
SPECIFICATIONS

FOR

PUBLIC IMPROVEMENTS

WAUKEE, IOWA

AUGUST 15, 2016



VEENSTRA & KIMM, INC.

STANDARD SPECIFICATIONS
FOR
PUBLIC IMPROVEMENTS
WAUKEE, IOWA

I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa.



Signed:

Date:

Forrest Aldrich August 15, 2016

Forrest S. Aldrich, P.E.

Iowa License No. 12248

My license renewal date is December 31, 2017

Detailed parts covered by this seal:

All

Prepared by
VEENSTRA & KIMM, INC.
West Des Moines,
Iowa

STANDARD SPECIFICATIONS
FOR
PUBLIC IMPROVEMENTS
WAUKEE, IOWA

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PART 1 - GENERAL CONDITIONS

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1. FORM

- 1.1 Standard specifications are in outline form and include incomplete sentences. Omission of words or phrases is intentional. Supply omitted words or phrases by inference.

2. INTENT

- 2.1 To set forth design standards and requirements of materials and construction for installation of street pavement, sidewalks, trails, water mains, sanitary sewers, storm sewers, sump pump drain lines, traffic signals and street lights in subdivisions, site plans and other public improvements.
- 2.2 To assist in implementing the Subdivision Ordinance of the City of Waukee, Iowa.
- 2.3 To ensure that streets and utilities meet requirements of the City of Waukee, Iowa, and the Iowa Department of Natural Resources (IDNR) and to ensure conformance to the Comprehensive Development Plan of the City of Waukee.
- 2.4 To require construction of street pavement, sidewalks, trails, water mains, sanitary sewers, storm sewers, sump pump drain lines, street lights and traffic signals in subdivisions.

3. DEFINITION OF TERMS

- 3.1 "City" shall mean the City of Waukee, Iowa, acting through a person or persons duly authorized by the City Council to act for said Council. City shall also mean the area within the corporate limits of the City of Waukee and such area outside the corporate limits over which the City has jurisdiction or control in accordance with statutory provisions of the Code of Iowa.

General Conditions

- 3.2 "City Engineer" shall mean a person or persons designated by the City with authority to perform official inspections, plan reviews and other functions designated by City Council.
- 3.3 "City Engineering Department" shall mean person or persons hired by the City within the department with authority to perform official inspections, plan reviews and other functions designated by City Council.
- 3.4 "Comprehensive Development Plan" shall mean the current comprehensive development plan approved by the City Council of the City of Waukee, Iowa.
- 3.5 "Contractor" shall mean the person, firm, partnership, association or corporation constructing streets and utilities.
- 3.6 "Landscape and Open Space Ordinance" shall refer to the Waukee Municipal Code and other governing ordinances or plans which provide regulation as to the beautification, buffering, or improvement of property relating to plantings, hardscape, streetscape, or similar treatments of property within the City of Waukee.
- 3.7 "Shared Use Path" shall mean a multi-use trail or other path, physically separated from motorized vehicular traffic by an open space or barrier, either within a highway right-of-way or within an independent right-of-way, and usable for transportation purposes.
- 3.8 "Site Plan" shall mean an architectural plan, landscape plan, or detailed engineering drawings of proposed improvements to a given lot or subdivision that can include any or all of the following information: building footprint, streets and drives, grades, parking, drainage facilities, storm water management, sanitary sewer mains and services, water mains and services, storm sewer mains and services, sidewalks and trails, lighting and landscaping elements.
- 3.9 "Site Plan Ordinance" shall refer to the Waukee Municipal Code along with other governing ordinances or plans which provide regulation of sites within the City of Waukee.
- 3.10 "Standard Drawings" shall mean drawings bound or referenced with these specifications.
- 3.11 "Subdivider" shall mean any person, partnership, corporation, trustee, trust or other legal entity dividing or proposing to divide or improve land so as to constitute a subdivision or site plan.

3.12 "Subdivision" shall mean the division of land into two or more lots, parcels or other divisions for the purpose of immediate or future sale or transfer of ownership or building development. The term includes resubdivision and, when appropriate to context, shall relate to the process of subdividing or to the land subdivided.

3.13 "Subdivision Ordinance" shall mean the current ordinance enacted by the City Council of the City of Waukee, Iowa, establishing regulations for the subdivision and platting of land, providing for the preparation of plats and providing for the installation of utilities, streets and other improvements.

3.14 "SUDAS" shall mean the latest edition of the Statewide Urban Design and Specifications including Design Manual and Standard Specifications.

4. INTERPRETATION

4.1 The City will answer questions regarding interpretation of intended meaning of specifications; its interpretation shall be accepted as final.

5. CONTRACT AND BOND REQUIREMENTS

5.1 Contract between subdivider and his contractor shall be executed on forms provided or approved by City prior to start of construction.

5.2 Subdivider's contractor shall provide maintenance bond to City, assuring faithful performance of his contract and maintenance of the improvements for a period after acceptance of the construction thereof by City; execute bond on forms provided or approved by City for the following bond periods:

5.2.1 Water, sanitary sewer, storm sewer and subdrains including services to property: 4 years.

5.2.2 Street pavement: 4 years.

5.2.3 Shared used paths:

5.2.3.1 Trails: 4 years.

5.2.3.2 Sidewalks: 4 years. Sidewalks by plat developer are limited to lots with double frontage to pay for sidewalk along the frontage without direct vehicular street access.

5.2.4 Site grading and subgrade preparation: 4 years.

General Conditions

- 5.3 Subdivider shall provide performance bond to City, assuring faithful performance of his contract for conversion of any and all temporary erosion control sediment basins to permanent stormwater control detention basins; execute bond on forms provided or approved by City.
- 5.4 Maintenance bond shall list each item and quantity of each item covered by the bond.
- 5.4 See Exhibit No. 1 following GENERAL CONDITIONS for acceptable forms of of bonds.

6. GENERAL REQUIREMENTS

- 6.1 Submit plans of proposed construction for approval and acceptance by the City, prior to construction and as set forth in the Municipal Code; all improvements to extend to plat boundary unless directed otherwise by City.
 - 6.1.1 Standard organization of construction drawings shall be as follows:
 - 6.1.1.1 Cover Sheet
 - 6.1.1.2 Quantities & General Information
 - 6.1.1.3 Hydrant Coverage Map
 - 6.1.1.4 Demolition Plan (if applicable)
 - 6.1.1.5 Grading Plan
 - 6.1.1.6 Erosion & Sediment Control Sheet
 - 6.1.1.7 Paving and Storm Plan and Profile
 - 6.1.1.8 Water and Sanitary Plan and Profile
 - 6.1.1.9 Intersection and Pedestrian Ramp Details
 - 6.1.1.10 General Details
 - 6.1.1.11 Landscaping Plan
- 6.2 Submit plans for proposed construction of water mains and sanitary sewers and stormwater General Permit No. 2 to the IDNR for review and approval in accordance with the requirements of that agency.
 - 6.2.1 Furnish City with 1 copy of plans approved by IDNR.

General Conditions

- 6.3 Begin no construction of water mains and sanitary sewers until plans are approved by City and Iowa Department of Natural Resources.
- 6.4 Begin no construction without City issuance of Construction Site Erosion and Sediment Control Ordinance (COSESCO) permit.
- 6.5 Materials and work are subject to inspection as deemed necessary by City; provide access for inspectors.
- 6.6 Make no connection to existing water and sewer systems or work in public right-of-way unless authorized by City.
- 6.7 Provide shop drawings for materials used in construction of public improvements.
- 6.8 Upon completion of construction, furnish one certified reproducible paper copy of as-built plans to City; plans shall be certified by Engineer licensed to practice in the State of Iowa; furnish electronic files of as-built plans; electronic files in .dwg and .pdf file extensions format approved by City and provided with information layers to allow retrieval of lot layout, water, sanitary sewer and storm sewer alignment information isolated from notes on background drawing information.
- 6.9 As-built plans shall contain the following information:
 - 6.9.1 Certified grading sheet shall provide point elevations for the low spot at each location where an overland flowage easement crosses a property line and at any change in grade across each lot. The grade between shots should also be labeled.
 - 6.9.2 As-built plans of all stormwater management facilities on site and a certification statement signed by the design engineer indicating that facilities were constructed as designed.
 - 6.9.3 Provide as-built location for the ends of all lot services in relation to lot property corners.
- 6.10 City will provide checklist for items remaining to be completed near the end of the construction. Certificate of Completion will be issued after acceptance of work by City Council and completion of all checklist items. Maintenance bond effective date begins on date of acceptance by City Council.
- 6.11 Design all public improvements to survey and coordinate system State Plane Iowa South Zone (1402) NAD 83. Note survey and coordinate system utilized on plans.

- 6.12 Design streets and utilities in accordance with Municipal Code, SUDAS Design Manual and Standard Specifications of the City of Waukee. In the event of conflicts between the documents, the Municipal Code shall govern, then the Standard Specifications of the City of Waukee and finally SUDAS Design Manual. All designs are subject to approval of City.
- 6.13 Locate utilities parallel to right-of-way lines as shown on Standard Drawings Nos. 1A and 1B. Where strict compliance to these locations causes substantial hardship, the City Council, upon recommendation of its staff, may modify these requirements.
- 6.14 Streets: conform to Municipal Code for right-of-way requirements for streets; provide street widths as specified hereinafter; construct streets to grades approved by City.
 - 6.14.1 Construct all street surfaces of reinforced portland cement concrete with integral curb and gutter.
 - 6.14.1.1 City will consider non-reinforced concrete pavement, if requested.
 - 6.14.2 Furnish and install all signs and barricades as specified herein.
- 6.15 Shared use paths: construct paths on both sides of street; locate as shown on Standard Drawing; plat developer responsible for paths along double frontage lots for frontage where lot does not have direct vehicular access; home builder responsible for construction of all other paths.
- 6.16 Storm sewers:
 - 6.16.1 Extend sewer line and grade to natural water course, to existing storm sewer, or as directed by City.
 - 6.16.2 Extend storm sewer upstream to plat or property boundary, or to within 500' of basin ridge, whichever is less, or as directed by City.
 - 6.16.3 Provide minimum 8" dia. perforated subdrain or minimum 3' wide concrete flume along rear lot lines or side yards where surface flowage has 2% or less longitudinal slope; provide flat grate intakes in areas where standing water is present after a 1" rainfall event after finished grading of the site is completed; comply with material standards for subdrains.

General Conditions

- 6.16.4 Construct manhole on temporary ends of storm sewer; locate manhole within 15' of plat boundary and install one segment of pipe upstream from manhole or as directed by City.
 - 6.16.5 Clean and televise storm sewer prior to or immediately following constructing street paving as directed by the City; provide copy of video and written report to City for review prior to or immediately following constructing street paving as directed by the City; correct defect prior to or immediately following paving as directed by the City.
- 6.17 Sanitary Sewers:
- 6.17.1 Clean and televise sanitary sewers prior to constructing street paving; provide copy of video and written report to City for review prior to constructing street paving; correct defects prior to paving.
 - 6.17.2 Extend sewer line and grade to plat of property boundary, to next street or sewer, or as directed by City; locate manhole within 15' of plat boundary and install one segment of pipe upstream from manhole.
- 6.18 Sanitary sewer service connections:
- 6.18.1 Provide service connection for each platted lot or building; extend service from sanitary sewer to minimum 1' inside property line, or as directed by City.
 - 6.18.2 Extension of sewer service pipe from property line to building or residence responsibility of property owner.
 - 6.18.3 Service connections include wye, fittings, riser pipe, if required, and pvc service pipe.
- 6.19 Pumping stations and force mains: where a pumping station is required to lift sewage to existing sewer system, submit complete design to City for approval; include equipment drawings, design data and proposed plans.
- 6.20 Water Main:
- 6.20.1 Extend Water main line and grade to plat or property boundary, to next street, or as directed by City; terminate dead end lines at plat boundary with valve and 10' section of water main and plug; to the extend possible, City will require looping of water mains in lieu of dead end mains.
 - 6.20.2 Furnish all water main and appurtenances including hydrants and valves.

General Conditions

- 6.21 Water services: provide service for each platted lot or building; include corporation stop or other fitting, water service pipe and curb valve with box.
 - 6.21.1 Extend service pipe from water main to property line or as directed by City; locate top of curb valve box at finished grade; locate curb valve at property line unless directed otherwise by City; do not locate service under property approach driveway.
 - 6.22 Sump pump drain lines: provide sump pump drain lines to receive discharge from foundation drain sump pumps; extend to minimum 1' inside lot line.
 - 6.23 Final adjustments of manhole covers, hydrants and valve boxes by Contractor installing the utility after street pavement is in place.
 - 6.24 All materials and accessories for construction of streets, sidewalks, trails, sewers and water main, street lights and traffic signals furnished by subdivider except by specific agreement with City.
 - 6.25 Provide necessary easements to City for all City utilities located in or adjacent to private property; minimum width: 10' either side of City utility or 2 times the utility depth, whichever is greater, unless otherwise permitted or required by City.
7. CONSTRUCTION IN RAILROAD RIGHT-OF-WAY
- 7.1 Submit detailed plans of construction operations including sheeting, shoring and bracing, for approval of Railroad and City.
 - 7.2 Start no work on Railroad right-of-way until plans required above are approved and license for construction is granted by Railroad; provide a copy of license to City.
 - 7.3 Notify Railroad Division Superintendent and City not less than one week in advance of proposed time for performance of any construction work on Railroad right-of-way or preparatory work thereto.
 - 7.4 Confer with representative of Railroad relative to requirements for operation and general safety regulations.
 - 7.5 Conduct work in manner satisfactory to Railroad and exercise care not to damage Railroad property or interfere with operations of Railroad.

General Conditions

7.6 The Railroad Division Superintendent or his representative will have jurisdiction over safety for operations of Railroad. The decision of the representative of the Railroad as to procedures which may affect safety of Railroad operation shall be final.

7.6.1 Provide insurance coverage requested by Railroad.

7.7 Do not stockpile or store excess material or debris on Railroad right-of-way.

7.8 Submit copy of the Railroad's certificate of acceptability to City after construction.

8. CONSTRUCTION IN HIGHWAY RIGHT-OF-WAY

8.1 Submit detailed plans of construction operations including sheeting, shoring and bracing, for approval of Iowa Department of Transportation (IDOT).

8.2 Secure construction permit for proposed construction; start no work in highway right-of-way until plans are approved and permit for construction is granted by IDOT; provide a copy of permit to City. All construction within the State Rights of Way shall comply with the appropriate approved permit and the agreements stated within them.

8.3 Comply with applicable sections of current "Utilities Accommodation Policy" of IDOT.

8.4 All traffic protection shall be in accordance with Part VI of the current Manual on Uniform Traffic Control Devices for Streets and Highways.

8.5 Comply with all safety regulations of IDOT.

9. CONSTRUCTION IN PUBLIC RIGHT-OF-WAY

9.1 Submit detailed plans or construction operations for approval of City; obtained permit for construction in public right-of-way from City.

9.2 Auger or directional bore water main, sewer, services and other utilities under all existing streets; do not open cut except when authorized by City.

9.3 Start no work on public right-of-way until plans required above are approved and permission is granted by City.

10. STANDARDS AND CODES

10.1 Do work in accordance with best present day construction practices.

- 10.2 Unless specifically noted to the contrary, conform with and test in accordance with applicable section of latest revisions of following standards and codes:
- 10.2.1 American Association of State Highway and Transportation Officials (AASHTO).
 - 10.2.2 American Concrete Institute (ACI).
 - 10.2.3 American Institute of Steel Construction (AISC).
 - 10.2.4 American National Standards Institute (ANSI).
 - 10.2.5 American Society for Testing and Materials (ASTM).
 - 10.2.6 American Water Works Association (AWWA).
 - 10.2.7 American Welding Society (AWS).
 - 10.2.8 Federal Specifications (FS).
 - 10.2.9 Iowa Department of Natural Resources (IDNR).
 - 10.2.10 Iowa Department of Transportation, Standard Specifications For Highway and Bridge Construction, latest edition (IDOT).
 - 10.2.11 Manual of Accident Prevention in Construction by Associated General Contractors of America, Inc. (AGC).
 - 10.2.12 National Sanitation Foundation (NSF).
 - 10.2.13 Occupational Safety and Health Act of 1970 (Public Law 91-596) (OSHA).
 - 10.2.14 Iowa Occupational Safety and Health Act of 1972 (Chapter 88, Code of Iowa,) (IOSHA).
 - 10.2.15 Standards and Codes of the State of Iowa and ordinances of the City of Waukee, Iowa.
 - 10.2.16 Other standards and codes which may be applicable to acceptable standards of the industry for equipment and materials and installation.
 - 10.2.17 Standards and codes of Railroad.
 - 10.2.18 Iowa Manual on Uniform Traffic Control Devices for Streets and Highways.

10.2.19 Statewide Urban Design and Specifications (SUDAS) including Design Manual and Standard Specifications.

11. MATERIALS TESTS

- 11.1 Submit to City duplicate copies of reports by an independent testing laboratory showing compliance of construction materials with specifications. Selection of testing laboratory subject to approval by City.
- 11.2 Subdivider to pay cost of all laboratory and job site tests including transportation charges on samples taken at job site.
- 11.3 Subdivider provide samples of materials and forms for preparing concrete compression cylinders required for laboratory tests; sampling of materials at the site and preparation of concrete compression cylinders performed by subdivider subject to approval of method by City Engineer or City Engineering Department.
- 11.4 All materials subject to testing and inspection at the site by City.
- 11.5 Laboratory tests:
 - 11.5.1 Portland cement: car, truck, or sealed bin samples for total requirements; ASTM C150.
 - 11.5.2 Fine aggregate for portland cement concrete: tests on each 100 tons for deleterious substances, mortar strength and gradation.
 - 11.5.3 Coarse aggregate for portland cement concrete: tests on each 500 tons for abrasion loss, durability, deleterious substances and gradation.
 - 11.5.4 Concrete pipe: certify that pipe conforms to ASTM C76 or ASTM C506, for class of pipe specified.
 - 11.5.5 Reinforcing steel: certify that steel conforms to ASTM A615, for grade of steel specified.
 - 11.5.6 Iron pipe: certify that ductile pipe conforms to ANSI/AWWA C150/A21.50 and ANSI/AWWA C151/A21.51, special thickness class 52.
 - 11.5.7 Polyvinylchloride pipe:
 - 11.5.7.1 Sump pump drain lines and subdrains: certify that pipe conforms to ASTM D1784 and ASTM D3034.

General Conditions

- 11.5.7.2 Water main and force main: certify that pipe conforms to AWWA C900 or C905, DR18.
- 11.5.7.3 Truss pipe for gravity sewers: certify that pipe conforms to ASTM D2680.
- 11.5.7.4 Corrugated pipe with smooth interior for gravity sewers: certify that pipe conforms to ASTM D1784, ASTM F794 and ASTM F949.
- 11.5.7.5 Sewer service pipe: certify that pipe conforms to ASTM D3034, DR23.5.
- 11.5.8 Steel pipe: certify that pipe conforms to ASTM A139.
- 11.5.9 Copper tubing: certify that tubing conforms to ASTM B88, Type K.
- 11.5.10 High density polyethylene (HDPE) corrugated pipe: certify that pipe conforms to ASTM F405 or F667.
- 11.5.11 Manholes: certify that precast sections conform to ASTM C478.
- 11.5.12 Welded wire fabric: certify that wire fabric conforms to ASTM A185.
- 11.5.13 Lining for reinforced concrete pipe:
 - 11.5.13.1 Liner material: polyvinylchloride resin pigments and plasticizers; compounded to remain flexible; polyvinylchloride resin not less than 99% by weight of total resin used; copolymer resins not permitted.
 - 11.5.13.2 Physical properties of liner: tensile strength: 2,200 psi minimum elongation at break: 200% minimum.
 - 11.5.13.3 Following installation all surfaces covered with lining, including welds shall be tested with an approved electrical holiday detector with instruments set between 18,000 volts and 22,000 volts.
 - 11.5.13.4 All welds shall be physically tested by a non-destructive probing method.

General Conditions

- 11.5.14 Concrete compression cylinders: ASTM C39; cast three cylinders for each days pour if pour is less than 100 CY; if pour is more than 100 CY, cast three cylinders for each 100 CY poured with a minimum of two sets per day. Contractor is responsible for hiring independent testing laboratory for casting, protecting, pick-up, delivery, proper storage and testing of cylinders. Submit written report and test results of 7-day and 28-day cylinder breaks to City. At the discretion of contractor, additional cylinders may be cast to allow testing for earlier access to pavement than 7 days.
- 11.5.15 Concrete air and slump: IDOT Instruction Manuals 317, 318 and 327; one test for air and slump for each 200 CY poured with a minimum of one per day. Contractor is responsible for hiring independent testing laboratory for testing. Submit written report of test results to City.
- 11.5.16 Moisture-density tests on subgrade: ASTM D698; make 2 tests per 150 LF feet of subgrade or where designated by City; make tests and submit written report and test results to City.
- 11.5.17 Moisture-density tests on pipe trench backfill: ASTM D698; make series of tests at 3' vertical intervals full depth of trench backfill at nominal 150 LF horizontal spacing; City reserves the right to vary spacing between test locations; make additional tests at all locations where trenches from storm sewer, sanitary sewer, water main, sanitary sewer service, water service and sump lines are located under proposed streets and trails and submit written report and test results to City; maintain moisture content of backfill material in range of optimum moisture content to 4% above optimum moisture content.

12. INSURANCE BY CONTRACTOR

- 12.1 Provide and maintain insurance throughout construction period in the following minimum amounts.
 - 12.1.1 Workmen's compensation and occupational disease insurance in accordance with laws of the State of Iowa covering all employees who perform any obligations assumed under the contract.
 - 12.1.2 Public liability (bodily injury and property damage) covering all operations under this contract; limits for bodily injury or death and property damage not less than \$1,000,000 per occurrence and \$2,000,000 aggregate.

General Conditions

- 12.1.3 Automobile liability insurance on all self-propelled vehicles used in connection with the contract, whether owned, non-owned, or hired; public liability limits of not less than \$1,000,000 CSL (Combined Single Limit).
- 12.1.4 Insurance as required by Railroad.
- 12.1.5 Provide minimum \$1,000,000 occurrence and \$1,000,000 aggregate umbrella insurance.
- 12.1.6 Certificates must reflect companies that are licensed and approved to do business in the state of Iowa and have a BEST guide rating of A minus or better.
- 12.1.7 Contractor must name the City as additional insured on a primary non contributory basis. Contractor shall submit endorsements showing such coverage with the certificate.

12.2 City shall have right at any time to require public liability insurance and property damage liability insurance greater than required in above paragraphs.

12.3 Furnish certificates of insurance to City made in favor of City showing compliance with foregoing requirements.

13. INSPECTION BY CITY

13.1 Construction will be inspected by the City's designee to insure compliance with these specifications.

13.2 Subdivider shall notify and coordinate preconstruction meeting to be held minimum one week prior to construction to be attended by subdivider, contractor, subcontractor(s), subdivider's engineer and City Engineering Department. Subdivider to notify City Engineering Department to schedule meeting.

13.3 Forward a construction schedule to City Engineering Department prior to start of construction and notify City Engineering Department not less than 48 hours in advance of readiness for required inspections.

13.3.1 City Engineering Department shall determine type and number of inspections required based on construction proposed.

13.3.2 Notify City Engineering Department not less than 48 hours in advance of performing any holiday or weekend work.

13.4 Subdivider shall reimburse City for costs of inspections and tests furnished and conducted by or on behalf of City.

14. MATERIAL SUBSTITUTIONS

14.1 Wherever items of materials or equipment are specified by a manufacturer's name and type, or equal, it is the intent that materials or equipment of other manufacturers, equal in quality and performance, may be substituted. Such substitution may be made only with written authorization of City.

14.2 Wherever items of materials or equipment are specified by a manufacturer's name and type, or equal, and additional features of items are specifically required by specifications, additional features specified shall be provided whether or not they are normally included in standard manufacturer's items listed.

14.3 Wherever items of materials or equipment are specified by a manufacturer's name and type, or equal, and specified items are or become obsolete and no longer available, Subdivider shall provide City acceptable equal items which are currently available.

14.4 When proposing "or equal" items or substitutions, Subdivider shall furnish general arrangement drawings, full descriptive data, manufacturer's specifications and such performance data as required to satisfy City that materials or equipment proposed are equal to that specified. Burden of proof of equality shall be responsibility of Subdivider.

14.5 Whenever items of materials or equipment are specified by a manufacturer's name and type and "or equal" is not listed, Subdivider shall provide specified equipment without substitution, unless prior approval of City is obtained for any substitution.

14.6 Subdivider shall abide by City's decision when proposed substitutes of material or equipment are deemed to be unacceptable by the City and in such an event Subdivider shall furnish items of equipment or materials specified.

14.7 City reserves right to consider such factors as overall project arrangement, overall operation and maintenance costs, and similar factors in determining whether proposed substitutions will be acceptable.

EXHIBIT NO. 1

MAINTENANCE BOND

Bond Number _____

Job Number _____

KNOW ALL MEN BY THESE PRESENTS:

That _____ of _____ as Principal, and _____ of _____ as Surety, are held and firmly bound unto the CITY OF WAUKEE, 230 Highway 6, Waukee, Iowa 50263, in the penal sum of _____ (\$ _____) Dollars, lawful money of the United States of America, for the payment of which, well and truly to be made, the Principal and Surety bind themselves, their, and each of their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the said Principal entered into a certain contract, dated the _____ day of _____, 20____, with the _____, to furnish all the material and labor necessary for the construction of _____

in the County of Dallas, State of Iowa, in conformity with certain specifications according to the subdivision ordinances of the City of Waukee, Iowa; and

WHEREAS, a further condition of said contract, and acceptance of the work by the City of Waukee, Iowa, is that said Principal shall furnish a bond of indemnity, guaranteeing to remedy any defects in workmanship or materials that may develop in the aforesaid work and improvements, and to otherwise keep said improvements in good repair, for a period of four (4) years from the date of the issuance of a Certificate of Completion by the City Council; and

WHEREAS, a request for a Certificate of Completion for the work has been submitted and is being considered by the City Council, and this bond is being submitted in support of said request; and

WHEREAS, the said _____ of _____, Iowa, for a valuable consideration, has agreed to join with said Principal in such bond and/or guarantee, indemnifying said City of Waukee, Iowa as aforesaid.

Now, the Principal and the Surety on this Bond hereby agree, at their own expense:

- A. To remedy any and all defects that may develop in, or result from, said work by reason of bad workmanship or poor material used in the construction of said work and improvements, and shall otherwise keep all work in continuous good repair, and shall in all other respects, comply with all the terms and conditions of the specifications and ordinances of the City of Waukee, Iowa with respect to maintenance and repair of said work and improvements for a period of four (4) year(s) from the date of issuance of a Certificate of Completion for said work by the City Council; and
- B. In addition, Principal and Surety shall pay the testing, expert evaluation, reports, and all associated costs incurred by the City (collectively referred to generally as Testing) related to the City's ascertaining the nature and extent of any defect that appears in said work for which Principal and/or Surety are responsible under Paragraph A above.

Prior to undertaking such Testing, the Parties shall attempt to reach agreement as to the person or firm who shall undertake the Testing, however, if the parties cannot reach agreement, the City shall select the person or firm to undertake the Testing and associated work, in its discretion.

NOW THEREFORE, the condition of this obligation is such that if said Principal shall faithfully perform all of the promises of the Principal, as set forth and provided in this Bond, then this obligation shall be null and void, otherwise it shall remain in full force and effect.

IN WITNESS WHEREOF, we have hereunto set our hands and seal this ____day of _____, 20 ____.

Principal

By: _____
Name and Title

Surety

By: _____
Name and Title

PERFORMANCE BOND

Bond Number _____

Job Number _____

KNOW ALL MEN BY THESE PRESENTS:

That _____ of _____ as Principal, and _____ of _____ as Surety, are held and firmly bound unto the CITY OF WAUKEE, 230 Highway 6, Waukee, Iowa 50263, in the penal sum of _____ (\$_____) Dollars, lawful money of the United States of America, for the payment of which, well and truly to be made, the Principal and Surety bind themselves, their, and each of their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the said Principal entered into a certain contract, dated the _____ day of _____, 20____, with the _____, to furnish all the material and labor necessary for the construction of _____

in the County of Dallas, State of Iowa, in conformity with certain specifications according to the subdivision ordinances of the City of Waukee, Iowa; and

WHEREAS, a further condition of said contract, and acceptance of the work by the City of Waukee, Iowa, is that said Principal shall furnish a performance bond guaranteeing the conversion of any and all temporary erosion control sediment basins to permanent stormwater control detention basins.

WHEREAS, a request for a Certificate of Completion for the work has been submitted and is being considered by the City Council, and this bond is being submitted in support of said request; and

WHEREAS, the said _____ of _____, Iowa, for a valuable consideration, has agreed to join with said Principal in such bond and/or guarantee, indemnifying said City of Waukee, Iowa as aforesaid.

Now, the Principal and the Surety on this Bond hereby agree, at their own expense:

- A. The conversion of any and all erosion control sediment basins to permanent stormwater control detention basins including silt removal and disposal, earthwork, grading, piping, stormwater control structures, rip-rap and surface restoration.

NOW THEREFORE, the condition of this obligation is such that if said Principal shall faithfully perform all of the promises of the Principal, as set forth and provided in this Bond, then this obligation shall be null and void, otherwise it shall remain in full force and effect.

IN WITNESS WHEREOF, we have hereunto set our hands and seal this ____day of _____, 20____.

_____,
Principal

By: _____
Name and Title

_____,
Surety

By: _____
Name and Title

PART 2 – DESIGN STANDARDS

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1. GENERAL

- 1.1 This section sets forth minimum design standards to be used for design of streets, sidewalks, trails, sewers, water mains, sump pump drain lines, traffic signals and street lights in subdivisions in the City of Waukee, Iowa.
- 1.2 The design standards specified hereinafter are minimum standards; all plans are subject to review and approval by the City.
- 1.3 Stub all utilities a minimum of 1' inside lot line except water services; install curb stop valve and box on lot lines; provide all lots in subdivision with water, sanitary sewer and sump pump drain service lines.
- 1.4 Provide geotechnical exploration and report for all proposed street, sanitary and storm sewer and water main projects in accordance with the SUDAS Design Manual; submit written report and test results to City for review.

2. STREETS

- 2.1 Design streets in accordance with SUDAS Design Manual, Subdivision Ordinance of the City of Waukee, Iowa, and the following standards:
- 2.2 Culs-de-sac are subject to approval by City on project-by-project basis; provide areas designated for snow removal storage from cul-de-sac.
 - 2.2.1 Provide temporary 40' radius, granular surfaced turn around at temporary ends of portland cement concrete pavement where temporary pavement end is more than 150' from a street intersection. Other temporary turn around configurations may be acceptable as approved by the City Engineering Department. Granular surfacing to be a total of 8" thick with 4" thick of 3" gradation rock base and with 4" thick of 1" road stone on top.

- 2.3 Minimum pavement thickness:
 - 2.3.1 Minor collectors, local service and loop streets: 6" reinforced portland cement concrete over 12" thick compacted natural subgrade; City will consider 7" non-reinforced portland cement concrete, if requested.
 - 2.3.2 Major collector streets: 7" reinforced portland cement concrete over 12" thick compacted natural subgrade; City will consider 8" non-reinforced portland cement concrete, if requested.
 - 2.3.3 Minor arterial streets: 8" reinforced portland cement concrete over 12" thick compacted natural subgrade; City will consider 9" non-reinforced portland cement concrete, if requested.
 - 2.3.4 Major arterial streets: 9" reinforced portland cement concrete over 6" thick granular modified subbase; City will consider 10" non-reinforced portland cement concrete, if requested.
 - 2.3.5 Construction requirements for reinforced and non-reinforced portland cement concrete pavement are set out in PORTLAND CEMENT CONCRETE PAVEMENT.
- 2.4 Minimum pavement width:
 - 2.4.1 Arterial and major collector streets: 31', back to back of curb. Minimum 41' at intersections.
 - 2.4.2 Minor collector streets: 31', back to back of curb.
 - 2.4.3 Local service streets: 29', back to back of curb.
 - 2.4.4 Streets ending at cul-de-sac: 26', back to back of curb.
- 2.5 Minimum pavement radius at intersections: meet requirements of SUDAS Design Manual.
- 2.6 Pavement gutter grades: minimum 0.60% and maximum 5.0% unless otherwise approved by City.

- 2.7 Construct streets in accordance with details shown on Standard Drawings; center pavement on right-of-way, unless otherwise permitted by City.
- 2.8 Minimum pavement diameter for culs-de-sac when approved by City: 80'; maximum length of street to serve culs-de-sac: 600' from end or radius of intersecting perpendicular street to beginning of radius for cul-de-sac.
- 2.9 Provide depressed curb where sidewalks intersect streets and at driveways constructed prior to pavement; construct 6" integral curb at other locations; mill or saw cut and remove 6" curb at sidewalks and driveways constructed after pavement. Sidewalks and crosswalks to meet requirements of Americans with Disabilities Act (ADA) and Public Right of Way Access Guidelines (PROWAG).
- 2.10 Construct driveway approaches as shown on Standard Drawings; single driveway approach width 10'; double driveway approach width 18'; triple driveway approach width 22' unless otherwise approved by City.
 - 2.10.1 Construct commercial driveway approaches in accordance with SUDAS Standard Specifications Figure 7030.101 for Concrete Driveway, Type A except minimum thickness is 8 inches.
- 2.11 Provide red nine dot object markers (OM4-2), 2 in each lane and one at centerline, at dead ends of streets.
- 2.12 City to provide street name signs, speed limit signs, stop signs and no parking signs as specified hereinafter; use symbol signs where appropriate. Subdivider to reimburse City for cost of materials and installation of signs.
- 2.13 Surface and pavement replacement of existing streets:
 - 2.13.1 Asphalt and seal coat streets: replace with asphalt or concrete as specified.
 - 2.13.2 Granular surfacing: replace with granular surfacing as specified.
 - 2.13.3 Concrete curb and gutter: minimum pavement thickness as specified.
- 2.14 Provide subdrain on all public street improvements unless specifically stated in geotechnical report that subdrain is not needed. Provide storm sewer, sump pump drain line, or subdrain on each side of street.

Design Standards

- 2.15 Provide appropriate street network enhancements based upon projected traffic volumes warranting additional travel lanes, turning lanes, or signalization.
 - 2.15.1 Projected traffic volumes to be based upon development anticipated within a 20 year planning period or as directed by the City. Traffic studies to provide a 5 year and 20 year projection.
 - 2.15.2 Costs associated with the street network enhancements and design will be distributed between Subdivider and City based upon the Subdivider's contribution to the traffic volumes necessitating the enhancements.
- 2.16 Provide commercial drives with thickened approach between sidewalk and edge of street pavement; minimum 8" thick; install expansion joint.
- 2.17 Subdivider responsible for installing pavement markings at improved street intersections that include turning lanes as directed by City.
 - 2.17.1 For purposes of these requirements the intersection will include all areas within 250 feet of the intersection covering the required improvements.
 - 2.17.2 Subdivider to create a plan identifying all required markings at intersection for City's review.
 - 2.17.3 Markings to be provided include centerline (2 solid or dashed yellow), turn lane(s) (1 solid white), lane separation(s) (1 dashed white), pedestrian crossings, (solid white longitudinal lines or bars parallel to vehicle traffic flow), and directional arrows (solid white).
 - 2.17.4 Markings to be comprised of Durable Paint.

3. SHARED USE PATHS

- 3.1 Design shared use paths including sidewalks and trails in accordance with Americans with Disabilities Act (ADA) and Public Right of Way Access Guidelines (PROWAG).
- 3.2 Provide minimum 1' clear zone from edge of shared use paths to edge of hydrants, poles, street signs, street lights and other obstacles.

3.3 Sidewalks:

3.3.1 Construct 5' wide sidewalks on both sides of street; or as directed by City; place inside edge of sidewalk 1' outside property line or as directed by City; conform to details shown on SUDAS Standard Specifications Figures 7030.204 through 7030.210 unless otherwise approved by the City.

3.3.2 Provide 1.5% +/- 0.5% cross slope.

3.4 Multi use trails:

3.4.1 Applicable to bike trails and multi-use trails including locations where trail replaces standard sidewalks.

3.4.2 Construct on prepared subgrade as specified for driveway approaches and sidewalks in EARTHWORK AND INCIDENTALS FOR PAVEMENT.

3.4.3 Construct 10' wide portland cement concrete surfacing, 6" minimum thickness with maximum 10' transverse joint spacing; thicken trail to 7" at driveways and street crossings. Provide 1.5% +/- 0.5% cross slope. Construct as specified for driveway approach and sidewalk construction in PORTLAND CEMENT CONCRETE PAVEMENT.

3.4.4 Provide 2' wide graded shoulder each side; sod shoulders.

4. STORM SEWERS

4.1 Provide adequately sized storm sewers and sump pump drain lines. Design storm sewers in accordance with SUDAS Design Manual, Subdivision Ordinance of the City of Waukee, Iowa and the following standards.

4.2 Determine runoff using the Rational Formula, $Q = CIA$, where:

Q = maximum rate of runoff in cubic feet per second.

C = runoff coefficient; use coefficients consistent with type of surfaces in drainage area.

I = average rainfall intensity in inches per hour for the period of rainfall of a given frequency having a duration equal to the time of concentration.

A = drainage area in acres.

- 4.3 Use 10-year storm frequency and the Mean Frequency Distribution for Storm Periods referenced under Paragraph 4.7 to determine intensity for storm sewer system including intakes, structures, and pipes except as follows:
 - 4.3.1 Use 100-year storm frequency for future development without regard for stormwater detention flow reduction for culvert design under roadways where roadway embankment blocks drainageway.
 - 4.3.2 Use 100-year storm frequency for future development storm sewers draining sump area in roadways and private lands unless drainage easements are provided for all areas inundated during 100-year storm.
 - 4.3.3 Provide stormwater detention for flow reduction where downstream culverts or channels are not capable of handling the 100-year future development undetained runoff; design and limit discharge per SUDAS Design Manual.
 - 4.3.3.1 Detention basins shall be sized using the TR-55 Method or the Modified Rational Method. The Modified Rational Method can only be used to determine detention volume on sites of 5 acres or less with no off-site pass through.
 - 4.3.3.2 Meet SUDAS Design Manual guidelines for earthen detention requirements for slopes, embankment widths, freeboard and emergency spillway.
 - 4.3.3.3 Paved parking lots can be used for storm water detention storage. Meet requirements of SUDAS Deign Manual. Storage not allowed in primary drives and entrances.
 - 4.3.3.4 Restrict discharge rate from detention basins using a correctly sized aluminum or stainless steel weir plate or orifice plate securely fastened with stainless steel hardware. Fasten orifice plate inside downstream pipe or structure. Pipe downstream from weir plate or orifice plate to have adequate capacity to accommodate a minimum of a 10-year storm frequency event.
- 4.4 City will consider stormwater retention.
- 4.5 City will consider open channel storm water drainage with a 15" dia. double wall polyethylene or reinforced concrete pipe subdrain when required pipe diameter is greater than 48".

Design Standards

- 4.6 Storm sewers, intakes and other structures located within the street right-of-way shall not discharge storm water during a less than or equal to 10-year storm frequency storm event into normally dry drainage swales located on private property unless otherwise permitted by City.
- 4.7 Mean Frequency Distribution for Storm Periods per SUDAS Design Manual.
- 4.8 Use minimum 15-minute time of concentration for single family residential area storm sewers; time of concentration for all other developments will be reviewed by City.
- 4.9 Minimum pipe size: 15" except for intake cross-runs which shall be 12" minimum diameter.
- 4.10 No bends or pipe deflections permitted on storm sewers unless otherwise permitted by City.
- 4.11 Storm sewers that cross a street shall cross the street at no more than 15 degrees from perpendicular. Intent is to locate storm sewer and the intakes on each side of the street within the same pavement panel.
- 4.12 Maximum velocity within pipe (1/2 full): 15' per second. Pipe slopes that exceed the following chart are not allowed:

<u>Pipe Diameter</u> (in.)	<u>Maximum Slope</u> (%)
12	10.9
15	8.1
18	6.3
21	5.1
24	4.3
30	3.2
36	2.5
42	2.0
48	1.7
54	1.4

- 4.13 Curb intakes:
 - 4.13.1 Single, SUDAS Standard Specifications Type SW-501, SW-502, SW-503 or SW-504.
 - 4.13.2 Double, SUDAS Standard Specifications Type SW-505 or SW-506.

Design Standards

- 4.13.3 Provide SUDAS Standard Specifications Types SW-501 through SW-506 Curb Intakes when street grade is less than 5.00%; provide special intakes when street grade is 5.00% or greater; consult with City Engineering Department.
- 4.13.4 Location: up grade from intersections, sidewalk ramps and other locations to meet specific topographic conditions; locate outside of intersection radius.
 - 4.13.4.1 Install at least one intake at the low point of the street grade.
 - 4.13.4.2 Install intake no further than 500 feet from the street high point.
 - 4.13.4.3 Maximum spacing 400 feet regardless of gutter flow capacity.
- 4.13.5 Connecting pipes: size to accommodate flow into intake without surcharging intake.
- 4.14 Area intakes:
 - 4.14.1 Rectangular area intake: SW-511.
 - 4.14.2 Circular area intakes: SW-512 with Type 4 flat grate.
 - 4.14.3 Open sided area intake: SW-513.
 - 4.14.4 Connecting pipes: size to accommodate flow into intake without surcharging intake.
- 4.15 Manholes: SUDAS Standard Specifications Types SW-301, SW-401, SW-402, SW-403, SW-404 or SW-405 modified as specified in STORM SEWERS AND STRUCTURES or Standard Drawings Types Special Manhole or Shallow Manhole.
- 4.16 Cleanouts: SUDAS Standard Specifications Figure 4040.232 Types A-1 or B.
- 4.17 Manholes, intakes and structures required that are larger or deeper than those shown in SUDAS Standard Specifications shall be designed and certified by a licensed professional engineer in the State of Iowa.

- 4.18 Provide minimum 8" dia. perforated subdrain surrounded by pea gravel or minimum 3' wide concrete flume along rear lot lines or side yards where surface flowage has 2% or less longitudinal slope; provide flat grate intakes in areas where standing water is present after a 1" rainfall event after finished grading of the site is completed; comply with material standards for subdrains.
 - 4.18.1 Tracer wire to be placed on the pipe so it can be located.
 - 4.18.2 Subdrain to be tied into the public storm sewer system or outletted into a detention facility designed to handle the 100 year storm event.
 - 4.18.3 Cleanouts or intakes to be provided a maximum of every 150 feet from the point of outlet and at deadends or as directed by the City. Use cleanouts as specified hereinbefore except use slotted casting.

5. SANITARY SEWERS

- 5.1 Comply with design standards contained in the SUDAS Design Manual and in CHAPTER 12 - IOWA STANDARDS FOR SEWER SYSTEMS from IOWA WASTEWATER FACILITIES DESIGN STANDARDS published by the IDNR.
 - 5.1.1 Size lateral sewers for residential areas to accommodate flow of 500 gallons per capita per day; volume of flow from areas other than residential subject to approval by City. Size trunk sewers as directed by the City.
- 5.2 Sanitary sewer service connections:
 - 5.2.1 Minimum service pipe size for single family dwellings: 4" at minimum slope of 1% or as specified in the adopted Plumbing Code.
 - 5.2.2 Minimum service pipe size for all other types of buildings: 6" at minimum slope of 1% or as specified in the adopted Plumbing Code.
 - 5.2.3 Shared sewer services from multiple buildings that are located on separately owned lots are not allowed.
- 5.3 Manholes: SUDAS Standard Specifications Types SW-301, SW-302, SW-303, SW304, SW-305 or Standard Drawings Types Special Manhole or Shallow Manhole. High point manholes are not allowed.

6. PUMPING STATIONS AND FORCE MAINS

- 6.1 Comply with design standards contained in the SUDAS Design Manual, SANITARY SEWERS AND APPURTENANCES and in CHAPTER 13 - SEWAGE PUMPING STATIONS from IOWA WASTEWATER FACILITIES DESIGN STANDARDS published by the IDNR.
 - 6.1.1 Pumping station capacity: size for maximum rate of flow from connected sewers.
 - 6.1.2 Provide at least 2 pumps of equal capacity, each capable of pumping maximum flow; if more than 2 pumps, size pumps so that with largest pump out of service remaining units have capacity for maximum sewage flow.
 - 6.1.3 Provide in-place standby power system; provide for automatic and manual start-up, automatic load transfer and exercising of system under load.
 - 6.1.4 Size force main to maintain velocity of 2' per second at design average flow and pass 3" solids.
 - 6.1.5 Provide fence around pumping station site.
 - 6.1.6 House major pump controls in heated above ground structure; provide disconnect switches for pumps and all other electrical equipment; blend pumping station superstructure with surrounding development including landscaping.
 - 6.1.7 Provide automatic pump alternators on multiple pump installation.
 - 6.1.8 Provide stainless steel guide rails, cable holders, chain, bolts and appurtenances inside wet well.
 - 6.1.9 Provide magnetic flow meter on pump discharge pipe.
 - 6.1.10 Provide water supply with yard hydrant.

7. WATER MAINS

- 7.1 Comply with design standards contained in the SUDAS Design Manual and in RECOMMENDED STANDARDS FOR WATER WORKS (Ten States Standards) as adopted by the IDNR.

Design Standards

- 7.1.1 Minimum water main size: Residential R-1 and Residential R-2 zoning: 8". Water main size other than in residentially zoned areas subject to approval by City.
- 7.1.2 Size major water mains as directed by the City.
- 7.1.3 Maximum dead end water main length: 300'.
- 7.2 Isolating valve spacing:
 - 7.2.1 Residential R-1 and Residential R-2 zoning: 800' maximum and at street intersections.
 - 7.2.2 Other zoning: 400' maximum and at street intersections.
 - 7.2.3 On all private lines at the connection with the City main.
- 7.3 Provide 1 hydrant at each street intersection and equally space hydrants between intersections, maximum hydrant spacing: 300', unless otherwise directed by City.
 - 7.3.1 Provide hydrant at entrance and at end of culs-de-sac when approved by City; maximum spacing as specified hereinbefore.
- 7.4 Minimum water service size: 1".
 - 7.4.1 Materials: use copper tubing for services 2" and smaller; larger than 2": use pvc or ductile iron pipe; if pvc is used for main: use a ductile iron fitting and reducer if required.

8. SUMP PUMP DRAIN LINES

- 8.1 Design sump drain lines in accordance with SUDAS Design Manual, Ordinances of the City of Waukee, Iowa and the following standards:
- 8.2 Provide sump pump drain line for each building requiring foundation drainage.
 - 8.2.1 Drain line standards herein are based on proper installation of a suitable, commercially available automatic, thermal overload protected sump pump capable of discharging 20 gpm at 20' TDH.
- 8.3 Outlet drain line in public collector pipe or storm sewer.
- 8.4 Collector pipes, receiving discharge of two or more sump pumps, may be used upon written approval of installation details by City; minimum pipe size: 8".

- 8.5 Arrange sump pump drain lines and collector pipes to prevent freezing; minimum depth of cover over buried pipe: 3'-6" or as approved by City.
- 8.6 Provide 4" pvc pipe with positive drainage for drain lines. Extend 4" drain line from public storm sewer or collector pipe to minimum 1' inside property line.

9. SUBDIVISION LOT GRADING AND MAINTENANCE

- 9.1 Construction sites covered by General Permit No. 2, issued by IDNR, are required to fulfill the topsoil preservation requirement by either:
 - 9.1.1 Stating that the requirements for on-site topsoil in SUDAS Standard Specifications Section 2010 will be met OR using the General Permit No. 2 language which states "The permittee shall minimize soil compaction and, unless infeasible, preserve topsoil".
- 9.2 Subdivider responsible for obtaining required borrow excavation and for disposal of surplus excavated material.
- 9.3 Scarify slopes to a minimum depth of 3" prior to placement of topsoil.
- 9.4 Compact fill in areas intended to support utilities to not less than 95% maximum density with moisture content between optimum moisture content percentage and 4% above optimum unless otherwise directed by geotechnical report; compact in horizontal layers not more than 8" in loose thickness.
- 9.5 Provide minimum 2% slope for buildable areas of lot; no slope limit for areas not disturbed by construction having slopes stabilized by existing vegetation or rock outcropping.
- 9.6 Provide unobstructed 100-year flood flow paths through platted areas subject to development to convey runoff from upstream areas of the watershed.
 - 9.6.1 Compute runoff in accordance with Paragraph 4. STORM SEWERS.
 - 9.6.2 Preserve or improve natural drainageways for use as flood flow paths.
 - 9.6.3 Grade lots for drainage as shown on Standard Drawings or in accordance with an agreed-upon plan with City.

- 9.6.4 All 100-year flood flow paths in rear and side yards shall be within a surface water flowage easement. Provide subdrains, storm sewers and flumes for low flow storm events in accordance with Paragraph 4. STORM SEWERS.
- 9.7 Stabilize disturbed areas by sodding or seeding and mulching; maintain undeveloped lots free of weeds.
- 9.8 Provide sediment and erosion control in areas subject to development in accordance with IDNR General Permit No. 2.
 - 9.8.1 Deposition of eroded soil on public rights-of-way, adjacent properties not owned by subdivider and established streams, drainage ditches and sewers is prohibited.
 - 9.8.2 Remove sediment deposited by erosion, vehicle tire or otherwise on public rights-of-way or adjacent properties by end of work day and prior to a storm event.

10. STREET LIGHTS

- 10.1 All lighting on private property including lighting for buildings, parking lots and private streets shall conform to the City of Waukee Site Plan Ordinance.
- 10.2 All lighting on public streets shall conform to the design standards contained in the SUDAS Design Manual and the following standards:
- 10.3 Poles:
 - 10.3.1 All new street light poles and appurtenances installed within the clear zone of any public street right-of-way shall be of a design to break-away when hit by a vehicle. The break-away design shall conform to the definitions of the U.S. Department of Transportation.
 - 10.3.2 Street light poles shall be placed near all intersections, outside the sight triangle, for proper lumination of the intersection.
 - 10.3.3 Street light poles along minor collectors and local streets shall be spaced at a maximum of 250 feet. Street light poles along major collectors and arterial streets shall be spaced as approved by the City.
 - 10.3.4 Locate poles in a straight line 3-feet to 6-feet behind the back of curb. Install poles plumb.

10.4 Fixtures:

10.4.1 All fixtures shall be full cut-off (no sag lens).

10.4.2 All fixtures shall be supported by MidAmerican Energy unless otherwise approved by the City as a part of a development agreement related to special development characteristics of a subdivision.

10.4.3 Mounting height shall be 28 feet along minor collector and local residential streets and 34 feet along major collector streets.

10.5 Provide photometric plan identifying all pole locations and project lighting levels with foot-candle measurements at 10' increments.

10.6 In cases where a homeowners association is created for a particular subdivision and includes the responsibility of on-going maintenance of street light poles and fixtures, a street lighting design utilizing unique poles and fixtures may be approved at the discretion of the City.

11. TRAFFIC SIGNALS

11.1 All traffic signal installations must meet the criteria as set forth in the MUTCD for minimum warrants to be met or be approved by the City following an engineering study.

11.2 Meet SUDAS Specifications for traffic signals.

11.3 Pedestrian crossings and ramp areas associated with a new traffic signal installation shall comply with Americans with Disabilities Act (ADA) and Public Right of Way Access Guidelines (PROWAG).

11.4 Traffic signal interconnection must be considered for any installation deemed appropriate by the City. Interconnection methodologies and technologies must be compatible with adjacent signal systems.

11.5 Placement of signal poles, cabinetry and pedestrian push buttons shall comply with appropriate clear zone requirements for design speeds of the adjacent roadway as set forth by AASHTO.

11.6 Traffic signal pole locations, traffic head placement and pedestrian crossings shall be located to accommodate design vehicle turning movements throughout the intersection.

11.7 All poles, footings and mast arms are to be designed to accommodate appropriate structural loadings that are expected for this installation. Additional loadings shall be considered for signage, aesthetic amenities, etc.

- 11.8 All components and appurtenances shall be made from materials to withstand the elements and be protected by low maintenance coatings. These coatings shall meet the standard colors for such installations as approved by the City.
- 11.9 All footings, cabinetry and handholes shall be placed to minimize the exposure to drainage paths or conflict with other utility providers.
- 11.10 For any combination signal and street light installations, street light components shall be as specified hereinbefore.

12. FIBER OPTIC LINES

- 12.1 Provide fiber optic lines on all minor collector streets and larger unless otherwise directed.
- 12.2 Design fiber optic lines in accordance with the following standards:
 - 12.2.1 Conduit: Comply with Iowa Department of Transportation Standard Specifications Section 4189. 2" diameter, 30" depth.
 - 12.2.2 Handholes: 30" x 48" x 24" precast polymer rated for 20,000 lb. load (Tier 15). Handholes shall be installed at splicing, building access, and future signal locations; 800' maximum spacing.

PART 3 – EARTHWORK AND INCIDENTALS FOR PAVEMENT

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1. GENERAL

- 1.1 This part of the specifications includes earthwork and incidentals to complete grading for portland cement concrete pavement, driveway approaches and shared use paths.
- 1.2 Reference to percent maximum density shall mean a soil density not less than the stated percent of maximum density of optimum moisture content for soils as determined by ASTM D698 Moisture-Density Relations of Soils using 5.5 lb. Rammer and 12" Drop. (Standard Proctor Method).
- 1.3 Do work in accordance with best present-day installation and construction practices.

2. EXCAVATION

- 2.1 Excavate to grade required for street construction.
- 2.2 Provide suitable approaches from intersecting streets and driveways.
- 2.3 Subdivider responsible for obtaining required borrow excavation.
- 2.4 Subdivider responsible for disposal of surplus excavated material.
- 2.5 Provide temporary drainage facilities to prevent damage to public or private interests when necessary to interrupt natural drainage or flow of artificial drains.
- 2.6 Restore original drains as soon as work will permit.
- 2.7 Subdivider liable for damage resulting from neglect to provide for interrupted natural or artificial drainage.
- 2.8 Do not damage pavement or disturb subgrade beneath existing pavement.

3. EMBANKMENT

- 3.1 Remove all ground cover and topsoil from area.
- 3.2 Construct embankment in horizontal layers not more than 8" in loose thickness.
- 3.3 Deposit each layer over full width of embankment as separate operation.
- 3.4 After layer is deposited, smooth to uniform depth by means of suitable grader or bulldozer.
- 3.5 Compact layer by rolling with tamping type roller filled with water until full weight of roller is supported by tamping feet, but with not less than one pass per inch of loose thickness of layer.
 - 3.5.1 Roller will be considered to be supported entirely on its tamping feet when feet do not penetrate more than 3" into material being compacted.
- 3.6 If soil is wet so that it will not sufficiently compact by one passage of roller per inch of loose thickness, provide one discing per 2" of loose thickness.
 - 3.6.1 Cut and stir full depth of layer.
 - 3.6.2 Allow interval of not longer than 2 hrs. between successive discings.
 - 3.6.3 After discing is completed, compact layer by rolling, as specified.
- 3.7 If soil is dry so that it will not satisfactorily compact by rolling, moisten material before compaction; manipulate material to secure proper distribution of moisture before compaction.
- 3.8 Whenever operations are suspended during period when rain is likely to occur, smooth and compact surface to shed water readily.
- 3.9 Other compacting equipment and construction methods may be used provided results obtained produce compacted lifts of soil having not less than 95% maximum density and moisture content between optimum moisture content percentage and 4% above optimum.
 - 3.9.1 Test for density and moisture content; one test per lift per 150 feet or as directed by City Engineering Department.

4. SUBGRADE PREPARATION

- 4.1 Provide uniform composition at least 12" below top of subgrade for full width of subgrade of pavement plus 2' on each side; roll and scarify materials, mix and re-compact, or otherwise treat to produce a uniform condition; remove top 6" and scarify, mix and re-compact the next 6" of subgrade; replace, mix and compact the top 6" of subgrade; proof roll finished subgrade with fully loaded tandem axle dump truck with maximum tandem axle gross weight of 34,000 pounds immediately prior to paving; correct soft areas visible during proof rolling. Provide additional proof rolling after a rainfall event prior to paving.
- 4.2 Remove and dispose of stones over 4" in size from loosened portion of subgrade.
- 4.3 Construct subgrade with uniform density for a width equal to that of proposed pavement plus 2' on each side; density is to be not less than 95% maximum density and moisture content between optimum moisture content percentage and 4% above optimum.
- 4.4 In areas where roller cannot compact; place 6" of Class B crushed limestone, IDOT 4120.05; compact to 95% maximum density with vibrator tamper.
- 4.5 Construct subgrade such that after rolling, surface will be at required grade and cross section.
 - 4.5.1 Shape edges of subgrade to keep flowing water away from pavement.
- 4.6 Fill depressions that develop during rolling with suitable material; continue rolling until subgrade is uniformly firm, properly shaped and true to grade and cross section.
 - 4.6.1 Maintain until pavement is placed.
 - 4.6.2 Remove materials other than sand which will not compact readily under roller; replace with materials which will compact readily; again roll that portion of subgrade.
- 4.7 If ruts or other objectionable irregularities form in subgrade during construction, reshape and re-roll subgrade before placing pavement or subbase; fill ruts or other depressions with material similar to other subgrade material.

- 4.8 Draw steel shod template, over subgrade prior to depositing concrete; check and trim subgrade to required grade and cross section.
 - 4.8.1 Use of template may be waived if subgrade has been shaped satisfactorily by suitable electronically controlled subgrade trimming machine.
 - 4.8.2 In irregular sections where use of template or subgrade trimming machine is impractical, check subgrade by most accurate practical method.
- 4.9 Subgrade preparation for driveway approaches and shared use paths:
 - 4.9.1 Excavate to provide finish grade approved by City.
 - 4.9.2 Excavate subgrade to a point 2" below proposed grade of bottom of slab; backfill with 2" of compacted crushed stone, depending on condition of subgrade.
 - 4.9.3 For driveway approaches and shared use paths constructed in fill: backfill with selected material; compact in not more than 6" lifts to a density of 95%; fill top 2" with compacted crushed stone, depending on condition of subgrade.
- 4.10 Test subgrade for density and moisture content; one test per lift per 150 feet of street to be paved or as directed by City Engineering Department.

5. SUBGRADE TREATMENTS

- 5.1 Use only to correct subgrade condition where specified density cannot be obtained by other methods.
- 5.2 Granular subbase for concrete pavement: use uniform mixture of granular material, uniformly moistened, placed on prepared subgrade; use also as suitable material to fill depressions in subgrade.
 - 5.2.1 Use crusher run limestone, crusher run sandstone, limestone screenings, soil-aggregate, pit run gravel, or a mixture of sand or pit run gravel with crushed limestone or limestone screenings.
 - 5.2.2 Use mixture uniform in composition with no visible segregation of constituent materials.

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- 5.2.3 If soil is added to material, pulverize soil particles so no particles are retained on 3/4" sieve.
- 5.2.4 If constituent materials are proportioned, blend to homogeneous mixture before placing on subgrade.
- 5.2.5 Not more than 5% of finished mixture retained on sieve having square openings equal to one-third nominal thickness of subbase and not more than 25% pass No. 200 sieve.
- 5.2.6 Material containing soil added in process of producing aggregate or added separately: solid volume ratio not less than 0.80; material without added soil: solid volume ratio not less than 0.75.
- 5.3 Equipment requirements for placing granular subbase:
 - 5.3.1 Compaction equipment: IDOT 2001.05.
 - 5.3.2 Prewetting equipment: IDOT 2001.08A.
 - 5.3.3 Equipment for applying water: IDOT 2001.09.
 - 5.3.4 Weighing equipment: IDOT 2001.07.
- 5.4 Lime subgrade treatment for concrete pavement:
 - 5.4.1 Provide lime, 20 lbs. per SY, in top 6" of subgrade.
 - 5.4.2 Mix until uniform consistency is obtained; add water as required for optimum moisture content and compact to specified density.
 - 5.4.3 Lime: use hydrated lime: ASTM C207, Type N.
- 5.5 Geogrid material: biaxial material of 98% minimum polypropylene and regular grid structure conforming to ASTM D4101 Group 1, Class 1, Grade 2 with .05% minimum carbon black per ASTM 4218; Tensar Geogrid BX1100, or equal.
 - 5.5.1 Aperture size suitable for mechanical interlock of base and geogrid; minimum of 70% open area; maximum openings: 1" (longitudinally along roll) and 1.3" (across roll).
 - 5.5.2 Tensile modulus of 14,000 lbs./ft.; flexural rigidity of 250,000 mg-cm.

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- 5.5.3 Nominal rib thickness of 0.03"; nominal junction thickness of 0.11" per ASTM D1777.
- 5.5.4 Resistant to damage by all forms of biological and chemical degradation caused by subgrade or subbase environment.
- 5.5.5 Avoid damage to subgrade; roll geogrid material over prepared subgrade; extend geogrid material minimum 1'; beyond back of curb line; cut to conform to fixtures; pin overlaps to provide anchorage.
- 5.5.6 Overlap geogrid material joints minimum 2' both transverse and longitudinal; overlap on 31' wide street pavement may be reduced to 1.5' to accommodate manufacturer's standard geogrid material widths in longitudinal lap joints only.
- 5.5.7 Overlap geogrid material in direction granular base will be spread.
- 5.5.8 Anchor geogrid material to subgrade as recommended by manufacturer.
- 5.6 Other subgrade treatments may be used provided they are approved by a geotechnical engineer licensed in Iowa.

6. FINISH GRADING

- 6.1 Finish grade and shape area from property line to back of curb to prevent water from entering subgrade.
- 6.2 Compact backfill behind curb to 95% maximum density.
- 6.3 Grade to drain to street; slope from property line to sidewalk 4%; sidewalk slope: 1.5% +/- 0.5%; slope from sidewalk to back of curb 4%.
 - 6.3.1 Maximum slope at driveways: meet requirements of the Driveway Design Criteria of the SUDAS Design Manual.
 - 6.3.2 Use above slope limitation unless exceptions are allowed by City.
- 6.4 Remove an adequate amount of topsoil from the upper 12" of existing on-site topsoil to allow finish grading with a finished grade of 8" of salvaged or amended topsoil. The topsoil may be moved directly to an area where it is to be used, or may be stockpiled for future use.

- 6.4.1 On-site topsoil material is material excavated from the top 12" of the site. Use of on-site topsoil material is subject to the Engineer's approval.
- 6.5 Degree of finish for grading slopes: that ordinarily obtainable through use of suitable power equipment operated by skilled workmen on favorable ground conditions.
- 6.6 Keep equipment off parkings after finishing.

7. STREET SIGNS

- 7.1 Furnish and install street name and traffic control signs and accessories in accordance with Iowa Manual on Uniform Traffic Control Devices and as directed by City; use symbol signs where appropriate; install signs prior to opening street for public use.
 - 7.1.1 Manufacturer: Iowa State Industries, Lyle Signs, Inc., Newman Signs, or approved equal.
- 7.2 Street name signs and accessories:
 - 7.2.1 Provide 1 street sign assembly at each intersection; locate where directed by City.
 - 7.2.2 Street nameplates: high intensity reflective sheeting with white letters on green background; white border.
 - 7.2.3 Provide two-way, four-way or six-way brackets, as required.
- 7.3 Furnish and install NO PARKING signs and accessories; Lyle Signs, Inc., or approved equal.
 - 7.3.1 Provide signs to prohibit parking on sides of streets as directed by City; place signs in parking, facing on-coming traffic; locate first sign in block approximately 100' from intersection; 200' maximum spacing on signs in remainder of block.
 - 7.3.2 Sign plate: Lyle Signs, Inc., or approved equal, high intensity reflective sheeting; urban: 12"x12" size; rural: 24"x24" size; legend: "P" in black letters, symbol in red, on white background; black border.
 - 7.3.3 Install sign on post with bottom of sign approximately 7'-0" above ground; use 5/16" cadmium plated bolts and lock washers.

- 7.4 Furnish and install DEAD END signs and accessories on streets which terminate in dead end or cul-de-sac; Lyle Signs, Inc., or approved equal.
 - 7.4.1 Locate sign where directed by City.
 - 7.4.2 Sign plate: Lyle Signs, Inc., or approved equal, high intensity reflective sheeting; 30" x 30" size; legend: "DEAD END" in black letters on yellow background; black border.
 - 7.4.3 Install sign on post with bottom of sign approximately 7'-0" above grade; use 5/16" cadmium plated bolts and lock washers.

- 7.5 Furnish and install speed limit signs and accessories: Lyle Signs, Inc., or approved equal.
 - 7.5.1 Provide signs of speed limits as directed by City; place signs in parking, facing on-coming traffic; locate signs as directed by City.
 - 7.5.2 Sign plate: Lyle Signs, Inc., or approved equal, high intensity reflective sheeting; 24" x 30" size; typical legend: SPEED LIMIT 25 in black letters and numerals on white background; black border; speed limit designation as determined by City.
 - 7.5.3 Install sign on post with bottom of sign approximately 7'-0" above grade; use 5/16" cadmium plated bolts and lock washers.

- 7.6 Furnish and install STOP signs and accessories; Lyle Signs, Inc., or approved equal.
 - 7.6.1 Locate signs at intersections where directed by City.
 - 7.6.2 Sign plate: Lyle Signs, Inc., or approved equal, high intensity reflective sheeting; 24" octagon on local service streets and 30" octagon on arterial streets; legend: white letters and borders on red background.
 - 7.6.3 Install sign on post with bottom of sign approximately 7'-0" above grade; use 5/16" cadmium plated bolt and lock washers.

- 7.7 Furnish and install post mounted object markers on streets that dead end at platted subdivision boundaries and are intended for extension in future.

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- 7.7.1 Sign: red nine dot object marker meeting requirements of the Manual on Uniform Traffic Control Devices (MUTCD) for Type 4 object marker OM4-2.
 - 7.7.2 Provide five object markers at each dead end; two in each lane and one at centerline.
 - 7.7.3 Install object marker on post with bottom of marker a minimum of 4'-0" above grade; use 5/16" cadmium plated bolts and lock washers.
- 7.8 Posts:
- 7.8.1 2" square galvanized steel; minimum 12 gauge; galvanized inside and outside; conform to ASTM A653, G90, structural quality Grade 50, Class 1; Telespar, or equal.
 - 7.8.2 Provide with holes 7/16 inch diameter at one inch centers on all four sides down the entire length of the post. Holes shall be on centerline of each side in true alignment and opposite each other directly and diagonally.
 - 7.8.3 Set in 3' x 2.25" square galvanized base post; minimum 12 gauge; anchor base post 3' below finished grade, or as directed by City.
- 7.9 Furnish and install other traffic control signs as determined by City.

PART 4 – PIPE EXCAVATION AND BACKFILL

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1. GENERAL

- 1.1 This part of the specifications includes excavation and backfill for storm sewers, sanitary sewers, water mains, subdrains, sump pump drain lines and structures.
 - 1.1.1 Excludes excavation for streets, driveway approaches and shared use paths.
- 1.2 Excavate in open cut except when tunneling is required or allowed by City; tunnel under railroads, highways, shared use paths, driveways, concrete pavement and curb and gutter except where permission to open cut is granted by City.
- 1.3 Protect all existing concrete pavement, shared use paths, driveways and curb and gutter in public right-of-way from damage during construction; if damage occurs, restore at no expense to City or private property owners. Restore in accordance with SURFACE RESTORATION AND PAVEMENT REPLACEMENT.
- 1.4 Reference to percent maximum density shall mean a soil density not less than the stated percent of maximum density for soil as determined by ASTM D698 Moisture-Density Relations of Soils using 5.5-lb. Rammer and 12" Drop. (Standard Proctor Method).

2. EXCAVATION FOR STRUCTURES

- 2.1 Includes excavation for manholes, intakes and other appurtenances.
- 2.2 Excavate as required to firm, undisturbed soil; if excavation is carried below bottom of foundation, fill with stabilizing material or Class B concrete.
- 2.3 Provide sheeting, shoring and bracing where required to hold walls of excavation, to protect existing structures or utilities or to provide safety for workmen.

3. TRENCH EXCAVATION

- 3.1 Keep width of trench as narrow as possible and still provide adequate room for backfill and jointing.
- 3.2 Keep sides of trench as nearly vertical as practicable; maintain vertical walls of excavation below top of pipe.
- 3.3 Maximum width of trench at top of pipe: as shown on Standard Drawings; water main and sanitary force main trench: outside diameter of pipe plus 12" on each side.

3.4 Bottom of trench for gravity sanitary sewers and services:

- 3.4.1 Bedding for iron gravity sewer in open cut: use Class C - Granular Type I. See Standard Drawings.
- 3.4.2 Bedding for pvc, pvc truss and pvc corrugated sanitary sewer pipe: lay pipe on 6" deep pipe bedding material; fill around and over pipe to a minimum depth of 12" above the top of pipe bell with pipe bedding material; compact all bedding material by vibration. See Standard Drawings for Standard PVC Pipe Bedding – Granular Encasements.
- 3.4.3 Excavate full depth by machine; place pipe bedding in bottom of trench.
- 3.4.4 Pipe bedding: sharp, 1" clean crushed stone; comply with following gradation, dependent upon pipe diameter:

Sieve	
<u>Size</u>	<u>% Passing</u>
1"	100
3/4"	80-95
1/2"	50-60
3/8"	20-40
No. 4	0-5

- 3.4.4.1 City may authorize change in gradation subject to materials available locally at time of construction.
- 3.4.5 Compact pipe bedding by rodding or slicing with shovel.

Pipe Excavation and Backfill

- 3.4.6 Hand shape bell holes at each pipe joint in pipe bedding; provide access around circumference of pipe for proper jointing.
- 3.4.7 Trench excavated below required grade: backfill to proper elevation with pipe bedding, as specified.
- 3.5 Bottom of trench for sump pump drain lines larger than 3": lay pipe on 6" deep pipe bedding material; fill around and over pipe to minimum depth of 6" above top of pipe bell with pipe bedding material; compact all bedding material by vibration. See Standard Drawings for Sump Pump Drain Lines.
- 3.6 Bottom of trench for sump pump drain lines 3" and smaller, storm sewer, water main, or force main.
 - 3.6.1 Hand shape to provide uniform bearing and support for full length of pipe barrel against undisturbed earth for at least 1/4 circumference as shown on Standard Drawings for Hand Shaped Trench Bottom.
 - 3.6.2 Provide suitable bell holes at each pipe joint after bottom of trench has been graded.
 - 3.6.3 Alternate to hand shaping trench bottom: at Contractor's option, excavate to full depth by machine; place 6" depth of pit run gravel or crushed rock on trench bottom to provide firm bearing 1/4 circumference of pipe.
 - 3.6.4 Remove large clods, stones, and other foreign material from bottom of trench.
- 3.7 Bottom of trench for subdrain: backfill with pea gravel. See Standard Drawings for Subdrains.
- 3.8 When unstable material is encountered which may not provide a suitable foundation for pipe, remove and replace with stabilizing material.
 - 3.8.1 Stabilizing material: sharp, clean crushed stone; comply with following gradation:

<u>Sieve Size</u>	<u>% Passing</u>
2-1/2"	100
2"	90-100
1-1/2"	35-70
1"	0-15
1/2"	0-5

- 3.8.2 Place pipe bedding on top of stabilizing material in sewer trenches; place excavated material on top of stabilizing material in other trenches.

4. ROCK AND RUBBLE EXCAVATION

- 4.1 If trench bottom is extremely hard or is in rock or rubble where there is possibility of pipe being subjected to point contact:
 - 4.1.1 Overexcavate trench bottom 6" minimum below grade.
 - 4.1.2 Backfill overexcavation with pipe bedding material; place pipe bedding material as shown on Standard Drawing.
- 4.2 Use of explosives: submit detailed plans to City Engineering Department outlining all proposed blasting operations, locations, methods and use of mats and other safety measures.
 - 4.2.1 Obtain written approval from City before using explosives.
 - 4.2.2 Use thoroughly experienced demolition personnel.
- 4.3 Dispose of excavated rock and rubble not suitable for backfill.

5. SHEETING, SHORING AND BRACING

- 5.1 Construct sheeting, shoring and bracing where required to hold walls of excavation, to provide safety for workers, to protect existing utilities or structures or to permit construction in the dry.
- 5.2 Leave in place all sheeting below a level 2' over top of pipe.
- 5.3 Leave sheeting and shoring in place 2' over top of pipe when removal might damage new pipe.

6. TUNNELING

- 6.1 Tunneling will be required under railroads, highways, shared use paths, driveways, concrete pavement and curb and gutter except when stipulated otherwise in writing by City.
 - 6.1.1 Water main, sanitary sewer and sanitary sewer force main must be installed in casing pipe under railroads and highways.

Pipe Excavation and Backfill

- 6.2 Obtain approval of City and IDOT or railroad on method before starting; auger or jack pipe in place.
- 6.3 If pipe is augered, clean out pipe upon completion of operation.
- 6.4 If pipe is jacked, clean out pipe as work progresses; use dry bore method.
- 6.5 If pipe is directionally bored, properly dispose of boring mud; do not deposit on ground or dispose of mud in any storm sewer or sanitary sewer.
- 6.6 If voids occur above pipe or casing pipe, blow full with sand or flowable fill.
- 6.7 Maintain correct vertical and horizontal alignment; tolerance for sanitary sewers:
 - 6.7.1 Vertical: 0.2' up to 100' with an additional 0.1' per 100' thereafter or as to permit gravity flow in proper direction. Backfall and sags in pipe are not allowed.
 - 6.7.2 Horizontal: 1.0' per 100'.
- 6.8 Maintain street, highway or railroad for full use by traffic at all times.
- 6.9 Tunneling below or adjacent to structures or pavement: do work in manner to prevent settlement of structures or pavement.
- 6.10 Casing spacers: stainless steel construction with polyethylene runners. Install within one foot of each side of the carrier pipe joint and at maximum spacing of 6-feet. Do not allow pipe to be supported by joint bells. Follow manufacturers recommendations.
- 6.11 Casing end seals: minimum 1/8 inch thick manufactured synthetic rubber with stainless steel bands and fasteners. Install at both ends of casing pipe around carrier pipe.

7. DEWATERING

- 7.1 Do all work in dry; provide for handling of water encountered during construction.
- 7.2 Lay no pipe in or pour no concrete on excessively wet soil.

Pipe Excavation and Backfill

- 7.3 Prevent surface water from flowing into excavation; remove water as it accumulates.
- 7.4 Divert stream flow away from areas of construction.
- 7.5 Do not discharge water into sanitary sewers.
- 7.6 Protect discharge points from erosion. Provide sediment control for sediment contaminated water.
- 7.7 Remove all dewatering equipment and wells at end of construction; wells not allowed to be abandoned in place.

8. BACKFILL FOR STRUCTURES

- 8.1 Backfill after concrete or masonry has cured.
- 8.2 Backfill with suitable material removed from excavation except where other backfill is specified; use no debris, frozen earth, large clods or stones.
- 8.3 Backfill simultaneously on all sides of structure; save structure from damage at all times.
- 8.4 Compact backfill at structures to density not less than specified for adjacent trench.
- 8.5 Terminate at original grade or at elevation shown on plans; dispose of excess excavation unless otherwise directed by City Engineering Department.
- 8.6 Prepare backfill for surface restoration as specified for adjacent trench.
- 8.7 If settlement occurs within period of guarantee and bond, refill, compact and level off, and provide surface restoration in accordance with SURFACE RESTORATION AND PAVEMENT REPLACEMENT.

9. TRENCH BACKFILL

- 9.1 Backfill trench immediately after locations of connections and appurtenances have been recorded and testing has been completed.
 - 9.1.1 Provide compacted backfill at all locations unless ordinary backfill is specifically permitted by City Engineering Department.
 - 9.1.2 Maintain compacted backfill moisture content between optimum moisture content percentage and 4% above optimum.

Pipe Excavation and Backfill

- 9.2 Allow no more than 200' of trench to be open at one time; construct manholes and appurtenances and backfill as work progresses.
- 9.3 Use no large stones, large clods, organic matter, rubbish, frozen or unsuitable materials in backfill.
- 9.4 Backfill simultaneously on both sides of pipe to prevent displacement.
- 9.5 Trenches where "compacted backfill" is required:
 - 9.5.1 Hand place and carefully compact backfill to 1' over top of pipe.
 - 9.5.2 Backfill above 1' over top of pipe with excavated material in layers not to exceed 6", moisten if required; compact to 95% maximum density.
 - 9.5.3 Fill upper portion of trench with topsoil where construction area is to be seeded or sodded; replace street surfacing material where trench is in or at edge of traveled way.
- 9.6 Trenches where "ordinary backfill" is allowed:
 - 9.6.1 Hand place and carefully compact backfill to 1' over top of pipe.
 - 9.6.2 Backfill above 1' over top of pipe with excavated material in layers not to exceed 6" up to 12"; moisten if required; compact to 90% maximum density.
 - 9.6.3 Fill upper portion of trench with topsoil; prepare for surface restoration.
 - 9.6.4 Mound up or level off to original surface.
- 9.7 Backfill above pvc truss pipe, PE pipe, solid wall pvc and pvc profile wall pipe.
 - 9.7.1 Backfill with pipe bedding material to minimum 12" above top of pipe; do not drop pipe bedding material from equipment bucket more than 2' above pipe.

Pipe Excavation and Backfill

- 9.7.2 Above pipe bedding material, except at creek crossings, backfill with excavated material, except frozen material, shale, and other non-suitable material; do not drop backfill material from equipment bucket more than 2' above bottom of trench until backfill material is in place 4' above pipe bedding backfill material.
- 9.7.3 Consolidate bottom 4' of trench backfill with hand tools, tampers and vibratory plates; do not use drop type compactor until above bottom 4' of trench backfill.
- 9.8 Pipe bedding for backfill to top of pipe may be required if mechanical compaction of backfill around pipe does not eliminate voids.
- 9.9 New pipes below existing water, sewer, or other mains: backfill under existing water, sewer or other main with pipe bedding; compact to 95% maximum density; length of pipe bedding backfill at elevation of existing utility: equal to depth of excavation below utility.
- 9.10 If removal of sheeting disturbs compacted backfill, recompact backfill to comply with specifications.

10. CONCRETE ENCASEMENT

- 10.1 Place concrete encasement at creek crossings or where directed by City Engineering Department.
 - 10.1.1 Make pipe joint in same manner specified for pipe not encased.
 - 10.1.2 Pour concrete beneath and around pipe after jointing is complete.
 - 10.1.3 Use two temporary pipe supports per pipe length: one near bell and one near spigot.
 - 10.1.4 Provide ties and braces to prevent displacement or flotation during encasement.
- 10.2 Use concrete encasement as shown on Standard Drawing.

PART 5 - STORM SEWERS AND STRUCTURES

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1. GENERAL

- 1.1 This part of the specifications includes materials and installation procedures for storm sewers and appurtenances, subdrains and sump pump drain and collector lines.

2. PIPE MATERIALS

- 2.1 Reinforced concrete pipe (RCP): ASTM C76, Class III, Wall B, tongue and groove, machined ends; provide reinforcement as set forth in Table 3 of ASTM C76; use for storm sewer except for pipe jacked or augered in place.
- 2.1.1 Use ASTM C76, Class IV, Wall B, tongue and groove pipe for jacking or augering; provide reinforcement as set forth in Table 4 of ASTM C76.
- 2.2 Reinforced concrete arch pipe (RCAP): ASTM C506, Class A-III, tongue and groove, machined ends. Use where clearance requirements preclude use of RCP.
- 2.3 For water main conflicts use RCP or RCAP; provide flexible joint rubber gasket; ASTM C443.
- 2.4 Corrugated metal pipe (CMP): AASHTO M36, galvanized 2-2/3" x 1/2" corrugations; 14 gauge; use for roadway culverts only; minimum pipe size: 12" dia.; size roadway culvert to convey carrying capacity of ditch.
- 2.5 Sump pump collector lines, sump pump drain lines and subdrains:
- 2.5.1 Polyvinylchloride pipe (pvc): ASTM D3034, SDR 23.5, manufactured in accordance with ASTM D1784; cell classification 12454-B; size 4"; joints according to manufacturer's recommendations; use for sump pump drain line in right-of-way.

- 2.5.2 Polyvinylchloride pipe (pvc): ASTM D3034, SDR 35, manufactured in accordance with ASTM D1784, cell classification 12454-B; joints according to manufacturer's recommendation; use for perforated and non-perforated subdrain lines equal to or larger than 4".
- 2.5.3 Polyvinylchloride (pvc) corrugated pipe with smooth interior: Contech A2000, or equal; ASTM F949; manufactured in accordance with ASTM D1784, cell classification 12454-B; joints according to manufacturer's recommendation; use for sump pump collector lines and for perforated and non-perforated subdrain lines equal to or larger than 4".
- 2.5.4 High density polyethylene (HDPE) corrugated pipe with smooth interior: ADS N12, or equal; ASTM F2648; manufactured in accordance with ASTM D3350, cell classification 424420C; use for sump pump collector lines and for perforated and non-perforated subdrain lines equal to or larger than 4".
- 2.5.5 Use manufacturer's recommended tees or wyes at all sump pump collector lines for services.
- 2.5.6 Use manufacturer's recommended tees or wyes at all connections between non-perforated subdrains or sump pump collector lines with perforated subdrains.

3. JOINTS FOR REINFORCED CONCRETE PIPE (RCP AND RCAP)

- 3.1 Pipe joints wrapped with engineering fabric; engineering fabric minimum 2' wide centered on pipe joint; engineering fabric shall conform to IDOT 4196.01 B.
- 3.2 Where required by City Engineer, in lieu of engineering fabric, provide cold-applied rubber asphalt pipe joint material; quality standard: FS-SS-S-00210.
 - 3.2.1 Apply cold joint compound to bottom 1/2 of groove and top 1/2 of matching tongue and force adjoining pipe together; wipe joint clean to provide smooth invert.
 - 3.2.2 Use plywood spacers as recommended by manufacturer to maintain structural integrity of pipe being jacked or augered in place.
- 3.3 Use flexible joint rubber gasket at locations specified hereinbefore.

4. MANHOLES

4.1 Manholes and end of line cleanouts:

- 4.1.1 Conform to details shown on Standard Drawings and to SUDAS Standard Specifications Figures. See DESIGN STANDARDS for types permitted.
 - 4.1.1.1 Type SW-301: Chimney seal not required. Joint sealant not required, joint material as specified for Shallow Manholes. Use SUDAS Standard Specifications Type SW-601 castings.
 - 4.1.1.2 Types SW-401 and SW-405: offset top slab opening toward steps.
 - 4.1.1.3 For all types: Concrete and reinforcing as specified in STRUCTURAL CONCRETE AND REINFORCING STEEL; precast reinforced concrete pipe manhole sections with minimum wall thickness 5" meeting ASTM C478.
- 4.1.2 Diameter and thickness of base may be increased by City Engineering Department due to poor foundation conditions.
- 4.1.3 Use shallow manhole only where required clearances above top of pipe preclude the use of any other manhole types; use end of line cleanouts for sump pump and subdrain lines only.
- 4.1.4 Shallow manholes:
 - 4.1.4.1 Conform to details shown on Standard Drawings.
 - 4.1.4.2 Poured in place, 48"x48" square manhole, concrete bottom slab, walls and top slab.
 - 4.1.4.3 Concrete as specified in STRUCTURAL CONCRETE AND REINFORCING STEEL. Bottom slab and walls minimum 8" thick. Top slab 6" thick in non-traffic areas. Top slab 10" thick in traffic areas. Maintain temperature of work at 40°F. for at least 24 hours after placing.

- 4.1.4.4 Reinforcing as specified in STRUCTURAL CONCRETE AND REINFORCING STEEL. Bottom slab use #5 at 12" each way. Walls use #5 at 12" horizontal and vertical; provide continuous steel through corners; top slab use #4 at 6".
- 4.1.4.5 Alternative wall material: 48" dia. reinforced concrete pipe; ASTM C478, minimum wall thickness: 5". Minimum wall height required above top of storm sewer pipe: 12".
- 4.1.4.6 Joints: cold-applied rubber asphalt pipe joint material: quality standard: FS-SS-S-00210.

4.2 Special manholes:

- 4.2.1 Conform to details shown on Standard Drawings.
- 4.2.2 Diameter and thickness of base may be increased by City Engineering Department due to poor foundation conditions.
- 4.2.3 Construct bottom section of precast reinforced concrete pipe; ASTM C478.
- 4.2.4 Construct upper section with precast reinforced concrete pipe; place eccentric to lower section.
- 4.2.5 Bottom section top slab: reinforced concrete as shown on Standard Drawing; provide keyway seat for mortaring in manhole top section, pour non-shrinking concrete fillet around outside of joint with manhole top section.
- 4.2.6 Use special manholes where any connecting pipe is 30" or larger in diameter or span.
- 4.2.7 Use manhole diameters shown on Standard Drawing.
- 4.2.8 Omit upper section if depth of manhole is less than 6'.

4.3 Manhole bottoms:

- 4.3.1 If precast or poured without manhole section being embedded: place primed manhole section in bed of mortar or cold-applied rubber asphalt pipe joint material; quality standard: FS-SS-S-00210; pour non-shrinking concrete fillet around outside of manhole section.
- 4.3.2 If poured with manhole section embedded: embed 2" minimum.

- 4.3.3 Use non-shrinking concrete between pipe and manhole blockout as specified in STRUCTURAL CONCRETE AND REINFORCING STEEL.
- 4.4 Accessories:
 - 4.4.1 Steps: M. A. Industries, Inc., PS1-PF, or approved equal; #4 steel bar in copolymer polypropylene plastic; provide on upstream side in all manholes; space 16" o.c.; top step 10" below top of cone section.
 - 4.4.2 Type E frame and cover for all manholes except shallow manholes: SUDAS Standard Specifications Figure SW-602; machined bearing surfaces; concealed pickholes; use unless specified otherwise.
 - 4.4.3 Type F frame and cover for all manholes except shallow manholes: SUDAS Standard Specifications Figure SW-602; machined bearing surfaces; concealed pickhole; use where manhole is located in concrete pavement.
 - 4.4.4 Type G frame and cover for shallow manholes: SUDAS Standard Specifications Figure SW-602; machined bearing surfaces, concealed pickhole.
 - 4.4.5 Frame and cover for cleanouts: SUDAS Standard Specifications Figure 4040.232; set top of frame and cover flush with finished ground.
 - 4.4.6 Drill two 1" dia. holes in manhole frame flange to accommodate anchor bolts specified hereinafter.
 - 4.4.7 Secure frame and adjusting rings to upper manhole section with two stainless steel 1/2" dia. anchor bolts, equally spaced on 2'-5" dia. circle to prevent movement of frame or entry of water; seal frame in place.
 - 4.4.8 Provide reinforced concrete or high density polyethylene adjusting rings on manholes as necessary to place cover at grade or to required elevation; provide one adjusting ring minimum; maximum height of manhole adjustment using adjusting rings: 12"; secure to upper manhole section; make joints with bituminous jointing material to prevent entry of water.
 - 4.4.8.1 Secure adjusting rings to manhole with stainless steel tie rods.
 - 4.4.8.2 Concrete adjusting rings: comply with ASTM C478.

4.4.8.3 High density polyethylene adjusting rings: comply with ASTM D1248.

4.4.8.4 Do not use polyethylene adjusting rings where exposed to HMA pavement.

5. INTAKES

5.1 Conform to SUDAS Standard Specifications Figures: See DESIGN STANDARDS for types permitted.

5.2 Construct top and bottom sections of reinforced concrete as specified in STRUCTURAL CONCRETE AND REINFORCING STEEL.

5.3 Construct intake walls of precast manhole sections or poured in place concrete; poured in place intakes: use reinforced concrete as specified in STRUCTURAL CONCRETE AND REINFORCING STEEL.

5.3.1 In freezing weather, heat materials and protect work from cold; maintain temperature of work at 40° for at least 24 hours after placing.

5.4 Accessories:

5.4.1 Frame and Cover for Curb Intakes; Type E, F or G.

5.4.2 Curb Intakes: Type Q or R.

5.4.3 Rectangular Area Intakes: Type 6.

5.4.4 Circular Area Intakes: Type 4; provide Type 5 where directed or allowed by City.

5.4.5 Open Sided Area Intakes: Type G.

5.4.6 Provide reinforced concrete or high density polyethylene adjusting rings as necessary to place cover at grade or to required elevation; maximum height of adjustment using adjusting rings: 12".

5.4.6.1 Concrete adjusting rings: comply with ASTM C478.

5.4.6.2 High density polyethylene adjusting rings: Comply with ASTM D1248.

5.4.6.3 Do not use polyethylene adjusting rings where exposed to HMA pavement.

5.4.7 Stamp intake castings with message "DUMP NO WASTE, DRAINS TO RIVER".

6. CONNECTIONS BETWEEN DISSIMILAR PIPE

- 6.1 Provide concrete collar 6" thick and 12" each way from joint in accordance with SUDAS Standard Specifications Figure 4020.211 (SW-211).
- 6.2 For connections between pvc sump pump drain lines and RCP storm sewer core drill RCP pipe and install Inserta Tee, or equal.
- 6.3 Provide Fernco Strong Back RC couplers, or equal, for subdrains, sump pump collector lines and sump pump drain line connections to existing pipe.
- 6.4 Modify above requirements as directed by City Engineering Department.

7. STORM SEWER INSTALLATION

- 7.1 Before laying pipe, verify all measurements at site; make necessary field measurements to accurately determine sewer make-up lengths or closures.
- 7.2 Begin at lowest point in line; lay bell or groove ends pointing upstream.
- 7.3 Place pipe such that joint openings on the outside or inside of the pipe do not exceed 1/8" at the bottom and 5/8" at the top.
- 7.4 Lower pipe carefully into trench; lay true to line and grade.
- 7.5 Provide a smooth and uniform hand shaped invert as shown on Standard Drawing; bear spigots against bell shoulders.
- 7.6 Conflict with water main: conform with requirements set forth in WATER MAINS AND APPURTENANCES.
- 7.7 Where new water main or sanitary sewer crosses under existing field drain tile, replace with 20' lengths of pipe; match size of existing drain line; use non-perforated pipe.
 - 7.7.1 Use subdrain pipe for sanitary sewer crossings.
 - 7.7.2 Use water main pipe for water main crossings.

- 7.7.3 Extend pipe minimum 4' beyond trench excavation for new pipe.
- 7.8 Line and grade:
 - 7.8.1 Lay pipe to design line and grade by use of laser equipment or other approved method.
 - 7.8.2 Check line and grade of each pipe length.
 - 7.8.3 Keep pipe free of all dirt and foreign material.
 - 7.8.4 Use no defective pipe; check each length for defects and hairline cracks at ends prior to lowering into trench.
 - 7.8.5 Do not allow horizontal and vertical alignment to vary from design line and grade at any structure by more than 1% of the inside diameter of the pipe or 1/4 inch, whichever is larger.
 - 7.8.6 Do not allow the horizontal alignment of the pipe to vary from design line at any point along the pipe by more than 1% of the inside diameter of the pipe.
 - 7.8.7 Continuously check alignment of pipe by flashing light between manholes or between last piece of pipe laid and opening at downstream manhole.
- 7.9 Correct misalignment, displacement or otherwise defective pipe.
- 7.10 Place concrete headwall at outlet of storm sewer as shown on Standard Drawing unless flared end section is permitted by City Engineering Department; provide minimum of 10 tons of rip-rap at downstream end of headwall; place rip-rap over engineering fabric, IDOT 4196.01C.
 - 7.10.1 Rip-rap: IDOT 4130.04 minimum Class D size revetment stone.
- 7.11 With approval of City Engineering Department, flared end sections may be used at outlet of storm sewers.
 - 7.11.1 Use rip-rap, as specified, at downstream end; provide minimum 10 tons of rip-rap or as permitted by City; place rip-rap over engineering fabric, IDOT 4196.01C. Construct concrete footing under downstream end of sewer flared end pipe section; footing full width of flared end.

- 7.11.1.1 Footing may be deleted on culverts provided written request is made by the contractor to the City, and City Engineering Department provides written approval to delete footing.
- 7.11.2 Flared end section: Cretex, complying with ASTM C76 or ASTM 506, or approved equal; flat bottom; provide tie holes for securing flared end section to upstream pipe section.
- 7.11.3 Provide two pipe joint ties on outside of last three pipe joints at each flared end section; order upstream pipe section and flared end section with holes provided; Cretex pipe joint ties, or approved equal.
- 7.11.4 Install minimum 3' wide clay waterstop at all storm sewer outlets per SUDAS Standard Specifications Figure SW-105.
- 7.12 Comply with tracer wire and installation as specified under Paragraph 10. TRACER WIRE.
- 7.13 Clean and televise sewers and submit copy of video and written report to City Engineering Department as specified under GENERAL CONDITIONS.

8. SUMP PUMP DRAIN LINES

- 8.1 Materials: as specified hereinbefore.
 - 8.1.1 Sump pump lines in public right-of-way minimum size 4".
- 8.2 Installation: as specified in DESIGN STANDARDS and PIPE EXCAVATION AND BACKFILL.
- 8.3 Mark location of sump pump drain line with steel post painted green; set top of post 3', minimum, above ground.
 - 8.3.1 City will mark location of sump pump drain line with the symbol "S" lying on its side stamped in front face of fresh concrete during pavement construction.

9. SUBDRAINS

- 9.1 Construct perforated or non-perforated subdrains as shown on plans or as directed by City Engineering Department.

- 9.2 Arrange subdrains and collector pipes to prevent freezing; minimum depth of cover over buried pipe: 3'-6" or as approved by City.
- 9.3 Slope subdrains to drain.
- 9.4 Backfill perforated subdrain with washed, round, durable, porous backfill material meeting IDOT Aggregate Gradation No. 29.
- 9.5 Connect subdrains to storm sewer, sump pump collector lines or daylight in drainageway.
- 9.6 Provide pipe, manholes, intakes or end of line cleanouts as specified hereinbefore.
- 9.7 Comply with tracer wire and installation as specified hereinafter.
- 9.8 Storm sewers may be used for subdrain provided edge of storm sewer is located within 3' of the back of the curb.

10. TRACER WIRE

- 10.1 Provide AWG #12, solid, green, single, insulated, direct-burial copper wire; tuck tracer wire under pipe at approximate 45° angle below horizontal spring line of pipe to protect tracer wire. Use wire with steel core with directional bored pipe.
- 10.2 Insulation: Linear low density polyethylene (LLDPE) suitable for direct burial. Minimum thickness 0.045 inches.
- 10.3 Run tracer wire from upper end of pipe to point where pipe daylights or enters storm sewer intake.
- 10.4 Provide splice kits, Scotchcast, 3M Company, or approved equal; do not splice tracer wire except as authorized by City Engineering Department.
- 10.5 Terminate tracer wire at manhole chimney and back of throat for intakes; attach to structure wall with stainless steel anchor.
- 10.6 Provide tracer wire along all storm sewer runs with bend or pipe deflections within the run, sump collector lines, and rear and side yard subdrains.

11. TESTS

- 11.1 Comply with applicable sections of ASTM and other applicable industry standards and codes.

- 11.2 Clean and televise all storm sewers including subdrains and sump pump collector lines. Subdrains 6" in diameter and smaller only need to be cleaned and not televised.
 - 11.2.1 Camera:
 - 11.2.1.1 High-resolution color with adjustable iris focus.
 - 11.2.1.2 Pan and tilt capabilities.
 - 11.2.1.3 Integral lighting suitable to provide proper illumination and a clear video image of the entire periphery of the pipe.
 - 11.2.1.4 Capable of operating in 100% humidity conditions.
 - 11.2.1.5 Produce a high quality video image.
 - 11.2.2 Provide closed-circuit video inspection equipment capable of displaying on-screen footage of distance measured to within 1% of actual distance.
 - 11.2.3 Record the inspection in color in the recording media specified by the City Engineering Department. Forward the recording and inspection report to the City Engineering Department.
 - 11.2.4 Clean all storm sewers and pipe culverts prior to testing by flushing with high pressure water and removing debris by vacuum extraction, and by removing sheeting, bracing, shoring, forms, soil sediment, concrete, or other debris.
 - 11.2.5 Do not discharge soil sediment or debris to drainage channels, existing storm sewers, or existing sanitary sewers.
 - 11.2.6 Prior to video inspection, run sufficient water through the pipe to saturate potential low spots so they may be detected during inspection.
 - 11.2.7 Inspect each pipe segment between manholes or access points in a single, continuous run. Progress through the entire project in a uniform direction.

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- 11.2.8 Inspect all lateral connections and other observations at right angles utilizing the pan and tilt capabilities of the camera.
 - 11.2.9 Center the video camera in the pipe during the inspection.
 - 11.2.10 Do not exceed 30 feet of inspection per minute.
 - 11.2.11 Provide a copy of the video inspection including on-screen continuous footage, pipe diameter, direction of viewing, and manhole and street location references in the recording. Affix labels to the recording media to include the name of the project, the date, and the location of the inspection.
 - 11.2.12 Provide a written report of the inspection. In the report, include true-to-scale drawings of all sewer defects and observation locations. Reference the time stamp on each line item entry on the written report.
- 11.3 Low spots holding water exceeding the following depths for each pipe size will be considered unacceptable and must be removed and reinstalled to proper grade.

<u>Pipe Diameter</u>	<u>Maximum Low Spot Depth Per Occurrence</u>	<u>Maximum Total Low Spot Depths For All Occurrences Between Two Adjacent Manholes</u>
8"	1/2"	1"
10"	1/2"	1"
12"	3/4"	1-1/2"
15"	3/4"	1-1/2"
18" and Larger	5% of Pipe Diameter Measured to the nearest 1/2"	10 % of Pipe Diameter Measured to the nearest 1/2"

- 11.4 Repair or replace any defective, broken, damaged or fractured pipe.

PART 6 - SANITARY SEWERS AND APPURTENANCES

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1. GENERAL

- 1.1 This part of the specifications includes materials and installation procedures for sanitary sewers and appurtenances.
- 1.2 Isolate sanitary sewer from downstream sewers and pumping stations with ball plug during construction; do not remove ball plug until completion of pavement construction; dewater manholes as required to maintain maximum 2' of standing water at ball plug; intent is to keep construction debris and ground water from washing into downstream system.

2. PIPE MATERIALS

- 2.1 Vitrified clay pipe (VCP): ASTM C700, extra strength; use only to repair or replace existing vitrified clay pipe for 12" or smaller diameter sanitary sewer pipe and sanitary sewer connections.
- 2.2 Polyvinylchloride truss pipe (pvc truss): ASTM D2680 pvc composite pipe; use for 15" or smaller diameter sanitary sewer pipe.
- 2.3 Polyvinyl chloride service pipe (pvc): 4" or 6"; ASTM D3034, SDR 23.5; cell classification 12454-B. Use for service pipe for sanitary sewer.
- 2.4 Polyvinylchloride (pvc) corrugated pipe with smooth interior: Contech A2000, JM Eagle Ultra Corr or equal; ASTM F949; manufactured in accordance with ASTM D1784; cell classification 12454-B; pipe stiffness of 46 psi; use for 18" or larger diameter sanitary sewer pipe.
- 2.5 Ductile iron pipe (DI): ANSI A21.50 manufactured in accordance with ANSI A21.51; minimum thickness Class 52; cement lined; standard outside asphalt coating.
 - 2.5.1 Use for force main at subdivider's option and use for underground gravity sewer at conflicts with water mains.

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- 2.5.2 Fittings: mechanical joint, meeting ANSI/AWWA C153/A21.53 compact design with joint meeting ANSI/AWWA C111/A21.11, 350 psi pressure rating.
- 2.5.3 Wrap all buried pipe and fittings; minimum 8 mils thickness polyethylene encasement; AWWA C105.
- 2.6 Polyvinylchloride pipe (pvc): AWWA C900; outside diameter conforming to ductile iron pipe; dimensional ratio (DR) equal to 18 for 150 psi working pressure rating.
 - 2.6.1 Use for buried force main at subdivider's option.
- 2.7 Steel casing pipe: smooth wall welded steel pipe, ASTM A139; 3/8" wall thickness, unless directed otherwise by IDOT or railroad; use for railroad and highway crossings or where directed by City.
 - 2.7.1 Coat outside of pipe with asphalt liquid, Iowa Paint Mfg. Co., or approved equal.
- 2.8 Other pipe materials may be acceptable with City approval.

3. PIPE JOINTS

- 3.1 Vitrified clay pipe (VCP): factory fabricated, O-ring, flexible compression joints; ASTM C425 or compression couplings: ASTM C594, Type B.
- 3.2 Polyvinylchloride truss pipe and corrugated pipe with smooth interior: elastomeric gasket, ASTM D3212; gasket materials, ASTM F477.
- 3.3 Polyvinylchloride pipe service pipe (pvc): flexible elastomeric gasket joint; ASTM F477 and ASTM D3212.
- 3.4 Polyvinylchloride (pvc) force main: push-on joint, AWWA C900; compatible with mechanical joint fittings specified hereinbefore.
- 3.5 Ductile iron pipe: mechanical or push-on joints; ANSI A21.11.
- 3.6 Steel casing pipe: welded joints: comply with American Welding Society (AWS) Code of Arc and Gas Welding in Building Construction.
 - 3.6.1 Bevel or space ends of pipe to insure penetration of weld for full thickness of pipe.

- 3.7 All sanitary sewer repairs made with water strength couplings, Hymax 2000 coupling, or equal.
- 3.8 Pipe joint protection and inspection:
 - 3.8.1 Carefully protect joints from injury while handling and storing pipe.
 - 3.8.2 Use no deformed, gouged or otherwise impaired joints.
 - 3.8.3 Clean joint surfaces of dirt and foreign matter before jointing pipe.
 - 3.8.4 Make joints in strict accordance with manufacturer's recommendations.

4. MANHOLES

- 4.1 Standard, special, or shallow manholes:
 - 4.1.1 Conform to details shown on Standard Drawings and to SUDAS Standard Specifications Figures. See DESIGN STANDARDS for types permitted.
 - 4.1.2 Use shallow manhole only where required clearances above top of pipe preclude the use of any other manhole types.
 - 4.1.3 Diameter and thickness of base may be increased by City Engineering Department due to poor foundation conditions.
 - 4.1.4 Reinforced concrete pipe; ASTM C478, minimum wall thickness: 5"; one cage reinforcing: minimum reinforcement: 0.18 sq.in. per linear foot of pipe wall.
 - 4.1.5 Joints: rubber ring gasket type, flexible joint, O-ring gasket, or approved equal; conform to ASTM C443.
 - 4.1.6 Apply 6" wide heavy bitumastic coating on outside of manhole at joints around entire perimeter.
 - 4.1.7 Pipe openings: flexible watertight connection integral with bottom barrel section of manhole; lockjoint flexible manhole sleeve, or approved equal.

- 4.2 Manhole bottoms:
 - 4.2.1 If precast or poured without manhole section being embedded: place primed manhole section in bed of mortar or cold-applied rubber asphalt pipe joint material; quality standard: FS-SS-S-00210; pour non-shrinking concrete fillet around outside of manhole section.
 - 4.2.2 If poured with manhole section embedded: embed 2" minimum.
- 4.3 Use non-shrink concrete between pipe and manhole blockout as specified in STRUCTURAL CONCRETE AND REINFORCING STEEL.
- 4.4 Drop connections: use for manholes where difference in elevation of connecting pipe is greater than 2'-0"; conform to details shown on Standard Drawings.
 - 4.4.1 Use external drop connections on all manholes 48" in diameter as shown on Standard Drawings.
 - 4.4.2 Internal drop connection may be used for sewers 12" in diameter or less provided manhole diameter is increased 12" for each internal drop connections.
 - 4.4.3 External drop connection pipe and fittings and 20' length of sewer pipe adjacent to manhole constructed with ductile iron.
 - 4.4.4 Internal drop connection pipe and fitting constructed with ductile iron or pvc with stainless steel hardware and fasteners.
- 4.5 Accessories:
 - 4.5.1 Steps: M. A. Industries, Inc., PS1-PF, or approved equal; #4 steel bar in copolymer polypropylene plastic; provide in all manholes; space 16" oc; top step 10" below top of cone section; place steps on straight side of manhole; locate 90° from direction of flow.
 - 4.5.2 Frame and cover for standard and special manholes:
 - 4.5.2.1 Type A frame and cover: SUDAS Standard Specifications Figure SW-601; machined bearing surfaces, gasket seal, concealed pickhole; use unless specified otherwise.

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- 4.5.2.2 Type B frame and cover: SUDAS Standard Specifications Figure SW-601; machined bearing surfaces, gasket seal, concealed pickhole; use where manhole is located in pavement.
- 4.5.2.3 Watertight frame and cover: Type C or D; SUDAS Standard Specifications Figure SW-601; use Type D where manhole is located in pavement; use where watertight covers are required.
- 4.5.3 Frame and cover for shallow manholes: Type C: SUDAS Standard Specifications Figure SW-602; machined bearing surfaces, gasketed seal, concealed pickhole.
- 4.5.4 Drill two 1" dia. holes in manhole frame flange to accommodate anchor bolts specified hereinafter.
- 4.5.5 Secure frame and adjusting rings to upper manhole section with two stainless steel 1/2" dia. anchor bolts, equally spaced on 2'-5" dia. circle to prevent movement of frame or entry of water; seal frame in place.
- 4.5.6 Provide reinforced concrete adjusting rings on manholes as necessary to place cover at grade or to required elevation; provide one adjusting ring minimum; maximum height of manhole adjustment using adjusting rings: 12"; grout in and make joints with bituminous jointing material to prevent entry of water.
 - 4.5.6.1 Secure adjusting rings to manhole with stainless steel tie rods.
 - 4.5.6.2 Comply with ASTM C478.
- 4.5.7 Provide chimney seals on all sanitary manholes; install internal chimney seal if manhole is under pavement; install external chimney seal if manhole is not under pavement.
 - 4.5.7.1 Seals to extend from the manhole frame flange to 3" below the adjusting rings.
 - 4.5.7.2 Rubber sleeve with stainless steel top and bottom bands: minimum rubber thickness 3/16", ASTM C923; allow for minimum vertical expansion of 2"; locking mechanism of studs and nuts conforming to ASTM F923 and 594, Type 304.

- 4.5.7.3 Provide stainless steel restraining hoop midpoint of sleeve for internal chimney seals to minimize ballooning of sleeve from hydrostatic pressure.

5. SERVICE CONNECTIONS

- 5.1 Conform to details shown on Standard Drawing; use 4" or 6" branch diameter wyes; if sewer invert is more than 12' below finished grade of street, use tee and riser; encase tee and riser in Pipe Bedding Material as shown on Standard Drawing.
- 5.2 pvc Services:
 - 5.2.1 For 8" main line and 4" or 6" services: use molded wye with all bell configuration; solvent weld factory-attached couplings.
 - 5.2.2 For larger than 8" main line: use reducing saddles with 4" or 6" stubs bell end ready for solvent welding to service.
- 5.3 Place stopper in end of service pipe:
 - 5.3.1 Provide watertight joint on stopper to match that on pipe spigot; block plug with 2"x4" vertical strut to 2' above ground.
 - 5.3.2 Mark end location of sewer service connection with steel post painted red; set top of post 3', minimum, above ground.
 - 5.3.2.1 City will mark location of sewer service with the symbol "S" stamped in front face of fresh concrete during pavement construction.
- 5.4 Backfill trench after recording exact location of service connection.

6. PUMPING STATIONS

- 6.1 Submit complete design to City for approval; include equipment drawings, design data and proposed plans.
- 6.2 Chain link fence: construct 6' high vinyl coated chain link fence including two 10' wide gates, and all posts, braces, clips, and miscellaneous materials for complete installation; provide and install privacy slats in fabric.
 - 6.2.1 Embed posts in concrete as recommended by manufacturer.

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- 6.2.2 Provide padlock for each gate with two keys, Master Size 1, or approved equal.
 - 6.3 Non-clog submersible pumps; Flygt, or equal.
 - 6.3.1 Explosion proof motors suitable for NEC Class I, Division I.
 - 6.3.2 Stainless steel guide rails, hardware, cables, chains and fasteners.
 - 6.3.3 Provide thermal and seal failure protection for pump and motor.
 - 6.3.4 Provide safety chain for each pump attached to pump and just under hatch.
 - 6.4 Trash basket: Fiberglass with vertical rods and drop bottom.
 - 6.5 Piping: painted ductile iron for all interior piping; ductile iron as specified herein before for all buried piping between structures.
 - 6.6 Shut off valves: rectangular port plug valve.
 - 6.7 Check valve: swing type with external weight and lever and air cushion cylinder assembly suitable for wastewater.
 - 6.8 Provide on site standby generator, magnetic flow meter and pre-manufactured control building. Connect all alarms and data outputs to City's data acquisition system.
 - 6.9 Provide minimum 2" water service with yard hydrant near pump station wet well.
7. LATERAL SEWER AND SERVICE PIPE INSTALLATION
- 7.1 Before laying pipe, verify all measurements at site; make necessary field measurements to accurately determine sewer make-up lengths or closures.
 - 7.2 Begin at lowest point in line; lay bell or groove ends pointing upstream.
 - 7.3 Lower pipe carefully into trench; lay true to line and grade.
 - 7.4 Provide smooth and uniform invert; bear spigots against bell shoulders.
 - 7.5 Make joints with equipment recommended by pipe manufacturer; do not use backhoe to push joints together.

- 7.6 Line and grade:
 - 7.6.1 Lay pipe to design line and grade by use of laser equipment or other approved method.
 - 7.6.2 Check line and grade of each pipe length.
 - 7.6.3 Keep pipe free of all dirt and foreign material.
 - 7.6.4 Use no defective pipe; carefully check each length of pipe for defects and hairline cracks at ends prior to lowering into trench; remove and replace cracked pipe; check each length of pvc pipe for punctures of outer ring; do not use punctured pipe; scratches and dents acceptable for use.
 - 7.6.5 Place in trench in sound, undamaged condition; do not damage pipe; use web slings to install or move pipe; use of end hooks, dropping or rolling pipe not permitted.
 - 7.6.6 Check alignment and grade of sewer at minimum 50' intervals off of construction stakes between manholes.
- 7.7 Correct misalignment, displacement or otherwise defective sewer.
- 7.8 Clean and televise sewers and submit copy of video and written report to City Engineering Department as specified under GENERAL CONDITIONS.
- 7.9 Conflicts with water main: conform to requirements set forth in WATER MAINS AND APPURTENANCES.
- 7.10 Connection to existing manhole:
 - 7.10.1 Insert flexible watertight connector into new opening.
 - 7.10.2 Install and tighten internal expansion sleeve to hold flexible connector in place.
 - 7.10.3 Insert pipe through flexible connector and tighten external compression ring.
 - 7.10.4 Do not install grout or concrete collar for cored opening with flexible connector.

8. FORCE MAIN INSTALLATION

- 8.1 Lay pipe in the dry; minimum earth cover: 5'.
- 8.2 Clean pipe interior of foreign materials before lowering into trench; keep clean at all times by closing open ends of pipe and fittings; use minimum amount of gasket lubricant; apply to gasket only; do not apply to inside of bell.
- 8.3 Before installation, examine pipe carefully; defective, damaged or unsound pipe will be rejected.
- 8.4 Place in trench in sound, undamaged condition; do not injure pipe coating or lining; do not use end hooks to install or move pipe; do not drag or scratch pvc pipe.
- 8.5 Cut pipe in neat and workmanlike manner without damage to pipe.
 - 8.5.1 Mechanical pipe cutters subject to approval of Engineering Department.
 - 8.5.2 Cut pvc pipe with fine tooth saw or tubing cutter; square cut; file jagged edges.
 - 8.5.3 Bevel cut ends of push-on type iron pipe.
 - 8.5.4 Completely coat damaged ends of cut iron pipe with bituminous sealer; use spray-on type sealer which will adhere to liner at any temperature; pipe and fittings showing blisters or holes will be rejected by Engineer on site.
 - 8.5.5 Seal ends of cut truss pipe with solvent cement or lubricant.
- 8.6 Use suitable fittings where grade or alignment requires offsets of more than 1" per foot.
- 8.7 Provide continuous tracer wire along all new pvc force main; tracer wire as specified in WATER MAINS AND APPURTENANCES ; start wire at meter manhole and end at discharge manhole; terminate tracer wire in tracer wire receptacle box with top flush with ground near meter manhole, discharge manhole and any intermediate structures.

9. RAILROAD AND HIGHWAY CROSSINGS

- 9.1 Tunnel casing pipe in place; length and method of installation as required by Railroad or IDOT.
- 9.2 Encase all sewers and force mains under railroads and highways.
- 9.3 9.3 Do not stockpile or store excess material or debris in right-of-way.

10. STREET CROSSINGS

- 10.1 Tunnel sewers under paved streets, driveways and sidewalks unless written permission to open cut is granted by City; use casing pipe if directed by City.

11. TESTS

11.1 Allowable leakage:

- 11.1.1 Maximum allowable infiltration or exfiltration for any new sanitary sewer section between manholes, including all manholes is 200 gallons per inch of diameter per mile of pipe per day; manholes may be tested separately.

11.2 Leakage test:

- 11.2.1 Conduct all infiltration and exfiltration tests after backfill for sewer line and manholes is complete; test sewer lines by low pressure air testing.
 - 11.2.1.1 Isolate and test all sections of pipe between manholes.
 - 11.2.1.2 Install plugs in accordance with manufacturer's recommendations; allow no one in manholes during testing.
 - 11.2.1.3 Wet line by flushing to produce consistent results.
 - 11.2.1.4 Plug and brace all stoppers to resist test pressure.
 - 11.2.1.5 Determine test duration for section under test from Table No. 1; table ignores pipe length and uses factor $0.472 d$, with d being in inches.

Table No. 1

<u>Pipe Diameter (Inches)</u>	<u>Test Period Duration min.</u>
8	4.0
10	5.0
12	6.0
15	7.0
18	8.5
21	10.0
24	11.5
27	13.0
30	14.0
36	17.0

Pressure holding time based on average holding pressure of 3 psi gauge or drop from 3.5 psi to 2.5 psi gauge.

- 11.2.1.6 Add air to line segment being tested until internal air pressure of sewer line is raised to approximately 4.0 psi gauge greater than average back pressure of any groundwater that may be over top of the pipe; allow at least 2 min. for air pressure to stabilize.
- 11.2.1.7 When pressure has stabilized and is at or above starting test pressure of 3.5 psi gauge, commence test; record drop in pressure for test period; if pressure has dropped more than 1.0 psi gauge during test period as set forth in Table No. 1, line is presumed to have failed; test may be discontinued when prescribed test time has been completed, even though 1.0 psi gauge drop has not occurred.
- 11.2.1.8 In areas of known groundwater above section being tested, divide total height of water in feet above pipe by 2.31 to establish pounds in pressure (psi gauge) that will be added to all readings; for example, if height of water is 7' then added pressure will be 3.0 psi gauge; this increases 3.5 psi gauge to 6.5 psi gauge and 2.5 psi gauge to 5.5 psi gauge; allowable drop of 1.0 psi and timing remain same.

Sanitary Sewers and Appurtenances

- 11.2.2 City may require water testing of sewers if results of air testing are unsatisfactory or indefinite.
 - 11.2.2.1 Test sewers at infiltration test manholes designated by City Engineering Department.
 - 11.2.2.2 Line infiltration test using weir: cover crown of pipe with minimum 2' of water at highest point in section being tested; maintain test head for not less than 24 hrs. before weir measurement is made; measure infiltration with V-notch weir located in downstream manhole; cap or plug all service connections and stubs to prevent entrance of groundwater into line at connections.
 - 11.2.2.3 Line exfiltration test: close inlet of upstream and downstream manholes with watertight bulkheads; fill sewer and upstream manhole with water until elevation of water in upstream manhole is 2' higher than top of pipe in line being tested, or 2' above existing groundwater in trench, whichever is higher elevation; measure exfiltration by determining amount of water required to maintain initial water elevation for 1 hour from start of test; if average head above section being tested exceeds 2', allowable leakage can be increased by 5% for each additional foot of head; test is preferable for dry areas where groundwater head over pipe does not exist at time of test.
- 11.3 Manhole tests: test using water exfiltration test or vacuum test.
 - 11.3.1 Manhole exfiltration test:
 - 11.3.1.1 Plug inlet and outlet of manhole and fill manhole to top of casting; allow water to stand 1 hour and refill to original elevation; after specific time, usually 15 min. to 1 hour, record difference in elevation and convert into gallons per hour lost through manhole leakage.
 - 11.3.1.2 To obtain actual line exfiltration subtract manhole loss from loss determined during line exfiltration test.
 - 11.3.2 Manhole vacuum test:
 - 11.3.2.1 Test all manholes in accordance with ASTM - C1244.
 - 11.3.2.2 Plug all lift holes with non-shrink grout.

Sanitary Sewers and Appurtenances

- 11.3.2.3 Temporarily plug all pipes entering manhole.
- 11.3.2.4 Place test head at top of manhole in accordance with the recommendations of the testing equipment manufacturer.
- 11.3.2.5 A vacuum of 10" of mercury shall be drawn from manhole; turn off testing equipment and close testing equipment valves; measure and record time for vacuum to top to 9" mercury.
- 11.3.2.6 A passing test is indicate when duration recorded for vacuum to drop from 10" of mercury to 9" mercury is equal to or longer than that shown in the following table for 48" and 60" dia. manholes.

Manhole Depth (ft.)	48" Dia. Minimum Duration (sec.)	60" Dia. Minimum Duration (sec.)
8	20	26
10	25	33
12	30	39
14	35	46
16	40	52
18	45	59
20	50	65
22	55	72
24	59	78
26	64	85
28	69	91
30	74	98

- 11.3.2.7 Complete necessary repairs to manholes that fail test; repeat test until manhole passes test.

11.4 Deflection test - sewer:

- 11.4.1 If pvc truss or profile wall pipe is used, provide deflection test 30 days after backfill of trench is completed; maximum allowable deflection: 5% of average inside diameter.

Sanitary Sewers and Appurtenances

- 11.4.2 Run rigid ball or mandrel without mechanical pulling device through sewer; diameter of ball or mandrel equal to 95% of average inside pipe diameter.
- 11.5 Alignment test: Check sewers for alignment by using laser beam or lamping; full barrel must be visible through section of pipe lamped.
- 11.6 Force mains:
 - 11.6.1 Evaluated at a test pressure of 150 lbs. per square inch for 2 hours, leakage shall not exceed 10 gallons per inch diameter per mile per day (24 hours); should a test of any section of pipe line disclose leakage per mile greater than specified, Contractor shall locate leaking joints and repair leaks until minimum leakage requirement has been satisfied in a 24 hour test.
 - 11.6.2 In cases where pipe line cannot be pressure tested at 150 psi, maximum leakage must be decreased proportionally to the decrease in test pressure.
 - 11.6.3 All pressure testing shall be performed to satisfaction of City Engineering Department.
- 11.7 Clean and televise all sanitary sewers not including services.
 - 11.7.1 Camera:
 - 11.7.1.1 High-resolution color with adjustable iris focus.
 - 11.7.1.2 Pan and tilt capabilities.
 - 11.7.1.3 Integral lighting suitable to provide proper illumination and a clear video image of the entire periphery of the pipe.
 - 11.7.1.4 Capable of operating in 100% humidity conditions.
 - 11.7.1.5 Produce a high quality video image.
 - 11.7.2 Provide closed-circuit video inspection equipment capable of displaying on-screen footage of distance measured to within 1% of actual distance.
 - 11.7.3 Record the inspection in color in the recording media specified by the City Engineering Department. Forward the recording and inspection report to the City Engineering Department.

Sanitary Sewers and Appurtenances

- 11.7.4 Clean all sanitary sewers prior to testing by flushing with high pressure water and removing debris by vacuum extraction, and by removing sheeting, bracing, shoring, forms, soil sediment, concrete, or other debris.
 - 11.7.5 Do not discharge soil sediment or debris to drainage channels, existing storm sewers, or existing sanitary sewers.
 - 11.7.6 Prior to video inspection, run sufficient water through the pipe to saturate potential low spots so they may be detected during inspection.
 - 11.7.7 Inspect each pipe segment between manholes or access points in a single, continuous run. Progress through the entire project in a uniform direction.
 - 11.7.8 Inspect all lateral connections and other observations at right angles utilizing the pan and tilt capabilities of the camera.
 - 11.7.9 Center the video camera in the pipe during the inspection.
 - 11.7.10 Do not exceed 30 feet of inspection per minute.
 - 11.7.11 Provide a copy of the video inspection including on-screen continuous footage, pipe diameter, direction of viewing, and manhole and street location references in the recording. Affix labels to the recording media to include the name of the project, the date, and the location of the inspection.
 - 11.7.12 Provide a written report of the inspection. In the report, include true-to-scale drawings of all sewer defects and observation locations. Reference the time stamp on each line item entry on the written report.
- 11.8 Low spots holding water exceeding the following depths for each pipe size will be considered unacceptable and must be removed and reinstalled to proper grade.

Sanitary Sewers and Appurtenances

<u>Pipe Diameter</u>	<u>Maximum Low Spot Depth Per Occurrence</u>	<u>Maximum Total Low Spot Depths For All Occurrences Between Two Adjacent Manholes</u>
8"	1/2"	1"
10"	1/2"	1"
12"	3/4"	1-1/2"
15"	3/4"	1-1/2"
18" and Larger	5% of Pipe Diameter Measured to the nearest 1/2"	10 % of Pipe Diameter Measured to the nearest 1/2"

11.9 Repair or replace any defective, broken, damaged or fractured pipe.

PART 7 - WATER MAINS AND APPURTENANCES

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1. GENERAL

- 1.1 This part of the specifications includes materials and installation procedures for water mains and appurtenances.

2. PIPE

- 2.1 Ductile iron pipe (DI): ANSI A21.50, manufactured in accordance with ANSI A21.51; minimum thickness Class 52; mechanical or push-on joint, ANSI A21.11; use restrained or locked joints on fittings and pipe adjacent to downward, vertical bends and for pipe augered or bored in place.
- 2.1.1 Standard thickness cement lining, ANSI A21.4 (AWWA C104), with bituminous seal coat sprayed on lining surface which will adhere to lining at all temperatures; provide coating free of blisters or visible holes.
- 2.1.2 Coat outside of pipe with bituminous compound, ANSI A21.51 (AWWA C151).
- 2.1.3 Wrap all buried pipe and fittings, minimum 8 mils thickness polyethylene encasement; AWWA C105.
- 2.1.4 Do not telescope small pipe inside larger pipe for shipment or storage.
- 2.1.5 Pipe with damaged cement lining will be rejected; field patching not permitted except on cut pipe.
- 2.1.6 Use for water main at subdivider's option.
- 2.1.7 Use in soils contaminated with gasoline or volatile organic compounds. Install with viton gaskets.

- 2.2 Polyvinylchloride pipe (pvc): AWWA C900, DR18, Class 150; push-on, rubber gasketed joint; ductile iron pipe size.
 - 2.2.1 Use restrained joints with coupling, gaskets and splines for augered and bored pipe. Certaineed Certa-Lok, or equal.
 - 2.2.2 Use for water main at subdivider's option.
 - 2.2.3 Do not use in soils contaminated with gasoline or volatile organic compounds.
- 2.3 Steel casing pipe: smooth wall welded steel pipe, ASTM A139; 3/8" wall thickness, unless directed otherwise by IDOT or railroad; use for railroad and highway crossings or where directed by City.
 - 2.3.1 Welded joints: comply with American Welding Society Code of Arc and Gas Welding in Building Construction.
 - 2.3.2 Bevel or space ends of pipe to insure penetration of weld for full thickness of pipe wall.
 - 2.3.3 Coat outside of pipe with asphalt liquid, Iowa Paint Mfg. Co., or approved equal.

3. FITTINGS

- 3.1 Mechanical joint, ANSI/AWWA C153/A21.53 compact design with joint meeting ANSI/AWWA C111/A21.11; 350 psi pressure rating; provide restrained or locked joints on all fittings; Megalug, or approved equal.
- 3.2 At all 90° bend locations use 2 compact design 45° bends or use standard 90° bend meeting AWWA C110.
- 3.3 Anchoring tee: Clow Corporation, or approved equal.
- 3.4 Anchoring elbow: Clow Corporation, or approved equal.
- 3.5 Anchoring pipe: Clow Corporation, or approved equal.
- 3.6 Anchoring coupling: Clow Corporation, or approved equal.
- 3.7 Retainer gland: Clow Corporation F-1058, or approved equal.

- 3.8 Cap: Clow Corporation, or approved equal.
- 3.9 Plug: Clow Corporation, or approved equal.
- 3.10 Anchoring rods and eye bolts: 3/4" stainless steel.
- 3.11 Sleeves: Dresser Style 38, or approved equal.
- 3.12 All T-bolts and hex-head nuts for mechanical joints shall be Cor-Blue steel or approved equal.
- 3.13 All exposed hex bolts and nuts on gate valves: stainless steel.
- 3.14 All exposed hex bolts, set screws and nuts on hydrants: stainless steel.

4. VALVES

- 4.1 Type permitting repacking under pressure when wide open.
- 4.2 Provide special tools required for disassembling and repacking valves.
- 4.3 Gate valves: resilient wedge, bronze trim; mechanical joint ends; conform to AWWA C509; non-rising stem with 2" square operating nut; open counterclockwise; resilient-seated; use for main line water valves, hydrant auxiliary valves, tapping valves and for services larger than 2"; Clow Corporation F-6100 RW, Mueller A-2370-20, or approved equal.
- 4.4 Tapping sleeves and valves: Clow Corporation F-5205, Mueller H-304, Smith-Blair 665 stainless steel sleeves, or approved equal; use in conjunction with resilient wedge valves specified hereinbefore except use a flanged/mechanical joint valve; Clow Corporation F-6106 RW, Mueller A-2370-16, or approved equal.
- 4.5 If top of nut riser is more than 6' below finished surface elevation, provide extension stem on valve nut to bring operating nut to within 4' of finished surface elevation.

5. SERVICE CONNECTIONS

- 5.1 Services 2" and smaller:
 - 5.1.1 Service pipe: Type K seamless, soft annealed copper water tube, ASTM B88.

Water Mains and Appurtenances

- 5.1.2 Corporation stops: Mueller H-15000 series, AY McDonald 74701, Ford F600 through 1-1/4" and Ford FB600 for 1-1/2" and 2", or approved equal.
- 5.1.3 Taps and tapping saddles: ductile iron body, single stainless steel strap, corrosion resistant nylon coating, design for use on pvc pipe, Rockwell Type 317, or approved equal.
 - 5.1.3.1 Use tapping saddles for all corporation stops.
 - 5.1.3.2 Use shell type cutting tool made especially for direct tapping heavy wall pvc.
- 5.1.4 Curb stops: AY McDonald 76100, or equal.
- 5.1.5 Curb stop box: AY McDonald 5601, or equal; provide lid and stainless steel stationary rod.
 - 5.1.5.1 Set lid at finish grade elevation as shown on Standard Drawing; terminate rod 1'-6" below finish grade; lid must be operable at time of final inspection.
 - 5.1.5.2 Provide cast iron curb box receptacle where curb stop located in pavement; A.Y. McDonald Mfg. No. 5639 or equal.
- 5.1.6 Meter setting: arrange piping to allow installation of meter in horizontal run of pipe, above floor and as close to point at which service enters building as possible; provide 1' minimum clearance over meter; install 1" full port ball valve on both sides of meter; allow space for meter and connecting nipples.
 - 5.1.6.1 Ball valve: AY McDonald 72032-T, or equal.
- 5.2 Services larger than 2":
 - 5.2.1 Service pipe: use iron pipe as specified for water main.
 - 5.2.2 Connection to main: provide suitable tee if main and service are installed at same time; provide tapping valve and sleeve specified for water main for service connected to existing main; spacing of service connections: not less than 2' apart.

Water Mains and Appurtenances

- 5.2.3 Curb stop: use resilient wedge gate valve specified for water main; omit curb stop if tapping valve installed at main.
- 5.2.4 Curb stop box: use valve box as specified for water main except use lock cover.
- 5.2.5 Meter setting: as specified for services 2" and smaller, except use gate valves with end connections matching those on meter.
- 5.3 City will furnish and install water meter, remote reading device; upon request and payment of fee; all other materials and work for water services by subdivider.
 - 5.3.1 Provide conduit and wiring from water meter to outside of commercial buildings for device installation; wiring as per City Standards.
- 5.4 Notify City 48 hours prior to tapping main, any proposed water shutdown and at completion of installation of service; backfill after City has inspected installation. Only City allowed to operate valves.
- 5.5 Mark end location of service connection with steel post painted blue; extend top of post 3', minimum, above ground.
 - 5.5.1 City will mark location of water service with the symbol "W" stamped in front face of fresh concrete during pavement construction.

6. VALVE AND METER MANHOLES

- 6.1 Use 60" dia. manholes for water service greater than 1": install as shown on Standard Drawing; valve manholes not required except when directed by Water Utility.
 - 6.1.1 Use precast manhole for pit mounted water meter installations; set manhole frame and cover directly above water service; install with sump pump and grate over sump; discharge to sump line or storm sewer.
 - 6.1.2 Reinforced concrete manhole: ASTM C478, minimum wall thickness: 6".
 - 6.1.3 Joints: cold-applied rubber asphalt pipe joint material; quality standard: FS-SS-S-00210.

- 6.1.4 Frame and cover: Type C: SUDAS Standard Specifications Figure SW-602; machined bearing surfaces, concealed pickhole; set frame and cover directly over operating nut of valve.
- 6.1.5 Place manhole cover at finished grade; do not use adjusting rings.
- 6.2 Use Mueller Thermal-Coil meter box or equal for water services 1" or less.

7. VALVE BOXES

- 7.1 Tyler 6850 or 6855, valve box with standard drop cover and extension piece, or approved equal; select top and bottom sections to suit depth of cover; use at hydrants and all valves unless directed otherwise by City; slide type when used in concrete street pavement areas; all other areas screw type; provide Valve Box Adapter II or approved equal rubberized centering ring seal between valve box and valve.

8. BLOWOFFS

- 8.1 Install hydrant and auxiliary valve at all deadends.

9. HYDRANTS

- 9.1 Waterous Pacer WB-67 safety flange type hydrant or approved equal, with hydrant auxiliary valve and valve box; conform to AWWA C502.
 - 9.1.1 Provide two 2-1/2" hose nozzles and one 4-1/2" pumper nozzle with National Standard threads; O-ring packing; depth of bury to suit depth of cover specified for various diameters of water mains.
 - 9.1.1.1 Provide 6" mechanical joint inlet and 5-1/4" main valve, unless otherwise directed by City.
 - 9.1.1.2 Provide hydrant extensions as required to set hydrant grade mark at proper elevation per manufacturers recommendation.
 - 9.1.1.3 Operating nut: National Standard; open counterclockwise; furnish with chains on caps.
 - 9.1.1.4 Pumper nozzle equipped with factory installed Storz quick connect coupling and cap.
 - 9.1.2 Auxiliary valve and box: as specified hereinbefore.

- 9.2 Use mechanical joint anchoring tee with plain end branch; Clow Corporation, or approved equal; provide integral gland and split Roto-Ring; use Clow Corporation anchoring pipe, or approved equal; connect mechanical joint end to anchoring tee; connect anchoring end to valve with integral gland and split Roto-Ring.
 - 9.2.1 Mechanical joint tee and anchoring coupling may be used in lieu of anchoring tee.
 - 9.2.2 Mechanical joint tee, anchoring elbow and anchoring coupling may be used where required.
- 9.3 Hydrant color: paint hydrant Safety Yellow to safety flange and black below flange; Tnemec alkyd system for exterior exposure, or approved equal; surface preparation SSPC-SP6 commercial blast.
- 9.4 Check all hydrant threads with City of Waukee fire department hose fittings after completion of installation of hydrants.

10. THRUST BLOCKS

- 10.1 Provide poured in place concrete thrust blocks where piping changes direction or deadends.
- 10.2 Carry thrust block to undisturbed edge of trench for bearing.
- 10.3 Minimum thickness of thrust blocks: 18".
- 10.4 Bearing area of thrust blocks, SF:

<u>Pipe Size</u> <u>(inches)</u>	<u>90° Bend</u>	<u>45° Bend</u>	<u>Tee or</u> <u>Deadend</u>
4	4	2	3
6	6	3	4
8	11	6	8
10	17	9	12
12	24	13	17
14	33	18	23
16	43	23	31

- 10.5 Refer to Standard Drawing for general arrangement of thrust blocks; place plywood between fittings and thrust block; do not plug end of fitting with concrete.

11. CONCRETE AND REINFORCING STEEL

- 11.1 Concrete materials and reinforcing steel for structures and thrust blocks are specified under STRUCTURAL CONCRETE AND REINFORCING STEEL.

12. PIPE INSTALLATION

- 12.1 Lay pipe in dry; 5'-6" minimum earth cover except where directed otherwise by City Engineering Department; locate water main back of curb line of existing or proposed pavement as shown on Standard Drawing.
- 12.1.1 Make pipe joints in accordance with AWWA C600 and C605 and as recommended by manufacturer; use minimum amount of gasket lubricant; apply to gasket only; do not apply to inside of bell.
- 12.1.2 Bottom of trench as specified under PIPE EXCAVATION AND BACKFILL.
- 12.2 Notify City 48 hours prior to tapping main or any proposed water shutdown. Only City allowed to operate valves.
- 12.3 Clean pipe interior of foreign material before lowering into trench; keep clean at all times; when pipe laying is not in progress, including lunch breaks, nights, weekends and other non-working periods, securely close open ends of pipe and fittings with watertight plug.
- 12.4 Place in trench in sound, undamaged condition; do not damage pipe coating or lining; use web slings to install or move pipe; use of end hooks, dropping and rolling pipe not permitted.
- 12.5 Cut iron pipe in neat and workmanlike manner without damage to pipe; bevel cut ends of push-on type pipe; completely coat damaged ends of cut pipe with bituminous sealer; use spray-on type sealer which will adhere to lining at any temperature; do not install pipe and fittings showing blisters or holes.
- 12.6 Cut pvc pipe with fine tooth saw or tubing cutter; square cut; file jagged edges smooth.
- 12.7 Before installation, tap iron pipe lightly with light hammer to detect cracks; visually inspect pipe lining for defects; do not install defective, damaged or unsound pipe.

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- 12.8 Deflect pipe joints not to exceed 3° as required in accordance with recommendations of pipe manufacturer; use suitable fittings where grade or alignment requires offsets of more than 5/8" per foot.
- 12.9 Minimum horizontal separation from sanitary sewers, storm sewers or sewer manholes: 10' from edge of sewer or manhole to edge of water main.
 - 12.9.1 If conditions prevent 10' separation, minimum may be reduced to 3' by placing bottom of water main at least 18" above top of sewer in separate trench or in same trench on bench of undisturbed earth.
 - 12.9.2 If impossible to obtain 18" clearance, replace 20' length of sewer with water main pipe centered on water main crossing as specified below; pressure test pipe as specified herein; provide minimum linear separation of 2'.
- 12.10 Minimum vertical clearance for water main crossing sewer service, sanitary sewer, storm sewer or drainage tile: 18" vertical clearance from bottom of water main to top of sewer.
 - 12.10.1 Where sewer crosses over or less than 18" below water main; replace sanitary sewer service or sanitary sewer with 20' length of water main pipe centered on water main; replace storm sewer with reinforced concrete pipe with flexible joint rubber gasket within 10' each way of water main crossings; maintain minimum vertical clearance of 6" from bottom of water main to top of sewer or minimum vertical clearance of 18" from top of water main to bottom of sewer.
 - 12.10.2 Adequately support sewer line to prevent settling or breaking of water main or sewer.
 - 12.10.3 Backfill trench with low permeability soil for 20' length centered on crossing.
 - 12.10.4 Pressure test sewer pipe replaced with water main material as specified herein.
- 12.11 Minimum horizontal separation from sewer force mains: 10' from edge of sewer force main to edge of water main.
 - 12.11.1 If conditions prevent 10' separation, construct force main of water main materials meeting a minimum pressure rating of 150 psi; provide minimum separation of 4'.

- 12.12 Plug or cap and block all pipe ends or fittings left for future connections. Use alternate method thrust block; SUDAS Standard Specifications Figure WM-101.
- 12.13 Use tracer wire for all pvc water mains.
- 12.13.1 Provide AWG #12, solid, blue, single, insulated, direct-burial copper wire along all pvc water mains; tuck tracer wire under water main at approximate 45° angle below horizontal spring line of water main to protect tracer wire. Use wire with steel core with directional bored pipe.
- 12.13.2 Insulation: Linear low density polyethylene (LLDPE) suitable for direct burial. Minimum thickness 0.045 inches.
- 12.13.3 Splice new tracer wire to existing tracer wire at existing main; if no tracer wire exists drive ground rod, Blackburn Catalog #3755, or approved equal and connect tracer wire to ground rod with a corrosion-resistant copper clamp; Blackburn Catalog #G3, or approved equal.
- 12.13.4 Where splicing is necessary, either at end of existing tracer wire or along new tracer wire, use splice kit, Scotchcast, 3M Company, or approved equal.
- 12.13.5 Extend tracer wire along new main; terminate wire in tracer wire receptacle box mounted on to each fire hydrant; secure to hydrant break flange; receptacle box: AA Manufacturing Tracer Wire Receptacle Model TW-18-2.

13. VALVE INSTALLATION

- 13.1 When water main is installed in proposed or existing street right-of-way, install valves at street intersections as shown on Standard Drawing; isolate pipe serving each block.
- 13.2 Install with stems vertical and centered in manhole or box, as shown on Standard Drawing.
- 13.3 Check all valve bolts when installed; tighten as necessary after valves are in operation and up to operating pressure.
- 13.4 Support valves in manholes or boxes as required.

- 13.5 Carefully tamp earth around each valve box or manhole to distance of 4' on all sides of box or manhole or to undisturbed trench face, if less than 4'; install as shown on Standard Drawing.

14. HYDRANT INSTALLATION

- 14.1 Install plumb; set at elevation so that cover will not be less than for adjacent main; set grade mark on hydrant barrel at finished ground level; install as shown on Standard Drawing.
- 14.2 Set on concrete foundation; backfill with 3/4" washed gravel as shown on Standard Drawing.
- 14.3 Carefully tamp backfill around hydrant to a distance of 4' on all sides of hydrant or to undisturbed trench face, if less than 4'.
- 14.4 Tighten all stuffing boxes as hydrant is installed; operate hydrant in open and closed position to assure all parts are in working condition.
- 14.5 Block hydrant in place with poured in place concrete thrust block.

15. RAILROAD AND HIGHWAY CROSSINGS

- 15.1 Tunnel casing pipe in place; length of casing pipe and method of installation as required by IDOT or railroad.
- 15.2 Install ductile iron water main in casing pipe as soon as casing pipe is installed.
- 15.3 Do not stockpile or store excess material or debris in right-of-way.
- 15.4 Tunnelling as specified in PIPE EXCAVATION AND BACKFILL.

16. STREET CROSSINGS

- 16.1 Auger or directional bore water main or service pipe under shared use paths, driveways, concrete pavement and curb and gutter except when stipulated otherwise in writing by City; no casing pipe required.
- 16.2 Meet requirements as specified in PIPE EXCAVATION AND BACKFILL.

17. CREEK CROSSINGS

- 17.1 A minimum cover of five feet shall be provided over pipe.
- 17.2 See Standard Drawing for creek crossing for water main.

18. TESTS

18.1 Water test all piping after installation in accordance with AWWA C600.

18.2 Hydrostatic test:

18.2.1 Flush out main before test to remove air; insert taps to release trapped air.

18.2.2 Test at 1.5 times working pressure or 150 psi, whichever is greater, at point of test for 2 hours; allowable pressure drop during test period: 5 psi.

18.3 Leakage test:

18.3.1 Conduct concurrently with pressure test; measure water loss by pumping from drum or by similar means.

18.3.2 Maximum allowable leakage (L) in gallons per hour:

$$L = \frac{SD \times P^{1/2}}{148,000}$$

S = length in feet of section under test.

D = pipe diameter in inches.

P = average test pressure, psig.

18.3.3 Provide all test pumps, test plugs, pipe and gauges; make all required piping connections.

18.3.4 Examine trench for leakage during test; replace all defective pipe and fittings that do not pass leakage test; repeat test until requirements have been met.

19. DISINFECTION

19.1 Disinfect and sample prior to placing main in service; AWWA C651.

Water Mains and Appurtenances

- 19.2 Disinfect by injecting a solution of calcium hypochlorite and water at slow rate to provide minimum residual chlorine content of 25 mg/l not more than 10' downstream of new water main; allow system to stand full of solution for 24 hours.
- 19.3 Minimum free chlorine residual at pipe extremities: 10 mg/l at end of test period; if requirement is not met, repeat disinfection procedure.
- 19.4 Operate all valves and hydrants in new main to assure full disinfection; repeat test procedure if necessary.
- 19.5 Thoroughly flush main after test until extremities indicate same chlorine residual as supply water.
- 19.6 Dispose of chlorinated water to prevent damage to the environment; AWWA C655. Chemically dechlorinate water or store water until chlorine residual is non-detectable (<0.10 mg/l) before releasing into the ground or storm sewers. Disposal not allowed into sanitary sewers.
 - 19.6.1 Collect a minimum of 3 grab samples evenly spaced over course of Discharge.
 - 19.6.2 Test each sample within 15 minutes of the sample being collected for chlorine residual.
 - 19.6.3 Stop discharge if chlorine is detected in any test until subsequent test shows chlorine is non-detectable.
- 19.7 After final flushing, and before the water main is placed in service, two samples shall be collected from the end of the main and tested for bacteriologic quality and shall show the absence of coliform organisms. One set of samples shall be collected every 1,200 linear feet of pipe, plus one set from the end of the line and at least one from each branch greater than one pipe length. There are two options for bacteriological testing:
 - 19.7.1 Option A: take an initial set of samples and then resample again after a minimum of 16 hr using the sampling site procedure. Both sets of samples must pass for the main to be approved for release.
 - 19.7.2 Option B: let water main sit for a minimum of 16 hr without any water use. Then collect, without flushing the main, two sets of samples a minimum of 15 min apart while the sampling taps are left running. Both sets of samples must pass for the main to be approved for release.

Water Mains and Appurtenances

- 19.7.3 Samples shall be collected in sterile bottles treated with sodium thiosulfate. No hose or fire hydrant shall be used in the collection of samples unless approved by City.
- 19.7.4 If the disinfection fails to produce satisfactory samples, disinfection shall be repeated until satisfactory samples have been obtained.
- 19.7.5 After the second set of failed samples, additional water used shall be charged to the Contractor at the retail rate for water usage.

PART 8 – STRUCTURAL CONCRETE AND REINFORCING STEEL

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| 4. FORMS | 8. WIRE FABRIC |

1. GENERAL

- 1.1 This part of the specifications includes all concrete and reinforcing steel placed on project site except portland cement concrete paving for streets, driveways and sidewalks.

2. CONCRETE MATERIALS

- 2.1 Portland cement: ASTM C150, Type I or Type III.
- 2.2 Aggregates: strong, durable, uniformly graded mineral grains conforming with ASTM C33.
- 2.2.1 Fine aggregate: Gradation within requirements of ASTM C33, Par. 3; natural or manufactured sand; clean, hard, strong, durable, uncoated grains; maximum coal and lignite: 1.0%.
- 2.2.2 Coarse aggregate: Gradation within requirements of ASTM C33, Table II #57, 1" to No. 4.
- 2.2.2.1 Crushed limestone: meet IDOT specifications 4115.03 for abrasion and 4115.04 for Class 2 or 3 durability; not more than 1.0% of clay lumps and friable particles, 2.0% of soft particles and 0.25% of coal and lignite allowed; prove acceptability by submission of certified laboratory test report.
- 2.3 Storage:
- 2.3.1 Cement: keep clean, dry and free from weather damage.
- 2.3.2 Aggregates: stockpile each gradation separately on clean, non-contaminating surfaces.
- 2.4 Water: clean and free from injurious materials; ASTM C94.
- 2.5 Admixtures: applicable sections of ASTM C94, C260, C494 and C168.
- 2.5.1 Fly ash: Class C.

Structural Concrete and Reinforcing Steel

- 2.5.2 Use of calcium chloride not permitted.
- 2.6 Non-shrink: Embeco by Master Builders Company, Alcoa, or approved equal.

2.7 Waterstops:

- 2.7.1 Polyvinylchloride with following characteristics when tested in accordance with ASTM test method listed.

Specific Gravity	1.32 plus or minus 0.05	ASTM D792
Hardness	76 plus or minus 3	ASTM D2240
Tensile Strength	2250 psi (minimum)	ASTM D638
Elongation	350% (minimum)	ASTM D638
Cold Brittleness	-35°F. or lower	ASTM D476

- 2.7.2 Design: 6", ribbed with corrugations and center bulb, except where shown otherwise; Greenstreak Type 705, or equal.
- 2.7.3 Expansive waterstop may be used for vertical construction joints and where approved by City Engineering Department; Volclay Waterstop-RX, Greenstreak Hydrotite, or equal.

2.8 Bonding Agent:

- 2.8.1 Epoxy bonding agent shall be a two-component, solvent-free, moisture insensitive, epoxy resin material confirming to ASTM C884 (1999), Type V. The bonding agent shall be Sikadur 32 Hi-Mod by Sika Corporation of Lyndhurst, NJ; Concessive Liquid (LPL) by Master Builders of Cleveland, OH or equal.

3. CONCRETE QUALITY

	<u>Class A</u>	<u>Class B</u>
3.1 Minimum compressive strength: psi at 28 days	4,000	2,500
3.2 Maximum water-cement ratio: pound per pound, including water in aggregates	0.45	0.45
3.3 Minimum cement content: pound per cubic yard	560	420

Structural Concrete and Reinforcing Steel

- 3.4 Slump: maximum 4" with no addition of water reducing admixture; with water reducer; slump per manufacturer's recommendations; ASTM C143.
- 3.5 Air content: 6.5% with a maximum variation of -1.0% and $+1.5\%$ by volume air entrained for the air content of fresh, unvibrated structural concrete; ASTM C231.
- 3.6 Admixtures: manufacturer's recommendations.
- 3.7 Fly ash: Class C; maximum 15% replacement, pound for pound for specified cement content, between and including April and October.
- 3.8 Concrete mix design: meet approval of City Engineering Department prior to placement.
- 3.9 Use Class A concrete unless shown or specified otherwise; use Class A concrete for fill, thrust blocks and to anchor sign posts.

4. FORMS

- 4.1 Form all concrete, unless permitted otherwise by City.
- 4.2 Use metal or plywood-lined forms for exposed surfaces; erect true to line and grade; brace and tie securely.
- 4.3 Coat forms with non-staining mineral oil before placing reinforcing.
- 4.4 Strip forms only after concrete has cured for the following periods:

Footings	24 hours.
Walls	48 hours.
Self-supported beams and slabs	2 weeks.

5. MIXING, PLACING, PROTECTING AND CURING

- 5.1 Provide accurate control for measuring materials
- 5.2 Mix until mass is homogeneous and uniform in color.
- 5.3 Ready-mixed concrete: conform with specifications and with ASTM C94.
- 5.4 Clean and dampen forms, reinforcing steel and embedded items: transfer concrete promptly from mixer to forms; thoroughly compact by tamping or vibrating.

Structural Concrete and Reinforcing Steel

- 5.5 Prevent segregation during placing; do not drop concrete more than 5'.
- 5.6 Place concrete continuously in each section until complete; permit not more than 30 min. between depositing adjacent layers of concrete within each section.
- 5.7 Thoroughly compact, puddle and vibrate concrete into corners and around reinforcing and embedded items.
- 5.8 Place sections of concrete in sequence which eliminates effect of shrinkage to greatest extent practicable.
- 5.9 Do not finish concrete with bleed water present on surfaces; do not over-finish.
- 5.10 Surfaces: float to uniform finish with cork float; use edger on exposed edges.
- 5.11 Immediately after finishing or stripping forms, apply continuous cover of polyethylene film; thickness: 0.004"; minimum lap: 6".
 - 5.11.1 Keep film in place for 7 days.
- 5.12 Maintain concrete temperature between 60°F. and 90°F. when placing and not less than 50°F. for 72 hours after placing.
- 5.13 Do not place concrete when storm or inclement weather is approaching or when air temperature is 38°F. or less and falling, or when darkness prevents good workmanship.

6. FINISHING

- 6.1 Patching:
 - 6.1.1 Chip out honeycomb to sound concrete.
 - 6.1.2 Fill with patching mortar: one part portland cement, three parts sand.
 - 6.1.3 Fill holes left by form ties with non-shrink grout to within 1" of surface; fill with patching mortar.
 - 6.1.4 Where existing concrete has been removed, patch uneven surfaces with patching mortar.

7. REINFORCING STEEL

- 7.1 Billet steel bars: ASTM A615, Grade 60.
- 7.2 Bend cold to conform with required details; bend bars in fabricating shop before delivery to site.
- 7.3 Space properly and tie securely in position before placing concrete; tie with minimum No. 18 tie wires as directed by City Engineer.
- 7.4 Lap bars 48 diameters, minimum.
- 7.5 Remove scale, rust, dirt or other coatings which may impair bond; comply with ACI 318.
- 7.6 Install reinforcing steel in correct position with preformed wire bar bolsters and spacers.
- 7.7 Place concrete only after reinforcing system is in place and approved by City Engineering Department; install reinforcing system plumb and true; tie securely: reinforcing must remain in proper position without distortion or displacement of individual bars or system during pour.
- 7.8 All reinforcing steel epoxy coated; IDOT Section 4151.03B.

8. WIRE FABRIC

- 8.1 Electrically welded wire fabric: ASTM A185.
- 8.2 Sizes and mesh: as shown on plans for Standard Drawing.
- 8.3 Place securely when show on plans or Standard Drawing.
- 8.4 Lap fabric not less than 6".
- 8.5 Remove scale, rust, dirt and other bond-impairing materials.

PART 9 - SURFACE RESTORATION AND PAVEMENT REPLACEMENT

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1. GENERAL

- 1.1 This part of specifications includes surface restoration and removal and replacement of existing sidewalks, shared use paths, driveways, streets and parkings by subdivider, utility companies and others in public rights-of-way and easements.
- 1.2 Submit plans of proposed construction for approval and acceptance by City; notify City Engineering Department in advance of performing work in public right-of-way.
- 1.3 Locate utilities parallel to right-of-way lines as shown on Standard Drawing unless otherwise approved by City.
- 1.4 Unless otherwise specified on plans, restore surfaces and replace pavement to conform with existing grade and cross section prior to construction.
- 1.5 Prepare subgrade or subbase and finish grade as specified in EARTHWORK AND INCIDENTALS FOR PAVEMENT.
- 1.6 Sod all grassed surfaces disturbed with nursery sod as specified herein, unless seeding is approved by City.

2. SURFACE RESTORATION

- 2.1 Furnish all materials, equipment and labor necessary to seed, sod, replace damaged flowers, shrubbery and trees and perform complete surface restoration on land not owned by subdivider to original or better condition.
- 2.2 Excavate and backfill trench and holes for utility installation and repair in accordance with specifications.
 - 2.2.1 Backfill trenches and holes below street and driveway pavement full depth to bottom of pavement with IDOT 3/4" Class A granular backfill material.

Surface Restoration and Pavement Replacement

- 2.3 Surface restoration including replacement of plantings, seeding and sodding: use competent subcontractor experienced in this type work.
- 2.4 Replace topsoil and fine grade all areas disturbed by construction.
- 2.5 Dispose of all brush and rubbish as directed by City Engineering Department.

3. SODDING

- 3.1 Sod areas which are disturbed by construction; extent and locations subject to approval of City.
- 3.2 Place new 1-1/2" Kentucky Bluegrass nursery sod; secure approval of City for new sod; field sod not acceptable.
- 3.3 Water thoroughly initially; keep damp until growth is well established.
- 3.4 Do not sod between June 15 and August 15 unless permitted by City Engineering Department.
- 3.5 Do not lay frozen sod. Do not lay sod on frozen soil or when freezing conditions are forecasted within 24 hours.
- 3.6 Provide two applications of fertilizer in accordance with SUDAS Standard Specifications.
- 3.7 Replace sod areas where 50% of the grass fails to grow within 1 year of placement.

4. SEEDING

- 4.1 Seed areas in public right-of-way, other than parkings, which are disturbed by construction, if approved by City.
- 4.2 Prepare site for seeding by discing, harrowing and hand raking or other means following site grading; work soil to depth of 3". Remove all rock from seed bed.
- 4.3 Precede seeding with uniform application of commercial grade fertilizer at rate and grade in accordance with SUDAS Standard Specifications; cultivate area 3" deep and work with harrow within 24 hours before seeding; smooth surface to eliminate clods and lumps before seeding.

Surface Restoration and Pavement Replacement

- 4.4 Seed mixture: Type 1 in accordance with SUDAS Standard Specifications unless otherwise permitted by City Engineering Department.
- 4.5 Seed between dates of August 10 and September 30 or between dates of March 1 and May 30. Do not seed on frozen soil.
- 4.6 Cover seed by rolling with cultipacker, or by dragging or hand raking.
- 4.7 Mulch all areas subject to erosion and where directed by City Engineering Department; mulch in accordance with SUDAS Standard Specifications.
- 4.8 Water seeded area sufficiently to saturate seed bed.
- 4.9 Replant or redevelop any bare spots or areas which do not attain a full stand during first growing season.
- 4.10 Seed areas within IDOT right-of-way in accordance with IDOT Standard Specifications.
 - 4.10.1 Include fertilizer and mulch; maintain as stated hereinbefore.

5. SIDEWALK AND SHARED USE PATH REMOVAL AND REPLACEMENT

- 5.1 Removal: saw cut and remove shared use paths and sidewalks, at joints, as required to accommodate construction.
- 5.2 Replacement: match existing construction for type, width, thickness, reinforcement and surface texture. Minimum thickness 4 inches.
 - 5.2.1 Reconstruct joints to match existing work.
 - 5.2.2 Concrete: Class C-4 or M-4 in accordance with IDOT specifications.
 - 5.2.3 Provide truncated dome warning panels at junction of handicapped sidewalk ramps and street pavement; provide at location directed by City where sidewalk abuts gravel roadways and other roadways without curb and gutter sections; truncated domes as specified in PORTLAND CEMENT CONCRETE PAVEMENT. Replace as originally designed.

6. STREET AND DRIVEWAY SURFACE REMOVAL AND REPLACEMENT

- 6.1 Saw cut and remove portland cement concrete or hot mix asphalt pavement on lines parallel to or perpendicular to centerline of pavement.

Surface Restoration and Pavement Replacement

- 6.1.1 Make saw cuts only at locations of existing joints in portland cement concrete pavement or at locations approved by City Engineering Department.
- 6.1.2 Minimum pavement replacement area 1' wider than the trench on all sides.
- 6.2 Reinstall driveway and road culverts; if culverts are damaged during construction, replace with new, identical size and type.
- 6.3 Replace street and driveway surfaces:
 - 6.3.1 Portland cement concrete pavement: match existing surface texture; thickness 1" thicker than existing pavement; minimum 8" thickness of new pour for streets; 6" minimum thickness of new pour for driveways.
 - 6.3.2 Hot mix asphalt (HMA) pavement: replace with portland cement concrete pavement; depth of pavement specified hereinbefore.
 - 6.3.3 Seal coat or low grade asphalt surfacing: replace with portland cement concrete pavement; depth of pavement specified hereinbefore.
 - 6.3.4 Granular surfacing: match existing surface; depth of surfacing specified hereinafter.
- 6.4 Portland cement concrete pavement replacement:
 - 6.4.1 Subgrade: provide approved, selected material; compact to 95% maximum density; 12" minimum thickness.
 - 6.4.2 Place new concrete slab 1" thicker than existing slab; minimum 8" thickness of new pour for streets.
 - 6.4.3 Vibrate, screed, float, drag and finish to match existing surface texture.
 - 6.4.4 Concrete: Class M-4 in accordance with IDOT specifications.
 - 6.4.5 Concrete curb and gutter: form and construct curb and gutter with mechanical equipment; finish curbs by hand methods with straight edge or slipform where necessary to produce uniform finish.

Surface Restoration and Pavement Replacement

- 6.4.6 Use Type C joints, for pavement thicknesses 8" or less and Type CD joints for pavements thicknesses greater than 8"; use RD joints at existing pavement; seal joints; saw as specified herein; joint types in accordance with SUDAS Standard Specifications.
- 6.5 Gravel or crushed stone:
 - 6.5.1 Place in 6" of compacted crushed stone to width of existing street or driveway; conform to IDOT Class A crushed stone; place and compact in 2 lifts.
 - 6.5.2 Place additional compacted crushed stone beyond width of existing street or driveway to restore to existing condition; minimum thickness: 2".

7. PUBLIC SAFETY

- 7.1 Provide temporary fence or cover excavated trench or hole during periods when construction and testing activity has ceased.
 - 7.1.1 Provide barricades and flashers in accordance with Iowa Manual on Uniform Traffic Control Devices to warn motorists and pedestrians when light intensity is less than 0.9 foot-candles.

PART 10 – PORTLAND CEMENT CONCRETE PAVEMENT

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1. GENERAL

- 1.1 This part of the specifications includes construction of portland cement concrete pavement with integral curb, driveway approaches, shared use paths and sidewalks, using preset forms on prepared subgrade or subbase.
- 1.1.1 Prepare subgrade or subbase as specified in EARTHWORK AND INCIDENTALS FOR PAVEMENT.
- 1.1.2 Construct non-reinforced or reinforced pavement as agreed upon between City and subdivider and as specified in DESIGN STANDARDS; use portland cement concrete as specified herein.
- 1.1.3 Install joints in accordance with SUDAS Standard Specifications Figures PV-101, 7010.904 and 7010.905 except on Sheet 3 of Figure PV-101 replace Note No. 11 with "Sawing and sealing of joint is required."
- 1.1.4 Construct driveway approaches, sidewalks and shared use paths as specified hereinafter.
- 1.1.5 Construct railroad crossing approaches in accordance with SUDAS Standard Specifications Figure 7010.903.
- 1.1.6 Construct boxouts for intakes in accordance with SUDAS Standard Specifications Figure SW-514, Sheet 1 except use boxout width of 42".
- 1.2 Non-reinforced portland cement concrete pavement includes expansion joints and dowels; see Standard Drawings.
- 1.3 Reinforced portland cement concrete pavement includes joint reinforcement and dowels and deformed bar reinforcing throughout remainder of pavement; see Standard Drawing.

Portland Cement Concrete Pavement

- 1.4 Use slip form paving machine for all uniform width street pavements 150' or more in length, unless alternate methods are approved by the City Engineering Department. Screeds may be used on short pavement runs up to 150'. Place, consolidate, and finish the concrete to the full depth and width conforming to the specified crown and cross-section in a single operation. Pavement cannot be paved in short sections just to meet the requirements above.
- 1.5 City will stamp location of sump pump drain line with the symbol "S" lying on its side, water service with the symbol "W" or sanitary sewer service with the symbol "S" in front face of fresh concrete during pavement construction.

2. MATERIALS

- 2.1 Portland cement: ASTM C150, Type I.
- 2.2 Admixtures:
 - 2.2.1 Air entraining: ASTM C260; no admixtures containing chlorides will be permitted.
 - 2.2.2 Retarding: a suitable retarding admixture may be used during hot weather, with approval of City Engineering Department.
 - 2.2.3 Other admixtures may be used, subject to approval of City Engineering Department.
 - 2.2.4 Only use compatible admixtures per manufacturer's recommendation.
- 2.3 Fine aggregate:
 - 2.3.1 Clean, hard, durable particles of natural sand, free from injurious amounts of silt, shale, coal, organic matter or other deleterious substances.
 - 2.3.2 Deleterious substances: not more than 2.0% shale and coal by weight retained on No. 16 sieve.
 - 2.3.3 Organic matter: other than coal, not more than standard reference color; ASTM C40.
 - 2.3.4 Conform to Gradation No. 1 of the Aggregate Gradation Table in the Appendix of the IDOT Standard Specifications for Highway and Bridge Construction.

Portland Cement Concrete Pavement

- 2.3.5 Percent passing one sieve and retained on next higher number sieve not more than 40% when sieved through 4 and 8 numbered sieves.
- 2.3.6 Mortar strength at 7 days not less than 1.5 times standard sand strength; IDOT Laboratory Test Method 212.

2.4 Coarse aggregate:

2.4.1 Clean, hard, durable particles of crushed stone free from injurious amounts of objectionable materials; Class 3 durability crushed stone; IDOT 4115.01.

2.4.2 Objectionable materials not more than:

<u>Materials</u>	<u>Percent</u>
Clay lumps	0.5
Coal and carbonaceous shale	0.5
Sticks (wet weight)	0.1
Total of all shale and coal combined	1.0
Organic material other than coal and sticks	0.0
Unsound chert particles retained on 3/8" sieve	3.0

2.4.2.1 Chert particles breaking into three or more pieces in freezing and thawing test, IDOT Laboratory Test Method 211, Method A, are considered unsound.

2.4.3 Conform to Gradation No. 4 of the Aggregate Gradation Table in the Appendix of the IDOT Standard Specifications for Highway and Bridge Construction.

2.4.4 Percent of wear, AASHTO T96, Grading A or B, not to exceed 35 for gravel, 50 for crushed stone which contains 90% or more calcium carbonate or 45 for all other crushed stone.

2.4.5 Particle durability: aggregate considered durable when it has no adverse affect upon durability of concrete in which used; minimum percent of durable particles in aggregate: 95; durability based on following:

2.4.5.1 That loss in freezing and thawing test, IDOT Laboratory Test Method 211, Method A, does not exceed 6%.

Portland Cement Concrete Pavement

- 2.4.5.2 Behavior of existing concrete containing aggregate of similar geological origin or chemical and mineral composition.
- 2.5 Water: clean and clear, free from salt, oil, acid, strong alkalis, vegetable matter, or other substances injurious to concrete.
 - 2.5.1 Water may be heated for cold weather paving operations; anti-freezing agents not permitted.
- 2.6 Reinforcing steel:
 - 2.6.1 Deformed bars: ASTM A615, Grade 40; epoxy coated.
 - 2.6.2 Plain and smooth dowel bars: ASTM A615, Grade 40; epoxy coated.
- 2.7 Expansion tubes: Comply with IDOT 4191.01.B.
- 2.8 Metal keyways: Comply with IDOT 4191.01.A.
- 2.9 Supports for reinforcing steel:
 - 2.9.1 Support tie bars as required to place and maintain correct location during construction.
 - 2.9.2 Support dowel bars at expansion joints as shown on SUDAS Standard Specifications Figure PV-101.
- 2.10 Joints:
 - 2.10.1 Bituminous joint filler and sealer: hot poured joint filler; comply with IDOT 4136.02.A.
 - 2.10.2 Preformed expansion joint filler: asphalt saturated fiber strips; AASHTO M213; furnish in strips of plan dimensions.
- 2.11 Liquid curing compound: white pigmented compound: IDOT Section 4105.
- 2.12 Plastic film: opaque, white pigmented polyethylene plastic, 0.00085" minimum thickness, use only once if less than 0.0034" thick.
- 2.13 Fly ash: Class C permitted as substitute for portland cement; comply with requirements of IDOT Standard Specifications and Supplemental Specifications for portland cement concrete proportions.

3. STORAGE AND PROTECTION OF MATERIALS

3.1 Aggregates:

3.1.1 Store fine and coarse aggregate in separate stockpile: avoid contamination of aggregates.

3.1.1.1 Place fine aggregate with more than 5.0% moisture in separate stockpile and allow to drain.

3.1.2 Stockpile coarse aggregate and unscreened gravel in horizontal layers; maximum depth: 4'.

3.1.3 Handle aggregates to avoid frequent variations in specific gravity, sieve analysis or moisture content.

3.1.3.1 Prevent variations of more than 0.5% in moisture content of aggregates in successive batches.

3.1.4 Coarse aggregate having absorption greater than 0.5%: wet 1 hour before use.

3.1.5 Place fine aggregate in proportioning bin only when uniform content can be maintained in successive batches for one day's run.

3.2 Cement:

3.2.1 Store cement in suitable weatherproof structure; prevent loss of cement during handling.

3.2.2 Use cement containing lumps only after careful screening through 20 mesh screen; retest in accordance with ASTM C150 before use.

4. PROPORTIONS FOR MIX

4.1 Mix proportions for street pavement, drive approaches and parking areas adjacent to street pavement.

Portland Cement Concrete Pavement

4.1.1 Basic absolute volumes of materials per unit volume of concrete per IDOT 2301.02:

	<u>C-4</u>	<u>M-4</u>
Cement Minimum	0.118	0.156
Water	0.159	0.161
Entrained Air	0.060	0.060
Fine Aggregate	0.331	0.311
Coarse Aggregate	0.332	0.312

4.1.2 Above quantities based on specific gravity of cement: 3.14; specific gravity of aggregates: 2.65; air voids: 6.0%.

4.1.3 Use C-4 mix unless otherwise shown on plans or directed by City Engineering Department.

4.2 Proportion adjustments:

4.2.1 Basis: when actual quantity of concrete is more than 101% or less than 99% of calculated quantity or if combination of materials does not produce quality of concrete specified.

4.2.1.1 Fine aggregate: not to exceed 50% of total aggregate in any adjustment.

4.2.1.2 Do not exceed maximum water-cement ratio specified.

4.3 Water quantity and concrete consistency:

4.3.1 Use proper amount of mixing water to produce concrete of uniform consistency; adapt to mix, characteristics of materials used, methods of consolidation, weather conditions and slope of finished surface.

4.3.2 Modify proportion if maximum water-cement ratio does not produce workability; increase cement to aggregate proportion to produce specified degree of workability without exceeding maximum water-cement ratio.

4.4 Tests on trial batches and concrete placed at project site:

4.4.1 Slump: ASTM C143; 1-1/2" to 3" for machine finished concrete; 4", maximum, for hand finished concrete.

Portland Cement Concrete Pavement

- 4.4.2 Air voids, of fresh concrete, by pressure method: ASTM C231; 8.0% +/- 2.0% for machine placed pavement and 7.0% +/- 1.5% for hand placed pavement.
- 4.4.3 Minimum compressive strength: ASTM C39; 3,000 psi when tested at 7 days and 4,000 psi when tested at 28 days.
- 4.4.4 Quantity of compression cylinders as specified in GENERAL CONDITIONS; cast, protect and cure cylinders in accordance with ASTM C31.
- 4.4.5 City will allow use of IDOT IM383 method of test for maturity to determine time for opening pavement to traffic.

5. MIXING

5.1 Batch mix:

- 5.1.1 Handle batches and charge mixer to insure complete introduction of batches separately without loss of materials; add water with other materials.
- 5.1.2 Maximum batch volume:

<u>Mixer Size Designation</u>	<u>Volume of Batch CF of Mixed Concrete</u>
16E	17.6
27E	29.7
34E	37.4

- 5.1.2.1 For other size mixers, do not allow batch volume of mixed concrete to exceed mixer size designation number.
- 5.1.2.2 Size designations: as shown in Concrete Mixer Standards of Mixer Manufacturers Bureau of Associated General Contractors of America, Inc. in effect at time of manufacture of mixer.
- 5.1.3 If uniform concrete cannot be produced with maximum batch volume; reduce batch volume and/or increase mixing time.

5.2 Ready-mix:

- 5.2.1 Applies to either central plant-mixed concrete or central plant-proportioned, truck-mixed concrete.

5.2.2 Time lapse from addition of water until placing on subgrade: not to exceed 30 min. when concrete is hauled in nonagitating trucks; 1-1/2 hours when hauled in truck mixers or agitating trucks.

5.2.2.1 Provide reliable reset-revolution counter on truck mixer.

5.2.3 Place concrete in plastic and workable condition; do not retemper partially hardened concrete.

6. EQUIPMENT REQUIREMENTS

6.1 Batch or ready-mix plant: IDOT 2001.06, 2001.20 and 2001.21.

6.1.1 Automatic cut-off gates at cement batching scale not required.

6.1.2 Certified scales and measuring devices.

6.2 Concrete mixing equipment: IDOT 2001.21.

6.3 Forms, form-line excavating machine, consolidating and finishing equipment, slip form paving equipment and equipment for hand methods: IDOT 2301.03.A.3.

7. PAVEMENT CONSTRUCTION

7.1 Setting and removing forms:

7.1.1 Set forms accurately to required grade and alignment on properly compacted subgrade or subbase.

7.1.1.1 For forms to support mechanical subgrader, mechanical spreader, mechanical finisher or other similar heavy equipment, excavate with machine designed to shape subgrade for forms.

7.1.2 Set base of forms at or below subgrade elevation and with top of form at pavement surface elevation at edge of slab.

7.1.2.1 Extra height forms may be used to back up integral curb; set base at or below subgrade elevation and top of form at top of curb elevation.

Portland Cement Concrete Pavement

- 7.1.2.2 Comply with IDOT 2301.03.C for additional excavation and concrete if base of form is set below subgrade elevation.
- 7.1.3 Secure forms in place to maintain grade and alignment while concrete is placed and finished.
 - 7.1.3.1 If voids occur under forms, remove forms and bring subgrade to proper elevation as specified in EARTHWORK AND INCIDENTALS FOR PAVEMENT.
 - 7.1.3.2 Check form joints with 10' straight edge; adjust forms to proper grade and alignment.
- 7.1.4 If supporting soil becomes softened by rain or standing water so form is inadequately supported, reset form on suitable material before placing concrete.
- 7.1.5 Oil forms before concrete is placed; prevent adherence of concrete.
- 7.1.6 Leave side forms in place not less than 6 hours after concrete is placed.
 - 7.1.6.1 If form removal causes damage to concrete, leave remaining forms in place longer than 6 hours, as required.
- 7.1.7 Remove forms with care to prevent cracking, spalling or overstressing concrete; remove form stakes prior to raising forms.
- 7.1.8 Clean forms before resetting.
- 7.2 Concrete and steel placement:
 - 7.2.1 Uniformly moisten subgrade or place plastic film, specified hereinbefore, on prepared subgrade or subbase; lap plastic film 12", minimum.
 - 7.2.2 Adjust manholes and other castings within area to be paved to conform to finished surface; clean outside of casting.
 - 7.2.3 Place reinforcing, dowel and tie bars as shown on plans or specified; secure in position by approved method.

Portland Cement Concrete Pavement

- 7.2.4 Place concrete to full depth of pavement in single operation for plain pavement or pavement reinforced with deformed bars; do not pile concrete more than 8" above design elevation of surface.
 - 7.2.4.1 Allow no segregation of material when concrete is deposited on subgrade.
- 7.2.5 Carefully place concrete; minimize disturbance of reinforcement.
- 7.2.6 Vibrate; do not displace or distort reinforcement.
- 7.3 Finishing:
 - 7.3.1 Begin finishing operations promptly after concrete has been placed and consolidated.
 - 7.3.2 Screed surface to grade and crown shown on plans.
 - 7.3.3 Finish surface with 10' long lightweight float; finish from both sides simultaneously if pavement is placed to full width of street with one pass of paving machine; finish gutter area and curbs as specified hereinafter.
 - 7.3.4 Provide uniformly gritty surface with burlap; round edges of pavement to 1/8" radius.
 - 7.3.5 Check pavement surface with 10' long straightedge; maximum permissible deviation: 1/8"; grind high spots, over 1/8", with carborundum grinding wheel.
- 7.4 Integral curb:
 - 7.4.1 Construct 6" integral curb, as shown on SUDAS Standard Specifications Figure PV-102, along with pavement or immediately following finishing of pavement; use paving machine with integral slip-forms for curb, curb mule or similar mechanical equipment providing equivalent results.
 - 7.4.2 Construct depressed curb where sidewalks intersect street and at driveways constructed prior to pavement; use templates to form faces of such curbs.

Portland Cement Concrete Pavement

- 7.4.2.1 Mill and remove 6" integral curb at sidewalks and driveways constructed after pavement. Sidewalks to meet Americans with Disabilities Act (ADA) and Public Right of Way Access Guidelines (PROWAG).
- 7.4.3 Form and construct curb by hand only where barrier or depressed curb is required, where curb length is less than 150' and where small radii or other special sections preclude use of mechanical equipment. Curb cannot be paved in short sections just to meet the requirements above.
 - 7.4.3.1 Construct curb as rapidly as finishing operations on pavement permit; maximum distance behind paving machine: 100'.
 - 7.4.3.2 Remove free water, laitance, dust, leaves or other foreign matter prior to placing concrete for curb.
 - 7.4.3.3 Use freshly mixed concrete; do not store concrete in receptacles at side of street for use in curb at a later time; do not use concrete requiring retempering.
 - 7.4.3.4 Secure bond with paving slab and eliminate rock pockets.
 - 7.4.3.5 Forms: IDOT 2301.03.A.3.
- 7.4.4 Secure final finish on curbs by hand method, including 6' straight edge or 6' slipform.
- 7.4.5 Edge, protect and cure curb in same manner as pavement.
- 7.4.6 Check surfaces of curb and gutter with 10' straight-edge; correct variations greater than 1/8"; remove and replace curbs having varying cross section if directed by City.
- 7.4.7 Provide expansion joint in curb over expansion joint in pavement; saw cut face and top of curb to depth of 3" over contraction joint in pavement and seal as specified hereinafter.
- 7.4.8 If curb is damaged by subsequent construction operations, saw cut, remove and replace as shown on Standard Drawing. Minimum length replaced is length of curb and gutter panel.

Portland Cement Concrete Pavement

- 7.5 Construct joints as shown on Standard Drawings; seal as specified hereinafter.
 - 7.5.1 Round edges of concrete adjacent to header boards and expansion joint material to 1/8" radius.
 - 7.5.2 Provide supplemental vibration adjacent to header boards and expansion joint material as required.
 - 7.5.3 Begin saw cutting as soon as concrete can be sawed without objectionable tearing of sawed edges; complete such work under reasonable weather conditions within 18 hours after concrete is placed.
 - 7.5.4 For adverse weather, end of day's work or when 30 min. elapse between concrete placement, install header board and 3/4" smooth dowels 1'-3" long at 1'-0" spacing through header board; grease protruding ends prior to next concrete placement.
 - 7.5.5 'CD' joints shall be used in gutterline joints to within 12" of the back of the curb. Early entry saw cutting can be used for 'CD' joints.
 - 7.5.6 Keyway tie (KT) joints are not allowed without prior approval by City.
- 7.6 Seal all joints before pavement is opened to Contractor's forces or general traffic; seal only dry and clean joint surfaces; slightly under-fill joints, keep sealer off of adjacent pavement.
 - 7.6.1 Heat joint sealer to required temperature in thermostatically controlled heating kettle, do not overheat.

8. CURING AND PROTECTION

- 8.1 Apply liquid curing compound in fine spray to form continuous, uniform film on surface and vertical edges of pavement and curbs.
 - 8.1.1 Apply compound with power sprayer, operating at 40 psi or less; rate of application: 0.067 gal. per square yard (1 gal. per 15 SY); do not dilute compound.
 - 8.1.2 Apply to pavement surface after finishing and after surface moisture has disappeared; apply to pavement edges within 30 min. after forms are removed.

Portland Cement Concrete Pavement

8.2 Protect concrete pavement in place for less than 36 hours during cold weather as follows:

<u>Forecast or Actual Temperature</u>	<u>Protection</u>
35° to 32°F.	One layer burlap.
31° to 25°F.	One layer burlap under one layer plastic film.
Below 25°F.	Four layers burlap between layers of 4 mil plastic film.

8.2.1 Burlap: AASHTO M182, Class 3.

8.2.2 Commercial insulation blankets may be substituted for burlap when approved by City Engineering Department.

8.2.3 Protect insulation from disturbance by wind; leave in place for 5 days, minimum, or until pavement is opened to traffic.

8.2.4 Lap plastic film 18" at junctions.

8.2.5 Have materials available, near the worksite, for cold weather protection as specified for temperature below 25° F. for all concrete placed after November 15.

8.3 Concrete damaged by rain or freezing: remove and replace.

8.4 Protect concrete pavement during hot weather in accordance with SUDAS Standard Specifications Section 7010, Paragraph 3.05.A.2.

9. RESTRICTIONS

9.1 Weather:

9.1.1 Place no concrete when stormy or inclement weather prevents good workmanship, when subgrade is frozen, if air temperature is 38°F. or below or evaporation rate is 0.3 pounds per square foot per hour or greater; use no aggregates containing frozen lumps.

9.1.2 With favorable weather conditions, start paving operations when temperature of concrete delivered to subgrade is 40°F. or higher.

9.1.3 Continue paving operations as long as concrete temperature requirement is met and air temperature remains above 38°F.

9.2 Night operation:

9.2.1 Place no concrete when darkness prevents good workmanship in placing and finishing.

9.2.2 Unless specifically approved by City Engineering Department, do not place or finish concrete under artificial light.

9.3 Use of pavement:

9.3.1 Time for opening pavement for use will be determined by results of test on cylinders taken during concrete placement or from testing of in place concrete using IDOT IM383 maturity method; City Engineering Department reserves the right to require use of test cylinders only.

9.3.2 Pavement may be opened to Contractor's forces and light equipment after 7 days for purpose of removing coverings and building shoulders if tests of cylinders from section show compressive strength of 3,000 psi or higher.

9.3.3 Open pavement to general traffic when authorized by City Engineering Department.

9.3.4 Concrete placed in cold weather may require additional curing time, as directed by City Engineering Department; keep all vehicles off pavement until such curing time has been completed.

10. DEFECTS

10.1 Pavement containing fractures, spalls, more than one random crack per panel or other defects: remove and replace at no cost to City; rout and seal random cracks; saw cut and epoxy cement tie bars at 30" centers transverse to crack where crack is 1/8" or wider.

10.2 Water ponding deeper than 1/8" in gutter: remove and replace panel, or grind gutter in adjacent panels to drain; City reserves the right to select method of correcting defects at no cost to City.

10.3 Remove and replace pavement if mud or mud balls appear.

10.4 Pavement thickness: determined by random cores as determined by the City Engineering Department; one 4" dia. core taken for each section of approximately 1,000 SY with a minimum of 3 cores per project. Cores, if required to be taken, at no cost to City.

Portland Cement Concrete Pavement

- 10.5 Restore core holes by tamping non shrink cement grout into hole, finishing and texturing surface.
- 10.6 If concrete cores taken are less than the specified thickness, remove and replace pavement at no cost to City; deficient thickness pavement will not be accepted.
- 10.7 Area represented by each core is one-half of distance to next core or to end of pavement.
- 10.8 Additional core samples may be made and measured at Contractor's expense to determine the extent and severity of pavement deficiency; minimum distance between core samples: 100'.

11. DRIVEWAY APPROACH, SHARED USE PATHS AND SIDEWALK CONSTRUCTION

- 11.1 Conform to details shown on Standard Drawing for new driveway approaches and sidewalks; prepare subgrade as specified under EARTHWORK AND INCIDENTALS FOR PAVEMENT.
- 11.2 Constructed shared use paths and sidewalk drop curbs to meet Americans with Disabilities Act (ADA) and Public Right of Way Access Guidelines (PROWAG).
- 11.3 Construct drop curb in existing pavement for driveways as shown on Standard Drawing.
 - 11.3.1 Mill to provide smooth uniform surface for approach.
 - 11.3.2 Remove concrete curb and gutter section and replace with depressed curb as shown on Standard Drawing.
 - 11.3.3 Remove and replace unacceptable drop curbs as directed by City Engineering Department.
- 11.4 Concrete materials:
 - 11.4.1 Portland cement, admixtures, fine aggregate and water; as specified for pavement.
 - 11.4.2 Coarse aggregate: as specified for pavement.
- 11.5 Concrete mix: as specified for pavement for IDOT C-4 mix proportions; test in accordance with ASTM C39; 28 day compressive strength: 4,000 psi, minimum.

Portland Cement Concrete Pavement

- 11.6 Forms: use wood or steel forms adequately staked and braced for all exposed slab edges; secure forms in place to maintain grade and alignment while concrete is placed and finished.
 - 11.6.1 Set base of form at subgrade elevation or below with top of form at pavement surface elevation at edge of slab; set forms on properly compacted materials.
 - 11.6.2 Oil forms before concrete is placed.
 - 11.6.3 Leave forms in place not less than 24 hours after concrete is placed.
 - 11.6.4 Remove forms with care to prevent cracking, spalling or overstressing concrete.
 - 11.7 Concrete placement: as specified for pavement; provide supplemental vibration or spading at edges, joints and other areas where honeycombing may occur.
 - 11.8 Screed to uniform lines; finish surface with wood or cork float.
 - 11.9 Construct expansion joints as shown on Standard Drawing; seal joints after concrete has cured; use applicable materials specified for pavement expansion joints.
 - 11.10 Cure and protect driveway approaches and sidewalks as specified for pavement.
 - 11.11 Restrictions on construction and use of pavement apply to driveway approaches and sidewalks.
 - 11.12 Provide raised truncated dome concrete detectable warning panels at ramps in compliance with Americans with Disabilities Act (ADA) and Public Right of Way Access Guidelines (PROWAG). At each ramp location provide 2' wide strip, minimum 4' long measured parallel to curb and along back of curb; for wider ramps, extend warning panels full width of ramp; provide panels in brick red color; Armorcast, or equal.
12. PAVEMENT MARKINGS
- 12.1 Meet requirements of Section 2527, except method of measurement and basis of payment, of the IDOT Standard Specifications for Highway and Bridge Construction.

Portland Cement Concrete Pavement

12.2 Meet requirements of Manual on Uniform Traffic Control Devices (MUTCD).

12.3 Materials: durable paint pavement markings; IDOT 4183.04.

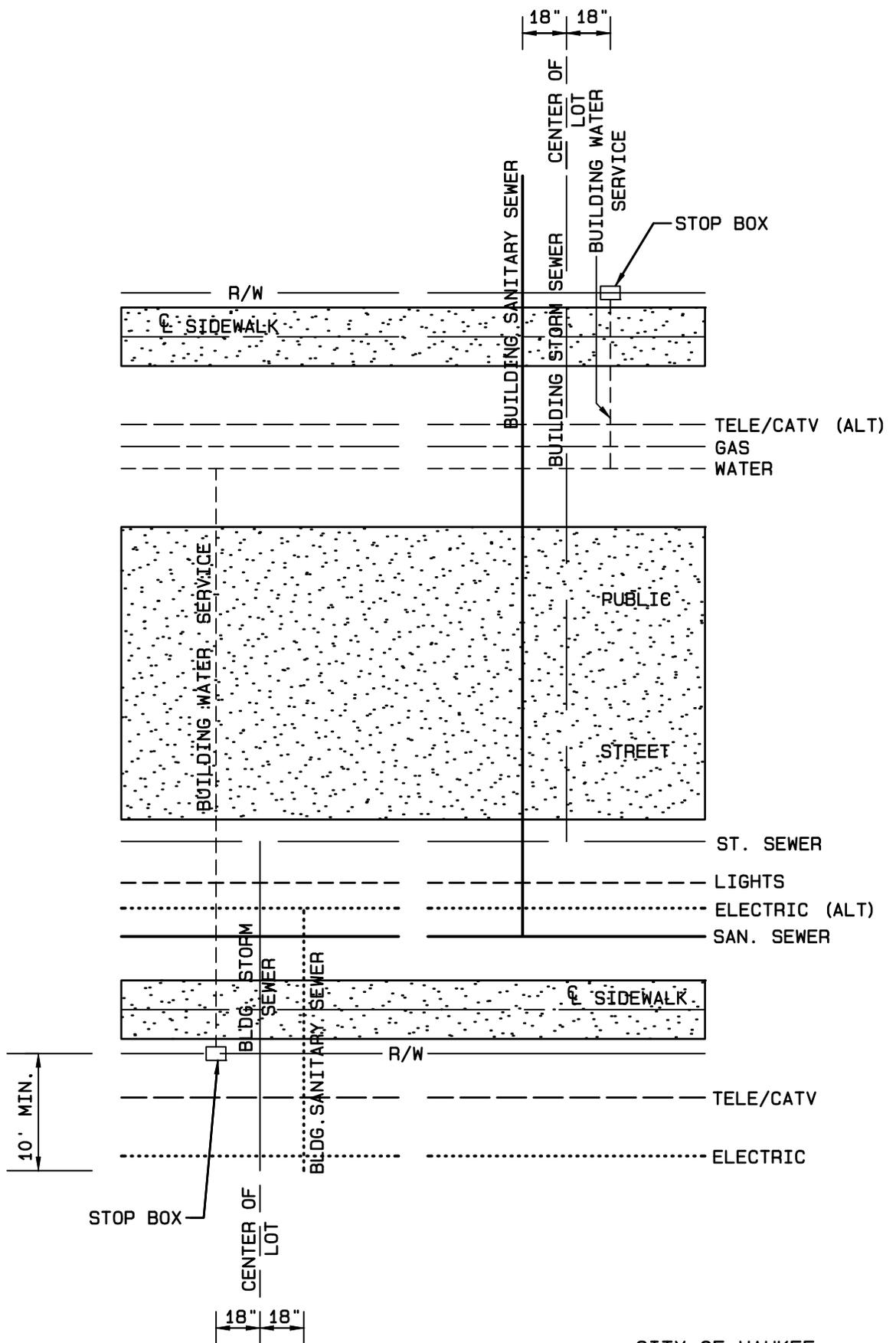
13. SHOULDERS

13.1 Install shoulders on rural section streets as shown on Standard Drawing.

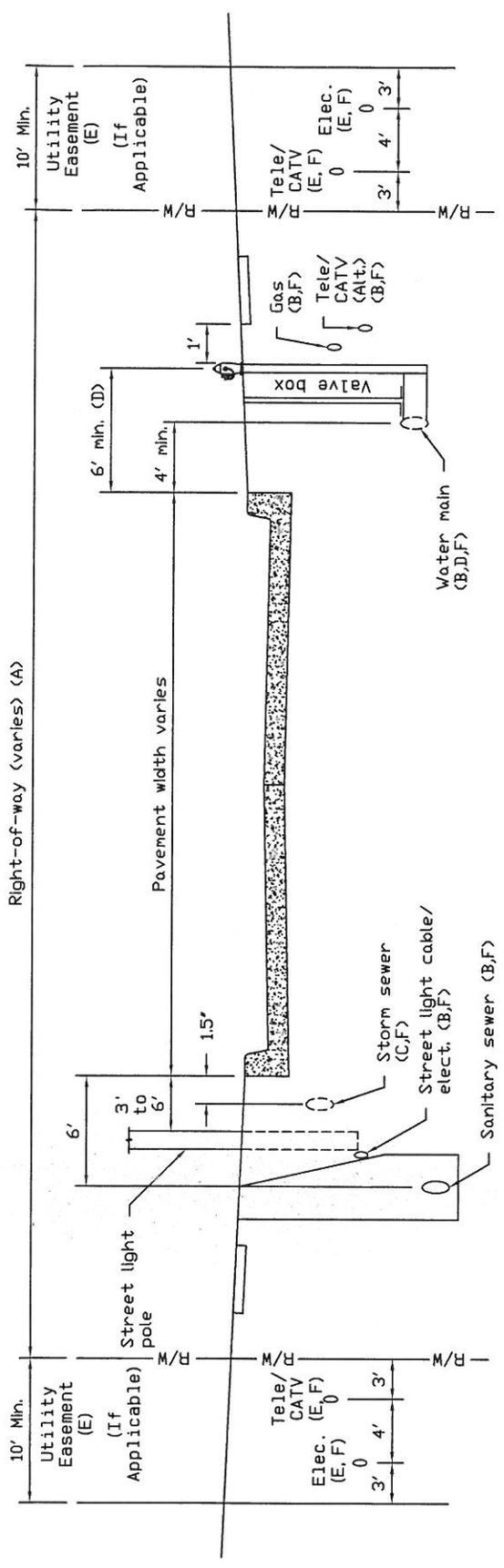
13.2 Conform to IDOT Class A crushed stone.

STANDARD DRAWINGS

<u>DRAWING</u> <u>NO.</u>	<u>TITLE</u>
1A	UTILITY SERVICE LOCATIONS
1B	UTILITY SERVICE LOCATIONS, REV. 1
2	GRANULAR ENCASEMENT STANDARD PVC PIPE BEDDING
3	CLASS C BEDDING – GRANULAR TYPE I
4	CLASS B BEDDING – GRANULAR TYPE II
5	CLASS A BEDDING - CONCRETE CRADLE TYPE V
6	CLASS A BEDDING - CONCRETE CRADLE
7	CLASS A BEDDING - CONCRETE ARCH TYPE VII
8	CLASS A BEDDING – CONCRETE ENCASEMENT TYPE VIII
9	HAND SHAPED TRENCH BOTTOM
10A	CREEK CROSSING FOR WATER MAIN
10B	CREEK CROSSING FOR SANITARY SEWER, REV. 1
11	SPECIAL MANHOLE
12	SHALLOW MANHOLE
13	OUTSIDE DROP CONNECTION
14	INSIDE DROP CONNECTION
15	RISER
16	TYPICAL PAVEMENT CROSS SECTION - 26' PAVEMENT
17	TYPICAL PAVEMENT CROSS SECTION - 29' PAVEMENT
18	TYPICAL PAVEMENT CROSS SECTION - 31' PAVEMENT
19	TYPICAL PAVEMENT CROSS SECTION - 41' PAVEMENT
20	REINFORCING - 26' PAVEMENT
21	REINFORCING - 29' PAVEMENT
22	REINFORCING - 31' PAVEMENT
23	CURB DETAILS
24	HEADER DETAILS
25	BURIED LUG DETAIL
26	DRIVEWAY APPROACH DETAIL - NEW PAVEMENT
27	DRIVEWAY APPROACH DETAIL - EXISTING PAVEMENT
28	CLUSTER MAILBOX PAD DETAIL
29	HEADWALL DETAIL
30	FLARED END SECTION FOOTING DETAIL
31	CONCRETE FLUME DETAIL
32	SERVICE CONNECTION, REV. 1
33	STANDARD VALVE MANHOLE
34	HYDRANT, REV. 1
35	THRUST BLOCK DETAILS
36	SUMP PUMP DRAIN LINES
37	SUBDRAINS, REV. 1
38A - 38D	SUBDIVISION LOT GRADING
39	TYPICAL RURAL PAVEMENT CROSS SECTION, REV. 1



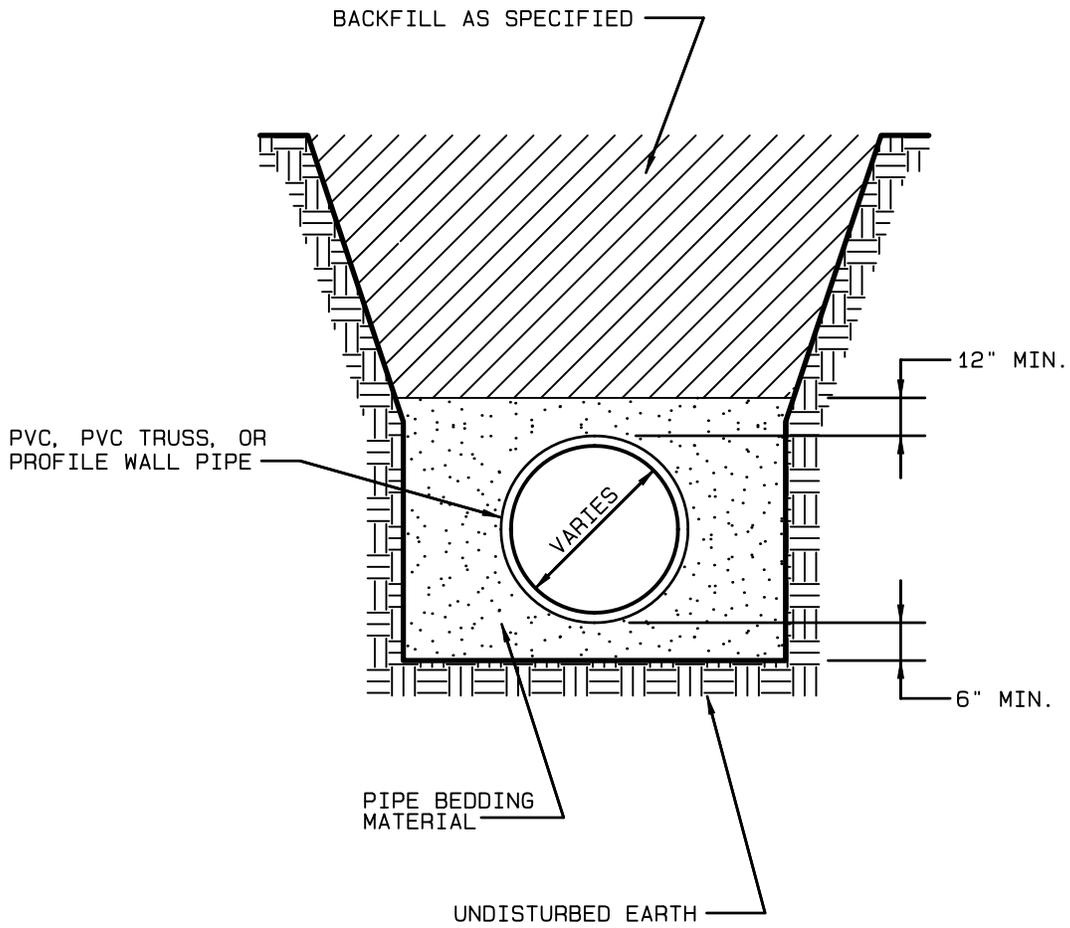
CITY OF WAUKEE
 UTILITY SERVICE LOCATIONS



Right-of-way (varies) (A)

GENERAL NOTES.

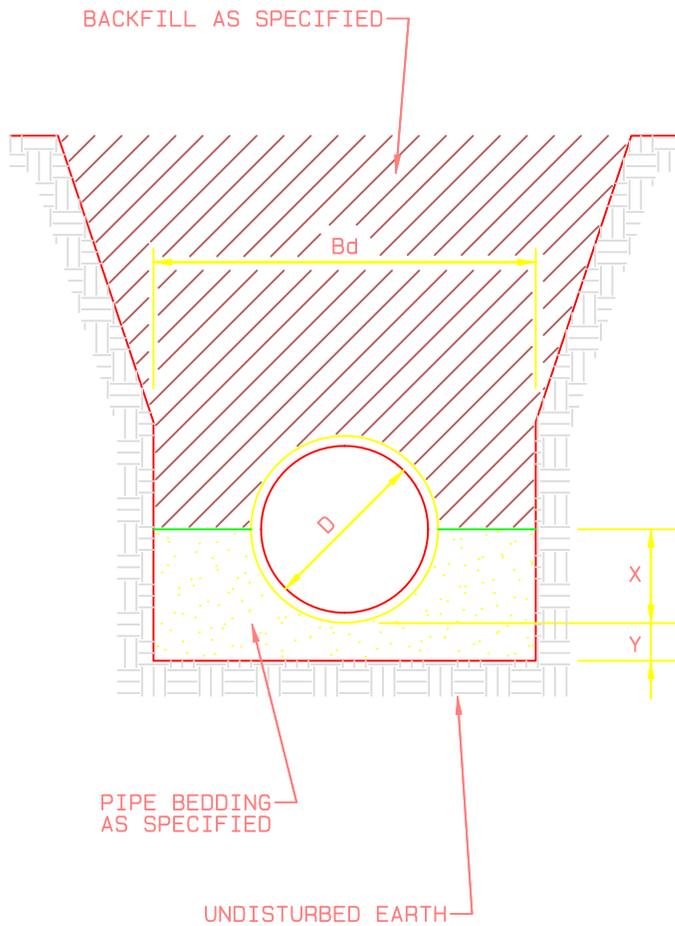
- A. ROW width varies.
- B. When utilities are in the ROW, the following should be adhered to utilities otherwise provided/approved:
 1. All utilities should be buried. When overhead utilities are allowed to cross the roadway, then minimum vertical clearances are 20 feet for the main cable, and 18 feet for services.
 2. Telephone, cable TV, and water: install on the east and south side of the road.
 3. Gas and electric: install on the west and north side of the road.
 4. Sanitary sewer: install on the west and north side of the road.
- C. Storm Sewers: The normal location for a storm sewer is 1.5 feet from back of curb. When combination manholes and intakes are used, the location increases to 5 feet.
- D. Water mains, Valves, and Hydrants:
 1. The normal water main location is 4 feet behind the back of curb. In areas of combination manholes and intakes, this distance is increased to a minimum of 6 feet.
 2. For local streets and minor collectors with limited ROW, use a 90° anchoring elbow between the hydrant tee and the valve. For maintenance purpose, the minimum distance between the centerline of the valve box and the face of the hydrant is 18 inches.
- E. Utility Easement: Telephone, fiber optic, cable TV, electric, and gas lines should be located in front or rear yard easements. Normally telephone and cable TV lines are placed in rear yard easements and fiber optic, electric, and gas lines in front yard easements. Upon approval of the jurisdiction, these utilities may be placed in the right of way at the alternative location when easements do not exist.
- F. Depth of bury:
 - Cable TV (CATV): 3 feet minimum.
 - Electric (Elec.): The recommended depth of bury for electric cable is 4 feet. The minimum depth of bury for electric lines as per the National Electric Safety Code is:
 - BkV to 5kV cable - 30 inches minimum.
 - Up to 600-volt cable - 24 inches minimum.
 - Street light cable - 18 inches minimum.
 - Gas: 3 feet minimum.
 - Water: varies.
 - Sanitary Sewer: Varies
 - Storm sewer: Varies
 - Telephone (Tele./Fiber optic (F.O.): 3 feet minimum.



NOTE

1. EXCAVATED MATERIAL FOR BACKFILL, WHEN SPECIFIED: FINELY DIVIDED MATERIAL FREE FROM DEBRIS, STONES, ORGANIC MATTER OR FROZEN LUMPS.

CITY OF WAUKEE
 GRANULAR ENCASEMENT
 STANDARD PVC PIPE BEDDING



D (INCHES)	Bd (FEET & INCHES)	X (INCHES)	Y (INCHES)
4	2-0	2	4
6	2-0	3	4
8	2-3	3	4
10	2-3	4	4
12	2-3	5	4
15	2-9	6	4
18	3-0	7	5
21	3-3	8	6
24	3-6	9	6
27	4-0	10	7
30	4-3	11	8
36	4-9	13	9
42	5-6	15	10
48	6-3	17	12
54	7-0	20	14
60	7-9	22	15
66	8-6	24	15
72	9-3	26	15
78	10-0	28	15
84	10-9	30	15

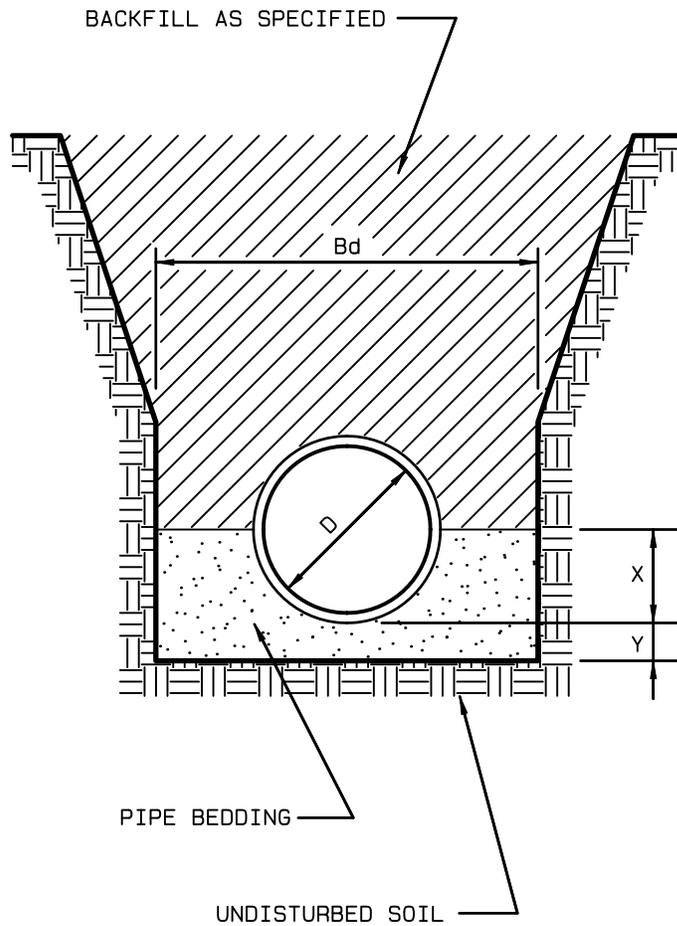
NOTES

1. EXCAVATED MATERIAL FOR BACKFILL, WHEN SPECIFIED: FINELY DIVIDED MATERIAL FREE FROM DEBRIS, STONES, ORGANIC MATTER OR FROZEN LUMPS; PIPE BEDDING OR SAND MAY BE USED AS SUBSTITUTE.
2. Bd = STANDARD TRENCH WIDTH AT TOP OF PIPE.
3. SEE SPECIFICATIONS FOR LIMITATIONS ON USE OF THIS TYPE OF BEDDING.
4. LOAD FACTOR: 1.5

CITY OF WAUKEE

CLASS C BEDDING - GRANULAR
TYPE I - LOAD FACTOR: 1.5

STD. DWG. NO. 3



D (INCHES)	Bd (FEET & INCHES)	X (INCHES)	Y (INCHES)
4	2-0	3	4
6	2-0	4	4
8	2-3	5	4
10	2-3	6	5
12	2-3	8	6
15	2-9	10	6
18	3-0	12	6
21	3-3	14	6
24	3-6	15	6
27	4-0	17	7
30	4-3	19	8
36	4-9	22	9
42	5-6	26	10
48	6-3	29	12
54	7-0	33	14
60	7-9	36	15
66	8-6	40	15
72	9-3	43	15
78	10-0	47	15
84	10-9	50	15

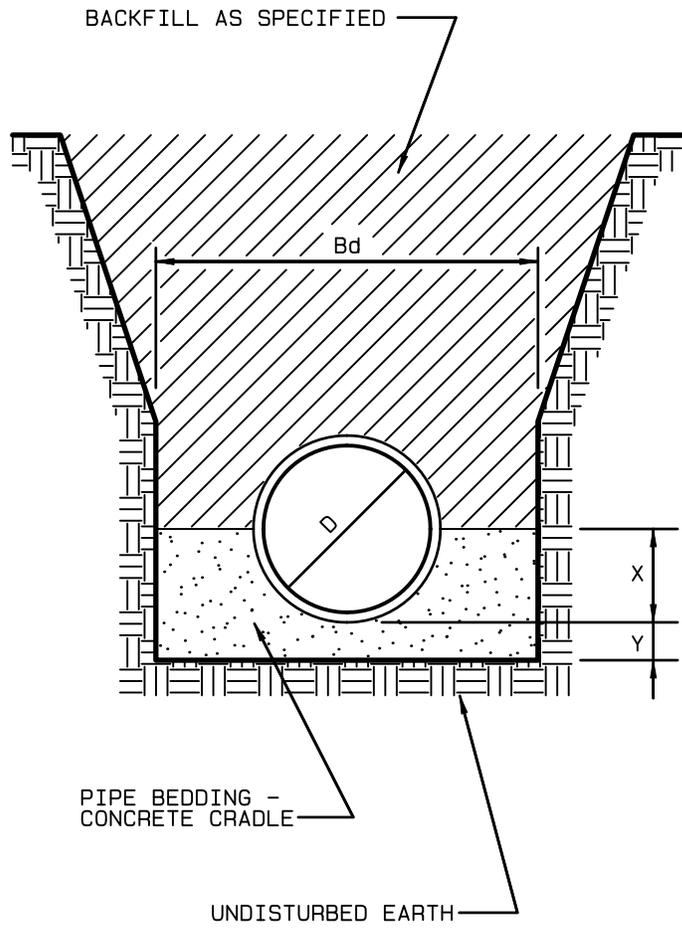
NOTES

1. EXCAVATED MATERIAL FOR BACKFILL, WHEN SPECIFIED: FINELY DIVIDED MATERIAL FREE FROM DEBRIS, STONES, ORGANIC MATTER OR FROZEN LUMPS; PIPE BEDDING MAY BE USED AS SUBSTITUTE.
2. Bd = STANDARD TRENCH WIDTH AT TOP OF PIPE.
3. SEE SPECIFICATIONS FOR LIMITATIONS ON USE OF THIS TYPE OF BEDDING.

CITY OF WAUKEE

CLASS B BEDDING - GRANULAR
TYPE II - LOAD FACTOR: 1.9

STD. DWG. NO. 4



D (INCHES)	Bd (FEET & INCHES)	X (INCHES)	Y (INCHES)
4	2-6	3	4
6	2-6	4	4
8	2-6	5	4
10	2-6	6	4
12	2-6	8	4
15	2-9	10	4
18	3-0	12	5
21	3-3	14	5
24	3-6	15	6
27	4-0	17	6
30	4-3	19	6
36	4-9	22	8
42	5-6	26	8
48	6-3	29	9
54	7-0	33	10
60	7-9	36	11
66	8-6	40	12
72	9-3	43	12
78	10-0	47	12
84	10-9	50	12
90	11-6	53	12
96	12-0	57	12

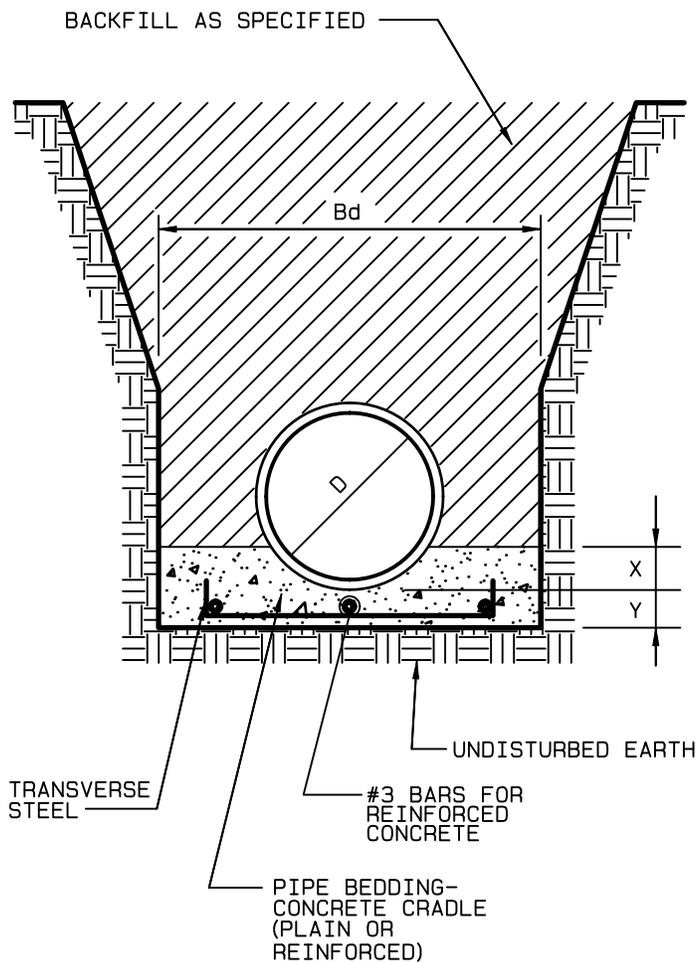
NOTES

1. EXCAVATED MATERIAL FOR BACKFILL, WHEN SPECIFIED: FINELY DIVIDED MATERIAL FREE FROM DEBRIS, STONES, ORGANIC MATTER OR FROZEN LUMPS; PIPE BEDDING MAY BE USED AS SUBSTITUTE.
2. MINIMUM CONCRETE COMPRESSIVE STRENGTH: 2500 PSI.
3. POUR CRADLE FULL WIDTH OF TRENCH EXCEPT FOR 4" & 6" PIPE.
4. CRADLE WIDTH FOR 4" & 6" PIPE: 16"
5. Bd = STANDARD TRENCH WIDTH AT TOP OF PIPE.
6. SEE SPECIFICATIONS FOR LIMITATIONS ON USE OF THIS TYPE OF BEDDING.
7. PROVIDE MINIMUM OF 2 TEMPORARY PIPE SUPPORTS UNDER BARREL PER PIPE LENGTH; PROVIDE TIES AND BRACES TO PREVENT DISPLACEMENT OR FLOTATION DURING BEDDING OR ENCASEMENT PROCEDURES.
8. LOAD FACTOR: 2.8.

CITY OF WAUKEE

CLASS A BEDDING - CONCRETE CRADLE
TYPE V - LOAD FACTOR: 2.8

STD. DWG. NO. 5



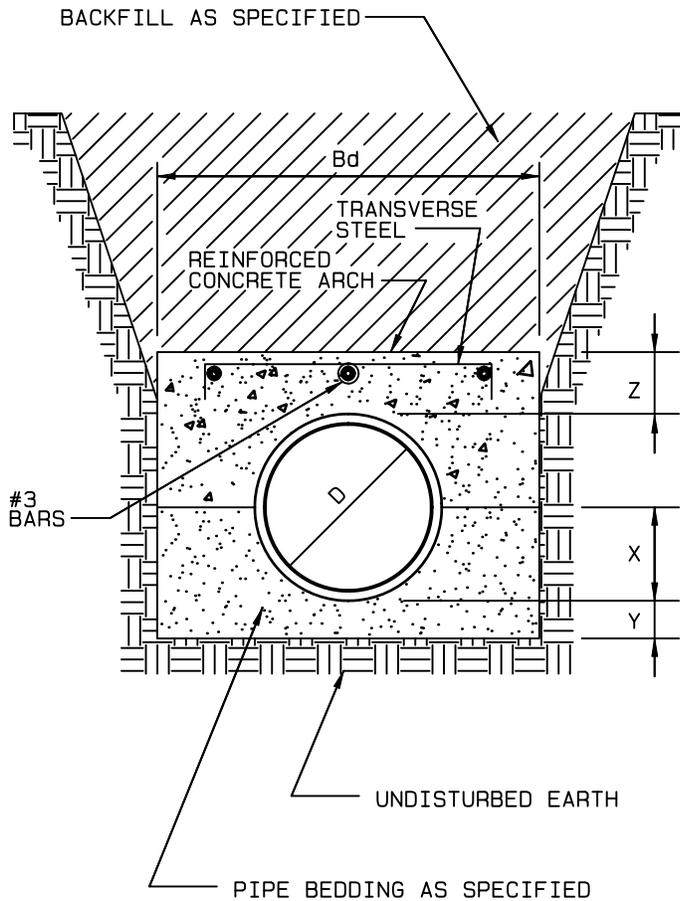
D (INCHES)	Bd (FEET & INCHES)	X (INCHES)	Y (INCHES)	TRANS. STEEL SPACING (INCHES)	TRANS. STEEL BAR SIZE
4	2-6	2	4	12	#4
6	2-6	2	4	12	#4
8	2-6	3	4	12	#4
10	2-6	3	5	10	#4
12	2-6	4	6	8	#4
15	2-9	5	6	8	#4
18	3-0	6	6	8	#4
21	3-3	7	6	8	#4
24	3-6	8	6	8	#4
27	4-0	9	7	7	#4
30	4-3	10	8	6	#4
36	4-9	11	9	12	#6
42	5-6	13	10	11	#6
48	6-3	15	12	9	#6
54	7-0	16	14	8	#6
60	7-9	18	15	10	#7
66	8-6	20	15	10	#7
72	9-3	22	15	10	#7
78	10-0	23	15	10	#7
84	10-9	25	15	10	#7
90	11-6	27	15	10	#7
96	12-0	29	15	10	#7

NOTES

1. DESCRIPTION OF BEDDING TYPES:
 - 1.1 TYPE III: PLAIN CONCRETE WITH HAND TAMPED BACKFILL.
 - 1.2 TYPE IV: PLAIN CONCRETE WITH CAREFULLY HAND TAMPED BACKFILL.
 - 1.3 TYPE VI: REINFORCED CONCRETE.
2. EXCAVATED MATERIAL FOR BACKFILL, WHEN SPECIFIED: FINELY DIVIDED MATERIAL FREE FROM DEBRIS, STONES, ORGANIC MATTER OR FROZEN LUMPS; PIPE BEDDING MAY BE USED AS SUBSTITUTE.
3. MINIMUM CONCRETE COMPRESSIVE STRENGTH: 2500 PSI.
4. POUR CRADLE FULL WIDTH OF TRENCH EXCEPT FOR 4" & 6" PIPE.
5. CRADLE WIDTH FOR 4" & 6" PIPE: 16".
6. Bd = STANDARD TRENCH WIDTH AT TOP OF PIPE.
7. SEE SPECIFICATIONS FOR LIMITATIONS ON USE OF THESE TYPES OF BEDDING.
8. PROVIDE MINIMUM OF 2 TEMPORARY PIPE SUPPORTS UNDER BARREL PER PIPE LENGTH; PROVIDE TIES AND BRACES TO PREVENT DISPLACEMENT OR FLOTATION DURING BEDDING OR ENCASEMENT PROCEDURES.
9. LOAD FACTORS:
 - TYPE III: 2.2
 - TYPE IV: 2.4
 - TYPE VI: 3.4

CITY OF WAUKEE

CLASS A BEDDING - CONCRETE CRADLE
 TYPE III - LOAD FACTOR: 2.2
 TYPE IV - LOAD FACTOR: 2.4
 TYPE VI - LOAD FACTOR: 3.4



D (INCHES)	Bd (FEET & INCHES)	X (INCHES)	Y (INCHES)	Z (INCHES)	TRANS. STEEL SPACING (INCHES)	TRANS. STEEL BAR SIZE
4	2-6	3	4	4	11	#6
6	2-6	4	4	4	11	#6
8	2-6	5	6	4	11	#6
10	2-6	6	6	4	11	#6
12	2-6	8	6	4	11	#6
15	2-9	10	6	4	11	#6
18	3-0	12	6	5	12	#7
21	3-3	13	7	5	12	#7
24	3-6	15	8	6	10	#7
27	4-0	17	9	7	10	#7
30	4-3	19	9	8	10	#8
36	4-9	22	11	9	8	#8
42	5-6	26	12	10	8	#8
48	6-3	29	15	12	6	#8
54	7-0	33	16	14	9	#10
60	7-9	36	18	15	8	#10
66	8-6	40	20	16	8	#10
72	9-3	43	22	18	7	#10
78	10-0	47	24	20	6	#10
84	10-9	50	24	21	6	#10
90	11-6	53	24	23	6	#10
96	12-0	57	24	25	5	#10

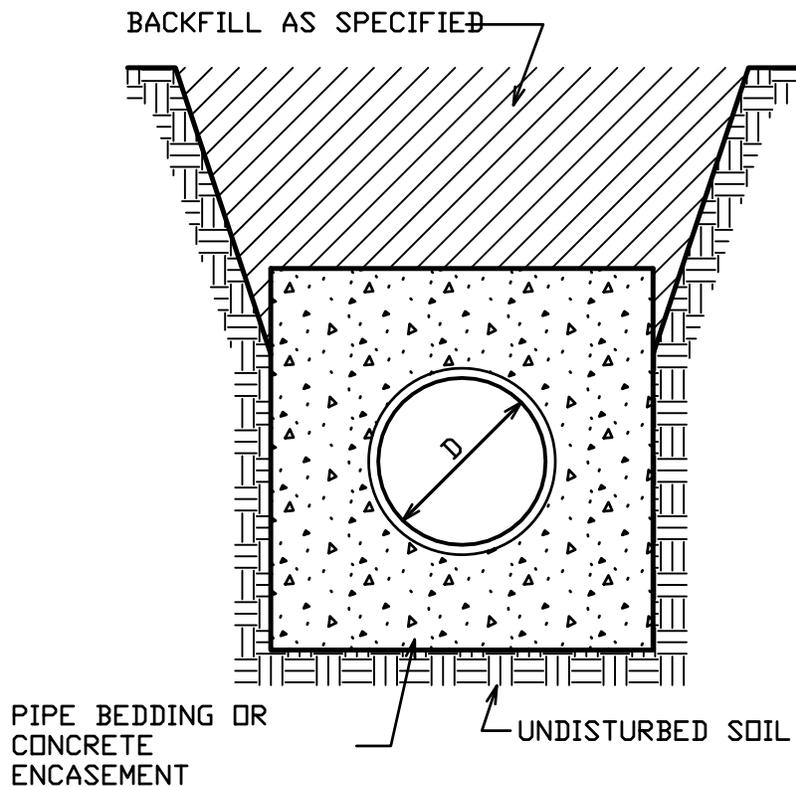
NOTES

1. EXCAVATED MATERIAL FOR BACKFILL, WHEN SPECIFIED: FINELY DIVIDED MATERIAL FREE FROM DEBRIS, STONES, ORGANIC MATTER OR FROZEN LUMPS; PIPE BEDDING MAY BE USED AS SUBSTITUTE.
2. MINIMUM CONCRETE COMPRESSIVE STRENGTH: 2500 PSI.
3. POUR ARCH FULL WIDTH OF TRENCH EXCEPT FOR 4" & 6" PIPE.
4. ARCH WIDTH FOR 4" & 6" PIPE: 16".
5. Bd = STANDARD TRENCH WIDTH AT TOP OF PIPE.
6. SEE SPECIFICATIONS FOR LIMITATIONS ON USE OF THIS TYPE OF BEDDING.
7. LOAD FACTOR: 4.8

CITY OF WAUKEE

CLASS A BEDDING - CONCRETE ARCH
TYPE VII - LOAD FACTOR: 4.8

STD.DWG.NO.7



NOTES:

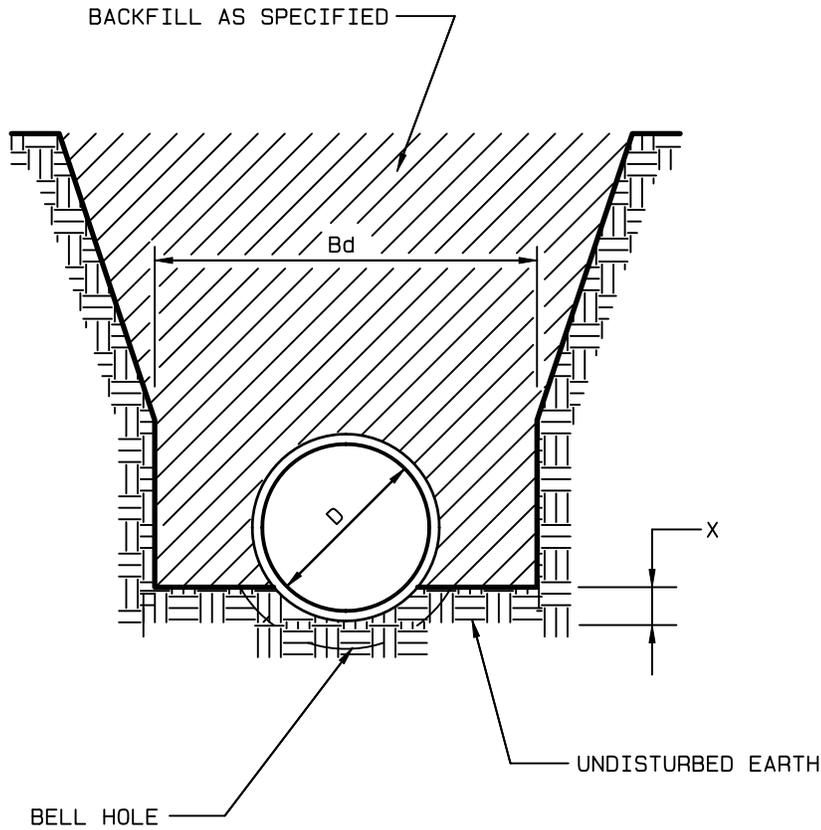
1. EXCAVATED MATERIAL FOR BACKFILL, WHEN SPECIFIED: FINELY DIVIDED MATERIAL FREE FROM DEBRIS, STONES, ORGANIC MATTER OR FROZEN LUMPS; PIPE BEDDING OR SAND MAY BE USED AS SUBSTITUTE.
2. MINIMUM CONCRETE COMPRESSIVE STRENGTH: 2,500 PSI
3. PROVIDE MINIMUM CONCRETE COVER OF 8" AT PIPE EXTREMITIES. TRENCH WALLS MAY BE USED TO FORM CONCRETE.
4. REINFORCE, AS SPECIFIED, TO DEVELOP REQUIRED LOAD FACTOR.
5. CONCRETE ENCASEMENT: USE WHERE SHOWN ON PLANS OR AS DIRECTED BY ENGINEERING DEPARTMENT.
6. MAKE PIPE JOINT IN SAME MANNER SPECIFIED FOR PIPE NOT ENCASED.
7. PROVIDE MINIMUM OF 2 TEMPORARY PIPE SUPPORTS UNDER BARREL PER PIPE LENGTH; PROVIDE TIES AND BRACES TO PREVENT DISPLACEMENT OR FLOTATION DURING BEDDING OR ENCASEMENT PROCEDURES.
8. DO NOT USE WITH PVC PIPE.

CITY OF WAUKEE

CLASS A BEDDING -
CONCRETE ENCASEMENT
TYPE VIII

STD.DWG.NO.8

D (INCHES)	Bd (FEET & INCHES)	X (INCHES)
4	2-6	1
6	2-6	1
8	2-6	1½
10	2-6	2
12	2-6	2½
15 & 16	2-9	3
18	3-0	3½
21	3-3	4
24	3-6	4½
27	4-0	5
30	4-3	5½
36	4-9	6½
42	5-6	7½
48	6-3	8½
54	7-0	9½
60	7-9	10½
66	8-6	11½
72	9-3	12½
78	10-0	13½
84	10-9	14½



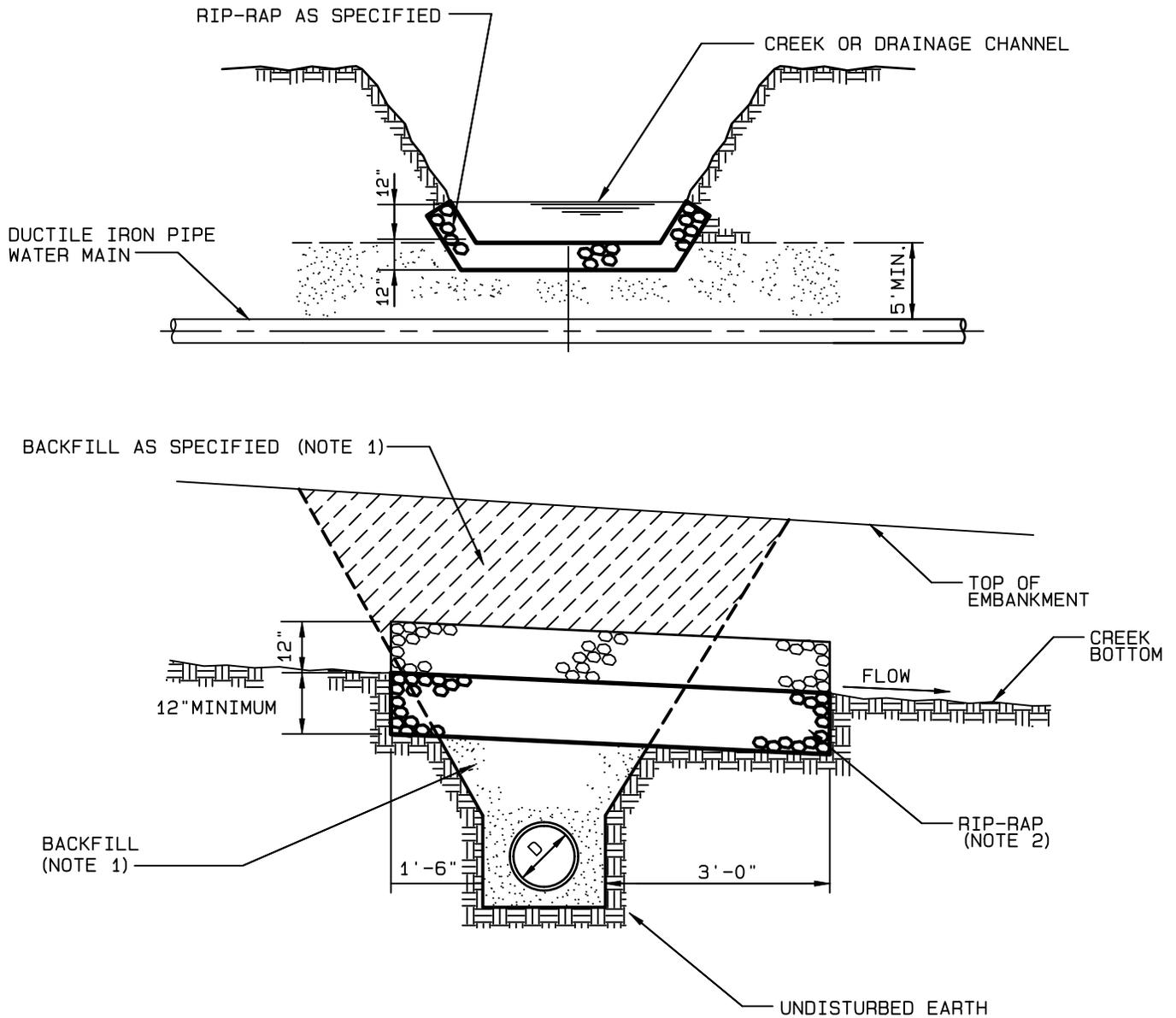
NOTES

1. EXCAVATED MATERIAL FOR BACKFILL, WHEN SPECIFIED: FINELY DIVIDED MATERIAL FREE FROM DEBRIS, STONES, ORGANIC MATTER OR FROZEN LUMPS.
2. Bd = STANDARD TRENCH WIDTH AT TOP OF PIPE.
3. X = MINIMUM DEPTH OF DEPRESSION SO THAT PIPE BARREL BEARS UNIFORMLY AGAINST UNDISTURBED EARTH FOR 1/4 OF ITS CIRCUMFERENCE; HAND SHAPE BELL HOLES BELOW "X" DIMENSION.
4. SEE SPECIFICATIONS FOR LIMITATIONS ON USE OF THIS TYPE OF BEDDING.

CITY OF WAUKEE

HAND SHAPED TRENCH BOTTOM

STD. DWG. NO. 9

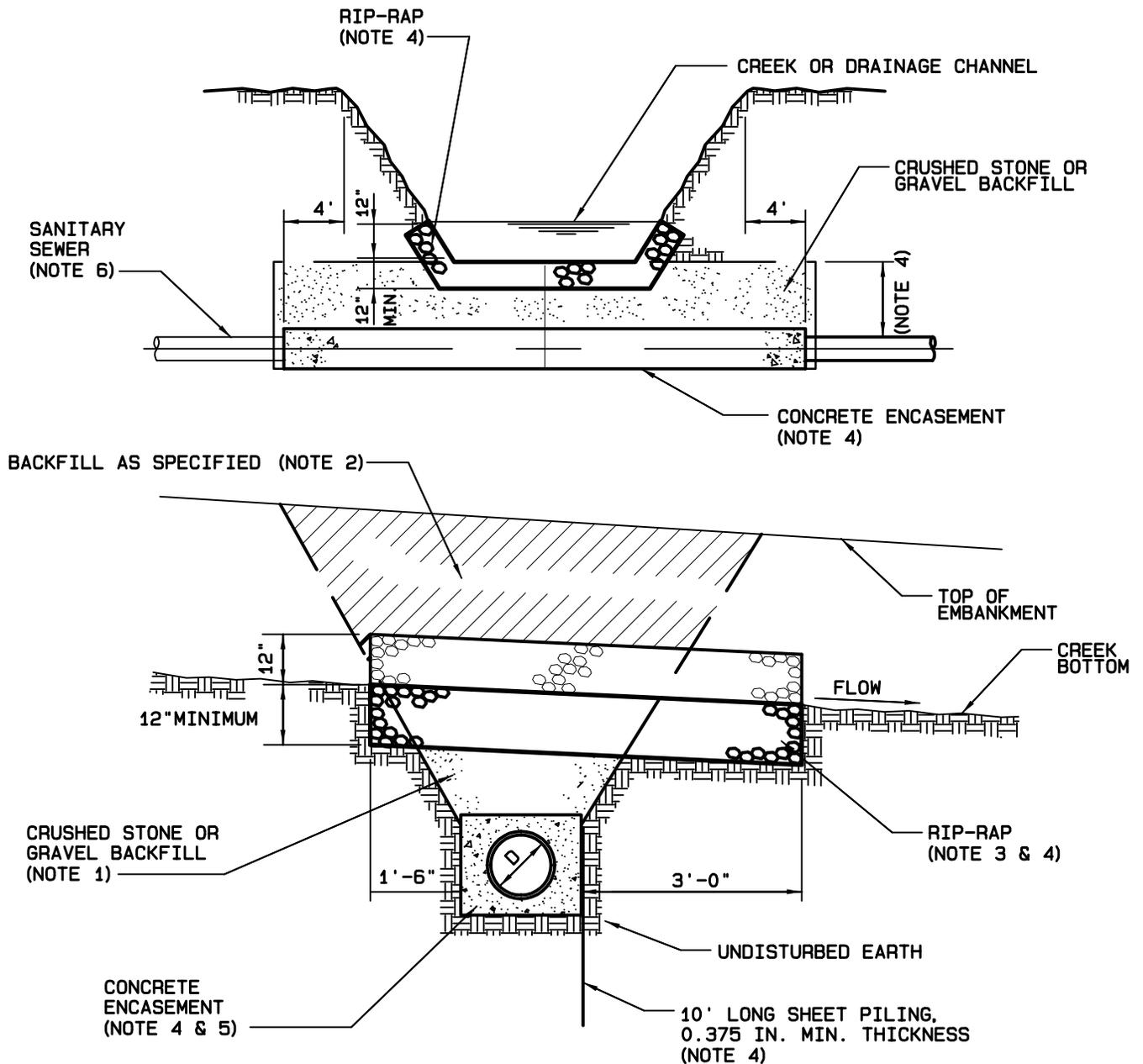


NOTES

1. BACKFILL: FINELY DIVIDED EXCAVATED MATERIAL: FREE FROM DEBRIS, STONES, ORGANIC MATTER OR FROZEN LUMPS.
2. BACKFILL BELOW CREEK OR DRAINAGE CHANNEL BED; RIP-RAP USING FOLLOWING MIXTURE;

% OF TOTAL WEIGHT	WEIGHT OF PIECES IN POUNDS
45	200 TO 400
40	15 TO 125
15	LESS THAN 15
3. WHERE CREEK GREATER THEN 15' IN WIDTH: PROVIDE GATE VALVE BEFORE AND AFTER CREEK CROSSING. FOR VALVE CLOSEST TO WATER SOURCE, INSTALL VALVE IN STANDARD VALVE MANHOLE WITH 1" TAPS WITH BALL VALVE BEFORE AND AFTER VALVE.

CITY OF WAUKEE
CREEK CROSSING FOR WATER MAIN



NOTES

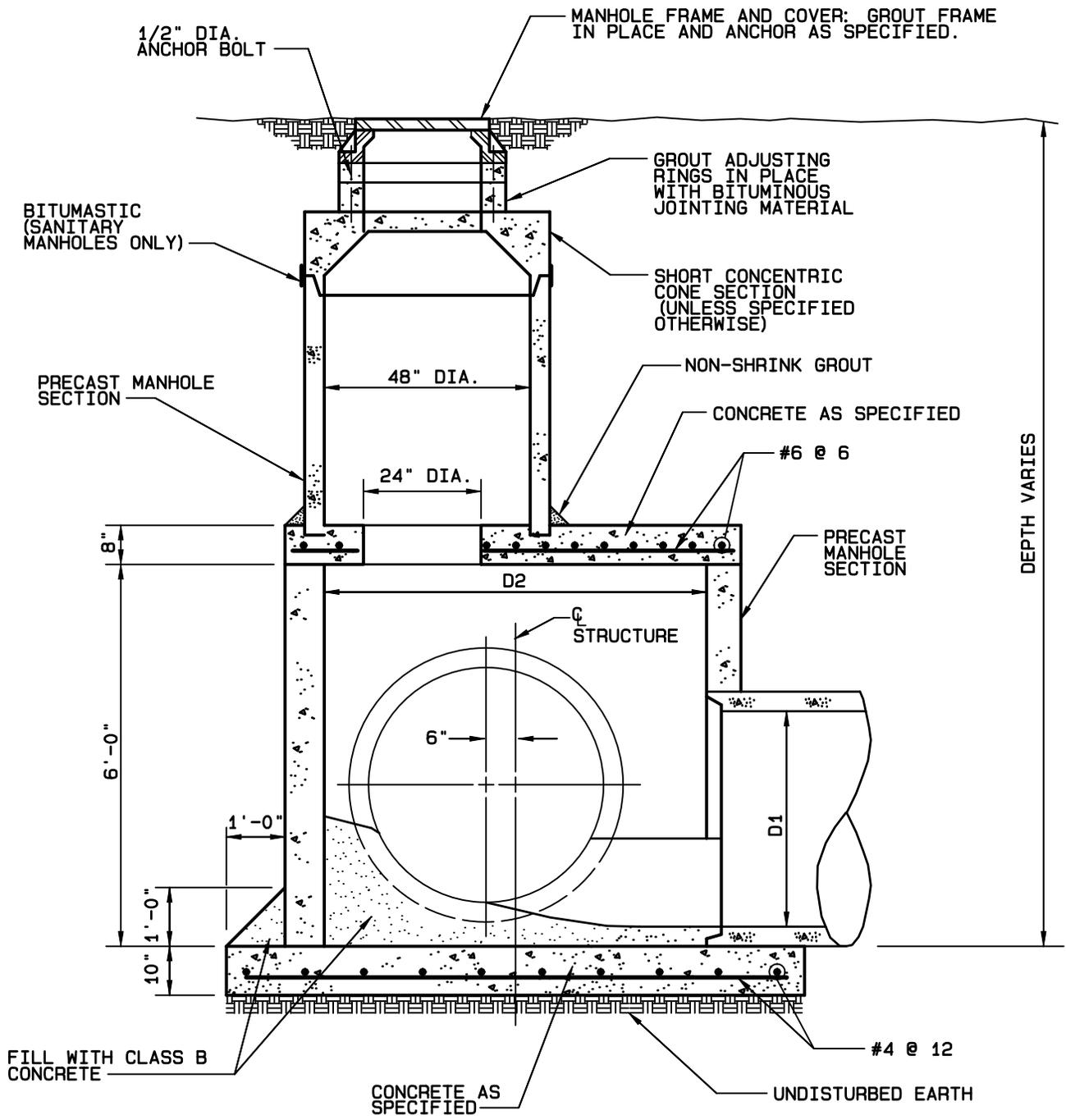
1. BACKFILL ONE FOOT BELOW CREEK OR DRAINAGE CHANNEL BED: CRUSHED STONE OR GRAVEL.
2. BACKFILL ABOVE CREEK OR DRAINAGE CHANNEL BED: FINELY DIVIDED EXCAVATED MATERIAL: FREE FROM DEBRIS, STONES, ORGANIC MATTER OR FROZEN LUMPS.
3. BACKFILL BELOW CREEK OR DRAINAGE CHANNEL BED; RIP-RAP USING FOLLOWING MIXTURE;

% OF TOTAL WEIGHT	WEIGHT OF PIECES IN POUNDS
45	200 TO 400
40	15 TO 125
15	LESS THAN 15
4. 1' MINIMUM FROM CREEK OR DRAINAGE CHANNEL BED TO TOP OF CONCRETE IF CONCRETE ENCASUREMENT, SHEETING AND RIP-RAP ARE USED. 4' MINIMUM FROM CREEK OR DRAINAGE CHANNEL BED TO TOP OF PIPE IF CONCRETE ENCASUREMENT IS NOT USED. 10' MINIMUM FROM CREEK OR DRAINAGE CHANNEL BED TO TOP OF PIPE IF SHEETING AND RIP-RAP ARE NOT USED.
5. FOR CONCRETE ENCASUREMENT SEE STD. DWG. FOR CLASS A BEDDING-CONCRETE ENCASUREMENT TYPE VIII.
6. USE DUCTILE IRON PIPE WHERE PIPE ENCASED IN CONCRETE OR WHERE SEWER CROSSES STREAM. DUCTILE IRON PIPE NOT REQUIRED WHERE SEWER CROSSES DRAINAGE CHANNEL AND WHERE SEWER DEPTH PRECLUDES CONCRETE ENCASUREMENT REQUIREMENT.
7. INSTALL COMPACTED CLAY WATERSTOP DOWNSTREAM OF CREEK OR DRAINAGE CHANNEL. SEE SUDAS STANDARD SPECIFICATIONS FIGURE SW-105.

CITY OF WAUKEE

CREEK CROSSING FOR SANITARY SEWER

STD. DWG. NO. 10B REV. 1



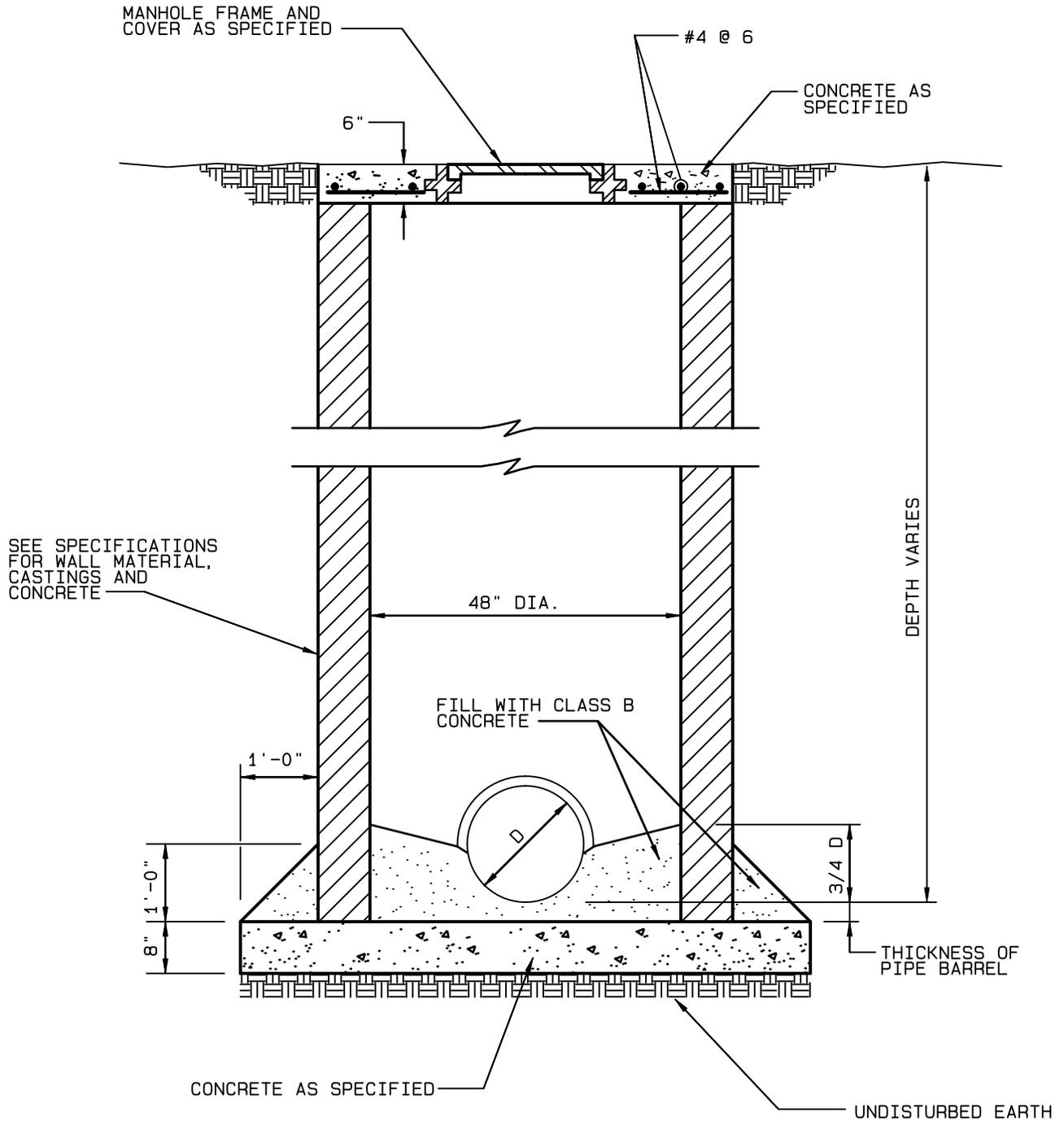
NOTES

1. SLOPE CONCRETE FILL 1/4 D1 MINIMUM TO INVERT OF OUTLET PIPE.
2. FOR PIPES LARGER THAN 48" USE TEE SECTION MANHOLE. USE CURVED PIPE IF SEWER CHANGES DIRECTION.
3. PROVIDE MANHOLE STEPS FOR SANITARY MANHOLE ONLY. IF SPECIFIED.
4. SET MANHOLE COVER FLUSH WITH GROUND UNLESS SHOWN OR SPECIFIED OTHERWISE.
5. FOR SANITARY SEWERS, PROVIDE JOINT IN ALL PIPES WITHIN 2' OF MANHOLE WALL OR FLEXIBLE GASKET IN MANHOLE WALL.
6. IF JOINTS ARE PROVIDED FOR SANITARY SEWERS OR MANHOLE IS USED FOR STORM SEWER, GROUT PIPE IN BLOCKOUT WITH NON-SHRINK GROUT.
7. PROVIDE CHIMNEY SEAL ALL SANITARY MANHOLES.

<u>DIAMETER D2</u>	<u>MAXIMUM D1</u>
60"	36"
66"	42"
78"	48"

CITY OF WAUKEE

SPECIAL MANHOLE



NOTES

1. USE FOR MANHOLES LESS THAN 6' IN DEPTH.
2. PROVIDE MANHOLE STEPS IF SPECIFIED.
3. SET MANHOLE COVER FLUSH WITH GROUND UNLESS SHOWN OR SPECIFIED OTHERWISE.
4. FOR SANITARY SEWERS, PROVIDE JOINT IN ALL PIPES WITHIN 2' OF MANHOLE WALL OR FLEXIBLE GASKET IN MANHOLE WALL.
5. IF JOINTS ARE PROVIDED FOR SANITARY SEWERS, OR PRECAST MANHOLE SECTION IS USED FOR STORM SEWERS, GROUT PIPE IN BLOCKOUT WITH NON-SHRINK GROUT.

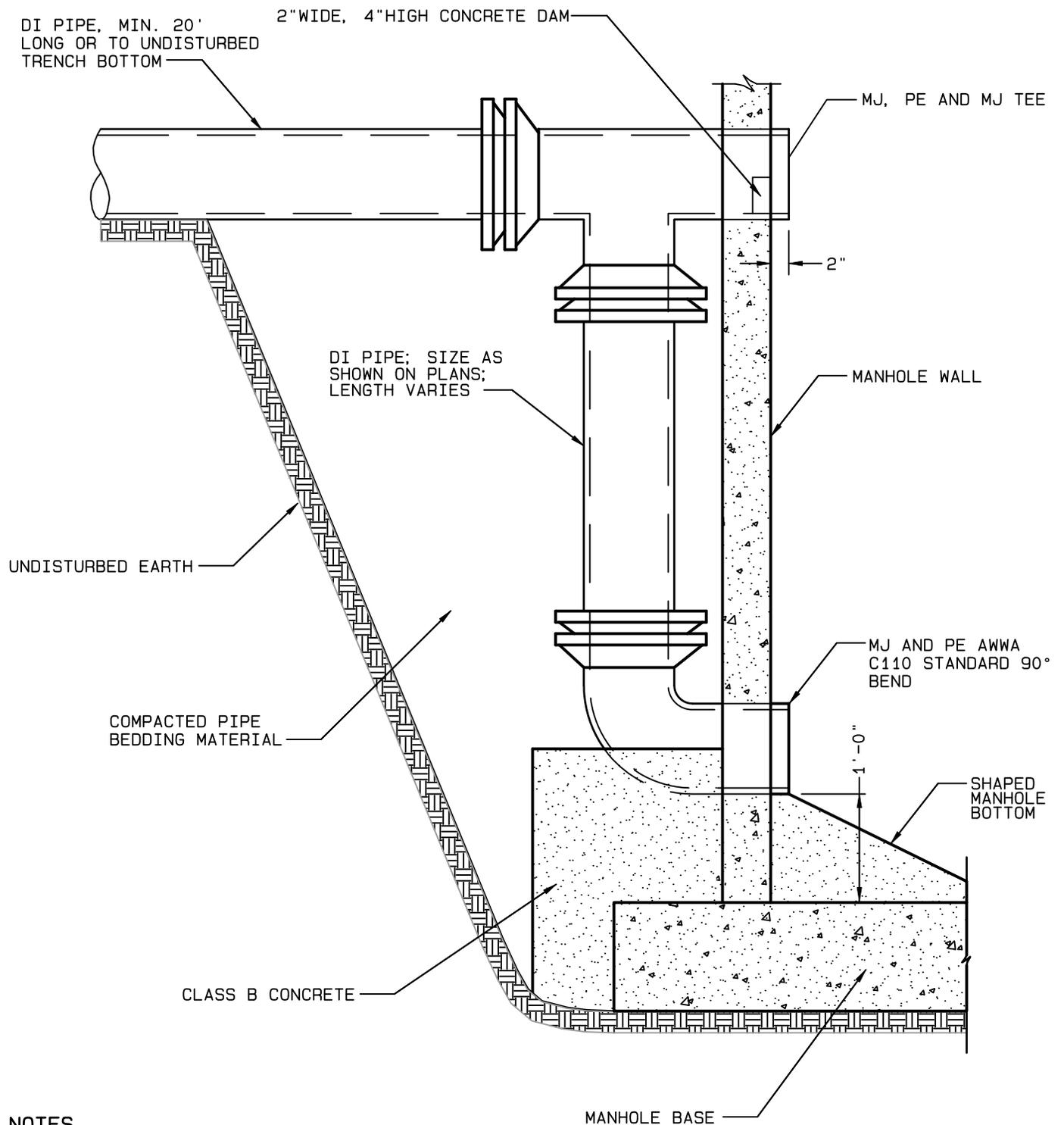
MAXIMUM D

27"

CITY OF WAUKEE

SHALLOW MANHOLE

STD. DWG. NO. 12



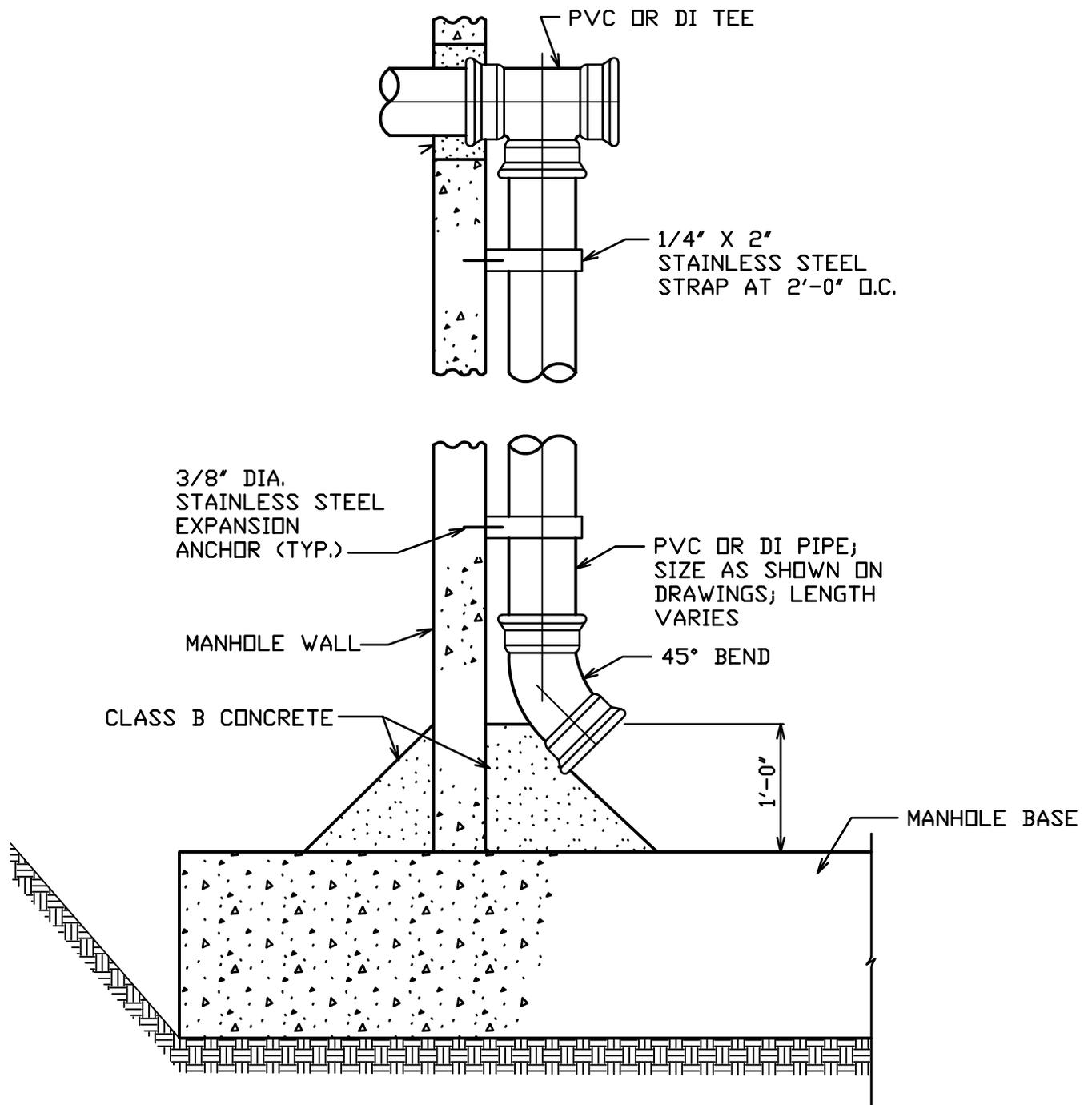
NOTES

1. EXTEND CLASS B CONCRETE SUPPORT FOR MJ AND PE QUARTER BEND 8" ALL SIDES.
2. USE ANSI A21.50 DUCTILE IRON PIPE; MINIMUM THICKNESS CLASS 52; COAT WITH STANDARD COATING INSIDE AND OUT.
3. USE ANSI A21.10 MECHANICAL JOINT FITTINGS; 150 PSI PRESSURE RATING. COAT WITH STANDARD COATING INSIDE AND OUT.
4. GROUT PIPE IN BLOCKOUT WITH NON-SHRINK GROUT IF PRECAST MANHOLE SECTION IS USED.
5. DROP CONNECTIONS NOT PERMITTED ON 18" OR LARGER SEWER PIPE.

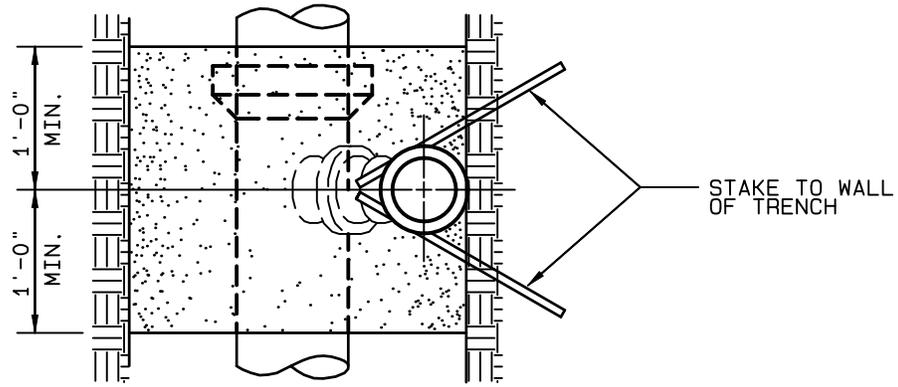
CITY OF WAUKEE

OUTSIDE DROP CONNECTION

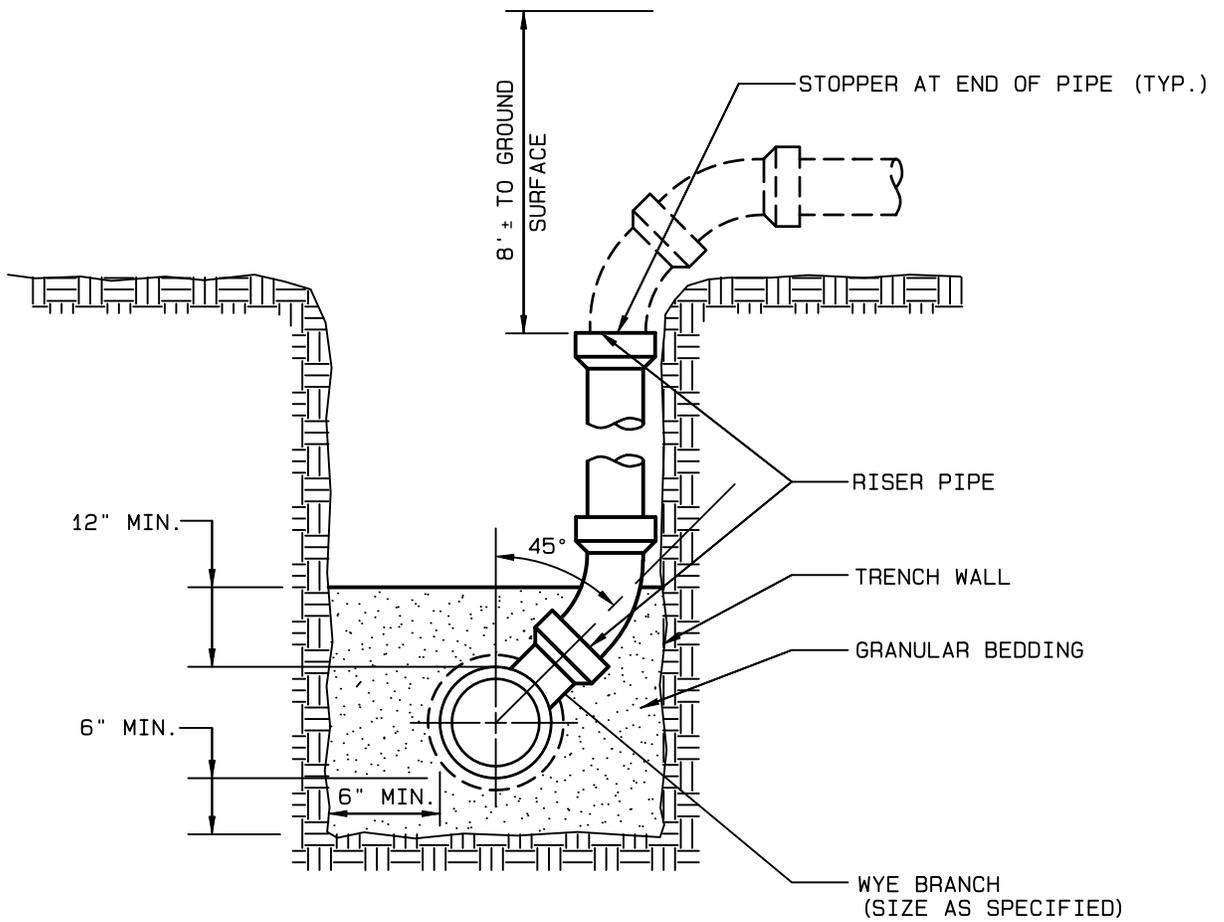
STD. DWG. NO. 13



CITY OF WAUKEE
 INSIDE DROP CONNECTION



PLAN



SECTION

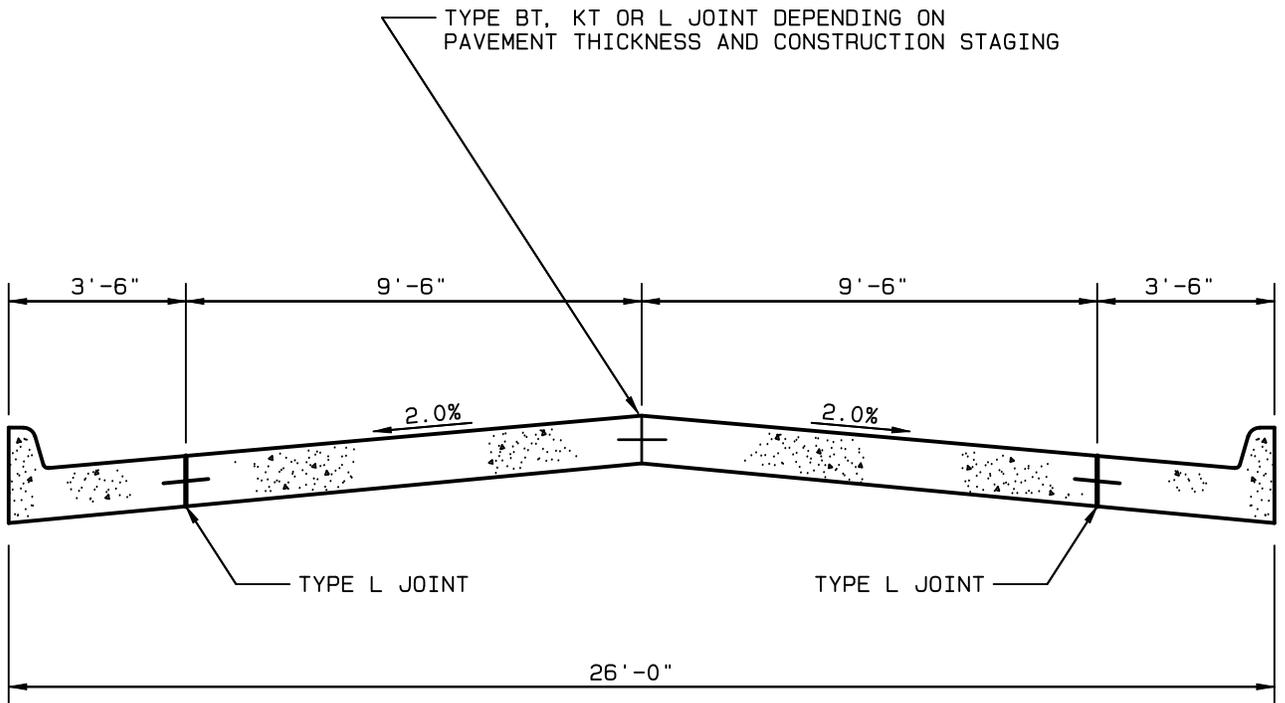
NOTES

1. INSTALL RISER PIPE TO BEAR FIRMLY AGAINST UNDISTURBED WALL OF TRENCH. STAKE RISER PIPE IN PLACE PRIOR TO BACK-FILLING TO PREVENT MOVEMENT OF PIPE
2. NOTCH WALL OF TRENCH TO RECEIVE PIPE WHERE POSSIBLE.

CITY OF WAUKEE

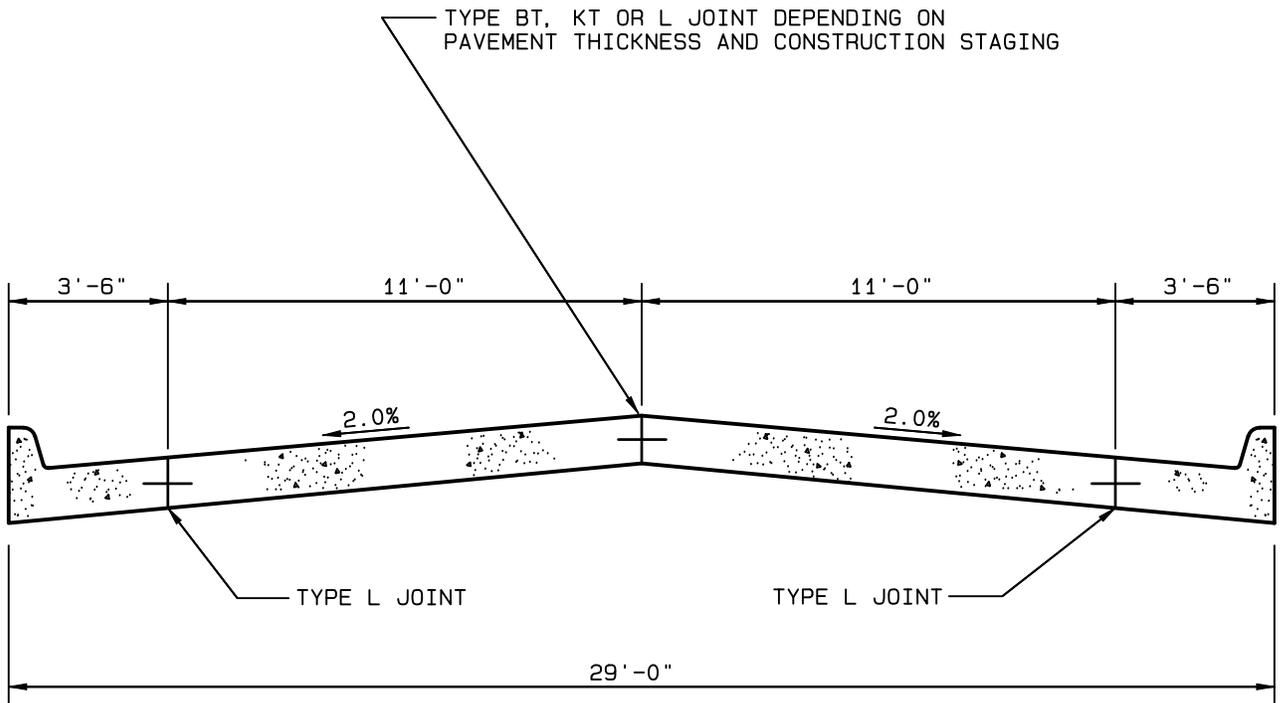
RISER

STD.DWG.NO. 15



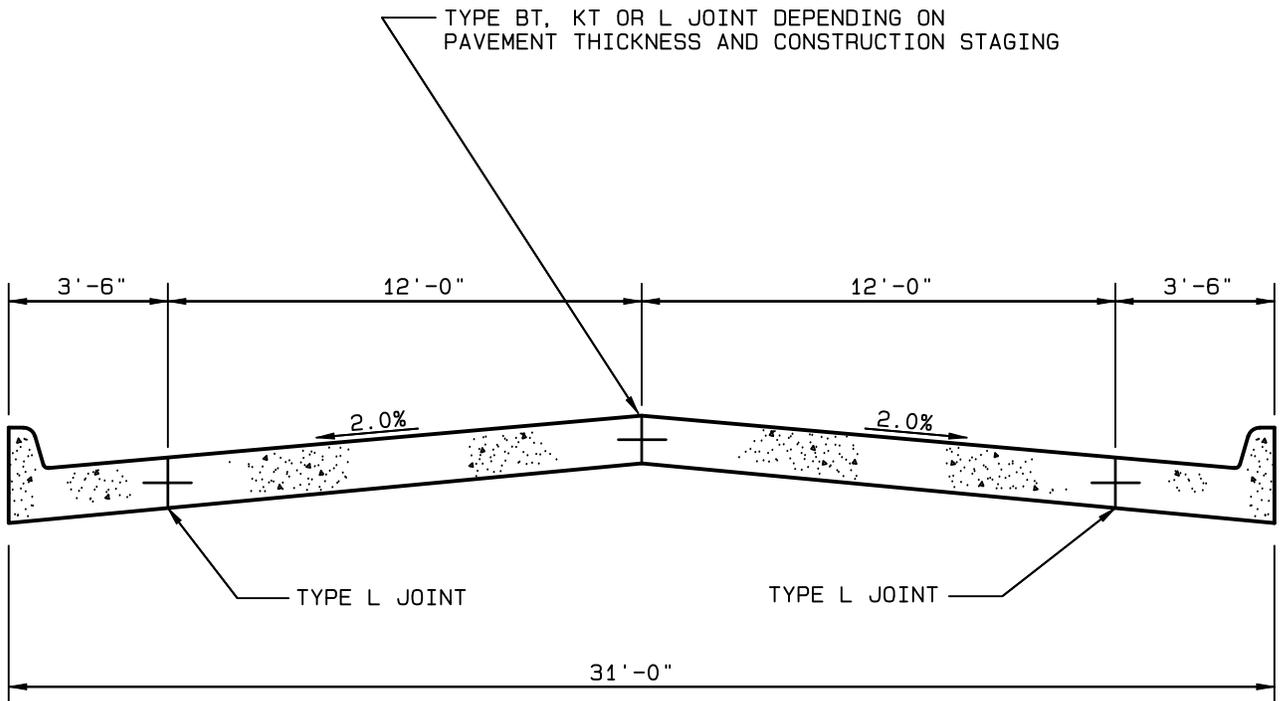
SECTION - 26' WIDTH

CITY OF WAUKEE
 TYPICAL PAVEMENT CROSS SECTION
 26' PAVEMENT



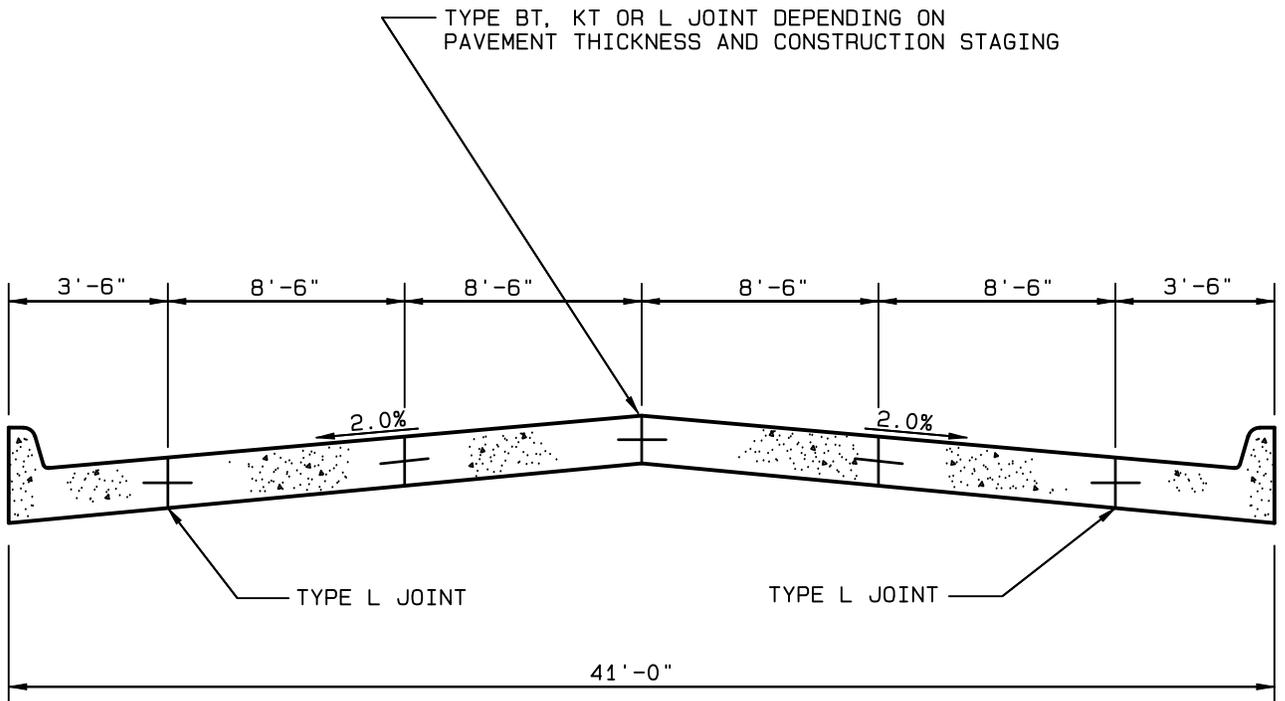
SECTION - 29' WIDTH

CITY OF WAUKEE
TYPICAL PAVEMENT CROSS SECTION
29' PAVEMENT



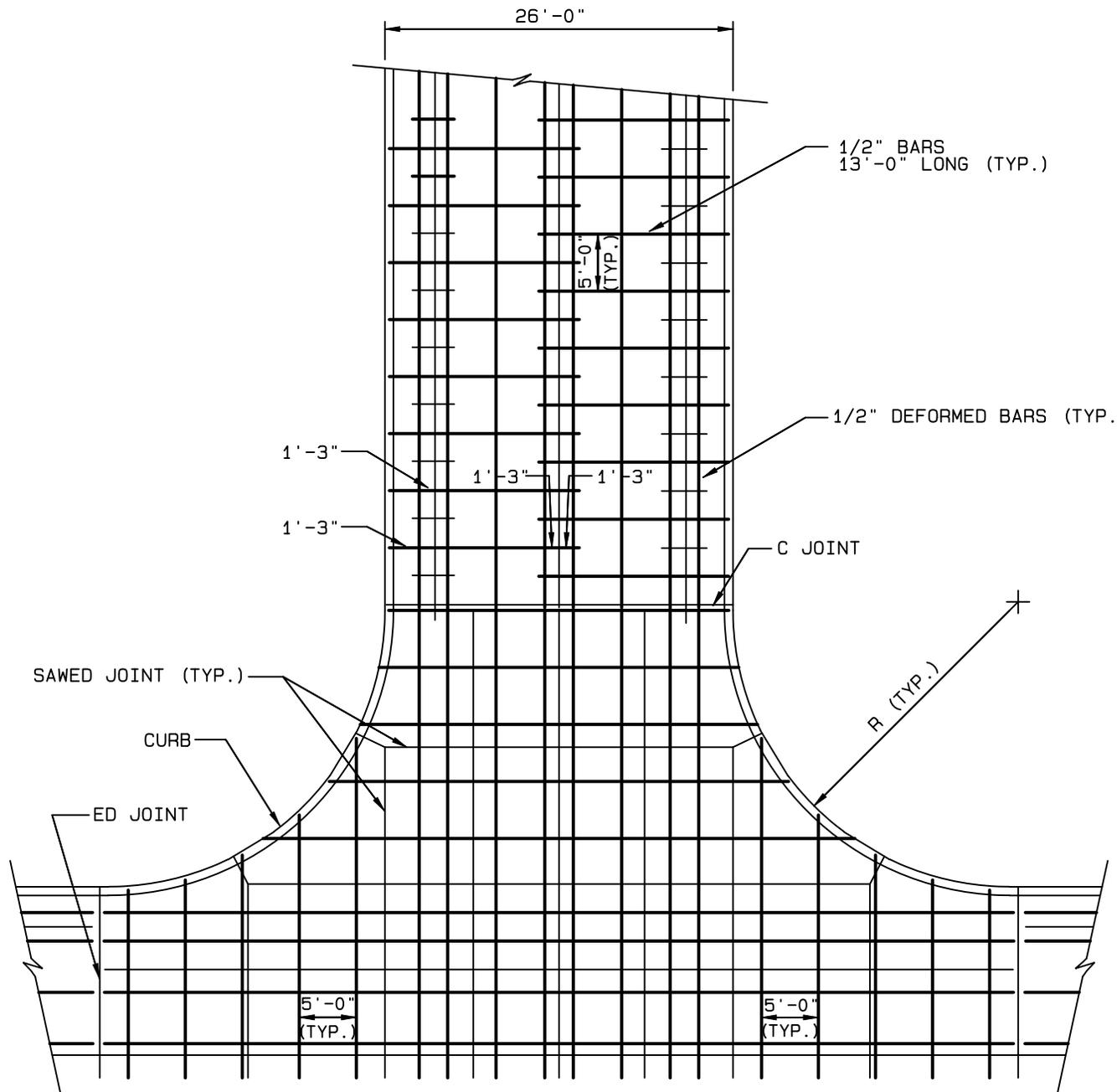
SECTION - 31' WIDTH

CITY OF WAUKEE
 TYPICAL PAVEMENT CROSS SECTION
 31' PAVEMENT



SECTION - 41' WIDTH

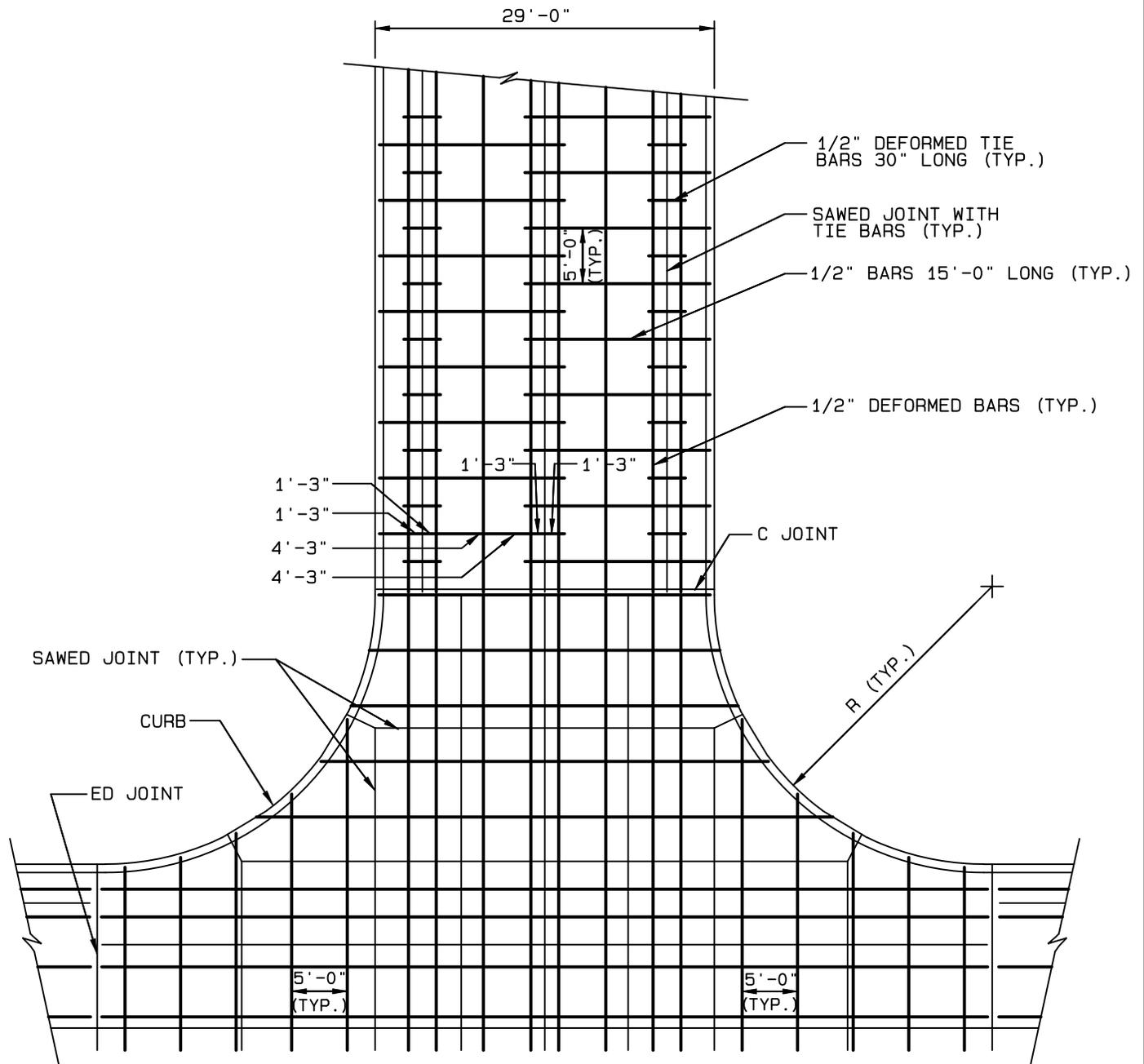
CITY OF WAUKEE
TYPICAL PAVEMENT CROSS SECTION
41' PAVEMENT



CITY OF WAUKEE

REINFORCING
26' PAVEMENT

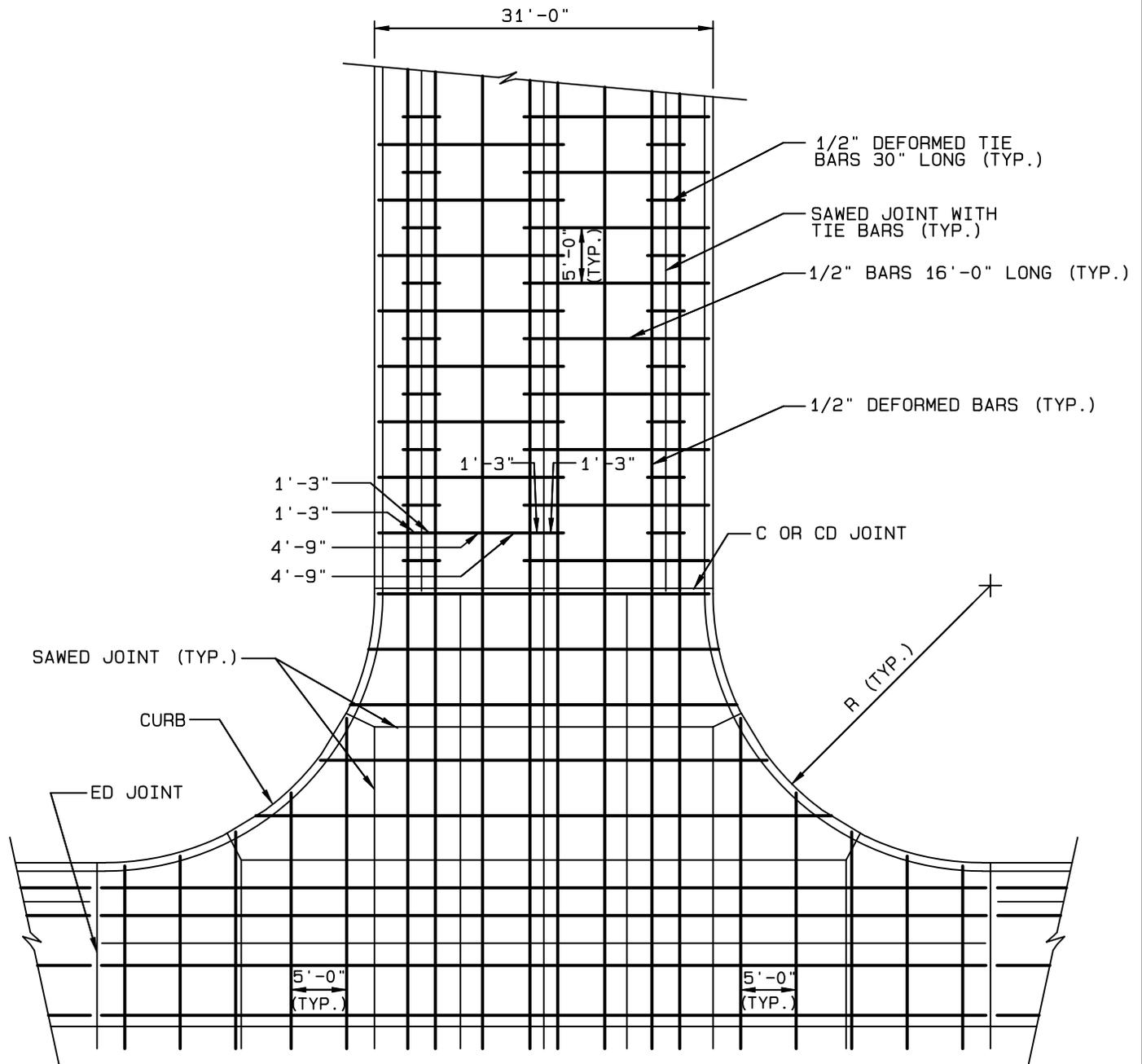
STD. DWG. NO. 20



CITY OF WAUKEE

REINFORCING
29' PAVEMENT

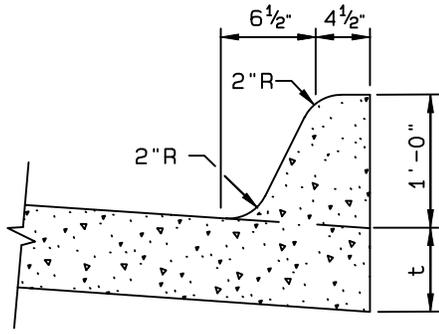
STD.DWG.NO.21



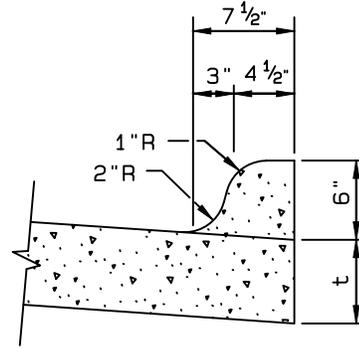
CITY OF WAUKEE

REINFORCING
31' PAVEMENT

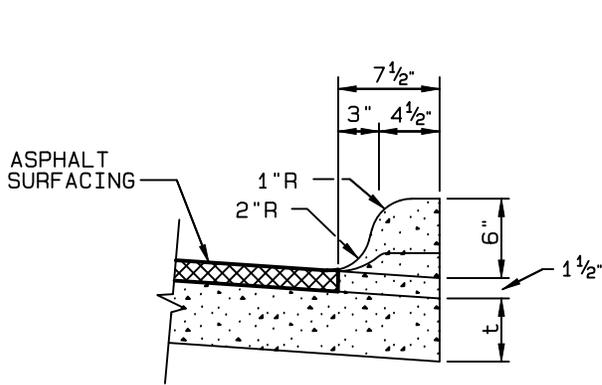
STD.DWG.NO.22



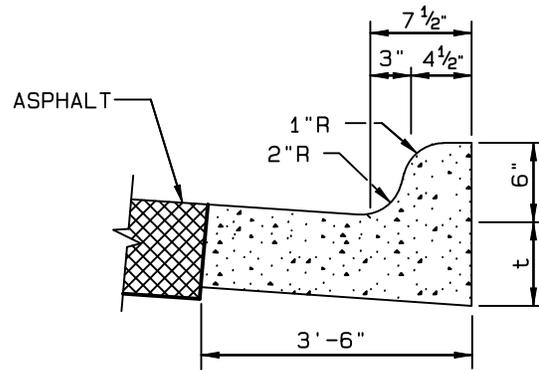
12" CURB



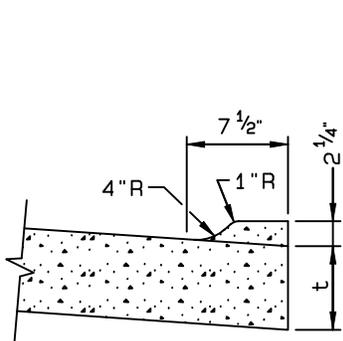
6" CURB



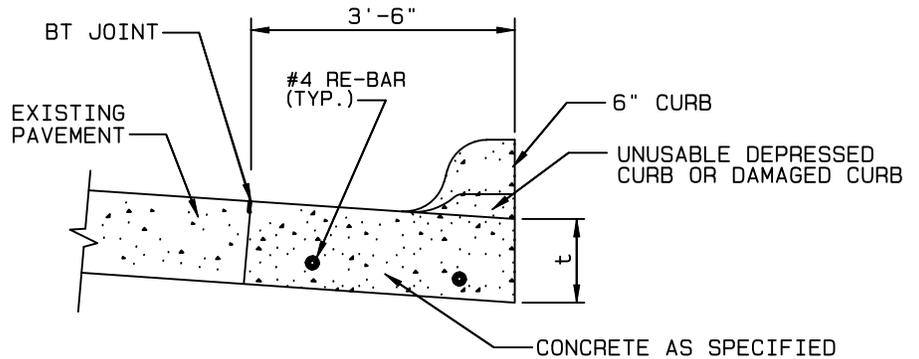
ASPHALT SURFACING AT CURB



SEPARATE CURB AND GUTTER WITH ASPHALT PAVEMENT



DRIVEWAY APPROACH DEPRESSED CURB



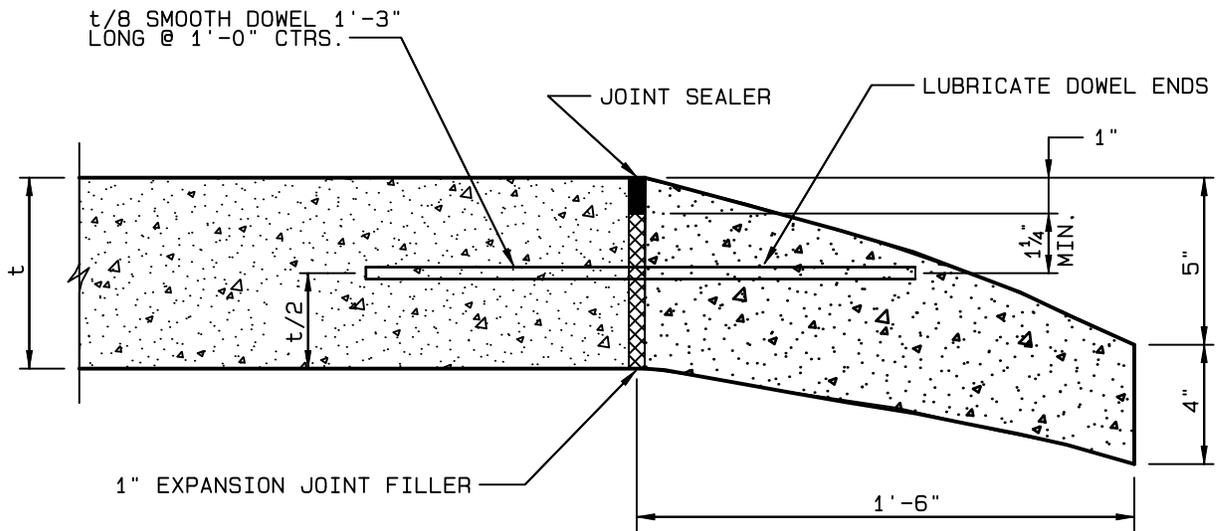
CURB REPLACEMENT

NOTE

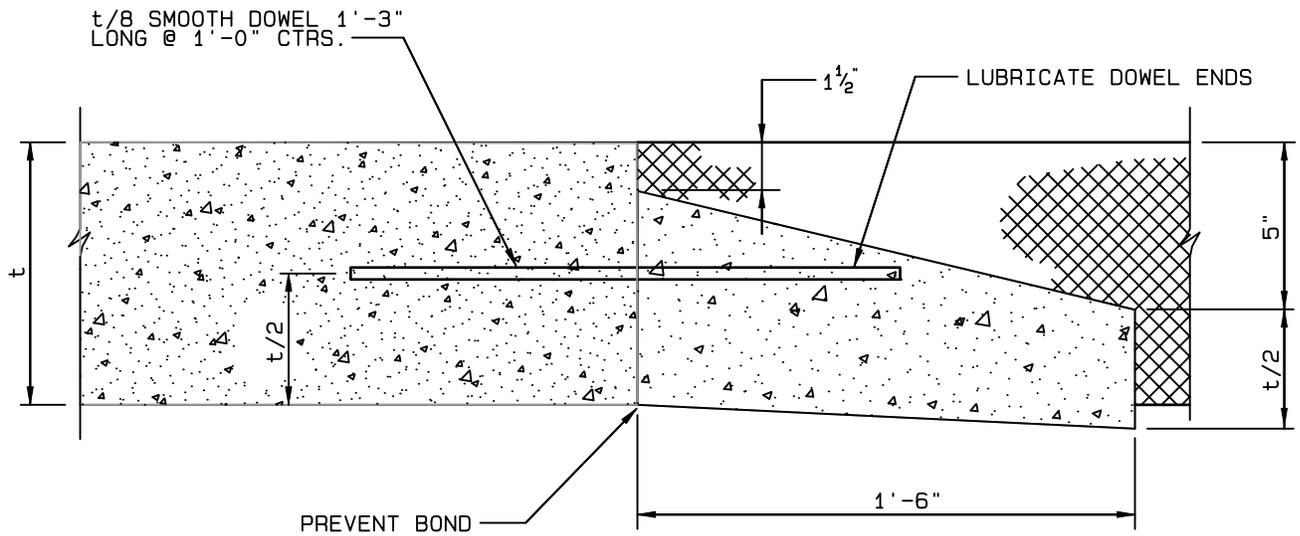
1. t = PAVEMENT THICKNESS IN INCHES; AS SPECIFIED.

CITY OF WAUKEE

CURB DETAILS



CONCRETE HEADER



ASPHALT TO CONCRETE HEADER

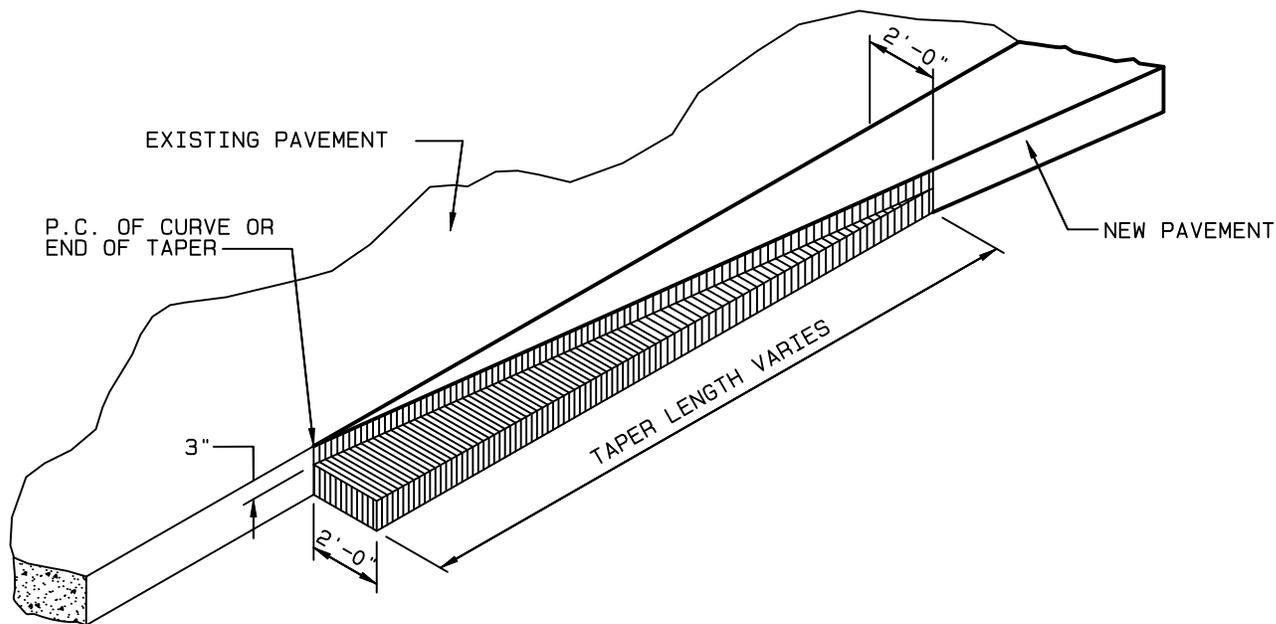
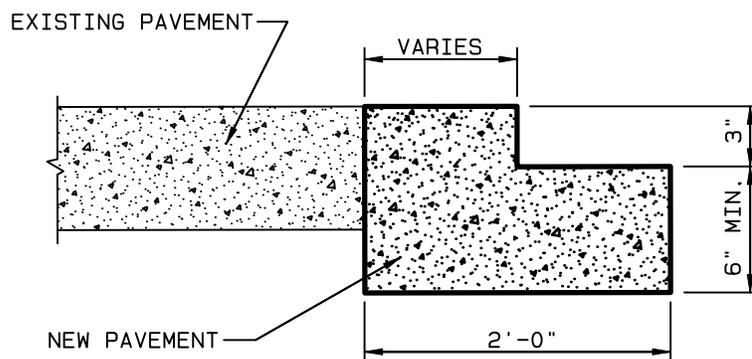
NOTE

1. t = PAVEMENT THICKNESS IN INCHES; AS SPECIFIED.

CITY OF WAUKEE

HEADER DETAILS

STD. DWG. NO. 24



NOTE

1. PAVEMENT REINFORCING IS CONTINUED TO END OF BURIED LUG.

CITY OF WAUKEE

BURIED LUG DETAIL

STD.DWG.NO.25

6" SIDEWALK THROUGH DRIVEWAY

1/2" FULL DEPTH EXPANSION JOINT

1/2" FULL DEPTH EXPANSION JOINT

CURB

10' (SINGLE DRIVE)
18' (DOUBLE DRIVE)
22' (TRIPLE DRIVE)

1'-0" R

PLAN VIEW

1/2" FULL DEPTH EXPANSION JOINT

VARIES

1/2" FULL DEPTH EXPANSION JOINT

PAVEMENT

SIDEWALK

CONCRETE AS SPECIFIED

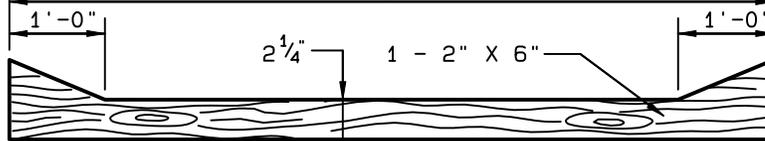
6" (SEE NOTE 4)

1'-0"

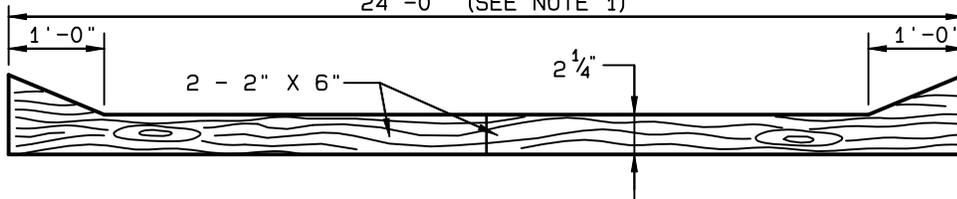
SUBGRADE AS SPECIFIED

SECTION AT CENTERLINE OF DRIVE

16'-0" (SEE NOTE 1)



24'-0" (SEE NOTE 1)



DRIVEWAY TEMPLATES
(AT CURB LINE)

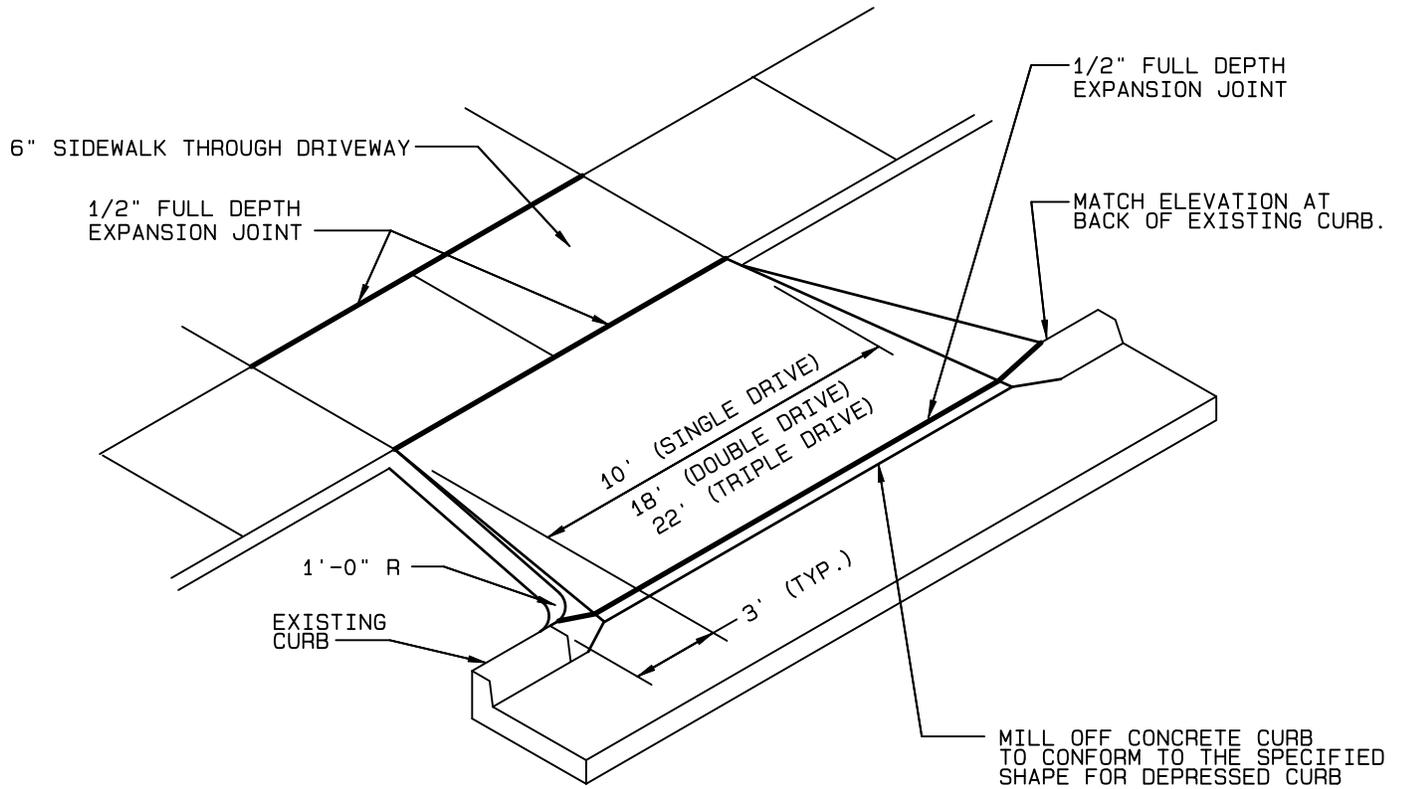
NOTES

1. WHEN CONSTRUCTING APPROACH FOR EXISTING DRIVEWAY, ADD 6' TO WIDTH OF DRIVEWAY TO OBTAIN MODIFIED OVERALL LENGTH OF TEMPLATE.
2. MINIMUM SLOPE ON DRIVEWAY - 1/2" : 1'-0".
3. USE THIS DETAIL TO CONSTRUCT APPROACHES TO EXISTING DRIVEWAYS. USE AT OTHER LOCATIONS ONLY IF AUTHORIZED BY CITY.
4. COMMERCIAL DRIVE MINIMUM THICKNESS 8" FROM PAVEMENT TO BACK OF SIDEWALK.

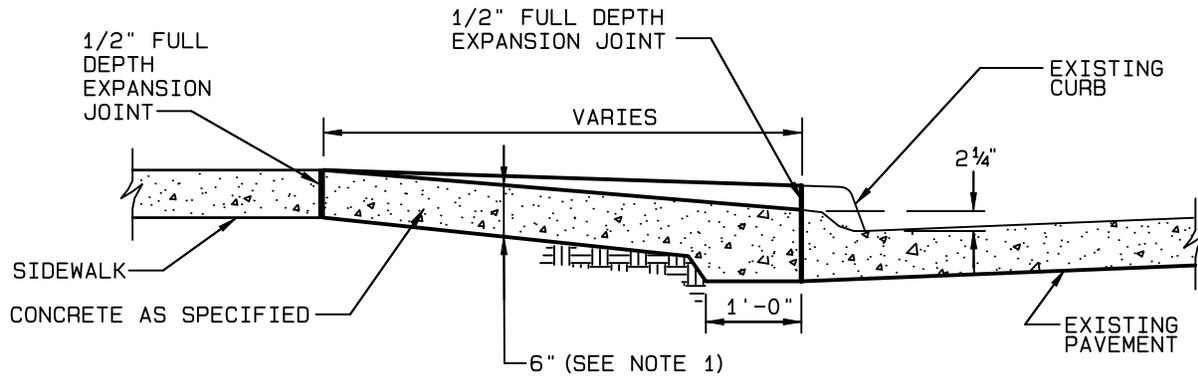
CITY OF WAUKEE

DRIVEWAY APPROACH DETAIL
NEW PAVEMENT

STD. DWG. NO. 26



PLAN VIEW



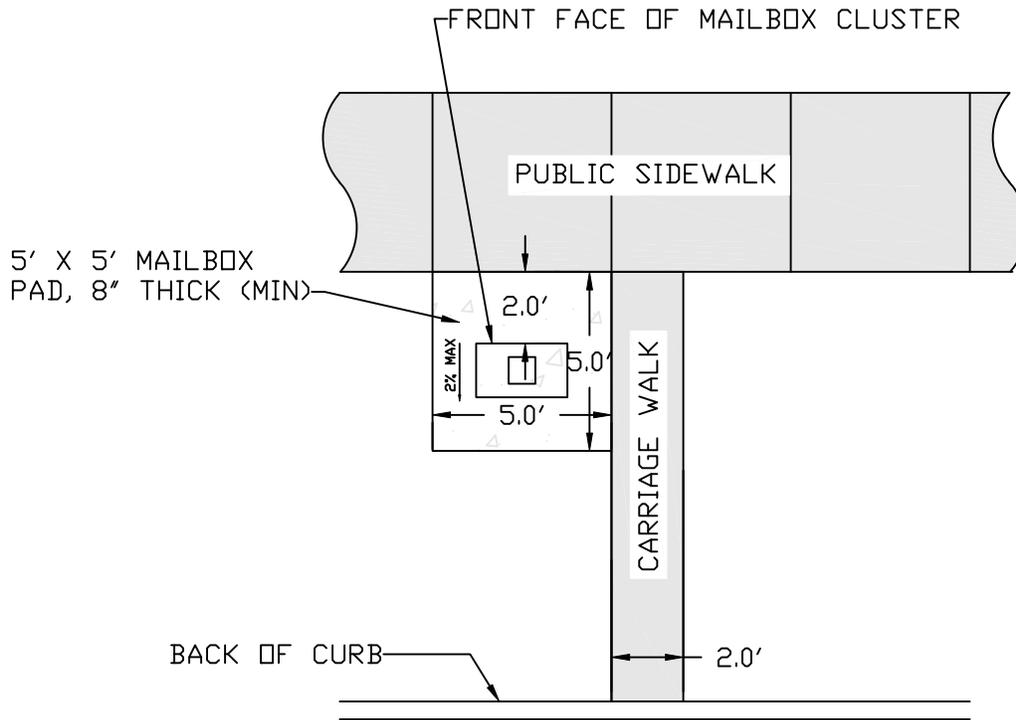
SECTION AT CENTERLINE OF DRIVEWAY APPROACH

NOTES

1. COMMERCIAL DRIVE MINIMUM THICKNESS 8" FROM PAVEMENT TO BACK OF SIDEWALK.

CITY OF WAUKEE

DRIVEWAY APPROACH DETAIL
EXISTING PAVEMENT



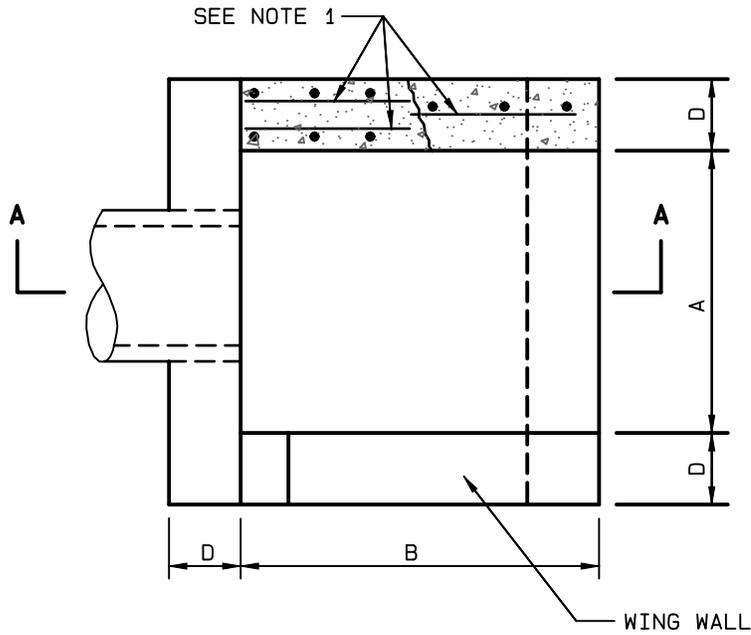
NOTES:

1. Cluster Mailbox to be located on the no parking/street light side of street.
2. Do not locate at intersection.
3. Locate near shared property line per approved plan.
4. Determine sidewalk side of mailbox pad elevation assuming constant 4% slope from back of curb to sidewalk side of mailbox pad. Resulting slope from back of curb to street side of mailbox pad will be greater than 4%. For example, for a 29' wide pavement with a 60' wide R.O.W. and a 2% mailbox pad cross slope, the resulting slope from the back of curb to the street side of mailbox pad is 6.2%.

CITY OF WAUKEE

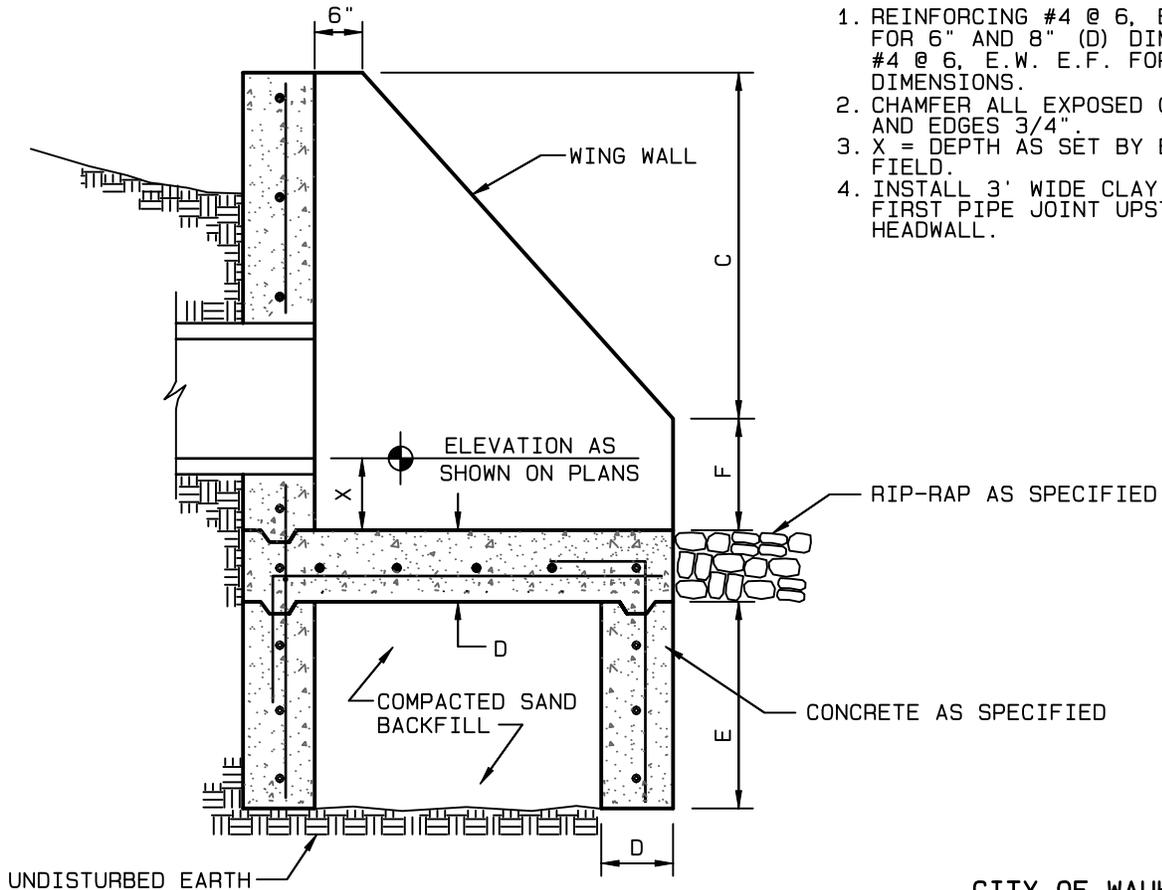
CLUSTER MAILBOX PAD DETAIL

STD.DWG.NO.28



PLAN

PIPE DIA. (INCHES)	STRUCTURE DIMENSIONS (FEET AND INCHES)					
	A	B	C	D	E	F
8	2-0	2-6	2-6	0-6	1-6	0-9
10	2-0	2-6	2-6	0-6	1-6	0-9
12	2-0	2-6	2-6	0-6	1-6	0-9
15	2-10	3-4	3-4	0-8	2-0	1-0
18	2-10	3-4	3-4	0-8	2-0	1-0
21	3-6	4-0	4-0	0-10	2-6	1-3
24	3-6	4-0	4-0	0-10	2-6	1-3
27	4-6	5-0	5-0	0-10	3-0	1-6
30	4-6	5-0	5-0	0-10	3-0	1-6
36	4-6	5-0	5-0	0-10	3-0	1-6



SECTION A-A

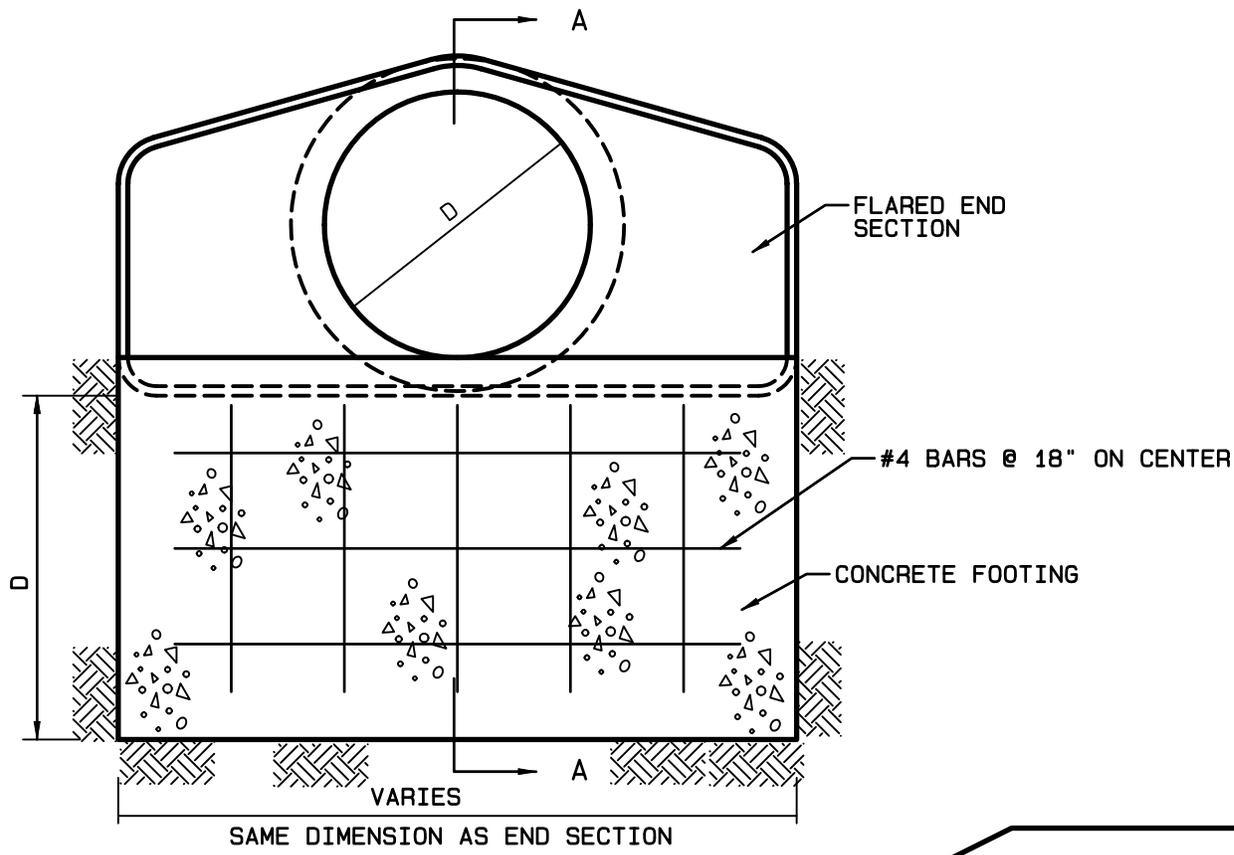
NOTES

1. REINFORCING #4 @ 6, E.W. IN CENTER, FOR 6" AND 8" (D) DIMENSIONS; #4 @ 6, E.W. E.F. FOR 10" (D) DIMENSIONS.
2. CHAMFER ALL EXPOSED CORNERS AND EDGES 3/4".
3. X = DEPTH AS SET BY ENGINEER IN FIELD.
4. INSTALL 3' WIDE CLAY WATERSTOP AT FIRST PIPE JOINT UPSTREAM FROM HEADWALL.

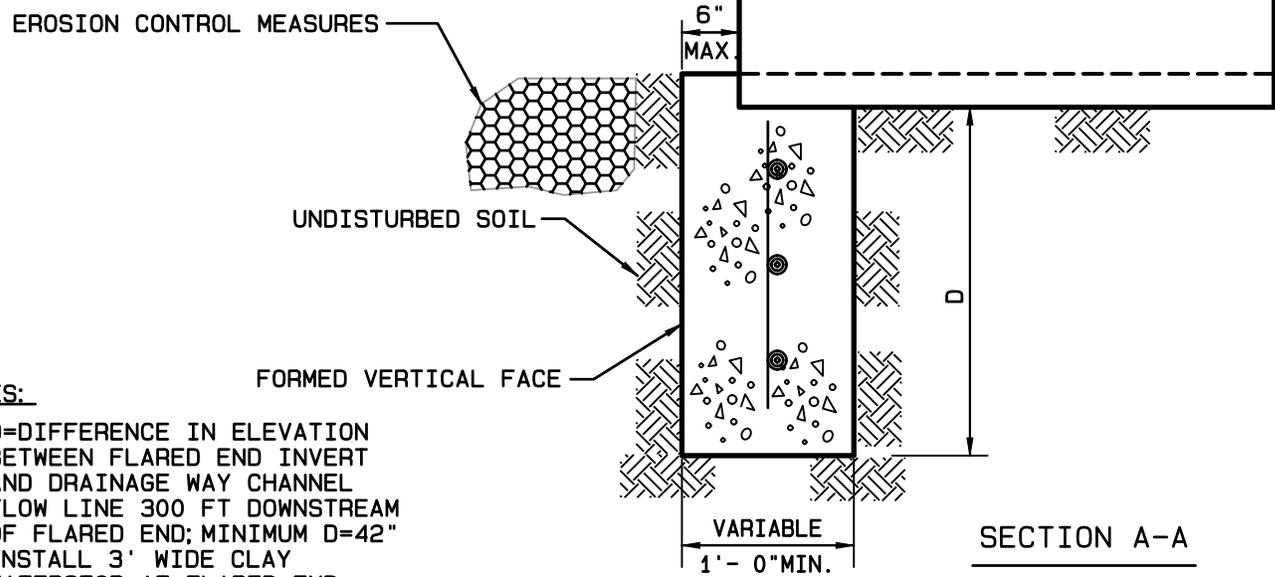
CITY OF WAUKEE

HEADWALL DETAIL

STD. DWG. NO. 29



ELEVATION



SECTION A-A

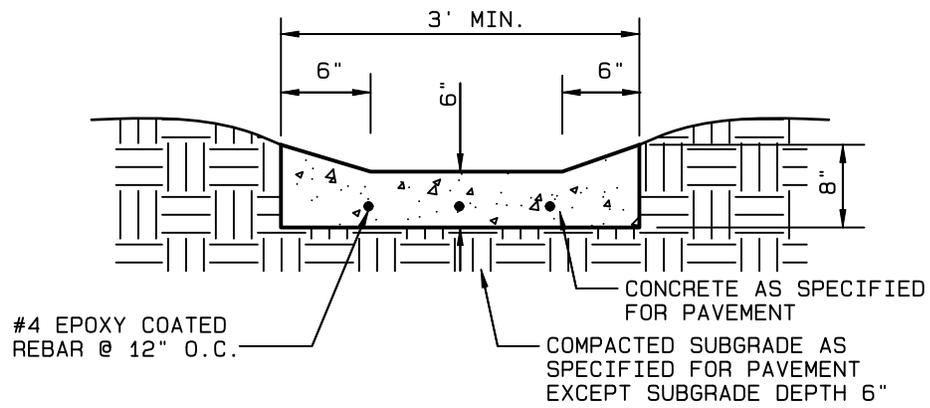
NOTES:

1. D=DIFFERENCE IN ELEVATION BETWEEN FLARED END INVERT AND DRAINAGE WAY CHANNEL FLOW LINE 300 FT DOWNSTREAM OF FLARED END; MINIMUM D=42"
2. INSTALL 3' WIDE CLAY WATERSTOP AT FLARED END SECTION PIPE JOINT.

CITY OF WAUKEE

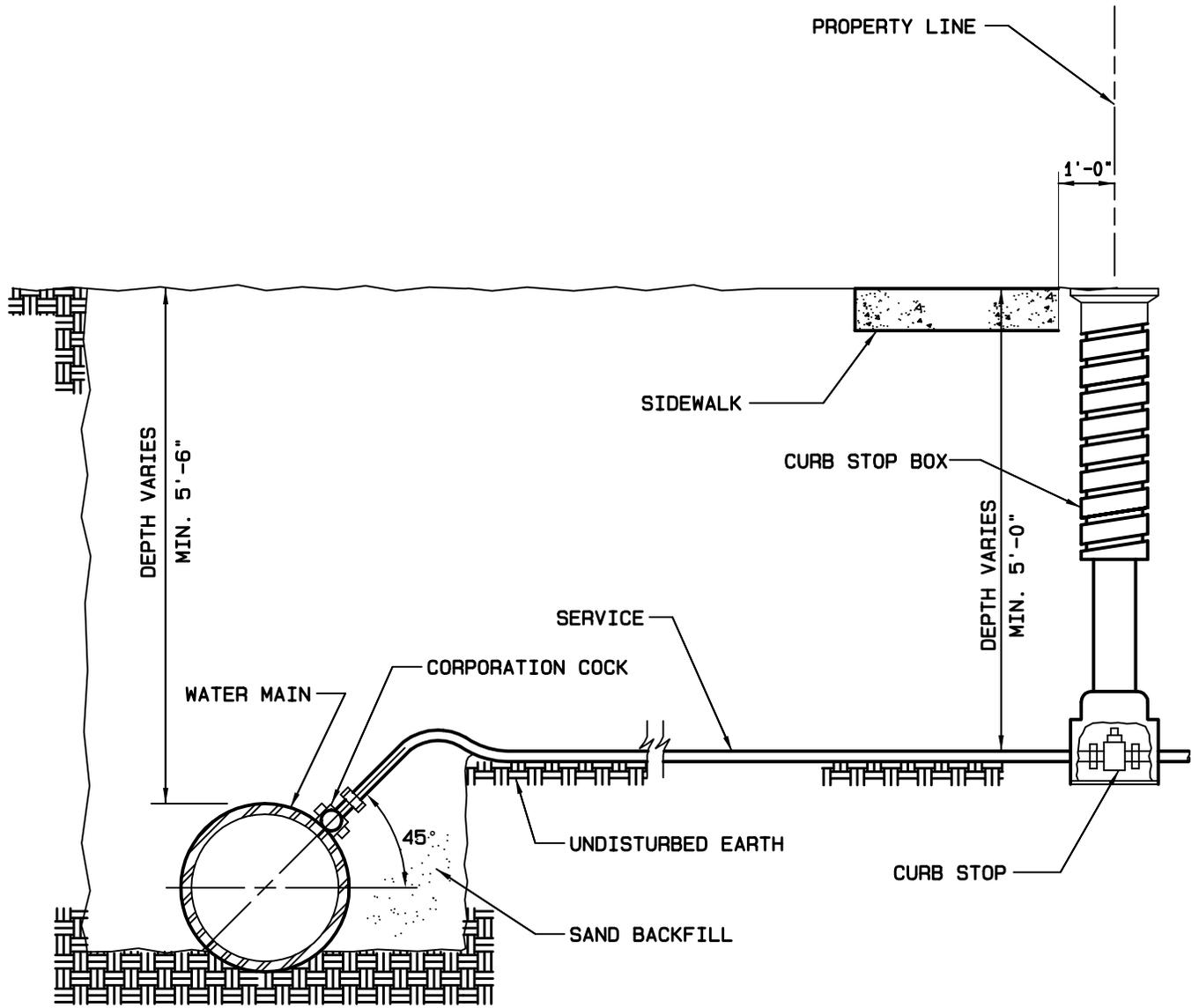
FLARED END SECTION FOOTING DETAIL

STD.DWG.NO.30



CITY OF WAUKEE
 CONCRETE FLUME DETAIL

STD.DWG.NO.31



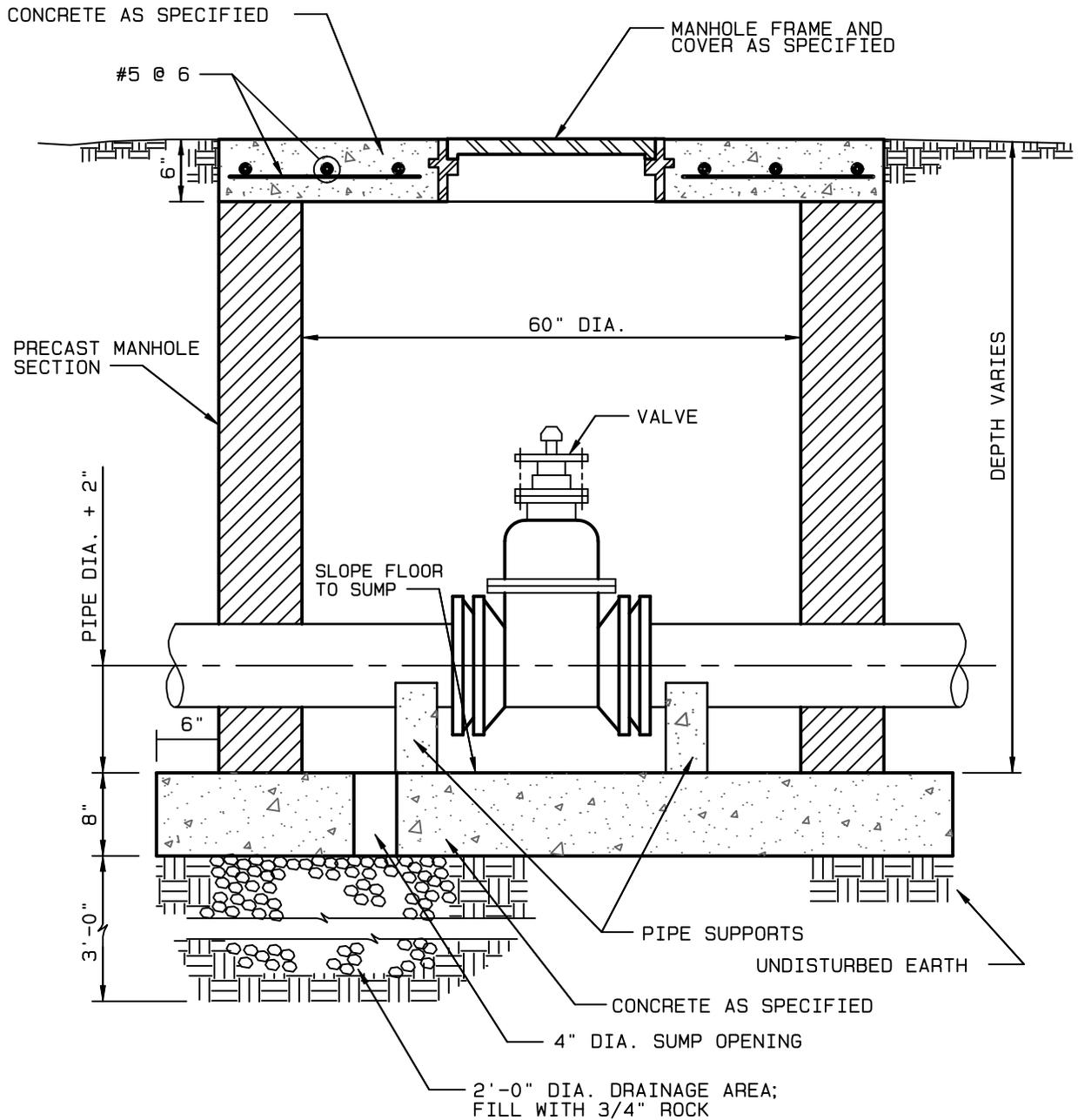
NOTES:

1. TERMINATE CURB STOP BOX ROD 1'-6" BELOW FINISHED GRADE.

CITY OF WAUKEE

SERVICE CONNECTION

STD.DWG.NO.32 REV.1



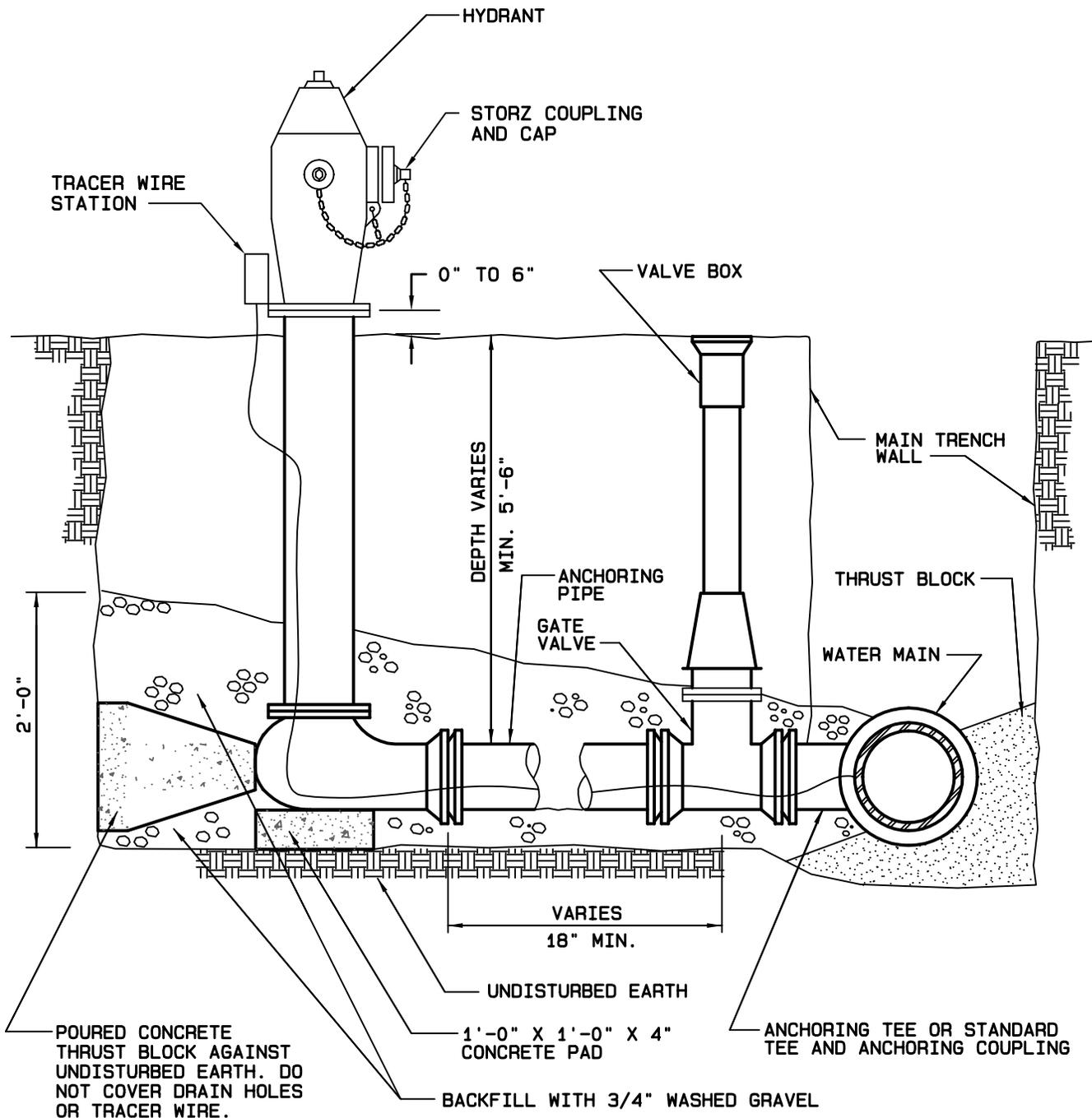
NOTES

1. PROVIDE MANHOLE STEPS.
2. SET MANHOLE COVER FLUSH WITH GROUND UNLESS SHOWN OR SPECIFIED OTHERWISE.
3. GROUT PIPE IN BLOCKOUT WITH NON-SHRINK GROUT IF PRECAST MANHOLE SECTION IS USED.

CITY OF WAUKEE

STANDARD VALVE MANHOLE

STD.DWG.NO.33



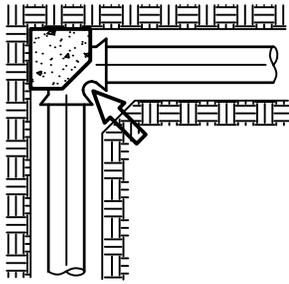
NOTES

1. MINIMUM SIZE FOR PIPING, VALVES AND FITTINGS FROM WATER MAIN TO HYDRANT INLET: 6".
2. PROVIDE TRACER WIRE AND TRACER WIRE STATION.
3. WRAP HYDRANT, PIPE AND FITTINGS WITH POLYETHYLENE ENCASEMENT.

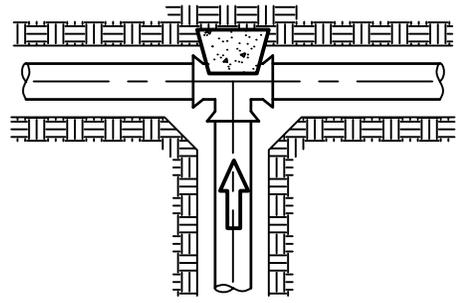
CITY OF WAUKEE

HYDRANT

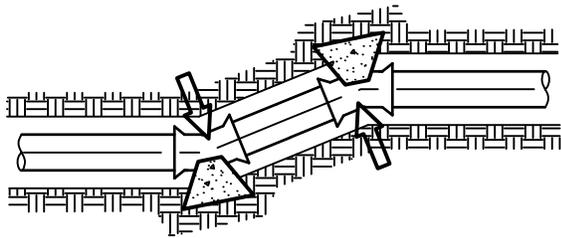
STD. DWG. NO. 34 REV. 1



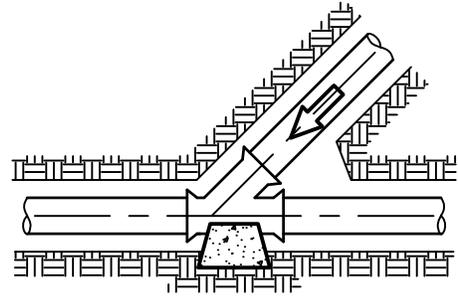
QUARTER BEND



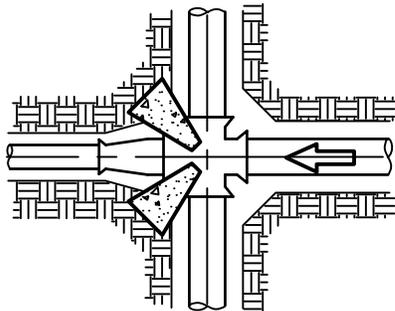
TEE



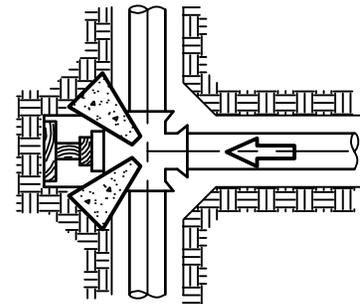
OFFSET LINE



"Y" BRANCH



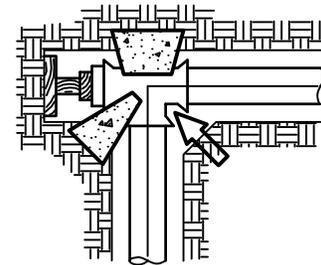
REDUCING CROSS



PLUGGED CROSS

NOTES

1. TO DETERMINE THRUST BLOCK SIZE SEE TABLE IN SPECIFICATIONS.
2. BEAR THRUST BLOCKS AGAINST UNDISTURBED EARTH.
3. BRACE PLUGS AGAINST UNDISTURBED EARTH.
4. ARROWS INDICATE DIRECTION OF THRUST.
5. USE CLASS B CONCRETE.
6. DO NOT EXTEND CONCRETE BEYOND FITTING BELL.
7. ALL FITTINGS ARE SHOWN IN PLAN VIEW.
8. PUSH-ON FITTINGS USED ONLY FOR ILLUSTRATION - USE FITTINGS AS SPECIFIED.

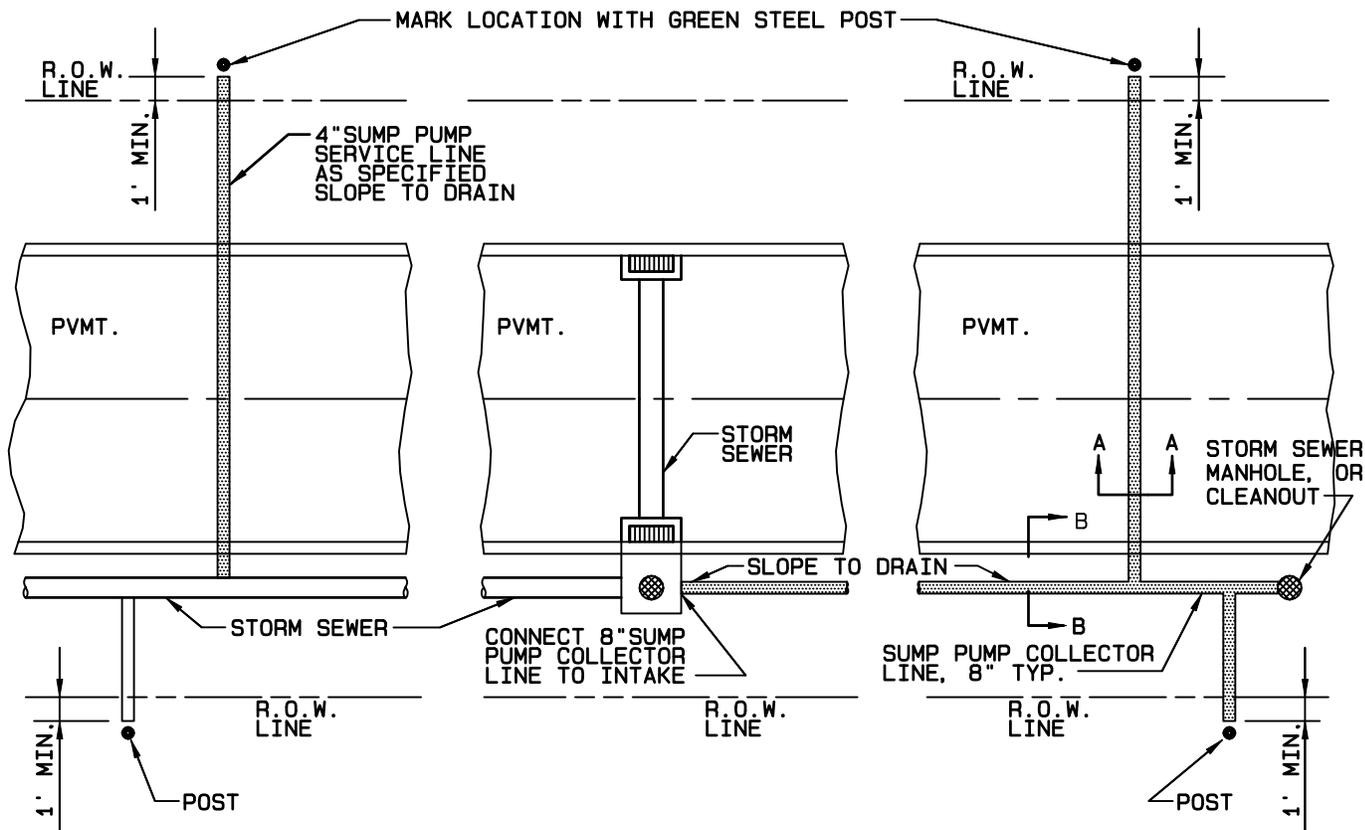


PLUGGED TEE

CITY OF WAUKEE

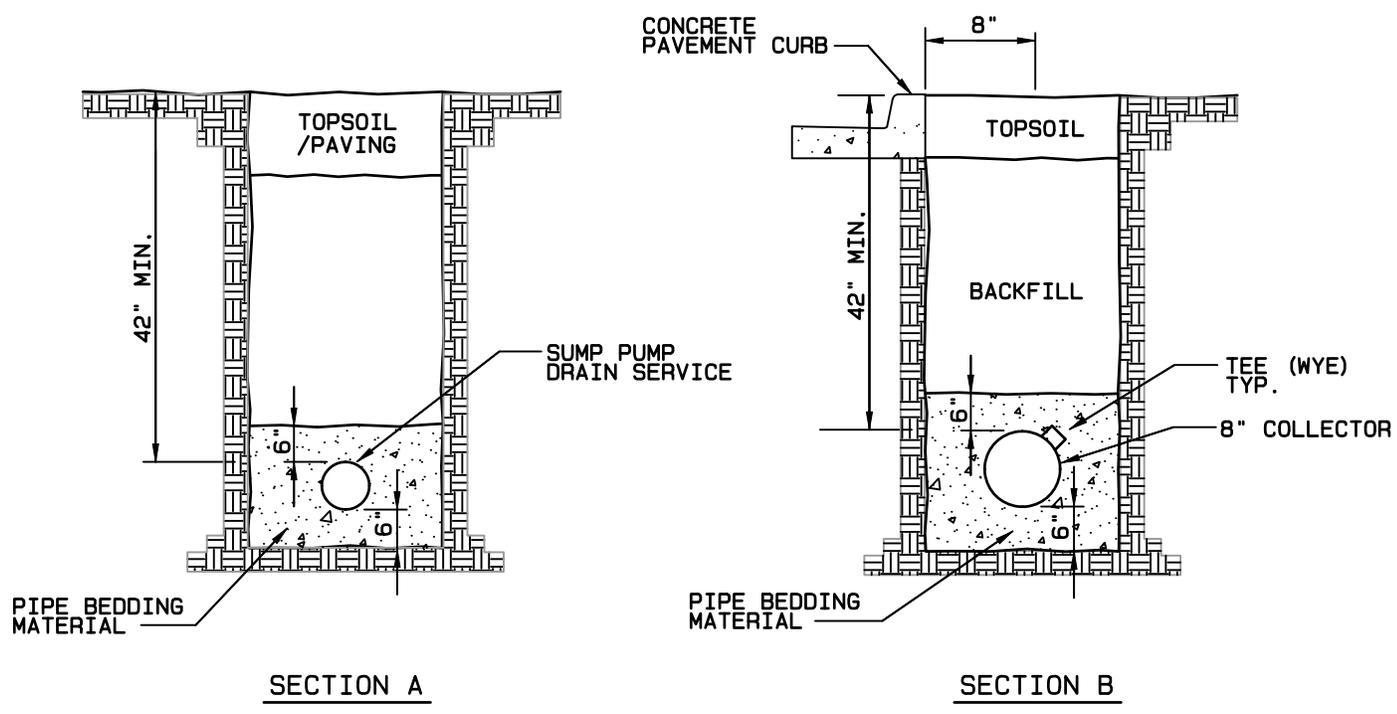
THRUST BLOCK DETAILS

STD. DWG. NO. 35



NOTE

CORE DRILL ALL STORM SEWER AND PLACE NON-SHRINK GROUT COLLAR AT CONNECTION.

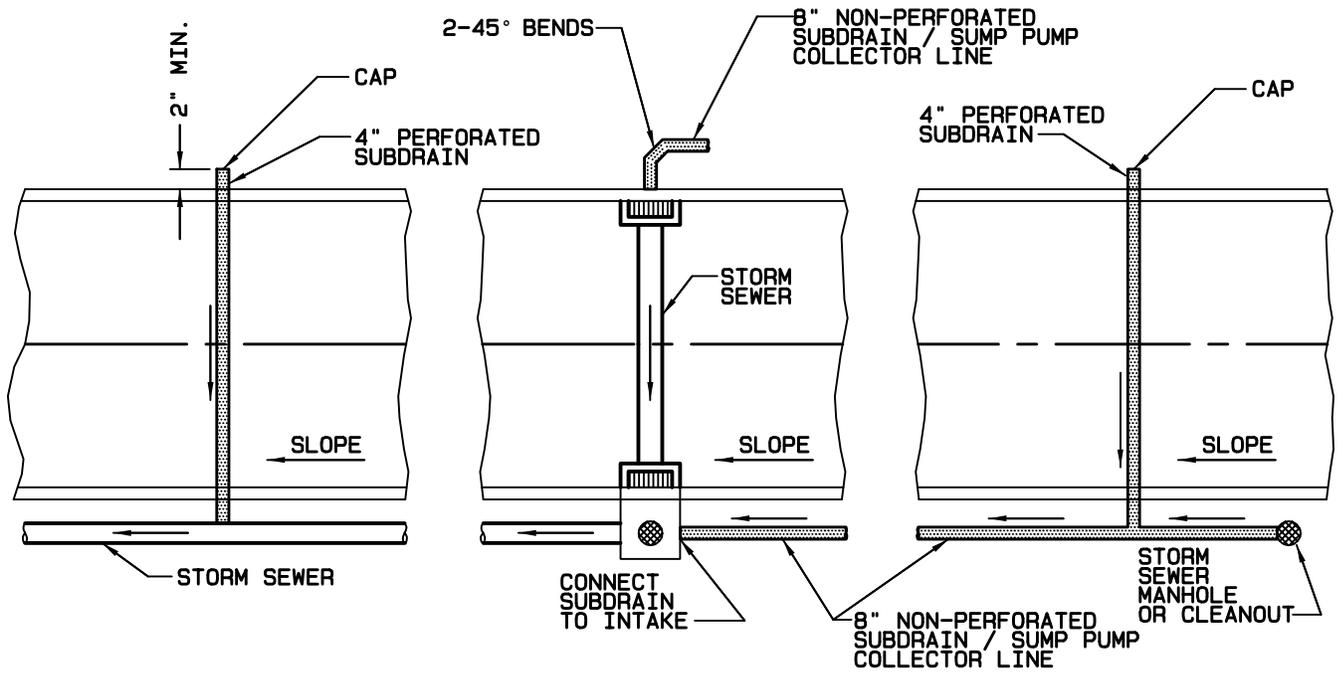


NOTES

1. ALL CONNECTIONS MADE OF DISIMILAR PIPE- USE APPROVED RUBBER GASKETED FITTINGS.
2. CAP ALL SERVICE LINES.
3. PROVIDE TRACER WIRE.

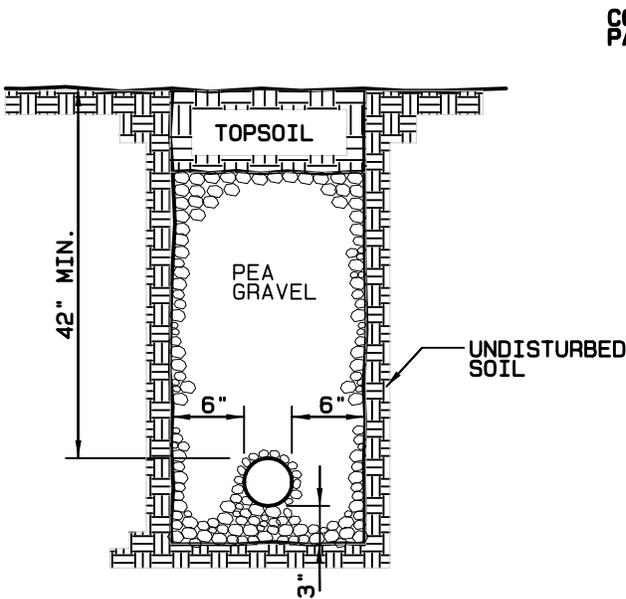
CITY OF WAUKEE

SUMP PUMP DRAIN LINES

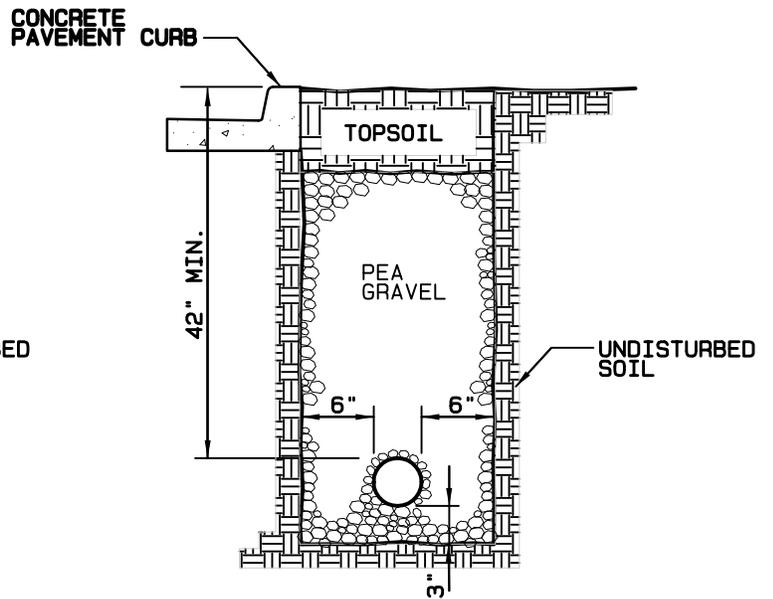


NOTE

CORE DRILL ALL STORM SEWER AND PLACE NON-SHRINK GROUT COLLAR AT CONNECTION.



USE AS SHOWN ON PLANS
BACK AND SIDE YARD



BACK OF CURB

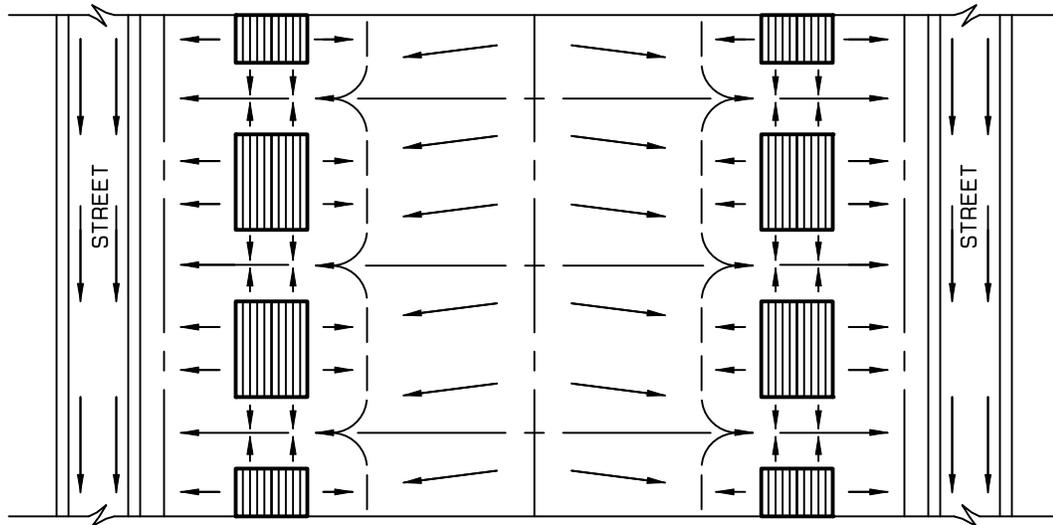
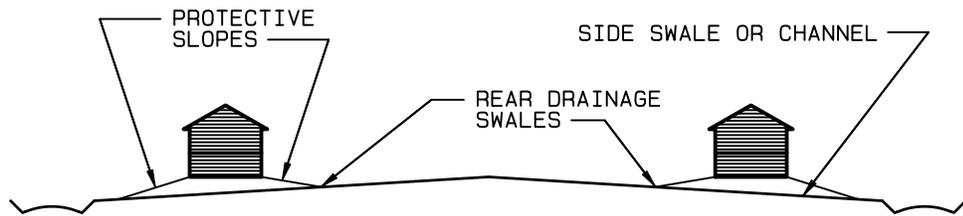
NOTES

1. SLOPE SUBDRAINS TO DRAIN.

CITY OF WAUKEE

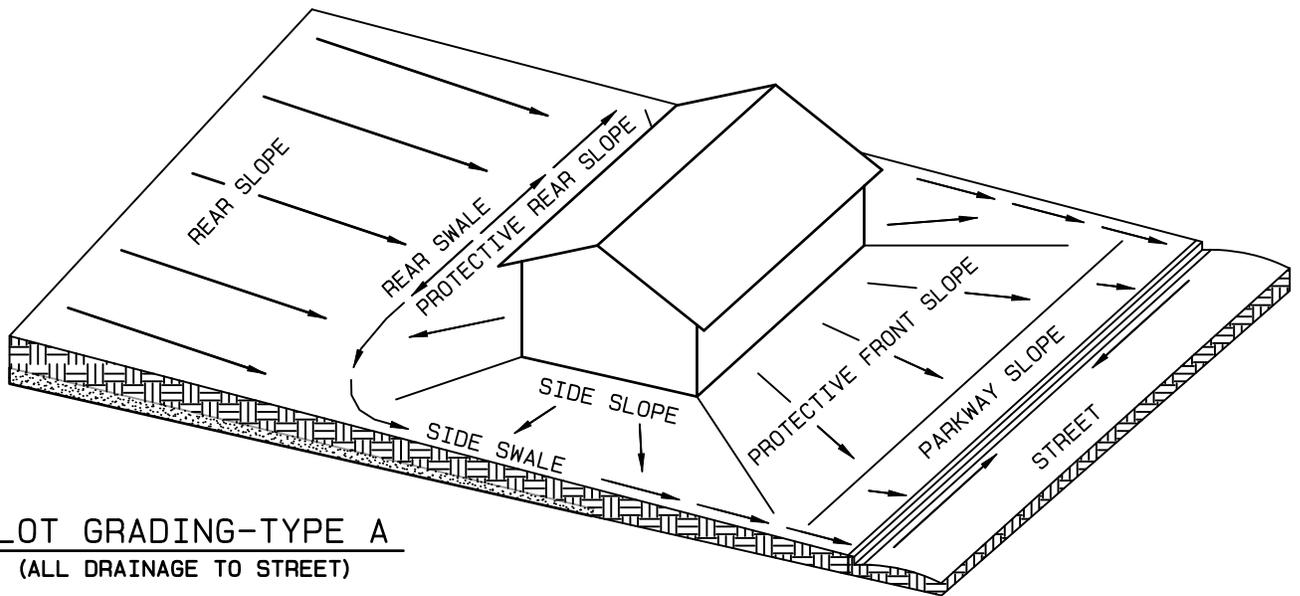
SUBDRAINS

STD.DWG.NO.37 REV. 1



LOT GRADING-TYPE A

LOT GRADING-TYPE A

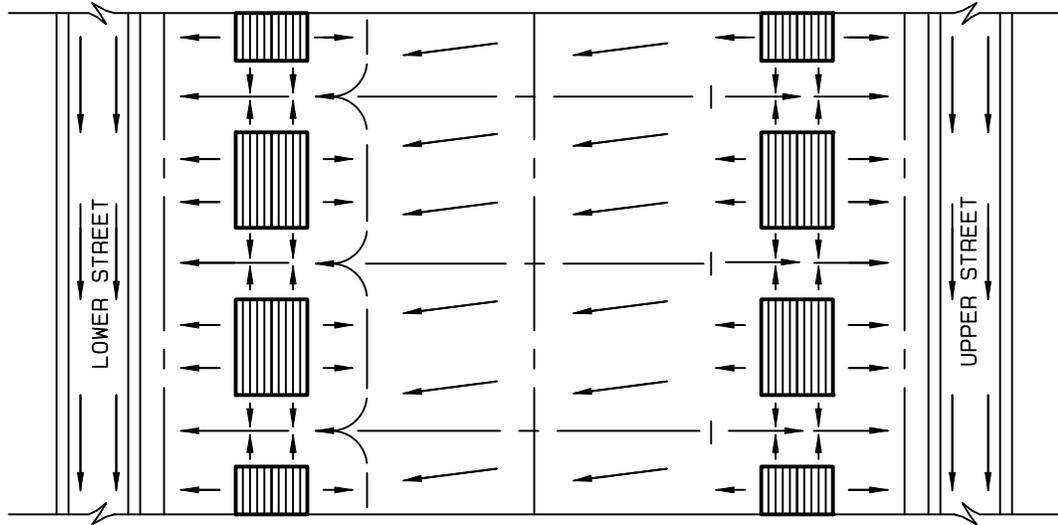
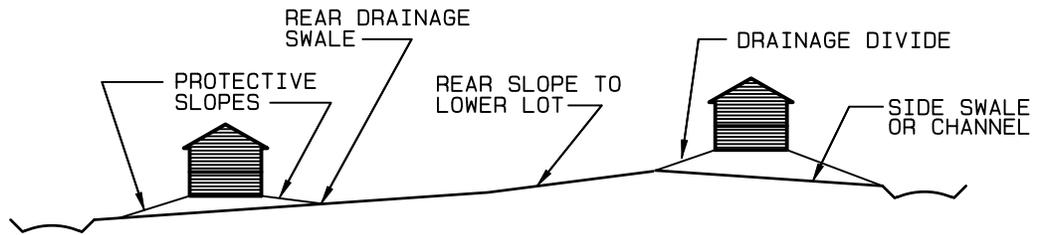


LOT GRADING-TYPE A
(ALL DRAINAGE TO STREET)

EXAMPLE: BLOCK GRADING TYPE 1
RIDGE ALONG REAR LOT LINES

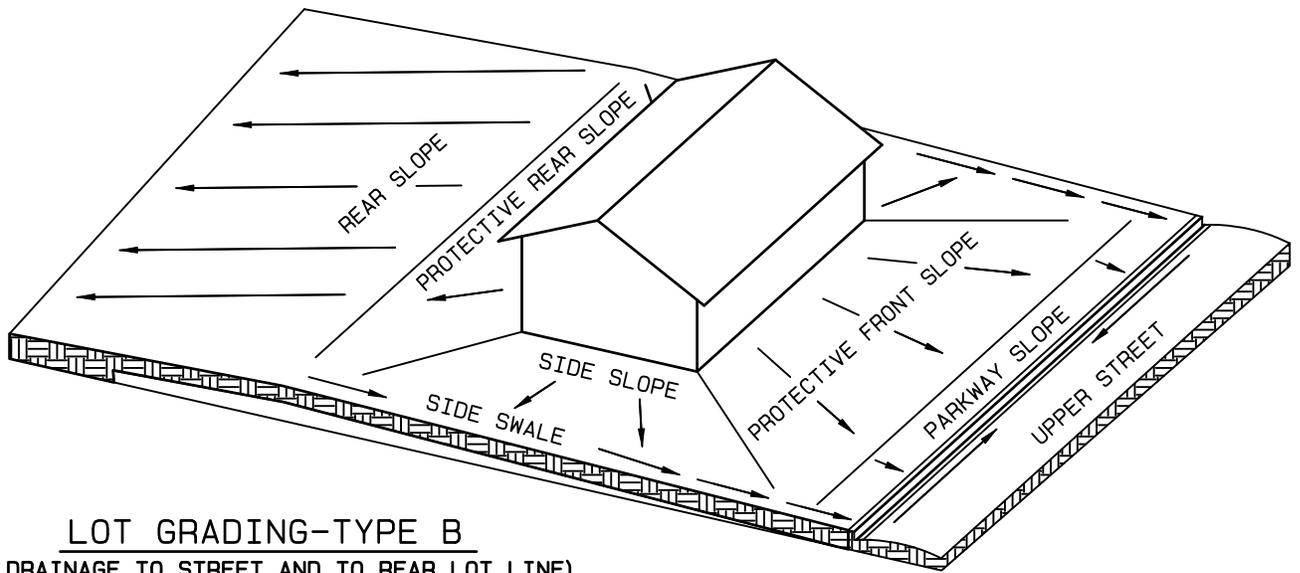
REFERENCE
"MINIMUM PROPERTY STANDARDS FOR
ONE AND TWO LIVING UNITS"
HUD-FHA
NOVEMBER 1966 FHA NO. 300

CITY OF WAUKEE
SUBDIVISION LOT GRADING



LOT GRADING-TYPE A

LOT GRADING-TYPE B



LOT GRADING-TYPE B

(ALL DRAINAGE TO STREET AND TO REAR LOT LINE)

EXAMPLE: BLOCK GRADING TYPE 2

GENTLE CROSS - SLOPE

REFERENCE

"MINIMUM PROPERTY STANDARDS FOR ONE AND TWO LIVING UNITS"

HUD-FHA

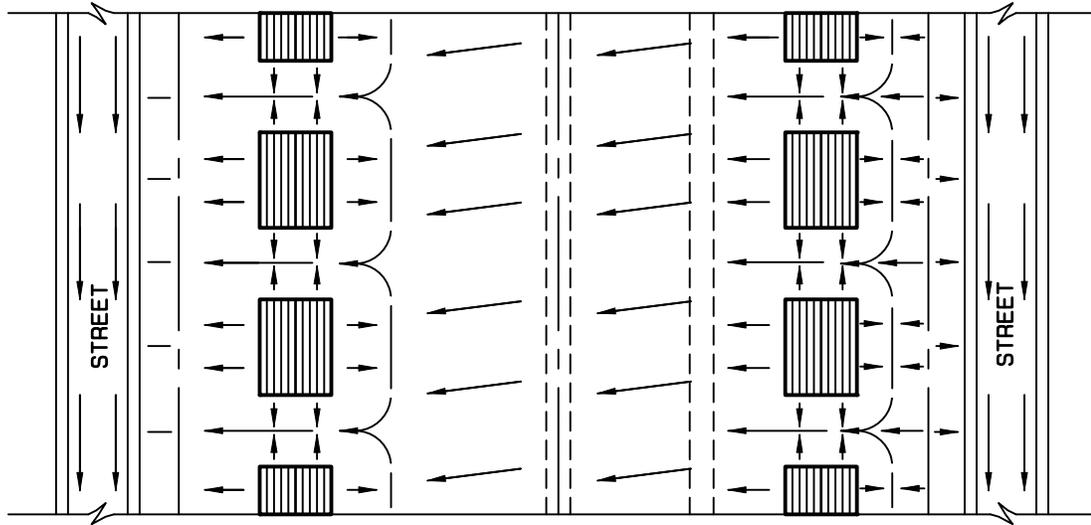
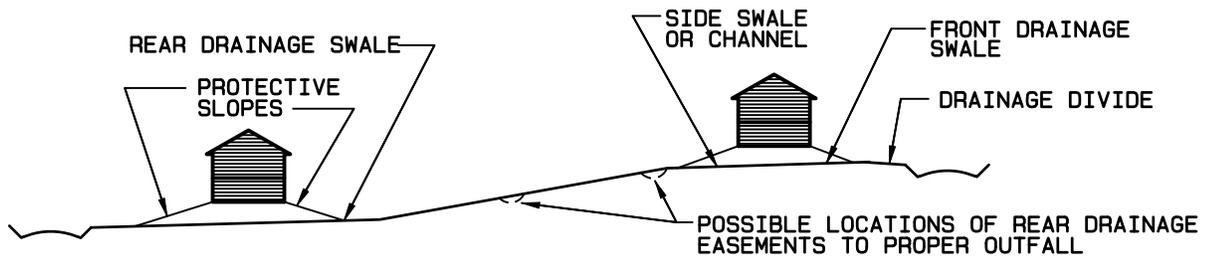
NOVEMBER 1966

FHA NO. 300

CITY OF WAUKEE

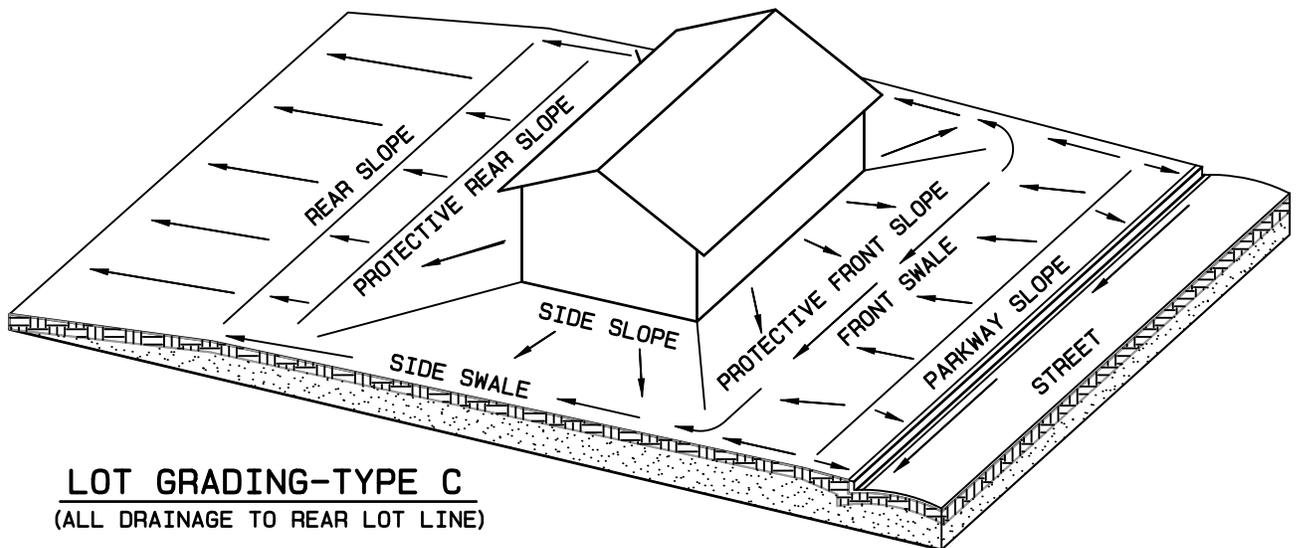
SUBDIVISION LOT GRADING

STD. DWG. NO. 38B



LOT GRADING-TYPE A

LOT GRADING-TYPE C

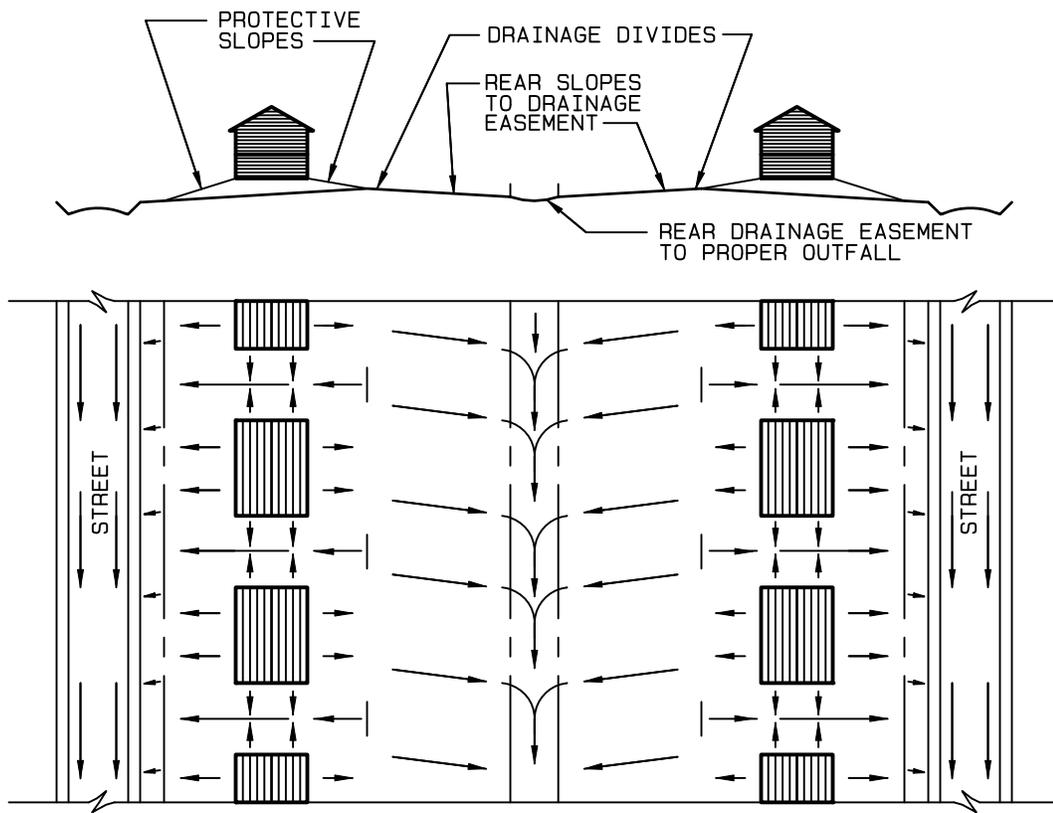


LOT GRADING-TYPE C
 (ALL DRAINAGE TO REAR LOT LINE)

EXAMPLE: BLOCK GRADING TYPE 3
 STEEP CROSS-SLOPE

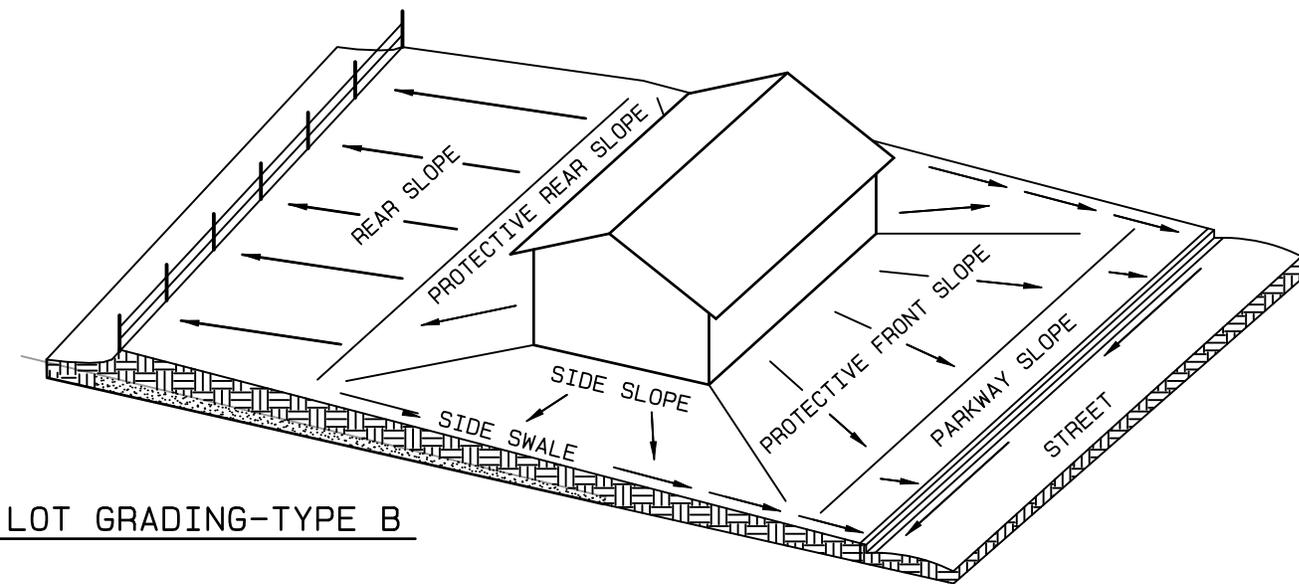
REFERENCE
 "MINIMUM PROPERTY STANDARDS FOR
 ONE AND TWO LIVING UNITS"
 HUD-FHA
 NOVEMBER 1966 FHA NO. 300

CITY OF WAUKEE
 SUBDIVISION LOT GRADING



LOT GRADING-TYPE B

LOT GRADING-TYPE B

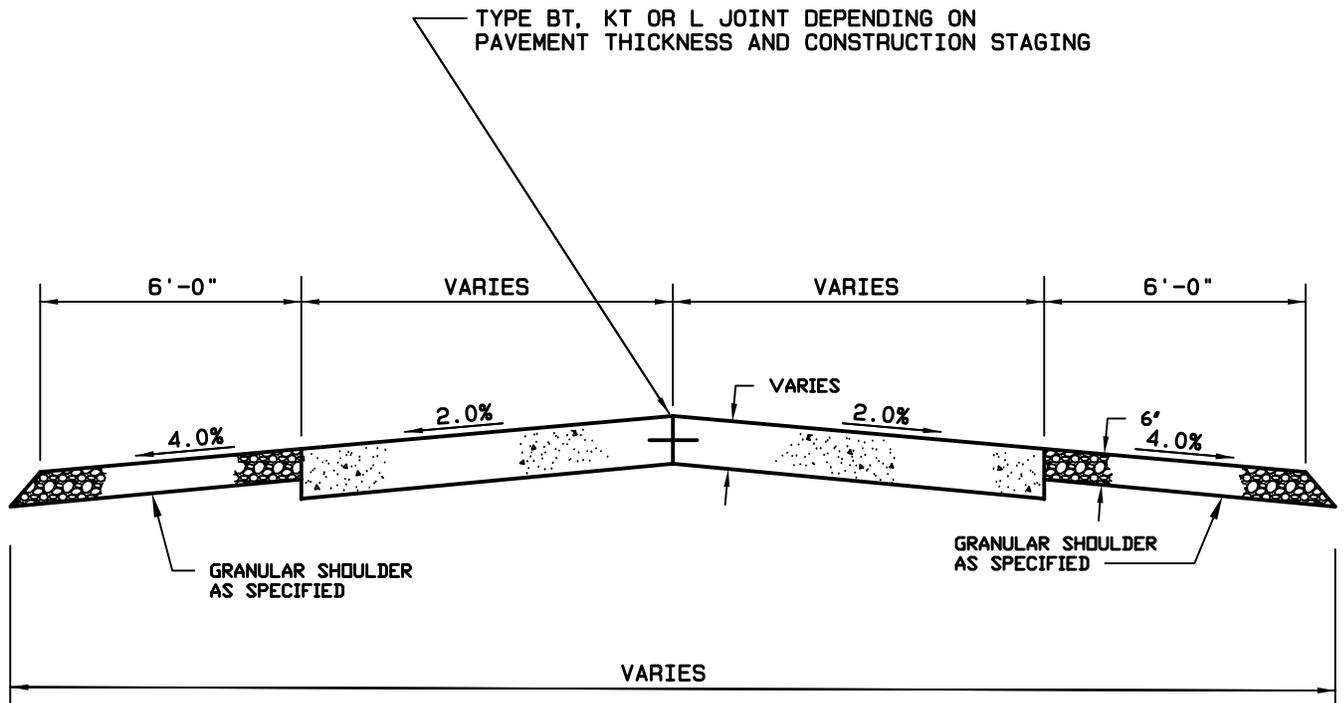


LOT GRADING-TYPE B

EXAMPLE: BLOCK GRADING TYPE 4
 VALLEY ALONG REAR LOT LINES

REFERENCE
 "MINIMUM PROPERTY STANDARDS FOR
 ONE AND TWO LIVING UNITS"
 HUD-FHA
 NOVEMBER 1966 FHA NO. 300

CITY OF WAUKEE
 SUBDIVISION LOT GRADING



SECTION - WIDTH VARIES

CITY OF WAUKEE

TYPICAL RURAL PAVEMENT CROSS SECTION

STD.DWG.NO.39 REV. 1

