streets shall not be used as primary floodways for major storm runoff. The amount of runoff in the streets shall not exceed the limits established in Section 613.04 STREET FLOW CAPACITIES of these DESIGN STANDARDS AND SPECIFICATIONS.

For inlet and manhole details, refer to the CDOT *M&S Standards*.

Stormwater detention facilities or natural drainage ways are to be used whenever feasible. Any alteration to natural drainage patterns shall not be approved unless a thorough investigation and analysis shows no hazard or liability. The Town will have final authority over any system design.

Public drainage facilities and all detention facilities shall be in an easement or public right-of-way (ROW). All drainage improvements shall be as natural in appearance as possible to be aesthetically pleasing. Maintenance access shall be provided for all drainage and flood control facilities.

Irrigation ditches shall not be used as the outfall of any drainage basin.

The Engineer shall submit all detention facilities to the Colorado Stormwater Detention and Infiltration Facilities database that meet the requirements of Colorado Statute § 37-92-602(8).

611.0 DESIGN METHODS

611.01 Minor and Major Design Storms

Every urban area has two separate and distinct drainage systems whether or not they are actually planned for and designed. One is the initial system, which corresponds to the minor (or ordinary) storm recurring at regular intervals. The other is the major system, which corresponds to the major (or extraordinary storm), which has a 1% chance of occurring in any given year (“100-year storm”). Since the effects and routing of storm waters for the major storm may not be the same as for the minor storm, all storm drainage plans submitted for approval shall be submitted in detail in two separate phases: one indicating the effects of the minor storm and the other showing the effects of the major storm.

- A. Minor storm provisions: The objectives of the minor storm planning are to minimize inconvenience, to protect against recurring minor damage, to reduce rising maintenance costs, to create an orderly drainage system, and to provide a sociological benefit to the urban resident. The minor storm drainage system may include curb and gutter, inlets, storm sewer, swales, and other open drainage ways and detention facilities.
- B. Major storm provisions: The major storm shall be considered the one hundred (100) year

storm. The objectives of the major storm planning are to eliminate substantial property damage or loss of life and shall be as directed and approved by the Town. Major drainage systems may include storm sewers, open drainage ways, and detention facilities. The correlation between the minor and major storm systems shall be analyzed to ensure a well-coordinated drainage system. The major storm system shall be designed to convey the portion of the a one hundred (100) year storm event not conveyed by the initial storm system through streets, swales, open channels, and storm sewers.

611.02 Storm Return Periods

The minor and major storm design return periods shall not be less than those shown below:

TABLE 600.01 DESIGN STORM RETURN PERIODS

Land Use or Zoning	Design Storm Return Period	
	Minor Storm	Major Storm
Residential	5-year	100-year
Business	5-year	100-year
Public Building Areas	5-year	100-year
Parks, Greenbelts, etc.	5-year	100-year
Open Channels and Drainageways	-	100-year
Detention Facilities	10-year ¹	100-year

¹A two (2) year storm return period shall be used if the detention facility does not have a water quality outlet.

611.03 Rainfall Intensities

The rainfall intensities to be used in the computation of runoff shall be obtained from the Time-Intensity-Frequency Curves shown in the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS.

611.04 Runoff Computations, Colorado Urban Hydrograph Procedure (CUHP)

The CUHP method is generally applicable to basins greater than ninety (90) acres and is required for watershed areas larger than one hundred sixty (160) acres. The procedures for the CUHP method, as explained in the UDFCD Manual (Volume 1), shall be followed in the preparation of drainage reports and storm drainage facility designs in the Town. The design storms to be used with the CUHP method are presented in the CUHP Design Storm for the Town in Section 611.03 RAINFALL INTENSITIES of these DESIGN STANDARDS AND SPECIFICATIONS.

611.05 Runoff Computations, Rational Method

The Rational Method shall be utilized for sizing storm sewers and for determining runoff magnitude of smaller watersheds. The limit of application for the Rational Method is approximately ninety (90) acres. When the drainage basin exceeds ninety (90) acres, the CUHP method shall be used.

The procedures for the Rational Method as explained in the latest edition of the UDFCD Manual (Volume 1) shall be followed in the preparation of drainage reports and storm drainage facility designs in the Town.

611.06 Runoff Coefficients

Rational method runoff coefficients: The runoff coefficient (C) to be used in conjunction with the Rational Method shall not be less than those listed in the Runoff Chapter of the most recent UDFCD Manual.

612.00 DETENTION

612.01 General

Onsite detention is required for all new development, expansion, and redevelopment. The required minimum detention volume and maximum release rates at these volumes for the two (2), five (5), and one hundred (100) year storms shall be determined in accordance with the procedure and data set forth in these criteria. If the pond does not include a water quality outlet, which controls about the one and one-half (1½) year storm, the pond shall be designed to release the two (2) year historic rate.

Exemptions from the detention requirement may be granted if it can be demonstrated that the developed area does not adversely affect the downstream major drainage ways (assuming the entire drainage area is fully developed) and that the water quality is maintained.

Offsite flows cannot be passed through the detention pond. Offsite areas shall be included in the drainage area contributing to the pond. In certain cases, offsite flow can be routed around the detention pond. Parking lots that serve as detention storage ponds shall not have a storage depth of more than six (6) inches and shall place notification signs that the area ponds during a rainfall event. The signs shall be permanent and high quality and shall meet the Town's specifications for traffic signs.

Pond outlet structures are required to have a minimum open area that results in a maximum flow velocity of two (2) feet per second through the trash rack. Trash racks are required to be sloped at a grade of six to one (6:1) or steeper. If the trash rack is flat, it is required to be sized assuming it is fifty (50) percent plugged.

612.02 Equation Method

If not specified otherwise in the Master Plan or by the Town, the equation method found in the Storage section of the UDFCD Manual may be used to design detention ponds for drainage areas smaller than ninety (90) acres. However, if the calculated allowable release is greater than the historic runoff, a different method shall be used to determine the storage requirements.

If the drainage area is larger than ninety (90) acres, a CUHP/UDSWM analysis shall be used to design the detention ponds.

612.03 Sequential Detention

The sequential detention method shall be used for ponds that drain into each other. The total drainage area cannot exceed ninety (90) acres. Use the Sequential Detention Form at the end of this section to size sequential detention ponds.

613.00 DESIGN STANDARDS

613.01 Open Channels

Except as modified herein, open channels shall be designed for the one hundred (100) year storm and shall conform to the UDFCD Manual. In addition, the channel design shall also be analyzed with respect to minor storm runoff. Whenever practical, the channel shall have slow flow characteristics, be wide and shallow, and be natural in its appearance and functioning.

Channels shall be designed so that critical depth and super-critical flows are avoided. Channel capacities shall be computed from Manning's Formula for uniform flow except at crossings and transitions, where the design shall account for backwater effects.

The channel cross-section may be any type suitable to the location; however, the limitations for design for the major storm and minor storm design flows shall include:

- A. Capacity: The channel and overbank areas shall have adequate capacity for one hundred (100) year storm runoff.
- B. Side slopes: Side slopes shall be as flat as practical. Side slopes of 4:1 (run:rise) shall be considered a normal minimum. Under special conditions, slopes of 3:1 may be utilized with written approval of the Town. The practical slope for mowing equipment is 4:1 or less.
- C. Depth: The maximum design depth of flow for the major storm shall be limited to five (5) feet of depth in the channel cross section outside of the low-flow or trickle channel. Any design variation exceeding the maximum depth of flow shall be submitted in writing for approval by the Town. Critical depths and velocities shall be investigated and reported for both the major and minor storm runoffs.
- D. Freeboard: Except where localized overflow in certain areas is desirable for additional ponding benefits or other reasons, the minimum allowable freeboard shall be one (1) foot.
- E. Bottom width: The bottom width shall be designed to satisfy the hydraulic capacity of the cross-section, recognizing the limitations on velocity, depth, and Froude number.
- F. Slope of channel: Grass-lined channel slopes are dictated by velocity and Froude number requirements. Grass-lined channels normally shall have slopes of two (2) to six (6) percent. Where the natural topography is steeper than desirable, drops may be utilized.
- G. Curvature: The centerline curvature shall have a radius of not less than twice the design flow top width, but not less than one hundred (100) feet.
- H. Trickle channels: Concrete or grouted rock trickle channels to carry low flows shall be required for all new urban grassed channels. The capacity of a trickle channel shall be approximately two (2) percent of the major design flow. The shape of concrete trickle channels shall be parabolic. Low flow channels shall be in accordance with the UDFCD Manual (Volume 2). All concrete trickle channels shall have a minimum slope of one (1) percent.

- I. Design velocity: The system shall be designed and constructed to give mean velocities, when flowing full, of not less than two (2) feet per second, nor more than fifteen (15) feet per second.
- J. Erosion: All channels shall be designed with the proper and adequate erosion control features.
- K. Grass lining: The grass lining for channels shall be in accordance with the UDFCD Manual (Volume 2).
- L. Water surface profile: A water surface profile for the major storm runoff shall be computed for all channels and clearly shown on the construction plans submitted for approval. Computations of the water surface profile shall utilize standard backwater methods, such as HEC-RAS, and shall take into consideration all losses due to velocity changes, drops, bridge and culvert openings, and other obstructions. A Computations Report shall be submitted along with the construction plans. The energy and hydraulic gradient lines for the minor and major storm shall be shown on the construction plans.
- M. Roughness coefficient (n): The value of the roughness coefficient (n) to be used in Manning's Formula shall not be less than those listed below:

TABLE 600.02 MINIMUM VALUES OF ROUGHNESS COEFFICIENT (n)

Type of Channel and Description Closed Conduits:		Minimum
Concrete Pipe:		
	Culverts with bends, connections, & debris	0.013
	Storm sewer	0.013
	Subdrain with open joints	0.016
PVC Pipe		0.011
Concrete Surfaces (bottom & sides):		
	Smooth finish	0.015
	Unfinished	0.017
Concrete Bottom (with sides of):		
	Mortared stone	0.02
	Dry rubble or riprap	0.03
Gravel Bottom (with sides of):		
	Formed concrete	0.02
	Dry rubble or riprap	0.04
Excavated or Dredged Channels and Ditches:		
Earthen, Straight, & Uniform, no brush or debris:		
Grassed, less than 6 inches high, with:		
	Depth of flow < 2.0 feet	0.035
	Depth of flow < 2.0 feet	0.03
Grassed, approx. 12 inches high, with:		
	Depth of flow < 2.0 feet	0.06
	Depth of flow < 2.0 feet	0.035
Grassed, approx. 24 inches high, with:		
	Depth of flow < 2.0 feet	0.07
	Depth of flow < 2.0 feet	0.035
	Earth bottom with riprap on sides	0.04
Rock or Shale Cuts:		
	Smooth and uniform	0.035
	Jagged and irregular	0.04
Curb and Gutter (concrete)		0.016

613.02 Storm Sewers and Storm Inlets

Except as subsequently modified, the design of storm sewers and inlets shall conform to the criteria set forth in the UDFCD Manual. Storm sewers and inlets shall be of sufficient capacity to adequately carry the expected runoff from the initial design storm. Computer programs, such as UDFCD's updated UD Sewer and UD Inlet, are encouraged in the design of the storm sewer system.

The storm drainage system design form in the back of this Section shall be used in the design of storm sewers and inlets. The completed form shall be included in the drainage report.

The storm sewer system shall be installed at all locations where the allowable street capacity is exceeded or wherever ponding of water is likely to occur.

The invert elevation of storm sewer outfalls into channels shall be at least one (1) foot above the channel invert.

The minimum allowable pipe size for storm sewer systems shall be as follows:

TABLE 600.03 MINIMUM ALLOWABLE PIPE SIZE

Type of Conduit	Min. Inside Pipe Dia. (Inches)
Main Trunk Sewer	18
Individual Laterals	15

Pipe diameters of less than fifteen (15) inches may be allowed; however, a variance request shall be submitted to the Town in writing, and approval shall be obtained from the Town prior to final design.

Arch pipes may be allowed where design conditions dictate, provided that the minimum cross sectional areas are not less than those specified above. All storm sewer conduits shall have sufficient structural strength to withstand an H-20 design load.

Manholes shall be a minimum of sixty (60) inches for lines eighteen (18) inches to twenty-one (21) inches diameter and seventy-two (72) inches for lines twenty-four (24) inches to thirty (30) inches diameter. For storm pipe larger than thirty (30) inches diameter, a CDOT box base manhole or the Town approved manhole design is required. Where two or more pipes enter a manhole, the Town shall approve the manhole design size.

The maximum allowable distance between manholes or other suitable appurtenances for cleanouts shall not exceed those listed below:

TABLE 600.04 MAXIMUM ALLOWABLE MANHOLE SPACING

Inside Diameter (Inches)	Maximum Allowable Distance Between Manholes and Cleanouts (Feet)
18-36	400
36-60	500
60 & Larger	750

Manholes shall be located at all bends in storm water systems that are forty-eight (48) inches or smaller.

At drop manholes, if the drop height exceeds six (6) feet, then six thousand (6,000) psi concrete is required for the manhole structure.

For manholes that exceed a depth of twenty (20) feet, it may be required to have an intermediate platform and sixty (60) inch minimum diameter manhole riser.

The velocity for the minor flows in conduits shall not be less than two (2) feet per second. Maximum

allowable velocity is fifteen (15) feet per second. In areas with steep grades, the flow velocity in storm water lines can be twenty (20) feet per second maximum, in the one hundred (100) year event as long as the velocity for the minor even is less than one hundred fifteen (115) feet per second. If the velocity exceeds fifteen (15) feet per second, then six thousand (6,000) psi concrete is required for the storm sewer lines and manholes.

Storm inlets shall be utilized at all points where ponding or sump conditions exist. Inlets shall be Type R curb opening inlets or grated inlets with curb openings. All inlets shall be equal to those in the CDOT *M&S Standards* or as approved by the Town. No. 16 inlets may be used in streets where the required length of Type R inlets would be excessive.

Grated inlets shall be recommended for areas with bicycle traffic. Grated inlets shall be Neenah Foundry model number R-3157A or R-3233 or an approved equivalent.

All storm sewer inlets shall be labeled as required by the Town's Public Works.

The theoretical capacity and spacing of storm inlets shall be analyzed using the criteria, including reduction factors, set forth in the most recent UDFCD Manual. Storm water inlets shall be sized to collect a minimum of eighty (80) percent of the gutter flow with a minimum open area of one hundred fifty (150) square inches.

The size of outlet pipes from storm water inlets shall be based on the theoretical capacity of the inlets. All pipe outlets shall be protected in accordance with the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS.

613.03 Culverts

Culvert capacities shall be at least equal to the capacities of culverts designed in accordance with the procedures outlined in Federal Highway Administration Hydraulic Design Series Number 5, "Hydraulic Design of Highway Culverts." The Town shall approve the shape, location, and type of construction of culverts.

Culverts shall be sized to have sufficient capacity to pass all of the runoff from the major storm if twenty (20) percent of the pipe is plugged.

The following design criteria shall be utilized for all culvert design:

- A. The culvert, including inlet and outlet structures, shall properly convey water and debris at all stages of flow.
- B. Culvert inlets shall be designed to minimize entrance and friction losses. Inlets shall be provided with either flared end sections or head walls with wing walls. Projecting ends are not acceptable. Large structures shall be designed to resist hydrostatic uplift forces.
- C. Culvert outlets shall be designed to avoid sedimentation, undermining of culvert, or erosion of downstream channels. Outlets shall be provided with either flared end sections or headwalls with wingwalls and riprap. Projecting ends are not acceptable. Additional outlet control in the form of riprap, channel shaping, etc., may be required.
- D. Culvert slopes shall be selected to eliminate excessive velocities and scour. Generally, the minimum slope of culverts shall be limited to one-half (½) percent.

- E. Headwater ponding above culvert inlets shall not be acceptable if such ponding appears likely to cause property or roadway damage, culvert clogging, saturation of fills, detrimental upstream deposits of debris, or inundation of existing or future utilities and structures.
- F. Tailwater height at the outlet shall be subject to approval by the Town.
- G. Culverts shall be analyzed to determine whether discharge is controlled by inlet or outlet conditions for both the minor storm discharge and the major storm discharge. Computations for selected culvert sizes shall be submitted to the Town Engineer for approval. Computer programs, such as the FHWA HY8, may be used to design culverts.
- H. Minimum Allowable Size: The required size of a culvert shall be based on adequate hydraulic design analysis.
 - 1. Circular culverts under roadways shall have a minimum diameter of thirty-six (36) inches.
 - 2. Oval culvert dimensions shall be forty-three (43) inches by twenty-seven (27) inches or larger.
 - 3. Box culverts shall have a minimum height of six (6) feet.
 - 4. Smaller culvert sized may be approved by the Town.
- I. An overflow path shall be provided in case the culvert becomes plugged.
- J. Where physical conditions dictate, multiple culvert installations may be approved by the Town.
- K. Trash racks at entrances to storm sewer and culverts are required to have a minimum open area that results in a maximum flow velocity of two (2) feet per second through the trash rack.
- L. The structural design of culverts shall conform to the methods and criteria recommended by the manufacturer of a specific type of culvert for the specified embankment conditions.

613.04 Street Flow Capacities

Except as modified herein, the criteria set forth in the UDFCD Manual shall be used to analyze and to determine the adequacy of streets as a function of the drainage system. Both the minor storm runoff and major storm runoff shall be considered, and calculations showing such runoff at critical sections shall be submitted. The following criteria shall apply in the determination of allowable street flow capacities:

- A. Street, curb and gutter, sidewalks, crosspans, and curb cuts shall conform to all applicable Sections of these DESIGN STANDARDS AND SPECIFICATIONS.
- B. Street encroachment for the minor design storm shall not exceed the limitations set forth below:

TABLE 600.05 ALLOWABLE STREET ENCROACHMENT AND DEPTH OF FLOW FOR MINOR STORM RUNOFF

Street Classification	Maximum Encroachment
Local	6") inches or top of curb, whichever is less.
Collector	6) inches or top of curb, whichever is less. Flow spread shall leave the equivalent of one (1) 10-foot driving lane clear of water.
Arterials	6) inches or top of curb, whichever is less. Flow spread shall leave the equivalent of two (2) 10-foot driving lanes clear of water—one (1) lane in each direction. No more than two lanes in each direction shall be flooded.

Where no curb exists, street encroachment shall not extend past the public ROW.

A storm sewer system shall be installed at all points where the maximum allowable street encroachment occurs.

- C. The allowable depth of flow and inundated area for the major design storm shall not exceed the following limitations:

TABLE 600.06 ALLOWABLE DEPTH OF FLOW AND INUNDATED AREA FOR MAJOR STORM RUNOFF

Street Classification	Allowable Depth and Inundated Areas
Local and Collector	The depth of water over the gutter flowline shall not exceed twelve (12) inches.
Arterial	Depth of water over gutter flow line shall not exceed twelve (12) Flow spread shall leave the equivalent of two (2) 10-foot driving lanes clear of water, one (1) lane each direction.

- D. Cross-street flow occurs when runoff flowing in a gutter flows across the street to the opposite gutter or inlet. Allowable cross-street flow is summarized in the following table:

TABLE 600.07 ALLOWABLE CROSS-STREET FLOW

Street Classification	Initial Storm Flow	Major Storm Flow
Local	None	Six (6) inches of depth above gutter flow line.
Collector	None	Six (6) inches of depth above gutter flow line.
Arterial	None	No cross-street flow. Maximum depth of upstream gutter is twelve (12) inches.

620.00 GENERAL PROVISIONS

621.00 GENERAL

All storm drainage construction in the public ROW shall comply with these DESIGN STANDARDS AND SPECIFICATIONS. These standards shall include new storm drainage construction and repairs and maintenance of existing facilities within the Town.

622.00 APPROVED PLANS

All storm drainage construction shall be in accordance with engineered construction plans prepared under the direction of a Colorado Registered Professional Engineer. Storm drainage plans shall include an Area Grading Plan and an Erosion Control plan as defined in Section 161.09 AREA GRADING PLAN DETAILS and Section 161.10 EROSION CONTROL PLAN DETAILS of these DESIGN STANDARDS AND SPECIFICATIONS. Where work is to be performed over, under, or in an irrigation ditch, written approval of the ditch owner is required prior to written approval by the Town.

623.00 PERMITS REQUIRED

A ROWP and/or Grading Permit issued by the Town shall be required and shall not be issued until the Town has approved the storm sewer plans. A NPDES permit shall be obtained for any disturbance of one acre or more. A Town of Superior Stormwater Quality permit shall be obtained for all projects. Refer to Section 150.00 PERMITS AND INSPECTIONS of these DESIGN STANDARDS AND SPECIFICATIONS for additional requirements.

624.00 TRAFFIC CONTROL

Traffic control shall comply with Section 141.13 TRAFFIC CONTROL, BARRICADES, AND WARNING SIGNS of these DESIGN STANDARDS AND SPECIFICATIONS.

630.00 EROSION CONTROL

631.00 GENERAL

Erosion and sedimentation are natural processes, the intensity of which is increased by land disturbing activities. Erosion and sedimentation can reduce or destroy the aesthetic and practical values of neighboring properties, streams, and lakes. The purpose of these erosion control criteria is to prevent pollution of state waters without placing undue burdens on the landowner, builder or community.

632.00 REQUIRMENTS

Erosion control measures shall be designed in conformance with the UDFCD Manual (Volume 3). All land-disturbing activities within the Town shall comply with the Colorado Department of Public Health and Environment Regulations and stormwater regulation in Chapter 16, Article XXVI, of the Superior Municipal Code.

633.00 SUBMITTAL

A discussion that summarizes erosion control methods shall be submitted as part of the preliminary and final drainage reports, as required in Section 162.00 ENGINEERING REPORTS of these DESIGN STANDARDS AND SPECIFICATIONS. A detailed Stormwater Management Plan (SWMP) plan prepared by a Certified SWMP Administrator shall accompany the Area Grading Plan and approved Drainage Plan, as required in Section 161.10 EROSION CONTROL PLAN DETAILS of these DESIGN STANDARDS AND SPECIFICATIONS. The SWMP shall be approved by the Town prior to receiving a ROWP or Grading Permit.

634.00 EROSION CONTROL MEASURES

A construction stormwater discharge permit (CDPS Permit) shall be obtained from the Colorado Department of Health and Environment for Construction Activity that disturbs at least one (1) acre of land or is part of a larger common plan of development of sale that will disturb at least one (1) acre.

Detailed erosion control measures shall be provided to protect the following:

- A. Inlets and culverts
- B. Drainage ways
- C. Streams or other water bodies immediately adjacent to land disturbed by construction activity
- D. Cut and fill areas
- E. Properties and improved streets adjacent to construction activity
- F. Others locations as required by the Town

Temporary erosion control measures, such as sediment traps, straw bales or, and silt fence shall be properly placed in accordance with the Colorado Department of Public Health and Environment approved SWMP CDPS Permit prior to any earthmoving on the site. Erosion control measures shall be kept in good repair and fully functional until erosion potential from the site no longer exists.

Permanent erosion control (sod, seed, mulching, etc.) shall be in place prior to the request for a Certificate of Occupancy or Letter of Final Acceptance/Release from Warranty.

635.00 EROSION CONTROL STRUCTURES

Refer to the UDFCD Manual (Volume 3, Chapter 7) for erosion control details and installation.

640.00 STORM DRAINAGE CONSTRUCTION

641.00 SITE WORK AND EARTHWORK

641.01 General

Site work and earthwork shall be performed in accordance with Section 300 SOILS AND EARTHWORK of these DESIGN STANDARDS AND SPECIFICATIONS.

641.02 Trenching, Backfilling and Compacting

Trenching, backfilling, and compacting shall be performed in accordance with Section 340.00 TRENCHING, BACKFILLING, AND COMPACTING of these DESIGN STANDARDS AND SPECIFICATIONS.

642.00 MATERIALS

642.01 Pipe

Reinforced Concrete Pipe (RCP) shall be manufactured to comply with ASTM C76. All RCP shall meet CDOT Class 2 sulfate resistance. All street and road culverts shall be equipped with restrained end sections. All applicable portions of Section 706 Concrete and Clay Pipe of the CDOT *Standard Specifications for Road and Bridge Construction* shall apply.

CSP, CMP, and plastic pipe may be approved at the discretion of the Town. Pipe class designation or gauge shall be as shown on the approved plans or as designated by the Town for each individual project. Pipe material shall be selected based on strength and soil conditions.

All pipe shall be inspected by the Town Construction Inspector in order to allow for rejection of pipe that fails to conform to the requirements of these DESIGN STANDARDS AND SPECIFICATIONS. Defects shall be marked so as not to disfigure the rejected pipe. Rejected pipe shall be removed from the job site within twenty-four (24) hours.

642.02 Pipe Joints

All pipe joints shall be watertight. Joints shall be tongue and groove and be sealed with Rub'r-Nek by K.T. Snyder Co. or approved equal.

642.03 Manholes, Inlets

Manhole bases, vaults, and inlets shall be cast-in-place unless approved by the Town Engineer. Manholes shall have a minimum inside diameter of four (4) feet. All manholes twelve (12) feet deep or deeper shall have a minimum inside diameter of five (5) feet. MacWrap shall be placed on the exterior of all joints. Interior joints shall be neatly grouted smooth in a workmanlike manner. Manhole materials, including access ring and cover sets for all inlet types, shall comply with all applicable portions of Section 532.05 MANHOLES of these DESIGN STANDARDS AND SPECIFICATIONS.

Inlets shall be constructed in accordance with CDOT *M&S Standards* unless otherwise approved by Town.

Chase drains shall be constructed in accordance with the Detail Drawings of these DESIGN STANDARDS AND SPECIFICATIONS.

642.04 Manhole Base Slabs & Base Beams

Refer to Section 532.06 MANHOLE BASES of these DESIGN STANDARDS AND SPECIFICATIONS.

642.05 Concrete

Concrete shall conform to Section 800 CONCRETE MIX DESIGN AND CONSTRUCTION of these DESIGN STANDARDS AND SPECIFICATIONS. Type II cement shall be used except where sulfate resistant cement is required. Concrete encasement of pipe shall conform to the details shown on the approved plans.

642.06 Cast and Ductile Iron Fittings

Refer to Section 532.08 CAST AND DUCTILE IRON FITTINGS of these DESIGN STANDARDS AND SPECIFICATIONS. Lids shall be furnished with a Denver pick hole and the words “No Dumping Drains to Stream” with a Fish logo cast on top.

642.07 Bedding Material

All applicable portions of Section 343.01 BEDDING FOR PIPELINES AND SERVICE LINES of these DESIGN STANDARDS AND SPECIFICATIONS shall apply.

642.08 Riprap and Filter Cloth

Riprap and filter cloth shall be installed at locations shown on the approved plans or in locations designated by the Town.

Rock used for riprap shall be hard, durable, angular in shape and be free from cracks, overburden, shale, and organic matter. Neither breadth nor thickness of a single stone shall be less than one-third ($\frac{1}{3}$) its length, and rounded stone shall not be approved. The rock shall sustain the abrasion test (Los Angeles machine - ASTM C0535-69) and shall sustain a loss of not more than ten (10) percent after twelve (12) cycles of freezing and thawing (AASHTO test 103 for ledge rock procedure A). The rock shall have a minimum specific gravity of two and one-half (2.50). Classification and gradation for riprap are shown below.

The riprap designation and total thickness of riprap shall be as specified on the approved plans. The maximum stone size shall not be larger than the thickness of the riprap. Exposed riprap is required to be Type M or larger.

TABLE 600.08 CLASSIFICATION AND GRADATION OF RIPRAP

Riprap Designation	% Smaller Than Given Size By Weight	Intermediate Rock Dimension (Inches)	d(50)* (Inches)
Type VL	70–100	12	
	50–70	9	
	35–50	6	6**
	2–10	2	
Type L	70–100	15	
	50–70	12	
	35–50	9	9**
	2–10	3	
Type M	70–100	21	
	50–70	18	
	35–50	12	12
	2–10	4	
Type H	70–100	30	
	50–70	24	
	35–50	18	18
	2–10	6	
Type VH	70–100	42	
	50–70	33	
	35–50	24	24
	2–10	9	

*d (50) = Mean particle size

** To minimize vandalism, mix Types VL and L riprap with thirty (30) percent (by volume) topsoil and bury it with a minimum of six (6) inches of topsoil, vibration compacted and revegetated.

Filter cloth shall be manufactured especially for the stability of erosion control construction and made from polyethylene, polypropylene, or polyester yarns in accordance with the following:

Filter cloth shall meet the requirements of CDOT Class B drainage geotextile as specified in Section 712 of the *CDOT Standards and Specifications for Road and Bridge Construction*.

Filter material which is to be placed on top of the filter cloth (at specified thickness) prior to placement of the riprap shall meet the bedding requirements in of the UDFCD Manual (Volume 1).

When requested by the Town, the Contractor shall furnish copies of test reports from a certified testing laboratory for the following:

- A. Gradation and soundness of riprap

- B. Gradation of filter material
- C. Strength and characteristic tests for filter cloth
- D. Compaction tests of the prepared subgrade

At outlet, erosion protection is required to be extended to the pond bottom or to the toe of the slope in a channel, whichever the case may be.

643.00 INSTALLATION

Refer to Section 533.01 GENERAL of these DESIGN STANDARDS AND SPECIFICATIONS.

643.01 Alignment and Grade

Refer to Section 533.02 ALIGNMENT AND GRADE of these DESIGN STANDARDS AND SPECIFICATIONS.

643.02 Protection of Existing Underground Utilities

Refer to Section 533.03 PROTECTION OF EXISTING UNDERGROUND UTILITIES of these DESIGN STANDARDS AND SPECIFICATIONS.

643.03 Wet Trench

Refer to Section 342.00 TRENCH EXCAVATION FOR PIPELINES AND SERVICE LINES of these DESIGN STANDARDS AND SPECIFICATIONS.

643.04 Storm Sewer Pipe Installation

Refer to Section 533.05 SEWER PIPE INSTALLATION of these DESIGN STANDARDS AND SPECIFICATIONS.

643.05 Connections to Existing Manholes

Refer to Section 533.06 CONNECTIONS TO EXISTING MANHOLES of these DESIGN STANDARDS AND SPECIFICATIONS.

643.06 Construction of Manholes, Inlets and Sidewalk Chases

Manholes and inlets shall be constructed in accordance with applicable portions of Section 533.07 CONSTRUCTION OF MANHOLES AND CLEAN-OUTS of these DESIGN STANDARDS AND SPECIFICATIONS.

643.07 Construction of Open Channels and Special Structures

All work shall conform to details in the approved plans and supplemental specifications. Construction shall comply with Section 533.02 ALIGNMENT AND GRADE of these DESIGN STANDARDS AND

SPECIFICATIONS.

When approved, sidewalk chases shall be constructed in accordance with the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS.

643.08 Riprap and Filter Cloth

Excavation for riprap shall conform to Section 300 SOILS AND EARTHWORK of these DESIGN STANDARDS AND SPECIFICATIONS.

Filter cloth shall be placed according to the manufacturer's specifications. Holes, rips, or other damage to the filter cloth shall be repaired at the Contractor's expense, in accordance with the manufacturer's recommendations.

Stabilization material, as described in Section 330.01 DEFINITIONS of these DESIGN STANDARDS AND SPECIFICATIONS, shall be placed on top of the filter cloth (where filter cloth is used) to the required thickness. The material shall be placed using equipment that shall not rip, tear or, otherwise damage the filter cloth. Any damaged areas shall be promptly repaired at the Contractor's expense. The material shall be leveled to a finished surface that is within one (1) inch of the specified thickness.

Riprap shall be placed to conform to the details shown on the approved plans. The larger size stones shall be placed first and roughly arranged in close contact. The toe trench and foundation course shall be closed first. The spaces between the larger stones shall then be filled with smaller stone of suitable size, and placed as to leave the surface evenly stepped and conforming to the contour required. The finished surface shall be even and tight and shall not vary from the planned surface grade by more than three (3) inches per foot of depth. The material may be machine placed with sufficient handwork to conform to these DESIGN STANDARDS AND SPECIFICATIONS.

All riprap shall be grouted. For grouted riprap, the stones shall be laid with care to prevent earth and sand from filling the joints. Joints shall be filled with grout and the surfaces swept with a stiff broom. The work shall be protected and kept moist during hot weather for at least three (3) days after grouting or coated with a clear membrane curing compound. Grout shall consist of one (1) part cement and three (3) parts aggregate by volume. The Portland Cement shall be Type II and aggregate shall be two (2) parts sand and one (1) part gravel passing a three-eighths ($\frac{3}{8}$) inch square mesh screen. Grout shall be mixed with enough water to permit gravity flow of grout into the interstices with limited spading and brooming. A six (6) inch by six (6) inch concrete mow strip is required around the edges of riprap structures.

When concreting is permitted during cold weather, the temperature of the mix shall not be less than sixty (60) degrees Fahrenheit at the time of placing. Filter cloth, stabilization material, or riprap shall not be placed on frozen ground. Concrete grout shall not be placed when there is frost in the subgrade.

644.00 TESTING

644.01 Description

This section concerns the testing of storm sewer trunk lines, laterals, manholes, and appurtenances.

644.02 Testing Equipment

- A. Conform to applicable sections of ASTM.

- B. Conform to other applicable industry standards and codes.

644.03 Cleaning

All storm sewer shall be cleaned in accordance with Section 534.07 PIPE CLEANING PRIOR TO INSPECTION of these RULES AND REGULATIONS WITH DESIGN STANDARDS AND SPECIFICATIONS.

- A. Clean all manholes, pipes, and structures by removing sheeting, bracing, forms, soil sediment, concrete waste, and other debris.
- B. Do not discharge soil sediment or debris to drainage channels or existing storm sewer. Dispose of properly in a waste containment site that is acceptable to the Town.

644.04 Visual Inspection

- A. Examine structures and pipes for:
 - 1. Damage;
 - 2. Indication of displacement of reinforcement, forms, pipes, or bedding;
 - 3. Porous areas or voids;
 - 4. Proper placement of seals, gaskets, and embedments;
 - 5. Visible infiltration.
- B. Verify that structures and pipes are set to true line, grade, and plumb.
- C. Verify structure and pipe dimensions and thickness.
- D. Measure actual inside dimensions of all flexible pipe prior to installation. Use these dimensions when sizing the mandrel should deflection testing be required.
- E. Storm sewer shall be inspected by lamping, flashing a light between manholes, or by physical passage where space permits.
 - 1. Lamping shall be done after pipe trench backfill is compacted and brought to grade or pavement subgrade.
 - 2. Full pipe diameter (“full moon”) shall be visible for grade alignment.
 - 3. No less than half pipe diameter (“half moon”) shall be visible for horizontal alignment.

644.05 Pipe - Water Tightness

All pipe shall be tested for water tightness in accordance with manufacturer’s requirements.

- A. Reinforced concrete pipe (RCP) shall be tested in accordance with ASTM C443.
- B. High density polyethylene pipe (HDPE) shall be tested in accordance with ASTM D3212.
- C. Polyvinyl chloride pipe (PVC) shall be tested in accordance with ASTM D3212.
- D. Spiral-ribbed aluminized steel pipe (CMP, ASP) does not require water tight joints.

644.06 Flexible Pipe - Deflection

All flexible pipe shall be tested for deflection in accordance with Section 534.04 DEFLECTION TESTING PIPE of these DESIGN STANDARDS AND SPECIFICATIONS.

644.07 Manhole Testing

The finished manholes are expected to be as watertight as the pipe system in which it is incorporated. Observed leaks (infiltration or exfiltration) at any time within the warranty period shall be cause for rejection.

All storm manholes shall be tested in accordance with Section 534.03 VACUUM TESTING MANHOLES of these DESIGN STANDARDS AND SPECIFICATIONS. Manholes that fail the vacuum test shall be replaced or shall have a chemical and gas resistant manhole interior lining applied, per the Town's instructions, prior to being retested. Lining material shall be in accordance with these DESIGN STANDARDS AND SPECIFICATIONS.

644.08 Infiltration and Exfiltration

If deemed necessary by the Town, the storm sewer system shall be tested in accordance with Section 534.02 LEAKAGE TESTING and Section 534.05 LOW-PRESSURE AIR TESTING of these DESIGN STANDARDS AND SPECIFICATIONS.

644.09 Video Inspection

The Contractor shall be responsible to video record the entire newly installed storm sewer system at least 30 days after completion of backfill and one month before the Town gives final acceptance for the two-year warranty. The recording shall be made using a color camera, self-propelled or other, having sufficient light to show detail of problem areas and joints. Camera speed shall not exceed 3 feet per second. If problems or concerns are seen by the operator, then the camera shall be reversed, and an extended look at the area will be recorded. All recordings will have time, date, and footage displayed. Supplement the video recording with a written log or orally recorded tape log noting observations, findings, and deficiencies shown on the video tape.

- A. The video recording inspection shall be performed by an outside independent testing agency acceptable to the Town.
- B. The video recording and log will be given to the Inspector for review. If the Town finds any problems with the storm sewer, the Contractor will repair the problem and re-camera that area before final acceptance will be approved at no added cost to the Town.
- C. Video recording of storm sewer may be waived if pipe diameter is sufficient for man access, as determined by the Inspector, but a log shall be developed.
- D. One copy of the video recording and log will become permanent Town property and record.

644.10 Storm Sewer Pipeline Air Testing

- A. If, after the visual inspection and video recording of the storm trunk or lateral lines, the Inspector finds that there is a potential joint tightness problem or excessive deflection, there may be required air testing of the line.
 - 1. A test section shall not be any longer than the length of pipe between adjacent manholes for eighteen (18) to twenty-four (24) inch diameter pipe. Air testing applies to only circular pipe and not elliptical, arch or box sections.
 - 2. Reference ASTM C924, latest revision for eighteen (18) to twenty-four (24) inch diameter pipe, and reference ASTM C1103, latest revision twenty-seven (27) inch and larger diameter pipe).
 - 3. The low-pressure air test shall occur at least thirty (30) days after completion of the backfilling and compaction.
 - 4. If the Inspector determines that reliable and uniform results are produced by the Contractor's construction techniques, the air test may occur after initial backfill and compaction.
- B. The Contractor shall provide all equipment and personnel to perform the tests.
- C. The Inspector shall record times and pressure and vacuum readings during the test period.
- D. Pressure testing of individual joints is applicable on pipes twenty-seven (27) inches and larger in diameter. Refer to ASTM C1103 for a detailed explanation of the testing procedures and requirements for individual joints.
- E. The ends of the storm sewer pipe being tested shall be plugged and braced (eighteen [18] to twenty-four [24] inch diameter pipe).
 - 1. It is recommended that the inside of the pipe be wetted prior to testing.
- F. The length of pipe being tested shall be pressurized to four (4.0) psi, allow the air to stabilize, then drop pressure to three and one-half (3.5) psi (eighteen [18] to twenty-four [24] inch diameter pipe).
- G. The pressure pump shall be turned off and the time monitored.
- H. The pressure must not drop more than one (1) psi for the amount of time indicated by the following formula (eighteen [18] to twenty-four [24] inch diameter pipe):

$$T = LD^2 \times \frac{0.00037 \times D \times 2}{Q} \times L$$

where T = time of test (in seconds),
 L = length of pipe (in feet),
 D = diameter of pipe (in inches).
 Q = allowable air loss (see chart)

Pipe Diameter (Inches)	Test Duration (Minutes per 100 lf)	Q (FT ³)
18	2.4	5
21	3.0	5.5
24	3.6	6

- I. Sections of the pipe which fail the air test shall have the defects repaired, and the test shall be repeated.
 1. The initial air testing, repair, and repeat testing of the failed section of pipe shall be repeated at no added cost to the Town until the testing requirements are met.

644.11 Repairs

- A. Repair or replace any unacceptable work at no additional cost to the Town.
- B. Repair all visible leaks.
- C. Remove any concrete webs or protrusions.
- D. Remove form ties and repair tie holes in a workmanlike manner.

645.00 INSPECTIONS

Refer to Section 153.00 INSPECTIONS of these DESIGN STANDARDS AND SPECIFICATIONS.

Adequate inspections assure compliance to the Town requirements and are the basis for the Town’s recommendation that said improvements be accepted for maintenance and for release of performance guarantees. It is the responsibility of the Contractor to contact the Town a minimum of one (1) full working day (twenty four [24] hours) in advance of the required inspections. Required inspections shall include:

- A. Stockpiled Materials Verify that materials meet DESIGN STANDARDS AND SPECIFICATIONS and approved submittals, including but not limited to: bedding material, pipe, fittings, valves, valve boxes, and fire hydrants. Verify that pipe meets roundness specifications and that pipe bells and spigots are not cracked or chipped.
- B. Excavation Verify proper trench depths, shoring, spoil pile location, dewatering, and location and protection of existing utilities.
- C. Installation Verify proper bedding depth, alignment and grade, clean pipe, and lubricants. Verify “slicing in” of bedding at haunches and that all lifting holes in RCP are plugged.
- D. Backfill and Compaction Verify proper methods of backfill and compaction, depths of lifts, moisture control, backfill material free of large rock and organic or frozen material, and proper compaction effort and passing tests.
- E. Testing Verify that testing methods comply with these DESIGN STANDARDS AND SPECIFICATIONS.

- F. Construction Acceptance into Warranty Refer to Section 200 ACCEPTANCE PROCEDURES of these DESIGN STANDARDS AND SPECIFICATIONS. General items include:
1. All temporary structures, debris, mud, and waste materials shall be removed from public property.
 2. All relative testing certifications and documentation shall be submitted to the Town, including all compaction tests. Copies of originals are acceptable.
 3. Construction of all facilities completed to the Town's standards and in conformity with the approved plans.
 4. Permanent survey monuments set at the corners of all easements.
 5. Provide the Town with recorded drawings meeting the Town standards, sealed by a Registered Professional Engineer, and verified as accurate by a utility service provided. Provide the Town with electronic versions of the drawings in a form compatible with the Town's programs.
 6. Furnish a summary of the total construction costs, including design, for all applicable facilities (sub-totaled separately). Include only facilities to be deeded to the Town.
 7. Thirty (30) month letter of credit, in a form and from an institution acceptable to the Town's attorney, to begin after the date of preliminary acceptance in an amount equal to the construction costs of the facilities.
 8. Payment of all fees and confirmation from the Town's attorney that the applicant for dedication of the facilities is not in default under any agreements with the Town.
 9. Easements for any facilities not located in public ROW in a manner satisfactory to the Town.
- G. Final Acceptance/Release from Warranty Refer to Section 200 ACCEPTANCE PROCEDURES of these DESIGN STANDARDS AND SPECIFICATIONS.
1. Bill of Sale for all facilities to be owned by the Town in a form satisfactory to the Town.
 2. Lien waivers from all contractors who performed work on or provided supplies for the facilities in a form satisfactory to the Town.
 3. Televising and flushing of all mains and cleaning out of storm water facilities for which acceptance is requested from the Town at the Developer's expense.
 4. Full payment to the Town for the costs incurred televising and flushing the mains requested for acceptance.
 5. Payment of all fees and confirmation from the Town's attorney that the applicant for dedication of the facilities is not in default under any agreements with the Town.

650.00 TRENCHING, BACKFILLING, AND COMPACTING

Refer to Section 340.00 TRENCHING, BACKFILLING, AND COMPACTING of these DESIGN STANDARDS AND SPECIFICATIONS.

660.00 RESTORATION AND CLEAN UP

Refer to Section 360.00 RESTORATION AND CLEAN UP of these DESIGN STANDARDS AND SPECIFICATIONS.

670.00 GRADING AND EXCAVATION

Refer to Section 320.00 SITE PREPARATION of these DESIGN STANDARDS AND SPECIFICATIONS.

TIME OF CONCENTRATION

SUBDIVISION: _____

CALCULATED BY: _____ DATE: _____

SUB-BASIN DATA			INITIAL / OVERLAND TIME (t_i)			TRAVEL TIME (t_t)				t_c CHECK (URBANIZED BASINS)		$t_c = t_i + t_t$ FINAL t_c	REMARKS
DESIGN (1)	C_5 (2)	AREA Ac (3)	LENGTH Ft (4)	SLOPE % (5)	t_i Min (6)	LENGTH Ft (7)	SLOPE % (8)	VEL. FPS (9)	t_t Min (10)	TOTAL LENGTH Ft (11)	$t_c = (L/180) + 10$ Min (12)	Min (13)	

STORM DRAINAGE SYSTEM DESIGN (RATIONAL METHOD PROCEDURE)

CALCULATED BY: _____

JOB NO: _____

DATE: _____

PROJECT: _____

CHECKED BY: _____

DESIGN STORM: _____

	STREET	DESIGN POINT	DIRECTION RUNOFF							TOTAL RUNOFF				STREET		PIPE		TRAVEL TIME			REMARKS	
			AREA DESIGN	AREA (AC)	RUNOFF COEFF	C*A (AC)	t _c (MIN)	I (IN/HR)	Q (CFS)	t _c (MIN)	I (IN/HR)	Σ(C*A) (AC)	Q (CFS)	SLOPE (%)	STREET FLOW (CFS)	DESIGN FLOW (CFS)	SLOPE (%)	PIPE SIZE	LENGTH (FT)	VELOCITY (FPS)		t _t (MIN)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
1																						
2																						
3																						
4																						
5																						
6																						
7																						

SEQUENTIAL DETENTION CALCULATION

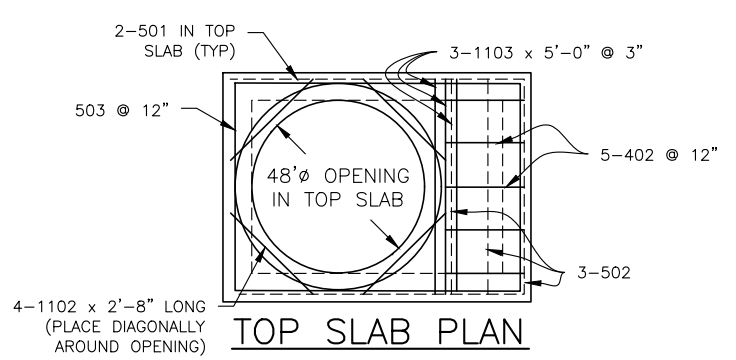
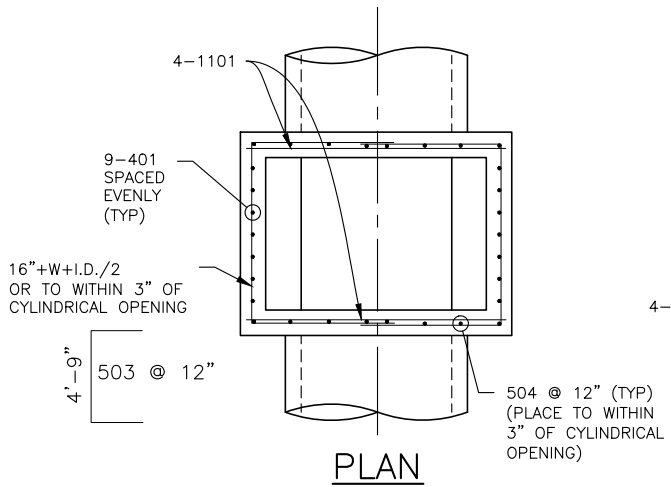
SUBDIVISION _____

CALCULATED BY: _____ DATE: _____

	FACILITY NUMBER (1)	BASIN AREA (A) Ac (2)	Q _i CFS (3)	IMP % (4)	K Ft (5)	Q _i /A CFS/A c (6)		ΣQ CFS (7)	Z Ac (8)	S _m Ac-Ft (9)	Q _m CFS (10)
10-YEAR											

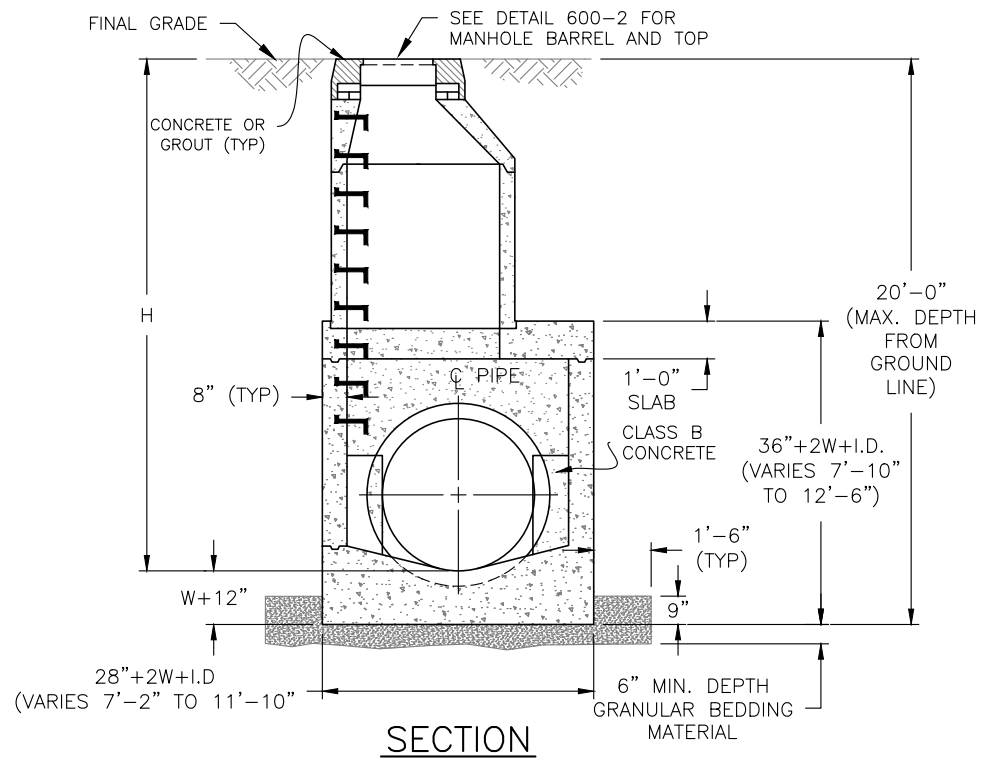
100-YEAR											

- (1) Facility Number: Designated number of the detention facility being analyzed
- (2) Basin Area: Area of basin (sub-basin) tributary to the detention facility not including any area tributary to an upstream detention facility
- (3) (3)Q_i: Peak inflow in cfs from the area described in Column 2
- (4) Imp %: Percent imperviousness of the area described in Column 2
- (5) K: $K_{100} = (1.78I - 0.002I^2 - 3.56)/1000$; $K_{10} = (0.95I - 1.9)/1000$
- (6) Q_i/A: Peak inflow (Q_i) in column 3 divided by the area (A) in Column 2
- (7) ΣQ: Peak inflow into detention facility computed by summation of the peak inflow in Column 3 and the maximum release rate in Column 10
- (8) Z: Equivalent inflow area computed by dividing Column 7 by Column 6 (ΣQ/Q_i/A)
- (9) Minimum S_m: Minimum allowed storage volume for the respective detention facility $V = KA$, where K is from Column 5 and A = Z from Column 8
- (10) Maximum Q_m: Maximum allowed release rate for the respective detention facility $Q_{10} = 0.24Z$, $Q_{100} = 1.00Z$, where Z is from Column 8



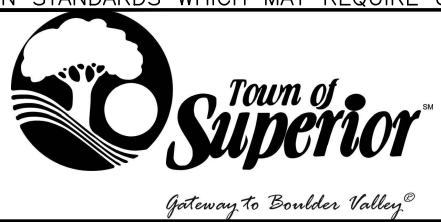
NOTES:

1. CONCRETE BOX BASE QUANTITIES AND DETAILS (SEE CDOT STANDARD DRAWING M-604-20)
2. SINCE ALL PIPE ENTRIES INTO THE BASE ARE VARIABLE, THE DIMENSIONS SHOWN ARE TYP. ACTUAL DIMENSION AND REINFORCEMENT SHALL BE REQUIRED IN THE WORK.
3. THE PRECAST FLAT TOP MAY BE USED ON ANY MANHOLE. THE ECCENTRIC CONE MAY BE USED WHEN THE MANHOLE "H" HEIGHT IS AT LEAST 8'.
4. THE MANHOLE RING FRAME SHALL BE SET IN A BED OF GROUT. THE FRAME SHALL BE SURROUNDED WITH A CEMENT GROUT IN UNPAVED AREA, OR A CONCRETE COLLAR IN PAVED AREA.
5. CAST IN PLACE CONCRETE SHALL BE CLASS B CONCRETE.
6. STEPS SHALL BE REQUIRED WHEN THE MANHOLE DEPTH EXCEEDS 3'-6' AND SHALL CONFORM WITH AASHTO M 199.



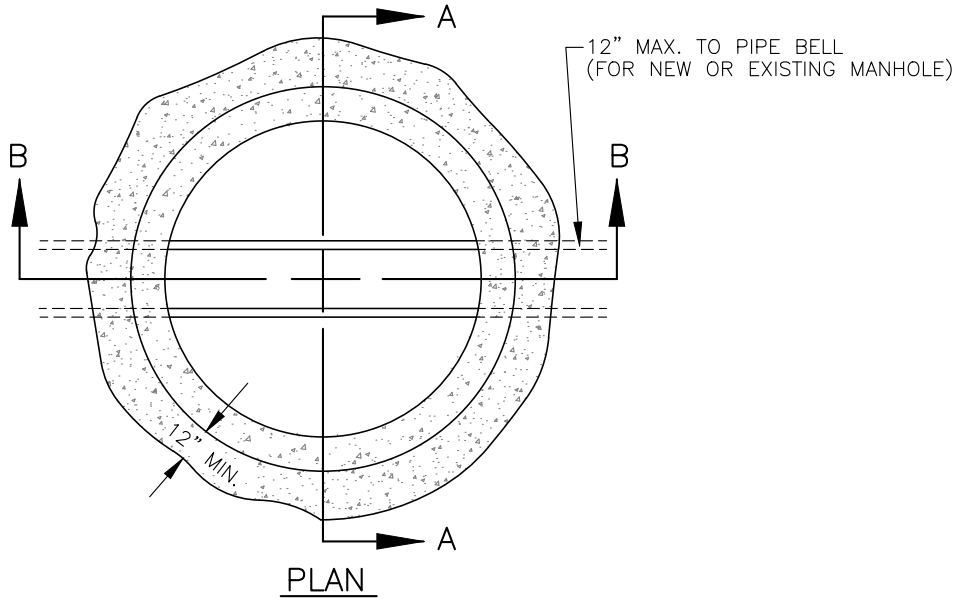
7. ALL REINFORCING STEEL SHALL BE GRADE 60 AND EPOXY COATED. VERTICAL STEEL SHALL BE PLACED AT CENTERLINE OF WALL. ALL BARS SHALL HAVE A MIN. 2" CLEARANCE.
8. ALL PIPE ENTRIES INTO THE BASE OF MANHOLE SHALL BE CONNECTED BY OPEN CHANNELIZATION ADJUSTED FOR PIPE SIZE, SHAPE, SLOPE, AND DIRECTION OF FLOW. DETAILS SHOWN ARE FOR TYPICAL INSTALLATIONS WITH ALL INVERTS OF SAME ELEVATION. FOR ELEVATION DIFFERENCE BETWEEN INVERTS, SPECIAL BASE/CHANNEL DETAILS WILL BE SHOWN ON PLANS.
9. FLOW CHANNEL AND INVERTS SHALL BE FORMED BY SHAPING WITH CLASS B CONCRETE.
10. STUB-OUTS SHALL EXTEND 2' MIN. BEYOND OUTSIDE WALL SURFACE OF MANHOLE AND BE SATISFACTORILY PLUGGED.
11. THE SLOPE OF MANHOLE COVER SHALL MATCH ROADWAY PROFILE AND CROSS-SLOPE.
12. WHEN FINAL GRADE IS PAVEMENT SURFACE, RECESS MANHOLE RING AND COVER 1/4" MIN. TO 1/2" MAX.

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS. N.T.S.

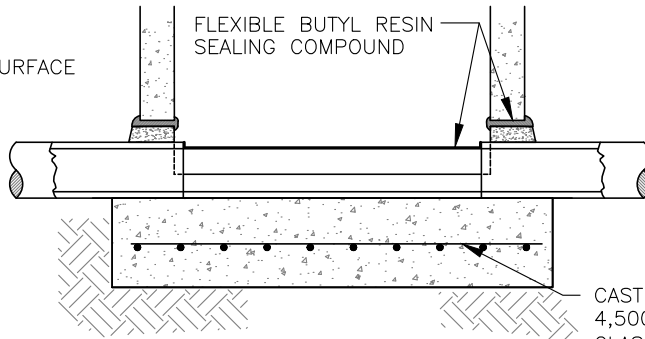


STANDARD STORM MANHOLE BOX BASE

DATE: JANUARY 2019 SHEET 600-1

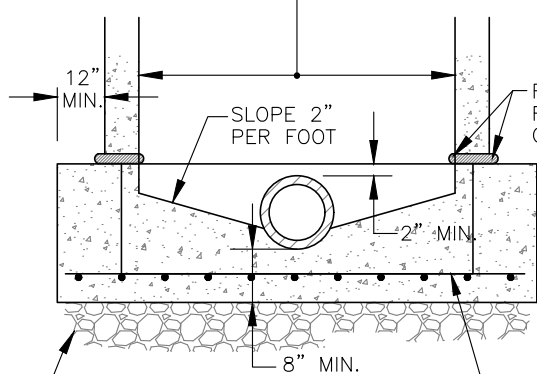


BENCH SHALL HAVE BRUSHED NON-SKID SURFACE



CAST-IN-PLACE
4,500 PSI CDOT
CLASS B/D CONCRETE
BASE WITH #5 EPOXY
COATED REBAR 12" O.C.E.W.

4'-0" DIA. (PIPE 15" AND SMALLER)
5'-0" DIA. (PIPE 18" THROUGH 27")
6'-0" DIA. (PIPE 30" THROUGH 36")



SECTION A-A

PLACE BASE ON UNDISTURBED
GROUND OR 3/4" NO. 67 CONC.
ROCK FOR STABILIZATION
#5 EPOXY COATED REBAR
12" O.C.E.W.

SECTION B-B

NOTES:

1. JOINTS TO BE SET IN FLEXIBLE BUTYL RESIN SEALING COMPOUND AND GROUTED WITH MORTAR INSIDE AND OUTSIDE.
2. BASES SHALL BE REINFORCED
3. SQUARE BASES ARE ACCEPTABLE.
4. FOR PIPE 36" AND LARGER, OR WHERE CONDITIONS SUCH AS MULTIPLE PIPES WARRANT, A CONCRETE BOX BASE WILL BE REQUIRED. (SEE CDOT STANDARD DRAWING M-604-20)
5. ALL BASES TO BE CAST-IN-PLACE
6. VIBRATE CONC. W/ MECH VIBRATOR. MANUAL VIBRATING NOT PERMITTED.

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

N.T.S.



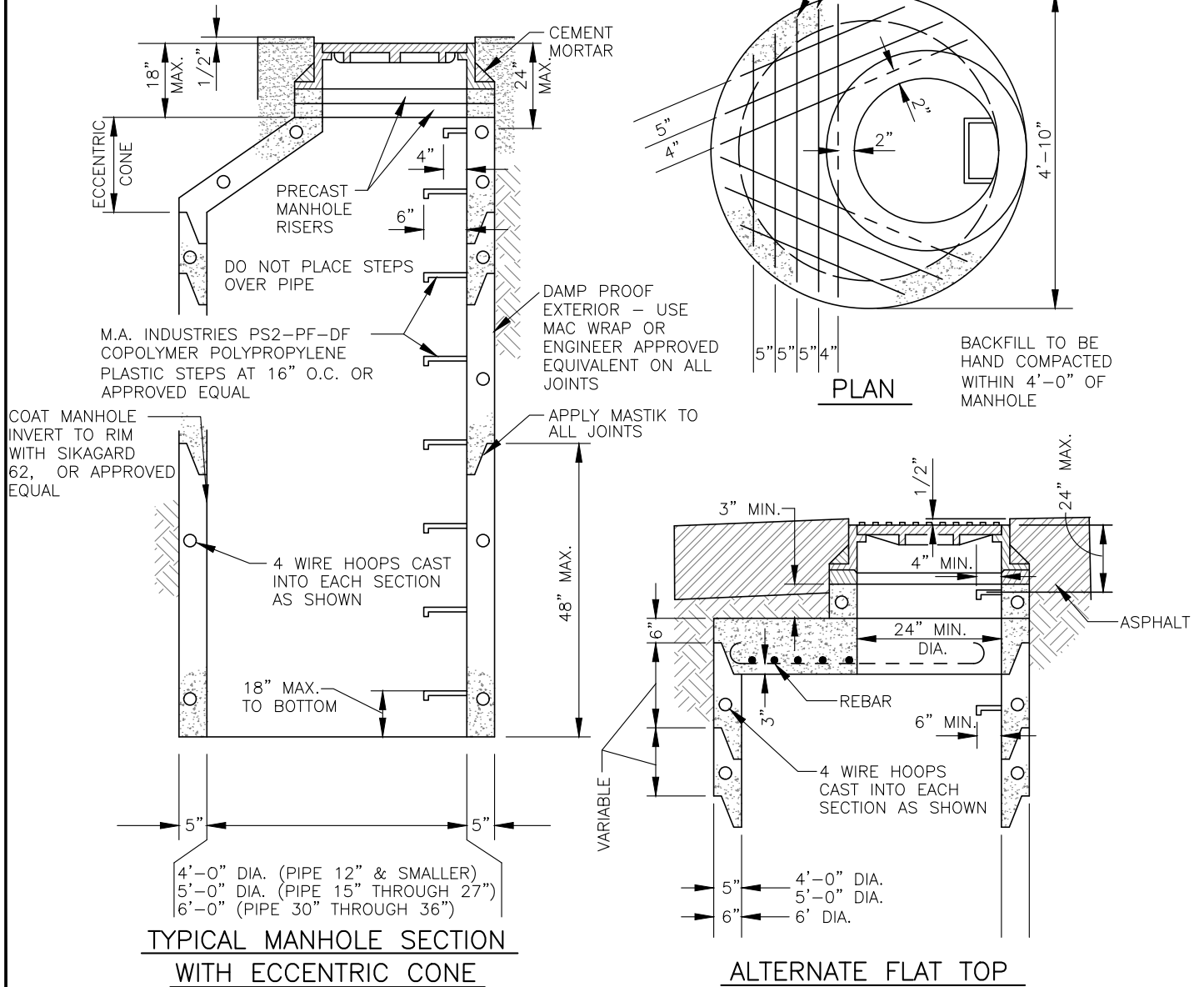
STANDARD STORM MANHOLE BASE

DATE: JANUARY 2019

SHEET 600-1a

NOTES:

1. ALL JOINTS TO BE SET IN FLEXIBLE BUTYL RESIN SEALING COMPOUND AND PLASTERED WITH MORTAR 5/8" THICK AND EXTENDING 4" EACH SIDE OF JOINT INSIDE AND OUTSIDE.
2. MORTAR ON RISER RINGS IS ACCEPTABLE.
3. MANHOLES INSTALLED OUTSIDE OF STREET RIGHT-OF-WAY SHALL HAVE LOCKING COVERS.
4. "STORM" TO BE IMPRINTED ON COVER. SEE DETAIL 600-6.



THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

N.T.S.

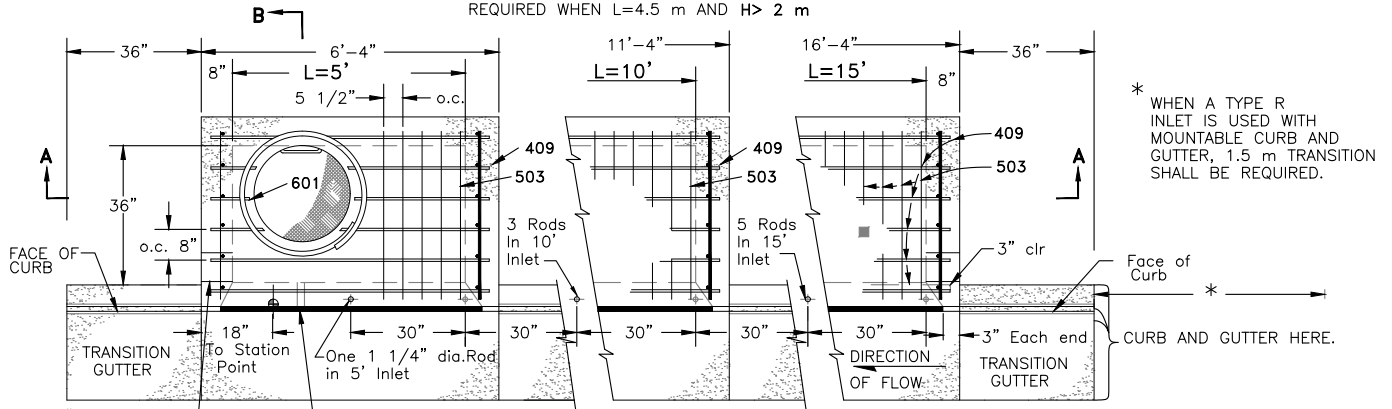


MANHOLE BARRELS AND ALTERNATE TOPS

DATE: JANUARY 2019

SHEET 600-2

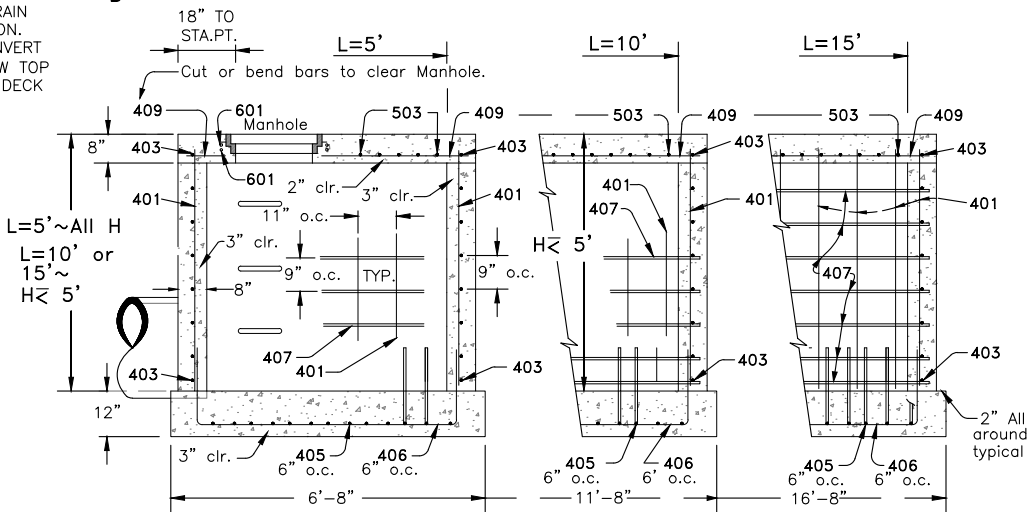
■ ADDITIONAL MANHOLE RING AND COVER
REQUIRED WHEN L=4.5 m AND H> 2 m



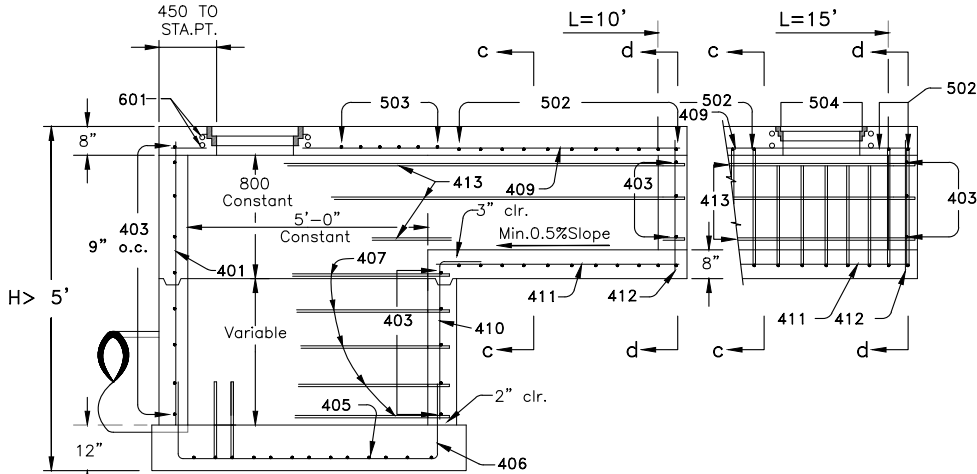
* WHEN A TYPE R
INLET IS USED WITH
MOUNTABLE CURB AND
GUTTER, 1.5 m TRANSITION
SHALL BE REQUIRED.

6" PVC SLEEVE
EACH END FROM
BEHIND CURB
UNDER DRAIN
CONNECTION.
INSTALL INVERT
32" BELOW TOP
OF INLET DECK
(TYP)

TYPICAL PLAN VIEW



SECTION A-A REGULAR INLET



SECTION A-A INLET WITH DROP BOX ~ H > 5'
(REFERENCE TABLES SEE SHEET 600-5)

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS
MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

N.T.S.

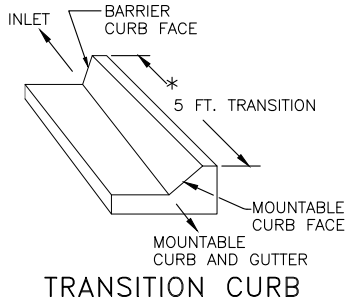


Gateway to Boulder Valley®

CURB INLET TYPE R
SHEET 1 OF 3
(CDOT M-604-12)

DATE: JANUARY 2019

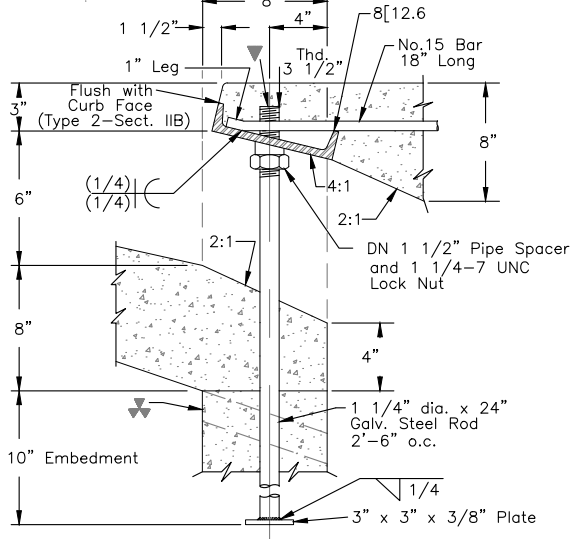
SHEET 600-3



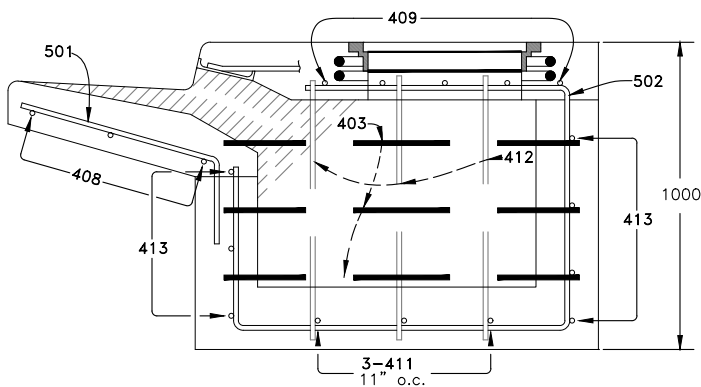
TRANSITION CURB

MEET SHAPE OF NORMAL BARRIER

See Channel Layout on Sheet 2.

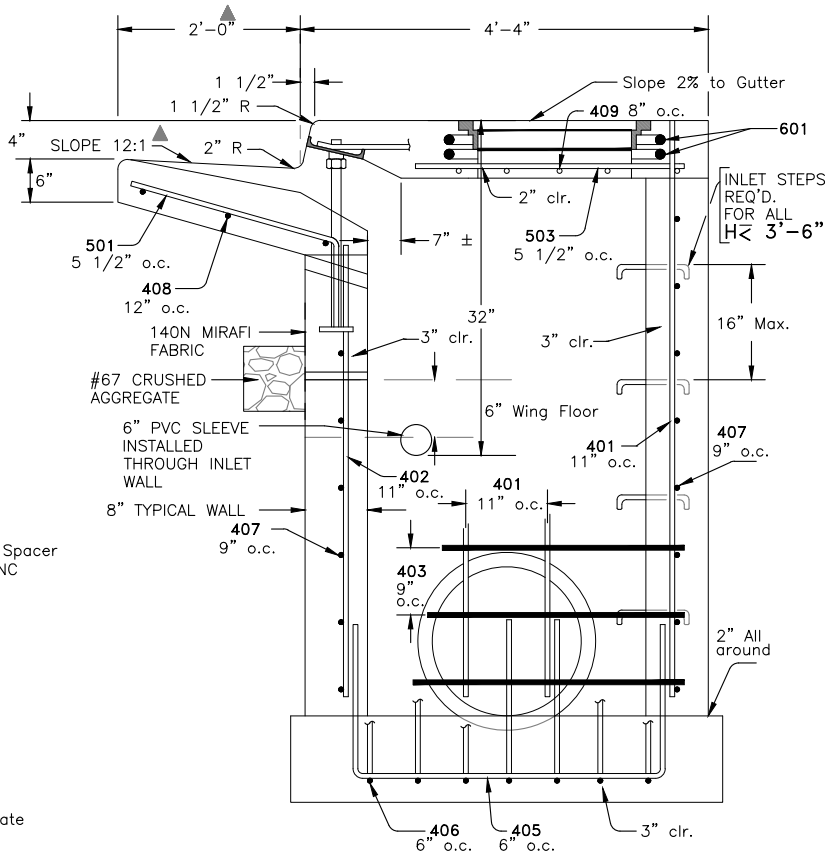


**▼ CURB FACE ASSEMBLY,
PLACE ENTIRE ASSEMBLY BEFORE
POURING CONCRETE**



(DOTTED BARS ARE IN SECTION d-d)
SECTIONS c-c & d-d

▲ - FOR A 1'-0" PAN SLOPE 6:1



**SECTION B-B
TYPICAL END VIEW**

NOTES:

MANHOLE RING & COVER, STATION POINT AND OUTFLOW PIPE SHALL BE LOCATED AT THE SAME END OF THE INLET.

2" DIAMETER PVC WEEP HOLES IN FRONT WALL OF INLET SHALL BE PLACED 2' O.C. INSTALL 12" BELOW FLOWLINE OF GUTTER.

ATTACH 140N MIRAFI FABRIC ACROSS SURFACE OF WEEP HOLES AND PLACE A 12"x12" SECTION OF #67 CRUSHED AGGREGATE THE LENGTH OF THE INLET.

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

N.T.S.



**CURB INLET TYPE R
SHEET 2 OF 3
(CDOT M-604-12)**

DATE: JANUARY 2019

SHEET 600-4

TABLE ONE ~ BAR LIST FOR CURB INLETS, TYPE "R"

MARK	DIA (in)	O.C. SPACING (in)	TYPE	ALL INLETS				INLETS, H ≤ 5'				INLETS, H ≥ 5'			
				L= → 5'		10'		15'		10'		15'			
				NO. REQ'D.	LENGTH (ft-in)	NO. REQ'D.	LENGTH (ft-in)	NO. REQ'D.	LENGTH (ft-in)	NO. REQ'D.	LENGTH (ft-in)	NO. REQ'D.	LENGTH (ft-in)		
401	↑	11"	II	15	*	21	*	26	*	11	*	11	*		
402		11"	II	7	*	13	*	18	*	7	*	7	*		
403		9"	II	*	4'-0"	*	4'-0"	*	4'-0"	*	4'-0"	*	4'-0"		
405		6"	VI	11	6'-10"	21	6'-10"	31	6'-10"	11	6'-10"	11	6'-10"		
406		6"	VIII	7	8'-10"	7	13'-10"	7	18'-10"	7	8'-10"	7	8'-10"		
407	1/2"	9"	II	*	5'-10"	*	10'-10"	*	15'-10"	*	5'-10"	*	5'-10"		
408		12"	II	3	6'-0"	3	11'-0"	3	16'-0"	3	11'-0"	3	16'-0"		
409		8"	II	6	5'-10"	6	10'-10"	6	15'-10"	6	10'-10"	6	15'-10"		
410		11"	VI							3	*	3	*		
411		11"	II							3	5'-2"	3	10'-2"		
412		11"	II							3	2'-9"	3	2'-9"		
413	↓	9"	II							7	10'-10"	7	15'-10"		
501	↑	5 1/2"	IV	11	3'-4"	22	3'-4"	33	3'-4"	22	3'-4"	33	3'-4"		
502	5/8"	5 1/2"	III							11	11'-5"	17	11'-5"		
503		5 1/2"	II	5	3'-6"	16	3'-6"	27	3'-6"	6	3'-6"	6	3'-6"		
504	↓	5 1/2"	IX									5	8'-4"		
601	3/4"	2 1/2"	V	2	8'-10"	2	8'-10"	2	8'-10"	2	8'-10"	4	8'-10"		
Ø8[8.5				1	5'-10"	1	10'-10"	1	15'-10"	1	10'-10"	1	15'-10"		
▼				2 BARS, 1 ROD	—	4 BARS, 3 RODS	—	8 BARS, 5 RODS	—	4 BARS, 3 RODS	—	8 BARS, 5 RODS	—		

* VARIABLE, REFER TO TABLE TWO.

Ø INCLUDE 18" NO. 4 BARS (SEE CHANNEL LAYOUT DETAIL).

▼ SEE CURB FACE ASSEMBLY ON SHEET 2 AND CHANNEL LAYOUT DETAILS ON SHEET 4.

REGULAR INLETS

DROP BOX INLETS

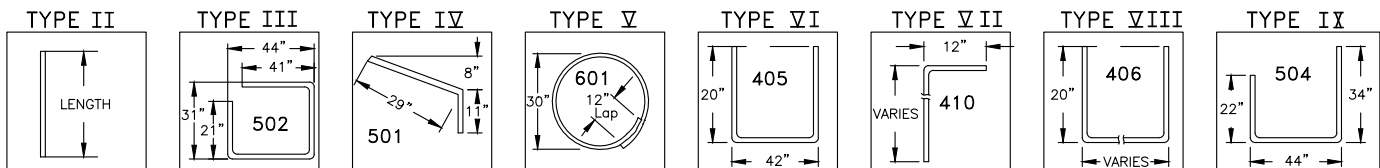
TABLE TWO ~ BARS AND QUANTITIES VARIABLE WITH "H"

"H" (ft-in)	LENGTH (ft-in)			NO. REQ'D. REGULAR		NO. REQ'D. DROP BOX		L= 5'		L= 10'		L= 15'	
	401	402	410	403	407	403	407	CONC.	STEEL	CONC.	STEEL	CONC.	STEEL
	CU.YD.	LBS.	CU.YD.	LBS.	CU.YD.	LBS.	CU.YD.	LBS.	CU.YD.	LBS.	CU.YD.	LBS.	
3'-0"	2'-8"	1'-8"		10	7			3.2	285	5.3	497	7.4	706
3'-6"	3'-2"	2'-2"		10	7			3.4	305	5.7	528	7.9	747
4'-0"	3'-8"	2'-8"		12	9			3.7	326	6.0	559	8.4	786
4'-6"	4'-2"	3'-2"		12	9			3.9	334	6.4	571	8.8	803
5'-0"	4'-8"	3'-8"		14	11			4.1	354	6.7	602	9.3	844
5'-6"	5'-2"	4'-2"	3'-5"	16	13	15	6	4.4	375	6.0	607	7.4	850
6'-0"	5'-8"	4'-8"	3'-11"	16	13	16	6	4.6	382	6.2	616	7.6	860
6'-6"	6'-2"	5'-2"	4'-5"	18	15	18	8	4.8	402	6.4	637	7.8	880
7'-0"	6'-8"	5'-8"	4'-11"	20	17	19	10	5.0	423	6.6	654	8.0	897
7'-6"	7'-2"	6'-2"	5'-5"	20	17	20	10	5.3	430	6.9	664	8.3	907
8'-0"	7'-8"	6'-8"	5'-11"	22	19	22	12	5.5	451	7.1	684	8.5	927
8'-6"	8'-2"	7'-2"	6'-5"	24	21	23	14	5.7	471	7.3	702	8.7	944
9'-0"	8'-8"	7'-8"	6'-11"	24	21	24	14	6.0	479	7.6	711	9.0	954
9'-6"	9'-2"	8'-2"	7'-5"	26	23	26	16	6.2	499	7.8	732	9.2	974
10'-0"	9'-8"	8'-8"	7'-11"	28	25	27	18	6.4	520	8.0	749	9.4	992
10'-6"	10'-2"	9'-2"	8'-5"	28	25	28	18	6.7	527	8.3	759	9.7	1001
11'-0"	10'-8"	9'-8"	8'-11"	30	27	30	20	6.9	547	8.5	779	9.9	1022

NOTE: FOR L= 5', L= 10' AND L= 15'

REGULAR INLETS: TOTAL QUANTITIES NEEDED ARE OUTSIDE OF THE HEAVY BLACK LINE.
DROP BOX INLETS: TOTAL QUANTITIES NEEDED ARE INSIDE OF THE HEAVY BLACK LINE.

STEEL WEIGHTS DO NOT INCLUDE STRUCTURAL STEEL.



BAR BENDING DIAGRAMS ~ (Dimensions are Out-to-Out of bar)

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

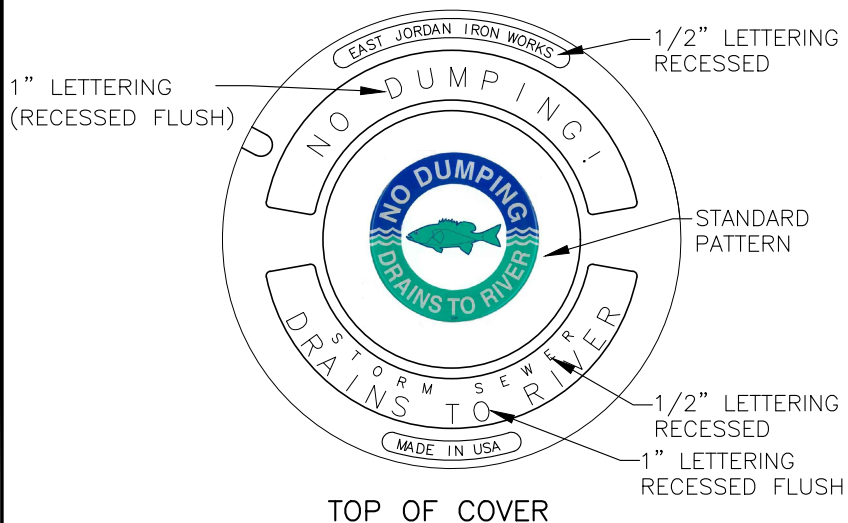
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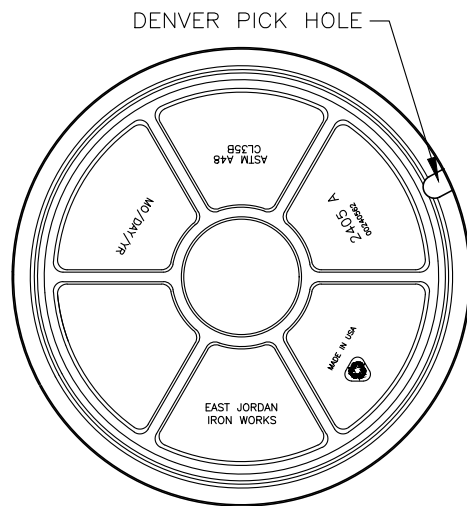
CURB INLET TYPE R
SHEET 3 OF 3
(CDOT M-604-12)

DATE: JANUARY 2019

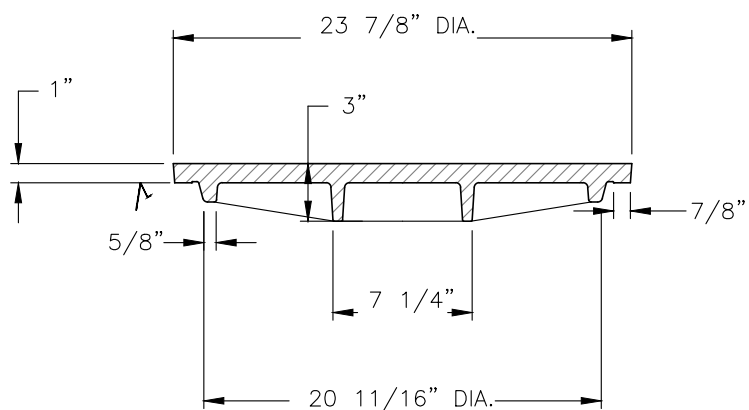
SHEET 600-5



TOP OF COVER



BOTTOM OF COVER



SECTION OF COVER

NOTES:

1. FULL BEARING SURFACE SHALL BE GROUTED WITH STEEL SHIMS, MINIMUM 6 LOCATIONS AROUND MANHOLE.
2. SMOOTH CHIMNEY INSIDE AND OUTSIDE WITH GROUT

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

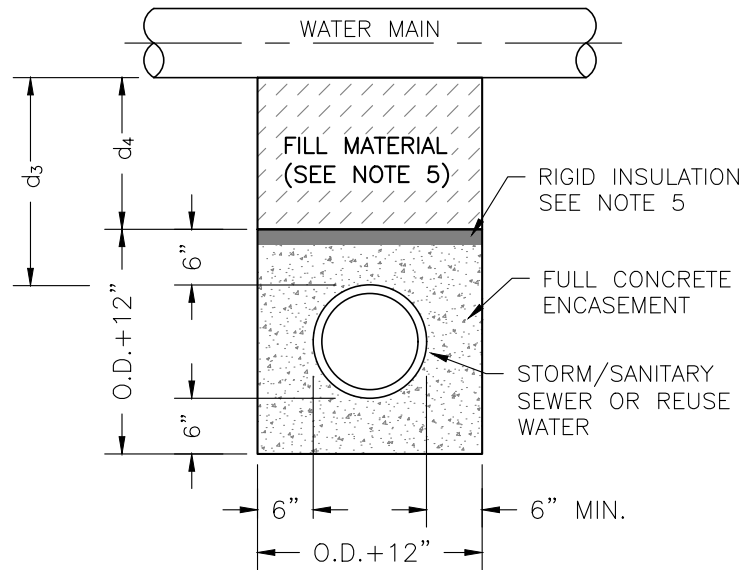
N.T.S.



STORM SEWER
MANHOLE LID

DATE: JANUARY 2019

SHEET 600-6

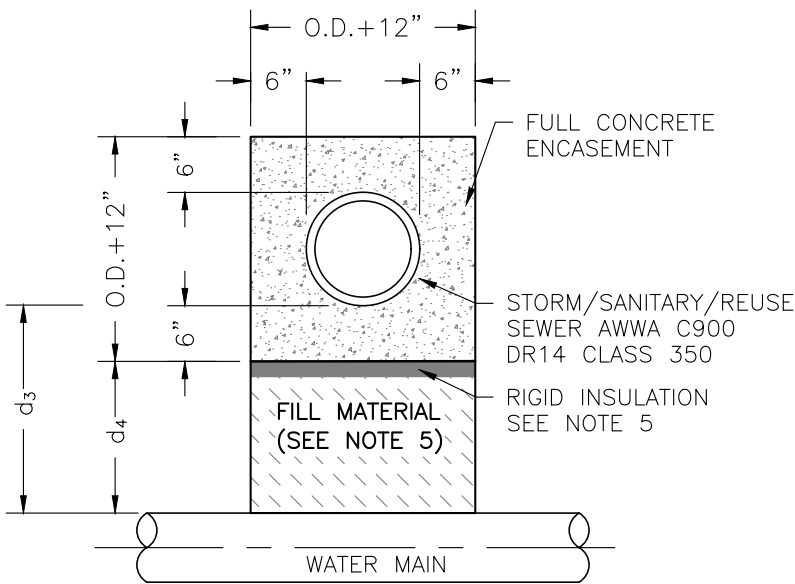


STORM, SANITARY SEWER, OR REUSE CROSSING UNDER WATER MAIN

IF $d_3 > 18"$, ENCASEMENT NOT REQUIRED

NOTES:

1. CONCRETE COLLAR AROUND STORM SEWER JOINTS MAY BE ACCEPTED WITH WRITTEN APPROVAL BY THE TOWN ENGINEER AND ONLY FOR PIPE 30" OR LARGER.
2. CONCRETE TO BE CAST AGAINST UNDISTURBED SOIL OR SHORING.
3. LENGTH OF ENCASEMENT SHALL EXTEND AT LEAST 10- FEET EACH SIDE OF WATER MAIN.
4. UNLESS OTHERWISE NOTED ON PLAN/PROFILE DRAWINGS, ENCASEMENTS NEED NOT BE REINFORCED.
5. FILLER MATERIAL BETWEEN CONDUITS TO BE:
 - a) APPROVED DOW HI LOAD 60 RIGID INSULATION. IF $d_4 \leq 6"$.
 - b) COMPACTED BACKFILL, IF $d_4 > 6"$.
6. SHORING OR SHEETING, IF USED, TO BE CUT OFF AT TOP OF ENCASEMENT



STORM, SANITARY SEWER, OR REUSE CROSSING OVER TOP OF WATER MAIN

ENCASEMENT REQUIRED REGARDLESS OF DIMENSION d_3

(SEE NOTE 1 FOR SPECIAL CASES)

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

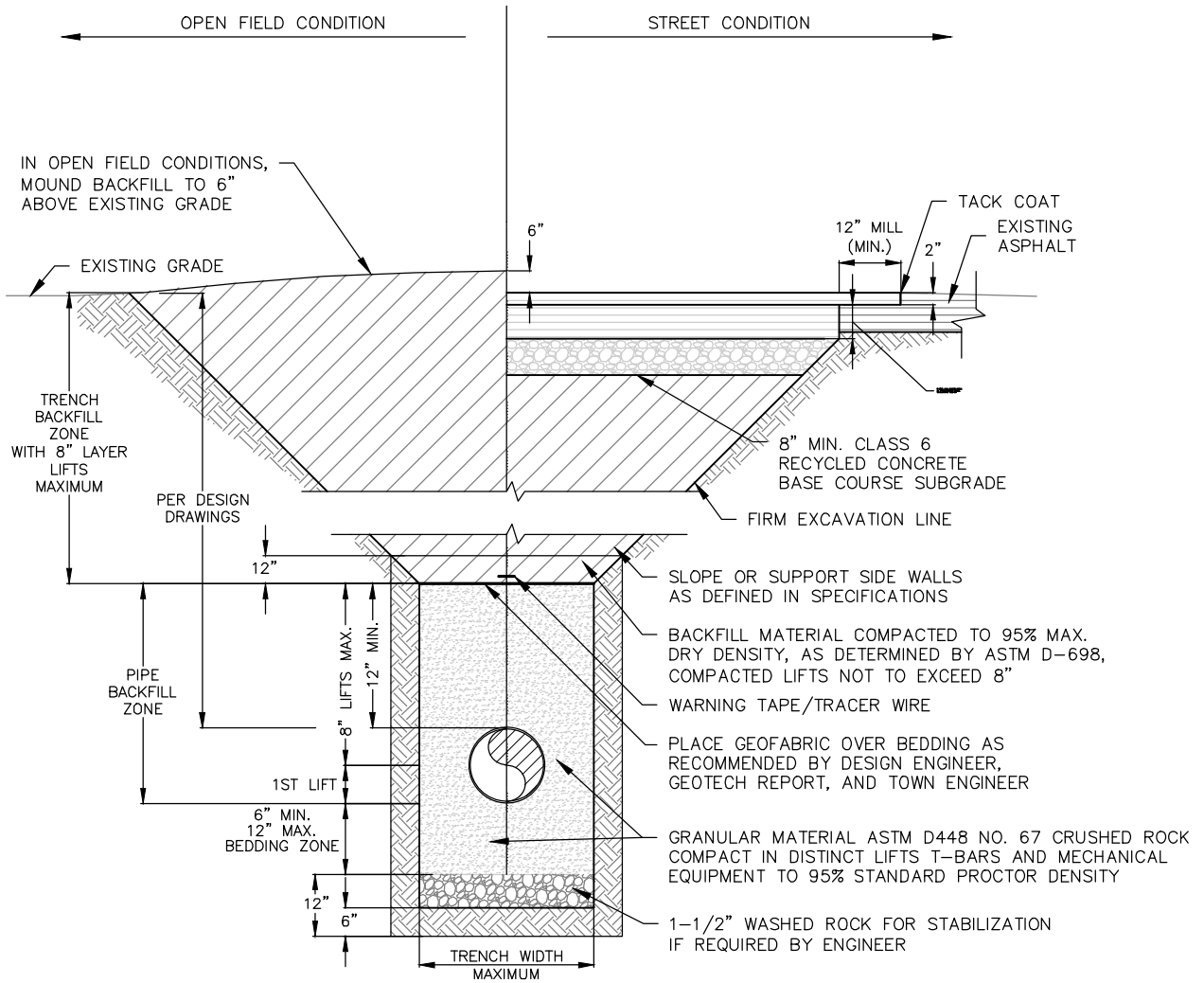
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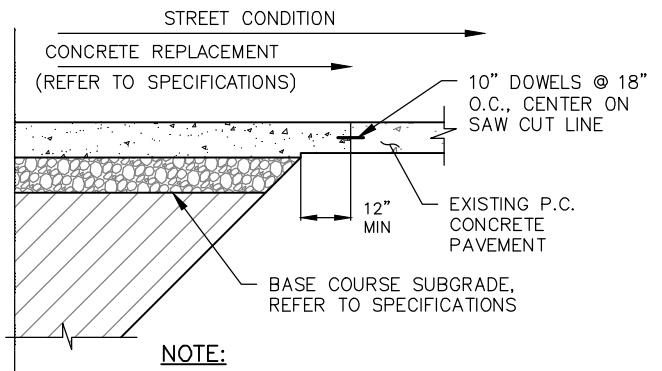
ENCASEMENT FOR CONDUIT CROSSINGS

DATE: JANUARY 2019

SHEET 600-7



PIPE DIAMETER (INCHES)	MAXIMUM TRENCH WIDTH (INCHES)
15	36
18	40
21	44
24	48
27	52
30	56
33	60
36	68
42	75
48	82
54	89
72	110



NOTE:

INSTALL DOWELS AT ALL SAWCUTS AND/OR WHEN MORE THAN 45 MINUTES ELAPSES BETWEEN PLACING ANY TWO CONSECUTIVE BATCHES OF CONCRETE.

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

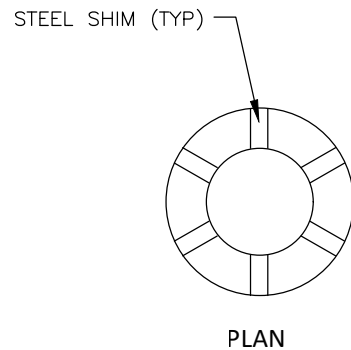
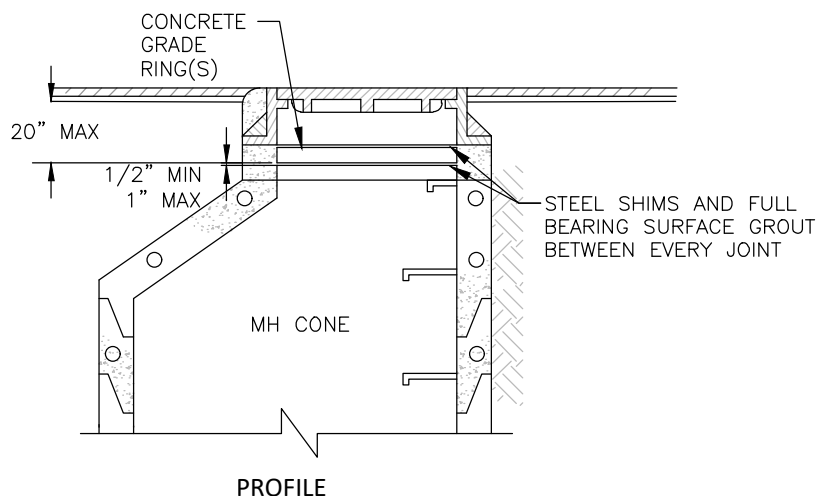
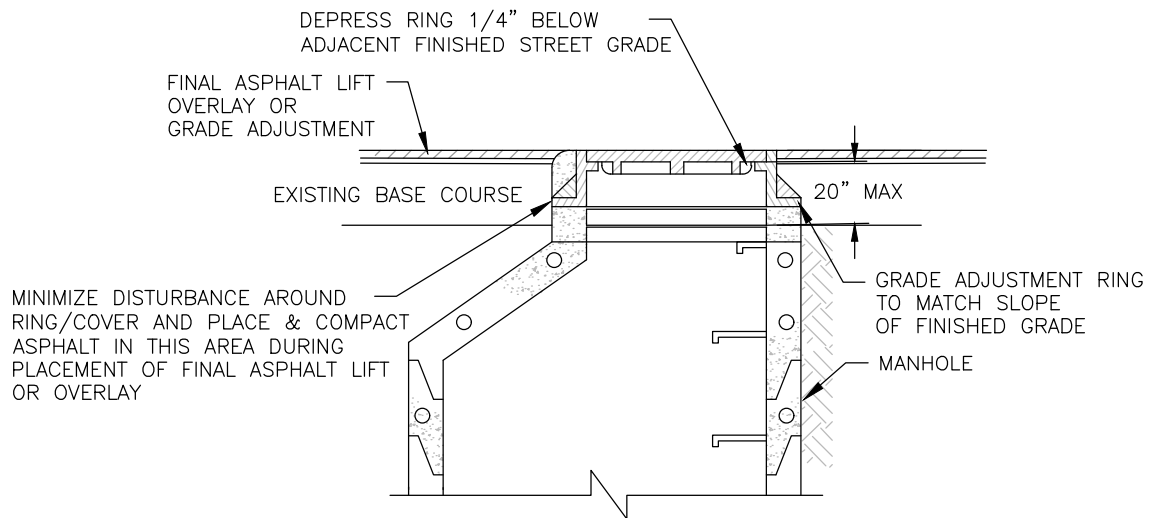
N.T.S.



STORM SEWER TYPICAL PIPE BEDDING

DATE: JANUARY 2019

SHEET 600-8

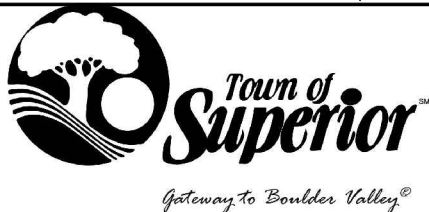


NOTES:

1. FULL BEARING SURFACE SHALL BE GROUTED WITH STEEL SHIMS, MINIMUM 6 LOCATIONS AROUND MANHOLE TO MATCH PROFILE OF ADJACENT SURFACES.
2. SMOOTH CHIMNEY INSIDE AND OUTSIDE WITH GROUT

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

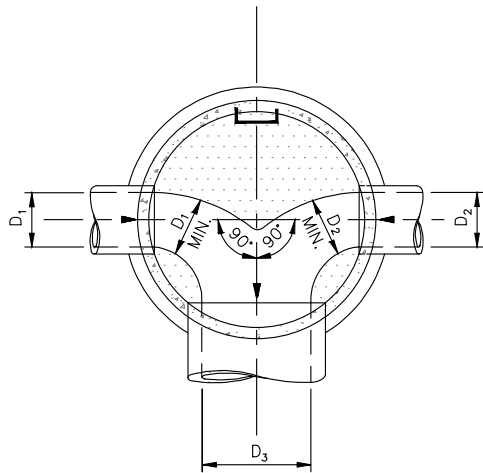
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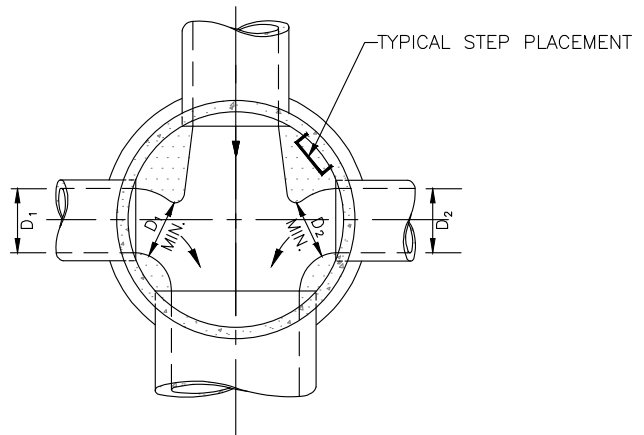
STORM MANHOLE RIM AND COVER ADJUSTMENT

DATE: JANUARY 2019

SHEET 600-9

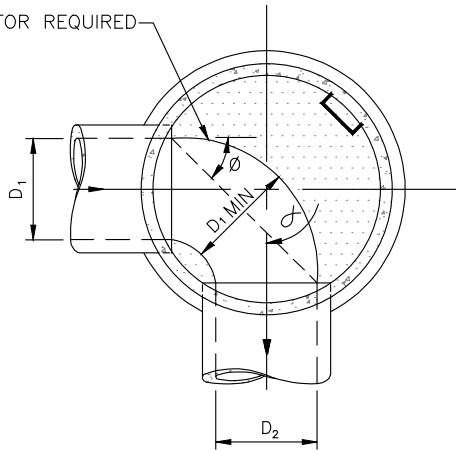


OPPOSED LATERALS



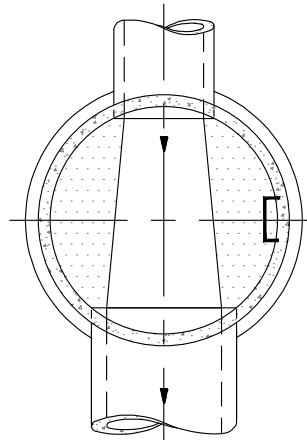
THROUGH PIPE
TWO LATERALS

CURVED DEFLECTOR REQUIRED



SHARP ANGLE

$\phi = 45^\circ$
 $\alpha = 90^\circ$



THROUGH PIPE

NOTES:

1. DETAILS SHOWN ARE TYPICAL ONLY FOR INSTALLATIONS WITH ALL INVERTS AT APPROXIMATELY THE SAME ELEVATION.
2. FOR LARGE ELEVATION DIFFERENCES BETWEEN INVERTS, SPECIAL BASE/CHANNEL DETAILS SHALL BE SHOWN ON PLANS.
3. THE MINIMUM VERTICAL DROP ACROSS MANHOLE BASE SHALL BE 0.20 FEET.

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

N.T.S.



MANHOLE BASE CHANNELIZATION

DATE: JANUARY 2019

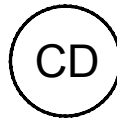
SHEET 600-10

TITLE

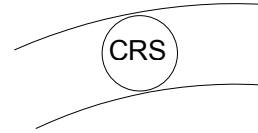
KEY

SYMBOL

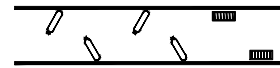
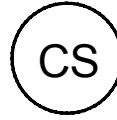
CHECK DAM



CONSTRUCTION ROAD STABILIZATION



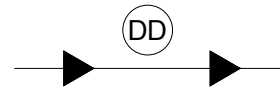
CURB SOCK INLET PROTECTION



CONCRETE WASHOUT AREA



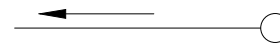
DIVERSION DITCH AND DIKE, TEMPORARY



DIVERSION CHANNEL, TEMPORARY



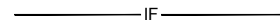
DEWATERING



EROSION CONTROL BLANKET



INLET FILTER



STORM DRAIN INLET PROTECTION



MULCHING



THIS DETAIL (EXCEPT MODIFICATIONS MADE BY THE TOWN OF SUPERIOR) COURTESY OF THE URBAN DRAINAGE AND FLOOD CONTROL DISTRICT.

N.T.S.



EROSION CONTROL MAP INDEX
SHEET 1 OF 3

DATE: JANUARY 2019

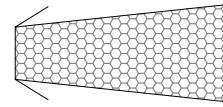
SHEET 600-11

TITLE

KEY

SYMBOL

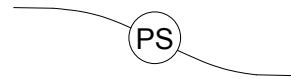
OUTLET PROTECTION



PAVED FLUME



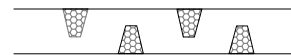
PERMANENT SEEDING



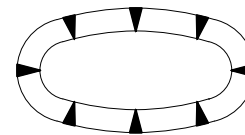
REINFORCED CONCRETE DAM



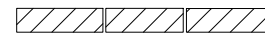
ROUGH CUT STREET CONTROL



SEDIMENT BASIN



STRAW BALE BARRIER



SILT FENCE



SURFACE ROUGHENING



THIS DETAIL (EXCEPT MODIFICATIONS MADE BY THE TOWN OF SUPERIOR) COURTESY OF THE URBAN DRAINAGE AND FLOOD CONTROL DISTRICT.

N.T.S.



EROSION CONTROL MAP INDEX
SHEET 2 OF 3

DATE: JANUARY 2019

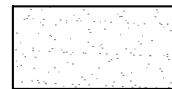
SHEET 600-12

TITLE

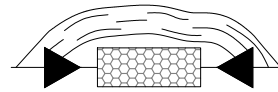
KEY

SYMBOL

STABILIZED STAGING AREA



SEDIMENT TRAP



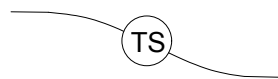
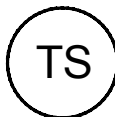
SEDIMENT CONTROL LOG



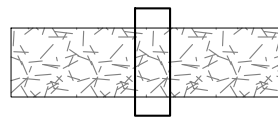
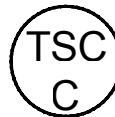
TERRACING



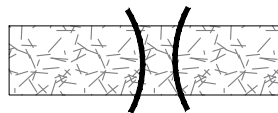
TEMPORARY SEEDING



TEMPORARY STREAM CROSSING CULVERT/BRIDGE TYPE



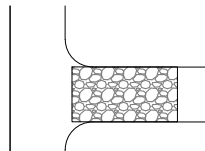
TEMPORARY STREAM CROSSING FORD TYPE



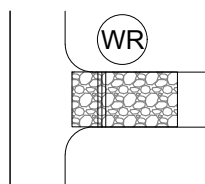
TEMPORARY SLOPE DRAIN



VEHICLE TRACKING CONTROL



VEHICLE TRACKING CONTROL WITH WASH RACK



THIS DETAIL (EXCEPT MODIFICATIONS MADE BY THE TOWN OF SUPERIOR) COURTESY OF THE URBAN DRAINAGE AND FLOOD CONTROL DISTRICT.

N.T.S.

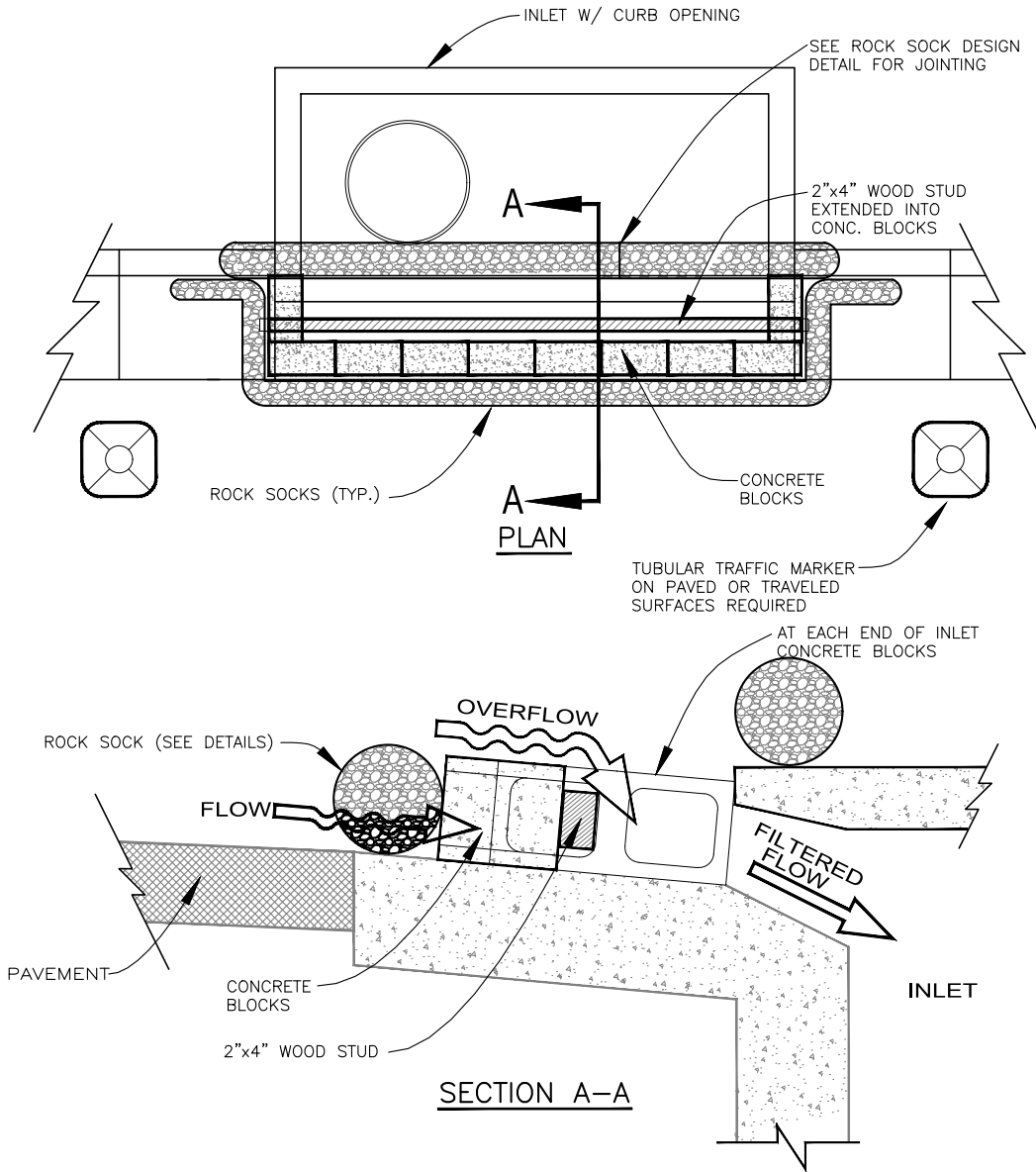


EROSION CONTROL MAP INDEX
SHEET 3 OF 3

DATE: JANUARY 2019

SHEET 600-13

IP



INLET PROTECTION INSTALLATION NOTES:

1. INLET PROTECTION SHALL BE INSTALLED WITHIN 48 HOURS OF CONSTRUCTING THE INLET.
2. SEE ROCK SOCK DESIGN DETAIL FOR INSTALLATION REQUIREMENTS. SEE SHEET 600-15.
3. CONCRETE "CINDER" BLOCKS SHALL BE LAID ON THEIR SIDES AROUND THE INLET IN A SINGLE ROW ABUTTING ONE ANOTHER WITH THE OPEN END FACING AWAY FROM THE CURB.
4. GRAVEL SOCKS SHALL BE PLACED AROUND THE CONCRETE BLOCKS, CLOSELY ABUTTING ONE ANOTHER AND JOINTED IN ACCORDANCE WITH THE ROCK SOCK DESIGN DETAIL.

THIS DETAIL (EXCEPT MODIFICATIONS MADE BY THE TOWN OF SUPERIOR) COURTESY OF THE URBAN DRAINAGE AND FLOOD CONTROL DISTRICT.

N.T.S.

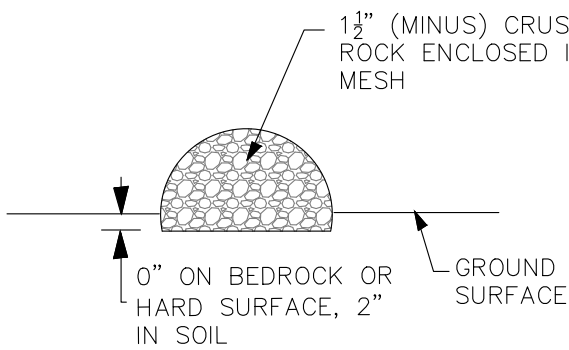


INLET GRAVEL FILTER – SUMP

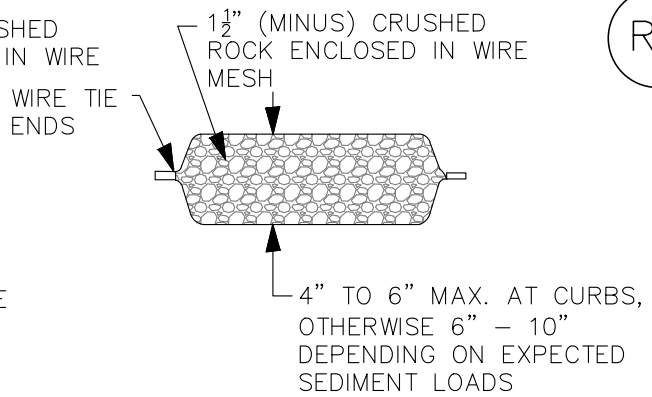
DATE: JANUARY 2019

SHEET 600-14

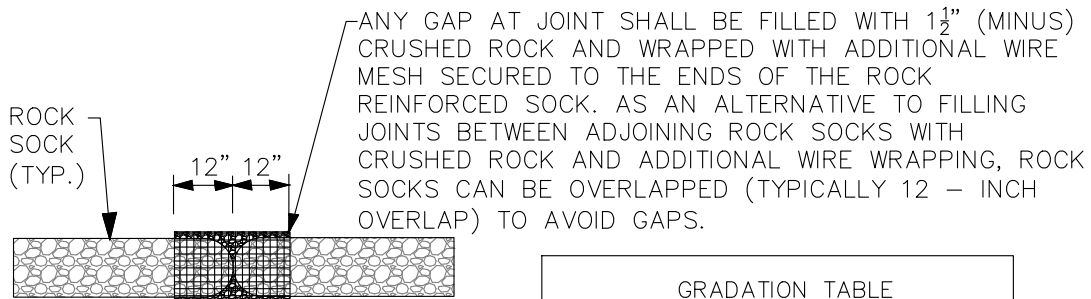
RS



ROCK SOCK SECTION



ROCK SOCK PLAN



ROCK SOCK JOINTING

GRADATION TABLE	
SIEVE SIZE	MASS PERCENT PASSING SQUARE MESH SIEVES
	NO. 4
2"	100
1-1/2"	90 - 100
1"	20 - 55
3/4"	0 - 15
3/8"	0 - 5

MATCHES SPECIFICATIONS FOR NO. 4 COARSE AGGREGATE FOR CONCRETE PER AASHTO M43. ALL ROCK SHALL BE FRACTURED FACE, ALL SIDES.

ROCK SOCK INSTALLATION NOTES

1. SEE PLAN VIEW FOR LOCATION OF ROCK SOCKS.
2. CRUSHED ROCK SHALL BE 1-1/2 " (MINUS) IN SIZE WITH A FRACTURED FACE (ALL SIDES) AND SHALL COMPLY WITH GRADATION SHOWN ON THIS SHEET (1-1/2" MINUS).
3. WIRE MESH SHALL BE FABRICATED OD 10 GAGE POULTRY MESH OR EQUIVALENT WITH A MAXIMUM OPENING OF 1/2", RECOMMENDED MINIMUM ROLL WIDTH OF 48".
4. WIRE MESH SHALL BE SECURED USING "HOG RINGS" OR WIRE TIES AT 6" CENTERS ALONG ALL JOINTS AND AT 2" CENTERS ON ENDS OF SOCKS.

THIS DETAIL (EXCEPT MODIFICATIONS MADE BY THE TOWN OF SUPERIOR) COURTESY OF THE URBAN DRAINAGE AND FLOOD CONTROL DISTRICT.

N.T.S.

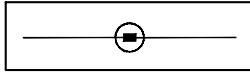


ON GRADE INLET PROTECTION
ROCK SOCK

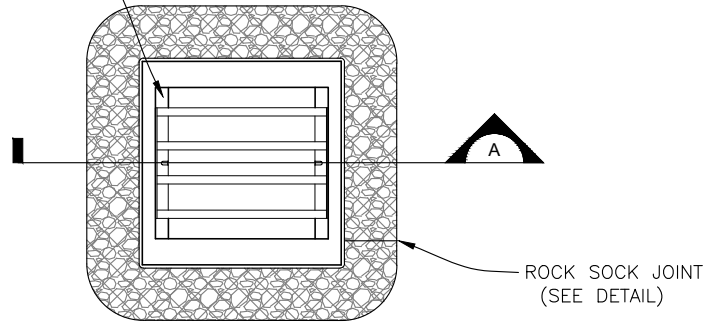
DATE: JANUARY 2019

SHEET 600-15

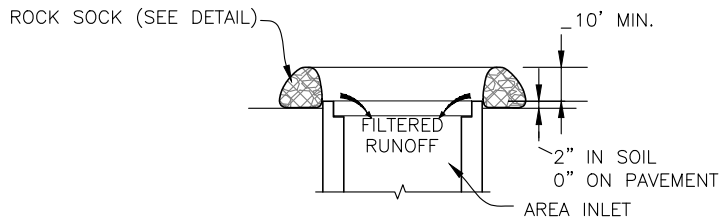
IP



AREA INLET
(TYPE C SHOWN)



AREA INLET - PLAN



SECTION A

INLET PROTECTION INSTALLATION NOTES:

1. INLET PROTECTION AFTER INLET CONSTRUCTION OR AFTER PAVEMENT SHALL BE INSTALLED WITHIN 48 HOUR AFTER INLET CONSTRUCTION OR PAVING IS COMPLETED.
2. STRAW WATTLES/SEDIMENT CONTROL LOGS MAY BE USED IN PLACE OF ROCK SOCKS FOR INLETS IN PERVIOUS AREAS. INSTALL PER SEDIMENT CONTROL LOG DETAIL.

INLET PROTECTION MAINTENANCE NOTES:

1. THE SWMP MANAGER SHALL INSPECT INLET PROTECTION WEEKLY, DURING AND AFTER STORM EVENT AND MAKE REPAIRS OR CLEAN OUT AS NECESSARY. INSPECT MORE FREQUENTLY DURING WINTER CONDITIONS DUE TO FREEZE PROBLEMS. REPAIR AS NEEDED.
2. SEDIMENT ACCUMULATED UPSTREAM OF INLET PROTECTION SHALL BE REMOVED WHEN THE SEDIMENT DEPTH UPSTREAM OF ROCK BERM IS WITHIN 2-1/2" OF THE CREST.
3. INLET PROTECTIONS TO REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS STABILIZED AND GRASS COVER IS APPROVED, UNLESS THE TOWN APPROVES EARLIER REMOVAL OF INLET PROTECTION IN STREETS.
4. WHEN INLET PROTECTION AT AREA INLETS IS REMOVED, THE DISTURBED AREA SHALL BE COVERED WITH TOPSOIL, DRILL SEEDED AND CRIMP MULCHED, OR OTHERWISE STABILIZED IN A MANNER APPROVED BY THE TOWN.

THIS DETAIL (EXCEPT MODIFICATIONS MADE BY THE TOWN OF SUPERIOR) COURTESY OF THE URBAN DRAINAGE AND FLOOD CONTROL DISTRICT.

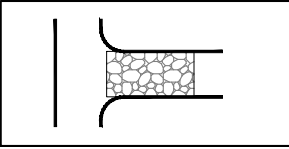
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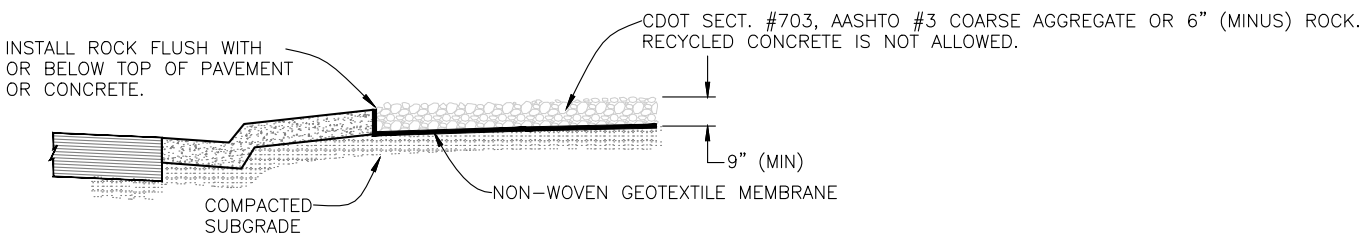
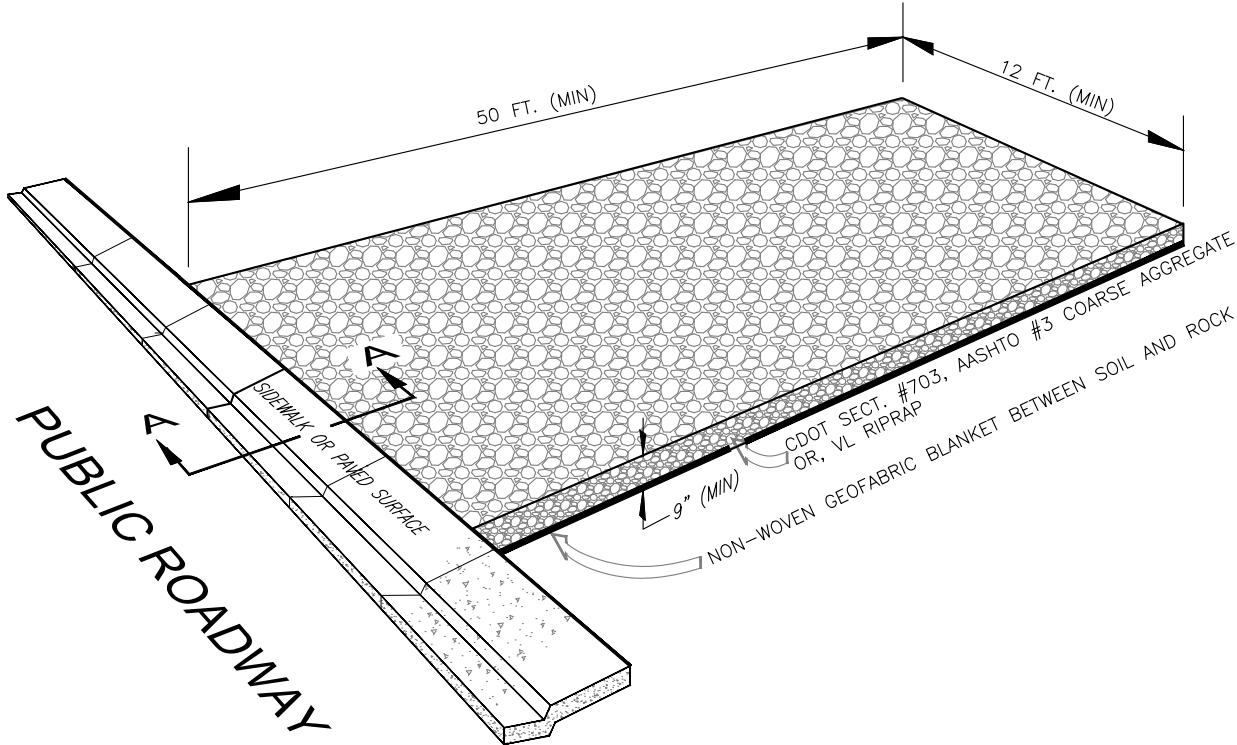
AREA INLET PROTECTION USING
GRAVEL FILTER

DATE: JANUARY 2019

SHEET 600-16



VTC



SECTION A-A

NOTES:

1. ALL ROCK TO BE REMOVED UPON COMPLETION OF CONSTRUCTION.
2. PUBLIC ROADWAY TO BE KEPT CLEAN AND FREE OF MUD, DIRT AND DEBRIS AT ALL TIMES.
3. EROSION CONTROL MEASURES SHALL BE MAINTAINED AT ALL TIMES AS DIRECTED BY THE TOWN.
4. ALTERNATIVE METHODS SUCH AS REINFORCED CONCRETE OR CATTLE CROSSING GUARD "WASH RACKS", CONSTRUCTION MATS OR TURF REINFORCEMENT MATS WILL BE CONSIDERED WITH PRIOR APPROVAL FROM THE TOWN.

THIS DETAIL (EXCEPT MODIFICATIONS MADE BY THE TOWN OF SUPERIOR) COURTESY OF THE URBAN DRAINAGE AND FLOOD CONTROL DISTRICT.

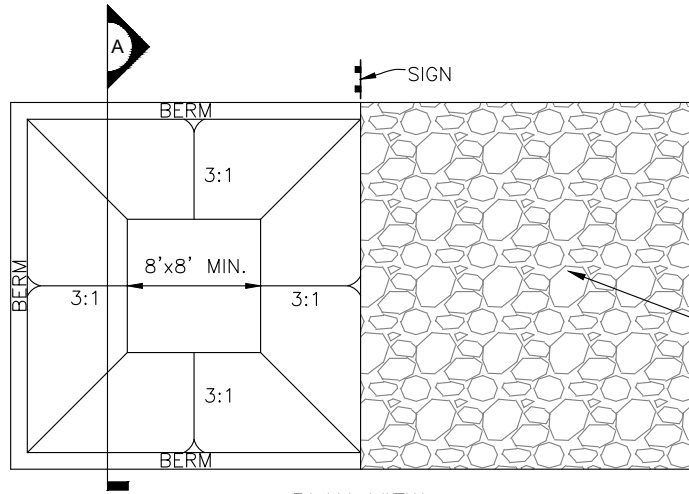
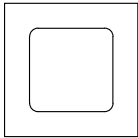
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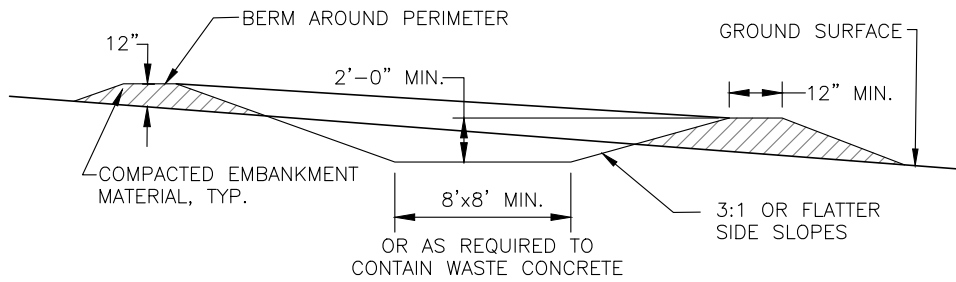
VEHICLE TRACKING CONTROL PAD

DATE: JANUARY 2019

SHEET 600-17



PLAN VIEW



SECTION A

CONCRETE WASHOUT AREA INSTALLATION NOTES:

1. SEE PLAN VIEW FOR LOCATIONS OF CONCRETE WASH AREA.
2. THE CONCRETE WASHOUT AREA SHALL BE INSTALLED PRIOR TO ANY CONCRETE PLACEMENT ON SITE.
3. VEHICLE TRACKING CONTROL IS REQUIRED AT THE ACCESS POINT.
4. SIGNS SHALL BE PLACED AT THE CONSTRUCTION ENTRANCE, AT THE WASHOUT AREA, AND ELSEWHERE AS NECESSARY TO CLEARLY INDICATE THE LOCATIONS OF THE CONCRETE WASHOUT AREA TO OPERATORS OF CONCRETE TRUCKS AND PUMP RIGS.

CONCRETE WASHOUT AREA MAINTENANCE NOTES:

1. THE CONCRETE WASHOUT AREA SHALL BE REPAIRED AND ENLARGED OR CLEANED OUT AS NECESSARY TO MAINTAIN CAPACITY FOR WASTED CONCRETE.
2. AT THE END OF CONSTRUCTION, ALL CONCRETE SHALL BE REMOVED FROM THE SITE AND DISPOSED OF AT AN APPROVED WASTE SITE.
3. WHEN THE CONCRETE WASHOUT AREA IS REMOVED, COVER THE DISTURBED AREA WITH TOP SOIL, DRILL SEED AND CRIMP MULCH OR OTHERWISE STABILIZE IN A MANNER APPROVED BY THE TOWN.
4. INSPECT WEEKLY, DURING AND AFTER ANY STORM EVENT.
5. PORTABLE ROLL-OFF TYPE OF CONCRETE WASHOUT FACILITIES WILL ALSO BE ALLOWED.

THIS DETAIL (EXCEPT MODIFICATIONS MADE BY THE TOWN OF SUPERIOR) COURTESY OF THE URBAN DRAINAGE AND FLOOD CONTROL DISTRICT.

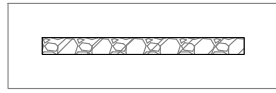
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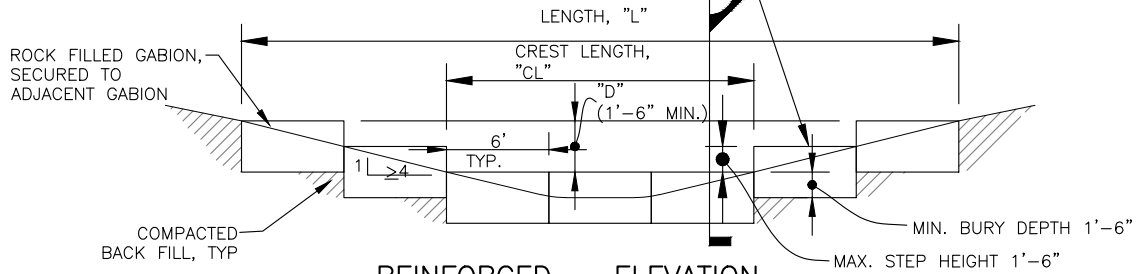
CONCRETE WASHOUT AREA

DATE: JANUARY 2019

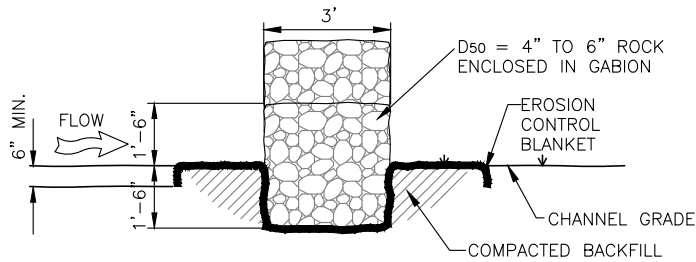
SHEET 600-18



ALTERNATIVE TO STEPS ON BANKS ABOVE CREST: DEFORM GABIONS AS NECESSARY TO ALIGN TOP OF GABIONS WITH GROUND SURFACE; AVOID GAPS BETWEEN GABIONS



REINFORCED – ELEVATION



REINFORCED – SECTION A

REINFORCED CHECK DAM INSTALLATION NOTES:

1. SEE PLAN VIEW FOR:
 - LOCATIONS OF CHECK DAMS.
 - CHECK DAM TYPE (CHECK DAM OR REINFORCED CHECK DAM).
 - LENGTH, "L", CREST LENGTH, "CL", AND DEPTH, "D".
2. CHECK DAMS INDICATED ON THE INITIAL SWMP SHALL BE INSTALLED AFTER CONSTRUCTION FENCE, BUT PRIOR TO ANY UPSTREAM LAND-DISTURBING ACTIVITIES.
3. REINFORCED CHECK DAMS, GABIONS SHALL HAVE GALVANIZED TWISTED WIRE NETTING WITH A MAXIMUM OPENING DIMENSION OF 4-1/2" AND A MINIMUM WIRE THICKNESS OF 0.10". WIRE "HOG RINGS" AT 4" SPACING OR OTHER APPROVED MEANS SHALL BE USED AT ALL GABION SEAMS AND TO SECURE THE GABION TO THE ADJACENT GABION.
4. THE CHECK DAM SHALL BE TRENCHED INTO THE GROUND A MINIMUM OF 1'-6".
5. EROSION BLANKET SHALL BE PLACED IN THE REINFORCED CHECK DAM TRENCH EXTENDING A MINIMUM OF 1'-6" ON BOTH THE UPSTREAM AND DOWNSTREAM SIDES OF THE REINFORCED CHECK DAM.

REINFORCED CHECK DAM MAINTENANCE NOTES:

1. THE SWMP MANAGER SHALL INSPECT CHECK DAMS WEEKLY, DURING AND AFTER ANY STORM EVENT AND MAKE REPAIRS OR CLEAN OUT AS NECESSARY.
2. SEDIMENT ACCUMULATED UPSTREAM OF CHECK DAMS SHALL BE REMOVED WHEN THE SEDIMENT DEPTH UPSTREAM OF CHECK DAM IS WITHIN 1/2 OF THE HEIGHT OF THE CREST.
3. CHECK DAMS ARE TO REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS STABILIZED AND GRASS COVER IS APPROVED BY THE TOWN.
4. WHEN CHECK DAMS ARE REMOVED, EXCAVATIONS SHALL BE FILLED WITH SUITABLE COMPACTED BACKFILL. ANY DISTURBED AREA SHALL BE COVERED WITH TOP SOIL, DRILL SEEDING AND CRIMP MULCHING AND COVERED WITH EROSION CONTROL BLANKET OR OTHERWISE STABILIZED IN A MANNER APPROVED BY THE TOWN.

THIS DETAIL (EXCEPT MODIFICATIONS MADE BY THE TOWN OF SUPERIOR) COURTESY OF THE URBAN DRAINAGE AND FLOOD CONTROL DISTRICT.

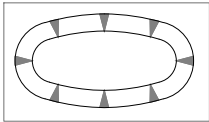
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REINFORCED CHECK DAM

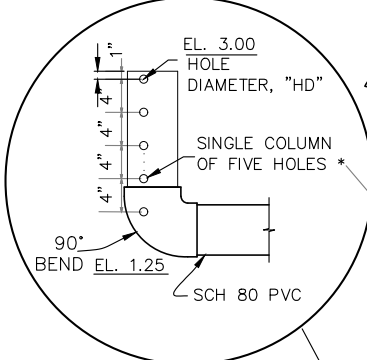
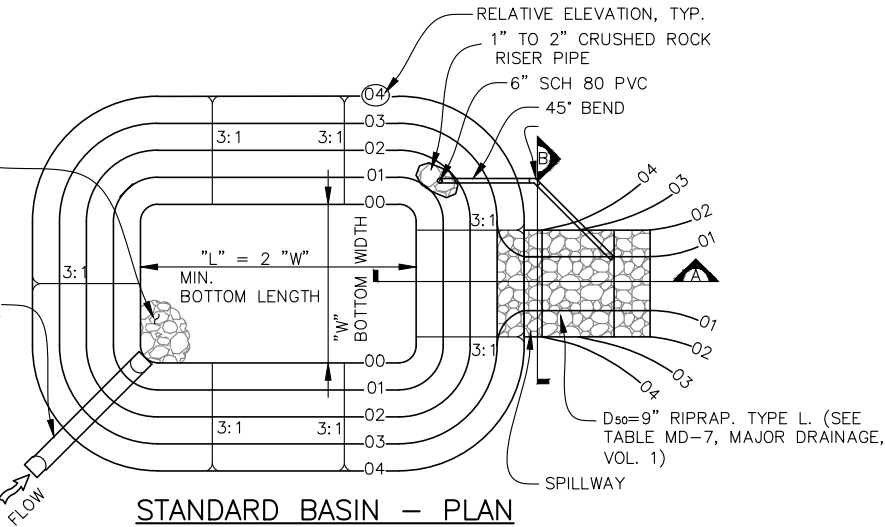
DATE: JANUARY 2019

SHEET 600-19

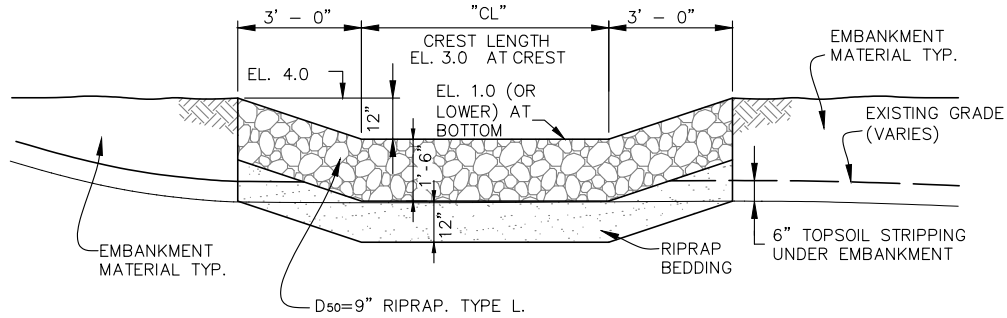
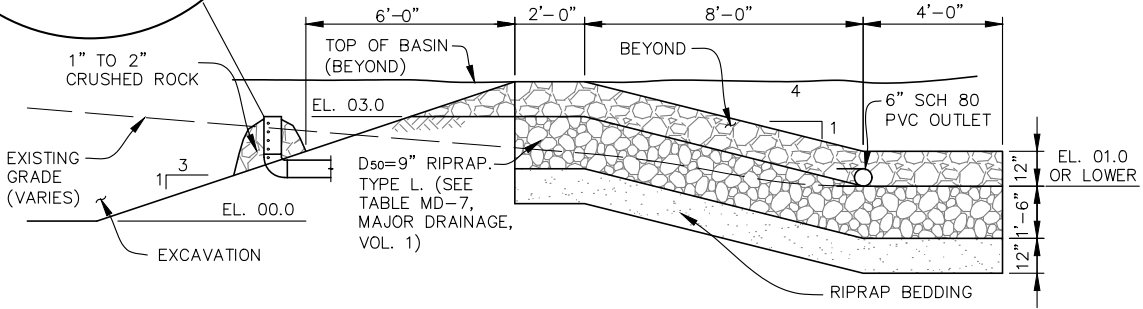


5.0 x 5.0 x 2.0 D RIPRAP PAD $D_{50} = 9"$, TYPE L. (SEE TABLE MD-7, MAJOR DRAINAGE, VOL. 1 OR AS CALLED OUT ON THE PLANS)

INLETS TO SEDIMENT BASIN SHALL ENTER AT FURTHEST DISTANCE TO OUTLET AND SHALL CONSIST OF TEMPORARY SLOPE DRAIN (SEE SHEET 600-23)



* EXCEPT WHERE THE HOLES EXCEED 1" DIAMETER, THEN UP TO TWO COLUMNS OF SAME SIZED HOLES MAY BE USED (ONE COLUMN PREFERRED)

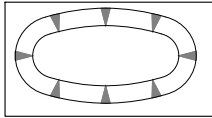


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N.T.S.



SEDIMENT BASIN DETAILS	
DATE: JANUARY 2019	SHEET 600-20



SIZING INFORMATION FOR STANDARD SEDIMENT BASIN			
Upstream Drainage Area (rounded to nearest acre), (ac)	Basin Bottom Width (W), (ft)	Spillway Crest Length (CL), (ft)	Hole Diameter (HD), (in)
1	12-1/2	2	9/32
2	21	3	13/16
3	28	5	1/2
4	33-1/2	6	9/16
5	38-1/2	8	21/32
6	43	9	21/32
7	47-1/4	11	25/32
8	51	12	27/32
9	55	13	7/8
10	58-1/4	15	15/16
11	61	16	31/32
12	64	18	1
13	67-1/2	19	1 1/16
14	70-1/2	21	1 1/8
15	73-1/4	22	1 3/16

Minimum Bottom Width and diameter of outlet plate holes based on 2,700 cu. ft. / acre of tributary area and 72 hour drain time.

SEDIMENT BASIN INSTALLATION NOTES:

- SEE PLAN VIEW AND SECTIONS FOR:
 - LOCATION OF SEDIMENT BASIN.
 - TYPE OF BASIN (STANDARD BASIN OR NONSTANDARD BASIN).
 - FOR STANDARD BASIN, BOTTOM WIDTH, "W", CREST LENGTH, "CL", AND HOLE DIAMETER, "HD".
 - FOR NONSTANDARD BASIN, SEE CONSTRUCTION DRAWINGS FOR DESIGN OF BASIN INCLUDING RISER HEIGHT, "H", NUMBER OF COLUMNS, "N", HOLE DIAMETER, "HD", AND PIPE DIAMETER "D".
- FOR STANDARD BASIN, BOTTOM DIMENSION MAY BE MODIFIED AS LONG AS BOTTOM AREA IS NOT REDUCED.
- SEDIMENT BASINS INDICATED ON INITIAL SWMP PLAN SHALL BE INSTALLED PRIOR TO ANY OTHER LAND-DISTURBING ACTIVITY.
- EMBANKMENT MATERIAL SHALL CONSIST OF SOIL FREE OF DEBRIS, ORGANIC MATERIAL, AND ROCKS OR CONCRETE GREATER THAN 3 INCHES AND SHALL HAVE A MINIMUM OF 15 PERCENT BY WEIGHT PASSING THE NO. 200 SIEVE.
- EMBANKMENT MATERIAL SHALL BE COMPACTED TO AT LEAST 95 PERCENT OF MAXIMUM DENSITY IN ACCORDANCE WITH ASTM D 698.
- PIPE SCH 80 SHALL BE USED.
- THE DETAILS SHOWN ON THESE SHEETS PERTAIN TO STANDARD SEDIMENT BASIN(S) IDENTIFIED ON THE SWMP PLAN VIEW DRAWINGS USED FOR DRAINAGE AREAS LESS THAN 15 ACRES. SEE CONSTRUCTION DRAWINGS FOR EMBANKMENT, STORAGE VOLUME, SPILLWAY, OUTLET, AND OUTLET PROTECTION DETAILS FOR ANY SEDIMENT BASIN(S) THAT HAVE BEEN INDIVIDUALLY DESIGNED FOR DRAINAGE AREAS LARGER THAN 15 ACRES.

SEDIMENT BASIN MAINTENANCE NOTES:

- THE SWMP MANAGER SHALL INSPECT SEDIMENT BASIN WEEKLY, DURING AND AFTER ANY STORM EVENT AND MAKE REPAIRS OR CLEAN OUT AS NECESSARY.
- SEDIMENT ACCUMULATED IN BASIN SHALL BE REMOVED WHEN SEDIMENT DEPTH IS ONE FOOT (I.E., 2- FEET BELOW THE SPILLWAY CREST).
- SEDIMENT BASINS ARE TO REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS STABILIZED AND GRASS COVER IS ACCEPTED BY THE TOWN.
- WHEN SEDIMENT BASINS ARE REMOVED, ALL DISTURBED AREAS SHALL BE COVERED WITH TOPSOIL, SEEDED AND MULCHED OR OTHERWISE STABILIZED AS APPROVED BY THE TOWN.

THIS DETAIL (EXCEPT MODIFICATIONS MADE BY THE TOWN OF SUPERIOR) COURTESY OF THE URBAN DRAINAGE AND FLOOD CONTROL DISTRICT.

N.T.S.

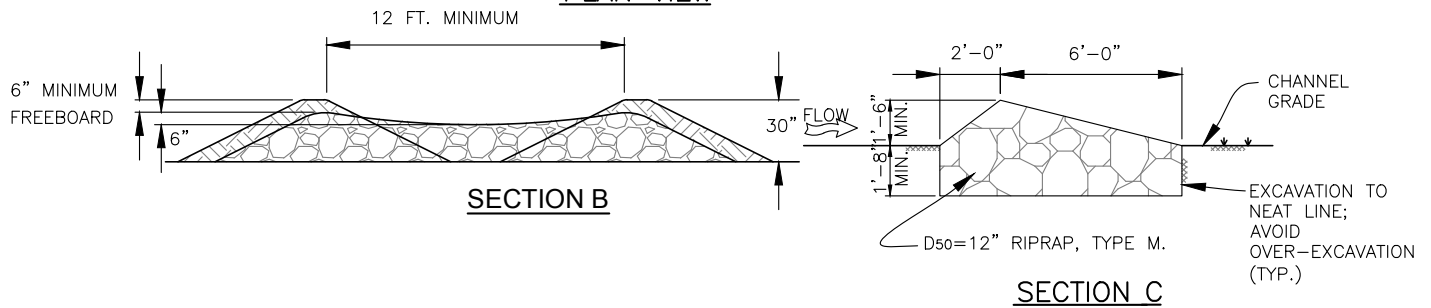
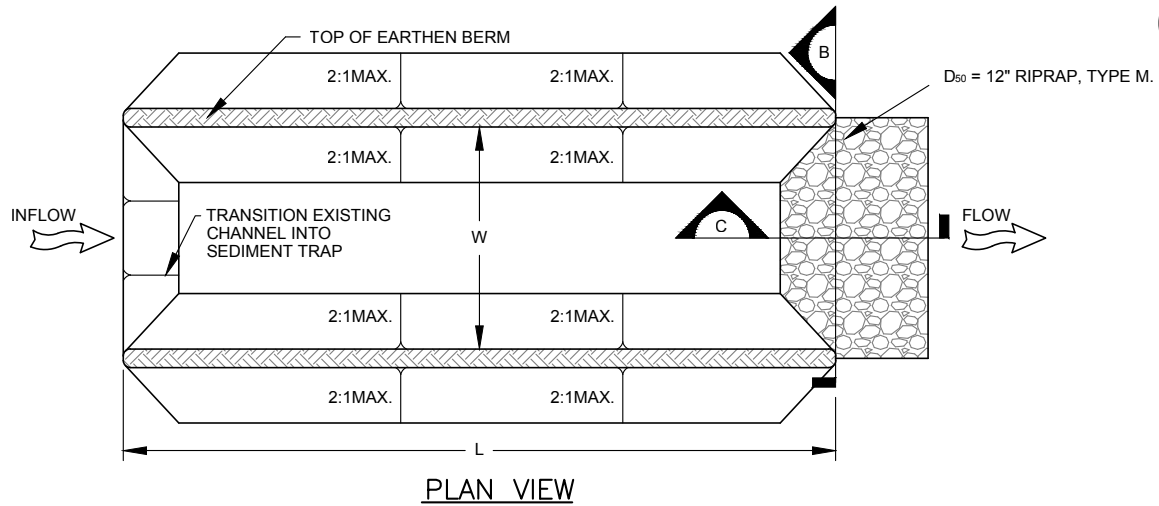


SEDIMENT BASIN SIZING AND NOTES

DATE: JANUARY 2019

SHEET 600-21

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SEDIMENT TRAP INSTALLATION NOTES:

1. SEE PLAN VIEW FOR:
 - LOCATION, LENGTH AND WIDTH OF SEDIMENT TRAP.
2. SEDIMENT TRAPS INDICATED ON INITIAL EROSION CONTROL PLAN SHALL BE INSTALLED PRIOR TO ANY LAND-DISTURBING ACTIVITIES.
3. SEDIMENT TRAP BERM SHALL BE CONSTRUCTED FROM MATERIAL FROM EXCAVATION. THE BERM SHALL BE COMPACTED TO 95% OF THE MAXIMUM DENSITY IN ACCORDANCE WITH ASTM D698.
4. RIPRAP OUTLET SHALL BE CONSTRUCTED WITH D₅₀=12" RIPRAP (TYPE M, SEE TABLE MD-7, MAJOR DRAINAGE, VOL. 1 , URBAN DRAINAGE AND FLOOD CONTROL DISTRICT CRITERIA MANUAL.
5. THE TOP OF THE EARTHEN BERM SHALL BE A MINIMUM OF 6" HIGHER THAN THE TOP OF THE RIPRAP OUTLET STRUCTURE.
6. THE ENDS OF THE RIPRAP OUTLET STRUCTURE SHALL BE MINIMUM OF 6" HIGHER THAN THE CENTER OF THE OUTLET STRUCTURE.

SEDIMENT TRAP MAINTENANCE NOTES:

1. THE SWMP MANAGER SHALL INSPECT SEDIMENT TRAPS WEEKLY, DURING AND AFTER ANY STORM EVENT AND MAKE REPAIRS OR CLEAN OUT UPSTREAM SEDIMENT AS NECESSARY.
2. SEDIMENT ACCUMULATED UPSTREAM OF RIPRAP SHALL BE REMOVED WHEN THE UPSTREAM DEPTH IS WITHIN 1/2 THE HEIGHT OF THE RIPRAP OUTLET STRUCTURE.
3. SEDIMENT TRAPS SHALL REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS STABILIZED AND GRASS COVERAGE IS APPROVED BY THE CITY.
4. WHEN SEDIMENT TRAPS ARE REMOVED THE DISTURBED AREA SHALL BE COVERED WITH TOP SOIL, DRILLED SEEDING AND CRIMP MULCHED OR STABILIZED IN A MANNER APPROVED BY THE CITY.

THIS DETAIL (EXCEPT MODIFICATIONS MADE BY THE TOWN OF SUPERIOR) COURTESY OF THE URBAN DRAINAGE AND FLOOD CONTROL DISTRICT.

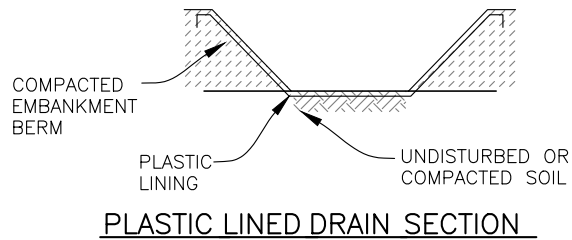
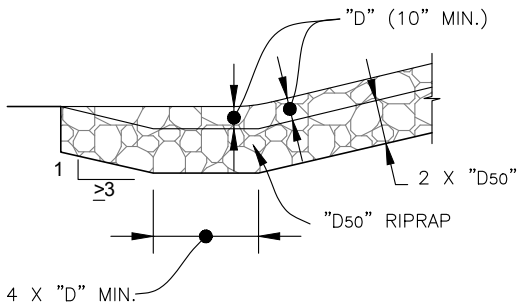
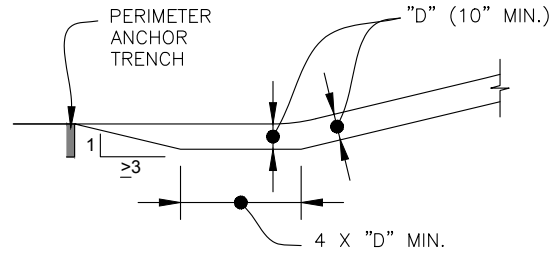
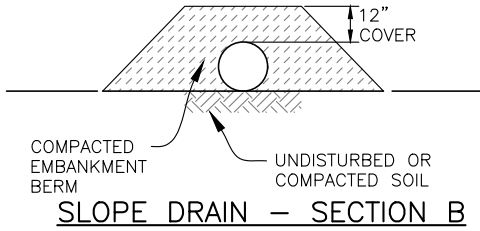
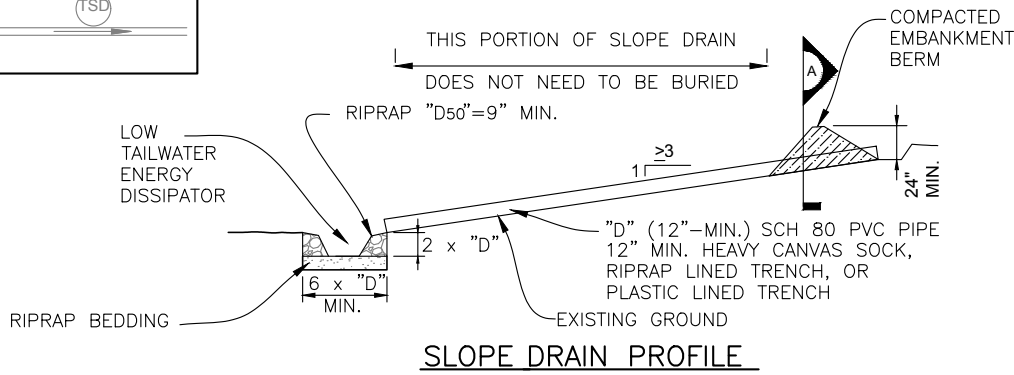
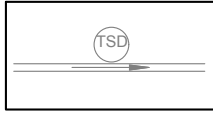
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SEDIMENT TRAP

DATE: JANUARY 2019

SHEET 600-22



SLOPE DRAIN INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
 - LOCATION AND LENGTH OF SLOPE DRAIN.
 - PIPE DIAMETER, "D", AND RIPRAP SIZE, "D50".
2. SLOPE DRAIN DIMENSIONS SHALL BE CONSIDERED MINIMUM DIMENSIONS; CONTRACTOR MAY ELECT TO INSTALL LARGER FACILITIES. ANY DAMAGE TO SLOPE OR SLOPE DRAIN DURING RUNOFF EVENTS SHALL BE THE DEVELOPER'S RESPONSIBILITY.
3. SLOPE DRAINS INDICATED ON INITIAL GESC PLAN SHALL BE INSTALLED PRIOR TO ANY UPSTREAM LAND-DISTURBING ACTIVITIES.
4. FOR TEMPORARY SLOPE DRAINS, PIPE MAY BE INSTALLED ON TOP OF SLOPE; HOWEVER, 12" MIN. COVER AT TOP OF SLOPE SHALL BE PROVIDED. PLASTIC-LINED OR RIPRAP-LINED TRENCHES MAY BE USED INSTEAD OF PIPE.
5. A RIPRAP PAD SHALL BE PLACED AT THE OUTFALL OF THE SLOPE DRAIN.

SLOPE DRAIN MAINTENANCE NOTES

1. THE SWMP MANAGER SHALL INSPECT SLOPE DRAINS WEEKLY, DURING AND AFTER ANY STORM EVENT AND MAKE REPAIRS AS NECESSARY.
2. TEMPORARY SLOPE DRAINS ARE TO REMAIN IN PLACE UNTIL NO LONGER NEEDED, BUT SHALL BE REMOVED PRIOR TO THE END OF CONSTRUCTION. WHEN SLOPE DRAINS ARE REMOVED, THE DISTURBED AREA SHALL BE COVERED WITH TOP SOIL, DRILL SEEDED AND CRIMP MULCHED OR OTHERWISE STABILIZED IN A MANNER APPROVED BY THE TOWN.

THIS DETAIL (EXCEPT MODIFICATIONS MADE BY THE TOWN OF SUPERIOR) COURTESY OF THE URBAN DRAINAGE AND FLOOD CONTROL DISTRICT.

N.T.S.



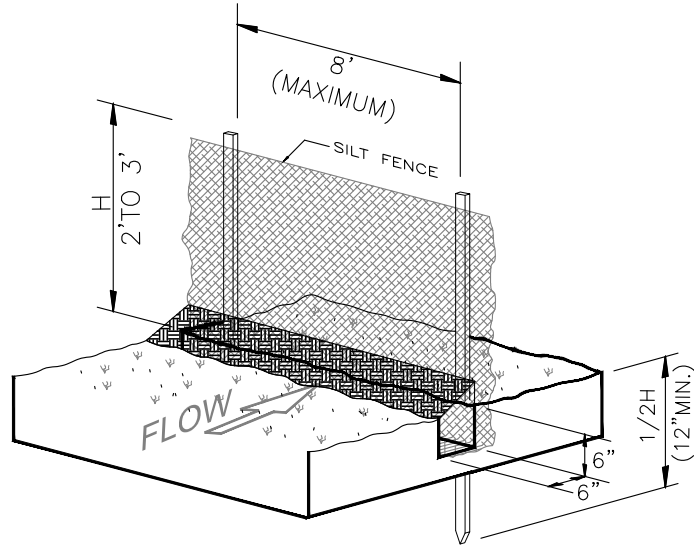
TEMPORARY SLOPE DRAIN

DATE: JANUARY 2019

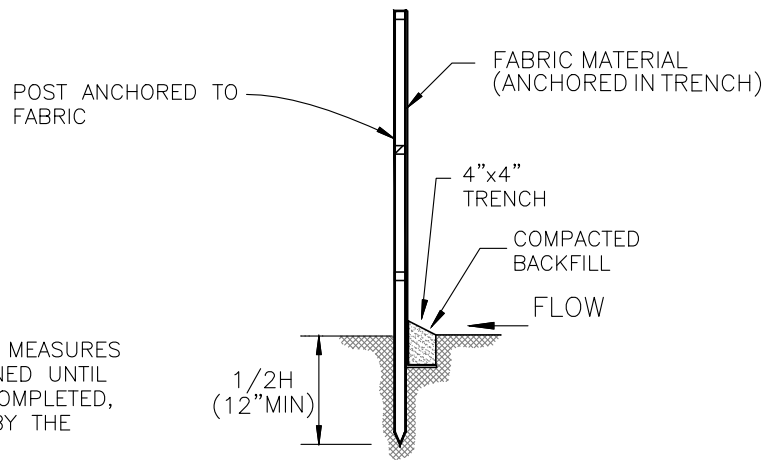
SHEET 600-23

SF ————— SF

SF



SILT FENCE INSTALLATION



SECTION

NOTE:

EROSION CONTROL MEASURES SHALL BE MAINTAINED UNTIL LANDSCAPING IS COMPLETED, OR AS DIRECTED BY THE TOWN

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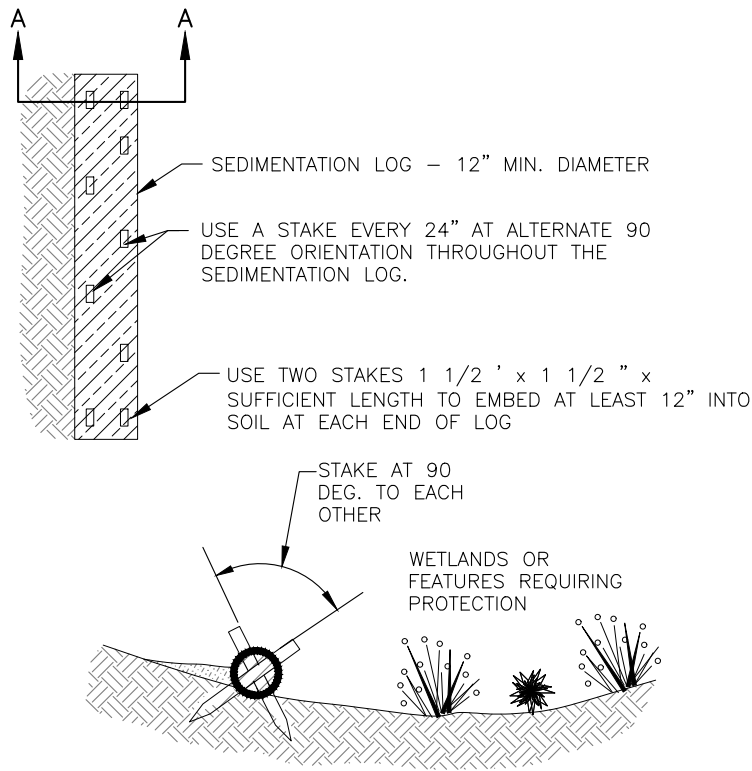
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SILT FENCE

DATE: JANUARY 2019

SHEET 600-24



SECTION A - A

SEDIMENT CONTROL LOG INSTALLATION NOTES:

1. SEE PLAN VIEW FOR:
-LOCATION AND LENGTH OF SEDIMENT CONTROL LOG.
2. SEDIMENT CONTROL LOGS INDICATED ON INITIAL SWMP PLAN SHALL BE INSTALLED PRIOR TO ANY LAND- DISTURBING ACTIVITIES.
3. SEDIMENT CONTROL LOGS SHALL CONSIST OF STRAW, COMPOST, EXCELSIOR, OR COCONUT FIBER.
4. NOT FOR USE IN CONCENTRATED FLOW AREAS.
5. THE SEDIMENT CONTROL LOG SHALL BE TRENCHED INTO THE GROUND A MINIMUM OF 2".

SEDIMENT CONTROL LOG MAINTENANCE NOTES:

1. THE SWMP MANAGER SHALL INSPECT SEDIMENT CONTROL LOGS DAILY, DURING AND AFTER ANY STORM EVENT AND MAKE REPAIRS OR CLEAN OUT UPSTREAM SEDIMENT AS NECESSARY.
2. SEDIMENT ACCUMULATED UPSTREAM OF SEDIMENT CONTROL LOGS SHALL BE REMOVED WHEN THE UPSTREAM SEDIMENT DEPTH IS WITHIN 1/2 THE HEIGHT OF THE CREST OF LOG.
3. SEDIMENT CONTROL LOG SHALL BE REMOVED AT THE END OF CONSTRUCTION. IF ANY DISTURBED AREA EXISTS AFTER REMOVAL, IT SHALL BE COVERED WITH TOP SOIL, DRILL SEEDED AND CRIMP MULCHED OR OTHERWISE STABILIZED IN A MANNER APPROVED BY THE TOWN.

THIS DETAIL (EXCEPT MODIFICATIONS MADE BY THE TOWN OF SUPERIOR) COURTESY OF THE URBAN DRAINAGE AND FLOOD CONTROL DISTRICT.

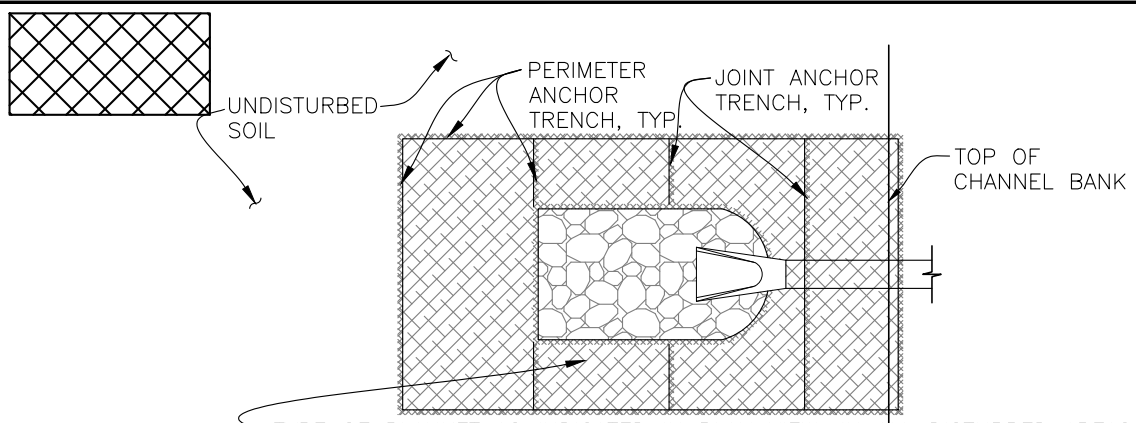
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SEDIMENT CONTROL LOG

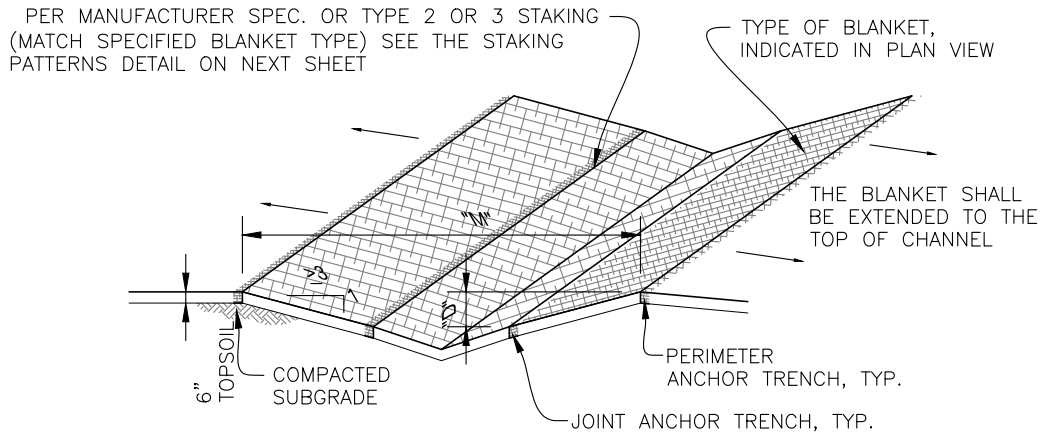
DATE: JANUARY 2019

SHEET 600-25

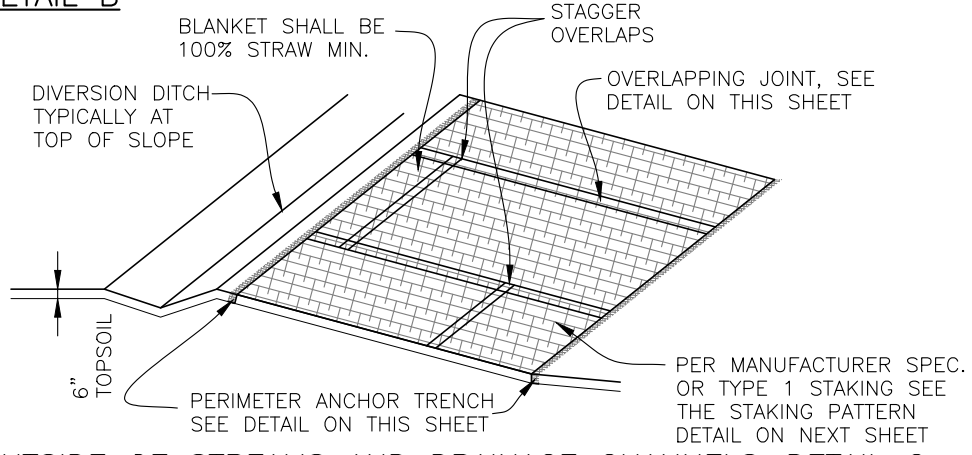


TYPE OF BLANKET AS INDICATED IN PLAN VIEW, IN ALL DISTURBED AREAS OF STREAMS AND DRAINAGE CHANNELS TO DEPTH "D" ABOVE CHANNEL INVERT. BLANKET SHALL GENERALLY BE ORIENTED PARALLEL TO FLOW DIRECTION. STAKING PATTERN SHALL MATCH BLANKET TYPE.

AT PIPE OUTLET AREAS OF STREAMS AND DRAINAGE CHANNELS – DETAIL A



IN DIVERSION DITCH OR SMALL DITCH DRAINAGE WAY – DETAIL B



OUTSIDE OF STREAMS AND DRAINAGE CHANNELS – DETAIL C

THIS DETAIL (EXCEPT MODIFICATIONS MADE BY THE TOWN OF SUPERIOR) COURTESY OF THE URBAN DRAINAGE AND FLOOD CONTROL DISTRICT.

N.T.S.

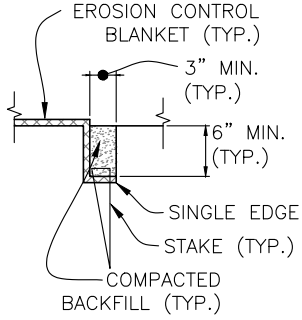


EROSION CONTROL BLANKET

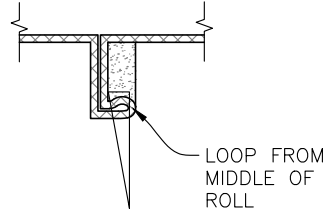
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SHEET 600-26

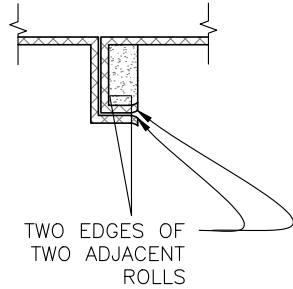
ANCHOR DETAILS



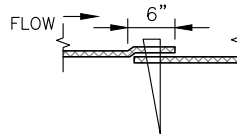
PERIMETER ANCHOR TRENCH



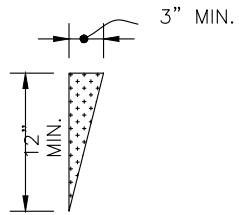
INTERMEDIATE ANCHOR TRENCH



JOINT ANCHOR TRENCH



OVERLAPPING JOINT



WOOD STAKE DETAIL

MINIMUM THICKNESS 1"
 USE 2x4 MATERIAL FOR STAKES

THIS DETAIL (EXCEPT MODIFICATIONS MADE BY THE TOWN OF SUPERIOR) COURTESY OF THE URBAN DRAINAGE AND FLOOD CONTROL DISTRICT.

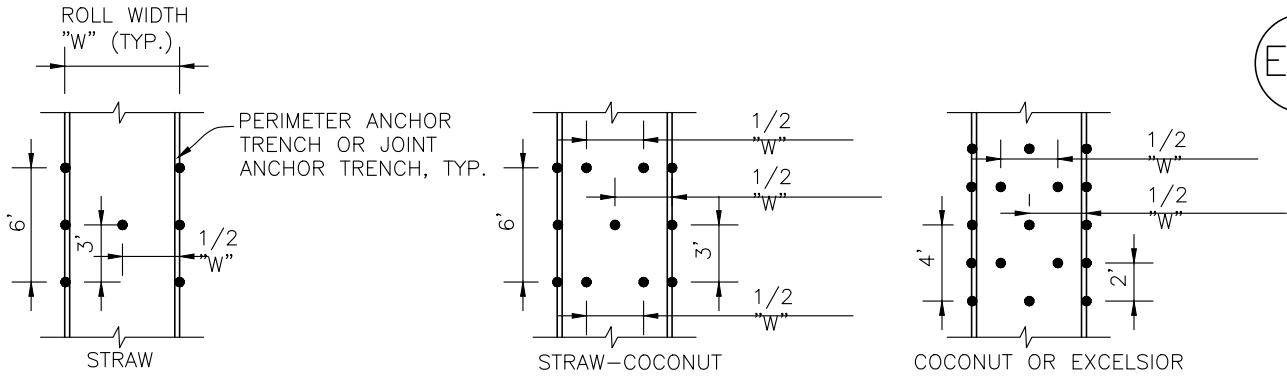
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EROSION CONTROL BLANKET

DATE: JANUARY 2019

SHEET 600-27



STAKING PATTERNS

SHALL BE IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATION. IF NO MANUFACTURER'S SPECIFICATION IS AVAILABLE USE THE ACCEPTABLE STAKING PATTERN (AS SHOWN ABOVE)

EROSION CONTROL BLANKET INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
 - LOCATION OF PERIMETER OF EROSION CONTROL BLANKET.
 - TYPE OF BLANKET (STRAW, STRAW-COCONUT, COCONUT, OR EXCELSIOR).
 - AREA "A" IN SQUARE YARDS OF EACH TYPE OF BLANKET.
2. ALL EROSION CONTROL BLANKETS AND NETTING SHALL BE MADE OF 100% NATURAL AND BIODEGRADABLE MATERIAL; NO PLASTIC OR OTHER SYNTHETIC MATERIAL, EVEN IF PHOTO DEGRADABLE, SHALL BE ALLOWED.
3. IN AREAS WHERE EROSION CONTROL BLANKET IS SHOWN ON THE PLANS, THE CONTRACTOR SHALL PLACE TOPSOIL AND PERFORM FINAL GRADING, SURFACE PREPARATION, AND SEEDING BELOW THE SEEDING AND MULCHING. SUBGRADE SHALL BE SMOOTH AND MOIST PRIOR TO BLANKET INSTALLATION AND THE BLANKET SHALL BE IN FULL CONTACT WITH SUBGRADE, NO GAPS OR VOIDS SHALL EXIST UNDER THE BLANKET.
4. PERIMETER ANCHOR TRENCH SHALL BE USED AT OUTSIDE PERIMETER OF ALL BLANKET AREAS.
5. JOINT ANCHOR TRENCH SHALL BE USED TO JOIN ROLLS OF BLANKETS TOGETHER (LONGITUDINALLY AND TRANSVERSELY) FOR ALL BLANKETS EXCEPT STRAW, WHICH MAY USE AN OVERLAPPING JOINT.
6. INTERMEDIATE ANCHOR TRENCH SHALL BE USED AT SPACING OF ONE-HALF THE ROLL LENGTH FOR COCONUT AND EXCELSIOR BLANKETS.
7. THE OVERLAPPING JOINT DETAIL SHALL BE USED TO JOIN ROLLS OF BLANKETS TOGETHER FOR BLANKETS ON SLOPES.
8. MATERIAL SPECIFICATIONS OF EROSION CONTROL BLANKET SHALL CONFORM TO TABLE 7.1.
9. ANY AREAS OF SEEDING AND MULCHING DISTURBED IN THE PROCESS OF INSTALLING EROSION CONTROL BLANKET SHALL BE RESEEDED AND MULCHED.
10. DETAILS ON DESIGN PLANS FOR MAJOR DRAINAGEWAY STABILIZATION WILL GOVERN IF DIFFERENT FROM ONES SHOWN HERE

TABLE 7.1 - EROSION CONTROL BLANKET TYPE				
TYPE	COCONUT CONTENT	STRAW CONTENT	EXCELSIOR CONTENT	NETTING MIN.
STRAW*	-	100%	-	DOUBLE/NATURAL
STRAW-COCONUT	30% MIN.	70% MAX.	-	DOUBLE/NATURAL
COCONUT	100%	-	-	DOUBLE/NATURAL
EXCELSIOR	-	-	100%	DOUBLE/NATURAL

* FOR OUTSIDE OF STREAMS AND DRAINAGE CHANNELS

EROSION CONTROL BLANKET MAINTENANCE NOTES:

1. THE SWMP MANAGER SHALL INSPECT EROSION CONTROL BLANKETS WEEKLY, DURING AND AFTER ANY STORM EVENT AND MAKE REPAIRS AS NECESSARY.
2. EROSION CONTROL BLANKET IS TO BE LEFT IN PLACE UNLESS DIRECTED TO BE REMOVED BY THE TOWN.
3. ANY EROSION CONTROL BLANKET PULLED OUT, TORN, OR OTHERWISE DAMAGED SHALL BE RE-INSTALLED. ANY SUBGRADE AREAS BELOW THE BLANKET THAT HAVE ERODED TO CREATE A VOID UNDER THE BLANKET, OR THAT REMAIN DEVOID OF GRASS SHALL BE REPAIRED, RESEEDED AND MULCHED AND THE EROSION CONTROL BLANKET REINSTALLED.

THIS DETAIL (EXCEPT MODIFICATIONS MADE BY THE TOWN OF SUPERIOR) COURTESY OF THE URBAN DRAINAGE AND FLOOD CONTROL DISTRICT.

N.T.S.



EROSION CONTROL BLANKET AND MAINTENANCE NOTES

DATE: JANUARY 2019

SHEET 600-28

SEDIMENT AND EROSION CONTROL

1. THE CONTRACTOR SHALL BE RESPONSIBLE FOR SEDIMENT AND EROSION CONTROL AT THE SITE THROUGHOUT CONSTRUCTION.
2. PERIMETER SILT FENCING SHALL BE INSTALLED PRIOR TO ANY LAND DISTURBING ACTIVITY (STOCKPILING, STRIPPING, GRADING, ETC.)
3. BEST MANAGEMENT PRACTICES (BMP'S) SHALL BE USED AS NECESSARY TO ADDRESS SEDIMENT AND DUST FROM SITE DISTURBANCE. ADDITIONAL MEASURES MAY BE REQUIRED AT THE DIRECTION OF THE ENGINEER.
4. BMP'S MAY INCLUDE, BUT ARE NOT LIMITED TO:
 - MINIMAL DISTURBANCE FOR MINIMAL TIME PERIODS
 - GRAVEL CONSTRUCTION ENTRIES
 - SILT FENCE, STRAW BALE OR SAND BAG BARRIERS, ROCK CHECK DAMS
 - STORM SEWER INLET PROTECTION
 - SEDIMENT CAPTURE PONDS
 - SITE WATERING FOR DUST SUPPRESSION
5. BMP'S SHALL BE MAINTAINED AND KEPT IN GOOD REPAIR FOR THE DURATION OF THE PROJECT. THE CONTRACTOR SHALL INSPECT BMP'S WEEKLY AND AFTER SIGNIFICANT (GREATER THAN 0.1" PRECIPITATION) STORM EVENTS. THE MAINTENANCE AND REPAIR SHALL BE COMPLETED IN A TIMELY MANNER. SEDIMENT AND DEBRIS SHALL BE REMOVED WHEN THEY REACH HALF THE BMP HEIGHT OR IMPACT THE FUNCTION OF THE BMP.
6. SOIL STOCKPILES SHALL BE PROTECTED FROM SEDIMENT TRANSPORT BY SURFACE ROUGHENING, WATERING AND PERIMETER SILT FENCING. SOILS THAT WILL BE STOCKPILED FOR MORE THAN 30 DAYS SHALL BE MULCHED AND SEEDED WITH A GRASS COVER WITHIN 14 DAYS OF STOCKPILE CONSTRUCTION.
7. THE CONTRACTOR SHALL ENSURE THAT ALL LOADS OF CUT AND FILL SOILS IMPORTED TO OR EXPORTED FROM THE SITE ARE PROPERLY LOADED AND COVERED TO PREVENT LOSS DURING TRANSPORT.
8. THE CONTRACTOR SHALL REMOVE ALL SEDIMENT, MUD, AND CONSTRUCTION DEBRIS RESULTING FROM THIS PROJECT FROM FLOWLINES AND PAVEMENT OF PUBLIC STREETS IN A TIMELY MANNER.
9. SOILS EXPOSED DURING LAND DISTURBING ACTIVITY SHALL BE KEPT IN A ROUGHENED CONDITION BY RIPPING OR DISCING ALONG LAND CONTOURS UNTIL MULCH, VEGETATION OR OTHER PERMANENT EROSION CONTROL IS IN PLACE. NO SOILS SHALL REMAIN EXPOSED BY LAND DISTURBING ACTIVITY FOR MORE THAN THIRTY (30) DAYS BEFORE REQUIRED TEMPORARY OR PERMANENT EROSION CONTROL IS INSTALLED UNLESS OTHERWISE APPROVED.
10. VEHICLE TRACKING CONTROL, INLET/OUTLET, ROCK SOCK, AND SILT FENCE PROTECTION WILL BE USED TO CONTROL EROSION DURING CONSTRUCTION.
11. ALL TEMPORARY SEDIMENT CONTROLS WILL BE REMOVED WITHIN 30 DAYS AFTER THE FINAL STABILIZATION IS ACHIEVED OR AFTER THE TEMPORARY MEASURES ARE NO LONGER NEEDED, WHICHEVER OCCURS FIRST.
12. NATURAL VEGETATION SHALL BE RETAINED AND PROTECTED WHENEVER POSSIBLE. EXPOSURE OF SOIL TO EROSION BY REMOVAL OR DISTURBANCE OF VEGETATION SHALL BE LIMITED TO THE AREA REQUIRED FOR IMMEDIATE CONSTRUCTION OPERATIONS AND FOR THE SHORTEST PRACTICAL PERIOD OF TIME.
13. USE CURRENT CDOT/UDFCD STANDARD DETAILS.

NOTE:
THESE NOTES TO BE INCLUDED
ON ALL CONSTRUCTION DRAWINGS

N.T.S.



SEDIMENT AND EROSION CONTROL NOTES

DATE: JANUARY 2019

SHEET 600-29

ALL STEEL TO BE 304 STAINLESS STEEL

NOTE:
ALL TRASH RACKS SHOULD BE
SIZED PER UDFCD CRITERIA
MANUAL VOLUME 3, FIGURE OS-1

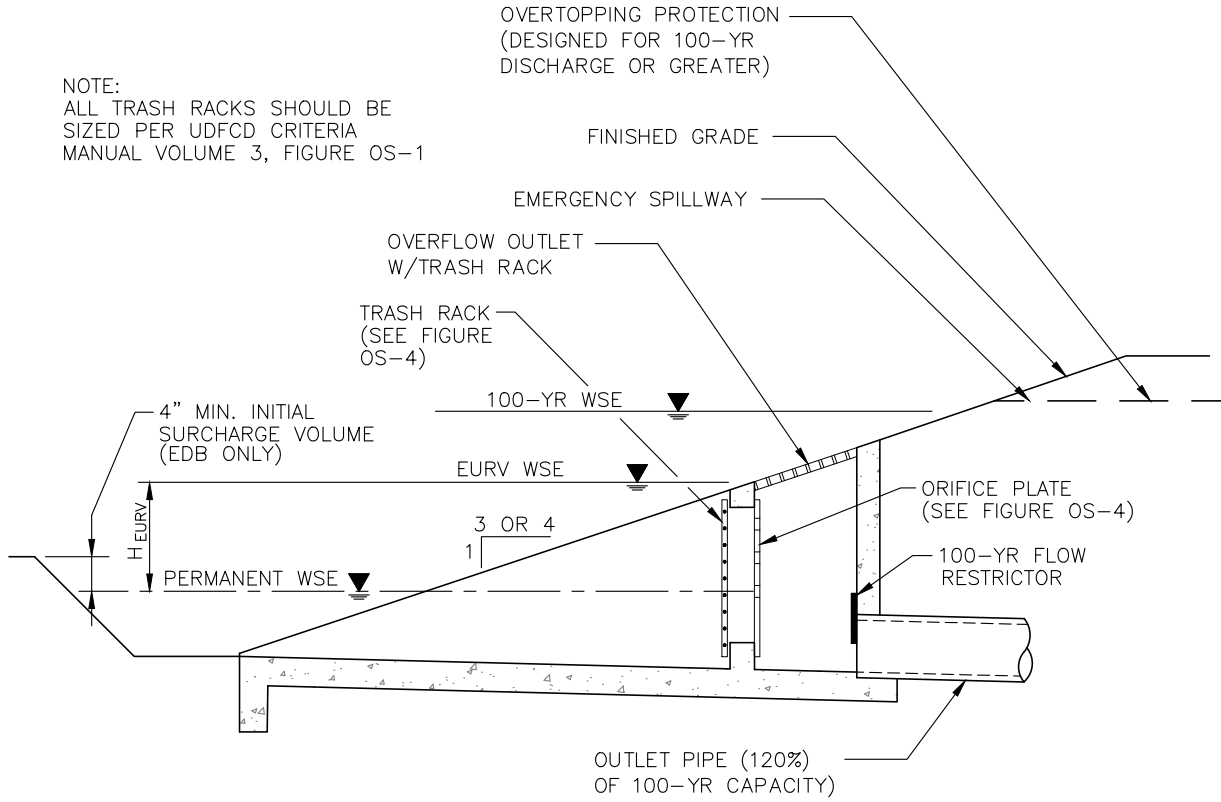


FIGURE OS-2 TYPICAL OUTLET STRUCTURE FOR FULL SPECTRUM DETENTION

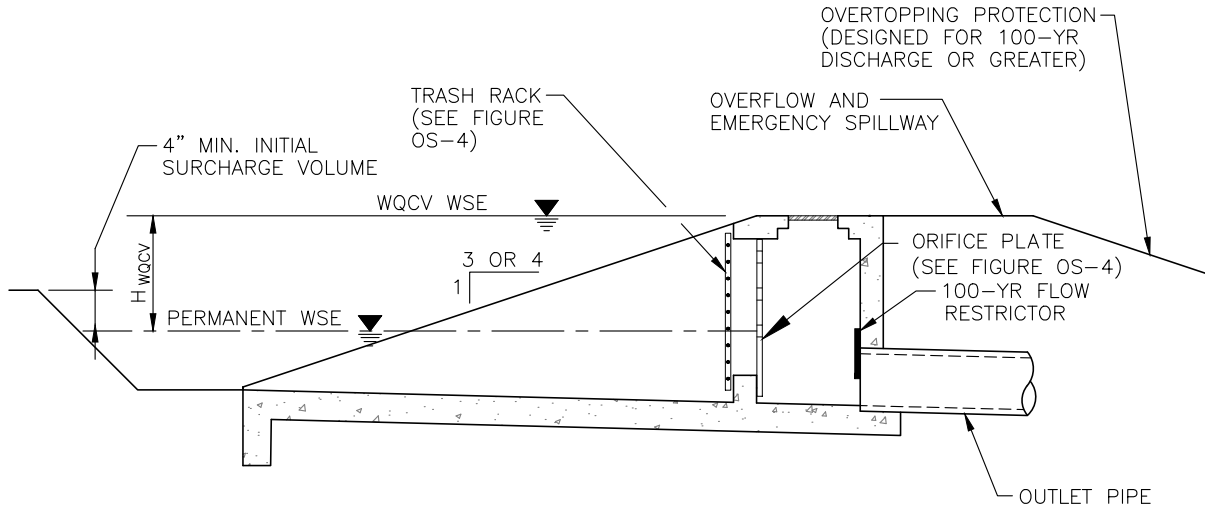


FIGURE OS-3 TYPICAL OUTLET STRUCTURE FOR WQCV TREATMENT AND ATTENUATION

THIS DETAIL (EXCEPT MODIFICATIONS MADE BY THE TOWN OF SUPERIOR) COURTESY OF THE URBAN DRAINAGE AND FLOOD CONTROL DISTRICT.

N.T.S.



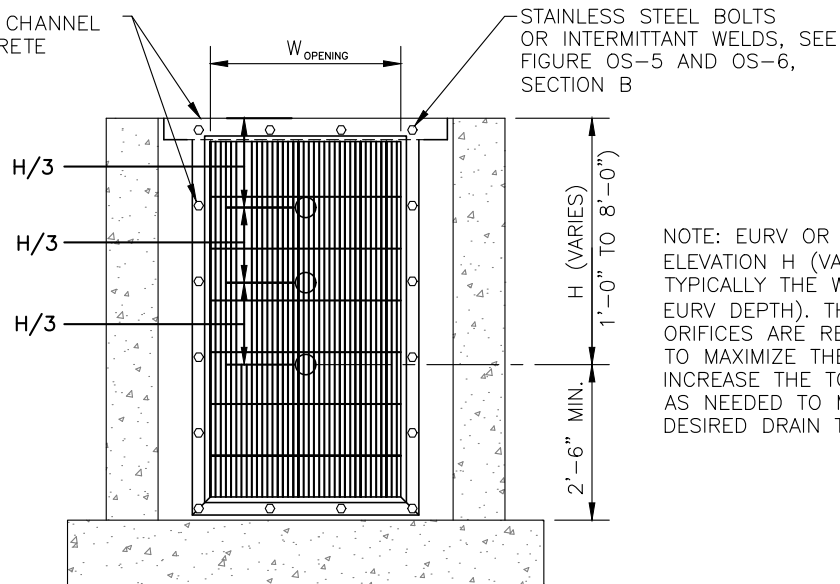
TYPICAL OUTLET STRUCTURE

DATE: JANUARY 2019

SHEET 600-30

ALL STEEL TO BE 304 STAINLESS STEEL

STRUCTURAL STEEL CHANNEL
FORMED INTO CONCRETE



NOTE: EURV OR WQCV
ELEVATION H (VARIES,
TYPICALLY THE WQCV OR
EURV DEPTH). THREE
ORIFICES ARE RECOMMENDED
TO MAXIMIZE THE DIAMETER.
INCREASE THE TOP ORIFICE
AS NEEDED TO MATCH THE
DESIRED DRAIN TIMES.

ELEVATION

ORIFICE PLATE NOTES:

1. PROVIDE CONTINUOUS NEOPRENE GASKET MATERIAL BETWEEN THE ORIFICE PLATE AND CONCRETE.
2. BOLT PLATE TO CONCRETE 12" MAX. ON CENTER. SEE UDFCD CRITERIA MANUAL VOLUME 3, TABLE OS-2 FOR PLATE THICKNESS.

EURV AND WQCV TRASH RACKS:

1. WELL-SCREEN TRASH RACKS SHALL BE 304 STAINLESS STEEL AND SHALL BE ATTACHED BY INTERMITTENT WELDS ALONG THE EDGE OF THE MOUNTING FRAME.
2. BAR GATE TRASH RACKS SHALL BE ALUMINUM AND SHALL BE BOLTED USING STAINLESS STEEL HARDWARE.
3. TRASH RACK OPEN AREAS ARE FOR SPECIFIED TRASH RACK MATERIALS. TOTAL TRASH RACK SIZE MAY NEED TO BE ADJUSTED FOR MATERIALS HAVING DIFFERENT OPEN AREA/GROSS AREA RATIO (R VALUE).
4. STRUCTURAL DESIGN OF TRASH RACKS SHALL BE BASED ON FULL HYDROSTATIC HEAD WITH ZERO HEAD DOWNSTREAM OF THE RACK.

OVERFLOW SAFETY GRATES:

1. ALL SAFETY GRATES SHALL BE MOUNTED USING STAINLESS STEEL HARDWARE AND PROVIDED WITH HINGED AND LOCKABLE OR BOLTABLE ACCESS PANELS.
2. SAFETY GRATES SHALL BE 304 STAINLESS STEEL.
3. SAFETY GRATES SHALL BE DESIGNED SUCH THAT THE DIAGONAL DIMENSION OF EACH OPENING IS SMALLER THAN THE DIAMETER OF THE OUTLET PIPE.
4. STRUCTURAL DESIGN OF SAFETY GRATES SHALL BE BASED ON FULL HYDROSTATIC HEAD WITH ZERO HEAD DOWNSTREAM OF THE RACK.

FIGURE OS-4 ORIFICE PLATE AND TRASH RACK DETAILS AND NOTES

THIS DETAIL (EXCEPT MODIFICATIONS MADE BY THE TOWN OF SUPERIOR) COURTESY OF THE
URBAN DRAINAGE AND FLOOD CONTROL DISTRICT.

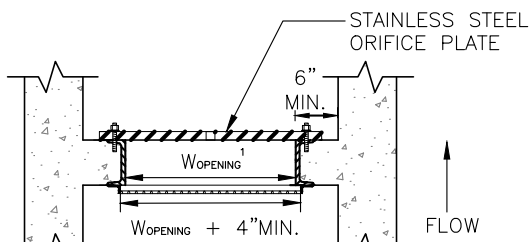
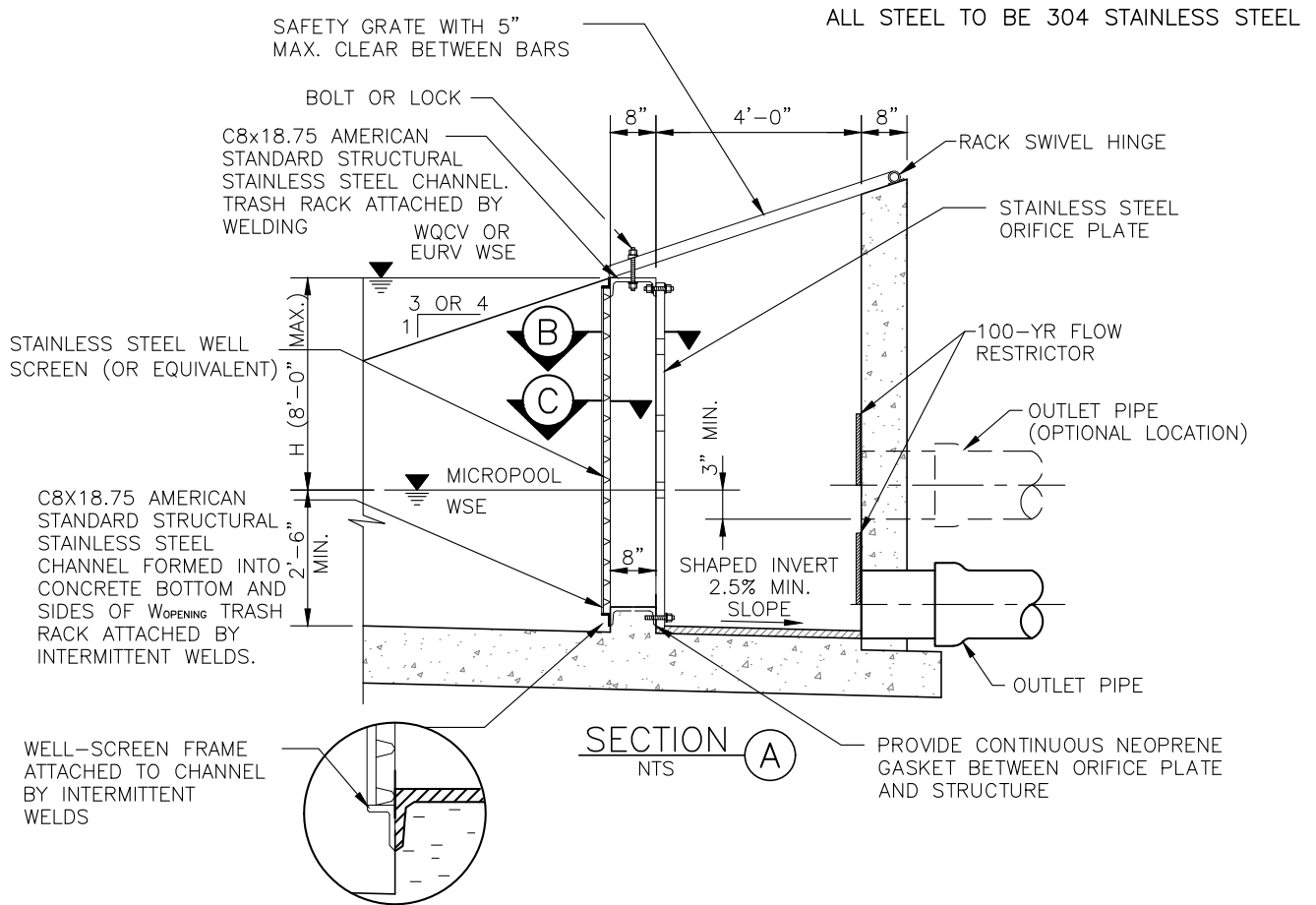
N.T.S.



ORIFICE PLATE AND TRASH RACK

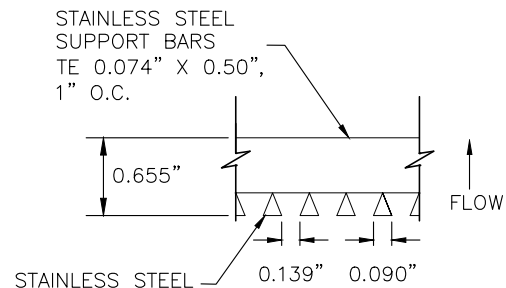
DATE: JANUARY 2019

SHEET 600-31



12" MIN. INCREASE AS NEEDED TO MEET RECOMMENDED OPEN AREA (SEE UDFCD CRITERIA MANUAL VOLUME 3, FIGURE OS-1)

SECTION B NTS



SECTION C NTS

$$R \text{ VALUE} = (\text{NET OPEN AREA}) / (\text{GROSS RACK AREA}) = 0.60$$

FIGURE OS-5 TYPICAL OUTLET STRUCTURE WITH WELL SCREEN TRASH RACK

THIS DETAIL (EXCEPT MODIFICATIONS MADE BY THE TOWN OF SUPERIOR) COURTESY OF THE URBAN DRAINAGE AND FLOOD CONTROL DISTRICT.

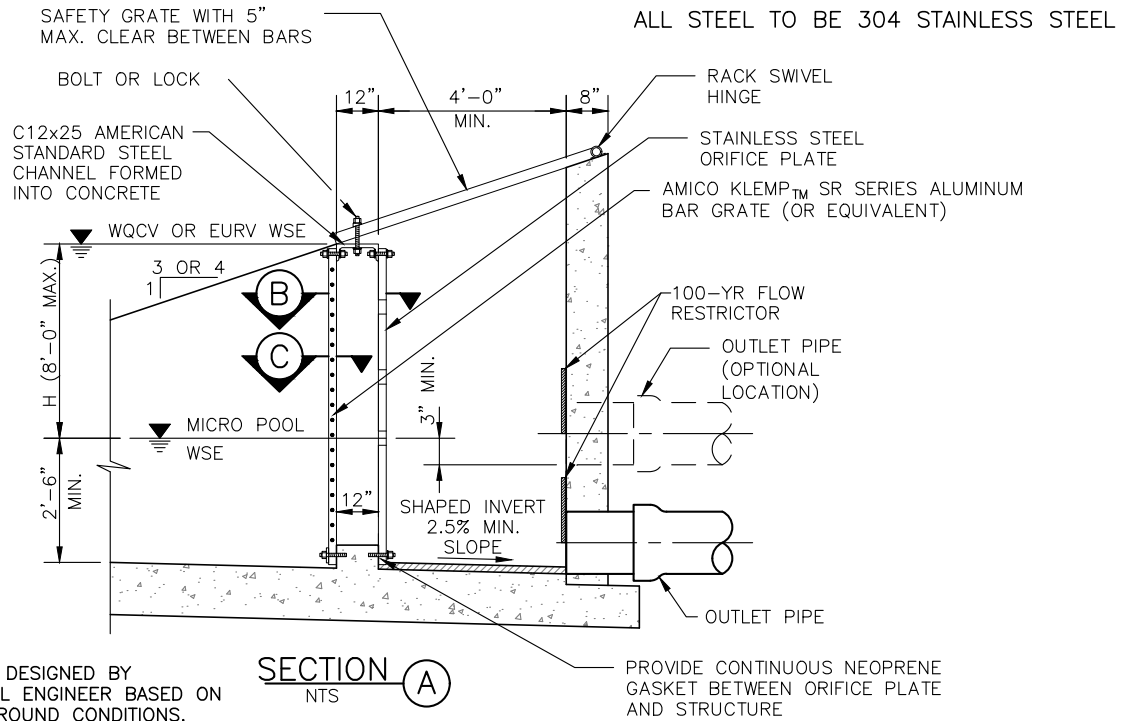
N.T.S.



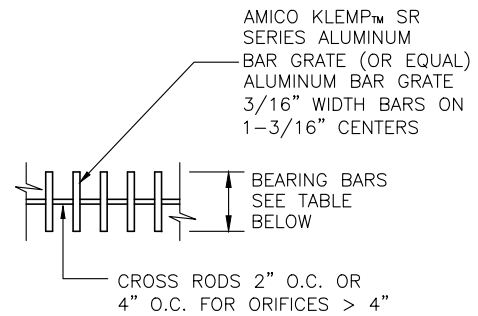
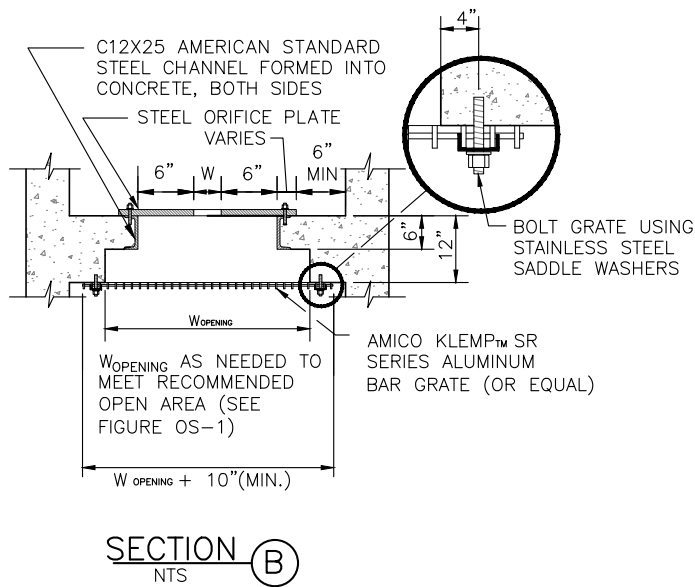
OUTLET STRUCTURE WITH TRASH RACK

DATE: JANUARY 2019

SHEET 600-32



ALL REINFORCEMENT TO BE DESIGNED BY A REGISTERED PROFESSIONAL ENGINEER BASED ON SIZE OF STRUCTURE AND GROUND CONDITIONS.



WATER DEPTH ABOVE LOWEST OPENING, H	MINIMUM BEARING BAR SIZE, BARS ALIGNED VERTICALLY
2.0 FT.	1" x 3/16"
3.0 FT.	1-1/4" x 3/16"
4.0 FT.	1-3/4" x 3/16"
5.0 FT.	2" x 3/16"
6.0 FT.	2-1/4" x 3/16"

R VALUE=(NET OPEN AREA)/GROSS RACK AREA
 =0.71 FOR CROSS RODS ON 2" CENTERS
 =0.77 FOR CROSS RODS ON 4" CENTERS

SECTION C
NTS

FIGURE OS-6 TYPICAL OUTLET STRUCTURE WITH BAR GRATE TRASH RACK

THIS DETAIL (EXCEPT MODIFICATIONS MADE BY THE TOWN OF SUPERIOR) COURTESY OF THE URBAN DRAINAGE AND FLOOD CONTROL DISTRICT.

N.T.S.

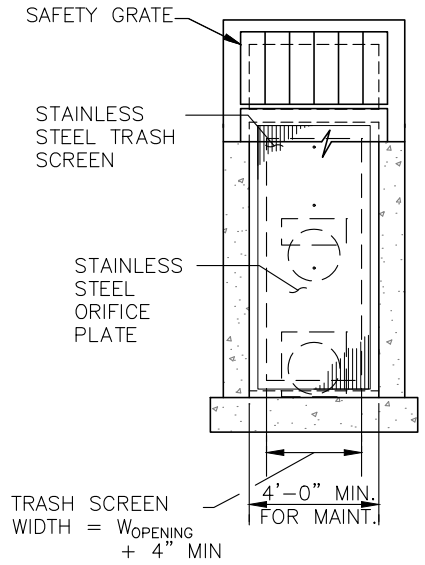
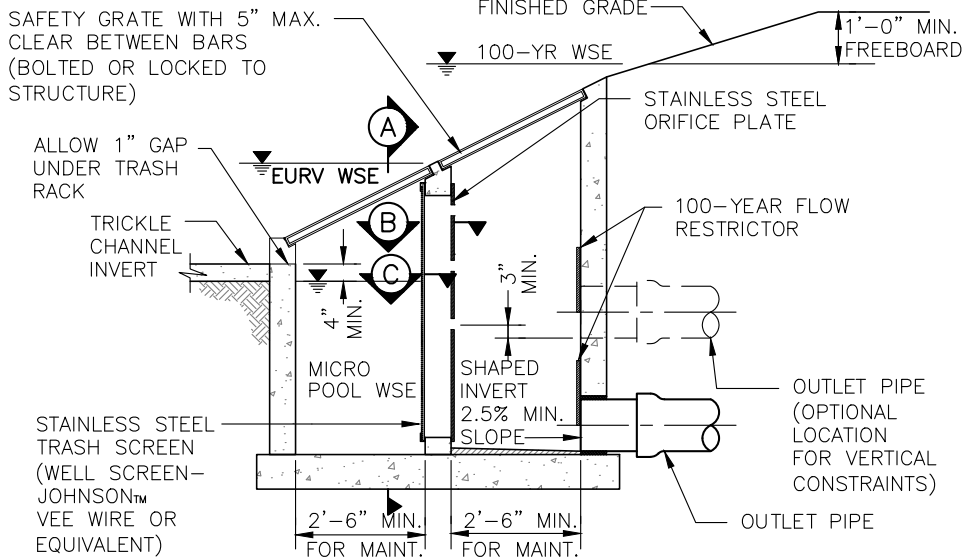


OUTLET STRUCTURE WITH BAR GRATE TRASH RACK

DATE: JANUARY 2019

SHEET 600-33

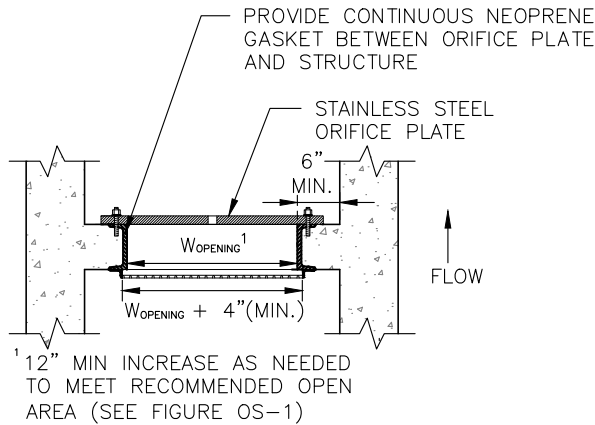
ALL STEEL TO BE 304 STAINLESS STEEL



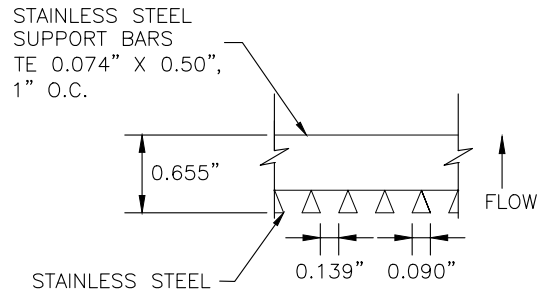
PROFILE
NTS

SECTION A
NTS

STAINLESS STEEL TRASH SCREEN (WELL SCREEN-JOHNSON™ VEE WIRE OR EQUIVALENT) ATTACH BY INTERMITTENT WELDS TO C8X18.75 AMERICAN STEEL CHANNEL FORMED INTO CONCRETE BOTTOM AND SIDES OF OPENING IN WALL.



SECTION B
NTS



SECTION C
NTS

$$R \text{ VALUE} = (\text{NET OPEN AREA}) / (\text{GROSS RACK AREA}) = 0.60$$

FIGURE OS-7
FULL SPECTRUM DETENTION
OUTLET STRUCTURE FOR 5 ACRE
IMPERVIOUS AREA OR LESS

THIS DETAIL (EXCEPT MODIFICATIONS MADE BY THE TOWN OF SUPERIOR) COURTESY OF THE URBAN DRAINAGE AND FLOOD CONTROL DISTRICT.

N.T.S.



OUTLET STRUCTURE FOR 5 ACRE IMPERVIOUS AREA OR LESS

DATE: JANUARY 2019

SHEET 600-34

ALL STEEL TO BE 304 STAINLESS STEEL

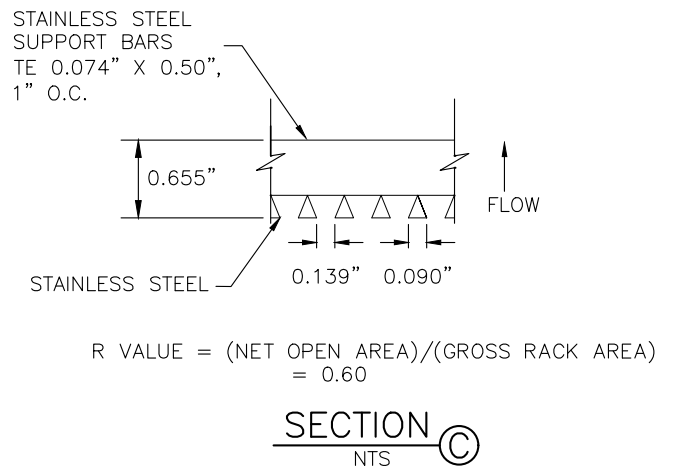
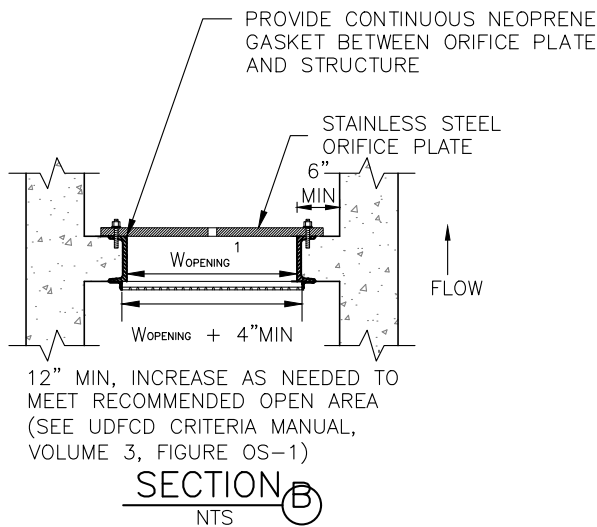
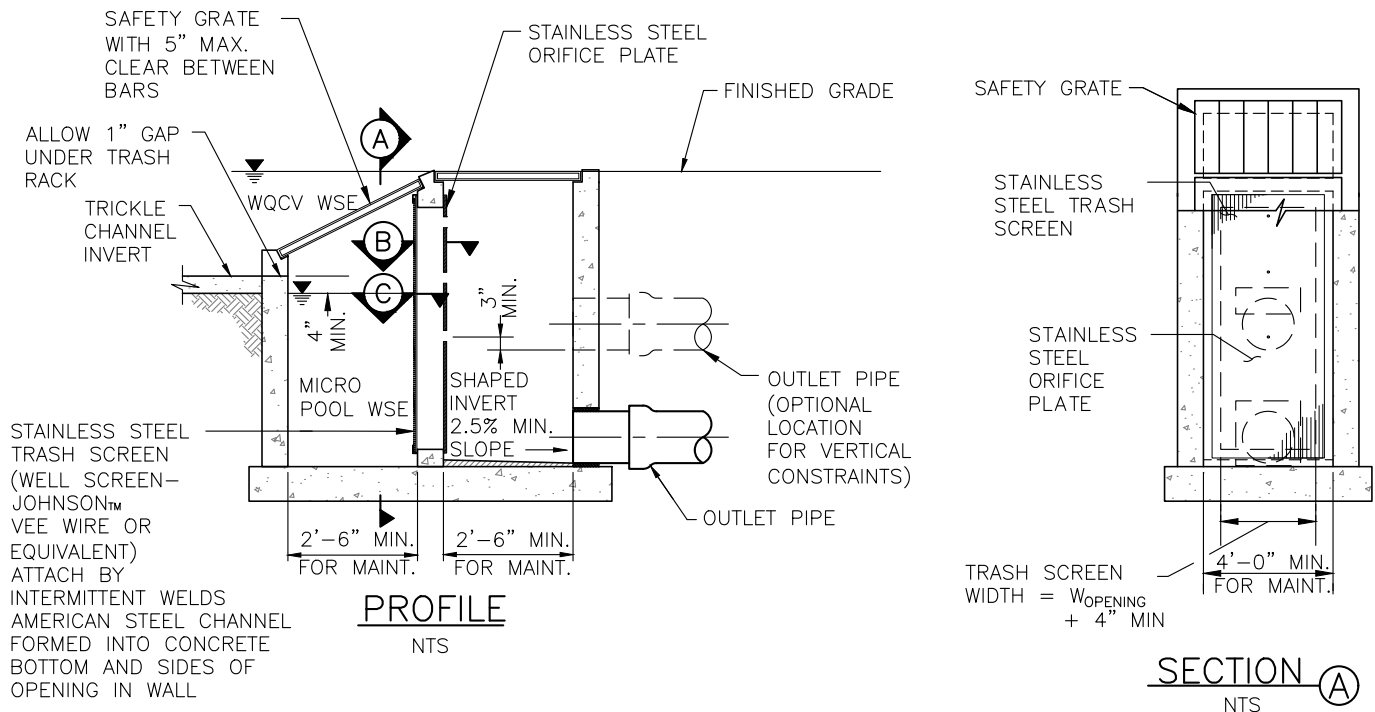


FIGURE OS-8
WQCV OUTLET
STRUCTURE FOR 5 ACRE
IMPERVIOUS AREA OR LESS

THIS DETAIL (EXCEPT MODIFICATIONS MADE BY THE TOWN OF SUPERIOR) COURTESY OF THE URBAN DRAINAGE AND FLOOD CONTROL DISTRICT.

N.T.S.



WQCV OUTLET STRUCTURE FOR 5 ACRE IMPERVIOUS AREA OR LESS

DATE: JANUARY 2019

SHEET 600-35

SECTION 700 – ROADWAY DESIGN, TRAFFIC CONTROL DEVICES, AND STREET LIGHTING

701.00 GENERAL CONDITIONS

Refer to Section 100 TITLE, SCOPE, AND GENERAL CONDITIONS of these DESIGN STANDARDS AND SPECIFICATIONS for additional requirements that apply to all projects within the Town.

710.00 SCOPE

This section contains minimum criteria to be met on all streets and parking lots designed and constructed in the Town, either by private land developers or by the Town. Sidewalks and curb ramps shall comply with ADA accessibility requirements.

All requirements of the Town's Subdivision and Zoning Ordinances and other applicable Titles of the *Superior Municipal Code* and Superior's *Comprehensive Plan* shall be met. Roadway design and ROW modifications shall conform to *AASHTO: A Policy on Geometric Design of Highways and Streets*, these DESIGN STANDARDS AND SPECIFICATIONS, and any other requirements determined by the Town Engineer.

Consideration shall be given, within the established framework of local streets, to provide for proper alignment and conformity to existing street patterns. The street design shall be directly related to the traffic needs and the adjacent land uses. Street design for Local and Collector streets in residential areas shall specifically focus on creating a pedestrian friendly design, avoiding excessively wide or long straight streets that encourage excess speed. Street design within such residential areas is intended to focus on developing a street system that can provide access to the adjacent properties, provide a safe transportation system for pedestrians, bicyclists, vehicles, and minimize the impacts of traffic on adjacent residential property. The streets, intersections, driveways, and pedestrian facilities shall be designed to provide for the greatest safety for both pedestrians and motorists.

All residential and commercial/industrial developments shall provide a Traffic Impact Analysis Report that complies with Section 162.00 ENGINEERING REPORTS of these DESIGN STANDARDS AND SPECIFICATIONS.

The design and installation of traffic control devices and street lighting shall comply with all applicable portions of the latest edition of the *CDOT Standard Specifications for Road and Bridge Construction*, the latest edition of the *Manual on Uniform Traffic Control Devices* (MUTCD), these DESIGN STANDARDS AND SPECIFICATIONS, and any other requirements determined by the Town Engineer.

The Traffic Control Plan and all submittals shall be approved by the Town Engineer prior to installation. Prior to installation of traffic control devices, all underground utilities shall be located. All traffic control devices shall be installed and maintained by the Developer or Contractor until Probationary Acceptance, into the warranty period, unless otherwise stated in the Subdivision/ Improvement Agreement.

710.01 Roadway Inspections

Refer to Section 153.00 INSPECTIONS and Section 931.00 ROADWAY INSPECTIONS of these DESIGN STANDARDS AND SPECIFICATIONS for required inspections during roadway construction.

720.00 ROADWAY DESIGN

721.00 STREET DESIGN CRITERIA

Street classifications shall conform to the Superior *Transportation Plan*. Typical street cross sections are shown in the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS. The Town Engineer may require or allow modifications to the typical street sections on a case-by-case basis due to factors such as surrounding land uses, access, or ROW constraints. Local residential cross sections shall be used in areas where the average daily traffic (ADT) is not likely to exceed two thousand (2,000) vehicles per day. Collector and arterial streets shall be constructed along the general alignment shown in the Superior *Transportation Plan*, and whenever a traffic engineering analysis of the future traffic volume indicates the need for a collector or arterial cross section.

Additional ROW may be required to satisfy other criteria contained in these DESIGN STANDARDS AND SPECIFICATIONS. Areas outside the R.O.W. shall be contour graded, compacted, and sloped, as required for proper drainage, soil stability, and maintenance accessibility. Cuts and fills proposed greater than four horizontal to vertical (4:1) shall require supporting calculations, provided by the Project Geotechnical Engineer based on a soils analysis.

Street design criteria for various street classifications are listed below:

TABLE 700.01

Design Element	Major Arterial 6/4 Lane	Minor Arterial 4/2 Lane	Major Collector with / w/o Median	Minor Collector	Commercial/ Office	Local	Private	Alley
R.O.W. Width	130' / 120'	110' / 100'	100' / 90'	60'	60'	60'	42'	16'
Roadway Width (Pavement Width ³)	88' / 64'	64' / 44'	58'	33'	32'	31'	21'	12'
Total Through Lanes	6 / 4	4 / 2	2	2	2	2	2	1
Travel Lanes	12'	12'	12'	N/A	N/A	N/A	N/A	N/A
Bike Lane Width ³	5'	5'	5'	5'	N/A	N/A	N/A	N/A
Planted Raised Median	16'	16' / 12'	12' / N/A	N/A	N/A	N/A	N/A	N/A
Curb & Gutter	6" Vertical with 2' Gutter							
Parking Lane	N/P	N/P	N/A	N/A	6'	7'	N/P	N/P
Plant Strip	7' / 9'	9' / 5'	7'	7'	7'	8'	4'	N/A
Sidewalk Width	5' (D)	5' (D)	5' (D)	5' (D)	5' (D)	5' (D)	5' (D)	N/A
Setback & Utility Easement	8'	8'	N/A	N/A	N/A	N/A	N/A	N/A
Flow Line Curb Radius	35' max	35' max	20' max	15' max	15' max	15' max	15' max	15' max
Typical Posted Speed Limit ⁴	35-45 mph	30-40 mph	25 mph	25 mph	25 mph	25 mph	25 mph	15 mph
Cross Slope w/o Super Elevation	Maximum 4% - Minimum 2%							
Super Elevation Max	4%	4% / N/A	N/A	N/A	N/A	N/A	N/A	N/A
Min Degree	8.5	10 / 22	22	22	22	22	22	22
Curve ²	454-900'R	667' / 300'R	181'R	181'R	181'R	181'R	181'R	47'R
Max Street Grade	5%	5% / 7%	7%	7%	7%	7%	7%	7%
Min Street Grade	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%
Max Grade at Intersection	2% for 300'	3% for 300'	4% for 100'	4% for 100'	4% for 100'	4% for 100'	4% for 100'	4% for 100'
Tangents Between Horizontal and Vertical Curves	400'	300'	N/A	N/A	N/A	N/A	N/A	N/A

D = Detached N/P = Not Permitted N/A = Not Applicable

¹ Minimum R.O.W. width. Width shall increase with accel, decel and turn lanes.

² Centerline radius, from *CDOT 2018 Roadway Design Guide*.

³ Width does not include curb and gutter.

721.01 Horizontal Alignment

Streets shall generally be aligned to bear a reasonable relationship to existing topography.

Where a curve radius of one hundred ninety-five (195) feet for through local residential streets cannot be achieved, a seventy-five (75) foot curve radius, with a bulb on the outside of the curve, may be allowed. Curve radii noted in the Street Design Criteria table are permitted only where sufficient sight distance to an intersection is provided.

Streets shall intersect or connect to other streets as closely as possible to right angles but shall not deviate more than thirty (30) degrees from a right angle. Horizontal and vertical alignment and ROW limits shall be coordinated, so as not to obstruct sight distance at intersections, in accordance with the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS. Curb return radii shall be as shown on the Street Design Criteria table. Where two different street types connect, the larger curb return radius shall apply.

721.02 Vertical Alignment

Street centerline profile grades shall be as shown on the Street Design Criteria table. Where a street is curved and minimum profile grade is desired, the centerline grade shall be adjusted so that the curbline grade on the outside of the radius shall be no less than the minimum street grade specified on the Street Design Criteria table. Safe stopping sight distances are illustrated in the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS.

Centerline profile grades shall not exceed four (4) percent for a distance of at least one hundred (100) feet to either side of an intersecting centerline. Gutter flowline grades shall be no less than one (1.0) percent along curb returns, in cul-de-sacs and bulb areas, and other locations where gutter flowline grades do not directly parallel centerline profile grades.

The minimum K values for crest and sag vertical curves shall be in accordance with the following table:

TABLE 700.02 MINIMUM 'K' VALUE FOR CREST AND SAG VERTICAL CURVES

Design Speed for Classification (MPH)	Minimum K Value Crest	Minimum K Value Sag
15	3	10
20	7	17
25	12	26
30	19	37
35	29	49
40	44	64
45	61	79
50	84	96

721.03 Intersections

Intersections shall be designed to provide for the safety of motorists, pedestrians, and bicyclists. At street intersections, property lines shall provide adequate ROW for curb ramps and utilities. Refer to the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS.

721.04 Major Structures

Major structures, such as retaining walls, box culverts, and bridges, that are appurtenant to proposed street and/or parking lot construction, shall conform to the structural design and loading requirements of the *CDOT Standard Specifications for Road and Bridge Construction* and the geometric and drainage requirements of these DESIGN STANDARDS AND SPECIFICATIONS. Plans and supporting calculations for major structures shall be prepared by a structural engineer who is a Colorado Registered Professional Engineer. Guardrails shall be designed to comply with the *CDOT Standard Specifications for Road and Bridge Construction*.

721.05 Design Element Coordination

Horizontal and vertical alignment continuity, shall be provided between new and existing streets to achieve safe and aesthetically pleasing transitions. Construction shall be staged to eliminate grade and alignment conflicts and unnecessary damage to existing or newly constructed facilities. Street design and proposed construction shall be coordinated with drainage and utility facilities.

722.00 ALLEYS

All alleys, when permitted by the Town, shall be paved to a full width and shall provide paved access to a paved street at both ends. Minimum right-of-way widths are 16' without utilities, and 30' with utilities. Pavement minimum width is 12'. Dead end alleys shall be a maximum length of 150' and alleys greater than 600' in length shall have a secondary access to a residential street.

723.00 EMERGENCY ACCESS

Emergency access roads shall have a minimum of ROW width of twenty-two (22) feet and a minimum roadway width of twenty (20) feet.

724.00 HALF STREETS

Where half streets are allowed, sufficient additional ROW shall be dedicated. Additional width shall be constructed, to allow sufficient paved width to accommodate two-way traffic and emergency parking.

725.00 CUL-DE-SACS AND DEAD END ROADS

Cul-de-sacs shall be in accordance with the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS. Lengths of cul-de-sacs are recommended to be between one hundred forty (140) feet and a maximum of six hundred (600) feet. Proposed cul-de-sac lengths that are not in this range shall be fully justified and based on the following considerations:

- A. Intersection vehicular traffic capacity
- B. Emergency vehicle response time
- C. Pedestrian trip time to bus routes
- D. Reduction of double travel distances for service and patrol vehicles

- E. Utility systems, drainage, and open space access
- F. Other requirements by the Town
- G. Emergency Access Locations

Surface drainage shall be directed toward the intersecting street, or if this is not reasonably practical, a drainage structure and easement shall be provided at the end of the cul-de-sac. Specially designed temporary cul-de-sacs may be allowed when approved by the Town.

Dead end roads shall be allowed only when a future extension of the road would be necessary to serve adjacent properties when developed at a future date. A temporary turn around shall be provided. The maximum length of a dead end road shall be the same as for a cul-de-sac.

726.00 TRAFFIC CALMING

Traffic calming involves changes in street alignments, installation of barriers, and other physical measures to reduce traffic speeds and/or cut-through volumes, in the interest of street safety, livability, and other public purposes. It is the combination of physical measures that reduces the negative effects of motor vehicle use, alters driver behavior, and improves conditions for non-motorized street users.

The Town’s street standards espouse the urgent need of balancing safety, efficiency of service, livability and economy. A hierarchy of street classifications has been established, with the higher classifications (major and minor arterials and major collectors) designed to carry higher volumes and higher speeds and the lower classifications (minor collector and local streets) designed primarily to provide land access with expected lower volumes and lower speeds. Clearly, traffic calming measures would not be appropriate on arterials or major collectors. Minor collectors or local streets should be designed with traffic calming in mind. In identifying streets that may be candidates for traffic calming measures, traffic volume and unimpeded street length should be considered. Unimpeded street length is the distance between speed impediments, i.e. Stop signs, traffic signals, sharp turns, cul-de-sacs, speed humps, etc. Streets that generally will require implementation of traffic calming measures are listed in Table 700.03 along with minimum criteria to qualify for Traffic Calming.

TABLE 700.03 MINIMUM CRITERIA FOR TRAFFIC CALMING

CLASSIFICATION	UNIMPEDED STREET LENGTH	TRAFFIC VOLUME
Local Street	> 1,200 feet	< 500 vpd
Local Street	> 900 feet	500 – 2,000 vpd
Minor Collector	> 900 feet	> 2,000 vpd

vpd = vehicles per day

There are many types of traffic calming measures that can be used on streets with higher speeds and more traffic than predicted. The Institute of Transportation Engineers (ITE) has published several reports describing traffic calming measures and their effectiveness, which can be found at <http://www.ite.org/traffic/index.asp> These resources should be consulted to identify and design appropriate traffic calming measures applicable for new developments. In general, vertical elements, such as speed bumps and humps, should be avoided, while horizontal elements such as roadway narrowing, medians, bulb-outs and traffic circles, etc. should be used.

727.00 PARKING LOTS, PRIVATE STREET SYSTEMS, AND COMBINED DRIVEWAYS

Parking lots shall conform to the *Superior Municipal Code* and shall be constructed with one (1) percent minimum and four (4) percent maximum cross-slopes throughout.

Private street systems and parking lots that are owned and maintained by a Homeowners Association (HOA) or other property management group shall be designed and constructed in accordance with these DESIGN STANDARDS AND SPECIFICATIONS. All private street systems and parking lots shall have curb and gutter in accordance with these DESIGN STANDARDS AND SPECIFICATIONS, unless otherwise approved by the Town Engineer. Compliance to these DESIGN STANDARDS AND SPECIFICATIONS shall be certified by a qualified third party approved by the Town. Construction shall not commence until the construction plans are approved by the Town.

All parking lots, private street systems, and combined driveways shall have adequate snow storage. This storage shall be a contiguous area. The surface area required for snow storage shall be ten (10) percent of the plowed surface, including all sidewalks and driving surfaces. Storage is not allowed on vegetated areas. The storage area shall be on the downhill side of the plowed area and not located in front of inlets or on top of manholes. The off-street parking space requirements shall be provided while storing snow. Snow requiring storage which is generated on private property shall not be stored in public ROW.

Combined driveways shall be limited to a maximum of two (2) units, to be served by the driveway from the street.

728.00 STREET TURN LANE DESIGN CRITERIA

728.01 Acceleration and Deceleration Lanes

TABLE 700.04

Posted Speed Limit in MPH	25	30	35	40	45	50	55	60	65	70
Deceleration Length in Feet*	180	250	310	370	435	500	600	700	800	900
Acceleration Length in Feet	N/A	N/A	270	380	550	760	960	1170	1380	1590
Transition Taper Ratio	7.5:1	8:1	10:1	12:1	13.5:1	15:1	18.5:1	25:1	25:1	25:1

* Includes Transition Taper Ratio for right turn for posted speed greater than or equal to 40 mph, add Storage Length for left turn posted speed greater than or equal to 40 mph

728.02 Storage Length

TABLE 700.05

Turning Vehicles Per Peak Hour	Below 30	30	60	100	200	300
Required Lane Length in Feet	25	40	50	100	200	300

For posted speed less than 40 mph, use Storage Length plus Transition Taper Ratio

728.03 Redirect Tapers for Through Lanes

TABLE 700.06

Posted speed in MPH	30 or less	35	40	45	50	55	60	65	70
Straight Taper Ratio	15:1	20:1	30:1	45:1	50:1	55:1	60:1	65:1	70:1

A left turn deceleration lane is required if:

1. The projected peak-hour turning volume is 25 vph (vehicles per hour) or greater; or
2. The posted speed limit is 40 mph or greater, and the peak-hour turning volume is greater than 10 vph.

The left turn deceleration lane may be dropped if the opposing traffic is predicted to be below 100 vph.

A right turn deceleration lane is required if:

1. The projected peak-hour turning volume is 50 vph or greater; or
2. The posted speed limit is 40 mph or greater, and the peak-hour turning volume is greater than 25 vph.

The right turn deceleration lane may be dropped if the volume in the travel lane is predicted to be below 150 vph.

Deceleration or acceleration lanes may be required if unique factors such as highway speeds, traffic density, access volume, truck usage, sight distance, and other features that create operational or safety concerns exist, as determined by the Town.

729.00 STRUCTURAL SECTIONS

This section provides the basic criteria and design procedures for roadway pavements. Required design methodologies for asphalt and Portland cement concrete are addressed, and essentially follow the Colorado Department of Transportation (CDOT) methodology. Subgrade stabilization methods using fly

ash or lime stabilization shall follow *CDOT Road and Bridge Standards* Section 307 and *MGPEC Volume 1*, Item 5, Part 1 specifications.

729.01 Subgrade Investigation

729.01.01 Field Investigation

The field investigation shall consist of borings or other suitable methods of sampling subgrade soils to a depth of at least five (5) feet below proposed subgrade elevation (10 feet below proposed subgrade on arterial roadways), at spacings of not more than 250 feet, unless otherwise accepted by the Town. Every fifth hole shall be ten (10) feet deep. Samples shall be taken after grading is completed and the subgrade is rough cut (± 1 foot).

729.01.02 Classification Testing

Each subgrade sample shall be tested to determine Liquid Limit, Plastic Limit, Plasticity Index, Atterberg Limits and the percentage passing the U.S. Standard No. 200 sieve.

Samples of sands and gravels may require gradation analysis for classification determination. These data shall be determined using the following methods:

Liquid Limit - AASHTO T89 (ASTM D4318)
Plastic Limit - AASHTO T90 (ASTM D4318)
% Passing No. 200 - AASHTO T11 (ASTM C117)
Gradation - AASHTO T27 (ASTM D422)

The results of these tests shall be used to calculate the AASHTO Classification and Group Index using AASHTO M 145.

729.01.03 Soil Grouping

To facilitate subgrade support testing, soil samples collected in the field investigation can be combined to form soil groups. These groups shall be based upon the AASHTO Classification, Group Index, and location within the area investigated. Groupings shall not consist of samples with different AASHTO Classifications. (Note: there may be more than one group within a given classification). Composite samples can be manufactured by combining small portions of each subgrade sample contained within the group and mixing to provide a uniform composite sample of the soil group. Composite samples shall be subjected to Classification Testing as outlined in Item 729.01.02.

729.01.04 Subgrade Support Testing

Individual subgrade or composite samples shall be tested to determine the subgrade support value, using either California Bearing Ratio (CBR), Hveem Stabilometer (R-value), or dynamic Resilient Modulus (Mr) testing. These values shall be used in the design of pavement sections and in accordance with the procedures outlined in Section 729.03. Tests shall be conducted in accordance with the procedures listed below, in items 729.01.03.01 or 729.01.03.02.

729.01.04.01 CBR Tests

California Bearing Ratio tests shall be conducted in accord with AASHTO T193, with the following modifications:

- a. Note 4 of AASHTO T 193 shall not apply. A 3-point CBR evaluation is required.
- b. The requirement for compaction shall be in accordance with the most recent edition of the *CDOT Road and Bridge Standards and Specifications*.
- c. Surcharge shall be calculated using a unit weight of 140 pcf for bituminous pavement, and 135 pcf for untreated aggregate base course.
- d. The design CBR Value shall be determined from the CBR – Dry Density Curve and shall be the CBR value at 95 percent compaction. If the CBR is less than 6 in the upper two (2) feet of subgrade, then the upper twelve (12) inches of subgrade must be stabilized with either fly ash or lime. The stabilized soil treatment shall extend one (1) foot behind the back of curb (if detached walk or no walk, or one (1) foot behind the back of walk (if attached or monolithic walk). Subgrade stabilization methods using fly ash or lime stabilization shall follow *CDOT Road and Bridge Standards* Section 307 and *MGPEC Volume 1*, Item 5, Part 1 specifications.
- e. In addition to the values requested in AASHTO T 193, Stress Penetration curves for each sample, a CBR - Dry Density curve and Proctor Compaction test results, shall be reported.

729.01.04.02 R-Value Tests

Hveem Stabilometer tests shall be conducted, in accordance with AASHTO T 190. The design R-value shall be at 300 psi exudation pressure. The reported data shall consist of:

- a. Dry density and moisture content for each sample
- b. Expansion pressure for each sample
- c. Exudation Pressure - corrected R-value curve, showing the 300 psi design R-value
- d. If the R-value is less than 15 in the upper 2 feet of subgrade, then the upper 12 inches of subgrade must be stabilized with either fly ash or lime. The stabilized soil treatment shall extend one (1) foot behind the back of curb (if detached walk or no walk, or one (1) foot behind the back of walk (if attached or monolithic walk). Subgrade stabilization

methods using fly ash or lime stabilization shall follow *CDOT Road and Bridge Standards* Section 307 and *MGPEC Volume 1*, Item 5, Part 1 specifications.

729.01.04.03 Mr Tests

Dynamic Resilient Modulus test shall be conducted in accordance with AASHTO T307. If the Mr is less than 4,000 psf in the upper 2 feet of subgrade, then the upper 12 inches of subgrade shall be stabilized with either fly ash or lime. The stabilized soil treatment shall extend one (1) foot behind the back of curb (if detached walk or no walk, or one (1) foot behind the back of walk (if attached or monolithic walk). Subgrade stabilization methods using fly ash or lime stabilization shall follow *CDOT Road and Bridge Standards* Section 307 and *MGPEC Volume 1*, Item 5, Part 1 specifications.

729.01.04.04 Swell Test

A Colorado Swell Test (also referred to as the Denver Swell Test or Swell Consolidation Test), shall be required in all pavement design reports. The swell tests shall be conducted on samples collected utilizing the modified California sampler and not on remolded samples.

If the swell at an overburden pressure of 150 psf, is 1.0% or greater, the pavement design report must provide mitigating measures to minimize the destructive swell potential. Since the pavement is not placed on the soils until after the soil has been scarified, moisture treated, and compacted to optimum, the percent swell shall be measured from the point after the overburden pressure is applied, to the point after water is added. In other words, after the overburden pressure is applied and consolidation has occurred, the “swell” = 0.0%, then add water and measure the swell. Mitigation could be overexcavation and recompaction or replacement with suitable non-expansive materials to a depth sufficient to protect the pavement (minimum 2 feet), or other procedures acceptable to the Town, as recommended and supported by a Geotechnical Engineer. Moisture treatment, by itself, will not be an adequate mitigating measure. If expansive soil mitigation is made, the soil treatment shall extend to 1 foot behind the back of curb (if detached walk or no walk), or to 1 foot behind the back-of-walk (if attached or monolithic walk).

729.02 Pavement Design Criteria

729.02.01 General

This section provides the parametric input data to be used for the design of pavement of various roadway classifications.

729.02.02 Equivalent (18 KIP) Single Axle Loads

The pavement design procedure in this chapter provides for a 20 year service life of pavement, given that normal maintenance is provided to keep roadway surface in an acceptable condition. ESAL and Design Traffic Number (DTN) are also equivalent units, based on a 20 year design criteria and an 18 kip axle loading. All data in this chapter use ESAL units for pavement loading repetitions.

ESAL criteria for each Town roadway classification are given in Table 729.02.03.

729.02.03 Recommended Equivalent (18 KIP) Single Axle Loads (ESAL)

TABLE 700.07

CLASSIFICATION	CLASS MODIFIER	ESAL VALUES ¹
Local/Private/Alley	Residential	
	Serving <80 D.U.'s	36,500
	All Others	73,000
	Commercial ²	220,000
	Office	730,000
Minor Collector	Residential	220,000
	Commercial ²	365,000
	Office ²	1,100,000
Major Collector ²	Residential	730,000
	Commercial ²	730,000
	Office ²	1,100,000
Minor Arterial ²	All	1,500,000
Major Arterial ²	All	1,500,000
Entry Street		73,000 (MIN) (ESAL may be required to be 220,000 if number of DU's served is over 100)

Notes: ¹ Alternative ESAL values may be considered with justification provided by the Traffic Impact Analysis, proposed land uses, and traffic analysis that defines proportion of truck vehicles.

² ESAL shall be calculated based on projected traffic uses. Minimum ESAL values are as prescribed in Table 729.02.03.

729.02.04 Design Serviceability

The following criteria shall be used for all Town roadways to be dedicated for public use:

TABLE 700.08 SERVICEABILITY INDEX

ROADWAY CLASSIFICATION	SI
Arterials (minor, major)	2.5
COLLECTORS	
Major	2.5
Minor Commercial/Office	2.5
Minor Residential	2.5
Local	
Residential	2.0
Commercial/Office	2.5
Alleys/private roads	2.0

729.02.05 Minimum Pavement Section

This paragraph provides the minimum acceptable pavement sections for public roadways in Town. These pavement thicknesses may be used for preliminary planning purposes or for estimating collateral requirements for subdivision improvement agreements. Final pavement designs must be based on actual subgrade support test results. Table 729.02.06 lists these minimum thicknesses for each roadway classification.

729.02.06 Required Minimum Pavement Sections**TABLE 700.09**

PAVEMENT SECTION					
CLASSIFICATION	ESAL	ASPHALT (inches)	TREATED SUBGRADE (inches)	FULL DEPTH ASPHALT (inches)	PORTLAND CEMENT CONCRETE (inches)
Alleys	(Table 729.02.03)	6	12	6.0	5.0
Private Road	(Table 729.02.03)	6	12	6.0	5.0
Local Residential	(Table 729.02.03)	6	12	6.0	5.0
Commercial	220,000	6	12	8.0	6.0
Office	730,000	6	12	9.5	6.0
Minor Collector Residential	220,000	6	12	8.0	6.0
Commercial	365,000	6.0	12	8.5	6.0
Office	1,100,000	6.5	12	10.0	7.5
Major Collector Residential	730,000	6.0	12	9.5	7.0
Commercial	730,000	6.0	12	9.5	7.0
Office	1,100,000	6.5	12	10.0	7.5
Minor Arterial	1,500,000	7.0	12	10.5	8.0
Major Arterial	1,500,000	7.0	12	10.5	8.0

HMA base lifts to be CDOT Grade SG, (75) PG 64-22, (up to 35% RAP allowed)

HMA intermediate lifts to be CDOT Grade S, (75) PG 64-22, (up to 25% RAP allowed)
HMA top lifts / wearing courses to be CDOT Grade SX, (75) PG 64-22, (Virgin Mix – no RAP allowed)

729.02.07 Flexible Pavement Strength Coefficients

Table 729.02.08 contains the standard design coefficients for various pavement materials. Nonstandard design coefficients may be used, only if approved in advance by the Town. In addition, design values must be verified by pre-design mix test data and supported by daily construction tests, or, redesign values will be required; i.e., such as - add 1/2 to 1 inch to the in-place surface course of final Asphalt Concrete.

729.02.08 Strength Coefficients

TABLE 700.10

PAVEMENT STRUCTURE COMPONENT *	STRENGTH COEFFICIENTS	LIMITING TEST CRITERIA
CONVENTIONAL MATERIALS		
Hot Mix Asphalt Pavement	.40	CDOT approved Mix Designs
Existing Hot Mix Asphalt Pavement	.30 .24	9-15 yr >15 yr
Aggregate Base Course	0.10-.15	<i>CDOT 2012 Pavement Design Manual Table 3.3</i>
TREATED MATERIALS		
Fly Ash Treated Subgrade	0.11-0.15	<i>CDOT 2012 Pavement Design Manual Table 3.2</i>
Lime Treated Subgrade	0.11-0.15	<i>CDOT 2012 Pavement Design Manual Table 3.2</i>

* The combination of one or more of the following courses placed on a subgrade to support the traffic load and distribute it to the roadbed.

- a. Aggregate Base Course. The layer or layers of specified or selected material of designed thickness placed on a subgrade to support a surface course.
- b. Surface Course. One or more layers of a pavement structure designed to accommodate the traffic load, the top layer of which resists skidding, traffic abrasion, and the disintegrating effects of climate. The top layer is sometimes called “Wearing Course”.

729.02.09 Portland Cement Concrete Working Stress (f)

The working stress (f_t) to be used in the design shall be 75% of that provided by third-point beam loading, which shall have a minimum laboratory 28-day strength of 650 psi, based on actual tests of materials to be used.

729.03 Pavement Design Procedure

729.03.01 Flexible Pavements

The following procedure should be used in determining the Structural Number (SN) of the pavement being designed:

729.03.01.01 Determine roadway classification and corresponding ESAL (Table 729.02.03)

729.03.01.02 Determine the Serviceability Index (SI) of the roadway classification (Table 729.02.05)

729.03.01.03 Use a Standard Deviation, S_o , of 0.44 and a Reliability of 90%.

729.03.01.04 Use a Drainage Coefficient, C_d , of 1.0.

729.03.01.05 Using subgrade CBR, R-value, or M_r test results and ESAL, determine the SN from CDOT (2012) Figure 3.1, PAVEXpress or *DARWin*.

729.03.01.06 Once the Structural Number (SN) has been determined, the design thickness of the pavement structure can be determined by the general equation:

$$SN = a_1D_1 + a_2D_2 + a_3D_3 + \dots$$

Where:

a_1 = Hot Mix Asphalt (HMA) strength coefficients

a_1, a_2, a_n = strength coefficients of additional pavement components

D_1 = thickness of Hot Mix Asphalt (HMA) (inches)

D_2, D_3, D_n = thickness of additional pavement component sections

The strength coefficients for various components of the pavement structure are given in Table 729.02.08.

The component thickness selected must meet two conditions.

- a. Total HMA thickness selected cannot be less than the minimum specified in Table 729.02.06 for the roadway classification.
- b. The base course thickness selected shall be between 1.5 and 2.5 times the HMA thickness selected.

729.03.01.07 The design must reference any mitigation measures required when the subgrade contains swelling soils (swell potential >1.5% under 150 psf surcharge pressures from a Colorado (Denver) Swell Test); If expansive soil mitigation is made, the soil treatment shall extend to 1 foot behind the back of curb (if detached walk or no walk), or to 1 foot behind the back-of-walk (if attached or monolithic walk).

729.03.01.08 Design reports recommending permeable layers, such as untreated aggregate base course in the pavement system, must present the measures to be used to ensure adequate drainage of such layers, and to maintain segregation of the layers from the clay subgrades (AASHTO Classification A-6 and A-7-6).

729.03.02 Rigid Pavement

The design of rigid pavements is a function of structural quality of the subgrade soil (CBR, R-value or Mr), traffic (ESAL), and the strength of the concrete (Modulus of Rupture). In comparison to the strength of the concrete slab, the structural contributions of underlying layers to the capacity of the pavement are relatively insignificant. Therefore, the use of thick bases or subbases under concrete pavement, to achieve greater structural capacity is considered to be uneconomical and is not recommended.

Use the following procedure to obtain required thickness:

729.03.02.01 Determine roadway classification and corresponding ESAL (Table 729.02.03)

729.03.02.02 Determine design Serviceability Index (SI) of the roadway (Table 729.02.05)

729.03.02.03 The Modulus of Rupture of the concrete is to be obtained from laboratory tests. For preliminary design, this value shall be assumed to be 650 psi, until laboratory tests have been completed. A Modulus of Elasticity of 3,400,000 psi shall be used unless laboratory testing determines a different value is justified.

729.03.02.04 Use a Standard Deviation, S_o , of 0.34 and a Reliability of 90%.

729.03.02.05 Chapter 2.6 of the CDOT Pavement Design Manual (2012) shall be used to determine the Modulus of Subgrade Reaction, k .

729.03.02.06 If a monolithic or tied curb and gutter are placed on both sides of the pavement, use a Load transfer Coefficient, J , of 3.6, otherwise use 4.2.

729.03.02.07 Use a Drainage Coefficient of 1.0

729.03.02.08 Slab thickness shall be determined, using Figure 3.7 of *1993 AASHTO Guide for Design of Pavement Structures*, or WINPAS 12. CDOT Road and Bridge Standards M-412 shall be followed for joint reinforcement.

729.03.02.09 The design must reference any mitigation measures required when the subgrade contains swelling soils (swell potential >1.5% under 150 psf surcharge pressures from a Colorado (Denver) Swell Test); design reports recommending permeable layers, such as untreated aggregate base course in the pavement system, must present the measures to be used to ensure adequate drainage of such layers, and to maintain segregation of the layers from the swelling soils. If expansive soil mitigation is made, the soil treatment shall extend to 1 foot behind the back of curb (if detached walk or no walk), or to 1 foot behind the back-of-walk (if attached or monolithic walk).

729.03.02.10 Design reports recommending permeable layers, such as untreated aggregate base course in the pavement system, must present the measures to be used to ensure adequate drainage of such layers, and to maintain segregation of

the layers from the swelling soils.

729.04 Edge Drains

Edge drains shall be required along public roadways in order to intercept groundwater, seepage from landscaping irrigation, and stormwater runoff.

Edge drains should be placed behind the curb and at a depth specified on the approved plans. Drains should be backfilled with free draining three-quarters ($\frac{3}{4}$) inch washed gravel, protected by geotextile fabric, as shown on the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS. Pre-fabricated edge drains, such as the Multi-Flow or approved equal may be approved by the Town on a case-by-case basis. Prefabricated edge drains shall be installed, to the manufacturer's specifications, at the minimum depths shown on the approved plans and on the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS.

729.05 Dry Utility Sleeves

Dry utility sleeves shall be installed across every leg of an intersection, and a maximum of every five hundred (500) feet on roadways to accommodate installation of electric, gas, telephone, cable, fiber optics, irrigation, and future facilities without requiring excavation of the roadway. A minimum of four (4) - four (4) inch schedule 80 PVC, and one (1) – six (6) inch schedule 80 PVC conduit shall be installed for exclusive use by the Town. Adequate number of additional conduits to accommodate proposed utility installations shall be provided. **The location of all conduit ends under curbs or behind structures shall be marked with a "C", which is at least four (4) inches high, cut into the top of the curb or wall directly above the conduit.** Refer to the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS for dry utility sleeve installations.

729.06 Utility Pothole Repair

Contractor shall be required to restore all utility potholes in a timely fashion, as determined by the Public Works Director or designee. Potholes located in or adjacent to sidewalks, handicap ramps or crosswalks shall be temporarily backfilled immediately for the safety of the public. Potholes located in pavement sections must be backfilled with approved Controlled Low Strength Material. Potholes located in concrete pavement sections require replacement of entire concrete panel section. Potholes located in asphalt pavement sections require placement and compaction of a minimum ten (10) inches of asphalt, then thoroughly coated with CSS-1H tack and heated to 175 degrees Fahrenheit to seal the pothole. Refer to the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS for pothole restoration.

730.00 TRAFFIC CONTROL SIGNAGE AND PAVEMENT MARKINGS

731.00 SIGNS

731.01 Street Name Signs

Street name signs shall be furnished and installed by the Contractor or Developer and may be inspected by the Town before and after installation. Street name signs shall have white letters on a green background, include the standard Superior logo, and shall comply with the following:

- A. All signs shall be constructed with 0.080 aluminum blanks (minimum thickness). They

shall have three-eighth ($\frac{3}{8}$) inch holes punched in the center, two (2) inches from the bottom and top edges, green high intensity, retro-reflective sheeting, high intensity retro-reflective letters or numbers.

- B. For arterial intersections, the street name blank shall be nine (9) inches in height, with six (6) inch Series C upper case letters or numbers and three (3) inch FHWA Series C upper case prefix or suffix. For other intersections, the street name blank shall be six (6) inches in height with four (4) inch Series C upper case letters or numbers and three (3) inch Series C upper case prefix or suffix.
- C. There shall be an eight (8) inch space to the left of the street name to provide for the placement of the six (6) inch Town of Superior logo. The logo shall be placed in the left face side of the sign and centered accordingly.
- D. The length of the sign shall vary due to the length of the street name. FHWA Series B letters may be permitted to maintain the length of the street name sign.
- E. Signs shall have a one-half ($\frac{1}{2}$) inch white high intensity, retro-reflective border with a ($\frac{3}{8}$) inch green high intensity, retro-reflective grade border on the outside edge.
- F. Signs shall have a three-quarter ($\frac{3}{4}$) inch “SUPERIOR” in white high intensity, retro-reflective FHWA Series D letters centered at the bottom of the sign, ($\frac{1}{4}$) inch above the bottom edge of the sign with a ($\frac{1}{2}$) inch gap between the end of the ($\frac{3}{4}$) inch letters and the ends of the border.
- G. Silk-screened signs are acceptable if they are manufactured with high intensity, retro-reflective sheeting and 3M “Scotchlite” Brand Process Colors transparent inks or equivalent. Signs fabricated with high intensity sheeting with translucent 3M “EC” film or equivalents are also allowed.
- H. At every cross intersection, two (2) street name signs shall be provided for each named street. At every tee intersection, one (1) street name sign shall be provided for each named street.
- I. Signs shall be double sided single blade.

Prior to installing custom signs and/or posts in a development, the Developer or Contractor shall obtain a signed maintenance agreement with the Public Works Director, and approved copies shall be sent to the Public Works Field Maintenance Superintendent.

731.02 Illuminated Signs

Signalized intersections shall have eight (8) foot internally illuminated street name signs, which shall be furnished and installed by the Contractor or Developer and shall be inspected by the Town. Signs shall be supplied by a manufacturing company approved by the Town. Signs shall be provided for installation on each traffic signal mast arm at each intersection. All sign lettering shall be uppercase and lowercase.

Sign lettering shall be ten (10) inches in height, Clearview Hwy-3-W. The use of Clearview Hwy-2-W letters may be allowed when space requirements are limited. Suffixes shall be five (5) inches in height.

Lettering shall be at least four (4) inches in height where a two-line application is desired or three (3) inches in height where a three-line application is desired.

- A. Borders The signs shall have a one (1) inch white border.
- B. Spacing The spacing to the top and bottom borders should be equal. The lateral spacing to the vertical borders should also be equal. Spacing used in words, words and arrow, a letter and arrow, or a word and numeral, in a line copy should be approximately one (1) to one and one-half (1½) times the uppercase letter height used in that line of copy. Excessively long street names may be allowed to have modified kern or letter widths, but shall maintain the ten (10) inch required letter height.
- C. Arrows Arrows shall comply with the *MUTCD Standard Highway Sign Handbook*. A ten (10) inch Superior logo shall be placed on the left face side of the sign and centered accordingly.
- D. Color Logo, letters, numbers, and borders shall be white with a MUTCD green background face. The sign panel shall consist of placing White 3M “3990t” translucent, high intensity, retro-reflective sheeting under green 3M “1177c” EC Film. The colors shall not fade when exposed to an accelerated test of ultraviolet light equivalent to five years of outdoor exposure.
- E. Mechanical Specifications The outer dimensions of the sign assembly shall be standard nominal heights of 22, or 24 inches, and standard nominal width of 8 feet. The maximum thickness of the sign shall be 1.60 inches. The maximum weight shall not exceed 75 lbs. The long edges of the sign shall be made from a single section of 6000 series aluminum extrusion. The ends caps shall be affixed to the frame with stainless steel screws. The power supply shall be mounted internally in one of the end caps. The non-electrical end cap shall be removable to enable replacing panels and components. The sign shall have a front panel that is UV-, weather-, abrasion-, and impact resistant. The front panel shall be replaceable, so that maintaining agencies have the option to supply their own sheeting and electrocute film for the sign faces.
- F. Mounting System Signs must be supplied with under hang mounting brackets on two positions on the top of the sign. Mounting bracket shall pivot to allow the sign to swing freely. Bracket shall have a bolt hole pattern to accept Pelco SE-5015, SE-5146, or equivalent.
- G. Environmental Specifications The sign shall be designed and constructed to withstand 178 Km/h (110 mph) wind loads in conformance with the requirements of the AASHTO publication, *Standard Specifications for Structural Supports of Highway Signs, Luminaries and Traffic Signals*, 4th Edition 2001. The sign and power supply should be able to withstand and operate at temperature extremes of -22° Fahrenheit to +140° Fahrenheit. Signs shall be tested and certified for the following environmental conditions: Exclusion of Water Test, Strain Relief Test, Temperature Test and Dielectric Voltage-Withstand Test. A representative sample of the product shall be tested in accordance with the Standards for Electric Signs (UL 48).

- H. Luminance The entire surface of the sign panel must be evenly illuminated with a minimum average brightness reading at the letters of 300 lux and a variation of no more than 40% for any reading from the average (minimum of 10 readings). Each background reading measured must not vary by more than 40% (minimum of 10 readings) from the average of the background brightness readings. The light transmission factor of the sign panel must provide a letter to background ratio of a minimum of 4:1.
- I. Light Source The light source for the sign shall be LEDs (light emitting diodes). LEDs shall be mounted along both the top and bottom edges of the sign. The LEDs shall evenly illuminate a light panel that is the same dimensions of the sign face. The LEDs shall have a minimum projected life of 50,000 hours. A maximum of four LEDs per square foot shall be used.
- J. Energy Requirements The overall power required shall not exceed 4 Watts per square foot.
- K. Energy Star Partner The sign shall be an Energy Star Qualified Product.
- L. Quality Assurance Manufacturer must be ISO 9001:2000 certified.
- M. Electrical Standards Sign shall be listed and approved to UL 48 Standards. The outside of the sign shall be marked with the authorized listing agency mark.
- N. Product Guarantee Sign must be guaranteed for a minimum of three years.
- O. Final Layout Final layout and lettering details shall be submitted to the Town prior to fabrication.

731.03 Stop Signs

Stop signs shall be installed at all approaches to streets designated by the Town as through streets. Stop signs shall be mounted on the same support posts as street name signs, where possible. All signs shall have high intensity, retro-reflective sheeting and meet the *MUTCD Conventional Road Dimension* charts and the *MUTCD Standard Highway Signs*.

731.04 Other Signs

Regulatory, warning, guide, informational, and custom signs shall be installed at locations designated by the Town. All signs shall have high intensity, retro-reflective sheeting and shall meet the *MUTCD Conventional Road Dimension* charts and the *MUTCD Standard Highway Signs*. School and pedestrian warning signs shall be fluorescent yellow/green with diamond grade, retroreflective sheeting.

731.05 “No Parking” Signs

- A. “No Parking” signs shall have high intensity, retro-reflective sheeting.
- B. Both the sign post and the support post shall be of the square telescoping type, twelve (12) gauge. Holes shall be punched on all four (4) sides and along the entire length of the post.

- C. The sign post shall be one and one-half (1½) inches by ten (10) feet, and the support post shall be one and three-quarter (1¾) inches by three (3) feet.

731.06 Sign Dimensions

The signs shall be fabricated in accordance with the dimensions described on the *MUTCD Conventional Road Dimension* charts and the *MUTCD Standard Highway Signs*.

731.07 Sign Installation

Signs shall be installed per the *MUTCD* guidelines, the *CDOT Standard Specifications for Road and Bridge Construction*, and sign placement guidelines contained in the Detail Drawings.

732.00 SIGN POSTS AND SUPPORT POSTS

All sign supports and sign posts shall conform to specifications for perforated square steel tubing and to *ASTM A366, Standard Specifications for Cold Rolled Carbon Steel Sheets, Commercial Quality*. Tubing with plain finish shall be roll-formed from 10 gauge (.135 U.S.S. Gauge) and 12 gauge (.105 U.S.S. Gauge) hot rolled steel, ASTM A1011 Grade 50 pickled and oiled. Tubing with galvanized finish shall be roll-formed from 10 gauge (.135 U.S.S. Gauge) and 12 gauge (.105 U.S.S. Gauge) hot rolled steel, galvanized material ASTM A653 Grade 50. The average minimum yield strength after cold forming shall be 60,000 psi. Posts shall conform to the following sign dimensions:

TABLE 700.11

Total Sign Area	Sign Post Dimensions	Support Post Dimensions
Less than 2 sq. ft.	1-½” x 1-½” x 10’	1 ¾” x 3’
2 to 9 sq. ft.	1-¾” x 1-¾” x 12’	2” x 3’
Over 9 sq. ft.	2” x 2” x 12’	2 ¼” x 3’

The finished members shall be straight and shall have a smooth, uniform finish. Consecutive sizes of tubes shall freely telescope with a minimum amount of play. All holes and cut-off ends shall be free of burrs. Seven-sixteenth (7/16) inch diameter holes shall be punched on one (1) inch centers on the entire length of all sides of the tube. All posts shall be galvanized.

733.00 PAVEMENT MARKINGS AND SYMBOLS

The Contractor shall submit a Pavement Marking Plan to the Town for approval prior to beginning work. The Pavement Marking Plan shall meet the requirements outlined in the *MUTCD*. Markings shall consist of extrusion applied, preformed plastic, or thermoplastic material conforming to Sections 713.12 and 713.14 of the *CDOT Standard Specifications for Road and Bridge Construction*. The Contractor is solely responsible for placement and maintenance of all necessary temporary and permanent pavement markings until Construction Acceptance into Warranty is issued.

All temporary pavement markings shall comply with Section 627 of the *CDOT Standard Specifications for Road and Bridge Construction*.

All permanent pavement markings shall be thermoplastic. No low VOC solvent paint shall be installed in the Town ROW. Paint may be used for lines. Waterborne paint or plastic preformed materials may be

allowed at the discretion of the Town.

733.01 General

Pavement marking material and construction shall comply with Sections 627 and 713.12 of the *CDOT Standard Specifications for Road and Bridge Construction*. Placement shall comply with the *MUTCD*, the *CDOT M&S Standards* and the manufacturer’s recommendations. All pavement markings shall be 0.125 mil thick.

733.02 Typical Pavement Markings

TABLE 700.12

Double Yellow Line	4” with a 4’ separation gap (4-4-4)
Median Yellow Line	4”
Yellow Passing Line	4” X 10’ gap spaced 30’ (ft)
Decel, Accel, or White Turn Pockets	8”
White Skip Lines	4” X 10’ gap spaced 30’
White Edge Line	4”, 6” for bike lanes
White 45° Diagonal Hatch Line	8” at 15’ spacing

733.03 Typical Crosswalks and Stop Bars on Collector and Local Streets

- A. When no center road lines are present, center a crosswalk bar on the road and space every next bar four (4) feet apart toward the gutter edge.
- B. Align crosswalks to pedestrian ramps.
- C. Keep crosswalk bars parallel to the traveling lane lines, even if the crosswalk is skewed.

Crosswalk Bars	2’ x 8’
Stop Bars	From center of road to gutter

733.04 Crosswalks and Stop Bars at Signalized Intersections or Mid-Crossings on Major and Minor Arterials

- A. Center crosswalk bars on designated travel lane markings of the road and place bars parallel and next to the gutter. Then, space bars a minimum of four (4) feet apart, as necessary. Crosswalk bars shall not be placed in the wheel paths of travel lanes.
- B. Align crosswalk bars to pedestrian ramps.
- C. Keep crosswalk bars parallel to the traveling lane lines even if the crosswalk is skewed.

Crosswalk Bars	2’ x 10’
Stop Bars	24” from travel center yellow to gutter

733.05 Surface Preparation

A general cleaning of the pavement surface is required, prior to placing extruded thermoplastic and/or preformed thermoplastic materials. The cleaning shall remove oil, dirt, dust, grease, and other foreign materials. It is recommended that new thermoplastic pavement markings be applied immediately after new asphalt has been placed, thereby reducing the necessary surface preparation and allowing the asphalt rollers to inlay preformed pavement marking material. If the roadway striping cannot be placed immediately following paving operations, then it is the sole responsibility of the Contractor to apply and maintain temporary pavement markings to sufficiently delineate travel lanes until permanent pavement markings can be placed. Pavement markings shall be placed within two (2) weeks of completion of paving operations.

733.06 Prior to Placement of Pavement Marking Materials

- A. Control Points Set control points to ensure compliance with the approved Pavement Marking Plan.
- B. Conflicts Verify that there are no conflicts between the approved Pavement Marking Plan and existing pavement markings.
- C. Material Verify the pavement marking materials to be installed.
- D. Surface Preparation Ensure the surface is cleaned and free of moisture, oil, dirt, dust, grease, and other foreign materials. Verify whether sandblasting or primer is required.
- E. Temperature Check that air temperature complies with the manufacturer's recommendations
- F. Signing Conflicts Check for conflicts with signage.

733.07 Placement of Pavement Markings

During the placement of pavement markings, regular checks shall be performed to ensure that the surface is clean and dry. The Contractor shall regularly check pavement markings for good workmanship and straightness. When placing pavement markings, the following requirements apply:

- A. Application Procedures Application procedures shall comply with the manufacturer's recommendations and these DESIGN STANDARDS AND SPECIFICATIONS.
- B. Application Rate Application rate of pavement marking materials shall comply with these DESIGN STANDARDS AND SPECIFICATIONS.
- C. Reflective Beads Check that the application rate of reflective beads complies with specified requirements.
- D. Protection Traffic cones shall be used to prevent damage to new pavement markings.
- E. Permanent Markings Verify proper application of all permanent markings.
- F. Conflicting Pavement Markings Pavement markings shall not conflict or confuse.

- G. Extruded Thermoplastic Pavement Markings Ensure that extrusion equipment provides proper heating, mixing, and flow of material.
- H. Preformed Thermoplastic Pavement Markings For the application of preformed pavement markings, consider the following:
 - 1. Heating Ensure that equipment provides proper heating and placement of material.
 - 2. Existing Pavement When placed on existing cold pavement, check for a clean dry, and properly prepared surface. Verify if sandblasting is required. Ensure that primer, if required, has been properly applied. Check for appropriate splicing sequence.
 - 3. Inlay For hot bituminous inlay placement, ensure that the material is applied in the proper location and sequence on the new mat. Check that the pavement surface is at the recommended temperature to obtain proper inlay.

740.00 STREET LIGHTING

741.00 STREET LIGHTING PROCEDURE

The Developer shall submit a written request for street light design to the electric service company. The Developer shall submit the final street light design to the Town for review and approval. Acceptable light standards are included in the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS. Additional technical specifications for the lighting standards shall be provided by the electric service company. At the time of inspection, all street lights shall be installed in accordance with these DESIGN STANDARDS AND SPECIFICATIONS and as shown on the approved plans. Developer shall pay the electric service company the total cost of design, materials and installation for all street lighting.

741.01 Street Lights on Local and Collector Roadways

Street lights in residential areas, along local and collector roadways, shall use fixtures with 100 watt equivalent LED lamps and fiberglass or steel rounded poles as shown in the list of Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS and as approved by the Town. Light poles shall be painted black in color. The mounting height shall not exceed twenty (20) feet from ground elevation in residential areas. Other luminaire styles require written approval of the Town prior to installation.

741.02 Street Lights on Minor and Major Arterial Roadways

In areas other than residential, street lighting shall be fixtures with LED lamps with round tapered steel poles and mast arms as shown in the list of Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS and as approved by the Town Engineer. Light poles shall be galvanized steel. The mounting height shall not exceed thirty (30) feet from ground elevation. Other luminaire styles require written approval of the Town prior to installation.

Pole spacing and illumination requirements for the Town roadways are shown below:

TABLE 700.13

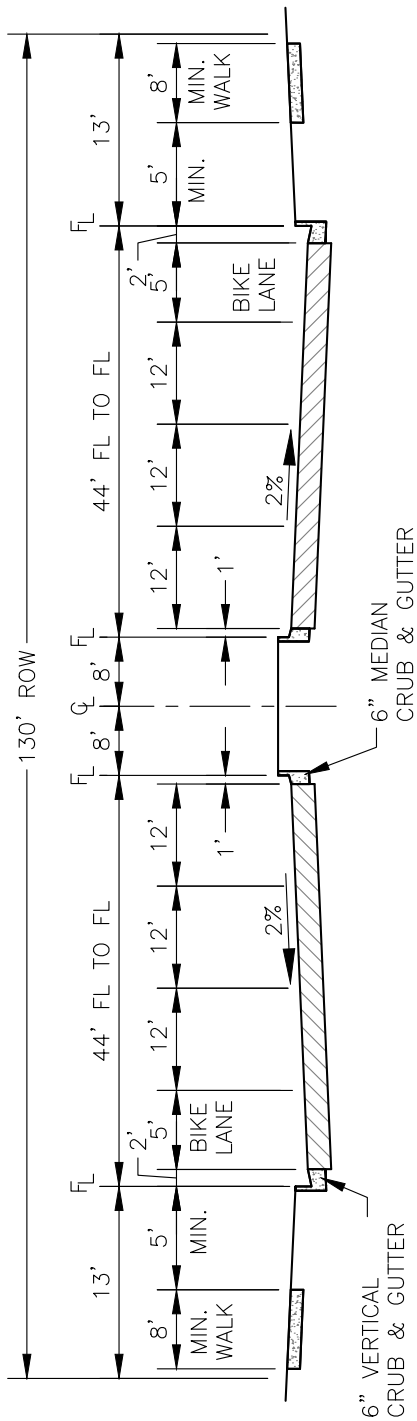
Street Type	Average Foot Candles	Lamp Lumens	Pole Spacing
Local Residential	0.15	9,500	300' ±
Rural Residential	0.15	9,500	At Intersections
Collector	0.25	9,500 to 27,500	200' ±
Arterial	0.50	27,500	150' ±

741.03 Street Light Luminaires

Cobra Head style LED luminaires shall be a power door or drop driver type and be constructed of a single piece diecast aluminum upper housing and one-piece or two-piece bottom door, hinged at the back and latched on the street side. The luminaire shall be equipped with an integral slipfitter for two (2) inch luminaire arm mounting.

The mounting device shall allow the luminaire to be mounted absolutely level and shall have no more than four (4) fasteners serving both the leveling and clamping functions. It shall allow one person to install the luminaire by simultaneously holding it in position and tightening the fasteners, such that the luminaire will be properly level at the first attempt. The luminaire shall be equipped with a 'trigger latch' for easy, one-hand no-tools opening of the fixture for installation and servicing. A factory installed bird guard shall fit snugly around the mounting device. The luminaire shall provide a moisture proof and dust proof chamber and weather protection for the ballast.

A removable power pad/module with quick connect electrical hookup for easy installation of the electrical system and easy access to the driver compartment shall be mounted on the door. Top housing mounting or a bridge assembly configuration will not be accepted. The lens shall be a single piece of optically clear, flat, heat-resistant, impact resistant glass. The sealed optical assembly shall be fully shielded (emitting no direct uplight). The reflector, if used, shall be natural unpainted alzak aluminum and shall be secured to the top housing. The luminaire shall be provided with a photocell receptacle unless otherwise noted on the Plans or Project Special Provisions. Luminaires shall be pre-wired, requiring only connection of service wires to a terminal board.



THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

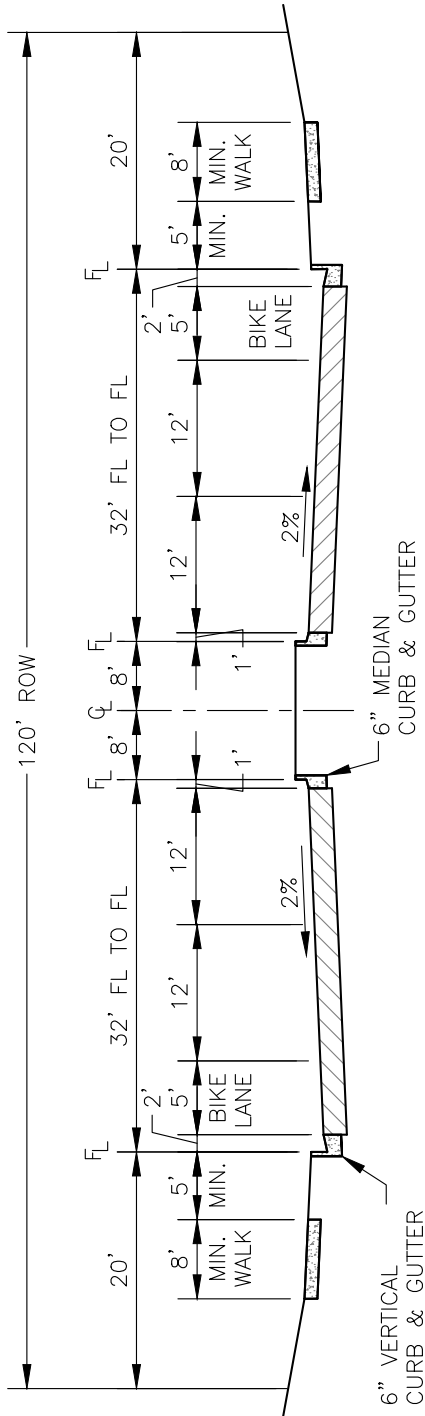
N.T.S.



MAJOR ARTERIAL STREET
SECTION (6 LANE)

DATE: JANUARY 2019

SHEET 700-1



THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

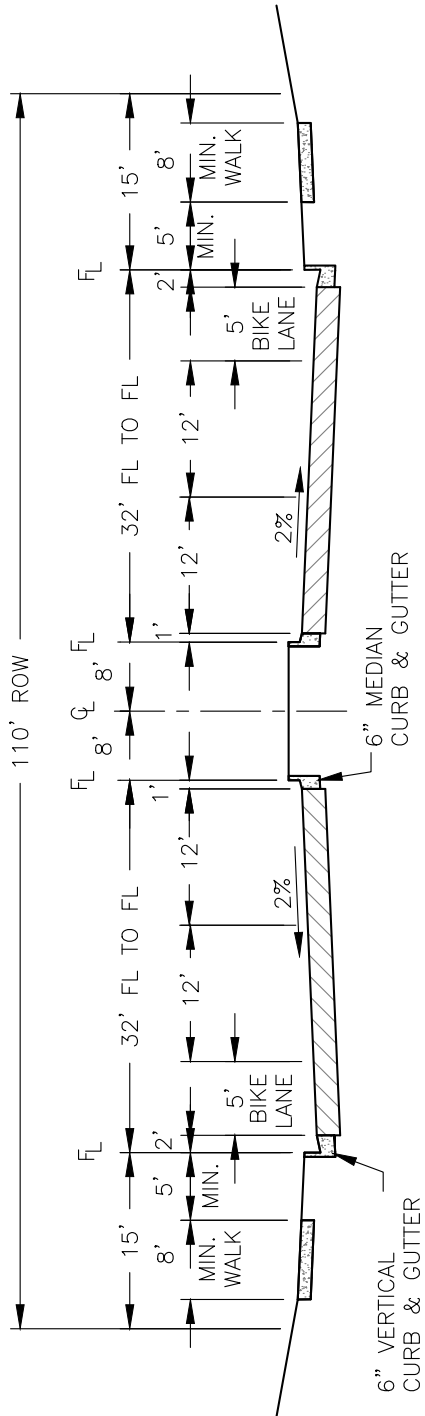
N.T.S.



MAJOR ARTERIAL STREET
SECTION (4 LANE)

DATE: JANUARY 2019

SHEET 700-2



THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

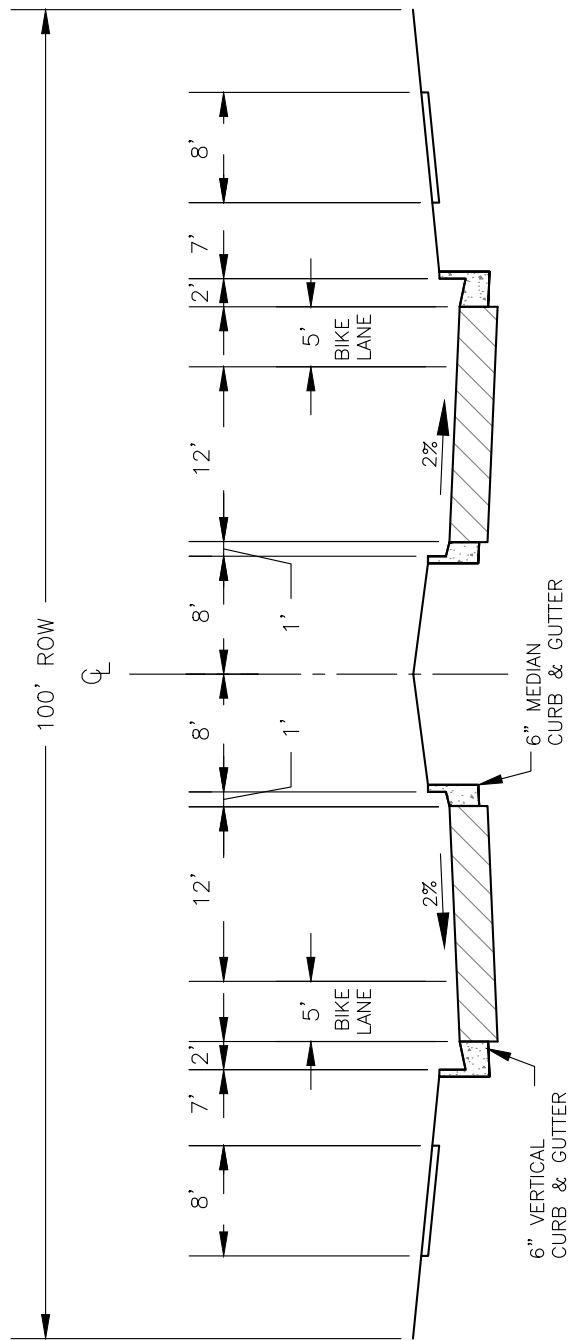
N.T.S.



MINOR ARTERIAL STREET
SECTION (4 LANE)

DATE: JANUARY 2019

SHEET 700-3



THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

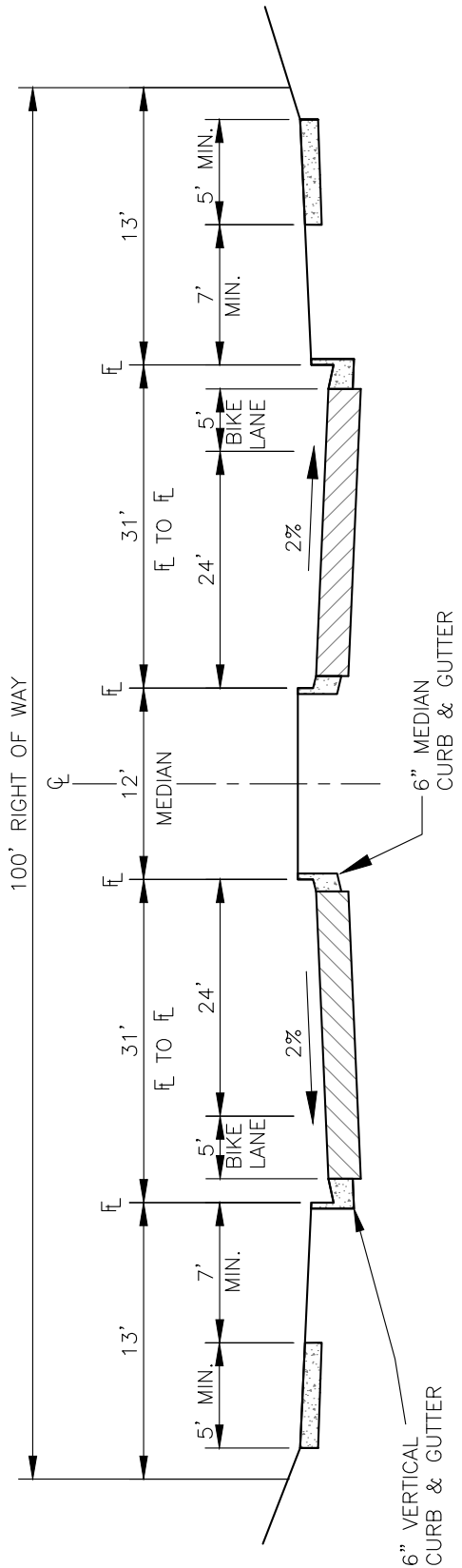
N.T.S.



MINOR ARTERIAL STREET
SECTION (2 LANE)

DATE: JANUARY 2019

SHEET 700-4



THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

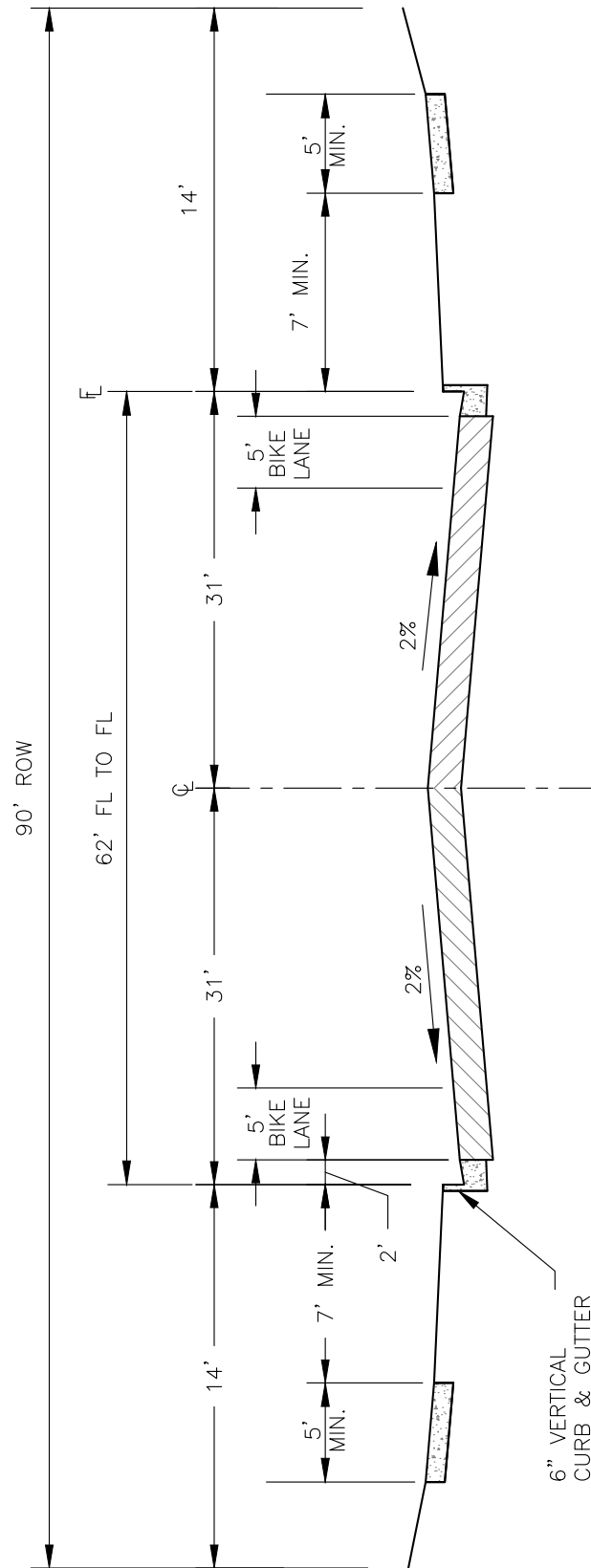
N.T.S.



MAJOR COLLECTOR WITH
MEDIAN STREET SECTION

DATE: JANUARY 2019

SHEET 700-5



6" VERTICAL CURB & GUTTER

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

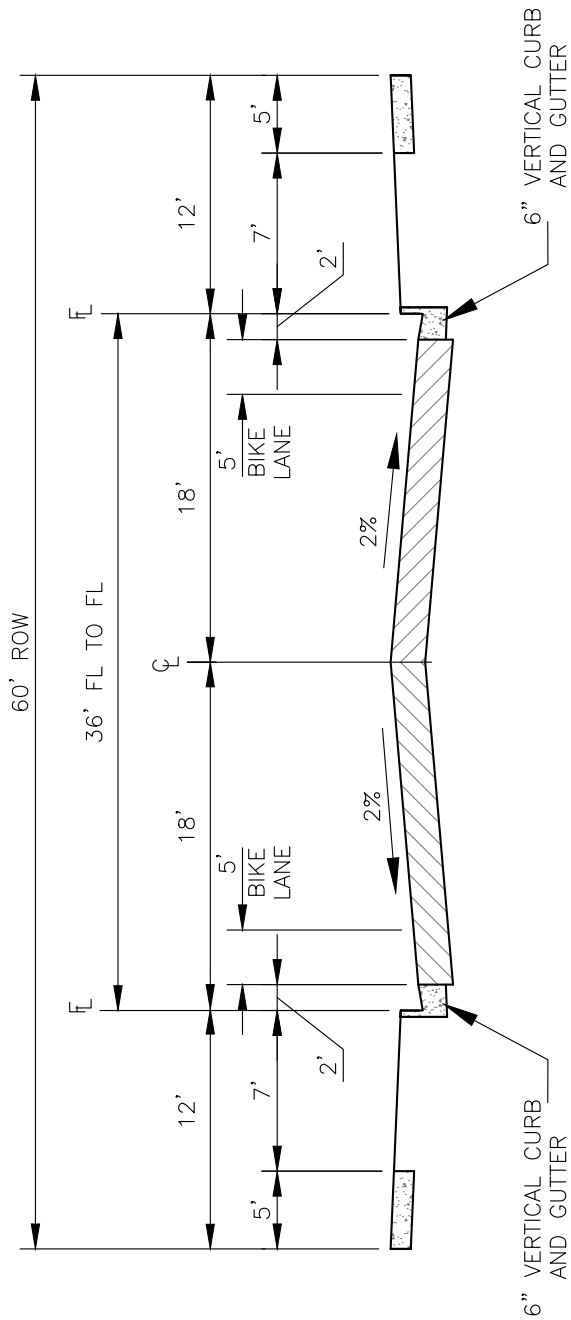
N.T.S.



MAJOR COLLECTOR STREET SECTION WITHOUT MEDIAN

DATE: JANUARY 2019

SHEET 700-6



THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

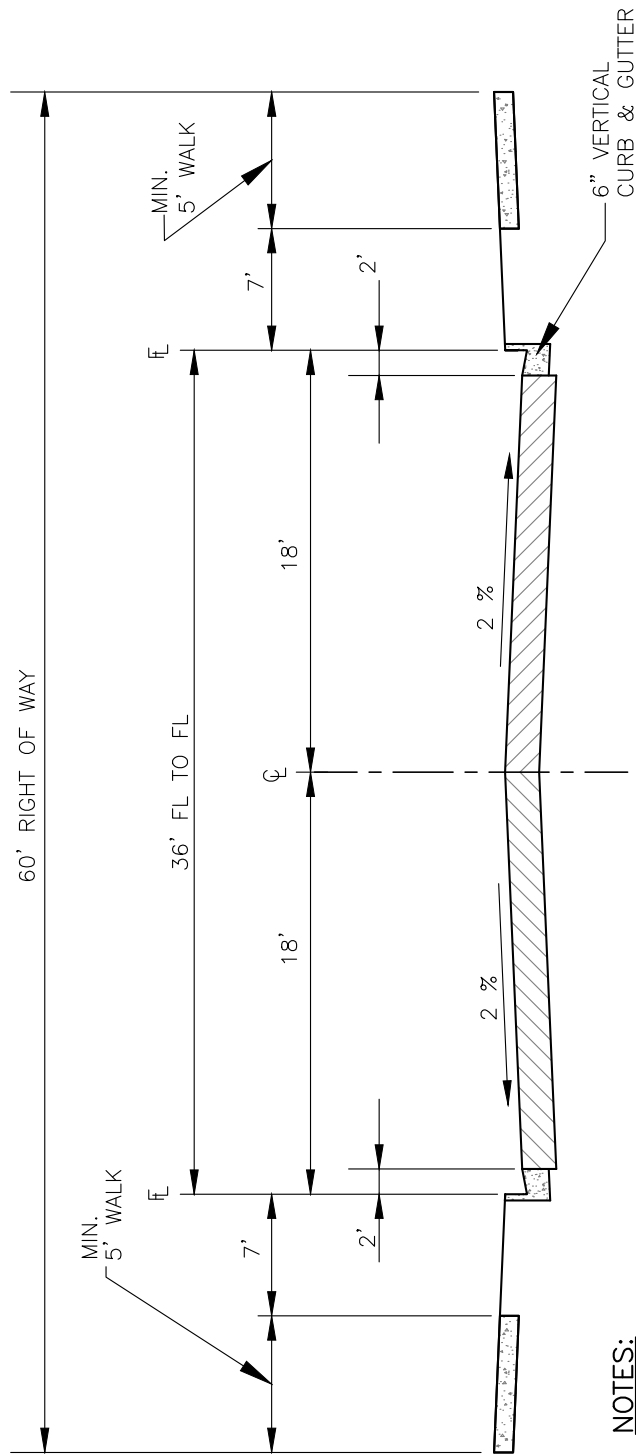
N.T.S.



MINOR COLLECTOR
STREET SECTION

DATE: JANUARY 2019

SHEET 700-7



NOTES:

WIDER WALK MAY BE REQUIRED DEPENDING UPON PEDESTRIAN VOLUMES.
 DIMENSION MAY BE REDUCED FOR WIDER WALK IN CERTAIN CASES
 ATTACHED WALK MAY BE ACCEPTABLE BASED ON TOWN
 ENGINEER'S APPROVAL.

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS
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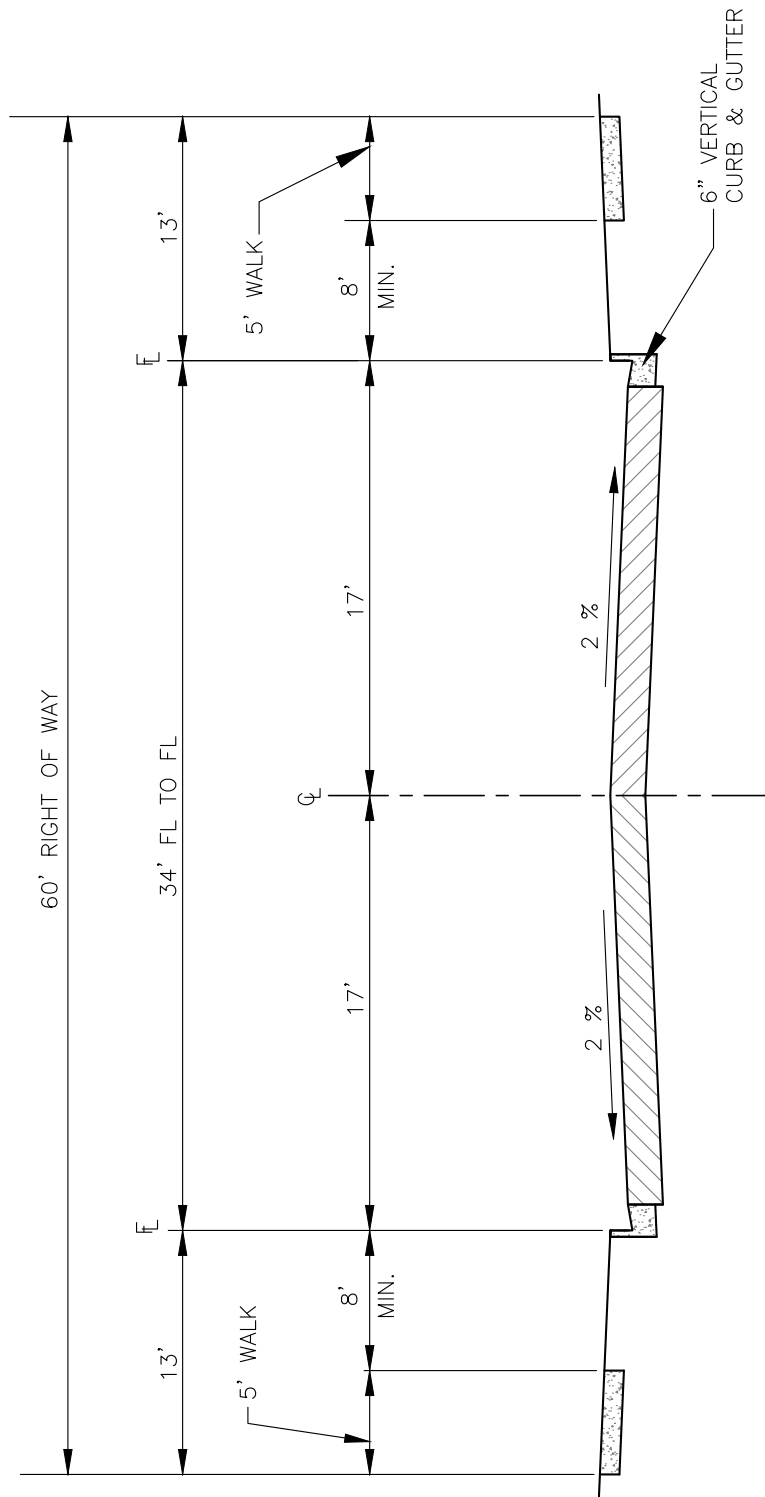
N.T.S.



COMMERCIAL/ OFFICE
 STREET SECTION

DATE: JANUARY 2019

SHEET 700-8



THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

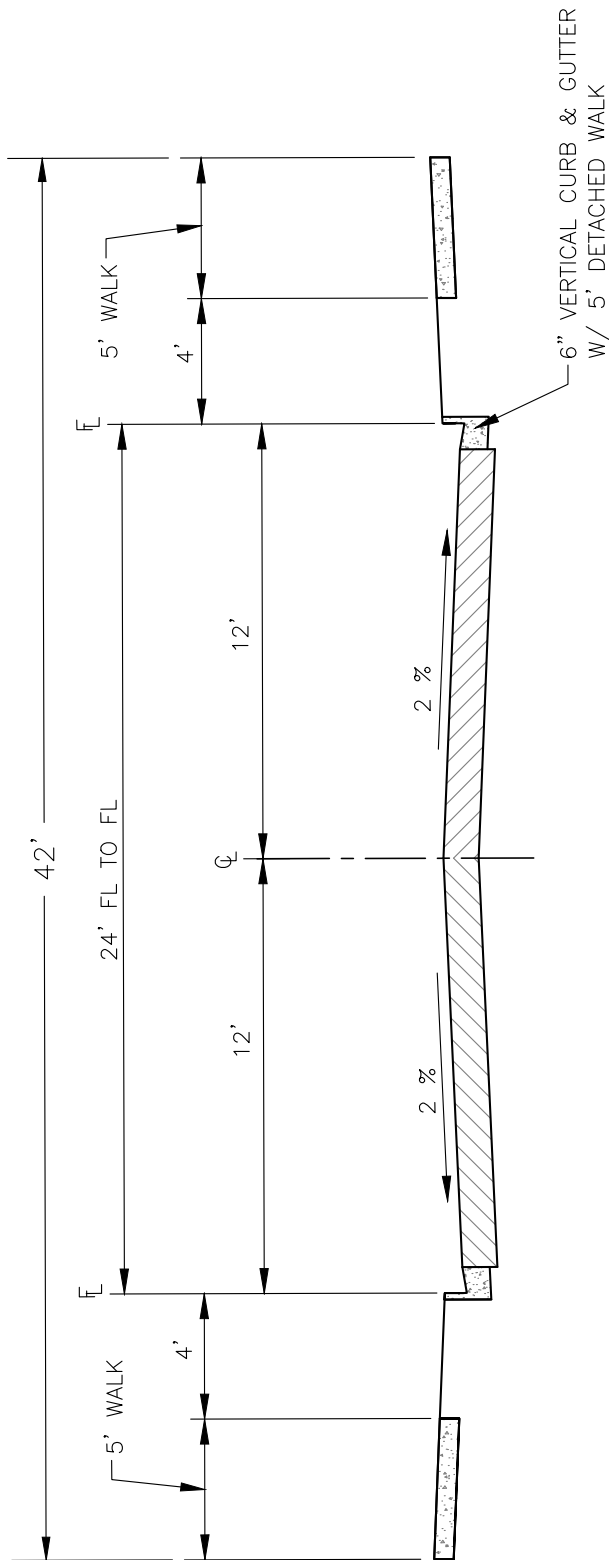
N.T.S.



LOCAL STREET SECTION

DATE: JANUARY 2019

SHEET 700-9



NOTE:

PAVEMENT WIDTH AND SIDEWALK REQUIREMENTS MAY BE MODIFIED BASED ON ACCESS NEEDS, PARKING AND TRAFFIC VOLUMES.

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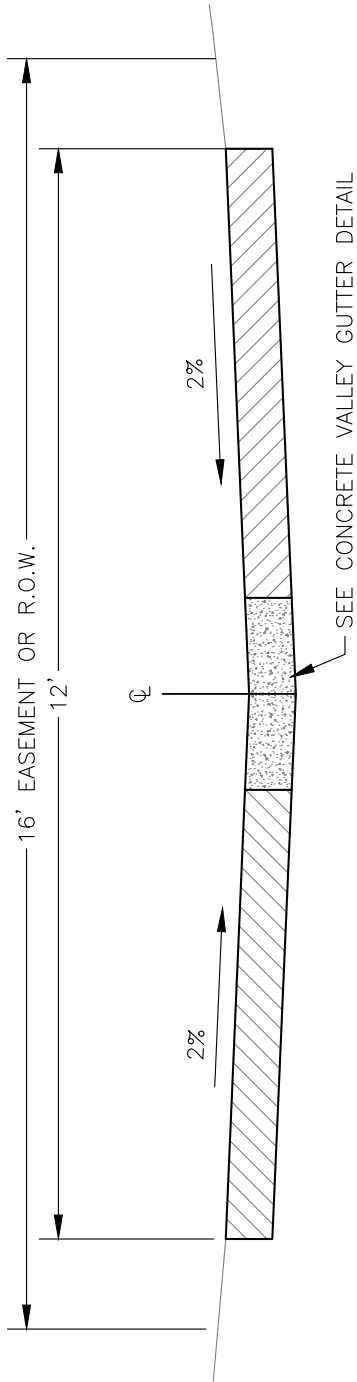
N.T.S.



PRIVATE STREET SECTION

DATE: JANUARY 2019

SHEET 700-10



NOTE:
 ADDITIONAL R.O.W. OR EASEMENT WIDTH MAY BE REQUIRED BASED ON UTILITY REQUIREMENTS.

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

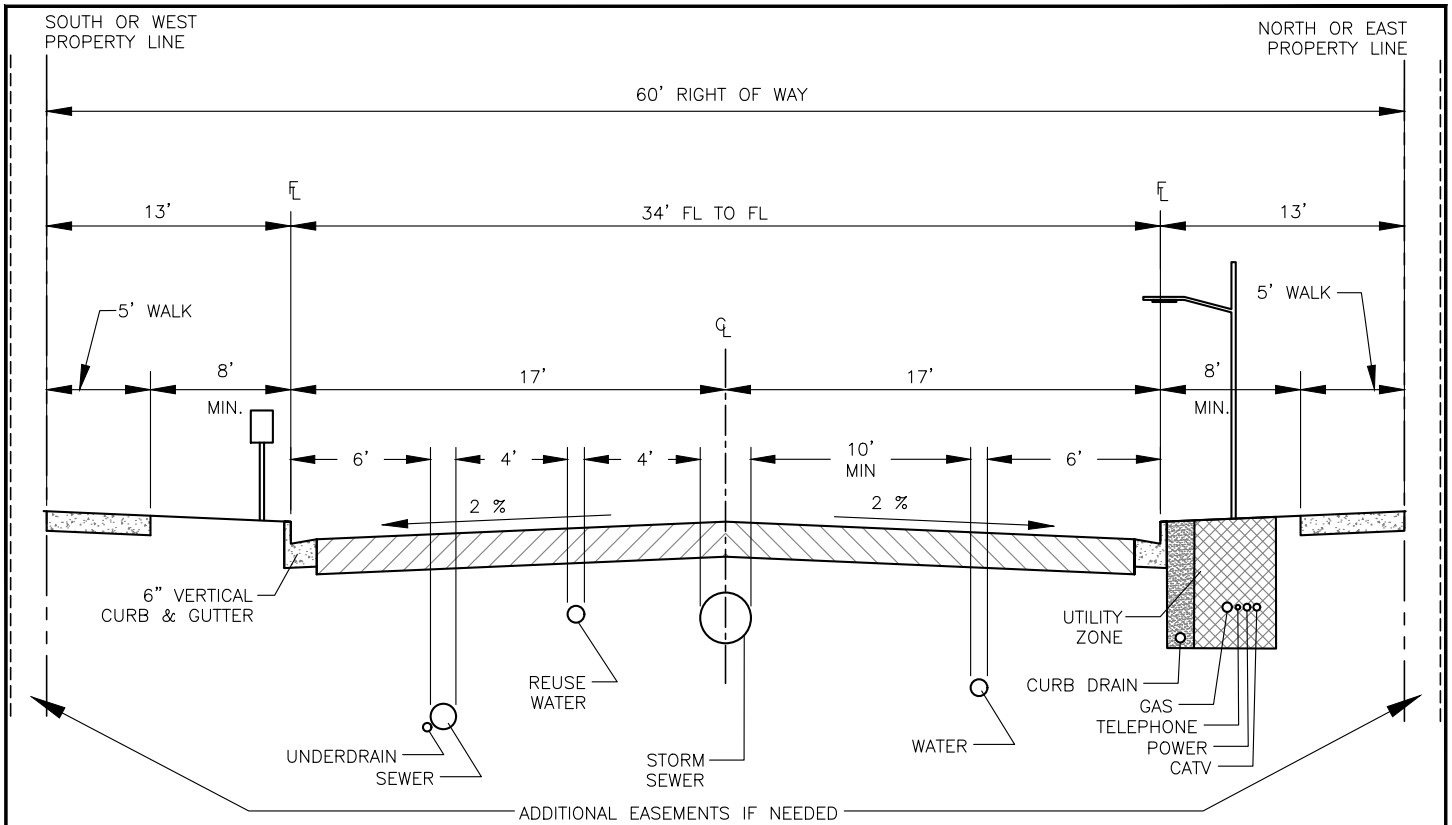
N.T.S.



PRIVATE ALLEY SECTION

DATE: JANUARY 2019

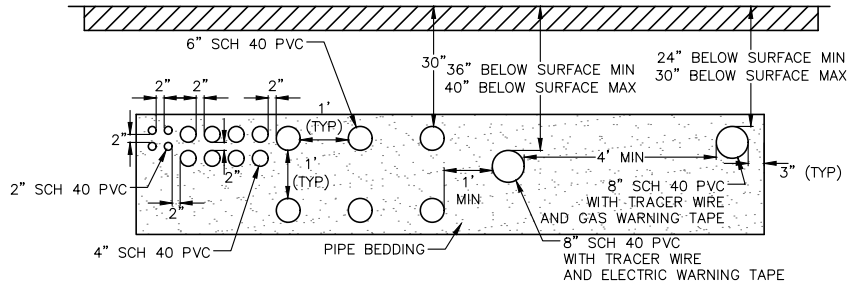
SHEET 700-11



MINIMUM DEPTHS

STREET LIGHTS.....	30"
GAS.....	30"
TELEPHONE.....	*
ELECTRIC POWER.....	*
STORM SEWER.....	40"
SANITARY SEWER.....	96"
CATV.....	24"
POTABLE AND RECYCLED WATER (WITH TRACER TAPED TO PVC, WARNING TAPE 1' ABOVE DIP.....	54"
FIBER OPTIC (WITH TRACER WIRE 1' ABOVE THE LINE).....	48"
OTHER.....	30"

*ELECTRIC AND TELEPHONE LINES PER LATEST ADDITION OF NATIONAL ELECTRIC SAFETY CODE



- NOTES:
- 4 - 2 INCH SCH 40 SLEEVES WITH CAPS, TRACER WIRE, AND BURIED UTILITIES WARNING TAPE.
 - 8 - 4 INCH SCH 40 SLEEVES WITH CAPS, TRACER WIRE, AND BURIED UTILITIES WARNING TAPE.
 - 6 - 6 INCH SCH 40 SLEEVES WITH CAPS, TRACER WIRE, AND BURIED UTILITIES WARNING TAPE.
 - 2 - 8 INCH SCH 40 SLEEVES WITH CAPS, TRACER WIRE, AND WARNING TAPE AS LABELED ABOVE.

1. ALL SLEEVES HAVE GLUED CAPS BOTH ENDS
2. INSTALL 10 AWG TRACER WIRE TO THE TOP OF SLEEVES AND TERMINATE IN CP MINI TEST STATION EACH END.
3. MARK LOCATION ON TOP OF CURB WITH 4" 'C'

UTILITY SLEEVE DETAIL

N.T.S.

NOTES:

1. THIS STANDARD IS A GUIDELINE ONLY AND DEVIATIONS MAY BE ACCEPTABLE WHERE CONDITIONS DICTATE. DIMENSIONS SHOWN ARE DESIRABLE BUT DO NOT GOVERN. THE INTENTION IS TO SHOW THE RELATIVE POSITION OF ALL UTILITIES. THIS DOES NOT PRECLUDE THE USE OF UTILITIES IN EASEMENTS IN OTHER LOCATION(IE. BACK LOT LINES).
2. REFER TO UTILITY STANDARDS FOR REQUIRED HORIZONTAL AND VERTICAL CLEARANCES BETWEEN UTILITIES.
3. CONSULT WITH XCEL AND OTHER UTILITY PROVIDERS FOR LOCATIONS AND DEPTHS.

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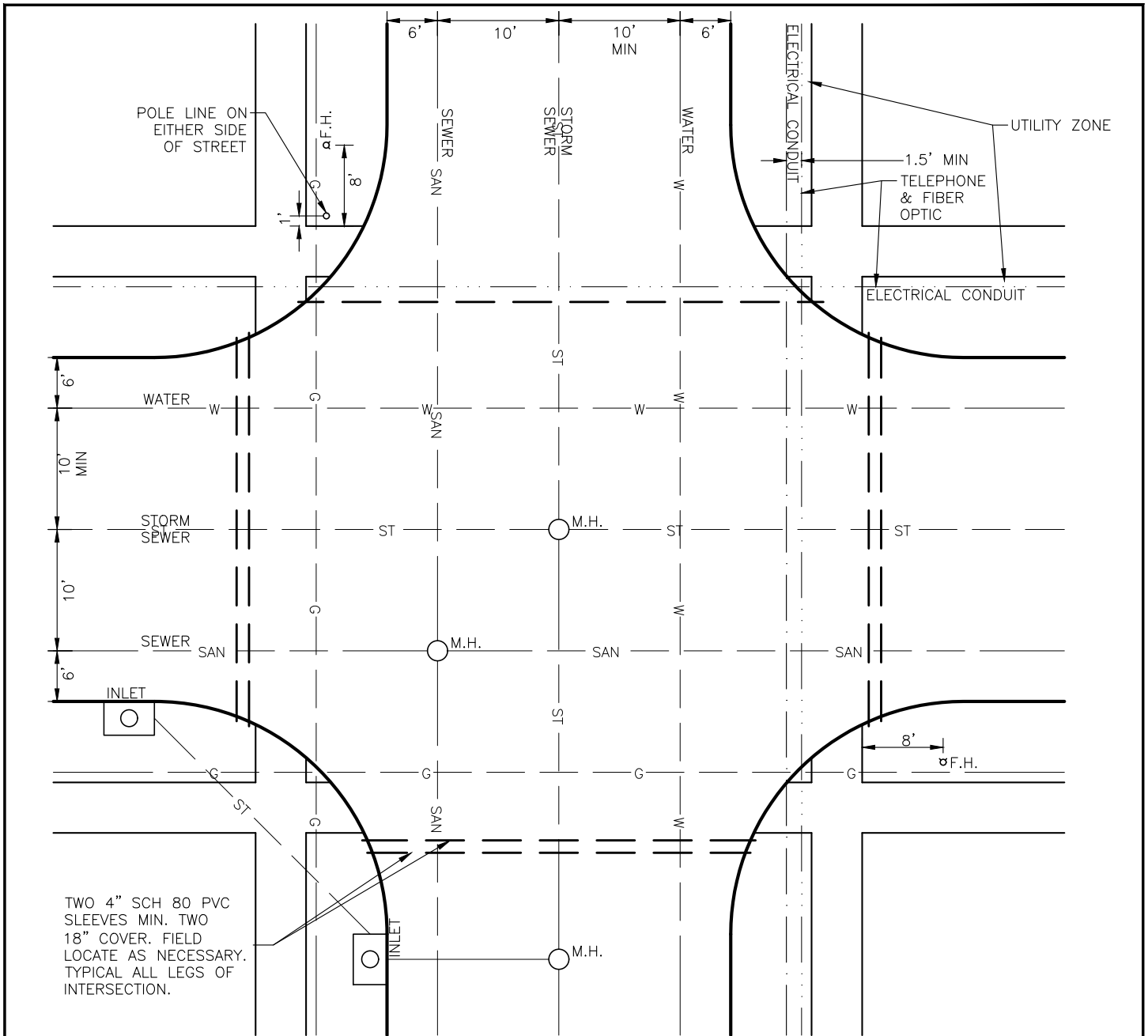
N.T.S.



UTILITY LINE LOCATIONS

DATE: JANUARY 2019

SHEET 700-12



NOTES:

1. THIS STANDARD IS A GUIDELINE ONLY AND DEVIATIONS MAY BE ACCEPTABLE WHERE CONDITIONS DICTATE. DIMENSIONS SHOWN ARE DESIRABLE BUT DO NOT GOVERN. THE INTENTION IS TO SHOW THE RELATIVE POSITION OF ALL UTILITIES. THIS DOES NOT PRECLUDE THE USE OF UTILITIES IN EASEMENTS IN OTHER LOCATIONS (IE. BACK LOT LINES). LOCATIONS OF RECYCLED WATER LINES TO BE APPROVED BY TOWN. FOLLOW CDPHE GUIDELINES FOR SEPARATION.
2. REFER TO UTILITY STANDARDS FOR REQUIRED HORIZONTAL AND VERTICAL CLEARANCES BETWEEN UTILITIES.
3. CONSULT WITH XCEL AND OTHER UTILITY PROVIDERS FOR LOCATIONS AND DEPTHS.

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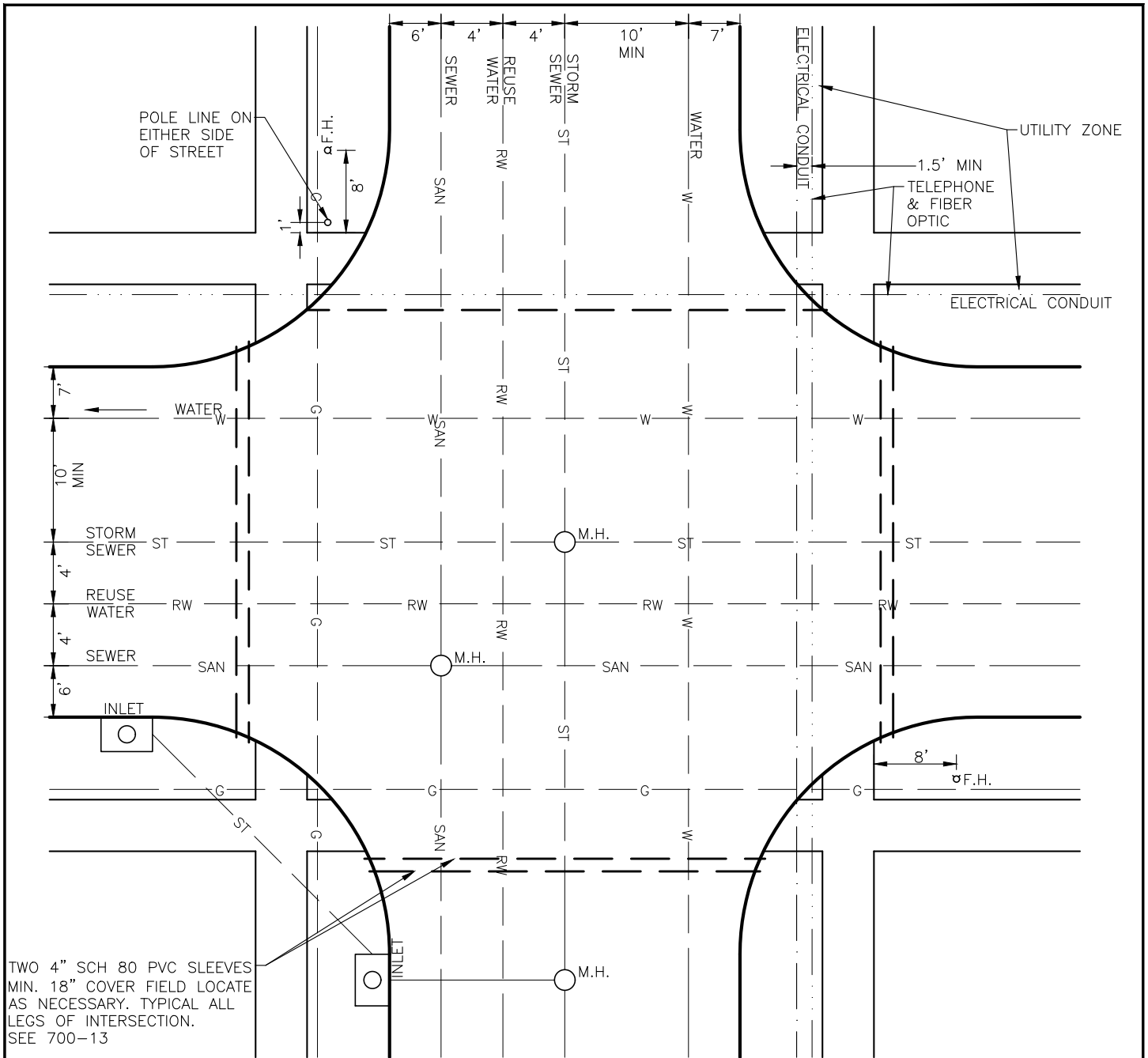
N.T.S.



UTILITY LINE LOCATION

DATE: JANUARY 2019

SHEET 700-13



NOTES:

1. THIS STANDARD IS A GUIDELINE ONLY AND DEVIATIONS MAY BE ACCEPTABLE WHERE CONDITIONS DICTATE. DIMENSIONS SHOWN ARE DESIRABLE BUT DO NOT GOVERN. THE INTENTION IS TO SHOW THE RELATIVE POSITION OF ALL UTILITIES. THIS DOES NOT PRECLUDE THE USE OF UTILITIES IN EASEMENTS IN OTHER LOCATIONS (IE. BACK LOT LINES). LOCATIONS OF RECYCLED WATER LINES TO BE APPROVED BY TOWN. FOLLOW CDPHE GUIDELINES FOR SEPARATION.
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N.T.S.

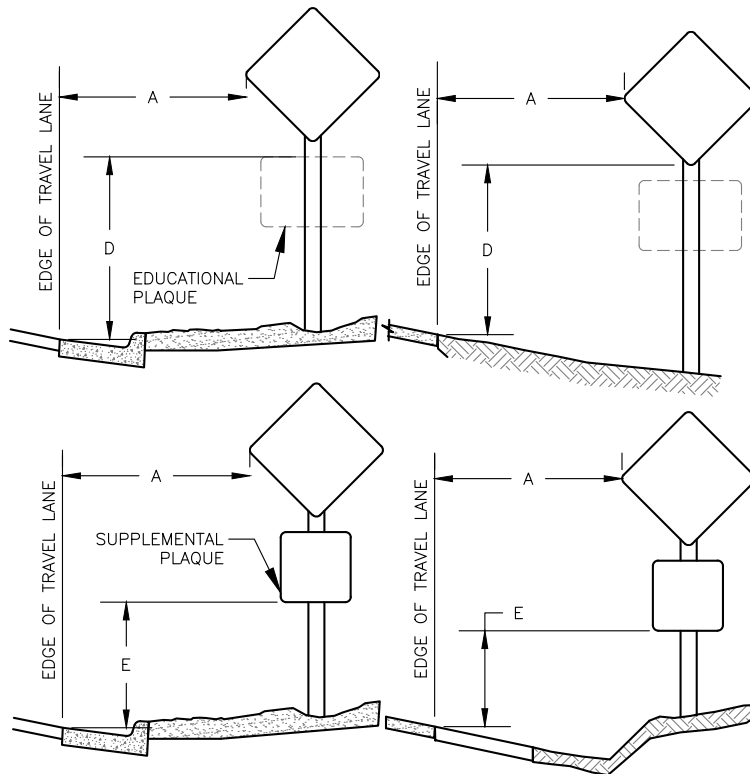


Gateway to Boulder Valley®

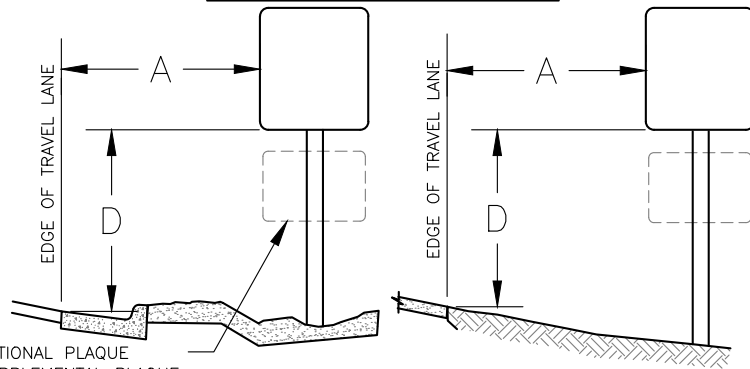
UTILITY LINE LOCATION WITH REUSE WATER

DATE: JANUARY 2019

SHEET 700-14



WARNING SIGN PLACEMENT



EDUCATIONAL PLAQUE
(IF SUPPLEMENTAL PLAQUE,
USE PLACEMENT "E")

REGULATORY SIGN PLACEMENT

LATERAL PLACEMENT				
KEY	LOCAL STREETS		COLLECTORS & ARTERIALS	
	MINIMUM	NORMAL	MINIMUM	NORMAL
A	8'-0"	12'-0"	10'-0"	14'-0"

VERTICAL PLACEMENT (MINIMUM)				
KEY	URBAN		RURAL	
	WITH SIDEWALKS	W/O SIDEWALKS	WITH SIDEWALKS	W/O SIDEWALKS
D	7'-0"	7'-0"	N/A	5'-0"
E	7'-0"	6'-0"	N/A	4'-0"

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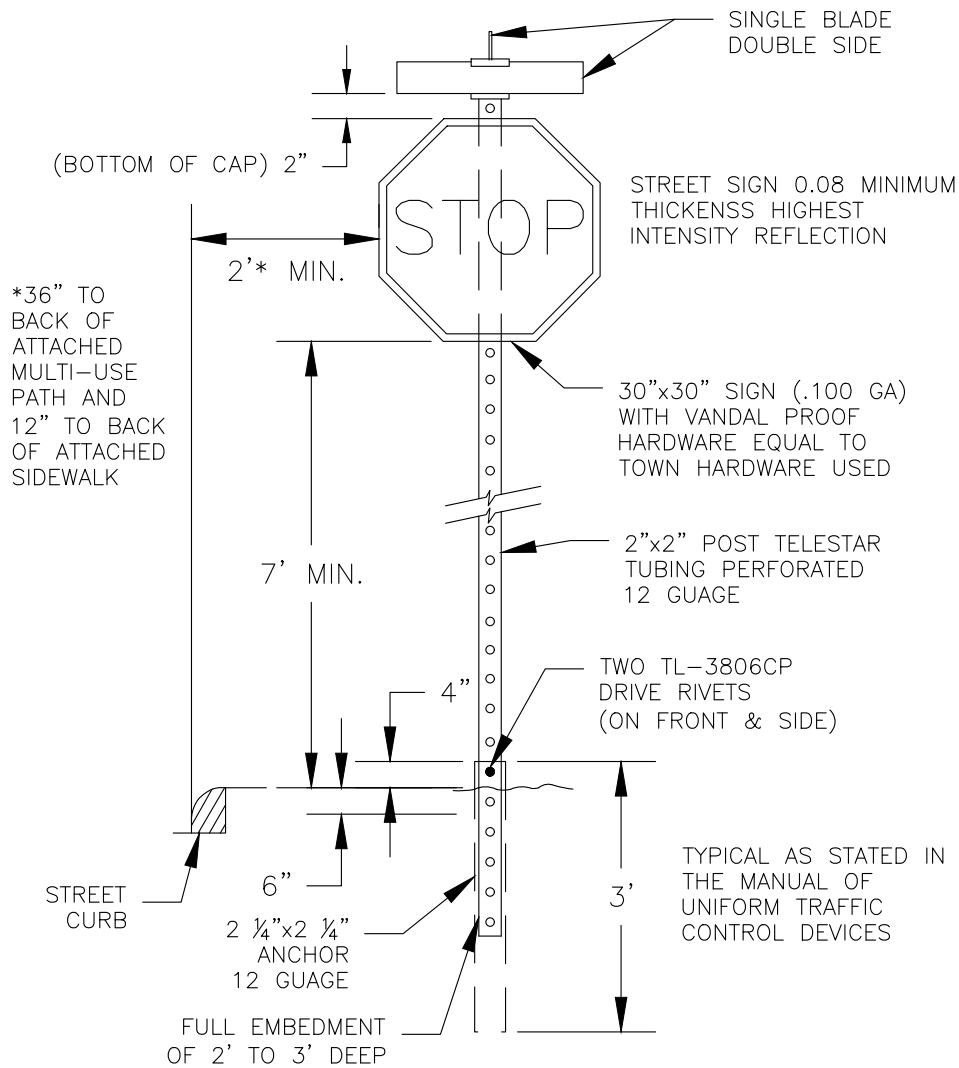
N.T.S.



**TRAFFIC CONTROL
SIGN PLACEMENT**

DATE: JANUARY 2019

SHEET 700-15



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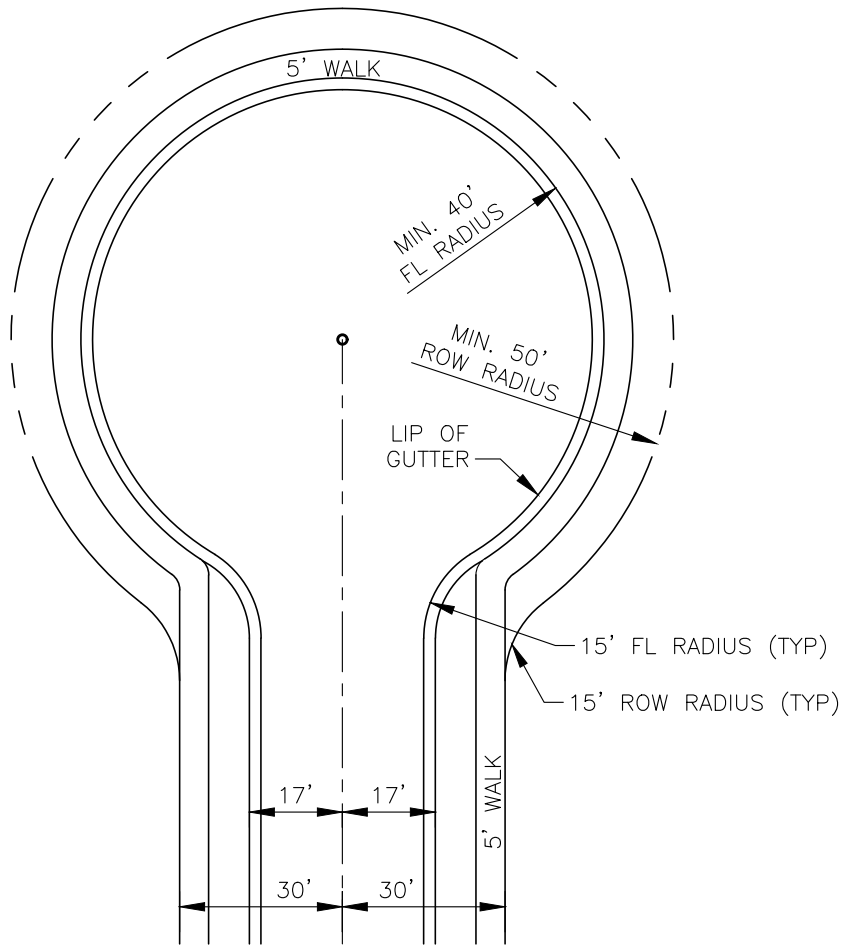
N.T.S.



SIGN INSTALLATION

DATE: JANUARY 2019

SHEET 700-16



THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

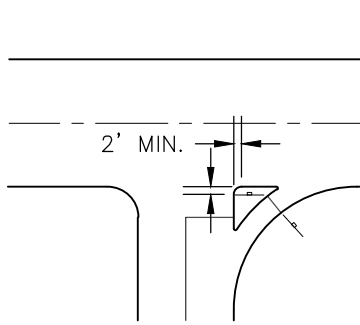
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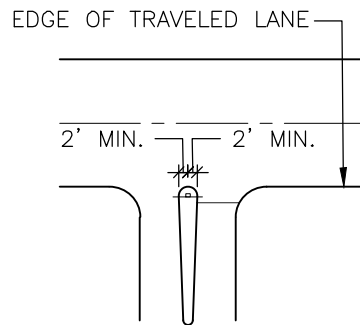
CUL-DE-SAC

DATE: JANUARY 2019

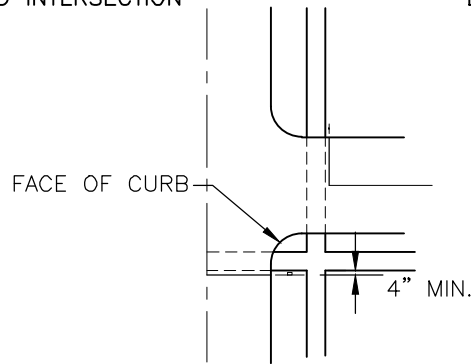
SHEET 700-17



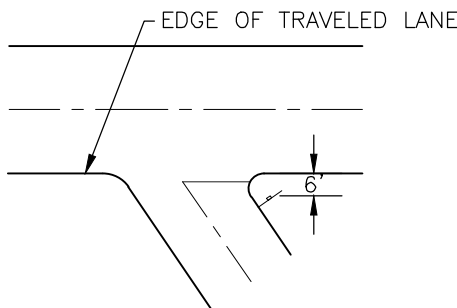
CHANNELIZED INTERSECTION



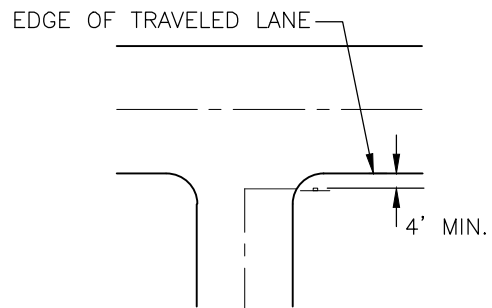
DIVISIONAL ISLAND



URBAN INTERSECTION



ACUTE ANGLE INTERSECTION



WIDE THROAT INTERSECTION

NOTE:
REFER TO THE MOST RECENT EDITION OF THE MANUAL OF
UNIFORM TRAFFIC CONTROL DEVICES FOR ADDITIONAL
INFORMATION.

TYPICAL LOCATIONS – STOP SIGNS AND YIELD SIGNS

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS
MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

N.T.S.

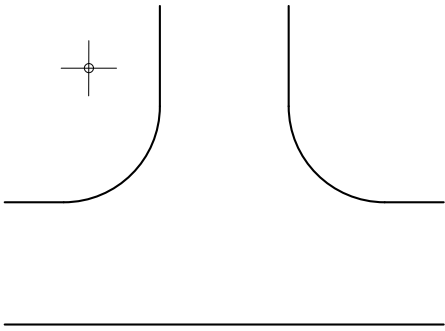


STOP OR YIELD
SIGN LOCATIONS

DATE: JANUARY 2019

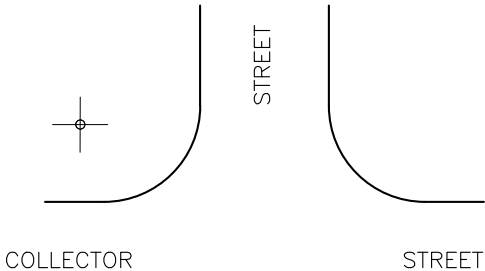
SHEET 700-18

T-INTERSECTION

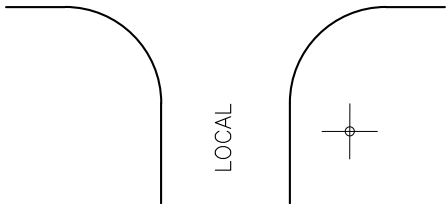


ASSEMBLY MUST BE PLACED AT THIS LOCATION.

LOCAL-COLLECTOR STREET INTERSECTION

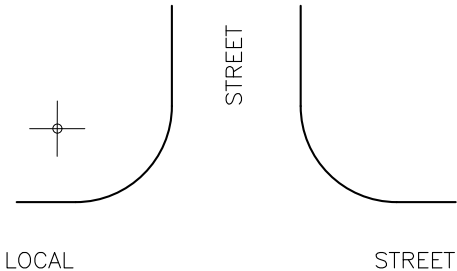


COLLECTOR STREET

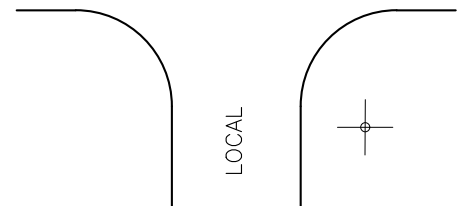


LOCAL STREET

LOCAL-LOCAL STREET INTERSECTION



LOCAL STREET



LOCAL STREET

NOTE:

REFER TO THE MOST RECENT EDITION OF THE MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES FOR ADDITIONAL INFORMATION.

STREET NAME ASSEMBLY LOCATIONS

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N.T.S.



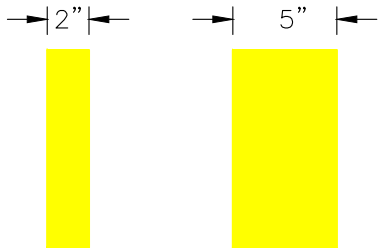
STREET NAME SIGN LOCATIONS

DATE: JANUARY 2019

SHEET 700-19

NOTES:

1. **ABOVE 25 MPH SIGN HEIGHT SHALL BE INCREASED TO 9 INCHES AND ALL OTHER DIMENSIONS INCREASED BY 33% TO MAINTAIN PROPORTIONS. THIS PRIMARILY APPLIES TO: MCCASLIN BOULEVARD, ROCK CREEK PARKWAY, 88TH STREET.
2. SIGN SHALL BE: SINGLE BLADE DOUBLE SIDE OR DOUBLE BLADE SINGLE SIDE, TO BE APPROVED BY PUBLIC WORKS DIRECTOR PRIOR TO INSTALLATION. 0.08 MINIMUM THICKNESS, HIGHEST INTENSITY REFLECTION
3. STREET NAMES SHALL BE FHWA "C" FONT. ALL OTHER REGULATORY SIGNS SHALL BE FHWA "C" OR "D" FONT. FONT TO BE APPROVED BY PUBLIC WORKS DIRECTOR PRIOR TO INSTALLATION.



6" BLADE



36"x6" HIP/G



30"x6" HIP/G



THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

N.T.S.



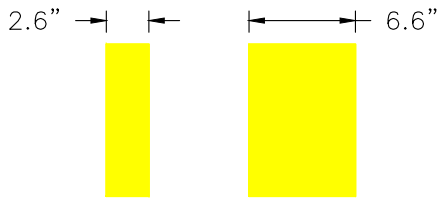
MINOR STREET NAME SIGN

DATE: JANUARY 2019

SHEET 700-20

NOTES:

1. **ABOVE 25 MPH SIGN HEIGHT SHALL BE INCREASED TO 9 INCHES AND ALL OTHER DIMENSIONS INCREASED BY 33% TO MAINTAIN PROPORTIONS. THIS PRIMARILY APPLIES TO: McCASLIN BOULEVARD, ROCK CREEK PARKWAY, 88TH STREET.
2. SIGN SHALL BE: SINGLE BLADE DOUBLE SIDE OR DOUBLE BLADE SINGLE SIDE, TO BE APPROVED BY PUBLIC WORKS DIRECTOR PRIOR TO INSTALLATION. 0.08 MINIMUM THICKNESS, HIGHEST INTENSITY REFLECTION
3. STREET NAMES SHALL BE FHWA "C" FONT. ALL OTHER REGULATORY SIGNS SHALL BE FHWA "C" OR "D" FONT. FONT TO BE APPROVED BY PUBLIC WORKS DIRECTOR PRIOR TO INSTALLATION.



9" BLADE



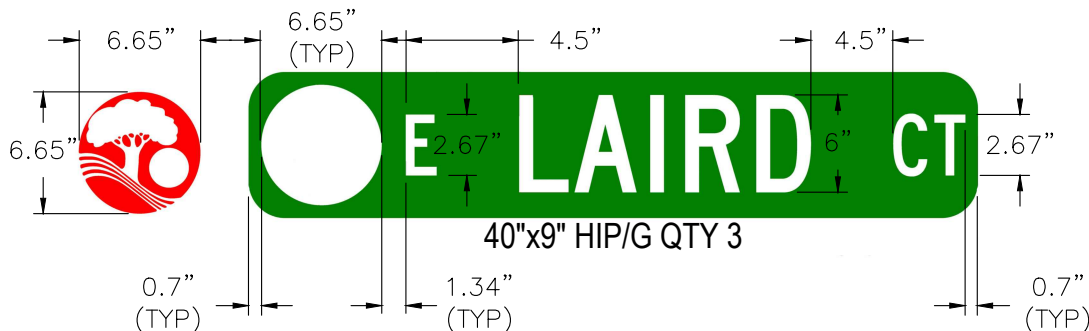
48"x9" HIP/G



48"x9" HIP/G QTY 3



40"x9" HIP/G



40"x9" HIP/G QTY 3

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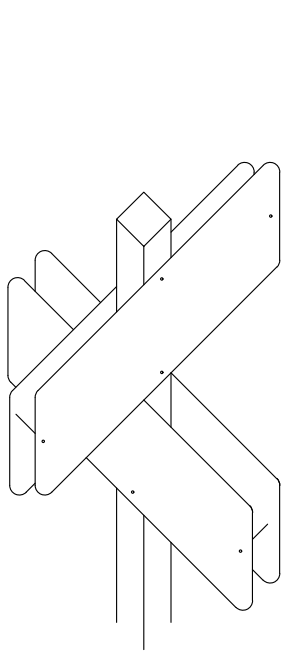
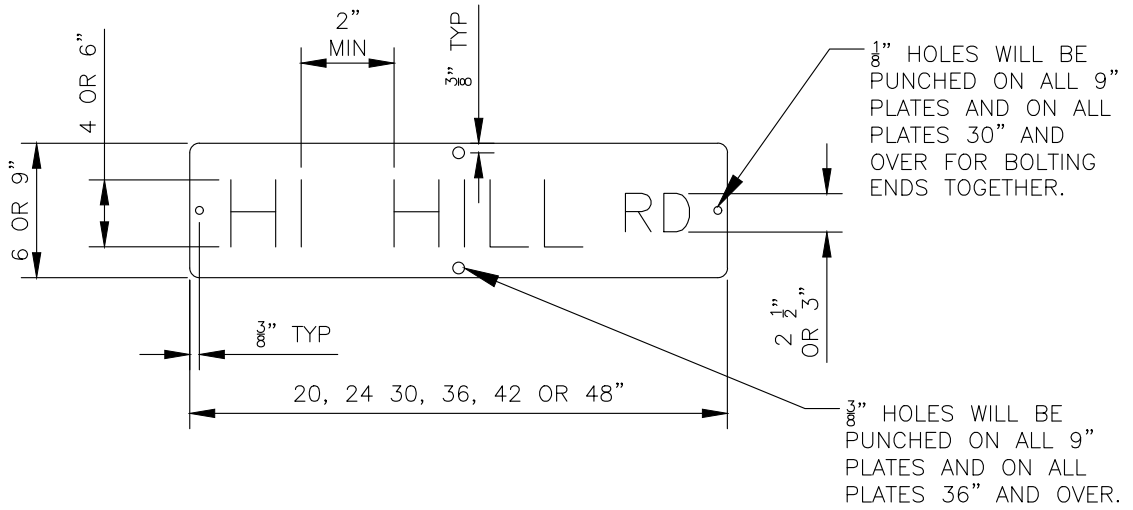
N.T.S.



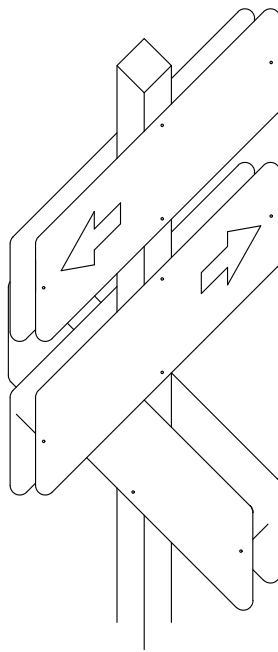
MAJOR STREET NAME SIGN

DATE: JANUARY 2019

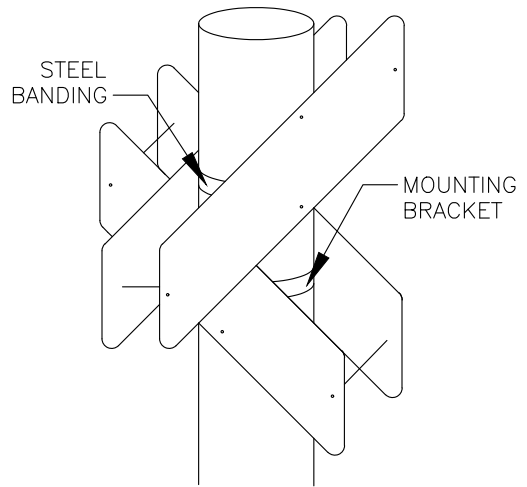
SHEET 700-21



STANDARD STREET SIGN ASSEMBLY



STREET SIGN ASSEMBLY WHEN STREET NAMES CHANGE



STREET SIGN ASSEMBLY ON UTILITY POLE

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

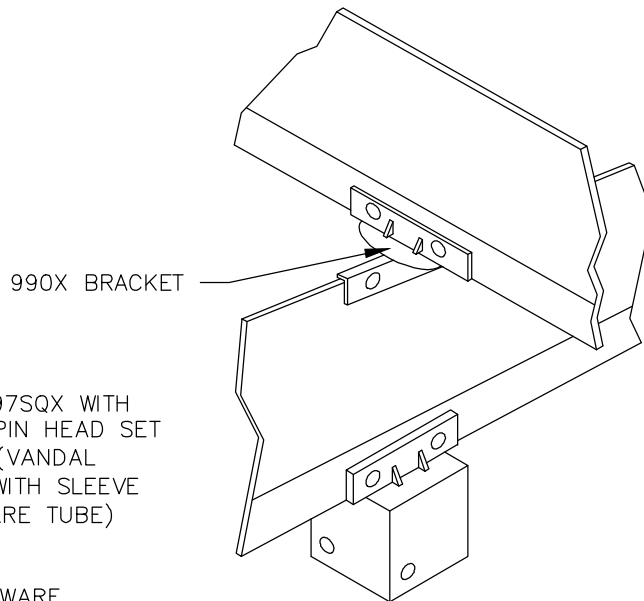
N.T.S.



STREET SIGN ASSEMBLY

DATE: JANUARY 2019

SHEET 700-22



1-SET #97SQX WITH
PRP 38 PIN HEAD SET
SCREWS (VANDAL
PROOF) WITH SLEEVE
(2" SQUARE TUBE)

ALL HARDWARE
CONSISTENT WITH
EXISTING TOWN
STANDARDS

NOTE:

ALL 9" STREET NAME SIGNS SHALL BE OF EXTRUDED ALUMINUM ALLOY 6065-T6, OR APPROVED EQUAL. 0.08" OR GREATER THICK WEB WITH 0.250" THICK EDGES. THEY SHALL BE DOUBLE-SIDED SINGLE BLADE WITH HIGH INTENSITY REFLECTION

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

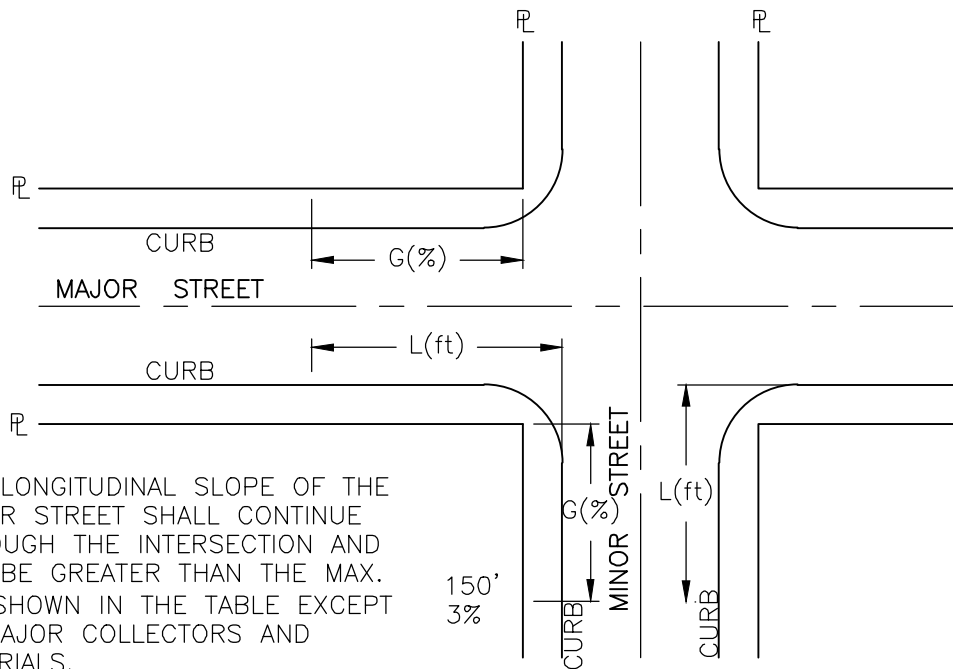
N.T.S.



STREET SIGN ASSEMBLY

DATE: JANUARY 2019

SHEET 700-23



MINOR STREET \ MAJOR STREET		LOCAL	MINOR COLLECTOR	MAJOR COLLECTOR	MINOR ARTERIAL	MAJOR ARTERIAL
		L G	L G	L G	L G	L G
LOCAL	L G	95' 4%	100' 4%	100' 4%	125' 4%	125' 4%
MINOR COLLECTOR	L G	— —	100' 4%	120' 3%	150' 3%	150' 3%
MAJOR COLLECTOR	L G	— —	— —	120' 3%	150' 3%	200' 3%
MINOR ARTERIAL	L G	— —	— —	— —	200' 2%	200' 2%
MAJOR ARTERIAL	L G	— —	— —	— —	— —	200' 2%

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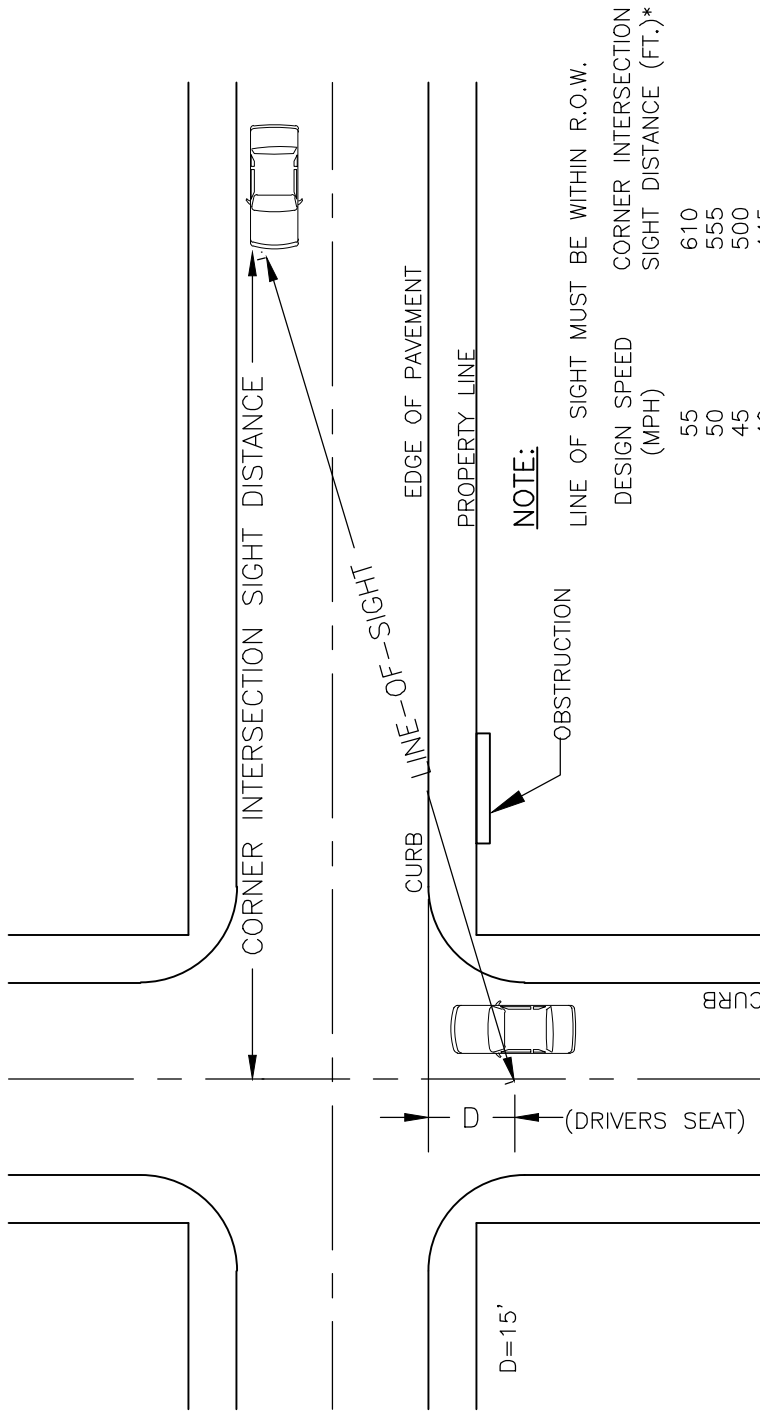
N.T.S.



PERMISSIBLE INTERSECTION
GRADE AND LENGTH

DATE: JANUARY 2019

SHEET 700-24



NOTE:

LINE OF SIGHT MUST BE WITHIN R.O.W.

DESIGN SPEED (MPH)	CORNER INTERSECTION SIGHT DISTANCE (FT.)*
55	610
50	555
45	500
40	445
35	390
30	335***
25	280***
20	225***

DESIGN INTERSECTION SIGHT DISTANCE (LEFT TURN FROM STOP)

- * CORNER SIGHT DISTANCE MEASURED FROM A POINT ON THE MINOR ROAD AT 15 FEET BACK FROM THE EDGE OF THE MAJOR ROAD PAVEMENT (FLOWLINE) AND MEASURED FROM A HEIGHT OF EYE AT 3.50 FEET ON THE MINOR ROAD TO A HEIGHT OF OBJECT AT 3.50 FEET ON THE MAJOR ROAD.
- ** AT LOCAL-LOCAL STREET INTERSECTIONS ONLY, THE "D" DISTANCE SHALL BE TEN FEET (10') AND THE SIGHT DISTANCE SHALL BE MEASURED TO THE CENTERLINE OF THE STREET.
- *** FOR PRIVATE DRIVEWAY ACCESS TO A PUBLIC STREET, USE 10 FEET BACK FROM FLOWLINE (OR SHOULDER FOR GRAVEL ROADS).

(AFTER EXHIBIT TABLE 9-55 AASHTO GREEN BOOK)

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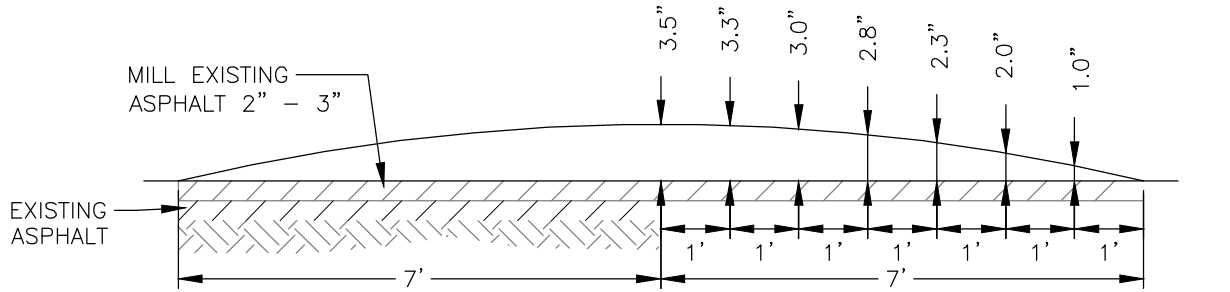
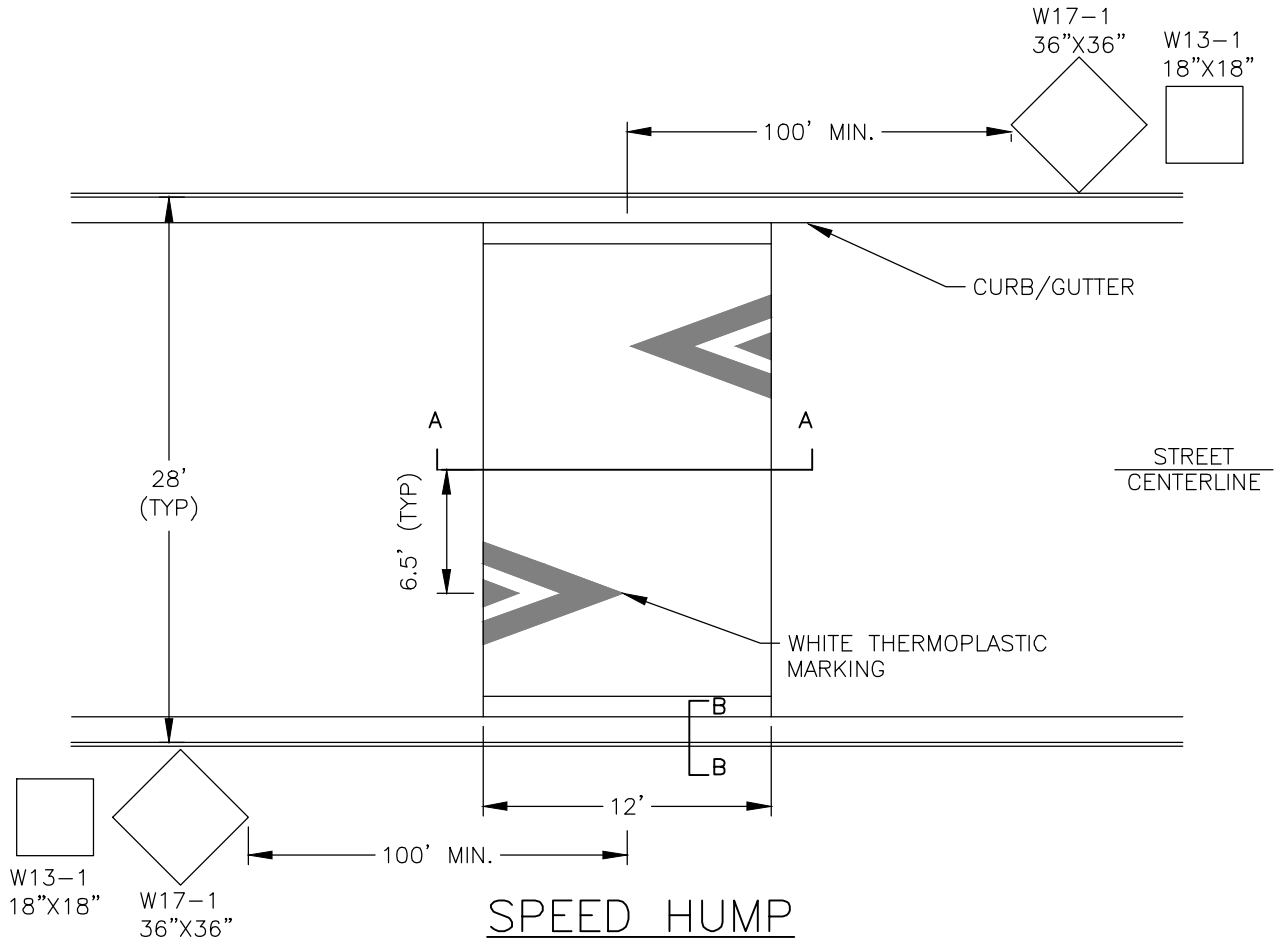
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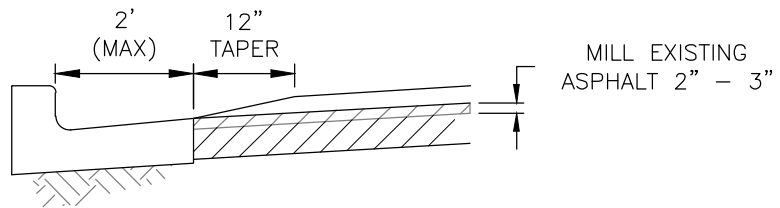
INTERSECTION SIGHT DISTANCE REQUIREMENTS

DATE: JANUARY 2019

SHEET 700-25



SECTION A-A



SECTION B-B

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

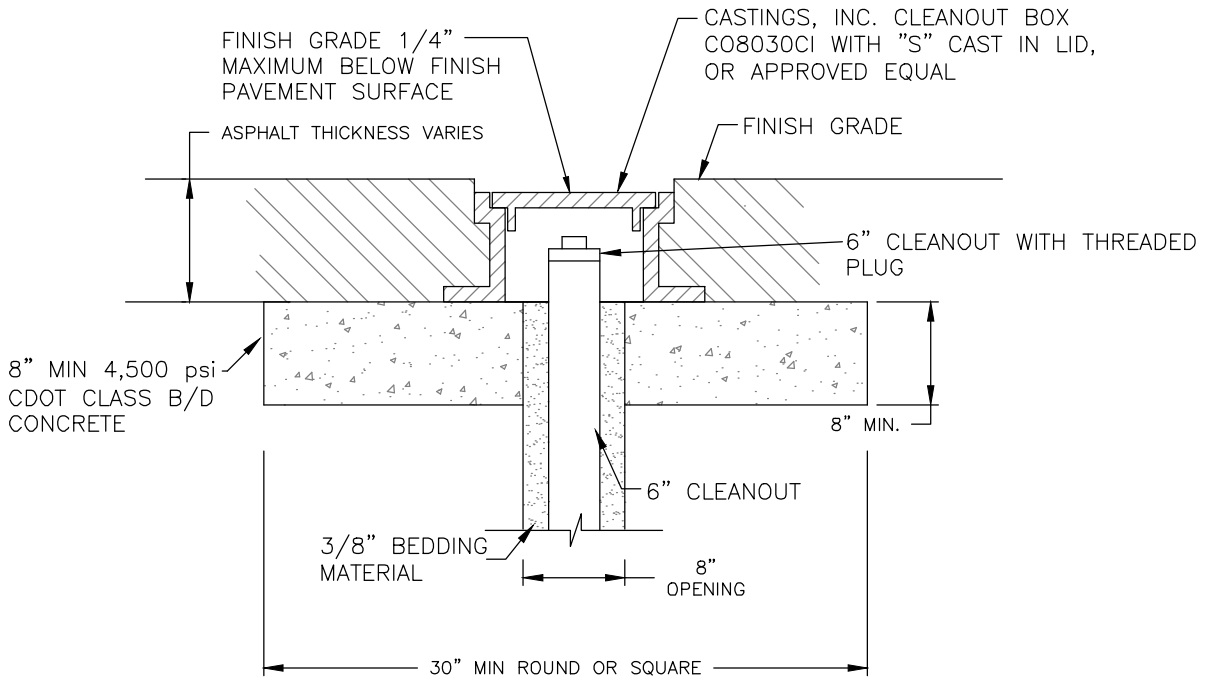
N.T.S.



SPEED HUMP DETAIL

DATE: JANUARY 2019

SHEET 700-26



THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

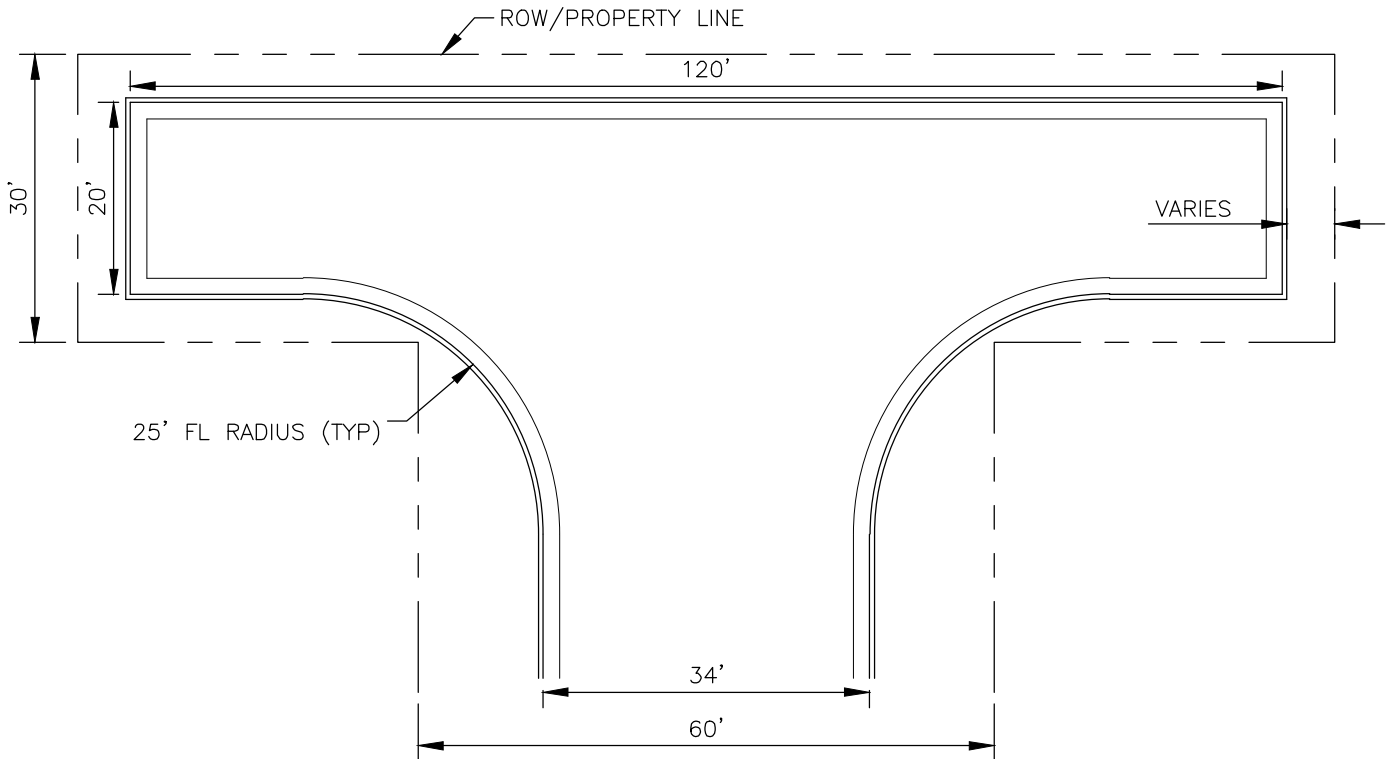
N.T.S.



SANITARY SEWER UNDER
DRAIN CLEANOUT

DATE: JANUARY 2019

SHEET 700-27



CLEAR AREA BEYOND CURB AND GUTTER, SHOULD BE ENOUGH FOR GARBAGE TRUCKS, AND FIRE TRUCKS (NO STRUCTURES OR SIGNS)

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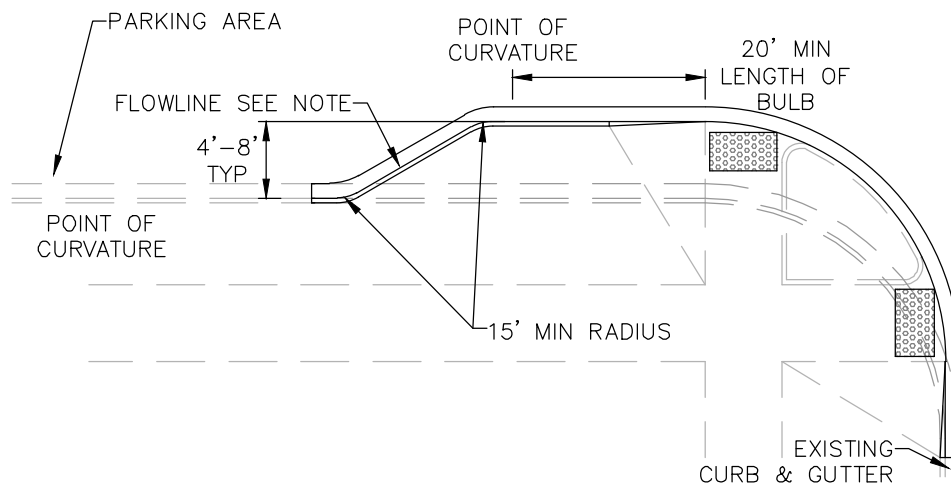
N.T.S.



HAMMERHEAD TURN AROUND

DATE: JANUARY 2019

SHEET 700-28



NOTES:

1. WHERE LENGTH OF BULB-OUT IS DESIRED TO BE AS SHORT AS POSSIBLE, THE BULB-OUT RADIUS CLOSEST TO THE TRAFFIC LANE MAY BE REDUCED TO 12'.
2. REVERSE CURVES AT EACH END OF PARKING POCKET SHALL BE TANGENT TO EACH OTHER, AND EACH CURVE SHALL BE TANGENT WITH THE CURB LINE CONTINUING IN EACH DIRECTION.
3. THE LENGTH OF THE BULB IS MEASURED AS 20' FROM THE CLOSEST EDGE OF THE CROSSWALK, WHICH IS TYPICALLY DEFINED AS THE CLOSEST POINT OF THE CURB RAMP THROAT, OR THE MARKED CROSSWALK, WHEN PRESENT. ANY REDUCTION IN THIS LENGTH SHALL BE APPROVED BY THE TOWN.
4. BULB-OUT DESIGN SHALL ENSURE POSITIVE 0.7% PREFERRED, 0.5% MIN, DRAINAGE SLOPE AT ALL POINTS ALONG NEW BULB-OUT FLOWLINE.
5. IF THERE IS AN EXISTING OR PROPOSED BUS STOP OR DRIVEWAY AT THE CORNER, THE LENGTH OF THE BULB SHOULD BE LENGTHENED TO ACCOMMODATE THE FULL LENGTH OF THE BUS STOP/DRIVEWAY. THE LENGTH OF THE EXTENSION WILL BE APPROVED BY THE TOWN.
6. COMPLETE DESIGN OF THE BULB-OUT SHALL BE REQUIRED WITH APPROVAL FROM THE TOWN.

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

N.T.S.



CURB BULB EXTENSION

DATE: JANUARY 2019

SHEET 700-29

SECTION 800 CONCRETE MIX DESIGN AND CONSTRUCTION

801.00 GENERAL CONDITIONS

Refer to Section 100 TITLE, SCOPE, AND GENERAL CONDITIONS of these DESIGN STANDARDS AND SPECIFICATIONS for additional requirements that apply to all projects within the Town.

810.00 SCOPE

All Portland cement concrete work within any street, parking lot, or ROW or in any part of the water system, reuse water system, sanitary sewer system, or storm drainage system of the Town shall meet the requirements of these DESIGN STANDARDS AND SPECIFICATIONS.

811.00 INSPECTIONS

Refer to Section 153.00 INSPECTIONS and Section 931.00 ROADWAY INSPECTIONS of these DESIGN STANDARDS AND SPECIFICATIONS.

Adequate inspections ensure compliance to the Town requirements and are the basis for the Town's recommendation that improvements be accepted for maintenance and/or for release of performance guarantees. It is the responsibility of the Contractor to contact the Town a minimum of one (1) full working day (twenty-four [24] hours) in advance of the required inspections. Required inspections shall include:

- A. Subgrades: Verify that material on which concrete shall be placed is to the line, grade, and cross-sections shown on the approved plans is not frozen or excessively dry at the surface and meets all moisture and compaction requirements.
- B. Forms/Reinforcing Steel: Verify that forms are set to proper grade and alignment, adequately braced, and set for proper thickness of concrete. Epoxy coated rebar is properly placed and spaced, at least fifty (50) percent of intersections are tied, and proper distances from surface grade and forms are maintained.
- C. Concrete Delivery and Testing: Confirm that mix design submittals are approved by the Town, and testing/sampling frequency, slump, air, and minimum/maximum air and concrete temperatures comply with these DESIGN STANDARDS AND SPECIFICATIONS.
- D. Cure and Finish: Verify that finished concrete complies with approved grades and alignment and is properly cured. If required by the Town, verify that concrete pavement surfaces comply with the smoothness requirements of Section 412.17 Surface Smoothness Test of the CDOT *Standard Specifications for Road and Bridge Construction*.
- E. General Items:
 - 1. All temporary structures, debris, mud, and waste materials shall be removed from public property.
 - 2. Remove and replace all areas of broken concrete. Subgrade failures shall be corrected before pouring back.

- F. Construction Acceptance into Warranty: Refer to Section 211.00 PROBATIONARY ACCEPTANCE INTO WARRANTY PERIOD of these DESIGN STANDARDS AND SPECIFICATIONS.
- G. Final Acceptance/Release from Warranty: Refer to Section 212.00 FINAL ACCEPTANCE AND RELEASE FROM WARRANTY BY THE TOWN of these DESIGN STANDARDS AND SPECIFICATIONS.

820.00 CONCRETE MIX DESIGN

Concrete shall be composed of Portland cement, aggregate, and water, and shall be reinforced with steel bars or steel wire fabric where required.

Concrete mix design information shall be prepared in accordance with ACI 301, Section 4.2, and submitted to the Town for approval. At least two (2) sets of certified twenty-eight (28) day strength test results shall also be submitted. No concrete shall be placed until the concrete mix design has been approved by the Town.

A separate mix design submittal shall be required for concrete to be pumped. Mix designs shall be prepared in accordance with ACI 211 and 304, as applicable.

821.00 MATERIALS

821.01 Cement

The cement used in concrete work shall depend upon the sulfate content of the surrounding soil. Refer to the table below and CDOT *Standard Specifications for Road and Bridge Construction* for appropriate sulfate resistant design.

TABLE 800.01 REQUIREMENTS TO PROTECT AGAINST DAMAGE TO CONCRETE BY SULFATE ATTACK FROM EXTERNAL SOURCES OF SULFATE

Severity of Sulfate Exposure	Water-Soluble Sulfate (SO ₄) in Dry Soil, %	Sulfate (SO ₄) in Water, ppm	Maximum Water-to-Cementitious Material Ratio	Cementitious Material Requirements
Class 0	0.00 to 0.10	0 to 150	0.45	Class 0
Class 1	0.11 to 0.20	151 to 1,500	0.45	Class 1
Class 2	0.21 to 2.00	1,501 to 10,000	0.45	Class 2
Class 3	2.01 or greater	10,000 or greater	0.40	Class 3

All cement used in concrete work shall be Portland cement that complies with ASTM C150, Type I or Type II, except where Type V cement is required for sulfate-resistant concrete. In general, Type II cement that complies with ASTM C150 shall be used in concrete in contact with the soil, unless otherwise allowed or directed by the Town. Cement for any reason that has become partially set or which contains lumps shall be rejected.

The Contractor shall be responsible for proper storage of all cement until it is used. When requested by the Town, the Contractor shall furnish the Town with a certificate from the manufacturer or an acceptable testing laboratory stating that the cement meets the requirements of these DESIGN STANDARDS AND SPECIFICATIONS for Portland cement.

821.02 Fly Ash

Fly ash may be utilized in the concrete mix design when permitted by the Town. Fly ash shall be Class F and shall comply with ASTM C618. The pozzolanic index shall be eighty-five (85). Fly ash may replace a maximum of twenty (20) percent of the amount of Portland cement that otherwise is required to produce concrete of the specified compressive strength. Class C fly ash shall not be permitted where sulfate resistant cement is required.

The Contractor shall notify the Town of the source of the fly ash prior to the fly ash being used in the project. When required by the Town, the Contractor shall provide the fly ash analysis performed by the fly ash supplier along with the concrete mix proportions. The Town may require a certificate from an approved testing laboratory stating that the fly ash meets the requirements of these DESIGN STANDARDS AND SPECIFICATIONS.

821.03 Water

Water for concrete shall be clean and free from sand, oil, acid, alkali, organic matter, or other deleterious substances; it shall meet the requirements for mix water, as published in ASTM C94. Water from public supplies or water that has been proven to be suitable for drinking is satisfactory.

821.04 Admixtures

The following requirements apply for admixtures:

- A. The Contractor shall use air-entraining admixtures for all surfaces of exposed concrete. Air entraining admixtures shall comply with ASTM C260.
- B. When weather restraints, site conditions, or project requirements require the ability to place concrete at a lower temperature, produce accelerated concrete setting time, or increase early and ultimate compressive strengths, an accelerating admixture may be utilized in the design mix when allowed by the Town.
- C. Calcium chloride may be utilized in the design mix when allowed by the Town.
- D. Type C accelerating admixtures and Type E water reducing and accelerating admixtures shall meet ASTM C494.
- E. When concrete is to be used with reinforcing steel, a non-chloride/non-corrosive admixture shall be used.
- F. Dosage rates shall be determined by recommendation of the ready mix company and shall be specified for daily site conditions.

821.05 Fine Aggregate

The fine aggregate shall be clean, hard, durable, uncoated particles of sand free from injurious amounts of clay, dust, soft or flaky particles, loam, shale, alkali, organic matter, or other deleterious matter. Fine aggregate shall be well graded and when tested by means of laboratory sieves shall comply with ASTM C33.

The fine aggregate gradation shall comply with CDOT Fine Aggregate.

821.06 Coarse Aggregate

The coarse aggregate shall consist of broken stone or gravel that is clean, hard, tough, and durable and free from soft, thin, elongated, or laminated pieces, disintegrated stone, clay, loam, vegetable, or other deleterious matter.

Coarse aggregate shall be well graded and when tested by means of laboratory, sieves shall comply with ASTM C33. The coarse aggregate gradation shall comply with CDOT' Coarse Aggregate Gradation #467.

821.07 Fibrous Reinforcing

Fibrous reinforcing shall be used in Portland cement concrete used for all curb, gutter, median splash guards, sidewalks, trails, curb returns, fillets, cross pans, concrete alleys, concrete roadways, trickle channels, and valley gutters.

The following shall be submitted to the Town:

- A. One (1) copy of manufacturer's printed product data, clearly marked, indicating proposed fibrous concrete reinforcement materials. Printed data should state one and one-half (1½) lbs of fiber to be added to each cubic yard of each type of concrete.
- B. One (1) copy of manufacturer's printed batching and mixing instructions.
- C. One (1) copy of a certificate prepared by the concrete supplier stating that the approved fibrous concrete reinforcement materials at the rate of one and one-half (1½) pounds per cubic yard were added to each batch of concrete delivered to the project site. Each certificate shall be accompanied by one (1) copy of each batch delivery ticket indicating amount of fibrous concrete reinforcement material added to each batch of concrete.

Fibrous concrete reinforcement shall consist of:

- A. 100% virgin polypropylene fibrillated fibers specifically manufactured for use as concrete reinforcement containing no reprocessed olefin materials. Fibrous concrete reinforcement shall be as manufactured by Fibermesh Company, Buckeye Ultra Fiber 500, or approved equal.
- B. Physical characteristics:
 - 1. Specific gravity = 0.905 grams per cubic centimeter
 - 2. Tensile strength: 70 to 110 psi
 - 3. Fibrous concrete reinforcement materials provided by this subsection shall produce concrete conforming to the requirements for each type and class of concrete required as indicated
 - 4. Construction methods:

- i. Add fibrous concrete reinforcement to concrete materials at the time concrete is batched in amounts in accord with approved submittals for each type of concrete required.
 - ii. Mix batched concrete in strict accord with fibrous concrete reinforcement manufacturer's instructions and recommendations for uniform and complete dispersion.
5. Concrete placing and finishing: Place and finish concrete materials as specified in subsections 831 and 838.

822.00 MIX PROPERTIES

Mix properties of Portland cement concrete for flatwork shall comply with the following:

TABLE 800.02

PROPERTY	MIX DESIGN
Minimum compressive strength - 28 days*	4,500 psi
Maximum water/cement ratio - by weight	0.45
Slump - inches	1-5
Air entrainment - % by volume	5-8

* When tested in accordance with ASTM C31

The grading and composition requirements for coarse and fine aggregate for concrete shall be in accordance with the CDOT *Standard Specifications for Road and Bridge Construction*. Additional concrete mix designs may be approved for decorative, non-structural concrete at the discretion of the Town.

822.01 Colored Patterned Concrete

Color shall be noted on the approved drawings or as approved by the Town. Concrete splash block in medians shall be Davis Color Spanish Gold (1 lb 160) or approved by the Town.

Where required on the approved plans, colored patterned concrete shall comply with the following:

- A. Minimum twenty-eight (28) day compressive strength of concrete shall be 4,500 psi.
- B. Air entrainment shall be six and one half (6.5) percent \pm [1%] for maximum aggregate size of three-quarter ($\frac{3}{4}$) inch or one (1) inch and shall be seven and one-half ($7 \frac{1}{2}$) percent \pm [1%] for a maximum aggregate size of three-eighth ($\frac{3}{8}$) inch or one-half ($\frac{1}{2}$) inch.
- C. Normal set or retarded set water reducing admixture shall comply with ASTM C494.
- D. No calcium chloride shall be added to the concrete mix.
- E. Matching integral color shall be used as a supplement but not as a color hardener.
- F. Color hardener shall be specially formulated for installation of patterned concrete, grade "Heavy Duty".

- G. Color curing compound shall comply with ASTM C309 and with all applicable air pollution regulations.

822.02 Controlled Low Strength Materials

Controlled low-strength materials (CLSMs), a flowable-fill material, is a self-leveling, low strength concrete material composed of cement, fly ash, aggregates, water, chemical admixtures, and/or cellular foam for air-entrainment. Flow-fill shall have a slump of seven (7) to ten (10) inches when tested in accordance with ASTM C143 or a minimum flow consistency of six (6) inches when tested in accordance with ASTM D6103. Flow-fill shall have a minimum compressive strength of fifty (50) psi after twenty-eight (28) days when tested in accordance with ASTM D4832. Foamed flash fill, a rapid setting flow-fill that may be used when approved by the Engineer.

CLSM mix designs shall be submitted to the Town for approval prior to placement. CLSMs used as structure backfill, as backfill for pipelines and service lines, or to fill abandoned pipelines and appurtenances shall have a twenty-eight (28) day compressive strength between fifty (50) and one hundred and fifty (150) psi, as tested by ASTM D4832.

CLSMs shall be placed in confined areas and under pipe haunches with methods approved by the Town. When backfilling pipelines and service lines, CLSMs shall be properly layered to prevent pipe from floating. The maximum layer thickness for CLSMs shall be three (3) feet, unless otherwise approved by the Engineer. The Contractor shall not place CLSMs in layers that are too thick to cause damage to culverts, pipes, and other structures or that will cause formwork or soil failures during placement. CLSMs shall have an indention diameter less than three (3) inches and the indention shall be free of visible water when tested in accordance with ASTM D6024 by the Contractor prior to placing additional layers of CLSMs. Testing CLSMs in accordance with ASTM D6024 will be witnessed by the Engineer. Damage resulting from placing CLSMs in layers that are too thick or from not allowing sufficient time between placements of layers shall be repaired at the Contractor's expense.

The Contractor shall submit a CLSM mix design for approval prior to placement. The mix design shall include the following laboratory test data:

- (1) ASTM C231 (Air Content)
- (2) ASTM D6023 (Unit Weight)
- (3) ASTM C143 (Slump) or ASTM D6103 (Flow Consistency)
- (4) ASTM D4832 (28-Day Compressive Strength)
- (5) Removability Modulus

Submittal of test sections and a placement plan may be required to receive approval by the Town.

When foamed flash fill is used, it shall be batched with a volumetric mixing truck. Volumetric mixing trucks to produce flow fill and foamed flash fill shall have a computer batching system capable of producing the approved mix design and printing tickets. For foamed flash fill, the batch weights of cement and/or fly ash per cubic yard shall be within two (2) percent of the mix design batch weights and the batch weight of water per cubic yard shall be within 2% of the mix design batch weight.

CLSMs shall conform to CDOT Standard 206.02 for structural backfill (flow-fill).

823.00 READY-MIXED CONCRETE

The use of ready-mixed concrete shall in no way relieve the Contractor or Developer of the responsibility for proportion, mix, delivery, or placement of concrete. All ready-mixed concrete shall comply with ASTM C94.

Concrete shall be continuously mixed or agitated from the time the water is added until the time of use, and discharge from the truck shall be completed within ninety (90) minutes after the concrete comes in contact with the mixing water or with the aggregates. In accordance with ASTM C94, water may be added to ready-mix concrete one time in order to get slump within range, as long as the specified water-cement ratio is not exceeded and approval is given by the Town. No water may be added after concrete testing is performed and test cylinders cast.

The Town shall have free access to the ready mix plant at all times. The organization supplying the concrete shall have sufficient plant and transportation facilities to ensure the continuous delivery of the concrete at the required rate.

The Contractor shall collect batch tickets from the driver for all concrete used on the project and shall deliver them to the Town. All concrete delivered without a batch ticket will be rejected. Batch tickets shall provide the following information, in accordance with ASTM C94:

- A. Name of ready-mix batch plant
- B. Serial number of ticket
- C. Date
- D. Truck number
- E. Name of purchaser
- F. Specific designation of job (name and location)
- G. Mix # or specific class or designation of the concrete
- H. Amount of concrete, in cubic yards
- I. Time loaded or of first mixing of cement and aggregates
- J. Water added by receiver of concrete and his initials
- K. Weights of fine and coarse aggregates
- L. Type, brand, and amount of cement
- M. Types, brands, and amounts of admixtures
- N. Volume (in gallons) of water, including surface water on aggregates

Concrete loads arriving without a batch ticket shall be rejected.

824.00 STEEL REINFORCING AND FORMS

824.01 Steel Reinforcing

The placement, fastening, splicing, and supporting of reinforcing steel or bar mat reinforcement shall comply with the plans and the latest edition of *CRSI Recommended Practice for Placing Reinforcing Bars*. Unless otherwise designated, bars conforming to AASHTO M31 and M53 shall be furnished in Grade 60, and all bars shall be epoxy coated. Before being positioned, all reinforcing steel shall be thoroughly cleaned of mill and rust scale and of coatings that may destroy or reduce the bond. Where there is delay in depositing concrete, reinforcement shall be reinspected and cleaned if necessary.

Reinforcement shall be carefully formed to the dimensions indicated on the approved plans by the cold bending method. Cold bends shall be made so that the inside diameter of the bend measured on the inside of the bar shall be as follows:

TABLE 800.03

BAR SIZE	GRADE 60
#3 through #8	6 bar dia.
#9, #10, and #11	8 bar dia.
#14 and #18	10 bar dia.

The inside diameter of bend for stirrups and ties shall not be less than four (4) bar diameters for sizes #5 and smaller, and five (5) bar diameters for #6 and #8. Reinforcement shall not be bent or straightened in a manner that may injure the material. Bars with kinks or bends shall not be used except where shown on the plans. Heating of reinforcement shall not be permitted.

Reinforcing steel shall be accurately placed and secured against displacement by using plastic or epoxy coated annealed iron wire of not less than No. 18 gauge, or by suitable clips at intersections. A minimum of fifty (50) percent of intersections shall be secured. Where necessary, reinforcing steel shall be supported by adequate plastic or epoxy coated metal chairs or spacers or metal hangers. Splicing of bars except where shown on the plans, shall not be allowed without approval of the Town.

The use of welded wire fabric is prohibited.

Contractor shall submit shop drawings of the reinforcement to the Town for approval. Unless otherwise shown on the plans, the minimum clear cover and reinforcement drawings shall match CDOT.

824.02 Forms and Form Setting

Forms shall not be placed until the subgrade extending one (1) foot outside of the forms is within one (1) inch of grade. Forms shall have sufficient strength to withstand, without deformation, the pressure resulting from the placement and vibration of the concrete. Forms shall be constructed so that the finished concrete shall conform to the shapes, lines, grades, and dimensions indicated on the approved plans. Any form which is not clean and which has not had the surface prepared with commercial form oil to effectively prevent bonding, staining, and softening of concrete surfaces shall not be used.

Forms may generally be wood or metal and shall have a depth equal to or greater than the slab thickness. Plywood forms, plastic coated plywood forms, or steel forms shall be used for all surfaces requiring forming which are exposed to view – whether inside or outside any structure. Surfaces against backfilled

earth, interior surfaces of covered channels, or other places permanently obscured from view may be formed with forms having sub-standard surfaces.

Forms that have become worn, bent, or broken shall not be used. Each section of form shall be straight and free from warps. The Contractor shall set a minimum length of three hundred (300) feet of forms to grade prior to placing concrete. In cases where the length of one run is less than three hundred (300) feet, the Contractor shall set forms to grade for the entire run.

The face of curbs shall be formed, unless otherwise permitted by the Town. Forms shall be secured to resist the pressure of the poured concrete without springing or settlement. The connection between sections shall be performed by a method in which the joint shall be free from movement in any direction.

Forms shall not deviate more than one-quarter ($\frac{1}{4}$) inch from the design line and grade.

When concrete pavement is constructed on a curve, flexible forms shall be used having a radius of two hundred (200) feet or less, unless otherwise directed by the Town. Face forms shall be pre-formed to the proper radius. Care shall be exercised to ensure the required cross section is maintained the entire radius.

The Contractor shall provide an approved metal straight edge, ten (10) feet in length, to check the alignment of the forms prior to placing the concrete and to check the concrete surface during the finishing operation.

Forms shall not be disturbed until the concrete has hardened sufficiently to permit removal without damaging the concrete – or until forms are not required to protect the concrete from mechanical damage. The minimum duration of time before removal of forms after placing concrete shall be one (1) day for footings and two (2) days for all other concrete. Crowbars or other heavy tools shall not be used against green concrete when removing forms. Forms shall be thoroughly cleaned before re-oiling and reused.

825.00 CONCRETE TESTING

The requirements of this section shall apply to testing services for all concrete curb and gutter, sidewalk, pavement, slope paving, retaining walls, structures, and for all miscellaneous concrete testing.

A representative of the concrete testing agency shall inspect, sample, and test material and production of concrete as required by the Town. Minimum testing frequency shall be as specified in Section 311.02 *Minimum Testing Requirements* of these DESIGN STANDARDS AND SPECIFICATIONS. When it appears that any material furnished or work performed by the Contractor fails to fulfill specification requirements, the testing agency shall report such deficiency to the Town and the Contractor.

The concrete testing agency shall report all test and inspection results to the Town and Contractor immediately after they are performed. All test reports shall include the exact location of the work at which the batch represented by a test was deposited. The report of the strength test shall include detailed information on storage and curing of specimen prior to testing, the project number and the location of the concrete (curb, manhole, inlet, sidewalk, paving, etc.).

The concrete testing agency or its representative is not authorized to revoke, alter, relax, expand, or release any requirements of these DESIGN STANDARDS AND SPECIFICATIONS, nor to approve or accept any portion of the work.

830.00 CONCRETE CONSTRUCTION

831.00 PLACING CONCRETE

Before placing concrete, debris shall be removed from the space to be occupied by the concrete. Soft, yielding, or otherwise unsuitable material shall be removed and replaced with suitable material. Filled sections shall be compacted and compaction shall extend a minimum of one (1) foot outside of the form lines. The forms and all concrete subgrade surfaces shall be thoroughly wetted. The concrete shall be placed on damp but not wet or muddy subgrade. Concrete shall be placed and vibrated so that it is free from honeycomb and free from pockets of segregated aggregate. Sections of segregation or honeycomb revealed by removal of the forms shall be removed and replaced or otherwise repaired as approved by the Town.

Concrete shall not be placed until all forms and reinforcing steel have been inspected and approved by the Town. Concrete shall be handled from the mixer to the place of final deposit as rapidly as possible by methods that prevent separation or loss of ingredients. The concrete shall be deposited in the forms as close as practicable in its final position to avoid re-handling. It shall be deposited in continuous layers, the thickness of which generally shall not exceed twelve (12) inches. Concrete shall be placed in a manner to avoid segregation and shall not be dropped freely more than five (5) feet. If segregation occurs, the Town Construction Inspector may require the concrete to be removed and replaced at the Contractor's expense.

Concrete shall be placed in one continuous operation, except where keyed construction joints are shown on the plans – or as approved by the Town. Delays in excess of thirty (30) minutes may require removal and replacement of concrete by the Town. At the end of the work day, or in case of an unavoidable interruption of more than thirty (30) minutes, a transverse construction joint shall be placed at the point of stopping work, provided that the section on which work has been suspended shall not be less than five (5) feet long. Sections less than five (5) feet in length shall be removed. Concrete shall not be placed when the weather is stormy, dusty, windy, or inclement to a degree that precludes good workmanship.

831.01 Vibrating

All concrete shall be compacted by internal vibration using mechanical vibrating equipment. Concrete in floor slabs, sidewalks, or curb and gutter which is not placed against form linings shall be either tamped or vibrated. Care shall be taken to vibrate only long enough to bring a continuous film of mortar to the surface. Vibration shall stop before any segregation of the concrete occurs. Mechanical vibrators shall be an approved type as specified in ACI 309, Chapter 5. Vibrators shall not be used to move or spread the concrete.

Any evidence of lack of consolidation or over-consolidation shall be regarded as sufficient reason to require removal and replacement of concrete at the Contractor's expense. The Contractor shall be responsible for any defects in the quality and appearance of the concrete.

831.02 Workability

The consistency of concrete shall be kept uniform and shall be checked by means of certified slump tests. The workability of the concrete shall be varied as directed by the Town. At all times concrete shall have a consistency such that it can be worked into corners and angles of the forms and around joints, dowels, and tie-bars by the construction methods which are being used without excessive spading, segregation or undue accumulation of water or laitance on the surface. If concrete fails to conform to the proportions of the approved mix design for any reason, such concrete shall not be incorporated in the work but shall be

discarded from the project site as waste material at the Contractor's expense. **No water may be added at the job site without the Town's permission.**

If approval is obtained and water is added at the job site, entrained air, slump, unit weight, and temperature tests shall be performed and test cylinders cast at the Contractor's expense.

831.03 Service Line and Dry Utility Sleeve Markings

Water, sanitary sewer, reuse irrigation service line locations shall be marked in the curb face using a four (4) inch metal stamp in the curb face. Water service lines shall be marked on the curb face with a "W." Sanitary sewer service lines shall be marked on the curb face with an "S," and reuse-irrigation service lines shall be marked on the curb face with an "IR."

Dry utility sleeve crossings shall be stamped on the top of the curb head with a "C."

831.04 Installation of Colored, Patterned Concrete

Special concrete mix with integral color shall be placed and screeded to the proper grade, and floated to a uniform surface in the normal manner for slabs on grade. While the concrete is still, the plastic imprinting tools shall be applied to make the desired patterned surface. The pattern shall be matched at imprint edges and joints.

Color curing compound – thinned in the proportion of one (1) part curing compound to one (1) part mineral spirits (i.e., paint thinner) – shall be applied uniformly with a roller or sprayer. The coverage shall be approximately six hundred (600) to six hundred and fifty (650) square feet per gallon of unthinned curing compound. At times when the air temperature is at or near freezing, the slab shall be cured using suitable curing blankets. The slab shall later be sealed with the color curing compound when the air temperature is above freezing.

Use of blankets and/or heaters may be necessary to maintain the concrete at or above fifty (50) degrees Fahrenheit for three (3) days after placement. The cured surface shall then be cleaned to remove any residual materials.

831.05 Weather Limitations

831.05.01 Cold Weather Concrete Placement

During extreme weather conditions, placement of concrete shall be allowed only when the temperature of the concrete placed in the forms is between sixty (60) degrees Fahrenheit and ninety (90) degrees Fahrenheit. Cold weather placement of concrete shall comply with ACI 306.

Concrete may be placed when the air temperature in the shade is forty (40) degrees Fahrenheit, and rising. No concrete shall be placed, regardless of the present temperature, when the weather forecast predicts freezing weather before final set of the concrete unless special means of heating and protection are used and approved by the Town. Protection against freezing is the Contractor's responsibility, regardless of the weather forecast or climatic conditions at the time of placement.

Small structures and slabs shall be protected by completely covering fresh concrete with suitable curing blankets to prevent freezing. Large structures and vertical walls shall be protected against freezing by enclosing the structure with blankets and using heating devices capable of providing uniform and even

heat throughout the structure. Heaters shall be vented so that combustion gases are exhausted outside the enclosure in order to avoid carbonation of the fresh concrete.

Cold weather is defined as a period when, for more than three (3) consecutive days, the following conditions exist:

- A. The average air temperature is less than forty (40) degrees Fahrenheit.
- B. The air temperature is not greater than fifty (50) degrees Fahrenheit for more than twelve (12) hours in any twenty-four (24) hour period.

Concrete placed in cold weather shall be protected from extreme temperatures as follows:

- A. A temperature of at least 50 degrees F for the first seventy-two (72) hours shall be maintained.
- B. After the first seventy-two (72) hours and until the concrete is seven (7) days old, it shall be protected from freezing temperatures.
- C. Concrete adjacent to heating devices shall be insulated from direct heat of the unit that may dry it out prior to being properly cured.
- D. Temperatures shall be measured by maximum and minimum thermometers furnished by the Contractor and installed adjacent to the concrete.

Concrete slabs shall not be placed, regardless of temperature conditions, if the supporting ground is frozen or contains frost. Use of salt or other additives to prevent concrete from freezing is not allowed. Concrete which has been frozen shall be removed and replaced, as required by the Town.

TABLE 800.04 MINIMUM CONCRETE PLACEMENT TEMPERATURE

Air Temperature	Section Thickness	
	< 12 inches	12-36 inches
Above 30°F	60°F	55°F
0°F-30°F	65°F	60°F
Below 0°F	70°F	65°F
Minimum Concrete Curing Temperature		
--	55°F	50°F

**TABLE 800.05 MINIMUM EXPOSURE TEMPERATURE FOR CONCRETE FLATWORK
(FOR PORTLAND CEMENT CONCRETE = 500 lb./CY)**

Slab Thickness (inches)	Minimum Ambient Air Temperature Allowable for Values of Thermal Resistance (R), hr*ft*°F/BTU		
	R = 2	R = 4	R = 6
4	**	**	**
8	**	**	**
12	42°F	36°F	30°F
18	30°F	12°F	-6°F
24	21°F	-5°F	-31°F

** > 50°F. Additional heat required.

831.05.02 Hot Weather Concrete Placement

Except by written authorization, concrete shall not be placed if the temperature of the plastic concrete cannot be maintained at ninety (90) degrees Fahrenheit or lower. Placement of concrete in hot weather shall comply with ACI 305.

832.00 CONCRETE PAVEMENT AND FLATWORK

The installation of Portland cement concrete pavement, including materials, equipment, foundation and construction methods, shall comply with Section 412 of the CDOT' *Standard Specifications for Road and Bridge Construction* and these DESIGN STANDARDS AND SPECIFICATIONS.

Concrete pavements shall be installed as shown on the approved plans or as approved by the Town. The Contractor shall furnish steel pins to use in setting grades for concrete pavement. The subgrade shall conform to the specified cross section. Immediately prior to placing concrete, the subgrade shall be tested for adequate compaction and moisture to a minimum depth of six (6) inches, or as specified in the approved Geotechnical Report. Concrete shall not be placed on any portion of the subgrade that has not been inspected by a Town Construction Inspector. There shall be no puddles or pockets of mud when the concrete is placed, and the subgrade shall be cleared of any loose material.

Curb, curb ramps, gutter, sidewalk, cross pan, and driveway construction shall conform to all applicable provisions and the Detail Drawings of these DESIGN STANDARDS AND SPECIFICATIONS.

832.01 Portland Cement Treated Base

In those instances where deemed necessary by the project Geotechnical Engineer and approved by the Town, Portland cement treated base may be required.

832.02 Curb and Gutter

The section to be constructed shall be as identified on the approved plans and as shown on the Detail Drawings of these DESIGN STANDARDS AND SPECIFICATIONS.

832.03 Sidewalks

Detached sidewalks and attached sidewalks shall be a minimum of six (6) inches thick, and shall be constructed as shown on the approved plans.

832.04 Crosspans and Curb Return Fillets

Typical crosspan sections are shown in the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS. Where unusual conditions exist, additional reinforcing steel and special joints may be required by the Town.

832.05 Curb Cuts and Driveways

Curb cuts in six (6) inch vertical curbs shall be constructed at all driveway locations and at additional locations, as shown on the approved plans and in the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS.

832.06 Curb Ramps

Curb ramps shall be installed at locations designated by the Town and as shown on the approved plans. Directional curb ramps, rather than diagonal or corner curb ramps, shall be installed unless site conditions or constraints prohibit their placement; or their placement creates an unsafe or undesirable condition for pedestrians or wheelchair travel along the sidewalk. The curb ramps shall be constructed with slopes, landings, jointing, and detectable warnings (cast iron truncated domes) shown as in the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS. Specific installation details shall be per the manufacturer. All panels shall be ADA/Title 24 compliant.

832.07 Joints

Joint materials shall comply with the following specifications:

TABLE 800.06

Concrete joint sealer, hot-poured elastic	M173
Preformed expansion joint filler (bituminous type)	M33
Preformed sponge-rubber and cork expansion joint fillers	M153
Preformed expansion joint fillers (fiberboard)	M213

Non-bituminous type materials shall be placed in widths shown on the approved plans or three-eighths ($\frac{3}{8}$) inch wide when not specified. Bituminous type materials shall be used for concrete paving and structural construction where joint sealers are not required.

All joints shall be constructed straight and plumb and shall extend through the entire section from edge to back and to the depths specified.

832.07.01 Expansion Joints

Expansion joint material shall be provided at the following locations and shall be in place prior to placement of concrete:

- A. Every 100 ft of sidewalk
- B. Each end of curb return
- C. Between back of sidewalk and driveway slab or service walk
- D. Between new concrete and existing masonry buildings
- E. At other unyielding structures
- F. As shown on the approved plans
- G. As directed by the Town

Epoxy coated reinforcing steel bars (minimum #4, 24" long) shall be used to tie together new and existing concrete pavements and flatwork. Refer to the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS for expansion joints.

Expansion joint filler, which is one-half ($\frac{1}{2}$) inch thick, preformed, non-extruding bituminous-treated fiber board conforming to AASHTO Specification M213 shall be used to form transverse expansion joints. Concrete tie-ins shall have epoxy coated reinforcing steel bars (#4 minimum) extending a minimum of twelve (12) inches into the concrete in each direction.

832.07.02 Contraction Joints

Transverse joints shall be placed at maximum intervals of ten (10) feet to control random cracking. Joints shall be formed, sawed, or tooled to a minimum depth of one-third ($\frac{1}{3}$) of the total thickness of the pavement or flatwork (no less than two (2) inches). If divider plates are used, the maximum depth of plates shall not be greater than one-half ($\frac{1}{2}$) depth at the finished surface and shall be no less than fifteen-sixteenths ($\frac{15}{16}$) inch thick. Refer to the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS for contraction joint details.

The curb and gutter or sidewalk shall be divided into stones not less than five (5) feet or more than ten (10) feet long using metal templates not less than one-sixteenth ($\frac{1}{16}$) inch or more than one-quarter ($\frac{1}{4}$) inch thick. Templates shall be a minimum of four (4) inches deep. Templates shall be designed to attach securely to the forms in such a manner as to prevent movement while the concrete is being placed and consolidated. Templates shall be removed prior to the concrete taking its initial set.

If a curbing machine or other method not requiring the use of templates is approved, dummy joints formed by a jointing tool, or other approved means shall be used. Dummy joints shall extend into the concrete for at least one-third ($\frac{1}{3}$) of the depth (no less than two [2] inches) and shall be approximately one-eighth ($\frac{1}{8}$) inch wide.

832.07.03 Tooled Joints

Tooled joints shall be spaced as follows:

- A. Not more than ten (10) feet or less than five (5) feet apart in curb and gutter, sidewalk, and combination curb-walk
- B. Joints in both directions, equally spaced at not greater than ten (10) foot intervals, as applicable in driveways
- C. Joints in handicap ramps shall be spaced nine (9) inches on center from the cast iron truncated domes to the top of the handicap ramp section
- D. As directed by the Town

832.08 Ponding

Ponding of water in concrete pavement and flatwork shall not exceed one-eighth ($\frac{1}{8}$) inch in depth. Where ponding exceeds one-eighth ($\frac{1}{8}$) inch in depth, pavement or flatwork shall be removed and replaced at the Contractor's expense.

833.00 APPURTENANT CONCRETE STRUCTURES

833.01 Forms

All exposed corners of concrete structures shall have three-quarter ($\frac{3}{4}$) inch chamfer edge. Refer to Section 824.02 *Forms and Form Setting* of these DESIGN STANDARDS AND SPECIFICATIONS for requirements for appurtenant concrete structures

833.02 Concrete Placement

Refer to Section 831.00 PLACING CONCRETE of these DESIGN STANDARDS AND SPECIFICATIONS for requirements for appurtenant concrete structures.

833.03 Expansion Joints

Expansion joint filler, which is one-half ($\frac{1}{2}$) inch thick, preformed, non-extruding bituminous-treated fiber board conforming to AASHTO Specification M-213, shall be used to form transverse expansion joints. Concrete tie-ins shall have epoxy reinforcing steel bars (#4 minimum) extending a minimum of twelve (12) inches into the concrete in each direction. Epoxy setting shall be done as directed by the Town.

833.04 Curing

Curing shall comply with Section 838.00 FINISHING, CURING, AND PROTECTION of these DESIGN STANDARDS AND SPECIFICATIONS.

834.00 CLEAN UP

The exposed surfaces of concrete shall be thoroughly cleaned upon completion of the work. Within forty-eight (48) hours after forms are removed, the area behind the sidewalk or curb shall be cleaned, backfilled, and graded to provide a smooth, even surface.

835.00 BACKFILL OF CONCRETE WORK

When forms are removed and the concrete has achieved minimum 75% strength, or minimum strength specified by the Engineer or Architect, the space adjoining the concrete shall be promptly backfilled with suitable material, properly moisture conditioned and compacted, and brought flush with the surface of the concrete and adjoining ground surface. In embankments, the backfill shall be level with the top of the concrete for at least two (2) feet and then sloped as shown on the approved plans or as directed by the Town.

836.00 PROTECTION AGAINST VANDALISM

It shall be the responsibility of the Contractor to protect all concrete work against damage or vandalism. When required, a guard shall be stationed over fresh work until the concrete is sufficiently set to prevent damage. Concrete damaged in any way by vandals shall be removed and replaced at the Contractor's expense.

Anti-graffiti materials shall be installed as shown on the approved plans or as required by the Town. Prior to installation, technical information regarding proposed anti-graffiti materials shall be submitted to the Town for approval.

837.00 REPAIRS

After stripping concrete forms, any concrete found to be inconsistent with the approved plans, is out of alignment, not level, or showing a defective surface shall be removed and replaced at the Contractor's expense, as directed by the Town. The Town may give written permission to patch the defective area. Ridges and bulges may be removed by grinding if approved by the Town. Chamfered edges shall be stoned smooth. Honeycombed and other defective concrete that does not affect the integrity of the structure may be chipped out, and the vacated areas filled in a workmanlike manner, if approved by the Town. All bolt holes, tie-rod holes, and minor imperfections shall be filled and smoothed in a workmanlike manner.

The repaired area shall be patched with a non-shrink, non-metallic grout with a minimum compressive strength of five thousand (5,000) psi in twenty-eight (28) days. All repair areas treated with an epoxy bonding agent shall have the approval of the Town before the repair filling is placed.

837.01 Flatwork Repairs and Replacement

All edges of the existing flatwork to remain shall be saw cut from joint to joint. Flatwork repairs and replacement shall be as directed by the Town and at the Contractor's expense

837.02 Concrete Structure Repairs

Bolt-holes, tie-rod holes, and minor imperfections as approved by the Town, shall be filled smooth and flat with non-shrink dry-patching mortar composed of approximately one (1) part Portland cement to two (2) parts of regular concrete sand (volume measurement) and only enough water so that after the ingredients are mixed thoroughly, the mortar sticks together when molded. Mortar repairs shall be placed in layers and thoroughly compacted by suitable tools. Care shall be taken in filling rod and bolt holes so that the entire depth of the hole is completely filled with compacted mortar. The surface shall be finished smooth in a workmanlike manner.

838.00 FINISHING, CURING, AND PROTECTION

838.01 Finishing

Where applicable, finishing shall be performed with a metal screed designed to give proper shape to the section, as detailed. Particular care shall be used to finish the gutter flowline to a true uniform grade. Face forms shall be left in place until the concrete has hardened sufficiently so that they can be removed without injury to the curb.

The Contractor shall use at all times, a ten (10) foot straightedge for finishing curb and gutter sections. Irregularities shall be corrected by adding or removing concrete. All disturbed places shall be floated with a wooden or metal float that is not less than thirty-six (36) inches long and not less than six (6) inches wide, and screeded. No water, curing compound, or cement shall be added to the surface of the concrete to aid in finishing. Edges of the concrete in contact with the forms, structures, and joints shall be carefully finished with an edger having a three-eighths inch ($\frac{3}{8}$) inch radius prior to the concrete reaching initial set. Concrete shall be finally finished with a wood float and lightly broomed to a slightly roughened

surface. On grades less than one (1) percent, the Contractor shall check for depressions before final finish so that no ponding exists.

Exposed faces of curbs and sidewalks shall be finished to the line and grade shown on the plans. The surface shall be floated to a smooth but not slippery finish. Sidewalk and curb shall be broomed or combed and edged, unless otherwise indicated by the Town. After completion of brooming and before concrete has initial set, all edges in contact with the forms shall be tooled with an edger having a three-eighths ($\frac{3}{8}$) inch radius.

No dusting or topping of the surface to facilitate finishing shall be permitted.

Immediately following the removal of forms, all fins and irregular projections shall be removed from all surfaces except from those which are not to be exposed or are not to be waterproofed. On all surfaces, the cavities produced by form ties, honeycomb spots, broken corners or edges, and other defects, shall be thoroughly cleaned, moistened with water and carefully pointed and trued with a mortar consisting of cement and fine aggregate. The surface shall be left sound, smooth, even, and uniform in color. Mortar used in pointing shall not be more than thirty (30) minutes old. All construction and expansion joints in the completed work shall be left carefully tooled and free of all mortar and concrete. The joint filler shall be left exposed for its full length with clean and true edges.

838.02 Curing and Protection

Fresh concrete shall be adequately protected from weather damage and mechanical injury during the curing periods. Curing processes described herein may be used at the option of the Town. The selected curing process shall be started as soon as it can be performed without injury to the concrete surface. The use of a white membrane-curing compound is required. The following curing procedures may be used, subject to the approval of the Town:

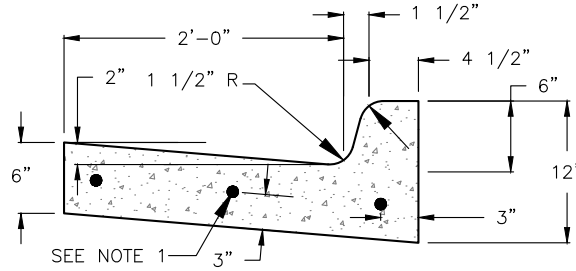
- A. Ponding (for slabs or footings)
- B. Spraying
- C. Placing wet burlap, earth, or cotton mats
- D. Covering with waterproof paper or polyethylene plastic
- E. Using a liquid membrane curing compound

Membrane curing compound shall not be used when the concrete surface shall be painted. The membrane curing compound shall not permanently discolor the concrete surface. Where membrane curing compound is not used, the curing process shall be as follows:

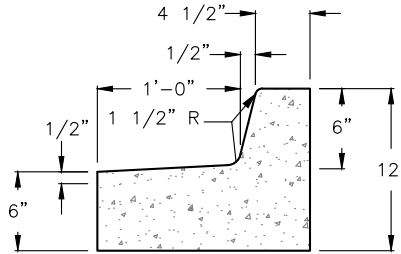
- A. Surfaces being wetted by ponding, spraying, or wetted material shall be kept completely wetted, with an excess of free water on the surface, at all times for the first seventy two (72) hours. After this period, but for the remaining four (4) days, a wetting schedule shall be followed whereby the concrete is wetted on a schedule approved by the Town.
- B. Surfaces being protected by waterproof paper or polyethylene plastic cover shall receive special attention during the first seventy-two (72) hours to ensure there is actually free moisture on the surface of the concrete under the waterproof surface. The Town Engineer or Town Construction Inspector may require the removal of the cover and a wetting of

the surface when, in his judgment, there is insufficient moisture for curing. After the first seventy-two (72) hours the cover shall be kept tightly in place for the remainder of the curing period.

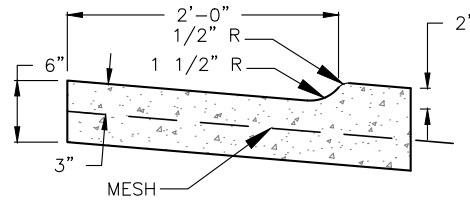
- C. Surfaces being protected by liquid curing membrane, immediately after the surface water has disappeared from the concrete surface, shall be sprayed with the liquid membrane curing compound (white pigmented) under pressure to the concrete surface at a rate not less than one (1) gallon per one hundred fifty (150) square feet with a spray nozzle, or nozzles, so that it covers the entire pavement with a uniform, water-impermeable film. If the forms are removed within seven (7) days, the exposed sides and edges shall be sprayed in the above described manner or the backfill completed immediately.



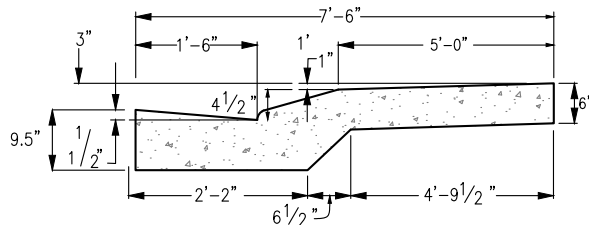
VERTICAL CURB & GUTTER



MEDIAN CURB & GUTTER

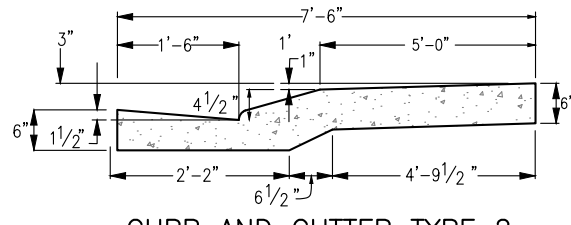


TYPICAL CURB & GUTTER AT DRIVEWAY



CURB AND GUTTER TYPE 2

(SECTION MS)
(USE WITH 9.5' CONCRETE)



CURB AND GUTTER TYPE 2

(SECTION MS)
(4" MOUNTABLE WITH SIDEWALK)

NOTES:

1. NO. 5 EPOXY COATED REBAR SHALL BE USED IN ALL CURB RETURNS WITH 25' OR LARGER RADII. THE REBAR SHALL BE USED FROM BEGINNING TO END OF THE CURB RETURN AND BE FULLY SUPPORTED WITH STEEL CHAIRS.
2. SUBGRADE UNDER CURB, GUTTER AND SIDEWALK TO BE COMPACTED TO 95% AASHTO T-180.
3. ALL ATTACHED SIDEWALK SHALL BE PLACED MONOLITHIC WITH THE CURB AND GUTTER.
4. CONCRETE TO BE CDOT B/D 4,500 PSI STRENGTH
5. REMOVE AND REPLACE SECTIONS OF CURB AND GUTTER/SIDEWALK SHALL BE REMOVED FROM CONTROL JOINT TO CONTROL JOINT. #5 X 24 INCH EPOXY COATED REBAR DOWELS SHALL BE DRILLED AND EPOXIED 12 INCHES INTO EXISTING CONCERT, MINIMUM 3 LOCATIONS

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

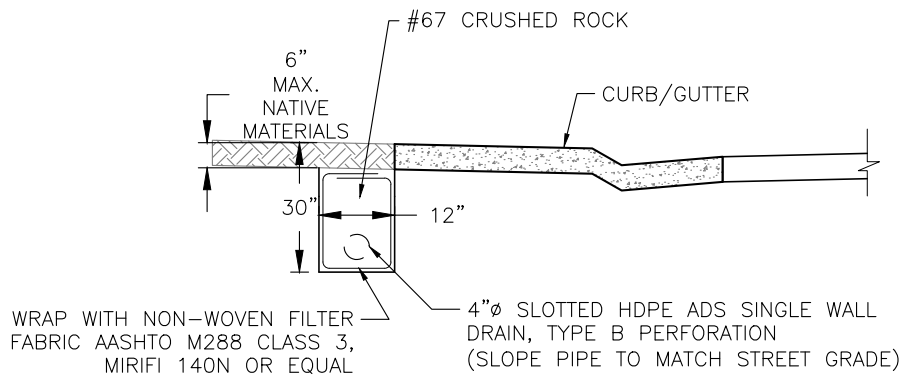
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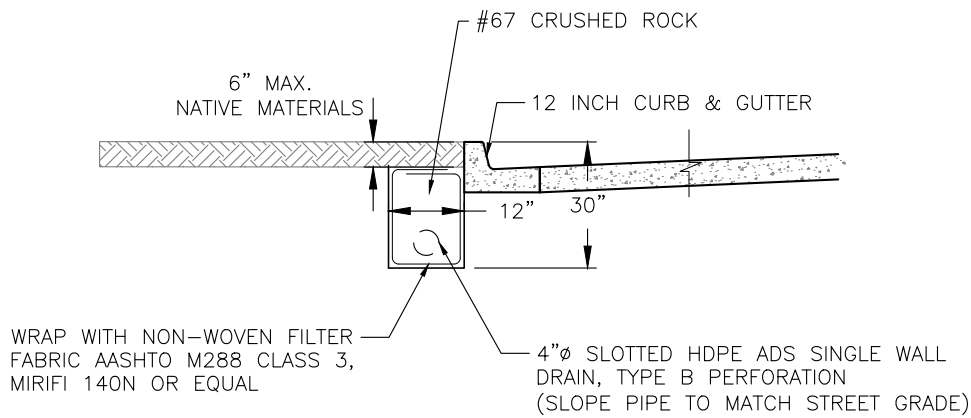
CURB, GUTTER, AND WALK

DATE: JANUARY 2019

SHEET 800-1



UNDERDRAIN AT BACK OF WALK



UNDERDRAIN AT CURB

NOTES:

1. UNDER DRAIN PIPE SHALL BE CONNECTED TO A STORM SEWER INLET. PIPE TO BE INSERTED THROUGH WALL OF INLET AND PENETRATION SHALL BE GROUTED AROUND PIPE TO ENSURE IT IS WATER TIGHT.
2. MIRIFI FABRIC TO BE BURRITO WRAPPED AND FABRIC OVERLAP PINNED TO PREVENT CONTAMINATION OF #67 CRUSHED ROCK

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

N.T.S.

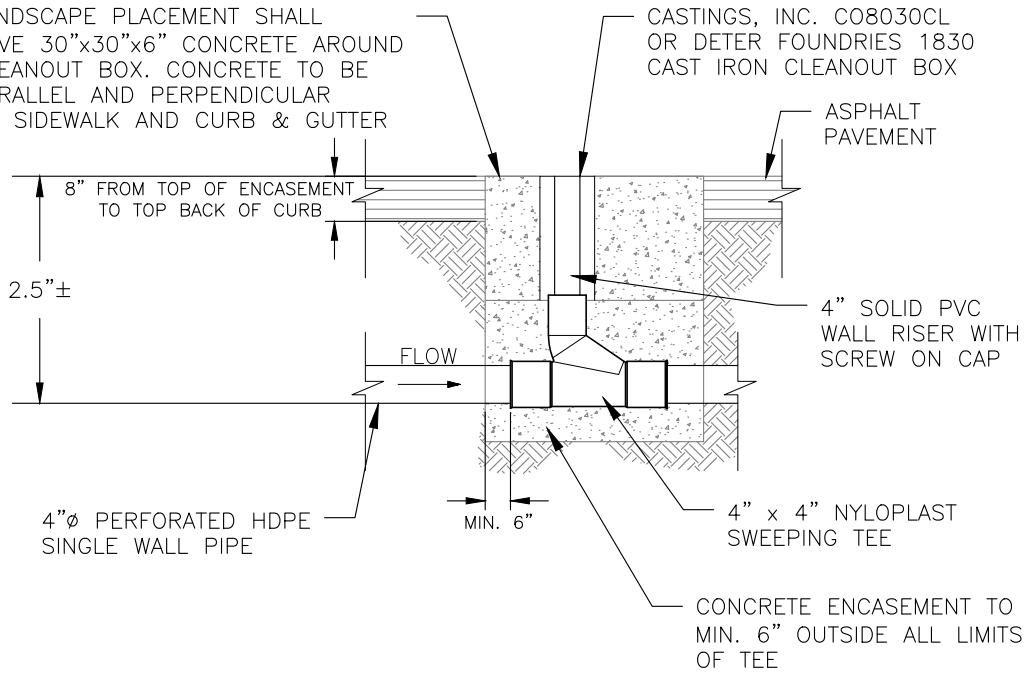


CURB DRAIN DETAIL

DATE: JANUARY 2019

SHEET 800-2

LANDSCAPE PLACEMENT SHALL HAVE 30"x30"x6" CONCRETE AROUND CLEANOUT BOX. CONCRETE TO BE PARALLEL AND PERPENDICULAR TO SIDEWALK AND CURB & GUTTER



NOTES:

1. CLEAN OUTS TO BE PLACED AT END OF CURB DRAIN (HIGH POINT) AND AT A MAXIMUM SPACING OF EVERY 400'.
2. PLACE DOUBLE CLEANOUTS AT HIGH POINTS, TOP OF CUL-DE-SACS, AND AS DIRECTED BY TOWN ENGINEER.
3. PLACE CLEANOUTS AT EVERY CHANGE OF DIRECTION

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

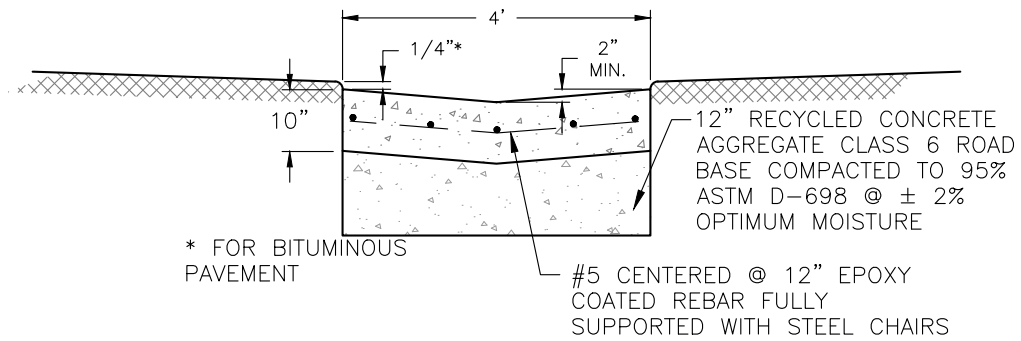
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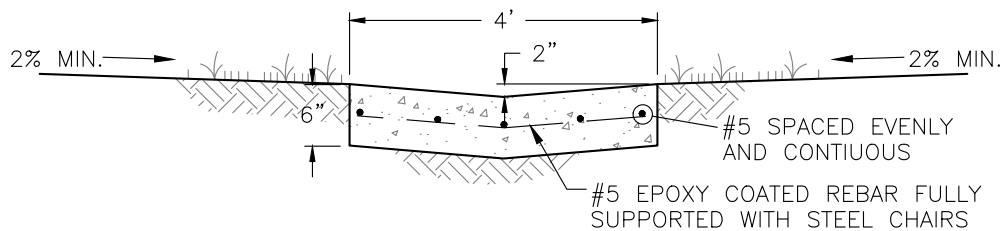
CURB DRAIN CLEANOUT

DATE: JANUARY 2019

SHEET 800-3



PARKING AREAS, FIRE LANE, ALLEYS, AND DRIVEWAYS



OPEN AREAS (GRASS)

NOTES:

1. CONCRETE TO BE CDOT CLASS B/D 4,500 PSI
2. TOOL JOINTS EVER 10 LINEAL FEET
3. DOWEL 6" INTO EXISTING CONCRETE USING #5 EPOXY COATED REBAR

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

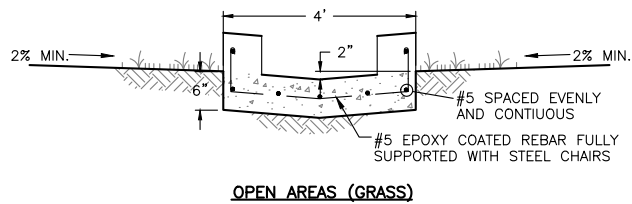
N.T.S.



VALLEY GUTTER

DATE: JANUARY 2019

SHEET 800-4



NOTES:

1. CONCRETE TO BE CDOT CLASS B/D 4,500 PSI
2. TOOL JOINTS EVER 10 LINEAL FEET
3. DOWEL 6" INTO EXISTING CONCRETE USING #5 EPOXY COATED REBAR

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

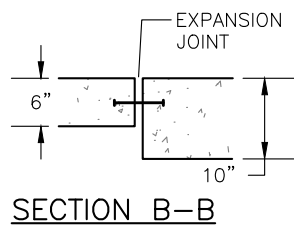
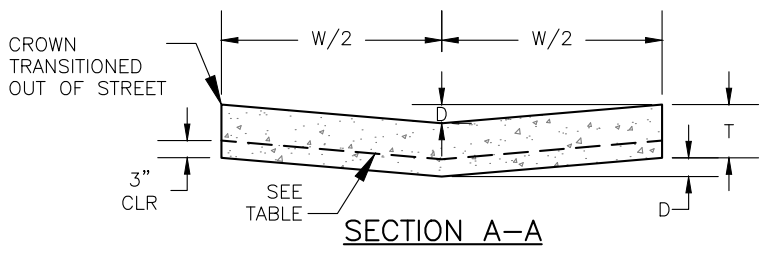
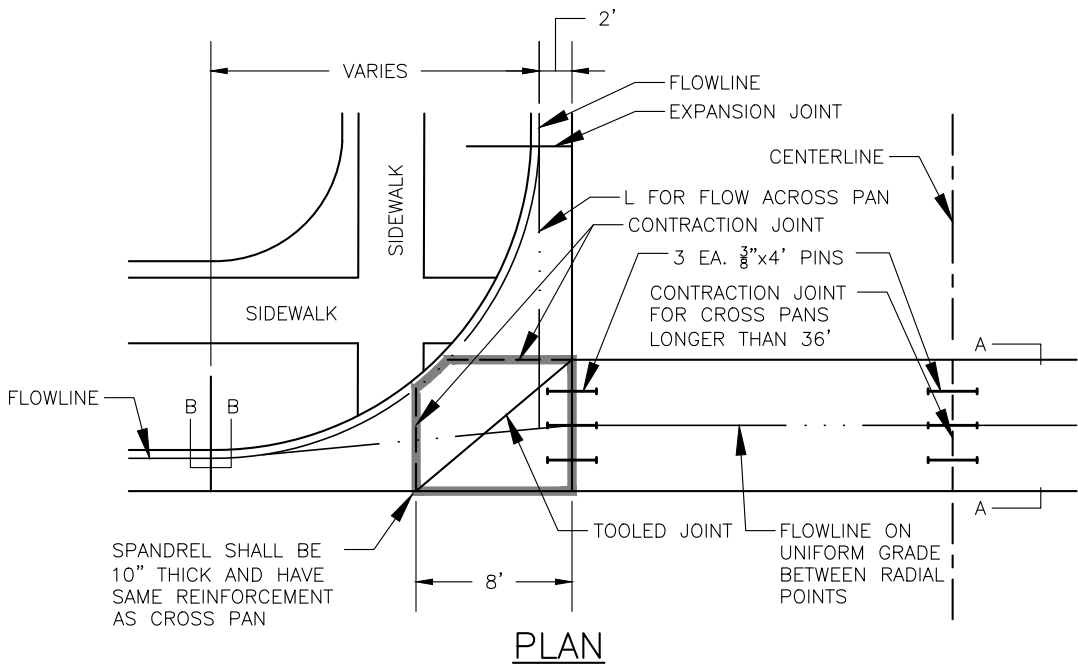
N.T.S.



TRICKLE CHANNEL

DATE: JANUARY 2019

SHEET 800-4a

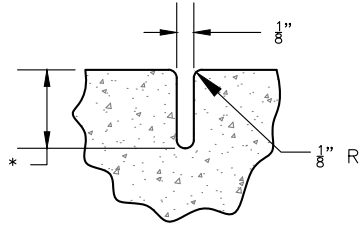


NOTE: CONCRETE TO BE CDOT CLASS B/D 4,500 PSI

WIDTH (W)	DEPTH (D)	THICKNESS (T)
8'	2"	10"
10'	2 1/2"	10"

USE 10' PAN WHEN PARALLEL TO ARTERIALS AND COLLECTORS

PAN LENGTH	REPLACE WITH EPOXY COATED REBAR HAVING END AREA OF
36'	0.10 SQ. IN. PER FT. (#4@18" E.W.)
46'	0.13 SQ. IN. PER FT. (#4@18" E.W.)
64'	0.20 SQ. IN. PER FT. (#4@12" E.W.)
84'	0.26 SQ. IN. PER FT. (#4@ 9" E.W.)



* 1/4" IF TEMPLATES ARE NOT USED

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

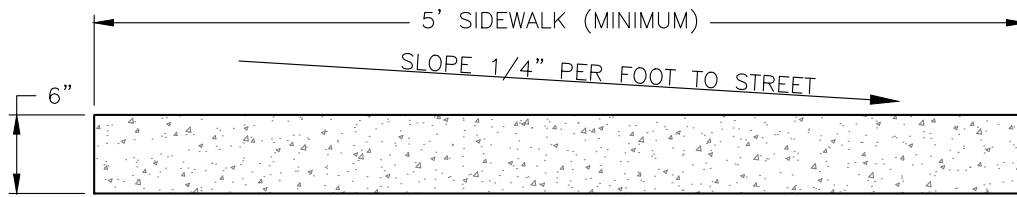
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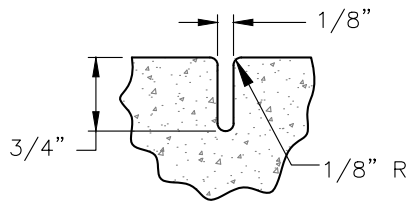
CROSS PAN

DATE: JANUARY 2019

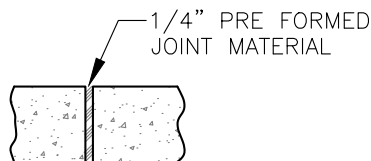
SHEET 800-5



STANDARD DETACHED/ATTACHED WALK



CONTRACTION OR
WEAKENED PLANE
JOINT
(EVERY 10 FEET)



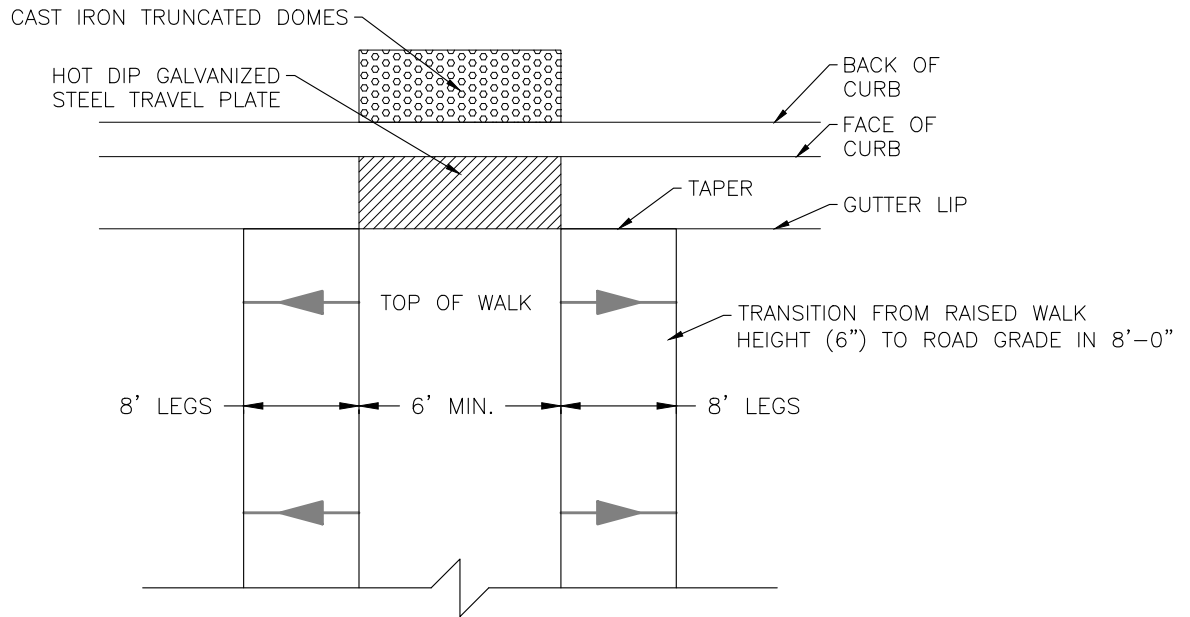
EXPANSION
JOINT
(EVERY 100 FEET)

NOTES:

1. CONCRETE TO BE CDOT CLASS B/D 4,500 PSI STRENGTH.
2. CONCRETE TO HAVE LIGHT BROOM FINISH.
3. SIDEWALK CROSS SLOPE SHALL NOT EXCEED 2%

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

N.T.S.



NOTES:

1. RAISED WALK SHALL FOLLOW CROWN OF ROAD WITH CONSTANT THICKNESS OF 6".
2. RAMP OR ELEVATED APPROACHES MAY BE USED.
3. RAISED WALKS ARE NOT ALLOWED ON MAJOR COLLECTOR OR ARTERIAL ROADWAYS.
4. SEE DETAIL 800-17 FOR SECTION.

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

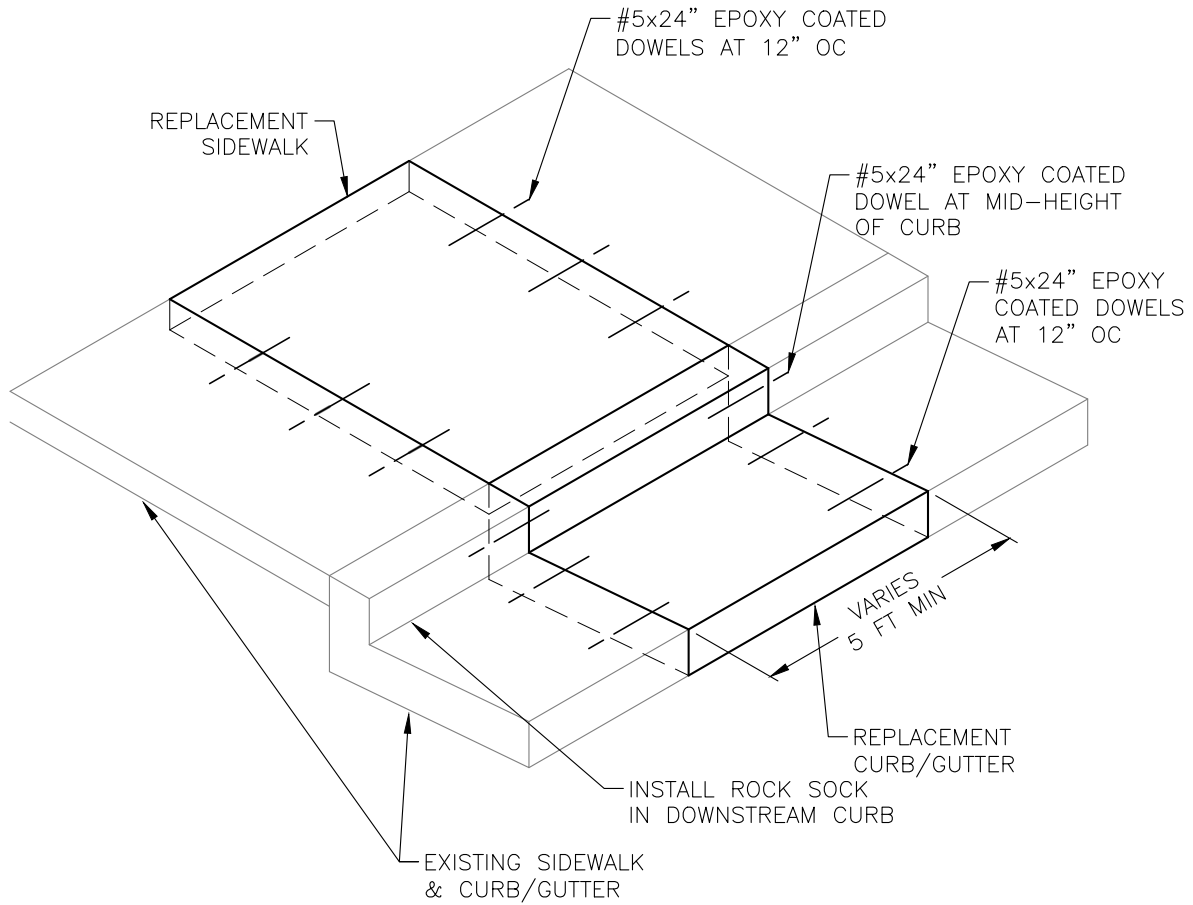
N.T.S.



RAISED PEDESTRIAN WALK

DATE: JANUARY 2019

SHEET 800-7



NOTE:

12" OF SUBGRADE TO BE REMOVED AND REPLACED WITH CLASS 6 RECYCLED CRUSHED CONCRETE ROADBASE

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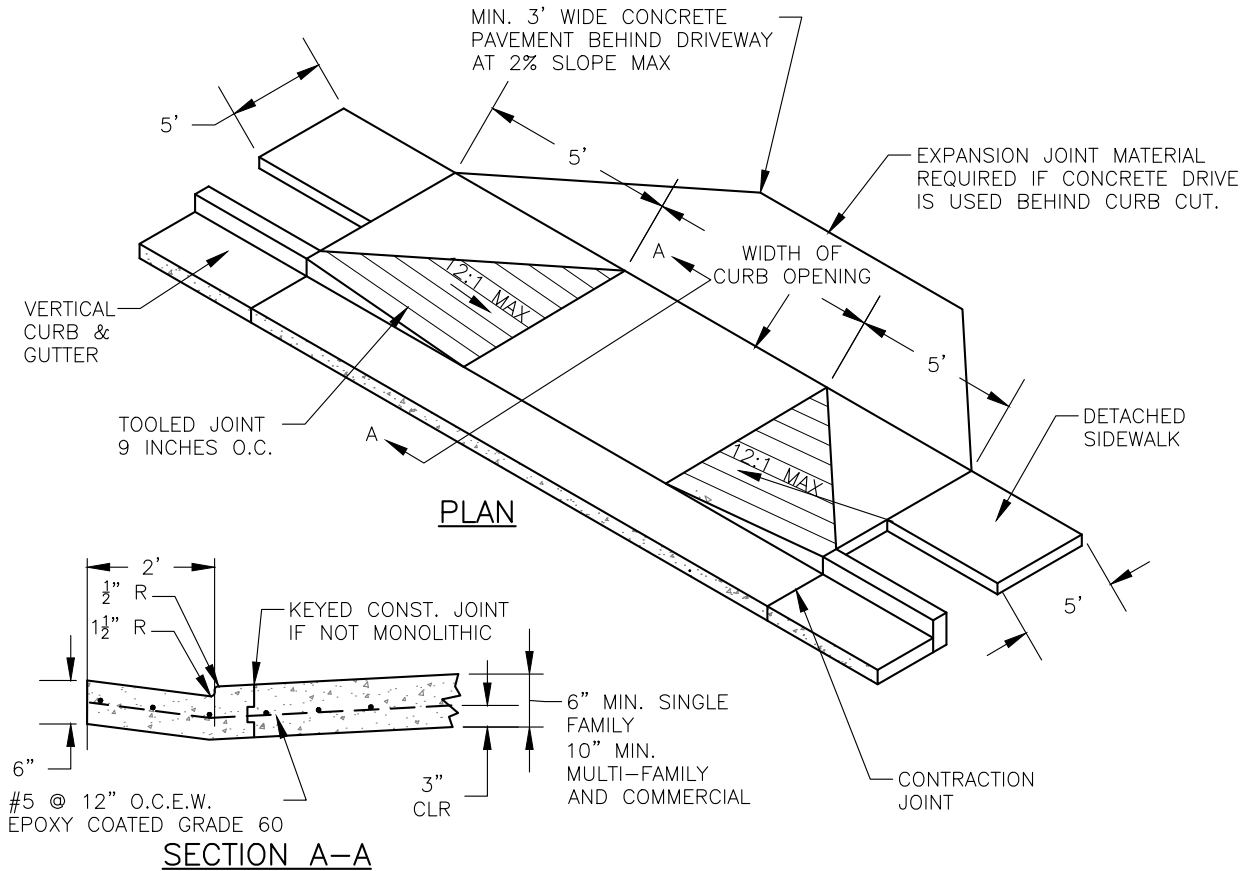
N.T.S.



SIDEWALK REPLACEMENT
VERTICAL CURB/ATTACHED
WALK

DATE: JANUARY 2019

SHEET 800-8



NOTES:

1. EXTEND BACK OF CURB CUT TO BACK OF SIDEWALK.
2. TOWN ENGINEER SHALL APPROVE LOCATION OF CURB CUT BEFORE CONSTRUCTION.
3. AN ACCESS SHALL BE LIMITED TO RIGHT TURNS ONLY, UNLESS (1) IT HAS THE POTENTIAL FOR SIGNALIZATION, (2) LEFT TURNS WOULD NOT CREATE UNREASONABLE CONGESTION OR SAFETY PROBLEMS AND LOWER THE LEVEL OF SERVICE, AND (3) ALTERNATIVES TO THE LEFT TURNS WOULD NOT CAUSE UNACCEPTABLE TRAFFIC OPERATION AND SAFETY PROBLEMS TO THE GENERAL STREET SYSTEM.
4. CONCRETE TO BE 4,500 psi STRENGTH.
5. CAST IRON TRUNCATED DOME WARNING PLATES SHALL BE REQUIRED IN SIDEWALKS CONNECTING TO DRIVEWAY/ALLEYWAY CUTS IN COMMERCIAL AREAS.

WIDTH OF CURB OPENINGS (UNITS)

	RESIDENTIAL SF	MF	COMMERCIAL	SERVICE STATION	INDUSTRIAL
MINOR COLLECTOR	NA	30-35	40-50	40-50	40-50
LOCAL	8-24	30-35	40-50	40-50	40-50

CURB OPENINGS 30' OR MORE MUST BE CONSTRUCTED WITH RADIUS CURB RETURNS.

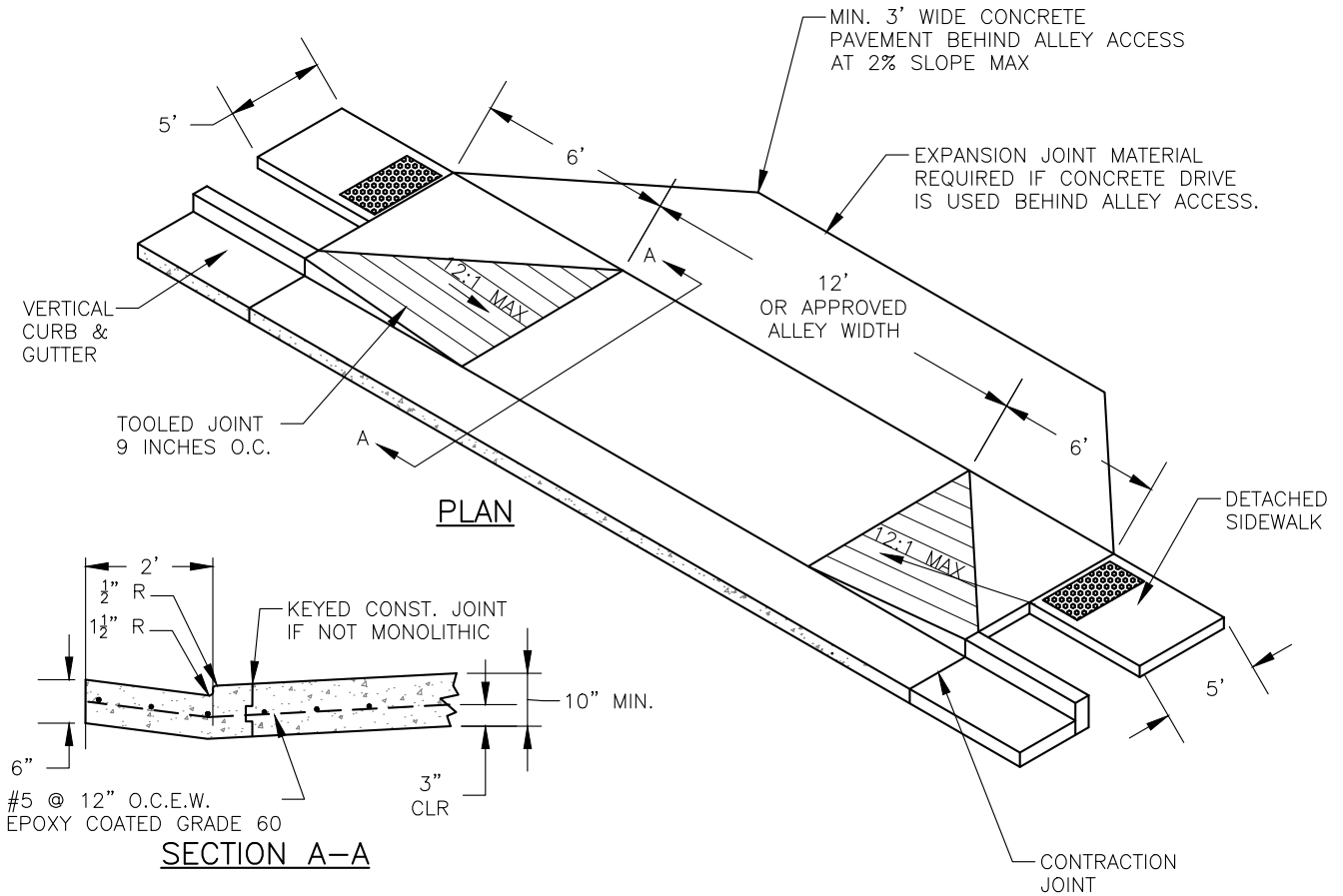
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N.T.S.



DRIVEWAY CUT

DATE: JANUARY 2019 SHEET 800-9



NOTES:

1. EXTEND BACK OF CURB CUT TO BACK OF SIDEWALK.
2. TOWN ENGINEER SHALL APPROVE LOCATION OF CURB CUT BEFORE CONSTRUCTION.
3. AN ACCESS SHALL BE LIMITED TO RIGHT TURNS ONLY, UNLESS (1) IT HAS THE POTENTIAL FOR SIGNALIZATION, (2) LEFT TURNS WOULD NOT CREATE UNREASONABLE CONGESTION OR SAFETY PROBLEMS AND LOWER THE LEVEL OF SERVICE, AND (3) ALTERNATIVES TO THE LEFT TURNS WOULD NOT CAUSE UNACCEPTABLE TRAFFIC OPERATION AND SAFETY PROBLEMS TO THE GENERAL STREET SYSTEM.
4. CONCRETE TO BE 4,500 psi STRENGTH.
5. CAST IRON TRUNCATED DOME WARNING PLATES SHALL BE REQUIRED.

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N.T.S.



ALLEY ACCESS

DATE: NOVEMBER 2019

SHEET 800-9a

GENERAL NOTES FOR CURB RAMPS:

1. THE FOLLOWING CURB RAMP TYPES ARE GENERAL REPRESENTATIONS AND MAY REQUIRE MODIFICATION TO FIT ACTUAL FIELD CONDITIONS. MOST APPLICATIONS WITHIN THE TOWN ARE RETROFIT SITUATIONS WHERE ONE OR MORE CONSTRAINTS SUCH AS LIMITED R.O.W. SIGNIFICANT GRADE DIFFERENCES, AND DRAINAGE CONCERNS MUST BE TAKEN INTO ACCOUNT IN LOCATING THE CURB RAMP(S). DESIGN RESOURCES ARE AVAILABLE WITHIN THE TOWN TO ASSIST WITH THE PROPER SELECTION AND APPLICATION OF RAMP TYPE TO MAINTAIN APPLICABLE STANDARDS.
2. CURB RAMPS ALIGNED IN THE DIRECTION OF PEDESTRIAN TRAVEL ARE THE PREFERRED STANDARD FOR NEW RAMP CONSTRUCTION. DIRECTIONAL RAMPS SHALL BE POSITIONED TO DIRECTLY ALIGN WITH OPPOSING CURB RAMPS, UNLESS SPECIFICALLY APPROVED OTHERWISE BY PUBLIC WORKS.
3. PLACEMENT OF DIAGONAL OR MID-BLOCK CURB RAMPS MUST BE APPROVED BY PUBLIC WORKS.
4. FOR EACH CURB RAMP INSTALLATION, ADDITIONAL REMOVAL AND REPLACEMENT OF EXISTING SIDEWALKS MAY BE REQUIRED TO FACILITATE PROPER TRANSITIONS TO RAMP.
5. CURB RAMPS SHALL MATCH APPROACHING CLEAR SIDEWALK WIDTH, OR 5' MINIMUM, WHICHEVER IS GREATER. CURB RAMP THROAT WIDTH SHALL NOT EXCEED 8'.
6. THE DISTANCE BETWEEN THE FLOW LINE (FL) AND THE BACK OF THE CURB RAMP IS VARIABLE DEPENDENT ON SITE CONDITIONS BUT SHALL BE NO LESS THAN 5'-6" AT THE RAMP CENTERLINE. IN NO CASE MAY THE RAMP SLOPE EXCEED 1" PER FOOT (12:1), OR BE LESS THAN ¼" PER FOOT (2%), EXCEPT AS ALLOWED BY APPLICABLE REGULATIONS.
7. THE MAXIMUM CROSS SLOPE OF THE CURB RAMP SURFACE SHALL BE 2%. WHERE RAMPS ARE BEING CONSTRUCTED ON EXISTING STREETS, THE CROSS SLOPE OF THE RAMP CAN INCREASE BEYOND 2% TO MATCH THE LONGITUDINAL STREET FLOWLINE GRADES AT THE BOTTOM OF THE RAMP. FOR CONSTRUCTION OF MULTIPLE CURB RAMPS AT CORNERS, THE LONGITUDINAL GRADE OF THE CURB AND GUTTER BETWEEN THE RAMPS SHALL NOT EXCEED AN AMOUNT THAT CAUSES EITHER RAMP TO FALL OUTSIDE SLOPES AS DEFINED IN NOTE 6.
8. THE MAXIMUM 'SLOPE' OF THE GUTTER IN FRONT OF THE RAMP SHALL BE 5/8 " PER FOOT (20:1). FOR A STANDARD 2' GUTTER PAN, THIS RESULTS IN A MAXIMUM GUTTER DEPTH OF NO MORE THAN 1 ¼". TO TRANSITION FROM THE STANDARD 2" GUTTER DEPTH TO THE 1 ¼" DEPTH IN FRONT OF THE RAMP, WARP THE GUTTER LIP IN A 5' CURB AND GUTTER SECTION ADJACENT TO THE RAMP. AT THE DISCRETION OF PW, THE 1 ¼" GUTTER DEPTH MAY BE CONTINUED AROUND THE FULL CURB RETURN RADIUS.
9. A LEVEL (2% SLOPE MAX IN ANY DIRECTION) LANDING AREA, 5' DEEP TYPICAL BY THE WIDTH OF THE RAMP THROAT SHALL BE REQUIRED AT THE TOP OF EACH CURB RAMP. THE DEPTH OF THE LEVEL LANDING AREA IS TYPICALLY SET AT 5' TO MATCH WIDTH OF APPROACHING SIDEWALKS, BUT IN NO CASES SHALL BE LESS THAN 4'.
10. IF POSSIBLE, DRAINAGE STRUCTURES SHALL NOT BE PLACED IN LINE WITH RAMPS. LOCATION OF THE RAMP SHALL TAKE PRECEDENCE OVER LOCATION OF THE DRAINAGE STRUCTURE, EXCEPT WHERE EXISTING STRUCTURES ARE BEING PRESERVED IN NEW CONSTRUCTION AREAS.
11. ALL CURB RAMPS SHALL BE CONSTRUCTED WITH TACTILE WARNINGS (CAST IRON TRUNCATED DOME PANEL) AS DEFINED IN THE AMERICANS WITH DISABILITIES ACT ACCESS GUIDELINES (ADAAG) LATEST REVISION. THE CAST IRON TRUNCATED DOME PANEL(S) SHALL BE INSTALLED ACROSS THE FULL WIDTH OF THE RAMP, AND SET SO THAT THE CLOSEST POINT(S) TO THE STREET IS 6" FROM THE FACE OF CURB/FLOWLINE. AT NO POINT SHALL THE STREET EDGE OF THE TRUNCATED DOME PANEL BE LOCATED MORE THAN 8" FROM THE FACE OF CURB/ FLOWLINE.
12. AS POSSIBLE, THE TRUNCATED DOME PATTERN SHALL BE LAID OUT PARALLEL TO THE DIRECTION OF PEDESTRIAN TRAVEL. THIS PARAMETER SHALL BE SECONDARY TO REQUIREMENTS OF NOTE 11.
13. CAST IRON TRUNCATED DOME PANELS SHALL BE BARE METAL CONTRAST WITH THE ADJOINING WALK SURFACE AS REQUIRED BY ADAAG, EXCEPT WHEN RETROFITTING OLD RED CONCRETE RAMPS OR WHERE SHOWN ON BLENDED TRANSITION RAMPS, AND THEN THE COLOR SHALL BE GRAY. COLORS MUST BE APPROVED BY PW PRIOR TO CONSTRUCTION.
CONCRETE FOR CURB RAMP CONSTRUCTION SHALL NOT BE STAINED OR HAVE COLOR ADDED.

A SAMPLE OF THE CAST IRON TRUNCATED DOMES SHALL BE SUBMITTED TO, AND APPROVED BY PW PRIOR TO CONSTRUCTION.
14. TRUNCATED DOME SIZE SHALL MEET ANSI REQUIREMENTS AND HAVE NON-SLIP TOPS.

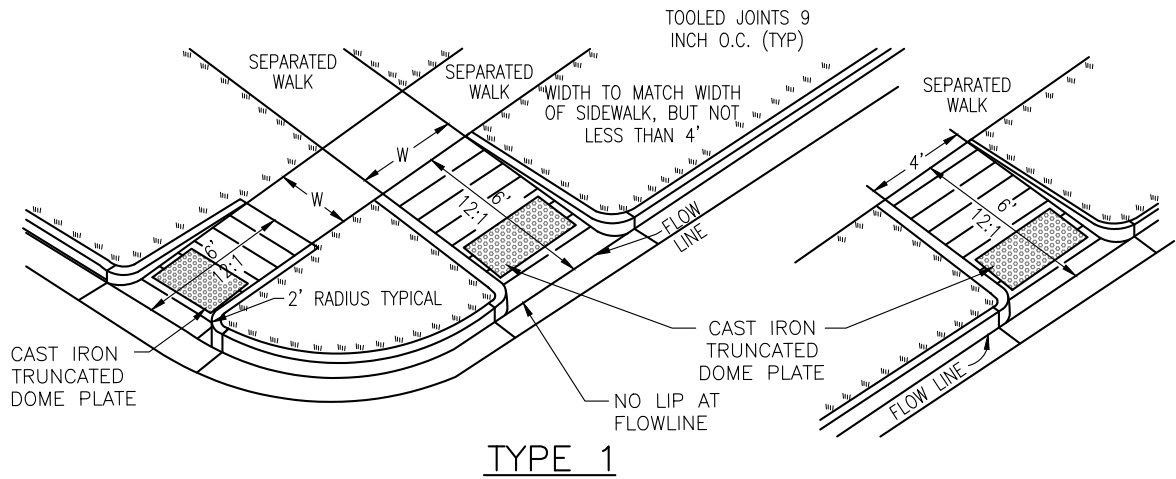
ABOVE TRUNCATED DOMES, CURB RAMPS SHALL BE SCORED WITH DUMMY GROOVES 3/8" DEEP ON 12" CENTERS. THE GROOVES SHALL BE PLACED IN THE RAMP SECTION ABOVE THE TRUNCATED DOMES AND ALIGNED PARALLEL TO THE DIRECTION OF THE RAMP AND STREET CROSSING.
15. ANY REQUIRED TRANSITION BETWEEN VERTICAL AND MOUNTABLE CURB ADJACENT TO RAMPS SHOULD OCCUR IN A MAXIMUM OF 10'.
16. AN ASPHALT PATCH IS NORMALLY REQUIRED IN STREET AREAS ADJACENT TO NEW CURB RAMP INSTALLATIONS.
17. PAY LIMITS OF ALL RAMPS ARE COMPRISED OF ALL AREA SHOWN WITH CONCRETE HATCHING, ON THE APPLICABLE DETAILS, UNLESS OTHERWISE NOTED.
18. OTHERWISE NOTED.



CURB RAMP NOTES

DATE: JANUARY 2019

SHEET 800-10



NOTES:

1. FOR USE IN AREAS WHERE THE SIDEWALK IS SET BACK FROM THE STREET, AND WHEELCHAIR ACCESS FROM THE SIDE OF THE RAMP IS NOT LIKELY TO OCCUR BECAUSE THE APPROACH AREA IS COVERED BY LAWN OR GRAVEL, OR AN OBSTRUCTION IS PRESENT. TYPE 1 CAN BE USED ANYWHERE IN THE BLOCK.
2. CONCRETE TO BE CDOT CLASS B/D 4,500 PSI.

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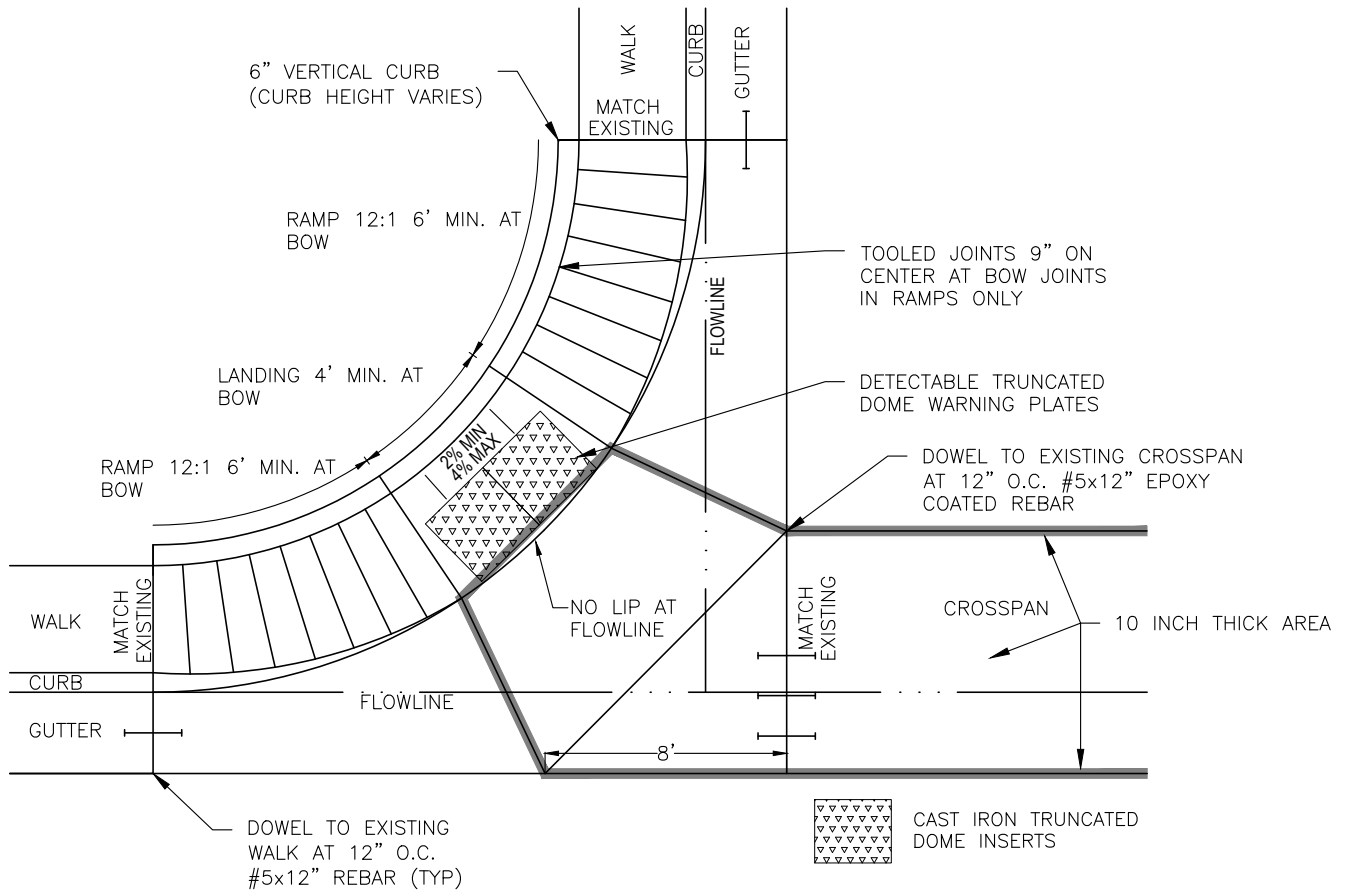
N.T.S.



TYPE 1 HANDICAP RAMP

DATE: JANUARY 2019

SHEET 800-11



TYPE 2 CROSSPAN FILLET

NOTES:

1. CONCRETE TO BE CDOT CLASS B/D 4,500 PSI.
2. ALL NEW CONCRETE SHALL BE DOWELED TO EXISTING CONCRETE WITH #5x12" REBAR AT 12" O.C.

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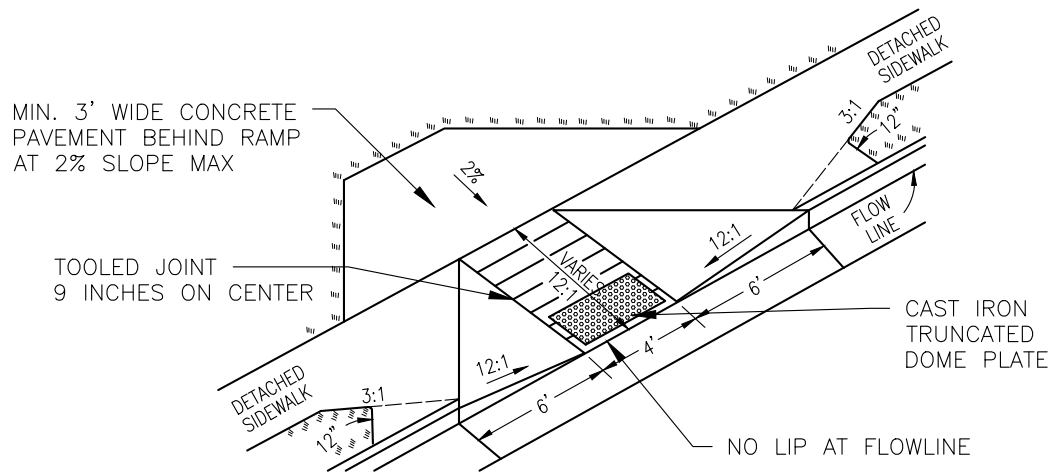
N.T.S.



TYPE 2 HANDICAP RAMP

DATE: JANUARY 2019

SHEET 800-12



TYPE 3

NOTES:

1. RAMP IS FOR USE WHERE THE SIDEWALK EXTENDS TO THE CURB OR CAN BE EASILY TRANSITIONED TO PERMIT WHEELCHAIR ACCESS TO THE RAMP FROM THE SIDE. TYPE 3 CAN BE USED ANYWHERE IN THE BLOCK, AS WELL AS AT INTERSECTIONS.
2. CONCRETE TO BE CDOT CLASS B/D 4,500 PSI

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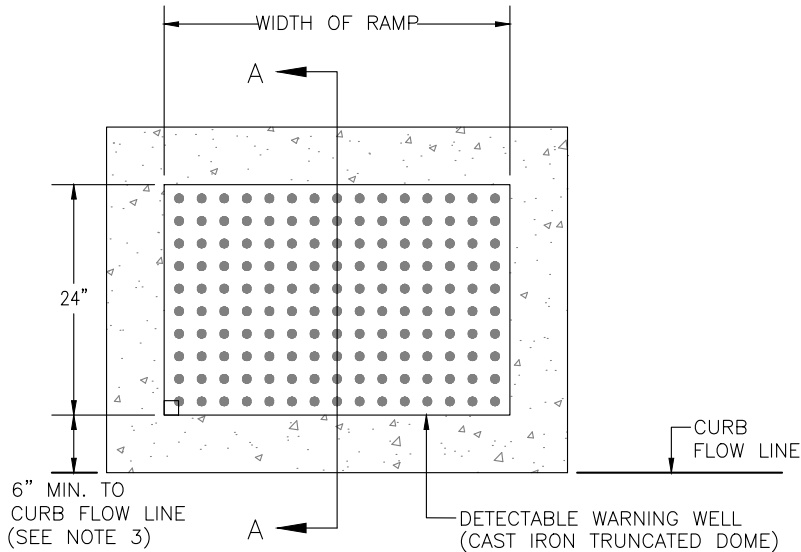
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TYPE 3 HANDICAP RAMP

DATE: JANUARY 2019

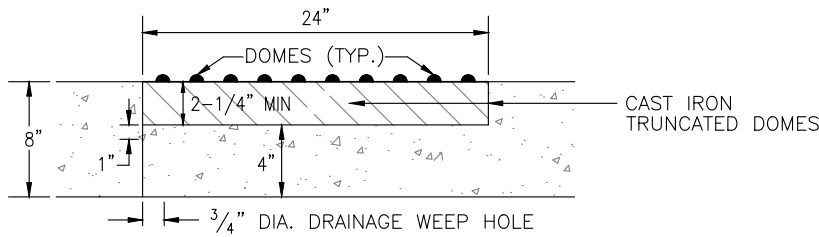
SHEET 800-13



**PLAN VIEW OF
DETECTABLE WARNING AND WELL**

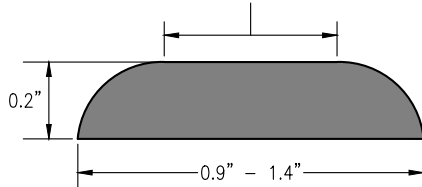
NOTES:

1. THE CAST IRON TRUNCATED DOMES SHALL BE INSTALLED AT SIDEWALK/STREET TRANSITIONS. THEY SHALL BE CAST IRON TRUNCATED DOME SURFACE. THE DOMES SHALL BE PLACED IN A SQUARE GRID.
2. THE TOP OF THE DRAINAGE WEEP HOLE SHALL BE LOCATED AT THE LOWEST POINT OF THE CAST IRON TRUNCATED DOMES WELL.
3. ALL CAST IRON TRUNCATED DOME AREAS SHALL START A MINIMUM OF 6 INCHES FROM THE FLOW LINE OF THE CURB AND NOT BE MORE THAN A MAXIMUM OF 8 INCHES FROM ANY POINT ON THE FLOW LINE OF THE CURB. ALL DETECTABLE WARNING AREAS SHALL BE 24 INCHES IN LENGTH AND COVER THE COMPLETE WIDTH OF THE RAMP AREA ONLY. THE DETECTABLE WARNING AREA SHALL BE INCLUDED
4. CONCRETE TO BE CDOT CLASS B/D 4,500 PSI

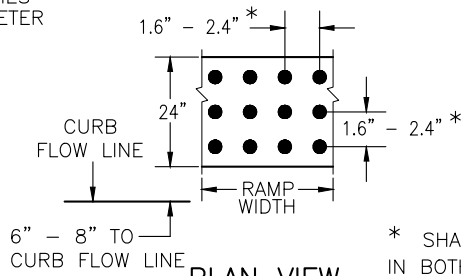


SECTION A-A

THE TOP DIAMETER OF THE TRUNCATED DOMES SHALL BE 50% TO 65% OF THE BASE DIAMETER



ELEVATION VIEW



PLAN VIEW

* SHALL BE EQUAL IN BOTH DIRECTIONS.

DOMES AND DETECTABLE WARNING DETAILS

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

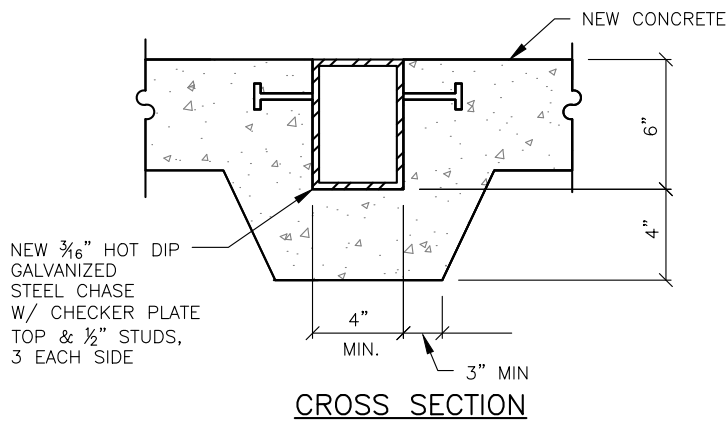
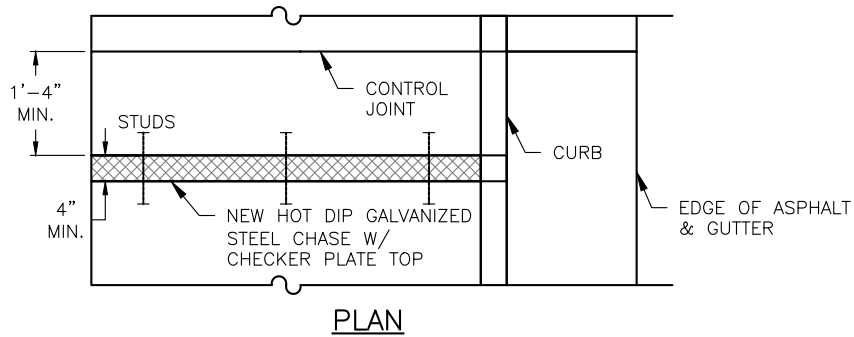
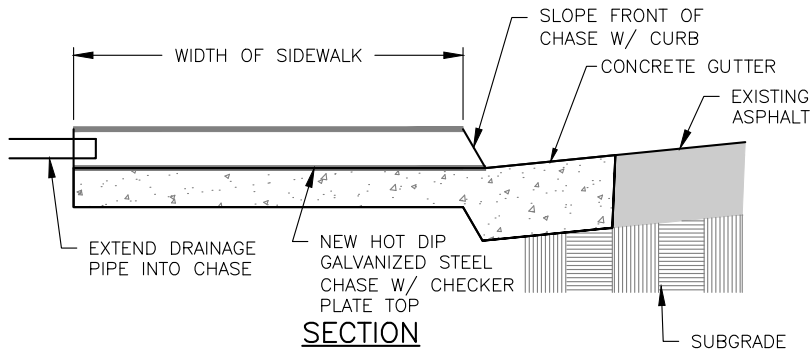
N.T.S.



CAST IRON TRUNCATED DOME

DATE: JANUARY 2019

SHEET 800-14



NOTE:

CONCRETE TO BE CDOT CLASS B/D 4,500 PSI

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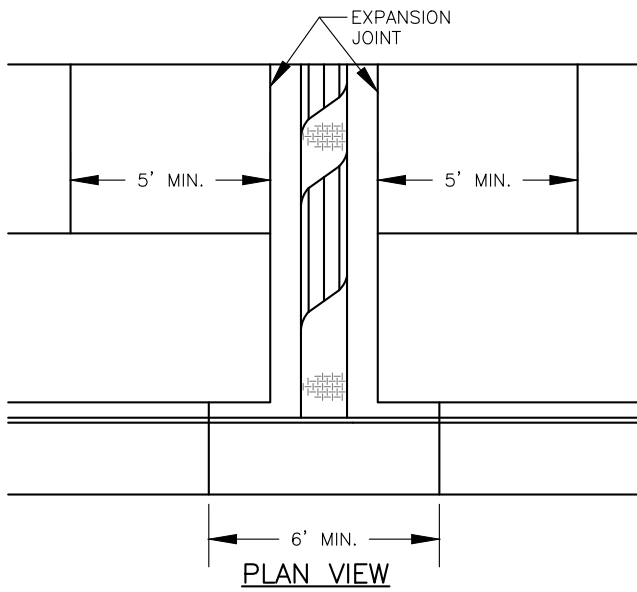
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DRAINAGE CHASE IN EXISTING ATTACHED SIDEWALK

DATE: JANUARY 2019

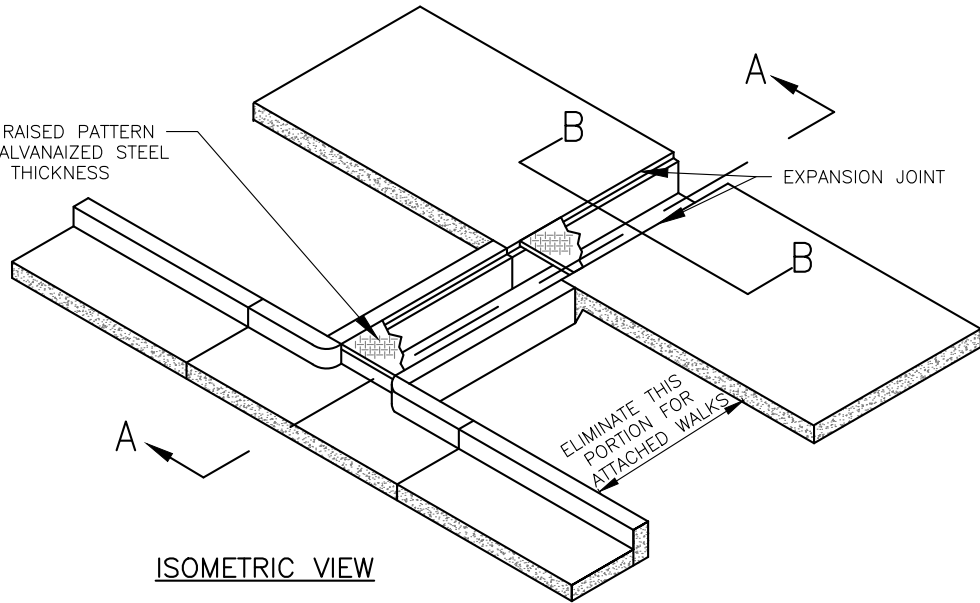
SHEET 800-15



NOTE:

CHASE NOT PERMITTED IN 4" CURB SECTION UNLESS TRANSITIONED INTO 6" VERTICAL

NON-SLIP RAISED PATTERN
HOT DIP GALVANIZED STEEL
PLATE FOR THICKNESS



NOTE:

CONCRETE TO BE CDOT CLASS B/D 4,500 PSI

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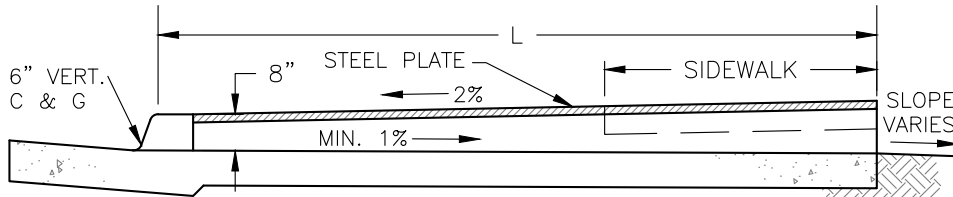
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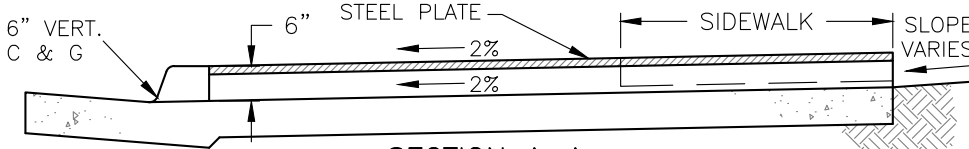
SIDEWALK CHASE IN
DETACHED SIDEWALK (1 OF 2)

DATE: JANUARY 2019

SHEET 800-16



**SECTION A-A
FLOW FROM GUTTER**

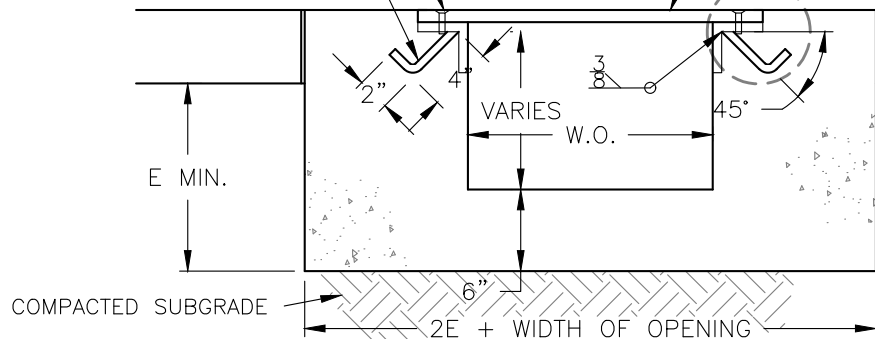


**SECTION A-A
FLOW TO GUTTER**

1/2" x 1" FLATHEAD
MACHINE SCREW BRASS OR
ELECTRO-GALVANIZED
FINISH, 2' O.C.
NO. 3 EPOXY COATED REBAR,
6" LONG, WELDED TO PLATE @
18" OC EACH SIDE

NON-SLIP RAISED PATTERN
HOT DIP GALVANIZED STEEL
PLATE. SEE CHART FOR
THICKNESS.

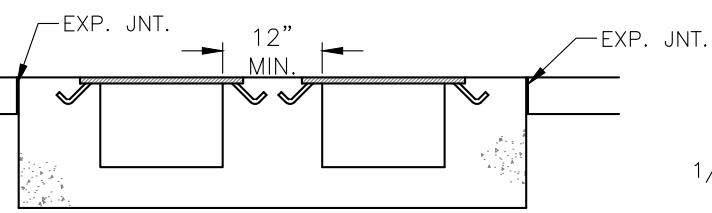
SEE DETAIL A



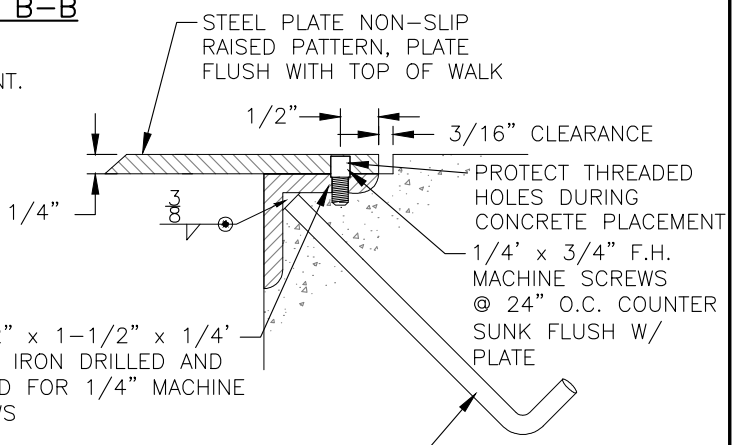
W.O., WIDTH OF OPENING	T.P., THICKNESS OF PLATE
12"	1/2"
12-18"	9/16"

E = 8" WHEN FLOW IS FROM GUTTER.
E = 6" WHEN FLOW IS TO GUTTER.

SECTION B-B



**MULTIPLE CHASE
WHEN OPENINGS ARE LARGER THAN
18"**



#3 REBAR 6" LONG, WELD
TO ANGLE, 18" O.C.

DETAIL A

NOTE:

CONCRETE TO BE CDOT CLASS B/D 4,500 PSI
WITH FIBERMESH

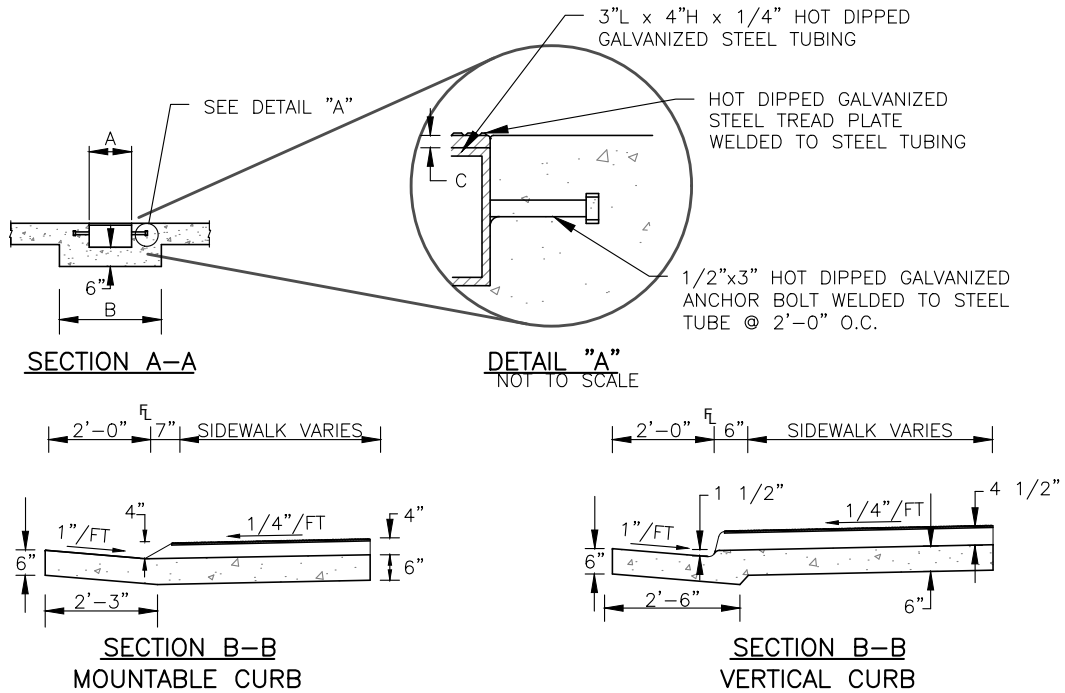
THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS
MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

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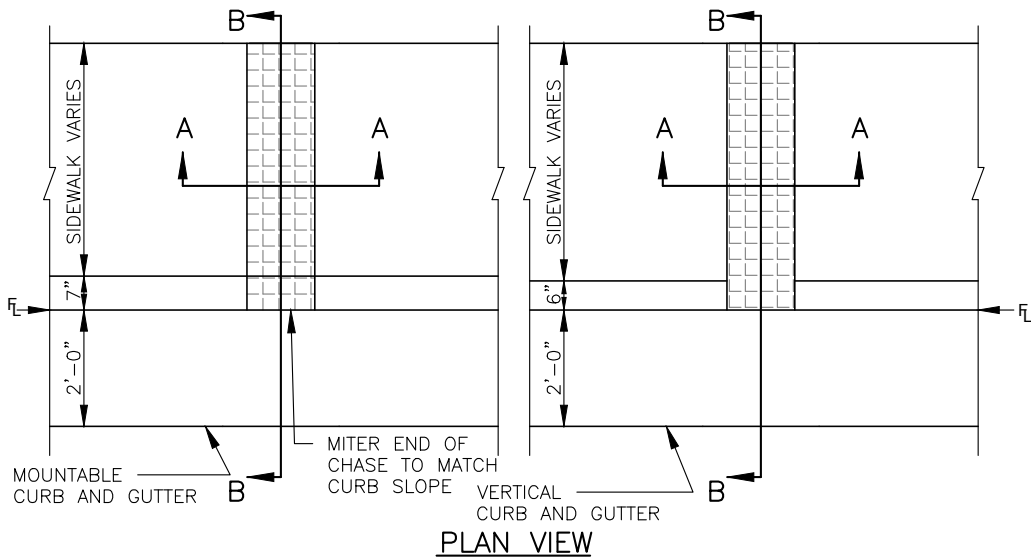


**SIDEWALK CHASE IN
DETACHED SIDEWALK (2 OF 2)**

DATE: JANUARY 2019 SHEET 800-17



TYPE	A	B	C
SC	4"	18"	3/8"



NOTE:

CONCRETE TO BE CDOT CLASS B/D 4,500 PSI.

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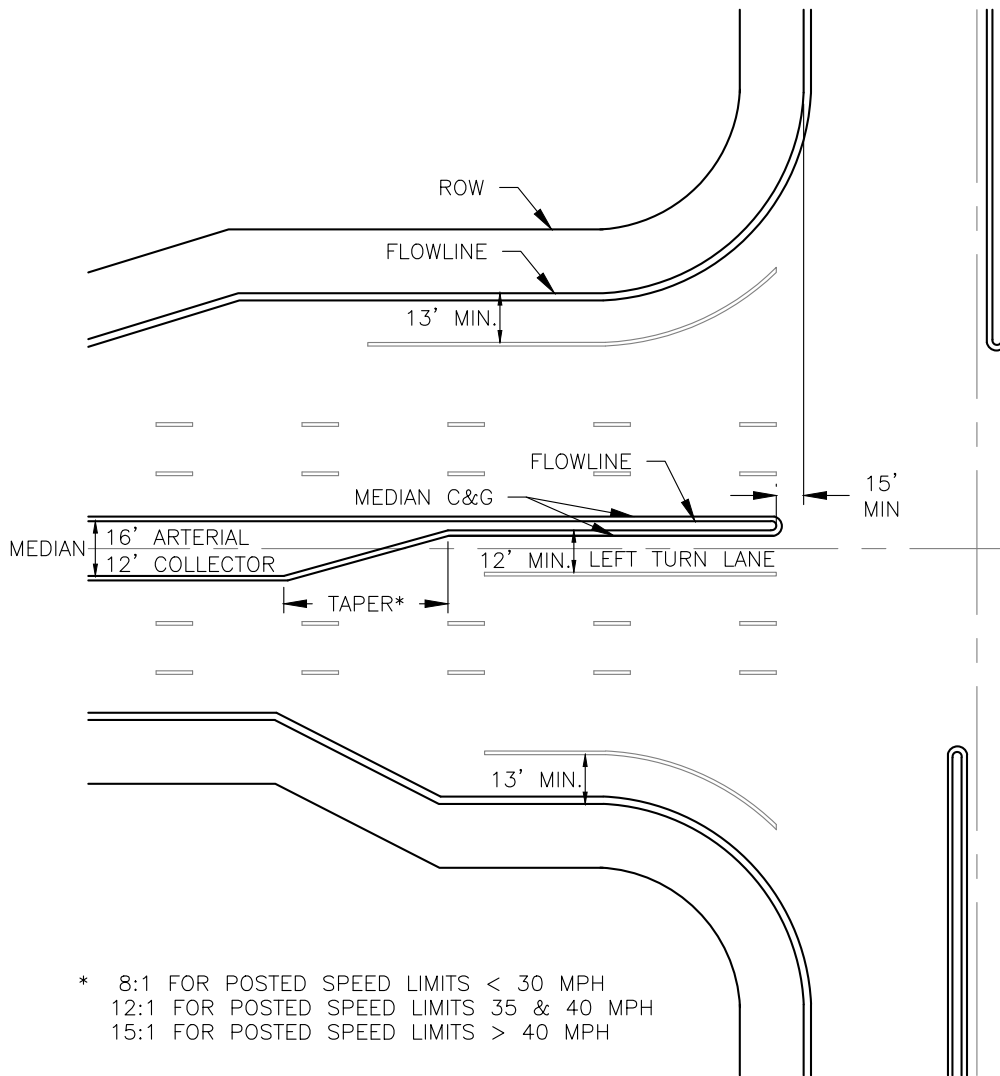
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SIDEWALK CHASE SECTIONS

DATE: JANUARY 2019

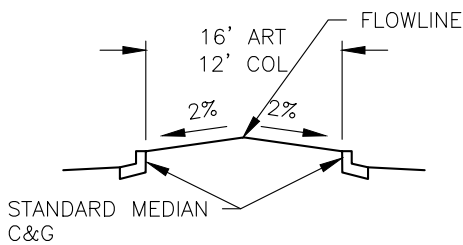
SHEET 800-18



- * 8:1 FOR POSTED SPEED LIMITS < 30 MPH
- 12:1 FOR POSTED SPEED LIMITS 35 & 40 MPH
- 15:1 FOR POSTED SPEED LIMITS > 40 MPH

NOTES:

1. TOP OF CURB TO BE LEVEL, INCLUDING DURING SUPERELEVATION. AT LEFT TURN LANES THERE WILL BE A VERTICAL DIFFERENCE BETWEEN THE TWO MEDIAN CURBS IN ORDER TO PROVIDE A TWO PERCENT (2%) CROSS SLOPE IN THE TURN LANE. ANY OTHER VERTICAL OFFSET IN THE TWO MEDIAN CURBS SHALL NEED TO BE APPROVED BY THE TOWN.
2. MEDIANS TO BE PAVED (DECORATIVELY TREATED CONCRETE) OR LANDSCAPED. MEDIAN TREATMENT TO BE APPROVED BY THE TOWN.



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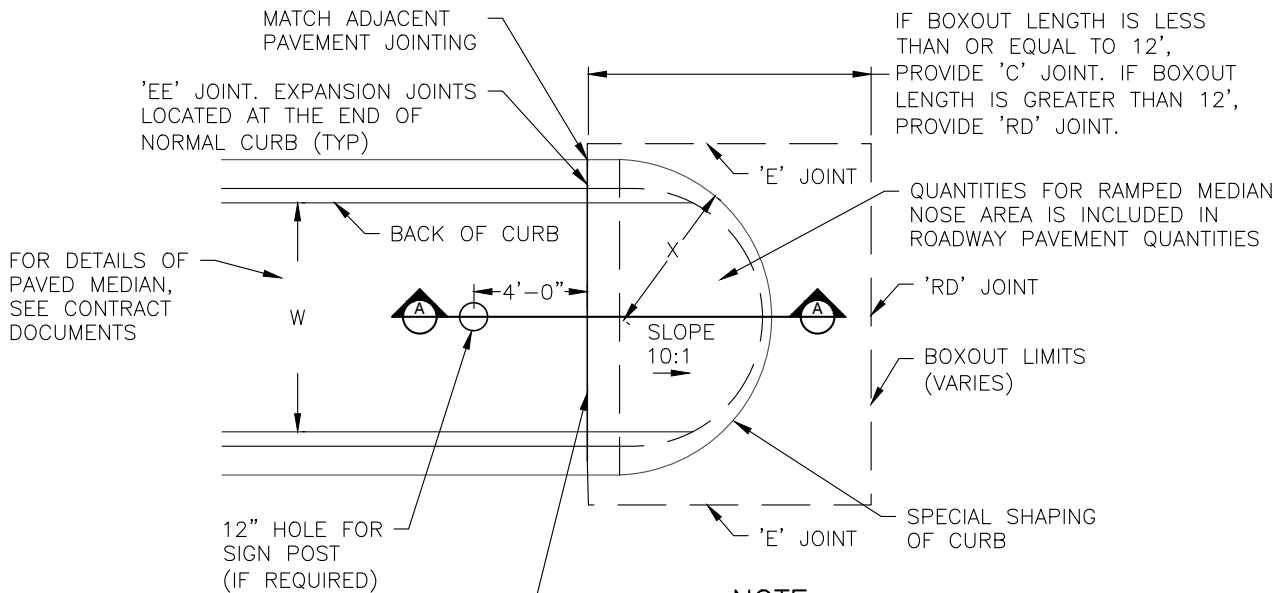
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STANDARD MEDIAN

DATE: JANUARY 2019

SHEET 800-19



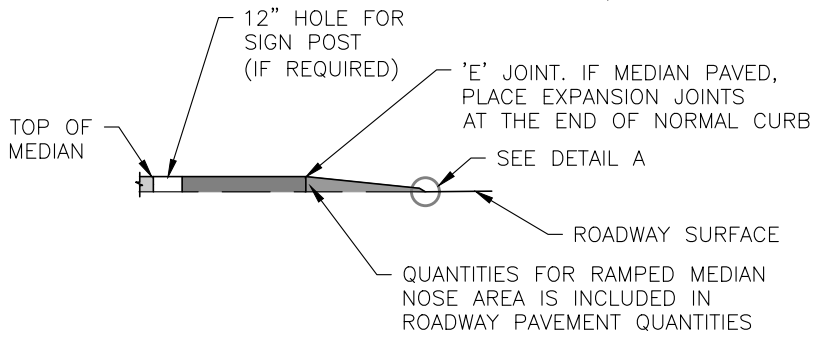
NOTE:

WHEN X OR Y IS 4' OR GREATER THE EXPANSION JOINTS WILL BE AT THE BEGINNING OF THE ROUNDED MEDIAN.

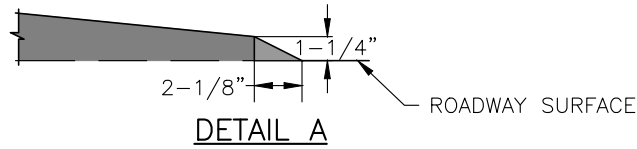
W = WIDTH FROM BACK OF CURB TO BACK OF CURB

$X = W/2 + 12"$

PLAN



SECTION A-A



DETAIL A

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

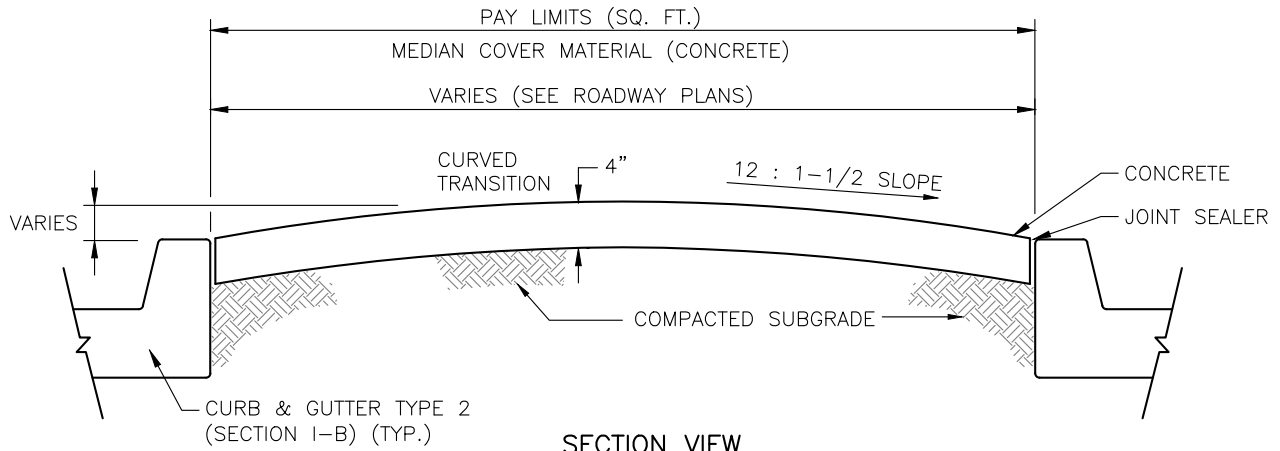
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RAMPED MEDIAN NOSE

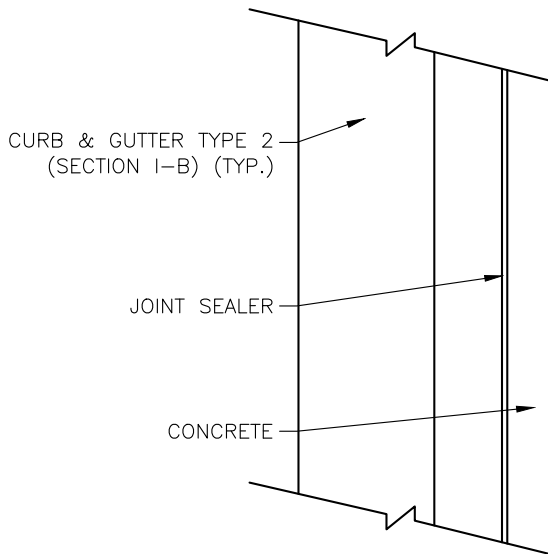
DATE: JANUARY 2019

SHEET 800-20



SECTION VIEW

PLACE JOINT SEALER IN JOINT BETWEEN CONCRETE ABUTTING CONCRETE (TYP). JOINT SEALER TO BE PEARL WHITE SIKAFLEX-2C OR APPROVED EQUAL. COST OF JOINT SEALER TO BE INCLUDED IN MEDIAN COVER



PLAN VIEW

CONCRETE - DAVIS "SPANISH GOLD" COLOR FINISH WITH CLEAR CURING COMPOUND. CONTROL JOINT SPACED EVERY 10'. MINIMUM DEPTH 1".

NOTE:

CONCRETE TO BE CDOT CLASS B/D 4,500 PSI

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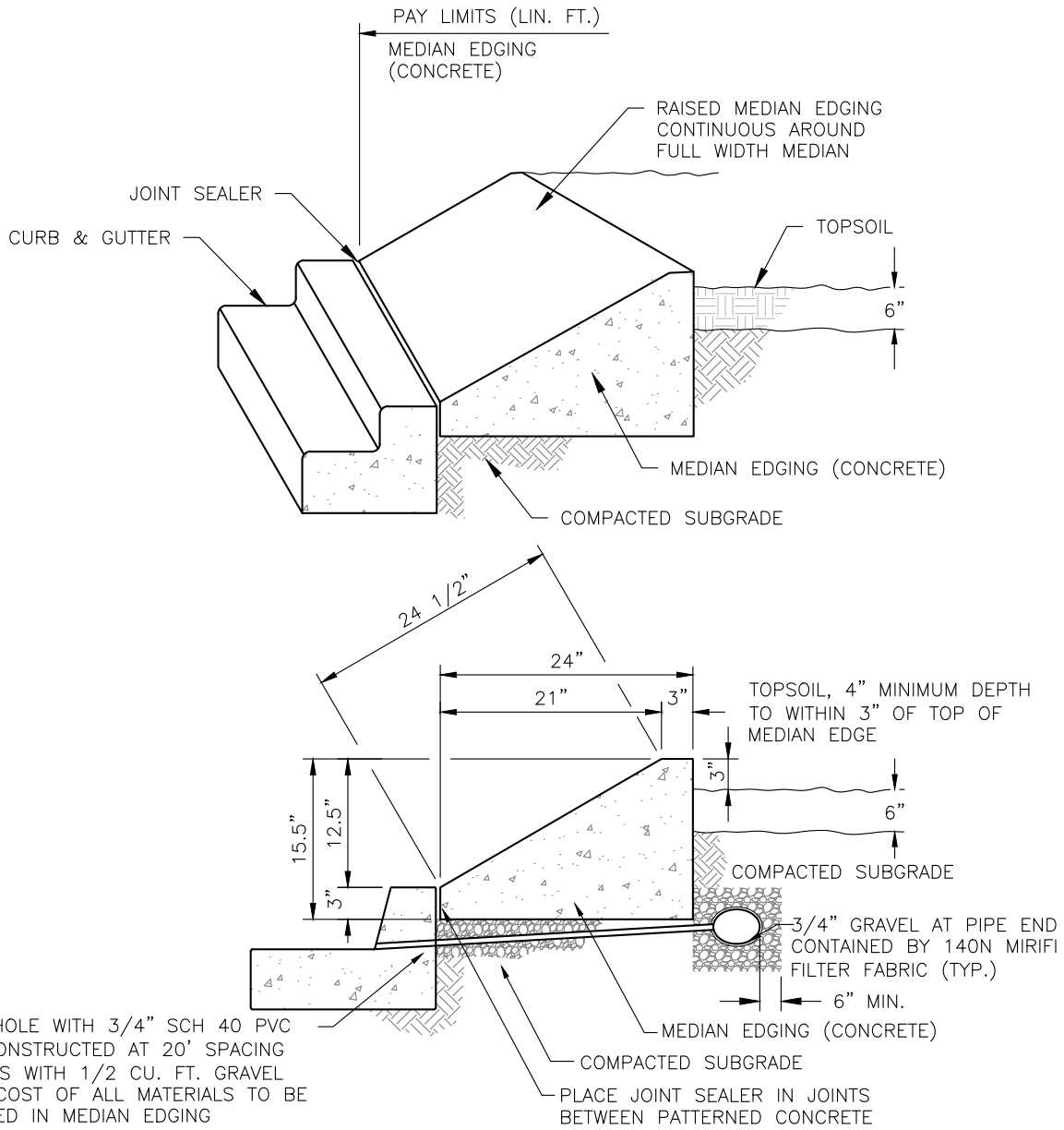
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MEDIAN MATERIAL COVER (CONCRETE)

DATE: JANUARY 2019

SHEET 800-21



WEEP HOLE WITH 3/4" SCH 40 PVC PIPE CONSTRUCTED AT 20' SPACING CENTERS WITH 1/2 CU. FT. GRAVEL PACK. COST OF ALL MATERIALS TO BE INCLUDED IN MEDIAN EDGING (CONCRETE)
 PLACE WEEP HOLES UNDER ALL RAISED MEDIAN EDGING THAT ABUTS CURBING.

NOTE:

CONCRETE TO BE CDOT CLASS B/D 4,500 PSI

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N.T.S.

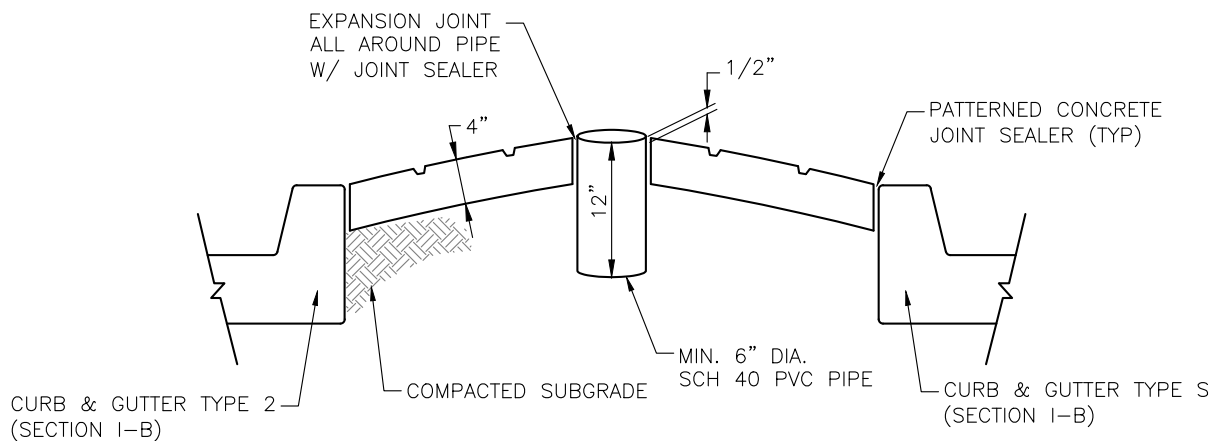


MEDIAN EDGING (CONCRETE)

DATE: JANUARY 2019

SHEET 800-22

USE SLEEVE WHERE TRAFFIC SIGN POST IS TO BE PLACED IN MEDIAN ISLAND WITH PATTERNED CONCRETE. INCLUDE COST IN ITEM 614-STEEL SIGN POST. (LOCATION AS DIRECTED BY ENGINEER.)



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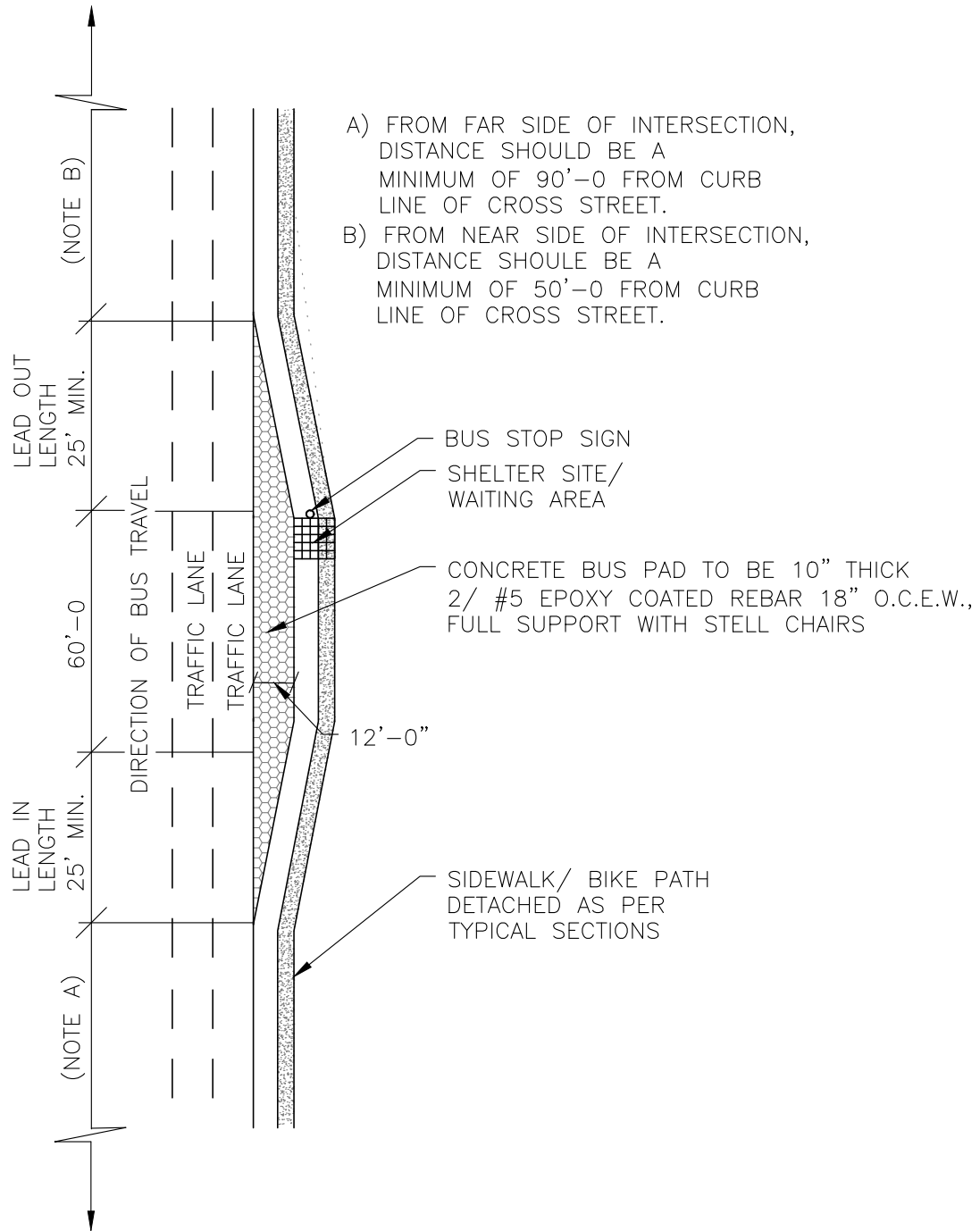
N.T.S.



SLEEVE DETAIL

DATE: JANUARY 2019

SHEET 800-23



NOTE:

CONCRETE TO BE CDOT CLASS B/D 4,500 PSI

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

N.T.S.



BUS PULL OUT

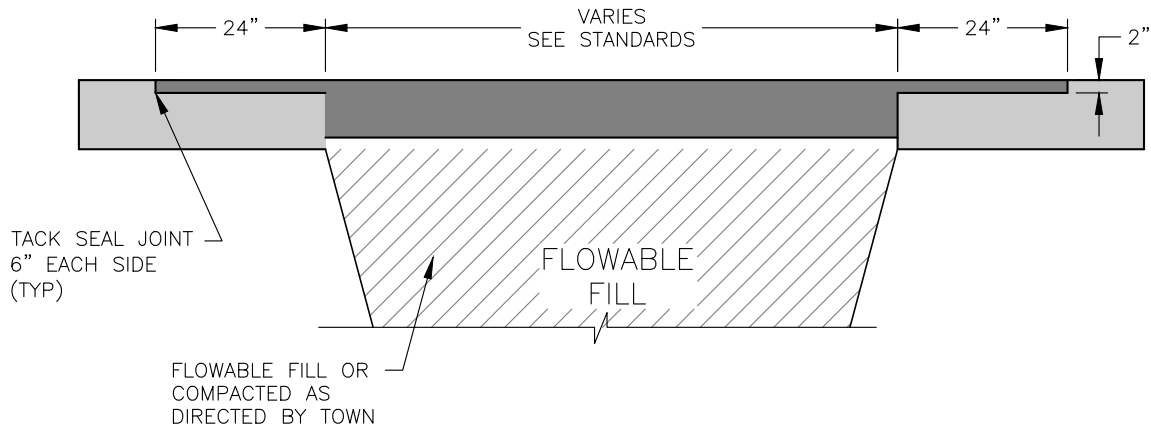
DATE: JANUARY 2019

SHEET 800-24

MINIMUM ASPHALT PATCH THICKNESS				
ZONING				
STREET CLASSIFICATION	INDUSTRIAL		ALL OTHER	
	THICKNESS	LIFTS	THICKNESS	LIFTS
ARTERIAL	11"	3	11"	3
COLLECTOR	7"	2	7"	2
LOCAL	6"	2	6"	2

Asphalt Patch

HMA OVER CDOT FLOW FILL, OR FOAMED FLASH FILL WITH
2" MILL AND OVERLAY 2' WIDER THAN FULL DEPTH PATCH
ON BOTH SIDES



NOTES:

1. CDOT FLOW FILL, OR FOAM FLASH FILL FOR TRENCH BACKFILL.
2. PAVEMENT CUTS WILL NOT BE ALLOWED WITHOUT TOWN ENGINEER APPROVAL WITHIN SEVEN (7) YEARS AFTER A STREET HAS BEEN CONSTRUCTED, RECONSTRUCTED, OR OVERLAID. EMERGENCY REPAIRS ARE EXEMPT.
3. SEE ALSO STANDARD STREET SECTION DETAIL.

MAXIMUM LIFT DEPTH - 5"

MINIMUM LIFT DEPTH - 2"

THICKNESS OF EACH LIFT BELOW THE TOP SHALL NOT VARY MORE THAN 3/8",
TOP LIFT SHALL BE GRADE SX HOT BITUMINOUS PAVEMENT

FINISH SURFACE TOLERANCE SHALL NOT EXCEED 3/16" IN ANY DIRECTION WHEN
CHECKED WITH 10 FOOT STRAIGHT EDGE. FINISHED SURFACE SHALL BE RAKED
FREE OF AGGREGATE PRIOR TO COMPACTION EQUIPMENT BEING USED

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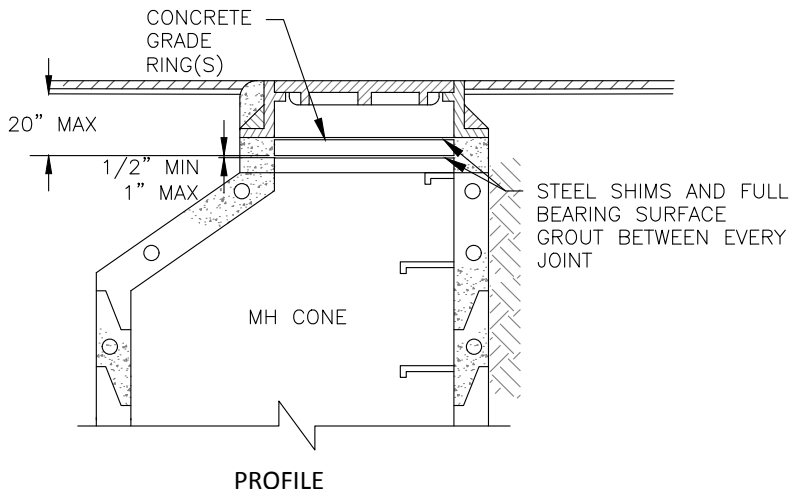
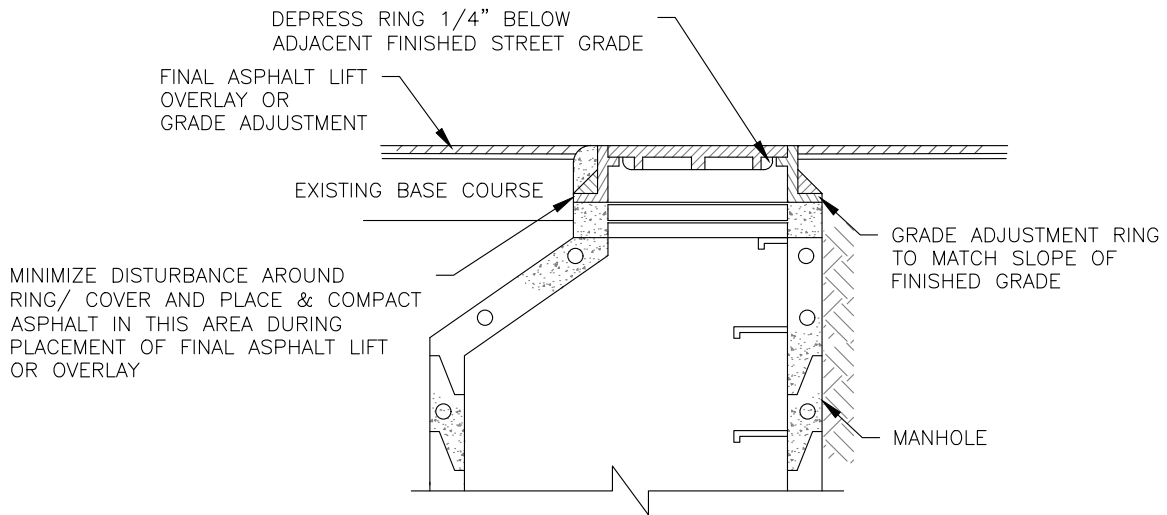
N.T.S.



ASPHALT PATCH

DATE: JANUARY 2019

SHEET 800-25



NOTES:

1. FULL BEARING SURFACE SHALL BE GROUTED WITH STEEL SHIMS, MINIMUM 6 LOCATIONS AROUND MANHOLE.
2. SMOOTH CHIMNEY INSIDE AND OUTSIDE WITH GROUT

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

N.T.S.



MANHOLE RIM AND COVER ADJUSTMENT

DATE: JANUARY 2019

SHEET 800-26

SECTION 900 – ASPHALT MIX DESIGN AND CONSTRUCTION

901.00 GENERAL CONDITIONS

Refer to Section 100 TITLE, SCOPE, AND GENERAL CONDITIONS of these DESIGN STANDARDS AND SPECIFICATIONS for additional requirements that apply to all projects within the Town.

910.00 SCOPE

The intent of this section is to specify materials and methods to be used for the construction, overlaying, seal coating, and pavement rejuvenating of streets, parking lots, and other miscellaneous work requiring the use of hot bituminous pavement (asphalt). This section shall cover work associated with aggregate base course, bituminous base, and pavements of the plant mix type, bituminous prime coat, bituminous tack coat, rejuvenating applications, and asphalt overlays. All workmanship and materials shall comply with these DESIGN STANDARDS AND SPECIFICATIONS and shall conform to the lines, grades, depths, quantities, and the typical pavement cross section(s) shown on the approved plans or as directed by the Town.

920.00 ASPHALT PAVEMENT MIXTURE

921.00 ASPHALT MIXTURE DESIGN PROPERTIES

All pavement shall be asphalt of the plant hot mix type unless otherwise approved in writing by the Town. Materials and construction shall comply with Section 403 of the CDOT *Standard Specifications for Road and Bridge Construction* and have the following requirements:

- A. Performance Graded Asphalt Binders: The Contractor shall provide to the Town acceptable “Certifications of Compliance” of each applicable asphalt binder grade from the supplier. Should testing or certificate show non-conformance with the specifications, the asphalt binder may be rejected. When production begins, the Contractor shall, upon request, provide to the Town a one (1) quart can of each specified asphalt binder for analysis. Additionally, the Contractor shall provide the refinery test results that pertain to the asphalt binders used during production
 1. Asphalt Binder: Asphalt binder shall meet the requirements of the Performance Graded Binders (PG) as presented in Table 1.

TABLE 900.01 PROPERTIES OF PERFORMANCE GRADED BINDERS

Property of Binder Grade	PG 58-28	PG 64-22	PG 76-28
Flash Point Temperature, °C, AASHTO T 48	230 Min.	230 Min.	230 Min.
Viscosity at 135 °C, Pas, ASTM D 4402	3 Max.	3 Max.	3 Max.
Dynamic Shear, Temperature °C, where $C^*/\sin \delta @ 10 \text{ rad/sec.} \geq 1.00 \text{ Kpa}$, AASHTO TP 5	58° C	64° C	76° C
<i>Rolling Thin Film Oven Residue Properties, AASHTO T 240</i>			
Mass Loss, %, AASHTO T 240	1.00 Max.	1.00 Max.	1.00 Max.
Dynamic Shear, Temperature °C, where $G^*/\sin \delta @ 10 \text{ rad/sec.} \geq 2.20 \text{ Kpa}$, AASHTO TP 5	58° C	64° C	76° C
Elastic Recovery ₁ , 25°C, % Min.	N/A	N/A	50 Min.
<i>Pressure Aging Vessel Residue Properties, Aging Temperature 100 °C AASHTO R 28</i>			
Dynamic Shear, Temperature °C, where $G^*/\sin \delta @ 10 \text{ rad/sec.} \leq 5,000 \text{ Kpa}$, AASHTO TP 5	19° C	25° C	28° C
Creep Stiffness, @ 60 sec. Test Temperature in °C, AASHTO TP 1	-18° C	-12° C	-18° C
S, Mpa, AASHTO TP 1	300 Max.	300 Max.	300 Max.
m-value, AASHTO TP 1	0.300 Min.	0.300 Min.	0.300 Min.

- B. Aggregate: The aggregate shall be of uniform quality, composed of clean, hard, durable particles of crushed stone or crushed gravel. The materials shall not contain clay balls, vegetable matter, rounded aggregate, or other deleterious substances and shall meet the following requirements below.

TABLE 900.02 AGGREGATE PROPERTIES

Aggregate Test Property	Coarse: Retained on #4	Fine: Passing the #4
Fine Aggregate Angularity, CP-L 5113 Method A or AASHTO T 304 (Does not apply to RAP aggregate)		45% Min
Two Fractured Faces, ASTM D 5821 SG Mixtures Top and Middle Lifts Bottom Lifts SMA Mixtures	90% Min. 80% Min. 70% Min. 100% required	
Flat and Elongated (Ratio 5:1) %, AASHTO M 283	10% Max.	
Sand Equivalent. AASHTO-T 176		45% Min.
Micro Deval (for combined samples) AASHTO T 327	18% Max for design 20% Max. for production	

TABLE 900.03 DENSE GRADED MIXTURE GRADATION

	ST (3/8-in. nominal)	SX (1/2-in. nominal)	S (3/4-in. nominal)	SG (1-in. nominal)
	Leveling, Maintenance, Bike Path, Sidewalk	Top and Bottom Lifts, Patching	Lower Lifts	Lower Lifts
Sieve Size				
1.5-in.				100
1-in.			100	90-100
3/4-in.		100	90-100	
1/2-in.	100	90-100		
3/8-in.	90-100			
#4				
#8	28-58	28-58	23-49	19-45
#16				
#30				
#50				
#200*	2.0-10.0	2.0-8.0	2.0-7.0	1.0-7.0

*Shall include 1% by total weight if lime is used as the anti-strip agent.

TABLE 900.04 SMA MIXTURE GRADATION

Sieve Size	½-in.	¾-in.
1-in.		100
¾-in.	100	90-100
½-in.	90-100	50-88
⅜-in.	50-80	25-60
#4	20-35	20-28
#8	16-24	16-24
#16		
#30	12-18	12-18
#50		
#100		
#200	8-11	8-11

C. Anti-Strip Additives

1. Anti-Strip shall be added into the APM. Anti-Strip agents may be liquids (added to the binder), lime (added to the aggregates), or other products, and shall be submitted for approval by the AGENCY.
2. The minimum value for Tensile Strength Ratio (TSR) shall be eighty (80) percent for the mix design and seventy (70) percent during production.
3. Liquid Anti-Strip agents shall be added per the manufactures recommendations. Typical product dosages are provided in Table 5.

TABLE 900.05 LIQUID ANTI-STRIP DOSAGE RATE

Type	Typical Dosage Rate
Amine	0.4% to 0.8%
Organo-silane	0.05% to 0.15%

4. Workability mixture additive (WMA) chemical products which display Anti-Stripping characteristics will be classified as a liquid Anti-Strip additive.
5. When a liquid Anti-Strip additive is used, the Contractor shall include the following information with the mixture design submission:
 - a. Information on the type of liquid Anti-Strip additive to be supplied, including product name, product manufacturer/supplier
 - b. Additive rate
 - c. TSR values for the treated mixes
 - d. The proposed method for incorporating the additive into the plant-produced mixture.

D. Hydrated Lime

1. The hydrated lime for APM shall conform to the requirements of AASHTO M 303, Type I. In addition, the particle size requirements shall conform to AASHTO M 303 when tested in accordance with CP-L 4209 Physical Testing of Quicklime, Hydrated Lime, and Limestone. Hydrated Lime shall be added at the rate of one (1) percent by dry weight of the aggregate and shall be included in the amount of material passing the No. 200 sieve.

E. Quality of Recycled Asphalt Product

1. Recycled Asphalt Product (RAP) may be used where allowed and shall be uniform quality and gradation with a maximum size no greater than the nominal aggregate size of the mix. RAP shall not contain clay balls, vegetable matter, or other deleterious substances.
2. Asphalt mixes containing RAP shall meet the same gradation and physical requirements as in Table 6.
3. Verification testing for asphalt content and gradation shall be performed on RAP at the frequencies listed in Table 6 below. The Contractor shall provide testing results on RAP mixtures daily for properties listed in this specification.
4. The aggregate obtained from the processed RAP shall be based on the required gradation limits for the mixture being used. The aggregate and binder obtained from the processed RAP shall meet the tolerances provided in Table 6.

TABLE 900.06 RAP BINDER & AGGREGATE UNIFORMITY TOLERANCES

Element	Standard Deviation
Binder Content	0.5
% Passing ¾-in.	4.0
% Passing ½-in.	4.0
% Passing ⅜-in.	4.0
% Passing #4	4.0
% Passing #8	4.0
% Passing #30	3.0
% Passing #200	1.5

F. Process Control (PC) Plan for RAP

1. A PC plan detailing how the RAP shall be processed and controlled shall be developed and followed by the Asphalt Producer/Contractor and shall explain the processing techniques for crushing, screening, rejecting, and stockpile operation.
2. RAP shall be tested as shown in Table 7.

TABLE 900.07 TEST FREQUENCY OF PROCESSED RAP

Test	Minimum Testing Frequency (Minimum 3 tests)
Asphalt Binder Content (AASHTO T-164)	1/500 tons
Gradation (AASHTO T-30)	1/500 tons

3. Process control charts shall be maintained for binder content and each screen when RAP material is added to the stockpile. Separate control charts for each RAP stockpile shall be maintained. These charts shall be displayed and shall be provided upon request.
- G. The asphalt mix design shall comply with the SUPERPAVE MIX DESIGN PROPERTIES and MINIMUM VOIDS IN THE MINERAL AGGREGATE (VMA) REQUIREMENTS tables that follow. A copy of the mix formula shall be submitted to the Town for review and approval at least seven (7) days prior to starting paving work. In the event that a current job mix formula is not available for the materials proposed for use, the Contractor shall submit a job mix formula prepared by a recognized testing laboratory for review and approval by the Town. A report giving the properties of the materials and certifying their conformance to or deviations from the requirements of the specifications shall accompany the job mix formula. Non-Superpave mixes may be approved at the discretion of the Town. Viscosity graded asphalt cements may be permitted at the discretion of the Town and shall adhere to the requirements of AASHTO M226, Table 2.
1. All asphalt pavement mix designs shall comply with the following properties:

TABLE 900.08 MIXTURE PROPERTIES FOR DENSE GRADED ASPHALT MIXTURES

Property	Traffic Level (ESALs)	
	<100,000	≥100,000 to 3 Million
Design Gyration, N_{design}	50	75
Air Voids (V_a) % at N_{design} (AASHTO T-132)	3.0 – 4.0	3.0 – 4.0
Hveem Stability (AASHTO T-246) (Grading ST, SX & S only)	28 Min.	28 Min.
Voids Filled with Asphalt (V_a), MS-2	70-80	65-80
Accelerated Moisture Susceptibility, Tensile Strength Ratio, (Lottman) (AASHTO T-283 Method B) (for S, SX, SG mixes)	80 Min.	80 Min.
Dry Tensile Strength, psi (AASHTO T-283)	30 Min.	30 Min.
Voids in Mineral Aggregates (VMA) % (AASHTO PP-19)	Table 20.3A-3	

- NOTES:**
- 1) Air Void of production mixes shall be within one (1) percent of design mix Air Void at optimum Asphalt Content. Air Void determination for N_{design} shall be made from samples compacted at N_{design} . Maximum Theoretical Specific Gravity of mix to be by *Colorado Procedure CP-51 for the Superpave Method of Mixture Design*.
 - 2) Further investigation or corrective action is required when production stability is below the mix design stability.

TABLE 900.09 MIXTURE PROPERTIES FOR SMA

Property	Test Method	Value
Lab Compaction (Gyrations) N _{Design}	AASHTO T-312	75
Air Voids (V _a) % at N _{Design}	AASHTO T-312	3.0 – 4.0
Accelerated Moisture Susceptibility, Tensile Strength Ratio, (Lottman)	AASHTO T-283, Method B	80 Min.
Dry Split Tensile Strength, psi	ASHTO T-283, Method B	30 Min.
Grade of Asphalt Binder	N/A	PG 76-28
Voids in the Mineral Aggregate (VMA) %, Minimum	AASHTO PP19	17
Drain Down at Production Temperature	AASHTO T-305	0.3 Max.

TABLE 900.10 MINIMUM VMA DENSE GRADED & SMA MIXES

Nominal Maximum Particle Size (in.)	Minimum VMA (%)		
	3.0% V _a	3.5% V _a	4.0% V _a
3/8 (ST)	15.5	15.6	15.7
1/2 (SX)	14.5	14.6	14.7
3/4 (S)	13.5	13.6	13.7
1 (SG)	12.5	12.6	12.7
SMA - 1/2	17.0	17.0	17.0
SMA - 3/4	17.0	17.0	17.0

¹ The Nominal Maximum size is defined as one size larger than the first sieve to retain more than ten (10) percent.

² Interpolate specified VMA values for design air voids between those listed.

922.00 ASPHALT SAMPLING AND TESTING

Asphalt pavement and asphalt cement sampling and testing shall be performed per the Certified Materials Testing Agency's Quality Control Plan, but not less than as specified in Section 311.02 of these DESIGN STANDARDS AND SPECIFICATIONS. All testing necessary to assure conformance of materials and workmanship to the specifications shall be at the Contractor's expense.

At any time during construction and/or the warranty period, the Town may require a Colorado Registered Professional Engineer to certify the quality of materials or construction procedures at the Contractor's expense. All commercial testing and laboratory work necessary to establish the job mix formula and to ensure conformance of materials and workmanship shall be done in accordance with recognized methods

and as specified in these DESIGN STANDARDS AND SPECIFICATIONS. Two (2) copies of all test reports shall be submitted to the Town.

930.00 ASPHALT PAVEMENT CONSTRUCTION

931.00 ROADWAY INSPECTIONS

Refer to Section 154.00 INSPECTIONS of these DESIGN STANDARDS AND SPECIFICATIONS.

Adequate roadway inspections assure compliance to Town requirements and are the basis for the Town's recommendation that roadway improvements be accepted for maintenance and/or release of the performance guarantee. It is the responsibility of the Contractor to contact the Town a minimum of one (1) full working day (twenty-four [24] hours) in advance of the required inspections. Required roadway inspections shall include:

- A. Utilities and Culverts All utility pipes, conduits, and culverts have been installed in accordance with the approved plans and these DESIGN STANDARDS AND SPECIFICATIONS.
- B. Curb and Gutter, Sidewalks, and Crosspans: Verify that all concrete improvements have been installed in accordance with the approved plans and these DESIGN STANDARDS AND SPECIFICATIONS.
- C. Structures: Verify that all structures have been installed in accordance with the approved plans and these DESIGN STANDARDS AND SPECIFICATIONS.
- D. Subgrade/Base Course: Verify that the surface proposed to be built upon meets all requirements including, but not limited to, depth of treatment, type of treatment, moisture content, compaction, and an approved proof-roll.
- E. Paving and Testing: Verify that mix design and submittals are approved and comply with these DESIGN STANDARDS AND SPECIFICATIONS. Verify that minimum air and asphalt temperatures adhere to these DESIGN STANDARDS AND SPECIFICATIONS. In the case of wind, cold temperatures, or threatening weather, trucks hauling asphalt shall have weather-proof tarps. The beds of trucks hauling asphalt shall be clean, and the asphalt shall be free of debris. Verify that thickness of asphalt pavement, rolling equipment and patterns, and grade of utility castings comply with the approved plans and these DESIGN STANDARDS AND SPECIFICATIONS.
- F. Construction Acceptance Into Warranty Refer to Section 211.00 PROBATIONARY ACCEPTANCE INTO WARRANTY PERIOD of these DESIGN STANDARDS AND SPECIFICATIONS.
General items include:
 - 1. Pavement Deflection Testing in accordance with Section 938.00 PAVEMENT DEFLECTION TESTING of these DESIGN STANDARDS AND SPECIFICATIONS may be required by the Town.
 - 2. Remove and replace areas of failing asphalt. Subgrade failures shall be corrected before placing asphalt. Heating and scarifying and/or grinding and overlaying areas of failing asphalt, in accordance with these DESIGN STANDARDS AND SPECIFICATIONS.

- SPECIFICATIONS, may be required by the Town.
3. Remove and replace areas that have ponding water.
- G. Final Acceptance/Release from Warranty: Refer to Section 212.00 FINAL ACCEPTANCE AND RELEASE FROM WARRANTY BY THE TOWN of these DESIGN STANDARDS AND SPECIFICATIONS. General items include:
1. Pavement deflection testing and/or core sampling of all areas of failing asphalt.
 2. Remove and replace areas of failing asphalt. Subgrade failures shall be corrected before placing asphalt.
 3. The final asphalt overlay or seal coat shall be determined by the Town based on the visual and structural quality of the roadway at the end of the warranty period. All areas requiring a final top lift or an overlay of asphalt shall be cleaned and prepared. Preparation shall include but not be limited to:
 - a. All lips of gutters, inlets, and crosspans shall have concrete exposed to a depth equal to the thickness of the final top lift or overlay of asphalt.
 - b. All joints shall be straight (vertical) and shall have a minimum of one and one-half (1½) inches of elevation difference. This is to ensure that an asphalt mat of consistent thickness is installed from edge of gutter to edge of gutter.
 - c. All weeds shall be cut, and debris, mud, and waste materials removed.
 - d. Before paving, tack coat shall be applied to the area(s) that are to receive a final top lift or overlay of asphalt, including exposed concrete faces and utility castings.

932.00 MIXING

The dried aggregates and asphalt binder shall be combined in the mixer in the quantities required to meet the design job mix formula. The materials shall be mixed until the aggregate is uniformly coated and the asphalt binder is uniformly distributed throughout the aggregate. Baghouse fines may be fed back to the mixing plant in a continuous manner to maintain uniformity in the mixture at the discretion of the producer.

Discharge temperatures are shown in Table 11.

TABLE 900.11 MIXTURE DISCHARGE TEMPERATURE

Binder Grade	Minimum Discharge Temperature	Maximum Discharge Temperature
PG 58-28	275° F	305° F
PG 64-22	290° F	320° F
PG 76-28	320° F	330° F
Workability Mixture Additive (WMA)	If a WMA technology (additive or foaming) is used, the discharge temperatures may be lowered during production at the discretion of the CONTRACTOR provided all specifications are achieved.	

To protect the properties of the binder, APM shall be produced at the lowest temperature within the specified range that produces a workable mix and provides for uniform coating of aggregates, and that

allows the Contractor to achieve the required compaction.

933.00 EQUIPMENT

- A. Trucks used for hauling bituminous mixtures shall have tight, clean, smooth metal beds thinly coated with a minimum amount of paraffin oil, lime solution, or other approved release agent. Petroleum distillates such as kerosene or fuel oil will not be permitted. Each truck shall have a cover of canvas or other suitable material to protect the mixture from the weather.
- B. Self-propelled asphalt pavers shall be provided and equipped with an activated screed assembly, heated if necessary, capable of spreading and finishing plant mix material in lane widths. The pavers receiving hopper shall have sufficient capacity for a uniform spreading operation and shall have an automatic distribution system that will place the mixture uniformly in front of the screed.
- C. The screed or strike-off assembly shall produce the specified finished surface without tearing, shoving, or gouging the mixture.
- D. The paver shall be capable of operating at forward speeds consistent with uniform and continuous laying of the mixture. Stop and go operations of the paver shall be avoided.
- E. The bituminous paver shall be equipped with a means of preventing the segregation of the coarse aggregate particles from the remainder of the bituminous plant mix when that mix is carried from the paver hopper back to the paver augers. The means and methods used shall be approved by the paver manufacturer and may consist of chain curtains, deflector plates, or other such devices and any combination of these.
- F. Prior to the start of using the paver for placing plant mix, the Contractor shall submit for approval a full description in writing of the means and methodologies that will be used to prevent bituminous paver segregation. Use of the paver shall not commence prior to receiving approval from the Engineer.
- G. The paver shall be equipped with automatic screed controls with sensors capable of sensing grade from an outside reference line, and maintaining the screed at the specified longitudinal grade and transverse slope. The sensor shall be constructed so that it will operate from either or both sides of the paver and shall be capable of working with the following devices:
 - 1. Ski-type device at least 30 feet in length.
 - 2. Short ski or short shoe.
 - 3. At least 5,000 feet of control line and stakes.
 - 4. The controls shall be capable of maintaining the screed at the specified transverse slope plus or minus 0.1 percent.
 - 5. Manual operation will be permitted for constructing irregularly shaped and minor areas.
- H. If the automatic controls fail, the paver may be operated manually for the remainder of the normal working day, provided the specified results are obtained. The variation between any two contacts with the surface shall not exceed 3/16 of an inch in ten (10)

feet. Irregularities exceeding the specified tolerance shall be corrected at the Contractor's expense.

- I. If the Contractor fails to obtain and maintain the specified surface tolerances, the paving operations shall be suspended until satisfactory corrections, repairs, or equipment replacements are made.
- J. The asphalt pavement shall be compacted by rolling. Both steel wheel and pneumatic tire rollers shall be required. The number, weight, and type of rollers furnished shall be sufficient to obtain the required density while the mixture is in a workable condition. Compaction shall begin immediately after the mixture is placed and be continuous until the required density is obtained.
- K. The paver shall be capable of a minimum 17' pass.

934.00 WEATHER LIMITATIONS

Asphalt shall be placed only on properly constructed subgrade and interim lifts that are free from water, snow, and ice. The asphalt shall be placed only when weather conditions permit the pavement be to properly placed and finished as determined by the Town. Asphalt pavement mixtures shall be placed in accordance with the following temperature limitations:

TABLE 900.12

Compacted Layer Thickness (Inches)	Minimum Air and Surface Temp. (Degrees F and rising)	
	Top Layer	Other Layers
1½ or less	60	50
>1½ to 3	50	40
3 to 4	--	35

Air temperature shall be taken in the shade. Surface is defined as the existing base on which the new pavement is to be placed.

The Town may waive minimum temperature requirements for placing prime coats and layers of asphalt below the top layer of the pavement section.

935.00 CONSTRUCTION OF PAVEMENT SECTIONS

In no case shall the compacted asphalt layer thickness be greater than six (6) inches for SG mixes, four (4) inches for S mixes, and two (2) inches for SX mixes.

During the final overlay of asphalt, all valve boxes, manholes, and vaults shall be brought to street grade minus one-quarter (¼) inch, and match finish cross slope. The contractor shall be responsible for coordinating with all affected and applicable utilities. No utility adjustments and/or asphalt patching shall be allowed following placement of the top lift of asphalt.

935.01 Base Course Composite Sections

All work shall be observed and tested by the project Geotechnical Engineer or representative and certified

by a Colorado Registered Professional Engineer. The standard procedures for base course composite construction include the following:

- A. The subgrade shall be prepared and conditioned to comply with all specifications. After passing compaction tests, the subgrade shall be shaped to the required cross section and grade checked, and then it shall be proof-rolled in accordance with Section 350.04 PROOF-ROLL OBSERVATION AND TESTING of these DESIGN STANDARDS AND SPECIFICATIONS.
- B. The proof roller shall be operated in a systematic manner so that a record may be readily kept of the area tested. Areas that are observed to have soft spots in the subgrade, where deflection is not uniform or is excessive as determined by the Engineer, shall be ripped, scarified, dried or wetted as necessary and re-compacted to the requirements for density and moisture at the Contractor's expense. After re-compaction, these areas shall be proof rolled again and all failures again corrected at the Contractor's expense.
- C. All failing areas shall be delineated by the project Geotechnical Engineer and shall be reworked and retested until passing.
- D. Upon passing all compaction tests and proof-rolls, the sub base, base course, or initial pavement course shall be placed within 24 hours. If the Contractor fails to place the sub base, base course, or initial pavement course within 24 hours or the condition of the subgrade changes due to weather or other conditions, proof rolling and correction shall be performed again at the Contractor's expense.
- E. Base course (Aggregate Base/Recycled Concrete) shall be placed on the fabric and prepared and conditioned to meet specifications.
- F. After passing all compaction tests, the base course shall be proof-rolled.
- G. All failing areas shall be delineated by the project Geotechnical Engineer and shall be reworked and retested until passing.
- H. Upon passing all compaction tests and proof-rolls, geotextile fabric shall be installed on the base course, if required by the approved pavement design.
- I. In the event the subgrade, base course, or any step of this process is subject to rain, snow, or other factors after the proof-roll has been performed, the project Geotechnical Engineer shall evaluate the areas proposed to be paved and shall make a recommendation to the Town. Paving shall not commence unless approved by the Town.

935.02 Lime, Fly-Ash, and Concrete Stabilized Composite Sections

Lime stabilization shall comply with Section 350.03 LIME-TREATED SUBGRADE of these DESIGN STANDARDS AND SPECIFICATIONS.

935.03 Full Depth Asphalt Sections

Subgrade preparation for full depth asphalt sections approved by the Town will comply with Section 331.00 EMBANKMENT CONSTRUCTION of these DESIGN STANDARDS AND SPECIFICATIONS.

935.04 Surface Preparation

- A. General: Irregularities in the existing pavement or base shall be brought to uniform grade and cross section.
- B. Immediately before pavement begins, the pavement surface shall be broomed or otherwise cleaned to provide a dry surface free from loose particles or other deleterious material.
- C. Existing Pavement Markings: Completely remove all existing pavement markings prior to any paving operations.
- D. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials. Mix herbicide with prime coat if formulated by manufacturer for that purpose.
- E. Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.15 to 0.50 gal./sq. yd.. Apply enough material to penetrate and seal but not flood surface. Allow prime coat to cure.
 - 1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
 - 2. Protect primed substrate from damage until ready to receive paving.

If required by the Town, subgrade shall be primed to comply with Section 407 of the CDOT *Standard Specifications for Road and Bridge Construction*. Bituminous material shall be MC-70 applied at the rate of two-tenths (0.20) to thirty-five one-hundredths (0.35) of a gallon per square yard.

935.05 Hot-Mix Asphalt Placing

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
 - 1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
 - 2. Place hot-mix asphalt surface course in single lift.
 - 3. Revise first subparagraph below to higher temperature if thin lifts in cool weather are likely. See National Asphalt Pavement Association recommendations.
 - 4. Spread mix at minimum temperature of 250 deg F.
 - 5. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
 - 6. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- B. Place paving in consecutive strips not less than a drive lane width unless infill edge strips of a lesser width are required.

1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of asphalt base course before placing asphalt surface course.
- C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.
- D. The bituminous mixture shall be transported and placed on the roadway without segregation. All segregated areas behind the paver shall be removed immediately upon discovery. The segregated material shall be replaced with specification material before the initial rolling has taken place. If more than 50 square feet of segregated pavement is ordered removed and replaced in any continuous 500 linear feet of paver width laydown, operations shall be discontinued until the source of the segregation has been found and corrected.
- E. If at any time, the Engineer observes segregated areas of pavement, he will notify the Contractor immediately.
- F. Segregated areas in the top lift shall be removed and replaced, full lane width, at the Contractor's expense. The Engineer may approve a method equivalent to remove and replace that results in a non-segregated top lift. Segregated areas in lifts below the top lift, that are smaller than 50 square feet per 100 linear feet of lane width, will be corrected by the Contractor at the Contractor's expense in a manner acceptable to the Engineer. Segregated areas larger than 50 square feet per 100 linear feet of lane width in any lift shall be removed and replaced, full lane width, by the Contractor at the Contractor's expense.

935.06 Asphalt Compaction

Asphalt compaction shall comply with Section 401.17 of the CDOT *Standard Specifications for Road and Bridge Construction*.

Asphalt density tests shall be taken per the Certified Materials Testing Agency's Quality Control Plan but not less than as specified in Section 311.02 MINIMUM TESTING REQUIREMENTS of these DESIGN STANDARDS AND SPECIFICATIONS. Densities shall be between ninety-two (92) percent and ninety-six (96) percent of the Rice unit weight (theoretical maximum density) as determined by an independent asphalt testing laboratory. Other methods of determining unit weight are subject to approval by the Town.

The longitudinal joints shall be compacted to a target density of ninety-two (92) percent of the theoretical maximum specific gravity. The tolerance shall be \pm four (4) percent. The theoretical maximum specific gravity used to determine the joint density shall be the average of the daily theoretical maximum specific gravities of the material that was placed on either side of the joint. Density (percent relative compaction) shall be determined in accordance with CP 44. Longitudinal joint density tests shall be taken per the Certified Materials Testing Agency's Quality Control Plan but not less than as specified in Section 311.02 MINIMUM TESTING REQUIREMENTS of these DESIGN STANDARDS AND SPECIFICATIONS.

- A. The Contractor shall construct a compaction pavement test section (CTS) for each job mix for which 500 or more tons are required for the project. The CTS will be used to evaluate the number of rollers and the most effective combination of rollers and rolling

patterns for achieving the specified densities. Factors to be considered include, but are not limited to, the following:

1. Number, size, and type of rollers
2. Amplitude, frequency, size and speed of vibratory rollers.
3. Size, speed, and tire pressure of rubber tire rollers.
4. Temperature of mixture being compacted.
5. Roller patterns.

B. The CTS shall be constructed according to the following procedures:

1. The CTS shall be constructed to provide the nominal layer thickness specified. The first 200 tons of hot mix asphalt on the project location shall constitute the CTS. The production and placement rates of the CTS shall closely approximate the anticipated production and placement rates for the remainder of the Contract.
2. Compaction of the CTS shall commence immediately after the hot mix asphalt has been spread, and shall be continuous and uniform over the entire CTS. For the CTS, compaction shall continue until no discernible increase in density is obtained by additional compactive efforts. All compaction shall be completed before the surface temperature of the mixture drops below 185°F.
3. Approved types of rollers shall be used to achieve the specified density. The Contractor shall determine what methods and procedures are to be used for the compaction operation. The compaction methods and procedures shall be used uniformly over the entire 200 tons. The Contractor shall record the following information and a copy of this data shall be furnished to the Engineer.
 - a. Type, size, amplitude, frequency, and speed of roller.
 - b. Tire pressure for rubber tire rollers, and whether the pass for vibratory rollers is vibratory or static.
 - c. Surface temperature of mixture behind the laydown machine and subsequent temperatures and densities after each roller pass.
 - d. Sequence and distance from laydown machine for each roller, and number of passes of each roller to obtain specified density.
4. If directed by the Town Inspector, two sets of cores shall be taken within the 200 tons of the CTS. Each set shall consist of a minimum of seven corings. The locations of these cores shall be such that one set can serve as a duplicate of the other. One set of these cores shall be immediately submitted to the Engineer. This set will be used for determining acceptance of the CTS and determining density correction factors for nuclear density equipment. Densities of the random samples will be determined by cores according to CDOT CP 44. Density correction factors for nuclear density equipment will be determined according to CDOT CP 81. Coring shall be performed under Engineer's observation. Coring will not be measured and paid for separately but shall be included in the work.
5. The CTS meets requirements if the Quality Level of the random samples is greater than or equal to 75. The Quality Level will be determined according to

CDOT CP 71. Once constructed and accepted, the CTS shall remain in place and become part of the hot mix asphalt on the project.

6. When the Quality level is less than 75 the Contractor shall construct an additional test section, utilizing different rollers, or roller positions, or roller patterns as required. A written proposal detailing the changes in methods and procedures that will be used to obtain density is to be submitted to the Engineer for review before constructing the additional test section.
7. Each CTS shall be 200 tons. If in-place densities of the CTS, as determined by nuclear density equipment prior to determining density of the cores, meet the CTS density requirements, the Contractor may begin production paving and continue to place hot mix bituminous pavement under the following conditions:
 - a. The period during which the Contractor continues to pave without test results from cores shall not exceed one working day.
 - b. Construction proceeds at the Contractor's risk. If correlation with the cores reveals that the densities do not meet the CTS requirements, the hot mix bituminous pavement placed subsequently will be subject to price reduction or removal and replacement.
8. After production paving work has begun, a new CTS shall be constructed when a change in the compaction process is implemented. A new CTS will be required for different layers of pavement. Each additional CTS shall be constructed as specified herein, and shall be sampled, tested and accepted or rejected as described herein.
9. All additional costs associated with construction of the CTS shall be at the Contractor's expense. The hot mix asphalt (HMA) placed in the CTS will be paid for in accordance with the contract price for the HMA mixture.

935.06 Joints

- A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.
- B. In every pavement layer, the joints shall not be constructed in the wheel paths. The Contractor shall submit a longitudinal joint and pavement marking plan three days prior to the Pre-Paving Conference. The plan shall show the location and configuration of the proposed longitudinal joints and pavement markings, and shall detail the methods to be used to field establish a control line. The Contractor shall use a continuous string line to delineate every longitudinal joint during paving operations. All exposed string line shall be picked up and disposed of at the end of each day's paving. Paving shall not commence until the plan has been approved in writing by the Engineer.
 1. Clean contact surfaces and apply tack coat to joints.
 2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
 3. Offset transverse joints, in successive courses, a minimum of 24 inches.
 4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either

- "bulkhead" or "papered" method according to AIMS-22, for both "Ending a Lane" and "Resumption of Paving Operations."
5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
 6. Compact asphalt at joints to a density within 2 percent of specified course density.
 7. Longitudinal joints shall not cross the centerline, lane line, or edge line unless approved by the Engineer.

935.07 Tack Coat

Prior to placement of the APM, a tack coat shall be applied to all existing concrete and asphalt surfaces. The tack coat shall meet the specification for the emulsified asphalt, consisting of CSS-1h or SS-1h and conform to AASHTO M208 or M140.

The tack coat shall be applied at a rate of one-tenth (0.1) to three-tenths (0.3) of a gallon per square yard. The surface receiving the tack coat shall be dry and clean, and dust, debris, and foreign matter shall be removed. Tack coat shall be applied uniformly. The Contractor shall allow the tack coat to cure (dehydrate) prior to the placement of APM. If the tack becomes contaminated during construction, it shall be cleaned, and if necessary, additional tack coat shall be applied and allowed to cure before paving resumes.

TABLE 900.13 TACK COAT APPLICATION RATES

Pavement Condition	Application Rate (gal/yd ²)		
	Residual	Undiluted	Diluted (1:1)
New Asphalt	0.03 – 0.04	0.05 – 0.07	0.10 – 0.13
Oxidized Asphalt	0.04 – 0.06	0.07 – 0.10	0.13 – 0.20
Milled Surface (Asphalt)	0.06 – 0.08	0.10 – 0.13	0.20 – 0.30
Milled Surface (PCC)	0.06 – 0.08	0.10 – 0.13	0.20 – 0.30
Portland Cement Concrete	0.04 – 0.06	0.07 – 0.10	0.13 – 0.20

935.08 Seal Coat

Seal coat materials and construction shall comply with Section 409 of the CDOT *Standard Specifications for Road and Bridge Construction*. The type of bituminous material, cover aggregate, and rates of application shall be as shown on the approved plans.

935.09 Rejuvenating Agent

Rejuvenating agent materials and construction shall comply with Section 407 of the CDOT *Standard Specifications for Road and Bridge Construction*.

935.10 Pavement Markings

- A. Permanent Pavement Markings: All permanent pavement markings should be replaced in like configuration to previous existing pavement markings within 14 days of paving for each location identified or as deemed necessary by the Town.
 1. Preformed Thermoplastic Pavement Markings shall be used for turning lanes, crosswalks, stop bars, and turn arrows.

2. Striping for other symbols shall be performed utilizing preformed thermoplastic materials as applicable.
3. Thickness: 125 mils.
4. Epoxy Paint Markings shall be used for solid and skip lane lines, parking stalls and island designations.

936.00 TRENCH CUTS AND EXPLORATORY POTHOLE/CORE REPAIR

936.01 Trench Cuts

Trench cut asphalt repairs in streets less than five (5) years old may be subject to special asphalt repair requirements at the discretion of the Town.

Backfill of utility trenches shall comply with Section 340.00 TRENCHING, BACKFILLING, AND COMPACTING of these DESIGN STANDARDS AND SPECIFICATIONS. Utility trench patches shall be in accordance with the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS.

936.02 Exploratory Pothole/Core Repair

When exploratory utility potholing is performed, the Contractor shall repair the pothole in the following manner.

ASPHALT

- Exploratory potholing voids are to be backfilled and the core patched with a temporary patching material immediately after initial potholing is complete.
- All material disturbed and/or removed during the exploratory operation shall be replaced with an approved flow-fill mix.
- Squeegee shall not be allowed as backfill material except for use as pipe bedding with a twelve- (12-) inch maximum depth over the pipe.
- Within seventy-two (72) hours of initial drilling, or within a reasonable and practical amount of time after completion of the projected work, potholes shall be permanently patched.
- Any exploratory pothole and/or patch that is deemed dangerous shall be repaired immediately.
- All permanent repairs shall be made to look symmetrical and/or uniform. No jagged, uneven patches shall be allowed.
- All edges and patch areas shall be dried, cleaned, and tacked. All newly placed asphalt shall be maximum one-half (½) inch mix (SX) and shall be compacted properly in two (2) inch lifts. Patching on streets, which have received an overlay within the past ten (10) years may be infra-red heat treated.
- Immediately after finish rolling, and before the asphalt surface temperature drops below 185 degrees, apply tack coat a minimum of six inches (6") either side of the joint to seal the joint. On patches of 40 square feet or less, apply tack coat to the entire surface and extend outside the joint six inches (6") onto existing pavement surface. Heat with propane weed burner torch to seal the tacked surface.

CONCRETE

- Exploratory potholing voids are to be backfilled and the core patched with a temporary patching material immediately after initial potholing is complete.
- All material disturbed and/or removed during the exploratory operation shall be replaced with an approved flow-fill mix.

- Squeegee shall not be allowed as backfill material except for to use as pipe bedding with a twelve (12) inch maximum depth over the pipe.
- Within 72 hours of initial drilling, or within a reasonable and practical amount of time after completion of the projected work, potholes shall be permanently patched.
- Any exploratory pothole and/or patch that is deemed dangerous shall be repaired immediately
- Any exploratory potholing in concrete, such as, but not limited to; sidewalk, curb and gutter, crosspans, curb-ramps, concrete median structures, or driveways, shall require the complete stone of concrete replaced. PERMANENT CONCRETE PATCHING IS ALLOWED ONLY AT THE DISCRETION OF THE TOWN.
- Colored or patterned concrete shall be replaced with the same color and pattern of the existing concrete.

937.00 HEATING AND SCARIFYING

Heating and scarifying materials and construction shall comply with Section 405 of the CDOT *Standard Specifications for Road and Bridge Construction*.

938.00 PAVEMENT DEFLECTION TESTING

Prior to Acceptance into Warranty, the Developer shall furnish the Town with two (2) copies of a Pavement Deflection Testing Report prepared by a Colorado Registered Professional Engineer utilizing non-destructive deflection testing to assess and predict the performance of the pavement.

The Colorado Registered Professional Engineer shall have experience and knowledge in performing these tests. Qualifications of the Colorado Registered Professional Engineer shall be submitted to the Town for approval before the start of work.

The pavement evaluation shall be performed in accordance with accepted engineering practices. The report shall generally incorporate the following testing and pavement evaluation techniques:

- A. Pavement surface evaluation
- B. Soil borings in areas of high deflection
- C. Pavement deflection analysis (Falling Weight Deflectometer, Dynaflex, or other method approved by the Town)

The report shall evaluate the existing condition of the base and binder course performance by deflection tests at a minimum of one hundred fifty (150) foot spacing per traffic lane over the deepest utility trench, at every manhole and storm inlet, and at all areas of visual distress. The report shall determine the Remaining Service Life (RSL) of the roadway. Pavement deflection testing and the final top lift or overlay of asphalt shall only be performed between April 1st and October 1st unless permission is granted by the Town.

If the pavement section is not projected to meet a twenty (20) year or greater pavement life based on the pavement deflection test results, the report shall detail the deficiencies and associated causes and shall recommend remedial measures to develop a twenty (20) year design life. The Town shall evaluate the report and inform the responsible party of the required pavement operations.

Pavement Deflection Testing is not required for Capital Improvement Projects (CIPs) or street

reconstruction unless otherwise specified in the contract documents.

939.00 GRINDING

Grinding shall consist of milling, grinding, or cold planing the existing pavement surface to establish a new surface profile and cross section in preparation for a bituminous overlay. After grinding, the surface shall have a grooved or ridged finish that is uniform and resistant to raveling or traffic displacement. This textured surface shall have grooves of one-quarter ($\frac{1}{4}$) inch \pm one-eighth ($\frac{1}{8}$) inch.

Grinding shall consist of milling the existing pavement surface from edge of gutter to edge of gutter to a minimum depth of one and one-half ($1\frac{1}{2}$) inches and as required by the Pavement Deflection Testing Report or as specified in the contract documents, unless otherwise directed by the Town. Grinding around utility castings shall be to a minimum depth of one and one-half ($1\frac{1}{2}$) inches and as required by the Pavement Deflection Testing Report or as specified in the contract documents.

The Contractor shall remove the cuttings immediately behind the grinding machine by belt loader, end loader, power sweeper, and/or by hand. The grinding machine shall be equipped with a pressurized watering system for dust control. Flushing into the Town's storm drainage system as a means of cleanup shall not be allowed.

Temporary Markings shall be installed in accordance with Section 935.10 Pavement Markings of the DESIGN STANDARDS AND SPECIFICATIONS.

940.00 ACCEPTANCE OF PUBLIC ROADWAYS

Workmanship shall meet all DESIGN STANDARDS AND SPECIFICATIONS. This includes thickness, crowns, drainage, areas around manholes and service covers, trench settlement and edges against curb and gutter and drain pans. Acceptance of roadways shall comply with SECTION 200 ACCEPTANCE PROCEDURES of these DESIGN STANDARDS AND SPECIFICATIONS. Pavement shall not exhibit any distress, such as alligator cracking, block cracking, edge cracking, potholes, trench settlement, raveling, heaving, sinking, separation from curb and gutter, patching, or areas of water ponding at the completion of the warranty period. Ponding of water in asphalt pavement shall not exceed one-eighth ($\frac{1}{8}$) inch in depth. Where ponding exceeds one-eighth ($\frac{1}{8}$) inch in depth, pavement shall be removed and replaced at the discretion of the Town.

Tolerances for the installation of pavement are below.

- A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:
 - 1. Base Course: Plus or minus $\frac{1}{2}$ inch.
 - 2. Surface Course: Plus $\frac{1}{4}$ inch, no minus.

- B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
 - 1. Base Course: $\frac{1}{4}$ inch.
 - 2. Surface Course: $\frac{1}{8}$ inch.
 - 3. Crowned Surfaces: Test with crowned template centered and at right angle to crown.

Maximum allowable variance from template is 1/4 inch.

SECTION 1000 – PARKS AND RECREATION CONSTRUCTION

1001.00 GENERAL CONDITIONS

Landscaping that is privately owned and maintained by a Homeowners Association (HOA) or other property management entity shall be designed and constructed in accordance with these DESIGN STANDARDS AND SPECIFICATIONS. Compliance to these DESIGN STANDARDS AND SPECIFICATIONS shall be certified by a qualified third party approved by the Town. Construction shall not commence until the construction plans are approved by the Town.

Refer to Section 100 TITLE, SCOPE AND GENERAL CONDITIONS of these DESIGN STANDARDS AND SPECIFICATIONS for additional requirements that apply to all projects within the Town.

1010.00 SITE DESIGN AND PREPARATION

Site preparation shall be completed in accordance with Section 300 SOILS AND EARTHWORK of these DESIGN STANDARDS AND SPECIFICATIONS.

Grades shall not exceed 4:1 (horizontal:vertical) in shrub beds, mulched areas, or turf areas. Landscaping at intersections shall conform to sight line “triangles” that are selected for ten (10) MPH more than the posted speed limit. Grades shall be designed to not drain onto residential lots.

All elevated center islands shall have an eighteen (18) inch minimum width colored and patterned concrete border as directed by the Town. Islands and traffic medians with turf shall have mower access ramps for maintenance for each individual turf area. Parking lot areas shall have stop blocks or buffer zones for vehicle overhang.

1020.00 TOPSOIL PREPARATION

1021.00 GENERAL

The Contractor shall provide all labor, equipment, and materials necessary to complete the topsoil preparation for seeding and/or sodding as required by the approved plans and these DESIGN STANDARDS AND SPECIFICATIONS.

If the area to be developed is undisturbed or infested with bindweed, Canadian thistle, or any other noxious or objectionable weeds, the vegetation shall be controlled by a chemical application of Glyphosate (Round-up) at a rate recommended on the chemical’s label for controlling all existing vegetation. All applicable portions of Section 323.04 TOPSOIL of these DESIGN STANDARDS AND SPECIFICATIONS shall apply.

1022.00 MATERIALS

1022.01 Organic Materials

Organic material shall be a certified Class I or II compost product, depending upon specific project applications. Lab analysis of the organic material shall be submitted for approval prior to delivery. Organic materials shall contain less than ten (10) mmhos/cm of soluble salts and shall have a pH in the range of 6.0-8.2 and 30-35% moisture content. Because of the difference in moisture content of organic

materials, certification of material volume may be required.

Organic materials shall be applied at a rate of five (5) cubic yards per one-thousand (1,000) square feet.

1022.02 Starter Fertilizer

Complete starter fertilizer shall contain the chemical analysis of Nitrogen-18, Phosphorous-46, and Potash-0. Fertilizer shall be delivered to the site in new, unopened bags bearing the manufacturer's name and the chemical analysis. Fertilizer shall conform to all Colorado Department of Agriculture fertilizer laws.

Starter fertilizer shall be applied at five (5) pounds per one-thousand (1000) square feet after fine grading is complete and before sod or seed is planted.

1023.00 PROCESS

The Contractor shall cultivate the area to be sodded/seeded to a depth of six (6) inches to remove weeds and other plants that may interfere with turf establishment. All stones, sticks, and debris larger than two (2) inches in diameter shall be removed. Prior to sodding/seeding, the Contractor shall uniformly apply organic materials and starter fertilizer at the rates specified to a depth of six (6) inches with a disc, rototiller, or other suitable tilling equipment. Organic materials shall be applied when the surface is within two-tenths (0.2) of a foot of final grade. No organic material containing manure shall be stockpiled on the site for more than eight (8) hours before it is incorporated into the soil. After tilling, the areas to be sodded/seeded shall be raked, graded, and rolled to final grade with two percent (2%) sloping surfaces to adequately drain surface water run-off. The finished surface shall be even and uniform, with no soil clumps or debris larger than two (2) inches in diameter. The prepared soil surface shall be on an even plane with all sidewalks, curbs, or borders for seeded areas and shall be three-fourths ($\frac{3}{4}$) inch below for sodded areas.

In no case shall slopes of sodded or seeded areas exceed four (4) horizontal to one (1) vertical.

All property pins shall be set and clearly marked before construction begins and shall be preserved until Final Acceptance/Release from Warranty by the Town. On sloping ground, the final harrowing or discing operation shall be on the general contour.

1024.00 INSPECTIONS

Required inspections shall include Materials, Trenching, Irrigation Pressure Testing, Soil Preparation and Sod, Trees, Shrubs, and Perennials. The Contractor shall request required inspections at least twenty-four (24) hours in advance. The Town may make inspections at any time.

1024.01 Materials Inspection

The Town may inspect all organic materials and fertilizer upon delivery. Unsatisfactory materials shall be removed. Weight tickets for all materials shall be submitted to the Town with the square footage to be amended. The Town Construction Inspector may confirm receipt of the order before materials are placed.

1024.02 Soil Preparation Inspection

The Town may inspect the soil preparation for conformance to the approved plans and these DESIGN

STANDARDS AND SPECIFICATIONS during or immediately following the completion of each segment of the preparation. Any workmanship deemed by the Town to be faulty or not in conformance with the approved plans and these DESIGN STANDARDS AND SPECIFICATIONS shall be corrected. Following is the sequence of required inspections:

- A. During or after first cultivation
- B. After application of specified organic materials
- C. During or after second cultivation
- D. After final grade is complete

1024.03 Tree, Shrub, and Perennial Inspection

The Town may inspect plant materials for conformance to the approved plans and these DESIGN STANDARDS AND SPECIFICATIONS. Unsatisfactory plant material shall be rejected. Inspections may be performed onsite for projects with fewer than twenty (20) plants and at the supplying nursery for projects with twenty (20) or more plants. All warranty replacement of plant materials shall be performed during the spring or early fall, regardless of when the warranty period ends.

1030.00 SEEDING SPECIFICATIONS

1031.00 GENERAL

The Contractor shall provide all labor, equipment and materials necessary to furnish and install seed as required by the approved plans and these DESIGN STANDARDS AND SPECIFICATIONS.

The mixture or blend of grass to be used, along with the seeding rate, shall be determined by a designated Town representative. In this determination, the following criteria may be taken into consideration:

- A. Location of seeding
- B. Intended purpose of the area
- C. Irrigation
- D. Erosion control
- E. Slope of terrain
- F. Aesthetics
- G. Availability of grass seed
- H. Maintenance requirements
- I. Compatibility with surrounding areas

1032.00 MATERIALS

1032.01 Topsoil

Refer to Section 1020.00 TOPSOIL PREPARATION of these DESIGN STANDARDS AND SPECIFICATIONS.

1032.02 Starter Fertilizer

Refer to Section 1020.00 TOPSOIL PREPARATION of these DESIGN STANDARDS AND SPECIFICATIONS.

1032.03 Bluegrass Seed

Seed shall be furnished in sealed, unopened, standard containers and labeled in accordance with the USDA Rules and Regulations and the Federal Seed Act. Seed shall be fresh, clean, pure live seed equal in quality to the standards for "Certified Seed," and shall pass the USDA test for germination of eighty-five (85) percent and for purity of ninety (90) percent. Seed shall be free of *Poa annua* and all noxious or objectionable weed and shall have a maximum weed crop of one-tenth (0.1) percent. The Town may require tests of seed verification at the Contractor's expense. Seed specifications and application rate may vary based on projected land use.

Bluegrass seed shall be applied at the rate of one hundred fifty (150) pounds per acre. The seed mixture shall be submitted for approval before seeding shall begin. Seed specifications may vary based on projected land use.

1032.04 Native Seed

Seed shall be furnished in sealed, unopened, standard containers and labeled in accordance with the USDA Rules and Regulations and the Federal Seed Act. A seed ticket must be submitted prior to installation for approval. Seed shall be fresh, clean, pure live seed equal in quality to the standards for "Certified Seed." The Town may require tests of seed verification at the Contractor's expense. Seed specifications and application rate may vary based on projected land use.

1032.05 Top Dressing

Hydro-mulch shall be a one hundred (100) percent wood cellulose fiber and shall be applied at a minimum rate of two thousand (2,000) pounds per acre with a three (3) percent tacifier. Hydromulch shall be applied immediately after seed application.

Straw shall be certified weed-free and shall be used on native seeding only. Straw shall be applied over the seeded surface at the minimum rate of two thousand (2,000) pounds per acre with partial embedment into the soil by a crimper or similar implement. Straw shall be applied immediately after seed application.

1033.00 SEEDING PROCESS

1033.01 Bluegrass Seeding

Seed shall be applied using a Brillion seeder or approved equal to drill the seed into the prepared seedbed. The seeder shall be equipped with a satisfactory feeding mechanism, an agitator, double-disc furrow

openers, depth bands and packer wheels. Seed shall be sown to a depth of one-quarter ($\frac{1}{4}$) inch into the prepared seedbed. Seed drilling shall be performed in two (2) separate applications, crossing the area at right angles to one another to guarantee proper coverage. On sloping land, the final seeding operation shall follow the general contour. Top dressing shall be applied immediately after seed application.

In areas where seed drilling is not feasible, a broadcast method may be substituted. If a broadcast method is used, the seeding rate shall be doubled and the area shall be dragged after seeding and top dressing applied.

All seeding shall occur between October 1st and April 30th unless approved in writing by the Town.

1033.02 Native Seeding

Seed shall be applied by seed drilling. Seed shall be sown to a depth of one-half ($\frac{1}{2}$) inch into a prepared seedbed. On sloping land, the seed shall be applied following the general contour. Top dressing shall be applied immediately after seed application.

In areas where seed drilling is not feasible, a broadcast method may be substituted. If a broadcast method is used, the seeding rate shall be doubled and the area shall be dragged after seeding and top dressing applied.

All seeding shall occur between October 1st and April 30th unless approved in writing by the Town.

1034.00 MAINTENANCE PROCEDURES FOR BLUEGRASS

The Contractor shall guarantee the health of the stand of grass until the entire project has been accepted by the Town. Any new grass deemed by the Town to be thin, weak, or dead shall be reseeded according to these DESIGN STANDARDS AND SPECIFICATIONS and germinated prior to the beginning of the warranty period.

The Contractor shall erect suitable fencing and signage at strategic points notifying the public to keep off the seeded areas until the lawn is well-established. Any traffic damage that may occur prior to Final Acceptance/Release from Warranty of the work shall be repaired and reseeded at the Contractor's expense.

1034.01 Mowing

During the maintenance period, after a suitable stand of grass has been established, the Contractor shall mow all lawn areas on a routine basis using a mowing height of three and one-half ($3\frac{1}{2}$) inches. Frequency of mowing shall be determined by the growth rate of the grass, but at no time should the clippings exceed more than one-third ($\frac{1}{3}$) of the total leaf blade height.

Only turf-type mowers shall be used for this operation.

1034.02 Additional Fertilizing

At the time of the first mowing, the Contractor shall apply a commercial fertilizer with the chemical analysis of Nitrogen-20, Phosphorous-10, Potash-5, plus two (2) percent iron at the rate of five (5) pounds per one thousand (1,000) square feet. When applied, the fertilizer shall be dry and free-flowing, and care should be taken to prevent burning. Fertilizer containing iron shall be cleaned off from any structures or

concrete areas. Any areas disturbed or damaged by the Contractor during fertilizing operations shall be repaired in accordance with these DESIGN STANDARDS AND SPECIFICATIONS at the Contractor's expense.

1034.03 Watering

The Contractor shall be responsible for watering the seeded area(s) a minimum of two (2) times per day (early morning and early evening), and for keeping areas moist until the lawn is established. The Developer shall be responsible for the cost of water usage until Construction Acceptance Into Warranty of the project.

1035.00 INSPECTIONS

Inspections shall be completed in accordance with Section 1024.00 INSPECTIONS of these DESIGN STANDARDS AND SPECIFICATIONS. The Contractor shall notify the Town for inspections of seed certification and germination.

1035.01 Inspection of Seed Certifications

Seed certification tags shall be delivered to the Town to verify compliance with these DESIGN STANDARDS AND SPECIFICATIONS.

1035.02 Germination Inspection

When germination is complete and plants are visible, the Contractor shall notify the Town and request a germination inspection for approval in order to begin the warranty period. Any areas determined by the Town to be thin, weak or dead shall be replaced. All washouts shall be reseeded immediately after the germination inspection. No partial acceptance shall be made.

1040.00 SODDING SPECIFICATIONS

1041.00 GENERAL

The Contractor shall provide all labor, equipment and materials necessary to furnish and install all sod as required by the approved plans and these DESIGN STANDARDS AND SPECIFICATIONS.

1042.00 MATERIALS

1042.01 Topsoil

Topsoil preparation shall be as described in Section 1020.00 TOPSOIL PREPARATION of these DESIGN STANDARDS AND SPECIFICATIONS.

1042.02 Starter Fertilizer

All fertilizer shall meet the requirements of Section 1020.00 TOPSOIL PREPARATION of these DESIGN STANDARDS AND SPECIFICATIONS. A starter fertilizer with a chemical analysis of Nitrogen-12, Phosphorous-12, Potash-4, with four (4) percent iron and eight (8) percent sulfur, shall be applied at a rate of five (5) pounds per one thousand (1,000) square feet immediately prior to sodding.

1042.03 Sod

The variety of sod will be submitted for approval before installation of sod shall begin. This blend is to be approved by the Town Construction Inspector prior to installation. Variety of sod may vary based on projected land use. An approved variety of drought-tolerant sod shall be used in passive park and right-of-way areas to assure low water use. Approved athletic grass blends shall be used in high-use park areas and on athletic fields.

Sod shall be strongly rooted and free of noxious weeds, undesirable plants, roots, stones, and other foreign materials that shall be detrimental or shall hinder proper development of the sod. The sod shall be procured from areas where the soil is reasonably fertile and contains a high percentage of loamy topsoil.

The sod shall be cut from living, thickly matted turf. The sod shall be mowed to a height not to exceed two and one-half (2½) inches and thoroughly watered before the sod is cut. All sod shall be cut to provide a minimum thickness of three-quarters (¾) inch of soil adhering to the roots. The Contractor shall furnish written proof of sod variety to the Town. Sod shall be tested by the Colorado State University laboratory or a certified laboratory at the Contractor's expense if requested by the Town.

1043.00 SODDING PROCESS

1043.01 Care and Handling

Care shall be exercised at all times to retain native soil on the sod roots during transportation, handling and planting. Dumping sod from vehicles shall not be permitted. The sod shall be transported to the site within twenty-four (24) hours from the time it is cut, unless it can be stored to the satisfaction of the Town. During delivery and while in stacks, all sod shall be kept moist and protected from exposure to the wind, sun and freezing. All sod delivered to the site shall be installed within twenty-four (24) hours of delivery. All damaged or dry sod shall be rejected.

1043.02 Transporting Sod On-Site

Sod may be transported on or across the site on pallets by forklift. Damage to the sod bed by vehicles shall be kept to a minimum and shall be regraded before sodding of the area. Damage caused to paving, curbs, fences, plants, or other objects during sodding shall be repaired or replaced by the Contractor at their expense as directed by the Town.

1043.03 Sodding

The sod bed shall be lightly watered immediately prior to installing the sod. All sod strips shall be placed tightly against each other so no open joints are apparent. Joints between ends of strips shall be staggered at least one (1) foot between adjacent rows. At the end of walks and drives, the sod shall have the same finish grade as the abutting surfaces. At curbs, the sod shall have the same finish grade as the top of the curb. Sod placed on slopes equal to four horizontal to one vertical (4:1) shall be staked with wire pins not less than six (6) inches long and spaced not more than thirty (30) inches apart. The pins shall be driven into the ground at an angle against the flow of the water until the top of the stake is just below the top of the soil and root mat. Sod shall be installed at the bottom of the slope and shall progress upward with strips laid transverse to the slopes. Immediately after the sod has been laid, it should be tamped or rolled with approved equipment to eliminate all air pockets and to provide a smooth, even surface. Immediately after rolling or tamping the sod, sufficient water shall be applied to completely saturate the sod. The sod shall be watered as often as required to prevent drying out. In settled areas, the sod shall be removed,

settled areas shall be regraded, and the sod shall be reinstalled at Contractor's expense.

1044.00 CLEAN UP

All debris and surplus materials shall be removed from the site. All disturbed areas shall be restored to original condition or to the required new condition.

1045.00 MAINTENANCE

The proper care and maintenance of the sodded areas shall be the responsibility of the Contractor until the work has been accepted by the Town. The maintenance operations shall begin as soon as each portion of the area is sodded. Maintenance shall consist of repair and replacement of eroded areas, watering, mowing (once sod is established), weeding, fertilizing, and re-sodding as necessary to provide an even, consistent stand of grass. All sod replacement required by the Town shall be done at the Contractor's expense.

1045.01 Mowing

During the maintenance period, after a suitable stand of grass has been established, the Contractor shall mow all lawn areas on a routine basis using a mowing height of three and one-half (3½) inches. Frequency of mowing shall be determined by the growth rate of the grass, but at no time should the clippings exceed more than one-third ($\frac{1}{3}$) the total leaf blade height.

Only turf-type mowers shall be used for this operation.

1045.02 Additional Fertilizing

At the time of the first mowing, the Contractor shall apply a commercial fertilizer with the chemical analysis of Nitrogen-20, Phosphorous-10, Potash-10, plus two (2) percent iron and eight (8) percent sulfur at the rate of five (5) pounds per one thousand (1,000) square feet. When applied, the fertilizer shall be dry and free-flowing, and care should be taken to prevent burning. Fertilizer containing iron shall be cleaned off from any structures or concrete areas. Any areas disturbed or damaged by the Contractor during fertilizing operations shall be repaired in accordance with these DESIGN STANDARDS AND SPECIFICATIONS at the Contractor's expense.

1045.03 Watering

The Contractor shall be responsible for watering the seeded area(s) a minimum of two (2) times per day (early morning and early evening) and for keeping areas moist until the lawn is established. The Developer shall be responsible for the cost of water usage until Construction Acceptance Into Warranty of the project.

1046.00 INSPECTIONS

Inspections shall be completed in accordance with Section 1024.00 INSPECTIONS of these DESIGN STANDARDS AND SPECIFICATIONS. The Contractor shall notify the Town for inspection of sod installation.

When sod installation is complete, the Contractor shall notify the Town and request a sod inspection for approval, in order to begin the warranty period. Any areas determined by the Town to be thin, weak,

contain excessive weeds, or dead shall be replaced. No partial acceptance shall be made.

1050.00 LANDSCAPE IRRIGATION SYSTEMS

1051.00 GENERAL

All irrigation design plans and specifications shall be submitted to the Town in accordance with Section 160.00 PLANS AND SPECIFICATIONS and Section 161.00 CONSTRUCTION PLAN REQUIREMENTS of these DESIGN STANDARDS AND SPECIFICATIONS. The Contractor is responsible for proper landscape irrigation system coverage. Landscape irrigation system design shall ensure that only planted areas are irrigated, and not paved surfaces. The Town will review and approve the design plans prior to the commencement of any work.

1051.01 Turn-over Items

Upon installation of an irrigation system, the Contractor shall furnish the Town with the following items:

- A. (2) Control Clock Keys
- B. (1) Gate Valve Key
- C. Transceiver compatible with Controller, extra battery and battery charger, one (1) per controller
- D. Laminated 11"x17" as-built drawings—three (3) copies for each controller with:
 - Color-coded valves and zones;
 - Zone listing that shows the precipitation per valve, type of head per valve, and gallons per valve; and
 - Physical addresses for the irrigation point of connection, water meter, and electrical meter.
- E. One (1) electronic copy of as-built drawings to be distributed to the Town.

1052.00 MATERIALS

1052.01 Water License and Tap Fee

The Developer shall purchase a water license and pay all applicable tap and meter fees prior to connecting into the Town's water system. The size of the water tap shall be determined and approved by the Town.

1052.02 Water Tap

All taps into the Town water mains shall comply with the requirements of Section 440.00 WATER SERVICE LINE CONSTRUCTION of these DESIGN STANDARDS AND SPECIFICATIONS. Refer to the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS.

1052.03 Water Service Line

All taps into the Town water mains shall comply with the requirements of Section 440.00 WATER SERVICE LINE CONSTRUCTION of these DESIGN STANDARDS AND SPECIFICATIONS. Refer

to the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS.

1052.04 Meter Pit

All meter pits that house meters and meter pits for drains shall be supplied by the Contractor. Refer to the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS for meter pit size and materials. Meters one and one-half (1½) inches and larger shall include a one (1) inch ball stop drain valve on the downstream side of the meter.

1052.05 Water Meter

The water meter shall be provided by the Town.

1052.06 Electrical Service

All electrical service lines shall be run underground and in electrical PVC conduit with a minimum of eighteen (18) inches cover. All wire shall be copper and shall be properly sized. When the irrigation controller is the only electrical service demand, a twenty (20) amp minimum metered service shall be installed. If a booster pump is required, a sixty (60) amp (minimum) metered service shall be installed.

If the irrigation controller is the only electrical demand, an un-metered flat rate service can be installed. All electrical service lines shall have yellow electrical warning tape in the trench six (6) inches above the conduit pipe. An electrical disconnect shall be mounted on the irrigation controller. Where electrical service is not viable, solar powered controllers may be allowed with approval by the Town.

1052.07 Backflow Prevention

All backflow preventers shall be sized in accordance with manufacturer's recommended velocities, but no velocities shall exceed the normal industrial practice of seven and one-half (7½) feet per second through the backflow device. The device shall meet the requirements of ASSE Standard 1013; AWWA Standard Code C-50678; and USC Foundation for Cross Connection Control and Hydraulic Research, latest edition.

Backflow preventers shall be installed in accordance with the applicable sections of the UBC. It shall have either a brass union or a bolted flange connection on both the inlet and discharge side of the device. Refer to the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS.

It shall be the responsibility of the Contractor to have certified tests made of all installed backflow prevention devices. These tests shall be performed by a certified cross-connection technician and copies of results presented to the Town before use of the backflow prevention device is allowed.

Backflow preventers for water taps that are two (2) inches and smaller shall be a FEBCO 825Y or 825 YA Series. Each backflow preventer shall be enclosed in a locked "Guard Shack" or approved equal enclosure with the following features:

- A. Powder-coated, rolled steel construction
- B. 100% stainless steel fasteners
- C. "Guard Shack Lock Shield" or approved equal locking mechanism for security

- D. Full-release locking mechanism for service and repair access
- E. Pre-punched viewing ports

Backflow preventer enclosures shall be centered on a concrete pad with a twelve (12) inch mow strip border. The pad shall be a minimum of six (6) inches thick and all piping shall have a PVC sleeve a minimum of one (1) inch larger than pipe size.

“Guard Shack” or approved equal enclosures shall be sized in accordance with manufacturer’s recommendations, and shall be approved by the Town. Refer to the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS.

For taps two and one-half (2½) inches and larger, the backflow prevention device shall be a FEBCO 860 or FEBCO 880 Series.

1052.08 Booster Pump

The requirement for a booster pump shall be determined by the Town water main static pressure and the design requirements of the irrigation system. When a booster pump is needed, it shall be a Peerless type-P.E., variable speed or approved equal, with magnetic starter and heater and a motor minder to monitor the pump and shut it down if necessary. The starter, heater, and motor minder shall be in a vandal resistant water tight enclosure approved by the Town. All pumps shall include a bypass. Refer to the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS.

1052.09 Pump Enclosures

Pump enclosures shall protect equipment to thirty degrees (30°) Fahrenheit below zero. Pump house may be cast-in-place or precast concrete. Fabrication drawings shall be submitted to the Town for approval prior to delivery. The pump house shall have an exposed aggregate finish; heavy duty aluminum powder-coated door and door jamb; non-locking door knob with latch; and a heavy-duty slide bolt hasp assembly secured with a padlock. The pump house shall enclose all above ground, plumbing, such as piping fittings, backflow preventer, and booster pump; all electrical equipment, such as breaker panels, switches, overhead light, and outlets; and irrigation controllers, heater, and ventilation. It shall have a minimum ceiling height of seven (7) feet.

All electrical equipment shall be Square D, Cutler Hammer, or G.E., and a waterproof type. All wire shall be copper conductor and installed in conduit. Contractor shall submit detailed drawings of equipment. An alternate pump enclosure may be pre-manufactured enclosure with all of the aforementioned features with approval by the Town.

1052.10 Controllers

The controller shall be a Toro Sentinel satellite controller with a display screen. The controller shall be housed in a stainless steel enclosure. It shall feature a pump start, manual advance switch, lightning protection, manual operating mode, data retrieval, flow sensing and flow control. Each controller shall have a maximum of 200 stations, which shall include a minimum of four (4) spare stations. Controller shall be properly grounded with an eight (8) foot long solid copper grounding rod to achieve a seven (7) ohm or less grounding quality.

The receiver shall be capable of being operated on an FM signal, with frequency to be determined and assigned by the Town. The transceiver shall be capable of transmitting and receiving signals and have a

dual tone multiple frequency (DTMF) pad and programmable cadence.

1052.11 Master Valves, Zone Valves and Flow Sensors

Master valves shall be installed at all connection points and shall be a Bermad model 410P- Opto-switch Pulse Transmitter or a Town approved master valve with a Data Industrial IR22OP flow sensor. Flow sensor must have a lay length of a minimum of five (5) times the pipe diameters from any elbows or valves for accurate readings.

All zone valves shall be preceded by a threaded 235 psi rated PVC ball valve and shall include a threaded PVC union on the lateral line (upstream) side. The zone valves shall be Rainbird EFB-CP or approved equivalent for zone valves two (2) inches and smaller. Three (3) inch or larger zone valves shall be Rainbird 300-BPE-PRS-D or approved equivalent. Zone valves shall be operated with a twenty four (24) volt solenoid and shall be capable of allowing compressed air to flow through them. Where working pressure exceeds eighty (80) psi, a PRS-D or approved equal regulator shall be required where irrigation equipment is installed. All zone valves shall be placed in a jumbo Carson or approved equivalent valve box. Valve box covers shall be brought to grade using stacked valve boxes. All valve boxes shall contain three (3) inches of three quarter ($\frac{3}{4}$) inch washed rock covered with filter fabric four (4) inches below the valve.

1052.12 Irrigation Heads

Consideration shall be given to water conserving equipment that minimizes spraying wherever practical.

- A. Turf Areas: All heads shall have a check valve. All gear drive heads shall be stainless steel. In large turf areas, Rainbird or approved equal gear driven heads shall be used. In turf areas wider than fifteen (15) feet, gear driven heads should be used unless overly obstructed. In turf areas narrower than fifteen (15) feet where spray heads are needed, Rainbird or approved equal heads shall be used. Each irrigation head shall have a minimum pop-up height of six (6) inches and shall be installed on a PVC swing joint consisting of three (3) street elbows and one (1) eight (8) inch or longer PVC nipple. Each drip zone shall have an 1812 indicator at the termination of each line.
- B. Flower Bed Areas: Irrigation for a typical flowerbed design shall consist of an EFB-CP electronic control valve with PRS-D PRV, ball valve, Rainbird 5 LRC quick coupler, and Xeri-sprays (XBA-1800 adapter) for areas eight (8) square feet or less. Larger areas will require 1812 Rainbird pop-ups. Contractor shall not mix Xeri-sprays and Rainbird 1812's in the same bed. All piping in the bed shall be one (1) inch or larger Schedule 40 PVC or SDR 26 PVC (Class 200). Equivalent materials must be approved.
- C. Shrub Beds and Trees: Shrub beds and trees shall be irrigated by a drip system. Drip irrigation systems shall consist of three-quarter ($\frac{3}{4}$) inch or one (1) inch drip line with emitters installed where required. Where approved by Parks Maintenance Staff, one-quarter ($\frac{1}{4}$) inch distribution tube with a maximum length of three (3) feet may be used. All emitters shall be pressure compensating. All laterals not in shrub beds shall be PVC pipe. The ends of the drip line shall have a ball valve and no caps. Location of ball valves shall be shown in the Record Documents. Pressure compensating Techline, or approved equal, irrigation system may be used if approved by the Town. In shrub spacings of twenty-four (24) inches and greater, the Techline shall be snaked in between plants, ensuring three emitters per plant. In shorter spacing, Techline shall be placed on two sides of the plant to ensure proper watering. Techline shall be staked in place under the

weed barrier fabric, where applicable, and covered with mulch. Techline in ground cover beds shall be staked in a grid to water entire area and covered with mulch. In sloped areas, the maximum length of a bed will be sixty (60) feet, with upper and lower supply header control by ball valves to adjust the flow. The Techline will be run perpendicular to the slope. The upper two-thirds of the slope shall be spaced at manufacturer's recommended spacing; for the lower third of the slope, increase the spacing by twenty-five percent (25%). For every four and a half (4.5) feet of elevation change, an inline check valve capable of holding a thirteen (13) foot column of water shall be included, or a separate zone or zones shall be necessary.

1052.13 Field Wiring

All wire shall be buried under and to one side of the irrigation piping. All wire shall be buried with a minimum of eighteen (18) inches of cover. All wiring shall be bundled every ten (10) feet.

- A. Lead Wire for Connecting Valve to Controller: For runs less than seven thousand seven hundred (7,700) feet, the lead wire shall be #14 UF single-strand, direct bury, PE jacketed copper wire. For runs in excess of seven thousand seven hundred (7,700) feet, the lead wire shall be #12 UF.
- B. Common Wire: All common wire shall be #12 UF single-strand, direct bury, PE jacketed copper wire with white insulation. A thirty (30) inch length of all spare wire shall be installed in every valve and wire splice box and left coiled. All wires shall be loosely installed on the back side of bends.
- C. Master Valve and Flow Sensor Wires: The Bermad 410-P master valve requires a minimum of four (4) blue, one (1) green, two (2) brown, and one (1) gray #14 AWG wire. As an alternate, the master valve shall require three (3) brown and two (2) gray wires, and the flow sensor shall require two (2) blue and two (2) green #14 AWG wires.
- D. Connectors: Only DBY-6 water-tight connectors shall be used to make wire connections, including connections in valve boxes.

1052.14 Pipe

All PVC pipe shall be continuously and permanently marked, showing the manufacturer's name, the size, and the class of the pipe. All PVC pipe shall conform to the requirements of IPS pressure pipe, ASTM D2241. Irrigation main pipe of six (6) inch diameter and larger shall comply with AWWA C-900 and be Class 200 (SDR-21). Irrigation main pipe shall be installed with tracer wire and warning tape, and shall comply with Section 432.19 TRACER WIRE AND WARNING TAPE of these DESIGN STANDARDS AND SPECIFICATIONS. Tracer wire shall be terminated in isolation valve boxes.

The velocity of the water through PVC pipe shall not exceed five (5) feet per second. The velocity of the water through copper pipe shall not exceed nine (9) feet per second. Irrigation system piping shall be as follows:

- A. Primary water service line (from Town water main to water meter) shall comply with Section 442.01 WATER SERVICE LINES of these DESIGN STANDARDS AND SPECIFICATIONS.
- B. Secondary water service line (from water meter to backflow preventer) shall be either

ductile iron or type “K” rigid copper pipe. Copper fittings less than three (3) inch diameter shall be soldered together using lead-free solder. Three (3) inch copper fittings shall be soldered together using silver solder.

- C. Irrigation main pipe less than six (6) inch diameter shall be ASTM D2241 Class 200 (SDR 21). One (1) inch to two and one half (2 ½) inch diameter pipe shall be solvent weld type and shall use ASTM F656 purple primer and ASTM D2564 glue. Three (3) inch diameter pipe shall be integral bell gasketed pipe.
- D. Irrigation main pipe six (6) inch diameter and larger shall be AWWA C900 Class 200 (SDR-21).
- E. Two and one half (2½) inch pipe installed in hard surface crossings under twenty (20) feet shall not use bell connections.
- F. All street crossings with pipe three (3) inch or larger shall require fused pipe.
- G. All gasketed pipe shall be restrained in compliance with Section 433.06 THRUST BLOCKING, RESTRAINED JOINTS AND FITTINGS of these DESIGN STANDARDS AND SPECIFICATIONS.
- H. The lateral lines shall be Class 200 (SDR 21) PVC pipe, and shall be assembled using the same primer and glue noted in Section 1052.14 C above. No main or lateral line pipe shall be smaller than one (1) inch diameter.

All gasketed pipe shall be restrained by thrust blocks and mechanical joint restraint as required in these DESIGN STANDARDS AND SPECIFICATIONS. Mechanical joint restraint (wedge action, self-actuating, such as Megalugs) shall be used for point of connection and fittings, such as but not limited to directional elbows, directional tees, and gate valves. Push-on fittings may be allowed for bends less than ninety (90) degrees with proper thrust blocks with rebar restraint excluding point of connections.

1052.15 Quick Coupler Valves

Each system shall have a minimum of one quick coupler valve located near the backflow preventer and one at the end of each stub of the mainline. When there is a looped mainline, quick coupler valves shall be located at various points or where directed by the Town. This valve shall be a Rainbird No. 5LRC or approved equivalent, and shall be both vinyl-covered and locking. It shall be installed in a ten (10) inch diameter valve box as manufactured by Carson or approved equal. Refer to the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS.

1052.16 Manual Drain Valves

All main lines shall have a minimum of two (2) manual drain valves, one on either side of the backflow preventer. Drain valves shall be one (1) inch diameter ball stop valves. One drain valve shall be installed inside the meter pit. One drain valve shall be installed on the downstream side of the backflow preventer. Access to the downstream drain valve shall be provided via a two (2) inch diameter PVC sleeve with a “Snug Cap” or approved equal. This shall be enclosed in a ten (10) inch diameter valve box manufactured by Carson or approved equal. All manual drains shall discharge into a gravel sump containing a minimum of three (3) cubic feet of three-fourths (¾) inch washed rock. The top surface of the rock shall be covered with filter fabric. Refer to the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS.

1052.17 Isolation Valves

Isolation valves shall be installed at locations noted on the approved plans and at both sides of a street crossing. Isolation valves two (2) inch diameter and larger shall be Clow or approved equal and shall comply with Section 432.05 GATE VALVES and Section 442.09 VALVES FOR USE WITH METERS of these DESIGN STANDARDS AND SPECIFICATIONS. Valves one and one-half (1½) inches diameter or smaller shall be brass gate valves with cross handles and resilient seats. Direction of valve operation for irrigation systems past the meter shall be open left and close right.

1052.18 Pressure Reducing Valves

When the Town main line static pressure exceeds one hundred (100) psi, a pressure reducing valve approved by the Town shall be installed in an in-ground enclosure and shall be a Clayton 90-91AB and/or Clayton 90-01AS pressure reducing PRV by CLA-VAL-CO or approved equal.

1052.19 Sleeving

Only irrigation equipment shall be installed in irrigation sleeves. Irrigation wiring and piping installed in separate sleeves under sidewalks, curbs, roadways or similar structures shall be sleeved.

Sleeves shall be PVC IPS pressure pipe, SDR-26 or heavier, and shall be a minimum of one and one-half (1½) inches larger inside diameter than the maximum outside diameter (bell) of the pipe to be installed through it. Sleeves shall extend a minimum of twelve (12) inches beyond the edge of the sidewalk, curb, roadway, or similar structure. The location of the sleeve shall be permanently marked on the structure that is crossed under.

1052.20 Materials for Use with Reclaimed Water

Materials used in reclaimed water irrigation systems shall comply with reclaimed water standards and shall be purple in color, or if approved, may be clearly marked as reclaimed. Materials covered by this requirement include (but are not limited to) meters, valves, quick couplers, valve box covers, irrigation heads, Techline, and warning tape. The Town shall provide and install its own signage. Reclaimed water connection point following the meter pit shall consist of, in consecutive order: one (1) isolation valve, one (1) ball stop drain and one (1) quick coupler.

1053.00 SITE CONDITIONS

The Contractor shall coordinate work with that of other trades to prevent conflicts.

Changes or alterations in the system to meet site conditions shall be subject to the Town approval. Contractor shall prepare a set of Record Documents as stated in Section 200 ACCEPTANCE PROCEDURES of these DESIGN STANDARDS AND SPECIFICATIONS.

The Contractor shall be responsible for providing electrical requirements required for the job. The appropriate electrical utility (Xcel Energy or United Power) should be contacted for information on possible electrical sources. All electrical work, except 24 volt, shall require a separate inspection by the Town.

1054.00 EXCAVATION

All applicable portions of Section 340.00 TRENCHING, BACKFILLING AND COMPACTING of these DESIGN STANDARDS AND SPECIFICATIONS shall apply. When approved by the Town, trench excavation and backfill for irrigation systems in excess of the limits noted in Section 350.00 may be allowed.

1055.00 PROCESS

1055.01 Staking

Contractor shall ensure that all existing utilities are field located. Prior to new construction, locations of proposed irrigation lines, sprinkler heads and system equipment shall be staked with six (6) foot wood or steel posts. Stakes shall be color coded for materials and maintained throughout the sprinkler installation process.

1055.02 Pump House

When a pump house is used, the secondary water service line shall be extended a minimum of twenty-four (24) inches below grade on the discharge side of the pump house and a minimum of twenty-four (24) inches beyond the pump house slab or footing.

1055.03 Pipe Assembly

The adaptation from copper to PVC shall be made by using a female copper adapter receiving a Schedule 80 PVC cut-off nipple.

PVC pipe shall comply with Section 1052.14 PIPE of these DESIGN STANDARDS AND SPECIFICATIONS. All excess glue shall be wiped from the joint with a cloth rag or similar material after assembly. The Town shall not allow gluing of pipe unless the temperature is forty (40) degrees and rising for one hour. Install purple insulated tracer wire and purple warning tape along all reuse water line pipe. Install tracer wire and blue warning tape along all potable water pipe. All threaded PVC fittings shall receive a double wrap of Teflon tape prior to assembly.

1055.04 Trenching

All pipes shall be installed along the center of an excavated trench to approved lines and grades. Trenches shall be dug true to the alignments shown on the approved plans. All bends shall be made with fittings. Excavation of the trenches shall be done in a workman- like manner with a flat bottom containing no rocks or other deleterious material that may damage the pipe. Separate trenches shall be dug for each line. No doubling up of lines in a single trench shall be allowed. Trenches shall be dug deep enough to allow the following cover over the top of the pipe:

TABLE 1000.01

Main Line Size	Minimum Cover	Maximum Cover
1" – 1½"	18"	24"
2" – 2½ "	24"	36"
3" and greater	30"	36"

TABLE 1000.02

Lateral Line Size		Minimum Cover	Maximum Cover
1"- 3"	Gear Driven Rotors	18"	24"
1"- 3"	6" Pop-Up Spray Heads	12"	24"
1"- 3"	12" Pop-Up Spray Heads	18"	24"
> 3"	6" or 12" Pop-Up Spray Heads	18"	24"

No trench shall be left open overnight without specific prior approval by the Town and without sufficient barricades to protect the public. Barricades shall comply with Section 141.13 TRAFFIC CONTROL, BARRICADES AND WARNING SIGNS of these DESIGN STANDARDS AND SPECIFICATIONS.

1055.05 Control Valves

Control valves shall be installed eight (8) inches below the bottom of the valve box lid. Stacked valve boxes shall be used to bring the cover of the valve box to the finished grade. All irrigation boxes should be permanently branded with two (2) inch high numbers or letters as follows: Master Valve (MV), Isolation Valve (GV), Quick Coupler (QC), Grounding Rod (GR), Wire Splice (WS), or Manual Drain (MD). Zone valve boxes shall be marked as follows: (Timer A, B, C, etc. – Zone #). For example, markings shall read “(A2)” or “(B19).” Branding shall also apply to all two (2) wire systems, and installation shall be as shown in the Detail Drawings.

1055.06 Backfill

Backfill material shall be free of rocks one (1) inch in diameter and larger. All backfill of irrigation trenches shall be done by puddling. Compaction of soils in landscape areas other than irrigation trenches shall be between eighty (80) and eighty-five (85) percent of the Standard Proctor per ASTM D698.

1056.00 INSPECTIONS

A copy of the approved construction plans, these DESIGN STANDARDS AND SPECIFICATIONS, and the project inspection sheets shall be onsite at all times. Any allowable variances from the approved Construction plans shall be noted on the project inspection the sheets by the Town Construction Inspector. The Contractor shall request the following required inspections twenty-four (24) hours in advance:

1056.01 Trailer Inspection

The Town shall inspect the storage area and equipment and materials trailer before any irrigation system installation begins. Only approved materials and equipment shall be allowed.

1056.02 Sprinkler Location Staking

The Town shall inspect the staked locations of all lines and heads for conformance to the approved plans and these DESIGN STANDARDS AND SPECIFICATIONS. The Town reserves the right to move, shift and adjust any of the stakes to better achieve the design intentions. No trenching shall be done until the inspection is complete and the staked locations approved by the Town.

1056.03 Main Line Inspection

Prior to trench backfilling, the Town shall inspect the depth of pipe, thrust blocking, manual drain valves, sumps, control valves and wiring for conformance to the approved plans and these DESIGN STANDARDS AND SPECIFICATIONS.

1056.04 Pressure Test

The contractor shall pre-test the system prior to requesting an inspection. All main lines shall be pressure tested to one hundred fifty (150) psi at the low point of the section being tested. The maximum loss shall be five (5) psi in one (1) hour.

All valve boxes shall be opened and ball valves shall be open and flagged for inspection. Prior to a pressure test, the zone valves shall be wired. A failed test requiring retesting shall be a one hundred (100) dollar fee remitted to the Town.

1056.05 Wiring Inspection

When the wiring installation has been completed, the Town shall inspect it for conformance with the approved plans and these DESIGN STANDARDS AND SPECIFICATIONS.

1056.06 Coverage Test

Upon completion of all irrigation system installation, the Contractor, in the presence of the Town, shall perform a coverage test. Prior to the coverage test, the controller shall be wired and set to the Town frequency. The controller shall respond to the hand held radio, or no test shall be performed.

1057.00 TURN-ON AND WINTERIZATION

In the fall, the Contractor shall shut down and winterize the system to protect from freezing. The Contractor shall start up the system in the spring and shall perform any necessary service work. The Town shall be notified prior to landscape irrigation system winterization and spring turn on. Refer to Section 200 ACCEPTANCE PROCEDURES of these DESIGN STANDARDS AND SPECIFICATIONS.

1058.00 ACCEPTANCE AND WARRANTY

Acceptance and warranty shall comply with the requirements of Section 200 ACCEPTANCE PROCEDURES of these DESIGN STANDARDS AND SPECIFICATIONS. No landscaping or irrigation inspections shall be performed between October 15 and March 15.

1060.00 PLANTING SPECIFICATIONS

1061.00 GENERAL

The scope of work involves furnishing all plants, equipment, materials, labor and supervision necessary for the installation of plant materials as indicated on the approved plans and in these DESIGN STANDARDS AND SPECIFICATIONS.

1062.00 MATERIALS

1062.01 Mulch and Edging

All trees shall be mulched with materials of a fibrous nature, such as shredded wood chips or shavings, which are between two (2) inches and six (6) inches in length and are placed to a depth of three (3) inches around each tree. In specific cases, when approved by the Town, cobble or rock mulch may be substituted for the fibrous mulch. All edging shall be six (6) inch wide and fourteen (14) minimum gauge painted green steel with a rolled top edge.

1062.02 Staking and Guying

All trees shall be staked and guyed using the following material:

- A. Stakes: 6-foot tall steel tees or 2" wood posts
- B. Wires: A double strand of #16 galvanized wire
- C. Nylon straps: 1 1/2" wide nylon strap with eyelets at each end.

1062.03 Ornamentals, Perennials, Shrubs and Trees

The Contractor shall furnish and install all plants shown on the approved plans.

All plant materials shall:

- A. Be alive, healthy and not newly potted
- B. Have a normal, well-developed branch and root system
- C. Show good annual growth
- D. Have plump buds, well-fitted for the species

Evergreen foliage shall have a good intense color. Trees shall contain a central dominant leader with evenly spaced branches. Foliage and branches shall be distributed on the upper two-thirds ($\frac{2}{3}$) of the tree. The trunk shall taper from a solid base to a more slender diameter at the top.

All plant materials shall be free from:

- A. Defects or mechanical damage
- B. Disfiguring knots
- C. Bark abrasions and discolorations
- D. Plant diseases and all forms of infestations
- E. Wilted leaves

F. Insect eggs and borers

Plants with damage shall be rejected.

Plant tags stating the correct plant name and size shall be securely attached to all plant materials.

Balled roots shall be firmly wrapped with burlap or similar material and bound with rope or wires. Roots shall not be girdling, circling or pot-bound. Plants with broken root balls shall not be installed. Any plant that is loose in the ball shall not be installed.

All plant materials shall conform to the measurements noted in the plant specifications and on the approved plans.

1062.03.01 Planting Plan Design

The planting plan shall insure a broad range of plant material to prevent a monoculture. Landscaping projects with greater than 100 trees are encouraged to follow the Urban Forestry Diversity Formula, which requires that no more than 10% of any single plant species, no more than 20% of a single genus, and no more than 30% of a single family shall be specified in the plans.

The plant count shall be based on the size at maturity. The following are minimum sizes:

- A. Deciduous trees—2” caliper or larger
- B. Coniferous Evergreen trees—6’ tall or larger
- C. Shrubs—#5 container
- D. Ornamentals and perennials—#1 container
- E. Ground Cover Plants—4” Container

TABLE 1000.03 BALL SIZE—DECIDUOUS TREES

Tree Size	Ball Depth Minimum (in.)	Ball Diameter Minimum (in.)
2" – 2½" caliper	20	24
2-½" - 3" caliper	22	28
3-½" - 4" caliper	30	38
5' - 6' height	14	16
6' - 8' height	16	18

TABLE 1000.04 BALL SIZE -- CONIFEROUS EVERGREEN TREES**

Types 1, 2, and 3		Types 4 and 5		Type 6	
Spreading, semi-spreading, broad spreading, globe, and compact upright		Pyramidal, broad		Columnar	
Spread (Types 1 and 2) Height (Type 3) (in.)	Minimum diameter ball (in.)	Height/caliper (in.)	Minimum diameter ball (in.)	Height/caliper (in.)	Minimum diameter ball (in.)
9	8	12	8	12	7
12	10	15	10	15	8
15	12	18	12	18	9
18	14	24	14	24	11
24	16	30	16	30	13
30	18	36	18	36	14
36	24	48	20	48	16
42	26	60	22	60	18
48	28	72	24	72	20
60	36	84	26	84	22
72	40	96	28	96	24
84	46	111	32	110.5	26
96	52	111.5	34	111	28
		112	38	111.5	32
		112.5	42	112	36
		113	48	112.5	40
		113.5	54	113	44
		114	60	113.5	48
		115	72	114	54
		116	84	115	66
		117	90	116	78
				117	90

Notes:

- A. Plant sizes and caliper measurements indicate minimum size in the size interval (e.g., “4 ½ in.” caliper indicates 4½ - 5 in. caliper interval).
- B. Rapid-growing varieties may have root balls one size smaller.
- C. Check with American Standard for Nursery Stock for exact specifications of each species.

1062.04 Weed Barrier Fabric

All cobble and rock mulched areas shall have a continuous layer of weed barrier fabric installed under the

mulch. It shall be Mirafi 140NSL fabric with four and three-tenths (4.3) ounces per square yard, or an approved equal. Bed areas with shrubs, trees, perennial plants, or ground cover plants shall not require weed barrier fabric.

1062.05 Backfill Mixture

Backfill mixture for annual plant materials shall be a mix of one-third ($\frac{1}{3}$) organic material mixed with native material. Refer to Section 1022.01 ORGANIC MATERIALS of these DESIGN STANDARDS AND SPECIFICATIONS. Backfill mixture for trees and shrubs shall be native material.

1063.00 LANDSCAPING

All landscaping shall be designed in accordance with the Town's Master Landscaping Plan as shown in the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS. Xeriscape or other landscape plans may be permitted with the approval of the Town.

1063.01 Street Right-of-Way

The following landscape requirements for street ROW and interchanges shall apply:

TABLE 1000.05 LANDSCAPE REQUIREMENTS FOR LOCAL AND COLLECTOR STREETS

	Minimum Quantity	Arrangement	Ideal Locations	Unacceptable Locations	Purpose	Specifics
DECIDUOUS SHADE TREES	1 TREE/LOT	FORMAL	LANDSCAPE STRIPS	N/R	SHADE/ MASSING	MINIMUM OF 35' SPACING
CONIFEROUS EVERGREEN TREES	N/R*	N/R	N/R	SIGHT TRIANGLES	N/R	N/R
ORNAMENTAL TREES	1 TREE/LOT	INFORMAL	FRONT YARD	SIGHT TRIANGLES	ACCENT	MINIMUM OF 15' SPACING
DECIDUOUS SHRUBS	N/R	CLUSTERED, INFORMAL	FRONT YARD	SIGHT TRIANGLES (SHRUBS OVER 2'- 0")	MASSING	
EVERGREEN SHRUBS	N/R	CLUSTERED, INFORMAL	FRONT YARD	SIGHT TRIANGLES (SHRUBS OVER 2'- 0")	MASSING	
PERENNIALS	N/R	N/R	SIGHT TRIANGLES, INTERSECTION CORNERS, FRONT YARD	N/R	MASSING	LOW MAINTENANCE
TURFGRASS	FRONT YARD	N/R	LENGTH OF STREET/ CORNERS	4:1 OR STEEPER SLOPES	GROUND-COVER	LOW WATER USE TURF
MOSS ROCK BOULDERS	N/R	CLUSTERED	SHRUB, PERENNIAL BEDS	LAWN AREAS	ACCENT, SLOPE STABILIZATION	MOSS ROCK, 36" MINIMUM SIZE
BERMS	N/R	N/R	ALONG LENGTH OF STREET	SIGHT TRIANGLES	SCREEN, VISUAL INTEREST	BERMS AT MAX 4:1 SLOPE

*N/R: not relevant at this location.

TABLE 1000.06 LANDSCAPE REQUIREMENTS FOR MINOR ARTERIALS

	Minimum Quantity	Arrangement	Ideal Locations	Unacceptable Locations	Purpose	Specifics
DECIDUOUS SHADE TREES	1 TREE/60'	FORMAL	LANDSCAPE STRIPS	MEDIANS	SHADE/MASSING	MINIMUM OF 35' SPACING
CONIFEROUS EVERGREEN TREES	1 TREE/90'	INFORMAL, INTERMIXED	LANDSCAPE TRACT	SIGHT TRIANGLES, MEDIANS, & WITHIN 55' OF R.O.W.	ACCENT, SCREEN	MINIMUM OF 25' SPACING
ORNAMENTAL TREES	1 TREE/120'	INFORMAL, INTERMIXED	LANDSCAPE TRACT, MEDIANS, & INTERSECTIONS	SIGHT TRIANGLES, WITHIN 55' OF R.O.W.	ACCENT	MINIMUM OF 15' SPACING
DECIDUOUS SHRUBS	½ OF SHRUB MATERIAL	CLUSTERED, INFORMAL	ALL	SIGHT TRIANGLES (SHRUBS OVER 2'- 0")	MASSING	
EVERGREEN SHRUBS	½ OF SHRUB MATERIAL	CLUSTERED, INFORMAL	ALL	SIGHT TRIANGLES (SHRUBS OVER 2'- 0")	MASSING	
PERENNIALS	N/R*	N/R	SIGHT TRIANGLES/ INTERSECTION CORNERS	LENGTH OF STREET, MEDIANS (PLANTS OVER 24" IN HEIGHT)	MASSING	LOW MAINTENANCE
TURFGRASS	N/R	N/R	LENGTH OF STREET/ CORNERS	4:1 OR STEEPER SLOPES	GROUND-COVER	LOW WATER USE TURF
MOSS ROCK BOULDERS	N/R	CLUSTERED	SHRUB/ PERENNIAL BEDS, MEDIANS, STEEP SLOPES	LAWN AREAS	ACCENT, SLOPE STABILIZATION	MOSS ROCK, 36" MINIMUM SIZE
BERMS	N/R	N/R	ALONG LENGTH OF STREET	SIGHT TRIANGLES	SCREEN, VISUAL INTEREST	BERMS AT MAX 4:1 SLOPE

*N/R: not relevant at this location.

TABLE 1000.07 LANDSCAPE REQUIREMENTS FOR MAJOR ARTERIALS

	Minimum Quantity	Arrangement	Ideal Locations	Unacceptable Locations	Purpose	Specifics
DECIDUOUS SHADE TREES	1 TREE/50'	FORMAL	LANDSCAPE STRIPS	MEDIANS	SHADE/MASSING	MINIMUM OF 35' SPACING
CONIFEROUS EVERGREEN TREES	1 TREE/100'	INFORMAL, INTERMIXED	LANDSCAPE TRACT	SIGHT TRIANGLES, MEDIANS, & WITHIN 65' OF R.O.W.	ACCENT, SCREEN	MINIMUM OF 25' SPACING
ORNAMENTAL TREES	1 TREE/60'	INFORMAL, INTERMIXED	LANDSCAPE TRACT, MEDIANS, & INTERSECTIONS	SIGHT TRIANGLES, WITHIN 65' OF R.O.W.	ACCENT	MINIMUM OF 15' SPACING
DECIDUOUS SHRUBS	½ OF SHRUB MATERIAL	CLUSTERED, INFORMAL	ALL	SIGHT TRIANGLES (SHRUBS OVER 2' - 0")	MASSING	
EVERGREEN SHRUBS	½ OF SHRUB MATERIAL	CLUSTERED, INFORMAL	ALL	SIGHT TRIANGLES (SHRUBS OVER 2' - 0")	MASSING	
PERENNIALS	N/R*	N/R	SIGHT TRIANGLES/ INTERSECTION CORNERS	N/R	MASSING & ACCENT	LOW MAINTENANCE
TURFGRASS	N/R	N/R	LENGTH OF STREET/ CORNERS	4:1 OR STEEPER SLOPES	GROUND-COVER	LOW WATER USE TURF
MOSS ROCK BOULDERS	N/R	CLUSTERED	SHRUB/ PERENNIAL BEDS, MEDIANS, STEEP SLOPES	LAWN AREAS	ACCENT, SLOPE STABILIZATION	MOSS ROCK, 36" MINIMUM SIZE
BERMS	N/R	N/R	ALONG LENGTH OF STREET	SIGHT TRIANGLES	SCREEN, VISUAL INTEREST	BERMS AT MAX 4:1 SLOPE
SITE FURNITURE	1 BENCH/300'	DISPERSED	ALONG LENGTH OF STREET	SIGHT TRIANGLES, MEDIANS	PEDESTRIAN USE	BENCHES, TRASH RECEPTACLES, & LIGHTING

*N/R: not relevant at this location

1063.02 Mow Strip

Concrete or crushed rock mow strips shall be constructed around all grouted rock areas and utilities, including fire hydrants, phone boxes, cable boxes, light fixtures, and traffic controller boxes.

Mow strips shall be placed along ballfield fencing and in site-specific fenced areas in Open Space. They shall be six (6) inches thick and eighteen (18) inches wide, and fencing shall be centered over the mow strip.

All materials and locations shall be determined and approved by the Town.

1063.03 Ditch Banks

All ditch banks, inlets, or outlets lined with rock or cobblestone shall be grouted and contained by a mow strip. Materials and locations shall be determined and approved by the Town.

1063.04 Annual Flower Beds

Annual flower beds shall be designed for high visibility areas in parks or traffic medians. They shall have separate irrigation system specific for beds. The beds shall have six (6) inches of native soil amended. The Town may amend with organic materials at the time of planting.

1064.00 PLANTING

1064.01 Location Staking

The Contractor shall stake the proposed locations of all trees and shrubs site for approval by the Town prior to planting. The Town reserves the right to move, shift, or adjust any or all of the stakes to better achieve the planting design intentions, as shown on the approved drawings.

The Contractor shall arrange to have the locations of all utility lines (including but not limited to water, sewer, gas, electrical, phone, and irrigation) marked prior to the inspection.

1064.02 Seasons of Planting

Planting may occur whenever the soil conditions are favorable or as authorized by the Town. All conifers planted in Candle growth stage shall be hand foliage watered by the Contractor for a period of one (1) week after planting.

1064.03 Planting Procedures

All plantings shall be in accordance with the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS. The size of tree pits shall be two (2) times the diameter of the root ball and deep enough so that the tree's root flair remains two (2) inches higher than finished grade after settling has occurred. The sides of the tree pit shall taper inward to the bottom of the hole.

The shrub pits shall be twelve (12) inches in diameter greater than the container diameter and as deep as necessary to properly set the plant.

All plants shall be set plumb and in the center of the pit. The root ball shall be set on compacted backfill

mix.

Balled and burlapped trees shall be set with backfill mixture. Backfill mixture shall be thoroughly blended prior to placement in the pit or planter bed. After placing the backfill mixture around the root ball, thoroughly water the plant to remove all voids.

All ropes or wires from the bases of trees and shrubs shall be removed. Wire baskets shall be removed before trees and shrubs are backfilled. All containers (including organic manufactured baskets) from container-grown plant materials shall be removed prior to planting.

Plant materials stored on site shall be watered daily. Plant materials stored on site for more than forty-eight (48) hours shall be healed in with mulch.

Compaction of soils in landscape areas shall be between eighty (80) and eighty-five (85) percent of the Standard Proctor, per ASTM D698.

1064.04 Pruning

After installation, broken and dead branches shall be removed. All pruning shall be performed with clean, sharp, sterile tools.

1064.05 Tree Wrapping

After installation, all deciduous trees shall be wrapped from November 1st until April 1st of the following year. No wrapping shall be permitted until the trees have been inspected by the Town. The trunks of all trees shall be wrapped spirally from bottom to top, overlapping the seams and entirely covering the trunk from the ground up to the second branch. The tree wrap shall be neat, snug, and secured with vinyl electric or duct tape at twenty-four (24) inch intervals or tape approved by the Town. Only approved four (4) inch wide tree wrap shall be used.

1064.06 Staking and Guying

Immediately after installation, all deciduous and coniferous evergreen trees shall be staked and guyed. Staking and guying shall be done with six (6) foot tall steel tee posts. Three (3) stakes in a triangle formation shall be used for coniferous trees. Two (2) stakes shall be used for deciduous trees up to three (3) inches in diameter, and three (3) stakes shall be used for trees larger than three (3) inches in diameter. Stakes shall be placed in undisturbed ground within the tree mulch ring. The tree shall be guyed using a one and one-half (1 ½) inch wide nylon strap with eyelets in each end. A double strand of galvanized wire shall be used to connect the nylon strap to the steel tee post. Proper tension on the guy wires shall be obtained by twisting the double strands of wire. Large trees may require additional tree posts and guys. Materials shall comply with Section 1062.02 STAKING AND GUYING of these DESIGN STANDARDS AND SPECIFICATIONS. Refer to the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS.

The timing of the removal of staking and guying shall be determined in the field on as-needed basis.

1064.07 Fertilizing

Trees and shrubs shall not be fertilized for the first twelve (12) months after installation.

1064.08 Mulching

After installation of all plant material, the Contractor shall construct a three (3) inch high earth berm built around the tree to form a saucer. The diameter of the saucer shall be twice the diameter for deciduous trees root ball and at the drip line for coniferous evergreen trees. Mulch shall be placed in the saucer to the depth of the berm and taper to the plant crown. A small gap shall be left between the tree trunk and the mulch. Mulch shall comply with Section 1062.01 MULCH AND EDGING of these DESIGN STANDARDS AND SPECIFICATIONS.

1064.09 Planting Beds and Ground Cover Areas

In areas where cobble, rock mulch, gravel, or wood mulch is to be used as a ground cover, the entire bed shall be excavated to a depth of three (3) inches, and a depth of three (3) inches of ground cover material shall be placed and maintained. Weed barrier fabric is required under cobble and rock mulch, but not under gravel. All seams in the fabric shall overlap a minimum of twelve (12) inches. Bed areas with shrubs, trees, perennial plants, or ground cover plants shall not require weed barrier fabric.

1064.10 Clean Up

The project site shall be kept clean. Rope, wire, burlap, empty containers, rocks, clods, and other debris shall not be allowed to accumulate on the site. Soil excavated from plant pits and planter beds and debris shall be removed from the site. Upon completion of the planting, all excess soils, rocks, and debris, which have not previously been cleaned up shall be removed from the site or disposed of.

1064.11 Transportation of Plant Materials

All plant material shall be covered with shade cloth tarps or enclosed so the plant material is protected from the wind and sun during transportation.

1065.00 MAINTENANCE

The Contractor shall be responsible for all maintenance following installation of all plant material and shall continue maintenance procedures until the project has been accepted after warranty period by the Town. The warranty is probationary for one (1) year and acceptable after two (2). Maintenance shall include hand watering, weeding, spraying with notification to the Town, cultivating, trimming, mulching, wrapping, tightening, and repairing of guy wires, as well as removing and replacing of all dead materials and resetting plants to proper grades and upright positions as required. Planting stock, replaced under warranty, shall be warranted for an additional year,

1066.00 INSPECTIONS

The Contractor shall request the following required inspections at least twenty-four (24) hours in advance.

1066.01 Plant Location Staking

The Town shall inspect the plant location staking prior to the installation of any plant materials specified in Section 1064.01 LOCATION STAKING of these DESIGN STANDARDS AND SPECIFICATIONS.

1066.02 Quantity and Quality of Plant Material

The Town shall inspect the plant material following their delivery to the site and prior to the planting on the site. The Town reserves the right to reject any plant not meeting the approved design requirements for size, shape, and conditions at that time.

1066.03 Planting Operations

The Town shall inspect the planting operations, including digging, planting, pruning, wrapping, fertilizing, and mulching.

1070.00 RECREATION EQUIPMENT

1071.00 GENERAL

Selection of recreation equipment shall be approved by the Town prior to purchase by the Contractor. In selecting equipment, the brand, style, color, size, and other criteria shall be considered and jointly selected by the Contractor and the Town. All installations of equipment shall be performed by the Contractor to ensure warranty remains intact.

1072.00 BALLFIELD SPECIFICATIONS

Adequate drainage shall be taken into account in ballfield designs. Infield slopes shall be between one-half (½) percent and one and one-half (1 ½) percent. Infield shall be designed so that drainage falls away from infield surface. Outfield slopes shall be between one and one-half (1½) percent and two and one-half (2½) percent. Outfield shall be designed so that drainage falls away from infield surface.

1072.01 Softball Infield

Infields shall be cut on a seventy (70) foot arc from the back center of the pitching plate. Home plate shall be twenty-five (25) feet from the backstop, and the foul line shall be twenty five- (25) feet from wing fences. The pitching plate shall be located fifty (50) feet from the back point of home plate. Up to three (3) sets of base receptacles shall be provided to accommodate play of different age groups. Infields shall include at least (3) irrigation heads designated to water the infield surface. The irrigation head layout design shall be approved by the Town before installation.

1072.02 Baseball Infield

Infields shall be cut on a ninety-five (95) foot arc from the back center of the pitching plate. Home plate shall be thirty-five (35) feet from the backstop with foul lines thirty-five (35) feet from wing fences. The pitching plate shall be located sixty (60) feet, six (6) inches, from the back point of home plate. Up to three (3) sets of base receptacles shall be provided to accommodate play of different age groups. Infields shall include at least (3) irrigation heads designated to water the infield surface. The irrigation head layout design shall be approved by the Town before installation.

1072.03 Field Composition

The infield area shall be excavated eight (8) inches below grade and eight (8) inches of suitable infield mixture, as approved by the Town. A computer blended ninety (90) percent sand and ten (10) percent silt/clay shall be installed, leveled, and compacted to a firm, smooth surface. All mixtures shall be

approved by the Town prior to installation.

1072.04 Field Drainage

All areas outside ballfield fencing, such as concrete bleacher pads, walks, and landscaping, shall be graded to drain away from the field surface.

1072.05 Fencing

A. Fabric:

1. All chain link fabric shall be six (6) gauge, knuckled selvage top; barbed or knuckled selvage bottom; two and one-half (2 ½) inch mesh.

B. Posts and rails:

1. Backstop support posts shall be 4 inch minimum, 7.29 lbs. per foot of pipe.
2. Terminal and gate posts shall be 2⁷/₈- inch O.D., minimum, 4.64 lbs. per foot of pipe.
3. Line posts shall be 2³/₈" O.D., minimum, 3.117 lbs. per foot of pipe.
4. Top rail and horizontal bracing shall be 1⁵/₈ inch O.D., minimum, 1.836 lbs. per foot of pipe.

C. Fittings and hardware:

1. Top rail caps, rail end caps, brace bands, tension bands, etc., shall be pressed steel or cast steel; all commercial quality.
2. Nuts and bolts shall be commercial fencing quality.
3. All top rail caps shall be rounded top with no points or extrusions.

D. Wire and ties:

1. Post and rail tie wires shall be #12 ½ gauge steel.
2. Tension wire shall be #7 gauge steel wire.
3. Tension bar shall be 3/16" X ¾" steel.

E. Dimensions:

1. Backstops shall be twenty (20) feet high and twenty (20) feet across the back with ten (10) feet wings. Baseball backstops shall include a hood. The hood on baseball backstops can be nine (9) gauge fabric.
2. Wing fences and dugout faces shall be ten (10) feet high from the backstop to a point one hundred (100) feet out on line.
3. Wing fences, from the ten (10) feet high section to the home run fence (if applicable) shall be four (4) feet high.
4. Dugout sides and backs shall be six (6) feet high.
5. Home run fences shall be eight (8) feet high.
6. All posts (terminal, line, and backstop) shall be spaced ten (10) feet apart or less, with even spacing, except for dugouts.
7. Backstop boards shall be installed on both sides of chainlink fence. On the back stop portion, they shall consist of two (2) two (2) by twelves (12s), and on the elevated wing fence they shall consist of one (1) two (2) by twelve (12). Board material shall be approved by Parks.

1072.06 Dugout Covers

All dugouts shall be covered with a wood framed metal roofed structure, to be approved by the Parks Division prior to installation.

1072.07 Soccer Field/Football Field/Multi-Use Field Specifications

Adequate drainage shall be taken into account in the field design. Field slopes shall be between one-half (1/2) percent and one and one-half (1 ½) percent. Subsurface- drainage shall be considered and approved (where necessary) by the Town. No irrigation boxes shall be placed on the field surface. Fields vary in size per the Town. Adequate spacing between fields, greater than thirty (30) feet, shall be used when more than one (1) field is included in design. Seed sod blends shall be sports turf prescription and approved by the Town. Goals shall be supplied and shall be mobile and constructed with aluminum.

1073.00 PLAYGROUND EQUIPMENT

1073.01 Proposal Submittals

The manufacturer's representative shall provide the following items and information to the Town with each playground proposal:

- A. Complete three-dimensional drawings of equipment.
- B. Individual components specifications and schematic drawings of the play system.
- C. A minimum of three (3) references for similar work recently completed. Each reference shall include a brief summary of work completed, location, and the owner's representative name and phone number.
- D. A schedule of work that includes the time it shall take to order and receive the playground equipment and the time it shall take to install once the play equipment is delivered.
- E. The name and qualifications of the installer of playground equipment.
- F. All guidelines, standards, laws, and regulations that pertain to CPSC, ASTM, and ADA will be followed at the time of installation of equipment and surfacing.
- G. Warranties for playground equipment installed for the Town will meet or exceed the guidelines mentioned in Section F, above. A letter from the manufacturer stating that the playground equipment shall meet or exceed the latest Consumer Product Safety Commission Guidelines and ASTM F1487 will be included. Letters from the manufacturers shall reference the model number or drawing numbers of each unit.

1073.02 Safety and ADA Requirements

All playground equipment shall meet or exceed the latest CPSC Handbook for Public Playground Safety Guidelines. All play equipment and the protective ground space area around the equipment shall meet or exceed ASTM F1487 Standard Consumer Safety Performance Specifications for Playground Equipment for public use.

All playground equipment shall comply with the current ADA law using ASTM F1487. This can be accomplished either by a safety surface or a ramp system as determined by the Town. The safety surface shall be an ADA approved surface (poured in place) for accessing the transfer point. The color of the surface shall be approved by the Town.

1073.03 Protective Ground Space Area

The play system layout for each site shall include a safety surface area surrounded by a protective barrier. The safety surfacing shall consist of engineered wood fiber, shredded rubber, or poured-in-place surfacing. The safety surface material shall be selected by the Town. The safety surface area shall be installed to a depth of twelve (12) inches to eighteen (18) inches, depending upon the components. A sub-surface drainage system shall be installed under each protective surface area and shall be separated from the finish surfacing by a layer of landscape fabric. The design of the drainage system shall be approved by the Town.

A concrete border will surround all new playground installations. The thickness and depth will be determined by the Town of the Town to match the surface that will be used. Typically, the border will be eighteen (18) inches deep by six (6) inches wide and be constructed with two (2) number four (#4) pieces of rebar running longitudinally along the entire length of the border: one (1) bar at six (6) inches from the top, and the other at six (6) inches from the bottom with twelve (12) inch number four (#4) vertical bars, thirty-six (36) inches O.C.

1073.04 Component Requirements

The following requirements for equipment components apply:

- A. Slides shall be double walled, except for tube slides.
- B. All barrier handrail separation bars shall be less than three and one-half (3½) inches apart.
- C. Upper body climbers shall have end step ladders, excluding overhead flyers.
- D. Components of the play system(s) for specific sites shall be approved by the Town. Each playground system shall include and not be limited to: roofs, climbers, slides, bridges, ladders, arches, overheads, play panels, transfer points, decks, barriers, guard rails, protective barriers, and swings.
- E. Playground decks shall be a minimum of forty-seven (47) inches square. The maximum opening of holes in the deck surface shall be one-quarter (¼) inch.
- F. Component colors shall be approved by the Town.

1073.05 Materials

Playground equipment components shall comply with the following material requirements:

- A. Wooden structures shall not be allowed.
- B. All decking and steps shall be coated.

- C. Metal slides shall not be allowed unless specifically requested by the Town.
- D. Support posts to be five (5) inch OD steel with corrosion protection and finished in powder coat with metal caps.
- E. Playground decks shall be metal with PVC coating.
- F. Deck to deck riser enclosures shall be metal.
- G. Swing support framework shall be five (5) inch OD steel with corrosion protection and finished in powder coat with metal caps.

1073.06 Installation, Inspection, and Warranty

A factory representative shall supervise the unloading of all materials shipped to the individual job sites. A company representative, along with the Town staff, shall conduct a post-installation inspection to certify the proper installation of playground equipment. The Town staff reserves the right to inspect materials prior to installation, with or without the installer’s representative present. Deficiencies that are identified prior to, during, or after installation will be documented either in writing or by pictures. Safety fencing will be installed and maintained by the installer until the installation is complete and the playground has been inspected, deficiencies corrected, and acceptance has been made.

Copies of warranty information for playground equipment shall be supplied to the Town by a company representative. Warranties for playground equipment shall be a minimum of

- Post and caps – fifty (50) years
- Decks, ramps, stairs, and rails – fifteen (15) years
- Fabric and shade cloth – ten (10) years
- Panel plastic and synthetic molded compounds – ten (10) years
- Clamps – ten (10) years
- Any material that covers cables or chains on climbers – five (5) years
- Poured-in-place surfacing – five (5) years on compacted subbases and ten (10) years where installed over concrete
- All other parts – three- (3-) year minimum

1080.00 WALKWAYS, MAINTENANCE PATHS, AND SOFT TRAILS

1081.00 WALKWAYS AND MAINTENANCE PATHS

All walkways and maintenance paths within the parks, open land areas, or greenbelts, which will be utilized by the public and the Town maintenance staff, shall be a minimum of eight (8) feet wide and shall be constructed with a minimum of six (6) inch thick concrete. The concrete shall comply with Section 800 CONCRETE MIX DESIGN AND CONSTRUCTION of these DESIGN STANDARDS AND SPECIFICATIONS.

1082.00 SOFT TRAILS

Soft trails shall comply with the Detail Drawings found in these DESIGN STANDARDS AND SPECIFICATIONS, unless otherwise approved by the Town. Trails shall generally be constructed with

slope less than 12.5:1 (horizontal:vertical). Short sections of trail may be constructed up to a maximum slope of 7:1, if approved by the Town.

1082.01 Soft Trail Subgrade

The subgrade for soft trails shall consist of twelve (12) inches of moisture density treated native material compacted to ninety-five (95) percent relative density, as determined by AASHTO-T99. Moisture density tests shall be performed at two-hundred and fifty (250) foot intervals to demonstrate proper preparation.

Install a geotextile fabric, Mirafi 140N or approved equal, on top of the prepared grade sub-before installing soft trail aggregate material where compacted design depth is less than five (5) inches.

1082.02 Trails With Slope Less Than 12.5:1 (Horizontal:Vertical)

Soft trails with a slope of less than 12.5:1 (horizontal:vertical) shall be constructed with five (5) inches compacted, minimum, of Soft Trail Aggregate. Aggregate material shall be compacted in place to ninety-five (95) percent, minimum, of the maximum standard Proctor dry density, as defined in ASTM D698.

Proof-roll with heavy pneumatic-tired equipment shall be used to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades. Completely proof-roll subgrade in one (1) direction, with a minimum of two (2) passes. Limit vehicle speed to three (3) mph. Proof-roll with a loaded ten (10) wheel, tandem-axle dump truck or water truck using a minimum axle load of eighteen (18) Kips per axle.

1082.03 Trails With Slope Equal To Or Greater Than 12.5:1 (Horizontal:Vertical)

Soft trails with a slope equal to or greater than 12.5:1 (horizontal:vertical) shall be constructed with three (3) to five (5) inches of Soft Trail Aggregate stabilized with a binder material. The depth of the aggregate will depend on the binder material proposed. Aggregate and binder material shall be compacted in place to ninety-five (95) percent, minimum, of the maximum standard modified Proctor dry density, as defined in ASTM D698.

Soft trails with a slope equal to or greater than 10:1 (horizontal:vertical) shall have cross timbers installed at twenty (20) foot intervals along the trail alignment.

- A. Binder Material The binder material shall be approved by the Town prior to trail construction.
- B. Cross Timbers Timbers shall be eight (8) inch by eight (8) inch pressure treated wood, recycled rubber, or plastic. Timbers shall be installed at fifteen (15) degrees from perpendicular to the trail centerline. The top of the timbers shall be at the same level as the trail surface, and the bottom of the timbers shall be keyed into the treated sub-grade. Each timber shall be anchored in place with three – (3) two (2) foot long #4 steel reinforcing bars (rebar). No part of the rebar shall protrude above the top of the timber.

1082.04 Cross Slope

Soft trails shall be constructed with a uniform two (2) percent slope from the high side of the trail to the low side. No crown shall be constructed. The intent of the cross grade is to provide sheet drainage of water across the trail and not along the trail.

1082.05 Soft Trail Aggregate

Soft trail aggregate shall be three-eighths ($\frac{3}{8}$) inch minus decomposed granite or crushed material, approximating the following gradation:

TABLE 1000.08

Sieve Designation	Range of % Passing
$\frac{3}{8}$ inch	100
No. 4	70 – 100
No. 8	50 – 75
No. 16	30 – 65
No. 30	20 – 45
No. 50	10 – 30
No. 100	2 – 20
No. 200	0 – 15

Submit the specific gradation proposed for the soft trail construction. Include binder details when aggregate is intended for soft trails with a slope equal to or greater than 12.5:1 (horizontal:vertical).

Soft trail aggregate material color shall be gray breeze unless otherwise specified.

1083.00 UNDERPASS LIGHTING

Lighting for pedestrian underpasses and similar applications shall be a Fail-Safe VR 2000 DW, DC six and one half ($6\frac{1}{2}$) inch Decorative Series fixture from Cooper Lighting, or equal approved by the Town.

1084.00 SITE FURNISHING

Submittals for site furnishings, such as benches, picnic tables, trash cans, dog waste stations, etc. shall be submitted to the Town for approval prior to installation and shall be required for all new park sites.

1085.00 SIGNAGE

Appropriate signage will be included as necessary in all newly constructed/developed areas. Signs will include, but not be limited to;

- Parks Rules – as supplied by Parks
- Leash Law
- Coyote Warning
- Reuse Irrigation
- Way Finding

1090.00 TREES, SHRUBS, ORNAMENTAL GRASSES, AND PERENNIALS

Acceptable trees, shrubs, ornamental grasses, and perennials for landscaping in the Town are included in the following lists. Other plant materials may be submitted for review and approval by the Town. Preference shall be given to drought resistant species.

1091.00 EVERGREEN SHRUBS

TABLE 1000.09

BOTANICAL NAME	COMMON NAME
<i>Archtostryphos x coloradoensis</i>	Mock -Bearberry Manzanita
<i>Archtostryphos uva -ursi</i>	Knickknick
<i>Artemesia tridentata</i>	Big Sagebrush
<i>Buxus spp.</i>	Boxwood
<i>Cercocarpus ledifolius</i>	Curl Leaf Mountain Mahogany
<i>Euonymus fortunei</i> 'Emerald Gaiety'	Euonymus
<i>Euonymus fortunei</i> 'Coloratus'	Purple Winter Creeper
<i>Euonymus kiautschovicus</i> 'Manhattan'	Manhattan Euonymus
<i>Juniperus x pfitzeriana</i> 'Wilhelm Pfitzer'	Pfitzer Juniper
<i>Juniperus pfitzeriana</i> 'Sea green'	Sea Green Juniper
<i>Juniperus horizontalis</i> 'Blue Chip'	Blue Chip Juniper
<i>Juniperus horizontalis</i> 'Prince of Wales'	Prince of Wales Juniper
<i>Juniperus horizontalis</i> 'Wiltonii'	Blue Rug Juniper
<i>Juniperus procumbens</i> 'Greenmound'	Greenmound Juniper
<i>Juniperus sabina</i> 'Broadmoor'	Broadmoor Juniper
<i>Juniperus sabina</i> 'Buffalo'	Buffalo Juniper
<i>Juniperus sabina</i> var. <i>tamariscilolia</i>	Tam Juniper
<i>Juniperus squamata</i> 'Blue Star'	Blue Star Juniper
<i>Mahonia aquifolium</i>	Oregon Grape Holly
<i>Mahonia repens</i>	Creeping Oregon Grape Holly
<i>Pyracantha spp.</i>	Firethorn
<i>Taxus x media</i>	Yew
<i>Yucca baccata</i>	Banana Yucca
<i>Yucca glauca</i>	Soapweed Yucca
<i>Yucca filamentosa</i>	Adams Needle

1092.00 DECIDUOUS SHRUBS

TABLE 1000.10

BOTANICAL NAME	COMMON NAME
<i>Amelanchier alnifolia</i>	Saskatoon Serviceberry
<i>Amphora canescens</i>	Leadplant
<i>Aronia melanocarpa</i>	Black Chokeberry
<i>Atriplex canescens</i>	Fourwing Saltbush
<i>Amelanchier utahensis</i>	Utah Serviceberry
<i>Berberis mentorensis</i>	Mentor Barberry
<i>Berberis thunbergii</i> 'Atropurpea'	Redleaf Barberry
<i>Buddleja alternifolia</i>	Fountain Butterfly Bush
<i>Buddleja davidii</i>	Butterfly Bush
<i>Caragana arborescens</i>	Siberian Pea Shrub
<i>Caryopteris x clandonensis</i>	Blue Mist Spirea
<i>Cercocarpus montanus</i>	Mountain Mahogany
<i>Chaenomeles Spp.</i>	Flowering Quince
<i>Chamaebatiaria millefolium</i>	Fernbush
<i>Chrysothamnus nauseosus</i>	Rabbitbrush
<i>Cornus sericea</i>	Dogwood var.
<i>Cotinus coggygria</i>	Common Smoke Plant
<i>Cotoneaster apiculatus</i>	Cranberry Cotoneaster
<i>Cotoneaster divaricatus</i>	Spreading Cotoneaster
<i>Cotoneaster horizontalis</i>	Rock Cotoneaster
<i>Cotoneaster lucidus</i>	Hedge Cotoneaster
<i>Euonymus alatus</i>	Burning Bush
<i>Fallugia paradoxa</i>	Apache Plume
<i>Forestiera neomexicana</i>	New Mexico Privet
<i>Forsythia spp.</i>	Garden Forsythia
<i>Frangula alnus</i>	Glossy Buckthorn
<i>Hibiscus syriacus</i>	Althea- Rose of Sharon
<i>Hydrangea arborescens</i> 'Annabelle'	Smooth Hydrangea
<i>Hydrangea paniculata</i> 'grandiflora'	Peegee Hydrangea
<i>Kolkwitzia amabilis</i>	Beautybush
<i>Ligustrum x vicaryi</i>	Golden Privet
<i>Ligustrum vulgare</i> 'Cheyenne'	Cheyenne Privet
<i>Lonicera korolkowii</i> var. <i>floribunda</i>	Blue Velvet Honeysuckle
<i>Lonicera tatarica</i>	Tatarian Honeysuckle
<i>Lonicera x xylostoeides</i>	Globe Honeysuckle
<i>Perovskia atriplicifolia</i>	Russian Sage
<i>Philadelphus spp.</i>	Mock Orange
<i>Physocarpus opulifolius</i>	Common Ninebark
<i>Potentilla fruticosa</i>	Shrubby Cinquifol
<i>Prunus besseyi</i>	Western Sand Cherry
<i>Prunus x cistena</i>	Purple-Leaf Sand Cherry
<i>Prunus tomentosa</i>	Nanking Cherry
<i>Rhamnus smithii</i>	Smith's Buckthorn

BOTANICAL NAME	COMMON NAME
<i>Rhus glabra</i>	Smooth Sumac
<i>Rhus trilobata</i>	Three-Leaf Sumac
<i>Rhus typhina</i>	Staghorn Sumac
<i>Ribes alpinum</i>	Alpine Current
<i>Ribes Aureum</i>	Golden Current
<i>Rosa</i> (all shrub roses)	Shrub Rose
<i>Sambucus canadensis</i>	American Elder
<i>Shepherdia argentea</i>	Buffaloberry
<i>Spirea bumalda - japonica</i>	Bumald Spirea
<i>Spirea nipponica</i>	Snowmound Spirea
<i>Spirea x Vanhouttei</i>	Vanhoutte Spirea
<i>Symphoricarpos albus</i>	Common Snowberry
<i>Symphoricarpos x chenaultii</i> 'Hancock'	Hancock Coralberry
<i>Syringa x Chinensis</i>	Chinese Lilac
<i>Syringa meyeri</i>	Korean Lilac
<i>Syringa patula</i> 'Miss Kim'	Miss Kim Lilac
<i>Syringa vulgaris</i>	Common Lilac
<i>Viburnum x burkwoodii</i>	Burkwood Viburnum
<i>Viburnum lantana</i>	Wayfaring Tree
<i>Viburnum lentago</i>	Nannyberry
<i>Viburnum opulus</i>	European Cranberry
<i>Viburnum trilobum</i>	American Cranberry
<i>Viburnum x rhytidophylloides</i>	Allegheny Viburnum
<i>Weigela florida</i>	Weigelia

1093.00 ORNAMENTAL GRASSES

TABLE 1000.11

BOTANICAL NAME	COMMON NAME
<i>Andropogon gerardii</i>	Big Blue Stem
<i>Calamagrostis x acutiflora</i>	Feather Reed
<i>Chasmanthium latifolium</i>	Northern Sea Oats
<i>Festuca Glauca</i>	Blue Fescue
<i>Helictotrichon sempervirens</i>	Blue Avena
<i>Miscanthus sinensis</i>	Maiden grass
<i>Nassella tenuissima</i>	Mexican Feather Grass
<i>Oryzopsis hymenoides</i>	Indian Rice Grass
<i>Pennisetum alopecuroides</i>	Hardy Fountain Grass
<i>Phalaris arundinacea</i> 'picta'	Ribbon Grass
<i>Saccharum ravennae</i>	Plume Grass
<i>Schizachrium scopulorum</i>	Little Blue Stem
<i>Sporobolus wrightii</i>	Giant Sacaaton

1094.00 DECIDUOUS TREES

Fruit trees drop fruit onto streets, sidewalks, and park areas and may create a safety hazard. Many varieties are highly subject to insect and disease problems that require special maintenance practices. These trees may be approved by the Town for use as accents but shall not be used in the Town parks or ROW unless approved by the Town.

TABLE 1000.12

BOTANICAL NAME	COMMON NAME
<i>Acer ginnala</i>	Amur Maple
<i>Acer grandidentatum</i>	Big Tooth Maple, Wasatch Maple
<i>Acer platanoides</i> 'Emerald Queen'	Emerald Queen Maple
<i>Acer platanoides</i> 'Schwedleri'	Schwedler Maple
<i>Acer platanoides</i>	Norway Maple
<i>Acer platanoides</i> 'Crimson King'	Crimson King Maple
<i>Acer rubrum</i> 'Franksred'	Red Sunset Maple
<i>Acer saccharum</i> 'Green Mountain'	Green Mountain Sugar Maple
<i>Acer tatarian</i>	Tatarian Maple
<i>Acer x freemanii</i>	Autumn Blaze Maple
<i>Aesculus x carnea</i>	Horsechestnut
<i>Aesculus glabra</i>	Ohio Buckeye
<i>Carpinus betulus</i>	European Hornbeam
<i>Carpinus carolinianc</i>	American Hornbeam
<i>Catalpa speciosa</i>	Western Catalpa
<i>Celtis occidentalis</i>	Western Hackberry
<i>Corylus colurna</i>	Turkish Filbert
<i>Crataegus phaenpyrum</i>	Washington Hawthorn
<i>Crataegus crus-galli inermis</i>	Thornless Cockspur Hawthorn
<i>Crataegus mollis</i>	Downy Hawthorn
<i>Crataegus virdis</i> 'Winterking'	Winterking Hawthron
<i>Crataegus x mordenensis</i> 'Toba'	Toba Hawthorn
<i>Fagus sylvatica</i> 'Currea'	Copper Beach
<i>Fagus sylvatica</i> 'roseomarginata'	Tricolor Beech
<i>Gleditsia triacanthos inermis</i> 'Imperial'	Imperial Honeylocust
<i>Gleditsia triacanthos inermis</i> 'Shademaster'	Shademaster Honeylocust
<i>Gleditsia triacanthos inermis</i> 'Skyline'	Skyline Honeylocust
<i>Gleditsia triacanthos inermis</i> 'Sunburst'	Sunburst Honeylocust
<i>Gymnocladus dioicus</i>	Kentucky Coffeetree
<i>Juglans nigra</i>	Black Walnut
<i>Koelreuteria paniculata</i>	Golden Raintree
<i>Malus</i> 'Thunberchild'	Thunderchild Crabapple
<i>Malus</i> 'David'	David Crabapple
<i>Malus</i> 'Prairie Fire'	Prairie Fire Crabapple
<i>Malus</i> 'Profusion'	Profusion Crabapple
<i>Malus</i> 'Radiant'	Radiant Crabapple
<i>Malus</i> 'Spring Snow'	Spring Snow Crabapple

BOTANICAL NAME	COMMON NAME
<i>Malus</i> 'Bob White'	Bob White Crabapple
<i>Malus</i> 'Centurion'	Centurion Crabapple
<i>Malus</i> 'Coralburst'	Coralburst Crabapple
<i>Malus</i> 'Guinevere'	Guinevere Crabapple
<i>Populus tremuloides</i>	Aspen
<i>Prunus cerasifera</i> 'Newportii'	Newport Plum
<i>Prunus virginiana</i> 'Canada Red'	Canada Red Cherry
<i>Pyrus calleryana</i> 'Chanticleer'	Chanticleer Pear
<i>Pyrus calleryana</i> 'Aristocrat'	Aristocrat Pear
<i>Pyrus ussuriensis</i>	Ussurian Pear
<i>Quercus bicolor</i>	Swamp White Oak
<i>Quercus macrocarpa</i>	Burr Oak
<i>Quercus muehlenbergii</i>	Chinkapin Oak
<i>Quercus robur</i>	English Oak
<i>Quercus rubra</i> 'Fastigata'	Columnar English Oak
<i>Quercus rubra</i>	Northern Red Oak
<i>Quercus shumardii</i>	Shumard Oak
<i>Robinia pseudoacacia</i>	Purple Robe Locust
<i>Sophora japonica</i>	Japanese Pagoda Tree
<i>Syringa reticulata</i>	Japanese Tree Lilac
<i>Tilia americana</i>	American Linden
<i>Tilia americana</i> 'Redmond'	Redmond Linden
<i>Tilia cordata</i> 'Glenleven'	Glenleven Linden
<i>Tilia cordata</i> 'Greenspire'	Greenspire Linden
<i>Ulmus</i> 'Frontier'	Frontier Elm

1095.00 CONIFER TRESS

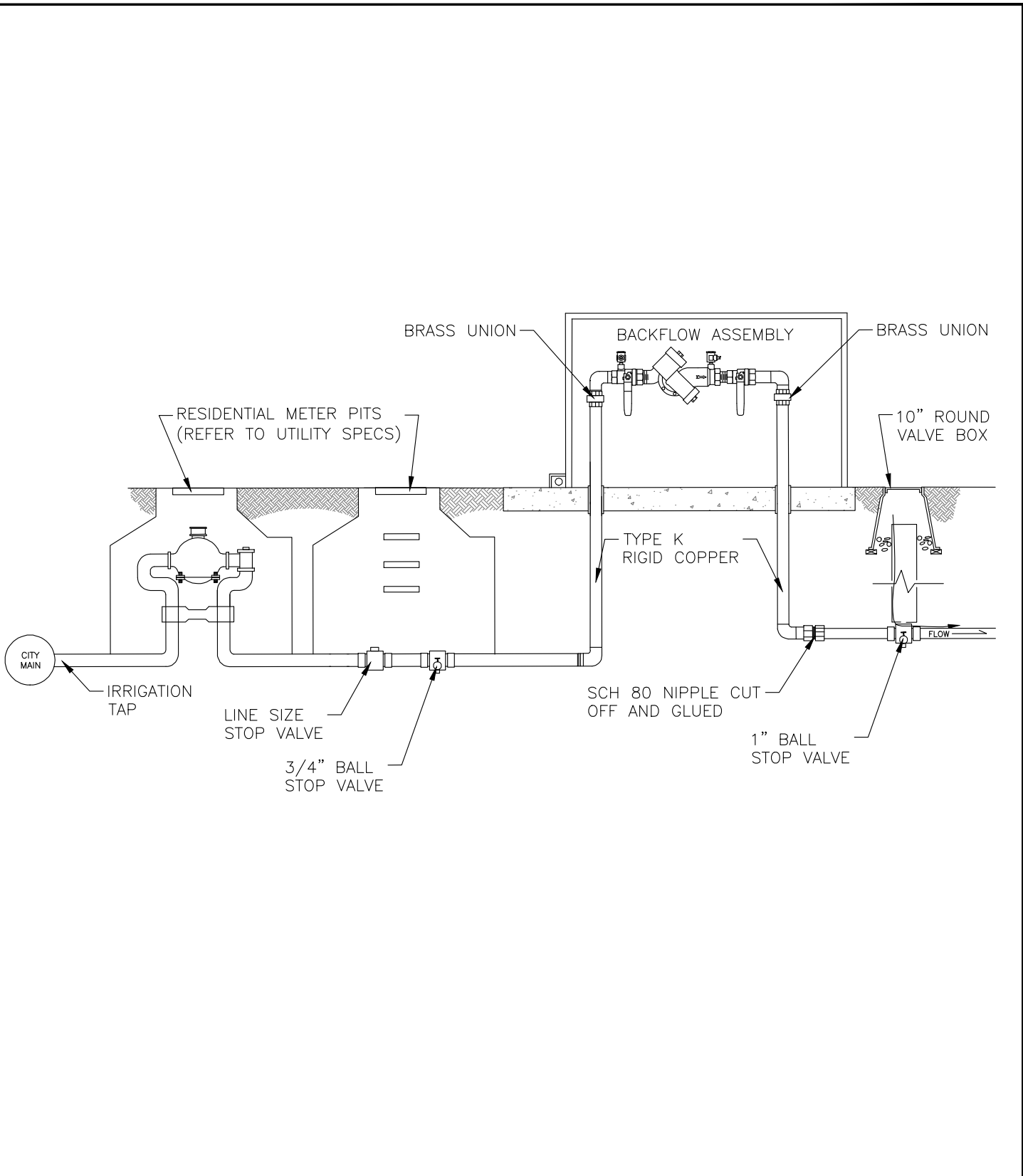
TABLE 1000.13

BOTANICAL NAME	COMMON NAME
<i>Abies concolor</i>	Fir – Concolor
<i>Pseudotsuga menziesii</i>	Fir – Douglas
<i>Larix occidentalis</i>	Larch – Western
<i>Pinus nigra</i>	Pine – Austrian
<i>Pinus heldreichii</i>	Pine – Bosnian
<i>Pinus aristata</i>	Pine – Foxtail, Bristlecone
<i>Pinus flexilis</i>	Pine – Limber
<i>Pinus edulis</i>	Pine – Pinyon
<i>Pinus ponderosa</i>	Pine – Ponderosa
<i>Pinus silvestris</i>	Pine – Scotch
<i>Pinus bungeana</i>	Pine – Lacebark
<i>Picea pungens</i>	Spruce – Colorado Blue

1096.00 PERENNIALS

TABLE 1000.14

BOTANICAL NAME	COMMON NAME	BOTANICAL NAME	COMMON NAME
<i>Achillea species</i>	Yarrow	<i>Kniphofia uvaria</i>	Torch Lily
<i>Agastache species</i>	Hummingbird Mint	<i>Leucanthemum superbum</i>	Shasta Daisy
<i>Alyssum montanum</i>	Mountain Basket of Gold	<i>Liatris spicata</i>	Gayfeather
<i>Aquilegia spp.</i>	Columbine	<i>Lineum perenne</i>	Blue Flax
<i>Armeria maritima</i>	Sea Pinks	<i>Monarda didyma</i>	Bee Balm
<i>Artemisia spp.</i>	Sage	<i>Nepeta spp.</i>	Catmint
<i>Asclepias tuberosa</i>	Butterfly Weed	<i>Oenothera spp.</i>	Evening Primrose
<i>Aster spp.</i>	Aster	<i>Osteospermum barberiae</i>	Sun Daisy
<i>Astilbe spp.</i>	False Spirea	<i>Paonia lactiflora</i>	Peony
<i>Aurinia saxatilis</i>	Basket of Gold	<i>Penstemon x mexicali</i>	Penstemon Mexican hyb.
<i>Berlandiera lyrata</i>	Chocolate flower	<i>Penstemon pinifolius</i>	Pineleaf Penstemon
<i>Callirhoe involucrata</i>	Prairie Wine Cups	<i>Penstemon spp.</i>	Beardstongue
<i>Campanula spp.</i>	Bellflower	<i>Persicaria affinis</i>	Himalayan Border Jewel
<i>Cerastium tomentosum</i>	Snow in Summer	<i>Phlox paniculata</i>	Garden Phlox
<i>Chrysanthemum x morifolium</i>	Garden Mum	<i>Phlox subulata</i>	Creeping Phlox
<i>Ceratostigma plumbaginoides</i>	Plumbago	<i>Platycodon grandiflorus</i>	Balloon Flower
<i>Coreopsis spp.</i>	Tickseed	<i>Potentilla neummanniana</i>	Creeping Cinquifol
<i>Delosperma species</i>	Ice plant	<i>Pulsatilla vulgaris</i>	European Pasque Flower
<i>Delphinium spp.</i>	Larkspur	<i>Ratibida columnifera</i>	Prairie Coneflower
<i>Dianthus spp.</i>	Pinks	<i>Rudbeckia fulgida</i>	Black Eyed Susan
<i>Echinacea purpurea</i>	Cone Flower	<i>Salvia nemerosa</i>	Blue Salvia
<i>Eriogonum spp.</i>	Sulphur Flower	<i>Santolina chamaecyparissus</i>	Lavender Cotton
<i>Galium odoratum</i>	Sweet Woodruff	<i>Saponaria ocymoides</i>	Rock Soapwort
<i>Gaillardia x grandiflora</i>	Blanket Flower	<i>Scabiosa spp.</i>	Pincushion Flower
<i>Gaura lindheimeri</i>	Whirling Butterflies	<i>Sedum cultivars</i>	Stonecrop
<i>Gazania spp.</i>	Gazania	<i>Solidago</i>	Goldenrod
<i>Geranium spp.</i>	Cranesbill	<i>Tanacetum densum var. amani</i>	Partridge Feather
<i>Geum spp.</i>	Avens	<i>Thymus spp.</i>	Creeping Thyme
<i>Helenium autumnale</i>	Sneezeweed	<i>Veronica spicata</i>	Speedwell
<i>Helianthemum spp.</i>	Sunrose	<i>Veronica spp.</i>	Creeping Speedwell
<i>Heliopsis helianthoides</i>	False Sunflower	<i>Vinca minor</i>	Periwinkle
<i>Hemerocallis cultivars</i>	Daylily	<i>Viola corsica</i>	Corsican Violet
<i>Heuchera cultivars</i>	Coral Bells	<i>Zauchneria spp.</i>	California Fuchsia
<i>Hibiscus moscheutos</i>	Rose Mallow	<i>Zinnia grandiflora</i>	Paperflower
<i>Hosta cultivars</i>	Hosta		
<i>Iberis sempervirens</i>	Candytuft		
<i>Iris spp.</i>	Iris		



THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

N.T.S.



POINT-OF-CONNECTION ASSEMBLY FOR 3/4" & 1" ONLY

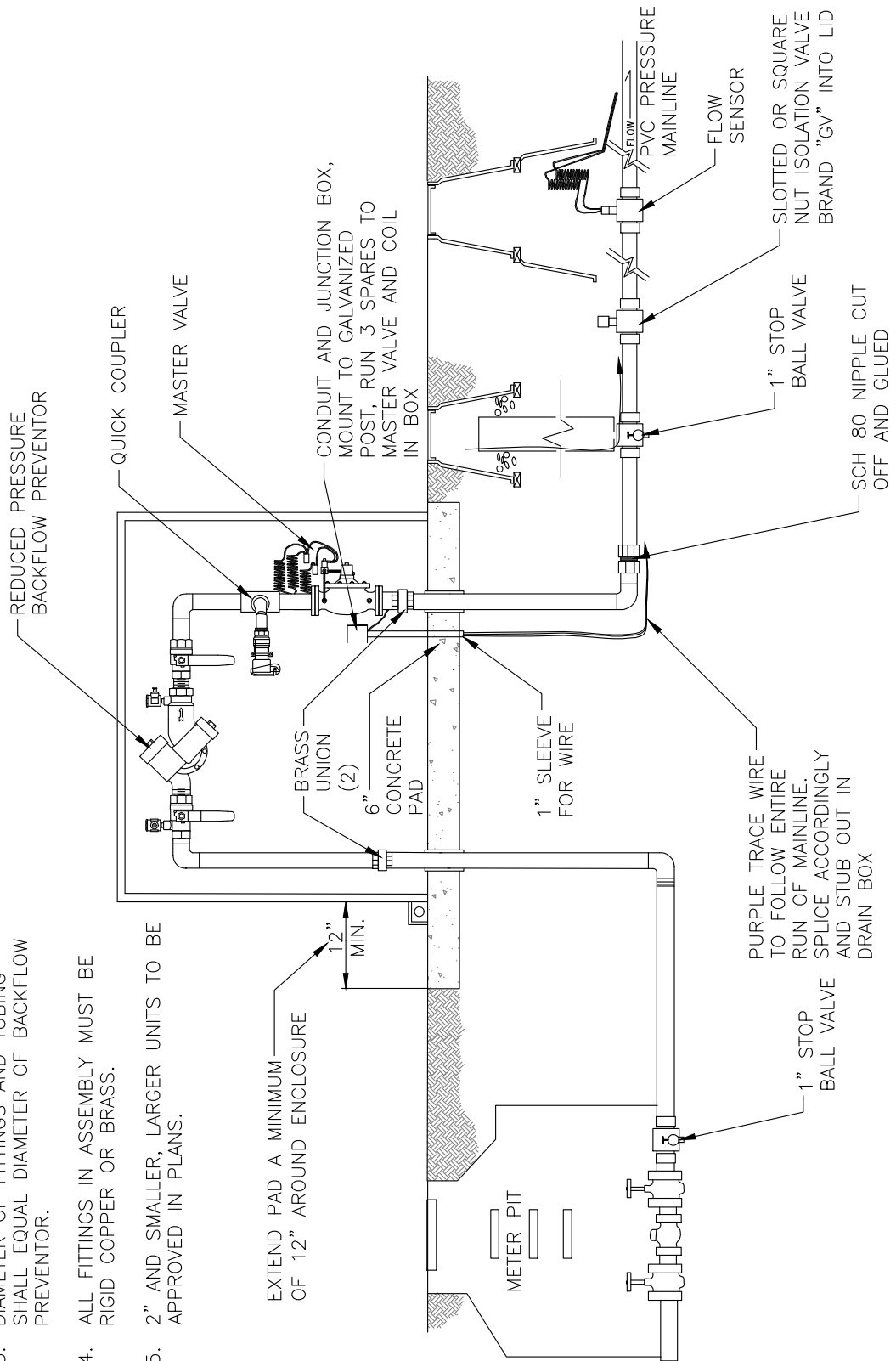
DATE: JANUARY 2019

SHEET 1000-1

NOTES:

1. CONCRETE PAD PENETRATIONS TO BE 1" LARGER THAN TUBING DIAMETER.
2. REFER TO ENCLOSURE DETAIL FOR CONCRETE PAD DIMENSIONS.
3. DIAMETER OF FITTINGS AND TUBING SHALL EQUAL DIAMETER OF BACKFLOW PREVENTOR.
4. ALL FITTINGS IN ASSEMBLY MUST BE RIGID COPPER OR BRASS.
5. 2" AND SMALLER, LARGER UNITS TO BE APPROVED IN PLANS.

EXTEND PAD A MINIMUM OF 12" AROUND ENCLOSURE
12" MIN.



THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

N.T.S.



Gateway to Boulder Valley®

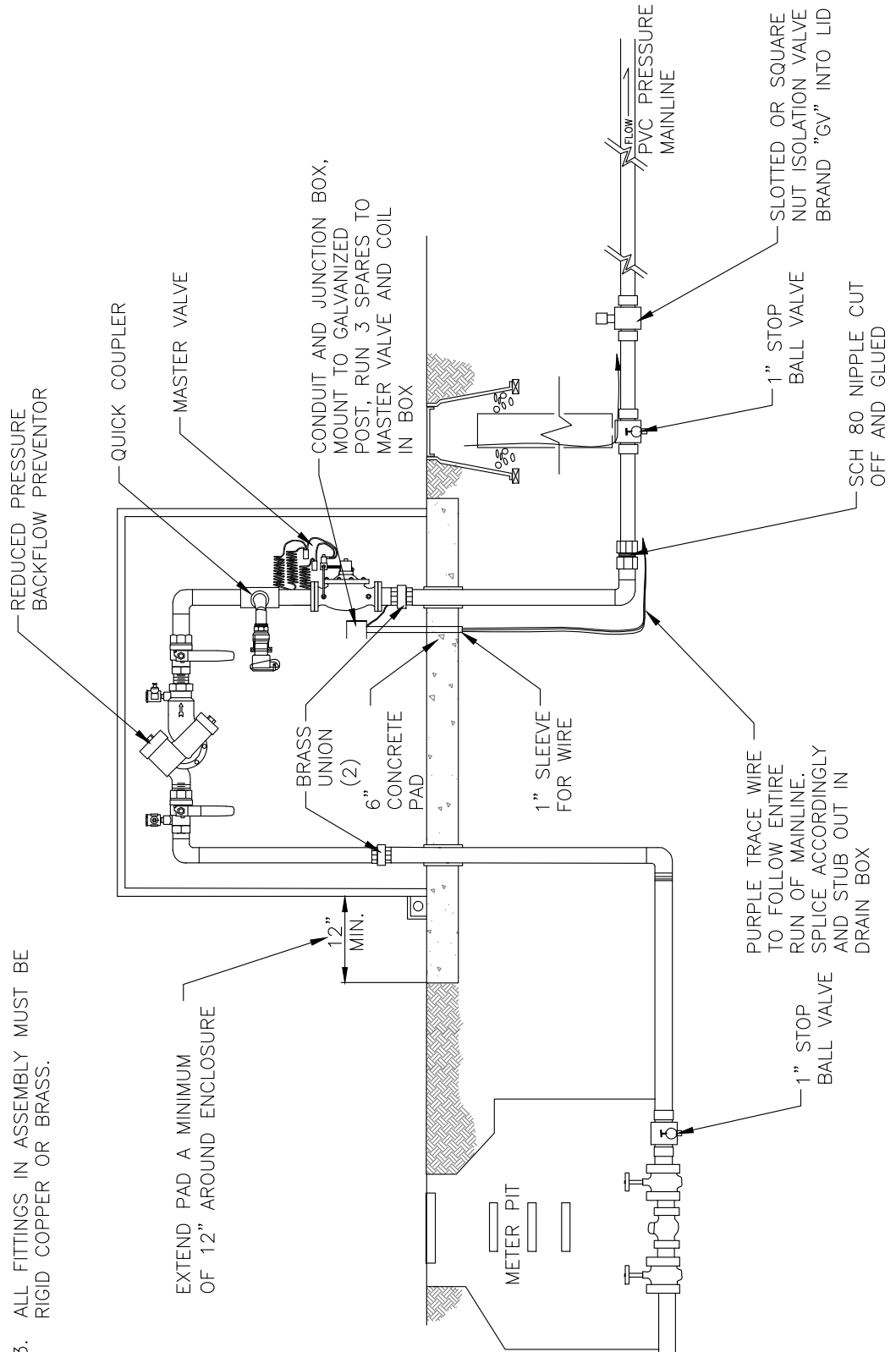
BACKFLOW ASSEMBLY WITH MASTER VALVE, FLOW SENSOR, AND ENCLOSURE

DATE: JANUARY 2019

SHEET 1000-2

NOTES:

1. CONCRETE PAD PENETRATIONS TO BE 1" LARGER THAN TUBING DIAMETER.
2. DIAMETER OF FITTINGS AND TUBING SHALL EQUAL DIAMETER OF BACKFLOW PREVENTOR.
3. ALL FITTINGS IN ASSEMBLY MUST BE RIGID COPPER OR BRASS.



THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

N.T.S.

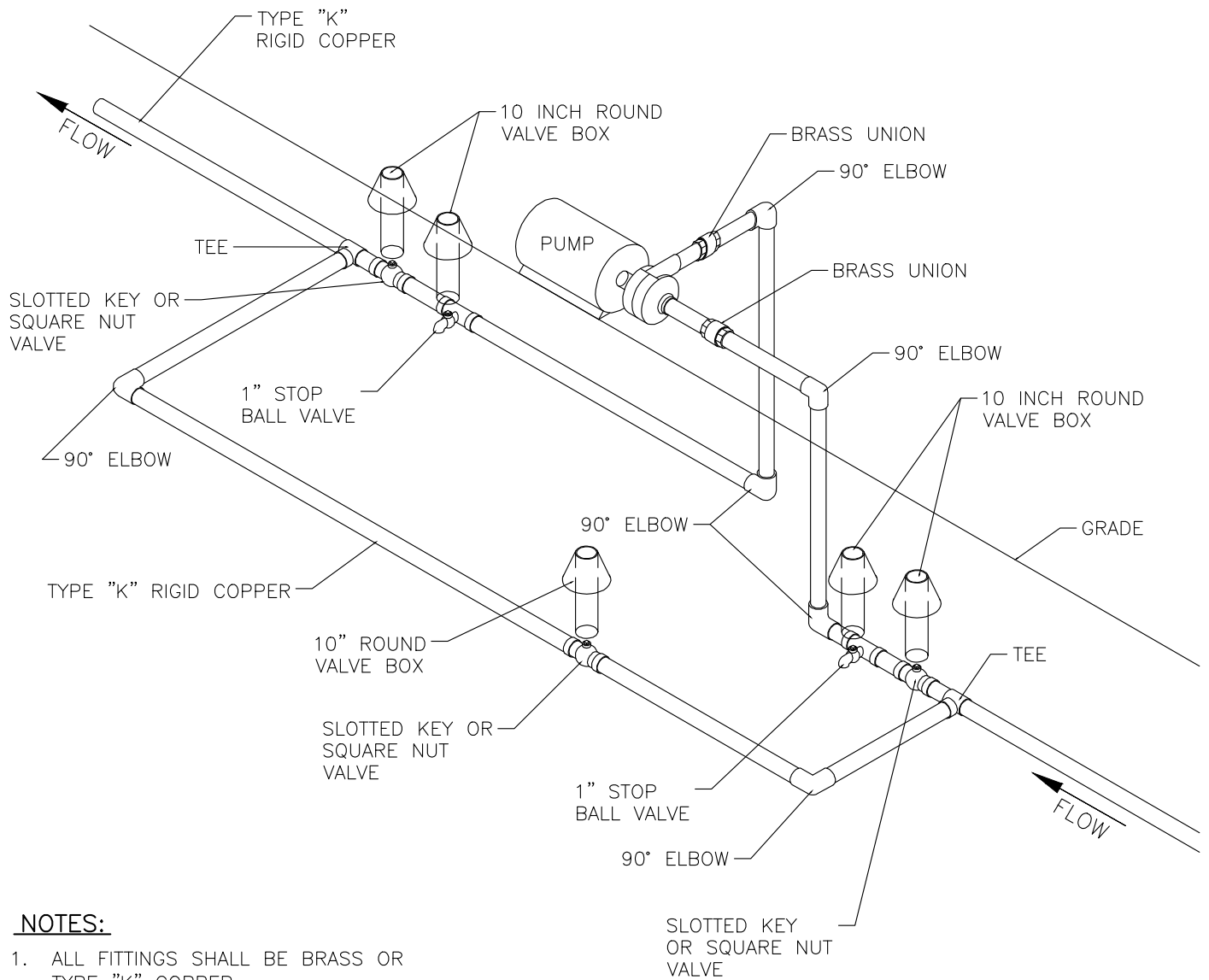


Gateway to Boulder Valley®

**BACKFLOW ASSEMBLY WITH
FLOW SENSING CAPABILITIES
825-Y SERIES ENCLOSURE**

DATE: JANUARY 2019

SHEET 1000-3



NOTES:

1. ALL FITTINGS SHALL BE BRASS OR TYPE "K" COPPER.
2. UNDERGROUND PUMP BY-PASS FOR 2" AND SMALLER PIPE, LARGER BY-PASSES SHALL BE DESIGNED AND APPROVED ON PLANS.

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

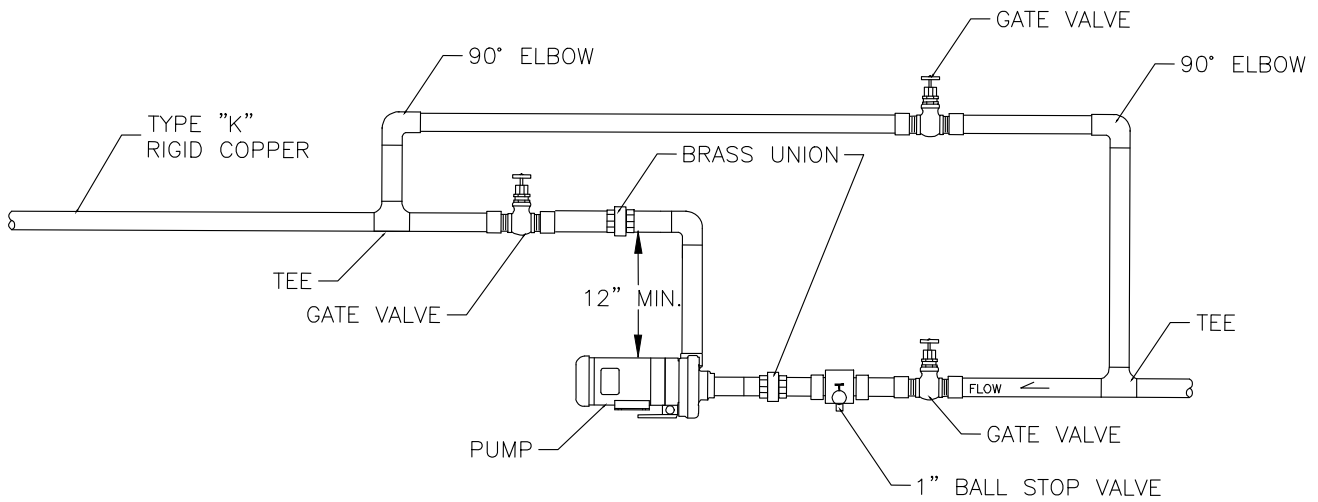
N.T.S.



UNDERGROUND PUMP BY-PASS SYSTEM

DATE: JANUARY 2019

SHEET 1000-4



NOTES:

1. ALL FITTINGS SHALL BE BRASS OR TYPE "K" COPPER.
2. PUMP HOUSE BY-PASS FOR 2 1/2" AND SMALLER PIPE, LARGER BY-PASSES SHALL BE DESIGNED AND APPROVED ON PLANS.

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

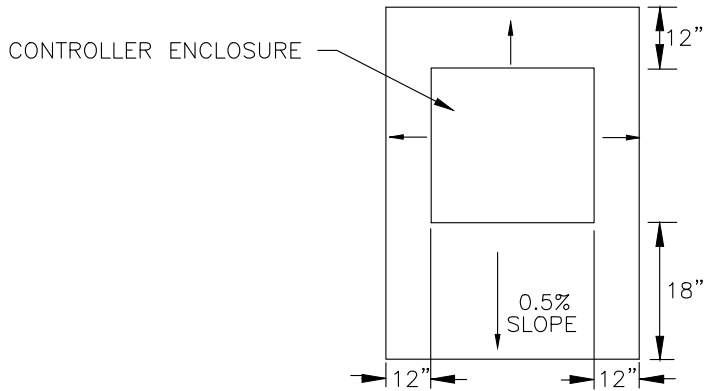
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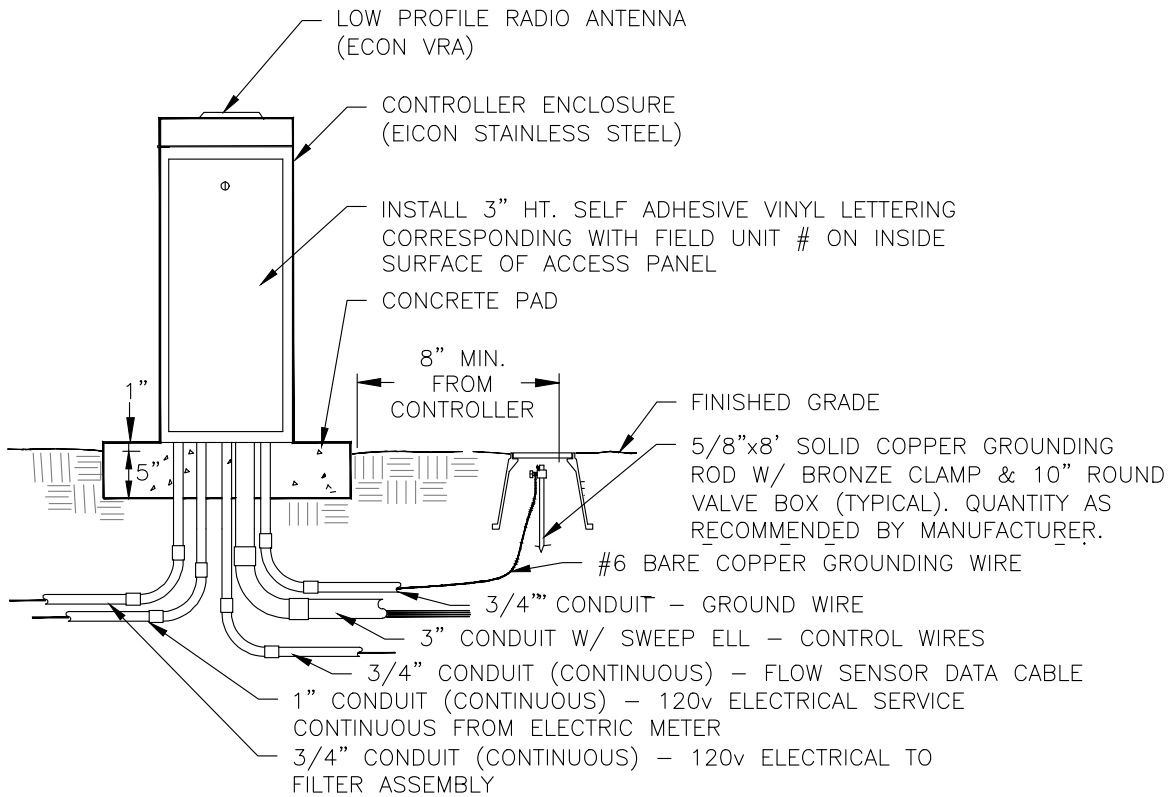
TYPICAL PUMP SYSTEM
BY-PASS IN PUMP HOUSE

DATE: JANUARY 2019

SHEET 1000-5



CONTROLLER PAD PLAN



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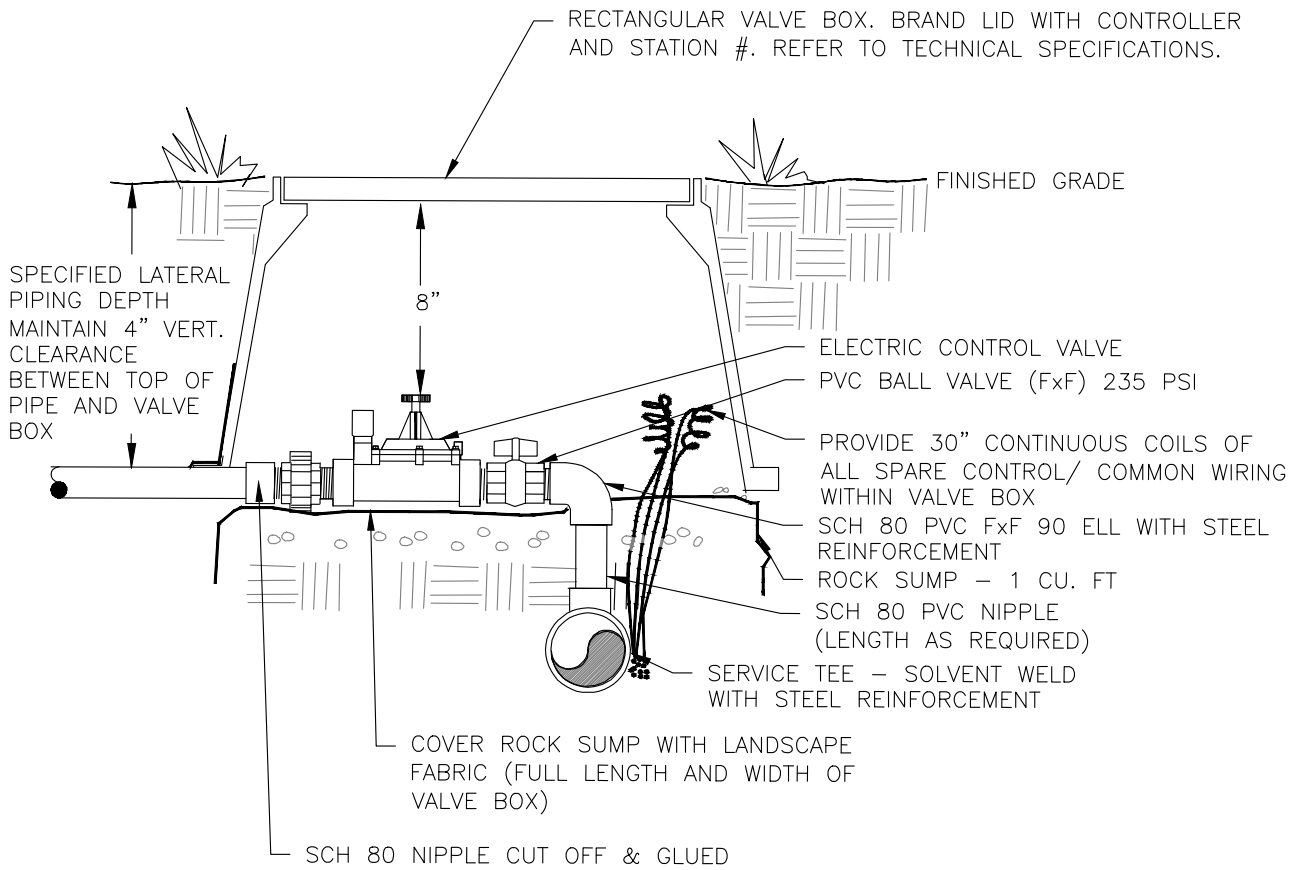
N.T.S.



TYPICAL PUMP SYSTEM
BY-PASS IN PUMP HOUSE

DATE: JANUARY 2019

SHEET 1000-6



NOTE:

1. DIAMETERS OF PVC FITTINGS AND RISER SHALL EQUAL ELECTRIC CONTROL VALVE DIAMETER.
2. VALVE BOXES SHALL BE INSTALLED PARALLEL OR PERPENDICULAR TO ADJACENT SIDEWALKS AND HARD SURFACES WHEN APPROVED BY TOWN.
3. PROVIDE 48" MIN. SEPARATION BETWEEN ALL BOXES.
4. TURF AREAS WILL REQUIRE A MINIMUM OF 2 VALVE BOXES TO BE STACKED ON TOP OF EACH OTHER.

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

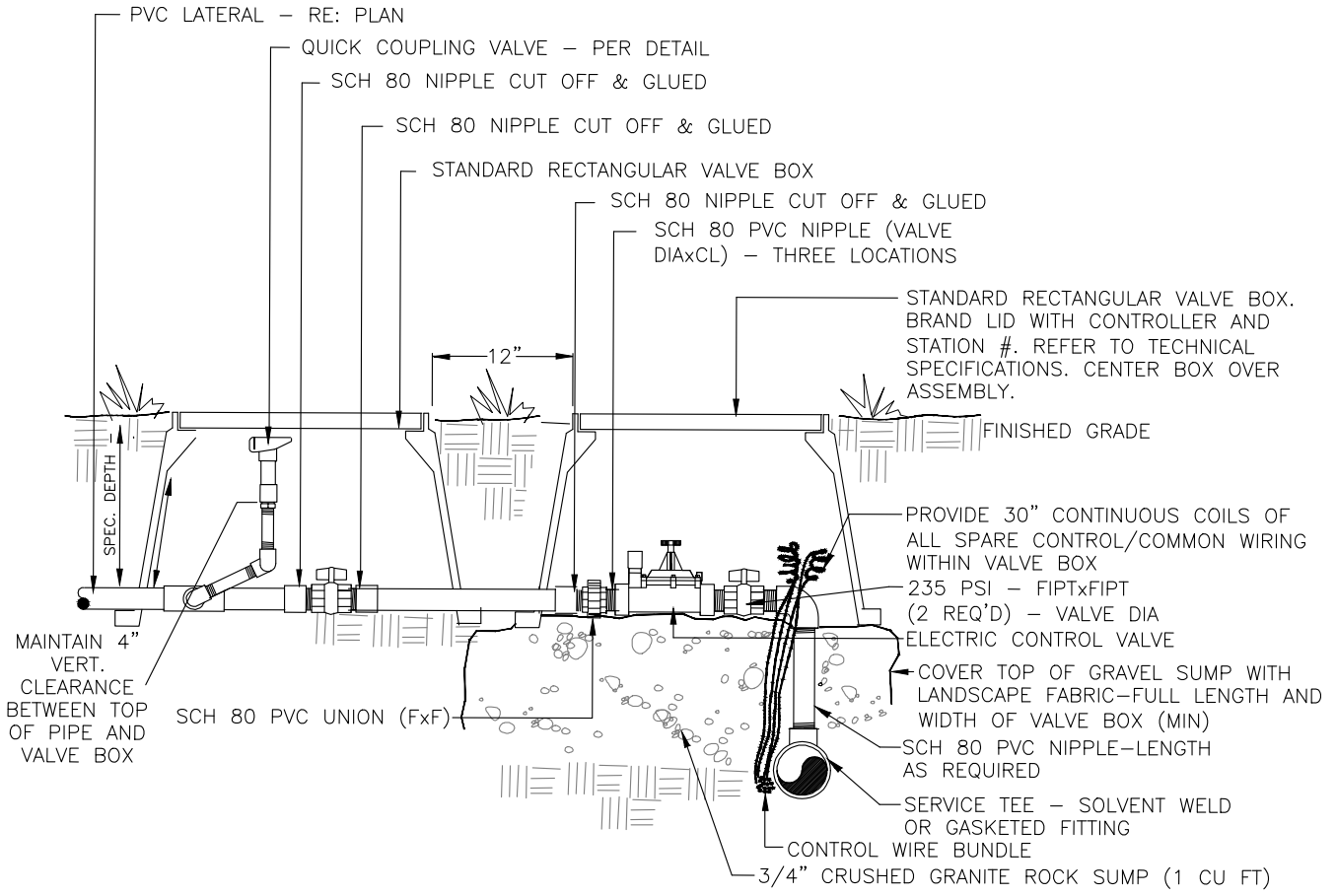
N.T.S.



ELECTRIC CONTROL VALVE

DATE: JANUARY 2019

SHEET 1000-7



NOTE:

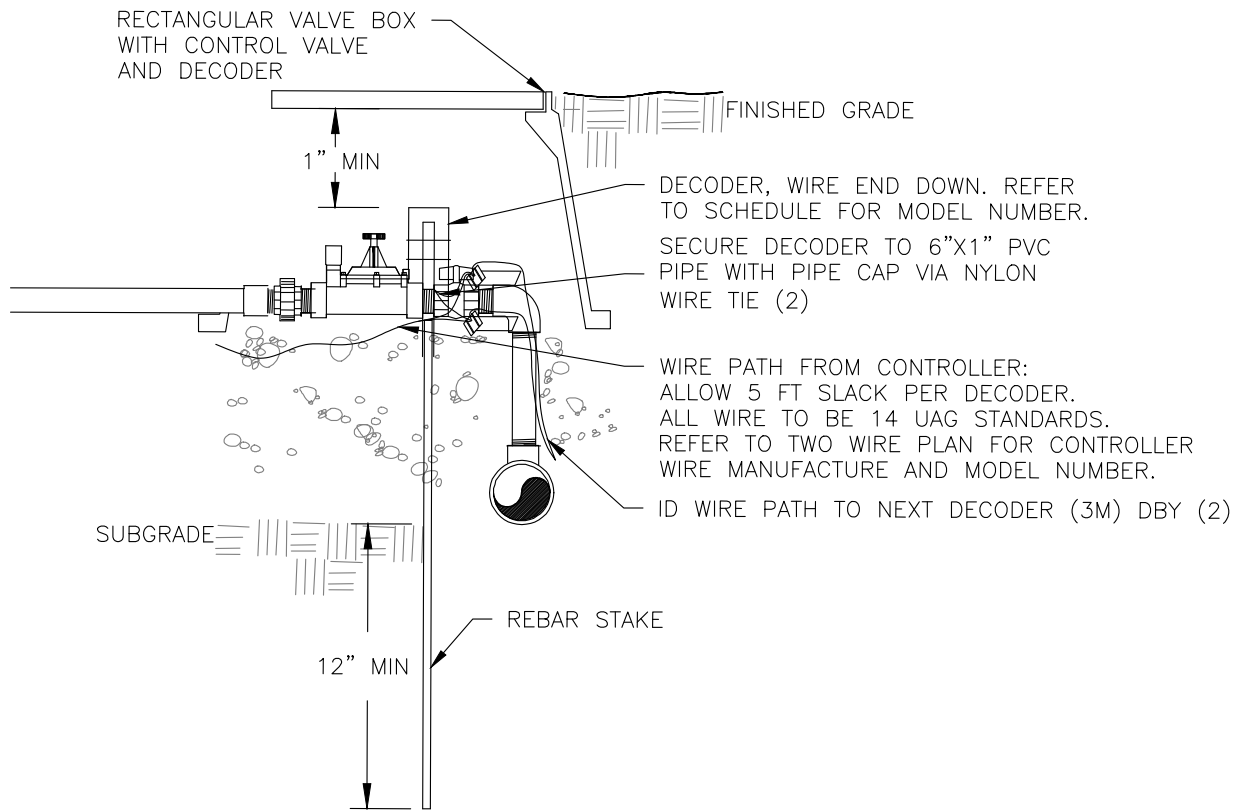
1. DIAMETERS PF PVC FITTINGS AND RISER SHALL EQUAL ELECTRIC CONTROL VALVE DIAMETER.
2. VALVE BOXES SHALL BE INSTALLED PARALLEL OR PERPENDICULAR TO ADJACENT SIDEWALKS AND HARD SURFACES WHEN APPROVED BY TOWN.
3. PROVIDE 48" MIN. SEPARATION BETWEEN ALL BOXES.
4. TURF AREAS WILL REQUIRE A MINIMUM OF 2 VALVE BOXES TO BE STACKED ON TOP OF EACH OTHER.

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ELECTRIC CONTROL VALVE WITH
PRS-D PRV FOR TREE ZONES

DATE: JANUARY 2019	SHEET 1000-8
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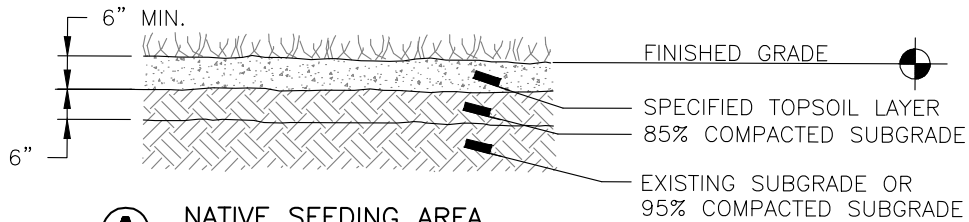
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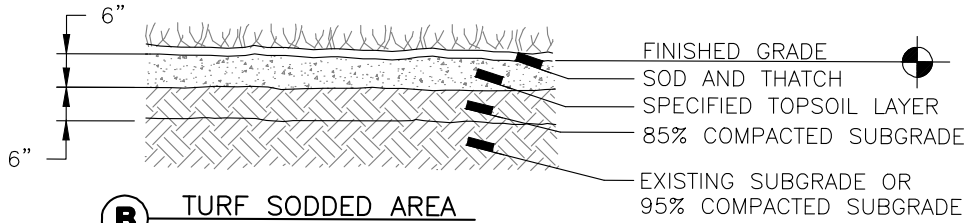
DECODER INSTALLATION TWO-WIRE SYSTEM

DATE: JANUARY 2019

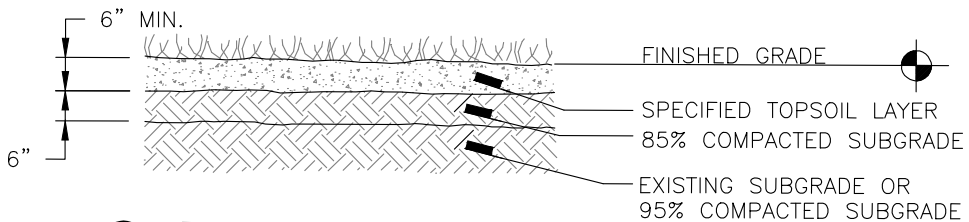
SHEET 1000-9



(A) NATIVE SEEDING AREA



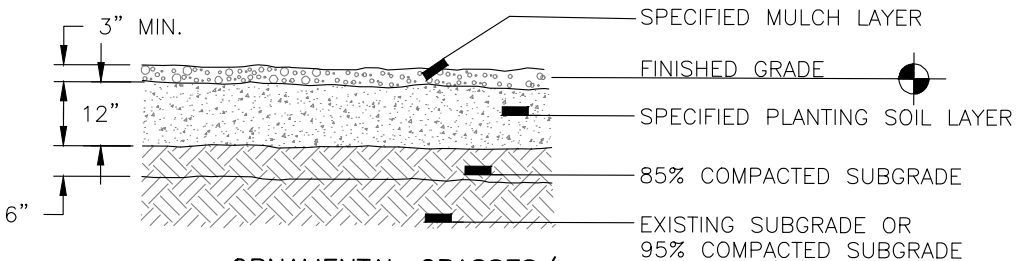
(B) TURF SODDED AREA



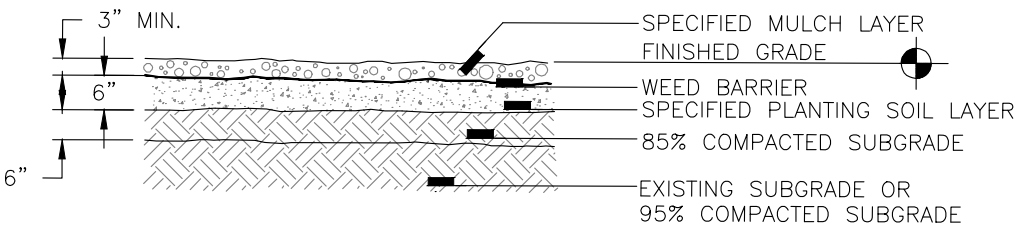
(C) TURF SEEDING AREA

NOTE:

EXCLUDE MULCH LAYER IN ALL ANNUAL AREAS



ORNAMENTAL GRASSES/
PERENNIAL/ANNUAL BED AREAS



(E) SHRUB BEDS AREAS

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS.

N.T.S.



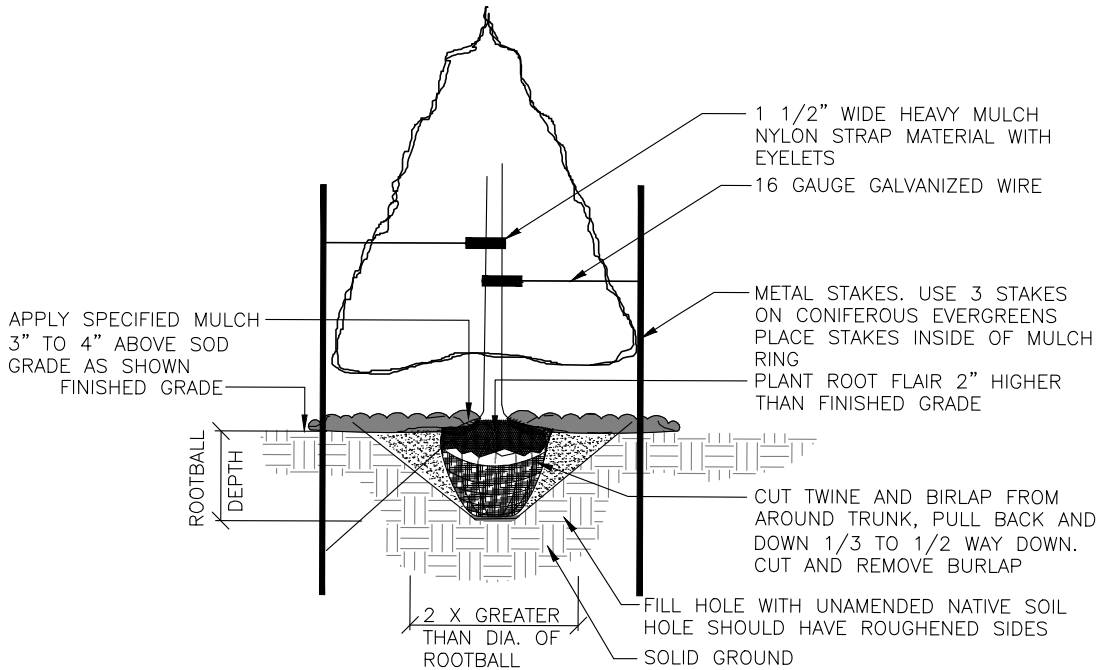
SPECIAL SECTION AREAS

DATE: JANUARY 2019

SHEET 1000-10

NOTES:

1. DO NOT CUT OR DAMAGE LEADER. PRUNE DAMAGED OR DEAD WOOD IMMEDIATELY PRIOR TO PLANTING.
2. CUT TWINE AT BOTTOM OF WIRE BASKETS AND TWINE UNDER ROOTBALL BEFORE PLACING IN TREE PIT.
3. REMOVE ALL WIRE ON SIDES AND TOP OF BAL. (WIRE BASKETS, CHICKEN WIRE, ETC., INCLUDING WIRE UNDER BURLAP.)
4. ANY BROKEN OR CRUMBLING ROOTBALL WILL BE REJECTED. REMOVING THE WIRE WILL NOT BE AN EXCUSE FOR DAMAGED ROOTBALLS.



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N.T.S.



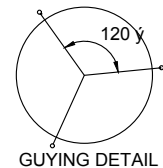
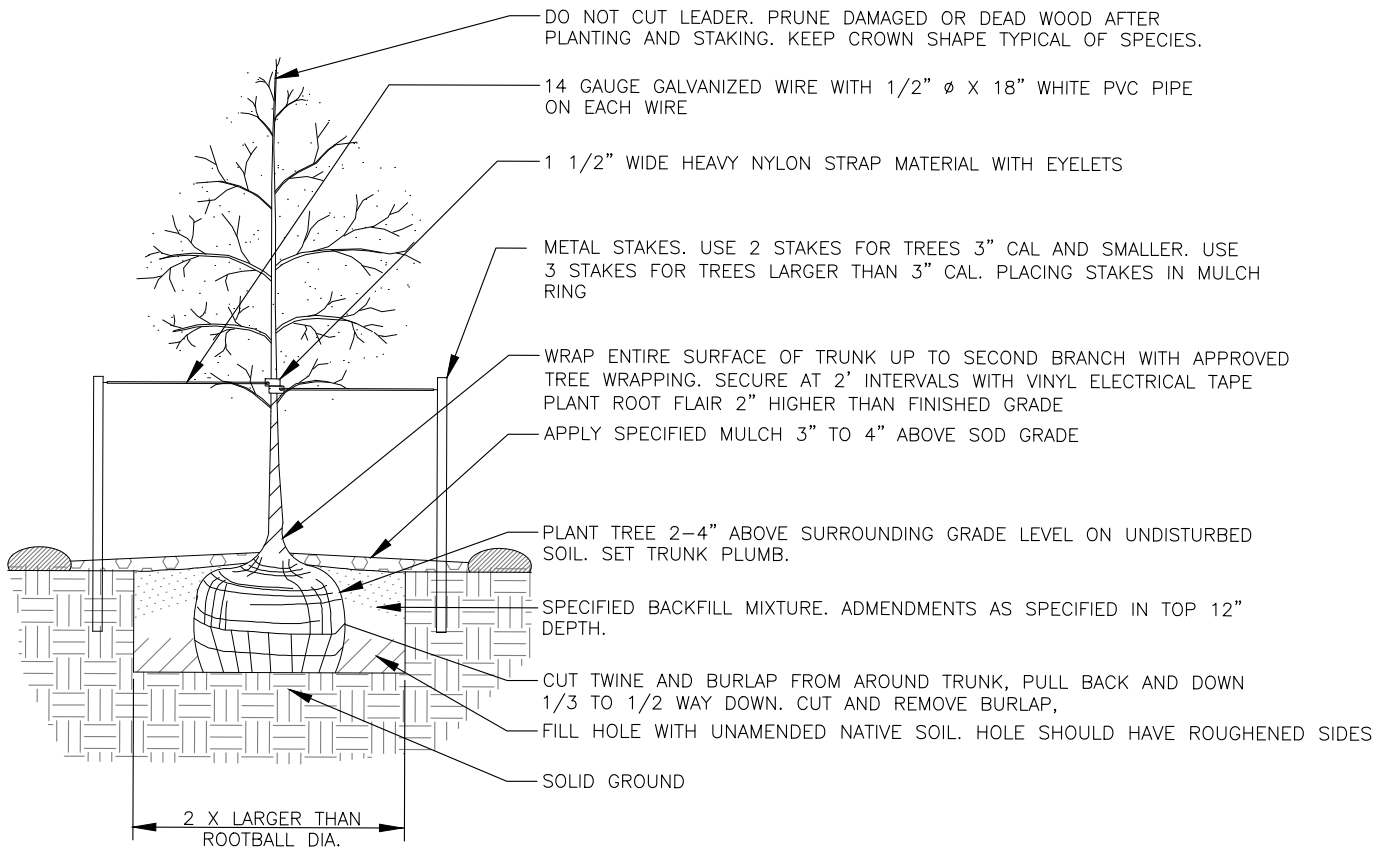
PLANTING SPECS FOR CONIFER TREE

DATE: JANUARY 2019

SHEET 1000-11

NOTES:

1. CENTRAL DOMINANT LEADER. EVENLY SPACED BRANCHES WITH TRUNK TAPER FROM A SOLID BASE GRADUALLY COMING MORE SLENDER AT THE TOP. DO NOT CUT LEADER. PRUNE DAMAGED OR DEAD WOOD PRIOR TO PLANTING.
2. CUT TWINE AT BOTTOM OF WIRE BASKETS AND TWINE UNDER ROOTBALL BEFORE PLACING TREE IN PIT.
3. REMOVE ALL WIRE ON SIDES AND TOP OF BALL. (WIRE BASKETS, CHICKEN WIRE, ETC., INCLUDING WIRE UNDER BURLAP.)
4. ANY BROKEN OR CRUMBLING ROOTBALL WILL BE REJECTED. REMOVING THE WIRE WILL NOT BE AN EXCUSE FOR DAMAGED ROOTBALLS.



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N.T.S.



PLANTING SPECS FOR DECIDUOUS TREE

DATE: JANUARY 2019

SHEET 1000-12