SECTION E: SPECIFICATIONS, PLANS, AND STANDARD DETAILS

This section provides specifications that provide minimum standards for infrastructure improvements, examples of plans for specific utilities, and standard details for the Town's infrastructure.

Specifications

Division 1 – General Construction Provisions

- 01001 Specification Structure
- 01045 Cutting and Patching
- 01050 Field Engineering
- 01070 Abbreviations and Symbols
- 01090 Reference Standards
- 01210 Preconstruction Conferences
- 01340 Shop Drawings, Project Data, and Samples
- 01410 Testing Laboratory Services
- 01420 Inspection Services
- 01545 Protection of Work and Property
- 01550 Access and Haul Roads
- 01560 Temporary Controls
- 01570 Traffic Regulation
- 01600 Material and Equipment
- 01650 Testing, Startup, and Operation
- 01700 Contract Closeout
- 01710 Cleaning
- 01720 Project Record Documents

Division 2 – Site Work

- 02050 Demolition
- 02110 Site Clearing
- 02140 Dewatering
- 02150 Shoring
- 02161 Rock Walls
- 02202 Rock Excavation
- 02222 Excavating, Backfilling, and Compacting for Utilities
- 02275 Sedimentation Control
- 02300 Pipe Boring and Jacking
- 02575 Pavement Repair and Resurfacing
- 02605 Manholes and Cleanouts
- 02610 Pipe and Fittings
- 02640 Valves
- 02645 Hydrants
- 02660 Water Lines
- 02720 Storm Drainage
- 02730 Sanitary Sewers

02732 Sewer Force Mains
02760 Existing Utilities/Facilities Underground and Overhead
02990 Landscape Restoration

Division 3 - Concrete
03300 Cast-in-place Concrete

Plans

Roadway Sections
Example of sewer plan
Example of water plan

Standard Details

General:

G1 Typical Trench Section
G2 Rigid Pavement Patching
G3 Asphalt Concrete Patching
G4 DE Plan Notes

Sewer:

S1 Type I – 48" Manhole
S2 Type IIIA – 48" Manhole
S3 Manhole Frame and Cover
S4 Manhole Channeling
S5 Manhole Steps and Ladder
S6 Street Side Sewer
S7 Sewer Cleanout
S8a Outside Drop Manhole Connection
S8b Inside Drop Manhole Connection
S9 Concrete Pipe Anchor

Water:

W1 ¾" and 1" Water Service
W2 1½" and 2" Water Service
W3 Fire Hydrant Assembly
W4 Concrete Thrust Blocking
W5 Blowoff Assembly
W6 Valve Operating Nut Extension
W7 Air Release Valve Assembly
W8 Valve Marker Post/Hydrant Guard Post
W9 Double Check Valve Assembly
W10 Double Check Detector Assembly

Storm and Roadway Features:

WSDOT F-3	Cement Concrete Sidewalk
WSDOT F-3b	Sidewalk Ramp
WSDOT F-4	Driveway Entrance
WSDOT F-1a	Curb and Gutter
WSDOT B-1	Catch Basin Type 1
WSDOT B-2	Catch Basin Cover
WSDOT B-2a	Catch Basin Frame
WSDOT B-2b	Catch Basin Vaned Grate
WSDOT B-2c	Catch Basin Bi-Directional Vaned Grate
WSDOT B-2d	Catch Basin Herringbone Grate

SECTION 01001

SPECIFICATION STRUCTURE

1. GENERAL

1.1 FORMAT

A. This specification is organized on the format promulgated by the Construction Specification Institute (CSI format).

B. This format assigns permanent numbers to all divisions and sections and, so far as possible, assigns permanent places in the specifications to all products, processes, activities and construction requirements. A number is assigned that will not change from specification to specification.

C. Division, section and subsection numbers that are not required are omitted from the Specification.

D. Reference to an Article is a numbered clause in the General Conditions.

1.2 INDEX

A. All sections required for a complete Contract appear in the index. Sections not required are omitted.

B. Bidders and Contractors should check sections present against the index to assure the presence of all required sections of the Contract.

1.3 ARRANGEMENT

A. The Project Manual is organized as follows:

1. Procedural and legal documents in the opening sections.
2. Specifications in divisions numbered 1 to 16.

B. No attempt has been made in these specifications or plans to segregate work covered by any trade or subcontractor under one specification. Such segregation and establishment of subcontract limits shall be solely a matter of specific agreement between the Contractor and his subcontractors and shall not be based upon an inclusion, segregation or arrangement in or of these specifications. The Contractor and subcontractor in each case is warned that work included in any subcontract may be divided between several general specifications and that each general specification or subhead of the Technical Specifications may include work covered by two or more subcontracts in excess of any one subcontract.

C. The Contractor shall be responsible for all work shown or specified, regardless of location in the Contract Documents.

1.4 LANGUAGE

A. These Specifications are written in imperative and abbreviated form.

B. This imperative language of the technical sections is directed at the Contractor, unless specifically noted otherwise.

C. Incomplete sentences shall be completed by inserting "shall", "the Contractor shall", and "shall be", and similar mandatory phrases by inference in the same manner as they are applied to notes on the drawings. The words "shall be" shall be supplied by inference where a colon (:) is used within sentences or phrases.

D. Except as worded to the contrary, fulfill (perform) all indicated requirements whether stated imperatively or otherwise.

* * * END OF SECTION * * *

SECTION 01045

CUTTING AND PATCHING

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Demolition: Section 02050
B. Pavement Repair and Resurfacing: Section 02575
C. Excavating, Backfilling and Compacting for Utilities: Section 02222

1.2 METHODS

A. Execute cutting (including excavating), fitting, or patching of work, required to:

1. Make several parts fit properly.
2. Remove and replace defective work.
3. Remove and replace work not conforming to requirements of Contract Documents.
4. Install specified work in existing construction.

B. Do not endanger any work by cutting or altering work or any part of it.

C. Do not cut or alter work of another contractor.

1.3 SUBMITTALS

A. Submit written notice to Engineer requesting consent to proceed prior to cutting which affects structural safety of project, or work of another contractor.

B. Submit notice to Engineer, designating the time the work will be uncovered, to provide for observation.

1.4 PAYMENT FOR COSTS

A. Contractor shall pay for all costs caused by ill-timed, unnecessary or defective work or work not conforming to Contract Documents, including costs for additional services of Engineer.

2. PRODUCTS

2.1 MATERIALS

A. For replacement of work removed: Contractor shall comply with Specifications for type of work to be done.

3. EXECUTION

3.1 INSPECTION

A. Inspect existing conditions of work, including elements subject to movement or damage during construction.

3.2 PREPARATION (PRIOR TO CUTTING)

A. Provide shoring, bracing and support as required to maintain structural integrity of all portions of the project.

3.3 PERFORMANCE

A. Execute fitting and adjustment of products to provide finished installation to comply with specified tolerances and finishes.

B. Execute excavating and backfilling as specified in Excavating, Backfilling and Compacting for Utilities.

C. Restore work that has been cut or removed.

* * * END OF SECTION * * *

SECTION 01050

FIELD ENGINEERING

[added due to pipeline section and Owner's review of surveyor selection]

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

D. Inspection Services: Section 01420.

1.3 GENERAL REQUIREMENTS

A. The Contractor shall protect and preserve in their original position all stakes, points, or marks set for the work.

G. Detailed staking will usually be done after clearing of right of way has been completed.

1.4 REQUIREMENTS FOR PIPELINES

A. Where line and grade is carried by stringline in the case of pipeline construction, not less than three (3) points shall be in use at one time.

B. Grades shall be checked by the Contractor and if the points do not line up, the work shall be immediately stopped, and the cause remedied before proceeding with the work.

C. Other methods of transferring line and grade may be used providing that such methods can be checked by the Engineer at not less than three points in each section of pipe between manholes before backfilling is started. Permission to use any specific method will not relieve the Contractor of his responsibility to meet any requirement of other sections of this Specification.

D. Line and grade shall be checked for each piece of pipe laid.

1.6 CONTRACTOR PROVIDED STAKES

A. Staking when performed by Contractor shall be done by qualified licensed surveyors.

B. Prior to the Contractor conducting any survey work, the Contractor shall submit to the Owner evidence of the qualifications of the person(s) he will assign to do the survey work for the project. The Owner reserves the right to disallow the person(s) selected by the Contractor for surveying if, in the Owner's opinion, the person is not qualified to do the work. The Contractor shall select another surveyor and submit qualifications to the Owner until a qualified person is approved by the Owner.

C. Control points shown on the drawings or outlined in the Special Provisions shall be utilized to stake out the project.

D. Field notes shall be kept in standard bound notebooks in a clear, orderly manner consistent with standard engineering practice including titles, numbering and indexing.

E. The Contractor shall provide the Owner with a copy of all field notes including references to monuments and property corners.

* * * END OF SECTION * * *

SECTION 01070

ABBREVIATIONS AND SYMBOLS

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Definitions: General Conditions

1.2 ABBREVIATIONS

A. Whenever the following abbreviations are used on the plans, specifications, proposals and contracts, they shall be construed to mean the words and terms as listed below.

B. Duplicate Definitions shall be interpreted in context of use.

A

AASHTO	American Association of State Highway and Transportation Officials
AC	Asbestos Cement or Asphaltic Concrete
ACI	American Concrete Institute
AFBMA	Anti Friction Bearing Manufacturers Assoc.
AFF	Above Finish Floor
AGA	American Gas Association
AGC	Associated General Contractors of America
AGMA	American Gear Manufacturer Association
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
AMCA	Air Moving and Conditioning Association
ANSI	American National Standards Institute
APA	American Plywood Association
API	American Petroleum Institute
APWA	American Public Works Association
AREA	American Railway Engineering Association
ASAE	American Society of Agriculture Engineers
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigeration, and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWPA	American Wood Preservers Association
AWS	American Welding Society
AWWA	American Water Works Association

B

BTU	British thermal unit
BTUH	British thermal units per hour

C

C	Centigrade/Celsius
CB	Catch Basin
CBMA	Certified Ballast Manufacturers Association
CFM	Cubic feet per minute
CFS	Cubic feet per second
CL^2	Chlorine Solution
CMP	Corrugated Metal Pipe
CO	Clean Out
CPM	Critical path method
CRSI	Concrete Reinforcing Steel Institute

D

D	Drain
DFP	Douglas Fir Plywood Association
DI	Ductile Iron
DIPRA	Ductile Iron Pipe Research Association

E

EA	Each
EEO	Equal Employment Opportunity
E/P	Edge of Pavement
EPA	Environmental Protection Agency (Federal)

F

F	Fahrenheit
FCA	Flanged Coupling Adapter
FED SPEC	Federal Specification
FHWA	Federal Highway Administration
FL	Flanged
FPM	Feet per minute
FT,FT^2,FT^3	Foot, square feet, cubic feet

G

GA	Gage, gauge
GAL	Gallon
GALV	Galvanized
GCE	Grit Chamber Effluent
GPD	Gallons per day
GPH	Gallons per hour
GPM	Gallons per minute

H

HB	Hose Bib
HDPE	High Density Polyethylene
HOA	Hand-off-auto
HP	Horsepower or High Point
HR	Hour
HT	Height
Hz	Hertz

I

ID	Inside Diameter
IE	Invert Elevation
IEEE	Institute of Electrical and Electronics Engineers
IN,IN^2,IN^3	Inch, square inches, cubic inches
IPCEA	Insulated Power Cable Engineers Association
ISA	Instrument Society of America

J

JIC	Joint Industry Conference of Hydraulic Manufacturers

K

KV	Kilovolt
KVA	Kilovolt ampere
KVAR	Reactive kilovolt amperes
KW	Kilowatts
KWH	Kilowatt hours

L

L	Length
LB	Pounds
LF	Linear feet
LS	Lump Sum

M

M	Thousand
MA	Milliamperes
MBTUH	One thousand British thermal units per hour
MGD	Million gallons per day
mgl	Milligrams per liter
MIN	Minute
MJ	Mechanical Joint
ML	Mixed Liquor
MSS	Manufacturers Standardization Society of the Valve and Fittings Industry
MV	Millivolts
MVA	Megavolt amperes

N

NAMM	National Association of Metal Manufacturers
NBFU	National Bureau of Fire Underwriters
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NESC	National Electric Safety Code
NFPA	National Fire Protection Association
NPC	National Plumbing Code
NPT	National pipe thread
NRS	Non-rising stem
NLMA	National Lumber Manufacturers Association

O

OD	Outside diameter
OECI	Overhead Electric Crane Institute
OSHA	Occupational Safety and Health Act
OZ	Ounce

P

PCA	Portland Cement Association
ph	Hydrogen ion concentration
PH	Phase
PPM	Parts per million
PSF	Pounds per square foot
PSI	Pounds per square inch
PSIG	Pounds per square inch gauge
PT	Pint
PVC	Polyvinyl chloride

Q

R

RAS	Return Activated Sludge
RPM	Revolutions per minute

S

S	Slip
SAE	Society of Automotive Engineers
SAMA	Scientific Apparatus Manufacturers Association
Sc	Scum
SCFM	Standard cubic feet per minute
SE	Secondary Effluent
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
SQFT	Square foot
SQIN	Square inch
SQMI	Square mile
SSPC	Steel Structures Painting Council
SW	Service Water (Effluent)

T

THD	Threaded
TOW	Top Of Wall

U

UBC	Uniform Building Code
UL	Underwriter's Laboratory
UPC	Uniform Plumbing Code

V

V	Volt

W

W	Plant Water
WAS	Waste Activated Sludge
WCLIB	West Coast Lumber Inspection Bureau
WWF	Welded Wire Fabric
WWPA	Western Wood Products Association

X

Y

Z

* * * END OF SECTION * * *

SECTION 01090

REFERENCE STANDARDS

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. All Divisions: As referenced

1.2 AUTHORITY

A. Contractor is responsible to conform to all codes and regulations legally in effect at the location of the project.

B. Contractor shall conform to all requirements and regulations of the authority administering such codes and regulations.

1.3 REFERENCE CODES

A. Contractor shall conform to all codes and sections thereof as may be referred to in the specifications.

B. Referenced codes are, by such reference, incorporated into this Contract as if set forth herein in full.

1.4 SPECIFICATIONS INCORPORATED BY REFERENCE

A. Where Federal, AWWA, ASTM, or any other standard specifications are referred to, or included by reference, the latest issue and/or amendment thereto published at the date of issue of the Advertisement for Bids shall be incorporated in the Contract by said reference as if set forth herein in full.

* * * END OF SECTION * * *

SECTION 01210

PRECONSTRUCTION CONFERENCES

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

F. Shop Drawings, Project Data and Samples: Section 01340
H. Traffic Regulation: Section 01570
I. Material and Equipment: Section 01600

1.2 SCHEDULE

A. the Owner will schedule a preconstruction meeting.

B. Present at the meeting to represent the Contractor shall be at least the official in charge of the project, the project superintendent, a representative with authority to speak for each of his principle subcontractors, and other representatives as he may deem expedient.

C. The Owner and/or his representatives shall be present as required.

D. Proceedings of meeting to be recorded and distributed to interested parties.

1.3 AGENDA

A. Both Owner and Contractor shall be prepared to speak to the following:

1. Name and field address of job superintendent.
2. Emergency phone and/or operator.
3. Date of construction start.
4. Date of Notice to Proceed.
5. Notification of utilities concerned, fire, police, schools, etc.
6. Coordination with other contractors.
7. Permits: county, city, state fisheries, government agencies as required.
8. Inspector: name, authority.
9. Field office (location).
10. Shop drawing submittals.
11. Responsibility for lines and grades.
12. Minimum wage rates and posting of wage rate determination.
16. Periodic monthly payments including date for submittal.
18. Safety requirements and special hazards.
19. Insurance and bonds.
20. Traffic control.
21. Construction signs.
22. Drawings revised to conform to construction records.
23. Beneficial occupancy.

24. Retention of Contract records.
25. Guarantees and warranties.
26. Operation and maintenance manuals.
27. Non-discrimination notice.
28. Project signs.
29. Testing.
30 Progress meetings.
31. Complaint procedure.
32. Job photos.
33. Other matters concerning construction.

* * * END OF SECTION * * *

SECTION 01340

SHOP DRAWINGS, PROJECT DATA AND SAMPLES

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Testing Laboratory Services: Section 01410
B. Project Record Documents: Section 01720

1.2 SCHEDULE

A. Prepare and submit a schedule listing dates for submission and dates that reviewed shop drawings, project data and samples will be needed.

B. Fabrication of an item or construction work shall not start before the Engineer has taken action on the shop drawing submittal. Any work shall be entirely at the Contractor's risk.

C. The Engineer will not accept for payment work performed by the Contractor that may be affected by materials, equipment, or methods of work not submitted in a timely manner so that final review can be accomplished before the affected work is complete.

D. Incomplete shop drawings or submittal rejected by the Engineer shall not be basis for claim for delay.

1.3 SUBMITTALS

A. Shop drawings shall be submitted and reviewed in the following manner:

1. The Contractor shall review, stamp with his approval and submit postpaid with such promptness as to cause no delay in his work or in that of any other contractor, the required number of copies of all shop drawings, schedules, data, and samples required for the work of the various trades determined necessary by the Engineer, required in the General Conditions and/or described elsewhere in the Project Manual.
2. Shop drawings shall establish the actual detail of all manufactured or fabricated items. All shall be drawn to scale and be completely dimensioned.
3. Provide on each drawing a clear space for the Engineer's and/or Owner's review and approval stamps and comments.
4. It shall be the Contractor's responsibility to clearly note on the shop drawings, and in writing specifically call to the Engineer's attention, any changes that vary from the Contract Drawings and Specifications. No review of the shop drawings by the Engineer shall relieve the Contractor of full responsibility and at his own cost and expense to

comply with the Contract Documents unless the changes are clearly noted and in writing called to the Engineer's attention as above provided, in which event subsequent acceptance by the Engineer in writing shall be authority for the change or changes proposed in the shop drawings.

5. If corrections are required, the Contractor shall make the corrections required by the Engineer . The Contractor shall direct specific attention in writing or on resubmitted shop drawings to revisions other than the corrections requested on previous submissions.
6. Shop drawings shall give complete information necessary for the fabrication and installation of all component parts of the equipment, structure, facility, etc. In the case of structural drawings, they shall include the location, type, size, and extent of all welds, if any are necessary. Manufacturers' standard details, catalogues, advertising literature, etc., shall not necessarily constitute all of the shop drawings required for any unit or facility. Additional shop details designed for the particular project shall be furnished when required by the Engineer. Shop drawings of electrical equipment shall include complete diagrams of electrical circuitry.
7. The Engineer's review of and placement of shop drawing review stamp on any shop drawing is understood to be an acceptance of the character of the details and not a check of any dimension or quantity and will not relieve the Contractor from responsibility for errors of any sort in shop drawings data or schedules, whether or not such errors are found by the Engineer in his review of such details.
8. The Engineer's review of and placement of shop drawing review stamp on any shop drawing will not relieve the Contractor of responsibility for consequences due to deviations from the Contract Documents unless the Contractor has called attention to such deviations in writing by a letter accompanying the drawings at the time of submission and the Engineer accepts such deviations in writing.
9. No changes will be made in any drawing after it has been reviewed except by the consent or direction of the Engineer in writing.

C. Samples shall be submitted in the same manner as shop drawings.

1. Samples to be physical examples to illustrate materials, equipment or workmanship, and to establish standards by which completed work is judged.

    a. Office samples: of sufficient size and quantity to clearly illustrate:

        (1) Functional characteristics of product or material, with integrally related parts and attachment devices.
        (2) Full range of color samples.

    b. Field samples and mockups

(1) Erect at project site location acceptable to Engineer
(2) Construct each required sample or complete mock-up, including work of all trades required in finished work.
(3) Coordinate sampling of natural materials with Field Engineer.

2. If any test sample fails to meet the specification requirements, all previous approvals will be withdrawn and such materials or equipment, which fail the testing, shall be subject to removal and replacement by the Contractor with materials or equipment meeting the specification requirements.
3. Affected finish work shall not be commenced until the Engineer has given written approval for the field samples.

1.4 CONTRACTOR RESPONSIBILITY

A. By approving and submitting shop drawings and samples, the Contractor thereby represents that he has determined and verified all field measurements, field construction criteria, materials, catalog numbers and similar data, or will do so, and that he has checked and coordinated each shop drawing with the requirements of the Work and of the Contract Documents and that there is no conflict with other submittals that may affect the work of another contractor or the Owner.

B. A copy of each approved shop drawing and each approved sample shall be kept in good order by the Contractor at the job site and shall be available to the Engineer.

* * * END OF SECTION * * *

SECTION 01380

CONSTRUCTION PHOTOGRAPHS

1. GENERAL

1.1 REQUIREMENTS

A. Unless otherwise specifically excepted, construction photographs will be required on the following projects.

1. All pipelines on easements.
2. All sewer projects.
3. All projects other than pipelines with a contract price in excess of $250,000.

B. Photographs shall be 3" x 5" size or larger, glossy finish, in color and unmounted.

C. All photographs shall be taken by an acceptable commercial photographer hired by the Contractor who shall coordinate his schedule with the Engineer.

D. Each photograph shall be marked with date and identification.

E. Each photograph must show flagged positions of route of pipeline and easement number.

F. The preconstruction photographs shall be delivered to and approved by the Engineer, prior to beginning of construction.

1.2 PROJECTS OTHER THAN PIPELINES

A. Contractor shall furnish a set of construction color photographs each month to show the general progress of construction.

B. The first set of photographs shall be taken before the Contractor moves on the site and the last shall be taken after completion.

C. Within three (3) days before or after the first day of the month, photographs shall be taken as follows:

1. One panoramic view of the whole project.
2. Enough shots of each structure to indicate the state of progress to date.

D. Three (3) copies of the pictures shall be delivered to the Engineer by the 15th of the month they were taken.

1.3 PIPELINES

A. A minimum of one preconstruction and one post-construction color photograph shall be taken of each lot or parcel of private property upon which sewer construction takes place.

B. Final photographs shall be taken as nearly as possible from the same locations as the preconstruction photographs.

C. At least one photograph on each sewer run from manhole to manhole.

D. At least one photograph every 300 feet on pipelines other than sewer.

E. On large lots or lots with extensive improvements several photographs shall be taken.

F. One (1) file of all photographs shall be delivered to the Engineer and one (1) to the Owner.

* * * END OF SECTION * * *

SECTION 01410

TESTING LABORATORY SERVICES

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Inspection Services: Section 01420
B. Testing Requirements: Various Sections

1.2 BIOLOGICAL TESTING

A. Biological tests required for disinfection of domestic water systems shall be by a laboratory approved by the Health Department or other authority having jurisdiction.

1.3 CONTRACTOR WILL PAY FOR SERVICES OF AN INDEPENDENT TESTING LABORATORY FOR:

A. Soils gradation, moisture density standards determination, and in place density tests per Division 2.

B. Concrete: Mix design, consistency, air content, yield, compressive test cylinder casting and compression testing per Section 03300.

C. Other materials and/or workmanship specified in Divisions 2 through 16.

1.4 LIMITATION

A. Employment of a testing laboratory shall in no way relieve the Contractor of his obligation to perform work in accordance with the Contract.

1.5 QUALIFICATION OF LABORATORY

A. Meet basic requirements of ASTM E329, "Standard Specification for Agencies Engaged in Construction Inspection and/or Testing".

B. Submit copy of report of inspection of facilities made by Materials Reference Laboratory of National Bureau of Standards during most recent tour of inspection; with memorandum of remedies of any deficiencies reported by inspection.

C. Testing Equipment:

1. Calibrated at maximum 12 month intervals by devices of accuracy traceable to National Bureau of Standards.
2. Submit copy of certificate of calibration, made by accredited calibration agency.

1.6 LABORATORY DUTIES, AUTHORITY AND LIMITATION

A. Cooperate with Engineer and Contractor.

B. Provide qualified personnel promptly on notice.

C. Perform specified inspections, sampling and testing of materials and methods of construction:

1. Comply with specified standards: ASTM, other recognized authorities, and as specified.
2. Ascertain compliance with requirements of Contract Documents.

C. Promptly notify Engineer and Contractor of irregularities or deficiencies of work that are observed during performance of services.

D. Promptly submit 2 copies of report of inspections and tests to Engineer, in addition to those required by the Contractor including:

1. Date issued.
2. Project title and number.
3. Testing Laboratory name and address.
4. Name and signature of Inspector.
5. Date of inspection of sampling.
6. Record of temperature and weather.
7. Date of test.
8. Identification of product and specification section.
9. Location in project.
10. Type of inspection or test.
11. Results of test.
12. Observations regarding compliance with Contract Documents.

F. Perform additional services as required.

G. Laboratory is not authorized to:

1. Release, revoke, alter, or enlarge on, requirements of Contract Documents.
2. Approve or accept any portion of work.

1.7 RESPONSIBILITIES OF CONTRACTOR

A. Cooperate with laboratory personnel and provide access to work.

B. Provide to laboratory, preliminary representative samples of materials to be tested in required quantities.

C. Furnish copies of mill test reports.

D. Furnish casual labor and facilities:

1. To provide access to work to be tested.
2. To assist laboratory personnel to obtain and handle samples at the site.
3. To facilitate inspections and tests.
4. For laboratory's exclusive use for storage and curing of test samples.

E. Notify laboratory sufficiently in advance of operations to allow for assignment of personnel and scheduling of tests.

F. Laboratory tests: Where such inspection and testing are to be conducted by an independent laboratory or agency, the sample or samples of materials to be tested shall be selected by such laboratory or agency, or the Engineer, and shipped to the laboratory by the Contractor at his expense.

* * * END OF SECTION * * *

SECTION 01420

INSPECTION SERVICES

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Testing Laboratory Services: Section 01410

1.2 AUTHORITY AND DUTIES OF INSPECTORS

A. Inspectors are placed on the work to keep the Project Engineer informed as to the progress of the work and the manner in which it is being done; to keep records; act as liaison between the Contractor and the Project Engineer; also to call the attention of the Contractor to any deviations from the Contract Documents, but failure of the Inspector to call to the attention of the Contractor to faulty work or deviations from the Contract Documents shall not constitute acceptance of said work.

B. The Inspector may reject or accept materials and equipment to be incorporated in the work and such specific items as he is authorized to accept.

C. When any material has been accepted by the Inspector, it passes from his control to the control of the Contractor and remains there until the job, as a whole, is complete. Since the Inspector cannot control how the material is used, the responsibility for its safety and proper use will be the Contractor's. Until the job is finally completed, the Contractor might do work that changes or modifies work previously done and even though at any given time a piece of work might be well done and acceptable in quality, the responsibility for keeping it in that condition until the job is completed is the sole responsibility of the Contractor. For this reason, it is impossible to accept, finally, any portion of a project until the project as a whole is acceptable and control of said project is withdrawn from the Contractor by final official written acceptance by the Owner.

D. Since one of the Inspector's primary interests is to see that work on the project progresses expediently and in a workmanlike manner, he may at various times offer suggestions to the Contractor that the Contractor may or may not follow, at his discretion. Such suggestions are never to be considered as anything but suggestions and involve no assumption of responsibility, financial or otherwise, by either the Inspector himself, the Engineer, or the Owner.

E. Any personal assistance which an Inspector may give the Contractor will not be construed as the basis of any assumption of responsibility in any manner, financial or otherwise, by the Inspector, the Engineer, or the Owner.

F. The Engineer is not and does not purport to be a Safety Engineer and is not engaged in that capacity by the Owner and shall have neither authority nor responsibility to enforce construction safety laws, rules, regulations, procedures or the safety of persons on and about the construction site.

G. The presence or absence of an Inspector on any job will be at the sole discretion of the Engineer, and such presence, or absence, of an Inspector will not relieve the Contractor of his responsibility to obtain the construction results specified in the Contract Documents.

H. The Inspector will not be authorized to approve or accept any portion of the work, to make changes in the work, or to issue instructions contrary to the Contract Documents, such approvals, acceptances, or instructions, when given, must be in writing and signed by the Project Engineer. The Inspector will have authority to reject defective material; however, the failure of the Inspector to reject defective material or any other work involving deviations from the Contract Documents will not constitute acceptance of such work.

I. Nothing in this subsection shall in any way be so construed as to require or to place responsibility for, the method, manner or supervision of the performance of the work upon the Inspector, the Engineer, or the Owner. Such responsibility rests solely with the Contractor.

1.3 EXAMINATION OF MATERIALS

A. The neglect or failure on the part of the Engineer to condemn or reject substandard material or work shall not imply an acceptance of the materials or work. The Contractor shall furnish, at his own expense, such labor as may be required to enable the Engineer to make a thorough inspection and culling of the materials, and the Contractor shall bear the costs of all laboratory or other testing called for in these Specifications.

B. Where required by the Specifications, the Engineer will examine certain materials such as masonry materials, concrete, aggregates, etc., at the manufacturer's plant prior to their delivery to the job site. The Contractor shall bear the cost of such material inspection including the Inspector's time, travel time and transportation expense and any other costs incurred, or chargeable to, or by, such material inspection. These inspection costs shall be billed to the Contractor at the Engineer's current billing rate. Transportation expense shall be billed at current rate. All such material inspection charges will be billed directly to the Contractor by the Owner and said costs shall be a lien against the Contractor's work.

* * * END OF SECTION * * *

SECTION 01545

PROTECTION OF WORK AND PROPERTY

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Access and Haul Roads: Section 01550
B. Temporary Controls: Section 01560
C. Pavement Repair and Resurfacing: Section 02575
D. Existing Utilities/Facilities - Underground and Overhead: Section 02760
E. Landscape Restoration: Section 02990

1.2 PUBLIC AND PRIVATE PROPERTY

A. The Contractor shall protect and maintain all underground or aboveground utilities and structures affected by the work and all lawns, shrubs, trees, fences, rockeries, etc., and parking strips or private property crossed by or adjacent to his operation, and any damage shall be repaired and restored by the Contractor to the satisfaction of the Owner.

B. The Contractor will be responsible for all damage to roads, highways, ditches, bulkheads, walls, bridges, culverts, utilities, barricades, lights, or other property, caused by the work, whether such damage be at the site of the work or caused by transporting or hauling to or from the work; and he shall repair or replace, or arrange for the repair or replacement of all such damage to the satisfaction of the Owner. Any material damaged by the Contractor's operations shall be replaced with new material.

C. Whenever construction work is undertaken on easement, right-of-way, or franchise, all work shall be confined to the limits of such easement, right-of-way, or franchise, and accomplished so as to cause the least amount of disturbance and a minimum amount of damage.

D. Completion of work across private property shall be carried out in one continuous operation of construction of the facilities with the immediate restoration and cleanup of the construction area. If the Contractor fails to perform such construction and restoration continuously as herein provided, the Owner may give the Contractor a written notice to so perform, and in event of failure by the Contractor to complete such construction and restoration within 72 hours of such notice, the Owner may complete the installation and restoration on such private property to the extent the Owner deems advisable and the cost of all work, labor, materials, and expenses incurred by the Owner in so doing shall be paid by the Contractor .

E. Particular care shall be exercised to see that the topsoil from the trench is preserved and replaced in its original location. It shall be

the Contractor's responsibility to strip such topsoil from the trench, or construction area, and stockpile it in such a manner that it may be replaced, by him, upon completion of construction.

F. Wherever it may be necessary for the Contractor to trench through any lawn areas, the sod shall be carefully cut and rolled and replaced after ditches have been water settled, or otherwise properly compacted. All work shall be done in a manner calculated to leave the lawn area clean of earth and debris and in a condition as near as possible to that which existed before work was started.

G. The Contractor shall not remove, even temporarily, any trees or shrubs that exist on easements across private property or in parking strips, without first having notified the property owners or authorities maintaining same.

H. Ornamental trees and shrubbery shall be carefully removed with the earth surrounding their roots, wrapped in burlap and replanted in their original positions within 48 hours. Ornamental trees or shrubbery that is destroyed or damaged by the Contractor, whether on public or private property, shall be replaced by the Contractor with material of equal quality, and no additional compensation will be allowed for such replacement.

I. It is expressly understood that the Contractor shall, in particular, restore all such easements and rights-of-way to a condition equal to its original condition and in a condition satisfactory to the property owners and the Owner. It is also understood that any private improvements made in public rights-of-way are included in the above category.

1.3 TREES

A. All existing trees and shrubs that are to be protected and that are damaged during construction shall be trimmed or replaced by the Contractor or a certified tree company under permit from the jurisdictional agency or owner and to the satisfaction of said agency and/or owner.

B. The Contractor shall immediately notify the Engineer and/or owner if any tree, which is to be protected, is damaged by his operations. If, in the opinion of said agency or the owner, the damage is such that replacement is necessary, the Contractor shall replace the tree at his own expense.

C. Replacement trees shall be of a like size and variety as the tree damaged, or, if of a smaller size, the Contractor shall pay to the owner of said tree a compensatory payment acceptable to the tree owner not to exceed the cost of replacing the tree as determined from quotes obtained by the tree owner from a minimum of two local nurseries. The size of the replacement trees shall be not less than 1-inch diameter nor less than 6 feet in height.

D. When trimming is permitted, symmetry of the tree shall be preserved. No stubs or splits or torn branches shall be left. Clean cuts shall be made close to trunk or large branch. Spikes shall not be used for climbing live trees. All cuts over 1-1/2 inches in diameter shall be coated with an asphaltic emulsion material.

1.4 EASEMENTS

A. Reference numbers of easements are shown on drawings.

B. The Contractor shall meet and fulfill all covenants and stipulations of each easement obtained by the Owner.

C. Copies of all easements and special covenants are on file in the office of the Owner, which is incorporated in this Contract by this reference, as if set forth herein in full.

1.5 ACQUISITION OF EASEMENTS

A. The Owner has obtained or is in the process of obtaining the easements required for this project.

B. If the Owner has not obtained all of the easements, it is anticipated that there may be additional stipulations and covenants on the remaining easements. It is also anticipated that the Owner may purchase certain items on easements, such as large trees within the permanent easement, thereby relieving the Contractor from the responsibility of restoring or protecting same.

1.6 COVENANTS ON EASEMENTS NOT LISTED

A. Work shall not be started on any private right-of-way or easement until clearance is given the Contractor by the Engineer.

1.7 EASEMENT RELEASE

A. Where work is done on easements, the Contractor shall obtain a written statement (see following form) of satisfactory restoration from each property owner involved, and furnish a copy of said statement to the Engineer. The statement will be required before the work will be accepted by the Owner provided, however, that where the Contractor contends that the property owner is making unreasonable demands, he shall submit a list of such demands to the Owner in writing. If in the opinion of the Owner, such demands are unreasonable, the Contractor may be excused from the necessity of obtaining a written statement of satisfactory restoration from the property owner making such unreasonable demand.

EASEMENT NO. _____

CONTRACT NO. _____

PROPERTY OWNER'S APPROVAL OF EASEMENT RESTORATION

We, the undersigned owner(s) of property identified as

_____

(Address or Property Description)

do hereby approve and accept the restoration work done by

_____

the Contractor on the construction of pipelines on easements over and across my (our) property.

SIGNED _____

_____

DATE _____

1.8 CARE OF EXISTING FACILITIES

A. The Contractor shall take adequate precautions to protect existing sidewalks, curbs, pavements, utilities, adjoining property, and structures, and to avoid damage thereto, and he shall at his own expense completely repair any damage thereto caused by his operation.

B. Access for firefighting equipment shall be maintained at all times.

1.9 SHORING, BRACING, ETC.

A. The Contractor shall shore up, brace, underpin, and protect, as may be necessary, all foundations and other parts of all existing structures adjoining the site of the Project that are in any way affected by the excavation or other operations connected with the completion of the work .

B. Whenever any notice is required to be given by the Owner or the Contractor to any adjoining or adjacent landowner or other party before commencement of any work, such notice shall be given by the Contractor.

C. The Contractor shall indemnify the Owner and save it harmless from any damages on account of settlements or the loss of lateral or subjacent support of adjoining property and from all loss or expense and all damages for which the Owner may become liable in consequence of such injury or damage to adjoining and adjacent structures and their premises.

1.10 EMERGENCIES

A. Whenever the Contractor's work could endanger the safety of life or property including adjoining property or property in the immediate proximity of the Project, the Contractor shall take all reasonable precautions to prevent threatened loss or injury therefrom.

1.11 EXISTING UTILITIES/FACILITIES - UNDERGROUND AND OVERHEAD

A. The Contractor shall protect existing utilities/facilities, both overhead and underground as provided in Section 02760.

1.12 TEMPORARY FENCE

A. The Contractor shall be responsible for the erection of temporary fence as required to protect his own work area.

B. The Contractor shall be responsible for erection and maintenance of temporary fencing or other facilities as required to retain livestock and/or periodic security of existing fenced areas.

C. Temporary fencing on facilities shall remain in place until the permanent fencing, as originally installed, is replaced under the restoration requirements of the Contract or as shown on the Contract Drawings.

* * * END OF SECTION * * *

SECTION 01550

ACCESS AND HAUL ROADS

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Traffic Regulation: Section 01570

1.2 PRIVATE ACCESS

A. Where required by the Contract or choice of the Contractor access may be over private land.

B. Access will be maintained by and at the expense of the Contractor.

C. Comply with local regulations and permits.

D. Comply with all legal requirements to include, as a minimum, written permission of private owners.

E. Control dust, noise, and traffic in compliance with local laws and regulations.

F. Leave private property in a condition satisfactory to the Owner and as indicated by a written release.

1.3 PUBLIC ACCESS AND HAUL ROADS

A. Comply with all laws and regulations.

B. All streets in the construction area used by Contractor's trucks or any other equipment hauling material to and from the area, whether within the Contract limits or adjacent thereto, shall be kept clean and shall be serviced by continuous use of sprinkling trucks to allay dust.

C. Unsurfaced roads and streets may receive an application of dust oil to allay dust.

D. Dust control shall continue until streets are accepted by the public agency responsible for maintenance or the Contractor is relieved of responsibility by such agency.

F. Any damage to roadway surfaces that results from the direct or indirect activities of the Contractor's operation shall be repaired by the Contractor to the satisfaction of the responsible agency.

* * * END OF SECTION * * *

SECTION 01560

TEMPORARY CONTROLS

1. GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Protection of Work and Property: Section 01545
B. Access and Haul Roads: Section 01550
C. Traffic Regulation: Section 01570
D. Landscape Restoration: Section 02990

1.2 LAWS

A. Requirements of federal, state, and local statutes and regulations dealing with temporary controls described in this section shall be strictly adhered to by the Contractor.

1.3 CONSTRUCTION CLEANING

A. The Contractor shall keep the site of the work and other areas used by him in a neat and clean condition, and free from any accumulation of rubbish.

B. The Contractor shall dispose of all rubbish and waste materials of any nature occurring at the work site, and shall establish regular intervals of collection and disposal of such materials and waste.

C. The Contractor shall keep his haul roads free from dirt, rubbish, and unnecessary obstructions resulting from his operations.

D. Equipment and material storage shall be confined to areas approved by the Engineer.

E. Disposal of all rubbish and surplus materials shall be off the site of constructionin accordance with local codes and ordinances governing locations and methods of disposal, and in conformance with all applicable safety laws.

1.4 AIR POLLUTION CONTROL

A. The Contractor shall not discharge smoke, dust or other contaminants into the atmosphere that violate the regulations of any legally constituted authority.

B. The Contractor shall furnish all labor, equipment, and means required and shall carry out effective measures wherever and as often as necessary to prevent his operation from producing dust in amounts damaging to property, cultivated vegetation, or domestic animals, or causing a nuisance to persons living in or occupying buildings in the vicinity.

C. The Contractor shall comply with specific requirements of air quality control laws.

D. The Contractor shall be responsible for any damage resulting from any dust originating from his operations.

E. The dust abatement measures shall be continued until the Contractor is relieved of further responsibility by the Owner.

1.5 EROSION CONTROL

A. Contractor shall provide temporary erosion control work required by state or local agencies during the life of the contract. This work is intended to provide prevention, control, and abatement of water pollution/erosion within the limits of the project, and to minimize damage to the work, adjacent property, streams, and other bodies of water.

B. The Contractor shall coordinate this temporary water pollution/erosion control work with the permanent drainage and erosion control work that may be specified in the Contract to the extent practicable to ensure that effective and continuous water pollution/erosion control is maintained during the construction of the Project.

C. Clearing and grubbing operations shall be so scheduled and performed such that grading operations and permanent erosion control features can follow immediately. If the project conditions do not permit this scheduling, temporary water pollution/erosion control measures will be required between successive construction stages.

D. The area of excavation, borrow, and embankment operations in progress will be limited commensurate with the Contractor's capability and progress in keeping the finish grading, mulching, seeding, and other permanent erosion control measures current according to the accepted schedule.

E. If the Engineer determines that water pollution and/or erosion could occur due to seasonal limitations, the nature of the material, or the Contractor's progress, temporary water pollution/erosion control measures shall be taken immediately.

F. The Engineer may require the Contractor's operations to be scheduled so that permanent erosion control features will be installed concurrently with or immediately following grading operations.

G. Compliance with the requirements of this section shall not relieve the Contractor from his responsibility to comply with other provisions of the contract.

1.6 NOISE CONTROL

A. Comply with state and local requirements as to allowable noise levels during construction.

B. Equip all internal combustion engines in vehicles and construction equipment with effective mufflers.

C. Prevent noise disturbance to adjoining property owners and the public.

D. Construction operations shall be restricted to between the hours of 7:00 AM and 7:00 PM Monday through Friday without specific approval by the Owner except in emergencies.

1.7 SANITARY PROVISIONS

A. The Contractor shall provide and maintain sanitary facilities for the use of his employees and the Engineer. The Contractor shall comply with the requirements and regulations of the agencies or organizations having jurisdiction over sanitary and health conditions and of other bodies or offices having jurisdiction thereof. He will permit no public nuisances.

B. The Contractor shall establish a regular collection of all sanitary and organic wastes.

C. All wastes and refuse from sanitary facilities provided by the Contractor or organic material wastes from any other source related to the Contractor's operations shall be disposed of away from the site in a manner satisfactory to the Owner and in accordance with all laws and regulations pertaining thereto.

1.8 CHEMICALS

A. All chemicals used during project construction or furnished for project operation, whether defoliant, soil sterilant, herbicide, pesticide, disinfectant, polymer, reactant, or of other classification, shall show approval of either the U.S. Environmental Protection Agency or the U.S. Department of Agriculture.

B. Use of all such chemicals and disposal of residues shall be in strict accordance with the printed instructions of the manufacturer.

1.9 PROVISION FOR WATER COURSES

A. The Contractor shall provide for the flow of all water courses, sewers, or drains intercepted or disturbed by the Contractor during the progress of the work, and shall replace the same in as good condition as he found them or shall make such final provisions for them as necessary.

B. The Contractor shall not obstruct the gutter of any street, but shall use all proper measures to provide for the free passage of surface water.

C. The Contractor shall make provisions to take care of all surplus water, mud, silt, or other runoff pumped from excavations or resulting from sluicing or other operations, and shall be responsible for any damage, of whatever nature, resulting from his failure so to provide.

E. All work adjacent to or in the vicinity of marine waters or fresh water courses shall be accomplished in accordance with the requirements of the agencies having jurisdiction.

1.10 FISHERIES PERMIT

A. All construction work in the vicinity of existing creeks, rivers, and lakes shall be subject to the provisions of state regulations.

B. A copy of any applicable permit is available at the office of the Owner for examination by bidders.

C. The Contractor shall conform to the requirements of the permits issued for this project.

D. Each Contractor shall secure separate approval from the Department of Fish and Wildlife concerning his proposed construction methods, operation, and scheduling that will affect the waterways or lakes, and shall conform to the requirements of this department to preserve the aquatic resources. The authorized representatives of the Department of Fisheries shall be the sole judges as to the effect of the Contractor's operations on the aquatic life in the streams and waterways.

E. In the event said agency waives jurisdiction or does not approve the Contractor's method of operations, the Contractor shall secure written notice to that effect prior to construction.

F. The Contractor may be held liable for any damage to fish life or habitat that results from failure to comply with the provisions of this section.

1.11 ARCHAEOLOGICAL OR CULTURAL RESOURCES

A. The Contractor is advised that construction work is subject to the provisions of state and federal laws and regulations pertaining to the preservation of archaeological and cultural resources.

B. In the event that any archaeological or cultural resources are uncovered during the course of construction, all work shall cease until an inspection and evaluation of the site has been made by an archaeologist to ensure that archaeological data are properly preserved. The Contractor shall notify the Owner who will in turn notify the proper authorities.

* * * END OF SECTION * * *

SECTION 01570

TRAFFIC REGULATION

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Access and Haul Roads: Section 01550

1.2 MATERIALS AND CONTRACT

A. Signs, warnings, light signals, bypass layouts, scheduling and routes shall conform to the requirements of U.S. Department of Transportation Federal Highway Administration "Manual on Uniform Traffic Control Devices", latest edition, as amended by local or state agency.

1.3 MAINTENANCE OF TRAFFIC

A. The Contractor shall conduct his work so as to interfere as little as possible with public travel, and shall at his own expense provide and maintain suitable bridges, detours, or other temporary facilities for the accommodation of public or private travel including mail delivery, and shall give reasonable notice to the owners of private drives before interfering with them provided, however, that such maintenance of traffic will not be required where the Contractor has obtained permission from the owners or tenants of private property, or the proper public authority, or both, to obstruct traffic within the said limits and time agreed upon.

B. Access for firefighting equipment, police, and ambulance services shall be provided at all times and the Contractor shall keep the local authorities informed at all times of the location of construction operations and fire lanes.

C. The Contractor shall also notify the authorities in charge of any municipal, private, or school transportation systems at least 48 hours in advance of road closures that will force a change in the regular routing of the transportation system. The Contractor shall also provide maintain suitable detour routes for the system.

D. Highway and arterial crossings shall be made in such a way that no more than half of the roadway is closed to traffic at any time, except where suitable detours or other arrangements are agreed to by the agency having jurisdiction.

1.4 COMPLIANCE WITH LOCAL REQUIREMENTS

A. The Contractor shall comply with all applicable state and local requirements for closure of streets.

B. The Contractor shall provide barriers, guards, lights, signs, temporary bridges, flagmen and watchmen advising the public of detours and construction hazards.

C. The Contractor shall also be responsible for compliance with additional public safety requirements that may arise during construction.

D. The Contractor shall furnish and install and, upon completion of the work, promptly remove all temporary signs and warning devices.

1.5 TRAFFIC CONTROL PLAN

A. Not less than ten days before beginning construction, the Contractor shall prepare and submit a general construction traffic control plan for the entire project, showing how detour routes will be signed and controlled.

B. The traffic control plan shall include and make provision for at least the following items:

1. Maintain at least one lane of traffic during construction in all streets and roads wherever possible.
2. Employ flagpersons to direct traffic as required to ensure safe vehicular traffic.
3. Provide for the protection of pedestrians at all times.
4. Provide, install, and maintain all signs, barricades, posts, guards, and notices whenever a street must be completely closed.
5. Provide for passage of local vehicles to businesses and homes.
6. Provide for passage and access of emergency vehicles, police, fire, and disaster units at all times. Assume liability for any damages resulting from failure to provide said access.

1.6 STORAGE OF MATERIALS AND EQUIPMENT

A. Materials or equipment shall not be stored where it will interfere with the free and safe passage of public traffic.

B. The Contractor shall remove all equipment and other obstructions from that portion of the roadway to be opened for use by public traffic at the end of each day's work and at other times when construction operations are suspended for any reason.

C. Materials or other obstructions shall not be placed within 20 feet of fire hydrants, which shall at all times be readily accessible to the fire department, nor within ten feet of United States mailboxes.

1.7 MAINTENANCE OF POSTAL SERVICE

A. The Contractor shall be responsible for determining and complying with the United States Post Office's requirements for maintaining postal service within the project area and along related detour routes.

B. Where required by street closures or excessive interferences, the Contractor shall move mailboxes to temporary locations designated by the post office and, when such closures are terminated, shall return the mailboxes to locations and conditions satisfactory to the owners and the post office.

C. Other mailboxes removed or damaged by the Contractor shall be placed to the satisfaction of the owners and the post office within 24 hours of their removal or damage.

* * * END OF SECTION * * *

SECTION 01600

MATERIAL AND EQUIPMENT

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Shop Drawings, Project Data, and Samples: Section 01340

1.2 PRODUCTS LIST

A. As soon as possible but not more than thirty (30) days after date of Notice to Proceed, submit copies of complete list of all products that are proposed for installation as substitutions or product options.

B. Tabulate list by each specification section.

1.3 CONTRACTOR'S OPTIONS

A. Unless otherwise specifically provided, all workmanship, equipment, materials and articles incorporated in the work are to be new and of the best available grade of their respective kinds.

B. For products specified only by reference standards, select any product meeting standards, by any manufacturer.

C. For products specified by naming one or more products, but indicating the option of selecting equivalent products by stating "or equivalent" after specified product, Contractor must submit request, as required for substitution, for any product not specifically named.

D. For products specified by naming only one product and manufacturer, there is no option, and no substitution will be allowed.

1.4 SUBSTITUTIONS

A. Submit request for substitution in accordance with requirements for submittal of shop drawings (Section 01340) and the following additional requirements.
   1. For construction methods:
      a. Detailed description of proposed method.
      b. Drawings illustrating methods.
   2. Itemized comparison of proposed substitution with product or method specification.

B. In making request for substitution, Contractor represents:
   1. He has personally investigated proposed product or method, and determined that it is equivalent or superior in all respects to that specified.
   2. He will provide the same guarantee for substitution as for product or method specified.

3. Contractor agrees to pay for all costs under separate contracts and Engineer's redesign costs.

C. The above shall not be construed to mean that any substitution for materials and equipment will be allowed.

1.5 MATERIAL CERTIFICATION

A. Upon request of the Engineer, the Contractor's material suppliers may be required to furnish a certification from a recognized testing laboratory, certifying that the material supplied is in full conformance with the Contract Documents.

1.6 ADDITIONAL ENGINEERING COSTS

A. Additional engineering costs accruing as a result of checking and/or redesign of substitutions will be charged to the Contractor and billed by the Owner at the Engineer's current established rates.

1.7 INSTALLATION

A. All materials, appliances, fixtures, and equipment shall be applied, installed, connected, erected, used, cleaned, and conditioned in accordance with such instructions as are commonly furnished by the manufacturers, unless herein specified to the contrary.

B. The Contractor shall use experienced millwrights, acceptable to the Engineer, in the installation and aligning of the equipment.

C. Manufacturers' instructions for handling, protecting, installation, lubrication and alignments of the equipment, shall be followed to the letter, with attendant penalties for insufficient performance.

D. No piping or valves shall be supported by means of its connection to any mechanical equipment. Pipe connections to equipment must be disconnected upon request to permit inspection and determination that the piping is not transmitting stresses to the equipment.

E. All motor flexible couplings shall be disconnected and checked with an indicator for misalignment after all other installation work has been completed unless the equipment installation instructions specifically prohibit this.

F. The Contractor must allow a representative of the Owner to observe the indicator readings and approve or disapprove prior to recoupling.

1.8 PUMPS AND PIPING

A. All pump and piping installations shall fully meet the standards of the Hydraulic Institute.

* * * END OF SECTION * * *

SECTION 01650

TESTING, STARTUP AND OPERATION

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Testing Laboratory Services: Section 01410
B. Inspection Services: Section 01420
C. Contract Closeout: Section 01700
D. Operation and Maintenance Data: Section 01730

1.2 RESPONSIBILITY

A. The Contractor shall provide all materials, supplies and labor necessary to efficiently complete the testing, startup and operation.

B. All power and utility bills shall be paid by the Contractor up to and including the day of final acceptance of the Contract by the Owner. If not paid, these charges shall be treated as claims against the Contractor.

C. If the Owner chooses to commence operations prior to final acceptance, the Owner will assume payment of all power and utility charges effective the day that operation is assumed by the Owner and notice is given in writing.

1.3 SCHEDULE

A. Placing all phases of the project in service shall consist of three parts: testing, starting and operations.

B. Not less than thirty (30) days before anticipated time for beginning the testing, the Contractor will submit to the Engineer for approval, a complete plan for:
   1. Schedules for tests.
   2. Detail schedules of procedures for startup.
   3. Complete schedule of events to be accomplished during startup.
   4. Schedule operator training as specified.
   5. An outline of work remaining under the Contract that will be carried out concurrently with the operation phases.

C. Notify the Engineer of the approximate date that water or sewage will be required for operation.

1.4 TESTING

A. Testing shall consist of individual tests and checks made on equipment intended to provide proof of performance of units and proper operation of unit controls together with such necessary tests whether or not described elsewhere in these Specifications to

ensure proper alignment, size, condition, capability, strength, proper adjustment, lubrication, pressure, hydraulic tests, leakage tests, and all other checks deemed necessary by the Engineer to determine that all materials and equipment are of specified quality, properly situated, anchored and in all respects ready for use.

B. All gravity sewer pipe and pressure piping shall be tested as required by these specifications and applicable codes.

C. Tests on individual items of equipment, pipelines, vessels, structures, tanks, controls and other items shall be as described in various sections describing such items.

D. Testing will be done by the Contractor in the presence of an Inspector designated by the Engineer. Records of all official tests will be made by the Inspector.

E. During tests, the Contractor shall correct any defective work discovered or that is not in first class operating condition.

1.5 STARTUP

A. Startup shall consist of testing by a simulated operation (using clear water to be furnished by the Contractor), all operational equipment and controls. The purpose of these tests shall be to check that all equipment will function under operating conditions, that all interlocking controls and sequences are properly set and that the facility will function as an operating unit.

B. Checks for leakage of tanks, ponds, piping, valves, gates and all other hydraulic systems and structures will be made.

C. Factory representatives of all major units will be present for the startup phase. The test shall continue until it is demonstrated that all malfunctioning controls and machinery are corrected.

D. The startup shall not begin until all tests required by these Specifications have been completed and approved by the Engineer.

E. The Contractor may, if approved by the Engineer, conduct the hydraulic testing of pumps, aerators and other equipment requiring large volumes of liquid simultaneously with the startup test. If required by the Owner, the Contractor shall dispose of the water used by pumping to waste.

1.6 OPERATION

A. Operation of the facility shall be immediately started after completion of testing and startup and after satisfactory repairs and adjustments have been made and providing supply and disposal facilities furnished by others are available. If these facilities are not available, the plant will be closed down and no further testing or operation by the Contractor will be required. The Contractor,

however, will be responsible that all details required by the Contract shall remain in good order until final acceptance of the whole Contract.

B. The facility will be operated by personnel placed on the project by the Owner who will perform all duties and operate all equipment.

C. Taking possession and use of the facility shall not be deemed an acceptance of any work not completed in accordance with the Contract Documents.

D. If such prior use increases or causes refinishing of completed work, the Contractor shall be entitled to such extra compensation or extension of time or both, as the Engineer may determine.

* * * END OF SECTION * * *

SECTION 01700

CONTRACT CLOSEOUT

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Protection of Work and Property: Section 01545
B. Testing, Startup and Operation: Section 01650
C. Cleaning: Section 01710
D. Project Record Documents: Section 01720
E. Operation and Maintenance Data: Section 01730
F. Spare Parts and Maintenance Materials: Section 01750

1.2 SUBSTANTIAL COMPLETION

A. Engineer will make an inspection after receipt of Contractor's certification, together with Owner's representative.

B. If it appears to the Engineer that work is substantially complete, the Engineer may, with the Owner's approval, issue a Certificate of Substantial Completion, with appropriate conditions, accompanied by a list of the items to be completed and corrected, as verified and amended by Engineer. Omission of any item from the list shall not relieve the Contractor from responsibility to complete all the work in accordance with the Contract.

C. Owner occupancy of Project or designated portion of Project:
   a. Contractor shall perform final cleaning in accordance with Section 01710.

D. Contractor shall complete all the work within the time designated in the Certificate, or if not so designated within a reasonable time.

E. Warranties: warranty periods begin with the date of final acceptance. However, in connection with any specific equipment certified by the Engineer as completed and its use or operation thereof for its intended purpose is assumed by the Owner, the warranty period for such equipment shall begin with the beginning date of such use or operation.

1.3 FINAL INSPECTION

A. The Contractor shall submit written certification that:
   1. Contract Documents have been reviewed.
   2. Work has been completed in accordance with Contract Documents.
   3. Equipment and systems have been tested in presence of Owner's representative and are operational.
   4. Project is completed, and ready for final inspection.

B. Engineer will make final inspection within a reasonable time after receipt of certification.

C. Should Engineer consider that work is complete in accordance with requirements of Contract Documents, he shall request Contractor to make project closeout submittals.

1.5 CLOSEOUT

E. At the close of the Contract the Contractor shall:
   1. Pay all utility bills.
   2. Remove all electrical, sanitary, gas, telephone, water, offices and any other temporary service equipment that may remain.
   3. Arrange for transfer of electrical, and water accounts to the Owner's name.

F. Deliver evidence of compliance with requirements of governing authorities:
   1. Certificates of Inspection:
      a. Mechanical:
         (1) As required by codes.
      b. Electrical:
         (1) State or city as required.
         (2) Megger by electrical subcontractor.

1.9 POST-CONSTRUCTION INSPECTION

A. Prior to expiration one year from Date of Substantial Completion or Final Acceptance, Engineer may make visual inspection of Project in company with Owner and Contractor to determine whether correction of work is required, in accordance with provisions of General Conditions.

B. For guarantees beyond one year, Engineer will make inspections at request of Owner, after notification to Contractor.

C. Owner will promptly notify Contractor, in writing, of any observed deficiencies.

* * * END OF SECTION * * *

SECTION 01710

CLEANING

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Cutting and Patching: Section 01045
B. Temporary Controls: Section 01560
C. Contract Closeout: Section 01700

1.2 GENERAL REQUIREMENTS

A. Maintain premises and public properties free from accumulations of waste, debris, and rubbish caused by operations.

B. At completion of work, remove waste materials, rubbish, tools, equipment, machinery and surplus materials, and clean all sight-exposed surfaces; leave project clean and ready for occupancy.

1.3 SAFETY REQUIREMENTS

A. Standards: Maintain project in accord with the applicable federal, state and local safety standards.

B. Hazards control:
   1. Store volatile wastes in covered metal containers, and remove from premises daily.
   2. Prevent accumulation of wastes that create hazardous conditions.
   3. Provide adequate ventilation during use of volatile or noxious substances.

C. Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws:
   1. Do not burn or bury rubbish and waste materials on project site unless approved by local fire and air pollution authorities.
   2. Do not dispose of volatile wastes such as mineral spirits, oil, or paint thinner in storm or sanitary drains.
   3. Do not dispose of wastes into streams or waterways.

2. PRODUCTS

2.1 MATERIALS

A. Use only cleaning materials recommended by manufacturer of surface to be cleaned.

B. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

3. EXECUTION

3.1 DURING CONSTRUCTION

A. Execute cleaning to ensure that grounds and public properties are maintained free from accumulations of waste materials and rubbish.

B. Wet down dry materials and rubbish to lay dust and prevent blowing dust.

C. Remove waste materials, debris and rubbish from site and legally dispose of at public or private dumping areas off Owner's property.

D. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet, newly painted surfaces.

E. The Contractor shall clean the right-of-way, material sites, and all ground the Contractor occupied to do the work periodically throughout the duration of the project. All rubbish, surplus materials, discarded materials, and debris shall be removed from the site and disposed of properly. At a minimum, the Contractor shall conduct such periodic cleaning for each 1,000 feet of pipeline installed, prior to proceeding with installation of additional pipeline. Such cleaning shall also occur immediately prior to weekends, holidays, extended work stoppages, or at the direction of the Owner or other regulatory agencies having jurisdiction.

3.2 FINAL CLEANING OF STRUCTURES

A. Employ experienced workmen, or professional cleaners, for final cleaning.

B. In preparation for substantial completion or occupancy, conduct final inspection of sight-exposed interior and exterior surfaces, and of concealed spaces.

C. Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials from sight-exposed interior and exterior finished surfaces; polish surfaces so designated to shine finish.

D. Repair, patch and touch up marred surfaces to specified finish; match adjacent surfaces.

E. Broom clean paved surfaces; rake clean other surfaces of grounds.

F. Clean windows.

G. Replace air conditioning filters if units were operated during construction.

H. Clean ducts, blowers and coils, if air conditioning units were operated without filters during construction.

I. Maintain cleaning until project is occupied by Owner.

3.3 FINAL CLEANUP OF PIPELINES

A. Final cleanup work shall be completed as closely behind the construction work as it is physically possible to do.

C. Refer to specific sections for detail requirements for cleanup of pipelines.

3.4 GENERAL CLEANUP

A. Before final acceptance, the Contractor shall remove and obliterate, insofar as feasible, all objects or disturbances of the ground that mar the landscape and were caused by his operations, whether or not part of the improvement.

B. Rubbish, excess materials, temporary structures, and discarded equipment shall be removed and disposed of.

C. Temporary haul roads shall be scarified and bladed to blend with surroundings.

D. Remove snags, down trees, brush, and stumps.

E. Fill holes and grade to smooth land contours. Shape ends of cuts and fills to fit adjacent terrain.

F. Hand rake disturbed areas to remove loose objects including rock and clods in excess of two inches in any dimension.

G. Sweep pavement, curb and gutter, sidewalks, and driveways.

* * * END OF SECTION * * *

SECTION 01720

PROJECT RECORD DOCUMENTS

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Shop Drawings, Project Data and Samples: Section 01340
B. Construction Photographs: Section 01380
C. Operation and Maintenance Data: Section 01730

1.2 MAINTENANCE OF DOCUMENTS

A. Maintain at job site, one copy of:
   1. Contract Drawings.
   2. Project Manual.
   3. Addenda.
   4. Reviewed Shop Drawings.
   5. Change Orders.
   6. Other Modifications to Contract.
   7. Field Test Records.
   8. Maintenance Data Delivered with Equipment.

B. Make documents available at all times for inspection by Engineer and Owner.

1.3 RECORDING

A. Do not permanently conceal any work until required information has been recorded.

B. Keep documents current.

C. Contract Drawings: Legibly mark to record actual construction:
   1. Depths of various elements of foundation in relation to variances from plan.
   2. Horizontal and vertical location of underground utilities and appurtenances and references to permanent surface improvements.
   3. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.
   4. Field changes of dimension and detail.
   5. Changes made by Change Order or Field Order.
   6. Details not on original Contract Drawings.
   7. Side sewer locations including stubs and tees.

D. Specifications and Addenda: Legibly mark up each Section to record:

1. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.
2. Changes made by Change Order or Field Order.
3. Other matters not originally specified.

E. Shop Drawings: Maintain as record documents; legibly annotate drawings to record changes made after review.

* * * END OF SECTION * * *

SECTION 02050

DEMOLITION

1. GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Site Clearing: Section 02110
B. Grading: Section 02210
C. Excavating, Backfilling and Compacting for Utilities: Section 02222
D. Pavement Repair and Resurfacing: Section 02575

1.2 PROTECTION

A. Streets, roads, adjacent property and other work to remain shall be protected throughout the work.

B. Pavement may be cut only where authorized and only to the extent specified.

C. Any material damaged by Contractor's operations shall be replaced with new material by the Contractor.

1.3 CUTTING PAVEMENT, CURBS AND WALKS

A. Unless specified otherwise by the authority having control over the pavement, curbs and walks, cutting and replacement shall be as specified in Section 02575.

1.4 PRIVATE DRIVEWAYS, CULVERTS AND MISCELLANEOUS

A. Pipe laying operations and street improvements in certain areas may necessitate temporary removal of mail boxes, private driveways, drains, service lines, conduits, etc. to facilitate construction. In the event that the Contractor finds it necessary to remove the above mentioned items, it is to be understood that it will be his responsibility to restore these items in a manner equal to their original condition. The Contractor shall maintain adequate temporary provisions for domestic deliveries and utilities service and access to firefighting equipment.

B. The preceding requirement will be the same for any temporary removal of road culverts whether under state, county or private jurisdiction.

C. The Contractor shall make every effort to prevent blocking private driveways for more than a reasonable time and shall make such driveways immediately accessible on order of the Owner.

1.5 REMOVAL OF STRUCTURES

A. Break up basement floors to promote drainage.

B. When salvageable material is to remain the Owner's property, the Contractor shall remove it and deliver it to site designated by the Engineer or project documents. Any material not designated as the Owner's property will belong to the Contractor. The Contractor shall store or dispose of such material at suitable disposal site or at his storage yard.

C. Work crews shall be provided with proper protective clothing and equipment.

D. Waste and abandoned asbestos materials and materials, clothing, etc. used in asbestos handling and removal shall be disposed of in a manner consistent with the regulations and provisions cited above.

E. The Contractor (person or organization removing asbestos with certified asbestos workers) shall assume ALL risk and all liability for the removal and disposal of the asbestos and the Contractor shall comply with all federal, state and local laws, statutes and regulatory agency regulations and requirements including but not limited to the requirements relating to environmental pollutants and the requirements relating to the removal and disposal of asbestos. The Contractor shall ensure that the asbestos removal is pursuant to all state and federal laws and regulations. The Contractor shall be responsible for any and all fines or penalties that may be levied due to the Contractor's violation of any of the aforementioned laws and regulations.

1.6 ASBESTOS REMOVAL

A. The Contractor shall conduct all work related to existing asbestos materials in accordance with WISHA safety regulations and provisions of WAC 296-62-077, WAC 296-65, and the requirements of the regional air pollution control authority. Advance notice of work on asbestos materials may be required.

B. Work crews shall be provided with proper protective clothing and equipment.

C. Waste and abandoned asbestos materials and materials, clothing, etc. used in asbestos handling and removal shall be disposed of in a manner consistent with the regulations and provisions cited above.

D. All costs associated with the demolition and abandonment of asbestos material shall be considered incidental to the work; no additional compensation will be made to the Contractor.

E. The Contractor (person or organization removing asbestos with certified asbestos workers) shall assume ALL risk and all liability for the removal and disposal of the asbestos and the Contractor shall comply with all federal, state and local laws, statutes and regulatory agency regulations and requirements including but not limited to the requirements relating to environmental pollutants and the

requirements relating to the removal and disposal of asbestos. The Contractor shall insure that the asbestos removal is pursuant to all state and federal laws and regulations. The Contractor shall be responsible for any and all fines or penalties that may be levied due to the Contractor's violation of any of the aforementioned laws and regulations.

* * * END OF SECTION * * *

SECTION 02110

SITE CLEARING

1. GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Field Engineering: Section 01050
B. Demolition: Section 02050
C. Grading: Section 02210
D. Excavating, Backfilling and Compacting for Utilities: Section 02222

1.2 PROTECTION

A. Streets, roads, adjacent property and other work to remain shall be protected throughout the work.

2. PRODUCTS

2.1 MATERIALS

A. Materials shall be at the Contractor's option.

3. EXECUTION

3.1 SURVEY STAKING IN UNCLEARED EASEMENTS

A. Centerlines of utility lines shall be flagged prior to clearing and it shall be the Contractor's responsibility to set his own offsets for clearing limits.

B. When the clearing is done, the survey for the utility construction shall be accomplished as per Section 01050.

3.2 CLEARING

A. Clearing work shall be performed within the confines of the area indicated on the Drawings, or in the Specifications.

B. Debris resulting from said clearing shall be disposed of by the Contractor and the right-of-way cleaned up in a neat and workmanlike manner.

C. No logs, stumps, rocks, etc., shall be left lying in the right-of-way or on adjacent property without specified written approval by the Owner.

D. All trees shall be felled within the area to be cleared except those marked to be left standing, or required by easement stipulations or by contract to be left standing, shall be close cut parallel to the ground, removed, and disposed of.

E. No trees or shrubbery in public right-of-way shall be cut except by approval of the Engineer.

3.3 GRUBBING

A. All trees or stumps within five (5) feet of the pipeline shall be removed.

B. Grubbing will be performed where designated on the drawings or as specified herein and shall include removal from the ground of all stumps, roots, buried logs and other vegetation not otherwise provided for and the removal and disposal of the refuse.

C. In areas to be filled to a depth of three (3) feet or more above the natural ground all tree stumps and brush shall be cut off not more than three (3) inches from the ground and removed. Stumps may remain at the Contractor's option.

3.4 DAMAGED VEGETATION

A. Neatly trim torn limbs and trunk and severed roots.

B. Apply wound paint to above-ground wounds.

C. Remove and replace in kind all vegetation damaged extensively.

3.5 DISPOSAL

A. Contractor shall comply with all laws and rules that govern burning and shall secure necessary permits.

B. When burning is permitted, it shall be done under the constant care of competent watchmen such that surrounding property or vegetative cover is not damaged.

C. Contractor may sell any saleable material.

* * * END OF SECTION * * *

SECTION 02140

DEWATERING

1. GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Temporary Controls: Section 01560
B. Excavating, Backfilling and Compaction for Utilities: Section 02222
C. Sedimentation Control: Section 02275

1.2 QUALITY CONTROL

A. It shall be the sole responsibility of the Contractor to control the rate and effect of the dewatering in such a manner as to avoid all objectionable settlement and subsidence.

B. The Contractor shall employ an independent qualified Professional Engineer with experience in similar dewatering problems to review and approve the Contractor's proposed method of dewatering and to, at least weekly, inspect the Contractor's operations and provide a report to the Engineer.

C. All dewatering operations shall be adequate to assure the integrity of the finished project and shall be the responsibility of the Contractor.

D. Where critical structures or facilities exist immediately adjacent to areas of proposed dewatering, reference points should be established and observed at frequent intervals to detect any settlement that may develop.

E. The responsibility for conducting the dewatering operation in a manner that will protect adjacent structures and facilities rests solely with the Contractor. The cost of repairing any damage to adjacent structures and restoration of facilities shall be the responsibility of the Contractor.

2. PRODUCTS

2.1 EQUIPMENT

A. Before operations begin, the Contractor shall have available on the site of work sufficient pumping equipment and/or other machinery to assure that the operation of the dewatering system can be maintained.

3. EXECUTION

3.1 METHODS

A. Dewatering shall be done by such method as the Contractor may elect.

B. Dewatering, sufficient to maintain the groundwater level at or below the surface of trench bottom or base of the foundation gravel shall be accomplished prior to excavation and placing of pipeline or concrete. The dewatering operation, however accomplished, shall be carried out so that it does not destroy or weaken the strength of the soil under or alongside the excavation.

C. The normal water table shall be restored to its natural level in such a manner as to not disturb the pipe, its foundation and structures.

D. If well points or wells are used, they shall be adequately spaced to provide the necessary dewatering and shall be sandpacked and/or other means used to prevent pumping of fine sands or silts from the subsurface. A continual check by the Contractor shall be maintained to ensure that the subsurface soil is not being removed by the dewatering operation.

E. Dispose of water so as not to cause injury to public or private property or to cause a nuisance or menace to the public and in accordance with the requirements of regulatory agencies.

F. Permanent piping systems shall not be incorporated in the dewatering system.

* * * END OF SECTION * * *

SECTION 02150

SHORING

1. GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Excavating, Backfilling and Compacting for Utilities: Section 02222

1.2 QUALITY ASSURANCE

A. Where the depth of excavation exceeds 20 (twenty) feet the Contractor's shoring systems shall be designed and inspected by a registered professional engineer with experience in the work, all in accordance with federal, state and local safety requirements (the most stringent requirement prevailing).

B. Where the depth of excavation is less than 20 (twenty) feet, the Contractor shall provide, place and maintain responsibility for shoring, sheeting, bracing, sloping or otherwise support the sides of trenches and excavations, including embankments by a means of sufficient strength to protect employees. Such shoring and associated responsibilities shall be in accordance with federal, state and local safety requirements (the most stringent requirement prevailing).

1.3 SUBMITTAL

A. For shoring systems to be used for depth of excavation greater than 20 (twenty) feet, submit material indicating compliance with federal, state and local safety requirements for shoring systems. Specifically, the material shall indicate that such systems have been designed by a registered professional engineer with experience in the work.

2. PRODUCTS

2.1 SHORING SYSTEMS

A. Materials used shall be at the Contractor's option.

3. EXECUTION

3.1 SAFETY REQUIREMENTS

A. Shoring shall be placed in accordance with federal, state and local safety requirements (the most stringent requirement prevailing).

3.2 SHORING SYSTEMS

A. Unless otherwise provided, the Contractor shall provide all shoring systems needed to protect the work, adjacent property and improvements, utilities, pavement, etc., and to provide safe working conditions in the trench.

B. Removal of any or all shoring systems from the trench shall be accomplished in such a manner as to fulfill all of the above requirements and shall also be accomplished in such a manner as to prevent any damage to the work.

C. Damages resulting from improper shoring or from failure to shore shall be the sole responsibility of the Contractor.

D. Whether shoring systems shall be left in place or removed shall be at the option of the Contractor, provided that removal of any and all shoring used in trench or structure excavation shall be accomplished in the manner as to prevent the settlement of the pipes or other work and to prevent increased backfill loading which might overload the pipe or walls of the structure.

Shoring shall be removed to a minimum of 5 feet below the final grade.

E. Should the Owner order that any shoring be left in place, the Contractor shall not remove the same but will receive payment for the materials left in place at the market value thereof.

3.3 SPECIAL REQUIREMENT FOR FLEXIBLE PIPE

A. Shoring to be removed, or moveable trench shields or boxes, shall be located at least 2 pipe diameters away from the pipe if the bottom of the shoring, shield or box extends below the top of flexible pipe, unless a satisfactory means of reconsolidating the bedding or side support material disturbed by shoring removal can be demonstrated.

B. Damages resulting from improper shoring or failure to shore shall be the sole responsibility of the Contractor.

* * * END OF SECTION * * *

SECTION 02161

ROCK WALLS

1. GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Grading: Section 02210

1.2 SUBMITTALS

A. Location of quarry where the proposed materials are to be secured.

B. Secure approval of source before delivery of materials to site.

2 PRODUCTS

2.1 ROCK MATERIAL

A. Hard, sound and durable.

B. Free from segregation, seams, cracks and other defects tending to destroy its resistance to weather.

C. Density of at least 155 pounds per cubic foot.

D. Nearly rectangular as possible.

E. Uniform in size for each size.

F. Rock for top 3 feet range in size from 400-800 pounds. Each lower 3 feet zone shall be 400 pounds heavier then the rock then the upper zone.

G. Unload rock at site to segregate the rock by size range.

2.2 BACKFILL MATERIAL

A. Same material as rock material except shall consist of quarry spalls.

B. Maximum size - six inches.

C. Minimum size - two inches.

3. EXECUTION

3.1 PREPARATION

A. Excavate a trench, not less than six (6) inches or more than one (1) foot in depth below subgrade in excavation sections or below the existing ground level in embankment sections.

B. Do not disturb private property.

C. Areas on which the rockery is to be placed shall be trimmed and dressed to conform to the elevation or slope indicated.

D. Construction will start as soon as possible upon the shaping of the cut or fill section.

E. Correct any problems or repair any damage caused by delay at no additional cost to the Owner.

3.2 ROCK PLACEMENT

A. Rocks shall be carefully placed by mechanical equipment and in a manner such that the longitudinal axis of the rock shall be at right angles or perpendicular to the rock wall face.

B. Larger rocks shall be placed at the base of the wall so that the wall will be stable and have a stable appearance.

C. Rocks shall have all inclining faces sloping to the back of the rockery.

D. Each row of rocks will be seated as tightly and evenly as possible on the rock below in such a manner that there will be no movement between the two.

E. Rock selection and placement shall be such that there will be no open voids in the exposed face of the wall over six (6) inches across in any direction.

F. Rocks shall be placed and keyed together with a minimum of voids.

G. Voids between the rocks shall be chinked on the back with quarry rock to eliminate any void sufficient to pass a 2-inch square probe.

H. Stones to extend through the wall.

I. Final course shall have a continuous appearance and be placed to minimize erosion of the backfill material.

J. Maximum of six inch tolerance permitted between the designated slope plane and the finished wall.

K. Construct wall one course at a time in embankment areas as adjoining embankment is constructed.

3.3 WALL BACKFILL

A. Place material to an 8-inch minimum thickness between the wall and the cut or fill material after each course of rocks.

B. Place in lifts to an elevation approximately six (6) inches below the course of rocks placed.

C. Backfill material on the bearing surface of the rock course will be removed before setting the next course.

3.4 REJECTED MATERIAL

A. Remove rejected material from job site.

B. Repair or replace walls not meeting these specifications.

* * * END OF SECTION * * *

SECTION 02202

ROCK EXCAVATION

1. GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Demolition: Section 02050
B. Grading: Section 02210
C. Excavating, Backfilling, and Compacting for Utilities: Section 02222
D. Underground Utilities/Facilities - Underground and Overhead: Section 02760

1.2 DEFINITIONS

A. Solid rock, firmly cemented unstratified masses or conglomerate deposits possessing the characteristics of solid rock not ordinarily removed without systematic drilling and blasting, and any boulder, masonry, or concrete except pavement and sidewalks and curbs, exceeding 2/3 cubic yard in volume.

1.3 QUALITY ASSURANCE

A. Assign a qualified blasting specialist of mature experience that is specialized in the use of explosives to the blasting operation, and maintain on a full-time basis during the time that blasting is in progress.

B. Blasting specialist shall have a valid state powder license, as required.

C. Comply with federal, state and local safety codes concerning transportation, handling, storage and use of explosives.

D. Comply with requirements of road agency when project is on public right-of-way.

1.4 SUBMITTAL

A. Schedule outlining time and locations of all drilling and blasting operations.

B. Preblast survey report shall be submitted prior to start of blasting.

1.5 PERMITS

A. Contractor shall be responsible for obtaining any federal, state, or local permits required for the transportation, storage, or use of explosives.

1.6 PRE-BLAST SURVEY

A. Contractor shall conduct a pre-blast survey of the interior and exterior of every structure identified as being within a zone of potential damage from adjacent blasting within a minimum of 100 feet each side of the blasting area.

B. Survey to be conducted by a person experienced in said surveys.

C. Prepare a photographic or videotape record outlining specific structural defects as well as general condition of each structure:
   1. Photographs shall be 3" x 5" minimum size, glossy finish, in color and unmounted.
   2. All photographs shall be taken by an acceptable commercial photographer hired by the Contractor.
   3. Each photograph shall be marked with date and identification.

D. Provide a written record including at least the following items:
   1. Date and time of inspection.
   2. Name of inspector.
   3. Location.
   4. Signature of person granting the approval for inspection.
   5. Name of person refusing approval to inspect.
   6. Description of specific structural defects as well as general condition of each structure.
   7. Other criteria recommended by blasting specialists.

E. Provide the Engineer and Owner with one (1) copy each of the photographs and written report prior to start of any work within the area in question.

1.7 NOTIFICATION

A. The Contractor shall notify the Engineer, police department, and fire department 24 hours in advance of detonating any charges.

B. Provide ample warning to all persons within the vicinity prior to blasting.

C. Erect warning signs.

D. Station personnel to warn people prior to blasting.

2. PRODUCTS

2.1 MATERIALS

A. Use explosive and initiators as recommended by the blasting specialist.

B. Use any standard cartridge explosives prepared and packaged by explosive manufacturing firms.

3. EXECUTION

3.1 TECHNIQUES

A. In excavating rock, the Contractor shall exercise care and use precautionary methods so as to not break down, loosen, or otherwise damage the supporting rock below the subgrade line.

B. The Contractor shall be responsible for the methods used and for any damage resulting from his operations.

C. The slopes of all rock cuts shall be scaled and dressed to a safe, stable condition by removing all loose spalls and rocks not firmly keyed to the rock slope and by removing all overhanging rock that may be a hazard to workmen or public.

D. The Contractor shall drill, blast, and excavate short test sections to determine the blasting method, hole spacing, and charge best suited to the material encountered, in order to obtain the desired rock fracture, and make necessary adjustments.

3.2 PROTECTION

A. Contractor shall control flying rock by proper spacing of charges and by placing blast mats or mounding soil over the shots after loading.

B. Contractor shall control noise due to blasting by proper stemming and cover of blast holes, control of blasting during heavy cloud cover, and shall control time of blasting to conform to specific requirements at each site.

C. Air blast pressures exerted on structures shall be kept below limits that may damage the structure.

D. All damage caused by Contractor's blasting operations shall be repaired at no additional cost to the Owner. Contractor shall be responsible for receiving and negotiating claims for damage.

3.3 WASTE MATERIAL

A. All shot rock removed from the excavation must be hauled to a waste site secured by the Contractor unless the material can be used for backfill or embankment included in the project.

B. Material used in the project must conform to the requirements of these specifications.

3.4 LIMITS OF ROCK EXCAVATION

A. Excavate to minimum of 6 inches below bottom of pipe barrel and sufficient distance outside of pipe to install pipe and bedding.

B. Maximum width of trench shall be 24 inches wider than the pipe barrel.

C. Excavate to minimum of 6 inches below structure subgrade unless otherwise specified.

D. Excavate to subgrade for roadways.

* * * END OF SECTION * * *

SECTION 02222

EXCAVATING, BACKFILLING AND COMPACTING FOR UTILITIES

1. GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Demolition: Section 02050
B. Site Clearing and Grubbing: Section 02110
C. Rock Excavations: Section 02202
D. Grading: Section 02210
E. Excavating, Backfilling and Compacting for Structures: Section 02221
F. Sedimentation Control: Section 02275
G. Water Lines: Section 02660
H. Sanitary Sewers: Section 02730
I. Sewer Force Mains: Section 02732
J. Existing Utilities/Facilities-Underground and Overhead: Section 02760
K. Shoring: Section 02150
L. Dewatering: Section 02140

1.2 CLASSIFICATION

A. The terms earthwork or excavation include all materials excavated or removed regardless of material characteristics.

B. The Contractor shall make his own estimate of the kind and extent of materials which will be encountered in the excavation.

1.3 QUALITY CONTROL ASSURANCE

A. Soils and backfill: Moisture density standard ASTM D1557 or AASHTO T-180 method unless otherwise specifically approved.

B. In-place density determination: Sandcone method ASTM D1556 or nuclear method ASTM D2922.

C. Classification of soils: ASTM D2487.

D. Quality control monitoring of subgrade backfill and embankment materials and construction by certified independent laboratory approved by Engineer and secured and paid for by the Contractor.

1.4 SUBMITTALS

A. Import backfill gradation and moisture density compaction curve test reports.

B. Embankment and native backfill materials gradations and moisture density standards curve test reports.

C. Certification of gradation and compliance with referenced standards and moisture density standards test reports.

D. Density test results in approved format.

E. At any time the Contractor shall change the source and/or stockpile from which materials are obtained, certificates of gradation for these new sources will also be required.

F. During construction, the Owner may elect to have further gradation testing completed on the materials being furnished by the Contractor. This testing will be at the expense of the Owner, however, the Contractor shall provide material samples as may be necessary to complete this testing and these material samples will be furnished from material available on the job site or from the Contractor's source and/or supplier.

G. Controlled Density Fill (CDF): Furnish a certificate with each truckload of CDF product delivered to the site, indicating the composition and quality of the mix. Include size and weight of each aggregate, amount of cement, amount of water and amount and kind of any additives.

2. PRODUCTS

2.1 BACKFILL MATERIALS

A. These materials shall be native materials and as described in this section.

2.2 GRAVEL BEDDING MATERIAL

A. Bedding for rigid pipe: Bedding material shall consist of clean, granular, well graded screened or crushed sand and gravel material conforming to the following gradation when tested in accordance with ASTM D422:

Sieve Size Square Opening	Percent Passing by Weight
3/4 inch	100
3/8 inch	95 - 100
No. 8	0 - 10
No. 200	0 - 3

B. Bedding for flexible pipe: Bedding material shall be a clean screened or crushed sand/gravel mixture free from organic matter and conforming to the following gradation when tested in accordance with ASTM D422:

Sieve Size Square Opening	Percent Passing by Weight
3/4 inch	100

3/8 inch	70 - 100
No. 4	55 - 100
No. 10	35 - 95
No. 20	20 - 80
No. 40	10 - 55
No. 100	0 - 10
No. 200	0 - 3

C. Minimum sand equivalent shall be 35 in accordance with ASTM D2419.

2.3 BACKFILL GRAVEL

A. All backfill gravel shall consist of naturally occurring screened or crushed gravel.

B. Shall be essentially free from wood waste or other extraneous or objectionable materials.

C. Shall have such characteristics of size and shape that it will compact readily and shall meet the following test requirements:

Stabilometer "R" Value	72 min.
Swell Pressure	0.3 psi max.
Maximum Particle Size	3 in.
Passing 1/4" Sq. Opening	25% min.
Passing No. 200 Sieve	10% max.
All percentages are by weight	
Dust Ratio: $\frac{\%\text{ Passing No. 200 Sieve}}{\%\text{ Passing No. 40 Sieve}}$	2/3 max.
Sand Equivalent (ASTM D2419)	30 min.

D. Backfill gravel material retained on a 1/4-inch square sieve shall contain not more than 0.20% by weight of wood waste.

E. The Contractor shall provide the Engineer with a certificate of gradation or sieve analysis from a qualified testing laboratory for backfill gravel.

2.4 NATIVE MATERIAL

A. Selected soil free from roots or other organic material, debris, or frozen material.

B. Maximum size to 6 inches with no stone larger than 4 inches in upper 6 inches of fill.

C. Free of excess moisture.

D. Processed to uniform measure and texture necessary to obtain specified density.

2.5 FOUNDATION GRAVEL

A. At least two basic trench-bottom conditions commonly cause problems: (1) where silty soils or fine sandy soils are encountered, they will usually flow in the presence of a stream of water, and (2) where clays, peats, or other soft materials are encountered, they may become saturated with water, but do not usually break down into fine particles and flow as do the silts or sands mentioned above.

B. Contractor's attention is called to conditions for use of the material as outlined in Paragraph 3.5 of this section.

C. Condition (1) Material: Where Condition (1) is encountered, the following foundation gravel has been found by experience usually to be adequate. Foundation gravel shall consist of clean bank run sand and gravel, free from dirt, roots, topsoil, and debris and contain not less than 35% retained on a 1/4-inch sieve and with all stones larger than two (2) inches removed. Such gravel must only be used in a dry trench bottom, free from quicksand or running sand.

D. Condition (2) Material: Where Condition (2) is encountered, Class A or Class B foundation gravel listed below, has been found by experience usually to be adequate. Other material may, however, be found more desirable by the Contractor:

Sieve Size Square Opening	Class A % Passing	Class B % Passing
2-1/2"	98 - 100	95 - 100
2"	92 - 100	75 - 100
1-1/2"	72 - 87	30 - 60
1-1/4"	58 - 75	0 - 15
3/4"	27 - 47	0 - 1
3/8"	3 - 14	---
No. 4	0 - 1	---

E. Foundation gravel shall contain no pieces larger than five (5) inches, measured along the line of greatest dimension.

2.6 RIGID INSULATION

A. Insulation shall be closed-cell, extruded polystyrene foam.

B. The insulation shall have a typical five year aged thermal conductivity, k factor of 0.2 Btu/hr/sq.ft./°F/in when tested at 75° F mean temperature in accordance with ASTM C518.

C. Minimum compressive strength of 25 psi when tested in the vertical direction in accordance with ASTM D1621.

D. Maximum water absorption of 0.3% by volume when tested in accordance with ASTM C272.

2.7 CONTROLLED DENSITY FILL (CDF)

A. CDF shall be a mixture of Portland cement, fly ash, aggregates, water, and admixtures proportioned to provide a non-segregating, self-consolidating, and free-flowing material which will result in a hardened, dense, non-settling, and excavatable fill.

B. CDF shall be used as fill above utilities wherever non-settling backfill is required or as a hydraulic barrier between coarse and fine grained soil.

C. CDF shall be batched and mixed in accordance with Section 6-02.3 of the WSDOT/APWA Specifications. Materials are as follows:

1. Portland Cement	AASHTO M 85 or WSDOT/APWA 9-01
2. Fly Ash	Class F
3. Aggregates	WSDOT/APWA 9-03.1(2)B
4. Water	WSDOT/APWA 9-25
5. Admixtures	WSDOT/APWA 9-23.6

D. CDF shall be used in the following proportions for one cubic yard. Batch weights may vary depending on specific weights of aggregates.

- Maximum gallons of mixing water per cubic yard 50
- Pounds of cement per cubic yard 50
- Pounds. of fly ash per cubic yard 250
- Pounds of dry aggregate per cubic yard, Class 1 or 2 sand as per WSDOT/APWA 9-03.1(2)B 3,200
-

E. CDF shall be batched to provide a flowing, non-segregating mix, with a slump between 6 inches and 8 inches.

3. EXECUTION

3.1 TRENCHING

A. Material shall be excavated from trenches and piled adjacent to the trench and maintained so that the toe of the slope of the spoil material is at least two (2) feet from the edge of the trench.

B. Material shall be piled in such a manner that will cause a minimum of inconvenience to public travel.

C. Free access shall be provided to all fire hydrants, water valves and meters, and clearance shall be left to enable the free flow of storm water in all gutters, conduits, and natural watercourses.

D. Ledge rock, boulders, or stones shall be removed to provide a minimum clearance of six (6) inches under and around the pipe.

E. Contractor shall keep excavations free of water in accordance with Section 02140.

F. Contractor is responsible for shoring in accordance with Section 02150.

3.2 TRENCHING FOR WATER LINES

A. Trenching shall be dug to true and smooth bottom grades in accordance with the lines given by the Engineer.

B. Trench widths shall not exceed 30 inches maximum or 1.5 times outside diameter of the pipe plus 18 inches whichever is greater.

C. Standard excavation equipment shall be adjusted so as to excavate the narrowest ditch possible.

D. Depth of trenching for water mains shall be such as to give a minimum cover of 36 inches over the top of the pipe unless otherwise specified.

E. Deeper excavation may be required due to localized breaks in grade, or to install the new main under existing culverts or other utilities where necessary.

F. Where profile of pipeline and ground surface is shown on the plans, pipeline shall be laid to elevation shown, regardless of depth.

G. Excavation shall be to such depth that the minimum cover over the valve nuts shall be one foot.

H. The length of trench excavated in advance of pipe laying shall be kept to a minimum and in no case shall length of open trench exceed 400 feet unless specifically authorized by the Engineer.

I. Trenches shall be over excavated below the specified grade to provide for bedding material specified.

3.3 TRENCHING FOR SEWERS AND DRAINS

A. Trenches must be of sufficient width to permit proper jointing of the pipe and backfilling of material along the sides of the pipe.

B. Trench width at the surface of the ground shall be kept to the minimum amount necessary to install the pipe in a safe manner.

C. Trenches wider than the maximum specified may result in a greater load of overburden than the pipe is designed for, and consequently, if the maximum trench width is exceeded by the Contractor, the Contractor shall at his own expense, provide pipe of higher strength classification, or provide a higher class of bedding where necessary to ensure that the pipe will not be overloaded.

D. The normal maximum permissible trench width, at the bottom of the trench and up to a point at the crown of the pipe, shall be 1.5 times the inside diameter plus 18 inches or 40 inches, whichever is greater.

E. Excavation for manholes and other structures shall be sufficient to provide a minimum of 12 inches between their outside surfaces and the sides of the excavation.

F. The length of trench excavated in advance of the pipe laying shall be kept to a minimum, and in no case shall it exceed 150 feet unless specifically authorized by the Engineer.

G. Trenches shall be excavated below the barrel of the pipe a sufficient distance to provide for bedding material specified.

3.4 TRENCHING FOR SEWER FORCE MAINS

A. Trenches shall be dug to true and smooth bottom grade and in accordance with the lines given by the Engineer.

B. Trench widths shall not exceed 30 inches maximum or 1.5 times outside diameter of the pipe plus 18 inches whichever is greater.

C. Standard excavation equipment shall be adjusted so as to excavate the narrowest ditch possible.

D. The depth of trenching shall be such as to give a minimum cover of 48 inches over the top of the pipe unless otherwise specified.

E. Where profile of pipeline and ground surface is shown on the plans, pipeline shall be laid to elevation shown regardless of depth.

G. Trench shall be graded so that there is an upward slope at all times from low point to high point.

H. The length of trench excavated in advance of the pipe laying shall be kept to a minimum and in no case shall length of open trench exceed 400 feet unless otherwise specifically authorized by the Engineer.

I. Trenches shall be overexcavated below the specified grade to provide for bedding material specified.

3.5 PIPE FOUNDATIONS

A. Where the trench bottom is in a material which is unsuitable for foundation or which will make it difficult to obtain uniform bearing for the pipe, such material shall be removed and a stable foundation provided in accordance with Standard Detail entitled "Foundation Gravel and Backfill".

B. Proper preparation of foundation and placement of foundation material, where required, shall precede the installation of all pipe.

This shall include the necessary preparation of the native trench bottom and/or the top of the foundation material to a uniform grade so that the entire length of pipe rests firmly on a suitable properly compacted material.

C. Gravel to be used for foundation purposes shall be of a type and gradation to provide a solid compact bedding in the trench. Because trench conditions vary, foundation gravel requirements will change.

D. Neither approval or disapproval of the foundation material proposed by the Contractor shall relieve him of his responsibility for providing adequate pipe foundation and guaranteeing his work as elsewhere required by the Contract.

E. Unsuitable material for foundation purposes below the depth required for the specified bedding shall be removed and replaced with suitable foundation gravel.

F. Excavated materials shall be disposed of at an approved waste site .

3.6 PIPE BEDDING

A. Placement of bedding material in the pipe zone shall be as specified in the section regarding the pipeline being constructed.

3.7 BACKFILLING

A. Pipe bedding and backfill to 6 inches over the top of the pipe shall be completed before backfilling operations are started.

B. The Contractor shall take all necessary precautions to protect the pipe from any damage, movement or shifting. In general, backfilling shall be performed by pushing the material from the end of the trench into, along, and directly over the pipe so that the material will be applied in the form of a rolling slope rather than by side filling which may damage the pipe. Backfilling from the sides of the trench will be permitted after sufficient material has first been carefully placed over the pipe to such a depth as to protect the pipe.

C. Compaction equipment used above the pipe zone shall be of a type that does not injure the pipe.

D. Provide for the proper maintenance of traffic flow and accessibility as may be necessary.

E. Make adequate provisions for the safety of property and persons.

F. Temporary shoring shall be removed unless specifically authorized in writing.

G. Dewatering shall be continued until the trench is completely backfilled.

H. Brush, stumps, logs, planking, disconnected drains, boulders, etc., shall be removed from the material to be used for backfilling the trench.

I. Where original excavated material is unsuitable for trench backfill, backfill gravel shall be placed. The unsuitable material shall be removed to a disposal area. Backfill gravel shall be used for backfill only where original material is unsuitable and upon approval by the Engineer.

J. Where it is required that a blanket of select material or bank run gravel be placed on top of the native backfill, the backfill shall be placed to the elevations shown on the plans, or to the elevation the Engineer may direct, and shall be leveled to provide for a uniform thickness of the selected material. Compaction of the native material shall be as required by the Owner and shall be performed prior to placing the select material.

K. Backfill gravel: Wherever a trench is excavated in a paved roadway, sidewalk or other area where minor settlements would be detrimental and where the native excavated material is not suitable for compaction as backfill, the trench shall be backfilled to such depth as the Engineer may direct with Backfill Gravel.

L. CDF: CDF shall be placed as shown on the drawings, or wherever mechanical compaction cannot be achieved due to physical space and/or clearance limitations (not allowing access for mechanical compaction equipment) and where additional excavation to provide the required space and/or clearance is not practical or possible. CDF shall be used as fill above utilities wherever non-settling backfill is required.

3.8 GENERAL COMPACTION REQUIREMENTS

A. Requirements of this section shall apply unless more stringent requirements are established by the local agency involved.

B. When working in an existing traveled roadway, restoration and compaction must be achieved as the trench is backfilled so as to maintain traffic.

C. Trench backfill under roadway shall be mechanically compacted to 95% of maximum density except for trenches over 8 feet in depth.

D. In the case of trenches over 8 feet deep, backfill at depths over 4 feet may be compacted by either water settling or mechanical compaction. The top four feet of the trench line shall then be mechanically compacted to 95%.

E. In any trench in which 95% density cannot be achieved with existing backfill, the top 4 feet shall be replaced with backfill gravel mechanically compacted to 95%.

F. When working in areas outside of proposed traveled roadway or on landscaped easements, backfill gravel shall be mechanically compacted to 95% density.

3.9 MECHANICAL COMPACTION

A. Method of compaction shall be at Contractor's option.

B. The Contractor shall be responsible to provide the proper size and type of compaction equipment and select the proper method of utilizing said equipment to attain the required compaction density.

C. In-place compaction tests may be made. Contractor shall remove and recompact material that does not meet specified requirements.

3.10 INSULATION BOARD INSTALLATION

A. Prior to placement of the insulation board, the subgrade shall be leveled and compacted to provide a smooth, firm foundation.

B. Insulation board shall be placed 12 inches above the pipe line whenever shown on the drawing.

C. The insulation shall be 2 feet wide and extend 5 additional feet along the length of pipe after minimum cover has been achieved.

D. Insulation shall be anchored prior to backfilling using a minimum of two 6-inch by 3/8-inch wooden skewers per board, driven at an angle to the vertical and flush to the surface of the insulation.

E. Layering of insulation to obtain the specified thickness shall be allowed as long as all joints are overlapped at least 6 inches.

3.11 CONTROLLED DENSITY FILL (CDF)

A. Haul excavated material immediately to waste; install and bed pipe per Section 02660 and other applicable sections.

B. Mix and deliver CDF in commercial concrete ready mix trucks. CDF shall be discharged from the mixer by any reasonable means (which does not segregate the material) into the area to be filled.

C. Contain CDF at either end of the excavation by bulkhead or earth fill.

D. Place CDF using suitable equipment to avoid injury to or displacement of installed utility lines, manholes, and other structures. CDF shall not be placed on frozen ground.

E. Vibrate fill with concrete vibrators during placement for complete consolidation, 95% minimum.

F. Provide steel plates to span utility trench and prevent traffic contact with the CDF for at least 12 hours but not more than 24 hours, or until fill has set sufficiently to prevent rutting.

G. Placement of CDF shall be scheduled during favorable weather conditions. At the time of placement, the temperature must be at least 40° F. Mixing and placing shall stop when the temperature is 38° F or less and falling. Each filling stage shall be as continuous an operation as practical.

* * * END OF SECTION * * *

SECTION 02275

SEDIMENTATION CONTROL

1. GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Site Clearing: Section 02110
B. Grading: Section 02210
C. Excavating, Backfilling and Compacting for Utilities: Section 02222
D. Landscape Restoration: Section 02990

1.2 QUALITY CONTROL

A. Conform to regulatory requirements including the latest edition of the Washington Department of Ecology's Stormwater Management Manual for Western Washington.

1.3 SCHEDULE

A. Required sedimentation control facilities must be constructed and in operation prior to land clearing and/or other construction to ensure that sediment-laden water does not enter the natural drainage system.

B. Sediment facilities shall be maintained in a satisfactory condition until such time that clearing and/or construction is completed and the potential for on-site erosion has passed.

C. The implementation, maintenance, replacement, and additions to erosion/sedimentation control systems shall be the responsibility of the Contractor.

2. PRODUCTS

2.1 PLANTING MATERIALS

Refer to Section 02990

2.2 STRAW

A. Shall be in an air-dried condition free of noxious weeds, weed seeds, and other materials detrimental to plant life.

B. Shall be seasoned before baling or loading and shall be acceptable to the Engineer.

2.3 JUTE MATTING

A. Be of a uniform open plain weave of unbleached, single jute yarn treated with a fire retardant chemical.

B. The yarn shall be of a loosely twisted construction and shall not vary in thickness by more than 1/2 of its normal diameter.

C. Furnished in rolled strips 48 inches wide by approximately 50 yards long.

D. Average weight of 0.92 pounds per square yard with an allowable tolerance of plus or minus 1 inch in width and 5% in weight.

2.4 FILTER FABRIC

A. Filter fabric for the erosion protection barriers shall be Mirafi 140 or equivalent.

2.5 WIRE

A. Wire for the erosion protection barriers shall be 2 x 2 mesh, 14 gauge galvanized wire.

2.6 SUPPORT POSTS

A. Support posts for the erosion protection barriers shall be 2-inch by 4-inch, Doug-FR No. 1 or better wood posts or 1-1/2-inch by 4/8-inch medium weight steel fence posts.

2.7 CLEAR PLASTIC COVERING

A. Clear plastic covering for protection of slopes and cuts shall meet the requirements of the NBS Voluntary Product Standard, PS 17 for polyethylene sheeting having a minimum thickness of 6 mil.

2.8 SEDIMENT RETENTION WATTLE

A. Wattles shall be a straw-filled tube of flexible netting material. The wattles shall be manufactured by a company whose principle business is wattle manufacturing and shall be a machine-produced tube of compacted rice straw that is Certified Weed Free Forage. The netting shall consist of seamless, high-density polyethylene and ethyl-vinyl-acetate and contain ultraviolet inhibitors

3. EXECUTION

3.1 EROSION CONTROL

A. Erosion control provisions shall meet or exceed the requirements of the local agency having jurisdiction.

B. When provisions are specified and shown on the Drawings, they are the minimum requirements.

C. Contractor shall not permit sediment-laden waters to enter drainage facilities.

D. As construction progresses and seasonal conditions dictate, more siltation control facilities may be required. It shall be the responsibility of the Contractor to address new conditions that may be created and to provide additional facilities over and above minimum requirements as may be required.

3.2 SILTATION/SEDIMENTATION PONDS

A. Siltation/sedimentation ponds shall be installed on site to desilt all stormwater or water pumped from excavations.

B. If additional siltation control is required, check dams or silt fences may be placed in ditches receiving stormwater from areas disturbed by construction.

C. Siltation/sedimentation ponds shall be constructed in accordance with the requirements of the agencies having jurisdiction over facilities to receive discharge from siltation/sedimentation ponds.

3.3 FILTER FABRIC FENCES

A. Filter fabric fence shall consist of filter fabric fastened to wire fabric with staples or wire rings.

B. Wire shall be fastened to posts set at 4-foot centers.

C. Fabric shall be buried into ground approximately 8 inches to prevent silt from washing under fabric.

D. Fence shall be located to catch silt and prevent discharge to drainage courses.

3.4 STRAW BALE FILTER

A. Installed in drainage way to catch silt.

B. Dig bales into ground approximately 6 inches and stake in place with 2 wooden stakes in each bale.

C. Bales to extend above anticipated surface of stream.

3.5 SEDIMENT RETENTION WATTLE

A. Install wattles in the trench, ensuring that no gaps exist between the soil and the bottom of the wattle. The ends of adjacent wattles should be tightly abutted so that no opening exists for water or sediment to short-circuit the system. Alternately, wattles may be lapped, 6" minimum, to prevent sediment passing through the field joint.

B. Wooden stakes should be used to fasten the wattles to the soil. When conditions warrant, a straight metal bar can be used to drive a "pilot hole- through the wattle and into the soil.

3.6 PLACING JUTE MATTING

A. Seed and fertilizer shall be placed prior to placing of matting.

B. Jute matting shall be unrolled parallel to the flow of water. Where more than 1 strip of jute matting is required to cover the given area, it shall overlap the adjacent mat a minimum of 4 inches. The ends of matting shall overlap at least 6 inches with the upgrade section on top.

C. The up-slope end of each strip of matting shall be staked and buried in a 6-inch deep trench with the soil firmly tamped against the mat. Three stakes per width of matting (1 stake at each overlap) shall be driven below the finish ground line prior to backfilling of the trench.

D. The Engineer may require that any other edge exposed to more than normal flow of water or strong prevailing winds be staked and buried in a similar manner.

E. Check-slots shall be placed between the ends of strips by placing a tight fold of the matting at least 6 inches vertically into the soil. These shall be tamped and stapled the same as upslope ends. Check-slots must be spaced so that one check-slot or one end occurs within each 50 feet of slope.

F. Edges of matting shall be buried around the edges of catch basins and other structures as herein described. Matting must be spread evenly and smoothly and in contact with the soil at all points.

G. Matting shall be held in place by approved wire staples, pins, spikes or wooden stakes driven vertically into the soil. Matting shall be fastened at intervals not more than 3 feet apart in 3 rows for each strip of matting, with 1 row along each edge and 1 row alternately spaced in the middle. All ends of the matting and check slots shall be fastened at 6-inch intervals across their width. Length of fastening devices shall be sufficient to securely anchor matting against the soil and driven flush with the finished grade.

3.7 PLACING CLEAR PLASTIC COVERING

A. Clear plastic covering shall be installed on erodible embankment slopes as shown in the plans or as designated by the Engineer.

B. The clear plastic covering shall be installed immediately after completion of the application of roadside seeding.

C. The Contractor shall maintain the cover tightly in place by using sandbags or tires on ropes with a minimum 10-foot grid spacing in all directions. All seams shall be taped or weighted down full length. There shall be at least a 12-inch overlap of all seams.

D. The Contractor shall be responsible to immediately repair all damaged areas.

3.8 EXISTING DRAINAGE FACILITIES

A. Should a storm sewer or culvert become blocked or have its capacity restricted due to silt discharged from Contractor's operations, the Contractor shall make arrangements with the jurisdictional agency for the cleaning of the facility at no additional expense to the Owner.

3.9 DRAINAGE DIVERSION

A. Contractor shall divert offsite surface runoff water around the site as may be required.

B. Drainage shall be restored to condition existing prior to construction unless otherwise shown on the Drawings.

* * * END OF SECTION * * *

SECTION 02300

PIPE BORING AND JACKING

1. GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Sanitary Sewers: Section 02730

1.2 REQUIREMENTS OF CONTROLLING AGENCY

A. All work shall be done in accordance with the requirements of the road or railroad agency in control of the facility being bored or jacked.

2. PRODUCTS

2.1 MATERIALS

A. All materials selected by the Contractor shall meet the minimum requirements of the controlling agency or the construction requirements.

B. Where casing size and thickness is shown on drawing, it is minimum size and thickness permitted. Contractor is permitted to use larger size or thicker walled casing if, in his opinion; it is required because of soil or other job conditions.

C. Minimum thickness of casing wall shall meet requirement of road or railroad agency involved.

3. EXECUTION

3.1 INSTALLATION OF ENCASING PIPE

A. Where shown on the Plans, the Contractor shall install the pipe in a large encasing pipe.

B. The encasing pipe shall be installed by jacking, tunneling, augering, or by a combination of these methods.

C. The encasing pipe shall normally extend from ditch-line on each side of the pavement or as shown on the drawings or in the road permit. No excavation shall be made closer than 6 feet from the edge of the pavement or as directed by the road or railroad agency. Exact length shall be approved by the road or railroad agency involved.

D. During jacking, augering, or tunneling operations, care shall be exercised to prevent caving ahead of the pipe, which will cause

voids outside the pipe. If voids occur, the Contractor shall backpack the voids with sand and pea gravel and fill the voids with a pumped Portland cement grout.

3.2 TUNNELING

A. Tunneling will not be allowed except by the liner plate method and unless approved by the road or railroad agency involved.

B. Liner plates shall be assembled and installed in accordance with the manufacturer's instructions and specifications and in accordance with accepted tunneling methods using poling plates or shields of a strength equal to that of the liner plates.

3.3 CARRIER PIPE INSTALLATION

A. The pipeline shall be skidded into position inside the casing pipe using suitable skids and blocked into position.

B. The annular space between the carrier pipe and the casing pipe or tunnel liner shall be filled by sluicing or blowing sand or pea gravel into the space unless otherwise specified. Care shall be exercised to ensure that the entire space is filled and that the pipe is not disturbed during the placement of the backfill between the pipe and the casing.

C. The Contractor shall remove the carrier pipe and reinstall it if the pipe is not within the tolerances shown on the drawings and as specified.

* * * END OF SECTION * * *

SECTION 02575

PAVEMENT REPAIR AND RESURFACING

1. GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Traffic Regulation: Section 01570
B. Demolition: Section 02050
C. Site Clearing: Section 02110
D. Excavation, Backfilling and Compacting for Utilities: Section 02222
E. Cast-in-Place Concrete: Section 03300

1.2 QUALITY ASSURANCE

A. Qualifications of asphalt concrete producer: Use only materials which are furnished by a bulk asphalt concrete producer regularly engaged in production of hot-mix, hot-laid asphalt concrete.

1.3 PAVING QUALITY REQUIREMENTS

A. General: In addition to other specified conditions, comply with following minimum requirements:
   1. Comply with requirements of road agency having jurisdiction.
   2. Provide final surfaces of uniform texture, conforming to required grades and cross-sections.
   3. Patches shall match existing grade and cross-section unless the standard details are more stringent or as otherwise directed by the road agency.

B. Surface Smoothness:
   1. Test finished surface of each asphalt concrete course for smoothness using a 10-foot straight edge applied parallel to and at right angles to centerline of paved areas.
   2. Surfaces will not be acceptable if exceeding 0.25 inch in 10 feet unless more rigid requirements are established by the road agency.

1.4 SUBMITTALS

A. Certify that materials comply with specification requirements.

B. Certificate to be signed by asphalt concrete producer and Contractor.

1.5 JOB CONDITIONS

A. Weather limitations:
   1. Construct only when temperatures are above minimum specified in WSDOT's standard specifications unless waived by road agency having jurisdiction.

2. Do not construct pavement or base when the base surface is wet or contains an excess of moisture that would prevent uniform distribution and the required penetration.

B. Grade control: Establish and maintain the required lines and grades, including crown and cross-slope, for each course during construction operations.

C. Traffic control:
1. Maintain vehicular and pedestrian traffic during paving operations, as required for other construction activities.
2. Provide flagmen, barricades, warning signs, and warning lights for movement of traffic and safety and to cause the least interruption of work.
3. See Section 01570 for additional requirements.

1.6 ROAD AND STREET RESTORATION REQUIREMENTS

A. The Contractor's responsibility as to road restoration shall include, but not be limited to, proper backfill and compaction of excavation, shaping and general restoration of the roadway, restoration of public and private improvements when damaged by construction, restoration of drainage facilities, scarification of existing surfacing, if required, removal of debris and surplus material, and all other requirements of these Specifications. In addition, upon completion of the above restoration, backfill gravel and crushed gravel or crushed rock surfacing shall be placed where required, in the opinion of the Engineer.

B. Unless otherwise specifically authorized by the authority responsible for the roadway, the final grade and cross-section shall conform to applicable road agency standard cross sections. In case of existing private roads, they shall conform to the roadway that existed prior to construction.

C. Manhole rings, valve boxes, and monument cases shall be adjusted as necessary to be flush with the restored surface.

D. The Contractor shall comply with all requirements of all permits for installation of pipelines in authorized rights-of-way.

E. The Contractor will place and maintain sufficient and proper lights and barricades at all locations on roads not accepted by the road agency involved.

F. After completion of pipeline installation, the Contractor shall clean drainage ditches and restore all existing drainage structures that he may have damaged during the course of construction. He shall also comply with all drainage requirements of the agency involved upon which the agency's acceptance of the roads is conditioned.

G. The Contractor shall restore any private improvement on road rights-of-way including, but not limited to, culverts, driveways, curbs, sidewalks, parking strips, parking areas, or other permanent

improvements, whether or not a permit for such improvements has been obtained.

I. All streets in the construction area as well as any unpaved streets used by Contractor's trucks or any other equipment hauling material to and from the area, whether within the construction area or adjacent thereto, and any unpaved streets used as detours during the construction shall be serviced with an application of or continuous use of sprinkler trucks to allay the dust. The sprinkling of the dust on roads or streets will continue until accepted by the road agency or the roads or streets have been graveled or resurfaced.

J. It is specifically understood and agreed that the Contractor is responsible for complying with all requirements of the road agency necessary to obtain written acceptance of the roads by the agency concerned.

K. Until accepted in writing by the road agency, the Contractor will maintain all roads in a condition satisfactory to the agency concerned. This shall include periodic grading of all streets on which traffic is allowed wherever, in the opinion of the Engineer, such grading is required. A suitable motor grader shall be available for this work.

L. Any settlement that occurs during the first year after final contract acceptance shall be repaired by the Contractor at his expense.

2. PRODUCTS

2.1 CRUSHED SURFACING

A. Crushed surfacing shall be manufactured from ledge rock, talus, or gravel. The materials shall be uniform in quality and substantially free from wood, roots, bark, and other extraneous material.

B. Crushed surfacing shall meet the following requirements for grading and quality:

Sieve Size Square Opening	Percent Passing by Weight
1 inch	100
3/4	70-100
3/8	50-80
No. 4	35-65
No. 10	25-50
No. 40	15-30
No. 200	0-10

C. The portion of crushed aggregate retained on a No. 10 sieve shall have a minimum of 75% of the particles with at least one fractured face.

D. The portions passing the No. 40 sieve shall have a liquid limit not greater than 25 and a plasticity index not greater than 6.

E. The portions passing No. 10 sieve shall have a percentage of wear of not greater than 35% when tested in the Los Angeles machine.

2.2 ASPHALT CONCRETE PAVEMENT

A. Asphalt-concrete pavement shall conform to WSDOT's technical requirements for plant mix asphalt concrete

2.3 ASPHALT TREATED BASE

A. Asphalt-treated base shall conform to WSDOT's technical requirements for asphalt-treated base.

2.4 CONCRETE

A. Refer to Section 03300.

3. EXECUTION

3.1 GENERAL PAVEMENT REPAIR REQUIREMENTS

A. Pavement patching shall be scheduled to accommodate the demands of traffic and shall be performed as rapidly as possible to provide maximum safety and convenience to public travel.

B. The placing and compaction of the trench backfill and the preparation and compaction of the subgrade shall be in accordance with the requirements of Section 02222 of these Specifications.

C. Prior to trench excavation in pavement surfaces, straight vertical trim lines shall be cut in order to minimize breakage and cracking of the remaining surfacing.

D. Before the patch is constructed, all pavement cuts shall be trued so that the marginal lines of the patch will form a rectangle with straight edges and vertical faces. The use of a concrete saw will not be required for asphalt pavement.

E. After completion of the patches, the entire roadway surface shall be cleaned by brooming or such other methods as may be required. The early completion of this phase of the restoration is required, not only to facilitate public relations, control dust, and alleviate traffic problems, but also to prevent the further break-up and cracking of the existing asphalt mat. If, in the opinion of the Engineer, the Contractor is not diligently pursuing the work in such a manner as to place the patch as soon as reasonably possible, the Contractor may be required to retrim and remove any and all cracked areas in such a manner to produce a straight uniform edge.

F. Finished grade and cross section of patch shall match grade and cross-section of existing pavement, unless the standard details are more stringent.

3.2 ASPHALT CONCRETE TRENCH PATCH

A. Preparation:
   1. As soon after compacting the trench backfill and placing and compacting backfill gravel, where required, the Contractor shall place and compact crushed surfacing in the trench area to a minimum depth of four (4) inches or depth to match the original cross-section, whichever is greater.
   2. A tack coat of asphalt applied at the rate of 0.02 to 0.08 gallons per square yard of retained asphalt shall be applied through the use of mechanical equipment to all surfaces on which any course of asphalt concrete is to be placed or abutted. The spreading equipment shall be capable of uniformly distributing asphalt materials over any area in controlled amounts and shall be equipped with hand operated spray equipment for use only on inaccessible and irregularly shaped areas.
   3. The tack coat shall be a heated cutback asphalt or emulsified asphalt, mixing grade. The emulsified asphalt may be mixed with water at the rate of 1 to 2 parts water to 1 part of emulsified asphalt.

B. Two-lift patch:
   1. Immediately after completion of placing the base, the Contractor shall place a two-inch minimum compacted thickness of asphalt concrete surfacing. The final surface of this lift shall be not lower than 1/2 inch below the existing surface.
   2. If the existing pavement is more than two inches, the first lift of asphalt concrete shall be of the same depth as the existing pavement.
   3. The Contractor may substitute an equal amount of asphalt treated base for crushed surfacing and first lift of asphalt concrete.
   4. A tack coat shall be placed over the patch area. Asphalt concrete modified so that maximum size aggregate is 1/2 inch shall be placed over the tack coat. Prior to rolling, the aggregate in the asphalt concrete shall be hand raked back from the edges and rolled in such a manner to produce a uniform "feather" edge over the existing surface. The minimum compacted thickness of the second lift over the trench area shall be one inch.
   5. Where excess settlement of the first patch occurs, a leveling course shall be used to prevent the thickness of the second lift from exceeding two inches.
   6. The edge of the patch shall be sealed by painting with a cut-back asphalt or SS-1 emulsion and immediately covered with sand and heated.

C. Single-lift patch:

1. Immediately after completion of placing the base, the Contractor shall place a two-inch minimum thickness of asphalt concrete surfacing.
2. If the existing pavement is more than two inches the asphalt concrete shall be of the same depth as the existing pavement.
3. The edge shall be hand raked to produce a smooth edge where the patch abuts the existing pavement.
4. The thickness shall be adjusted so that a smooth uniform grade exists after rolling.
5. The edge of the patch shall be sealed by painting with a cut-back asphalt or SS-1 emulsion and immediately covered with sand and heated.

3.3 CEMENT CONCRETE PAVEMENT PATCH

A. After the subgrade for the pavement has been compacted and constructed to line and grade, the cement concrete pavement patch shall be placed, compacted, and struck off to the grade of the adjacent pavement.

B. Minimum thickness shall be eight inches or the thickness of the existing pavement plus two inches, whichever is greater.

C. Through and dummy joints shall be placed and edged to match existing joints.

D. The surface shall be finished and brushed with a fiber brush.

E. Approved curing compound shall be placed on the finished concrete immediately after finishing.

F. Concrete used in patches shall be in accordance with Section 03300 unless Type III cement is required because of urgency of opening the street to traffic.

3.4 RIGID TYPE PAVEMENT RESURFACED WITH ASPHALT CONCRETE

A. Cement concrete patch shall be placed as specified above for cement concrete pavement patch except that the surface of the cement concrete portion of the patch shall be left low enough to accommodate the asphalt portion of the patch. Brush finishing will not be required.

B. Curing shall be accomplished with an asphalt emulsion cut back with water.

C. Asphalt concrete or bituminous plant mix shall not be placed until the day after the cement concrete has been placed.

D. The edges of the existing asphalt pavements and castings shall be painted with hot asphalt cement or asphalt emulsion immediately before placing the asphalt patching material.

E. The asphalt concrete pavement shall then be placed leveled and compacted to conform to the adjacent paved surface.

F. All joints between the new and original asphalt pavement shall be painted with hot asphalt or asphalt emulsion and be covered with dry paving sand before the asphalt solidifies.

3.5 ASPHALT CONCRETE PAVEMENT

A. Full-width asphalt concrete pavement shall conform to the WSDOT's technical requirements.

B. After the subgrade has been properly prepared and compacted, a minimum of two inches of asphalt concrete pavement Class B shall be placed and compacted.

C. If the existing pavement is more than two inches thick, asphalt concrete shall be of the same depth as existing pavement prior to construction.

D. The edges of the existing asphalt pavements and castings shall be painted with hot asphalt cement or asphalt emulsion immediately before placing the asphalt patching material.

E. The asphalt concrete pavement shall then be placed, leveled, and compacted to conform to established cross-section and grade and to match adjacent paved surface.

F. The edge of the new pavement shall be sealed by painting with a cutback asphalt or SS-1 emulsion and immediately covered with sand and heated.

3.6 ASPHALT CONCRETE OVERLAY

A. Before construction of an asphalt concrete pavement overlay on an existing surface, all fatty asphalt patches, grease drippings, and other objectionable matter shall be removed from the existing pavement. Excess asphalt joint filler shall be removed and premolded joint filler shall be removed to at least one-half inch below the surface of the existing pavement. Existing pavement or bituminous surfaces shall be thoroughly cleaned by sweeping to remove dust and other foreign matter.

B. Prior to placing asphalt concrete, a tack coat shall be applied using a heated cutback asphalt or emulsified asphalt at the rate of 0.02 to 0.05 gallons per square yard.

C. When the surface of the existing pavement or old base is irregular, it shall be brought to uniform grade and cross section as required by the road agency involved. Preleveling of uneven or broken surfaces over which asphalt concrete is to be placed is required and may be accomplished by the use of asphalt concrete placed with a motor patrol grader, a paving machine, by hand raking, or by

a combination of these methods. After placement, the asphalt concrete used for preleveling shall be compacted with rollers.

D. When asphalt concrete pavement is to be constructed over an existing paved or oiled surface, in addition to the preparation as outlined hereinbefore, all holes and small depressions shall be filled with an appropriate class of asphalt concrete mix. The surface of the patched area shall be leveled and compacted thoroughly. All previous patches that have settled shall be preleveled so that depth of overlay does not exceed two inches in thickness.

E. After preparation of the base, a one-inch minimum compacted full width layer of asphalt concrete shall be placed on top of an existing paving surface. Surfacing shall be placed in such a manner as to prevent disturbing existing drainage. Surfacing shall be feathered out as required to meet existing driveways, catch basins, traffic control pads, street intersections, etc., and shall include thickened edge paving where it now exists.

F. The edges of the overlay shall be sealed by painting with a cutback asphalt or SS-1 emulsion and immediately covered with dry sand and heated.

3.7 BITUMINOUS SURFACE TREATMENT REPLACEMENT

A. Unless otherwise specified, all light bituminous surface treatment shall be replaced with a one-inch asphalt concrete overlay over a crushed surfacing base.

B. Base shall consist of four inches of crushed surfacing.

3.8 CRUSHED SURFACING

A. Existing crushed surfacing shall be replaced with new material.

B. Thickness of course shall be as directed by the Owner.

C. When the utility line is along the shoulder of a roadway, the Contractor may be directed to place a course of crushed surfacing along shoulder of the roadway. Thickness shall be as required by the road agency.

D. During dry periods, the Engineer may require water sprinkling prior to and during the placement of crushed surfacing

3.9 TEMPORARY TRENCH PATCH

A. The Contractor may be required to furnish and install a temporary trench patch when specifically directed by the Owner or as provided on the Plans.

B. Area to be patched shall be cleaned out and graded to the bottom of the base course. Any loose asphalt shall be removed.

C. Place a patch consisting of a 2-inch minimum course of crushed surfacing base and a 2-inch minimum course of cold asphalt plant mix placed over the trench area.

D. Both the base and surface course shall be placed and compacted so that the finished surface will match the grade and cross-section of the existing pavement.

E. Surface of pavement shall be cleaned of all dirt and debris before opening to traffic.

F. The Contractor shall maintain temporary patch until the permanent patch is installed.

3.10 CEMENT CONCRETE CURBS AND GUTTERS

A. Constructed with air entrained concrete.

B. Side forms shall rest throughout their length on firm ground and shall be full depth of the curb. They shall be either metal of suitable gauge for the work or surfaced "construction" grade lumber not less than two (2) inches (commercial) in thickness. Forms shall be cleaned and well oiled prior to use. Forms used more than one time shall be cleaned thoroughly and any forms that have become worn, splintered, or warped shall not be used again. Forms shall be adequately supported to prevent deflection or movement.

C. The foundation shall be watered thoroughly before the concrete is placed.

D. Concrete shall be well tamped and spaded or vibrated in the forms.

E. Exposed surfaces shall be finished full width with a trowel and edger. Remove forms of all roadway face of curbs within 24 hours of placement of concrete and treat with a float finish. The top and face of the curb shall receive a light brush finish and the top of the gutter shall receive a broom finish.

F. Joints shall be spaced to match joints in the abutting pavement. If the abutting pavement is not jointed or the curb or gutter is not abutting pavement, joints in the curb and gutter shall be spaced at 15-foot intervals. These joints shall be 1/8-inch minimum thickness and constructed to a minimum depth of 1 inch by sawing or scoring with a tool which leaves the corners rounded and destroys aggregate interlock to a depth specified. Expansion joints, filled to full cross-section with filler ¼-inch thick shall be placed in the curb and gutter to match joints in the abutting pavement, at structures, at curb returns, and where shown in the plans.

G. Cure for 72 hours by one of the methods specified in Section 03300.

H. Curb and gutter may be constructed by the use of slip-form equipment provided the completed curb or gutter retains its shape, grade, and line. Finishing, joints, and curing shall be as provided above.

I. Top of the form shall not depart from grade more than 1/8 inch when checked with a 10-foot straight edge. Alignment shall not vary more than ¼ inch in 10 feet.

3.11 ASPHALT CONCRETE CURBS AND GUTTERS

A. Placed, shaped and compacted true to line and grade with machine capable of shaping and compacting the materials to the required cross section.

B. Provide tack coat of asphalt applied to the surface upon which asphalt concrete curb is to be placed immediately prior to placing of curb.

3.12 CEMENT CONCRETE SIDEWALKS

A. The concrete in the sidewalks shall be air entrained concrete in accordance with the requirements of Section 03300.

B. Forms shall be of wood or metal and shall extend for the full depth of the concrete. All forms shall be straight, free from warp and of sufficient strength to resist the pressure of the concrete without springing. Bracing and staking of forms shall be such that the forms remain in both horizontal and vertical alignment until their removal.

C. The foundation shall be brought to the grade required and well wetted before placing the concrete.

D. Place concrete in the forms and strike off with a heavy iron-shod straight edge; trowel surface smooth with a steel trowel as soon as surface can be worked. After troweling and before jointing or edging, the surface of the walk shall be lightly brushed in a transverse direction with a soft brush. On grades of over 4%, the surface shall be finished with a stipple brush.

E. Joints shall be constructed at the locations and of the sizes as indicated in the plan.

F. The concrete shall be cured for at least 72 hours by means of moist burlap or quilted blankets. Exclude all traffic, both pedestrian and vehicular, during curing period.

3.13 PAVEMENT MARKINGS

A. The Contractor shall restore any and all pavement striping and traffic buttons damaged during construction.

B. Restoration shall be in accordance with the current standards of the road agency involved.

3.15 ADJUSTING MANHOLES TO GRADE

A. The Contractor shall adjust manhole castings to final grade by adding brick and/or mortar under the casting and patching with asphalt concrete. Paving adjusting rings will not be allowed.

B. The Contractor shall exercise extreme care in preventing foreign material from entering the manhole.

C. All manholes shall be adjusted to grade after the asphalt concrete surfacing has been placed. Disturbed area around cover shall be patched and sealed to the satisfaction of the road agency having jurisdiction.

D. The Contractor shall take care not to extend the manholes above finished grade.

3.16 ADJUSTING MONUMENT CASES AND VALVES BOXES TO GRADE

A. Monument cases and/or valve boxes shall be adjusted to final grade and patched with asphalt concrete.

B. Adjustment shall be made after the resurfacing.

C. Patching around monument cases and/or valve boxes shall be done to the satisfaction of the road agency having jurisdiction.

D. Valve boxes shall be adjusted to the satisfaction of the utility having jurisdiction.

E. The Contractor shall take care not to extend the monument cases and/or valve boxes above the finished grade.

* * * END OF SECTION * * *

SECTION 02605

MANHOLES AND CLEANOUTS

1. GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Inspection Services: Section 01420
B. Shoring: Section 02150
C. Excavating, Backfilling and Compacting for Utilities: Section 02222
D. Sanitary Sewer: Section 02730

1.2 QUALITY ASSURANCE

A. Testing by manufacturer:
   1. Manufacturer shall test all material as required by these Specifications and the Standards referenced.
   2. Manufacturer shall submit to the Engineer two (2) copies of all test results which shall include a certification that materials to be delivered are represented by the samples tested and that such delivered materials meets or exceeds the specification requirements.
   3. No material shall be delivered until test results and certifications are in the possession of the Engineer.
   4. The Engineer shall have free access to all testing and records pertaining to materials to be delivered to the job site.
   5. The Engineer may elect to be present at any or all material testing operations.

2. PRODUCTS

2.1 PRECAST MANHOLES

A. Precast concrete manholes shall conform to the requirements of ASTM C478 except as specifically modified herein.

B. Joints between precast elements used for sanitary sewers shall be tongue and groove designed to accommodate a rubber gasket joint similar to pipe joints conforming to ASTM C443. Design of joints shall be approved by the Engineer before manufacture. Shop drawings shall be submitted for review. Variations in joint dimensions shall meet the gasket design .

C. Joints between precast sections used for storm sewers may be rubber gasketed or cement mortar.

D. Base sections shall be made with the base slab integral with the wall in such a manner to achieve a completely watertight structure.

Design of base shall be in accordance with the following table for all manholes up to 25 feet deep using Grade 60 reinforcing steel.

Manhole Inside Diameter	Minimum Base Thickness	Minimum Steel-Sq.In/LF Both Directions	
		Separate Base	Base Integral With Wall
48"	6"	0.23	0.15
54"	8"	0.19	0.19
72"	8"	0.35	0.24
96"	12"	0.39	0.29

E. Proportion of Portland cement in concrete mixture shall be not less than 564 pounds per cubic yard of concrete.

F. Openings to receive pipes shall be circular, and shall be sized to equal the outside diameter of the pipe to be inserted in the joint plus the manhole wall thickness.

G. The manufacturer may produce each manhole riser and base in one section if approved by the Engineer.

H. Cones with diameter at small end of 36 inches shall be not less than 24 inches in height. Cones with a diameter at the small end of 24 inches shall be not less than 17 inches in height.

I. The openings in the top slab shall be eccentrically located so as to provide at least 6 inches minimum radial distance from the edge of the opening to the outer edge of the slab but not more than 2.5 inch off-set distance from the edge of the opening to the inside face of the standard section.

J. Unless otherwise provided, steps shall be installed in each section so that sections placed together in any combination will provide a continuous vertical ladder.

2.2 MANHOLE PIPE ENTRY COUPLINGS

A. Manhole entry coupling for PVC pipe connections to manholes shall provide a watertight joint and utilize a rubber ring to seal against the pipe. The coupling's exterior surface shall be sand impregnated epoxy or similar rough surface to insure adhesion with the mortar.

B. Resilient connectors conforming to ASTM C923 may be used at the Contractor's option. Such connectors shall not be cast-in-place in precast structures.

2.3 DROP MANHOLES

A. Drop manholes shall be an inside drop or outside drop as specified and constructed in accordance with the Standard Details.

B. One length of ductile iron pipe shall be provided outside the manhole, to reach original solid bearing ground.

C. An outside drop manhole shall be fabricated with the drop outside the manhole section as shown on the details.

D. An inside drop shall be fabricated with polyvinyl chloride pipe as detailed on the details.

2.4 MANHOLE STEPS AND LADDER

A. Conform to applicable requirements of ASTM C478 and as shown on the details.

B. Conform to OSHA or WISHA requirements, whichever is more stringent.

C. Designed so that foot cannot slide off the ends.

D. Vertical spacing at 12 inches.

E. Project uniformly inside wall.

F. Shall be deformed bar conforming to ASTM A615, intermediate or standard grade, hot bent and galvanized after bending. For bending, the temperature shall be at least 1600^{O}F. Galvanizing shall conform to ASTM A123. As an alternative, steps may be steel reinforced polypropylene. The reinforcement shall be ½-inch Grade 60 deformed reinforcing bar per ASTM A615. Polypropylene shall conform with ASTM D4101.

G. Design utilizing other materials or shapes that conform to the requirements of this specification may be used upon written approval of the Engineer.

H. Step dimensions and pattern shall conform to the details.

I. Ladders: Base sections of precast manholes may be provided with a ladder made of aluminum or steel galvanized after fabrication, as shown on the Standard Details. Ladder shall be adjusted so that it is in line with manhole steps above and extends out the same distance from the wall as the steps above. Ladder shall be securely imbedded and grouted into channel shelf. As an alternative, ladder may be steel reinforced polypropylene. Ladder rungs shall be reinforced with ½-inch Grade 60 reinforcing bar per ASTM A615. Ladder rails shall be reinforced with 9/16-inch cold drawn bar. Polypropylene shall conform with ASTM D4101.

2.5 CAST METAL FRAMES AND COVERS

A. Conform to Manhole Frame and Cover Detail.

B. Frames shall be gray-iron conforming to the requirements of AASHTO M105 (ASTM A48), Grade 30B. Covers shall be ductile iron conforming to ASTM A536, Grade 80-55-06.

C. Be free of porosity, shrink cavities, cold shuts, or cracks or any surface defects which would impair serviceability.

D. Repair of defects by welding or by the use of "smooth-on" or similar material will not be permitted.

E. Manufacturer shall certify that the product conforms to the requirements of these specifications.

F. Apply a bituminous coating to all surfaces. The finished coating shall be continuous, smooth, neither brittle when cold nor sticky when exposed to the sun, and shall be strongly adherent to the casting.

G. The Owner shall have the right to require inspection and approval of all castings prior to painting.

H. Machine finish the horizontal seating surface and inside vertical recessed face of the frame, and the horizontal seating surface and vertical outside edge of the cover to the following tolerances.
   1. Frame +3/32 inch to -3/32 inch. Cover +3/32 inch to -3/32 inch.
   2. Cover shall not rock when it is seated in any position in its frame.
   3. There shall be not more than 3/16 of an inch side play in any direction between the cover and the frame when any cover is placed in any position in its frame. All covers shall be interchangeable within the dimensions shown on the details.

I. All frames and covers shall be identified by the name or symbol of the manufacturer in a plainly visible location when the frame and cover is installed. In addition to the manufacturer's identification, when ductile iron is furnished, the material shall be identified by the notation "DUC" or "DI". The manufacturer's identification and the material identification shall be adjacent to each other and shall be minimum ½-inch to maximum 1-inch high letters recessed to be flush with the adjacent surfaces.

J. Cover shall have type of service indicated on cover with two-inch raised letters such as WATER, SEWER OR DRAIN.

K. Cover shall be the bolt-down type with separate provision for lifting/removal per detail.

2.6 CLEANOUT FRAMES AND COVERS

A. Conform to Sewer Cleanout Detail

2.7 MANHOLE COLLAR

A. Manhole collar shall be constructed of concrete with 3,000 psi concrete prepared from ASTM C150 Type I or II Portland cement or of cold mix asphaltic concrete.

B. Collar shall extend vertically from grade (top of cover elevation) to bottom of highest adjustment ring. Collar shall extend a minimum of 12 inches measured radially beyond the manhole cover frame.

3. EXECUTION

3.1 MANHOLE INSTALLATION

A. Manholes shall be constructed of precast units and/or cast-in-place concrete.
   1. Maintain the design slope between manholes. Check all intermediate grade stakes by means of a taut grade wire between at least three intermediate grade stakes. The use of a laser for maintaining pipe slope does not preclude the use of grade stakes or the checking of said stakes. In the event that the grade stakes do not line up, the work shall be stopped until the situation is corrected.
   2. Ensure that all sewers run at a constant grade and alignment between manholes.

B. Foundations:
   1. Adequate foundations for all manhole structures shall be obtained by removal and replacement of unsuitable material with well-graded granular material, or by tightening with coarse ballast rock, or by such other means as provided for foundation preparation of the connected sewers.
   2. Where water is encountered at the site, all cast-in-place base or monolithic structures shall be placed on a one-piece waterproof membrane to prevent any movement of water into the fresh concrete.
   3. Place base on a well-graded granular bedding course conforming to the requirements for sewer bedding, not less than 4 inches in thickness and extending either to the limits of the excavation or to a minimum of 12 inches outside the outside limits of the base section. In the latter case, the balance of the excavated area shall be filled with select material, well tamped to the level of the top of the bedding to positively prevent any lateral movement of the bedding when the weight of the manhole is placed upon it.
   4. Bedding course shall be firmly tamped and made smooth and level to assure uniform contact and support of the precast elements.

C. Precast base section:
   1. Place on the prepared bedding so as to be fully and uniformly supported in true alignment.

2. Make sure that all entering pipes can be inserted on proper grade.

D. Cast-in-place bases:
   1. At least 6 inches in thickness. Extend at least 6 inches radially outside of the manhole wall.
   2. Concrete shall have minimum of 4000 psi 28-day compression strength.
   3. Place first precast section on the cast-in-place base structure before the base has taken initial set and adjust to true grade and alignment with all inlet pipes installed so as to form an integral, watertight unit or mortar the section into a suitable groove provided in the top of the cast-in-place base.
   4. The first section shall be uniformly supported by the base concrete, and shall not bear directly on any of the pipes.

E. Precast sections:
   1. Placed and aligned to provide vertical sides and vertical alignment of the ladder rungs.
   2. The completed manhole shall be true to dimensions and watertight.
   3. Lift holes shall be thoroughly wetted and then be completely filled with mortar, smoothed, and pointed both inside and out to ensure watertightness.
   4. Steel loops must be removed and the remaining void shall be covered with mortar, smoothed, and pointed.

F. Pipe connections:
   1. Provide flexible joint at a distance from the face of the manhole of not more than 1-1/2 times the nominal pipe diameter or 12 inches, whichever is greater, for all rigid pipes entering or leaving any manhole.
   2. No flexible joint shall be placed within 10 feet of the manhole wall, when flexible pipe is used.
   3. Firmly compact bedding under pipe within the area of the manhole excavation.
   4. Openings through which pipes enter the structure are completely and firmly rammed full of mortar to ensure watertightness.
   5. Provide a watertight joint where flexible PVC pipe enters the manhole wall by utilizing a manhole entry coupling that is mortared into the wall. Where resilient connectors are used, the Contractor shall extend the channel into the connector to insure pipe support and a watertight joint. Resilient connectors shall be installed in accordance with the manufacturer’s requirements.

G. Channels:
   1. Constructed in field.
   2. Conform accurately to the sewer grade and bring together smoothly with well rounded junctions.

3. Channel sides shall be carried up vertically to the crown elevation of the various pipes.
4. Shelf between channels shall be constructed with concrete and smoothly finished and warped evenly with slopes to drain.

H. Manhole cover:
1. Final elevation and tilt of cover shall conform to the restored street surface unless otherwise specified.
2. Warping of surfacing to meet grade of castings will not be allowed.
3. Provide not less than 4 inches or more than 16 inches of grade rings between the top of the cone or slab and the underside of the manhole casting ring for adjustment of the casting ring to street grade or ground surface.
4. Both inside and outside of the grade rings shall have a smooth uniform mortar finish to ensure a watertight seal.

I. Backfill:
1. Extend around manhole and at least one pipe length into each trench.
2. Hand place and tamp selected native material up to an elevation of 6 inches above the crown of all entering pipes.

J. Manhole Collar:
1. Contractor shall install either a concrete or asphalt collar of sufficient size around the neck and frame to hold assembly in place in traffic areas.

3.2 CONNECTIONS TO EXISTING MANHOLES

A. The Contractor shall verify the existing manhole invert elevations prior to construction.

B. Excavate completely around the existing manhole to ensure against unbalanced loading on the manhole.

C. Keep the manhole in operation at all times and take precautions necessary to prevent any debris or other materials from entering the sewer.

D. Contractor may be required to install a tight pipeline bypass through the existing channel. If the connection is to a dead end manhole, the outlet shall be plugged watertight with a metal mechanical screw type plug. Plug shall be secured to the ladder with a rope or chain.

E. Bring laterals into the existing manhole so that the crowns of the two incoming pipes are at the same elevation unless otherwise specified.

F. Reshape the existing base to provide a channel equivalent to that specified for a new manhole. Ensure that the new system slopes towards the existing manhole.

G. The Contractor shall be responsible for repairing all damage to the manholes resulting from his operations.

3.3 CLEANOUTS

A. Sewer cleanouts shall be constructed as shown on the standard plan.

B. All materials incorporated into the cleanout structure shall meet the requirements of the various applicable sections of these specifications.

C. Pipe joints shall be the type specified for sewer pipe used.

D. The trench excavation shall be made in such a manner as to provide an undisturbed base upon which the pipe shall be placed.

E. Bedding around and under the pipe shall be tamped.

* * * END OF SECTION * * *

SECTION 02610

PIPE AND FITTINGS

1. GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Inspection Services: Section 01420

B. Excavating, Backfilling and Compacting for Utilities: Section 02222

C. Water Lines: Section 02660

D. Storm Drainage: Section 02720

E.. Sanitary Sewers: Section 02730

F. Sewer Force Mains: Section 02732

1.2 QUALITY ASSURANCE

A. Testing by Manufacturer:
1. Manufacturer shall test all materials as required by these Specifications and the standards referenced.
2. Manufacturer shall submit to the Engineer two (2) copies of all test results which shall include a certification that materials to be delivered are represented by the samples tested and that such delivered materials meet or exceed the specification requirements.
3. No material shall be delivered until test results and certifications are in the possession of the Engineer.
4. Engineer shall have free access to all testing and records pertaining to material to be delivered to the job site.
5. The Engineer may elect to be present at any or all material testing operations.

B. Joint tests are intended for qualification of joint design and shall be considered to be a qualification test to establish the adequacy of the manufacturer's joint design. The manufacturer shall certify that tests have been performed within the last year with pipes equivalent in size and design and that they have passed the test enumerated in the specifications. Tests may be waived for pipes of different strength class if joint design is the same as the pipe tested.

2. PRODUCT

2.1 DUCTILE IRON PIPE

A. For underground pressure pipelines (water main and sewer force main), conform to AWWA C150/C151 and shall be Pressure Class 350, unless otherwise specified. For above grade pressure pipelines (pump stations), conform to AWWA C150/C151 and shall

be thickness Class 52, unless otherwise specified. For gravity pipelines, conform to ASTM A746 and shall be thickness Class 50, unless otherwise specified.

B. Joints shall be mechanical joint or push-on joint and shall conform to AWWA C111 (ANSI A21.11).

C. Pipe and fittings shall have a cement mortar lining conforming to AWWA C104 (ANSI A21.4).

2.2 POLYVINYL CHLORIDE (PVC) PRESSURE PIPE (4 INCHES AND OVER)

A. Conform to AWWA C900.

B. Outside diameter equal to ductile iron pipe and with gasket bell ends.

C. Minimum wall thickness shall be equal to or greater than dimension ratio (DR) of 18 (150 psi) unless otherwise specified.

D. Joints shall conform to ASTM D3139 using a restrained rubber gasket conforming to ASTM F477.

E. All PVC water pipe shall be considered flexible conduit.

2.3 POLYVINYL CHLORIDE (PVC) PRESSURE PIPE (UNDER 4 INCHES)

A. Conform to ASTM D2241.

B. Pipe material shall be PVC 1120, PVC 1220 or PVC 2120.

C. Minimum wall thickness shall be equal or greater than a standard dimension ratio (SDR) of 21 unless otherwise specified.

D. Pipe shall bear the National Sanitation Foundation Seal for use to transport potable water.

E. Joints shall conform to ASTM D3139 using a restrained rubber gasket conforming to ASTM F477.

2.4 DUCTILE IRON AND GRAY IRON FITTINGS

A. Use for ductile iron or PVC pipe.

B. Conform to AWWA C110 (ANSI A21.10) or AWWA C153 (ANSI 1921.53) as indicated.

C. Joint shall conform to AWWA C111 (ANSI A21.11).

D. Dimensions of fittings and design of bell may be modified to conform with the pipe being used.

E. Cement mortar lining conforming to AWWA C104 (ANSI A21.4).

F. Gaskets for flat faced or raised faced flanges shall be 1/8-inch thick neoprene having a durometer of 60 plus or minus 5.

G. Gaskets for flanges having a recess machined to receive an "O" ring shall be neoprene and shall have the dimensions and durometer as recommended for the particular service application by the flange manufacturer.

H. Provide type, material and identification mark for bolts and nuts.

2.5 STEEL PIPE (4 INCHES AND SMALLER)

A. Conform to ASTM A120.

B. Schedule 40, unless otherwise specified.

C. Fitting shall be malleable iron screw type conforming to ANSI B16.3.

D. Pipe and fittings shall be hot dipped, galvanized inside and out.

2.6 STEEL PIPE (OVER 4 INCHES)

A. Conform to AWWA C200.

B. Design Pressure 150 psi.

C. Design stress 50% of yield strength.

D. All pipe and fittings shall receive coal tar protective treatment in accordance with AWWA C203.

E. Field couplings shall be compression style coupling.

F. When flanges are required, they shall conform to AWWA C207.

G. All couplings shall be coated the same as pipe.

2.7. FLEXIBLE COUPLINGS

A. Use for connection between plain end pipe of same or different material.

B. Sleeve: Gray iron ASTM A126 Class B or ductile iron ASTM A536. Ends have a smooth inside taper for uniform gasket seating.

C. Followers: Ductile iron ASTM A536.

D. Gaskets: Grade 30 specially compounded rubber of all new materials.

E. Bolts and nuts: High strength low alloy steel with heavy, semi-finished hexagon nuts to AWWA C111 (ANSI-A21.11).

2.8 WATER SERVICE PIPE:

A. Copper Tubing:
1. Copper tubing shall conform to the requirements of ASTM B88, Type K, annealed. Use for connection between plain end pipe of same or different material.
2. The tubing shall be coupled using flare-type compression fittings, conforming to the requirements of AWWA C800, minimum 150 psi working pressure.

B. Polyethylene Pipe:
1 Polyethylene Pipe to be used for water service lines 2 inches in size and smaller shall conform to the requirements of AWWA C901 Class 160 pse manufactured with PE 3406 material.
2. Bear the seal of the National Sanitation Foundation for potable water pipe.
3. Joints shall be made in accordance with the manufacturer's recommendations. Solvent welded pipe joints will not be permitted.

C. Polybutalene Pipe:
1. Polybutalene pipe to be used for water service lines 2 inches in size and smaller shall conform to the requirements of AWWA C902 Class 160 psi.
2. Bear the seal of the National Sanitation Foundation for potable water pipe.
3. Joints shall be made in accordance with the manufacturer's recommendations. Solvent welded pipe joints will not be permitted.

D. Compression Couplings:
1. Compression couplings for use in connecting plain end water service pipes shall be applicable for the type of pipe being coupled.
2. Compression couplings shall have armored gaskets when similar metal pipes are being joined.

E. Insulating Couplings:
1. Insulating couplings shall be required at any point of connection of two dissimilar metallic pipes (i.e., copper to galvanized iron or steel).

2.9 WATER SERVICE MATERIALS

A. Saddles:
1. Shall be ductile iron, bronze, or stainless steel, double straps or band type with standard tapping to match service requirements.

B. Corporation Stops:
   1. Conform to AWWA C800.
   2. Corporation stops for use with saddles shall be or bronze alloy with inlet I.P. standard thread and outlet thread compatible with connection piping with no special adapters.
   3. Corporation stops for direct tapping shall be bronze alloy with AWWA tapered thread inlet and outlet thread compatible with connecting pipe without special adapters.

C. Meter Stops:
   1. Meter stops shall be angle pattern with lock wings.

2.10. CONCRETE PIPE, NONREINFORCED

A. Concrete pipe under 12 inches in diameter shall be nonreinforced concrete pipe conforming to ASTM C14, Class 2, except as otherwise provided.

B. Joints shall conform to ASTM C443.

C. A differential load test shall be performed on the joints in addition to the joint tests specified in ASTM C443. The test section for the differential load test shall be supported on blocks so that one of the pipes is suspended freely between adjacent pipe bearing only on the joints. A force of 150 pounds per inch of diameter shall be applied over an arc of not less than 120` along a longitudinal distance of 12 inches immediately adjacent to one of the couplings. There shall be no visible leakage when the joint is subjected to 10 psi of hydrostatic pressure for a minimum of 10 minutes.

D. Proportion of Portland cement in concrete mixture shall be not less than 564 pounds per cubic yard of concrete.

2.11 CONCRETE PIPE, REINFORCED

A. Concrete pipe 12 inches and over in diameter shall be reinforced concrete pipe conforming to ASTM C76, Class IV, except as otherwise provided.

B. Joints shall conform to ASTM C443.

C. Non-reinforced concrete pipe conforming to ASTM C14 may be substituted for reinforced concrete pipe provided that the three-edge strength is equal to or greater than the ultimate specified for ASTM C76 pipe.

D. Basis of acceptance of pipe shall be the three edge bearing tests for load to produce 0.01 inch crack and the ultimate strength material tests outlined in ASTM C76 and by visual inspection.

E. A differential load test shall be performed on the joints of all pipe 24 inches and less in diameter in addition to the joint tests specified in ASTM C443. The test section for the differential load test shall be supported on blocks so that one of the pipes is suspended freely

between adjacent pipe bearing only on the joints. A force of 240 pounds per inch of diameter shall be applied over an arc of not less than 120` along a longitudinal distance of 12 inches immediately adjacent to one of the couplings. There shall be no visible leakage when the joint is subjected to 10 psi of hydrostatic pressure for a minimum of 10 minutes.

F. Proportion of Portland cement in concrete mixture shall be not less than 564 pounds per cubic yard of concrete.

2.12. VITRIFIED-CLAY PIPE

A. Conform to ASTM C700.

B. Joints shall conform to ASTM C425.

2.13 POLYVINYL CHLORIDE (PVC) SEWER PIPE

A. Conform to ASTM D3034, SDR 35, or ASTM F789.

B. Joints shall conform to ASTM D3212 using a restrained rubber gasket conforming to ASTM F477.

C. Fittings shall be injection molded tees or factory solvent welded saddle tees. Saddles fastened to pipe with external bands are not acceptable on any new system, unless specifically approved by the Engineer.

D. All PVC sewer pipe shall be considered flexible conduit.

E. Maximum size - 12 inches.

2.14 TEE FITTINGS FOR SEWERS

A. Unless otherwise specified, all tee connections shall be 6 inches inside diameter and shall be factory made.

B. All fittings shall be the same material as the pipe, unless otherwise specified. Cast iron fittings may be used for ductile iron pipe.

C. Fittings shall have sufficient strength to withstand handling and load stresses normally encountered.

D. All fittings shall be sealed with plugs of same material as the pipe and gasketed with the same gasket material as the pipe joint.

2.15 GALVANIZED CORRUGATED STEEL PIPE:

A. Conform To The Requirements Of AASHTO Designation M36, 16 Guage Unless Otherwise Provided.

B Coated uniformly inside and out with asphalt coating to meet the requirements of AASHTO Designation M190.

C. Coupling band shall meet the requirements of AASHTO m36 and wide enough to cover at least two annular corrugations. Gasket shall be provided.

D. When specified, galvanized steel end sections shall be flared, beveled shop-assembled units to serve as structural, hydraulic and aesthetic end treatment to corrugated steel culverts by threaded rods, by riveting or bolting per manufacturer's standard procedure. End sections shall have a turned down lip or toe plate at the wide end to act as a cut-off. The material for the end section shall be galvanized steel meeting the requirements of AASHTO M36 or same gauge as pipe.

2.16 CORRUGATED ALUMINUM ALLOY CULVERT PIPE

A. Conform to the requirements of AASHTO Destinations M196, 16 gauge unless otherwise noted.

B. Aluminum coupling bands shall meet the requirements for galvanized corrugated steel pipe and shall be by the same manufacturer as the pipe.

C. End sections shall comply with AASHTO Designation M196 and applicable requirements for galvanized metal end sections.

2.17 POLYETHYLENE ENCASING

A. Polyethylene film shall be manufactured of virgin polyethylene material confirming to the requirements of ASTM D-1248-68 Polyethylene Plastics Molding and Extrusion Materials.

B. Polyethylene film shall have a minimum nominal thickness of 0.008 m (8 mils). The minus tolerance of thickness shall not exceed 10 percent of the nominal thickness.

C. Tube size for each pipe diameter shall be as listed below:

Nominal Pipe Diameter	Flat Tube Width
3	14
4	16
6	20
8	24
10	27
12	30
14	34
16	37
18	41
20	45
24	54
30	67

2.18 DETECTABLE LOCATOR TAPE

A. The tape shall consist of a minimum 4.0 mil thickness, inert polyethylene plastic which is impervious to all known alkalis, acids, chemical reagents and solvents likely to be encountered in the soil, with a minimum 1/3-mil metallic foil. The tape shall be at least three inches (3") in width and shall be solid blue with identifying print in black letters. The tape shall have printed thereon the following or similar as commercially available:

"CAUTION - BURIED WATERLINE BELOW"

or

“CAUTION - BURIED SEWER LINE BELOW”

as appropriate.

The identifying lettering shall be minimum 1" high and repeated continuously the full length of the tap. In no instance shall the spacing of the individual segment of the identifying message be greater than eighteen inches (18").

B. Detectable locator tape shall be installed 18 inches above the pipe it identifies. The backfill shall be sufficiently leveled so that the tape will be installed on a flat surface. The tape shall be centered in the trench and laid flat with printed side up. Caution shall be exercised to avoid displacement of tape and to ensure its integrity. The remainder of the trench is then backfilled in accordance with applicable specifications.

3. EXECUTION

3.1 INSTALLATION

A. Install pipe in accordance with specification section for pipeline being installed.

* * * END OF SECTION * * *

SECTION 02640

VALVES

1. GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Inspection Services: Section 01420

B. Excavating, Backfilling and Compacting for Utilities: Section 02222

C. Pipe and Fittings: Section 02610

1.2 QUALITY ASSURANCE

A. Testing by Manufacturer:
   1. Manufacturer shall test all materials as required by these Specifications and the standards referenced.
   2. Manufacturer shall submit to the Engineer two (2) copies of all test results which shall include a certification that materials to be delivered are represented by the samples tested and that such delivered materials meet or exceed the specification requirements.
   3. No materials shall be delivered until test results and certifications are in the hands of the Engineer.
   4. Engineer shall have free access to all testing and records pertaining to materials to be delivered to the job site.
   5. The Engineer may elect to be present at any or all materials testing operations.

2. PRODUCTS

2.1 GATE VALVES - (UNDER 12 INCHES)

A. Conform to AWWA C509.

B. Iron body, bronze stem, resilient wedge.

C. O-ring stuffing box.

D. Open counter-clockwise unless otherwise specified.

E. Non-rising stem type.

F. Equipped with 2-inch standard operating nut.

G. Mechanical joint or push-on joint suitable for installation with the type and class of pipe being used or flanged where detailed.

H. All flange faces shall be machined. Flanges shall be drilled to straddle vertical centerline.

2.2 GATE VALVES - (12-INCHES AND LARGER)

A. Conform to applicable provisions of Article 2.1 for gate valves under 12 inches and the following additional requirements.

B. Arranged for operation in the horizontal position.

C. Equipped with bronze tracks fastened into a groove or slot within the valve body casting, together with bronze rollers, shafts, bushings and scrapers.

D. Gears shall be cut tooth steel gears, housed in heavy cast iron extended type grease cases.

E. Equipped with bypass of the size adopted as standard in the AWWA specification.

F. Provide three certified copies of performance tests, as specified in Section 5 of AWWA C509 to the Engineer for review.

2.3 BUTTERFLY VALVES

A. Conform to AWWA C504, Class 250B.

B. Suitable for direct burial.

C. Mechanical joint or push on joint suitable for installation with type and class of pipe being used or flanged where detailed.

D. Standard O-ring shaft seal.

E. Operator shall be traveling nut or worm gear type, sealed, gasketed and permanently lubricated for underground service.

F. Operator shall be designed to withstand all anticipated operating torques and designed to resist submergence in ground water.

G. Equipped with a standard two-inch operating nut.

H. Open counter-clockwise.

I. Flanges shall be drilled to match fittings.

2.4 STEM EXTENSION

A. Provide stem extension with standard operating nut and self-centering rockplate support for all valves with operating nut more than 4 feet below grade to raise operating nut to within 36 inches of the ground surface.

2.5 VALVE BOXES

A. Provide for all buried valves.

B. Valve boxes and tops shall be cast iron 2 piece slip joint type.

C. Lengths suitable for the particular project or as specified.

D. Base corresponding to size of valve.

E. Cover shall have the word "Water" cast on it.

2.6 VALVE MARKER POST

A. Shall have a 4-inch minimum square section and a minimum length of 42 inches, with beveled edges.

B. Contain at least one No. 3 bar reinforcing steel.

C. Paint exposed portion of the marker posts with two (2) coats of concrete paint in a color selected by the Owner.

D. Stencil the size of the valve and the distance in feet and inches to the valve on the face of the post, using black paint and a stencil which will produce letters 2 inches high.

2.7 COMBINATION AIR RELEASE VALVE

A. Designed to operate with potable water under pressure to allow entrapped air to escape from the pipeline.

B. Body and cover: Cast iron conforming to ASTM A48, Class 30.

C. Floats: Stainless steel conforming to ASTM A240 and designed to withstand 1,000 psi pressure.

D. Seats: Buna N rubber.

E. Internal Parts: Stainless steel or bronze.

F. Designed to withstand 300 psi pressure with normal operating pressure under 100 psi.

G. Manufactured by APCO or equivalent with following listed orifice sizes:

Model No.	Size of Valve	Large Orifice	Small Orifice
143C	1"	1"	5/64"
145C	2"	2"	3/32"
147C	3"	3"	3/32"

H. Vault shall be precast concrete meter box or utility vault as indicated on the detail.

2.8 COMBINATION SEWAGE AIR AND VACUUM RELEASE ASSEMBLY

A. Combination sewer air and vacuum release assembly shall consist of an air release valve and an air and vacuum valve.

B. Valves shall be constructed for minimum pressure of 150 psi. Some valves may operate at certain times at less than 20 psi. Supplier shall evaluate normal operating conditions for each valve and furnish a valve capable of seating under normal conditions.

C. Assembly shall be manufactured by APCO or equivalent, Series 400.

D. Air release valves shall be especially adopted for use with sewage and shall be designed to vent gases under pressure:
   1. Body and cover: Cast iron conforming to ASTM A48, Class 30.
   2. Float and pins in mechanism: Stainless steel conforming to ASTM A240. Float shall be designed to withstand a minimum pressure of 1,000 psi. Float stem shall be elongated to provide an air gap between the mechanism and the sewage.
   3. Seats: Bronze.
   4. Mechanisms: Bronze or stainless steel.

E. The sewage air and vacuum valve shall be specially designed for use with sewage and shall be designed to vent large quantities of air when filling the line and to allow air to re-enter the line when the line is being drained:
   1. Body, cover and baffle: Conforming to ASTM A48, Class 30.
   2. Two floats having a common stainless steel float guide shall be provided. Floats shall be stainless steel conforming to ASTM A240 and designed to withstand a minimum pressure of 1,000 psi.
   3. Seats: Buna N rubber.
   4. Float stem and guides: Bronze or stainless steel.

F. Valves shall be provided with quick disconnect couplings and valves to permit backflushing without dismantling.

G. Vault Cover:
   1. Design Load: H-20 traffic load 300 PSF minimum.
   2. Door Leaf: 5/16-inch steel diamond pattern plate.
   3. Access door shall be single leaf type, Utility Vault Co. or equivalent.
   4. Door and frame shall be for dimensions shown.
   5. Provide spring assisted operators for opening and hold open arm with release handle.
   6. Provide recessed padlock hasp.
   7. Hardware shall be cadmium plated. Factory finish shall be prime coat of red oxide applied to steel doors and frames.

H. Vault shall be precast concrete utility vault as manufactured by utility vault company or equivalent designed for H-20 traffic loads.

I. Vent shall be galvanized steel pipe.

2.9 VALVE VAULT HEATER

A. Provide when insulated vault is specified.

B. Conform to requirements of National Electric Code (NEC) latest edition.

C. Provision of electrical service is incidental to heater installation.

2.10 TAPPING SLEEVE AND VALVE ASSEMBLY

A. Furnished with flanged inlet end connections having a machined projection on the flanges to mate with a machined recess on the outlet flanges of the tapping sleeves and crosses.

B. Outlet ends shall conform in dimensions to the AWWA Standards for hub or mechanical joint connections, except that the outside of the hub shall have a large flange for attaching a drilling machine.

C. Seat opening of the valves shall be larger than normal size to permit full diameter cuts.

D. Tapping sleeves shall be cast iron, stainless steel, epoxy-coated steel, or other approved materials.

3. EXECUTION

3.1 GATE VALVE OR BUTTERFLY VALVE INSTALLATION

A. Valves shall be accurately set at places designated on the drawings.

B. Inspect each valve for defects.

C. Adjust stuffing boxes to ensure watertightness without binding the stem.

D. Set valve and valve box plumb.

E. Set lower casting of valve box so that it is supported by a styrofoam collar not less than 2 inches in thickness.

F. Tamp backfill around valve box to a minimum distance of 3 feet on all sides or to face of trench.

G. Set valve box cover flush with surface.

3.2 VALVE MARKER POST

A. Where required, set valve marker post at edge of right of way opposite the valve.

B. Leave 18 inches of post exposed above grade.

3.3 INSTALLATION OF COMBINATION AIR RELEASE VALVE

A. Install in accordance with standard detail.

B. Locate so that high point of water main is vented.

C. Pipe between main and valve shall slope upward.

D. Locate valve adjacent to property line unless otherwise indicated.

3.4 INSTALLATION OF COMBINATION SEWAGE AIR AND VACUUM RELEASE ASSEMBLY

A. Install in accordance with standard detail.

B. Locate so that high point of sewage force main is vented.

C. Adjust grade of force main so that valve assembly can be properly installed.

D. Pipe shall slope upward from force main to valve assembly.

E. Locate valve adjacent to property line unless otherwise indicated.

3.5 BLOCKING

A. Provide blocking for valve not connected to fitting with bolted connection.

3.6 TESTING

A. Test valves along with pipeline in which they are installed.

* * * END OF SECTION * * *

SECTION 02645

HYDRANTS

1. GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Inspection Services: Section 01420

B. Excavating, Backfilling and Compacting for Utilities: Section 02222

C. Pipe and Fittings: Section 02610

D. Valves: Section 02640

E. Water Lines: Section 02660

1.2 QUALITY ASSURANCE

A. Testing by Manufacturer:

1. Manufacturer shall test all materials as required by these Specifications and the standards referenced.
2. Manufacturer shall submit to the Engineer two (2) copies of all test results which shall include a certification that materials to be delivered are represented by the samples tested and that such delivered materials meet or exceed the specifications requirements.
3. No materials shall be delivered until test results and certifications are in the hands of the Engineer.
4. Engineer shall have free access to all testing and records pertaining to materials to be delivered to the job site.
5. The Engineer may elect to be present at any or all materials testing operations.

2. PRODUCTS

2.1 FIRE HYDRANTS

A. Conform to AWWA C502 except as herein modified.

B. Main valve opening of the hydrant shall be a minimum of 5-inch diameter.

C. Provide mechanical or flanged joint outlet with an auxiliary gate valve and valve box. Suitable lugs for anchor rods shall be provided.

D. One pumper nozzle to match Owner's existing pattern, two (2) two and one-half inch (2-1/2") hose nozzles shall be provided.

E. Provide pentagon operating nuts.

F. Open by turning counterclockwise.

G. Nozzles and operating nuts shall be identical with the Owner's existing equipment or as elsewhere provided.

H. Nozzles shall be equipped with bronze nipples screwed into the hydrant and locked in place.

I. Depth of clear cover over the pipe shall be three feet (3') unless larger depth or cover is required where the hydrant is installed.

J. Provide sidewalk flange and safety stem coupling which will allow hydrant barrel to separate with minimum damage.

K. Interior and exterior of hydrant to have an epoxy coating. Exterior color of “International Yellow”.

L. The Contractor shall furnish the location of the nearest point at which replacement working parts are stocked.

M. Hydrant barrel extension standard of manufacturer of hydrant provided.

N. Hydrants shall be as manufactured by CLOW Medallion – Series 2500, or approved equal.

2.2 GUARD POST

A. Precast concrete 8 inches in diameter by six feet long constructed with concrete having minimum strength of 3500 psi.

B. Reinforcing shall consist of minimum of five No. 3 deformed steel bars.

2.3 YARD HYDRANTS

A. Frost Proof Hose Bibbs:
1. Type: Non-freeze, exposed head, stop and waste post hydrant with non-turning operating rod with free-floating compression closure valve, drain port, and operating key lock.
2. Size: 1-inch.
3. Hose Connection: 1-inch American National straight.
4. Rating: 150 psi.
5. End: Screwed.
6. Casing: Bronze.
7. Casing Guard: Cast aluminum.
8. Exposed Head: Bronze.
9. Interior Parts: All bronze.

B. Curb Stop and Waste Valves:
1. Type: 90` turn plug, solid tee head, with check and drain port.
2. Size: Same as line size.

3. Rating: 150 psi.
4. Body and Trim: Bronze.
5. Ends: Screwed.
6. Operators: Two portable tee wrenches supplied to service all buried yard curb stop and waste valves.
7. Service Boxes: Cast iron, 2 1/2-inch minimum shaft diameter, cast iron lids marked "Water".

3. EXECUTION

3.1 SETTING HYDRANTS

A. Hydrants shall be inspected in the field upon arrival to ensure proper working order.

B. Hydrants shall be installed in accordance with the standard detail.

C. Hydrants shall not be installed within 3 feet of a traveled roadway.

D. A minimum 3-foot radius unobstructed working area shall be provided around all hydrants.

E. Sidewalk flange shall be set 2 inches above finished grade.

F. Hydrants shall be set on concrete blocks.

G. Hydrant drain shall waste into a pit of 1-1/4-inch minimum washed rock situated at the base of the hydrant as shown in the detail.

H. Hydrant laterals under 50 feet long shall consist of a section of 6-inch ductile iron pipe from the main to the hydrant and shall include an auxiliary gate valve set vertically and placed in the line as indicated in the detail.

I. Hydrant branches over 50 feet long shall consist of a section of 8 inch ductile iron pipe and include required reducer to connect to hydrant.

J. Hydrants shall be restrained as shown in the detail. Shackle rods shall be cleaned and painted after installation with 2 coats of asphalt varnish, or with such other bituminous paint as may be approved by the Engineer.

K. The exposed portion of the hydrant shall be painted with one field coat. The type and color of the paint will be designated by the Owner.

L. Any new or existing hydrant not in service shall be identified by covering with a burlap or plastic bag.

M. Install guard posts only where specifically directed by the Owner.

3.2 RESETTING OR RELOCATING EXISTING HYDRANTS

A. Conform to applicable requirements for setting new hydrants.

B. Materials requirements to be adjusted to field conditions.

3.3 HYDRANT BARREL EXTENSIONS

A. Provide where required due to placement of main at greater than normal depth or for adjustment to surface grade.

3.4 TESTING

A. Test hydrants along with pipeline on which they are installed.

* * * END OF SECTION * * *

SECTION 02660

WATER LINES

1. GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Field Engineering: Section 01050

B. Inspection Services: Section 01420

C. Dewatering: Section 02140

D. Shoring: Section 02150

E. Excavating, Backfilling and Compacting for Utilities: Section 02222

F. Pipe and Fittings: Section 02610

G. Valves: Section 02640

H. Hydrants: Section 02645

I. Existing Utilities/Facilities-Underground and Overhead: Section 02760

1.2 QUALITY ASSURANCE

A. Testing before acceptance:
   1. The Engineer may require that the first section of pipe, not less than 1,000 feet in length, installed by each of the Contractor's crews, be tested in order to qualify the crew and/or the material.
   2. Pipelaying shall not be continued more than an additional 1,000 feet until the first section has been tested successfully.

B. Final acceptance:
   1. Prior to final inspection all pipelines shall be flushed and cleaned of all debris, disinfected and hydrostatically tested.
   2. Any corrections required shall be made at the expense of the Contractor and the line retested.

2. PRODUCTS

2.1 BEDDING MATERIALS

A. Conform to Section 02222.

2.2 ALTERNATE PIPE MATERIALS

A. Pipe used for water line construction may be either ductile iron, or polyvinyl chloride pressure pipe as specified in Section 02610 unless otherwise specified.

B. Pipe for water services shall be as indicated on the detail for the utility and as specified in Section 02610.

C. When ductile iron pipe is specified, no substitute is permitted.

D. Steel pipe shall be used only where specifically called for on the drawings.

3. EXECUTION

3.1 BEDDING FOR RIGID PIPE

A. Bedding for rigid pipe except ductile iron shall be as specified in Section 02222.

B. Unless otherwise ordered, bedding for ductile iron may be native bedding material, free of stones.

C. Bedding shall be carefully placed under the pipe and to a depth of at least six (6) inches over the top of the pipe.

D. Bedding shall be thoroughly rammed and tamped around the pipe with the proper tools, so as to provide firm and uniform support over the full length of all pipe, valves and fittings.

E. Care shall be taken to prevent any damage to the pipe or its protective coating.

3.2 BEDDING FOR FLEXIBLE PIPE

A. Material to be used for bedding for flexible pipe shall be sand/gravel material as specified in Section 02222.

B. Bedding shall be placed in more than one lift. The first lift is to provide at least a 4-inch thickness under any portion of the pipe and shall be placed before the pipe is installed, and shall be spread smoothly so that the pipe is uniformly supported along the barrel.

C. Subsequent lifts of not more than 6-inch thickness shall be installed to 6 inches over the crown of the pipe and individually compacted to 90 percent of maximum density.

3.3 PIPE LAYING

A. Pipe laying shall be done in accordance with the Specifications and instructions of the manufacturer of the kind of pipe used.

B. Tools designed especially for installing each particular type and kind of pipe shall be used.

C. Short lengths and field cut joints:
   1. Short lengths of pipe supplied by the manufacturer shall be used to provide the proper spacing of valves, tees or special fittings.
   2. Whenever it becomes necessary to cut a length of pipe, the cut shall be made by abrasive saw or by a special pipe cutter.
   3. Pipe ends shall be square with the longitudinal axis of the pipe and shall be reamed and otherwise smoothed so that good connections can be made.
   4. Threads shall be cleanly cut.
   5. Flaring of copper tubing shall be accurately and smoothly done.
   6. All operations for any connection shall be carefully done in accordance with the manufacturer's instructions.

D. Laying of pipe on curves:
   1. Long radius curves, either horizontal or vertical, may be laid with standard pipe by deflections at the joints or by the use of shorter lengths of pipe.
   2. When pipe is laid on a curve, the pipe shall be jointed in a straight alignment and then deflected to the curved alignment.
   3. Where field conditions require deflection or curves not anticipated by the Plans, the Contractor shall use deflected joints, short lengths or special fittings as required. No additional payment will be made for laying pipe on curves as shown on the Plans or for field changes involving pipe deflected at the joints. When special fittings not shown on the Plans are required to meet field conditions, additional payment will be made for fittings.
   4. Maximum deflections at pipe joints and laying radius for various pipe lengths shall be as recommended by the pipe manufacturer.

E. Contamination prevention:
   1. Pipe, fittings and valves shall be carefully cleaned of all dirt and foreign material as they are placed.
   2. Open ends of pipe and fittings shall be plugged with a temporary watertight plug whenever work is stopped and/or when water in the trench threatens to enter the pipe.
   3. Groundwater shall be excluded from the pipe at all times.
   4. Particular care shall be exercised to guard against the entrance of sewage into the water line trench during the course of construction. All sewer lines, house side sewers or other subsurface drains should be located prior to excavation. Adequate provision shall be made for the flow of sewers, drains, and other watercourses during construction.

F. Condition of pipe and fittings:
   1. The interior of all pipe, fittings and other accessories stockpiled on the project shall be kept free of dirt and other foreign matter at all times.
   2. Each pipe, fitting or other accessory shall be carefully inspected and thoroughly cleaned of any dirt or foreign matter that might be present on the inside.
   3. Cleaning shall be accomplished prior to lowering the pipe or other accessories into the trench.
   4. Care shall be taken to keep materials internally clean after the pipe is placed in the trench.

3.4 BLOCKING AND BRACING

A. Blocking and bracing of the pipe and fittings shall be placed so as to secure bearing on undisturbed earth.

B. Blocking and bracing size shall be determined by the Contractor and shall be of sufficient proportions and installed so as to withstand the required test pressure and operating conditions.

C. Concrete shall be placed in back of all fittings with unbalanced thrust. Pre-cast blocking shall not be used.

D. Blocking shall not be covered up until it has been seen by the Engineer.

E. Blocking shall be formed so that bolts, joints, gaskets, and flanges of adjacent joints are clear of the concrete and so that bolts and joints can be dismantled without removing the concrete.

F. At tees and crosses where future mains connect, a pre-cast concrete brick may be used between fittings and thrust block.

3.5 CONNECTION TO EXISTING WATER MAINS

A. An approved backflow prevention assembly (double check valve assembly or better) must be used on the supplying water line when filling the new water main during disinfection and flushing. The assembly and supply piping must be removed or isolated during hydrostatic pressure testing of the new main.

B. Type of connections shall be as shown on the Drawings.

C. Wet tap connections made without shutting off the existing line shall be made unless otherwise approved by the Owner.

D. Connections to the existing water main shall not be made without first making the necessary arrangements with the Owner in advance.

E. Work shall not be started until all of the materials, equipment and labor necessary to properly complete the work are assembled on the site.

F. When work is once started on this connection, it shall proceed continuously without interruption and as rapidly as possible until completed. No shut-off of mains will be permitted overnight or over weekends or holidays.

G. If the connection to the existing system involves turning off the water, the Contractor shall be responsible for notifying the residents affected by the shut-off. The Owner will advise which owners are to be notified.

H. The Contractor may be required to perform the connection during times other than normal working hours.

I. The Contractor shall not operate any valves on the existing system without specific permission of the Owner.

J. The types of connections are varied and suggested pipe arrangements have been shown on the Plans. In general, they involve deflecting new pipe to match the existing pipe alignment and utilization of necessary fittings and new pipe. For the installation of these connections, the surfaced portion of the road shall not be penetrated unless the connecting point is directly under it. For connection by any other method, the Contractor shall furnish a detailed sketch for approval not less than one week prior to the expected construction.

K. Interior of pipe and fittings used in making connections shall be swabbed or sprayed with a 1% solution of hypochlorite before they are installed.

L. Exterior of main shall be cleaned and interior surface of tapping sleeve shall be dusted with calcium hypochlorite powder before tapping sleeve is installed.

M. Installation of tapping tee shall be tested with air or water at a minimum pressure of 100 psi before cutting into the existing line.

N. Any replacement pipe used for cutting into existing mains shall be same material and strength as existing pipe except that ductile iron may be substituted for other materials.

3.6 EXISTING SYSTEM MAINTENANCE

A. The Contractor shall acquaint himself with all aspects of the existing system prior to starting construction on new mains. Pertinent information concerning existing system may be obtained from the Owner and from the Owner's records.

B. Materials, fittings, pumps, equipment and qualified personnel must be available on the project at all times during construction, so that in the event of damage to or disruption of the existing water system service there will be immediate repair and restoration by the Contractor. Any unnecessary delay in repairs or service restoration

due to Contractor's failure to adhere to these requirements shall be reason to immediately suspend any further new main installation until repairs are completed to the Owner's satisfaction.

C. Existing water services shall be located by the Contractor prior to beginning work so that it may be properly protected and maintained in service during construction and during the changeover from the existing pipes to the pipe installed under this Contract.

3.7 SERVICE CONNECTIONS

A. Service connections to water mains except ductile iron Class 52 or stronger shall be made using saddles of the size and type suitable for use with the pipe being installed.

B. Ductile iron Class 52 or stronger may be direct tapped with a corporation stop.

C. The depth of trenching for service connection piping shall be such as to provide cover over the top of the pipe as shown on the service detail.

D. Particular care shall be exercised to assure that the main is not damaged by installation of the service line.

E. Service lines shall be cut using a tool or tools specifically designed to leave a smooth, even, and square end on the piping material to be cut. Cut ends shall be reamed to the full inside diameter of the pipe.

F. Where shown in the plans, existing water service connections shall be reconnected to the new water mains installed under this Contract using the materials specified. The location of water service connections shall be verified in the field by the Contractor.

G. Pipe materials used to extend or replace existing water service lines shall be in accordance with utilities standard details for new service.

H. Insulating couplings shall be used at any connection between galvanized steel or iron pipe and copper pipe.

I. Contractor shall arrange his work to minimize interruptions of water service to existing water customers.

J. Line shall be installed, tested and disinfected up to point of connection prior to interruption of service.

K. Customer shall be notified prior to shutting off service. Time that water is shut off shall be held to a minimum.

3.8 HYDROSTATIC PRESSURE TEST

A. Water mains and appurtenances (including water service connections on new water mains) shall be tested in sections of convenient length under a hydrostatic pressure equal to 150 psi in excess of that under which they will operate.

B. The pumps, gauges, plugs, saddles, corporations, miscellaneous hose and piping, and measuring equipment necessary for performing the test shall be furnished and operated by the Contractor.

C. Pipeline shall be backfilled sufficiently to prevent movement of pipe under pressure.

D. Thrust blocks shall be in place and time allowed for the concrete to cure before testing.

E. Procedure:

1. The mains shall be filled with water and all air removed prior to starting the test.
2. The test shall be accomplished by pumping the main up to the required pressure; stop the pump for fifteen (15) minutes, and then pump the main up to the test pressure again.
3. The quantity of water required to restore the pressure shall be accurately determined by pumping through a positive displacement water meter with a sweep unit hand registering 1 gallon per revolution. The meter to be approved by the Engineer.
4. Acceptability of the test will be determined by two factors:
   a. The quantity of water lost from the main shall not exceed the number of gallons per hour as determined by the formula:

$$L = \frac{ND\,(P)^{0.5}}{7{,}400}$$

in which

L = Allowable leakage, gallons/hour
N = No. of joints in the length of pipeline tested
D = Nominal diameter of the pipe in inches
P = Average test pressure during the leakage test, psig

   b. There shall not be an appreciable or abrupt loss in pressure during the fifteen (15) minute test period.
5. Gauges used in the test shall be accompanied with satisfactory certifications of accuracy from a laboratory approved by the Engineer.

F. All tests shall be made with the hydrant gate valves open and pressure against the hydrant valve. After the test has been completed, each gate valve shall be tested by closing each in turn and relieving the pressure beyond. This test of the gate valve will

be acceptable if there is no immediate loss of pressure on the gauge when the pressure comes against the valve being checked.

G. Sections to be tested shall normally be limited to 1,500 feet.

H. Prior to calling out the Engineer to witness the pressure test, the Contractor shall have all equipment set up completely ready for operation and shall have successfully performed the test to assure himself that the pipe is in a satisfactory condition.

3.9 DISINFECTION OF MAINS

A. Before being placed in service, all new water mains and repaired portions of, or extensions to, existing mains shall be chlorinated and a satisfactory bacteriological report obtained.

B. Temporary or permanent physical connections shall not be allowed between the existing distribution system and non-disinfected pipelines constructed under this Contact without a State Department of Health approved backflow preventer (double check valve assembly or better) temporarily installed in the connecting line.

C. Main sterilization shall be accomplished by either of the following two methods at the Contractor's option. No other method of sterilization will be accepted by the Engineer, unless, prior to use, the Contractor obtains written approval from the Engineer.

D. Method No. 1:
   1. A chlorine gas-water mixture, or dry chlorine gas may be applied by means of a chlorinator, or the gas may be fed directly from a chlorine cylinder equipped with the proper devices for regulating the flow, and the effective diffusion of gas within the pipe. Use of the chlorinator is preferred to direct feed from the cylinder.
   2. The preferable point of application for the chlorinating agent is at the beginning of the pipeline extension, or any valved section thereof, and through a corporation cock inserted in the horizontal axis of the pipe. The water injector for delivering the gas-water mixture into the pipe may be supplied from a tap on the pressure side of the gate valve controlling the flow into the pipeline extension. In a new system, application may be at the pumping station, elevated tank, standpipe, or reservoir.
   3. Water from the existing distribution system, or other source of supply, shall be controlled to flow very slowly into the newly laid pipeline during application of the chlorine. The rate of chlorine gas-water mixture or dry gas feed shall be in such proportion that the rate of water entering the newly laid pipe will be at least 50 parts per million.
   4. Back pressure, causing a reversal of flow in the pipe being treated, shall be prevented.
   5. Treated water shall be retained in the pipe at least twenty-four (24) hours. After this period, the chlorine

residual at pipe extremities and at other representative points shall be at least twenty-five (25) parts per million.

6. In the process of chlorinating newly laid water pipe, all valves or other appurtenances shall be operated while the pipeline is filled with the chlorinating agent.
7. Following chlorination, all treated water shall be thoroughly flushed from the newly laid pipe at its extremity, until the replacement water throughout its length, upon test, shows the absence of chlorine or in the event chlorine is normally used in the source of supply, until the tests shall show a residual not in excess of that carried by the system.
8. Should the initial treatment prove ineffective, the chlorination procedures shall be repeated until tests show that the water sample from the newly laid pipe conforms to the requirements of this Specification.

E. Method No. 2:

1. A mixture of either calcium or sodium hypochlorite of known chlorine content and water may be substituted as an alternative for liquid chlorine. (Typical commercial products of this type are HTH, Perchloron, Clor, Purex, etc.).
2. Prepare a solution containing approximately 5% available chlorine by weight, in the case of HTH or Perchloron, at 70% available chlorine, use 6 pounds per 10 gallons of water. In the case of Clor, at 15% available chlorine, add 2 parts of water to 1 part of Clor. For other strength compounds, adjust dilutions accordingly.
3. To prepare the chlorine compound-water mixture, first make a paste, and then thin to a slurry, to ensure getting all active ingredients into solution. The prepared solution shall be injected by means of a hypochlorinator, or hand or engine operated pump. Retention time, parts per million and pumping into the newly laid pipe shall follow the conditions outlined under Method No. 1 for chlorine applications.
4. Provisions for flushing and bacteriological testing under this alternative shall be the same as those described in Method No. 1 above.

F. Before placing the lines in service, a satisfactory report or approval shall be received by the Owner on samples collected from representative points in the new system.

G. Sterilized sample bottles and/or instructions shall be obtained by the Contractor from the laboratory where the samples will be tested unless the Owner directs otherwise. Bacteriological test samples will be taken by the Owner. Corporation stops shall be inserted in the main by the Contractor at all locations required to take bacteriological test samples. If original test samples prove unsatisfactory, a charge of $25.00 will be made for processing each additional sample.

H. Discharge of hypochlorinated water to surface waters is strictly prohibited. The environment to which the chlorinated water is to be discharged shall be inspected by the Owner and, if there is any

question that the chlorinated discharge will cause damage to the environment, a reducing agent shall be applied to the water to be wasted to neutralize the chlorine residual remaining in the water. Disposal may be made to any available sanitary sewer provided the rate of disposal does not overload the sewer and the disposal is approved by the sewer agency having jurisdiction. The sewer agency shall be given 48 hours advance notice of such disposal. Where necessary, federal, state, and local regulatory agencies should be contacted to determine special provisions for the disposal of heavily chlorinated water.

3.10 FLUSHING THE MAINS

A. Upon completion of pipe laying, chlorination and pressure testing, all dirt and foreign matter shall be removed by a thorough flushing through all hydrants, blowoffs or other approved means. Each section of newly laid pipe between valves or dead ends shall be flushed independently, and fire hydrants or other dead end appurtenances shall be flushed simultaneously with the parent line. A minimum flushing velocity of 2.5 fps shall be developed in the main.

B. The Contractor shall be responsible for scheduling and organizing his work so as to use flushing water only during off-peak hours and in the most economical manner.

C. Taps required by the Contractor for temporary or permanent release of air, chlorination or flushing purposes shall be provided by the Contractor as a part of the construction of water mains.

D. No flushing shall be performed without the prior approval of the Owner.

3.11 CHLORINATING CONNECTIONS TO EXISTING WATER MAINS AND WATER SERVICE CONNECTIONS

A. The chlorinating procedure to be followed shall be as specified in AWWA Standard C651. All closure fittings shall be swabbed with a very strong chlorine solution at least as strong as liquid household bleach (5-6% Cl).

3.12 PLACING IN OPERATION

A. Upon completion of the work and before its final acceptance, the entire system shall be put in operation under normal pressure and operated at that pressure for a period of not less than ten (10) days by the Contractor.

B. Any leaks or defects in the construction of the system that may develop, shall be repaired and the test continued until the system is practically watertight.

C. No provision of this Section shall be construed as waiving any provision of the Contractor's guarantee.

* * * END OF SECTION * * *

SECTION 02720

STORM DRAINAGE

1. GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Field Engineering: Section 01050

B. Inspection Services: Section 01420

D. Dewatering: Section 02140

E. Shoring: Section 02150

F. Excavating, Backfilling and Compacting for Utilities: Section 02222

G. Manholes and Cleanouts: Section 02605

H. Pipe and Fittings: Section 02610

I. Existing Utilities/Facilities - Underground and Overhead: Section 02760

1.2 QUALITY ASSURANCE

A. Testing before acceptance: The Engineer may require that the first section of pipe, not less than 300 feet in length, installed by each of the Contractor's crews be tested in order to qualify the crew and/or the material. Pipelaying shall not be continued more than an additional 300 feet until the first section shall have been tested successfully.

B. Final acceptance: Prior to final inspection all pipelines shall be flushed and cleaned and all debris removed. Before storm drains are accepted, all lines shall be tested for leakage as specified herein and inspected for line and grade by checking each section between catch basins for alignment. A full circle of light shall be seen by looking through the pipe at a light held in the catch basin at the opposite end of the section of storm drain being inspected.

2. PRODUCTS

2.1 BEDDING MATERIALS

A. Refer to Section 02200.

2.2 GENERAL REQUIREMENTS FOR PIPE MATERIAL

A. Pipe used for storm drainage construction may be of nonreinforced concrete, reinforced concrete, vitrified clay, polyvinyl chloride, ductile iron, galvanized corrugated steel pipe or corrugated aluminum alloy as specified in Section 02610 unless otherwise provided.

B. All pipe shall have flexible watertight joints utilizing rubber gaskets.

C. All pipe shall meet the minimum strength requirements as specified for concrete pipe unless otherwise provided. Any rigid pipe material substituted for the class specified shall have a minimum three-edge strength equal to or greater than that of the concrete pipe class indicated. Flexible pipe of the class specified herein or on the drawings shall be considered equivalent in load supporting capacity to rigid pipe as indicated, unless otherwise specified.

D. When ductile iron pipe is specified, no substitute is permitted.

E. Design is based on smooth wall pipe with a Manning friction factor of n = 0.013. Contractor may substitute larger size corrugated pipe upon approval of the Engineer. Review will be based on using a friction factor of n = 0.024.

2.3 CATCH BASINS AND INLETS

A. Catch basins and inlets may be constructed of precast units, concrete masonry units, or of concrete or clay brick, or cast-in-place concrete, all in accordance with the drawings.

B. Precast units shall conform to the applicable requirements of ASTM C478.

2.4 FRAME AND GRATE FOR CATCH BASINS AND INLETS

A. Conform to Standard Drawings.

B. Casting for metal frame shall be cast steel, cast iron, or ductile iron.

C. Casting for grates shall be cast steel or ductile iron.

D. Steel castings shall conform to the requirements of ASTM A27, Standard Specification for Steel Castings, Carbon, for General Application, Grade 70-36.

E. Cast iron castings shall conform to the requirements of ASTM A48, Class 30.

F. Ductile iron castings shall conform to the requirements of ASTM A536, Grade 80-55-06.

G. Repair of defects by welding shall not be permitted.

H. Dimensions to have $\pm$1/16 inch tolerance.

I. Machine or grind supporting pads for solid non-rocking bearing in any of four possible positions in frame.

J. Foundry name shall be embossed on top of grate. Lettering to be recessed 1/16 inch.

K. Material used for grate shall be designated by embossing "DI" (ductile iron) or "CS" (cast steel) near manufacturer's name.

3. EXECUTION

3.1 INSTALLATION

A. Conform to applicable requirements of Section 02730 except as modified herein.

3.2 BEDDING FOR CORRUGATED METAL PIPE

A. Material for sidefill around and to the crown elevation of corrugated metal pipe shall be selected and shall not contain stones larger than 3 inches in greatest dimension, frozen lumps, roots, or moisture in excess of that permitting through compaction.

B. Material placed within the pipe compaction zone shall be brought up simultaneously on each side of the pipe to the top of the pipe and compacted to 90% density as defined by Section 02222.

3.3 TREATMENT OF ALUMINUM PIPE

A. Whenever plain aluminum pipe is used where it will be in contact with concrete or concrete pipe, all aluminum surfaces in contact with the concrete or concrete pipe shall be painted with 2 coats of asphalt paint.

3.4 CATCH BASINS AND INLETS

A. Construction details for catch basins and inlets shall follow all applicable provisions for construction of manholes.

B. Backfill around catch basins shall be placed around the catch basins and compacted in successive layers six (6) inches in thickness and up to six (6) inches over the crown of the highest pipe connected to the catch basin.

C. The inlet frame may be either cast into a concrete collar or set flange down on concrete adjustment blocks and mortared.

D. Inlet frame shall not be grouted to final grade until the final elevation of the pavement, gutter, ditch, or sidewalk in which it is to be placed has been established.

E. Location of catch basins will be staked by the Engineer.

F. All openings in the walls of catch basins constructed with precast sections for the insertion of pipe connections and outlet trap castings shall, after pipe or castings have been placed to their final position, be grouted tightly in place to present an inside and outside surface conforming to the Standard Details.

G. The spigot end of the pipe shall be cut square with the last point of contact with the inside wall surface.

* * * END OF SECTION * * *

SECTION 02730

SANITARY SEWERS

1. GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Field Engineering: Section 01050

B. Inspection Services: Section 01420

D. Dewatering: Section 02140

E. Shoring: Section 02150

F. Excavating, Backfilling and Compacting for Utilities: Section 02222

G. Manholes and Cleanouts: Section 02605

H. Pipe and Fittings: Section 02610

I. Sewer Force Mains: Section 02732

J. Existing Utilities/Facilities-Underground and Overhead: Section 02760

1.2 QUALITY ASSURANCE

A. Testing before acceptance:
1. The Engineer may require that the first section of pipe, not less than 300 feet in length, installed by each of the Contractor's crews be tested in order to qualify the crew and/or the materials.
2. Pipelaying shall not be continued more than an additional 300 feet until the first section shall have been tested successfully.

B. Final acceptance:
1. Prior to final inspection all pipelines shall be flushed and cleaned and all debris removed.
2. Before sewer lines are accepted, all lines shall be tested as specified herein and inspected for line and grade by checking each section between manholes for alignment. A full circle of light shall be seen by looking through the pipe at a light held in the manhole at the opposite end of the section of sewer line being inspected.
3. All lines shall be tested for leakage.
4. Deflection test shall be performed on all flexible pipe.
5. Owner may elect to perform a TV inspection.
6. Any corrections required shall be made and the line retested.

1.3 PROTECTION OF LIVE SEWERS

A. All existing live sewers including septic tanks and drain fields shall remain in service at all times. Adequate provision shall be made for disposal of existing sewage flow if any existing sewers are damaged.

B. Any damage to the Owner's existing system shall be repaired to a condition equal to or better than that existing prior to the damage at no cost to the Owner.

C. The existing system is discharged through some sewers with flat grades and in some cases through lift stations. All water accumulating during construction shall be removed from the new sewers and shall not be permitted to enter the existing system. The Contractor will be required to flush out the existing lines and/or repair lift stations or other facilities if gravel, rocks, or other debris are permitted to enter the existing lines.

D. The physical connection to an existing manhole or sewer line shall not be made until so authorized by the Owner. This authorization will not be given until all upstream lines have been completely cleaned, all debris removed, and, where applicable, a pipe temporarily placed in the existing channel and sealed.

1.4 USE OF SEWERS PRIOR TO COMPLETION

A. The Owner hereby reserves the right to make use of any portion of the work prior to completion of the entire Contract without invalidating the Contract and without constituting acceptance of any of the work.

2. PRODUCTS

2.1 BEDDING MATERIALS

A. Refer to Section 02222.

2.2 GENERAL REQUIREMENTS FOR PIPE MATERIAL

A. Pipe used for sewer construction may be nonreinforced concrete, reinforced concrete, vitrified clay, polyvinyl chloride (PVC) or ductile iron as specified in Section 02610 unless otherwise provided.

B. All pipe shall have flexible watertight joints utilizing rubber gaskets.

C. All pipe shall meet the minimum strength requirements as specified for concrete pipe unless otherwise provided. Any rigid pipe material substituted for the class specified shall have a minimum three-edge strength equal to or greater

than that of the concrete pipe class indicated. Flexible pipe of the class specified herein or on the drawings shall be considered equivalent in load supporting capacity to rigid pipe as indicated, unless otherwise specified.

D. When ductile iron pipe is specified, no substitute is permitted.

3. EXECUTION

3.1 SURVEY LINE AND GRADE

A. The Contractor shall constantly check line and grade of the pipe and in the event they do not meet specified limits, the work shall be immediately stopped, the Engineer notified, and the cause remedied before proceeding with the work.

3.2 BEDDING

A. Proper preparation of foundation, placement of foundation material where required, and placement of bedding material shall precede the installation of all sewer pipe. This shall include the necessary preparation of the native trench bottom and/or the top of the foundation material as well as placement and compaction of required bedding material to a uniform grade. Backfill material around the pipe will be placed in a manner to meet requirements specified herein.

B. If no bedding class is specified for rigid pipe, Class B bedding shall be provided.

C. Class F bedding shall be provided for all flexible pipe.

D. The pipe bedding shall be placed so that the entire length of the pipe will have full bearing on the bedding. No blocking of any kind shall be used to adjust the pipe to grade except when used with embedment concrete. Bell holes shall be dug to ensure uniform support along the pipe barrel.

E. It may be necessary to change bedding classifications and the limits thereof during the progress of the construction, consistent with the requirements outlined under the definitions and requirements of the various classifications contained herein.

F. Where unauthorized excavation has been made below the established grade, the Contractor shall provide, place and compact suitable bedding material to the proper grade elevation.

G. Classification of bedding:

1. Class A (Special Concrete Bedding) shall consist of a pipe cradle constructed of Portland cement concrete containing not less than four (4) sacks of cement per yard. Maximum aggregate size shall be 1/2 inch.

Maximum slump shall be 4 inches. The Contractor shall protect pipe against flotation during the pouring of the concrete. The bottom of the trench shall be fully compacted before placement of pipe or cradle. Cradle construction shall conform to the Standard Detail.

2. Class B (Normal Gravel Bedding) shall consist of the leveling of the bottom of the trench and/or the top of the foundation material at the appropriate elevation, and the furnishing and placing of bedding materials under the pipe and along the sides of the pipe. Minimum thickness of the layer of bedding material required under any portion of the pipe shall be four inches for all pipe sizes of 27 inches diameter and smaller, and six inches for all pipe sizes of 30 inches diameter and larger. Bedding shall extend up to the spring-line of rigid pipe. Bedding material shall be carefully placed and firmly compacted to provide a firm, uniform cradle for the pipe.
3. Class C (Shallow Gravel Bedding) shall meet the requirements outlined for Class B bedding except that bedding material need be placed only to the lower quadrant of the pipe. This type of bedding will be used only where specifically designated on the Plans and only for shallow pipelines.
4. Class D (Native Bedding) shall consist of carefully excavating the trench to proper grade and placing select native material around the pipe. Native bedding shall be used only where specifically called for or specifically authorized by the Engineer.
5. Class F bedding shall be placed in more than one lift. The first lift to provide at least 4-inch thickness under any portion of the pipe shall be placed before the pipe is installed and shall be spread smoothly so that the pipe is uniformly supported along the barrel. Subsequent lifts of not more than 6-inch thickness shall be placed to 6 inches over the crown on the pipe and individually compacted to 90% of maximum density. Material shall be pipe bedding material described in Section 02222.

3.3 PIPE LAYING

A. Laying of sewer pipe shall be accomplished to line and grade in the trench only after it has been dewatered and the foundation and/or bedding has been prepared.

B. Mud, silt, gravel and other foreign material shall be kept out of the pipe and off the jointing surfaces.

C. Pipe laid shall be retained in position by mechanical means or otherwise, so as to maintain alignment and joint closure until sufficient backfill has been completed to adequately hold the pipe in place. Wherever moveable shoring (steel box) is used in the ditch, pipe shall be restrained by use of a

winch mounted in the downstream manhole and a line of sufficient strength threaded through the pipe and set tightly before each move. Any indication that joints are not being adequately held shall be sufficient reason to require this or other equivalent method of restraint, whether or not moveable shoring is being used.

D. Variance from established line and grade shall not be greater than 1/32 of an inch per inch of pipe diameter, not to exceed 1/2 inch provided that such variation does not result in a level or reverse sloping invert; provided also that variation in the invert elevation between adjoining ends of pipe, due to non-concentricity of joining surface and pipe interior surfaces, does not exceed 1/64 inch per inch of pipe diameter, 1/2 inch maximum.

E. The sewer pipe shall be laid upgrade from point of connection on the existing sewer or from a designated starting point. The sewer pipe shall be installed with the bell end forward or upgrade.

F. When pipe laying is not in progress, the forward end of the pipe shall be kept tightly closed with a temporary plug.

G. As the pipe is installed, it shall be backfilled with the specified bedding material and selected native material up to an elevation 6 inches above the pipe crown, taking care that the backfill is in contact with the entire periphery of the pipe. The backfill shall be carefully placed and firmly compacted such that the subsequent backfilling operations will not disturb the pipe in any way.

H. Pipe branches, stubs, or other open ends that are not to be connected immediately shall be plugged with approved material consistent with these Specifications and secured in place.

I. The markings on reinforced concrete pipe indicating the minor axis of the elliptical reinforcement shall be placed in a vertical plane (top to bottom) when the pipe is laid.

J. Install concrete anchors on sewers laid on slopes of 20% or greater in accordance with Standard Detail.

3.4 PIPE JOINTING

A. All extensions, additions and revisions of the sewer system, unless otherwise specified, shall be made with sewer pipe jointed by means of a flexible gasket, which shall be fabricated and installed in accordance with these Specifications.

B. Pipe handling after the gasket has been affixed shall be carefully controlled to avoid disturbing the gasket and knocking it out of position, or loading it with dirt or other

foreign material. Any gaskets so disturbed shall be removed and replaced, cleaned, and relubricated if required before the jointing is attempted.

C. Care shall be taken to properly align the pipe before joints are entirely forced home. During insertion of the tongue or spigot, the pipe shall be partially supported by hand, sling or crane to minimize unequal lateral pressure on the gasket and to maintain concentricity until the gasket is properly positioned. Since most flexible gasketed joints tend to creep apart when the end pipe is deflected and straightened, such movement shall be held to a minimum once the joint is home.

D. Sufficient pressure shall be applied in making the joint to ensure that it is home, as described in the installation instructions provided by the pipe manufacturer. Sufficient restraint shall be applied to the line to ensure that joints once home are held so, until fill material under and alongside the pipe has been sufficiently compacted.

E. At the end of the work day, the last pipe laid shall be blocked to prevent creep during "down time."

F. Pipe required to be laid on curved alignment shall be joined in straight alignment and then be deflected, joint by joint. Special care shall be taken in blocking the pipe just previously laid, by tamped fill or otherwise, to resist the misaligning forces generated during compression of the joints being made.

G. For dissimilar pipes where suitable adaptor couplings are not available, the jointing shall be accomplished with a special factory fabricated coupling.

3.5 SIDE SEWERS

A. All applicable Specifications given herein for sewer construction shall apply to side sewers.

B. Provide side sewers extending to the right of way line for all properties adjacent to main line sewer unless otherwise directed by the Owner.

C. Unless authorized in writing by the Owner, excavation for main line sewers shall not begin more than 1,000 feet ahead of the completion of side sewer construction in the public right-of-way.

D. Sewers are designed to serve the downstream side of properties. Exceptions shall be as directed by the Owner at the time of construction. Such exceptions shall be marked by a stake or other suitable marker. Contractor shall be responsible that a "tee" be located in the main line opposite each marker and shall construct a side sewer to terminate at

the property lines, edge of easements, or as otherwise directed by the Owner.

E. The Contractor shall be responsible that the side sewer depth at the property line is 5 feet below the floor to be served, or 6 feet below street centerline, whichever is deeper. Where the property is vacant, the side sewer shall be constructed on a slope of 2% unless otherwise approved in writing by the Owner.

F. Side sewers shall not be installed as vertical risers, but shall be laid on a slope not to exceed two feet vertical to one foot horizontal.

G. Side sewers shall be constructed with a maximum deflection not to exceed manufacturer's recommendations. Larger changes in direction shall be made by use of standard 1/8 bends.

H. Plugs shall be installed at end of line and blocked to withstand test pressures without leakage.

I. A 1-1/4-inch white PVC pipe, ASTM 2241 SDR 21 200 psi shall be placed vertically at the end of each stub and shall rise 2 feet above finish grade level. Both ends of the PVC pipe shall have caps glued on and the pipe interior kept clean for the purpose of future depth measurement.

J. General requirements for side sewer construction are shown on Standard Detail entitled "Street Side Sewer". Any side sewer contractor shall also satisfy all requirements relating to side sewer construction as set forth in the "Infrastructure Improvements Project Manual. Side sewer inspection for work under the Contract will be performed without charge to the Contractor.

K. No side sewers shall be constructed inside private property unless approved in writing by the Owner.

L. The Contractor shall not backfill any side sewers until the Owner has visually inspected and approved the installation. Should any such work be covered up without such approval or consent it must, if required by the Owner, be uncovered for examination at the Contractor's expense.

3.6 CLEANING

A. Before acceptance testing is performed, the pipe installation should be reasonably clean. The pipe shall be cleaned either before or after.

B. The Contractor shall furnish an inflatable rubber ball of a size that will inflate to fit snugly into the pipe to be tested. The ball may, at the option of the Contractor, be used without a tag line; or a rope or cord may be fastened to the

ball to enable the Contractor to know and control its position at all times. The ball shall be placed in the last cleanout or manhole on the pipe to be cleaned, and water shall be introduced behind it. The ball shall pass through the pipe with only the pressure of the water impelling it. All debris flushed out ahead of the ball shall be removed at the first manhole where its presence is noted. In the event cemented or wedged debris or a damaged pipe shall stop the ball, the Contractor shall remove the obstruction and/or repair any damaged pipe. All visible leaks showing flowing water in pipelines or manholes shall be stopped even if the test results fall within the allowable leakage.

3.7 LEAKAGE TESTING

A. General requirements:
1. All sanitary sewer pipe and appurtenances shall be cleaned and tested after backfill by the low-pressure air test method. Pipe over 36 inches in diameter may be tested a joint at a time with the water exfiltration method or by low-pressure air test.
2. All work involved in cleaning and testing sewer lines between manholes shall be completed within fifteen (15) working days after the backfilling of sewer lines and structures.
3. The Contractor shall furnish all labor, materials, tools and equipment necessary to make the test, clean the lines, and - perform all work incidental thereto.
4. Precautions shall be taken to prevent joints from drawing during tests, and any damage resulting from tests shall be repaired by the Contractor.
5. In the event that the Contractor elects to test large-diameter pipe one joint at a time, leakage allowances for water exfiltration per 100 feet shall be converted to allowances per joint by dividing by the number of joints occurring in 100 feet.
6. If the pipe installation fails to meet these requirements, the Contractor shall determine the source or sources of leakage, and he shall replace all defective materials or workmanship. The completed pipe installation shall then be retested as required to meet the requirements of this test.

B. Low-pressure air test:
1. Recommended procedure:
a. Pipe may be tested with or without pre-wetting.
b. Plug all pipe outlets with suitable test plugs. Brace each plug securely.
c. If the pipe to be tested is submerged in groundwater, insert a pipe probe by boring or jetting into the backfill material adjacent to the center of the pipe and determine the pressure in the probe when air passes slowly through it. This is the back pressure due to groundwater submergence over the end of the probe. All

gauge pressures in the test should be increased by this amount.

d. Add air slowly to the portion of the pipe installation under test until the internal air pressure is raised to 4.0 psig in excess of any groundwater backpressure.

e. Check exposed pipe and plugs for abnormal leakage by coating with a soap solution. If any failures are observed, bleed off air and make necessary repairs.

f. After an internal pressure is obtained, allow at least two minutes for air temperature to stabilize, adding only the amount of air required to maintain pressure.

g. After that two-minute period, disconnect air supply.

h. When pressure decreases to 3.5 psig over groundwater backpressure, start stopwatch. Determine the time in seconds that is required for the internal air pressure to drop 1.0 psig. This time interval should then be compared with the time required by Specification.

2. Safety precautions:

a. Plugs used to close the sewer pipe for the air test must be securely braced to prevent the unintentional release of a plug that could become a high velocity projectile. Gauges, air piping manifold, and valves shall be located at the top of the ground. No one shall be permitted to enter a manhole where a plugged pipe is under pressure. Air testing apparatus shall be equipped with a pressure release device designed to relieve pressure in the pipe under test at 6 psi.

3. Basis of acceptance:

a. Concrete and clay pipe (36 inches and under): The rate of air loss shall not exceed 0.003 CFM per square foot of internal pipe surface except that the computed rate for the test shall be not less than 2 CFM nor more than 3.5 CFM.

b. Other pipe materials: The time for the test shall be four (4) times that computed for concrete and clay pipe.

c. Pipe over 36 inches in diameter: Each joint shall show no appreciable loss of pressure when held for thirty (30) seconds.

4. Limit of test section:

a. Pipe under 36 inches in diameter shall be tested from manhole to manhole or such shorter lengths as the Contractor may choose.

b. Pipe over 36 inches in diameter shall be tested one joint at a time.

5. Excessive infiltration:

a. The Engineer may require an infiltration test if it appears that there is excessive infiltration after air tests are completed. The Engineer shall also be the sole judge of whether or not this test is required. Excessive infiltration shall be cause for rejection.

C. Exfiltration test:

1. Exfiltration test shall be used only if specifically authorized by the Engineer.
2. Contractor may fill the pipe any time up to 24 hours prior to the time of exfiltration testing to permit normal absorption into the pipe walls.
3.. Leakage shall be no more than 0.28 gph per inch diameter per 100 feet of sewer, with a hydrostatic head of six feet above the crown at the upper end of the test section, or above the natural groundwater table at the time of test, whichever is higher.
4. Where the test head is other than six feet, the measured leakage shall not exceed 0.28 gph per inch diameter per 100 feet times the ratio of the square root of the test head to the square root of six.
5. The length of pipe tested shall be limited so that the pressure at the lower end of the section tested does not exceed 16 feet of head above the invert, and in no case shall be greater than 700 feet or the distance between manholes when greater than 700 feet.
6. It shall be the Contractor's responsibility to determine the level of the water table at each manhole.

D. Infiltration Test:

1. Infiltration test shall be used only if specifically authorized by the Engineer.
2. Infiltration testing shall take place only when the natural groundwater table is above the crown of the higher end of the test section.
3. Infiltration test leakage shall not exceed 0.16 gph per inch diameter per 100 feet, when the natural groundwater head over the pipe is two feet or less above the crown of the pipe at the upper end of the test section.
4. Where the natural groundwater head is more than two feet, the measured leakage shall not exceed 0.16 gph per inch diameter per 100 feet times the ratio of the square root of the natural groundwater head to the square root of 2.
5. The length of pipe tested shall not exceed 700 feet or the distance between manholes when greater than 700 feet.

3.8 DEFLECTION TEST FOR FLEXIBLE PIPE

A. Sanitary sewers constructed of flexible pipe shall be deflection tested not less than 30 days after the trench backfill and compaction has been completed.

B. The test shall be conducted by pulling a solid pointed mandrel with a circular cross section with diameter equal to 95% of the inside pipe diameter through the completed pipeline. Minimum length of circular portion shall be equal to the diameter of the pipe.

C. Testing shall be conducted on a manhole-to-manhole basis and shall be done after the line has been completely flushed out with water.

D. Contractor will be required, at his expense, to locate and repair any sections failing to pass the test and to retest the section.

3.9 VIDEO INSPECTION

A. The Owner may at his option require any or all sewers to be inspected by the use of a video camera before final acceptance. The costs incurred in making the initial inspection shall be borne by the Owner.

B. If pipe is checked for grade, a device will be attached in front of the camera to measure the depth of any ponding water.

C. Any observed defects or ponded water with a depth of over 3/4 inch shall be cause for the rejection of the line.

D. The Contractor shall be responsible for all costs incurred in any video inspection performed solely for the benefit of the Contractor.

3.10 REPAIRS

A. Any pipe or appurtenance, which has been laid or jointed, that is not in conformance with the Specifications shall be repaired or be removed and replaced.

B. Any concrete pipe or manhole with any continuous crack having a surface width of 0.01 inch or more extending for a length of 12 inches or more regardless of position in the wall of the pipe or main shall be removed and replaced.

C. Repair bands or clamps or concrete collars shall not be used to repair defective pipe.

* * * END OF SECTION * * *

SECTION 02732

SEWER FORCE MAINS

1. GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Field Engineering: Section 01050

B. Inspection Services: Section 01420

D. Dewatering: Section 02140

E. Shoring: Section 02150

F. Excavating, Backfilling and Compacting for Utilities: Section 02222

G. Manholes and Cleanouts: Section 02605

H. Pipe and Fittings: Section 02610

I. Water Lines: Section 02660

J. Sanitary Sewer: Section 02730

K. Existing Utilities/Facilities - Underground and Overhead: Section 02760

1.2 QUALITY ASSURANCE

A. Testing before acceptance
   1. The Engineer may require that the first section of pipe, not less than 300 feet in length, installed by each of the Contractor's crews be tested in order to qualify the crew and/or the material.
   2. Pipelaying shall not be continued more than an additional 300 feet until the first section shall have been tested successfully.

B. Final acceptance:
   1. Prior to final acceptance all pipelines shall be flushed and cleaned of all debris and the line tested as specified herein.
   2. Any corrections required shall be made at the expense of the Contractor and the line retested.

2. PRODUCTS

2.1 BEDDING MATERIALS

A. Conform to Section 02222.

2.2 PIPE MATERIALS

A. Pipe used for sewer force main may be ductile iron or PVC pressure pipe as specified in Section 02610, unless otherwise noted.

3. EXECUTION

3.1 INSTALLATION

A. Bedding and pipe laying of force mains shall conform to the applicable provisions for water lines as set forth in Section 02660.

B. Minimum depth of cover shall be 42 inches unless otherwise shown on the Drawings.

C. Pipe shall be laid on a uniform grade with no sags or overbends between high and low points shown on the Drawings.

D. Cover of sewage air valve assembly vault shall be accurately adjusted to grade and slopes of ground surface.

3.2 BLOCKING AND BRACING

A. Blocking and bracing of the pipe and fittings shall be placed so as to secure bearing on undisturbed earth.

B. Blocking and bracing size shall be determined by the Contractor and shall be of sufficient proportions and installed so as to withstand the required test pressure and operating conditions.

C. Concrete shall be placed in back of all fittings with unbalanced thrust. Pre-cast blocking shall not be used.

D. Blocking shall not be covered up until it has been seen by the Engineer.

E. Blocking shall be formed so that bolts, joints, gaskets, and flanges of adjacent joints are clear of the concrete and so that bolts and joints can be dismantled without removing the concrete.

F. At tees and crosses where future mains connect, a pre-cast concrete brick may be used between fittings and thrust block.

3.3 PRESSURE TESTS

A. Sewer force mains shall be subjected to the hydrostatic test described in Section 02660 except that pressure tests shall be made at a pressure equal to twice the working pressure of the pipe line or 75 psi in excess of the working pressure of the line, whichever is greater, unless otherwise specified.

B. The pumps, gauges, plugs, saddles, corporations, miscellaneous hose and piping, and measuring equipment necessary for

performing the test shall be furnished and operated by the Contractor.

C. Pipeline shall be backfilled sufficiently to prevent movement of pipe under pressure.

D. Thrust blocks shall be in place and time allowed for the concrete to cure before testing.

E. Procedure:
1. The mains shall be filled with water and all air removed prior to starting the test.
2. The test shall be accomplished by pumping the main up to the required pressure; stop the pump for fifteen (15) minutes, and then pump the main up to the test pressure again.
3. The quantity of water required to restore the pressure shall be accurately determined by pumping through a positive displacement water meter with a sweep unit hand registering 1 gallon per revolution. The meter shall be approved by the Engineer.
4. Acceptability of the test will be determined by two factors:
   a. The quantity of water lost from the main shall not exceed the number of gallons per hour as determined by the formula:

$$L = \frac{ND\,(P)^{0.5}}{7{,}400}$$

in which:
L = Allowable leakage, gallons/hour
N = No. of joints in the length of pipeline tested
D = Nominal diameter of the pipe in inches
P = Average test pressure during the leakage test, psig

   b. There shall not be an appreciable or abrupt loss in pressure during the fifteen (15) minute test period.
5. Gauges used in the test shall be accompanied with satisfactory certifications of accuracy from a laboratory approved by the Engineer.

F. Sections to be tested shall normally be limited to 1,500 feet.

G. Prior to calling out the Engineer to witness the pressure test, the Contractor shall have all equipment set up completely ready for operation and shall have successfully performed the test to assure himself that the pipe is in a satisfactory condition.

* * * END OF SECTION * * *

SECTION 02760

EXISTING UTILITIES/FACILITIES UNDERGROUND AND OVERHEAD

1. GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Inspection Services: Section 01420

B. Grading: Section 02210

C. Excavating, Backfilling and Compacting for Utilities: Section 02222

1.2 LEGAL REQUIREMENTS-UNDERGROUND FACILITIES

A. The Contractor shall, before commencing excavation in any area, comply with the provisions of any applicable laws relating to or governing the identification, location, marking, and responsibility for protecting and repairing of underground facilities.

B. Whenever there may be a conflict between the provisions of any law and the provisions of these specifications, the provisions of law shall control.

1.3 DEFINITIONS

A. Utility means any facility or item placed above or below ground for use in connection with the storage or conveyance of water, sewage, electronic, telephonic or telegraphic communication, cablevision, electric energy, petroleum products, gas, gaseous vapors, hazardous liquids, or other substances and including, but not limited to pipes, sewers, conduits, cables, valves, lines, wires, manholes, and attachments.

B. Pipe zone is defined as extending from the bottom of the required excavation to six (6) inches over the top of the pipe.

1.4 IDENTIFICATION

A. All underground utilities known by the Owner to be in the proposed area of excavation are identified on the project plan.

B. The underground utilities identified on the plans have not and cannot be precisely located by the Owner or its agents or engineers and location is approximate only because such information is within the control of the owners of the underground utilities. The Owner does not warrant the location of underground utilities.

C. NOTICE: Overhead electrical service lines are generally not shown on the drawings. Electrical transmission lines shown on the drawings are located by point-to-point, power pole-to-power pole con-

nections. The transmission cables or wires may be located on either side of the drawing location depending upon the configuration of the crossarms on the power poles or towers. Line voltage is not shown.

D. Other overhead utility lines are generally not shown on the drawings.

1.5 NOTIFICATION

A. It is the responsibility of the Contractor to give notice to the Owner or owners of any utilities known or suspected to be within the area of any proposed excavation or construction activities.

B. The Contractor is responsible to have the locations of underground utilities marked by the utility owners prior to beginning excavation.

C. The Contractor is responsible for determining the extent of any hazard created by electrical power in all areas and shall follow procedures during construction as required by law and regulation. Prior to construction, the Contractor shall meet with utility owners and determine the extent of hazards and remedial measures and shall take whatever precautions may be required.

D. The Contractor's attention is directed to federal, state, and local safety codes relative to limitations of work in proximity to overhead power lines.

1.6 QUALITY ASSURANCE

A. The Contractor will be required to have available a pipe finder and a person capable in its use and to utilize same to satisfy himself as to the exact location of such underground facilities in the interest of avoiding unnecessary damage, maintenance costs, and to ensure continuity of customer service.

B. Contractors shall cooperate with utility owners to aid in locations and maintenance of existing utilities.

1.7 ELECTRICAL TRANSMISSION AND SERVICE LINES

A. Since neither the Engineer nor the Owner can anticipate the construction methods or techniques and equipment to be used by the Contractor in performing the work, the extent of the possibility of the Contractor's equipment and personnel coming in contact with electrical transmission lines cannot be fully anticipated, and there is no representation that all electrical transmission lines are shown on the plans.

B. The Contractor is charged with the responsibility of observing and investigating the presence of any electrical transmission lines which might impinge on his work whether overhead or underground and shall consult with and utilize the information given by utility owners

and operators to determine the extent of any hazards and remedial measures required, and follow appropriate safety procedures.

1.8 ABOVE GROUND UTILITIES

A. Existing above ground utilities, whether shown on the drawings or not, shall be maintained, relocated, rerouted, removed and restored as may be necessary by the Contractor in a manner satisfactory to owners and operators of the utilities.

1.9 UTILITY SERVICE LATERALS

A. Minor underground utility service lines, including but not limited to sanitary sewer services, gas services, water services, house or yard drains, and electricity or telephone services and driveway culverts shall be maintained, relocated, rerouted, removed and restored by the Contractor with the least possible interference with such services.

1.10 RESTORATION BY UTILITY OWNER

A. The right is reserved by owners of public utilities and franchises to enter upon any street, road, right-of-way, or easement for the purpose of maintaining their property and for making necessary repairs or adjustments caused by the Contractor's operations.

B. The Contractor shall save the Owner harmless of any costs so incurred in restoration of a utility damaged by the Contractor except in special cases outlined above, and subject to the provisions of any law.

1.11 RESTORATION OF DRAINAGE FACILITIES

A. Where it is necessary for drainage facilities to be removed and replaced, existing pipe and catch basins may be reinstalled when approved by the agency having jurisdiction.

B. The materials shall be cleaned.

C. When it is necessary to replace existing pipe or catch basins, the new materials shall be of equal strength and similar design to existing materials.

D. Installation shall be in accordance with the applicable provisions of these specifications.

* * * END OF SECTION * * *

SECTION 02990

LANDSCAPE RESTORATION

1. GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Protection of Work and Property: Section 01545
B. Site Clearing: Section 02110
C. Trenching, Backfilling, and Compacting for Utilities: Section 02221

1.2 SUBMITTALS

A. Duplicate copies of a statement signed by the vendor certifying that each lot of seed has been tested by a recognized seed testing laboratory within 6 months before the date of delivery on the project.

B. Duplicate copies of certification from grower certifying the grass species and locations of field from which sod was cut.

1.3 JOB CONDITIONS

A. Areas landscaped and/or seeded prior to construction shall be restored to their original condition.

B. Unless otherwise specified, the Contractor shall have the option of reseeding or resodding lawn areas that are disturbed during construction.

C. A cover crop shall be sown in all areas other than landscaped areas that are excavated or disturbed during construction. Cover crop seeding shall follow backfilling operations by not more than three weeks. Weekly seeding shall be required for projects in which all backfilling cannot be completed in three weeks.

D. All plants or shrubs within landscaped areas that are damaged during construction shall be replaced with plants equal to that existing prior to construction. Any covenants to stipulations in easements shall be adhered to.

E. All areas shown on the Plans to be planted, seeded or sodded shall be accomplished in accordance with this section.

2. PRODUCTS

2.1 TOPSOIL

A. Topsoil that is required to be furnished by the Contractor from a source other than the area upon which it will be placed shall consist of fertile, friable soil, preferably of a loamy character, typical of the

topsoil common to the locality and it shall contain a normal amount of organic matter.

B. It shall be obtained from arable land and shall be free from subsoil, refuse and other deleterious substances. It shall be reasonably free from brush, roots, heavy clay, sticks and other litter and shall contain no stones or gravel larger than 1/2 inch in diameter.

C. It shall be free of toxic amounts of either acid or alkaline elements and be capable of sustaining healthy plant life.

D. It shall be approved by the Engineer before placement.

2.2 SEED

A. Grasses and legumes for cover crop seed shall conform to the standards of State Department of Agriculture. Seed shall be furnished in standard containers on which shall be shown the following information:
1. Common name of seed.
2. Lot number.
3. Net weight.
4. Percentage of purity.
5. Percentage of germination (in case of legumes percentage of germination to include hard seed).
6. Percentage of weed seed content and inert material clearly marked for each kind of seed in accordance with applicable state and federal laws.

2.3 FERTILIZER

A. General:
1. Fertilizer shall be a standard commercial grade of organic or inorganic fertilizer of the kind and quality specified herein. It may be separate or in a mixture containing the percentage of total nitrogen, available phosphoric acid, and water-soluble potash in the amounts specified.
2. All fertilizers shall be furnished in standard unopened containers with weight, name of plant nutrients, and manufacturer's guaranteed statement of analysis clearly marked, all in accordance with state and federal laws.
3. Fertilizer shall be ground to a fineness as required for the method of application.

B. Lawn fertilizer:

Total nitrogen	7%
Available phosphoric acid.....	16%
Water-soluble potash	18%

C. Cover crop fertilizer:

Total nitrogen	12%
Available phosphoric acid.....	12%
Water-soluble potash	12%

2.4 MULCH

A. Wood cellulose fiber:
   1. Wood cellulose fiber mulch shall be specially processed wood fiber containing no growth or germination inhibiting factors and shall be dyed a suitable color to facilitate inspection of the placement of the material.
   2. It shall be manufactured in such a manner that after addition and agitation in slurry tanks with water, the fibers in the material will become uniformly suspended to form a homogeneous slurry.
   3. Each package shall be marked by the manufacturer to show the air dry weight content.

B. Peat:
   1. Peat shall be a natural domestic product of either sphagnum moss, reed or sedge peat, taken from a freshwater site, free from lumps, roots and stones.

C. Straw:
   1. All straw mulch material shall be in an air dried condition free of noxious weeds, weed seeds, and other materials detrimental to plant life.
   2. Straw shall be seasoned before baling or loading.
   3. Straw mulch shall be suitable for spreading with mulch blower equipment.

2.5 SOD

A. Imported sod:
   1. Sod shall be of first quality turf grass sod composed of acceptable grass mixtures, relatively weed free.
   2. Sod shall be machine cut to a uniform soil thickness not less than 3/4 inch or more than 1 inch. Individual sod pieces shall be cut to a standard width and to an acceptable length that provides for efficient and proper installation.
   3. Sod shall be harvested, delivered and installed within a 48-hour period.
   4. The Contractor, upon request, shall submit one standard piece of sod for the Engineer's approval.

B. Native sod:
   1. Native sod shall be replaced in the lawn of original removal.
   2. The area of sod to be removed shall be laid out in squares or strips of such size as to provide easy handling and matching. The sod shall then be carefully cut along these lines taking care to keep all cuts straight and strips of the same width. After the sod has been cut vertically, it shall be removed to a uniform depth with an approved type of sod cutter. This operation shall be performed in such manner as to ensure uniform thickness of sod throughout the operation.
   3. As the sod scalping proceeds, the sod strips shall be placed in neat piles at convenient locations and from then on they shall be maintained in a damp condition continuously until

the sod strips are replaced on the lawn. In no case shall the sod remain in piles longer than 10 days before replacement on the lawn.

2.6 PLANT MATERIALS

A. Plants shall be healthy, in vigorous growing condition, and be guaranteed true to size, name and variety. Nomenclature shall be listed in Standardized Plant Names, Second Edition, 1942.

B. Size and quality shall be equal to existing plants or as shown on the Plans. Plants shall be No. 1, nursery grown, freshly dug, of normal growth and habit, free from diseases and insects.

3. EXECUTION

3.1 LAWN SEEDING

A. All areas to be put into lawn shall have a minimum depth of 6 inches of topsoil.

B. Immediately prior to placing topsoil, the surface area upon which it is to be placed shall be cleaned of objectionable matter and the area be smoothed and compacted.

C. The finish grade of all areas to be put into lawn shall be smooth, without visible depressions or mounds and shall be flush with the top of adjoining curbs, walks and drives.

D. After establishing the finish grade, all areas shall be hand raked, rolled and again hand raked, removing all rocks, weeds and debris.

E. Commercial fertilizer shall be applied at the rate of 8 pounds per 1,000 square feet.

F. Lawn seed shall be seeded over all areas to be put into lawn at the rate of 3 pounds per 1,000 square feet.

G. After seeding, ground horticultural peat moss shall be spread 1/4 inch deep with an approved spreader over all seeded areas.

H. The exact time for seeding will be determined by actual weather conditions. The normal satisfactory periods for seeding shall be considered as being between March 1 and May 1 and between September 15 and October 20.

I. When delays in operations carry the work beyond the most favorable planting season, or when weather conditions are such that satisfactory results are not likely to be obtained for any stage of the seeding operations, the Contractor will stop the work and it shall be resumed only when the desired results are likely to be obtained or when approved alternates or corrective measures and procedures are adopted.

J. Maintenance shall commence immediately on planting and the lawn area shall be kept damp for 10 days to 2 weeks. Protect all seeded areas by watering, mowing and replanting as necessary for at least 30 days and as long as necessary to establish a uniform stand of grass, and a minimum of 2 cuttings.

3.2 SOD

A. Prior to placing the strips of sod, the scalped area shall be carefully shaped to proper grade and be thoroughly compacted. Wherever the construction operations have resulted in the placement of unsuitable or poorer soils in the area to be resodded, the surface shall be left low and covered with topsoil.

B. The finished grade, after shaping and compacting the topsoil, shall be thoroughly dampened prior to and immediately before replacing the sod.

C. The sod shall be replaced to the required grade, taking care to butt each piece tightly against the adjacent one.

D. Upon completion, the sod shall be dampened and rolled with a lawn roller.

E. All sod shall be kept moist during the first week after sodding. Water shall be provided for each of the next three weeks to provide a minimum of 2 inches of moisture per week.

3.3 COVER CROP SEEDING

A. Seeding shall not be done during windy weather or when the ground is frozen, excessively wet or otherwise untillable.

B. Seed may be sown by one of the following methods:
   1. Hydro-seeded, which utilizes water as the carrying agent, and maintains continuous agitation through paddle blades. It shall have an operating capacity sufficient to agitate, suspend and mix into a homogeneous slurry of the specified amount of seed and water or other material. Distribution and discharge lines shall be large enough to prevent stoppage and shall be equipped with a set of hydraulic discharge spray nozzles that will provide a uniform distribution of the slurry.
   2. Blower equipment with an adjustable disseminating device capable of maintaining a constant, measured rate of material discharge that will ensure an even distribution of seed at the rates specified.

C. Grass seed shall be seeded at the rate of 130 pounds per acre.

D. Fertilizer shall be applied at the rate of 300 pounds per acre.

E. Wood cellulose fiber shall be applied at the rate of 1 ton per acre.

F. The exact time for seeding will be determined by actual weather conditions. The normal satisfactory period for seeding shall be considered between March 1 to June 1 and September 1 to November 1 unless otherwise authorized by the Owner except that the Contractor may perform seeding operations from June 1 to September 1 provided that he waters the new grass to the satisfaction of the Owner.

G. When delays in operations carry the work beyond the most favorable planting season, or when weather conditions are such that satisfactory results are not likely to be obtained for any stage of the seeding operations, the Contractor will stop the work and it shall be resumed only when the desired results are likely to be obtained or when approved alternates or corrective measures and procedures are adopted.

H. The Contractor shall protect all seeded areas from erosion until final inspection and acceptance has been made. Areas damaged by erosion shall be repaired by the Contractor at his own expense.

3.4 PLANTING PITS

A. Trees: Vertical sides, flat bottom, circular or square 6-inch minimum planting soil below ball and/or roots, diameter or side dimension 2 feet greater than root system or ball diameter.

B. Shrubs conform to A above except diameter or side dimension 1 foot greater than ball diameter or root.

C. Bulbs, bedding plants and ground cover: 12 inches below finished grade.

3.5 PLANTING TREES, SHRUBS, GROUND COVER, BULBS AND BEDDING PLANTS

A. Use planting soil beneath and around cavity between plant ball or roots and pit sides. Tamp base firmly, place plant or tree, tamp soil in layers, thoroughly water each layer, loosen and fold burlap away from top of ball into pit. Fill balance of cavity with planting soil. Soak and continuously maintain adequate moisture.

B. Use approved root transplanting compounds and herbicides for bulbs and plants to prevent disease and assure best plant growth.

C. Leave watering "saucers" around each plant.

D. Support trees immediately after planting by staking and/or guying to maintain trees in plumb position.

E. Apply mulch where shown or noted on the Drawings. Mulch depth 3 inches unless otherwise noted.

F. Fertilize all trees, shrubs and ground covers at time of planting.

3.6 FINAL INSPECTION

A. Final inspection for seeded areas will not be made until thirty (30) days following completion of all seeding, fertilizing, and mulching as specified. Damage caused by the Contractor to areas that have been seeded or sodded shall be repaired and/or replaced by the Contractor at his own expense.

3.7 GUARANTEE

A. Guarantee of planting and seeding shall continue for one year from date of final project acceptance. Contractor shall replace all plants or sod dead or dying within the guarantee period, or reseed lawns and cover crop where required. Guarantee shall include both materials and labor. Replacements shall be the same as originally planted.

* * * END OF SECTION * * *

SECTION 03300
CAST-IN-PLACE CONCRETE

1. GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Testing Laboratory Services: Section 01410

1.2 QUALITY ASSURANCE

A. Delivery: Furnish a certificate with each truckload of concrete product delivered to the site, indicating the composition and quality of the mix. Include size and weight of each aggregate, amount of cement, amount of water and amount and kind of any additives included in the concrete, grout fill, or mortar.

B. Standards: All current and applicable standards of the following:
   1. American Concrete Institute – ACI 318
   2. Concrete Reinforcing Steel Institute - CRSI
   3. IBC
   4. Other local codes or criteria noted on drawings.

C. Concrete consistency:
   1. Test each truckload of concrete for slump. Calibrate each mixer or haul unit to be used by measuring slump near the beginning and near the end of the discharge cycle. Mix units determined by the Engineer to be deficient in mixing capability shall not be used in subsequent deliveries. Slump testing procedures shall be per ASTM C143.
   2. Consistency shall be per values below with tolerance of ± 1 inch.
      a. 3 inches maximum slump for structural elements 12 inches and greater in thickness.
      b. 4 inches maximum slump for structural elements less than 12 inches in thickness and columns.

D. Concrete test cylinders:
   1. Prepare a minimum of three test cylinders for each location (slab, wall, column, beam, etc.) for each day's placement or each 50 cu. yd., whichever is greater.
   2. Test set of 3 cylinders as follows:
      a. One at 7 days.
      b. Two at 28 days.
   3. Prepare and test cylinders per ASTM C31 and C39.

E. Prior to placement, have available at placement location all tools, cylinder molds, slump cone, rod, curing containers and all other apparatus required for sampling and testing.

F. Air-entrained: One test for each mix design.

1.3 SUBMITTALS

A. Concrete mix design (for each concrete type used) by independent laboratory, including strength tests of 3 cylinders proportioned to mix design formula.

B. Certification of quality of all concrete, mortar, and grout mix design ingredients including admixtures with supporting test data, mill quality control results and all information specified and requested by the Engineer.

C. Qualifications of Quality Assurance Control personnel responsible for concrete consistency, strength, air content and all testing.

D. Curing materials and methods proposed with certification statements of material's quality.

E. Test results, in approved format, at specified intervals for all field sampling and specimens. (Provide a minimum of two copies to the Engineer.)

F. Certification of quality and type of epoxy bonding materials.

G. Trip tickets for each load of concrete, grout or mortar indicating weights of all materials and additives used in the batch.
H. Location of construction joints not shown on the plans.

1.4 STORAGE OF MATERIALS

A. Maintain in continuously clean environment and in manner required to maintain homogeneity.
B. Cements, grouts, and mortar containerized and kept in dry humidity environment. Engineer shall reject materials which have hardened or show any evidence of initial hydration.

2. PRODUCTS

2.1 CONCRETE

A. ASTM C94 and mix design approved by Engineer.
B. Compression strength and water cement ratio: The minimum compressive strength and cement content of concrete shall be not less than that shown in the tabulation that follows. The Engineer may order the cement content for any class of concrete to be increased over the quantity specified in the tabulation if it is determined that such increase is necessary to attain the required strength. Such increased quantities of cement, if so ordered, shall be furnished by the Contractor at no additional cost to the Owner.
   1. Class of concrete:

Minimum 28-day Compressive Strength (psi)	Type of Work	Aggregate, Max. Size (in)	Cement, Min. lbs per cu. yd.	Max. W/C Ratio
4,000	Walls, slabs and foundations	1	564	0.45
3,000	Cradles, thrust blocks, and all other uses	1½	517	0.50

   2. Fly ash shall be used at the rate of 100 pounds per cubic yard.
C. Cement ASTM C150:
   1. Type II for all wastewater holding or process structures.
   2. Type I or II for all other structures.
D. Aggregates:
   1. Conform to ASTM C33.
   2. Maximum wear 50% at 500 revolutions, AASHTO T96.
E. Water:
   1. Clear free from injurious amounts of oil, acid, salt, alkali, organic matter, or other deleterious substances.
F. Fly Ash:
   1. In accordance with ASTM C618 and ASTM C311.
G. Coloring Agent
   1. Applicable in Historic District or where otherwise required by Town; Add “Lamp Black” or equivalent coloring agent to match the tone of existing, adjacent, concrete walks and curbs.
   2. Coloring agent shall added to concrete mix prior to placement, topical coatings applied after placement are not acceptable.
H. Admixtures:
   1. Use only those specified in approved mix design.
   2. Air-entrain all concrete unless elsewhere excepted, with agent conforming to ASTM C260. Freshwater concrete air content shall be between 3% and 5% by volume.

3. Apply in strict accordance with manufacturer's printed instructions.
4. No chloride contents permitted.
5. Compatible with coatings specified elsewhere.

2.2 AGGREGATE FOR MORTAR

A. Conform to 2.1 except gradation as follows:

Sieve Size By Weight	Percent Passing Square Opening
95 - 100	No. 4
80 - 90	No. 8
55 - 97	No. 16
30 - 60	No. 30
12 - 30	No. 50
0 - 10	No. 100

2.3 GROUT

A. For equipment and column bases and drilled-in anchors use no shrink, no staining, pre-mixed grout; Masterflow 713 by Master Builders or equivalent. Mix in accordance with the manufacturer's directions.
B. For fill: Driest consistency practical composed of 1 part Portland cement and 3 parts sand (by volume). Aggregate proportions may be varied slightly to give the most workable mix.
C. For placement at base of walls: one part fine aggregate and one part cement, in a thick cream consistency.
D. Cure in accordance with manufacturer's recommendations.

2.4 CURING MATERIALS

A. Polyethylene sheeting: 0.004 inch thick.
B. Waterproof paper: Polyethylene-coated, Fed. Spec. UU-B-790 Type I, Grades A, B, C, Style 4. Define lap control lines clearly by printed markings.
C. Masonry sand: ASTM C144 (maintained continually moist).

3. EXECUTION

3.1 MIXING AND TRANSPORTATION

A. Ready-mixed concrete: Conform to ASTM C94 Alternate No. 3.

3.2 PLACING

A. Concrete shall not be placed until the Engineer has observed the reinforcement for conformance with the plans and shop drawings.
B. Deliver only in sufficient quantities required for specified time interval use and placement. Discard concrete having initial set before placement. No remixing with water or supplementing with other materials will be permitted once initial set has occurred. Initial set as evidenced by typical hydration characteristics to be determined by Engineer and Contractor quality assurance representative.
C. Place as nearly as possible to final position to avoid segregation of the materials and displacement of reinforcement. Placement shall be completed within 30 minutes after water is first added to the mix. However, at the Engineer's discretion if climatic and temperature conditions are suitable and when the concrete is continually agitated, the time may be extended to 1-1/2 hours.
D. Place no concrete in the absence of or without the permission of the Engineer.
E. Do not change consistency (slump) for a given placement without the Engineer's written permission.
F. Keep open trough and chutes of steel or steel lined, clean and free from coatings of hardened concrete.

G. Do not drop concrete a distance of more than 5 feet unless approved in writing by the Engineer.
H. Do not place concrete in horizontal members or sections until the concrete in the supporting vertical members or sections has been consolidated and a 2-hour period has elapsed since placement in the vertical member to permit shrinkage to occur.
I. In walls containing door and window openings, hold up placements at the top and bottom of the openings. Stop other placements at levels to conform to drawing details.
J. Layout and sequence of placing of concrete in monolithic structures shall be as shown on the drawings or approved by the Engineer.
K. Within a placement, deposit concrete in horizontal layers not to exceed 18 inches in depth. Place at rate such that: (1) no concrete surface shall obtain initial set before additional concrete is placed on it and (2) yielding of forms is not so great as to cause the concrete surfaces to exceed the tolerances specified.
L. Unless specified otherwise, place all slabs and finished floors to finish elevation in one continuous operation, except that the Contractor may place a separate finish topping if prior approval is received from the Engineer. Floor and roof slab sectional thicknesses shown are minimum thicknesses. Slopes on floors or roofs shall increase, rather than decrease, slab thicknesses.
M. Where a separate finish topping is placed, increase structural slab thickness by the maximum thickness of the finish topping and maintain finished floor elevation as noted on the drawings.
N. Construction joints:
    1. Locate construction joints as shown on the drawings or as approved by the Engineer.
    2. Locate construction joints so as not to impair the strength of the structure, and only at locations shown on the drawings or approved by the Engineer.
    3. Construct bulkheads to neatly fit reinforcement and water stops and prevent concrete leakage.
    4. Provide water stops or sealants in construction joints where required.
    5. Unless shown otherwise, key all construction joints.
    6. Continue reinforcement through construction joint unless otherwise shown or noted.
    7. Before placing concrete against previously placed concrete, thoroughly roughen and clean by wet sandblasting or green cutting with an air water jet.
        a. Use air water cutting at the proper time after the initial set. Use a high pressure air water jet to expose clean, sound aggregate without undercutting the edges of the larger aggregate. Protect adjacent subgrade when cutting is used on slab edges.
        b. After cutting or sandblasting, rinse the surface until wash water contains no cloudiness. Dispose of wastes from cutting, washing and rinsing so they do not stain or abrade exposed surfaces.
    8. Place concrete continuously to a predetermined construction joint.
O. Care shall be taken in placing concrete through reinforcement so that no segregation of the coarse aggregate occurs. On the bottom of beams and slabs where the congestion of steel near the forms makes placing difficult, a layer of mortar, of the same strength as used in concrete, shall first be deposited in the forms, followed immediately by the concrete. The thickness and use of this mortar layer shall be as approved by the Engineer.
P. Special care shall be taken to prevent splashing forms or reinforcement with concrete. Any hardened concrete or partially hardened concrete on the forms or

reinforcements above the level of the concrete already in place shall be removed before proceeding with the work.

Q. Cold weather placement:
   1. Concrete shall be placed only when the temperature is at least 40°F and rising, unless permission to pour is obtained from the Engineer.
   2. Material shall be heated and otherwise prepared so that batching and mixing can proceed in full accord with the provisions of this Specification.
   3. Suitable means shall be provided for maintaining the concrete at a temperature of at least 50ºF for a period of at least the first 5 days and at a temperature above freezing for the remainder of the specified curing period, except that where high-early strength cement is used, this period may be reduced to 72 hours. The methods proposed for heating the materials and protecting the concrete shall be approved by the Engineer.
   4. Salt, chemicals, or other materials shall not be mixed with the concrete for the purpose of preventing freezing. Accelerating agents shall not be used.

R. Hot weather placement:
   1. The temperature of fresh concrete at the time of placement during hot weather shall be a maximum of 90°F to prevent an accelerated setting of the concrete.
   2. A retarding densifier admixture shall be used when the high expected atmospheric temperature for the day is 85°F or above. Admixture shall be used in accordance with the manufacturer's recommendations.

S. Placing concrete against earth:
   1. Unless otherwise called for on the drawings, earth cuts shall not be used as forms for vertical surfaces without the prior approval of the Engineer.
   2. Concrete placed on or against earth shall be placed only upon or against firm, damp surfaces free from frost, ice and standing or running water. Concrete shall not be placed upon mud or upon fills until the required compaction has been obtained.

T. Placing concrete slabs:
   1. Smooth subgrade surface irregularity with thin film of masonry sand prior to placing vapor barrier.
   2. Place vapor barrier on subgrade in maximum widths commercially available. Longitudinal laps: 6 inches minimum. End laps: 2 feet minimum.
   3. Edge and side laps must be in continuous contact. Place materials to maintain tight lap contact.
   4. Repair any tears in the material.
   5. Place concrete without displacing vapor barrier.

3.3 COMPACTING

A. Compact all concrete with high frequency internal vibrators immediately after placing.

B. Use external vibrators for compacting concrete where the concrete is inaccessible for adequate compaction by internal vibrators; construct forms sufficiently rigid to resist displacement or damage from external vibration.

C. Penetrate concrete with a sufficient number of vibrations immediately after it is deposited. Move vibrator throughout the mass so as to thoroughly work the concrete around reinforcement and embedded fixtures and into corners and form recesses. Vibrate the minimum time required to compact the concrete in place and not cause separation of the materials. Concrete shall be compacted to maximum density as determined by tests for yield. Select vibrator size to efficiently accommodate reinforcement clearances.

3.4 CURING AND PROTECTION

A. General:

1. Maintain at site ready to install, before actual concrete placing begins, all equipment and materials needed for optimum concrete curing and protection; maintain extra vibrators on standby in case of malfunction of any unit.
2. Protect finished surfaces or edges from stains, abrasions and breakage during the entire construction period.
3. Protect all concrete from accelerated drying and excessive heat at all times. Close all galleries, conduits and other formed openings through the concrete during the entire curing period and as long thereafter as practicable to prevent drying of concrete by air circulation.
4. Install slab curing covers immediately after initial set or as soon as free water has disappeared from the surface of the concrete after finishing or surfacing.

3.5 REPAIRING CONCRETE

A. Immediately after removal of forms, break back all form ties and inspect concrete surfaces for defects. Complete repair of defects within 48 hours after removal of forms. No repairs shall be made until the defects have been reviewed and method of repair approved by the Engineer.
B. Remove all defective or damaged concrete, including honeycombed, sand streaked or fractured material from the area to be repaired. Chip out areas to one inch minimum depth. Edge shall be squared with the surface to eliminate feather edges.
C. Before placing the repair material obtain Engineer inspection. Clean area free of chipping dust, dried mortar, and all other foreign materials.
D. Keep surfaces to be repaired continuously wet for at least three hours prior to placing new concrete or mortar. No free water on the surface when the repair material is placed.
E. Apply a bonding agent to the area to be repaired before placing repair material. Apply the bonding agent per manufacturer's published instructions attached to container.
F. For all repair surfaces permanently exposed to atmosphere use white cement in proportions found by trial to be effective in producing a color that, in the hardened patch, will match the surrounding concrete surface.
G. Make repairs or patch form tie holes by (1) dry packing, (2) filling with concrete, or (3) plastering with mortar or a combination of all 3 in conformance with the following:
    1. Use the dry pack method for holes at least one inch deep where the depth is equal to, or greater than the smallest surface dimension of the defect, such as cone bolt or form tie holes, and for narrow slots cut for the repair of cracks. Do not use the dry pack method where lateral restraint cannot be obtained. Place and pack dry pack mortar in layers having a compacted thickness of approximately 3/8 inch. Solidly compact each layer over its entire surface by use of a hardwood stick and hammer. Do not use metal tools for compacting. Compact surface just flush with adjacent area. Do not use steel finishing tools or water to facilitate finishing.
    2. Use concrete replacement for (1) holes extending entirely through concrete sections; (2) for holes larger than one square foot and deeper than four inches in which no reinforcement is encountered; (3) for holes larger than 1/2 of one square foot where reinforcement is exposed. Concrete used for replacement shall be of the same strength and mixture as used in the structure except for color matching as specified above.
    3. Use mortar replacement for holes too wide to dry pack and too shallow for concrete replacement and when approved by the Engineer for other conditions not covered above.
H. Cure all repairs with the same methods as new concrete.

3.6 CONCRETE FINISHES AND TOLERANCE

A. General finish:
   1. Finish concrete surfaces to conform to the following table unless otherwise noted on the drawings.

	System
2. Formed surfaces	
a. Exterior - exposed and one foot below	F4
b. Exterior - below grade	F2
c. Interior	F4
3. Slabs	
a. Tops of exterior footings in contact with soil or backfill	U2
b. Exterior - except as otherwise noted	U5
c. Interior - walking surface except as otherwise noted (with hardener)	U4
d. Interior - tank and channels	U4
e. Exterior and interior walks on or over structures including interior clarifier slab to receive swept in grout fill	U1

B. Formed surfaces: Finishes for formed surfaces shall be as designated below:
   1. Finishing for F1 and F2 finishes consists of concrete repairing only, which is to be completed within 48 hours after forms are removed.
   2. Finishing for F3 and F4 finishes shall immediately follow concrete repairing and be completed within 96 hours after the forms are removed. Except where forms are left in place for the duration of the curing period, finishing shall be done during the curing period, keeping the interruptions to the curing process as short as possible. Where forms left on prevent finishing during the curing period, finishing shall be completed within 48 hours after forms are removed. All finishes shall receive a minimum of 24 hours of curing after completion of the finish. Curing shall be carefully done so as not to disturb or remove any of the mortar.
   3. Finish F1: Rough formed surface with defective concrete repaired and form tie holes and other holes over ½-inch deep filled. Forms may be built with a minimum of refinement and form sheathing may be any material that will not leak mortar or yield beyond specified tolerances when the concrete is vibrated.
   4. Finish F2: Smooth, formed concrete surface with all fins, projections and loose material removed and defective concrete and form tie holes and other holes over ½-inch deep, repaired and filled. Forms in contact with concrete shall be plywood or steel.
   5. Finish F3: Smooth, formed concrete surface with all fins, projections and loose material removed, and defective concrete, form tie holes, air bubble holes, surface pits, holes from defective forms, nail head holes and similar surface defects, repaired and filled. Forms in contact with concrete shall be plywood or steel. Form construction shall be planned so that if any pattern from the forms is left in the concrete surface it will harmonize with the structure or building. All joints shall be horizontal or vertical.
   6. Finish F4: Exceptionally smooth, formed concrete surface with all fins, joint marks, bulges, projections and loose material removed. Sandblast to expose air bubble holes, surface pits and similar minor surface defects. Defective concrete, form tie holes, holes from defective forms, and other holes too large to fill by "sack rubbing" shall be repaired and filled. Finish with sack rubbing as follows:
      a. Thoroughly wet the surface and begin treatment while the concrete is still damp. Use 1 part cement, 2 parts (by volume) of sand which will pass a No. 16 screen, and enough water so that mortar consistency will be that of thick cream. Rub mortar thoroughly over the area with clean burlap or a cork or sponge rubber float to fill all pits, surface holes and air bubble holes. While the mortar in the pits is still plastic, rub the surface with a dry mix of mortar.

This dry rub shall remove all excess mortar and place enough dry material in the pits to stiffen and solidify the mortar flush with the surface. No material shall remain on the surface except that within the pits. When the ambient temperature is 85°F or higher, keep the mortar continuously damp by means of a fog spray for 24 hours during the setting period. Take care that the fog spray does not remove any of the mortar. Break finish for any area only at natural breaks in the finished surface.

b. Rub all surfaces that are to be finish painted with a carborundum stone to provide a smooth texture and to remove any latent material on the surface. Pre-blast walls to remove any residual form oils prior to finishing when walls are to be finish painted.

c. Form requirements shall be the same as Finish F-3.

C. Unformed surfaces:

1. Working on unformed surfaces in various finishing operations shall be held to the minimum required to produce the desired finish. Use of any finishing tool in areas where water has accumulated will not be allowed. Work in these areas shall be delayed until the water has been absorbed, has evaporated, or has been removed by draining, mopping, dragging off with a loop of hose, or by other means. In no case, shall cement or mixture of cement and sand be spread on the surface to absorb excess moisture nor shall such materials or water be added to facilitate trowelling. Joints and edges, unless specified otherwise, shall be carefully finished with edging tools.

2. Finishes for unformed surfaces shall be as designated below:

a. Finish U1: Even, uniform finish. Consolidate level and screed concrete to obtain an even, uniform surface. Surplus concrete shall be removed immediately after consolidation by striking it off with a sawing motion of the straight edge or template across wood or metal strips that have been set as guides. When the surface is curbed use screed strips at approved intervals. For long, narrow stretches of curved surfaces such as on invert paving, a heavy slip form may be used. In the case of extensive flat paving, a paving and finishing machine is preferred.

b. Finish U2: A wood float finish. Follow treatment specified for finish U1 by floating either by hand, or by power driven equipment. Floating to be started after some stiffening has taken place in the surface concrete and the moisture or "shine" has disappeared. Work the concrete no more than necessary to produce a surface known as "wood float finish" which is uniform in texture and free of screed marks. Do any necessary cutting and filling during the floating operations.

c. Finish U3: A steel troweled finish. Follow the treatment specified for the finish U2, except leave a small amount of mortar without excess water at the surface to permit effective trowelling. Start steel trowelling after the moisture film or "shine" has disappeared from the float surface and after the concrete has hardened enough to prevent an excess of fine material and water from being worked to the surface. Trowel with firm pressure that will flatten the sand surface left by the floating and produce a dense, uniform surface free of blemishes, ripples and trowel marks.

d. Finish U4: A hard, steel troweled finish burnished. Follow the treatment specified for finish U3 with additional steel trowelling after the surface has nearly hardened, using firm pressure and trowelling until the surface has a burnished appearance.

e. Finish U5: Broom finish. Follow the treatment specified for finish U3 by roughening the surface immediately after toweling with a fiber bristle broom in

a direction perpendicular to the direction of traffic. Broom grooves not more than 1/16-inch deep. After brooming, neatly tool all joints and edges to configuration.

f. Finish U6: Anti-slip finish. Follow the treatment specified for finish U3 and immediately after trowelling, dust 30 to 40 lbs. or regular non-slip aluminum oxide 14/36 grit abrasive grain uniformly over each 100 sq. ft. of area. Trowel the grit into the surface and after trowelling, brush with a fiber bristle broom in a direction perpendicular to the direction of traffic. Broom grooves not more than 1/16" deep. After brooming neatly tool all joints and edges to configuration.

D. Tolerances:

1. Unless otherwise required, allowable tolerances for concrete surfaces shall be in accordance with those shown in the table below. Surface irregularities are classified as either "abrupt" or "gradual". Offsets caused by displaced or misplaced form sheathing, lining, or form section or by defective form lumber shall be considered as abrupt irregularities. All others are classed as gradual irregularities. Gradual irregularities shall be measured with a template consisting of a straight edge for plane surfaces and its equivalent for curved surfaces.
2. The length of the template for testing formed surfaces shall be 5 feet. The length of the template for unformed surfaces shall be 10 feet. Maintain a 5 foot length and 10 foot length steel template on the job site.
3. Maximum allowable irregularities in concrete:

Finish	Irregularity in Inches	
Designation	Gradual	Abrupt
F1	1	1/2
F2	1/2	1/4
F3	1/4	3/16
F4	3/16	3/16
U1 thru U6	1/8	1/8

3.7 TESTING AND REPAIRING CONCRETE STRUCTURES

A. Testing:

1. Separately test each individual chamber that will contain liquid by filling to the overflow with water after the 28-day design strength of the concrete has been obtained. Repair any visible leakage. Damp spots that do not run may be acceptable if below ground or not on walls common with pump rooms or passageways.
2. Allowable leakage not to exceed 0.1% of the volume contained in the chamber in a 24-hour period. Leakage in excess of the allowable amount requires repair to reduce leakage and will be considered to lack water tightness.

B. Repairs:

1. In the event that the structure is not watertight, outline a procedure for repair prior to proceeding with the repair work. Complete any repairs to new work as per specifications at Contractor expense.
2. Approved repairs can include, but not necessarily be limited to, one or a combination of the repairs listed below. Use of these techniques is not to be construed as a warranty by the Engineer that the methods outlined will satisfy leakage repair requirements:
   a. Replace defective concrete.
   b. Grout the joint by drilling grout holes to the center of the structural unit and forcing grout into the joint under pressure.

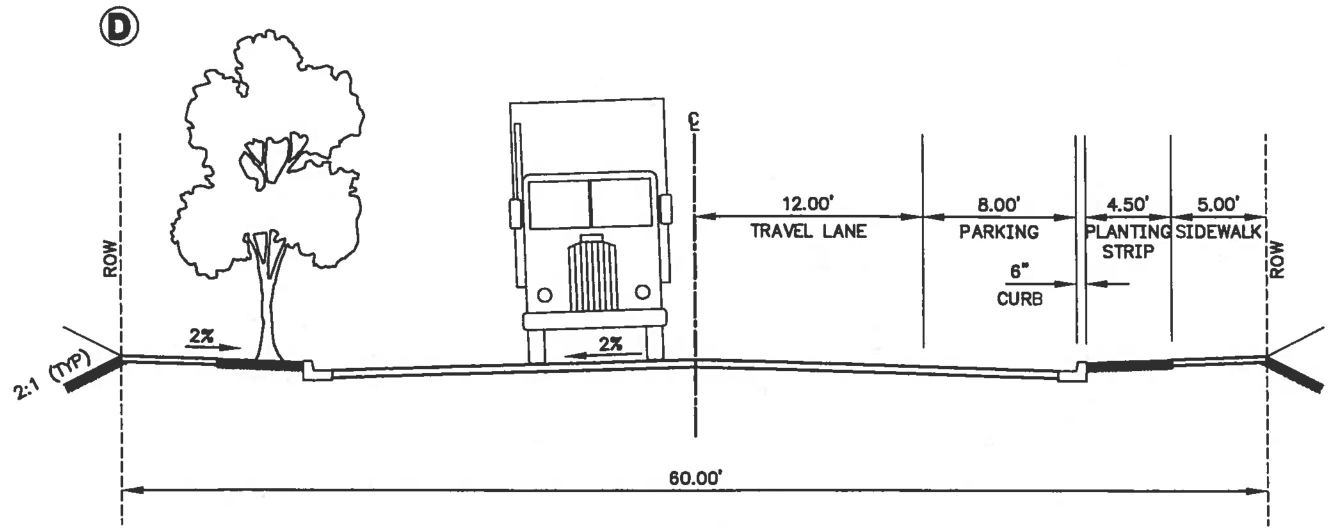
c. Cut a bevel groove on the pressure side of the joint. Groove: ½- to ¾-inch in width and depth, caulked with epoxy joint sealer in accordance with the manufacturer's instructions.

3.8 UNSATISFACTORY CONCRETE

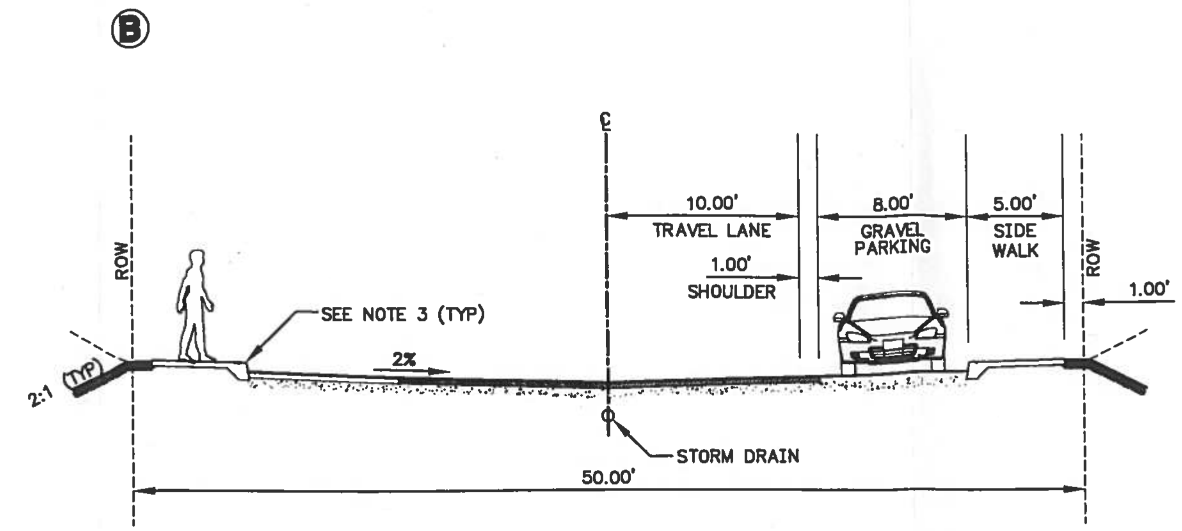
A. Any concrete placed which fails to meet or exceed the specified strength requirements as determined from molded cylinders or cores, or to meet the density or surface requirements, or which has been frozen during placing or curing, shall be removed and replaced with satisfactory materials at the Contractor's expense.

B. Method of determining unsatisfactory concrete: Visual appearance characteristic of rain or freeze damage to concrete which is apparent to the Engineer.

* * * END OF SECTION * * *



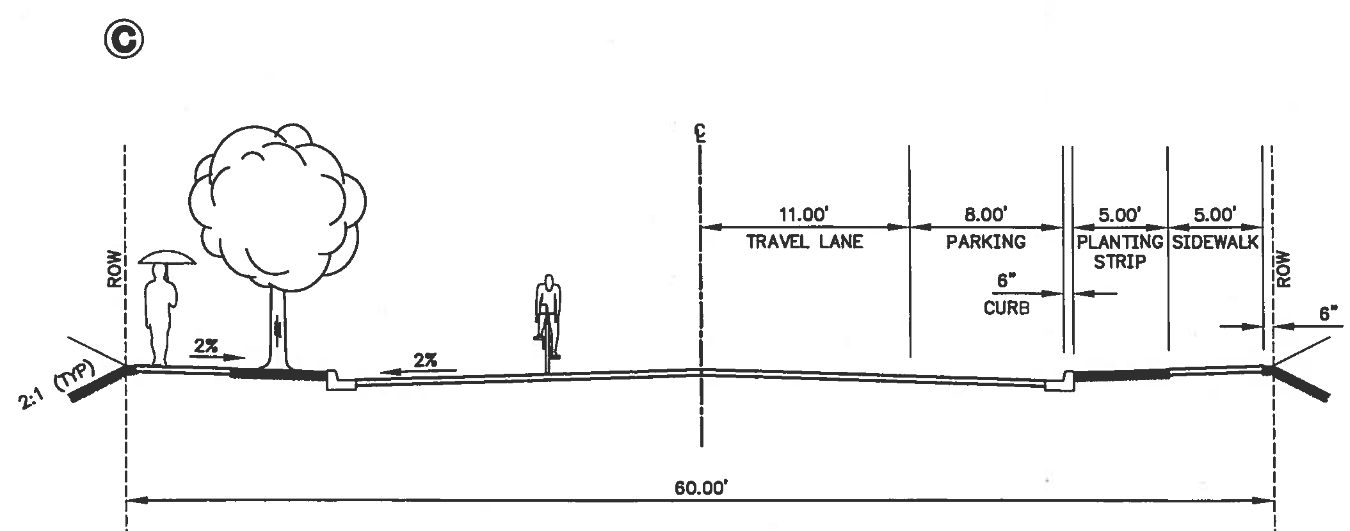
COMMERCIAL AND INDUSTRIAL ACCESS STREETS



RESIDENTIAL ACCESS STREETS

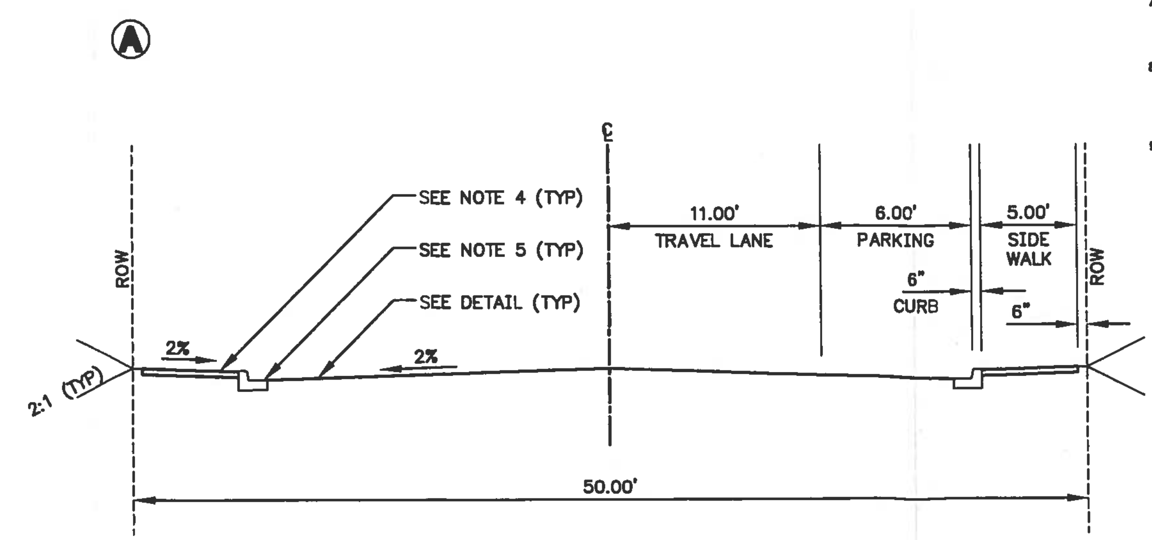
NOTES:

1. USE WSDOT STANDARD PLANS FOR GEOMETRY AND DIMESNSIONS, EXCEPT AS MODIFIED HEREIN.
2. GRADES SHALL NOT EXCEED 15 PERCENT EXCEPT WITHIN APPROVED HILLSIDE SUBDIVISIONS.
3. WSDOT STANDARD PLAN F-3, MONOLITHIC CEMENT CONCRETE CURB AND SIDEWALK.
4. WSDOT STANDARD PLAN F-3, CEMENT CONCRETE SIDEWALK.
5. WSDOT STANDARD PLAN F-1, CEMENT CONCRETE TRAFFIC CURB AND GUTTER.
6. AT RESIDENTIAL STREET INTERSECTIONS, INSTALL SIDEWALK BULBS USING A 20-FOOT RADIUS. SEE WSDOT SIDEWALK DETAILS: A GUIDE FOR WASHINGTON LOCAL AGENCIES AND TRIBES, MAY 2000, FIGURE 2-6C, AND ADAPT IT TO THESE STREET STANDARDS. SEE NOTE 8 FOR RAMPS.
7. AT ALL OTHER INTERSECTIONS, PROVIDE A 20-FOOT CURB RETURN RADIUS AND RESTRICT PARKING NEAR THE INTERSECTION IN ORDER TO PROVIDE AN APPROPRIATE LINE OF SIGHT TO SIDEWALK USERS WHO ARE NEARING THE CROSSWALK.
8. INSTALL SIDEWALK RAMPS AT ALL INTERSECTIONS. USE WSDOT STANDARD PLAN F-3B, MODIFIED TO FIT EACH INTERSECTION CONDITION. FOR INSTANCE, AT AN ARTERIAL INTERSECTION, THE RAMP GEOMETRICS WILL ENCROACH UPON THE PLANTING STRIP IN ORDER TO MAINTAIN A 60-FOOT RIGHT-OF-WAY (ROW).
9. INSTALL DRIVEWAYS ACCORDING TO WSDOT STANDARD PLAN F-4, TYPE 4; MODIFY TO INTEGRATE WITH THESE STREET STANDARDS.



COLLECTOR STREETS

Current code for



MINIMUM DESIGN STANDARDS FOR RESIDENTIAL ACCESS STREET FOR FULL PLAT

No.	Date	By	Ckd.	Appr.	Revision

CHS
12507 BEL-RED ROAD SUITE 101
BELLEVUE, WA 98005-2500
CHS ENGINEERS, LLC TEL (425) 637-3693 FAX (425) 637-3694

Drawn By	Date	Checked By	Date
NJH	05-06	SG	05-06
Designed By	**Date**	**Approved By**	**Date**
DJ	05-06	SG	05-06

Scale:
Horiz. 1"=5'
Vert. N/A
Job No. 200408

TOWN OF LA CONNER

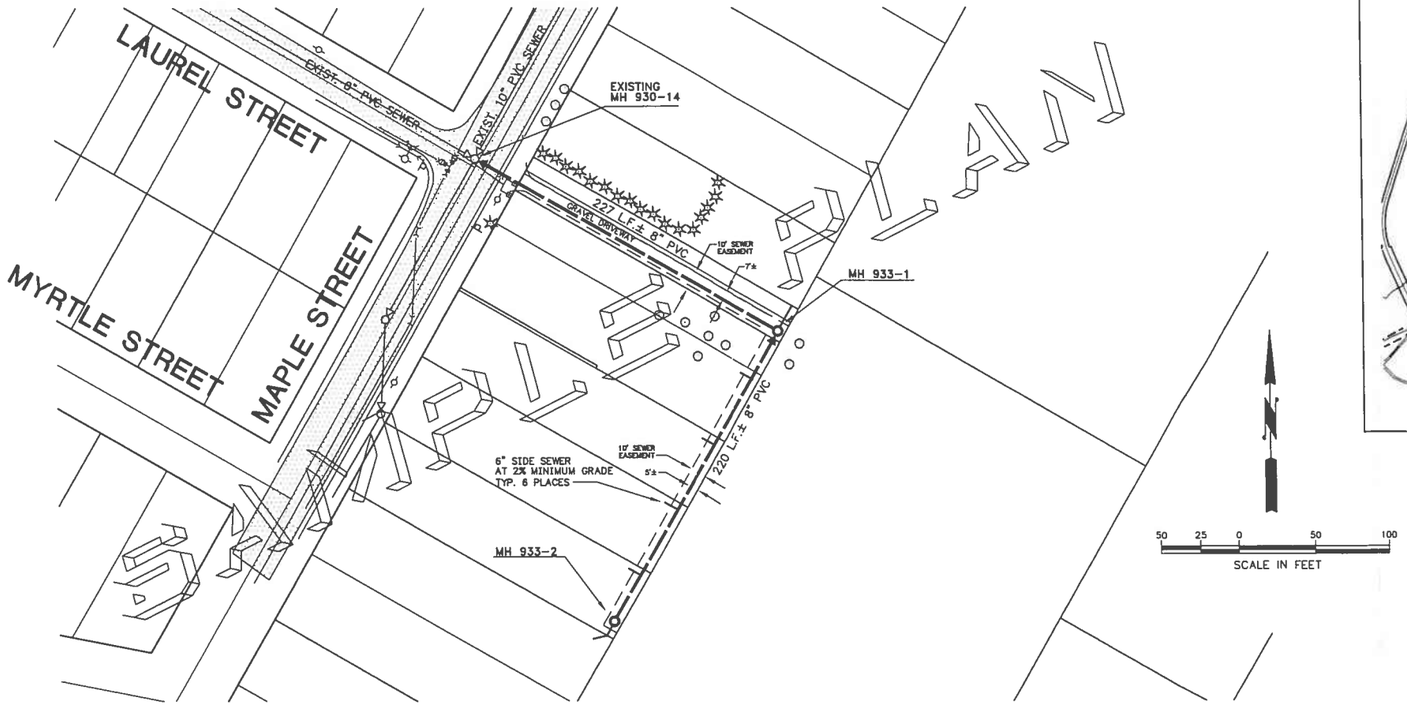
ROADWAY SECTIONS

Sheet NO.
Of NO.
NO.

GENERAL NOTES

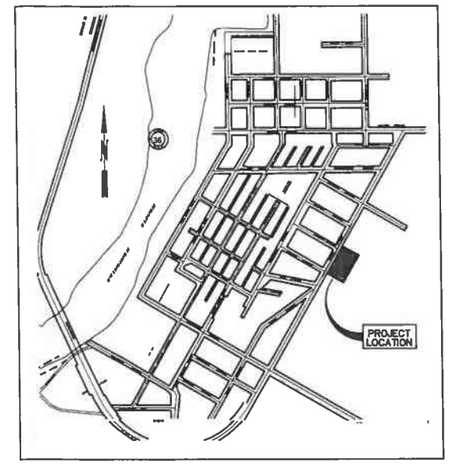
USE THE NOTES PROVIDED IN THE PROJECT MANUAL.

A PORTION OF SECTION ___, TOWNSHIP ___ NORTH, RANGE ___ EAST, W.M., SKAGIT COUNTY, WASHINGTON



SEWER PLAN

SCALE 1" = 50'

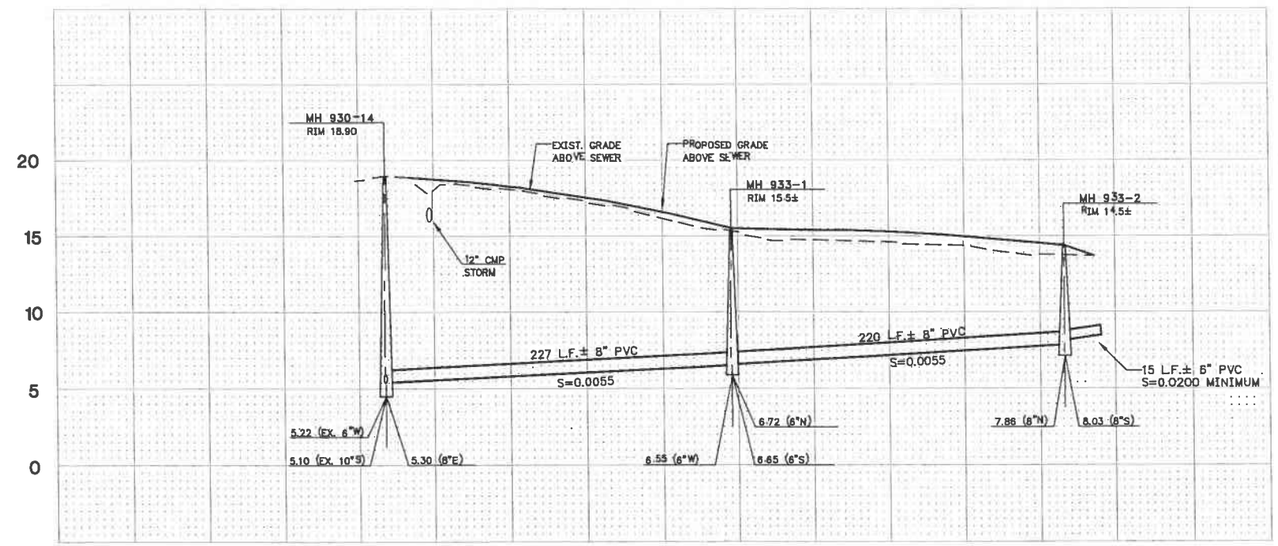


VICINITY MAP

NOT TO SCALE

LEGEND

- EXIST. DRIVEWAY / ACCESS (GRAVEL)
- EXIST. ASPHALT PAVEMENT
- EXIST. DITCH LINE
- EXIST. FENCE LINE
- EXIST. SEWER LINE
- EXIST. WATER LINE
- PROPOSED SEWER LINE
- EXIST. CULVERT
- FIRE HYDRANT (FH)
- WATER VALVE (WV)
- BLOW-OFF ASSEMBLY
- PROPOSED WATER SERVICE
- EXISTING WATER SERVICE
- EXIST. UTILITY POLE
- EXIST. ROAD SIGN
- EXIST. TREES
- EXIST. UTILITY BOX



SEWER PROFILE

SCALE HORIZ 1" = 50'
VERT 1" = 5'

NAVD 88
LIST BENCHMARK LOCATION AND ELEVATION

DRAFTING NOTES

1. STANDARD SHEET SIZE 22"x34"
2. MANHOLE NUMBERS ASSIGNED BY TOWN
3. SCALES HORIZONTAL 1"=50' TO 1"=20'
   VERTICAL 1"=5 OR 1"=10'

CALL 2 BUSINESS DAYS BEFORE YOU DIG 1-800-424-5555

APPROVED BY TOWN PUBLIC WORKS DEPT.

BY DATE

No.	Date	By	Ckd	Revision

TOWN OF LA CONNER

CHS ENGINEERS, LLC
12507 BEL-RED ROAD SUITE 101
BELLEVUE, WA 98005-2500
TEL (425) 637-3600 - FAX (425) 637-3694
www.chsengineers.com

Drawn / Date XX -07
Designed / Date XX -07
Checked / Date XX -07

PROJECT NAME

SANITARY SEWER PLAN AND PROFILE

Scale: Horiz. 1"=50' Vert. 1"=5'

Sheet 1 of -

Job No.

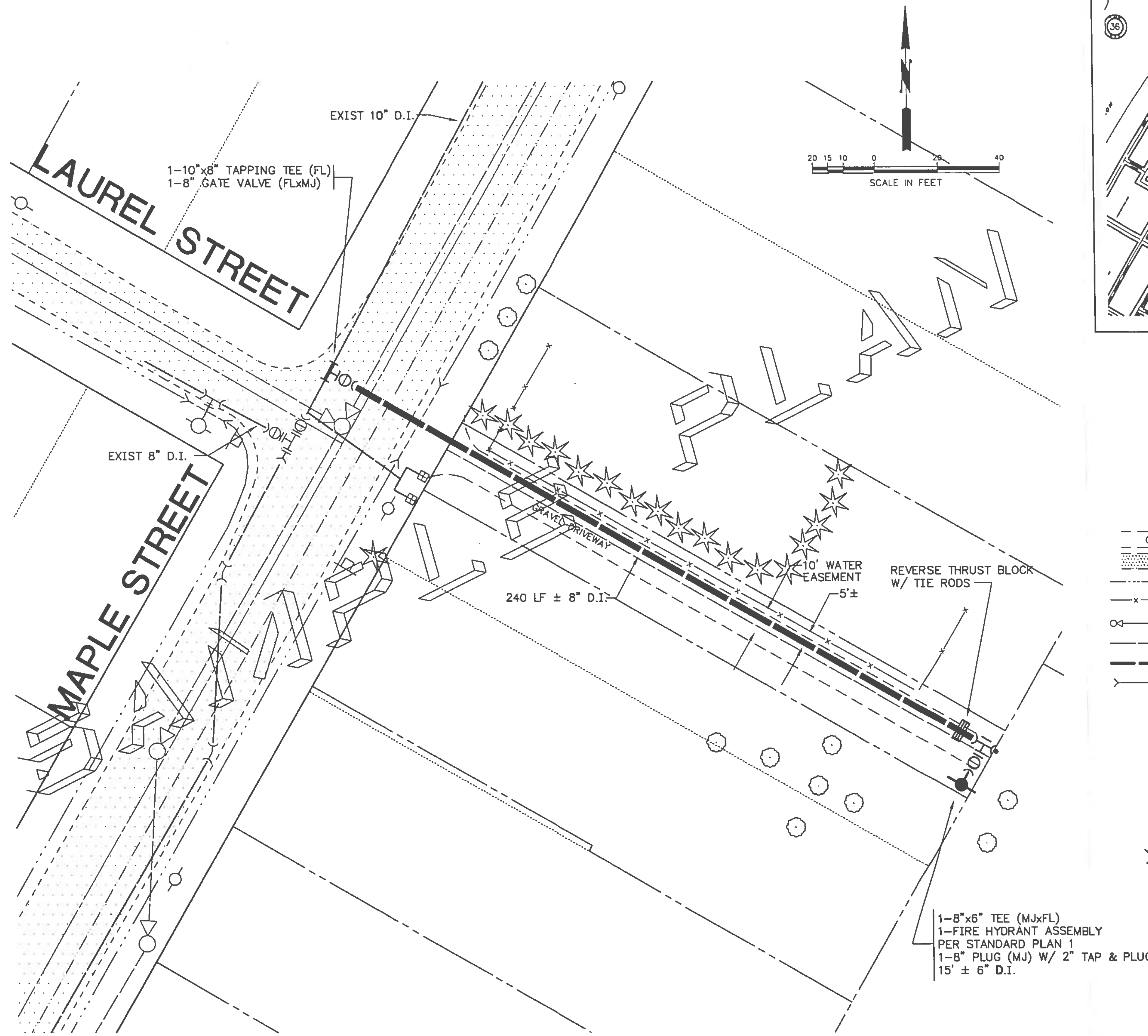
DE #

NUMBER - NAME.dwg 1:1 22x34 XX-XX-07

GENERAL NOTES

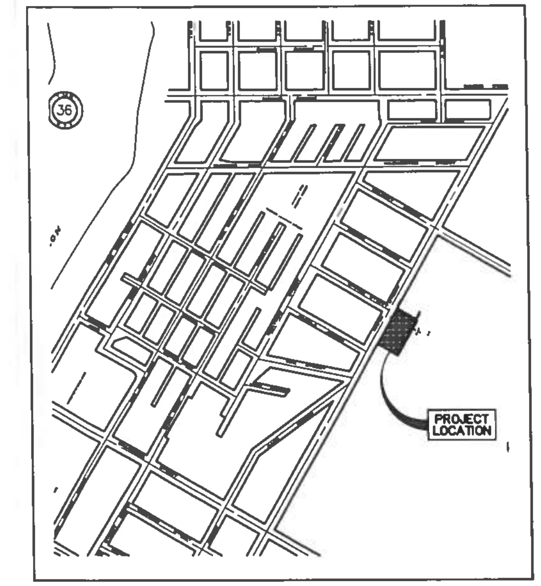
A PORTION OF SECTION ___, TOWNSHIP ___ NORTH, RANGE ___ EAST, W.M., SKAGIT COUNTY, WASHINGTON

USE THE NOTES PROVIDED IN THE DEVELOPER MANUAL.



WATER PLAN

SCALE 1" = 50'



VICINITY MAP

NOT TO SCALE

LEGEND

- GRAVEL — EXIST. DRIVEWAY / ACCESS
- EXIST. ASPHALT PAVEMENT
- EXIST. DITCH LINE
- EXIST. FENCE LINE
- EXIST. SEWER LINE
- EXIST. WATER LINE
- PROPOSED WATER LINE
- EXIST. CULVERT
- FIRE HYDRANT (FH)
- WATER VALVE (WV)
- BLOW-OFF ASSEMBLY
- PROPOSED WATER SERVICE
- EXISTING WATER SERVICE
- EXIST. UTILITY POLE
- EXIST. ROAD SIGN
- EXIST. TREES
- EXIST. UTILITY BOX

DATUM

NAVD 88
LIST BENCHMARK LOCATION AND ELEVATION

DRAFTING NOTES

1. STANDARD SHEET SIZE 22"x34"
2. SCALES HORIZONTAL 1"=50 TO 1"=20'

NUMBER – NAME.dwg 1:1 22x34 XX-XX-07

CALL 2 BUSINESS DAYS BEFORE YOU DIG
1-800-424-5555

APPROVED BY TOWN PUBLIC WORKS DEPT.

BY DATE

No.	Date	By	Ckd	Revision

TOWN OF LA CONNER

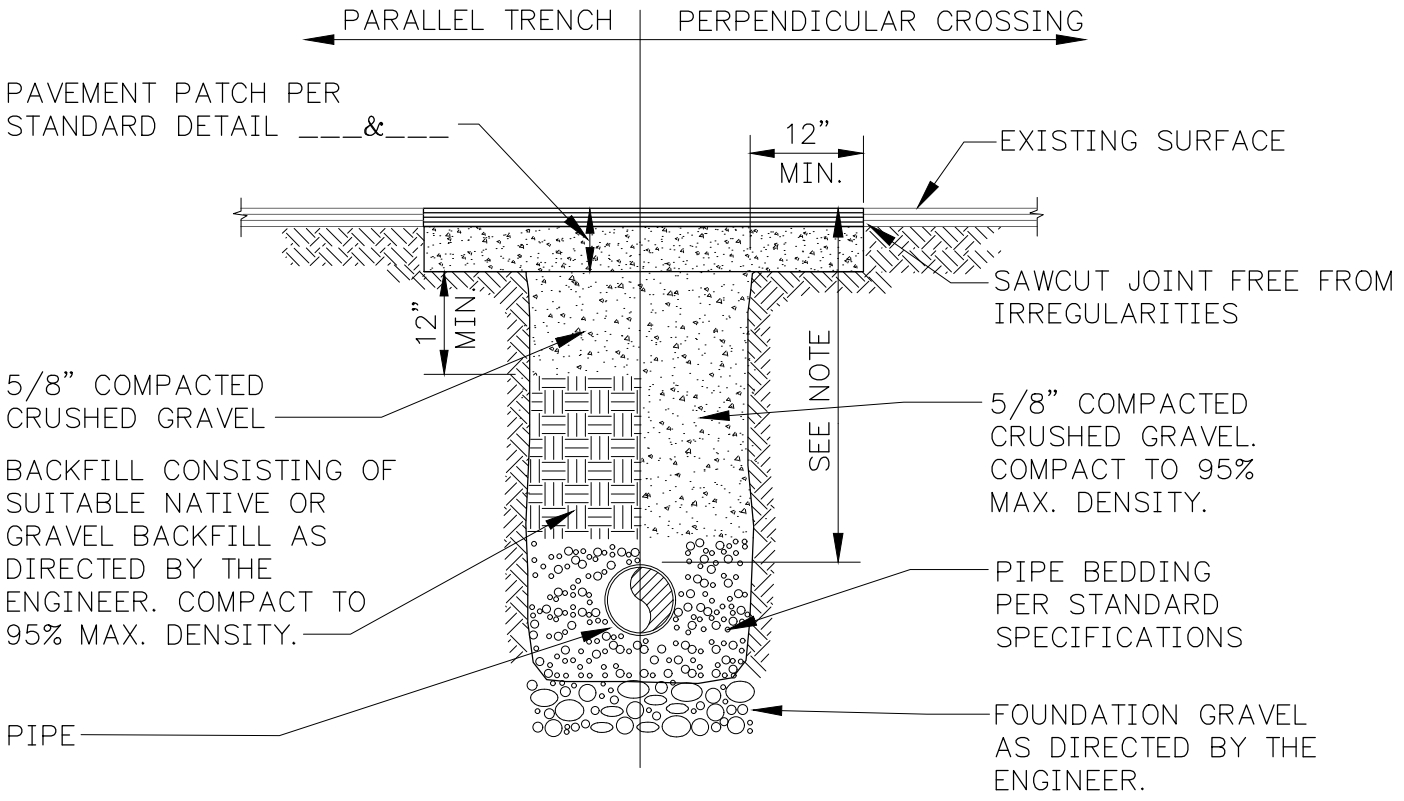
CHS ENGINEERS, LLC
12507 BEL-RED ROAD SUITE 101
BELLEVUE, WA 98005-2500
TEL (425) 637-3693 - FAX (425) 637-3694
www.chsengineers.com

Drawn / Date	Designed / Date	Checked / Date
XX -07	XX -07	XX -07

PROJECT NAME

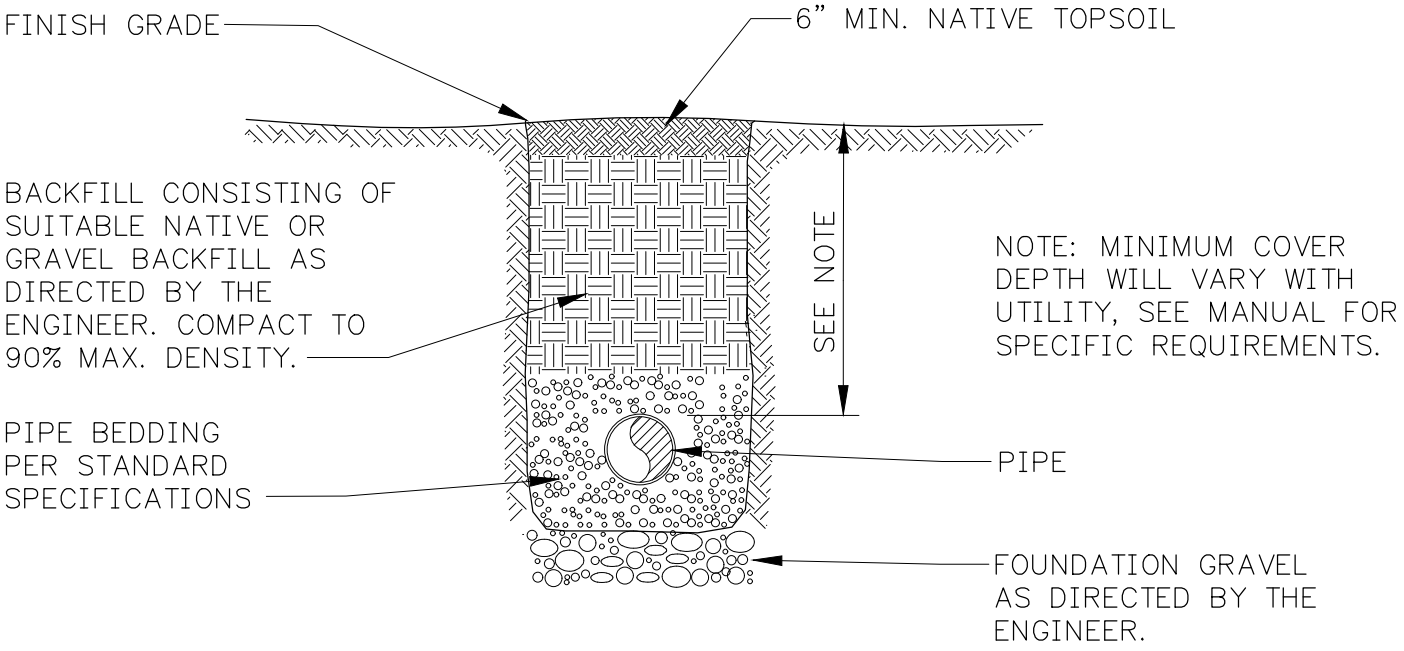
WATER PLAN

Scale:
Horiz. 1"=50'
Vert. 1"=5'
Sheet 1
Of -
Job No.
DE #



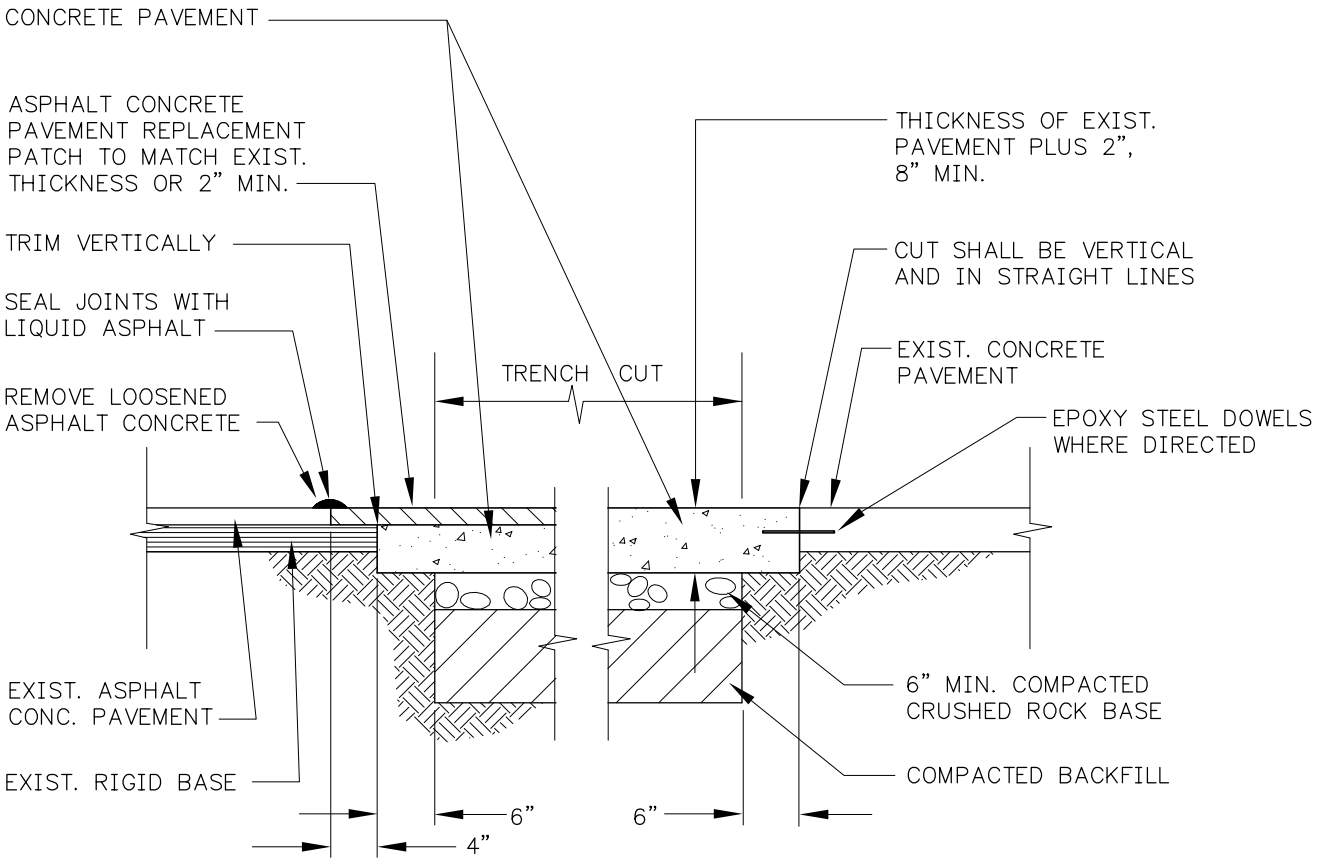
PAVEMENT REPAIR SECTION

TRENCH SECTION IN ROADWAY



TRENCH SECTION IN UNIMPROVED AREAS

G1 TYPICAL TRENCH SECTION



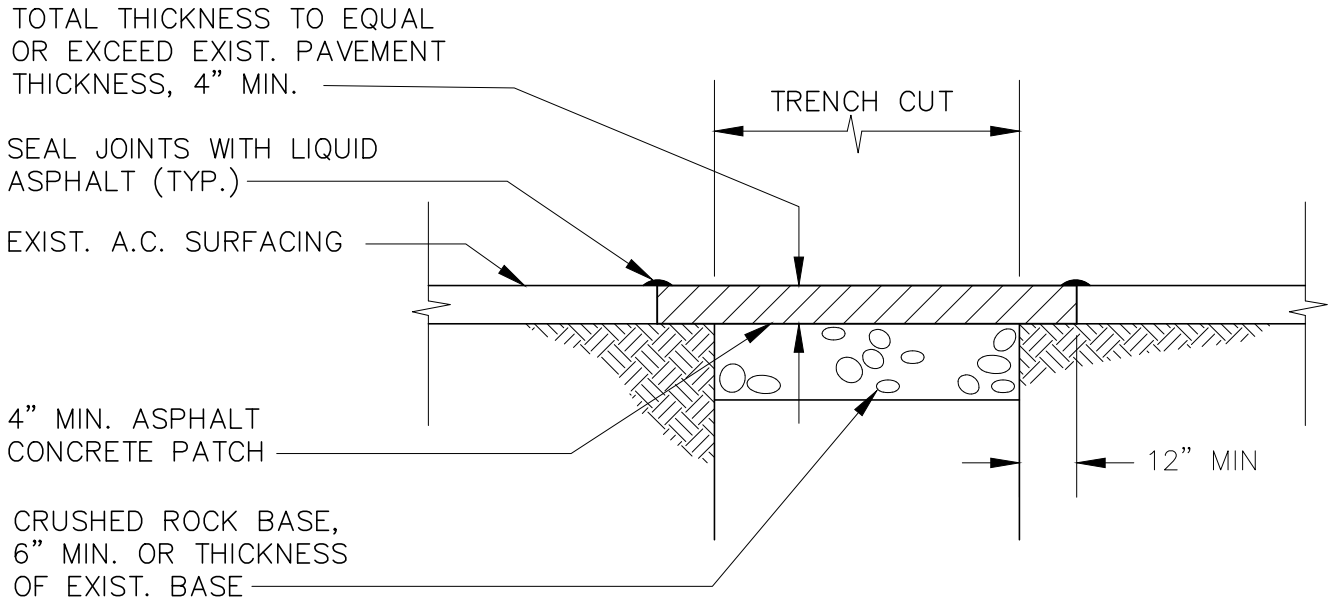
RIGID PAVEMENT WITH ASPHALTIC CONCRETE SURFACE

CEMENT CONCRETE PAVEMENT

NOTE: TRENCHING THROUGH EXISTING CONCRETE ROADWAY PANELS WILL REQUIRE REPLACEMENT OF FULL PANEL TO NEAREST COLD JOINT. MINIMUM HALF-PANEL REPLACEMENT WITH DOWELS REQUIRES PRIOR APPROVAL FROM TOWN.

G2 RIGID PAVEMENT PATCHING

REV 12/05



NOTE: ASPHALT TREATED BASE MAY BE SUBSTITUTED FOR THE FIRST LIFT ASPHALT CONCRETE AND CRUSHED BASE. SEE SPECIFICATIONS.

G3 ASPHALT CONCRETE PATCHING

REV 12/01

G4

The applicable text below is to be included in Developer Extension construction drawings.

GENERAL NOTES

1. All construction shall conform to the requirements of the Town of La Conner that are contained in a bound volume entitled “Infrastructure Improvements Project Manual.”

2. The location of the existing utilities shown on the drawing is approximate. Location and protection of underground utilities shall be in accordance with Chapter 19.122 RCW. Call 800-424-5555 at least two business days before any excavation.

3. Replace any damaged or destroyed monuments.

4. This plan and profile information has been furnished by the developer or his engineer.

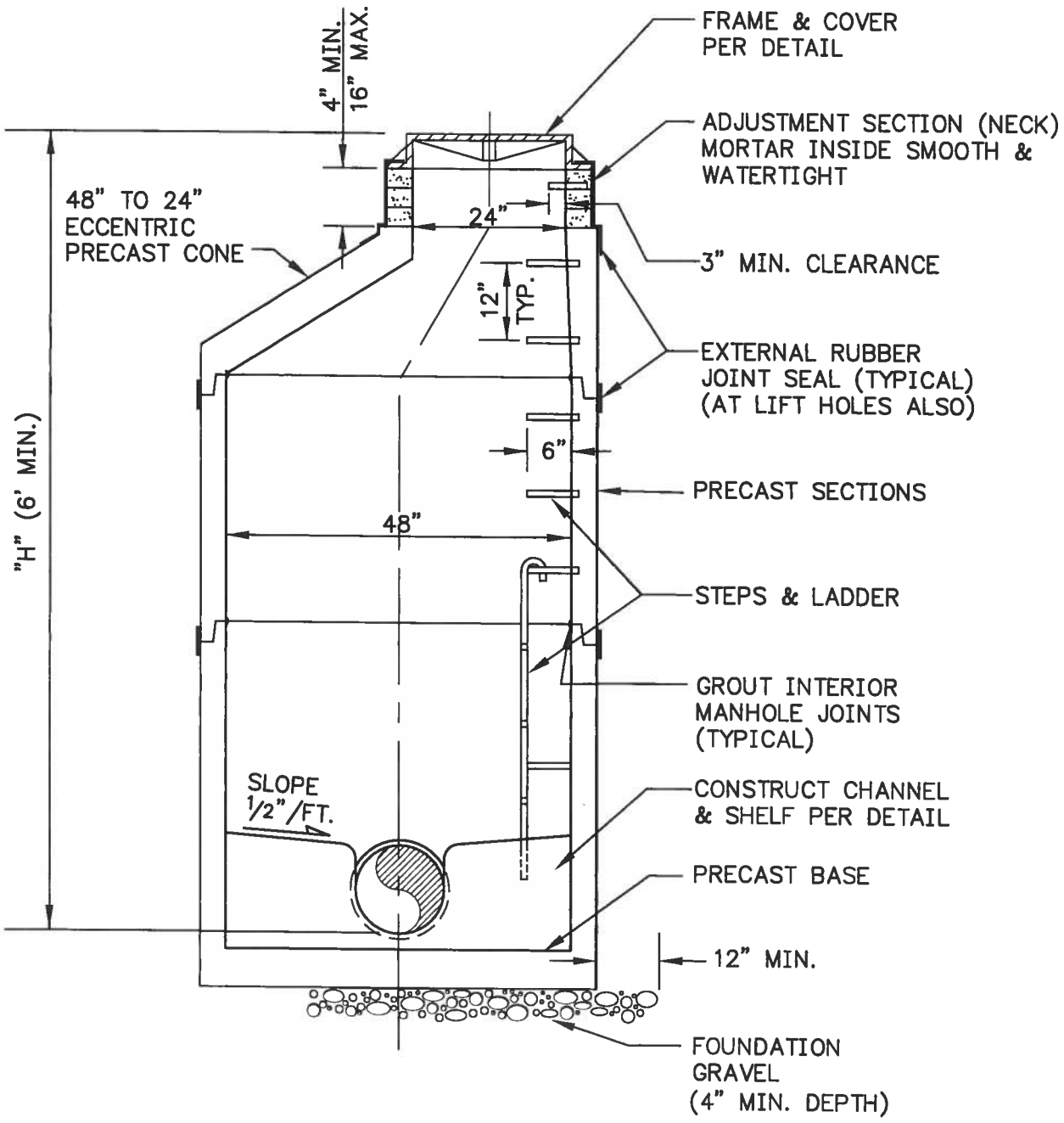
5. Minimum separation between sanitary sewers and potable water lines shall be 10 feet horizontally (measured side to side) and 18 inches vertically from bottom of water line to crown of sewer. Minimum vertical separation for perpendicular or oblique crossings shall be 3 feet from outside edges. Situations that require less than minimum separation shall be constructed in accordance with DOE’s “Criteria for Sewage Works Design”, latest edition.

6. The Developer shall be responsible for acquiring all necessary easements and agreements prior to construction.

7. A plug shall be placed in the outlet pipe of the existing manhole to which new pipe is to be connected or in the outlet of the first new manhole. This plug shall remain in place and may not be removed without the permission of the Town of La Conner. Removal will result in forfeiture of the system isolation deposit.

8. A Pre-Construction Conference is required. Call Town of La Conner Public Works (360) 466-3933 to schedule prior to performing any work.

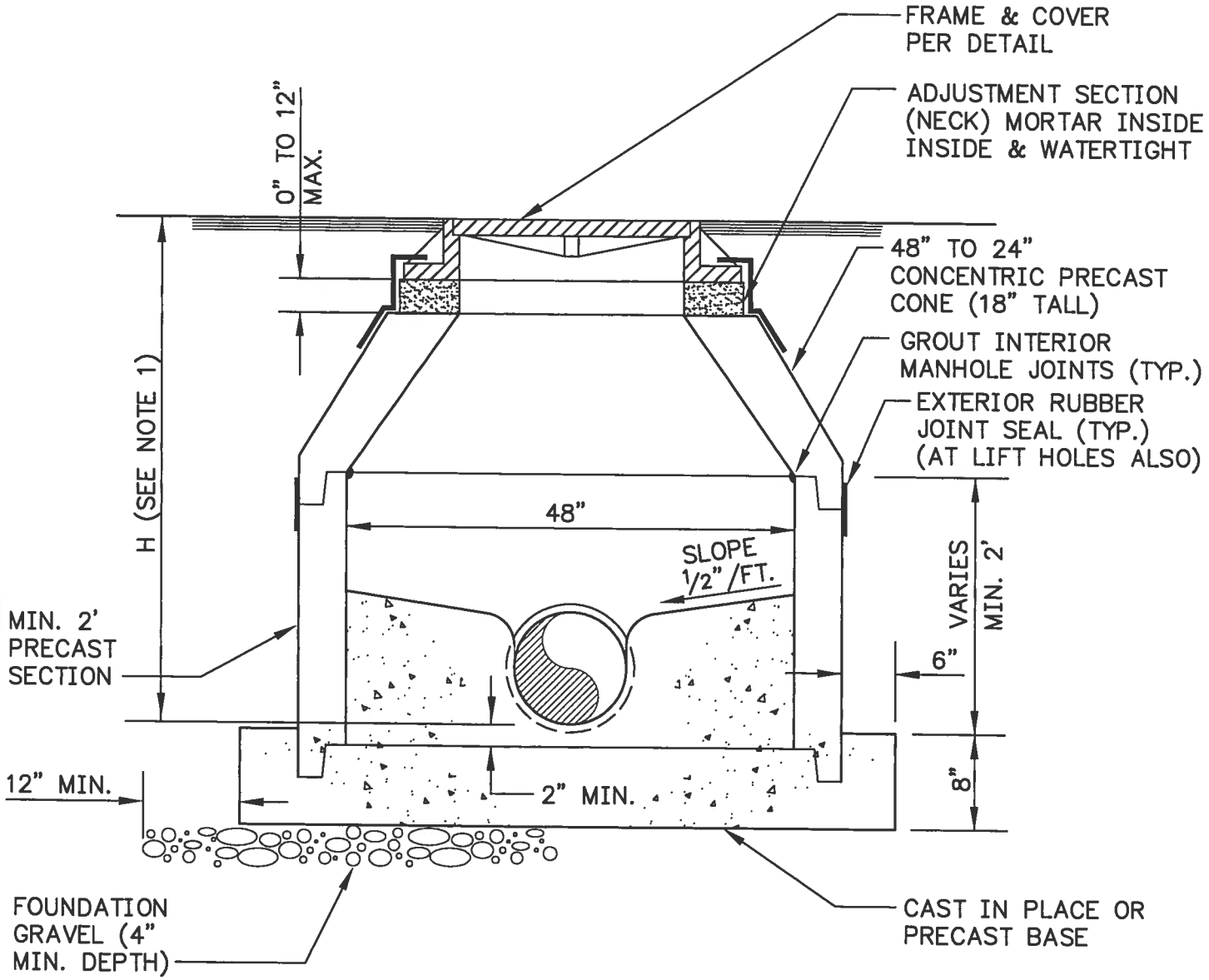
CAUTION - EXTREME HAZARD - Overhead electrical service lines are generally not shown on the drawings. Electrical lines shown on the drawings are located by point-to-point, power-pole-to-power-pole connection. The contractor is responsible for determining the extent of any hazard created by overhead electrical power in all areas and shall follow procedures during construction as required by law and regulation. Prior to construction, the contractor shall meet with utility owners and determine the extent of hazard and remedial measures, and shall take whatever precautions may be required.



NOTES:

1. WALL OPENING REQUIREMENTS FOR PIPE:
   A. HOLE SIZE AS REQUIRED FOR KOR-N-SEAL WEDGE KORBAND PIPE CONNECTOR OR GASKETED COLLAR.
   B. 8" MINIMUM BETWEEN HOLES
   C. MAXIMUM PIPE SIZE 21"

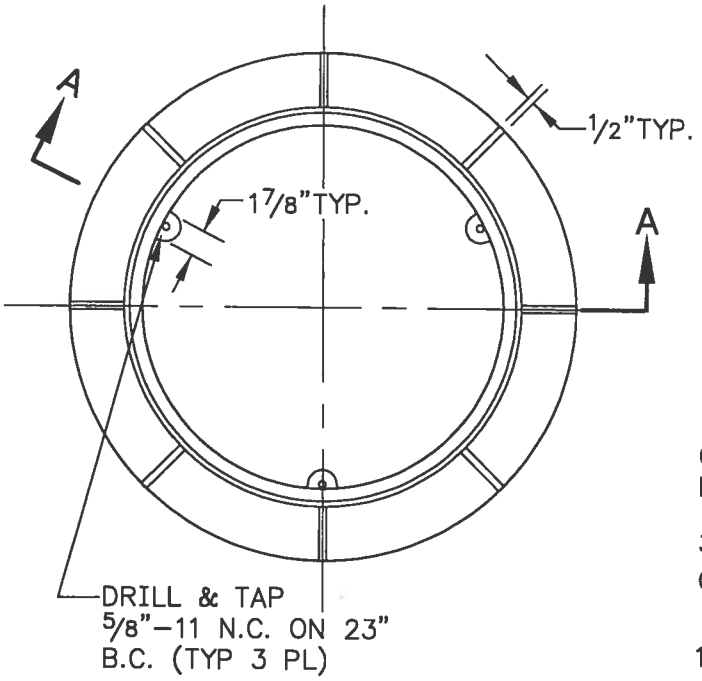
S1 TYPE I - 48" MANHOLE

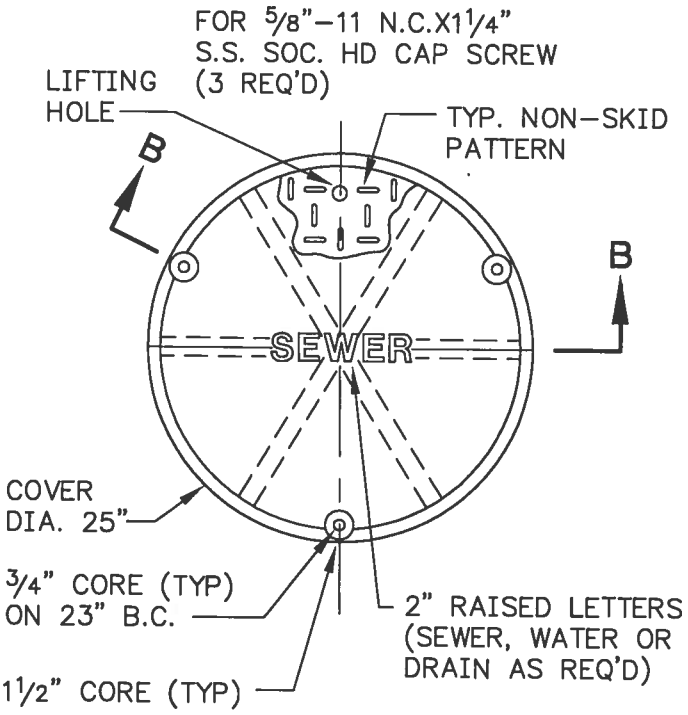


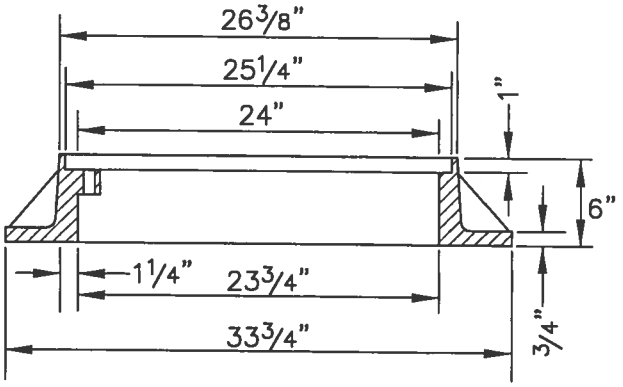
NOTES:

1. MAXIMUM H IS 5'. MINIMUM H IS 3'-8"
2. TO BE USED ONLY WITH PRIOR AUTHORIZATION
3. MAXIMUM PIPE SIZE 12"
4. HOLE SIZE AS REQUIRED FOR KOR-N-SEAL WEDGE KORBAND PIPE CONNECTOR OR GASKETED COLLAR
5. EXTERNAL JOINT SEAL SHALL BE "BEST SEAL" OR APPROVED EQUAL

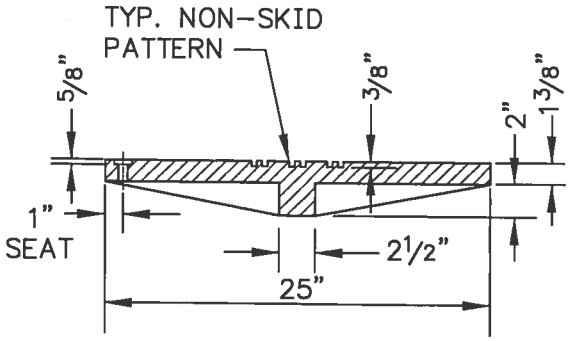
S2 TYPE IIIA - 48" MANHOLE







SECTION A-A

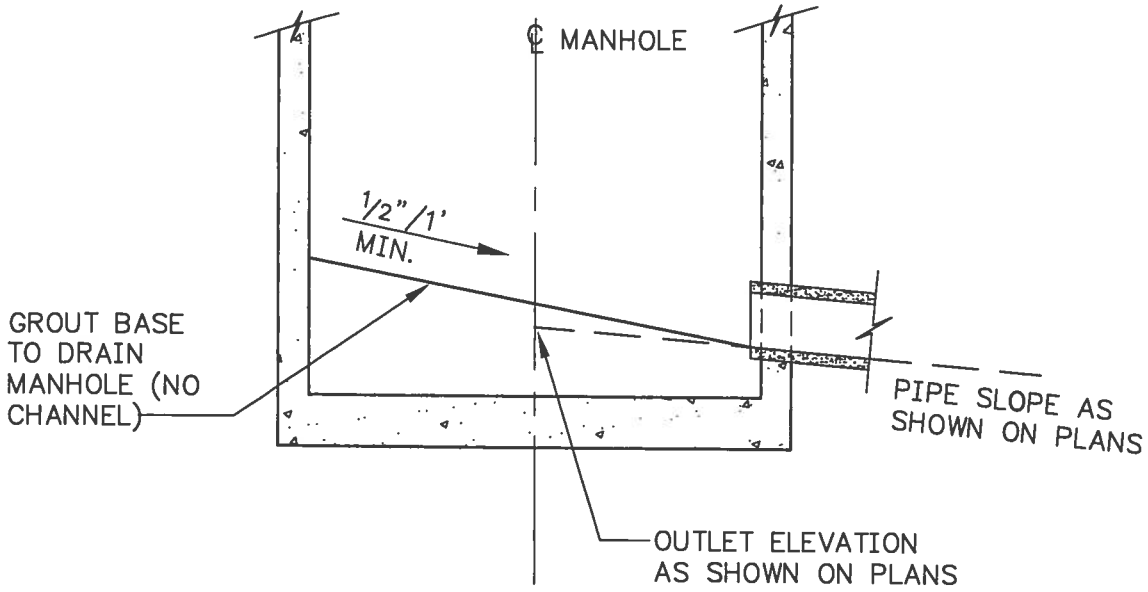


SECTION B-B

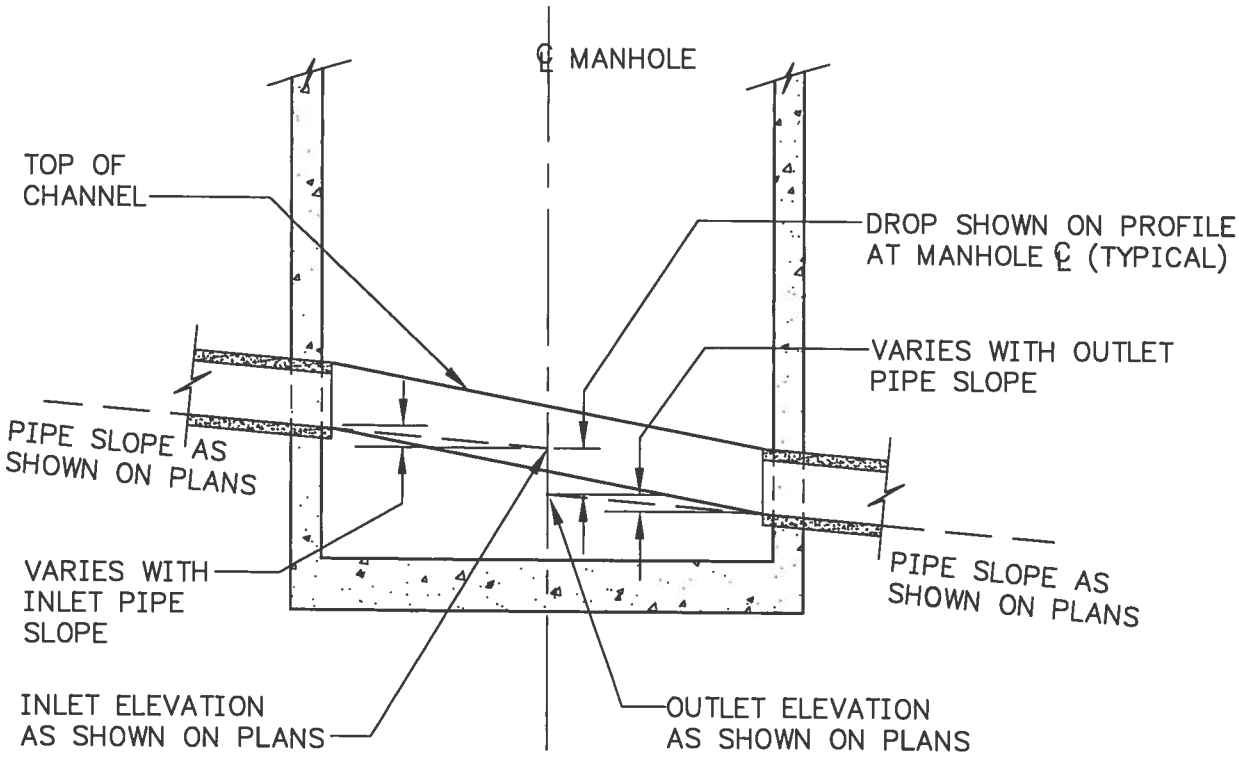
NOTES:

1. DRILL LUG HOLES FULL DEPTH
2. BOLT COVER TO LUGS IN RING
3. PROVIDE 7/8" LIFTING HOLE
4. DUCTILE IRON COVER, CAST IRON FRAME, SS HEX CAP SCREWS
5. SEE SPECIFICATION 02605 FOR ADDITIONAL REQUIREMENTS
6. FRAME AND COVER PER APWA

S3 MANHOLE FRAME AND COVER

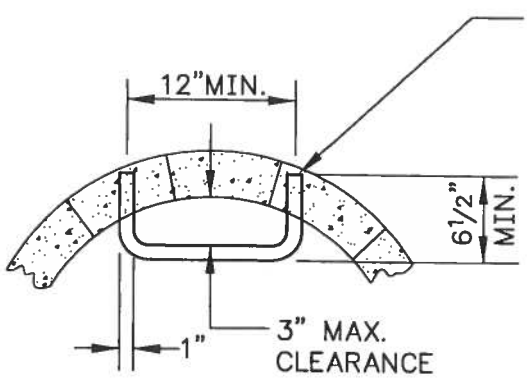


TERMINAL MANHOLE

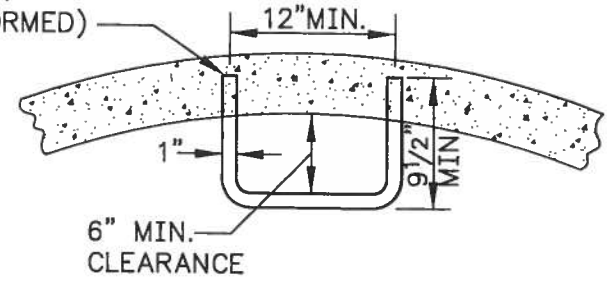


MAIN-LINE MANHOLE

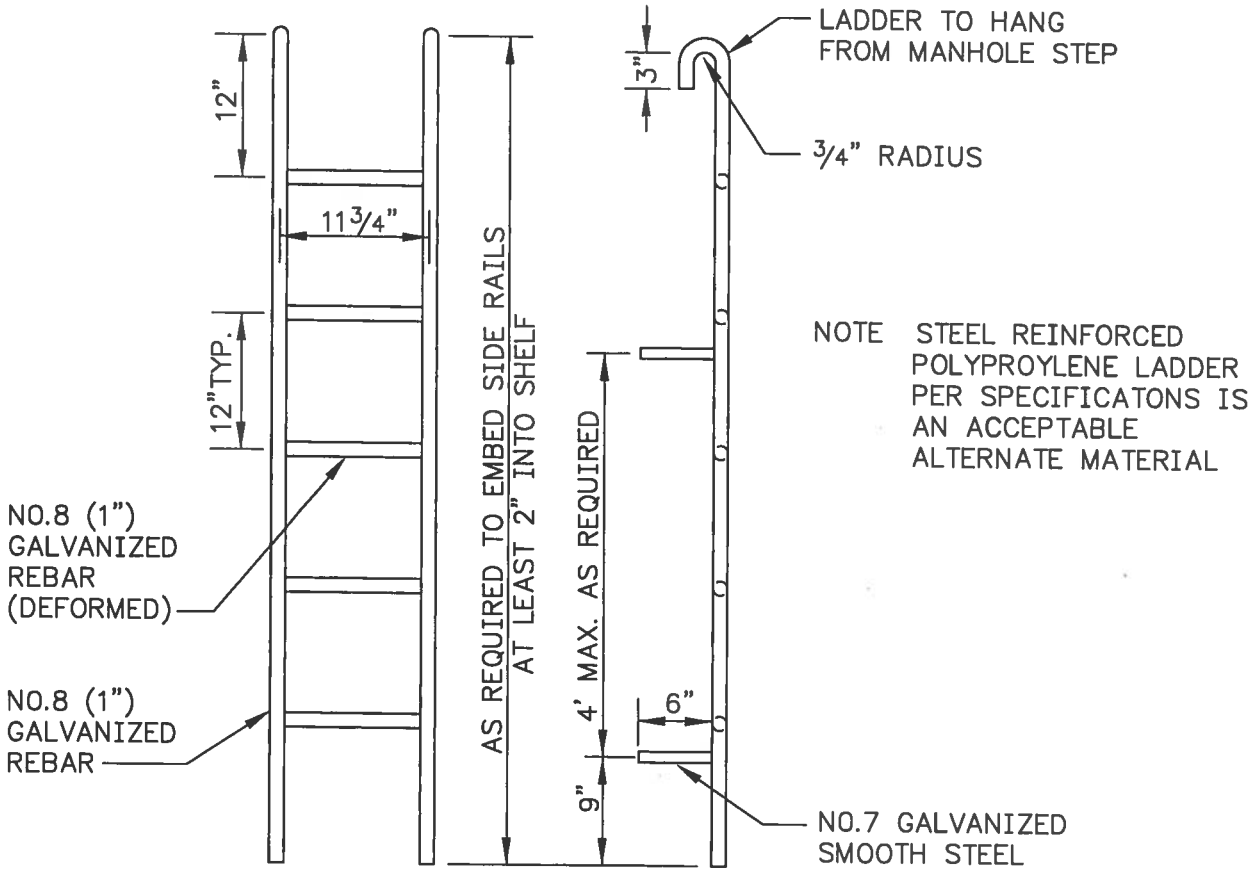
S4 MANHOLE CHANNELING



ADJUSTMENT RING HAND HOLD

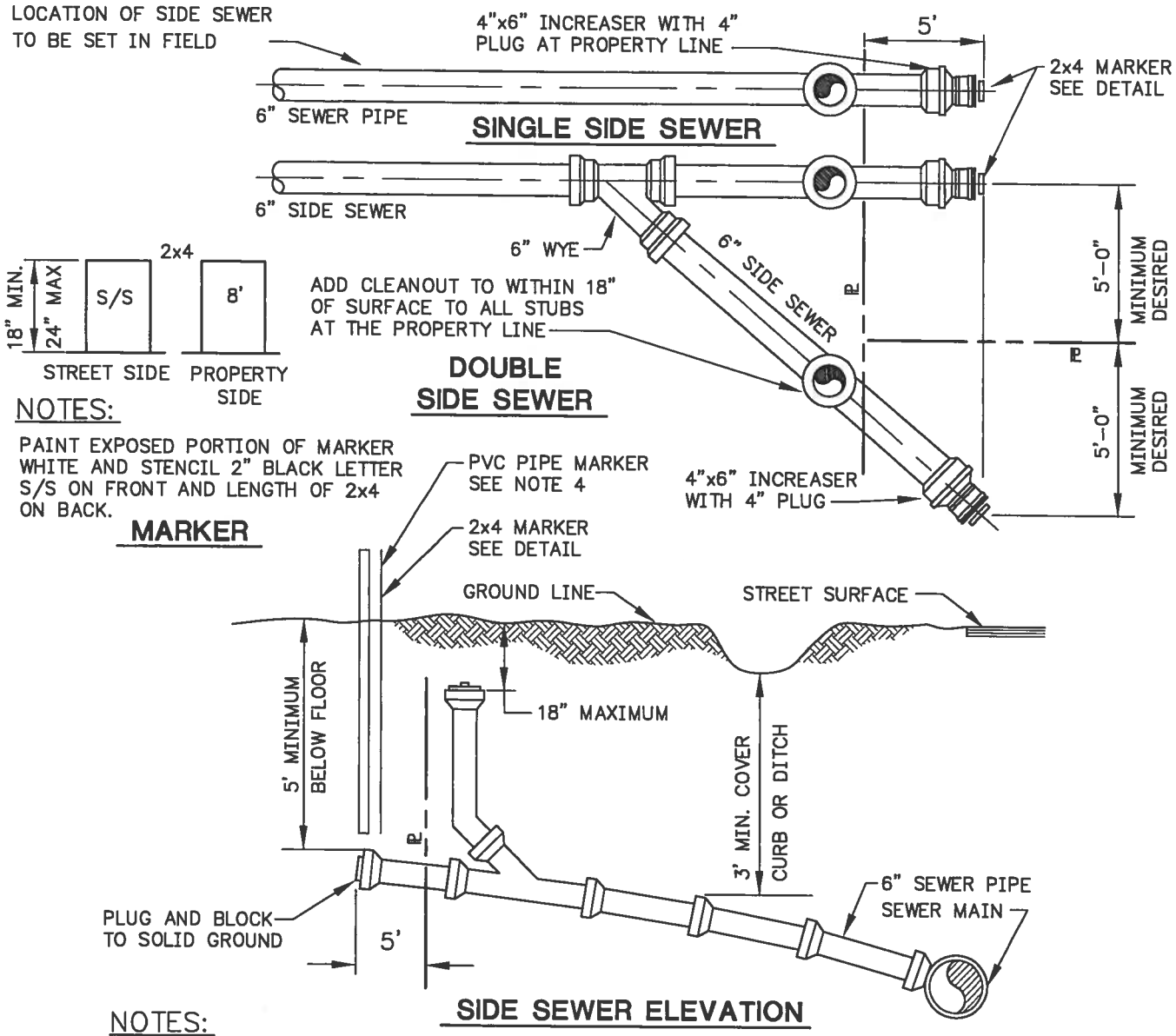


TYPICAL MANHOLE STEP



PREFABRICATED LADDER

S5 MANHOLE STEPS AND LADDER

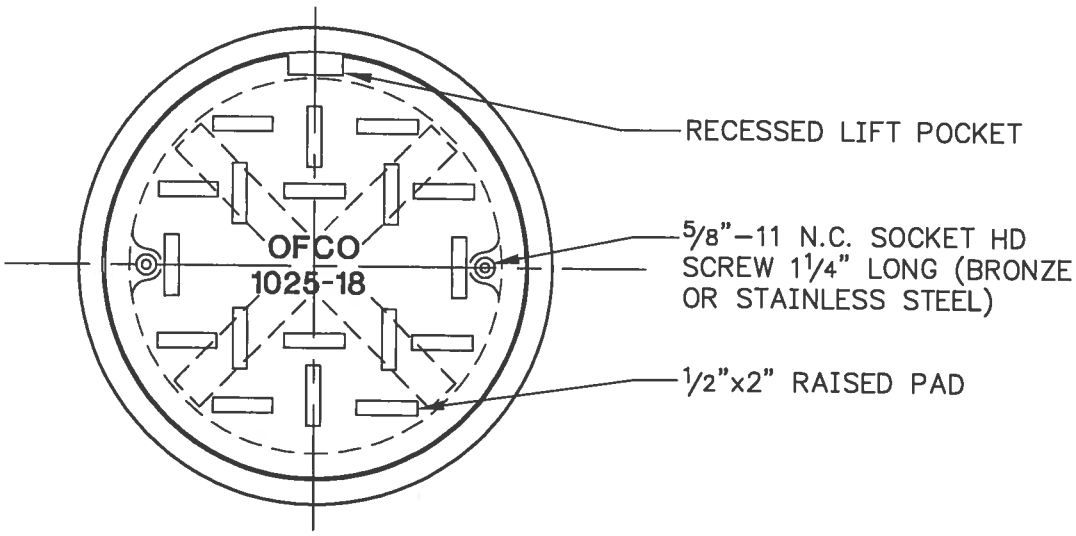


NOTES:

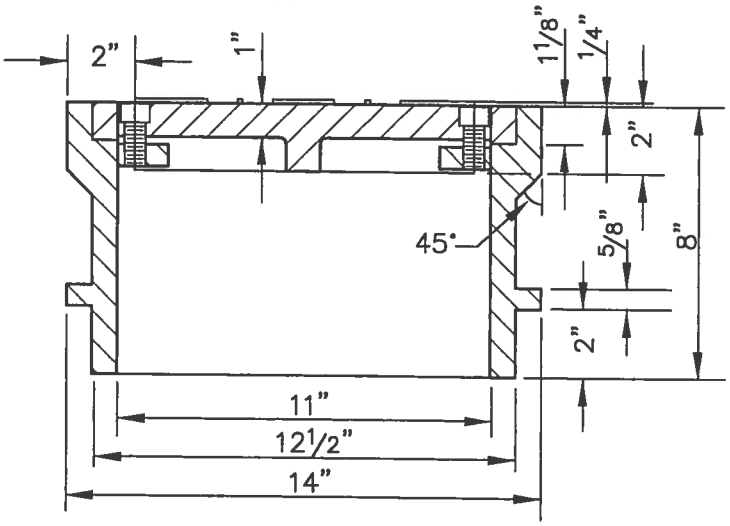
1. UNLESS OTHERWISE SHOWN ON PLAN, SIDE SEWER SHALL BE SLOPED 2% UP FROM SEWER LINE OR SHALL BE MIN. 5' COVER AT PROPERTY LINE OR 3.5' LOWER THAN THE LOWEST HOUSE ELEVATION, WHICHEVER IS LOWER.
2. 6" MINIMUM SIZE PIPE TO PROPERTY LINE. MAXIMUM DEFLECTION PER JOINT IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.
3. MAXIMUM SLOPE = 2 VERTICAL : 1 HORIZONTAL
4. MINIMUM SLOPE = 2%
5. A 1¼" WHITE PVC PIPE, ASTM 2241 SDR 21 200 PSI SHALL BE PLACED VERTICALLY AT THE END OF EACH STUB AND SHALL RISE TWO FEET ABOVE FINISH GRADE LEVEL OR AS APPROVED BY SWSSD. BOTH ENDS OF THE PVC PIPE SHALL HAVE CAPS GLUED ON AND THE PIPE INTERIOR KEPT CLEAN FOR THE PURPOSE OF FUTURE DEPTH MEASUREMENT.
6. PIPE SHALL BE PVC ASTM D3034.

S6 STREET SIDE SEWER

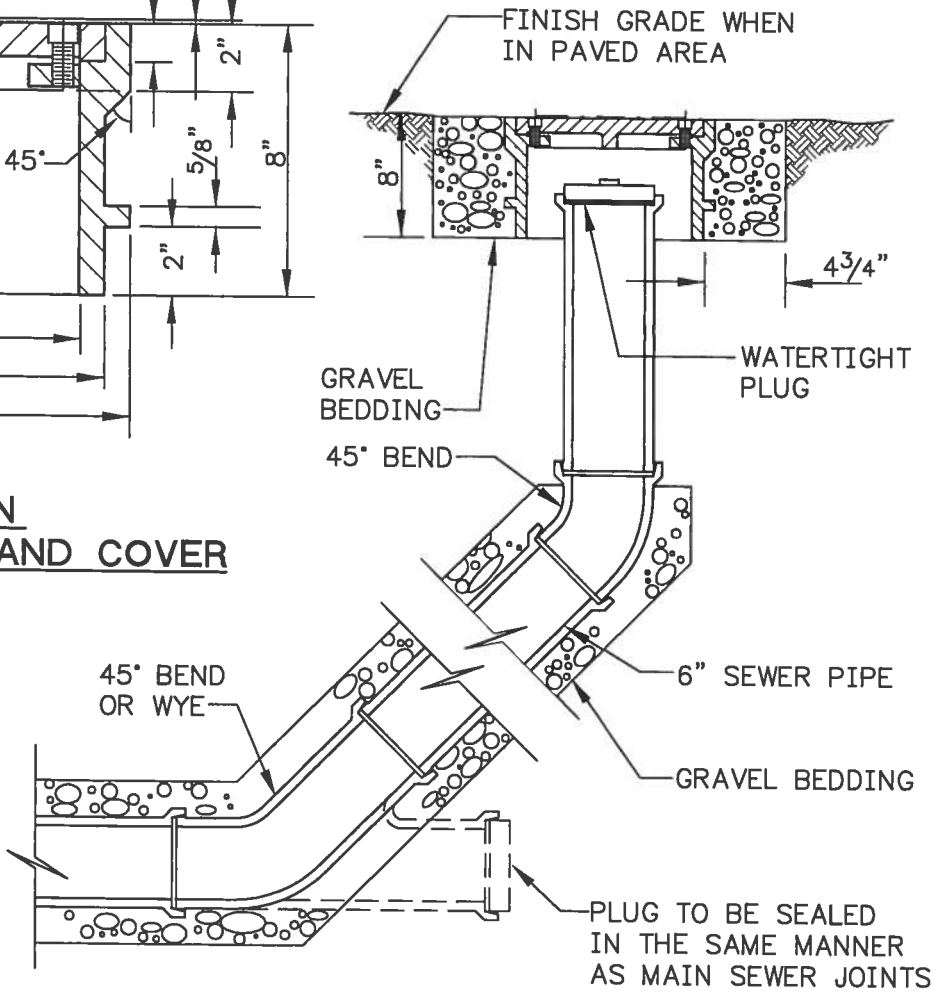
REV 02/06



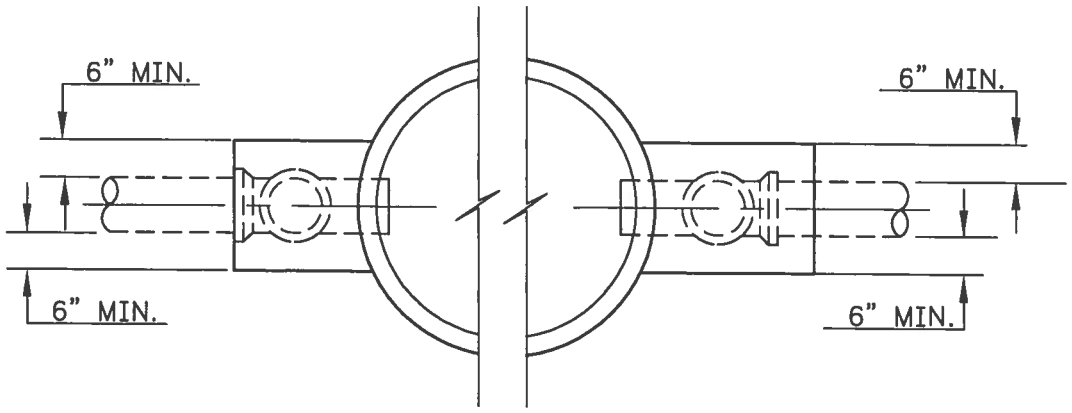
PLAN



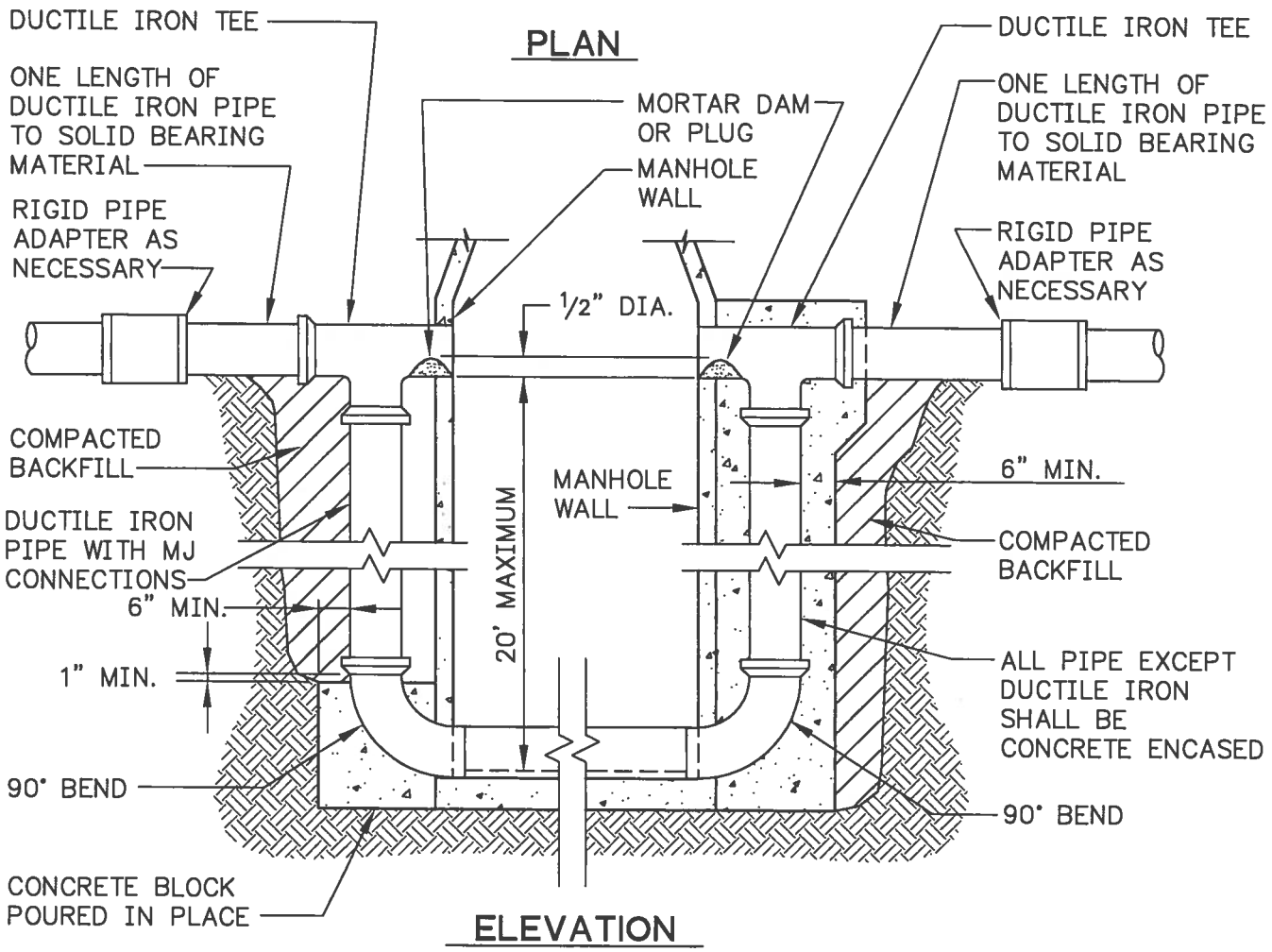
ELEVATION
CAST IRON RING AND COVER



S7 SEWER CLEANOUT



PLAN



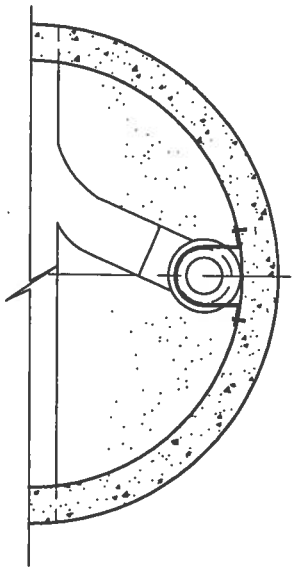
ELEVATION

DUCTILE IRON ALTERNATIVE

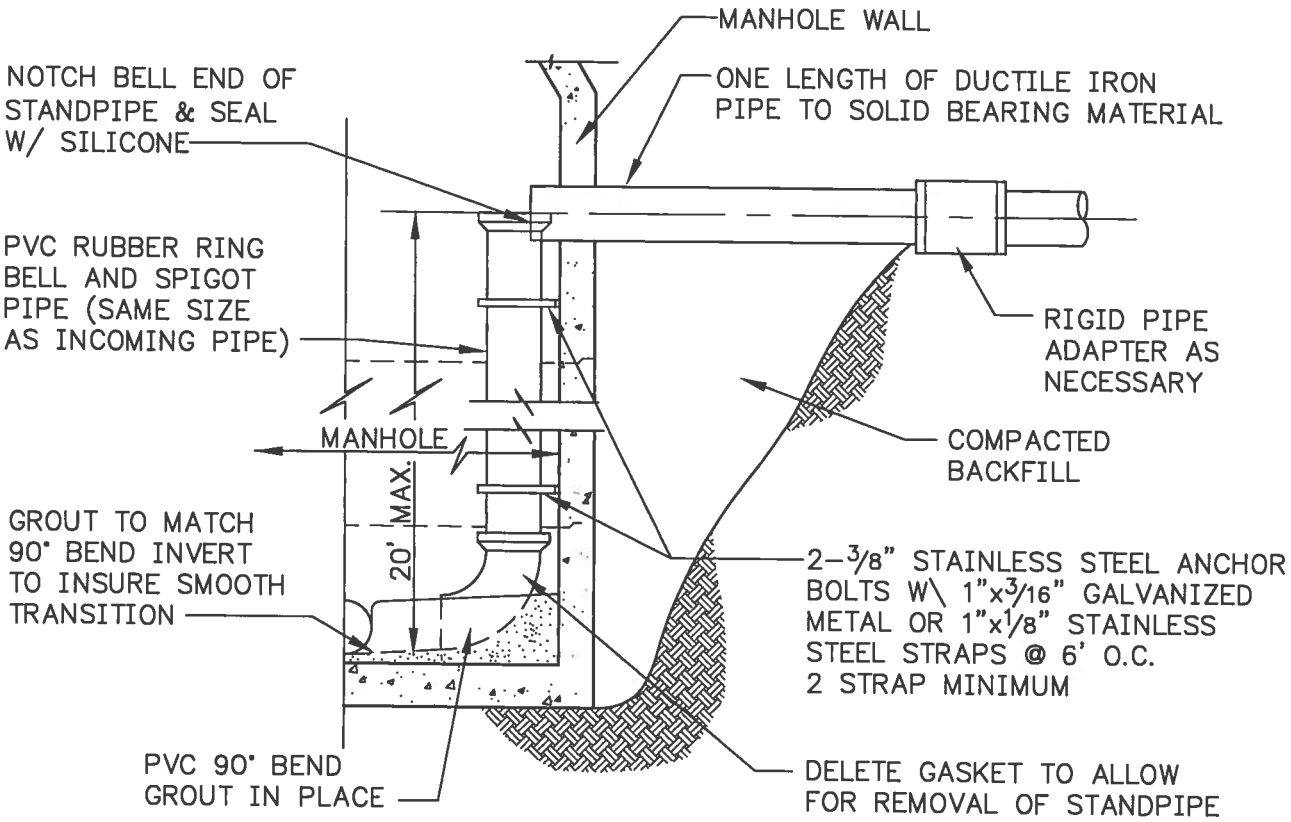
CONCRETE ENCASED ALTERNATIVE

OUTSIDE DROP MANHOLE CONNECTION

S8a



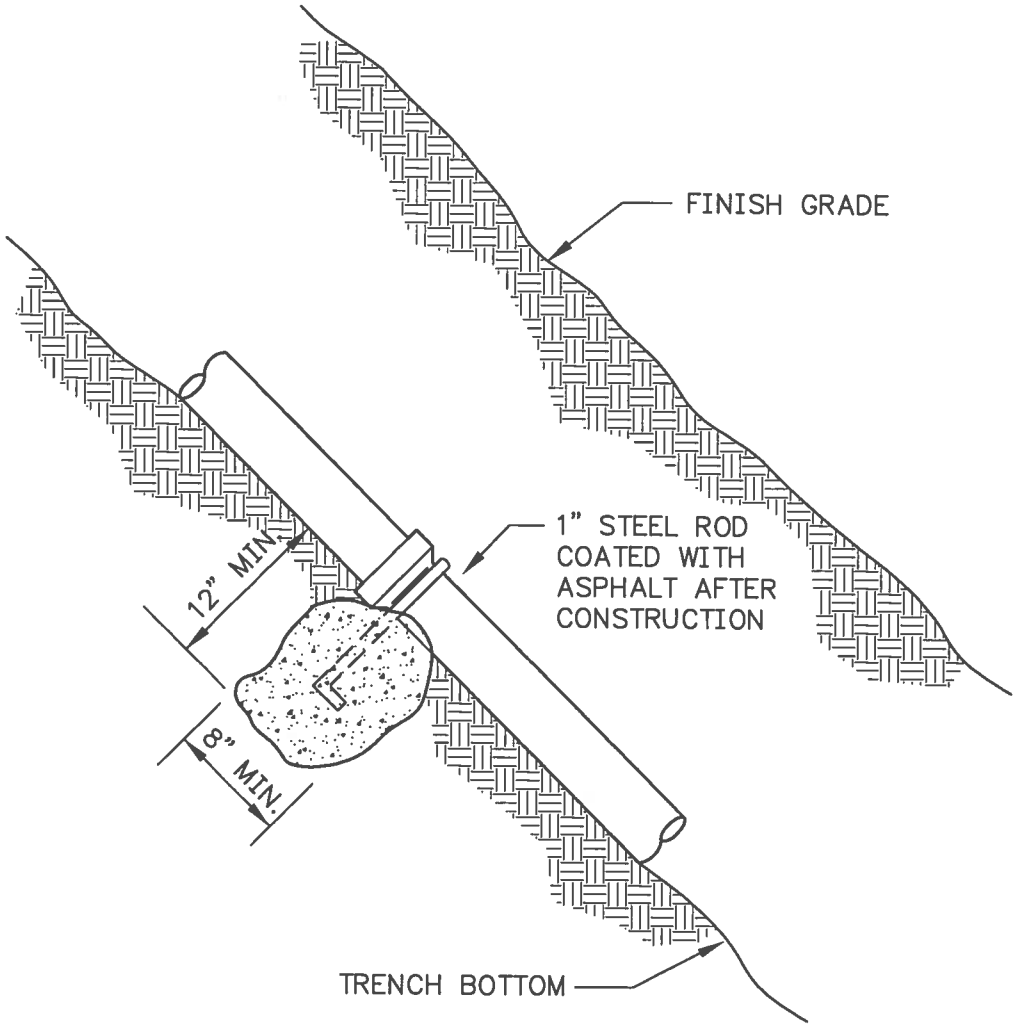
PLAN



ELEVATION

NOTE: THIS ASSEMBLY TO BE USED ONLY WITH SPECIFIC AUTHORIZATION

S8b INSIDE DROP MANHOLE CONNECTION

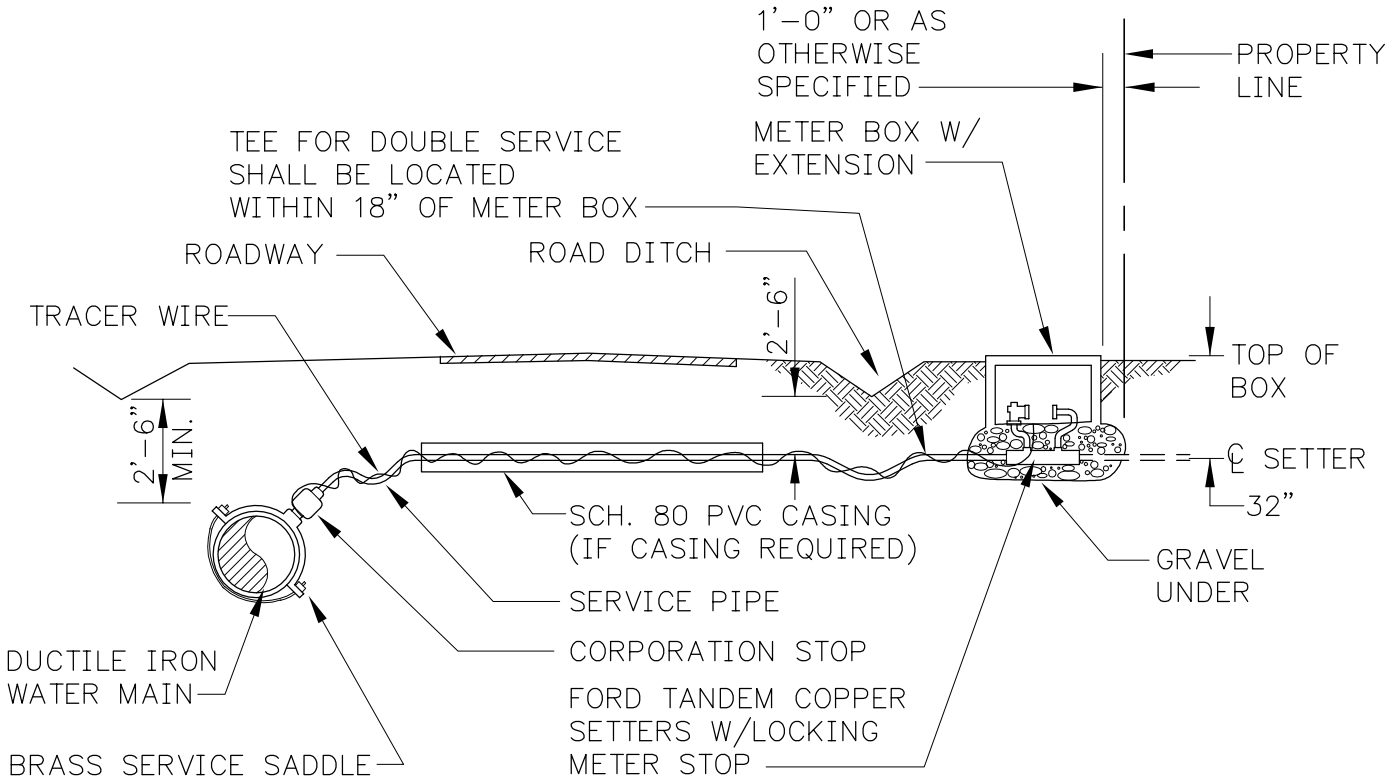


NOTES:

1. POUR BLOCKING AGAINST UNDISTURBED SOIL.
2. MINIMUM STRENGTH OF CONCRETE TO BE 2500 PSI.
3. MINIMUM SPACING BETWEEN ANCHORS TO BE 36' ON GRADES OF 20–30%, 20' ON GRADES OF 35–50%, AND 16' ON GRADES OVER 50%.

S9 PIPE ANCHOR

REV 12/05



PARTS FOR SINGLE SERVICE

1–¾" IPT x MAIN SIZE BRASS SERVICE SADDLE
1–¾" BRASS MIPT x GRIPPER CORPORATION STOP (FORD F–1101G)
1–¾" BRASS MIPT x GRIPPER ADAPTER (FORD C86–33G)
1–¾" BRASS MALE x INSERT ADAPTER (FORD PTM–1)
1–¾" x 12" COPPER SETTER WITH LOCKING METER STOP AND DUAL CHECK VALVE (FORD VBHC72–12W–11–33 DP x DP)
1–PLASTIC METER BOX (CARSON 1419)
1–PLASTIC METER BOX EXTENSION (CARSON 1419)
1–SETTER LOCK (FIROMATIC #93180100 OR EQUAL)

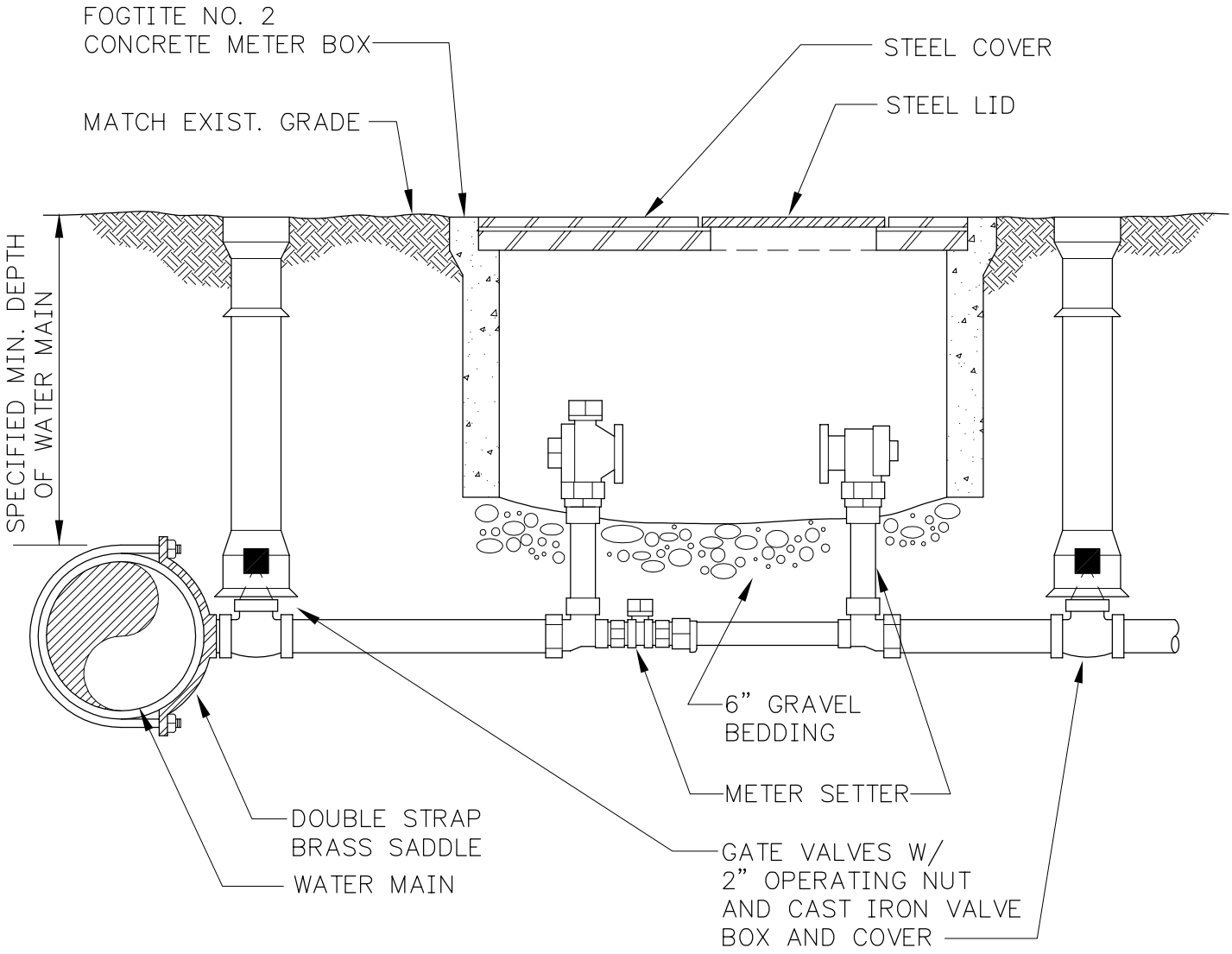
PARTS FOR DOUBLE SERVICE

1–1" IPT x MAIN SIZE BRASS SERVICE SADDLE
1–1" BRASS MIPT x GRIPPER CORPORATION STOP (FORD F–1101G)
1–1" BRASS GRIPPER TEE ¾" x ¾" x 1" (FORD T666–334G)
2–¾" BRASS STREET ELLS
2–¾" BRASS MIPT x GRIPPER ADAPTER (FORD C86–33G)
2–¾" x 12" COPPER SETTERS WITH LOCKING METER STOPS AND DUAL CHECK VALVES (FORD VBHC72–12W–11–33 DP x DP)
2–¾" BRASS MIPT x INSERT ADAPTERS (FORD PTM–1)
2–PLASTIC METER BOXES (CARSON 1419)
2–PLASTIC METER BOX EXTENSIONS (CARSON 1419)
1–SETTER LOCK (FIROMATIC #93180100 OR EQUAL)

NOTES:

1. WATER SERVICE LINE SHALL BE 200 PSI IPS PE 3408, ASTM–2239 (DRISCO ULTRA–HI MOLECULAR PE–3408)
2. USE BRASS DOUBLE STRAP SADDLE ON MAINS 10" AND LARGER.
3. WHERE FORD MATERIALS ARE CALLED OUT, EQUAL PRODUCTS ARE ACCEPTABLE

W1 ¾" AND 1" WATER SERVICE



PARTS FOR 1½" AND 2" SERVICE

1 – DOUBLE STRAP BRASS SADDLE WITH BRONZE STRAP

4 – FORD PACKJOINT COUPLINGS/PLASTIC PIPE

SETTERS: 1½" FORD VBH6612BX LENGTH WITH LOCKING BYPASS
2" FORD VBH7712BX LENGTH WITH LOCKING BYPASS
(SETTER LENGTH WILL BE DETERMINED BY TOWN)

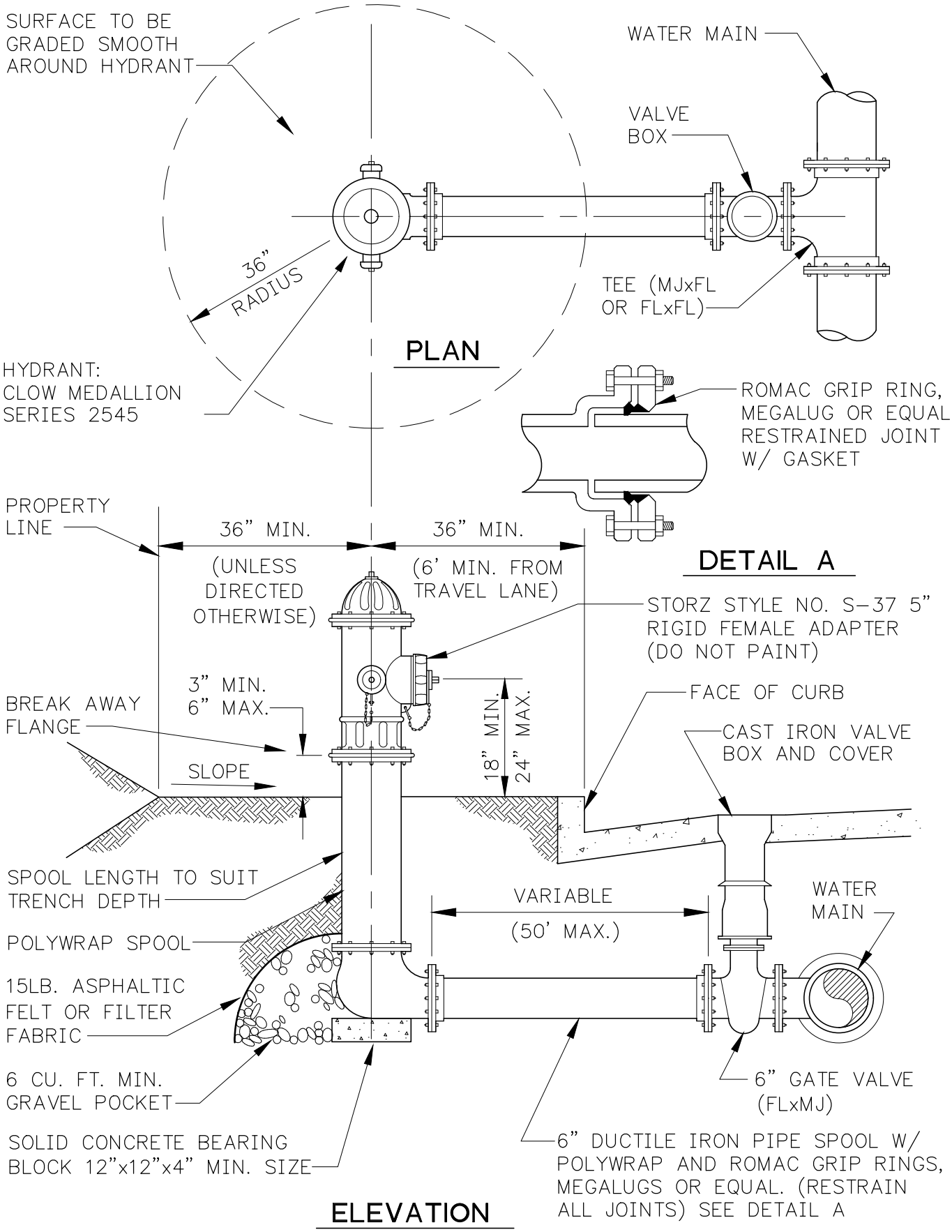
CONCRETE METER BOX WITH STEEL COVER AND METER LID
FOGTITE NO. 2

2 – GATE VALVES: 2 INCH–RESILIENT WEDGE SEATED (APWA C–509)
1½ INCH–BRASS

2 – CAST IRON VALVE BOX WITH COVER

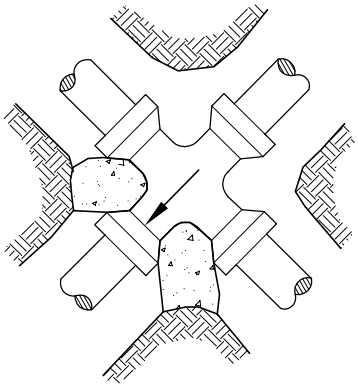
WATER SERVICE LINE 200 PSI IPS PE 3408, ASTM D–2239

W2 1½" AND 2" WATER SERVICE

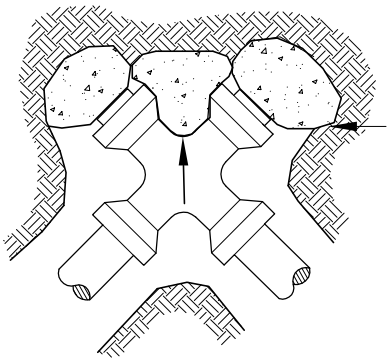


W3 FIRE HYDRANT ASSEMBLY

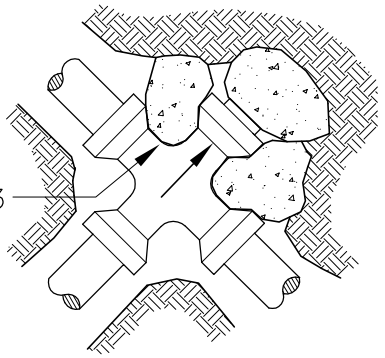
REV: 7/24/18



UNBALANCED CROSS



PLUGGED CROSS



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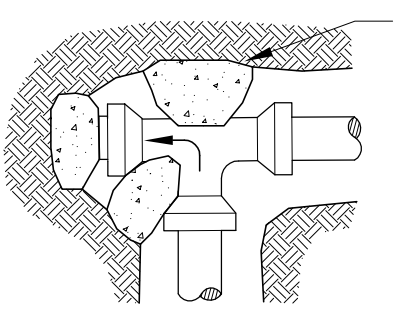
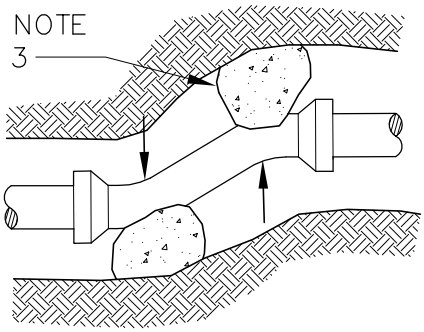
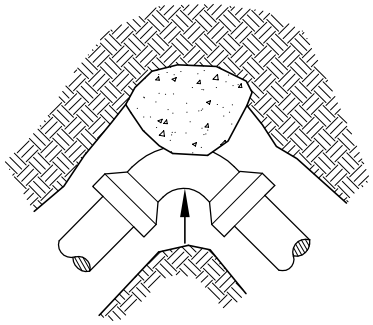


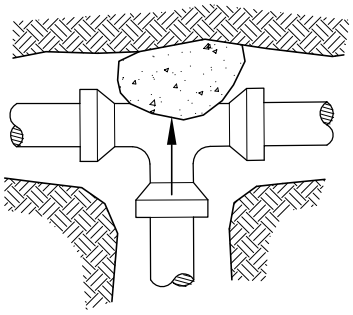
PLUGGED TEE



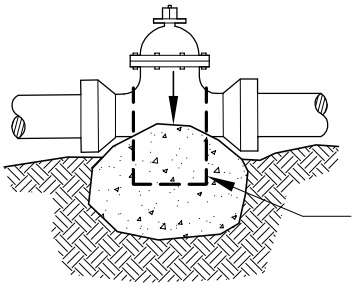
OFFSET



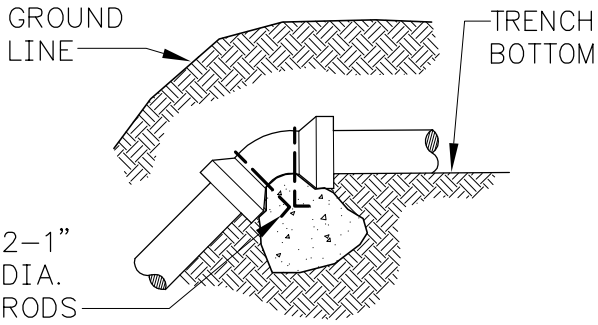
HORIZONTAL BEND



TEE



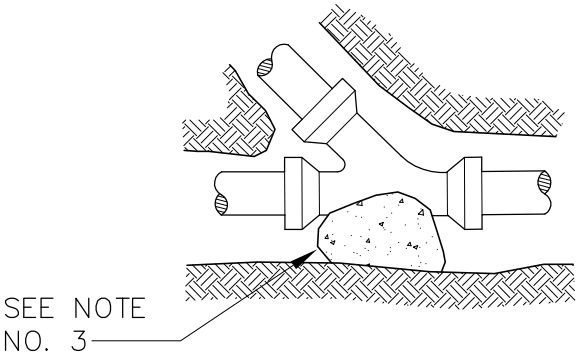
VALVE



VERTICAL BEND

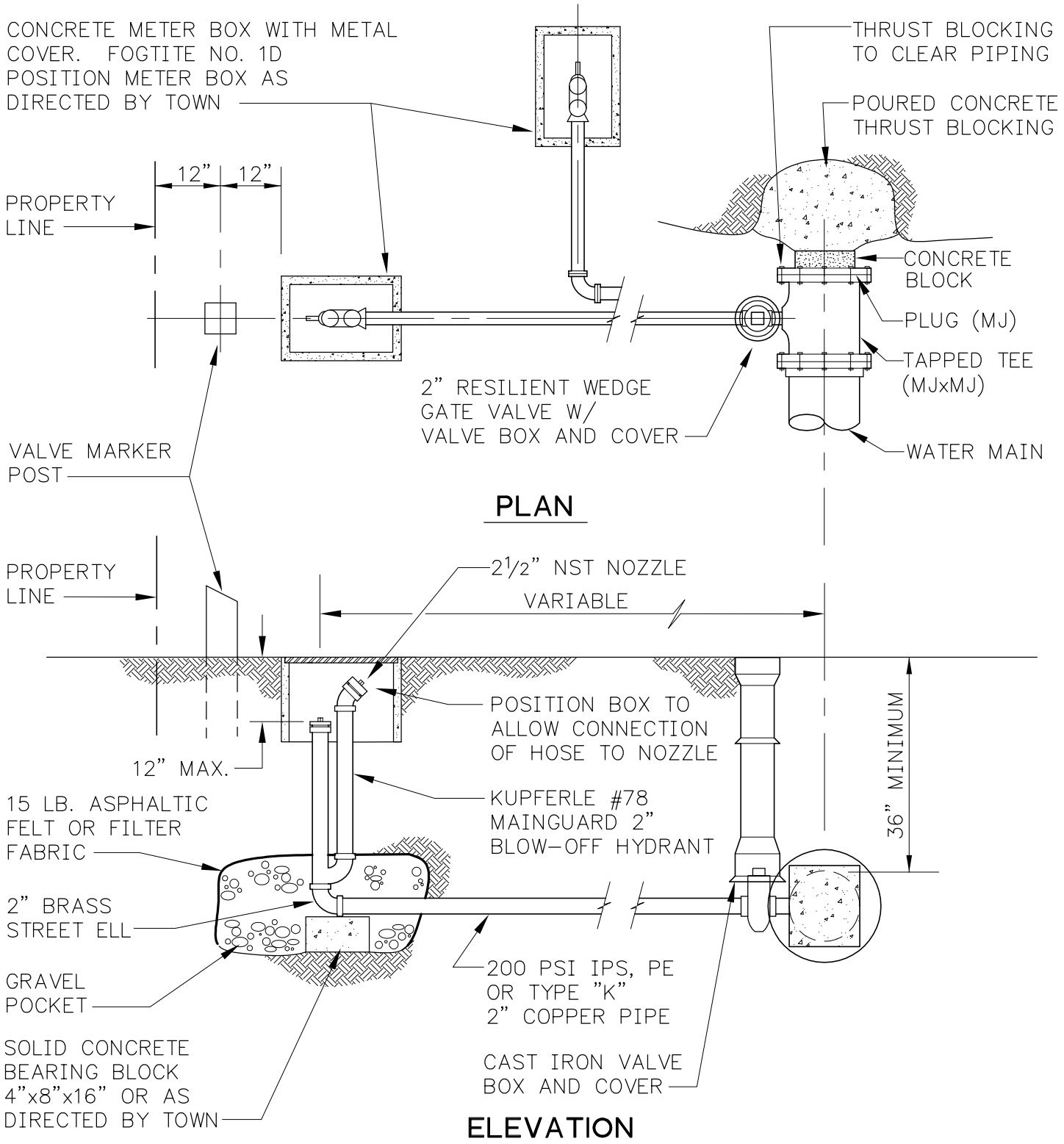
NOTES:

1. SIZE OF BLOCK TO BE DETERMINED BY THE CONTRACTOR, TO BE ADEQUATE FOR SOIL CONDITION AND PRESSURE INVOLVED.
2. ALL BLOCKING TO BE ON UNDISTURBED MATERIAL.
3. BLOCKING REQUIRED IF PLUGS NOT SECURED BY BOLTING OR ADEQUATE STRAPS.



"Y" BRANCH

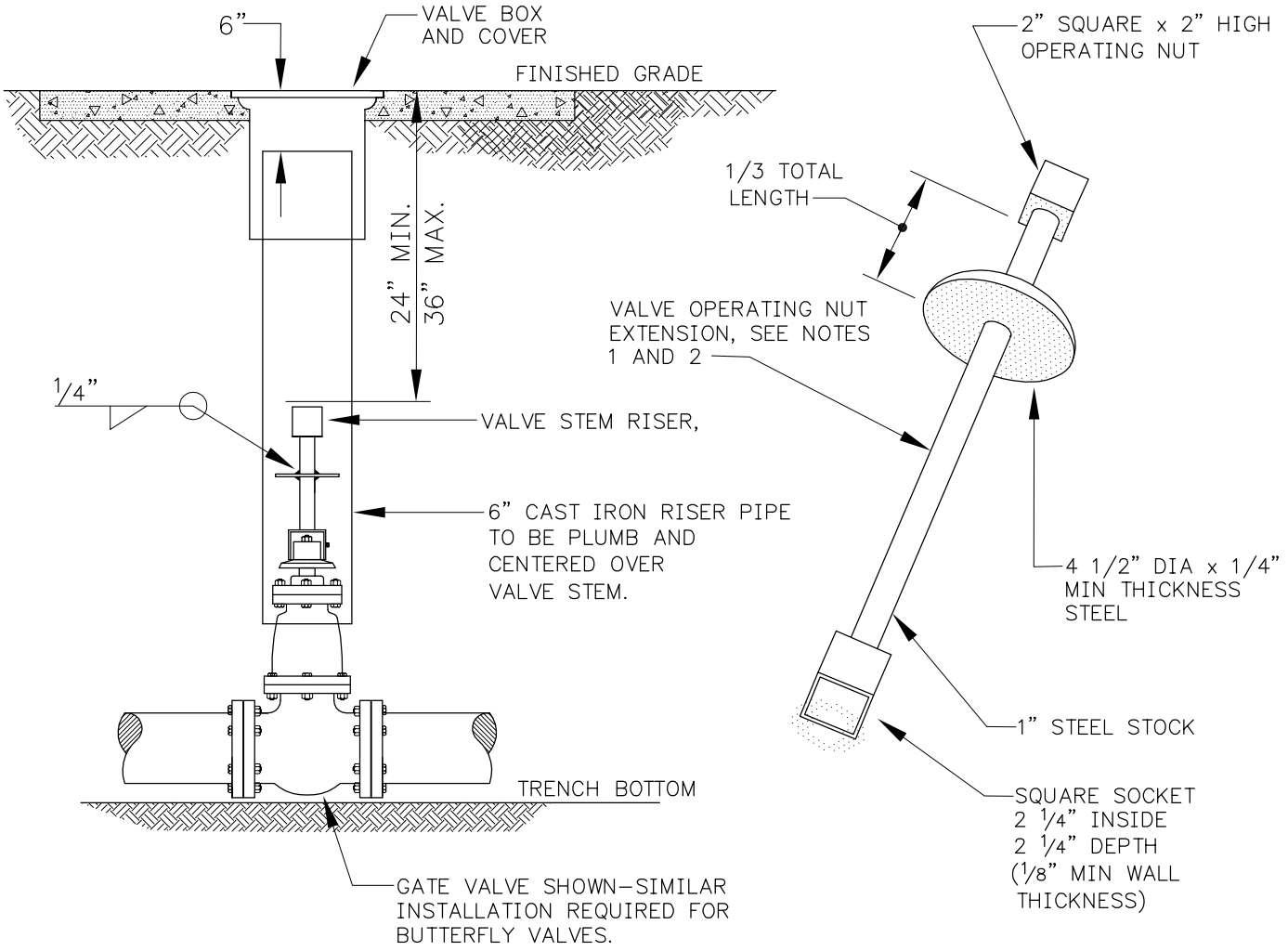
W4 CONCRETE THRUST BLOCKING



NOTES:

1. PAINT PIPE THREADS WITH ASPHALT PAINT AFTER ASSEMBLY.
2. VALVE AND ALL FITTINGS TO BE BRASS.
3. PIPING TO VALVE TO BE 2" UNLESS OTHERWISE NOTED ON PLAN.
4. PAINT VALVE MARKER POST PER TOWN REQUIREMENTS.

W5 BLOWOFF ASSEMBLY

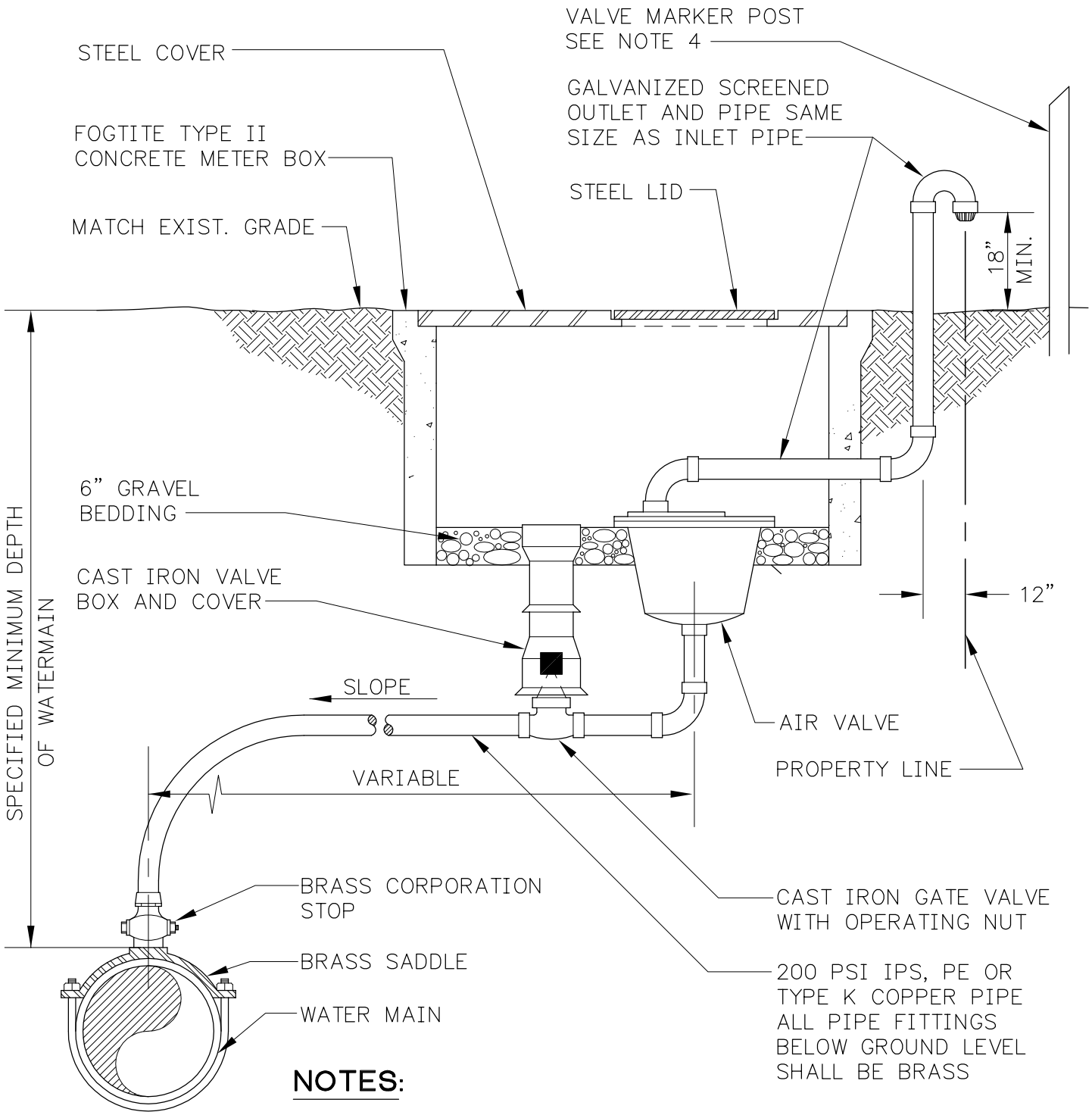


NOTES:

1. VALVE OPERATING NUT EXTENSIONS ARE REQUIRED WHEN THE VALVE NUT IS MORE THAN THREE (3) FEET BELOW FINISHED GRADE. EXTENSIONS ARE TO BE A MINIMUM OF ONE (1) FOOT LONG. ONLY ONE EXTENSION WILL BE ALLOWED PER VALVE.

2. ALL VALVE OPERATING NUT EXTENSIONS ARE TO BE MADE OF STEEL, SIZED AS NOTED, AND PAINTED WITH TWO (2) COATS OF METAL PAINT.

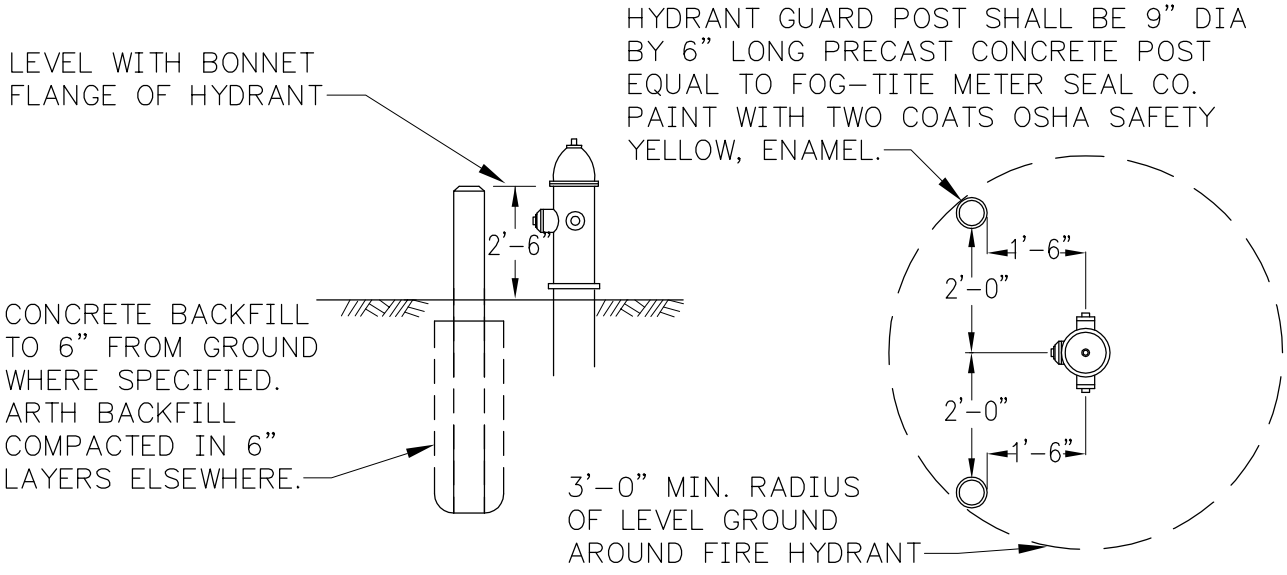
W6 VALVE OPERATING NUT EXTENSION



NOTES:

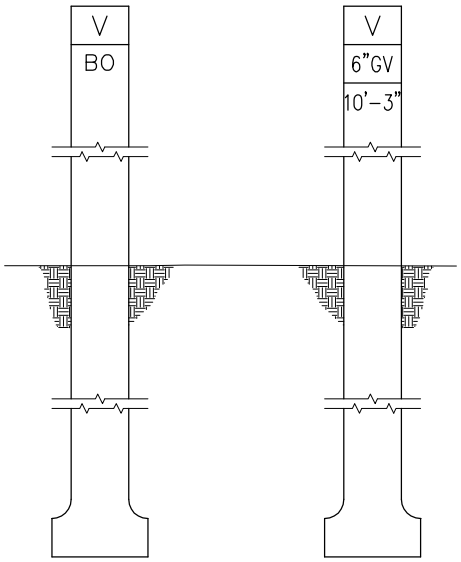
1. VALVE AND PIPING TO VALVE TO BE 2" UNLESS OTHERWISE NOTED ON PLAN.
2. LOCATE AT HIGH POINT OF MAIN.
3. TAP TOP OF MAIN.
4. VALVE MARKER POST TO BE PAINTED PER TOWN STANDARD. TOWN TO DETERMINE LOCATION.

W7 AIR RELEASE VALVE ASSEMBLY



ELEVATION **PLAN**

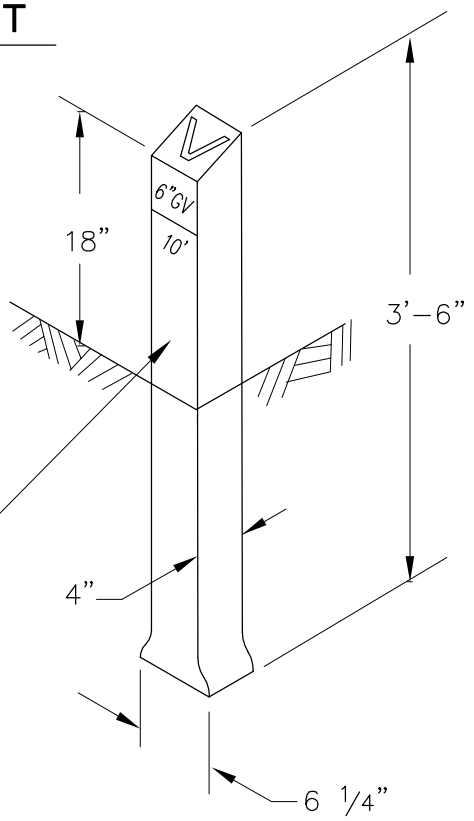
FIRE HYDRANT GUARD POST



FRONT VIEW (FOR BLOW-OFF ASSEMBLY)

FRONT VIEW (FOR GATE VALVE)

VALVE MARKER POST SHALL BE EQUAL TO FOG-TITE METER CO. PAINT AS SPECIFIED FOR HYDRANT GUARD POST. PAINT TYPE AND SIZE OF VALVE AND DISTANCE FROM THE VALVE MARKER TO THE VALVE ON THE POST WITH NEATLY STENCILED BLACK ENAMEL NUMBERS, 1" IN HEIGHT.

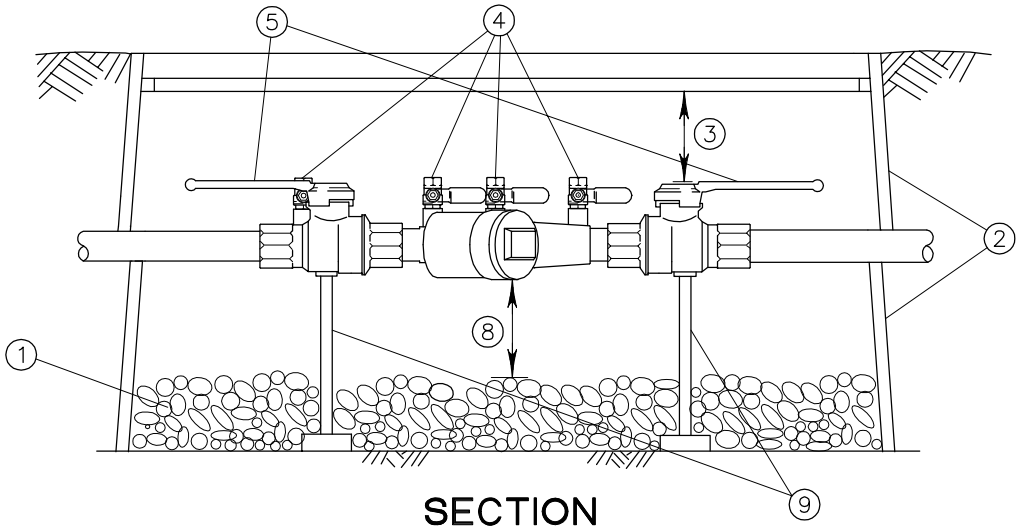


VALVE MARKER POST

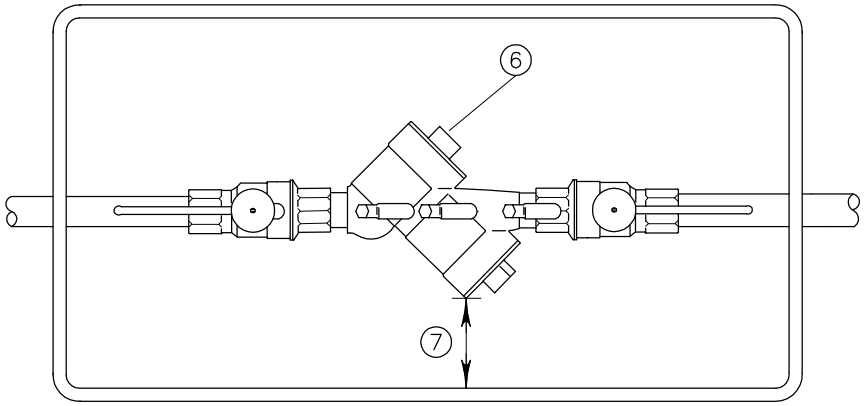
NOTES:

1. GUARD POSTS TO BE INSTALLED ONLY AS DIRECTED BY THE TOWN.
2. VALVE MARKERS TO BE USED FOR BLOW OFF AND MAINLINE VALVES OUTSIDE PAVED AREAS.

VALVE MARKER POST
W8 HYDRANT GUARD POST



SECTION



PLAN

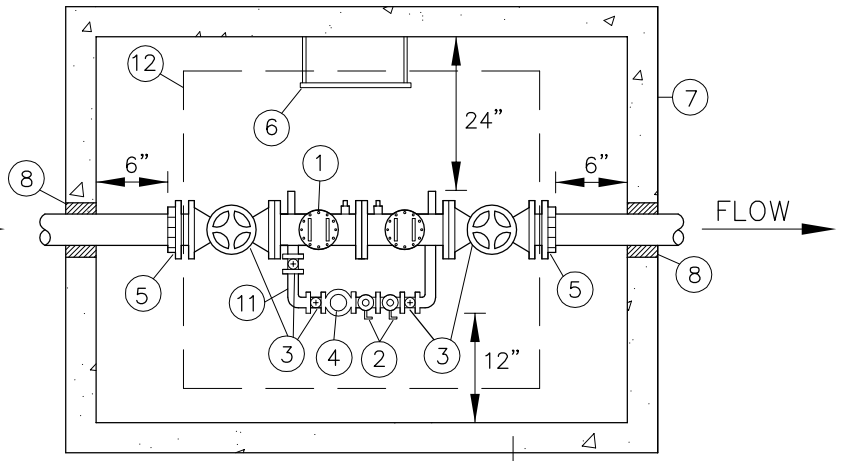
1. IF DAYLIGHT DRAIN SYSTEM CANNOT BE PROVIDED THEN INSTALL A 6" MINIMUM LAYER OF 1" ROUND WASHED GRAVEL AT THE BOTTOM OF THE BOX.
2. TWO NO. 2 METER BOXES STACKED ON TOP OF EACH OTHER OR APPROVED EQUAL.
3. A MAXIMUM DISTANCE OF 6" BETWEEN THE UNDERSIDE OF THE LID AND THE HIGHEST POINT OF THE DEVICE IS REQUIRED.
4. THE DEVICE MUST BE EQUIPPED WITH FOUR RESILIENT SEATED TEST COCKS WITH PLUGS INSTALLED. THE ASSEMBLY MUST ALSO BE INSTALLED WITH THE TEST COCKS FACING UP OR TO ONE SIDE.
5. THE DEVICE MUST ALSO BE EQUIPPED WITH TWO RESILIENT SEATED SHUT OFF VALVES.
6. THE DEVICE MUST BE INSTALLED HORIZONTALLY.
7. A MINIMUM DISTANCE OF 6" BETWEEN THE SIDE OF THE BOX AND THE TEST COCKS WHEN THEY ARE INSTALLED SIDE WAYS.
8. A MINIMUM DISTANCE OF 1 FOOT BETWEEN THE LOWEST POINT OF THE DEVICE AND THE DRAIN ROCK.
9. SUPPORTS WILL BE REQUIRED ON 2" AND LARGER DEVICES AS SHOWN.

GENERAL NOTE

THE D.C.V.A. CHOSEN MUST BE ON THE MOST RECENT WASHINGTON STATE APPROVAL LISTING. THE D.C.V.A. MUST BE TESTED BY A WASHINGTON STATE CERTIFIED BACKFLOW ASSEMBLY TESTER AT TIME OF INSTALLATION AND ANNUALLY, AND WHEN MOVED OR REPAIRED. ALL INSTALLATION MUST MEET MANUFACTURERS SPECIFICATIONS AND THE MINIMUM STANDARDS OF THE U.P.C.

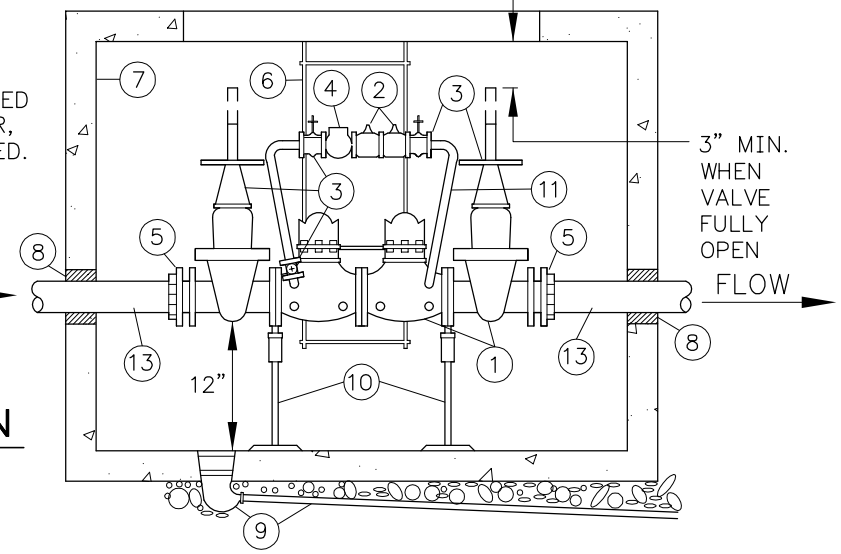
W9 DOUBLE CHECK VALVE ASSEMBLY

PLAN



NOTES:

1. TOWN WILL DETERMINE IF REDUCED PRESSURE PRINCIPAL DEVICE IS REQUIRED.
2. ASSEMBLY TO BE MAINTAINED BY PROPERTY OWNER/CUSTOMER & ANNUAL CERTIFICATION REQUIRED.
3. FIRELINE SHALL NOT BE PUT INTO SERVICE UNTIL THE BACKFLOW PREVENTION ASSEMBLY IS APPROVED BY TOWN. CERTIFICATION FOLLOWING INSTALLATION REQUIRED.
4. VALVE ASSEMBLY TO BE CENTERED IN VAULT.
5. TEE & GATE VALVE REQUIRED ON MAIN.
6. WHEN DOUBLE CHECK VALVE ASSEMBLY IS USED IN SAME LINE W/ DOMESTIC BUILDING METER, METERED DETECTOR BYPASS SHALL BE OMITTED.
7. ALL CLEARANCES SHOWN ARE MINIMUM.
8. VAULTS SHALL NOT BE INSTALLED IN AREAS W/ VEHICULAR TRAFFIC.
9. UL/FM METER REQUIRED IF POTABLE SERVICE ALSO PROVIDED FROM FIRE PROTECTION SERVICE LINE.



ELEVATION

(1) STATE APPROVED DOUBLE CHECK VALVE ASSEMBLY, COMPLETE W/ (2) RESILIENT SEATED O.S.&Y. VALVES & (4) RESILIENT SEATED TEST COCKS, & BRASS OR COPPER DETECTOR BY-PASS.

(2) STATE APPROVED 3/4" DOUBLE CHECK VALVE ASSEMBLY, COMPLETE W/ (2) RESILIENT SEATED BALL VALVES & (4) RESILIENT SEATED TEST COCKS.

(3) EACH VALVE SHALL BE MARKED W/ MODEL NUMBER W/ DESIGNATION OF RESILIENT SEAT, SUCH AS "RS" OR "R", WHICH MUST BE CAST, MOLDED, OR AFFIXED ONTO THE BODY OR BONNET OF THE VALVE. ALL FERROUS BODIED VALVES SHALL BE COATED W/ A MIN. OF 4 MLS. OF EPOXY OR EQUIVALENT POLYMERIZED COATING.

(4) 5/8"x3/4" METER (CUBIC FEET READING)-SENSUS METER W/ "TOUCH READ" SYSTEM.

(5) UNI-FLANGE W/ SETSCREWS.

(6) ONE GALVANIZED STEEL LADDER TO BE SECURED TO VAULT.

(7) CONCRETE VAULT W/ A MIN. OF 2, 3'x3' ALUM. DIAMOND PLATE DOORS RATED FOR H20 LOADING, MARKED "WATER". DOORS SHALL BE LW HATCH OR EQUAL W/ SPRING LIFT & RECESSED PADLOCK HASP. PAINTED ALUM. SIGN TO BE MOUNTED ON UNDERSIDE OF HATCH "CONFINED SPACE. ENTRY BY PERMIT ONLY". VAULT SHALL BE EQUAL TO UTILITY VAULT CO. MODEL LISTED IN TABLE BELOW.

(8) WATER TIGHT GROUT. RESTRAIN INLET/OUTLET PIPE W/ WELDED FLANGE OR ANCHOR BLOCKS.

(9) DRAIN, SLOPE TO DAYLIGHT WHERE APPLICABLE.

(10) TWO ADJUSTABLE PIPE STANCHIONS.

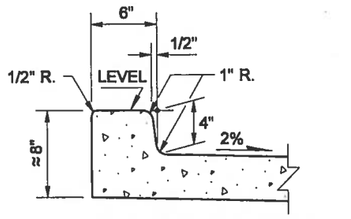
(11) ALL PLUMBING FOR BY-PASS TO BE COPPER & BRASS.

(12) ACCESS TO BE CENTERED OVER METER.

(13) CL. 52 D.I., M.J. W/ RETAINER GLANDS.

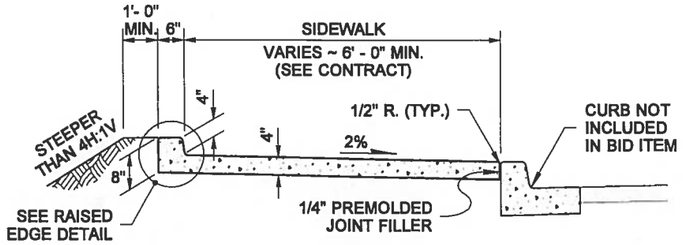
SIZE	MIN. VAULT SIZE (INSIDE) W	L	H	UTIL. VAULT CO. MODEL	UTIL. VAULT CO. COVER
3"	4'-2"	4'-8"	3'-3"	675-WA	675-2-332P
4"	4'-6"	5'-3"	3'-8"	675-WA	675-2-332P
6"	4'-8"	6'-6"	4'-5"	675-WA	675-2-332P
8"	5'-0"	7'-8"	5'-3"	687-LA	687-TL-2-332
10"	5'-2"	8'-8"	6'-1"	5106-LA	5106-TL3-332

W10 DOUBLE CHECK DETECTOR ASSEMBLY

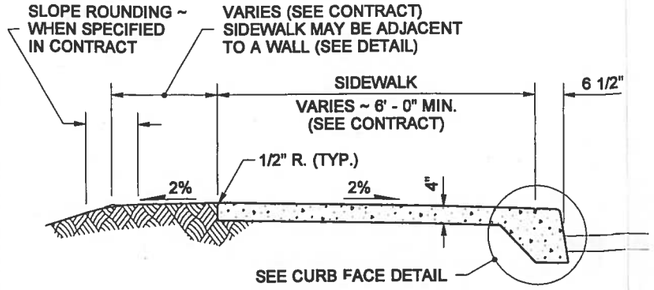


NOTE: EXTEND SIDEWALK TRANSVERSE JOINTS TO INCLUDE RAISED EDGE

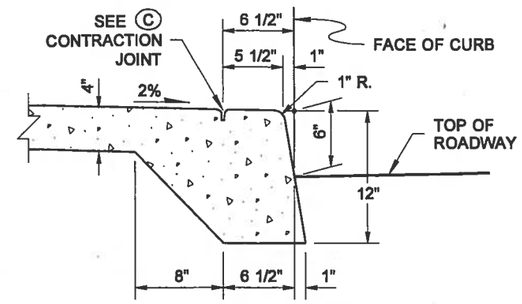
RAISED EDGE DETAIL



CEMENT CONCRETE SIDEWALK WITH RAISED EDGE

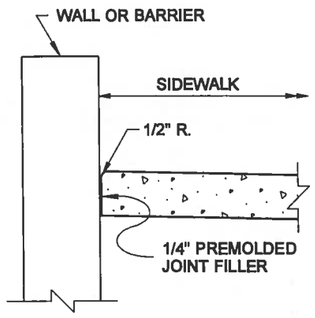


MONOLITHIC CEMENT CONCRETE CURB AND SIDEWALK

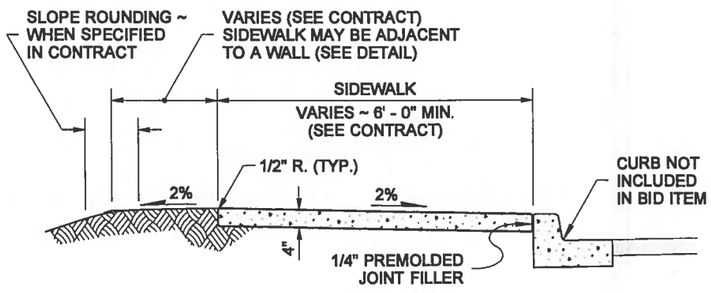


NOTE: EXTEND SIDEWALK TRANSVERSE EXPANSION JOINTS TO INCLUDE CURB (FULL DEPTH)

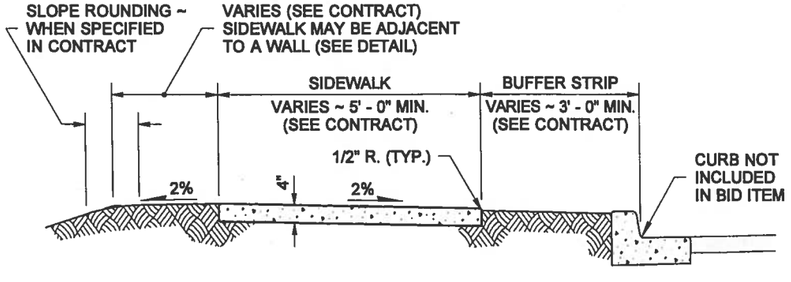
CURB FACE DETAIL



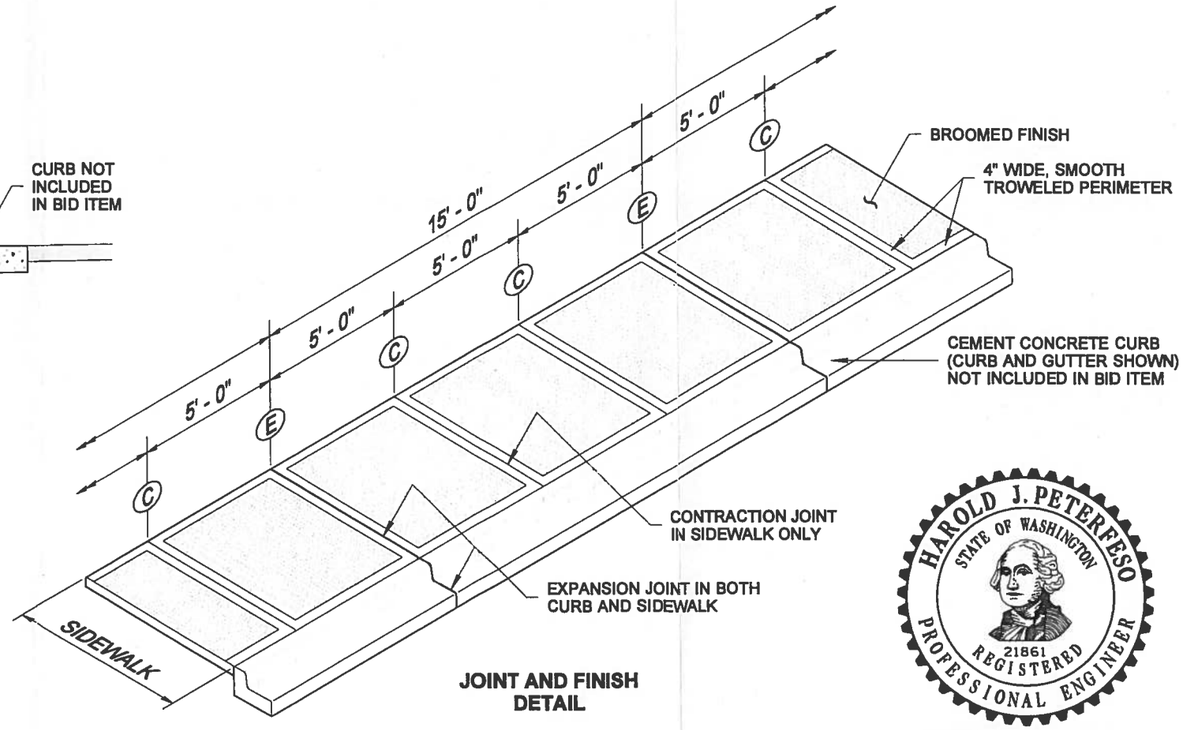
SIDEWALK ADJACENT TO WALL DETAIL



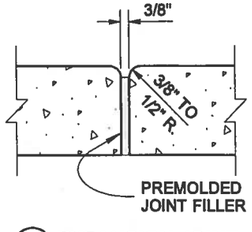
CEMENT CONCRETE SIDEWALK
ADJACENT TO CURB



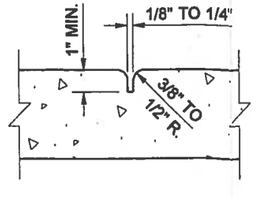
CEMENT CONCRETE SIDEWALK
ADJACENT TO BUFFER STRIP



JOINT AND FINISH DETAIL



(E) EXPANSION JOINT



(C) CONTRACTION JOINT

HAROLD J. PETERFESO
STATE OF WASHINGTON
21861
REGISTERED
PROFESSIONAL ENGINEER

EXPIRES MAY 16, 2003

CEMENT CONCRETE SIDEWALK

STANDARD PLAN F-3

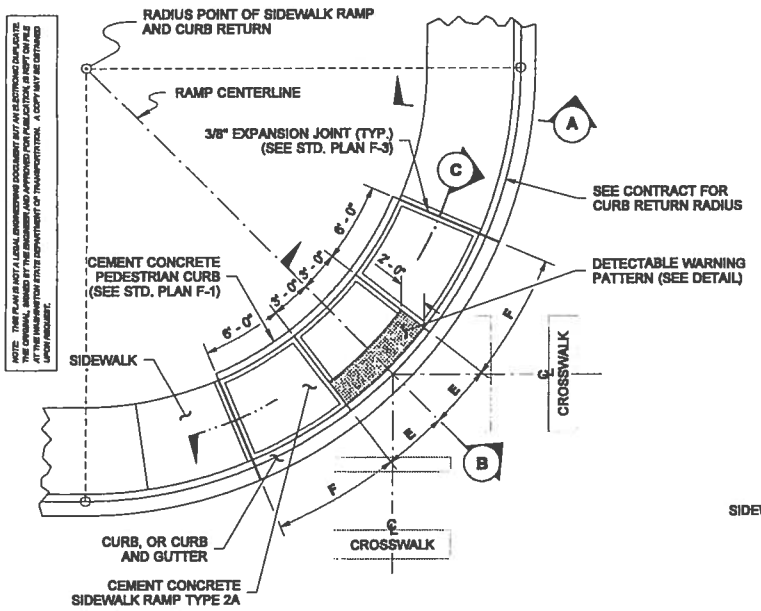
SHEET 1 OF 1 SHEET

APPROVED FOR PUBLICATION

Harold J. Peterfeso — STATE DESIGN ENGINEER — *01-13-03* — DATE

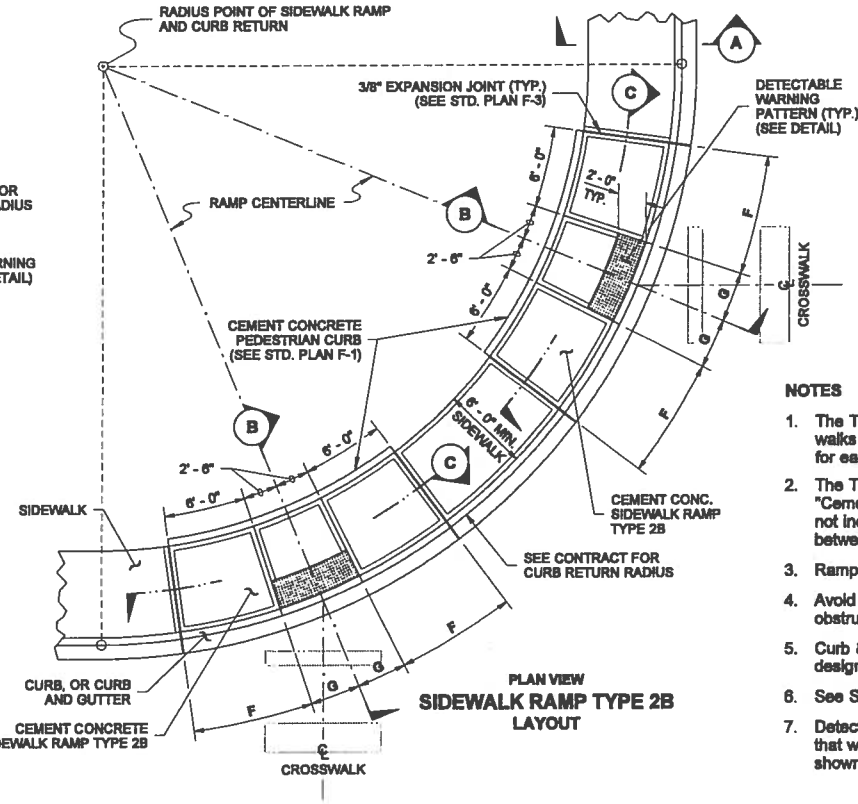
Washington State Department of Transportation

NOTE: THIS PLAN IS NOT A LEGAL ENGINEERING DOCUMENT BUT AN ELECTRONIC DUPLICATE. THE ORIGINAL, SIGNED BY THE ENGINEER AND APPROVED FOR PUBLICATION, IS KEPT ON FILE AT THE WASHINGTON STATE DEPARTMENT OF TRANSPORTATION. A COPY MAY BE OBTAINED UPON REQUEST.



PLAN VIEW

SIDEWALK RAMP TYPE 2A LAYOUT



PLAN VIEW

SIDEWALK RAMP TYPE 2B LAYOUT

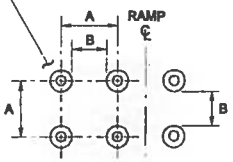
RADIUS (AT CURB FACE)	E	F	G
20 FEET	4' - 5 1/4"	6' - 10 1/2"	3' - 8 1/2"
30 FEET	3' - 10"	7' - 6"	3' - 2 1/4"
40 FEET	3' - 7"	7' - 2"	3' - 0"
50 FEET	3' - 5 1/2"	6' - 10 3/4"	2' - 10 1/2"
60 FEET	3' - 4 1/2"	6' - 8 3/4"	2' - 9 1/2"
70 FEET	3' - 3 3/4"	6' - 7 1/2"	2' - 9"
80 FEET	3' - 3 1/4"	6' - 8 1/2"	2' - 8 1/2"
90 FEET	3' - 2 3/4"	6' - 5 1/2"	2' - 8 1/4"
100 FEET	3' - 2 1/2"	6' - 5"	2' - 8"

INTERMEDIATE RADII CAN BE INTERPOLATED

NOTES

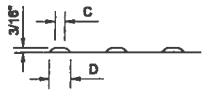
1. The Type 2A Ramp is used to provide access to two cross-walks only when it is infeasible to provide a separate ramp for each crosswalk.
2. The Type 2B Ramp Layout requires two (2) of this bid item: "Cement Conc. Sidewalk Ramp Type 2B". The bid item does not include the adjacent Curb (or Curb & Gutter), the Sidewalk between Ramps, or the Cement Conc. Pedestrian Curb.
3. Ramp slopes shall not be steeper than 12H:1V.
4. Avoid placing drainage structures, junction boxes or other obstructions in front of ramp access areas.
5. Curb & Gutter is shown, see the Contract Plans for the curb design specified. See Standard Plan F-1 for curb details.
6. See Std. Plan F-3 for sidewalk joint placement and details.
7. Detectable warning patterns may be created by any method that will achieve the truncated dome dimensions and spacing shown.

DETECTABLE WARNING PATTERN AREA SHALL BE YELLOW, IN COMPLIANCE WITH STD. SPEC. 8-14.3(3)



PLAN

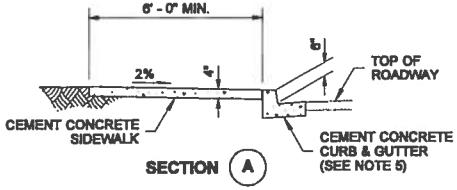
	MIN.	MAX.
A	1 5/8"	2 3/8"
B	5/8"	1 1/2"
C	7/16"	3/4"
D	7/8"	1 7/16"



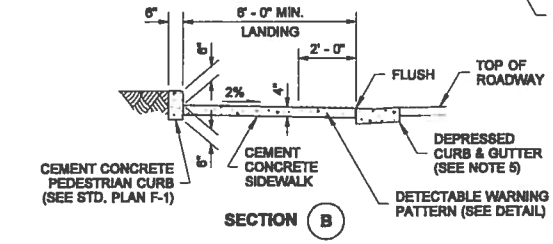
ELEVATION

TRUNCATED DOMES (SEE NOTE 7)

DETECTABLE WARNING PATTERN DETAIL



SECTION (A)



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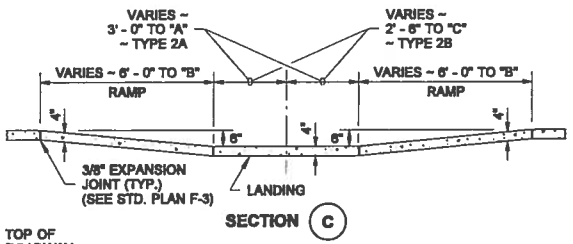

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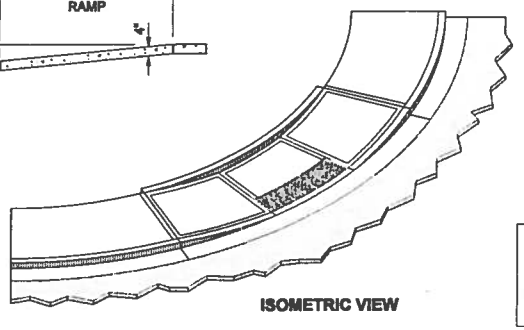


ISOMETRIC VIEW

EXPIRES MAY 16, 2007

SIDEWALK RAMP TYPES 2A & 2B WITH LAYOUTS STANDARD PLAN F-3b

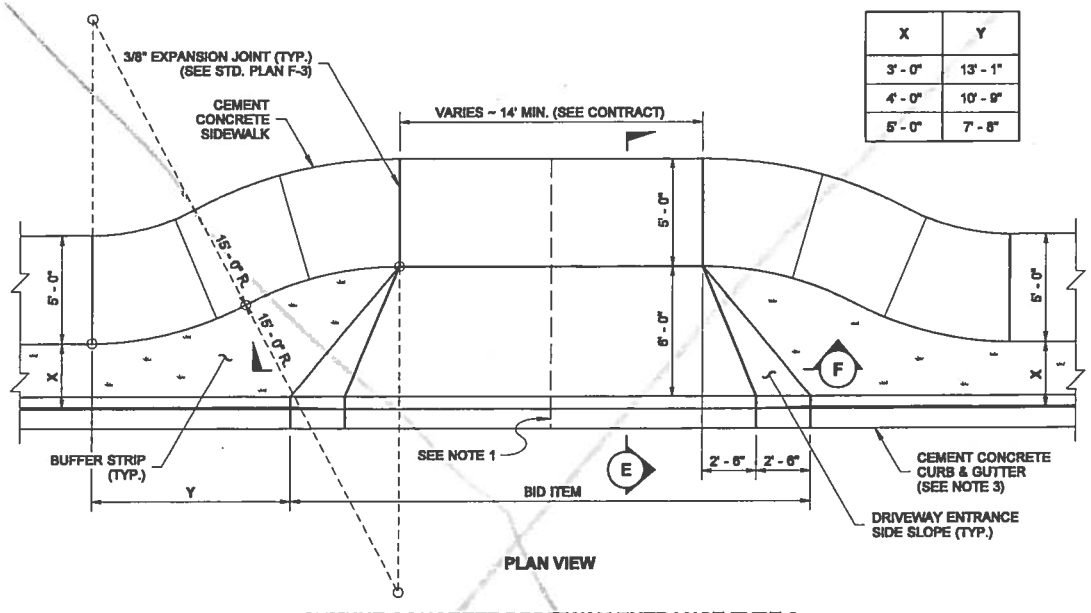
SHEET 1 OF 1 SHEET

APPROVED FOR PUBLICATION

Harold J. Peterfeso 09-02-05

STATE DESIGN ENGINEER — DATE

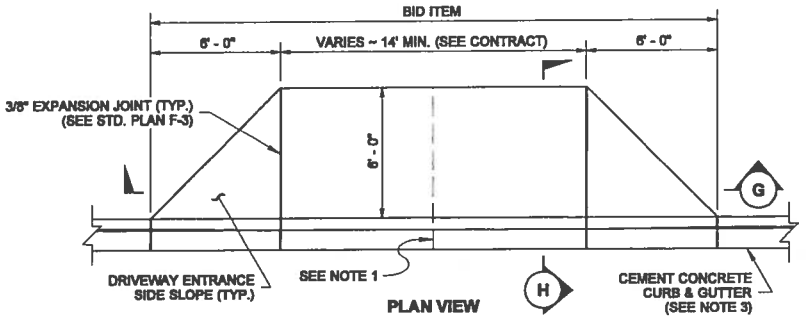
Washington State Department of Transportation



X	Y
3' - 0"	13' - 1"
4' - 0"	10' - 9"
5' - 0"	7' - 8"

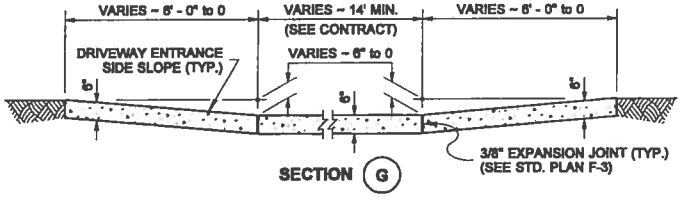
PLAN VIEW

CEMENT CONCRETE DRIVEWAY ENTRANCE TYPE 3

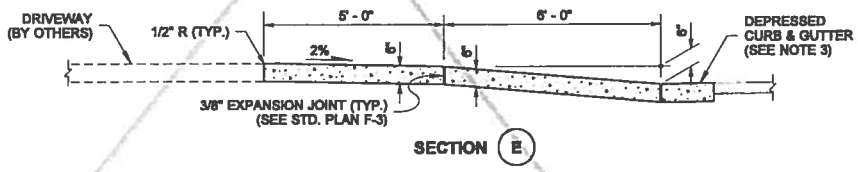


PLAN VIEW

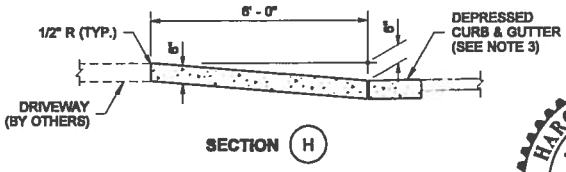
CEMENT CONCRETE DRIVEWAY ENTRANCE TYPE 4



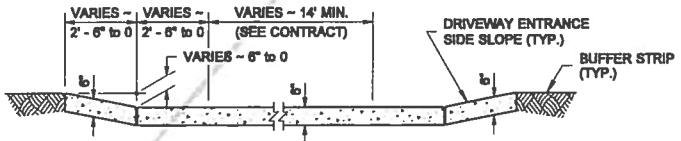
SECTION G



SECTION E



SECTION H



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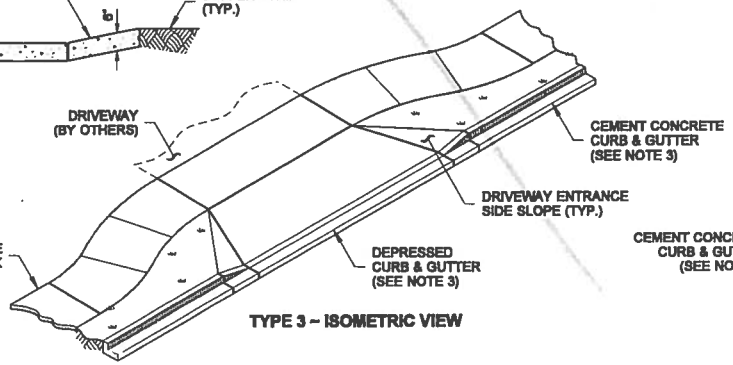
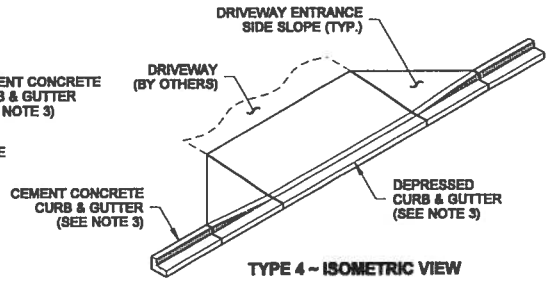


TYPE 3 ~ ISOMETRIC VIEW



TYPE 4 ~ ISOMETRIC VIEW

HAROLD J. PETERFESO
STATE OF WASHINGTON
21861
REGISTERED
PROFESSIONAL ENGINEER

EXPIRES MAY 16, 2003

CEMENT CONCRETE DRIVEWAY ENTRANCE TYPES 1, 2, 3 & 4 STANDARD PLAN F-4

SHEET 2 OF 2 SHEETS

APPROVED FOR PUBLICATION

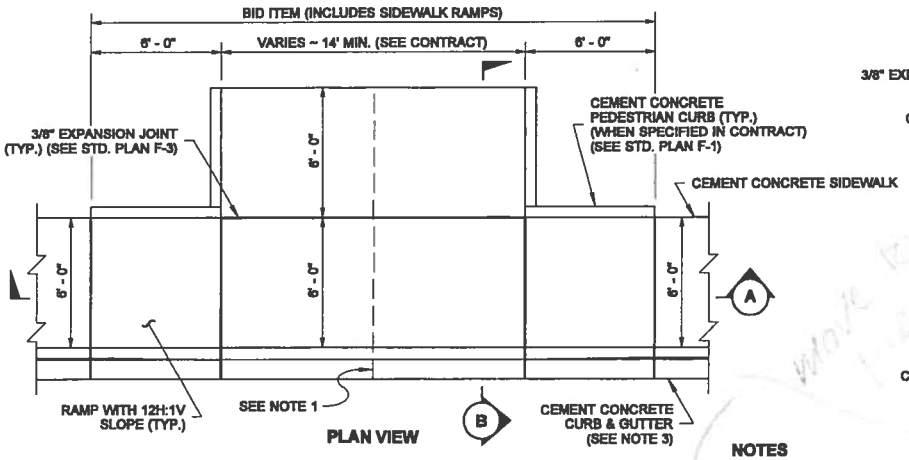
Harold J. Peterfeso 01-13-03

STATE DESIGN ENGINEER — DATE

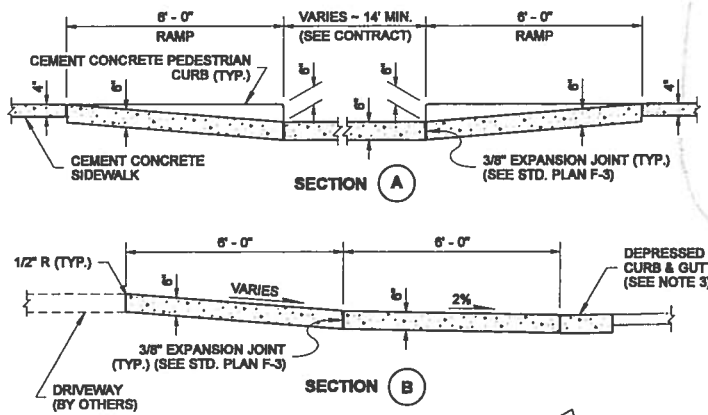
Washington State Department of Transportation

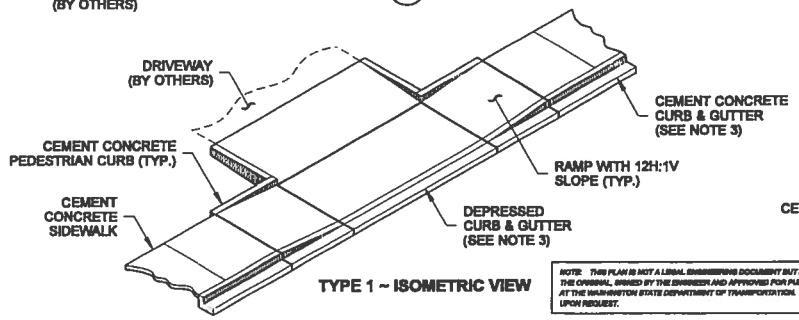
Okay

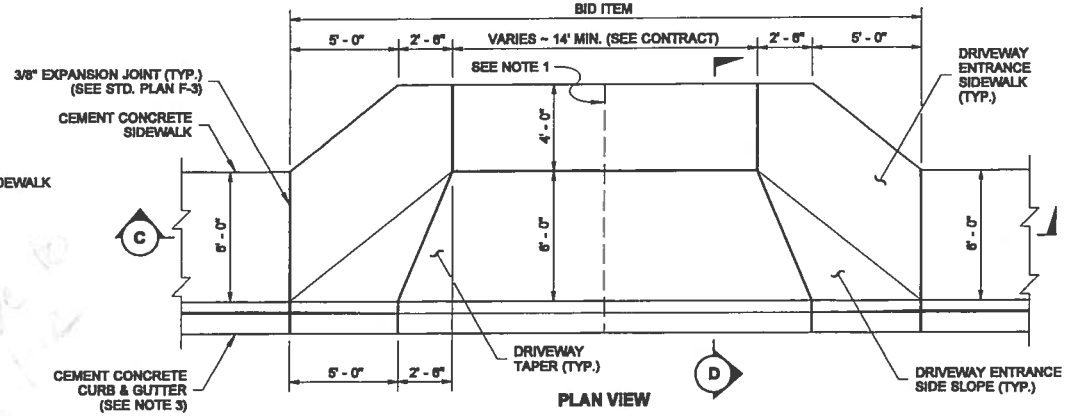
Add notes from page 1. (It will not be included in manual)



CEMENT CONCRETE DRIVEWAY ENTRANCE TYPE 1



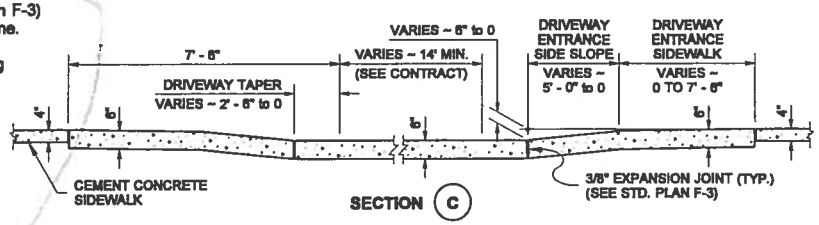


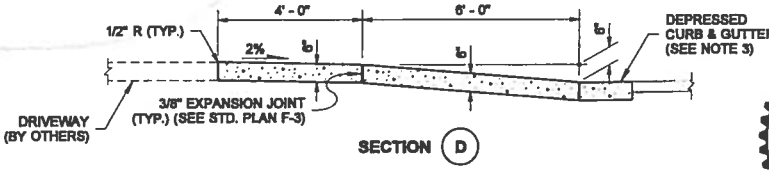


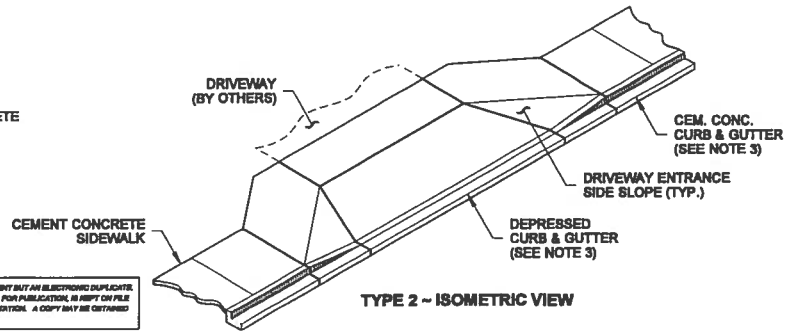
NOTES

1. When the driveway width exceeds 15 feet, construct a full depth expansion joint (see Standard Plan F-3) with 3/8" joint filler along the driveway centerline. Construct expansion joints parallel with the centerline as required at 15' maximum spacing when driveway widths exceed 30'.
2. See Std. Plan F-3 for sidewalk details.
3. Curb and gutter shown, see the Contract Plans for the curb design specified. See Std. Plan F-1 for curb details.
4. Avoid placing drainage structures, junction boxes or other obstructions in front of driveway entrances.

CEMENT CONCRETE DRIVEWAY ENTRANCE TYPE 2







HAROLD J. PETERESO
STATE OF WASHINGTON
21861
REGISTERED
PROFESSIONAL ENGINEER

EXPIRES MAY 16, 2003

CEMENT CONCRETE DRIVEWAY ENTRANCE TYPES 1, 2, 3 & 4

STANDARD PLAN F-4

SHEET 1 OF 2 SHEETS

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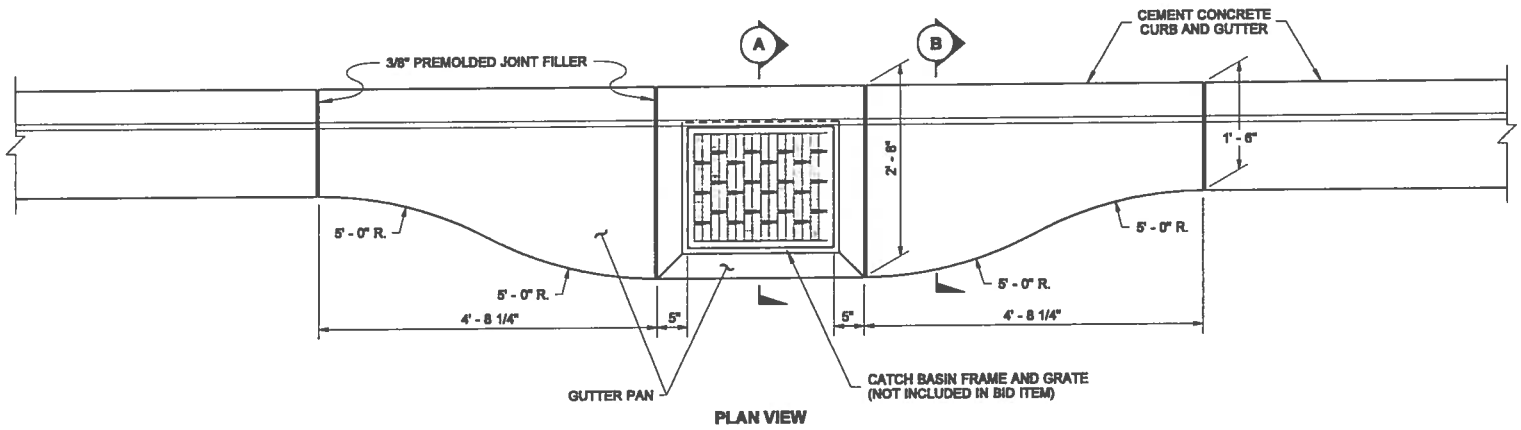
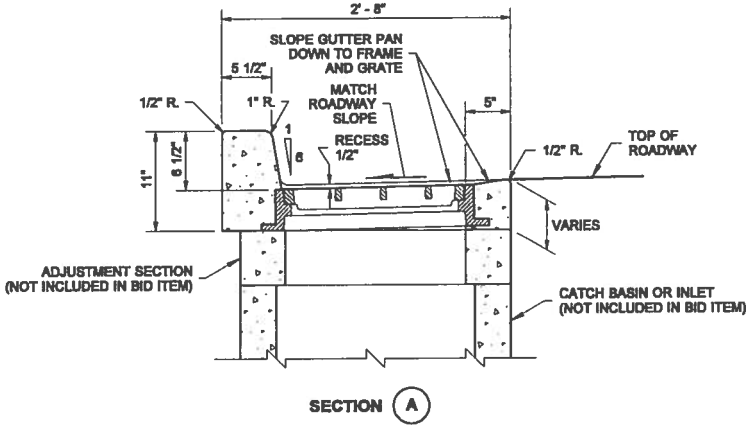
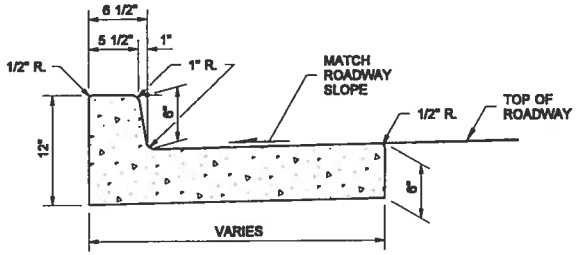


PLAN VIEW

CATCH BASIN GUTTER PAN



SECTION (A)



SECTION (B)

HAROLD J. PETERFESO
STATE OF WASHINGTON
21861
REGISTERED
PROFESSIONAL ENGINEER

EXPIRES MAY 16, 2003

CEMENT CONCRETE CURB AND GUTTER PAN

STANDARD PLAN F-1a

SHEET 1 OF 1 SHEET

APPROVED FOR PUBLICATION

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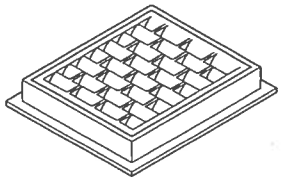
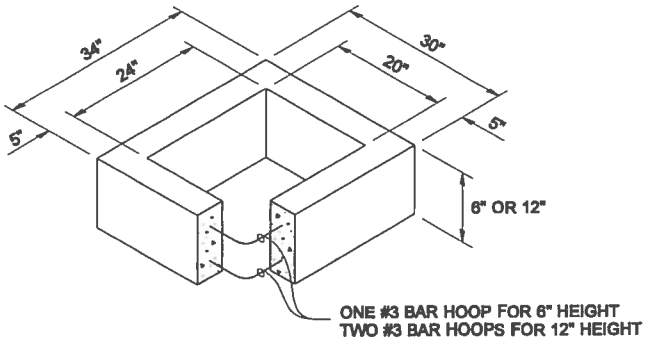
DRAWN BY: MARK SUJKA



FRAME AND VANED GRATE



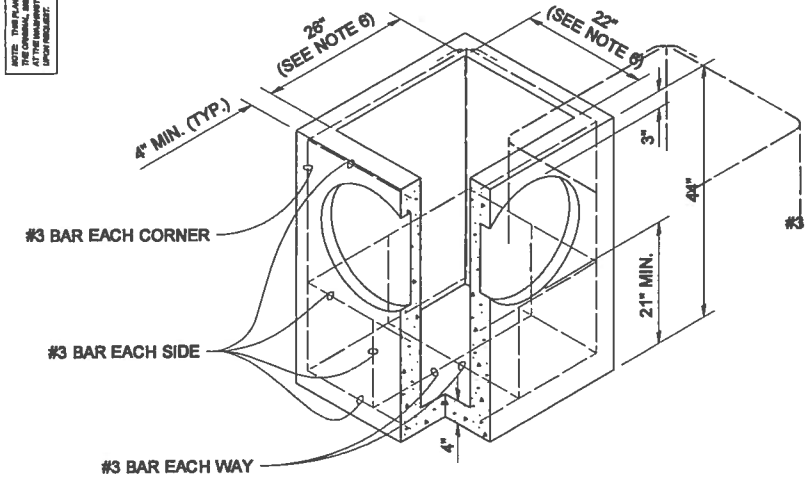
RECTANGULAR ADJUSTMENT SECTION

PIPE ALLOWANCES	
PIPE MATERIAL	MAXIMUM INSIDE DIAMETER
REINFORCED OR PLAIN CONCRETE	12"
ALL METAL PIPE	15"
CPSSP * (STD. SPEC. 9-05.20)	12"
SOLID WALL PVC (STD. SPEC. 9-05.12(1))	15"
PROFILE WALL PVC (STD. SPEC. 9-05.12(2))	15"

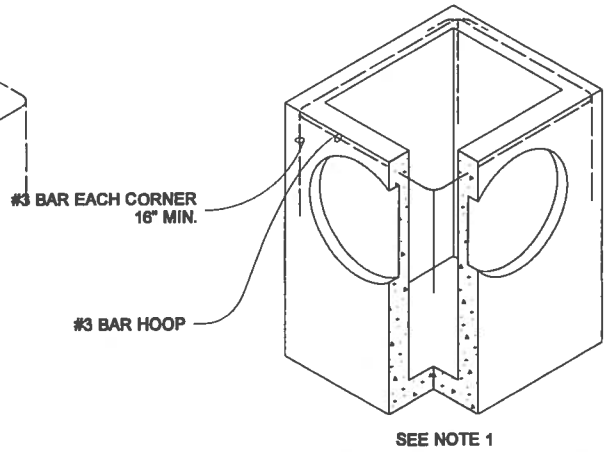
* CORRUGATED POLYETHYLENE STORM SEWER PIPE

NOTES

1. As acceptable alternatives to the rebar shown in the PRECAST BASE SECTION, fibers (placed according to the Standard Specifications), or wire mesh having a minimum area of 0.12 square inches per foot shall be used with the minimum required rebar shown in the ALTERNATIVE PRECAST BASE SECTION. Wire mesh shall not be placed in the knockouts.
2. The knockout diameter shall not be greater than 20". Knockouts shall have a wall thickness of 2" minimum to 2.5" maximum. Provide a 1.5" minimum gap between the knockout wall and the outside of the pipe. After the pipe is installed, fill the gap with joint mortar in accordance with Standard Specification 9-04.3.
3. The maximum depth from the finished grade to the pipe invert shall be 5'.
4. The frame and grate may be installed with the flange up or down. The frame may be cast into the adjustment section.
5. The precast base section may have a rounded floor, and the walls may be sloped at a rate of 1:24 or steeper.
6. The opening shall be measured at the top of the precast base section.
7. All pickup holes shall be grouted full after the basin has been placed.



PRECAST BASE SECTION



SEE NOTE 1

ALTERNATIVE PRECAST BASE SECTION

EXPIRES JULY 1, 2007

CATCH BASIN TYPE 1

STANDARD PLAN B-1

SHEET 1 OF 1 SHEET

APPROVED FOR PUBLICATION

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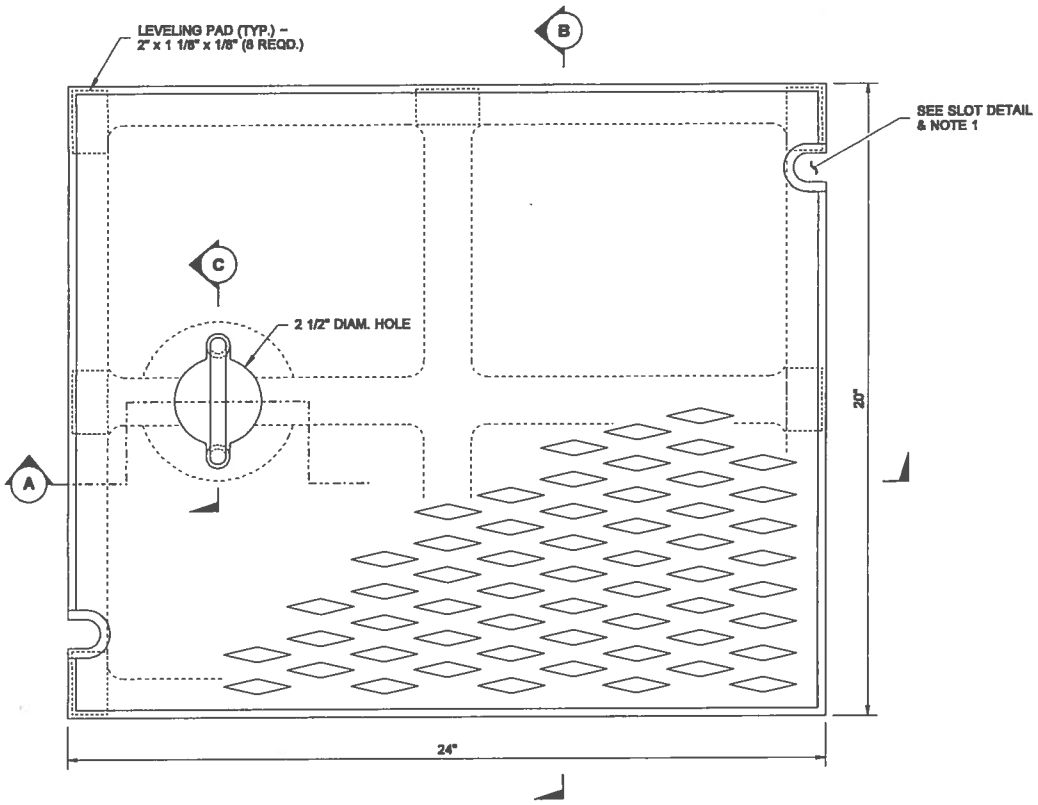
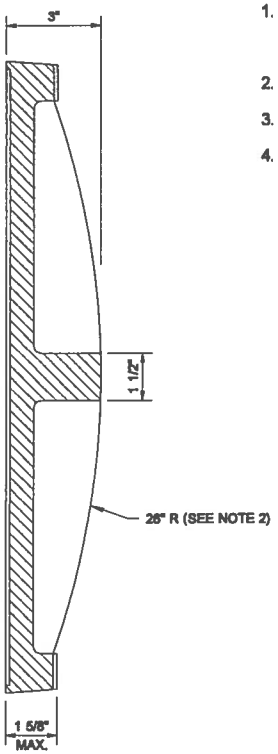


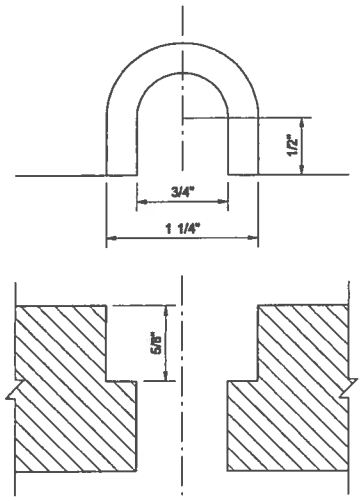
TOP VIEW



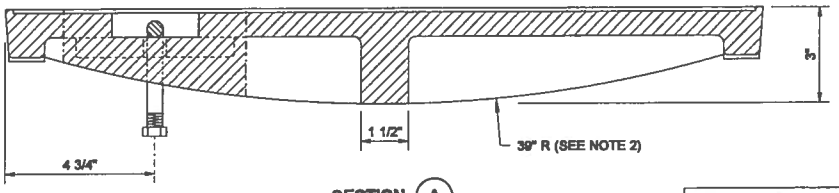
SECTION (B)

NOTES

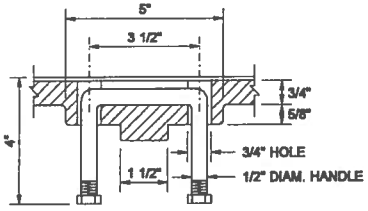
1. When bolt down covers are specified in the Contract, provide two slots in the cover that are vertically aligned with the holes in the frame. Location of bolt down slots varies among different manufacturers.
2. Alternate reinforcing rib designs are acceptable.
3. Refer to Standard Specification 9-05.15(2) for additional requirements.
4. For frame details, see Standard Plan B-2a.



SLOT DETAIL



SECTION (A)



SECTION (C)

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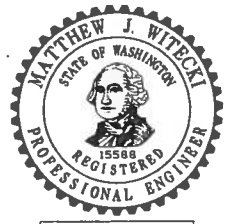


EXPIRES JULY 1, 2005

SOLID METAL COVER FOR CATCH BASIN

STANDARD PLAN B-2

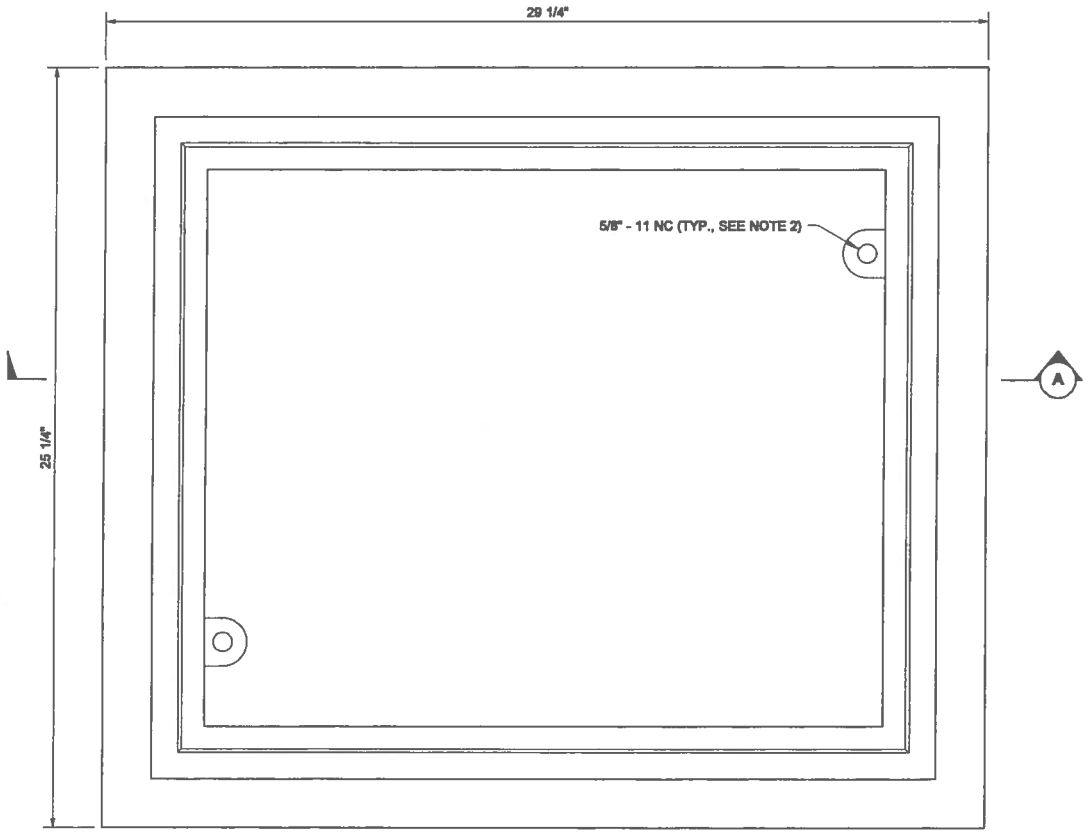
SHEET 1 OF 1 SHEET

APPROVED FOR PUBLICATION

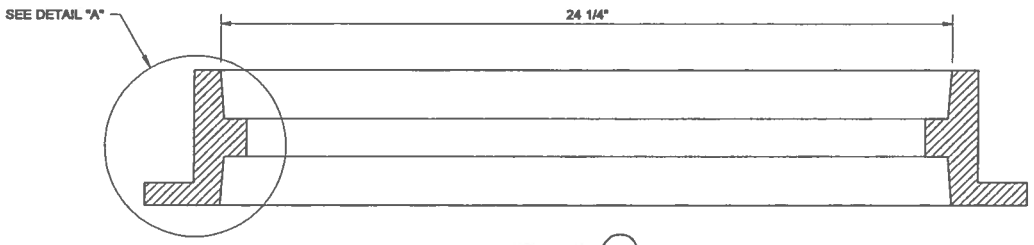
Harold J. Peterfeso 02-25-05

STATE DESIGN ENGINEER — DATE

Washington State Department of Transportation



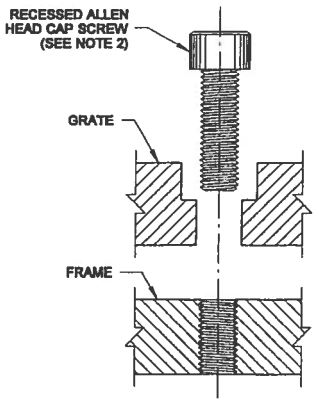
TOP VIEW



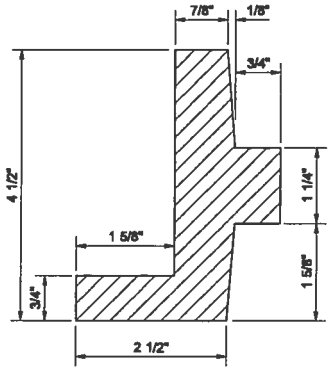
SECTION (A)

NOTES

1. This frame is designed to accommodate 20" × 24" grates or covers as shown on Standard Plans B-2, B-2b, B-2c and B-2d.
2. When bolt down grates or covers are specified in the Contract, provide two holes in the frame that are vertically aligned with the grate or cover slots. Tap each hole to accept a 5/8" - 11 NC × 2" allen head cap screw. Location of bolt down holes varies among different manufacturers
3. Refer to Standard Specification 9-05.15(2) for additional requirements.



BOLT DOWN DETAIL



DETAIL "A"

EXPIRES JULY 1, 2005

REVERSIBLE FRAME FOR CATCH BASIN OR CONCRETE INLET STANDARD PLAN B-2a

SHEET 1 OF 1 SHEET

APPROVED FOR PUBLICATION

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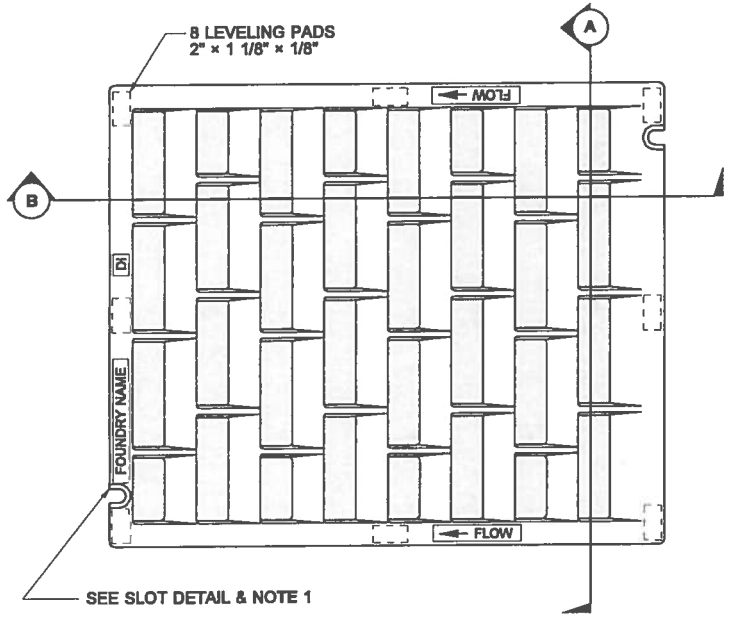
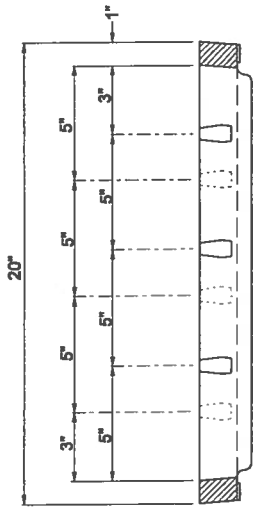
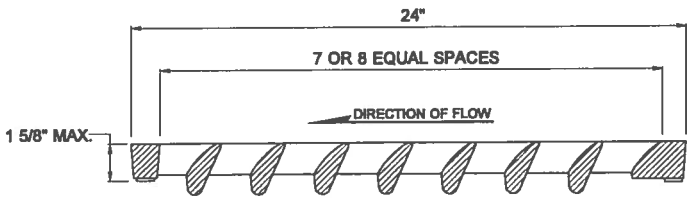


PLAN VIEW



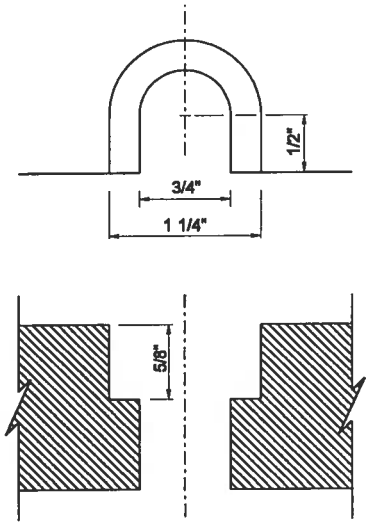
SECTION (A)



SECTION (B)

NOTES

1. When bolt down grates are specified in the Contract, provide two slots in the grate that are vertically aligned with the holes in the frame. Location of bolt down slots varies among different manufacturers.
2. Refer to Standard Specification 9-05.15(2) for additional requirements.
3. For frame details, see Standard Plan B-2a.



SLOT DETAIL

MATTHEW J. WITECKI
STATE OF WASHINGTON
15588
REGISTERED
PROFESSIONAL ENGINEER

EXPIRES JULY 1, 2003

VANED GRATE FOR CATCH BASIN AND CONCRETE INLET STANDARD PLAN B-2b

SHEET 1 OF 1 SHEET

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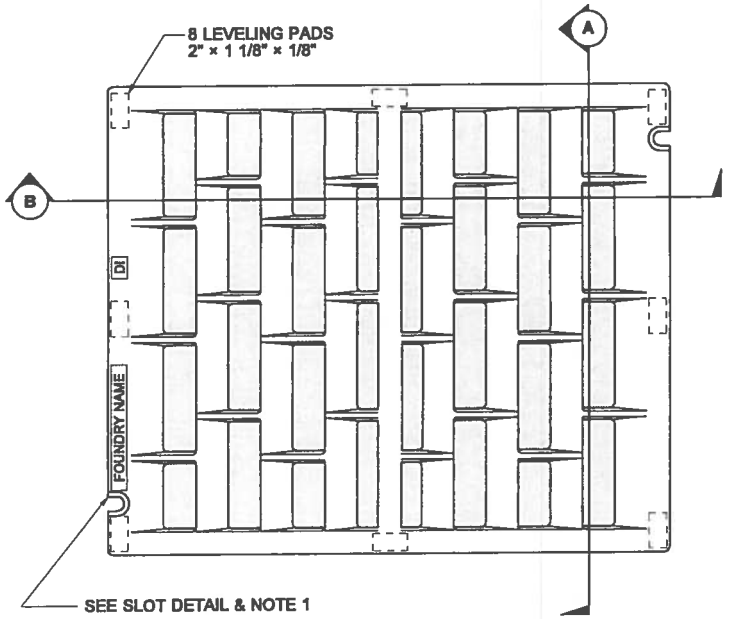
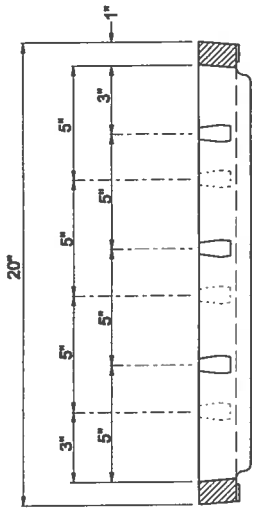
Washington State Department of Transportation

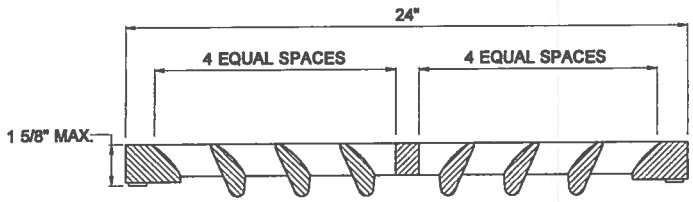
DATE	REVISION	BY
05/2002	DELETED VANE DETAIL; ADDED SLOT DETAIL; REVISED NOTES.	RC



PLAN VIEW



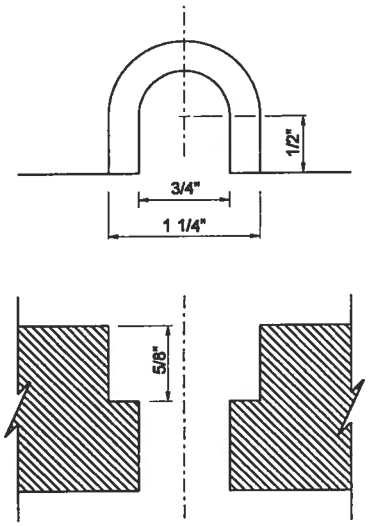
SECTION (A)



SECTION (B)

NOTES

1. When bolt down grates are specified in the Contract, provide two slots in the grate that are vertically aligned with the holes in the frame. Location of bolt down slots varies among different manufacturers.
2. Refer to Standard Specification 9-05.15(2) for additional requirements.
3. For frame details, see Standard Plan B-2a.



SLOT DETAIL

EXPIRES JULY 1, 2003

BI-DIRECTIONAL VANED GRATE FOR CATCH BASIN AND INLET

STANDARD PLAN B-2c

SHEET 1 OF 1 SHEET

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DATE	REVISION	BY
05/2002	DELETED VANE DETAIL; ADDED SLOT DETAIL; REVISED NOTES.	RG

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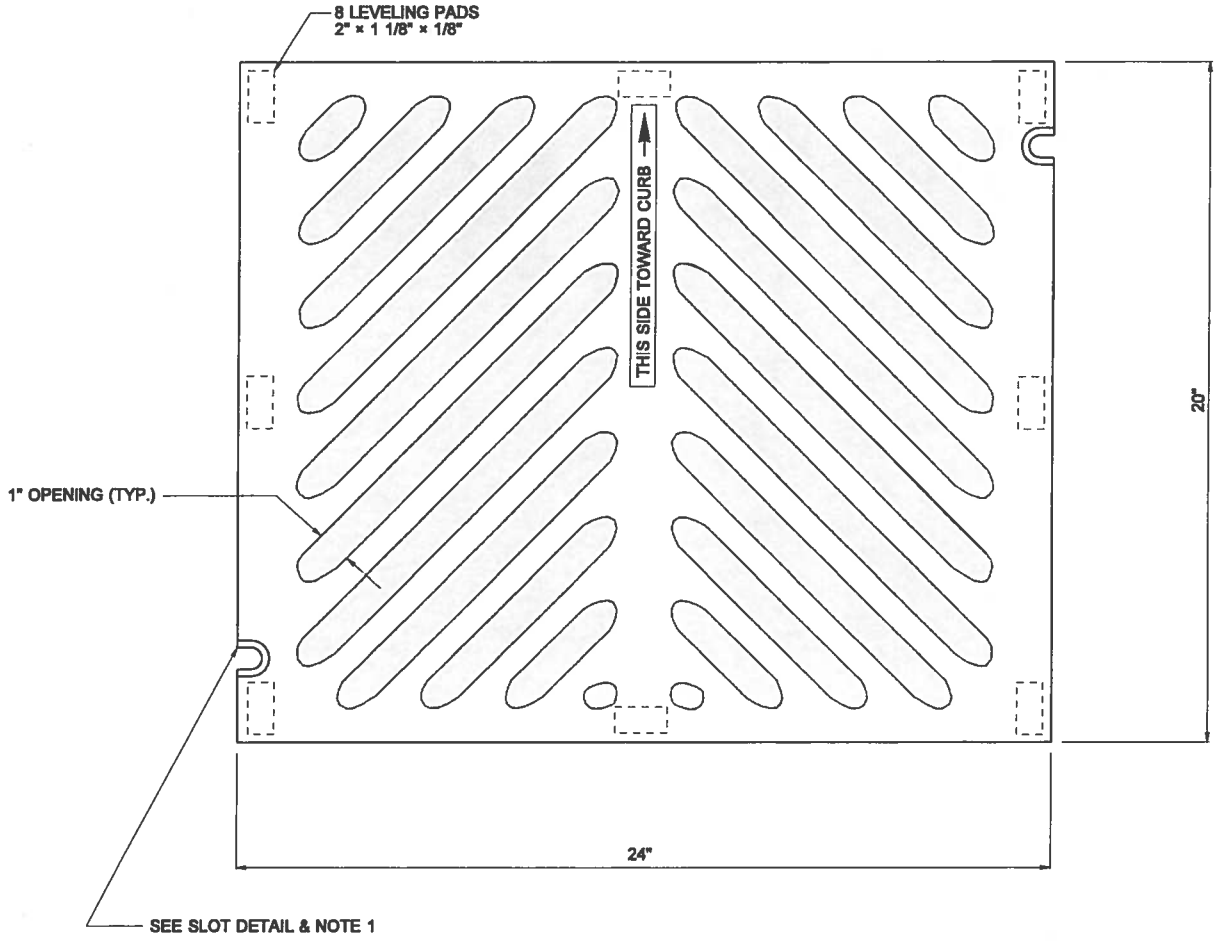
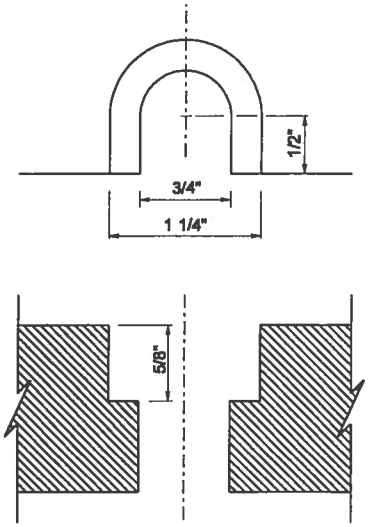


NOTES

1. When bolt down grates are specified in the Contract, provide two slots in the grate that are vertically aligned with the holes in the frame. Location of bolt down slots varies among different manufacturers.
2. Refer to Standard Specification 9-05.15(2) for additional requirements.
3. For frame details, see Standard Plan B-2a.
4. The thickness of the grate shall not exceed 1 5/8".



SLOT DETAIL

MATTHEW J. WITECKI
STATE OF WASHINGTON
15588
REGISTERED
PROFESSIONAL ENGINEER
EXPIRES JULY 1, 2003

HERRINGBONE GRATE FOR CATCH BASIN AND INLET

STANDARD PLAN B-2d

SHEET 1 OF 1 SHEET

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