City of
Baker City, Oregon

PUBLIC WORKS
STANDARD SPECIFICATIONS AND DRAWINGS

1655 1st Street
Baker City, Oregon 97814
(541) 523-6541
www.bakercity.com

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GENERAL REQUIREMENTS

A. PUBLIC WORKS STANDARDS

1.1 Authority and Purpose

The City of Baker City, Oregon, Development Code (Code) regulates construction and development. These Standard Specifications and Drawings for Public Works Construction (Public Works Standards) supplement and support the general rules and policies contained in the Code.

The purpose of these Public Works Standards is to provide a consistent policy under which certain physical aspects of public facility design and construction shall be implemented. Most of the elements contained in the Public Works Standards are intended to be applied to both public improvements under City contract and public improvements under private contract designated herein.

These Public Works Standards cannot provide for all situations. They are intended to assist but not to substitute for competent work by design professionals and experienced contractors. It is expected that engineers and contractors will bring to each project the best of skills from their respective disciplines.

These Public Works Standards are not intended to unreasonably limit any innovative or creative effort that could result in better quality, better cost savings, or both. Any proposed departure from the Public Works Standards will be judged, however, on the likelihood that such variances will produce a comparable result, in every way adequate for the user and City residents.

Alternate materials and methods will be considered for approval by the City Engineer as the need arises and conditions warrant modification. This consideration will be on a case-by-case basis and will require sufficient justification prior to approval (see Section 1.5 of this section).

1.2 Engineering Policy

It shall be the policy of the City to require compliance with Oregon Revised Statutes, Chapter 672 for professional engineers.

All Plans, reports, or documents shall be prepared by a registered professional engineer (design engineer), or by a subordinate employee under the design engineer's direction, and shall be signed by the design engineer and stamped with the design engineer's seal to indicate the design engineer's responsibility for them. It shall be the design engineer's responsibility to review any proposed public facility extension, modification or other change with the City, prior to engineering or proposed design work, to determine any special requirements or whether the proposal is permissible. Approval of the Plans for any job does not in any way relieve the design engineer of responsibility to meet all requirements of the City or obligation to protect life, health, and property of the public.

The Plans for any project shall be revised or supplemented at any time it is determined that the full requirements of the City have not been met.

1.3 Applicability

The Public Works Standards contained herein shall govern all construction and upgrading of all public and privately financed public facilities in the City and applicable work within its service areas.

1.4 Standard Specifications

Except as otherwise provided by these Public Works Standards, all construction, design, craftsmanship, materials, equipment, and details shall be in accordance with the current Oregon Standard Specifications for Construction and Standard Drawings as published by the Oregon Department of Transportation (ODOT) and American Public Works Association (APWA), Oregon Chapter.

1.5 Approval of Alternate Materials or Methods

Any alternate method or material not explicitly approved herein will be considered for approval as set forth in Section 1.1 of this section. Persons seeking such approvals shall make application in writing. Approval of any deviation from these Public Works Standards shall be in written form. Approval of alternate methods and/or materials will be made in writing.

Alternates must meet or exceed the minimum requirements as set forth in these Public Works Standards.

The written application is to include, but is not limited to, the manufacturer's specifications and testing results, Design Drawings, calculations, reason, justification, and other pertinent information.

Any deviations or special issues shall be reviewed on a case-by-case basis and approved by the City Engineer. When requested by the City, full design calculations shall be submitted for review with the request for approval.

1.6 Revisions to Public Works Standards

Revisions to these Public Works Standards are anticipated to be made from time to time. The date appearing on the bottom of each page is the date of the latest revision. Users should apply the latest published issue to the work contemplated.

Some sections may be changed more than once and it shall be the user's responsibility to maintain his/her copy of these Public Works Standards with the latest changes.

1.7 Definitions

Backflow - The flow of water or other liquids, mixtures, or substances into the distributing pipes of a potable supply of water from any sources other than its intended source.

Backflow Preventer - A device or means to prevent backflow into the potable water system.

Building Service Lateral - A public sanitary sewer beginning at the property line or public easement line and extending to the sanitary sewer main.

Building Sewer - A private sanitary sewer beginning 5 feet outside the building and extending to the property line or public easement line, connecting to the building service lateral.

Building Supply - The pipe carrying potable water from the water meter or other source of water supply to a building or other point of use or distribution on the lot. Building supply shall also mean customer or service line.

City - The City of Baker City, Oregon.

City Engineer - The individual (a registered professional engineer) designated to have the authority to review and approve all Public Works design and construction projects.

Collection Systems - Facilities maintained by the City and connected thereto for collecting, pumping, conveying, and controlling the sewer.

Collector Sewer - The portion of the public sewerage system that is primarily installed to receive sewer water directly from individual residences and other individual public or private structures.

Core - To cut and remove a circular portion of concrete, pavement, pipe, or soil.

Cross Connection - Any connection or arrangement, physical or otherwise, between a potable water supply system and any plumbing fixture or any tank, receptacle, equipment or device, through which it may be possible for non-potable, used, unclean, polluted and contaminated water, or other substances, to enter into any part of such potable water system under any condition.

Cul-de-sac - A dead-end street having a turnaround area at the end.

Curb - The line indicating the edge of the vehicular roadway within the overall ROW.

Cut Sheets - Sheets of tabulated data indicating stationing, structures, fittings, angle points, beginning of curve, points on curve, end of curves, storm drain slope, staking

offset, various elevations, offset cuts, and storm drain depths for streets, water lines, sanitary sewers, and storm drains.

Datum - The vertical elevation control for the City is the North American Vertical Datum of 1988 (NAVD 88). The horizontal datum is State Plane Oregon North (the North American Datum of 1983 [NAD 83]), expressed in international feet.

Design Engineer - The engineer, licensed by the State of Oregon as a Professional Engineer, under whose direction Plans, profiles, and details for the work are prepared and submitted to the City for review and approval, or who is in charge of and responsible for construction management of the improvements.

Designated Arterial or Collector Street - A street designated as an arterial or collector in the Comprehensive Plan.

Detention - The holding of runoff for a short period of time and then releasing it to the natural water course where it returns to the hydrologic cycle.

Domestic Sewage - The liquid and waterborne waste derived from the ordinary living processes, free from industrial wastes, and of such character to permit satisfactory disposal, without special treatment into the public sewer or by means of private sewage disposal system.

Double Check Valve Assembly - An assembly composed of two single, independently acting, approved check valves, including tightly closing shut-off valves located at each end of the assembly and fitted with properly located test cocks.

Double Check Detector Check Valve Assembly - A line-sized approved double check valve assembly with a parallel meter and meter-sized approved double check valve assembly. The purpose of this assembly is to provide backflow protection for the distribution system and at the same time provide metering of the fire system showing any system leakage or unauthorized use of water.

Drainage Facilities - Pipes, ditches, detention basins, creeks, culvert bridges, etc., used singularly or in combination with each other for the purpose of conveying or storing stormwater runoff.

Expansion Joint - A joint to control cracking in the concrete surface structure and filled with preformed expansion joint filler.

Fire Hydrant Assembly - The fire hydrant, attached auxiliary valve, and associated piping and fittings.

Fire Protection Service - A metered connection to the public water main intended only for extinguishing fires and the necessary flushing for its proper maintenance.

Grade - The degree of inclination of a road or slope.

Hydrant Lead - The water line connecting the fire hydrant to the auxiliary valve on the City distribution main.

Industrial Waste - Solid, liquid, or gaseous waste resulting from any industrial, manufacturing, trade, or business process or from development, recovery, or processing of natural resource.

Interceptor Sewer - The primary public sanitary sewer that conveys wastewater directly to the wastewater treatment plant.

Irrigation Service - A metered connection intended for seasonal use and delivering water not discharged to the sanitary sewer.

Lateral Sewer - A building service lateral.

Longitudinal Joint - A joint that follows a course approximately parallel to the centerline of the roadway.

Manufacturer's Name - Any manufacturer's name, specification, catalog, number, or type used herein is specified by make and order to establish the standard requirements of the City. Other equivalent makes will be considered for approval, providing they are comparable with this established standard.

Natural Grade - The grade of the land in an undisturbed state.

On-Site Detention - The storage of excess runoff on the development site prior to its entry into a public storm drain system and gradual release of the stored runoff after the peak of the runoff has passed.

Peak Runoff - The maximum water runoff rate in cubic feet per second (cfs) determined for the design storm.

Plans - Construction plans, including system plans, sewer plans, and profiles, cross sections, detailed drawings, specifications, etc., or reproductions thereof, approved or to be approved by the City Engineer, which show the location, character, dimensions, and details for the work to be performed, in which constitute a supplement to these Public Works Standards.

Potable Water - Water that is satisfactory for drinking, culinary, and domestic purposes and meets the requirement of the health authority having jurisdiction.

Private Collection System - A privately owned and maintained sewer system installed to serve multi-unit structures on single ownership properties, which cannot legally be further divided.

Private Storm Drain - A storm drain located on private property serving more than one structure on the same premises or parking lot catch basins.

Public Sanitary Sewer - Any sewer located in a public ROW or easement and operated and maintained by the City for carrying sewage and industrial waste.

Public Storm Drain - Any storm sewer located in a public ROW or easement and operated and maintained by the City.

Record Drawings - Plans signed and dated by the project engineer indicating that the Plans have been reviewed and revised, if necessary, to accurately show all as-built construction details and changes.

Release Rate - The controlled rate of release of drainage, storm, and runoff water from property, storage pond, runoff detention pond, or other facility during and following a storm event.

Right-of-Way - All land or interest therein which by deed, conveyance, agreement, easement, dedication, usage, or process of law is reserved for or dedicated to the use of the public for sidewalk, utility, and/or roadway purposes, which the City has sole responsibility to maintain.

Roadway - All of that portion of the ROW used or to be used for vehicle movement, which exists between the curbs or proposed curb lines.

Sedimentation - Disposition of erosional debris, soil sediment transported by water from a higher elevation to an area of lower gradient where sediments are deposited as a result of slack water.

Sewage - A combination of the water-carried wastes from residences, business buildings, institutions, and industrial establishments, except industrial wastes.

Sidewalk - A walk or path along the side of a road for pedestrians. A ROW deeded, dedicated, and designated for the use of non-motorized vehicles and pedestrians.

Standard Drawings - The drawings of structures or devices commonly used on public improvements and referred to on construction Plans.

Streets or Roads - Any public highway, road, street, avenue, alleyway, easement, or ROW used or to be used for vehicle movement.

Structures - Those structures designated on the Plans such as catch basins, manholes, etc.

Super Elevation - The vertical distance between the heights of the inner and outer edges of a highway pavement.

Transverse Joint - A joint that follows a course approximately perpendicular to the centerline of the roadway.

Traveled Way - That portion of the roadway for the movement of vehicles, exclusive of shoulder and auxiliary lanes.

Turnaround Area - An area of sufficient size and configuration that a motor vehicle may maneuver so as to travel in the opposite direction.

Trunk Sewer (Interceptor) - A sanitary sewer that is primarily intended to receive wastewater from a collector sewer, another trunk sewer, an existing major discharger of raw or inadequately treated wastewater, or water pollution control facility.

Uniform Plumbing Code - The Uniform Plumbing Code adopted by the current edition of the International Association of Plumbing and Mechanical Officials, as revised by the State of Oregon, called the "Oregon State Plumbing Specialty Code."

Wastewater - The total fluid flow in the sanitary sewerage system, which includes industrial waste-sewage or any other waste including that which may be combined with any groundwater, surface water, or stormwater that may be discharged into the sanitary sewerage system.

Water Distribution System - Water distribution pipelines, pumping stations, valves, and ancillary equipment used to transmit water from the supply source to the service line.

Water Main - The water supply pipes for public or community use.

Water Service Line - The pipe connection from the City water main to the users water meter, hydrant, backflow prevention device, or fire sprinkler double check valve.

Wetlands - Those lands adjacent to watercourses or isolated therefrom which may normally or periodically be inundated by the waters from the watercourse or the drainage waters from the drainage basin in which it is located. These include swamps, bogs, sinks, marshes and lakes, all of which are considered to be part of the watercourse and drainage system of the City and shall include the headwater areas where the watercourse first surfaces. They may be, but are not necessarily, characterized by special vegetation or soils such as peat, muck, and mud.

1.8 Construction Plans

a. Plan Preparation

Construction Plans and Specifications shall be prepared as specified in Sections b through i below by a professional engineer licensed in the State of Oregon.

b. General Information

Prior to any construction work and Plan approval, complete construction Plans, Specifications, stormwater calculations, and all other necessary submittals shall be submitted to the City Engineer for review.

c. Sheet Size

All Plans shall be clearly and legibly drawn in ink on Mylar sheets measuring 22 x 34 inches or other permanent paper stock that is approved by the City. Sheets shall have 1-1/2 inches of clear margin on the left edge and a 1/2-inch margin on all other edges.

d. Sets of Plans

When Plans are prepared for developer-financed projects, the following scale of drawings is suggested.

Plan/Scale	Horizontal	Vertical
Street	1 inch = 20 feet*	1 inch = 5 feet
Sewer	1 inch = 40 feet	1 inch = 5 feet
Storm	1 inch = 40 feet or 20 feet	1 inch = 5 feet
Water	1 inch = 20 feet or 40 feet**	1 inch = 5 feet

**Subdivision street Plans, when combined with other proposed facilities listed above, may be drawn at 1 inch = 40 feet scale.*
***When a scale is used that is smaller than 1 inch = 20 feet (i.e., 1-inch = 40-foot) intersection details showing fittings and valving shall be provided at a larger scale.*

Architectural scales (i.e., 1/4-inch = 1 foot, 0 inches) are not permitted unless otherwise approved.

e. Required Sheets

Plan submittals shall contain the following minimum sheets: title sheet, plan and profile sheets, and detail sheets.

f. Title Sheet

All subdivision projects and multiple street improvements projects shall have a title sheet as the first page of the Plans. This sheet shall contain the following minimum information.

1) Site Plans of the entire project with street ROW and/or subdivision layout at a 1 inch = 100 feet scale. A 1 inch = 200 feet scale may be used if project size is too large. The Site Plans shall also be a composite utility plan showing all properties served by proposed sewer, water, and storm

facilities, in addition to the proposed facility and all easements. The Site Plans shall also include all adjacent public facilities within 100 feet of the proposed project.

2) Vicinity map at a 1 inch = 1,000 feet scale, or greater.

3) Index of sheets.

4) Complete legend of symbols, line types, and hatches used. Legend items shall clearly differentiate between existing and proposed improvements, with proposed improvements shown more prominently than existing improvements. All legend items shall be unique.

5) General and construction notes pertinent to project.

6) Temporary and/or permanent benchmarks used along with their descriptions, elevations of benchmark, and datum.

7) Horizontal and vertical coordinate systems. The City requires the use of the Oregon State Plane North (NAD 83) and NAVD 88.

8) Design engineer's name, address, phone number, and seal.

9) Developer's/owner's name, address, and phone number for public improvements with private financing.

10) Statement referencing City Public Works Standards, City Standard Drawings, and the current Oregon Standard Specifications for Construction and Standard Drawings.

11) Provide contact phone number for all affected utility companies.

12) Show tax lot numbers or lot and block designations.

13) A City Standard Drawing index for all referenced Standard Drawings.

g. Plan Sheet

The plan view of each sheet shall be drawn at the appropriate scale showing the following minimum information:

1) Adjacent street curbs, property lines, ROW lines, utility easements referenced to property lines, street centerlines and intersections. Show property corner and curb elevations to determine water service level, serviceability of lot/property and sanitary sewer, points of disposal for building storm drains, and how new curbs will join to existing curbs.

2) Location of all underground utilities within 100 feet of the project (if they are affected by the project), existing power/telephone poles and guy anchors, valves, manholes, catch basins, fire hydrants, meter boxes, vaults, signs, etc.

3) Location of all watercourses, railroad crossings, culverts, bridges, major trees, water lines, sewer lines, and/or storm drain lines within 200 feet of proposed gravity sewer and storm drain extensions if they affect the design of the project. All watercourses shall show the 100-year floodplain as indicated on the U.S. Army Corps of Engineers and Federal Emergency Management Agency (FEMA) maps.

4) On sewer and storm drain Plans, each manhole, catch basin, and cleanout shall be numbered and stationed. Stationing shall tie to existing street monuments, property corners, or manholes. Each line shall be stationed continuously upgrade from left to right on the plan sheet. Each separate line shall be individually designated (e.g., sewer line 'A', storm line 'A', etc.).

5) On street Plans, horizontal stationing shall show points of tangent and curvature for centerline curve data and shall show tangent length, radius distance, centerline curve length, and delta angle. Centerline intersection stationing, in both directions, shall be shown.

6) Where streets are being widened, edge of pavement elevations shall be shown to determine pavement cross-slope to new curb or pavement edge.

7) On water Plans, all fittings shall be shown and identified by type (i.e., MJ x MJ, FLG X MJ, etc.). Fire hydrants and intersection details for valves and fittings are required when scale of Plans is smaller than 1 inch = 20 feet (i.e., 1 inch = 40 feet). All valves, fittings, and pipe conditions shall be indicated.

8) On erosion control Plans, the location of silt fences, inlet barriers, gravel entryways, temporary ditches and detention ponds, and surface preparation shall be shown. The Plans shall show the entire development. Details of erosion control devices can be shown on these sheets.

9) All notes and key notes shall reference appropriate City Specifications and/or Drawings when applicable.

h. Profile Sheet

Profiles for construction Plans shall be the same horizontal scale as the plan sheet. Where profiles are drawn on the same sheet as the plan view, the profile shall be immediately below the plan view. Stationing shall be continuously upgrade from left to right with lower stations to the left. The following minimum information shall be shown:

1) For sewers and storm drains, show locations of manholes, catch basins, and cleanouts with each numbered and stationed.

2) Existing profile at centerline of proposed utility or street.

3) Proposed profile grade, as appropriate, for all sewers, storm drains and water lines giving pipe size, length between structures, slope, surface restoration type, pipe materials, sewer inverts, rim elevations, etc.

4) Existing underground utilities that cross the alignment of the proposed facility.

5) Beginning of all vertical curves, points of vertical intersection, end of vertical curve, low point of sag curve and length of vertical curve. Profiles of existing centerline grade shall extend a minimum of 250 feet beyond the end of the improvement.

6) Clearly show all potential utility conflicts with appropriate pipes, conduits, vaults, etc., that affect the proposed design.

7) All notes and key notes shall reference appropriate City Specifications and/or Drawings when applicable.

Note: City Record Drawings are only to be used as an aid to the design engineer. When a potential conflict may occur, the design engineer shall field locate, or cause to be located, and verify the alignment, depth, and inverts of all existing facilities shown on the Plans that will be crossed by the proposed facility.

i. Detail Sheets

Detailed drawings shall be included with all construction Plans where Oregon or City Standard Drawings do not exist or apply. If a Standard Drawing must be modified to fit existing or unique conditions, the modified drawing shall be shown on the Plans. When appropriate, due to required detail complexity, a separate detail sheet shall be drawn. When Oregon or City Standard Drawings are used, they must be included with the Plan set. In lieu of including the actual Standard Drawings with the design documents, an index referencing all pertinent

Standard Drawings with their specific drawing number(s) may be included on the title sheet.

1.9 Supporting Information

The design engineer shall submit sufficient supporting information to justify the proposed design. Such information shall include, but not be limited to, the following:

a. Design calculations

b. Stormwater Management Plan and associated calculations

1) Hydrology and hydraulic calculations with basin maps

2) Grading Plan

3) Details and appropriate cross sections of proposed facilities

4) Calculations confirming that all increases to stormwater runoff shall be retained on site

5) Calculations utilizing the 10-year, 24-hour Type 1A storm event (design storm)

c. Alternate materials specifications including manufacturers' design application recommendations.

d. Plan support information to include as required:

1) Geotechnical Report

2) Hydrology, hydraulic, and stormwater calculations

3) Engineering Geology Report

1.10 Utility Plan

When designing sanitary or storm sewer facilities, a utility plan shall be submitted with the construction Plans when required by the City. The utility plan shall be used to identify and analyze the extension of the proposed facilities and shall include a topographic plan. The topographic plan shall show all upstream and tributary areas within no less than 200 feet of the proposed development.

The utility plan shall include existing contours at 1-foot intervals, or as approved by the City. Include locations of existing structures and public and private utilities.

1.11 Grading Plan

When required by the City's development code, a grading plan shall be submitted with the construction Plans. The grading plan shall include all grading elements as required and described in Technical Specifications - "Excavation and Grading."

1.12 Plan Submittal

Plans for all privately financed Public Works facility improvements shall be submitted to the City with the appropriate fee. The City Engineer will coordinate the plan review and approval of all construction Plans, which will include reviews for compliance with all City Codes, Ordinances, Public Works Standards, Oregon Standard Drawings, and utility master plans.

All Plan submittals shall include information required in Section 1.9 of the General Requirements of these Public Works Standards along with all other information requested by the City. This information shall include, but is not limited to, easement documents, ROW dedications, and executed agreements. All submittals shall be reviewed for completeness by the design engineer, and the City Engineer shall be notified if required information is missing. Submittals should be made in a timely manner as lack of information to the City may impede the review process.

1.13 Preconstruction Conference

A preconstruction conference shall be held prior to the Work commencing on the project. The Contractor, City, City Engineer, and other appropriate agencies, utilities, etc., shall attend. The meeting shall be held to discuss general contracting procedures, communications, roles and responsibilities, quality control, project work schedule, agency requirements, and other topics that relate to the Work as appropriate.

1.14 Public Improvement Procedure

The developers/contractors of all major developments and subdivisions within the City are responsible for installation of public improvements within all newly proposed streets, all existing adjacent unimproved streets and off-site improvements determined by the City to be necessary for the functionality of the development and/or to mitigate development impacts. Public improvements shall include, but are not limited to:

- Street paving
- Storm drainage
- Curbs
- Sidewalks
- Gutters
- Public water lines
- Public sewer lines

- Street lights
- Bike paths
- Fire hydrants
- Americans with Disabilities Act ramps

In addition to the above listed improvements, it may be necessary to construct or contribute to the future construction of traffic signals, water or sewer pump stations, or future infrastructure upgrades such as pipe oversizing.

Following completion of improvement installation, City Public Works staff will inspect all improvements. The City will generate a punch list of corrections needed and submit said list to the applicant. Following completion of all punch list items, the applicant may request re-inspection. Once the improvements are accepted by the City, the applicant must provide Record Drawings of all public improvements, prepared by the design engineer. The applicant must also provide a one-year maintenance bond for 25 percent of the cost of the installed improvements.

CHECKLIST FOR PLAN REVIEW AND SUBMISSION

Action	Date
Attend Pre-Application Meeting	
Obtain Standard Drawings and Specifications	
Submit Preliminary Design Drawings with Erosion Control Plan	
Revised Design Drawings per City Comments*	
Resubmit Design Drawings as Required	
City Approves Design Drawings	
Developer Schedules and Attends Pre-Construction Meeting with Selected Contractor	
Begin Construction of Improvements	
Complete Testing of Improvements as Required	
Complete Construction of Improvements	
Call for Final Inspection of Improvements	
City Issues Punch List of Corrections	
Call for Reinspection and Request Acceptance	
City Approves Improvements	
Submit Record Drawings (see Section 1.15 below)	
City Releases Certificate of Occupancy	

**All revised Design Drawings shall include revision numbers and dates, and all revisions shall be clouded.*

1.15 Record Drawings

For all Public Works facility improvements, the design engineer shall submit certified Record Drawings for all Plans approved for construction. Record Drawings shall meet the requirements of Sections a through e of this section and shall be of archival quality. The Record Drawings shall be 4 mil Mylar with silver halide emulsion. Original inked

Mylars may also be submitted in lieu of photographic Mylars on Mylar sheets. The design engineer may submit Record Drawings on another permanent paper as approved by the City.

The design engineer shall submit a signed statement certifying that all work for which Plans were approved has been completed in accordance with the Public Works Standards (Standard Specifications and Standard Drawings) and design documents. This statement shall be included directly on the Record Drawings.

The words "Record Drawing" shall appear as the last entry in the revision block along with the month, day, and year the Record Drawing was prepared.

Note: Actual location and depth from finish grade of any other utilities encountered during construction shall be noted on the Record Drawings.

a. Sheets

The following minimum information shall be noted on the street Record Drawings:

1) Change in horizontal alignment, curve data, and stationing of primary control points (e.g., PC, PI, PT, PRC).

2) Vertical curve or grade changes; change in location of low point in sag vertical curve.

3) Change to approved thickness for street pavement section components. Show station limits where changes in structural section have occurred.

4) Change to driveway locations or widths.

5) Other change(s) altering the approved Plans including, but not limited to, curbs, sidewalks, Americans with Disabilities Act ramps, and lighting.

b. Storm Drains

The following minimum information shall be noted on storm drain Record Drawings:

1) Station of drainage structures such as manholes and catch basins. Tie each drainage structure to nearest property corner ROW line, and distance back from the top back of curb.

2) Show alignment changes, grade changes, and changes in construction materials. If alignment changes result in station changes, a station equation shall be shown as appropriate at a manhole.

3) Other change(s) altering the approved Plans including, but not limited to, catch basin location, manhole location, pipe size, dry well location, etc.

c. Sanitary Sewers

The following minimum information shall be noted on sanitary sewer Record Drawings:

1) Station of manhole, wye, or tee into main line. Tie each to nearest property corner at ROW line, and distance back from the top back of curb.

2) Depth at the end of service lateral measured from existing ground to invert of pipe. When required by the City Engineer, invert elevations shall be noted.

3) Length of service lateral measured from centerline of sewer main to end of pipe.

4) Changes in alignment, grade, pipe size and construction materials. If such changes in alignment and/or grade result in station changes, the stationing and offsets shall be changed for the manholes and other structures affected by the changes.

5) Other change altering the approved Plans.

6) Type of pipe, backfill material, and location.

d. Water Mains

The following minimum information shall be noted on water main Record Drawings:

1) Station and/or property line/corner to valves (not at standard location), all fittings, blowoffs and dead-end lines.

2) All changes from standard 48-inch depth cover. Limits shall be shown on all Plans with annotated reason for change. Actual pipe elevation (top of pipe) will be taken at each fitting.

3) Changes in alignment, grade, pipe size, and construction materials. If such changes in alignment and/or grade result in station changes, the stationing and offsets shall be changed for the valves and other fittings affected by the changes.

4) Provide manufacturer of all valves identify types of fittings (i.e., MJ x MJ, FLG x MJ, etc.) if there are deviations from the Plans. Provide information in the form of an inventory list on construction drawings.

5) Other changes altering the approved Plans.

6) Provide photographs of all installed valves and fittings in place before backfilling if required by the City.

e. Inspection and Testing Results

The Contractor/developer shall submit all inspection and testing results to the City as part of the Record Drawings submittal. This shall include all compaction density testing for aggregate base and asphalt concrete pavement, concrete cylinder test results (i.e., slump, air, break result, etc.), bacteria testing, air test documentation, hydrostatic test results, etc. The Record Drawings shall not be deemed complete until this information is provided.

B. PROJECT WORK MEETINGS

The Contractor and/or their superintendent shall meet with the City on a regular basis to review the progress of the Work, Work schedule, Project concerns, etc., as may be appropriate. The intent of this meeting will be to keep communication channels open and to keep all parties informed as to the status of the Work. Generally, the meeting shall be held bi-weekly; however, it may be scheduled at other times if needed. This meeting will be used to review Record Drawings being kept on the Project by the Contractor.

C. ENVIRONMENTAL REQUIREMENTS

The Contractor shall be responsible for obtaining an National Pollutant Discharge Elimination System Permit 1200-C for erosion and sedimentation control during construction if this permit is required. A copy of the permit shall be provided to the City prior to the start of construction.

D. PROJECT SAFETY

1.1 The Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work, including excavation safety. The Contractor shall comply with all applicable Laws and Regulations, ordinances, rules, and orders of any public body having jurisdiction as it relates to Project and Work safety.

1.2 The Contractor shall maintain local access to area residents and emergency traffic throughout the life of the Project and coordinate construction activities closely with area residents to keep them informed of operations that may impact their use of any streets or roadways.

1.3 All signs, barricades, barriers, lights, cones, trench boxes, shoring/bracing, and other such "devices" required to warn, protect, or direct the public and workmen during the life of the Contract shall be furnished, installed, moved, and removed by the Contractor. When conditions warrant their use, flagpersons shall also be provided by the Contractor. The determination of what measures are required, in addition to those specifically called for by the Public Works Standards, shall be solely the responsibility of the Contractor.

1.4 All construction Work shall be performed in accordance with the provisions of the Occupational Safety and Health Regulations of the Oregon Occupational Safety and Health Division, and other applicable regulations. It shall be the Contractor's responsibility to meet all requirements of Chapter 437 of the State of Oregon Administrative Rules. In addition, Oregon Revised Statutes (ORS) 757.542 through 757.562 and Oregon Administrative Rules (OAR) 860-024-0007 administered by the Oregon Public Utilities Commission shall apply.

1.5 The materials used for and the installation of all warning and traffic control devices shall be in like-new condition and shall conform to the applicable provisions of the Oregon Standard Specifications for Construction - current edition, Sections 00220 and 00225, and the Manual on Uniform Traffic Control Devices, U.S. Department of Transportation, Federal Highway Administration, current edition.

E. QUALITY CONTROL

1.1 The Contractor shall be responsible for providing their own construction monitoring and quality control program to ensure the materials used on the Project and in the Contractor's operations are in compliance with the Public Works Standards. A written quality control program shall be provided to the City for their review prior to any Work being performed. The written quality control program shall describe how the Contractor will monitor and ensure quality control throughout the Work. Materials, equipment, or Work that fails to meet the Contract requirements shall not be used in the Work.

1.2 Special inspections and testing shall be performed in accordance with the latest edition of the Oregon Structural Specialty Code (OSSC). As required by the OSSC, any special inspections or tests performed on a project shall be completed by a qualified firm normally engaged in the business of providing said special inspections and tests. The special inspection and testing services shall be performed and paid for by the Contractor. All other testing and inspections required that are not deemed special inspections and testing, as defined in the OSSC, shall also be performed and paid for by the Contractor, unless, at the City's discretion, they elect to contract the testing and/or inspection services. The Contractor or developer shall be responsible for reimbursement to the City for all inspection and testing costs.

1.3 The City and their representatives will at all times have access to the Work. In addition, authorized representatives and agents of any participating federal or state agency shall

be permitted to review all Work, materials, invoices of materials, and other relevant data and records. The Contractor will provide proper facilities for such access and observation of the Work and also for any review or testing thereof. The Contractor shall notify testing personnel, including testing personnel provided by the City, at least 24 hours in advance of operations to allow for personnel assignments and test scheduling. All materials to be tested shall be provided by the Contractor at their expense. After tests are completed, the Contractor shall be responsible for repairing test areas to match original conditions. The Contractor shall pay for all additional reviews and retesting required because of defective Work or ill-timed notices.

1.4 Tests or reviews by the City Engineer or others shall not relieve the Contractor from their obligations to perform the Work in accordance with the requirements of the Public Works Standards and does not make the City, or others, an insurer of the Contractor's Work.

1.5 When tests are required, the technician or technicians performing any testing shall possess valid Western Alliance for Quality Transportation Construction (WAQTC) recognized certifications, Oregon Department of Transportation (ODOT) recognized certifications, or American Concrete Institute (ACI) recognized certifications in the following disciplines:

- Aggregate Testing Technician (AgTT)
- Asphalt Testing Technician (AsTT)
- Concrete Testing Technician (CTT)
- Embankment and Base Testing Technician (EBTT)
- Density Testing Technician (DTT)
- ACI Concrete Strength Testing Technician (CSTT)
- ACI Concrete Field Testing Technician (CTT)
- Certified Aggregate Technician (CAgT) (WAQTC = AgTT)
- Certified Embankment and Base Technician (CEBT) (WAQTC = EBTT)
- Certified Density Technician (CDT) (WAQTC = DTT)
- Certified Asphalt Technician I (CAT-I) (WAQTC = AsTT)
- Certified Asphalt Technician II (CAT-II)
- Certified Mix Design Technician (CMDT)
- Quality Control Technician (QCT)
- Concrete Control Technician (CCT)
- Concrete Strength Technician (CST)
- Concrete Laboratory Testing Technician (CLTT)

1.6 Following are the minimum required tests and testing frequency that shall be included in the Contractor's quality control program for the materials listed. See other sections of these Public Works Standards for other testing and quality control requirements. If the Contractor fails to provide all or any part of the required quality control testing and corresponding reports for the Project after the City has requested the Contractor to do

so in writing, the City may elect to have the quality control work performed by others and charge the Contractor the actual cost of quality work plus $100 for each test performed.

a. Trench Backfill Materials

A minimum of one ASTM D1557 laboratory density test will be performed for each testable material used as trench backfill, providing the maximum theoretical density and optimum moisture content of the material. A minimum of one nuclear gauge density test (ASTM D6938) will be performed every 300 feet along the trench line on each lift of material to show required density is being achieved. Once an acceptable compaction method is established and verified with field density tests, the testing interval can be reduced to 600 feet along the trench line. If backfill material or compaction equipment changes, compaction testing shall immediately be performed to verify that density is being achieved and shall continue at 300-foot intervals until a new compaction method is verified.

b. Earthwork

A minimum of one AASHTO T 180 laboratory density test will be performed for each testable material used as embankment material, providing the maximum theoretical density and optimum moisture content of the material can be determined. A minimum of one nuclear gauge density test (ASTM D6938) will be performed every 800 square yards on each lift of material to show required density is being achieved. Once an acceptable compaction method is established and verified with field density tests, the testing interval can be reduced to one test each 1,600 square yards on each lift. If backfill material or compaction equipment changes, compaction testing shall immediately be performed to verify that density is being achieved and shall continue at 800 square yard intervals until a new compaction method is verified.

c. Aggregate Base

1) Testing required to qualify material source prior to production as outlined in Technical Specifications - "Streets."

2) Quality control testing required during production consists of the following:

Gradation	AASHTO T 27	Start of production and one test every 1,000 tons (three tests minimum)

Fracture Face	AASHTO T 335	Start of production and one test every 3,000 tons (three tests minimum)
Sand Equivalent	AASHTO T 176	Start of production and one test every 3,000 tons (three tests minimum)

3) Compliance of aggregate base produced and stockpiled before the beginning of this Project will be determined by the following:

a) Provide all production records for testing that was performed during production.

b) If production records are not available, provide post testing of the stockpile per AASHTO T 2 as follows:

Gradation	AASHTO T 27	One test every 1,000 tons in stockpile (three tests minimum)
Fracture Face	AASHTO T 335	One test every 3,000 tons in stockpile (three tests minimum)
Sand Equivalent	AASHTO T 176	One test every 3,000 tons in stockpile (three tests minimum)

4) Compliance of aggregate base delivered to the Project Site will be determined by the following:

Gradation	AASHTO T 27	One test every 1,000 tons (three tests minimum)
Fracture Face	AASHTO T 335	One test every 3,000 tons (three tests minimum)
Sand Equivalent	AASHTO T 176	One test every 3,000 tons (three tests minimum)

5) A minimum of one AASHTO T 180 laboratory density test will be performed on aggregate base material, providing the maximum theoretical density and optimum moisture content of the material can be determined. A minimum of one nuclear gauge density test (ASTM D6938 or AASHTO T 310) will be performed every 800 square yards on each lift of base rock to show required density is being achieved. Once an acceptable compaction method is established and verified with field density tests, the testing interval can be reduced to one test each 1,600 square yards on each lift. If base rock material or compaction equipment changes, compaction testing shall immediately be performed

to verify that density is being achieved and shall continue at 800 square yard intervals until a new compaction method is verified.

d. Asphalt Concrete Pavement (ACP)

1) Testing required to qualify ACP aggregate material source prior to production consists of the following (current ODOT certification of the material source can be substituted for this testing):

Soundness	AASHTO T 104
Abrasion	AASHTO T 96
Degradation	ODOT TM T-208
Lightweight Pieces	AASHTO T 113
Plastic Index	AASHTO T 103
Friable Particles	AASHTO T 112

2) Quality control testing required on ACP aggregate during production consists of the following:

Gradation	AASHTO T 27	Start of production and one test every 1,000 tons (three tests minimum)
Sand Equivalent	AASHTO T 176	Start of production and one test every 3,000 tons (three tests minimum)
Fracture Face	AASHTO T 335	Start of production and one test every 3,000 tons (three tests minimum)
Wood Particles	ODOT TM T-225	Start of production and one test every 3,000 tons (three tests minimum)
Elongated Pieces	ODOT TM T-229	Start of production and one test every 3,000 tons (three tests minimum)
Dust or Clay Coating	ODOT TM T-226	Start of production and one test every 3,000 tons (three tests minimum)

3) Compliance of ACP aggregates produced and stockpiled before the Award Date or Notice to Proceed of this Contract will be determined by the following:

a) Provide all production records for testing that was performed during production.

b) If production records are not available, provide post testing of the stockpile per AASHTO T 2 as follows:

Gradation	AASHTO T 27	One test every 1,000 tons in stockpile (three tests minimum)
Sand Equivalent	AASHTO T 176	One test every 3,000 tons in stockpile (three tests minimum)
Fracture Face	AASHTO T 335	One test every 3,000 tons in stockpile (three tests minimum)
Wood Particles	ODOT TM T-225	One test every 3,000 tons in stockpile (three tests minimum)
Elongated Pieces	ODOT TM T-229	One test every 3,000 tons in stockpile (three tests minimum)
Dust or Clay Coating	ODOT TM T-226	One test every 3,000 tons in stockpile (three tests minimum)

4) Quality control testing of ACP mixture required during placement is as follows:

Asphalt Content	AASHTO T 308	One test every 1,000 tons, one test per day minimum
Gradation	AASHTO T 30	One test every 1,000 tons, one test per day minimum
Maximum Specific Gravity	AASHTO T 209	One test every 1,000 tons, one test per day minimum
Compaction	WAQTC TM 8	5 tests every 1,000 tons
Percent Hydrated Lime	ODOT TM T-321	One test every 1,000 tons

Asphalt content, gradation, and maximum specific gravity testing will be performed at the start of production to verify the hot-mix asphalt mix design.

e. Portland Cement Concrete (PCC)

Aggregate testing is required to be completed with the mix design. Should additional testing of aggregate for PCC be deemed necessary by the City Engineer, testing shall be performed by the Contractor as specified by ASTM C33. Samples shall be selected at random from the stockpile and tested for conformance with the Specifications. The decision to perform aggregate testing and testing frequencies shall be left to the City Engineer.

Quality control testing of PCC during and following placement is as follows:

Air Content	AASHTO T 152	One test per each set of cylinders One test per each truck
Slump	AASHTO T 119	One test per each set of cylinders One test per each truck
Concrete Temperature	AASHTO T 309 ASTM C1064	One test per each set of cylinders One test per each set of cylinders
Strength	AASHTO T 22, AASHTO T 23, ASTM C31, AND ASTM C39	One set of three cylinders per 25 cubic yards (minimum one set per day)

F. REVIEW OF WORK

It is not the intent of the City to provide continuous or full-time observation of all Work. When required by the City, the Contractor shall provide the City a weekly report of their Work progress and proposed Work schedule for the next week. This weekly communication may be a requirement if requested in writing by the City.

G. COOPERATION WITH OTHERS

The Contractor shall cooperate with the residents and business owners in the area to provide good access to private property whenever possible. Sidewalks shall be kept clear at all times of any construction materials. Barricades, traffic cones, blinkers, and signing shall be used to direct the public through the Work area safely.

H. EXISTING SURVEY MONUMENTATION

1.1 The Contractor shall be responsible for the protection and perpetuation of existing land survey, property, or construction monuments shown on the Drawings, which are marked or are clearly visible on the ground.

1.2 The Contractor shall give the City a minimum of 48 hours' notice prior to working in the vicinity of any such monument that the Contractor may disturb so the City can arrange for such monuments to be referenced. When proper notice is provided, the City shall have any disturbed monuments restored following construction. Should the Contractor fail to provide adequate notice to the City, the Contractor shall be responsible for the expense of having the disturbed monument restored by a qualified surveyor.

I. EXISTING UTILITIES

1.1 The Contractor shall notify by the one-call number, 1-800-332-2344, at least 72 hours in advance, all utility offices affected by the construction operations. The Contractor shall not expose any marked out underground utility without first notifying the affected agency and being granted permission to do so. The Contractor is responsible for locating

and exposing, if necessary, all existing underground utilities in advance of the trenching operation.

The Contractor is responsible for protecting all power and telephone poles and overhead cables from damage. If interfering power poles, telephone poles, guy wires, or anchors are encountered, the Contractor shall notify the utility owner at least 72 hours in advance of construction operations to permit the necessary arrangements with the affected utility company for protection or relocation of the interfering structure. The Contractor shall be solely and directly responsible to the owner and operators of such utilities/properties for any damage, injury, expense, loss or inconvenience, delay, suits, actions, or claims of any kind brought because of injuries or damage that result from performing the contract work.

The Contractor shall immediately notify the proper authority in the event of interruption to domestic water, sanitary sewer, storm sewer, or other utility service resulting from accidental breakage, or as a result of being exposed or unsupported. All repair or replacement of existing water or sewer pipe must conform to the City's Specifications. If an existing water or sewer pipe is damaged to any extent, the City must be immediately notified. The damaged pipe must remain exposed until inspected by a City Representative. Repairs will be made upon approval by the City. All repairs or replacements will be inspected by the City prior to backfill. Repaired or replaced sewer lines will be inspected by closed circuit television video by the City or an independent third party at the Contractor's expense after the trench is backfilled and prior to City acceptance. The Contractor shall cooperate with the affected agency to restore services as promptly as possible and shall bear all costs of repair for the utility. In no case shall interruption of any water, sanitary sewer, or utility service be allowed outside normal working hours unless prior approval is granted by the City.

Neither the City, the utility owner, nor its officers or agents, shall be responsible to the Contractor for damages resulting from the location of any underground utilities being other than that shown on the Plans, or for the existence of underground utilities not shown on the Plans or properly marked out on the site.

Should the Contractor encounter any utility service lines that interfere with trenching or conflict with the proposed work, the Contractor may obtain prior approval of the utility owner and governing authority to cut the service, dig through, and cause the service to be restored or relocated with similar and equal materials at the Contractor's expense.

The Contractor shall make any advance exploration necessary to protect all existing utilities and to properly plan the installation of pipelines or other work to the design line and grade. The Work shall include all labor, equipment, etc., necessary to perform the location work.

ATTENTION: Oregon law requires contractors to follow rules adopted by the Oregon Utility Notification Center. Those rules are set forth in OAR 952-001-0001 through

952-001-0100. Copies of the rules may be obtained by calling the center at 503-232-1987.

1.2 The Contractor shall receive prior approval from the appropriate authority or utility owner before any public or private utility service is interrupted.

a. The Contractor shall give a minimum of 48 hours' notice to all utility customers who will be affected by the Contractor's operations. No utility service shall be disconnected or interrupted for more than nine hours or as required by the utility owner, whichever is less, in any 24-hour period. When disruption of service will be longer than nine hours in any one day, the Contractor shall provide safe and appropriate temporary service. All temporary service shall be coordinated with the utility owner.

b. When regular utility service interruption is required during the course of the Work, the Contractor shall submit a written plan to the Engineer and utility owner which details proposed Work plan notification procedures, and estimated extent of service interruption. The Contractor must obtain written approval of their plan from the utility owner prior to interrupting the utility service. As a minimum, notification shall include door hangers and public notification in the newspaper and radio, as appropriate. Personal contact shall be made where practical.

c. The Contractor shall make every effort possible to provide continuous utility service to all utility customers. When special conditions exist where an interruption of utility service would create an extra hardship on the utility customer or create a hazardous condition, the Contractor shall provide continuous service. Particular care and planning must be arranged to provide continuous service of existing services or temporary services as approved by the utility owner and the City.

d. If the Contractor inadvertently damages or interrupts an existing utility, the Contractor shall immediately notify the affected utility company, City, and utility users and make arrangements to provide temporary service to the parties affected.

1.3 The Contractor shall support and otherwise protect all pipes, conduits, cables, poles, and other existing services where they cross the trench or are otherwise undermined or affected by their Work. The Contractor shall restore the support of an undermined existing utility using select backfill compacted to 95 percent maximum density as determined by ASTM D698.

1.4 Any connections to existing City-owned utilities shall be completed by City crews at the expense of the developer.

J. PROGRESS OF THE WORK - CLEANUP

1.1 The Contractor shall arrange their work schedule such that all phases of Work, once started, shall be diligently pursued until completed. The intent is that the work area shall not be disturbed for undue periods of time. Work shall not be left uncompleted. If the Engineer determines that Work is not being diligently completed, the City shall request the Contractor to complete said Work.

1.2 Cleaning up shall be a continuing process from the start of the Work to final acceptance of the Project. The Contractor shall, at all times, at their own expense and without further order, keep property on which Work is in progress free from accumulations of waste material or rubbish caused by employees or by the Work, and at all times during the construction period shall maintain structure sites, rights-of-way, easements, adjacent property, and the surfaces of streets and roads on which Work is being done in a safe condition for the Contractor's workers and the public.

a. Accumulations of waste materials that might constitute a fire hazard will not be permitted.

b. Spillage from the Contractor's hauling vehicles on traveled public or private roads shall be promptly cleaned up. The Contractor shall take appropriate action to control dust caused by their operations. This shall include, but not be limited to, watering of exposed areas, cleaning of roadways, etc. This is considered a normal part of the construction Project.

c. Upon completion of the Work, the Contractor shall, at their own expense, remove all temporary structures, rubbish, waste material, equipment, and supplies resulting from their operations. They shall leave such lands in a neat and orderly condition that is at least as good as the condition in which they found them prior to their operations.

d. Should the Contractor fail to provide said cleanup upon 24-hour written notice, the City shall have the right to perform such Work at the expense of the Contractor.

1.3 The Contractor shall replace or restore, equivalent to their original condition, all surfaces or existing facilities disturbed by their Work, whether within or outside of the Work areas. Restoration work will include, but is not limited to, roadways, utilities, structures, landscaping, etc.

K. PERMITS

1.1 Temporary permits and licenses necessary for the prosecution of the Work including building, electrical, and plumbing permits, shall be obtained by the Contractor unless otherwise stated in the Drawings and Specifications. Permanent permits and licenses such as state highway permits, railroad crossing licenses, county road crossing permits,

etc., shall be obtained by the Contractor. The Contractor shall comply with all requirements of these temporary and permanent permits and licenses as they relate to the Work, i.e., insurance, traffic control, scheduling, etc. The Contractor shall pay all inspection fees, flagging costs, etc., if any, required by the permits or licenses.

The Contractor shall give all notices and comply with all laws, ordinances, rules and regulations bearing on the conduct of the Work as drawn and specified. If the Contractor observes that the Drawings and Specifications are at variance therewith, he/she shall promptly notify the City Engineer in writing.

For City infrastructure projects, all easements and rights-of way required for the Work shall be obtained by the City. For infrastructure projects by others, all easements and rights-of-way required for the Work shall be obtained by the developer and/or Contractor. The Contractor shall comply with all requirements of these easements and rights-of way as they relate to the Work, i.e., insurance, traffic control, scheduling, restoration, etc.

1.2 Inspections

a. General

All construction or work for which a permit is required shall be subject to inspection by the City and all such construction or work shall remain accessible and exposed for inspection purposes until approved by the City. In addition, certain types of construction shall have continuous inspection.

Approval as a result of an inspection shall not be construed to be an approval of a violation of the provisions of the Codes and/or Ordinances of the City. Inspections presuming to give authority to violate or cancel the provisions of the Codes and/or Ordinances of the City shall not be valid.

It shall be the duty of the permit applicant to cause the work to remain accessible and exposed for inspection purposes. Neither the City Representative nor the City shall be liable for expense entailed in the removal or replacement of any material required to allow inspection.

b. Inspections for Right-of-Way Improvements

If the construction of sidewalk, curb and gutter, or asphalt concrete pavement improvements, is not included in a performance bond of an approved subdivision or the performance bond has lapsed, then every person, firm, or corporation desiring to construct sidewalks as provided by these Public Works Standards, before commencing the work or improvement, shall comply with the following:

1) An occupancy permit shall not be issued for a development until provisions of these Public Works Standards are satisfied.

2) The City may allow temporary noncompliance with the provisions of these Public Works Standards to the landowner, builder or Contractor when, in the City Engineer's opinion, the construction of the sidewalk is impractical for one or more of the following reasons:

   a) Sidewalk grades have not and cannot be established for the property in question within a reasonable length of time;

   b) Forthcoming installation of public utilities or street paving would be likely to cause severe damage to the new sidewalk;

   c) Street ROW is insufficient to accommodate a sidewalk on one or both sides of the street; or

   d) Topography or elevation of the sidewalk base area makes construction of a sidewalk impractical or economically feasible.

c. Inspections by City Representatives

A City Representative shall be notified and/or present for the following work items.

1) Grading - Streets

   a) Erosion control up before construction begins

   b) Geotechnical Report and special details review, if any

   c) Swale and soil replacement

   d) Fill material (compaction and in lifts)

   e) Proof roll and deflection test of subgrade

   f) Aggregate base rock material (compaction method [test strip if needed], depth, and cross grade and street grade)

   g) Observe curb and gutter install

   h) Aggregate base rock (subbase and finish grade)

   i) ACP (material, cross grade, street grade, density test)

j) ADA ramps

k) Sidewalk forms, subbase, finish grade

2) Sanitary Sewer

a) Pipe material

b) Manhole material and type

c) First manhole: aggregate base rock, mastic, boots, channel, backfill, compaction, etc.

d) Initial pipe install: bedding, haunches, setting pipe, pipe zone, locating wire, backfill, and laser for grade

e) First service lateral: tee/wye, grade, pipe, bed and backfill

f) Testing: manholes, pipe pressure, mandrel, and TV

3) Water

a) Pipe material

b) Check valve, fittings and other materials

c) Initial pipe install: same as above

d) First valve/fitting install

e) First service line install

f) Pressure test

g) Disinfection and bacteria testing

4) Storm Drain

a) Pipe material

b) Manhole material

c) First manhole: base rock, mastic, boots, channel, backfill, and compaction.

d) Initial pipe install: bedding, haunches, setting pipe, pipe zone, locating wire, backfill, and laser for grade

e) First catch basin/inlet install

f) Testing: manholes, pipe pressure, mandrel, and TV

g) Test swale infiltration by flooding the swale

5) Final Walkthrough

a) A final walkthrough with the City shall be completed and a punch list created after improvements are complete.

b) The punch list should include items that may be unfinished such as grading of the lots, damage done by construction (chipped curbs, etc.), items that do not meet Plans or City Standards, restoration, cleanup, Record Drawings, and/or testing documentation.

c) Record Drawings with design engineer certification shall be provided to the City along with design engineer certifications and compaction testing results.

d) The project shall be considered complete when all the punch list items are completed and approved.

TECHNICAL SPECIFICATIONS

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EXCAVATION AND GRADING

TECHNICAL SPECIFICATIONS

SECTION 1

EXCAVATION AND GRADING

PART 1 - GENERAL

1.1 Scope

These Specifications set forth rules and regulations to control excavation, grading, and earthwork construction, including fills and embankments, and provide for approval of the Plans and the inspection of grading construction, when required by the Baker City Development Code.

The standards listed below are guideline standards and, as such, are not adopted as part of these Specifications.

A. Testing

1. ASTM D1557, Moisture-density Relations of Soils and Soil Aggregate Mixtures
2. ASTM D1556, In-Place Density of Soils by the Sand-Cone Method
3. ASTM D2167, In-Place Density of Soils by the Rubber-Balloon Method
4. ASTM D2937, In-Place Density of Soils by the Drive-Cylinder Method
5. ASTM D2922 and ASTM D3017, In-Place Moisture Contact and Density of Soils by Nuclear Methods.

1.2 Hazards

Whenever the City determines that any existing excavation, embankment, or fill on private property has become a hazard to life and limb; endangers property; or adversely affects the safety, use, or stability of a public way or drainage channel the owner of the property upon which the excavation or fill is located or other person or agent in control of said property, upon receipt of notice in writing from the City, shall within the period specified therein repair or eliminate such excavation, embankment, or fill so as to eliminate the hazard and be in conformance with the requirements of these Specifications.

1.3 Definitions

For the purpose of this section of these Specifications, the definitions listed shall be construed as specified in this section.

Approval - The proposed work or completed work conforms to this section in the opinion of the City.

TECHNICAL SPECIFICATIONS

SECTION 1

EXCAVATION AND GRADING

As-Graded - The extent of the surface conditions on completion of grading.

Bedrock - In-place solid rock (typically underlying soil layer[s]).

Bench - A relatively level step excavated into earth material where fill is to be placed.

Borrow - Earth material acquired from an off-site location for use in grading on a site.

Compaction - The densification of fill by mechanical means.

Design Engineer - A professional engineer registered in the state to practice in the field of civil works.

Earth Material - Any rock, natural soil, or fill or any combination thereof.

Engineering Geologist - A geologist experienced and knowledgeable in engineering geology.

Engineering Geology - The application of geologic knowledge and principles in the investigation and evaluation of naturally occurring rock and soil for use in the design of civil works.

Erosion - The wearing away of the ground surface as result of the movement of wind, water, or ice.

Excavation - The mechanical removal of earth material.

Existing Grade - The grade prior to grading.

Finish Grade -The final grade of the site, which conforms to the approved plan.

Fill - The deposit of earth material placed by artificial means.

Geotechnical Engineer - See "soils engineer."

Grade - The vertical location of the ground surface or the inclination of a road or slope.

Grading - Any excavating or filling or combination thereof.

Key - A designed compacted fill placed in a trench excavated in earth material beneath the toe of a proposed fill slope.

Professional Inspection - The inspection required by this section to be performed by the design engineer, soils engineer, or engineering geologist. Such inspections include that performed by

persons supervised by such engineers or geologists and shall be sufficient to form an opinion relating to the conduct of the work.

Rough - Grade is the stage at which the grade approximately conforms to the approved plan.

Site - Any lot or parcel of land or contiguous combination thereof, under the same ownership, where grading is performed or permitted.

Slope -An inclined ground surface the inclination of which is expressed as a ratio of horizontal distance to vertical distance.

Soil - Naturally occurring superficial deposits overlying bedrock.

Soils Engineer (Geotechnical Engineer) - An engineer experienced and knowledgeable in the practice of soils engineering (geotechnical).

Soils Engineering (Geotechnical Engineering) - The application of the principles of soils mechanics in the investigation, evaluation, and design of civil works involving the use of earth materials and the inspection or testing of the construction thereof.

Terrace - A relatively level step constructed in the face of a graded slope surface for drainage and maintenance purposes.

1.4 Grading Requirements

A. Grading Designation

Grading in excess of 5,000 CY shall be performed in accordance with an approved grading plan prepared by a design engineer, and shall be designated as "engineered grading." Grading involving less than 5,000 CY shall be designated "regular grading," unless the developer chooses to have the grading performed as engineered grading or the City determines that special conditions or unusual hazards exist, in which case grading shall conform to the requirements for engineered grading.

B. Engineered Grading Requirements

Construction Plans shall be accompanied by two sets of Plans and Specifications, and supporting data consisting of a Geotechnical Report and Engineering Geology Report. The Plans and Specifications shall be prepared and signed by an individual licensed by the state to prepare such Plans or Specifications when required by the City Engineer.

C. Specifications

Specifications shall contain information covering construction and material requirements.

D. Plans

1. Plans shall be prepared in accordance with the General Requirements and this section and shall be of sufficient clarity to indicate the nature and extent of the work proposed and shown in detail that they will conform to the provisions of these Specifications and all relevant laws, ordinances, rules, and regulations. The first sheet of each set of Plans shall identify the location of the work, the names and addresses of the owner, and the person by whom they were prepared.

2. The Plans shall include the following information:

   a. General vicinity of the proposed site.

   b. Property limits and accurate contours of existing ground and details of terrain and area drainage.

   c. Limiting dimensions, elevations and finish contours to be achieved by the grading, and proposed drainage channels and related construction.

   d. Detailed plans of all surface and subsurface drainage devices, walls, cribbing, dams and other protective devices to be constructed with, or as a part of, the proposed work, together with a map showing the drainage area and the estimated runoff of the area served by any drain.

   e. Locations of any buildings or structures on the property where the work is to be performed and the location of any buildings or structures on adjacent land within 15 feet of the property or which may be affected by the proposed grading operations.

   f. Recommendations included in the Soils Engineering Report and the Engineering Geology Report shall be incorporated in the grading plans or specifications. When approved by the City, specific recommendations contained in the Soils Engineering Report and the Engineering Geology Report, which are applicable to grading, may be included by reference.

g. The dates of the Soils Engineering and Engineering Geology Reports, together with the names, addresses, and phone numbers of the firms or individuals who prepared the reports.

E. Geotechnical Report

The Geotechnical Report required by Part 1- General, 1.4 Grading Requirements, B. Engineered Grading Requirements, of these Technical Specifications shall include data regarding the water table; the nature, distribution, and strength of existing soils; conclusions and recommendations for grading procedures; design criteria for corrective measures, including buttress fills, when necessary; and an opinion on adequacy for the intended use of sites to be developed by the proposed grading as affected by soils engineering factors, including the stability of slopes.

F. Engineering Geology Report

The Engineering Geology Report required by Part 1- General, 1.4 Grading Requirements, B. Engineered Grading Requirements, of these Technical Specifications shall include an adequate description of the geology of the site, conclusions and recommendations regarding the effect of geologic conditions on the proposed development, and an opinion on the adequacy for the intended use of sites to be developed by the proposed grading, as affected by geologic factors.

G. Regular Grading Requirements

Construction Plans shall be accompanied by a plan in sufficient clarity to indicate the nature and extent of the work. The Plans shall give the location of the work, the names of the owner, and the name of the person who prepared the Plans. The Plans shall include the following information:

1. General vicinity of the proposed site.

2. Limiting dimensions and depth of cut and fill.

3. Location of any buildings or structures where work is to be performed, and the location of any buildings or structures within 15 feet of the proposed grading.

4. A Soils Engineering Report and/or an Engineering Geology Report may be required by the City depending upon site conditions such as steep slopes, evidence of slippage or slides, high ground water, location of improvements, geologic conditions, etc.

Note: The City Engineer may require professional inspection and testing by the soils engineer. When the City Engineer has cause to believe that geologic factors may be involved, the grading shall conform to engineered grading.

1.5 Cuts

A. General

1. Unless otherwise recommended in the approved Geotechnical Report or an Engineering Geology Report, cuts shall conform to the provisions of these Specifications.

2. In the absence of an approved Geotechnical Report, these provisions may be waived for minor cuts not intended to support structures.

B. Slope

The slope of cut surfaces shall be no steeper than is safe for the intended use and shall be no steeper than 3H:1V, unless the developer furnishes a Geotechnical Report or an Engineering Geology Report, or both, stating the site has been investigated and an opinion that a cut at a steeper slope will be stable and not create a hazard to public or private property is given.

1.6 Fill

A. General

1. Unless otherwise recommended in the approved Geotechnical Report, fill shall conform to the provisions of these Specifications.

2. In the absence of an approved Geotechnical Report, these provisions may be waived for minor fill not intended to support structures.

B. Preparation of Ground

Fill slopes shall not be constructed on natural slopes steeper than 3H:1V. The ground surface shall be prepared to receive fill by removing vegetation, noncomplying fill, topsoil, and other unsuitable material to provide a bond with the new fill and, where slopes are steeper than 5H:1V and the height is greater than 5 feet, by benching into sound bedrock or other competent material as determined by the soils engineer. The bench under the toe of a fill on a slope steeper than 5H:1V vertical shall be at least 10 feet wide. The area beyond the toe of fill shall be sloped for sheet overflow or a

paved drain shall be provided. When fill is to be placed over a cut, the bench under the toe of fill shall be at least 10 feet wide but the cut shall be made before placing the fill and acceptance by the soils engineer or engineering geologist or both as a suitable foundation for fill.

C. Fill Material

Organic material shall not be permitted in fills. Except as permitted by the City, no rock or other material with a dimension greater than 8 inches shall be buried or placed in fills.

Exception: The City may permit placement of larger rock when the soils engineer properly devises a method of placement, and continuously inspects its placement and approves the fill stability. The following conditions shall also apply:

1. Potential rock disposal areas shall be delineated on the grading plan.

2. Rock sizes greater than 8 inches in dimension shall be at least 10 feet below finish grade.

3. Rocks shall be placed so as to ensure filling of all voids with well-graded soil.

D. Compaction

All fill shall be compacted to a minimum of 90 percent of maximum density per ASTM D1557, unless the Geotechnical Report and/or the Engineering Geology Report suggest a denser compaction.

E. Slope

The slope of fill surfaces shall be no steeper than is safe for the intended use. Fill slopes shall be no steeper than 3H:1V unless the developer furnishes a Geotechnical Report or an Engineering Geology Report, or both, stating the site has been investigated and an opinion is given that a fill at a steeper slope will be stable and not create a hazard to public or private property.

1.7 Drainage and Terracing

A. General

Unless otherwise indicated on the approved grading plan, drainage facilities and terracing shall conform to the provisions of these Specifications for cut or fill slopes steeper than 3H:1V.

B. Terrace

1. Terraces shall be designed and constructed in accordance with the Oregon Department of Transportation Geotechnical Design Manual (current edition).

2. Swales or ditches on terraces shall have a minimum gradient of 5 percent and must be paved with reinforced concrete not less than 3 inches in thickness or an approved equal paving. They shall have a minimum depth at the deepest point of 1 foot and a minimum paved width of 5 feet.

3. A single run of swale or ditch shall not collect runoff from a tributary area exceeding 13,500 square feet (projected) without discharging into a down drain.

C. Subsurface Drainage

Cut and fill slopes shall be provided with subsurface drainage as necessary for stability.

D. Disposal

1. All drainage facilities shall be designed to carry waters to the nearest practicable drainage way approved by the City or other appropriate jurisdiction as a safe place to deposit such water, erosion of ground in the area of discharge shall be prevented by installation of non-corrosive down drains or other devices.

2. Building pads shall have a drainage gradient of 2 percent toward approved drainage facilities, unless waived by the City.

   Exception: The gradient for the building pad may be reduced to 1 percent if all of the following conditions exist throughout the permit area:

   a. No proposed fills are greater than 10 feet in maximum depth.

   b. No proposed finish cut or fill slope faces have a vertical height in excess of 10 feet.

c. No existing slope faces, which have a slope face steeper than 10H:1V, have a vertical height in excess of 10 feet.

E. Interceptor Drains

Paved interceptor drains shall be installed along the top of all cut slopes where the tributary drainage area above slopes toward the cut and has a drainage path greater than 40 feet measured horizontally. Interceptor drains shall be paved with a minimum of 3 inches of concrete or gunite and be reinforced. They shall have a minimum depth of 12 inches and minimum paved width of 30 inches measured horizontally across the drain. The drain slope shall be approved by the City Engineer.

1.8 Erosion Control

A. Slopes

The faces of cut and fill slopes shall be prepared and maintained to control against erosion. This control may consist of effective planting, matting or covering. The protection for the slopes shall be installed as soon as practicable and prior to calling for final approval. Where cut slopes are not subject to erosion due to the erosion-resistant character of the materials, such protection may be omitted.

B. Other Devices

Where necessary, check dams, cribbing, riprap, or other devices or methods shall be employed to control erosion and provide safety.

C. Construction

Temporary erosion control facilities shall be used to protect against erosion during construction. See Technical Specifications - "Storm Drainage" for additional erosion control requirements.

1.9 Grading Inspection

A. General

Professional inspection of grading operations shall be provided by the design engineer, soils engineer, and/or the engineering geologist retained to provide such services for engineered grading and as required by the City for regular grading.

B. Design engineer

The design engineer shall provide professional inspection within such engineer's area of technical specialty, which shall consist of observation and review as to the establishment of line, grade and surface drainage of the development area. If revised Plans are required during the course of the work they shall be prepared by the design engineer.

C. Soils Engineer

The soils engineer shall provide professional inspection within such engineer's area of technical specialty, which shall include observation during grading and testing for required compaction. The soils engineer shall provide sufficient observation during the preparation of the natural ground and placement and compaction of the fill to verify that such work is being performed in accordance with the conditions of the approved plan and the appropriate requirements of this section of these Specifications. Revised recommendations relating to conditions differing from the approved Geotechnical and Engineering Geology Reports shall be submitted to the developer, the City Representative, and the design engineer.

D. Engineering Geologist

The engineering geologist shall provide professional inspection within such engineer's area of technical specialty, which shall include professional inspection of the bedrock excavation to determine if conditions encountered are in conformance with the approved report, revised recommendations relating to conditions differing from the approved Engineering Geology Report shall be submitted to the soils engineer.

E. Developer

The developer shall be responsible for the work to be performed in accordance with the approved Plans and Specifications and in conformance with the provisions of this section, and the developer shall engage consultants, if required, to provide professional inspections on a timely basis. The developer shall act as a coordinator between the consultants, the Contractor, and the City Representative. In the event of changed conditions, the developer shall be responsible for informing the City Representative of such change and shall provide revised Plans for approval.

F. City Representative

The City Representative shall inspect the project at the various stages of work requiring approval to determine that adequate control is being exercised by the professional consultants.

G. Notification of Noncompliance

If, in the course of fulfilling their respective duties under this section of these Specifications, the design engineer, soils engineer, or the engineering geologist find that the work is not being performed in conformance with this section or the approved grading plans, the discrepancies shall be reported immediately in writing to the developer and to the City Representative.

H. Transfer of Responsibility

If the design engineer, the soils engineer, or the engineering geologist of record is changed during grading, the work shall be stopped until the replacement has agreed in writing to accept their responsibility within the area of technical competence for approval upon completion of the work.

It shall be the duty of the developer to notify the City Representative in writing of such change prior to the recommencement of such grading.

1.10 Completion of Work

A. Final Reports

Upon completion of the rough grading work and at the final completion of the work, the following reports, drawings, and supplements thereto are required for engineered grading or when professional inspection is performed for regular grading, as applicable.

1. A Record Drawings grading plan prepared by the design engineer retained to provide such service in accordance with Part 1 - General, 1.4 Grading Requirements, D. Plans, of these Technical Specifications showing original ground surface elevations, as-graded ground surface elevations, lot drainage patterns, and the locations and elevations of surface drainage facilities and of the outlets of subsurface drains. As-constructed locations, elevations, and details of subsurface drains shall be shown as reported by the soils engineer.

Design engineer shall submit a statement that to the best of their knowledge the work within their area of responsibility was performed in accordance with the final approved grading plan.

2. A report prepared by the soils engineer retained to provide such services in accordance with Part 1 - General, 1.4 Grading Requirements, E. Geotechnical Report, of these Technical Specifications, including locations and elevations of field density tests, summaries of field and laboratory tests, other substantiating data, and comments on any changes made during grading and their effect on the recommendations made in the approved Geotechnical Report. Soils engineers shall submit a statement that, to the best of their knowledge, the work within their area of responsibilities is in accordance with the approved Geotechnical Report and applicable provisions of this section .

3. A report prepared by the engineering geologist retained to provide such services in accordance with Part 1 - General, 1.4 Grading Requirements, F. Engineering Geology Report, of these Technical Specifications, including a final description of the geology of the site and any new information disclosed during the grading and the effect of same on recommendations incorporated in the approved grading plan. Engineering geologists shall submit a statement that, to the best of their knowledge, the work within their area or responsibility is in accordance with the approved engineering geologist report and applicable provisions of this section of these Specifications.

4. The grading contractor shall submit a form prescribed by the City Representative in a statement of conformance to said Record Drawings and the Specifications.

B. Notification of Completion

The developer shall notify the City Representative when the grading operation is ready for final inspection. Final approval shall not be given until all work, including installation of all drainage facilities and their protective devices, and all erosion-control measures have been completed in accordance with the approved grading plan, and the required reports have been submitted.

1.11 Safety

See requirements for Project safety in the General Requirements.

1.12 Existing Utilities

See the General Requirements for Contract requirements for existing utilities and for preservation of survey monumentation.

1.13 Dust and Mud Control

The Contractor shall take appropriate action to control dust and mud caused by their operations. This shall include, but not be limited to, watering of exposed areas, cleaning of roadways, etc. This is considered a normal part of the Project.

1.14 Restoration of Disturbed Areas

The Contractor shall perform all Work and furnish all materials to restore the work area or adjacent other disturbed areas including any gravel, asphalt, concrete, lawn, fences, or any other surfaces or items damaged or disturbed by their construction operation. Surface restoration shall follow as closely as possible the backfill and compaction of excavations.

PART 2 - MATERIALS

2.1 Earthwork

A. Embankment Material

The embankment material shall be native or import free of vegetative or organic matter, boulders 8 inches or larger in diameter, or frozen material and shall be at or below optimum moisture content at the time of placement.

B. Backfill Material

Suitable backfill material, unless shown otherwise on the City Standard Drawings, shall be the material excavated at the Site or crushed rock as approved by the City Engineer. Backfill material shall be free from sod, roots, trash, large cobbles, or other debris, etc., and shall be at a proper moisture content to achieve compaction.

C. Borrow Material

Borrow material shall be equal to or better than the on-site embankment material.

2.2 Geotextile Fabric

Geotextile fabric shall be Mirafi 500X or approved equal.

2.3 Aggregate Materials

A. General

All aggregate materials for aggregate base rock or surface rock, unless called for otherwise, shall meet the following requirements:

Percent Wear (AASHTO T 96)	40% Maximum
Durability Index Coarse and Fine	35% Maximum

B. Aggregate Base Rock

Aggregate base rock shall substantially conform to current Oregon "Standard Specifications for Construction" for base aggregate materials, Section 02630, or as otherwise approved by the City Engineer. The Contractor shall use the size of aggregate base rock as called for on the City Standard Drawings. Aggregate base rock shall be 100 percent fractured face basalt.

C. Surface Rock

1. The surface rock shall be crushed stone or gravel meeting the following requirements:

Liquid Limit (AASHTO T 89)		35 Maximum
Plasticity Index (AASHTO T 90)		2-9 Maximum
Dust Ratio	% Passing No. 200	2/3 Maximum
	% Passing No. 30	

2. Grading Requirements (AASHTO T 11 and T 27)

Sieve	Percent Passing
1"	100
3/4"	70-98
#4	36-60
#8	25-47
#30	12-31
#200	8-15

3. Surface rock shall have at least 70 percent by weight of the particles retained on the #4 sieve and shall have at least two fractured faces.

2.4 Select Backfill

Select backfill shall be well-graded 1"-0 or 3/4"-0 aggregate base rock or approved equal. All bedding and select backfill materials shall be subject to the approval of the City Engineer.

2.5 General Backfill

A. General backfill will consist of material excavated from the trench, or material imported by the Contractor. General backfill material shall be free of vegetative matter, boulders (8-inch plus), frozen material and any other unsuitable material, and shall have a moisture content that will allow for the required compaction of the general backfill material unless approved otherwise by the City Engineer. Use of backfill material containing consolidated masses 6-inch in diameter or greater is prohibited.

B. When the City Representative determines that the native material excavated from the trench is unsuitable or unacceptable for use as general backfill, the City Representative may require the Contractor to remove the unsuitable material from the Project Site and import suitable general backfill material. Suitable material shall be similar in nature to native soils as approved by the City Engineer. When imported general backfill must be placed in or below the groundwater, the imported general backfill shall be free draining granular material with less than 20 percent passing a No. 4 sieve and less than 3 percent passing a No. 200 sieve.

2.6 Controlled Low-Strength Material (CLSM)

A. CLSM material shall be a flowable cement, sand or pea gravel, and Fly Ash Pozzolanic, or other approved materials, mixture that contains 75 to 120 pounds of Type II cement per cubic yard.

B. The sand and other aggregates shall generally conform with the requirements of ASTM C33.

C. Air-entraining agent shall be added at the rate of 3 to 5 oz. per cubic yard.

D. The material shall have a 28-day compressive strength of 100 to 200 psi and have a slump of 7 inches plus or minus 1-1/2 inches at the time of placement. The Contractor shall provide a mix design and data on the CLSM material they propose to use along with typical compression test results.

2.7 Seed

A. Lawn Seed

Lawn seed shall be a blend typically used in the area and of the type to match existing lawn areas, and must be approved by the property owner, if any, prior to use.

B. Pasture Seed

Pasture seed shall be a mixture of orchard grass, rye grass, and fescue, native to the area and must be approved by the property owner, if any, prior to use.

2.8 Topsoil

Topsoil shall be native to the area and shall be approved by the City Engineer prior to use.

Furnish topsoil containing no substance detrimental to the growth of plants, that is free of plants designated by the Oregon Department of Agriculture as Type "A" or Type "B" weeds, and that is free of quack grass or crabgrass species.

Furnish topsoil that is from the fertile part of a soil profile, commonly referred to as the "A" horizon, typically ranging in depth from 3 inches to 12 inches below original ground surface. Do not take material for topsoil from a depth greater than 12 inches below original ground surface.

2.9 Mulch

All mulch shall be straw that has been air dried and seasoned before baling or loading. It shall be free of noxious weeds and other materials detrimental to grass growth.

2.10 Sod

A. Sod shall be 100 percent Kentucky Blue Grass or other types as approved by the City.

B. The sod shall be grown on agricultural land that is cultivated specifically for turf sod. The sod shall be free of weeds, diseases, nematodes, and insects. All sod shall be mature and not less than 10 months old. All sod shall be machine cut to a uniform thickness of 5/8-inch or more, excluding top growth and thatch.

2.11 Erosion Control Matting

Erosion control matting shall be seed and curlex blanket as supplied by American Excelsior Co., of Yakima, Washington, or approved equal.

2.12 Hydroseed

A. The hydroseed shall be a specifically designed hydromulch consisting of cellulose fiber, fertilizers, seed, tackifier, etc.

B. The hydromulch shall be specifically processed cellulose fiber containing no growth or germination inhibiting factors. It shall be manufactured in such a manner that, after addition and agitation in slurry tanks with water, the fibers in the material become uniformly suspended to form a homogenous slurry. When sprayed on the ground, the material shall allow absorption and percolation of moisture. Each package of cellulose fiber shall be marked by the manufacturer to show the air dry weight and content.

C. The fertilizer shall be a complete plant food containing slow release nitrogen, phosphoric acid, and potash in the amounts of 16-16-16+1.5 FE. It shall be delivered in uniform composition and be dry and free flowing and delivered in the original unopened containers bearing the manufacturer's guaranteed analysis.

D. The grass seed shall be certified, blue tagged, cleaned, and delivered in original unopened packages bearing an analysis of the contents. It shall be guaranteed 95 percent pure and have a minimum germination rate of 85 percent within 1 year of test. The seed shall be as agreed upon by the City. The seed shall be applied at a minimum rate of 4 pounds per 1,000 square feet.

2.13 Slope Stabilization Rock

A. Slope stabilization rock shall be pit run, a well-graded 4"-0 material with the approximate gradation:

Sieve	Percent Passing
4"	100
2"	35-50
1/2"	10-20
Less 1/4"	0-5

B. The 4"-0 slope stabilization rock shall be hard, durable, and resistant to weathering. The rock shall be angular in shape with an apparent specific gravity of 2.5 minimum. The Contractor shall develop a test pile of 4"-0 slope stabilization rock for approval by the Engineer. Once the test pile has been approved by the Engineer, all other 4"-0 rock shall be visually the same as the test pile.

PART 3 - EXECUTION

3.1 Earthwork

A. Clearing and Grubbing

1. All vegetation, rubbish, and debris shall be removed and disposed of by the Contractor in conformance with the requirements of local authorities controlling air pollution and solid waste disposal.

2. When topsoil at the Site is to be saved and reused, it shall be stripped and stored clear of the construction area. Take reasonable care to prevent the topsoil from becoming mixed with subsoil and other debris, etc.

3. The Contractor shall exercise care to minimize disturbing the natural ground or vegetation outside the limits of the construction area.

B. Excavation

1. Prior to any excavation, the area to be excavated shall be cleared and grubbed.

2. Allow for forms, working space, granular base, and finish topsoil as shown or required. Do not carry excavation for footings and slabs deeper than the elevation shown. All over-excavated areas shall be corrected at the Contractor's expense and to the satisfaction of the City Engineer.

C. Embankments

1. Prior to construction of any embankment on the Site, the area beneath the embankment and the areas from which embankment material will be obtained shall be cleared and grubbed. The existing soil beneath the embankment shall then be compacted to 90 percent of maximum density as determined by ASTM D1557 for a minimum of 6 inches below ground surface. Any unsuitable soils or material shall be removed prior to placement of any embankment.

2. Upon completion of the embankment foundation, embankment material shall be placed in horizontal lifts and compacted. Compaction of embankments supporting footings and structures shall be compacted to 95 percent of ASTM D1557 laboratory density. All other embankments, unless otherwise noted on the Drawings, shall be compacted to 90 percent of ASTM D1557 laboratory density. Embankment lift depth shall not exceed the capability of compaction

equipment being used to achieve the required compaction for the full depth of each lift.

3. The embankment shall be brought to the lines and grade required on the Design Drawings. Any unsuitable material which may have been used in constructing the embankment shall be removed and replaced with suitable material and compacted.

D. Backfilling

The Contractor shall exercise care during backfilling operations to prevent damage to footings, pipes, manholes, or other structural elements. The Contractor shall also pay particular attention to compaction around footings to avoid settlement of floor slabs or steel floors at the footing-floor connection points. All fill material shall be compacted to 95 percent of ASTM D1557 laboratory density.

E. Subgrade Cut Areas

In subgrade cut areas, the subgrade material shall be compacted to 90 percent of maximum density as determined by ASTM D1557 for a minimum of 6 inches below the top of the subgrade. Depending on the type of material encountered, the Contractor may have to scarify, aerate or add water, over-excavate, or take other actions as necessary to achieve the required compaction.

F. Roadway and Site Subgrades

1. All grading and subgrade preparation and other excavations and embankments shall be trimmed accurately to the lines, grades and cross sections as shown on the Design Drawings and established by the design engineer and shall be finished in a thoroughly workmanlike manner to within plus or minus 0.05 foot of the required grade.

2. The grade shall be in a neat and well-finished condition at the time the project is completed. The entire right-of-way area shall be cleaned up and made free of debris and foreign matter of all kinds. Accumulations of dirt and/or other materials shall be disposed of in a manner satisfactory to the City Representative.

3. Upon completion of the subgrade and prior to placement of any geotextile fabric, if required, and aggregate materials, the Contractor shall load test the finished subgrade surface. The load test shall consist of slowly driving a loaded

dump truck over the subgrade surface. The dump truck shall have a minimum capacity of 10 cubic yards. The City Representative and Contractor shall note any soft areas.

4. The Contractor shall excavate and either replace unsuitable material or properly compact all soft areas in order to provide a firm base that conforms to the Specifications. Any soft areas that occur as part of the project because of overwatering, improper compaction, weather, etc., shall be replaced.

G. Water for Compaction

The Contractor shall be responsible for obtaining, transporting and the application of the water.

H. Shoring, Sheeting, Bracing, and Sloping

Install and maintain shoring, sheeting, bracing, and sloping necessary to support the sides of the excavation, to keep and to prevent any movement which may damage adjacent pavements, utilities, or structures, damage or delay the Work, or endanger life and health. Install and maintain shoring, sheeting, bracing, and sloping as required by OSHA, and other applicable governmental regulations and agencies.

3.2 Geotextile Fabric Installation

Geotextile fabric shall be installed as shown on the Design Drawings or as directed by the design engineer. Fabric placed for subgrade stabilization under embankments or over roadbed subgrade shall be placed parallel to the centerline of the roadway, with placement starting at the low side of the super elevation or crown. The fabric shall either be sewn together at all longitudinal and transverse edges or overlapped a minimum of two feet at all edges. Transverse overlaps shall be made in the direction of base material placement.

3.3 Placement of Aggregate Materials

A. The construction procedure described herein shall be understood to apply to each of the courses and/or layers of aggregate materials of which the Site is to be constructed.

1. After the subgrade is brought to the proper line, cross section and compaction, the aggregate materials shall be spread and shaped as required.

2. The spreading and shaping of the aggregate materials shall be so performed as to prevent separation of the coarser material from the finer materials including the use of adequate water.

3. The aggregate materials shall be brought to proper moisture content as required for compaction and compacted to 95 percent of maximum density as determined by ASTM D1557.

4. The finished surface when tested with a 10-foot straightedge shall not vary from the testing edge by more than 0.05 foot at any point.

5. Following construction of each lift, the Contractor shall do such blading, brooming, watering and other work as necessary to prevent raveling and rutting.

6. These operations are to be continued as required until the lift is covered by a following lift or until all Work to be done under the Contract is completed.

7. If the required compacted depth of any lift exceeds 6 inches, it shall be constructed in two or more lifts, each lift not exceeding 6 inches in depth.

B. Upon completion of the aggregate materials placement, the Contractor shall load test the finished surface. The load test shall consist of slowly driving a loaded minimum 10 yard dump truck over the road surface.

C. All soft areas shall be noted. The Contractor shall excavate and/or compact all soft areas in order to provide a firm base that conforms to the requirements of these Specifications.

3.4 Site Cleanup

The Site shall be left in a clean, neat, and presentable condition. All debris, construction materials, unsightly rocks, tree roots, or other material which detracts from the appearance of the Site shall be disposed of in a satisfactory manner.

3.5 Dewatering Excavated Areas

A. All groundwater, seepage, or stormwater that may occur or accumulate in the excavation during the progress of the Work shall be removed. In areas where the nature of soil and hydrostatic pressures are of such a character as to develop a quick condition in the earth mass of the trench, the dewatering operation shall be conducted so that the hydrostatic pressure will be reduced to or near zero in the immediate vicinity of the trench.

B. All excavations shall be kept free of standing water during the construction or until otherwise requested by the design engineer.

3.6 Location of Excavated Materials

A. During trench excavation, the excavated material shall be located within the construction easement or right-of-way so that the excavated material will not obstruct any private or public traveled roadways or streets, or cause undue damage to the streets.

B. Contractor shall provide means of containing overly saturated soils, i.e., muck, or remove the muck from the Work area as it is excavated, if such soils are encountered in the excavation.

3.7 Disposal of Excavated Materials

Contractor shall dispose of all excavated material, which is not required for, or is unsuitable for, backfill. The Contractor's method of disposal shall comply with regulations of the governing body having jurisdiction.

3.8 Execution of Dust and Mud Control

If the Contractor fails to properly control the dust and mud, the City Engineer may request them to do so in writing. If, after 24 hours from this request, the Contractor has not corrected the dust or mud problem, the City may elect to have the corrective work performed and bill the cost to the Contractor.

3.9 General Surface Restoration

A. General

1. The Contractor shall replace or restore, equivalent to their original condition, all surfaces, trees and shrubbery, lawns, agricultural areas, pastures and fences, or other existing facilities disturbed by their Work unless otherwise specified. Restoration and cleanup shall be a continuing operation and shall be diligently pursued until completed. Surface restoration shall be completed as soon as possible after the underground work is complete.

2. All surplus material, rock and debris, and temporary structures, as well as excess excavation, shall be removed by the Contractor and the entire Site of Contractor's operations shall be left in a neat and clean condition.

3. Lawns and pastures in private easements shall be restored to a smooth condition and reseeded with a like mixture of grass unless specified otherwise on the Design Drawings. When backfilling trenches in private easements, unless

otherwise specified, Contractor shall replace topsoil to minimum 1-foot depth or to a depth equal to the original depth, whichever is less. Lawn sod shall be utilized where called for on the Design Drawings or where required by the design engineer.

B. Agricultural Areas

1. Where called for on the Drawings, the existing top soils in the excavation area shall be removed and stockpiled at a separate location from the general trench excavation material. This topsoil shall not be mixed or contaminated with any other materials.

2. Upon completion of the trench backfill and after all rocks and unsuitable material have been removed from the work area, the stockpiled topsoil shall be replaced and graded to match the existing ground. The depth of topsoil restoration shall be as shown on the Design Drawings.

C. Seeding

1. All areas to be seeded shall have a minimum of 6 inches of topsoil.

2. After the backfilling and compaction have been completed, the top 2 inches of the topsoil shall be scarified to provide a good seed bed and the area seeded, fertilized, compacted with a weighted roller, a straw mulch or approved equal applied, and the initial watering completed.

3. All additional watering of the grass seed shall be the responsibility of the property owners.

4. Unless required otherwise, the seed shall be applied at a minimum rate of 4 pounds per 1,000 square feet, the fertilizer at 1 pound per 100 square feet, and the mulch at a rate needed to provide a minimum mulch thickness of 1 inch.

3.10 Lawn Sod Restoration

A. Preparation of Areas

1. Cultivate the existing ground or new topsoil so the soil is loose and friable for at least a 6 inch depth and suitable for fine grading. Remove vegetative matter, rocks, clods, roots, sticks, debris, and other matter detrimental to the germination and growth of sod from the areas to be sodded.

2. Apply herbicide to kill existing weeds and grasses.

3. Spread soil amendments and fertilizers evenly over the sod bed at the rates specified below, then thoroughly till into the upper 4 inches of the soil.

4. After tilling, fine-grade and roll the area to provide a fine-textured, smooth, firm surface, free of any undulations or irregularities.

5. The finish grade of the sod bed shall be 1 inch below the finish grade of the walks. Rates of applications shall be as follows:

Material	Rate Per 1,000 Sq. Ft.
Soil Conditioner	6 Cu. Yds. (2" Depth)
Fertilizer: 22-16-8	10 Lbs.

B. Planting Season

Perform the Work only when local weather and other conditions are favorable to bed preparation and placing of sod. Do not place sod before March 15 or after September 30, unless approved otherwise.

C. Placing Sod

1. Do not place sod until the sod bed has been approved. Immediately before placing sod, water the bed to prevent drying of grass roots.

2. Lay the first row in a straight line and place subsequent rows parallel to and tightly against each other. Stagger lateral joints. Do not stretch or overlap the sod. Tightly butt all joints. Do not use sod segments containing less than 2 square feet of surface area, broken, torn, or uneven pieces.

3. After placing sod, diagonally roll and thoroughly water. Apply a second application of fertilizer (22-16-8) at the rate specified for preparation of areas and thoroughly water.

D. Sod Lawn Establishment

1. The establishment period for sod lawn begins after placing of sod in an area is completed. The establishment period will be at least two weeks and ends when accepted by the City Engineer. During the established period, the Contractor

shall adequately water the sod to keep the new sod green. Keep mowed to a height of 1-1/2 to 2 inches.

2. Do not attempt the first mowing until the sod is firmly rooted and secure in place. Remove no more than 1/3 of the grass leaf during initial or subsequent cuttings.

3. Control all weeds, foreign grasses, etc., that grow in or through the sod for up to 45 days after the sod is placed.

4. Acceptance of sod lawn will be contingent on the grass being uniform in color, density, and height, and being weed-free. All dead or brown sod shall be replaced at no cost to the City.

3.11 Hydroseeding

A. Application Rates

Hydroseeding shall be placed at the following application rates unless otherwise shown on the Design Drawings or approved by the City Engineer.

Material	Application Rate
Mulch	2,000 pounds per acre
Fertilizer	Lawn 430 pounds per acre Dryland Grass 50 pounds per acre
Tackifier	20 pounds per acre
Seed	4 pounds per 1,000 square feet
Wood Cellulose Fiber Tracer	< 250 pounds per acre

B. Seeding shall not be done during windy weather or when the ground is excessively wet or otherwise un-tillable. Seed shall be placed at the rate and mix specified below. Seed will be placed with an approved hydroseeder which utilizes water as the carrying agent, and maintains continuous agitation through paddle blades.

C. Hydroseeder

1. Hydroseeder shall have an operating capacity sufficient to agitate, suspend and mix into a homogenous slurry, and the specified amount of seed and water or other material.

2. Distribution and discharge lines shall be large enough to prevent stoppage and shall be equipped with a set of hydraulic spray nozzles which will provide a uniform distribution of the slurry.

D. Seed and fertilizer may be applied in one application provided the fertilizer is placed in the hydroseeder tank no more than 30 minutes prior to application. The seed shall have a tracer added to aid uniform application. This tracer shall not be harmful to plant and animal life.

E. The Contractor shall remove mulch material which falls on plants, roadways, gravel shoulders, structures, areas where mulching is not specified, or which collects at the ends of culverts or accumulates to excessive depths, as directed.

3.12 Erosion Control Matting

A. Place matting as called for on the Design Drawings or as required by the design engineer. Prepare Site as specified for permanent seeding area preparation.

B. Immediately following the establishment of the finished grade, matting shall be placed parallel to the flow of water. Where more than one strip of matting is required to cover the given area, it shall overlap the adjacent mat a minimum of 4 inches.

C. The ends of the matting shall overlap at least 6 inches with the upgrade section on top. The upslope end of matting shall be staked and buried in a 6-inch deep trench with the soil firmly tamped against the mat. Three stakes per width of matting (one stake at each overlap) shall be driven below the finish ground line prior to backfilling of the trench. The City Engineer may require that any other edge exposed to more than normal flow of water or strong prevailing winds be staked and buried in a similar manner.

D. The edges of matting shall be buried around the edges of catch basins and other structures. Matting must be spread evenly and smoothly and in contact with the soil at all points.

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

3.13 Mulch

A. Place mulch approximately 1-1/2 inches deep in a loose condition at a rate of 2 to 2.5 tons/acre. Place grass straw mulch so that it is loose enough for sunlight to penetrate and air to circulate; but dense enough to shade the ground, reduce water evaporation, and materially reduce soil erosion.

B. Anchor using a crimping disc, an approved tackifier, or approved modified sheepsfoot roller, or another method approved by the City Engineer.

3.14 Cleanup

A. Cleaning up shall be a continuing process from the start of the work to final acceptance of the Project. The Contractor shall, at all times, keep the area on which work is in progress free from accumulations of waste material or rubbish.

B. Spillage from the Contractor's hauling vehicles on traveled public or private roads shall be promptly cleaned up. Upon completion of the work the Contractor shall remove all temporary structures, rubbish, and waste material, equipment and supplies, resulting from the Contractor's operations. The Contractor shall leave such lands in a neat and orderly condition which is at least as good as the condition in which the Contractor found them prior to the Contractor's operations.

C. In roadways and traffic areas, the Contractor shall be responsible for maintaining a road surface suitable for travel by the public from the time of excavation until the road surface has been restored. Such work includes dust control, temporary patching, signing, grading, and filling of potholes on temporary street surfaces, etc. The Contractor shall be responsible for all Claims and damages resulting from their failure to maintain a suitable surface.

END OF SECTION

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SECTION 2

STORM DRAINAGE

TECHNICAL SPECIFICATIONS

SECTION 2

STORM DRAINAGE

PART 1 - GENERAL

1.1 General Design Requirements

A. Performance Standards

1. Storm drainage design within a development area shall include provisions to adequately control runoff from all public and private streets and the roof, footing, and area drains of residential, multi-family, commercial, or industrial buildings. The design engineer must ensure future extension of the drainage system is accounted for to the entire drainage basin in conformance with these Specifications. These provisions include:

   a. Surface or subsurface drainage, caused or effected by the changing of the natural grade of the existing ground or removal of natural ground cover or placement of impervious surfaces, shall not be allowed to flow over adjacent public or private property in a volume or location materially different from that what existed before development occurred but shall be collected and conveyed in an approved manner to an approved point of disposal.

   b. Surface water entering the subject property shall be received at the naturally occurring locations and surface water exiting the subject property shall be discharged at the natural locations with adequate energy dissipaters within the subject property to minimize downstream damage with no diversion at any of these points.

   c. The approved point of disposal for all stormwater may be a storm drain or existing open channel, creek, detention, or retention pond approved by the City Engineer. Acceptance of suggested systems will depend upon the prevailing site conditions, capacity of existing downstream facilities, and feasibility of the alternate design.

   d. When private property must be crossed to reach an approved point of disposal, it shall be the developer's responsibility to acquire a recorded drainage easement (of dimensions in accordance with Part 1- General, 1.2 Alignment and Cover, D. Easements, of these Technical Specifications. The drainage facility shall be a closed conduit system. Temporary drainage ditch facilities, when approved, shall be engineered to contain the stormwater without causing erosion or other adverse effects.

e. The design peak discharge from the subject property shall not be increased from conditions existing prior to the proposed development, except where it can be satisfactorily demonstrated by the developer that there is no adverse impact.

f. Retention/detention facilities will be required when necessary to maintain surface water discharge rates at or below the existing design storm peak discharge.

g. Minimum width of an access easement from an existing public road to a drainage facility shall be 15 feet.

h. Vegetation shall be established on areas disturbed by/or on areas of construction as necessary to minimize erosion, in accordance with Part 1 - General, 1.5 Erosion Control, of these Technical Specifications.

2. All storm drain system designs shall make adequate provisions for collecting all stormwater runoff. The system shall accommodate all runoff from upstream tributary areas whether or not such areas are within the proposed development. The amount of runoff to be accommodated shall be based upon ultimate development of all upstream tributary areas.

3. Where storm drains are constructed on slopes greater than 20 percent; in areas designated as hazardous; where site conditions may cause damage to improvements, slippage, or slides; or as determined by the City Engineer, a soils report and/or Engineering Geology Report may be required.

4. For erosion control requirements, refer to Technical Specifications - "Excavation and Grading," Part 1 - General, 1.8 Erosion Control.

5. Where the finished graded surface has a greater than 20 percent slope, or as required, soil stabilization fabric shall be placed over the entire disturbed area.

6. Proposed storm drain systems shall not discharge flows into inadequate downstream systems unless approved by the City Engineer.

7. Public storm lines shall be located within the public right-of-way (ROW) per Part 1 - General, 1.2 Alignment and Cover, A. Right-of-Way Location, of these Technical Specifications.

8. Drawings relevant to this section are included in the Standard Drawings.

B. Site Drainage Plans

1. Existing Drainage Plan

a. A topographical contour map defining existing conditions shall be provided and include the following minimum information:

1) Two-foot contour intervals, slopes over 10 percent may use 5-foot intervals, extend the contours a minimum of 100 feet beyond the property boundary.

2) All structures, buildings, parking lots, and utilities on the property.

3) Isolation of all existing drainage facilities and watercourses, including wetlands and floodplain areas.

b. Locations of all subsurface water outlets (e.g., springs.) Show arrows to indicate direction of flow for all drainage information.

2. Proposed Drainage Plan

Show proposed site grading and drainage facilities on a topographical contour map. Unless the detail for proposed improvements will obscure the conditions shown on the existing drainage plan, proposed site grading and drainage may be shown on the existing drainage plan. The following minimum information shall also be shown.

a. Finished contours of the property after development shall be at 2-foot contour intervals, slopes over 10 percent may use 5-foot intervals, extending the contours a minimum of 100 feet beyond the property boundary.

b. Percent grade, for graded slopes, elevations, dimensions, and locations for all graded slopes.

c. Cut/fill areas, structural fill placement areas, and erosion/sedimentation control methods including reseeding areas.

d. All proposed drainage facilities including public and private systems, drainage ditches, and culverts.

e. All proposed changes to floodplain boundaries must meet the requirements of the Federal Emergency Management Agency (FEMA).

C. Drainage Calculations

Furnish such supporting information as required per General Requirements, A. Public Works Standards, 1.9 Supportive Information, and Part 1 - General, 1.1 General Design Requirements, E. Minimum Design Criteria, of these Technical Specifications.

D. Detention Requirements

All proposed development is required to use adequate drainage management practices. Developments located within a master planned drainage basin will follow the recommendations adopted to that plan. Developments not located within master planned drainage basins shall minimize the rate and amount of runoff to receiving systems and streams.

E. Minimum Design Criteria

1. Storm Frequency

All public storm drain systems shall be designed for the design storm recurrence interval in the following table:

DRAINAGE SYSTEM DESIGN CAPACITY

Drainage System Element	Design Storm Recurrence Interval (Years)
Minor	
Streets, curbs, gutters, inlets, catch basins, and connector drains	10
Major	
Laterals (collectors)	
Less than 250 tributary acres	10
Trunk	
Greater than 250 tributary acres	50*
Arterial streets and the drainage system in or under arterial streets	50*
Watercourses	
Without designated floodplain	50
With designated floodplain	100
Bridges	100

Drainage System Element	Design Storm Recurrence Interval (Years)
Detention Facilities	
Storage volume (on site)	25
Discharge Rate	Function of downstream capacity

**Surcharging contained within pipe system may be allowed.*

2. Time of Concentration

Overland flow of runoff to the initial catchment point into the storm drain system shall be a minimum of 5 minutes.

3. Velocity and Slope

All storm drains shall be on a grade that produces a mean velocity, when flowing full, of at least 3 feet per second.

4. Manning's Equation

When calculating minimum pipe slopes and velocities, the design engineer shall use the Manning pipe friction equation.

5. Pipe Coefficient

The storm drain pipe roughness coefficient to be used in the Mannings' equation shall be not less than 0.013.

6. Stormwater Flows

Several alternative methods are available to design engineers for estimating peak runoff. For areas under 240 acres, the "Rational" formula can be used. Regression equations can only be used as a check on other methods. For areas over 240 acres, a hydrographic-based formula shall be used.

1.2 Alignment and Cover

A. Right-of-Way Location

Storm drain lines shall generally be located 12 feet west or south of the centerline. All changes in direction of pipe shall be made at an approved structure, except as provided in Part 1 - General.

B. Curvature

Storm drain lines shall not be curved between structures. If unusual circumstances are present, as determined by the City Engineer, small diameter storm drains may be curved. Such curves shall conform to the street curvature.

C. Minimum Cover

1. All storm drains shall be laid at a depth sufficient to protect against damage by traffic and to drain building footings where practical. Sufficient depth shall mean the minimum cover from the top of the pipe to finish grade at the storm drain alignment.

2. Minimum cover shall be 30 inches above the top of the pipe in paved areas and 36 inches at all other locations. Less than minimum cover shall be allowed only if unusual circumstances are present and appropriate measures are taken to protect the pipe's integrity, as determined by the City Engineer.

3. The design engineer must show that sufficient depth is provided at the boundary of the development to properly drain the remainder of the upstream basin area tributary to the site.

D. Easements

1. When it is necessary to locate storm drains in easements, the storm drain shall be centered in the easement. All storm drain easements shall be exclusive and shall not be used for any purpose that would interfere with the unrestricted use of the storm drain line. Exceptions to this requirement will be reviewed on a case-by-case basis (e.g., a utility corridor in a new subdivision).

2. Easements for storm drain lines 36 inches or less in diameter shall have a minimum width of 15 feet. Easements for storm drain lines greater than 36 inches in diameter, shall have a minimum width of 20 feet. Wider easement widths may be required for special circumstances.

3. Open channels shall have easements sufficient in width to cover the 100-year floodplain line when a 100-year design storm is required, or 15 feet from the waterway centerline, or 10 feet from the top of the recognized bank, whichever is greater. A 15-foot wide access easement shall be provided on both sides of the channel for channel widths greater than 14 feet at the top of the recognized bank.

4. Easement locations for public storm drains serving a Public Utility District, apartment complex, or commercial/industrial development shall be in parking lots, private drives, or similar open areas, which will permit unobstructed vehicle access for maintenance.

5. Structures shall not be built over the easements, nor shall trees or large bushes be planted in the easement.

6. Easements shall be furnished to the City Engineer for review and approval prior to recording.

E. Relation to Watercourses

Storm drain lines discharging to a creek or drainage channel shall be preapproved by the Oregon Department of Environmental Quality (DEQ).

1.3 Structure Location

A. Manholes

1. Manholes shall be included at all changes in slope, alignment, pipe size, and pipe junctions with present or future storm drains. Manhole spacing shall not be greater than 400 feet.

2. Standard manholes are required when rim to crown of pipe elevations exceed 5.5 feet at pipe junctions. Flat-top manholes shall be used when rim to crown of pipe elevations are less than 5.5 feet.

3. When the downstream pipe size increases, the crown of all upstream pipes shall not be lower than the crown of the larger downstream pipe.

B. Catch Basins

1. Catch basins shall be located in streets at the curb line to receive stormwater runoff and convey it to the main storm drain.

2. Catch basins shall be located at the following locations but in no case be spaced farther than 300 feet:

a. Curb returns on the upstream side of an intersection.

b. Dead-end streets with a descending grade.

c. At intermediate locations so storm flows at the curb line do not exceed 3 feet in width (measured from the curb face) or 3 inches in depth (measured at the curb face,) whichever is less.

d. At the low points of vertical curves.

e. For grades greater than 10 percent the maximum spacing shall be reduced to 150 feet.

f. For grades less than 1 percent the maximum spacing shall be reduced to 150 feet.

3. Catch basins shall be capable of intercepting design storm flows at the curb.

C. Drywells

Drywells may not be used as a discharge point within the City.

D. Anchor Blocks

For storm drain pipes greater than 4 inches in diameter, concrete anchor blocks shall be required if the slopes are greater than 20 percent. Anchor blocks shall key into trench sides. Spacing for anchor blocks is as follows:

SPACING FOR ANCHOR BLOCK FOR ALL SIZE PIPE

Slope (Percent)	Minimum Spacing (Feet)
0 to 19.99	No Anchor Required
20 to 34.99	35
35 to 50.99	25
51 or more	15 or Special Design

E. Water Bars

Where the finished graded surface has a slope greater than or equal to 3H:1V or as required, water bars shall be installed. The water bars shall be sloped slightly to drain runoff water away from the pipe line alignment. Water bars shall have a maximum spacing of 40 feet.

1.4 Storm Detention

A. Development Not Requiring Detention

In general, developments meeting the following criteria will not be required to provide detention:

1. Land divisions of less than four lots.

2. Multi-family developments of less than four units.

3. Commercial and industrial development where the construction of a new or the expansion of an existing facility will not increase the impervious area by more than 5,000 square feet.

B. Floodplain Information

Floodplain information, delineating the 100-year floodplain limits, shall be shown where it occurs within the development. Floodplain limits shall be based on maps prepared by the U.S. Army Corps of Engineers and FEMA. Where better information is available, it shall be used by the design engineer.

C. Detention Volume

When detention is required, the volume to be detained shall be based on the following:

1. The rate of runoff from a developed site during a 25-year recurrence interval storm which shall not exceed the pre-development rate of runoff released based on a 10-year recurrence interval storm.

D. Emergency Overflow

1. The design engineer shall assess the impacts of system failure for on-site detention. Overflows may occur due to rainfall intensity that exceeds the design storm, debris blockage of storm drain system, or some other reason.

2. If a system overflows, it shall not cause inundation of neighboring properties. Potential overflow routes shall be protected from erosion by adequate means.

E. Detention Facilities

The preferred detention volume storage method is surface storage in swales. Alternative methods may be proposed by the developer and reviewed on a case-by-case basis.

1.5 Erosion Control

Developments shall provide erosion control methods to limit the removal of soil materials caused by storm runoff during the construction phase of a project. Developers shall obtain a DEQ 1200-C Permit if required by the DEQ. It shall be the responsibility of the developer to determine if a 1200-C Permit is required.

A. For subdivision plats, temporary erosion control measures shall be utilized by the developer during installation of plat improvements and by subsequent builders during construction of dwellings and other lot improvements.

B. Prior to the initial clearing and grading of any land development, provisions shall be made for the interception of all potential silt-laden runoff that could result from said clearing and grading. Said interception shall preclude any silt-laden runoff from discharging from the proposed land development to downstream properties, unless previously approved by the City Engineer. Said interception shall cause all silt-laden runoff to be conveyed by open ditch or other means to a temporary facility designed by the design engineer to remove silt prior to discharge to downstream properties.

C. Prior to initial clearing and grading of the construction site, an evaluation of the following factors must be carried out:

1. Soil Erodibility

Soil erodibility should be identified using Natural Resources Conservation Service erodibility ratings. Erosion control techniques shall be designed accordingly.

2. Slope and Runoff

Cleared areas will require protection from erosion.

3. Cover

Erosion protection will be required for all disturbed areas.

D. Temporary facilities may include silt fences, drain barriers, gravel entries, ditches, surface stabilization, or other methods and devices as necessary.

E. Temporary/permanent hydro-seeding or acceptable seeding and mulching must be provided whenever perennial cover cannot be established on sites that will be exposed after September 1 or prior to June 1.

1.6 Private Drainage Systems

Private drainage systems shall not enter the public ROW and shall be in accordance with DEQ requirements.

A. Subdivisions

When subdivision lots drain to the rear, it may be necessary to provide a private drainage system in private easements. This system shall be for collection of roof drains, footing drains, and surface runoff. This system shall be designed to meet the Oregon Plumbing Specialty Code, current edition.

B. Subsurface Drainage

Subsurface drains (under drains) shall be provided at the following locations:

1. For all existing springs and field tile intercepted during construction activity for other facilities, i.e., sewer, water, mains, street excavations, foundations, etc. Subsurface drains are not needed if the tile is removed.

2. Where high groundwater exists or when it is necessary to reduce the piezometric surface to an acceptable level to prevent land slippage or under floor flooding of buildings.

3. The drainage line installed shall begin at a cleanout and terminate at an approved point of disposal. Open jointed storm drain lines will not be considered as an acceptable solution.

1.7 Specification References

Specification references made herein for manufactured materials such as pipe, fittings, and manhole rings and covers refer to designations for the American Water Works Association (AWWA), ASTM International, or the American Association of State Highway and Transportation Officials (AASHTO), current edition.

1.8 Care and Handling of Materials

A. Adequate precautions shall be taken to prevent damage to pipes, fittings, manhole components, and all other materials used in construction of the storm drainage system. Pipe and other materials during transport shall be secured individually by use of wood spacer blocks or wood crates, or otherwise protected to prevent collision of individual pieces and possible subsequent damage.

B. All pipe, fittings, and manhole components shall be loaded and unloaded in a manner to prevent shock or damage. Under no circumstances shall such material be dropped. All materials on the ground shall be protected from damage. All pipes, fittings, manhole components, and all other materials used in the construction of the drainage system shall be carefully inspected by the Contractor prior to installation. All defective materials shall be rejected. All materials that are delivered considerably in advance of their installation shall be stored in a satisfactory manner.

C. Proper materials, tools, and equipment shall be used by the Contractor for safe and convenient prosecution of the Work. All pipes, fittings, etc., shall be carefully lowered into the trench piece by piece in such a manner to prevent any damage to the materials. Under no circumstances shall materials be dropped or dumped into the trenches.

PART 2 - MATERIALS

2.1 Bedding and Select Backfill

Bedding and select backfill, when native materials are not suitable, shall be well-graded 3/4"-0 or 1"-0 crushed rock or approved equal. All bedding and select backfill materials shall be subject to the approval of the City. Placement of bedding and select backfill shall be as required and as shown on the City Standard Drawings.

2.2 General Backfill

See Technical Specifications - "Excavation and Grading," Part 2 Materials, 2.5 General Backfill.

2.3 Gravity Storm Drains

A. General

1. Public storm drains shall be constructed of solid wall PVC.

2. When pipe has less than minimum cover as defined in Part 1 - General, 1.2 Alignment and Cover, C. Minimum Cover, of these Technical Specifications, the pipe material shall be ductile iron.

3. Public storm drain pipe shall meet DEQ requirements and shall be in accordance with the City's Stormwater Facilities Plan.

4. All public storm drain lateral lines to catch basins and other inlet structures shall be a minimum of 12 inches in diameter. All public storm drain main lines shall be a minimum of 12 inches in diameter.

B. Solid Wall PVC Pipe

Solid wall PVC pipe shall be solid wall construction and shall conform to the requirements of ASTM D3034, SDR 35 for pipe up to 15-inch diameter and ASTM F679, Type 1 only, for pipe sizes 18- to 27-inch diameter. Joints for solid wall PVC pipe shall conform to ASTM D3212 using elastomeric gaskets conforming to ASTM F477.

C. Ductile Iron Pipe

Ductile iron pipe and fittings shall conform to AWWA C150, AWWA C115, AWWA C151, and AWWA C110 and shall be minimum pressure Class 150 unless specified otherwise. All ductile iron pipe shall have a bituminous sealed cement mortar lining conforming to AWWA C104. All joints, unless otherwise specified, shall be push-on rubber gasket joints conforming to AWWA C111.

2.4 Manholes

A. Cast-in-place Base Sections

1. Cast-in-place base sections for manhole construction shall have a minimum 28 day strength of 4,000 psi, unless approved otherwise by the City Engineer, and shall not be less than 5 inches in thickness in any section. All shelf area shall be uniformly shaped, have a rough float finish, and slightly slope towards the channel.

2. The Contractor shall be responsible for the determination of pipe hole orientation and grade.

3. After placement of the concrete for the base, the bottom manhole ring shall be set level into the wet concrete to form a tight seal. The base concrete shall then

be properly cured for a minimum of 24 hours before placing the remaining rings and cone.

4. Cast-in-place base sections will be used only when specifically approved by the City Engineer.

B. Precast Base Sections

1. Precast base sections shall conform to ASTM C479. Concrete shall be consolidated by mechanical vibration. Reinforcing shall be provided in the base and walls. Minimum concrete thickness shall be 5 inches.

2. All shelf area shall be uniformly shaped, have a rough float finish, and slightly slope towards the channel. The shelf shall be above the top of the storm drain pipe.

3. The Contractor shall be responsible for the determination of pipe hole orientation and grade.

4. Precast base sections shall be used unless otherwise specifically approved by the City Engineer.

C. Precast Manhole Sections

1. Precast manhole sections shall conform to ASTM C478 and consist of circular sections in the standard 48-inch diameter.

2. No more than two lift holes shall be cast into each section. Holes shall be located as to not damage reinforcing or expose it to corrosion. At the manufacturer's option, steel loops may be provided for handling in lieu of lift holes. All lift holes shall be patched after installation.

3. Precast manhole cones shall be eccentric, unless otherwise specified, and shall meet ASTM C478.

4. Flat slab covers for Type "B" manholes shall conform to ASTM C478.

5. Slabs, cones, and ring sections shall be free from fractures, cracks, rock pockets, or exposed reinforcement.

D. Pipe Connections to Manholes

1. All pipe connections to manholes shall be constructed as shown on the City Standard Drawings. All pipe-to-manhole connections shall be watertight.

2. For solid wall PVC and ductile iron pipe, sewer couplings with an appropriate adaptor gasket by Romac Industries, or approved equal, may be used for cast-in-place manhole bases OR an A-Lok pipe connector as manufactured by A-Lok Products, Inc., PSC Flexible Connector as manufactured by Press Seal Gasket Corporation, Kor-N-Seal as manufactured by Core and Seal Company, or approved equal shall be used when precast base sections are used.

3. All connections shall match the grade and alignment of the pipe entering and exiting each manhole. Manhole pipe connections shall be constructed so flow through the manhole is not restricted in any way.

E. Manhole Rings and Covers

1. Manhole rings and covers shall be as called for on the City Standard Drawings, or approved equal.

2. Castings shall be tough, close-grained, gray iron free from blow holes, shrinkage, and cold sheets. They shall conform to ASTM A48 and shall be smooth, sound, clean, and free from blisters and defects.

3. Castings and covers shall be planed and ground when necessary to ensure flat and true surfaces.

4. Covers shall be true and shall seat within the ring at all points.

2.5 Catch Basins

A. Catch Basins

1. Catch basins shall be precast units manufactured in accordance with ASTM C139 and C913. Basin type shall be as called for on the City Standard Drawings, or approved equal.

2. Concrete shall have a compressive strength of 4,000 psi.

3. Reinforcement in precast structures shall be rebar meeting ASTM A615 Grade 60 or welded wire meeting ASTM A497.

4. Precast bases shall be furnished with cutouts or knockouts. Knockouts for pipes shall have a wall thickness of 2 inches minimum and may be located on all four sides.

B. Frames and Grates

1. Catch basin grates shall be metal castings conforming to the requirements of ASTM A48, Class 30. Castings shall be tough, close-grained, gray iron free from blow holes, shrinkage, and cold sheets. They shall be smooth, sound, clean, and free from blisters and defects. Castings shall be planed and ground when necessary to ensure flat and true surfaces.

2. Catch basin frame, hood, and grate shall be as called for on the City Standard Drawings, or approved equal.

3. Field inlet frames, hoods, and grates shall be hot dip galvanized flat bar A36 steel as shown on the City Standard Drawings, or approved equal.

C. Oil-Water Separators

1. Oil-water separators shall be The Snout by Best Management Products, Inc. (800-504-8008), or approved equal.

2. Oil-water separators shall be constructed of a corrosion resistant material and be equipped with a watertight access port, a mounting flange, and a means to prevent siphons.

3. The size and position of the oil-water separator shall accommodate the outlet pipe size and allow the bottom of the device to be located 6 inches below the pipe invert elevation. The oil-water separator shall be securely attached to the structure wall with an oil-resistant gasket, corrosion resistant hardware, couplings, etc., for a complete installation.

D. Pipe Connection to Catch Basins

1. All pipe connections to precast units shall be watertight.

2. For solid wall PVC and ductile iron pipe, a 1/2-inch pipe gasket stretched over the pipe shall be used in combination with a non-shrink grout to provide a watertight seal.

2.6 Culverts

A. Corrugated Steel

Culverts shall be Type 2 corrugated steel pipe and shall be a minimum 14-gauge with 2-2/3-inch x 1/2-inch corrugations. Fabrication of pipe shall conform to AASHTO M 274 and AASHTO M 36 specifications. Joints shall be made with corrugated steel culvert bands over 3/8-inch neoprene gaskets. Culvert bands shall be 12 inches wide.

B. Reinforced Concrete Culvert Pipe

1. Reinforced concrete culvert pipe shall be round and conform to the requirements of AASHTO M 170 except as modified below. Pipes shall be within the maximum and minimum diameters set forth in AASHTO M 170. The wall thickness and steel area for all classes of pipe that are not described in AASHTO M 170 shall be determined by interpolation from data given in the tables for pipes of diameters next smaller and next larger, respectively.

2. For all classes of pipe, except Class I, which are smaller than the minimum size set forth in AASHTO M 170 for the particular class, the minimum wall thickness shall be 1-3/4-inch and the steel area shall not be less than 0.06 square inch per linear foot of pipe barrel length.

3. All bell and spigot concrete culvert pipe shall be joined with rubber gaskets conforming to AASHTO M 198.

2.7 Hydroseed

See Technical Specifications - "Excavation and Grading," Part 2 Materials, 2.12 Hydroseed.

2.8 Mulch

See Technical Specifications - Excavation and Grading, Part 2 Materials, 2.9 Mulch.

PART 3 - EXECUTION

3.1 Trench Excavation

A. General

When solid rock is encountered in trench excavation, the City Engineer shall be notified.

B. Trench Width

1. The maximum trench width in the pipe zone shall be 2 feet plus the O.D. of the pipe and the minimum trench width in the pipe zone shall be 1 foot plus the O.D. of the pipe. This width shall be maintained to the top of the pipe.

2. The maximum clear width above the top of the pipe will not be limited except in cases where excess width of excavation would cause damage to adjacent structures or utilities.

C. Unsuitable Material

1. When natural soil conditions exist in the bottom of the trench that are unsuitable for proper pipe installation, the Contractor shall immediately notify the design engineer. The Contractor shall then over-excavate the trench below the design grade to a depth specified by the design engineer. Such over-excavation shall be to provide for foundation material.

2. Foundation material or stabilization fabric, as shown on the City Standard Drawings, shall be provided by the Contractor only when specifically called for on the City Standard Drawings or when required by the City Engineer.

3. As an alternative to over-excavation and placement of foundation material, a geotextile fabric may be used if field use proves acceptable. The fabric material shall be placed on the bottom of the trench and the bedding material placed over the fabric to proper pipe grade. The fabric width shall be one foot wider than the trench bottom.

D. Exploratory Work

Contractor shall perform appropriate exploratory work to locate utilities when they are known to exist but the specific location is unknown or not marked accurately. Appropriate exploratory work shall be performed in these situations.

3.2 Shoring, Sheeting, and Bracing of Trenches

A. The Contractor shall adequately sheet and brace the trench during excavation whenever necessary to satisfy trench safety standards, prevent cave-ins, or to protect adjacent structures or property. Where sheeting and bracing are used, the Contractor shall increase trench widths for the bracing material accordingly.

B. The sheeting must be kept in place until the pipe has been placed, backfilled at the pipe zone, tested for defects, and repaired if necessary. All sheeting, shoring, and bracing of trenches shall conform to the requirements of the public agency having jurisdiction.

3.3 Dewatering Excavated Areas

A. All groundwater, seepage, or stormwater that may occur or accumulate in the excavation during the progress of the Work shall be removed. In areas where the nature of soil and hydrostatic pressures are of such a character as to develop a quick condition in the earth mass of the trench, the dewatering operation shall be conducted so that the hydrostatic pressure will be reduced to or near zero in the immediate vicinity of the trench.

B. All excavations shall be kept free of water during the construction or until otherwise requested by the City Engineer.

C. Contractor shall dispose of all waste and water removed from the trench. Disposal shall be in accordance with all state and local regulations.

3.4 Location of Excavated Materials

A. During trench excavation, the excavated material shall be located within the construction easement or right-of-way so that the excavated material will not obstruct any private or public traveled roadways or streets, or cause undue damage to the streets.

B. Contractor shall provide means of containing overly saturated soils, i.e., muck, or remove the muck from the Work area as it is excavated, if such soils are encountered in the excavation. The intent is to prevent excessive damage or disruption to street rights-of-way or easement beyond what would normally occur during such Work. Pile and maintain material from trenches so that the toe of the slope of the material excavated is at least two feet from the edge of the trench. It shall be the Contractor's responsibility, however, to determine the safe loading of all trenches.

3.5 Disposal of Excavated Materials

Contractor shall dispose of all excavated material, which is not required for, or is unsuitable for, backfill. The Contractor's method of disposal shall comply with regulations of the governing body having jurisdiction.

3.6 Trench Backfill

A. All backfill material shall be placed into the trench so that free fall of the materials into the trench is prevented until at least two feet of cover is provided over the pipe. Under no circumstances shall sharp or heavy pieces of material be allowed to drop directly onto the pipe. Methods of backfilling, other than as specified herein, shall be used only upon the approval of the City Engineer.

B. Bedding and Select Backfill

1. A minimum 6-inch depth of bedding shall be placed on the trench bottom, in accordance with the City Standard Drawings, as applicable, and smoothed to provide uniform bedding so the pipe is supported along its full length and not by the bells. Bell holes at each joint shall be provided to ensure support along the entire pipe length.

2. It shall be understood that the 6-inch depth is a minimum depth only, not an average depth, and does not preclude the Contractor at their option from placing additional depth of bedding to facilitate their Work. Care shall be used to ensure that the bedding material is properly worked under the haunch of the pipe for its full length.

3. Select backfill shall then be brought up from the spring line to the minimum distance above the top of the pipe shown on the City Standard Drawings, leveled and compacted. Compaction of the bedding and select backfill by hand tamping will be allowed if the required compaction density is achieved; otherwise, mechanical tamping will be required.

4. When an open-graded material is used for bedding or foundation material to facilitate trench dewatering, the open graded material shall be placed to the spring line of the pipe. The Contractor shall make provisions to ensure that fines from the select backfill do not migrate into the open graded bedding or foundation material. To prevent soil migration the Contractor may use any of the following:

   a. Provide an approved fiber/fabric between the open graded bedding material and select backfill.

   b. Provide an alternative approved by the City Engineer.

C. All general backfill material shall be pushed first onto the slope of the backfill previously placed and allowed to roll down into the trench. The Contractor shall not push the backfill material directly into the trench until at least two feet of cover is provided over the pipe.

D. Controlled Low-Strength Material (CLSM) Placement

1. When called for on the Design Drawings, Contractor shall backfill trenches with CLSM.

2. CLSM shall be placed in the trench in such a manner to ensure the trench is completely filled to the lines and grades called for on the Design Drawings.

3. CLSM shall be protected from traffic loads for a three-hour period, after which required surface restoration work may be performed.

E. Canal or Irrigation Ditch Crossing

1. Where the trench crosses a canal, irrigation ditch or culvert, the backfill shall be compacted the entire trench depth with mechanical tampers to 90 percent of the laboratory density as determined by ASTM D1557.

2. All backfill material in the canal or ditch liner and in the trench cut-off wall shall be imported clay or a soil/bentonite mixture as approved by the City Engineer. Unless required otherwise, the soil/bentonite mixture shall be 1 part bentonite to 10 parts soil by weight. A high grade bentonite material shall be used.

3. The ditch lining, conduit or pipe shall be restored to its original condition. The crossing shall be water tight and free of any leakage or seepage. The Contractor shall be fully responsible for repairing canal or ditch banks should leakage occur at the crossing.

F. Anti-Flotation Fabric Placement

1. When called for on the Design Drawings or called for by the design engineer, the Contractor shall place geotextile fabric over the select backfill material prior to placing general backfill. This fabric will help reduce the exposure to pipeline flotation.

2. The fabric shall be placed in accordance with the requirements shown on the City Standard Drawings.

3.7 Execution of Dust and Mud Control

If the Contractor fails to properly control the dust and mud, the City Engineer may request them to do so in writing. If, after 24 hours from this request, the Contractor has not corrected the dust or mud problem, the City may elect to have the corrective work performed and charge the Contractor for said work.

3.8 Restoration, Finishing, and Cleanup

A. The Contractor shall restore or replace all paved surfaces, graveled surfaces, curbing, sidewalks, trees and shrubbery, lawns, pastures and fences, or other existing facilities disturbed by their Work unless otherwise specified. Restoration and cleanup shall be a continuing operation and shall be diligently pursued until completed.

B. All surplus material and temporary structures as well as excess excavation shall be removed by the Contractor and the entire Site of Contractor operations shall be left in a neat and clean condition.

3.9 Existing Utilities

The Contractor shall be responsible for the actual locating and protecting of existing utilities. If a conflict develops between the design line and grade of a pipeline and an existing utility, the Design Engineer may adjust the pipeline grade or have the existing utility relocated.

3.10 Installation of Pipe

A. Gravity storm drain pipe shall be installed in accordance with the best current practices and as required by the manufacturer. Gravity storm drain pipe, unless otherwise approved by the City Engineer, shall be laid by progressing upgrade from the existing or newly constructed storm drain; the pipe shall be installed with bell ends laid upgrade unless otherwise approved. Each pipe shall be properly bedded so as to be supported along the full length of the pipe. A suitable foundation shall be achieved by a slight excavation for the bell at each joint.

B. All joints shall be properly lubricated, where required, and installed in accordance with the installation instructions of the pipe manufacturer, taking particular care to avoid pinching or otherwise causing damage to pipe gaskets. All joints shall be free of dirt and other foreign matter prior to the joining of the next pipe. All joints shall be restrained to prevent creep and misalignment of joints. All pipe shall have a ring painted around the spigot ends in such a manner as to allow field checking of setting depth of pipe in socket.

C. Gravity storm drain main lines shall be installed with the use of a laser beam and target. The design engineer shall provide slopes for each line. Careful attention shall be given to the setting up of the laser and the periodic checking of its aim, etc. All grade checking of the laser shall be the responsibility of the Contractor.

D. All pipe shall be installed true to line except when approved otherwise by the City Engineer. A tolerance of ±1/4-inch deviation from true grade at each joint will be allowed. Extra care shall be given to the installation of storm drain lines at minimum slopes to avoid flat slopes in the line.

E. All foreign matter and gravel shall be removed from the inside of the pipe and fittings before being installed, and the pipe and fittings shall be kept clean during placement. No pipe shall be laid when conditions exist that, in the opinion of the City Engineer, are unsuitable for the placing of pipe. All pipe and manholes shall be covered or plugged at night.

F. Testing

1. Visual Inspection

Upon completion of new storm drains, the City will complete a visual inspection utilizing City crews and equipment. After review of the visual inspection, the City may require additional deflection testing.

2. Deflection Test for PVC Pipe

If required, storm drains constructed of PVC pipe shall be deflection tested not less than 30 days after the trench backfill and compaction has been completed. The test shall be conducted by pulling a go/no-go solid pointed mandrel or sewer ball through the completed pipeline. The diameter of the mandrel or ball shall be 95 percent of the inside pipe diameter. Testing shall be conducted on a catch basin-to-manhole and manhole-to-manhole basis and shall be done after the line has been completely cleaned and flushed with water. The Contractor shall locate and repair any sections failing to pass the deflection test and retest the section.

3. Equipment

The Contractor shall perform all Work and furnish all materials and equipment as required to perform all required tests.

3.11 Manhole Installation and Connections

A. Construction

1. Manholes shall be constructed to the line, grade, and detail as shown on the Design Drawings and as approved by the design engineer.

2. Backfill of the manhole shall be brought up evenly on all sides of the manhole.

3. The "U" shaped channels in the manhole bases shall be constructed by the use of properly shaped forms.

4. Intersecting flow channels shall have uniform transitions. All channels inside the manhole shall have smooth troweled finishes.

B. Connection to Existing Manhole

1. Connections to existing manholes, when required on the Design Drawings, shall be made by the City.

2. All flow lines shall be properly shaped, and all new concrete shall be placed against a clean and sound surface.

3. An approved epoxy bonding agent shall be used on all existing surfaces to be bonded to new concrete or mortar.

4. All applicable conditions for new manholes described previously shall apply.

3.12 Catch Basins

A. Catch basins shall be constructed to the line, grade, and detail as shown on the Design Drawings and as approved by the City Engineer.

B. Backfill shall be brought up evenly on all sides of the catch basin.

C. All catch basins are to be watertight, including all connections and joints, and any leakage shall be corrected in an approved manner.

D. New Connections

1. All connections shall match the grade and alignment of the pipe entering and exiting each unit. Pipe connections shall be constructed so flow is not restricted in any way.

2. All holes shall be located to provide the design flow line and direction of any pipe entering the catch basin. After the pipe connection is made and set to grade, the annular space between the pre-cast unit and the pipe shall be cement grouted to permanently set the flow line of the pipe. Non-shrink cement grout shall be used.

E. Connection to Existing Catch Basins

1. Connections to existing catch basins, when required on the Design Drawings, shall be made by the Contractor.

2. All connections shall be made in such a manner as to leave the existing catch basin watertight. All new concrete shall be placed against a clean and sound surface.

3. An approved epoxy bonding agent shall be used on all existing surfaces to be bonded to new concrete or mortar.

4. All applicable conditions for new catch basins described previously shall apply.

3.13 Culverts

A. Culverts shall be installed in the location and at the grade shown on the Design Drawings and specified herein.

B. Culverts shall be bedded and backfilled uniformly on both sides of the pipe at the same time to prevent displacement or buckling of the pipe. Bedding material shall be worked carefully under the pipe haunches and then compacted. Bedding and backfill material shall consist of select native material free of particle sizes greater than 1-1/2-inch in diameter unless otherwise approved by the City Engineer.

3.14 Cleaning and Flushing of Completed and Tested Storm Drains

A. Prior to final inspection of the storm drain system by a City Representative, the Contractor shall flush and clean all parts of the system. All accumulated construction debris, rocks, gravel, sand, silt, and other foreign material shall be removed from the system at or near the closest downstream manhole.

B. All storm drain pipes, manholes, and catch basins installed shall be flushed as thoroughly as possible. It must be understood that flushing removes only the lighter solids and cannot be relied upon to remove heavy material allowed to get into the pipes during construction. The Contractor shall provide sufficient water and appropriately

sized taps to develop a velocity in the pipes during flushing of at least 2.5 fps. Check local rules for discharges to natural waterways.

3.15 Environmental Protection of Catch Basins

The Contractor shall provide biofilter bags, or approved equal, at each catch basin, field inlet, or area drain installed by the Contractor on the project. The biofilter bags shall be in place during the Contractor's Work to prevent sediment from entering the catch basins and shall be maintained until the risk of sediment entering the catch basin from construction activities on the Site no longer exists. When all Work is complete, the biofilter bags shall be removed by the Contractor.

END OF SECTION

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SECTION 3

SANITARY SEWERS

TECHNICAL SPECIFICATIONS

SECTION 3

SANITARY SEWERS

PART 1 - GENERAL

1.1 General Design Requirements

A. Performance Standards

1. Sanitary sewer system design shall meet the policies and guidelines of the current Oregon Administrative Rules (OAR) and the Oregon Department of Environmental Quality (DEQ) guidelines.

2. Sanitary sewer systems shall be designed to provide gravity service to all areas of developments. Pump stations are acceptable only if it is not possible to provide gravity service.

3. Sanitary sewer system capacity shall be designed for ultimate development density of the tributary area. The system shall allow for future system extension and development.

4. Sanitary sewers shall be designed to remove the domestic sewage and industrial wastes from basements of residences, commercial or industrial buildings, and all public and private establishments where practical.

5. Stormwater, including street, roof, or footing drainage, shall not be discharged into the sanitary sewer system, but shall be removed by a system of storm drains or by some other method. See Technical Specifications - "Storm Drainage."

6. Unpolluted or non-contact cooling waters shall not be discharged into sanitary sewers. The overflow drains and filter backwash lines of swimming pools and hot tubs shall not drain into a sanitary sewer.

7. As a condition of sewer service, all developments will be required to provide public sewers to adjacent upstream parcels to provide for an orderly development of the drainage area. This includes the extension of sewer mains in easements across the property to adjoining properties and across the street frontage of the property to adjoining properties when the main is located in the street right-of-way (ROW) and trunk sewers that are oversized to provide capacity for upstream development.

8. All sewer main lines shall be extended to the end of the farthest development site.

9. All sewer lines shall be located within the public ROW as directed by the City Engineer. These lines are placed in the public ROW for ease of maintenance, access, control of the facility operation, and to provide required replacement and/or repair.

10. Where sewers are constructed on slopes greater than 20 percent; in areas designated as hazardous; where site conditions may cause damage to improvements, slippage, or slides; or as determined by the City Engineer, a soils and/or geologic report may be required.

11. Where the finished graded surface is greater than 20 percent, or as required by the City Engineer, soil stabilization fabric shall be placed over the entire disturbed area.

12. Notify the City's recycled water personnel 72 hours prior to the installation of any sanitary sewer main.

13. All trench construction shall be per City Standard Drawings.

14. Manhole adjustment grade rings shall have a maximum of 12 inches conforming to City Standard Drawings.

15. The Contractor shall field-verify the depth and location of all existing sewer lines to be connected to prior to beginning construction. The Contractor shall inform the City Engineer of any discrepancies with the information found in the field compared with that given on the Plans.

16. Where conditions make compliance with these rules impractical, exceptions may be permitted. However, it will be necessary for the design engineer to provide a complete analysis of the need for such exceptions.

17. The Contractor shall not make any connections to new service stubs until sewer lines have been tested and approved.

18. Connections to existing main lines will be completed by City crews.

Drawings relevant to this section are included in the Standard Drawings.

B. Pipe Size

Private sanitary sewers shall meet the appropriate sections of the Oregon Plumbing Specialty Code, current edition. All sanitary sewer main lines shall be a minimum

diameter of 8 inches; 6-inch diameter sewer for non-extendible sewers of up to 250 feet in length serving eight lots or less may be permitted with approval.

C. Minimum Design Criteria

1. Velocity

All sanitary sewers shall be designed on a grade that produces a mean velocity when flowing half-full or full of no less than 2 feet per second (fps) and not to exceed 10 fps. Sewer grades shall not be less than those recommended by the DEQ.

2. Manning's Equation

When calculating minimum pipe slopes and velocities, the design engineer shall use the Mannings' pipe friction equation.

3. Pipe Coefficient

The minimum pipe roughness coefficient for sanitary sewers shall be 0.013.

D. Alignment and Cover

1. Right-of-Way Location

a. Sanitary sewer lines shall be located 6 feet south and west from the ROW centerline. All changes in direction of pipe shall be made at a manhole.

b. Sewers shall be located in the street ROW. If streets have curved alignments, the center of the manhole shall not be less than 6 feet from the curb face on the outside of the curve nor the sewer centerline less than 6 feet from the curb face on the inside of the curve.

c. Curved alignments in sanitary sewers are not permitted.

2. Minimum Cover

a. Sanitary sewers shall be laid at a depth sufficient to drain building and basement sewers, and to protect against damage by frost or traffic. In new residential hillside subdivisions, main and lateral sewers shall be placed at a depth sufficient to drain structures on the low side of the street.

b. Where pipes cross under ditches or streams and the cover is less than 3 feet, extra protection is required in accordance with Part 1 - General, 1.1 General Design Requirements, D. Alignment and Cover, 5. Relation to Watercourse, of these Technical Specifications.

c. Where existing sewers are shallow (5 feet or less), the cover shall be a minimum of 3 feet. Deviation from the above standards will be considered on a case-by-case basis when one of the following circumstances exist:

1) Underlying Rock Strata

Requires a written request to the City Engineer containing a soils report and a plan and profile certifying bedrock exists 3 feet below the undisturbed ground surface at all investigated alignments.

2) Crossing a Ditch or Stream

Requires a written request to the City Engineer containing a plan and profile with a horizontal scale of 1 inch = 20 feet and a vertical scale of 1 inch = 2 feet.

3) Cover Depth Less than 3 feet

Requires a written request to the City Engineer allowing the use of ductile iron pipe, pipe encasement, or other methods be used.

3. Separation with Water Lines

a. Mains shall be installed in accordance with OAR Division 52 a minimum clear distance of 10 feet horizontally and 1-1/2 feet vertically from water lines. Exceptions to these requirements shall be approved by the City Engineer prior to construction.

b. The minimum spacing between water mains, storm drains, gas lines, and other underground utilities shall be 3 feet horizontally when the standard utility location cannot be maintained.

4. Easements

   a. Easements will only be allowed when no other alternative for sewer service is available.

   b. Sewers placed in easements along a property line shall have the easement centered on the property line and the sewer shall be offset 18 inches from the property lines. For sewers placed in an easement located other than along a property line, the sewer shall be placed in the center of the easement. The conditions of the easement shall be such that the easement shall not be used for any purpose that would interfere with the unrestricted use for sewer main purposes. Under no circumstances shall a building or structure be placed over a sanitary sewer easement. This includes overhanging structures with footings located outside the easement. Further, no trees or large bushes shall be planted in the easement.

   c. Easements for sewers less than 12 inches in diameter shall have a minimum width of 15 feet. Sewers greater than 12 inches in diameter shall have a minimum easement width of 20 feet.

   d. Sewers with more than 8 feet of cover and/or inside diameters 24 inches or greater will require wider easements. A slope of 1H:1V from the sewer invert to ground surface will be used to determining easement width. Easement widths shall increase from the 15 foot minimum by 5-foot increments, e.g., 15, 20, 25 feet.

   e. Easement locations for public sewer mains serving a Public Utility District, apartment complex, or commercial/industrial development shall be in parking lots, private drives, or similar open areas, which will permit unobstructed vehicle access for maintenance by City personnel. Full vehicle access shall be provided to all sewer easements, pipelines, cleanouts, and manholes outside of public ROW.

   f. All easements shall be submitted to the City for review and approval prior to recording.

5. Relation to Watercourses

   a. Generally, the top of all sanitary sewers entering, crossing, or adjacent to streams, irrigation ditches, or drainage ways shall be at a sufficient depth

below the natural bottom of the waterway to protect the sewer line. One foot of cover is required where the sewer is in rock, 3 feet of cover is required in other materials. In paved channels, the top of the sewer line shall be placed at least 6 inches below finish grade of the bottom of the channel, except as provided above.

b. Sewers located along streams shall be located outside of the streambed and sufficiently removed to provide for future possible stream channel widening. All manhole covers shall be watertight and at or above the 100-year flood elevation.

c. Sewers crossing streams or drainage channels shall be designed to cross the stream as nearly perpendicular to the stream channel as possible and shall be free from change in grade. The minimum cover shall be 36 inches from the bottom of the streambed or drainage channel.

d. Pipe material shall be ductile iron with an 18 foot length of pipe centered on the stream or drainage channel centerline. The ductile iron pipe shall extend to a point where a 1:1 slope, which begins at the top of the bank and slopes down from the bank away from the channel centerline, intersects the top of the pipe.

e. A scour pad centered on the sewer line will be required when the top of the pipe to the bottom of the stream or drainage channel is 30 inches or less. The scour pad shall be concrete, 6 inches thick and 6 feet wide, reinforced with #4 rebar spaced 12 inches on center both ways, and shall extend to a point where a 1:1 slope, that begins at the top of the bank and slopes down from the bank away from channel centerline, intersects the top of the pipe. Deviations from the above requirements shall require review and approval on a case-by-case basis.

E. Structures

1. Manholes

a. Manholes shall be located at changes in slope, alignment, pipe size, and at all pipe junctions with present or future sanitary sewers.

b. Manhole spacing shall not exceed 500 feet, unless approved by the City Engineer.

c. The angle between incoming and outgoing sewer lines shall be greater than 80 degrees. Manholes are shown in the City Standard Drawings and are suitable for most conditions. New designs or revisions should not be shown on the Design Drawings, unless the City Standard Drawings are not suitable. New or revised designs may be necessary if:

1) One or more of the sewers to be connected to the manhole is over 36 inches in diameter. Smaller diameters may require a special design if the manhole is at an alignment change.

2) Several sewers will be connected to the manhole.

3) There is less than 80 degrees between the incoming and outgoing sewer.

4) The manhole will be subject to unusual structural loads.

5) Diversion or other flow control measures are required.

d. Where one or more of conditions 1), 2), or 3) above are encountered, a drawing of the manhole base should be made to determine if it is feasible to use designs shown in the City Standard Drawings. It may be necessary to restrict the options to a specific City Standard Drawing specified by a note on the construction drawings. If a special design is required for any reason, it will be necessary to show the details on the Design Drawings and to provide structural calculations as needed.

e. Some alternate manhole features are shown on the City Standard Drawings. Where these features are required, they must be specified by a note on the Design Drawings. Some examples are:

1) Flat tops must be used in lieu of cones where there will be less than 5.5 feet between the manhole shelf and the top of the manhole.

2) Watertight manhole frames and covers are to be used if floodwaters are expected to cover the manhole top or if the manhole must be located in the street gutter. Such conditions should be avoided wherever feasible.

3) Tamper-proof manhole frames and covers are required in areas subject to vandalism, such as areas that are not readily visible to the general public or the property occupants.

f. Design standards for elevation differences at manholes have been established to compensate for normal energy losses and to prevent surcharging of a sewer by a larger sewer. For purposes of slope calculation and for establishing elevation differences, the elevations are given at the intersection of the sewer centerline (usually the center of the manhole). The rules for elevation differences at manholes are:

1) The crowns of incoming sewers shall be at least as high as the crown of the outgoing sewer.

2) If sewers intersect or the alignment changes at the manhole, the invert elevation difference shall be at least 0.10 foot for 0 to 45 degrees of horizontal deflection angle, and 0.20 foot for over 45 degrees of horizontal deflection angle.

3) The slope of a sewer within a manhole shall be no less than the slope of the same sewer outside of the manhole. Where the difference between the slope of the incoming and outgoing pipe is greater than 6 percent, the slope across the manhole shall be the average of the incoming and outgoing pipes.

4) Drop connections are required when the vertical distance between flow lines exceeds 2 feet. The diameter of the drop connection must be specified on the construction drawings. The diameter of the drop connection shall not be more than one pipe size smaller than the diameter of the incoming sewer. Smooth flow lines with vertical distances of less than 1 foot must be provided wherever feasible. Drop connections shall be outside drops.

5) All connections must enter the manhole through a channel in the base. This includes drop connections and connections to existing manholes.

g. Where conditions make compliance with these rules impractical, exceptions may be permitted. However, it will be necessary for the

design engineer to provide a complete analysis of the need for such designs.

2. Cleanouts

a. Cleanouts will not be approved as substitutes for manholes on public sewer lines. Cleanouts are permitted at the upper end of a sewer that will be extended during a future construction phase. When the sewer is extended, the clean out will be removed and a manhole shall be installed in the appropriate location. If future extension requires a change in sewer alignment or grade, a manhole will be required at the cleanout location.

b. Cleanouts are permitted at the end of a non-extendable sewer line that does not exceed 250 feet in length nor serve more than eight lots.

3. Anchor Blocks

For sewer pipes greater than 4 inches in diameter, concrete anchor blocks shall be required if the slopes are greater than 20 percent. Anchor blocks shall key into trench sides. Spacing for anchor blocks is as follows:

SPACING FOR ANCHOR BLOCK FOR ALL SIZE PIPE

Slope (Percent)	Minimum Spacing (Feet)
0 to 19.99	No Anchor Required
20 to 34.99	35
35 to 50.99	25
51 or more	15 or Special Design

F. Service Lateral

1. Service laterals are those public sewer lines where a private building sewer connects.

2. Each individual building site shall be connected by a separate private building sewer service line connected to the public sewer. Combined sewer service lines will be permitted only when the property cannot legally be further divided. Examples of this are a residential lot with a house and an unattached garage or shop with plumbing facilities.

3. The minimum inside diameter of a sewer service lateral shall be 4 inches and shall be equal to or greater than the building sewer diameter. Service laterals are to be built to the same construction standards and of the same materials as the sewer main line. Service laterals in general shall be placed at 90 degrees to the main sewer line to avoid excessive exposure to other utilities during excavation for construction or maintenance of the service lines. Angles other than 90 degrees may be approved for special conditions such as cul-de-sac lots. In no case shall the angle between the main and the service be less than 90 degrees. Service line connections shall not be made at manholes except at cul-de-sacs unless otherwise approved by the City.

4. The minimum slope of sewer service lines shall be 2 percent except that for unusual conditions, a slope of 1 percent may be approved. However, it will be necessary for the designer to provide a complete analysis of the need for any sewer service lateral slope less than 2 percent. The maximum slope shall be 100 percent (45 degrees or 1 foot per foot). Deep connection risers (see the City Standard Drawing for service lateral to deep sewers) or drop connections to manholes must be used where service line slopes would exceed 100 percent.

5. Tees for service laterals shall be installed at 100 percent slope, and one-sixteenth or one-eighth bends shall be installed to provide proper grade for service lateral. Service laterals shall be extended to the end at the street ROW line or easement line, when a sewer is installed in the easement. A water tight plug shall be installed in the end of the lateral.

6. The Contractor shall not make any connections to new service stubs until sewer lines have been tested and approved.

G. Connection to Existing Sewers

1. Connections to, and extensions of, existing sewers will occur to facilitate new development. Connections to existing manholes shall be made by City crews.

2. When sewers are extended from cleanouts, the entire cleanout assembly, including the wye, shall be removed.

3. New building service laterals will be made at existing tees where possible.

4. When tees do not exist on the Public Sanitary Sewer System, the new lateral sewer will enter the collection system through a "cored" opening with an approved connector.

H. Private Sewer Lines

Private sewer systems shall be constructed in accordance with the Oregon Plumbing Specialty Code, current edition.

I. Sewage Pump Station Design Standards

1. General

The pump station shall be a duplex submersible pumping system designed by an engineer registered in the State of Oregon and experienced in the design of such facilities. Service area peak flows, pump station cycle, and hydrogen sulfide calculations shall be submitted to the City Engineer for review and approval.

2. Construction

Pump station construction shall include a wetwell, pump enclosure, associated piping and valves, electrical controls, automatic dialer, alarm system compatible with the City's current alarm system, emergency power transfer switch and connection receptacle, lighting, heater, ventilating fan, instrumentation, access road, fencing, landscaping, and potable water supply, and shall conform to DEQ standards and OAR Chapter 340, Division 52.

3. Capacities

Pump station shall be designed to pump the peak wastewater flow from the service area. When the service area is not built out, staging of pump station capacity will be allowed. The wetwell shall be sized to allow for a maximum number of ten starts per hour. Inlet piping shall not be used as a portion of the wetwell.

4. Hydrogen Sulfide

Calculations for hydrogen sulfide production shall be performed. Hydrogen sulfide control equipment shall be installed as required. The method used (flow back, air injection, chemical injection) shall be reviewed and approved by the City Engineer.

5. Electrical and Controls

a. Electrical

1) Pump station and related facilities will be constructed to electrical and building codes.

2) Electrical controls shall be located aboveground and mounted in a waterproof enclosure. Electrical panels shall be UL listed. The pump station wetwell shall be considered a hazardous location. Level controls in the wetwell shall be intrinsically safe.

b. Controls

1) Controls may be mechanical relays or programmable logic-controllers. Pumps shall automatically alternate lead-lag position with each pumping cycle.

2) Pump level control shall be by multitrode, or approved equal.

c. Power

1) An auxiliary power connector shall be mounted on the exterior of the station with a manual transfer switch mounted in the interior.

2) Where the flow is substantial or where environmental damage may occur due to power failure, the City Engineer may require permanent standby power.

d. Alarms

Alarms shall include:

1) Power failure

2) Telemetry failure

3) High water level

6. Materials

a. Pumps

A minimum of two pumps shall be supplied. Each pump shall be capable of pumping the peak wastewater flow. When more than two pumps are used, the station shall be able to pump peak wastewater flow when the largest pump is out of service. See Part 2 - Materials, 2.9 Sewage Pump Station Pumps and Appurtenances, of these Technical Specifications for more information regarding pumps.

b. Piping and Valves

1) Piping shall be ductile iron to a point at least 5 feet outside the station. Valves shall be AWWA-rated metal, suitable for wastewater use. Pressure gauges with isolation and purge valves on pump suction and discharge piping shall be provided.

2) Steel fabrications shall be hot-dipped galvanized. Paint is required on all valves, piping, and pipe fittings.

3) Forcemain shall be designed for nominal flow velocity in the range of 3 to 5 fps. Forcemains shall not be less than 4 inches in diameter for raw sewage.

7. Additional Features

a. Provide a 1-inch anti-freeze hose bib. Potable water shall be provided by an aboveground, reduced pressure backflow preventer.

b. Provide positive ventilation in the enclosure. Provide odor control as required.

c. Landscaping will only be required when the station is visible from a public roadway, and then only to blend with the local aesthetics.

d. A 6-foot high chain link fence shall surround the pump station when required by the City Engineer.

8. Operating and Maintenance Data

   a. Compile product data and related information appropriate for City's maintenance and operation or products furnished under the contract.

   b. Prepare an Operations and Maintenance Manual.

   c. Instruct City personnel in the maintenance of products and in the operation of equipment and systems.

9. Erosion Control

   a. Erosion control shall be required for all areas disturbed during construction and following construction until permanent protection is established.

   b. Temporary facilities may include silt fences, drain barriers, gravel entries, ditches, surface stabilization, or other devices, as necessary.

   c. Temporary/permanent hydroseeding or acceptable seeding and mulching must be provided whenever perennial cover cannot be established on sites that will be exposed after September 1 or prior to June 1.

1.2 Specifications References

Specification references made herein for manufactured materials such as pipe, fittings, and manhole rings and covers refer to designations for the current edition of the American Public Works Association (APWA), the American Water Works Association (AWWA), or ASTM International (ASTM).

1.3 Submittals

Catalog information on all materials and/or equipment to be installed shall be submitted to the City for review prior to installation.

1.4 Care and Handling of Materials

A. Adequate precautions shall be taken to prevent damage to pipes, fittings, manhole components, and all other materials used in construction of a sewerage system. Pipe and other materials during transport shall be secured individually by use of wood spacer blocks or wood crates, or otherwise protected to prevent collision of individual pieces and the possible subsequent damage.

B. All pipe, fittings, manhole components, and valves shall be loaded and unloaded in a manner to prevent shock or damage. Under no circumstances shall such material be dropped. All materials on the ground shall be protected from damage. All pipes, fittings, manhole components, valves, and all other materials used in the construction of the sewerage system shall be carefully inspected by the Contractor prior to installation. All defective materials shall be rejected. All materials which are delivered considerably in advance of their installation shall be stored in a satisfactory manner.

C. Proper materials, tools and equipment shall be used by the Contractor for safe and convenient prosecution of the Work. All pipes, fittings, etc., shall be carefully lowered into the trench piece by piece in such a manner to prevent any damage to the materials. Under no circumstances shall sewage system materials be dropped or dumped into the trenches.

1.5 Materials Furnished by the City

The Contractor's responsibility for material furnished by the City shall begin at the point of delivery to the Contractor. Materials already on the Site shall become the Contractor's responsibility on the start work date of the Contract. The Contractor shall examine all material furnished by the City at the time and place of delivery and shall reject all defective material. Any material furnished by the City that becomes damaged by the Contractor shall be replaced by the Contractor at their own expense. The Contractor shall assume full responsibility for materials furnished by the City once they are received by the Contractor.

1.6 Restoration, Finishing, and Cleanup

The Contractor shall restore or replace all paved surfaces, graveled surfaces, curbing, sidewalks, trees and shrubbery, lawns, pastures, fences, and other existing facilities to their original condition.

PART 2 - MATERIALS

2.1 Pipe

A. General

All public sanitary sewer lines shall be constructed of polyvinyl chloride (PVC) pipe. When required for added strength, ductile iron pipe may be used.

B. PVC Gravity Pipe

PVC gravity sewer pipe and fittings 15-inch diameter and smaller shall conform to ASTM D3034, SDR 35 unless called for otherwise on the Drawings. Pipes 18-inch diameter to 24-inch diameter shall conform to ASTM F679 unless called for otherwise on the Drawings. The joints shall be flexible joint with rubber ring gasket.

C. PVC Pressure Pipe

PVC pipe for pressure sewer lines shall conform to AWWA C900-16, DR 18 (235 psi pipe), or as otherwise specified. The pipe shall have flexible rubber gasketed joints conforming to ASTM D3139 and ASTM F477. Pipe color shall be green.

D. Ductile Iron Pipe

1. Ductile iron pipe and fittings shall conform to AWWA C150, AWWA C115, AWWA C151, AWWA C153, and AWWA C110 and shall be minimum pressure Class 350 unless specified otherwise. All ductile iron pipe shall have a bituminous sealed cement mortar lining conforming to AWWA C104. All joints, unless otherwise specified, shall be push-on rubber gasket joints conforming to AWWA C111.

2. When flanged pipe is required, the Contractor shall provide the D.I. pipe class required by the flange manufacturer to ensure the pipe and flange units are compatible. This data shall be provided to the City Engineer for review prior to ordering these materials. Flanges for couplings and fittings shall conform to ANSI 16.1, 125-pound bolt hole template.

E. High Density Polyethylene (HDPE) Pressure Pipe

1. HDPE pipe shall conform to AWWA C906 and shall have the SDR as required by the City Engineer. All joints shall be by the heat fusion method in accordance with the manufacturer's requirements.

2. Fittings shall be standard commercial products manufactured by injection molding or by extrusion and machining or fabricated from AWWA C906 pipe.

3. The Contractor shall provide detailed Shop Drawings for all joints and connections, including provisions for expansion and contraction as recommended by the pipe manufacturer.

2.2 Fittings

A. Fittings for Ductile Iron and PVC Pressure Pipe

Unless specified otherwise, all fittings such as elbows, tees, crosses, etc., shall be mechanical joint short-bodied compact ductile iron fittings conforming to AWWA C153, Class 350. When called for, flanged cast iron fittings shall conform to AWWA C110 with ANSI B16.1, 125-pound bolt hole template. All fittings shall be cement mortar lined in accordance with AWWA C104. Gaskets for flanges shall be either ring or full faced, 1/8 inch thick conforming to AWWA C111, Appendix B.

B. Fittings for Sewer Service Connection

Main line fittings for sewer service connections when installing new gravity sewer pipe shall be a gasketed tee suitable for ASTM D3034 or ASTM F679 sewer pipe. When service connections are required on existing sewer lines, a sewer tapping saddle shall be used, such as "Geneco Sealtite," of the type and model required to match the sewer main line and service line pipe materials, or approved equal.

C. Couplings

Couplings shall have stainless steel shear rings of the size and style required to match the pipe size and type being utilized. Couplings shall be manufactured by Fernco with stainless steel shear rings or approved equal.

D. Restrained Push-on Joint Pipe

When restrained joint ductile iron pipe is required, the pipe shall be the same class and type as the ductile iron pipe specified herein. Joints shall be Tyton Joint with Field Lok 350 gaskets, or approved equal. The restraint shall be boltless, integral restraining system, rated for 350 psi in accordance with the performance requirements of ANSI/AWWA C111/A21.11.

E. Restrained Fittings

All mechanical joint fittings called out to be restrained shall be equipped with a MEGALUG Series 1100 mechanical joint restraint system as manufactured by EBAA Iron, Inc., or approved equal.

2.3 Valves and Appurtenances

A. Plug Valves

1. All plug valves shall conform to AWWA C504. The valve body shall be constructed of cast iron (semi-steel) conforming to ASTM A126 Class B and shall be protected with a factory-applied fusion-bonded coating meeting AWWA C550. The shaft and plug shall be integrally constructed of cast iron (semi-steel) and shall be 100 percent encapsulated with Buna N rubber. The stem seals shall be Buna N multiple "V" ring stem packing seals. The valve seat surface shall be raised welded-in overlay of not less than 90 percent nickel.

2. Flange dimensions, facing, and drilling shall conform to ANSI B16.1, Class 125. Mechanical joints shall meet the requirements of AWWA C111/ANSI A21.11.

3. The valve shall have a 2-inch AWWA operator nut for buried services and hand wheel operator for non-buried services or as called for on the Drawings. Worm gear operators shall be furnished for all 4-inch or larger valves.

4. Valves shall be Dezurik eccentric plug valves, Pratt Ballcentric plug valves, or approved equal.

B. Valve Boxes

Each valve shall be equipped with an adjustable cast iron box of the sliding type with a base large enough to cover the top casting of the valve. The diameter of the valve box shall be not less than five (5) inches, and shall be of such length so as to provide the depth of cover over the pipe without full extension. Materials and installation workmanship for valve boxes shall be in accordance with AWWA C600, Section 10.3.

C. Sewage Air Release Valve

1. Air release valves where called for shall be Valve and Primer Corporation, #400 APCO Sewage Air Release Valve and/or #401 APCO Sewage Air and Vacuum Valve with 2-inch inlet or approved equal. An auxiliary 2-inch 125 psi bronze rising stem solid disc gate valve shall be installed with all sewage air release valves.

2. Air release valves shall also be furnished with accessory valves and connections (for flushing purposes) as shown on the City Standard Drawings.

3. The furnishing and installation of sewage air release valves shall include the construction of all associated structures and appurtenances as shown on the design drawings.

2.4 Thrust and Anchor Blocks

Thrust and anchor blocks shall be located and sized as shown on the City Standard Drawings, and at all changes in direction, or as required by the design engineer or City. Concrete used for the blocks shall be Portland Cement concrete with a minimum 28-day strength of 2,500 psi. All concrete shall be placed so that pipe joints and fittings will be accessible for repair. Concrete shall be placed against undisturbed material. Anchor rods shall be 3/4-inch diameter galvanized steel, embedded a minimum of 18 inches in concrete.

2.5 Manholes

A. Cast-in-place Concrete Base Sections

1. Cast-in-place concrete base sections for manhole construction shall have a minimum 28-day strength of 4,000 psi, unless approved otherwise by the City Engineer, and shall not be less than 6 inches in thickness in any section.

2. Required "U" shaped channels shall be constructed by the use of properly shaped forms. Intersecting flow channels shall have smooth uniform transitions. All channels shall have smooth troweled finishes. All shelf area shall be uniformly shaped, have a rough float finish and shall slightly slope towards the channel.

3. The Contractor shall be responsible for the determination of pipe hole orientation and grade. Cast-in-place base sections will only be used where called for specifically on the Drawings or where required by the design engineer.

B. Precast Concrete Base Sections

1. Precast concrete base sections shall be approved by the design engineer and shall conform to ASTM C478. Concrete shall be consolidated by mechanical vibration. Reinforcing shall be provided in the base and walls. Minimum concrete thickness shall be 5 inches unless otherwise required for deep manholes.

2. Required "U" shaped channels shall be constructed by the use of properly shaped forms. Intersecting flow channels shall have smooth uniform transitions. All channels shall have smooth troweled finishes. All shelf area shall be uniformly shaped, have a rough float finish and shall slightly slope towards the channel. The shelf shall be above the top of the sewer pipe.

3. The Contractor shall be responsible for the determination of pipe hole orientation and grade. Precast base sections shall be used unless specifically called for otherwise on the design drawings or by the design engineer.

C. Precast Concrete Manhole Sections

1. Precast concrete manhole sections shall conform to ASTM C478 and consist of circular sections in the standard 48-inch diameter, unless otherwise noted. No more than two lift holes shall be cast into each section. Holes shall be located as to not damage reinforcing or expose it to corrosion. All lift holes shall be patched to prevent water seepage into the manhole, utilizing an approved, non-shrink grout.

2. Precast manhole cones shall be eccentric unless otherwise specified and shall meet ASTM C478.

3. Flat slab covers for manholes shall conform to ASTM C478. Slabs, cones and ring sections shall be free from fractures, cracks, rock pockets, or exposed reinforcement. Joint seal material shall be "Kent seal" mastic acrylic polymeric sealant, or approved equal.

4. Manholes which have a depth of 4 feet or less, from the top of the manhole cover to the pipe invert, shall utilize a 48-inch diameter section and flat slab cover. Cone sections shall not be used for manholes less than 4 feet in depth, unless approved by the City Engineer, or called for on the Drawings.

D. Pipe Connection to Manholes

1. All pipe connections to manholes shall be constructed as shown on the Drawings, shall be flexible, and shall allow movement of the sewer pipe in all directions. Manhole pipe couplings shall be suitable for the sewer pipe type connecting to the manhole.

2. A-Lok field sleeve, or approved equal, may be used for cast-in-place manhole bases.

3. When precast base sections are used, an A-Lok pipe connector as manufactured by A-Lok Products, Inc., PSX Flexible Connector as manufactured by Press Seal Gasket Corporation, Kor-N-Seal as manufactured by Core and Seal Company, or approved equal shall be used.

4. Fittings for drop manholes shall be of the same material as the attached sewer pipe.

E. Manhole Rings and Covers

1. Castings shall be tough, close-grained, gray iron free from blow holes, shrinkage and cold sheets.

2. Manhole rings and covers shall conform to ASTM A48 and shall be smooth, sound, clean and free from blisters and defects. Castings and covers shall be planed and ground when necessary to insure flat and true surfaces. Covers shall be true and shall seat within the ring at all points. Manhole rings shall have a maximum height as shown on the City Standard Drawings.

3. Manhole rings and covers shall be as called for on the City Standard Drawings.

F. Manhole Stubouts

1. Manhole stubouts shall be constructed as called for on the Drawings or as directed by the City Engineer. The stubouts shall have the appropriate flexible connection at the manhole.

2. The outside end of the stubout shall be secured, sealed watertight with a block and plug with rubber ring seal.

3. All stubouts shall be 8-inch minimum, unless otherwise approved or shown.

G. Pressure Sewer Discharge Manholes

The Contractor shall construct the Pressure Sewer Discharge Manholes as shown on the Drawings and also in accordance with the Specifications herein for standard manholes.

2.6 Cleanouts

A. Cast Iron Rings and Covers

Main line cleanouts shall have cast iron rings and covers as called for on the City Standard Drawings, or approved equal. Service line cleanouts shall have cast iron rings and covers such as Inland Foundry Co., Inc., No. 274, or approved equal.

B. Pipe

Pipe used in the construction of cleanouts shall be consistent with type of sewer pipe to which it is connected.

2.7 Frost-free Sanitary Yard Hydrant

Frost-free sanitary yard hydrant shall be Hoeptner FreezeFlow, or approved equal, with a PK1400 self-draining vacuum breaker as manufactured by Arrowhead Brass and Plumbing, LLC, or approved equal.

2.8 Sewage Pump Station Valve Vault

A. General

The valve vault shall be a 72-inch precast manhole or an approved precast valve vault. The valve vault shall be watertight and set plumb and to grade.

B. Precast Manhole Sections

Precast manhole base, wall, and top slab sections shall conform to ASTM C478. Steel loops shall be provided for handling. Lift holes shall not be used. All sections shall be free from fractures, cracks, rock pockets, or exposed reinforcement. Joint seal material shall be "Kent seal" mastic acrylic polymeric sealant, O-ring rubber gasket, or approved equal.

C. Pipe Connection to Valve Vault

1. An A-Lok pipe connector as manufactured by A-Lok Products, Inc., PSX Flexible Connector as manufactured by Press Seal Gasket Corporation, or approved equal shall be used.

2. Rubber boot pipe-to-manhole connections, such as Kor-N-Seal as manufactured by Core and Seal Company or equal may also be used. The rubber-booted connection of sewer pipe to manholes shall be performed as per manufacturer instructions and as required to make long lasting flexible watertight connections. The rubber-booted connection shall be used in conjunction with precast manhole bases with core-drilled holes. All holes shall be located so as to provide the design flow line and direction of all pipe entering each manhole. After the pipe-to-manhole connection is made and set to grade, the annular space between the rubber boot and the pipe shall be cement grouted in order to

permanently set the flow line of the pipe, as recommended by the manufacturer.

3. All pipe connections shall be constructed as shown on the Drawings and shall be flexible and watertight.

2.9 Sewage Pump Station Pumps and Appurtenances

A. General

1. The Contractor shall furnish and install a complete duplex submersible non-clog pumping system in the wetwell including two submersible wastewater non-clog pumps, rail guides, float switches, etc.

2. A duplex pump control panel shall be installed in an above-ground Contractor-furnished enclosure.

3. In addition, the Contractor shall furnish one identical spare submersible wastewater grinder pump, complete with motor.

B. Performance

Motor shall be sized to be non-overloading on any part of the curve. Service factor shall not be used in this determination.

C. Pump Design

1. The pump(s) shall be capable of handling raw, unscreened wastewater.

2. The discharge connection elbow shall be permanently installed in the pump well along with the discharge piping. The pump shall be automatically connected to the discharge connection elbow when lowered into place, and shall be easily removed for inspection or service.

3. There shall be no need for personnel to enter the pump well to remove a pump. Sealing of the pumping unit to the discharge connection elbow shall be accomplished by a simple linear downward motion of the pump. A sliding guide bracket shall be an integral part of the pump unit. The entire weight of the pumping unit shall be guided by one or two guide bars and pressed tightly against the discharge connection elbow with a watertight seal. No portion of the pump shall bear directly on the floor of the sump.

4. The pump, with its appurtenances and cable, shall be capable of continuous submergence under water without loss of watertight integrity to a depth of 65 feet.

D. Pump and Motor Construction

1. Major pump components shall be of gray cast iron, Class 30B, with smooth surfaces devoid of blow holes and other irregularities. Where watertight sealing is required, O-rings made of nitrile rubber 70° IRH shall be used. All exposed nuts and bolts shall be of AISI Type 304 stainless steel or brass construction. All surfaces, other than stainless steel or brass, coming into contact with wastewater, shall be protected by an approved wastewater resistant coating.

2. All mating surfaces where watertight sealing is required shall be machined and fitted with nitrile rubber O-rings. Fitting shall be such that sealing is accomplished by metal-to-metal contact between machined surfaces. This will result in controlled compression of nitrile rubber O-rings without the requirement of a specific torque limit. No secondary sealing compounds, rectangular gaskets, elliptical O-rings, grease, or other devices shall be used.

3. The cable entry water seal design shall preclude specific torque requirements to ensure a watertight and submersible seal. The cable entry shall be comprised of a single cylindrical elastomer grommet, flanked by stainless steel washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter and compressed by the entry body containing a strain relief function, separate from the function of sealing the cable. The assembly shall bear against a shoulder in the pump top. The cable entry junction chamber and motor shall be separated by a stator lead sealing gland or terminal board, which shall isolate the motor interior from foreign material gaining access through the pump top.

4. **The pump motor shall be an explosion proof FM approved, squirrel cage, induction shell type design, housed in an air-filled, watertight chamber and suitable for operation in a Class 1, Division 1, Group C and D, hazardous location**. The stator winding shall be insulated with moisture resistant Class F insulation which will resist a temperature of 155°C (311°F). The stator shall be dipped and baked three times in Class F varnish and shall be heat-shrink fitted into the stator housing. The use of bolts, pins or other fastening devices requiring penetration of the stator housing shall be rejected. The motor shall be designed for continuous duty, capable of sustaining a minimum of ten (10) starts per hour. The rotor bars and short circuit rings shall be of aluminum. Bimetallic

thermal switches shall be imbedded in each phase of the winding to sense high temperature. These sensors shall be wired to the control panel for use in conjunction with the external motor overload protection.

5. The pump motor cable, installed, shall be suitable for submersible pump application with P122-MSHA approval and this shall be indicated by a code or legend permanently embossed on the cable. Cable sizing shall conform to NEC and ICEA specifications for pump motors. A ground check conductor shall be provided.

6. At the maximum rated power of this unit, thermal radiators (cooling fins) integral to the stator housing, shall be adequate to provide the cooling required by the motor. Water jacket or other device shall not be necessary for continuous pumping at sump liquid levels down to the midpoint of stator housing.

7. The junction chamber, containing the terminal board, shall be sealed from the motor by an elastomer compression seal (grommet).

8. The pump shaft shall be of AISI Type 420 stainless steel. This is a nickel bearing chromium steel designed for heat treatment to high mechanical properties providing superior corrosion resistant characteristics.

9. Each pump shall be provided with a tandem mechanical shaft seal system. The lower seal (pump side) shall be of the mechanical type with silicon or tungsten carbide faces. The upper seal shall be a lip-type seal or silicon or tungsten carbide seals.

10. Each pump shall be provided with an oil chamber for the shaft sealing system. The drain and inspection plug, with positive anti-leak seal, shall be easily accessible from the outside. The oil chamber shall include an air pressure reserve for oil pressure compensation. An electronic probe connected to the control panel shall be provided in the oil chamber to detect the leakage of water into the chamber. If water enters the oil chamber, the probe shall activate a seal failure warning light in the control panel.

11. The pump shaft shall rotate on two permanently-lubricated bearings. The upper bearing shall be a single-row ball bearing and the lower bearing a two-row angular contact ball bearing.

12. The volute shall be of a single piece, non-concentric design and shall have smooth fluid passage large enough to pass any size solids which can pass through the impeller.

E. Guide Rails

Two-inch diameter Type 304 or 316 stainless steel pipe guide rail(s) shall be installed. Intermediate supports shall be provided as recommended by the pump Supplier to ensure necessary rigidity. Lifting chains shall be provided for each pump. Chain shall be 3/8-inch stainless steel and be securely attached both to the pump lifting bracket and the access frame.

2.10 Sewage Pump Station Controls

A. Pump motor circuits provided must be adequate to meet all the requirements of the system.

B. Pump motor starters shall be rated and properly sized to ensure proper operation of the pump motors.

C. Pump motor circuit breakers shall be rated properly to ensure proper operation of the pump motors.

D. All applications that are single- or 3-phase require surge and lightning protection.

E. Transformers shall be fused on the primary and secondary side of the windings.

F. Transformers shall be sized properly to accommodate all controls functions.

G. The controls shall include Hand-Off-Auto selector switches for operation of the pump station in conjunction with liquid level controls.

H. Pump alternating circuit to equalize pump motor run time shall be included.

I. Dry alarm contacts shall be provided.

J. The controls shall include an intrinsically safe barrier for connection to level sensing devices.

K. Pump run and fail indicator lights shall be provided.

L. Controls shall be by relays only. Programmable logic controller controls will not be allowed.

M. All fail alarms shall be sent to an automatic dialer.

2.11 Sewage Pump Control Operation

Primary level control operation shall be:

A. Stop level - All pumps stop

B. Lead pump start level - Lead pump starts

C. Lag pump start level - Lag pump starts

D. High level alarm level - High level beacon and alarm activated

2.12 Sewage Pump Control Panel

A control panel and associated field devices shall be provided. The control panel shall be prewired and factory tested and shall meet UL508A standard for industrial control panels. The control panel shall be UL listed and labeled with intrinsically safe circuit extensions. The pump control panel shall fit inside the electrical service panel.

2.13 Sewage Pump Station Electrical Requirements

A. Panel wiring to be numbered and labeled.

B. Controls shall be assembled, prewired, and tested by a reputable UL508A-certified control manufacturing company with a minimum of ten (10) years of custom control fabrication.

C. Control wiring schematics shall be located on the inner door front.

D. Warning labels applied to outer door as per National Electric Code.

PART 3 - EXECUTION

3.1 Gravity Sewer Construction

A. Trench Excavation and Backfill

Trench excavation and backfill shall be performed as specified in Technical Specifications - "Storm Drainage," Part 3 Execution, 3.1 through 3.8.

3.2 Installation of Pipe

A. Gravity sewer pipe shall be installed in accordance with the best current practices and as required by the manufacturer. Gravity sewer pipe, unless otherwise approved by the City Engineer, shall be laid by progressing up grade from the existing or newly constructed sewer; the sewer pipe shall be installed with bell ends laid upgrade unless otherwise approved.

B. All rubber ring joints shall be lubricated and installed in accordance with the installation instructions of the pipe manufacturer, taking particular care to avoid pinching or otherwise causing damage to the rubber ring. All joints shall be free of dirt and other foreign matter prior to the joining of the next pipe. All pipe shall be installed to prevent creep and misalignment of joints. All pipe shall have a ring painted around the spigot ends in such a manner as to allow field checking of setting depth of pipe in socket.

C. Gravity sewer pipe shall be installed with the use of a laser beam and target. Unless the Work involves deep excavations, traffic problems, water problems, or approved by the City Engineer, the trench for the first 100 feet shall not be backfilled until the sewer grade has been checked. The Contractor shall set and aim the laser as controlled by the "cuts" and "slopes." Careful attention shall be given to the setting up of the laser and the periodic checking of its aim, etc. All grade checking of laser shall be the responsibility of the Contractor. All pipe shall be installed true to line and grade. A tolerance of ±1/8-inch deviation from true grade at each joint will be allowed. Extra care shall be given to the installation of sewer lines at minimum slopes to avoid flat slopes in the line. All pipe shall be installed true to line. Except when approved by the City Engineer, the Contractor may not install a pipeline on a curve.

D. All foreign matter and gravel shall be removed from the inside of the pipe and fittings before being installed and the pipe and fittings shall be kept clean during placement. No pipe shall be laid in water or when conditions exist that in the opinion of the City Engineer are unsuitable for the placing of pipe. All pipe and manholes shall be covered or plugged at night and whenever the Work is not supervised.

E. All pipe/manhole connections shall be watertight. The manhole pipe couplings shall be installed in accordance with all manufacturer instructions. All connections shall match the grade and alignment of the pipe entering and exiting each manhole. Manhole pipe connections shall be constructed so that the wastewater flow through the manhole is not restricted in any way.

3.3 Gravity Service Lines

A. Gravity service lines shall be constructed in accordance with the Drawings, Specifications, and applicable provisions of the Oregon Plumbing Specialty Code, current edition. The minimum slope of service lines shall be 1/4-inch per foot unless otherwise approved by the City Engineer. The pipe size of gravity service lines shall be a minimum 4-inch diameter unless otherwise specified. The Contractor shall end gravity service lines at the location as per the Drawings and at the invert elevation as shown on the Drawings or as set by the design engineer. Dead ends of service lines shall be marked as shown on the City Standard Drawings.

B. Connection of service lines to new or existing gravity sewer main lines shall be as per the Drawings and shall be inspected and accepted by the City prior to backfilling. All sewer service connections shall be watertight utilizing appropriate sewer service saddles or wyes. An approved tee fitting shall be used when new sewer mains are being installed. All holes and taps into an existing sewer main shall be cut using an approved tapping machine.

C. In the construction of new sewage collection systems, connection of new services allowing sewage into the system shall not be made until approval for connections has been given by the City. No existing sewer service shall be interrupted without the approval of the City and service owner. Connections of new service lines to existing service lines shall be by the proper adaptor coupling.

D. The Contractor shall obtain all necessary permits required to construct service lines on private property. The Contractor must utilize a licensed plumber for service line work on private property when required by state or local regulations.

3.4 Gravity Sewer Testing

A. General

The Contractor shall furnish all labor, necessary equipment, and other apparatus including, but not limited to, gauges, mechanical or pneumatic plugs, and air hoses, necessary to properly perform the testing of sewer lines as specified. The Contractor may low pressure test sections of sewer lines before backfilling at their own option; but the acceptance test shall be performed only after backfilling, cleaning, and flushing has been completed.

B. Visual Inspection

Prior to the acceptance test being completed, the City will visually inspect the line utilizing City crews and equipment.

C. Acceptance Test

The Contractor shall perform all preliminary testing required to determine that the lines to be tested are acceptable and comply with the requirements of this section of the Specifications. After the Contractor has determined that the lines will pass the required test, the Contractor shall arrange for an acceptance test to be witnessed by the City representative. The Contractor shall coordinate the timing of this acceptance test with the City representative. The lines will not be accepted until the acceptance test has been witnessed and documented as passing.

D. Test Procedure

The method of testing follows the procedures outlined in the Oregon Standard Specifications for Construction, Part 00400, Section 00445.72(c), current edition. All air testing shall be by the Time Pressure Drop Method. Specific questions concerning test procedures may be referred to this publication. To facilitate test verification by the Engineer, all air used shall pass through a single, above-ground control panel. The pressure gauge used in air testing shall have minimum divisions of 0.10 psi and have an accuracy of 0.0625 psi (one ounce per square inch). The Engineer shall have the option of requiring the use of their own gauge. Test procedures are summarized below:

1. Field Test

   a. The Contractor may wet the lines prior to testing.

   b. Determine the average height of the groundwater over the line. The test pressures required shall be increased 0.433 psi for each foot of average water depth over the exterior crown of the pipe, but no greater than 9.0 psig.

   c. Add air slowly to the section of system being tested until the internal air pressure is raised to 4.0 psig greater than the average back pressure due to groundwater.

   d. After the test pressure is reached, allow at least two minutes for the air temperature to stabilize adding only the amount of air required to maintain pressure.

e. After the temperature stabilization period, disconnect the air supply.

f. Record the time in seconds that is required for the internal air pressure to drop from 3.5 psig to 2.5 psig greater than the average back pressure due to groundwater.

g. Compare the time recorded in the above step with the test time determined hereafter.

2. Acceptance

a. Record the diameter in inches and the length in feet of all pipe in the section to be tested, including the service connections on the worksheet found at the end of this Technical Specification.

b. Using the nomograph (Figure No. 1) found at the end of this Technical Specification, place a straightedge from the "d" column (diameter in inches) to the "L" column (length in feet). Read the corresponding "K" and "C" values for each of the pipes listed above, and record them on the worksheet.

c. Add all values of "K" and all values of "C" for the section being tested.

d. If the total of all the "C" values is less than one, the time shall be the total of all the "K" values.

e. If the total of all the "C" values is greater than one, the time shall be found by dividing the total of all the "K" values by the total of all the "C" values. The result is the maximum test time. To make this division using the nomograph (Figure No. 1), use the total "C" and "K" values and read the time from the "tq" scale.

f. In the event that the "d" and "L" values for a particular section of the system do not fall within the limits of the nomograph, the values of "K" and "C" may be computed from the following equations: "K" = 0.011d2L; "C" = 0.0003882dL.

g. If the "actual time" (field test) is equal to or greater than the "test time" required for the pipe section being tested, the pipe section will have passed the pressure test. (See worksheet.)

E. Infiltration Allowance

Groundwater infiltration to the collection system, including manholes, shall not exceed 50 gallons/inch diameter of pipe/mile/day. Any infiltration in excess of this amount shall be corrected at the Contractor's expense.

F. Deflection Test for PVC Pipe

1. All sanitary sewers constructed of PVC pipe shall be able to pass a deflection test. The test shall be conducted by pulling a go-nogo solid pointed mandrel or sewer ball through the completed pipeline. The diameter of the mandrel or ball shall not be less than 95 percent of the base inside pipe diameter as defined by ASTM D3034, SDR 35 and ASTM F679, T-1 pipe. The base inside pipe diameter and minimum mandrel diameter are as follows:

Nominal Pipe Size, In.	Minimum Mandrel Dia., In.	Base Inside Pipe Dia., In.
6"	5.46	5.742
8"	7.28	7.665
10"	9.08	9.568
12"	10.79	11.361
15"	13.20	13.898
18"	16.13	16.970
21"	19.00	20.004
24"	21.36	22.480
27"	24.06	25.327

2. All lines shall be tested unless determined otherwise by the City Engineer based upon their observations during pipeline installation and visual inspection of the pipeline. Testing shall be conducted on a manhole to manhole basis and shall be done after the line has been completely cleaned and flushed with water. The Contractor shall, at their own expense, locate and repair any sections failing to pass the deflection test. All areas failing the deflection test shall be retested after corrective action has been taken. Results shall be recorded on the form "Mandrel Test Record" at the end of this section.

G. Equipment

The Contractor shall perform all Work and furnish all materials and equipment as required to perform all required tests.

3.5 Pressure Sewer Construction

A. Pipeline

1. The Contractor shall construct pressure sewer lines of the size, type, and class specified on the Drawings. Pipe shall meet the material specifications contained herein. All Work performed in the installation of pressure sewer lines shall be performed as per the Design Drawings, the applicable portions of subsection "Gravity Sewer Construction" contained herein, and as required by the manufacturer. When it is necessary to deflect pipe joints to conform to the profile and alignment of the sewage forcemain, the amount of deflection per joint shall not exceed 70 percent of the deflection recommended by the Manufacturer. All pressure sewer lines shall be installed to grade as shown on the Drawings.

2. Installation of service line pipe shall be in accordance with the applicable requirements contained herein. The Contractor shall end pressure service lines at the location as per the Design Drawings and at the invert elevation as shown on the Design Drawings. Dead ends of service lines shall be marked as shown on the City Standard Drawings.

3. In the construction of new sewage collection systems, connection of new services allowing sewage into the system shall not be made until approval for connections has been given by the City. No existing sewer service shall be interrupted without the approval of the City and service owner.

4. The Contractor shall obtain all necessary permits required to construct service lines on private property.

B. Testing

1. General

The Contractor shall be responsible for determining the length of any given section of line to be tested. It is recommended that the length of line to be tested not be excessive so that the identification of any problem areas can be readily made. It is also recommended that testing follow closely after the pipe installation and backfill.

2. Hydrostatic Testing of Pressure Sewer Lines

   a. Before being placed into service, each section of the lines shall be isolated and slowly filled with water. Air should be expelled from the lines through taps made at the high points. The Contractor shall be responsible for making any necessary taps in addition to those shown on the Design Drawings.

   b. All lines shall be pressure tested by the Contractor at 100 psi pressure, at the lowest pipe elevation, for one hour. Any cracked or defective pipe or fitting shall be removed and replaced.

3. Leakage Test

   a. Each section of the line before being placed into service shall be tested by the Contractor for leakage for a period of two hours at an average gage pressure of 60 psi. The pressure during the test shall not fall below 40 psi. The allowable leakage is defined by the following equation:

$$L = \frac{ND(P)^{0.5}}{7400}$$

   In which:

   L = Allowable Leakage Gal/Hr
   N = Number of Joints or Connections
   D = Nominal Diameter in Inches
   P = Average Gage Pressure During the Test in psi.

   b. Leakage is defined as the quantity of water supplied into the section of line being tested, during and at the end of the test, that quantity being such that the pressure at the end of the test is equal to the pressure at the beginning of the test.

   c. Should any test disclose leakage greater than that specified, the Contractor shall locate and repair the defective joints until the leakage is within the specified allowance.

4. Equipment

The Contractor shall perform and provide all equipment and materials necessary to perform the required test.

3.6 Manhole Construction

A. Installation

1. Manholes shall be constructed to the line, grade and detail as shown on the Design Drawings and as approved by the design engineer. Excavation and backfill of the manhole shall be performed in the same manner as specified in Technical Specifications - "Excavation and Grading," Part 3 Execution, Section 3.1 Earthwork, D. Backfilling. Backfill shall be brought up evenly on all sides of the manhole.

2. The manhole base section shall be carefully placed on a prepared base of 6-inch minimum deep 3/4"-0 aggregate base and geotextile fabric so as to be fully and uniformly supported in true alignment, and making sure that all entering pipes can be inserted on proper grade.

3. All connections and joints made at manholes shall be watertight. All manholes are to be watertight and any leakage shall be corrected in an approved manner.

B. Testing

1. The Contractor shall be responsible for providing all equipment, labor, and materials necessary for performing manhole testing.

2. All manholes shall be individually tested to verify their watertightness. Each manhole shall be tested for acceptance after all Work has been completed, including restoration work. Testing shall be completed in accordance with Oregon Standard Specifications for Construction, Part 00400, Section 00470.71 (a) or (b), current edition. Results shall be recorded on the form "Manhole Test Record" at the end of this section. Preliminary testing prior to final acceptance is advised.

C. Connection to Existing Manhole

Connections to existing manholes when required on the Drawings shall be made by the City.

3.7 Cleanout Construction

A. Main Line Cleanouts

Main line cleanouts shall be constructed as shown on the City Standard Drawings. The select backfill shall be carefully compacted around the cleanout riser pipe to prevent damage or displacement of the pipe.

B. Service Line Cleanouts

Service line cleanouts in public rights-of-way shall be constructed as per the City Standard Drawings and approved by the City. Service line cleanouts on private property shall be constructed in accordance with the Oregon Plumbing Specialty Code, current edition.

C. Testing

Cleanouts shall be tested as a part of the lines to which they are connected.

3.8 Water-Sewer Crossing

A. Wherever possible, the bottom of new or existing water lines shall be 1.5 feet or more above the top of the sanitary sewer line. Where the water line crosses over the sanitary sewer line but with a clearance of less than 1.5 feet, or where the water line crosses under the sanitary sewer line, the Contractor shall construct the water-sewer line crossing as shown on the City Standard Drawings.

B. If the City Engineer determines that conditions are not favorable or finds evidence of poor water line condition, the existing water line shall be replaced with a full length of water pipe centered at the crossing point.

C. When constructing sewer service lines, the City Engineer may require the depth of the service lines to be revised in order to eliminate the need for a water-sewer line crossing.

3.9 Locating Wire

A. A continuous solid copper tracer or locating wire shall be taped along the top of all pressure sewer lines, including service lines. This wire shall be secured to the top of the pipe at maximum 10-foot intervals using 6-inch strips of 2-inch wide duct tape. All splices shall be tied, electrically continuous, and made waterproof.

B. The location wire shall be brought to the surface at all valve boxes, cleanouts, and terminal line marker posts. The wire shall be secured to valve boxes, cleanouts, and posts with stainless steel pipe clamps.

C. Access to terminal ends of the locating wire shall be made at all manholes, cleanouts, valve boxes, terminal line marker posts, etc. The result of this installation shall be a continuous wire circuit electrically isolated from ground.

D. The Contractor shall be responsible for testing continuity and for testing isolation from ground in the wire after all Work has been completed on the test section. The Contractor is advised to do intermediate testing on their own after backfilling operations and prior to surface restoration work to be sure continuity is maintained. If there is a break or defect in the wire, it shall be the Contractor's responsibility to locate and repair the defect.

E. The continuity of the location wire shall be tested from one test load point to the next by use of a temporary wire laid between test points in-line with an ohmmeter. Resistance shall be measured with an approved ohmmeter that has been properly calibrated. The continuity of a test section will be accepted if the resistance of the test section does not exceed 5 ohms per 500 feet of location wire being tested. Isolation from ground shall be measured with a megohm meter and shall be a minimum of 20 megohms for any section of location wire tested.

F. A City representative shall witness the acceptance test.

3.10 Cleaning and Flushing of Completed and Tested Sewers

A. Prior to final inspection of the sewer system by the City Engineer, the Contractor shall flush and clean all parts of the system. All accumulated construction debris, rocks, gravel, sand, silt, and other foreign material shall be removed from the sewer system at or near the closest downstream manhole. If necessary, mechanical rodding or bucketing equipment shall be used.

B. All sewer pipes including gravity sewers, pressure sewer lines, service lines, etc., installed shall be flushed, as thoroughly as possible with the water pressure and outlets available. Flushing shall be done after the pressure test has been made. It must be understood that flushing removes only the lighter solids and cannot be relied upon to remove heavy material allowed to get into the sewers during construction. The Contractor shall provide sufficient water and appropriately sized taps at either end of the line to develop a velocity in the sewers during flushing of at least 2.5 fps.

3.11 Sewer Line Cleaning and Inspection

A. General

The City may television (TV) inspect the sewer system following the cleaning of the system by the Contractor.

B. Necessary Repairs

If in the opinion of the City Engineer, after TV inspection, the sewer lines in question require repair and/or replacement to meet the original approved Design Drawings and/or City Standards, the Contractor shall be required to perform all necessary repairs and replacement at no cost to the City. It shall be understood that any necessary repairs required will have been the result of poor construction or defective materials.

C. Inspection of Lines

Supplemental to TV inspection shall be the inspection of lines by excavation at suspected joints, etc. If, in the opinion of the City Engineer, a line is suspected to have excess infiltration, the City Engineer may require the Contractor to excavate down to the joint(s) in question. The Contractor is responsible only for those lines or parts thereof they actually constructed.

END OF SECTION

WORKSHEET FOR THE
GRAVITY SEWER LINE LOW PRESSURE AIR TEST
BY THE TIME PRESSURE DROP METHOD

Project Name _____

Date _____ **Job No.** _____

Location of Test/Stationing _____

1. Wetted Line: Yes _____ No _____
2. Average height of groundwater over crown of sewer line _____ ft.
3. Internal Air Pressure (P_1):
   P_1 = 4.0 psig + Groundwater Ht. x 0.433 psi = 4.0 + (____' x .433) = ____ psig
4. Initial Starting Test Air Pressure (P_2):
   $P_2 = P_1$ - 0.5 psig = _____ - 0.5 = _____ psig
5. Ending Test Air Pressure (P_3)
   $P_3 = P_2$ - 1.0 psig = _____ - 1.0 = _____ psig
6. Time of test from P_2 to P_3 (in seconds)
   Start Time T_1 _____
   End Time T_2 _____

   Actual Time = $T_2 - T_1$ _____ seconds

7. Test Time

Pipe Diameter (inches)	Length of Pipe	"C" Value*	"K" Value*
	TOTAL		

*See Figure No. 1
for "C" & "K" Values

If Total "C" Value is <1.0, use Total "K" Value as Test Time in seconds.

If Total "C" Value is ≥1.0, use Total "K" Value ÷ Total "C" Value as Test Time in seconds.

Results of Test

Actual time = _____ seconds

Test time = _____ seconds

If Actual Time is equal to or greater than test time required for the pipe section being tested, the pipe section will have passed the Pressure Test.

Test Passed: _____yes _____no

Corrective Measures: _____

_____

_____

_____

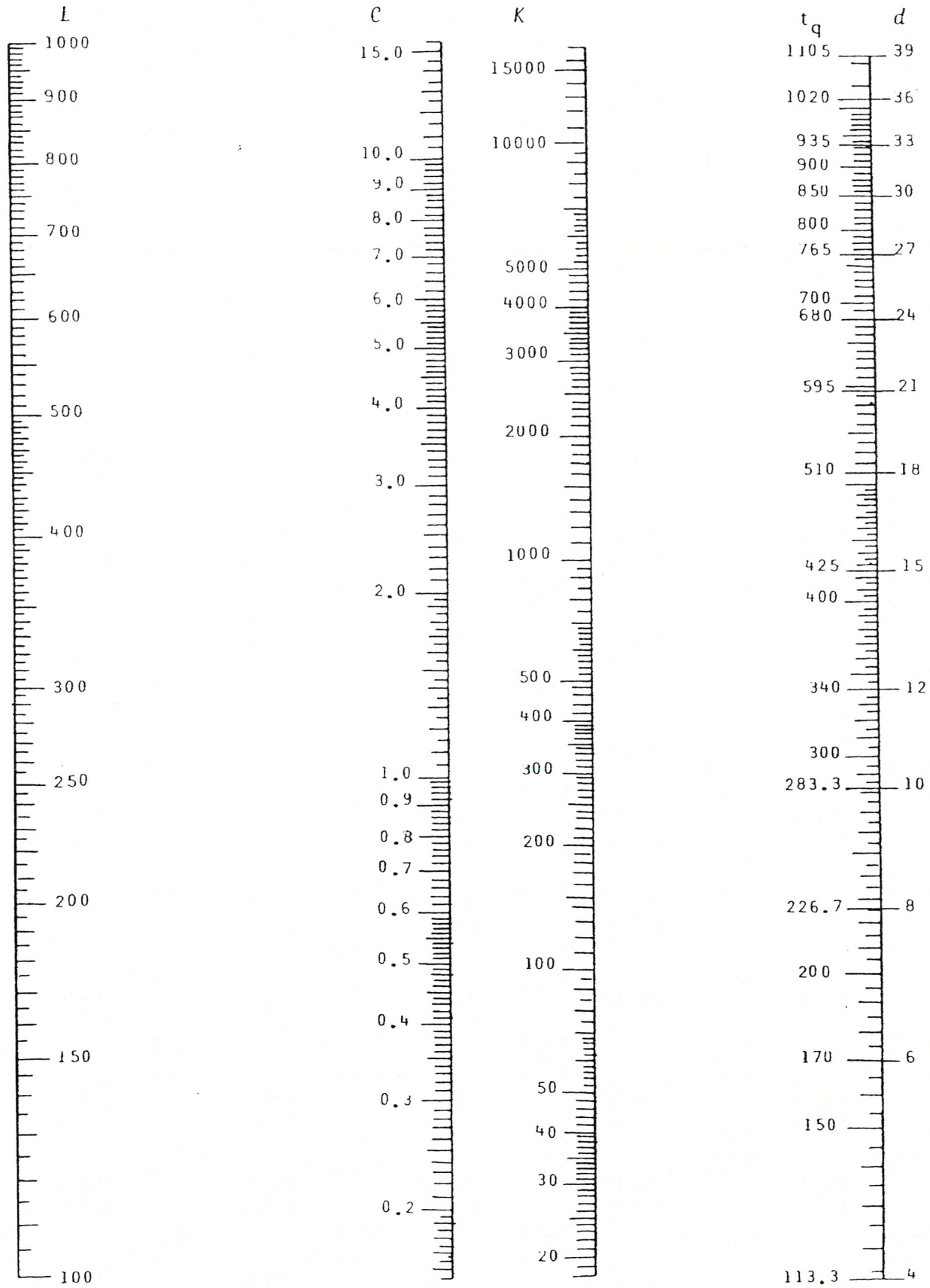
_____

Contractor's Firm Name: _____

Contractor's Representative Signature: _____ Title: _____

Engineer's Representative Signature: _____ Title: _____

FIGURE NO. 1



Nomograph for the solution of $K = .011d^2L$, $C = .0003882dL$, $t_q = K \div C$

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WATER MAINS

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SECTION 4

WATER MAINS

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TECHNICAL SPECIFICATIONS

SECTION 4

WATER MAINS

PART 1 - GENERAL

1.1 General Design Requirements

A. Performance Standards

1. Water distribution systems shall be designed to meet Oregon Administrative Rules and guidelines of the Water System Master Plan (WSMP), American Water Works Association (AWWA), and their updates.

2. Water system design shall provide adequate flow for fire protection and maximum water usage and consumption. Required water system demands shall be met by maintaining the minimum operating pressures required by the City. For single-family residential areas the minimum static pressure shall be 50 pounds per square inch (psi), and the minimum fire flow shall be 1,000 gallons per minute (gpm). For all other developments, the required fire flow and pressure shall be as determined by the Fire Chief.

3. Water system design shall meet distribution needs for maximum water usage and consumption within a given service area. New water systems shall be extended to the far side of the property to allow for future extensions beyond present development and to be consistent with the WSMP.

4. All water lines shall be located within the public right-of-way (ROW) or as directed by the City Engineer. The City Engineer, under special conditions, may allow a public water line to be located within a public water easement as referenced in Part 1 - General, 1.1 General Design Requirements, E. Alignment and Cover, 4. Easements, of these Technical Specifications.

5. Where water lines are constructed on slopes greater than 20 percent; in areas designated as hazardous; where site conditions may cause damage to improvements, slippage, or slides; or as determined by the City Engineer, a soils report and/or Engineering Geology Report may be required.

6. Where the finished graded surface is greater than 20 percent, or as required by the City Engineer, soil stabilization fabric shall be placed over the entire disturbed area.

7. Drawings relevant to this section are included in the Standard Drawings.

B. Pipe Size

1. All public water mains shall be constructed with 8-inch minimum diameter ductile iron pipe of the class shown in the following table unless otherwise approved by the City Engineer.

Pipe Size (inches)	Ductile Iron Class
8 and smaller	52
10	51
12	50

For more information regarding pipe, see Part 2 - Materials, 2.2 Pipe, of these Technical Specifications.

2. Pipe constructed per Part 1 - General, 1.1 General Design Requirements, E. Alignment and Cover, 5. Relation to Watercourses, of these Technical Specifications will require the use of restrained pipe joints or ball and socket river pipe.

3. Service lines shall be as shown on the following table.

Service Pipe Size (inches)	Pipe Material
2-inch and Smaller	Type K Copper Tubing
3-inch and Larger	Ductile Iron

4. Water distribution main sizes shall conform to the following:

a. Eight-inch

Minimum size for permanent mains supplying fire hydrants with a fire flow less than 1,500 gpm and for primary feeder mains in residential subdivisions.

b. Ten-inch and greater

As required for primary feeder lines in subdivisions, industrial, and commercial areas.

5. Water service lines shall conform to the following:

   a. One-inch for residential services.

   b. One-inch and up for public, commercial, industrial, and other non-residential uses shall be sized per actual usage.

6. Velocity in distribution mains shall be designed not to exceed 5 feet per second. Velocity in service lines shall not exceed 10 fps in accordance with Part 1 - General, 1.1 General Design Requirements, H. Water Service Lines, of these Technical Specifications.

C. Grid System

The distribution system mains shall be looped at all possible locations. All developments will be required to extend mains across existing or proposed streets for future extensions by the City or other developments. All terminations shall be planned and located such that new or existing pavement shall not be cut in the future when the main is extended. The installation of dead-end water mains with a length greater than 250 feet upon, which fire protection is dependent and the fire protection dependence of relatively large areas on single mains shall not be permitted.

D. Dead-end Mains

Temporary and permanent dead-end mains shall terminate with a standard fire hydrant assembly, unless otherwise approved by the City Engineer.

E. Alignment and Cover

1. Right-of-Way Location

Water systems shall be located 12 feet north and east from the ROW centerline, except as provided in Part 1 - General, 1.1 General Design Requirements, E. Alignment and Cover, 4. Easements, of these Technical Specifications or as directed by the City Engineer. All abrupt changes in vertical or horizontal alignment shall be made with a concrete thrust block, a MEGALUG, MJ grip ring, or as required by the City Engineer. Curved alignment for water lines or mains is permitted and shall follow the street centerline when practical. The maximum amount of deflection for pipe shall not exceed 80 percent of the recommended maximum deflection specified in AWWA C600.

2. Minimum Cover

   a. The bury depth of water mains within the street ROW or easements shall be 48 inches from finish grade.

   b. Deviation from the above standards will be considered on a case-by-case basis when the following exists:

      1) When there is underlying rock strata that prohibits placement of the water main 48 inches below finish grade, a written request must be submitted to the City Engineer, together with submission of a soils report with a plan and profile certifying that bedrock exists less than 4 feet below the undisturbed ground surface.

3. Separation with Sewer Lines

   a. Water mains shall be installed a minimum clear distance of 10 feet horizontally from sanitary sewers and shall be installed to cross over the top of such sewers with a minimum of 18 inches of clearance at the intersections of these pipes. Any exceptions shall be approved by the City Engineer. In all instances, the distances shall be measured edge to edge. The minimum spacing between water mains and storm drains, gas lines, and other underground utilities, except sanitary sewers, shall be 3 feet horizontally when the standard utility location cannot be maintained.

   b. Where water lines are being designed for installation parallel with the other water mains, utility pipe, or conduit lines, the vertical separation shall be 12 inches below or in such a manner that will permit future side connections of mains, hydrants, or services and avoid conflicts with parallel utilities without abrupt changes in vertical grade of the abovementioned main, hydrant, or service. Where crossing of utilities other than sanitary sewer lines is required, the minimum vertical clearance shall be 6 inches.

4. Easements

   a. Mains placed in easements along a property line shall have easements centered on the property line and shall be offset 3 feet from the property line. For mains placed in easements in locations other than along a property line, the main shall be placed in the center of the easement. Easements shall be exclusive and a minimum of 15 feet in width. The

conditions of the easement shall be such that the easement shall not be used for any purpose that would interfere with the unrestricted use for water main purposes. Under no circumstances shall a building or structure be placed over a water main or water main easement. This includes overhanging structures with footings located outside the easement. Further, no trees or large bushes shall be planted in the easement.

b. Easement locations for public mains serving a Public Utility District, apartment complex, or commercial/industrial development shall be in parking lots, private drives, or similar open areas, which will permit unobstructed vehicle access for maintenance by City personnel.

c. Easements shall be furnished to the City for review and approval prior to recording.

5. Relation to Watercourses

New water mains may cross over or under existing streams, ponds, rivers, or other waterbodies.

a. Above Water Crossings

The pipe shall be engineered to provide support, anchorage, and protection from freezing and damage, yet shall remain accessible for repair and maintenance. All above water crossings require review and approval by the City Engineer.

1) Valves shall be provided at each end.

2) Air/vacuum relief valves shall be provided.

b. Underwater Crossings

1) Mains that cross stream or drainage channels shall be designed to cross as near perpendicular to the channel as possible.

2) Valves shall be provided at both ends of the water crossing so that the section can be isolated for testing or repair. The valves shall be easily accessible and not subject to flooding. The valve nearest to the supply source shall be in a manhole. Permanent taps shall

be made on each side of the valve within the manhole to allow insertion of a small meter for testing to determine leakage and for sampling.

3) The minimum cover from the bottom of the streambed or drainage channel to the top of pipe shall be 36 inches.

4) A scour pad centered on the water line will be required if the top of the pipe to the bottom of the streambed or drainage channel is 30 inches or less. The scour pad shall be concrete, 6 inches thick and 6 feet wide, reinforced with #4 bars on 12 inch centers in both directions, and shall extend to a point where a 1H:1V slope, that begins at the top of the bank and slopes down from the bank away from channel centerline, intersects the top of the pipe.

c. The following surface water crossings will be treated on a case-by-case basis:

1) Stream or drainage channel crossing for pipes 12 inches inside diameter and greater.

2) River or creek crossings requiring special approval from the Oregon Department of State Lands.

F. Appurtenances

1. Valves

a. Valves shall be the same size as the water main. Main line valves shall be resilient, seated gate valves meeting the requirements of AWWA C509. Valves 12 inches and larger shall be butterfly valves.

b. Distribution system valves shall be located at tee or cross fittings. Valves shall be installed on all branches of a tee or cross fitting. Deviation of this standard will be considered by the City Engineer on a case-by-case basis. Spacing of valves shall not exceed 500 feet in commercial or industrial areas and shall not exceed 800 feet in other areas.

c. Transmission water mains shall have valves at no more than 1,000 foot spacing. Hazardous crossings, such as creek, railroad, and highway crossings, shall be valved on each side.

d. Distribution tees and crosses with valves for future branch lines on transmission mains may be required as directed by the City Engineer.

2. Valve Boxes

Valve boxes shall be as shown on the City Standard Drawings.

3. Blowoff Assemblies

Blowoff assemblies shall be as shown on the City Standard Drawings.

4. Fire Hydrant Assemblies

a. Fire hydrant assemblies shall be as shown on the City Standard Drawings. See Part 2 - Materials, 2.5 Fire Hydrants, of these Technical Specifications for more information regarding fire hydrant materials.

b. Hydrants shall be installed on minimum 8-inch diameter water mains. The hydrant lead pipe shall be a minimum of 6 inches in diameter.

c. All fire hydrants will be located 2.5 feet behind the existing or proposed curb. Hydrants that encroach on private property shall require an easement as directed by the City Engineer.

d. Hydrants shall not be installed within 5 feet of any existing aboveground utility nor shall any utility install facilities closer than 5 feet from an existing hydrant.

e. Full-depth hydrants will be required in all installations. Hydrant extensions require prior approval of the City Engineer.

f. Hydrants shall not be located within 20 feet of any building, nor will they be blocked by parking. The large hydrant port should face the road or travel way.

g. Hydrant guard posts a minimum of 3 feet high shall be required for protection from vehicles when necessary. Such protection shall consist of 4-inch diameter steel pipes 6 feet long filled with concrete and buried at a minimum of 3 feet deep in concrete and located at the corners of a 6 foot square with the hydrant located in the center. Use of posts other than at the four corners may be approved by the City Engineer.

h. Residential hydrants shall be located as near as possible to the corner of street intersections and not more than 500 feet from cul-de-sac radius points.

i. The distribution of hydrants shall be based upon the required average fire flow for the area served. Design coverage shall result in hydrant spacing of approximately 500 feet in residential areas, approximately 300 feet in commercial or industrial areas, or as approved by the Fire Chief and City Engineer. In addition, sufficient hydrants shall be available within 1,000 feet of a building in commercial/industrial areas to provide its required fire flow.

j. The public fire hydrant system shall be designed to provide up to a maximum of 3,500 gpm. The distribution system shall be designed in commercial/industrial areas to accommodate fire flows up to 4,500 gpm or as required by the Fire Chief. Minimum fire flow in single-family residential areas shall be 1,500 gpm.

5. Pressure Reducing and Air Release Valves

a. The City's water distribution system is divided into several pressure zones. Where water systems cross these zone lines, a pressure reducing valve station will be required. The specific design and location for such valves require review and approval by the City Engineer.

b. When required by the City Engineer, air release valves shall be installed. Such valves are required on large diameter lines at all high points in the grade.

6. Railroad or Highway Crossings

Such crossings defined above, or as determined by the City, shall be valved on both sides of the crossing. Casing of railroad or highway crossings, if required, shall be as noted in the permit from the respective agency.

7. Anchor Blocks

For water pipes, concrete anchor blocks shall be required if the slopes are greater than 20 percent. Anchor blocks shall key into trench sides. Spacing for anchor blocks is as follows:

SPACING FOR ANCHOR BLOCK FOR ALL SIZE PIPE

Slope (Percent)	Minimum Spacing (Feet)
0 to 19.99	No Anchor Required
20 to 34.99	35
35 to 50.99	25
51 or more	15 or Special Design

G. Backflow Prevention

Backflow prevention devices shall be required on all 1-1/2-inch and larger water services as provided for in OAR Chapter 333.

H. Water Service Lines

1. The sizes of water service lines that may be used are 1-, 1-1/2-, 2-, 4-, 6-, 8-, 10-, and 12-inch. Water service lines will be reviewed for effects on the distribution system and shall not be greater in size than the distribution main.

2. For services 2 inches and larger, a Design Drawing must be submitted showing the vault and fitting requirements with the expected flow (normal and maximum daily flow) requirements and proposed usage.

3. Domestic service lines 1-inch through 2-inch shall normally extend from the main to behind the curb with a meter setter and meter box located at the termination of the service connection. Meters, meter boxes, and setters shall be provided and installed by the City at the cost of the developer. Individual service connections shall terminate in front of the property to be served and shall be located 2 feet on each side of a common property line.

4. Meters shall be provided by the City for individual services.

5. Meter boxes and setters and water service lines shall be as shown on the City Standard Drawings.

6. Fire Service

   a. There are three categories of private fire services:

      1) Hydrants

2) Fire sprinkler lines

3) Combination hydrant and fire sprinkler lines.

b. The water fire service line shall normally extend from the main to the property line and end with a vault, metering device, and valves. A double detector check backflow prevention device installed in a vault shall be required at each property being served.

7. Fire Vaults

A vault will be required when a development provides fire sprinklers. The vault Design Drawing shall be included on construction drawings submitted to the City Engineer. The vault shall contain all valves, fittings, meters, and appurtenances required for fire service to the development.

I. System Testing

All new water systems (lines, valves, hydrants, and services) shall be individually pressure tested, chlorinated, and tested for bacteria as shown on the City Standard Drawings. Tests shall be performed in the presence of a City representative. The City requires notification for scheduling of water main testing a minimum of 72 hours prior to the start of testing.

J. Erosion Control

1. Erosion control will be required for all areas disturbed during construction and following construction until permanent protection is established.

2. Temporary facilities may include silt fences, drain barriers, gravel entries, ditches, surface stabilization or other devices as necessary.

3. Temporary/permanent hydroseeding or acceptable seeding and mulching must be provided whenever perennial cover cannot be established on sites that will be exposed after September 1 or prior to June 1.

1.2 Specifications References

Specification references made herein for manufactured materials such as pipe, valves, and fittings refer to designations for the current edition of the AWWA, American National Standards Institute, Inc. (ANSI), or to ASTM International (ASTM).

1.3 Delivery, Storage, and Handling

A. Adequate precautions shall be taken to prevent damage to piping and protective coatings. During transporting, pipe and other materials shall be secured individually by use of wood spacer blocks, wood crates, or otherwise protected to prevent collision of individual pieces and accompanying damage.

B. Where possible, all materials furnished by the Contractor shall be delivered and distributed at the Site by the Contractor so that each piece is unloaded opposite or near the place where it is to be placed in the trench.

C. All pipe, fittings, valves, hydrants, and accessories shall be loaded and unloaded by lifting with hoists or skidding so as to avoid shock or damage. During freezing weather, valves shall be stored to prevent accumulation of water in housing which could freeze and damage valves. Under no circumstances shall materials dropped during handling be installed or be used in the Work.

D. All pipes, valves, fittings, and all other materials used in the construction of the water lines shall be carefully inspected by the Contractor prior to installation. All defective materials shall be rejected.

E. Proper materials, tools, and equipment shall be used by the Contractor to provide safe and convenient prosecution of the Work.

1.4 Materials Furnished by the City

A. The Contractor's responsibility for material furnished by the City, if any, shall begin at the point of delivery to the Contractor. Materials already on the Site shall become the Contractor's responsibility on the day of the award of the Contract.

B. The Contractor shall examine all material furnished by the City at the time and place of delivery and shall separate all defective material.

C. Any material furnished by the City that becomes damaged by the Contractor shall be replaced by the Contractor at their own expense.

D. The Contractor shall assume full responsibility for materials furnished by the City once they are received by the Contractor.

PART 2 - MATERIALS

2.1 General

A. The Contractor shall furnish and install water lines and valves of the size, type, class, and material called for on the Drawings and as specified herein.

B. Materials and products which come into contact with drinking water supplied by public water systems or which come into contact with drinking water treatment chemicals used by public water systems shall meet the requirements of National Sanitation Foundation Standard 61 Drinking Water System Components - Health Effects (latest version) or equivalent. These materials and products include, but are not limited to, process media, protective materials, joining and sealing materials, pipes and related products, and mechanical devices used in treatment, transmission, and distribution systems.

2.2 Pipe

A. Ductile Iron Pipe

1. City water mains shall be ductile iron, unless specifically approved by the City Engineer.

2. Ductile iron pipe and fittings shall conform to AWWA C150, AWWA C115, AWWA C151, AWWA C153, and AWWA C110 and shall be minimum pressure Class 350 unless specified otherwise.

3. All ductile iron pipe shall have a bituminous sealed cement mortar lining conforming to AWWA C104 on the interior.

4. All joints unless otherwise specified shall be Tyton push-on rubber gaskets or Fastite push-on rubber gaskets conforming to AWWA C111 and shall be furnished complete with all necessary accessories.

    a. Flanges for couplings and fittings shall conform to ANSI B16.1, 125-pound bolt hole template.

    b. Mechanical joints shall conform to AWWA C111.

5. Where called for on the Design Drawings, restrained pipe joints shall be per Part 2 - Materials, 2.3 Fittings for Iron and PVC Pipe, B. Restrained Pipe Joints and Fittings, of these Technical Specifications.

6. When flanged pipe is required, the Contractor shall provide the D.I. pipe class required by the flange manufacturer to ensure the pipe and flange units are compatible. These data shall be provided to the City Engineer for review prior to ordering these materials.

B. Copper Pipe for Service Lines

All copper pipe, when required, shall be type K, seamless, soft, annealed conforming to ASTM B88.

2.3 Fittings for Iron Pipe

A. General

1. Unless specified otherwise, all fittings such as elbows, tees, crosses, valves, etc., shall have mechanical joints conforming to AWWA C111 and shall be short-bodied compact ductile iron fittings conforming to AWWA C153, Class 350.

2. When called for, flanged cast iron fittings shall conform to AWWA C110 with ANSI B16.1, 125-pound bolt hole template.

3. All fittings shall be cement mortar lined in accordance with AWWA C104.

4. Gaskets shall be either ring or full faced, 1/8-inch thick conforming to AWWA C111, Appendix B.

B. Restrained Pipe Joints and Fittings

1. Restrained Push-on Joint Pipe

When restrained joint ductile iron pipe is required, the pipe shall be the same class and type as the ductile iron pipe specified herein. Joints shall be Tyton Joint with Field Lok 350 gaskets, Fastite flex-ring restrained joint, or approved equal. The restraint shall be boltless, integral restraining system, rated for 350 psi in accordance with the performance requirements of ANSI/AWWA C111/A21.11.

2. Restrained Fittings

All mechanical joint fittings called out to be restrained shall be equipped with a MEGALUG Series 1100 mechanical joint restraint system as manufactured by EBAA Iron, Inc., or approved equal.

C. Water Main Couplings

1. Water main couplings shall be fabricated steel "Dresser" style couplings, or approved equal, conforming to AWWA C219.

2. The Contractor shall provide the appropriate coupling and gaskets as required to match the water line types and sizes being utilized.

3. Couplings shall be rated for the working pressure of the pipe main for which they will be utilized.

2.4 Valves

A. Gate Valves

1. Gate valves 2 inches and smaller shall be all bronze, non-rising stem, conforming to Manufacturers Standardization Society (MSS) SP-80, Class A rated for a minimum working pressure of 125 psi.

2. Gate valves 2-1/2-inch to 12-inch shall conform to AWWA C509 or C515. Valves shall be designed for 200 psi minimum working pressure and shall be of iron body, resilient wedge, non-rising stem construction. Valves shall be equipped with O-ring type packing. The valve shall have a 2-inch AWWA operating nut for buried service or as called for on the Drawings. The valve ends shall be of the type required to match the pipe to which they will be connected, or as shown on the Drawings. Valves shall have mechanical joint connections, unless called for otherwise on the Drawings. Valves shall be resilient wedge, Kennedy KSRW or KSFW, M&H Style 4067 or 7000, Clow, or equal.

B. Ball Valves

Ball valves 2 inches and smaller shall be bronze, conforming to Federal Specifications MSS SP-72 and MSS SP-110 rated for a minimum working pressure of 125 psi.

C. Butterfly Valves

1. All valves 12 inches and greater shall be butterfly valves, unless otherwise approved by the City Engineer.

2. All butterfly valves shall be of the rubber-seated tight-closing type that shall meet or exceed the requirements of AWWA C504. All valves shall be M&H 4500, Clow 4500, or approved equal.

3. The valve shall be for direct buried service with a sealed gear operator having 2-inch AWWA operating nut and shall open counter-clockwise.

4. The valve ends shall be of type required to match the pipe to which they will be connected as shown on the Design Drawings.

D. Cast Iron Valve Box

1. Each valve shall be equipped with an adjustable cast iron box of the sliding type as shown on the City Standard Drawings.

2. The diameter of the valve box shall be not less than 5 inches, and shall be of such length so as to provide the depth of cover over the pipe without full extension.

2.5 Fire Hydrants

A. Fire hydrants shall conform to AWWA C502 and shall have 5-1/4-inch main valve opening, two 2-1/2-inch NST nozzles and one 4-1/2-inch NST pumper nozzle. Operating nut shall be 1-1/2-inch pentagon. Fire hydrants shall be Kennedy K-81 Guardian, M&H Model 929, Clow Medallion, or equal.

B. All hydrants shall have a bury depth of 48 inches. Where conditions require, hydrant extensions shall be provided and installed to provide the proper placement and installation of the hydrant.

C. Hydrants shall receive factory coats of Benjamin Moore enamel paint, or approved equal, and shall also receive an additional field coat after installation. The hydrant shall be yellow.

D. All hydrants shall be of the traffic model type.

2.6 Combination Air Release Valves

Air release valves shall be a combination air and vacuum type as shown on the City Standard Drawings, with an appropriately sized inlet and designed for 150 psi operating pressure. Gaskets shall be specified to accommodate the anticipated working pressure range.

2.7 Service Saddles

A. Service saddles shall have a ductile iron body, wide stainless steel band, and stainless steel bolts and nuts. Service saddles shall be as shown on the City Standard Drawings.

B. Saddle sizes and threads shall be AWWA iron pipe thread or compatible with the pipe type and sizes being utilized.

C. Service saddles are not required for ductile iron pressure class pipe for taps 1-inch and less. Service saddles are required for ductile iron pressure class pipe for taps greater than 1-inch.

2.8 Corporation Stops

A. Corporation stops shall be brass ball valve stops complying with AWWA C800. Corporation stops shall be Ford ball corp or approved equal.

B. Inlet threads and outlet connections shall be as required for type and size of water service lines and service saddles being utilized.

2.9 Service Line Couplings

A. Service line couplings, when approved by the City Engineer, shall be Ford pack joint couplings or approved equal.

B. Provide appropriate coupling as required to match water service line types and sizes being utilized. Appropriate stainless steel insert stiffeners shall be used for all PVC pipe and polyethylene tubing.

C. Where metal pipe of dissimilar type are being connected, an insulating adaptor gasket such as Dresser Style 65, or approved equal, shall be utilized to prevent galvanic corrosion.

2.10 Meter Setters

A. Meter setters shall be Ford copper setters in the following configuration:

- 3/4-inch V72-24W-44-33G-NL
- 1-inch VV74-24W-44-44Q-NL
- 2-inch VBB77-12B-44-77-G-NL

B. Provide appropriate meter setter heights, sizes, and connections, etc., as required for the meter and water service lines sizes and types being utilized.

2.11 Water Meters

The City shall purchase and install all meters. Developer to provide compensation to the City for purchase of all meters.

2.12 Water Meter Box and Cover

Water meter boxes shall be Raven meter pits. For 5/8-inch by 3/4-inch meters, the meter box shall be 20 inches by 24 inches by 36 inches. For 1-inch and 2-inch meters, the meter box shall be 24 inches by 33 inches by 42 inches. The meter box cover shall be Ford W-4 for 5/8-inch by 3/4-inch meters and Ford MC-30-MB for 1-inch and 2-inch meters.

2.13 Locating Wire

A. Locating wire shall be a minimum of 12 awg UF solid copper with blue colored insulation. The use of THHN wire will not be acceptable. The silicone splice kit shall be King Technology Model 50-566 or approved equal.

B. Where location wire is to be secured to the exterior of fire hydrants, valve boxes, posts, etc., stainless steel pipe straps shall be used.

2.14 Thrust and Anchor Blocks and Concrete Collars

A. Concrete used for thrust and anchor blocks, and concrete collars shall be Portland Cement concrete with a 28-day compressive strength of 2,500 psi. Concrete thrust blocks shall cure for 3 to 5 days before hydrostatic or leakage testing of pipelines unless otherwise approved by the City Engineer.

B. Anchor rods shall be 3/4-inch diameter galvanized steel or epoxy coated reinforcement bar conforming to AASHTO M 284, embedded a minimum of 18 inches in the concrete.

2.15 Water Line Blowoff

Water line blowoff shall be as shown on the City Standard Drawings.

2.16 Water Utility Markers

Markers shall be as shown on the City Standard Drawings.

PART 3 - EXECUTION

3.1 Trench Excavation

Trench excavation and backfill shall be performed as specified in Technical Specifications - "Storm Drainage," Part 3 Execution, 3.1 through 3.8.

3.2 Installation of Pipe

A. Water pipe shall be installed in accordance with best current practices as required by the manufacturer and as specified herein. Ductile iron pipe installation shall conform to the requirements of AWWA C600.

B. Water pipe shall be installed with bell ends laid facing in the direction of laying unless directed otherwise by the City Engineer. Each pipe shall be properly bedded so as to be supported for the full length of the pipe. A suitable foundation shall be achieved by a slight excavation under the bell at each joint. All rubber ring joints shall be lubricated and installed in accordance with the installation instructions of the pipe manufacturer, taking particular care to avoid pinching or otherwise causing damage to the rubber ring. All joints shall be free of dirt and other foreign matter prior to the joining of the next pipe. All joints shall be restrained to prevent creep and misalignment of joints.

C. Water lines shall be installed to the depths called for on the Drawings and to the lines and grades when shown.

1. It shall be recognized that water line depths may vary from the depths shown when adjustment of grade is required to avoid conflict with existing utilities.

2. Additional fittings may also be required when a grade adjustment is required.

D. No pipe shall be installed in water or when conditions exist that, in the opinion of the City Engineer, are unsuitable for the laying of the pipe.

1. At times when pipe laying is not in progress, the open ends of pipe shall be closed by a watertight plug or other approved means. This provision applies during the noon hour as well as overnight.

2. If there is water in the trench, the seal should remain in place until the trench is dewatered sufficiently to prevent groundwater from entering the pipe. Adequate provisions shall be made by the Contractor for final disposal of the groundwater pumped from trenches.

E. All pipe shall be installed true to line. The Contractor may install a pipeline on a curve when called for on the Plans or when approved by the City Engineer. For rubber gasketed ductile iron pipe installed on a curve, the pipe shall be joined in a straight alignment, then deflected.

3.3 Thrust and Anchor Blocks

A. Thrust and anchor blocks shall be constructed as shown on the City Standard Drawings and placed at all changes in direction, all changes in the diameter of the pipe, all dead-ends, as specifically shown on the Drawings and as required by the City Engineer.

B. All thrust blocks shall be placed between the undisturbed ground and the fitting to be anchored. Plastic sheeting shall be used to provide a bonding barrier between the fittings and the concrete. The quantity of concrete and the area of bearing on the soil shall be as shown on the City Standard Drawings or as approved by the City Engineer.

C. All thrust blocks shall be placed so that the entire pipe and fitting joints will be accessible for repairs. Bolts for mechanical and flange fittings and fire hydrant weep holes shall not be covered with concrete. All bolts shall be accessible and removable without interference from the thrust block.

D. Thrust blocks may not be required where approved restraint joint pipe and fittings are utilized.

E. Concrete thrust blocks shall cure for 3 to 5 days before hydrostatic or leakage testing of pipelines unless otherwise approved by the City Engineer.

F. No backfill of thrust blocks shall occur until the Work has been observed by the City' representative.

3.4 Service Connections

The Contractor shall connect service lines to new or existing water mains as shown on the Plans. This Work includes the installation direct tap and corporation stop, and making the connection. The Work will include potholing to locate any existing pipeline or service lines as required so the service connection can be performed.

3.5 Service Lines

A. The installation of new service lines and the connecting of existing service lines shall be performed in accordance with the Plans, manufacturer requirements, and as specified

herein. Water service lines shall be laid by placing the pipe on the trench bottom with sufficient slack to prevent pulling apart of the joints when the backfill is placed. Splices shall be kept to an absolute minimum. If required, they shall be made using brass compression joint couplings, Ford Pack Joint or approved equal.

B. When constructing a new water line to replace an existing line, the existing water line shall remain in service until the new water line has been tested, disinfected, and approved by the City Engineer. When possible, the existing line and new line shall both be in operation during the transfer of service lines. The transfer shall be made so that the interruption of water service to the utility customer is held to a minimum. All service lines shall be thoroughly flushed before connecting to existing lines or meters.

C. The Contractor shall pothole to locate any existing pipelines or service lines as may be required so the service lines can be installed. The Work also includes connecting to the existing service lines when required.

D. When the Drawings indicate that existing service lines will be utilized, and if the Contractor encounters an existing service line which appears to be in poor or unserviceable condition, the Contractor shall promptly contact the City Engineer. If the City Engineer determines that a portion of the existing service line needs replacement, the Contractor shall install a new service line.

3.6 Service Lines by Boring and Open Trench Methods

A. It is the general intent to try to install service lines under paved streets by boring where practical. A pneumatic boring tool or other approved method will be used to install service lines under all paved streets. There may be areas where it is not possible to bore due to ground conditions which interfere in the operation.

1. Where requested by the City Engineer, the Contractor shall attempt to bore under paved streets. In areas where it appears that boring will be difficult as determined by the City Engineer and the Contractor, the service lines shall be installed by the open trench method. The Contractor shall make two attempts, if required, to bore under paved streets. If the second attempt fails, the Contractor shall install the service line by the open trench method.

B. The Contractor shall take care to not damage other utilities which might exist in the area. Prior to boring, the Contractor shall pothole to locate existing utilities. "Blind-boring" is not allowed. Repairs for damage to other utilities shall be the responsibility of the Contractor.

C. Service lines to be installed in areas not under asphalt streets may be installed by either open trenching or boring as the Contractor may elect.

3.7 Valves and Valve Boxes

A. Valves and valve boxes shall be installed as shown on the City Standard Drawings. All valves and valve boxes shall be set plumb. The valve box shall be centered over the valve operator and free of any obstruction which would prevent operation of the valve nut.

B. If the bury depth of the valve is greater than 4-1/2 feet, a valve operator extension shall be provided to within 1 foot of finish grade. The extension shall not be permanently attached to the valve operator and a self-centering device shall be provided near the top of the valve operator extension. The box cover shall be flush with the finished grade. A concrete collar, where required, shall be installed.

3.8 Water Meters

Water meters shall be installed by City Water Department personnel.

3.9 Fire Hydrants

A. Hydrant installation shall conform with AWWA Manual M17 and AWWA C600, and as shown on the City Standard Drawings. Extensions required for hydrant adjustment shall be installed to the manufacturer's specifications.

B. Hydrants may be installed on new water mains installed as part of the Work, or on existing mains. Special attention shall be given when installing hydrants on existing mains to ensure that adequate thrust restraint is being achieved as the hydrants can be placed in service before normal cast-in-place thrust blocks can achieve the required strength. The block and plug shall be held securely by temporary thrust block or other approved method, such as precast thrust blocks, restraining rods, etc.

C. The newly installed hydrants shall be covered in a manner acceptable to the City until they are placed into permanent service.

3.10 Removal of Existing Fire Hydrants

A. All hydrants removed shall remain the property of the City and shall be delivered and properly stacked at a site designated by the City.

B. After the old hydrant is removed, the lead line, if it is to be abandoned, shall be plugged at the main line tee with a watertight plug and thrust block. When the lead pipe is connected to a water main which is being abandoned, it will not need to be plugged.

C. The fire hydrant assembly valve and valve box shall be removed and delivered to a location designated by the City.

3.11 Water Line Blowoffs

The 2-inch water line blowoffs shall be constructed as shown on the City Standard Drawings. Unless noted by the City Engineer, a fire hydrant shall be installed in lieu of a water line blowoff.

3.12 Water-Sewer Line Crossings

A. See Technical Specifications - "Sanitary Sewers," Part 3 - Execution, 3.8 Water-Sewer Crossings.

B. When constructing water service lines, the City Engineer may require the depth of the service line to be revised in order to eliminate the need for a water-sewer line crossing.

3.13 Abandoning Water Services

A. When required, the Contractor shall remove the service line and install a plug in the existing water main when an existing service is to be taken out of service. All plugs are to be permanent and watertight. When required, thrust restraints shall be provided.

B. Unless specified otherwise, the plugging of an abandoned service line shall be performed at the connection to the water main which is to remain in service. No stubbed service lines shall be left in the ground unless approved otherwise by the City Engineer. The Contractor shall excavate and expose the service line connection to be plugged, perform the Work, and backfill as required.

3.14 Abandoned Water Lines

A. The existing water lines to be taken out of service are to remain in service until the new lines are properly installed and tested, and water services have been connected. Approval from the City Engineer shall be obtained before any line is abandoned.

B. The existing lines shall then be abandoned and their actual location and abandoned designation recorded on all Record Drawings.

C. Unless called for otherwise, the abandoned lines will remain in the ground. The ends of all pipes which are abandoned shall be plugged with concrete or other methods approved by the City Engineer.

3.15 Air Release Valves

Air release valves shall be installed as shown on the City Standard Drawings, and as required by the manufacturer.

3.16 Removal and Salvage of Water Main Appurtenances, Fittings, and Other Items

The Contractor shall remove all existing valves, hydrants, and fittings as required to properly perform the Work, or as shown on the Drawings. All such materials shall be transported to an area designated by the City and stockpiled. Materials shall be removed and handled in such a manner which will prevent damage.

3.17 Testing and Disinfection

A. General

1. All testing and disinfection shall be scheduled 48 hours in advance with City Water Department staff. A City representative shall observe all steps in the testing and disinfection process.

2. The Contractor shall furnish all necessary equipment and other apparatus, including gauges, necessary to properly perform the testing and disinfection of water lines as specified herein and as shown on the City Standard Drawings. Lines to be tested include mains and service lines. Each section of the lines, before being tested and placed into service, shall be isolated and slowly filled with water. Air should be expelled from the line through hydrants or taps made at the high points. The City Engineer shall have the option of requiring the use of their own gauges. Water mains shall be generally tested in sections between valves and as the Work progresses. The Contractor shall be responsible for determining the length, timing, and section of lines to be tested, unless otherwise noted. When appropriate, testing intermediate sections of long lines should be considered. The Contractor shall provide any temporary test heads, fittings, blocking, etc., as may be required to properly test any given water main section. The Contractor shall be responsible for locating and repairing any defects in the water mains that fail to pass the required test.

3. Standard process for fill, flush, disinfection, and pressure testing is four to five business days. This process shall start at the beginning of a typical work week.

B. Acceptance Test

The Contractor shall perform all preliminary testing required to determine that the lines to be tested are acceptable and comply with the requirements of this section of the Specifications. After the Contractor has determined that the lines will pass the required test, the Contractor shall arrange for an acceptance test to be witnessed by the City's representative. The Contractor shall coordinate the timing of this acceptance test with the City's representative. The lines will not be accepted until the acceptance test has been witnessed and documented as passing. Forms for performing the various tests are included at the end of this section for use and reference by the Contractor.

C. Hydrostatic Testing of Pressure Lines

All lines 10 inches and smaller shall be pressure tested at 150 psi gauge or 1.5 times the actual working pressure, whichever is greater, for one hour, unless otherwise approved by the City Engineer. Any cracked or defective pipe, joints, or fittings shall be removed and replaced.

D. Leakage Test

Each section of the line, after all backfill and compaction work has been completed and before being placed into service, shall be tested for leakage for a period of two hours at a minimum average gauge pressure of 100 psi. Leakage is defined as the quantity of water supplied into the section of line being tested, during and at the end of the test, that quantity being such that the pressure at the end of the test is equal to the pressure at the beginning of the test. Should any test disclose leakage greater than that specified, the Contractor shall locate and repair the defective joints until the leakage is within the specified allowance.

$$\text{DI Pipe: } L = \frac{SD\sqrt{P}}{148{,}000}$$

In which:

L = Allowable Leakage Gal/Hr
S = Length of Pipe Tested in Ft.
D = Nominal Diameter in Inches
P = Gauge Pressure in psi

E. Disinfection of Potable Water Mains

1. Each section of the line, before being placed into service, shall be thoroughly flushed and disinfected in accordance with regulations of the Oregon Health Authority - Drinking Water Services (DWS), specifically Oregon Administrative Rule, Section 333-061-0050(10) Construction Standards, current edition, which reads as follows:

"(10) Disinfection of facilities:

(a) Following construction or installation of new facilities and repairs to existing facilities, those portions of the facilities which will be in contact with water delivered to users must be cleaned and flushed with potable water and disinfected according to AWWA Standards C651 through C654 before they are placed into service. Disinfection must be by liquid chlorine unless another disinfectant can be demonstrated to be equally effective.

(b) For construction of new distribution pipelines (with any associated service connections and other appurtenances installed at the time of construction), disinfection by chlorination must be conducted as specified in paragraphs (A) through (C) of this subsection unless another method from AWWA Standard C651 is used.

(A) A solution with a free chlorine residual of at least 25 mg/l must be introduced to the pipe such that the solution will contact all surfaces and trapped air will be eliminated. The solution must remain in place for at least 24 hours.

(B) After 24 hours, if the free chlorine residual is 10 mg/l or greater, the chlorine solution must be drained and the pipe flushed with potable water. If the free chlorine residual is less than 10 mg/l after 24-hours, the pipe must be flushed and rechlorinated until a free chlorine residual of 10 mg/l or more is present after a 24 hour period.

(C) After the pipe is disinfected, flushed and filled with potable water, bacteriological samples must be collected to determine the procedures' effectiveness. At least two samples must be collected from the new pipe at least 16 hours apart and analyzed for coliform bacteria. If the pipe has held potable

water for at least 16 hours before sample collection, two samples may be collected at least 15 minutes apart while the sample tap is left running. If the results of both analyses indicate the water is free of coliform bacteria, the pipe may be put into service. If either sample indicates the presence of coliform bacteria, the disinfection and flushing process must be repeated until samples are free of coliform.

(c) For repaired pipelines that were depressurized and wholly or partly dewatered during repair or that likely experienced contamination during repair, disinfection according to the procedure specified in paragraphs (10)(b)(A) through (C) of this rule must be followed except that bacteriological samples must be collected downstream of the repair site. If the direction of flow is unknown, samples must be collected on each side of the repair site.

(d) A water line may be returned to service, following repairs or routine maintenance, prior to receiving a report on the bacteriological analysis if the following procedures have been completed:

(A) Customer meters were shut off prior to placing the water line out of service;

(B) The area below the water line to be repaired was excavated and dewatered;

(C) The exposed pipe was treated with a hypochlorite solution;

(D) The water line was flushed thoroughly, and a concentration of residual chlorine has been re-established that is comparable to the level normally maintained by the water system, if applicable; and

(E) Bacteriological analysis has been conducted as a record of repair effectiveness."

2. When fittings, service lines, or other components of the water system (i.e., fittings used to connect to an existing main) are not disinfected in conjunction with the water mains, the Contractor shall disinfect these items using a 300 mg/L minimum chlorine solution. These items shall be flushed or otherwise coated with the chlorine solution in such a manner that will result in thorough wetting

of all surfaces on the inside of these items. These items shall have at least 15 minutes of contact time with the chlorine solution prior to flushing/rinsing and being put into service.

3. After disinfection, the Contractor shall collect bacteriological samples for testing in the presence of the City Engineer. A minimum of two samples shall be taken every 1,000 feet of water line to be tested. The Engineer may require additional samples to be taken if the section to be tested is complex and proper disinfection could be difficult. The analysis shall be performed by a laboratory certified by the DWS or the EPA. The cost of the bacteriological testing(s) is to be paid by the Contractor. If positive results are obtained, the system shall be disinfected again by the Contractor, at their own expense. Bacteriological samples will again be collected in the presence of the Engineer and resubmitted for testing. This shall be repeated until negative results are obtained. The method of disinfecting and the chlorination materials used are subject to the approval of the City Engineer. Disinfection by introducing granular or tablet chlorine compounds in each pipe length is not an acceptable method of disinfection.

4. The results of all bacteriological tests shall be submitted to the City Engineer and placed in the Operation and Maintenance Manual. No section of pipe shall be placed into service until acceptable bacteriological tests have been obtained.

5. Disposal of any water containing chlorine shall be performed in accordance with AWWA C651, Section 4.5.2, and any other local requirements. Disposal may be made into existing sanitary sewer systems providing approvals are obtained from the respective sewerage agency. Any chlorinated water discharged to open stream channels must be dechlorinated prior to discharge.

3.18 Restoration, Finishing, and Cleanup

A. The Contractor shall restore or replace all paved surfaces, graveled surfaces, curbing, sidewalks, trees, shrubbery, lawns, pastures, fences, and other existing facilities equal to their original condition.

B. All surplus material and temporary structures as well as excess excavation shall be removed and the entire Site of Contractor operations shall be left in a neat and clean condition as outlined in the General Conditions.

END OF SECTION

TEST WORKSHEET FOR THE

WATER LINES - LEAKAGE TEST

Project Name _____

Date_____ Job No._____

Location of Test/Stationing _____

_____

Hydrostatic Test

Test Pressure _____

Time Test Started _____

Time Test Completed _____

TOTAL TIME _____minutes

Test Passed ☐ Yes ☐ No

Leakage Test (Min. Test Pressure 100 psi)

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

In which:

L = Allowable Leakage Gal/Hr
S = Length of Pipe Tested in Ft.
D = Nominal Diameter in Inches
P = Gauge Pressure in psi

Allowable Leakage

Pipe Section	Nominal Diameter	Number of Joints or Connections	Length of Pipe	Allowable Leakage

Total Allowable Leakage _____ gal/hr

Time Test Started _____ Total Leakage Measured _____gal.

Time Test Completed _____ Total Leakage Measured/Gal=_____ gal/hr

TOTAL TIME _____mins. _____Time (hr.)

Test Passed ☐ Yes ☐ No

Contractor's Firm Name: _____

_____

Contractor's Representative Signature _____

City's Representative Signature _____

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SECTION 5

STREETS

TECHNICAL SPECIFICATIONS

SECTION 5

STREETS

PART 1 - GENERAL

1.1 General Design Requirements

A. Performance Standards

1. All street designs shall provide for the safe and efficient travel of the motoring public. Streets shall be designed to carry the recommended traffic volumes identified for each street classification. Street classifications shall be in accordance with Part 1 - General, 1.1 General Design Requirements, B. Right-of-Way and Pavement Width, of these Technical Specifications.

2. Streets shall be designed to meet or exceed minimum guidelines in accordance with the current AASHTO, "Policy on Geometric Design of Highways and Streets." Traffic control and traffic control devices (TCD) shall conform with the current Federal Highway Administration "Manual on Uniform Traffic Control Devices for Streets and Highways," and Oregon Department of Transportation (ODOT)/APWA supplements.

3. All vertical and horizontal curves shall meet AASHTO design speed and street classification guidelines. Where practical, the design engineer shall provide the desirable stopping sight distance set forth in AASHTO, but in no case shall it be less than the minimum stopping sight distance.

4. Drawings relevant to this section are included in the Standard Drawings.

B. Right-of-Way and Pavement Width

Right-of-way (ROW) and pavement widths for each street classification shall be as shown in the City Development Code.

C. Traffic Analysis

1. The City will require a Traffic Analysis Report (TAR) as determined by the type of development and its potential impact to existing street systems. A TAR may be required for a development when:

   a. it will generate 1,000 vehicle trips per weekday or more, or

   b. its location, proposed site plan, and traffic characteristics could affect traffic safety, access management, street capacity, or known traffic problems or deficiencies in a development's study area.

2. The TAR shall be prepared by a professional engineer licensed in the State of Oregon who specializes in traffic engineering. At a minimum, the TAR shall contain the following:

   a. Purpose of TAR and Study Objectives

      1) A discussion of key traffic issues to be addressed and the transportation system and development objectives related to a specific development.

      2) General transportation system objectives are:

         a) to maintain safe and efficient traffic flow on surrounding street system;

         b) to provide safe and effective transfer of vehicular traffic between the site and the street system, providing a convenient, safe, and efficient on-site and off-site movement of private, service, and delivery vehicles, pedestrians, transit and bicycles; and

         c) to effectively mitigate adverse site-generated traffic impacts on affected streets and intersections. Site-specific objectives may be established by the City for each study and report.

   b. Executive Summary

      A concise summary of the study purpose/objectives, site location and study area, development description, key assumptions, findings, conclusions, and recommendations.

   c. Description of Site and Study Area Roadways

      1) A description of the site, study area, existing traffic conditions in the study area, anticipated nearby development, and committed roadway improvements that would affect future traffic in the study area.

      2) The study area will be defined as all roads, ramps, and intersections through which peak hour site traffic composes at least 5 percent of the existing capacity of an intersection

approach, or roadway sections on which accident character or residential traffic character is expected to be significantly impacted.

d. On-site Traffic Evaluation

An evaluation of the proposed (and alternative) site access locations, the adequacy of access depth, number of lanes, queuing storage, safety, and efficiency of proposed vehicular circulation, parking layout, pedestrians, service vehicle routes/facilities, together with recommendations for on-site traffic markings and controls.

e. Technical Appendix

A technical appendix including worksheets, charts, traffic count, and drawings to support findings as described in the body of the report.

f. Recommendations for Public Improvements

1) Recommendations should be made for external roadway improvements, such as additional through and turn lanes, and TCD necessitated as a result of the development. Recommended improvements to transit facilities, pedestrian, and bicycle circulation should also be reported.

2) The recommendations should specify the time period within which improvements should be made, particularly if improvements are associated with a phased development; the estimated cost of improvements; and any monitoring of operating conditions and improvements that may be needed. If needed street improvements, unrelated to the development, are identified during the analysis, such improvements shall be reported.

g. Access Management

1) On sites with arterial and collector street frontages, the report shall evaluate and recommend the use of access management plans or techniques:

2) To separate basic conflict areas: Reduce the number of approaches or increase spacing between approaches and intersections.

3) To remove turning vehicles or queues from the through lanes (reduce both the frequency and severity of conflicts by providing separate paths and storage areas for turning vehicles and queues): Techniques may include turn restrictions, striping, medians, frontage roads, channelizing of lanes or approaches, shared approaches, access between similar uses, access consolidation, lanes for left or right turns, and other transportation system management actions.

h. A review of alternative access points for site access to highways, city streets, and county roads.

i. The analysis of alternate access proposals should include:

1) Existing daily and p.m. peak hour counts, by traffic movements, at intersections affected by generated traffic from the development. (Use traffic flow diagrams).

2) Projected daily and p.m. peak hour volumes for the same intersections and proposed access points when the development is in full service. (Use traffic flow diagrams.)

3) A determination of the existing levels of service and projected levels of service at each intersection and access points studied.

4) A discussion of the need for traffic signals. This should include a traffic warrant computation based on the "Manual on Uniform Traffic Control Devices."

a) The recommendations made in the TAR should be specific and should be based on a minimum level of service when the development is in full service. As an example, if a traffic signal is recommended, the recommendation should include the type of traffic signal control and what movements should be signalized. If a storage lane for right turn or left turn is needed, the recommendation should include the amount of storage needed. If several

intersections are involved for signalization and an interconnect system is considered, specific analysis should be made concerning progression of traffic between intersections.

b) The TAR should include a discussion of bicycle and pedestrian usage and the facilities provided along with the availability of mass transit to serve the development, if appropriate.

D. Intersections

1. Connecting Street Intersections

Connecting street intersections shall be located to provide for traffic flow, safety, and turning movements, as conditions warrant.

2. Arterial Intersections

a. Exclusive left and right turn lanes shall be provided.

b. Bus turnouts shall be provided if traffic flow and safety conditions warrant.

c. Designated crosswalks shall be provided at controlled locations.

d. Street alignments across intersections shall be continuous.

3. Collector and Local Street Intersections

a. Street and intersection alignments should facilitate local circulation but avoid alignments that encourage non-local through traffic.

b. Streets shall be aligned to intersect at right angles, 90°. Angles of less than 75° will not be permitted.

c. Intersection of more than two streets at one point will not be permitted.

d. New streets shall intersect with existing street intersections so that centerlines are not offset, except as provided below. Where existing streets adjacent to a proposed development do not align properly,

conditions may warrant the development to provide the proper alignment.

e. For intersections that are not directly aligned, the minimum separation distance shall be as follows:

Street Class	Intersection Spacing (feet)
Arterial	300 to 500*
Collector	300 to 400*
Local	300*
Cul-de-sac	150

* The City may permit a minimum intersection spacing of not less than 300 feet for Arterial, and 200 feet for Collector/Local, when findings establish that:

a. without the change, there could be no public street access from the parcel(s) to the existing street, and

b. all other provisions of the street design requirements can be met.

E. Half-Street Construction

Half-street design is generally not acceptable. Where such a street is justified, the ROW and pavement width shall be approved by the City. In no case shall the pavement width required be less than that required to provide two lanes of traffic to pass at a safe distance. For a 36-foot local street, the half-street pavement width shall be 20 feet. Half-streets shall be approved only when the abutting or opposite frontage property is undeveloped and the full improvement will be provided with development of the abutting or opposite (upon ROW dedication) frontage property.

Half-street improvements shall include curb, sidewalk, and storm drainage on one side of the street. When a half-street improvement is required, the entire street shall be designed.

A development on an unimproved street shall be responsible for constructing a continuous City standard street to a connection with the nearest standard (publicly maintained) street.

F. Street Classification

1. All streets within the City shall be classified in accordance with Part 1 - General, 1.1 General Design Requirements, B. Right-of-Way and Pavement Width, of these Technical Specifications.

2. The classification for any street not listed in Part 1 - General, 1.1 General Design Requirements, B. Right-of-Way and Pavement Width, of these Technical Specifications shall be as determined by the City Engineer.

G. Design Speed

Design speeds for classified streets shall be 25 miles per hour unless a speed study is performed by the developer and the City Engineer reviews the study and approves the change.

H. Horizontal Curves

Horizontal curve radius (on centerline) for each street classification shall be designed according to the roadway design speed. The radius shall not be less than the following:

Classification	Feet
Arterial	700
Collector	500
Local	100
Cul-de-sac	100

I. Vertical Curves

1. Vertical curve lengths shall be based on design criteria which includes:

   a. design speed,

   b. crest vertical curve, and

   c. sag vertical curve.

2. Stopping sight distance for crest and sag vertical curves shall be based on sight distance and headlight sight distance, respectively.

3. All vertical curves shall be parabolic, and the length shall be computed for each location.

J. Grades

1. Maximum grades for each street classification shall be as follows:

Classification	Feet per Foot (ft/ft)*
Arterial	0.06
Collector	0.06
Local	0.06
Cul-de-sac	0.06

**All street grades shall not exceed 3 percent within 30 feet of the edge of an intersection.*

2. The City Engineer may approve a grade greater than those specified when all of the following conditions exist:

   a. Topographic constraints do not allow the development to be served by a street with a maximum grade of 6 percent without causing destabilization of soils by excessive cuts and fills.

   b. There is no access to the property being developed through adjacent properties at a maximum 6 percent grade.

   c. The section of local street will not exceed a combination of length, horizontal alignment, and/or grades exceeding 6 percent that will create hazardous traffic conditions.

   d. In no case shall the maximum street grade exceed 10 percent.

3. Minimum grade for all streets shall be 0.005 ft/ft (0.50 percent); however, in all cases, street grades shall allow for proper and adequate drainage. Cul-de-sac "bulbs" shall have a minimum slope of 0.006 ft/ft (0.60 percent).

4. Street cross slopes shall be 2 percent. Where there are site constraints, the cross slope can vary from 1 to 3 percent.

K. Pavement Design

1. In general, all streets shall be constructed with asphalt concrete pavement (ACP) unless otherwise approved by the City.

2. Typical flexible pavement sections shall be as shown on the City Standard Drawings per street classification.

3. The design engineer will provide a street structural design section for all roadways classified collector and higher and local streets in Industrial zones. A pavement section structural number shall be provided to confirm or revise the pavement section when the soils report indicates poor soil.

L. Concrete Curb

1. All development projects are required to construct street improvements with concrete curbs and gutters. Curb exposure for curb and gutter shall be 6 inches. Joint spacing in curbs shall be in accordance with the City Standard Drawings.

2. Curb Return Radius

a. Curb return radius at street intersections shall be designed to accommodate all expected traffic. Minimum curb radius required shall be as follows:

Intersection	Radius (feet)
Local/Cul-de-sac with Local/Cul-de-sac	25
Local/Cul-de-sac with Collector /Arterial	35
Collector/Arterial with Collector/Arterial	35

b. A larger curb radius may be required to be installed on streets serving commercial/industrial properties for vehicle movements.

M. Parking

Street Classification	Parking Lanes	Parking Required
Arterial	None	May be allowed in some areas
Collector	2	Variable (a, b)
Local	2	Yes (c)
Cul-de-sac	2	Yes (c)

a. Where bike lanes exist on collectors, parking may be prohibited.
b. Collector - No parking within 45 feet of curb return.
c. Local - No parking within 30 feet of curb return.

1. For streets designated Collector and below, the City may consider design modifications to conserve major trees in the public ROW. Parking lanes may be removed on one or on both sides of a street subject to approval by the City.

2. Design Standards - Parking and Loading

   a. Scope

      1) These Design Standards shall apply to all parking, loading, and maneuvering areas.

      2) All parking and loading areas shall provide for the turning, maneuvering, and parking of all vehicles in the lot.

   b. Access

      Where a parking or loading area does not abut directly on a public street, an unobstructed drive of not less than 20 feet in width for two-way traffic leading to a public street shall be provided, and traffic directions shall be plainly marked.

   c. Parking Area Improvements

      All public or private parking areas that contain three or more parking spaces, and outdoor vehicle areas, shall be improved according to the following:

      1) All parking areas shall have durable, dust free surfacing of ACP, Portland cement concrete, or other approved materials. The design section shall conform to the use and the soils report. All parking areas, including those in conjunction with a single-family or two-family dwelling, shall be graded so as not to drain excess stormwater over the public sidewalk or onto any abutting public or private property.

      2) All parking areas, except those required in conjunction with single-family or two-family dwellings or vehicle sales areas, that abut a residential district, shall conform to the screening requirements as set forth in the City's Development Code.

      3) All parking areas, except those required in conjunction with single-family or two-family dwellings or vehicle sales areas, may

contain a maximum of 25 percent of parking spaces sized for compact vehicles.

4) All required handicap parking spaces shall conform to Oregon Revised Statutes 447.210.

5) All parking areas, except those required with single-family or two-family dwellings or vehicle sales areas, shall have physically marked individual parking spaces such as painted lines, lettering, curbs, and landscaping.

N. Sidewalks

1. In general, new sidewalks are required for all development requiring a development permit.

2. New sidewalks that abut the back of curb shall have a minimum width of 5 feet in residential zones and 6 feet in commercial zones, not including the curb width. Sidewalks that do not abut the back of curb shall have a minimum width of 5 feet. Sidewalks may be required to meander within the dedicated ROW and/or outside of the ROW within an easement.

3. Americans with Disabilities Act (ADA) Ramps

   a. At intersections, each corner radius shall include ADA ramps. ADA ramps shall also be included at marked crossings. ADA ramps shall be in accordance with the City Standard Drawings.

   b. Locations of sidewalk ramps shall be designed with regard to stormwater flows, street grades, and pole locations. Other factors may also dictate sidewalk ramp locations.

O. Bikeways

1. These Specifications summarize the City's policy and implementation strategies for bikeways within the City. The City's plan has adopted both AASHTO and ODOT/APWA standards and criteria as the minimum guidelines for bikeway design and construction.

2. The City's adopted guidelines for bikeways consist of the following:

   a. Guide for Development of New Bicycle Facilities, 1981.

b. AASHTO, Oregon Supplements and Exceptions to AASHTO Guide.

c. Manual on Uniform Traffic Control Devices with Oregon supplements by the Oregon Transportation Commission.

3. Bikeway Location and Width

a. For on-street bike lanes, see City Standard Drawings ST07 through ST13.

b. See the table below for off-street bike lanes.

Bikeway Location	Minimum Width (feet)	Comments
Off-Street Bicycle Path	5 *	One-Way Travel Off-Street
Bicycle Path	10 *	Two-Way Travel Off-Street

* Paths are constructed with 2-foot gravel shoulders on both sides unless otherwise approved by the City Engineer.

4. Design Criteria

a. All bikeways shall have a minimum cross slope 2 percent and a maximum cross slope of 5 percent. On curved alignments, the cross slope shall be to the inside of the curve.

b. Bikeway curvature shall be based on a minimum design speed of 20 MPH. Bikeway grades shall be limited to a maximum of 5 percent. Where topography dictates, grades over 5 percent are acceptable when a higher design speed is used and additional width is provided.

c. Where bikeways are shared with pedestrians, all ADA design criteria shall apply.

5. Construction

a. Off-street bikeways shall be constructed for heavy City maintenance vehicle use. This section shall include 3 inches of ACP on 9 inches of aggregate base. Subgrade preparation will require removal of existing organic material and compaction.

b. When drainage, such as side ditches, is required parallel with the bikeway, the ditch centerline shall be at least 5 feet from the edge of the pavement. Ditch side slope adjacent to a bikeway shall be no steeper

than 2H:1V when measuring the horizontal distance to the vertical distance.

c. When culverts cross bikeways, the ends of the pipe shall be no closer than 5 feet from the edge of the bikeway.

6. Lighting

Lighting should be included in the bikeway design when nighttime security could be a problem and a high nighttime use is expected (i.e., paths serving students, commuters). The horizontal illumination levels shall be 0.05 foot-candle (5 lux) to 2 foot-candles (22 lux) except when security problems exist; higher illumination levels should be considered in these locations. The placement of the light standards (poles) shall meet all vertical and horizontal clearances.

P. Driveways

1. Access to private property shall be permitted with the use of approach curb cuts (driveways). The access points with the street shall be the minimum necessary to provide access while not inhibiting the safe circulation and carrying capacity of the street.

2. One driveway per site frontage will be the normal maximum number. Double frontage lots and corner lots on these streets may be limited to access from a single street, usually the lower classification street. If additional driveways on a frontage are approved by the City, a finding shall be made that no eminent traffic hazard would result and impacts on through traffic would be minimal. Restrictions may be imposed on additional driveways, such as limited turn movements, shared access between uses, closure of existing driveways, or other access management actions.

3. Should the length of a driveway be greater than 50 feet and the driveway has only one access to the street, a turnaround shall be provided. The minimum inside radius of the turnaround shall be 15 feet with a width at the turnaround point of 30 feet for maneuvering.

4. The City Standard Drawings show driveway widths.

TECHNICAL SPECIFICATIONS

SECTION 5

STREETS

Q. Street Lighting, Names, and Signage

1. Street Lighting

a. A complete streetlighting system shall be the responsibility of the development. All streets fronting the property shall be provided with adequate lighting. Developer is required to provide lighting for public convenience and safety. For lighting requirements, all developments will be required to submit three copies of the final plat (residential and major land partitions) to the City. Commercial and industrial developments, in addition to the above requirement, shall submit three copies of the site plan to the City.

b. Streetlighting shall be provided as part of the street design process. Design illumination levels shall be in accordance with the recommendations of the "Illuminating Engineering Society" and are summarized on the following table.

Recommendations for Roadway Average Maintained Horizontal Illumination (Foot-Candles)

Street Classification	Commercial	Urban Intermediate	Residential
Highway	1.4	1.2	1.0
Arterial	2.0	1.4	1.0
Collector	1.2	0.9	0.6
Local/Cul-de-sac	-	0.9	0.6

c. The average-to-minimum uniformity ratios for roadways in commercial and intermediate areas shall be 4H:1V or better. In residential areas this uniformity ratio shall be 6H:1V or better.

d. The streetlighting system shall be provided using high pressure sodium vapor luminaries. The design average horizontal illumination and uniformity ratio shall be obtained by considering together the factors of lamp wattage, pole support spacing, maintaining height and luminaire of the streetlights to locate poles at lot line extensions and not in the middle of a lot, and to locate poles at corners.

e. The Developer is required to provide Design Drawings and calculations for pole foundation to the City for approval.

2. Street Names and Traffic Control

   a. Street names for all new developments will be approved by the City prior to recording of any maps or plats. The developments shall pay for all street name and traffic control signage prior to the signing of the final plat or map by the City. All new signage will be provided and installed by the developer.

   b. Street names shall conform with the established grid system(s) in the City and its urban growth boundary (UGB). No new street name shall be used that will duplicate or be confused with the name of existing streets in the UGB area.

   c. Building numbering will be issued by the City.

R. Mailboxes

1. Joint mailbox facilities shall be provided in all residential developments, with each joint mailbox serving at least two dwelling units.

2. Joint mailbox structures shall be placed adjacent to roadway curbs.

3. Proposed locations of joint mailboxes shall be designated as part of the development plan and shall be approved by the U.S. Postal Service.

4. Plans for the joint mailbox structure to be used shall be submitted as part of the development plan for approval by the U.S. Postal Service.

S. Street System Description and Function

1. General Guidelines

The UGB map, policies, and access requirements for various land uses, as adopted by the Comprehensive Plan and City Development Code, shall serve as guidelines for the functional classifications, definitions, and standards requirements and rules adopted under these Specifications.

2. Functional Classifications

   a. Functional classifications categorize roads and streets by their operational purpose. Some of the key factors considered when adopting the functional classifications are the following:

1) Relation between street traffic and land use of the abutting properties.

2) Volume and kinds of traffic.

3) Relative origins and destinations of traffic and lengths of trips.

b. The basic hierarchy of functional classifications are Arterial, Collector, and Local/Cul-de-sac streets. These categories are defined as follows:

1) Arterial Streets

Arterial streets carry higher volumes of traffic, usually more than 4,000 vehicles per day, and generally consist of three or more lanes, with the third lane being a common turn lane. Their function is to serve intra-county trips, that is, trips that have at least one end trip within the county.

2) Collector Streets

Collector streets gather area traffic from local streets within a 1/2-mile radius and connect it to the arterial system. They are not intended to serve through traffic and are the lowest order of streets designed to carry transient vehicles. Collector streets generally have a traffic volume rate of 1,000 to 4,000 vehicles per day. Abutting land uses are generally residential.

3) Local Streets

Local streets provide access to abutting property and do not serve to move through traffic. Local street standards will be further categorized by adjacent land use into residential, commercial, and industrial local streets.

4) Local Streets (Commercial/Industrial)

Within the local street classification, there may be considerable difference between the kind of improvement specified where commercial or industrial land uses access a local street, as compared to the kind of improvement specified for residential access. Generally, a local street classification in commercial or

industrial areas will require an improvement equal to that specified for a collector classification.

5) Cul-de-sac Streets

a) Cul-de-sac streets provide access to abutting property only and will be as short as possible. In no event shall a cul-de-sac be more than 400 feet in length.

b) The length of a cul-de-sac shall be measured along the centerline of the roadway from the near side of the intersecting street to the farthest point of the cul-de-sac.

c) All cul-de-sac streets shall terminate in a circular turnaround.

T. Permanent Dead-End Streets

1. A standard cul-de-sac turnaround shall be provided at the end of a permanent dead-end street that does not provide looped circulation. Permanent dead-end streets shall be limited to serving no more than 25 dwellings and shall not exceed 800 feet in length from the point of the nearest intersection centerline.

2. A permanent dead-end street is measured from the ROW line at the nearest intersecting street, which has at least two points of access, to the ROW line at the farthest end of the dead-end street.

3. Temporary dead-end streets more than 150 feet in length shall be provided with an approved turnaround for emergency vehicles.

U. Alleyways and Private Residential Streets/Access Ways

1. Alleyways

a. Alleyways may be provided in commercial and industrial developments with approval by the City. When approved, alleyways shall be dedicated to the City. The ROW width shall be 20 feet with a 20-foot surfacing width.

b. Design for alleyways shall be as shown on the City Standard Drawings. Generally, alleyways shall be designed for one-way operations.

2. Private Residential Access Ways

In general, private residential streets and access ways shall be provided for multi-family developments such as condominiums and apartments. Interior design for private access ways in a manufactured home park shall meet standards for private residential access ways:

a. Dead-end access ways shall not exceed 800 feet in length nor serve more than 25 dwellings units. Dead-end access ways that exceed 150 feet in length shall be provided with an approved turnaround.

b. "Private street" signage and approaches shall be placed at the intersection with the public street to clearly identify the private access way.

c. Private maintenance of the private streets/access ways shall be provided by a Homeowner's Association or other appropriate entity. Maintenance shall ensure continual emergency access at all times.

d. The location of private access ways shall meet the Uniform Fire Code and meet the minimum pavement section of local residential streets.

e. Private residential access ways shall not be allowed in manufactured home parks or subdivisions.

3. Pavement Cuts

Where pavement is installed next to existing pavement and at all trench cuts, the existing pavement shall be saw cut. The face of the joint between the new and existing pavement shall be coated with asphalt emulsion and the surface of the joint shall be sand-sealed.

4. Shoulders

Where sidewalks and pavement end or where there is no curb and sidewalk (such as half-street improvements), shoulder rock shall be provided to grade with the pavement. Shoulder rock shall be a minimum of 6 inches in depth, 36 inches wide, and shall be 3/4"-0 crushed aggregate base.

1.2 Definitions

A. Painted Markings. Markings constructed of paint and traffic paint beads.

B. Type B - Preformed, Fused Thermoplastic Film Markings. Preformed, fused thermoplastic film with intermixed traffic paint beads, and with or without a separate application of additional traffic paint beads on the surface.

C. Pavement Striping. Lines of paint and glass beads applied to the pavement surface.

PART 2 - MATERIALS

2.1 Water for Compaction

The Contractor shall be responsible for obtaining, transporting and the application of the water.

2.2 Geotextile Fabric

Geotextile fabric shall be Mirafi 500X, Exxon GTF 200, or approved equal.

2.3 Aggregate Base

A. Aggregate Base

Base rock shall conform to the requirements of Section 02630 - Base Aggregate, Oregon Standard Specifications for Construction, current edition, for dense graded aggregate as modified hereafter. Acceptable gradation includes 1"-0 or 3/4"-0 as selected by the Contractor. Aggregate base shall be 100 percent fractured. No round faces shall be permitted. The Contractor shall submit to the City Engineer samples of the aggregate base for use on the Project.

B. Surface Rock

1. The surface rock shall be crushed stone, slag, or gravel meeting the following requirements:

a.	Liquid Limit (AASHTO T 89)		35 Maximum
b.	Plastic Index (AASHTO T 90)		2-9 Maximum
c.	Dust Ratio:	% Passing No. 200	2/3 Maximum
		% Passing No. 30	

Grading Requirements (AASHTO T 11 and T 27):

Sieve	Percent Passing
1"	100
3/4"	70-98
No. 4	36-60
No. 8	25-47
No. 30	12-31
No. 200	8-15

2. Surface rock shall have at least 70 percent by weight of the particles retained on the No. 4 sieve and shall have 100 percent fractured faces.

C. Select Pit Run

1. Select pit run shall be crushed or uncrushed, including sand, reasonably well graded from coarse to fine. Maximum size aggregate shall not exceed 75 percent of the compacted thickness of the layer in which it is incorporated. Aggregates passing the 1/4-inch sieve shall not be less than 10 percent nor more than 50 percent of the whole, by weight. No more than 10 percent of the aggregate shall pass the No. 100 sieve. Within these limits, the subbase aggregate gradation shall be adequate to produce a dense and firm base when placed and compacted.

2. All grading requirements are given as percentages by weight. The gradation will be determined by sieve analysis in accordance with AASHTO T 27.

3. The source materials for select pit run base shall not exceed 45 percent wear when tested in accordance with AASHTO T 96.

4. Select pit run base will be tested according to AASHTO T 176 and shall have a sand equivalent of not less than 30.

5. The Contractor shall furnish the City with current standard proctor curve test ASTM D698 from the material source. The proctor curve must be made by an approved licensed testing laboratory and/or engineer and be submitted to the City a minimum of two weeks prior to select pit run base placement.

2.4 Soil Sterilant

The sterilant shall be Pramitol 5PS as manufactured by Makhteshim Agan of North America, Inc., Monobor-chlorate, or approved equal and shall be applied in accordance with the manufacturer's or Supplier's recommendations to adequately sterilize the base.

2.5 Paving Fabric

The paving fabric used shall be non-woven, fabricated from polypropylene resin, and shall have the following properties:

Weight, oz./sq.yd.	4.0 Minimum
Grab Tensile Strength, lbs.	90 Minimum
Elongation at Break, percent	55 Minimum
Asphalt Retention, gals/sq.yd.	0.20 Minimum

2.6 Asphalt Tack Coat

A. The material is to be CRS-1 or CSS-1 emulsified asphalt unless otherwise approved.

B. Furnish emulsified asphalt meeting the requirements of ODOT's publication "Standard Specifications for Asphalt Materials." Copies of the publication are available from the ODOT Pavement Services Engineer. The applicable Specifications are those contained in the current publication. The materials may be conditionally accepted at the source or point of loading for transport to the Project.

C. Excessive delay in the use of the emulsified asphalt or excessive pumping of the emulsified asphalt may significantly reduce the viscosity and may make the material unsuitable for tack coat use. For this reason, limit pumping between the bulk storage tank, hauling transportation, field storage tanks, and distributors to an absolute minimum to maintain proper viscosity. Final acceptance of emulsified asphalt will be at the point of application.

D. Dilution of the tack coat material may be allowed to a maximum 1:1 ratio. Determine the proportion of water to be added to the emulsified asphalt. Do not dilute the emulsified asphalt until the City Engineer approves the dilution ratio. Add the water to the emulsified asphalt and mix according to the asphalt Supplier.

E. Obtain Samples according to AASHTO T 40 prior to dilution with water, if allowed. Samples will be tested at the ODOT Materials Laboratory or other laboratory as designated by the City Engineer. Emulsified asphalt will be tested within 30 calendar days from the date it is sampled.

2.7 Asphalt Concrete Pavement

A. General

The asphalt concrete pavement (ACP) shall consist of a hot mixture of asphalt cement, well-graded high quality aggregate, mineral filler and adhesive as required. It shall be plant mixed into a uniformly coated mass, hot laid on a prepared foundation and compacted to the specified density.

B. Asphalt Concrete Pavement

Materials shall be in accordance with "Section 00744 - Asphalt Concrete Pavement" and related sections of the Oregon Standard Specifications for Construction, current edition, supplemented and modified as follows:

1. Add the following to subsection 00744.02:

The terms "ACP" as well as "Agency" and "City" may be used interchangeably in this Technical Specification.

2. Project Mix Requirements

a. Level 3 ACP
b. 1/2-inch Dense Graded
c. Asphalt Cement PG 70-28

3. Add the following to the end of subsection 00744.11:

Testing of the asphalt cement used on this Project will be at the discretion and expense of the City.

4. Replace the first paragraph of subsection 00744.13 with the following:

00744.13 Job Mix Formula (JMF) Requirements - Previously prepared JMF will be allowed, provided adequate test data are available to document the suitability of the mix, the Contractor can document that the same materials are being used, the JMF was prepared within the last 12 months, and the JMF meets the requirements of these Specifications. Copies of the results of tests made on the mix during production on previous projects shall also be submitted if any are available.

Do not begin production on the Project until the JMF is reviewed by the City Engineer and written consent is provided to proceed. A new JMF is required if the asphalt cement grade, any additives, or the source of the aggregate change during production. Provide a JMF for the Project meeting the following criteria:

2.8 Asphalt Fog Seal

Asphalt for the asphalt fog seal shall consist of CSS-1, CSS-1h, or HFRS-P1 emulsified asphalt mixed with water at a rate of 1 to 1.

2.9 Street Monument Boxes

The monument boxes shall be as shown on the City Standard Drawings.

2.10 Concrete Characteristics

A. The Portland Cement concrete used for this Work shall be a commercial transit mix. The exact proportions of all the materials entering into the concrete shall be as established by an approved laboratory mix design and shall be changed only as directed by the City Engineer or Laboratory when necessary to obtain the specified strength, desired density, uniformity, or workability. Previously prepared mix designs will be allowed provided adequate test data is available to document the suitability of the mix and the Contractor can document that the same materials are being used. The mix design shall be provided to the City Engineer for review.

B. The concrete shall have the following characteristics.

Parameter	Value
Min. 28-day Compressive Strength	4,000 psi
Min. Cement per Cubic Yard	564 lbs./yd.
Max. Water-Cement Ratio	0.45
Air Content (range)	5-7 percent
Max. Allowable Slump	4 inches

C. In some localities, additional cement may be required to achieve the minimum 4,000 psi 28-day compressive strength. The use of additives will be allowed when designed into

the mix. Mixes used with reinforcing steel shall have a maximum water soluble chlorine ion content of 0.06 percent of mix design concrete weight.

2.11 Portland Cement

A. Portland cement shall conform to the requirements of ASTM C150, for Type I - II cement. The City may direct the use of Portland Cement of a type other than that specified in the Specifications. In this case, the City will pay the additional cost, if any, for the cement required over the cost of that specified or shall receive appropriate credit for any cement required of a lesser cost than that specified.

B. All cement shall be stored in a suitable weather-tight building in such a manner as to protect the cement from dampness and to permit easy access for proper inspection. Storage bins for bulk cement shall be weather-tight and constructed so there will be no dead storage.

2.12 Aggregates

A. General

All aggregates for concrete shall conform to the requirements of ASTM C33. No aggregate shall be incorporated into the Work until and unless the aggregates are approved by the City. The decision to perform any or all tests on aggregates shall be left to the City. Should testing of the aggregates be deemed necessary, Samples shall be selected at random from the stockpile and tested for conformance with the Specifications. When the aggregates have been approved by the City, the source shall not be changed without written approval from the City.

Fine and coarse aggregates shall be stored and measured separately. Aggregates shall be protected from contamination with dust, dirt, or other foreign materials.

B. Fine Aggregate

Fine aggregate shall consist of natural sand having hard, strong, and durable particles, which does not contain more than 2 percent by weight of such deleterious substances as clay lumps, shale, schist, alkali, mica coated grains, or soft and flaky particles. The grading of fine aggregate shall range uniformly from coarse to fine within the limits indicated in ASTM C33.

C. Coarse Aggregate

1. Coarse aggregate shall consist of clean, hard, fine grained, sound crushed rock, or washed gravel that does not contain in excess of 5 percent by weight of flat, chip like, thin, elongated, friable, or laminated pieces, or more than 2 percent by weight of shale or cherty material.

2. Any piece having a major dimension in excess of 2-1/2 times the average thickness shall be considered to be flat and/or elongated.

3. The maximum size of coarse aggregate shall not exceed 1-1/2 inches or one-fifth of the narrowest dimension between the forms nor three-quarters of the clear spacing between reinforcing bars. The minimum size of coarse aggregate shall be 3/4-inch unless approved otherwise.

4. Coarse aggregate shall be uniformly graded from coarse to fine within the limits allowed in ASTM C33.

2.13 Water

Water for mixing shall be clean, fresh, and free from injurious amounts of oil, acid, chlorides, sulfates, alkali, organic matter, or other deleterious substances.

2.14 Admixtures

The use of admixtures will be allowed only when included in the mix design or as specified. Admixtures used will be considered a means of improving workability and/or placement of the concrete. Admixtures shall conform to requirements:

Parameter	Reference
Air-entraining	ASTM C260
Water Reducer	ASTM C494, Type A
Set Retarding	ASTM C494, Type B
Water Reducing/Set Retarding	ASTM C494, Type D
High Range Water Reducing (Superplasticizer)	ASTM C494, Type F and G
Pozzolanic	ASTM C618
Fly Ash	AASHTO M 295, Class C or F

2.15 Pre-molded Joint Filler

Pre-molded joint filler for use in expansion (through) joints shall be asphalt-impregnated cane fiber and shall conform to ASTM D1751. The thickness shall be 1/4-inch or 3/8-inch or match existing adjacent expansion joints.

2.16 Truncated Dome Detectable Warning Texture

Truncated dome detectable warning texture used on sidewalk ramps shall be a material listed on the ODOT Qualified Products List as approved by ODOT for the intended use. See Oregon Standard Drawings RD755, RD756, and RD757, current edition.

2.17 Painting and Pavement Markings (General)

Use materials conforming to the requirements of Section 00850 of the Oregon Standard Specifications for Construction, current edition. Materials and Suppliers for paint, traffic beads, and pavement marking legends shall be listed in the ODOT Qualified Products List as approved by ODOT for the intended use.

2.18 Signs

Use materials conforming to the requirements of the City Standard Drawings.

2.19 Sign Posts

Use materials conforming to the requirements of the City Standard Drawings.

2.20 Street Lighting

A. Poles

1. Pole shaft: Hot rolled commercial quality carbon steel conforming to ASTM A595 grade A with 55,000 psi minimum yield strength, linear taper 0.14 foot/foot. The pole shaft shall have a diameter of 8 inches at the base.

2. Luminaire arm shaft: 11 gauge hot rolled commercial quality carbon steel with 55,000 psi minimum yield strength, linear taper 0.14 foot per foot with 2-3/8-inch O.D. by 8-inch straight section luminaire end.

3. Arm connection: Simplex plates 36,000 psi minimum yield strength, gusset plates 36,000 psi minimum yield strength.

4. Base plate: 36,000 psi minimum yield strength.

5. Four cast anchor bolt covers secured in place with stainless steel self-tapping screws.

6. All threaded fasteners to be galvanized unless otherwise noted.

7. Anchor bolts conform to ASTM A449.

8. Each luminaire shall have an inline fuseholder, SEC Model 1791-SF with an FRM-5 fuse on each phase conductor at the base of the pole. Access to these fuseholders shall be through the hand hole on the pole. Additional conductor length shall be left inside the pole to equal a loop having a diameter of 1 foot.

9. Streetlights shall be placed at 300-foot intervals and at each intersection.

B. Luminaire

1. All luminaires shall be LED cobra head style fixtures. GE Evolve LED Roadway Lighting or LEOTEK GreenCobra LED Streetlight models shall be used unless an equal product is approved by the city engineer.

2. Luminaires shall meet the following specifications:

   a. Type III medium distribution with cutoff optics.

   b. LED light sources shall produce a light color between 3,000 and 4,000 Kelvin.

   c. Energized by 240 volts.

   d. Luminaire shall include "per" receptacle and photocell.

   e. Finish shall be battleship gray.

   f. Light sources will meet or exceed the following efficiency and longevity benchmarks:

      1) Luminous efficacy: 65 lumens/watt

      2) Average lamp life: Greater than 50,000 hours

      3) Maintenance factor at 50,000 hours: 0.80

3. Luminaires shall be placed at 30 feet, 0 inches above the street surface for arterial lighting. Luminaires shall be placed at 28 feet, 0 inches above the street surface for residential lighting.

PART 3 - EXECUTION

3.1 Earthwork

A. Clearing and Grubbing

1. Clearing and grubbing shall include the removal and disposal of any obstructions, such as existing curbs, sidewalks, pavement, culverts, fences, etc., and organic material such as trees, tree stumps, brush, hedges, vegetation, roots, rubbish, posts, fences, topsoil, and any other obstacles or materials in the construction area which would prevent completing the Project, and which are unsuitable for road work construction.

2. All vegetation and rubbish shall be removed and disposed of by the Contractor in conformance with the requirements of local authorities controlling air pollution and solid waste disposal.

B. Roadway Excavation

1. Prior to any excavation, the area to be excavated shall be cleared and grubbed.

2. Roadway excavation shall consist of the excavation, haul, and satisfactory disposal of all materials taken from within the right-of-way for the construction of embankments, subgrade, shoulders, intersections, ditches, waterways, entrances, approaches (including excavation at private entrances outside the right-of-way), curbs, sidewalks, and incidental work, in accordance with the lines, grades, and cross sections shown on the Plans, and as required by the design engineer.

C. Embankments

1. Prior to construction of any embankment, the area beneath the embankment and the areas from which embankment material will be obtained shall be cleared and grubbed. The existing soil beneath the embankment shall then be compacted to 90 percent of maximum density as determined by ASTM D1557 for a minimum of 6 inches below ground surface. Any unsuitable material shall be removed prior to placement of any embankment.

2. Upon completion of the embankment foundation, embankment material shall be placed in horizontal lifts and compacted to 90 percent of ASTM D1557. Embankment lift depth shall not exceed the capability of compaction equipment being used to achieve the required compaction for the full depth of each lift. The embankment material shall be native or import free of vegetative or organic matter, boulders 6 inches or larger in diameter, or frozen material and shall be at or below optimum moisture content at the time of placement. Depending on the type of embankment material, the Contractor may have to scarify, aerate, water, or take other actions as necessary to bring soils to proper moisture in order to achieve the required compaction.

3. The embankment shall be brought to the lines and grade required on the Plans and as established by the design engineer. Any unsuitable material which may have been used in constructing the embankment shall be removed and replaced with suitable material and compacted at no cost to the City.

D. Roadbed Cuts

1. In roadbed cuts, the subgrade material shall be compacted to 90 percent of maximum density as determined by ASTM D1557 for a minimum of 6 inches below the top of the subgrade.

2. Depending on the type of material encountered, the Contractor may have to scarify, aerate or water, over-excavate, or take other actions as necessary to bring soils to proper moisture in order to achieve the required compaction.

E. Finishing of Subgrade

1. All roadbeds, ditches, and other excavations and embankments shall be trimmed accurately to the lines, grades and cross sections as shown on the Drawings and established by the design engineer and shall be finished in a thoroughly workmanlike manner to within plus or minus 0.05 foot of the required grade.

2. Upon completion of the subgrade and prior to placement of the geotextile fabric, if any, and aggregate base, the Contractor shall load test the finished subgrade surface. The load test shall consist of slowly driving a loaded dump truck over the road surface. The dump truck shall have a minimum capacity of 10 cubic yards. The City representative and Contractor shall note and mark any soft areas. The Contractor shall excavate out and either replace unsuitable material or properly compact all soft areas in order to provide a firm base that

conforms to these Specifications. Any soft areas that occur as part of the Project because of over-watering, improper compaction, weather, etc., shall be replaced.

F. Dust and Mud Control

1. The Contractor shall be responsible for controlling dust and mud caused by their operations. This shall include, but not be limited to, street work, trench work, shoulder work, sidewalk work, driveways, connecting streets, etc. The Contractor shall be responsible for controlling dust on the roadway surface until the time asphalt pavement is placed.

2. Dust and mud control performed by the Contractor is considered a normal part of the construction Project. If the Contractor fails to properly control the dust and mud, the City Engineer may request the Contractor to do so in writing. If, after 24 hours from this request, the Contractor has not corrected the dust or mud problem, the City may elect to have the corrective work performed and charge the Contractor for said Work.

3.2 Geotextile Fabric

A. Scope

This Work consists of furnishing and placing geotextile fabrics in underdrains, under embankments, over roadbed subgrade, and at other locations as shown on the Plans or directed by the City Engineer.

B. Fabric

Fabric placed for subgrade stabilization under embankments or over roadbed subgrade shall be placed parallel to the centerline of the roadway, with placement starting at the low side of the super elevation or crown. The fabric shall either be sewn together at all longitudinal and transverse edges or overlapped a minimum of two feet at all edges. Transverse overlaps shall be made in the direction of base material placement.

3.3 Aggregate Base Rock

A. Scope

Aggregate base rock shall be placed to the lines, depths, and grades shown on the City Standard Drawings. Prior to placement of the materials, each succeeding lift, i.e.,

subgrade, select pit run base, aggregate base, etc., shall be properly constructed and reviewed by a City representative.

B. Construction

1. The construction procedure described herein shall be understood to apply to each of the courses and/or layers of which the road base is to be constructed. The construction of the road base shall not be limited to the construction of the main roadway to which the Contract applies, but shall include the construction of base on approach roads, driveways, connecting roads and connecting streets as shown on the Plans.

2. After the subgrade is brought to the proper line, cross section and compaction, the aggregate materials shall be spread and shaped as required. The spreading and shaping of the aggregate materials shall be so performed as to prevent separation of the coarser material from the finer materials including the use of adequate water.

3. The aggregate materials shall be brought to proper moisture content as required for compaction and compacted to 95 percent of maximum density as determined by ASTM D1557.

4. The finished surface when tested with a 10-foot straightedge shall not vary from the testing edge by more than 0.05 foot at any point.

5. Following construction of each lift, the Contractor shall do such blading, brooming, watering, and other work as necessary to prevent raveling and rutting. These operations are to be continued as required until the lift is covered by a following lift or until all Work to be done under the Contract is completed. If the required compacted depth of the base rock exceeds 6 inches, it shall be constructed in two or more lifts, each lift not exceeding 6 inches in depth.

6. Upon completion of the aggregate materials and prior to placement of asphalt concrete pavement, the Contractor shall load test the finished base surface. The load test shall consist of slowly driving a loaded minimum 10 yard dump truck over the road surface. All soft areas shall be noted. The Contractor shall excavate and/or compact all soft areas in order to provide a firm base that conforms to these Specifications.

7. Gravel shoulders when required shall be constructed as a part of construction of the base and are not to be added on after completion of asphalt paving. The finished gravel shoulder shall be graded, trimmed and compacted to the required lines, grades and cross sections in a neat manner leaving the gravel shoulder flush with the edge of the asphalt pavement. Coarse segregated aggregate shall not be used in the construction of gravel shoulders. All such non-specification material shall be removed and replaced with specification material.

3.4 Pulverizing and Mixing Cement Base

This work shall include all tasks associated with the scarification (if needed), pulverization, spreading Portland cement, watering, mixing, shaping, and compacting to make the cement-treated base (CTB).

Prior to beginning any pulverization, mixing, or ground disturbance, the Contractor shall pothole existing known storm drainage lines and culverts to ensure sufficient depth of cover above said utility is maintained. In the event insufficient cover is discovered, the Contractor's operations shall be adjusted at those specific locations to protect said utilities. Coordination with the utility provider and the City Engineer shall be completed prior to any adjustments.

Scarifying: Before the cement is applied, pulverization or scarification may be required to the full depth of mixing. Scarification or pre-pulverization is a requirement for the following conditions:

1. When the pulverized existing pavement and base is more than 3 percent above optimum moisture content, scarifications shall be accomplished to dry the pulverized existing pavement and base to within 3 percent of optimum moisture content. Note, if the pulverized existing pavement and base is 3 percent below optimum moisture content, water shall be added.

2. When the cement is applied in slurry form, scarification shall be done to provide a method to uniformly distribute the slurry over the pulverized existing pavement and base without excessive runoff or ponding.

3. Mixing of the pulverized existing pavement and base, cement, and water shall be accomplished by the mixed-in-place method. The operations of cement spreading, water applications, and mixing shall be continuous and completed in daylight hours. The Type II cement can be added to the existing pulverized material in a dry or slurry form. The time from cement placement on the soil to

start of mixing shall not exceed 30 minutes whether using the dry or slurry form of cement application.

If applied in slurry form, the slurry mixer and truck shall be capable of completely dispersing the cement in the water to produce uniform slurry, and shall continuously agitate the slurry once mixed.

When using the slurry form, the total elapsed time from first contact of cement with water to application on the soil shall not exceed 60 minutes.

If cement application is in the dry form, mixing, spreading, compacting, and finishing shall be continuous. The total elapsed time between the addition of water to the soil-cement mixture and the completion of finishing shall not exceed 2 hours. No cement shall be spread or mixed when the soil or subgrade is frozen or when the air temperature is less than 40 degrees in the shade. No cement shall be spread more than 500 feet beyond the mixing operation, unless approved by the City Engineer. The mixing operation shall not exceed more than 500 feet beyond the grading, shaping, and compaction.

The following specifications shall be met:

Total Depth of Reclamation:	8 inches
Cement Content:	6 percent (estimated)
7-Day Strength:	750 psi

A. Mixed-in-Place Method

The mixing process shall incorporate Type II Portland cement through a second pulverization to the previously pulverized existing pavement and base to make a CTB. The CTB shall consist of pulverized existing pavement and base, Portland cement, and water uniformly mixed, compacted, finished, microcracked, and cured in accordance with these Specifications. The finished CTB shall conform to the lines, grades, thickness, and typical cross sections shown on the Plans. Mixing with Portland cement shall be to a depth of 8 inches and across the entire width of the roadway for the total project length unless otherwise directed by the City Engineer.

Mixing operation:

1. When using the dry form to apply the cement, the water shall be applied evenly across the width of the machine and metered through the mixing machine by approved pressure-distributing equipment.

2. For both forms of cement application, the cement shall be uniformly distributed and mixed with the pulverized existing pavement and base and any imported material as specified. Mixing shall be continued until the mixture is uniform in color and at the required moisture content throughout. Operations of cement spreading, water application, mixing, and grading mixed material shall result in a uniform soil, cement, and water mixture for the full 8-inch depth and width of the road.

3. The mixing operation may be accomplished by using either the same machine used for the pulverizing operation or a separate machine designed for in-place continuous mixing as approved by the City Engineer. The mixing machine shall be a single shaft or multiple shaft mixer. Agricultural disks or motor graders are not acceptable mixing equipment. Regardless of which method is used, a control system capable of metering or measuring the cement application rate to an accuracy of plus or minus one 1 pound per square yard shall be used.

4. The equipment used to spread the cement shall have weighing scales, a foot per minute gauge, and a revolution per minute vane feeder to provide control of the cement distribution process. The City Engineer may accept other quantity and quality control equipment after review and approval.

5. The metering system shall include a totalizer, so that the amount of water used during any given period can be read directly, and a gauge to indicate the instantaneous application rate during the mixing operation.

6. The application rate of the cement will be expressed in terms of pounds per square yard. This rate shall be calculated from the designated percent of cement based on the dry unit weight of the unmixed in-place material as determined by the Design Engineer.

7. The mixing operation shall be completed in continuous full width segments unless otherwise approved by the City Engineer. Each segment must be processed and compacted by the end of each day and opened to traffic.

8. The mixed material (CTB) shall meet the following gradation conditions:

    a. The final mixture (bituminous surface, granular base, subgrade soil, cement, and water) shall be pulverized such that 100 percent passes the 3-inch (75 millimeter [mm]) sieve, at least 95 percent passes the 2-inch (5mm) sieve, and at least 55 percent passes the No. 6 (4.75mm) sieve. No more than 50 percent of the final mixed material shall be made of the

existing bituminous material unless approved by the City Engineer and included in a mixture design. Additional material cannot be added to the top or front of the subgrade to improve the mixture gradation unless the material was included in the mixture design.

b. The final pulverization test shall be made at the conclusion of mixing operations. Mixing shall be continued until the product is uniform in color, meets gradation requirements, and is at the required moisture content throughout. The entire operation of cement spreading, water, and mixing for the full design depth and width shall be completed for one segment at a time as indicated above.

B. Compaction

1. The processed material shall be uniformly compacted to a minimum of 98 percent of maximum density based on a moving average of five consecutive tests with no individual test below 96 percent. Field density of compacted material can be determined by nuclear method in the direct transmission mode (ASTM D 2922, AASHTO T 310), sand cone method (ASTM D 1556, AASHTO T 191), or rubber balloon method (ASTM D 2167). Optimum moisture and maximum density shall be determined prior to start of construction and also in the field during construction by a moisture density test (ASTM D 558 or AASHTO T 134).

2. At the start of compaction, the moisture content shall be within 2 percent of the specified optimum moisture. No section shall be left undisturbed for longer than 30 minutes during compaction operations.

C. Finishing

1. As compaction nears completion, the surface of the CTB material shall be shaped to the specified lines, grades, and cross sections. If necessary or as required by the City Engineer, the surface shall be lightly scarified or broom-dragged to remove imprints left by equipment or to prevent compaction planes. Compaction shall then be continued until uniform and adequate density is obtained. During the finishing process, the surface shall be kept moist by means of water spray devices that will not erode the surface. Compaction and finishing shall be done in such a manner as to produce a dense surface free of compaction planes, cracks, ridges, or loose material. Finished portion of the CTB traveled on by equipment used in construction an

adjoining section shall be protected in such a manner as to prevent equipment from marring or damaging completed work.

2. The CTB shall be kept moist by means of water spray devices prior to the microcracking according to the curing specification below. The Contractor may not apply a curing compound in lieu of continuous moist curing until after microcracking has been accomplished.

D. Microcracking

Between 24 and 72 hours after completing the shaping and compaction of the CTB, the Contractor shall microcrack the CTB by making five passes with large vibratory rollers. Before, during, and after the microcracking process, the surface of the CTB shall be kept moist by means of water spray devices that will not erode the surface. After microcracking, in lieu of continuous moist curing, the Contractor may apply a curing compound.

E. Curing

1. After completion of shaping and compaction, the surface shall be cured by being kept continuously moist with a water spray that will not erode the surface of the CTB for the entire time prior to microcracking. After the microcracking process has been completed, the surface shall continue to be cured by either applying an approved curing material of by being kept continuously moist with a water spray that will not erode the surface for a period of 7 days after completion of shaping and compaction of the CTB. If curing material is used, it shall be applied no later than 24 hours after completing the microcracking operations.

2. For bituminous curing material, the CTB surface shall be dense, free of all loose and extraneous materials, and shall contain sufficient moisture to prevent excessive penetration of the bituminous material. The bituminous material shall be CSS-1 and be uniformly applied to the surface of the completed CTB and be according to fog seal requirements of Asphalt Fog Seal section. The application rate indicated shall be deleted. The application rate shall be between 0.15 and 0.30 U.S. gallons per square yard.

3. Should it be necessary for construction equipment or other traffic to use the bituminous covered surface before the bituminous material has dried sufficiently to prevent pickup, sufficient sand cover shall be applied before such use.

4. Sufficient protection from freezing shall be given the cement-treated material for 7 days after its construction or as approved by the City Engineer.

F. Traffic

Upon approval from the City Engineer, completed portions of CTB can be opened to low speed traffic and to construction equipment, provided moist curing operations are not impaired, and provided the CTB is sufficiently stable to withstand marring or permanent deformation. After microcracking, the section can be opened up to all traffic after the CTB has received a curing compound or subsequent surface and is sufficiently stable to withstand marring or permanent deformation. If continuous moist curing is employed in lieu of a curing compound or subsequent surfacing within 7 days, the CTB can be opened to all traffic after the 7-day moist curing period, provided the cement-treated baes has hardened sufficiently to prevent marring or permanent deformation.

G. Surfacing

Subsequent crushed gravel and ACP surfacing may be placed any time after finishing, as long as the CTB is sufficiently stable to support the required construction equipment without marring or permanent distortion of the surface. The Contractor shall receive written authorization from the City Engineer to commence placement of finish surfaces.

H. Maintenance

1. The Contractor shall maintain the CTB in good condition until all work is completed and accepted. Such maintenance shall be done by the Contractor at his own expense.

2. Maintenance shall include immediate repairs of any defects that may occur. IF it is necessary to replace any processed material, the replacement shall be for the full depth, with vertical cuts, using either cement-treated material or concrete. Faulty work shall be replaced for the full depth of treatment rather than by adding a thin layer of soil-cement to the completed work.

I. Construction Joints

1. At the beginning of each day's construction, a straight transverse construction joint shall be formed by cutting back onto the completed work. CTB for large, wide areas shall be built on a series of parallel lanes of convenient length and width meeting approval of the City Engineer. Straight longitudinal joints shall

be formed at the edge of each day's construction by cutting back into completed work to form a true vertical face free of loose or shattered material.

2. Special attention shall be given to joint construction to ensure a vertical joint, adequately mixed material, and compaction up against the joint. One mixed-in-place construction using traverse shaft mixers, a longitudinal joint construction adjacent to partially hardened soil-cement built the preceding day may be formed by cutting back into the previously constructed area during mixing operations.

3. Guide stakes, or control methods as approved by the City Engineer, shall be set by the Contractor for cement spreading and mixing.

3.5 Soil Sterilant

A. Upon completion of the base and prior to placement of asphalt concrete, the Contractor shall apply a soil sterilant to the surface of the base.

B. The applicator shall be licensed by the State of Oregon for the class of herbicide utilized. Any damage to adjacent areas caused by the sterilant shall be repaired by the Contractor at no expense to the City.

3.6 Pre-paving Conference

At least one week before paving is scheduled to begin, the Contractor will set up a pre-paving meeting between the Contractor and a City representative. If a paving Subcontractor is being used they shall also be present. The intent of the meeting is to allow the City representative and the Contractor to jointly review the proposed method of operation, equipment, personnel, mix, schedule, etc., along with these Specifications.

3.7 Overlay Preparation

A. Asphalt Concrete Patching

1. The City Engineer will mark all unstable or unsuitable areas. The Contractor shall then remove all material from the designated areas to a depth as detailed on the Plans or as required by the City Engineer.

2. The area shall then be backfilled as detailed on the Plans, or as required by the City Engineer. All materials shall be properly placed and compacted to these Specifications.

B. Asphalt Crack Sealing

1. All cracks and joints shall be routed and cleaned of all loose material and vegetation. Cleaning shall be accomplished with using a hook or other similar device to loosen the material and either blowing, brooming or flushing the material from the crack. After all cracks are cleaned, the entire paved surface shall be cleaned of foreign material. Care shall be taken not to refill the cracks with foreign material.

2. Filling of cracks and voids shall not commence until they are clean and dry.

   a. Voids in the base below the pavement shall be filled with clean sand and compacted. Cracks 1-inch and less in width shall be completely filled to the pavement surface with hot liquid rubberized asphalt conforming to ASTM D3405.

   b. Cracks greater than 1-inch in width shall be filled with a mixture of 50 percent 1/4-0 aggregate and 50 percent CSS-1 asphalt emulsion or other approved mixture to within 1/4 inch of the pavement surface and topped off with hot liquid rubberized asphalt.

   c. The following day, any cracks which are not completely full shall be topped off with additional rubberized asphalt. After sealing, the filler shall be broomed or squeegeed flush with the existing pavement surface and allowed to cure prior to constructing the asphalt concrete overlay.

   d. All sealed cracks shall be flush with the existing pavement after sealing is complete.

C. Cleaning

The existing surface of all areas to be overlaid shall be thoroughly cleaned of all loose material, dirt, debris, or other undesirable materials by brooming, flushing with water, or other methods acceptable to the City Engineer.

D. Asphalt Concrete Pre-leveling

1. All areas with irregular grades to be pre-leveled shall be marked by the design engineer and pre-leveled with 3/8-inch dense asphalt concrete.

2. The pre-leveling will be performed while the street is clean and thoroughly dry and will be accomplished by applying a tack coat of asphalt at a rate of 0.05 to

0.15 gallons per square yard and then placing and compacting the asphalt mix. The actual rate of tack coat application will be determined in the field by the design engineer.

3. The compaction of the asphalt concrete shall be accomplished with a pneumatic tired roller. The rolling shall follow directly behind the placement and be performed in such a manner that the entire surface receives at least four coverages of the roller. The pneumatic-tired roller shall be capable of exerting at least 80 pounds per square inch ground pressures and shall not be operated at speeds in excess of 5 mph. Finish rolling shall be accomplished with a steel wheeled roller and shall continue until all roller marks are eliminated.

E. Paving Fabric

Once the street is clean and all repair work is completed the paving fabric, if any, shall be installed where called for on the Plans. The following procedures and materials are to be used.

1. Track Coat Application

   a. Apply a tack coat of AR4000W graded asphalt cement at the rate of 0.15 to 0.25 gallons per square yard. This can only be done with the ambient temperatures above 60°F. The actual rate will be determined in the field by the design engineer to suit the existing surface.

   b. The tack material shall be between 275° and 325°F at the time of application and shall be applied with a single pass of distributor truck.

   c. An accessory hand sprayer shall be used on patches, lap sections and areas where truck spraying is impractical. It is extremely important that the tack coat be uniformly applied. Application will not be allowed unless the distributor equipment is operating properly.

2. The paving fabric shall be placed directly behind the distributor with the use of equipment that will provide automatic tensioning capabilities to assure fast wrinkle-free unrolling.

   a. Any minor wrinkles or air bubbles shall be brushed out with a stiff-bristle push broom. Wrinkles that won't brush out shall be cut out and a patch of fabric layered at least 6 inches in all directions be installed.

b. The fabric shall be cut into sections to match curves and corners. Overlap these sections and the start of all new rolls at least 6 inches and apply approximately 0.20 gallons per square yard tack coat to the seams.

c. If any blistering of the fabric arises a 4-ton tandem roller shall be used to restore the fabric adhesion prior to the overlay application.

3. The overlay work shall begin as soon after lay-down of the paving fabric as practical.

F. Asphalt Tack Coat

1. An asphalt tack coat shall be applied to existing pavement surfaces to be overlaid with new asphalt concrete, except where paving fabric has been placed. All pavement repair work and surface cleaning shall be completed prior to application of tack coat.

2. Provide an asphalt distributor designed, equipped, maintained, and operated so the emulsified asphalt material may be applied uniformly at even heat. The distributor shall be capable of applying the asphalt on variable surface widths up to 16 feet, at readily determined and controlled rates from 0.05 to 2.0 gallons per square yard, and with uniform pressure. The variation allowed from any specified rate shall not exceed 0.02 gallons per square yard. Provide distributor equipment that includes a tachometer, pressure gauges, accurate volume measuring devices, and a thermometer for measuring temperature of tank contents. Provide distributors equipped with a positive power unit for the asphalt pump, and full circulation spray bars adjustable both laterally and vertically. Set the bar height for triple lap coverage.

3. Apply the emulsified asphalt with a pressure distributor. Apply the emulsified asphalt to the prepared surface at a rate between 0.05 and 0.20 gallons per square yard as directed and with the emulsified asphalt temperature between 140°F and 185°F as recommended by the manufacturer. Application rates for tack coat diluted will be increased as necessary to provide the same amount of residual asphalt as the application rates specified above.

Do not place hot mixed asphalt concrete pavement or emulsified asphalt concrete pavement on the tack coat until the emulsified asphalt separates from the water (breaks), but before it loses its tackiness.

4. All surfaces must be clean and dry at the time of the tack coat application and at a temperature of at least 50°F. Remove all loose material from the surface. The tack coat shall only be constructed far enough in advance as is appropriate to ensure a tacky, sticky condition at the time the asphalt concrete is placed on it.

5. A tack coat will not be required between pavement lifts if paving of succeeding lifts occurs within 24 hours and the pavement surface is kept clean. If the pavement surface is not clean, as determined by the design engineer, a tack coat will be required between lifts.

3.8 Asphalt Concrete Pavement

A. Scope

After completion of the base, the Contractor shall place and compact the ACP to the lines, grades, thicknesses, and cross-sections shown on the Drawings and as established by the Design Engineer.

B. Construction

Construction shall be performed in accordance with applicable "Section 00744 - Asphalt Concrete Pavement" and related sections of the Oregon Standard Specifications for Construction, current edition, supplemented and modified as follows:

1. Delete subsection 00744.16 and 00744.17 and replace with the following:

00744.16 ACP Acceptance - Perform sampling and testing according to the "Quality Control" section of the General Requirements.

2. Replace subsection 00744.30 with the following:

00744.30 Paving Crew - Only trained and experienced personnel shall be used on the paving crew performing the Work. The Contractor shall submit to the City Engineer, prior to the pre-paving conference, job assignments, experience history, and training background for all members of the paving crew. Untrained and inexperienced personnel may not be used. The City Engineer may request personnel be replaced if it cannot be demonstrated that they have the proper training and experience to be a part of an experienced crew. The paving superintendent and paving machine operator shall have at least five years' experience, and the roller operators shall have at least two years' experience.

3. Replace Section 00744.40 with the following:

00744.40 Season and Temperature Limitations - Place ACP when the temperature of the surface that is to be paved is not less than the temperature indicated, unless approved by the City Engineer:

Nominal Compacted Thickness of Individual Lifts and Courses as shown on the typical section of the plans	**All Levels**
	Surface Temperature*
Dense Graded Mixes	
Less than 2 inches	60°F
2 inches - 2-1/2 inches	50°F
Greater than 2-1/2 inches	40°F
Temporary	40°F

* If placing MHMAC between March 15 and September 30, temperature requirement may be lowered 5°F.
** Do not use field burners or other devices to heat the pavement surface to the specified minimum temperature.

4. Add the following paragraph to the end of subsection 00744.42:

All edges of manholes, valve boxes, curbs, existing pavement, etc., that are to be in contact with the new asphalt concrete shall be cleaned and painted or sprayed with a thin tack coat. This tack coat is to be applied only far enough in advance as is appropriate to ensure a tacky, sticky condition at the time the asphalt concrete comes in contact with the structure. The application of the tack coat shall be done in a neat, workmanlike fashion. Any material inadvertently applied to surfaces outside the limits of the paving, such as on sidewalks, exposed sections of curbs, etc., shall be fully cleaned by the Contractor.

5. Delete the following subsections:

a. 00744.80
b. 00744.90

3.9 Adjustment of Utility Covers to Grade

The Contractor shall adjust the tops of all manholes, valve boxes, and other utility covers as required to bring the covers or gratings of the structures to the grade shown on the City

Standard Drawings. The Contractor shall repair any of these structures which are damaged during performance of the Work.

3.10 Asphalt Fog Seal

A. After the construction of the asphalt concrete, the City Engineer will evaluate the surface to determine whether a fog seal is required. When a seal is determined necessary by the design engineer, the Contractor shall apply an asphalt fog seal. It is anticipated that the application rate will be between 0.05 to 0.20 (0.03 to 0.10 residual) gallons per square yard. The application rate shall be determined by the design engineer.

B. The areas to be sealed shall be dry and free of dirt, dust, leaves, or other foreign matter at the time of placement.

C. Provide an asphalt distributor designed, equipped, maintained, and operated so the emulsified asphalt material is applied uniformly at even heat. The distributor shall be capable of applying the asphalt on variable surface widths up to 16 feet, at readily determined and controlled rates from 0.05 to 2.0 gallons per square yard, and with uniform pressure. The variation allowed from any specified rate shall not exceed 0.02 gallons per square yard. Provide distributor equipment that includes a tachometer, pressure gauges, accurate volume measuring devices and a thermometer for measuring temperature of tank contents. Provide distributors equipped with a positive power unit for the asphalt pump, and full circulation spray bars adjustable both laterally and vertically. Set the bar height for triple lap coverage.

D. Discontinue application of the emulsified asphalt fog seal sufficiently early in the day to permit the termination of traffic control prior to sunset. Apply emulsified asphalt to only one designated traffic lane at a time.

E. All of this Work, a portion of it, or none of it may be performed, depending on the evaluation made by the design engineer.

3.11 Street Monument Boxes

The Contractor shall provide and install cast iron street monument boxes at all points shown on the Plans. Monument boxes shall be installed during placement of the asphalt concrete pavement. The asphalt concrete shall be placed to leave a smooth ride. Monuments within the boxes shall be installed by others.

3.12 Restoration, Finishing, and Cleanup

A. Prior to the final inspection of the Work, the Contractor shall restore or replace all paved surfaces, graveled surfaces, curbing, sidewalks, trees and shrubbery, lawns, pastures and fences, or other existing facilities disturbed or damaged by their Work.

B. The Contractor shall cleanup and leave in a neat, orderly condition the right of way, and other property occupied in connection with the Work.

C. The Contractor shall reshape, clean out ditches, retrieve shoulders and slopes, and do all other work required to bring the Project to the final lines, grades, and condition called for. The finished Project shall be clean and neat in its final appearance.

3.13 Concrete Forms

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

3.14 Concrete General Placement and Finishing

A. The foundation and forms shall be well wetted prior to placement of the concrete. Unless otherwise specified, all concrete shall be placed upon clean, damp surfaces free of running or standing water, and never upon soft mud, dry porous earth, or frozen subgrade.

B. All concrete shall be placed before the initial set has occurred and unless otherwise authorized by the City Engineer. It shall be placed within 1-1/2 hours after water has been added to the mix. The temperature of the concrete at placement shall not be below 50°F or exceed 90°F unless approved otherwise by the City Engineer.

C. The concrete shall be placed on a moist base and deposited as close as possible to its final location and to its required depth. Movement of the concrete horizontally with a vibrator will not be allowed.

D. Once the concrete has been placed, it shall be struck off to the proper elevation using a straightedge and sawing motion. A smooth surface shall be provided after the concrete has been straight edged by the use of a bull float or Darbie. A wooden bull float shall be used unless the Contractor can show that a magnesium bull float does not seal in the bleed water.

E. Bull floating shall occur immediately after striking off and before bleed water accumulates on the surface. Bull floating shall be done in such a manner that the surface is not sealed, so bleed water is not trapped below the surface. Care shall be taken not to overwork the surface. The use of a jitterbug or tamper will not be allowed unless approved by the City Engineer. Initial edging shall be performed with a wide edger, again in a manner that will avoid sealing the surface.

F. Upon completion of the above floating, the concrete shall be allowed to sit until the bleeding has stopped, the bleed water has disappeared, and the concrete is firm enough to permit a man to walk on the surface leaving footprints no more than 1/4-inch deep. After the waiting period, the concrete may be floated and finished as required. Adding water to the surface or working bleed water to aid in finishing is not allowed.

3.15 Curing

A. As soon as the concrete has been placed and finished, as specified, it shall be cured:

1. By application of an approved Type 2, Class B white or gray pigmented or Type 1-D clear compound with fugitive dye liquid membrane-forming compound applied uniformly at a rate of at least 1 gallon per 200 square feet to the damp concrete by pressure spray methods; or

2. By keeping the concrete continually damp for at least 120 hours. The actual curing method and materials shall meet the requirements of ACI 308 and ASTM C309.

B. The Contractor shall submit a proposed method of curing to the design engineer prior to placement of any concrete.

C. The Contractor shall protect the newly placed concrete from vandalism and any other damages. The exact method of protection shall be left up to the Contractor. Any damages, regardless of the cause, shall be repaired or replaced to the satisfaction of the design engineer.

3.16 Restrictions Due to Weather

A. Cold Weather

1. Concrete placement in cold weather (50°F or less) will be permitted only under conditions that shall meet the approval of the City Engineer. In general, cold weather placing shall conform to "Recommended Practice for Cold Weather Concreting" (ACI 306).

2. Salts, chemicals, or other foreign materials shall not be mixed with the concrete to prevent freezing, unless such use is authorized by the design engineer in writing.

3. All concrete shall be effectively protected from frost action for a period of five days after placement. Upon written notice from the design engineer, all concrete that may have become damaged by frost action shall be replaced by the Contractor.

B. Hot Weather

1. For concrete placed during extremely hot weather (air temperature exceeding 95°F), the aggregate shall be cooled by frequent spraying in such a manner as to utilize the cooling effect of evaporation.

2. During such periods, the placement schedule shall be arranged, as approved, in such a manner as to provide time for the temperature of the previously placed concrete to begin to recede.

3. The mixing water shall be the coolest available at the Site insofar as is practical.

C. Low Humidity/Wind

1. Pouring of concrete during periods of low humidity (below 50 percent) and/or windy conditions should be avoided when feasible and economically possible, particularly when large surface areas need to be finished.

2. No concrete shall be placed if the rate of evaporation approaches 0.2 pounds per square foot per hour unless approved by the design engineer and precautions against plastic shrinkage cracking are taken.

3. In any event, surfaces exposed to the drying wind shall be covered up immediately after finishing with polyethylene sheets and be water cured continuously as soon as the concrete has set up. Curing compounds, in lieu of water, may not be used.

3.17 Backfill

A. After the concrete has reached sufficient strength, the space in back of structures shall be backfilled to the required elevation with the proper material as shown on the Plans, which shall be compacted until firm and solid.

B. When the entire Project has been finished, any damaged structure sections shall be repaired or replaced by the Contractor.

3.18 Curb and Curb and Gutter

A. General

1. Concrete curb and curb and gutter shall be constructed in accordance with these Specifications and the lines, grades, and cross sections shown on the Plans. They can be constructed with forms or with a curbing machine meeting these Specifications.

2. Curbs located on vertical or horizontal curves shall be constructed to result in a smooth curve.

B. Curbing Machine

1. The machine for extruding Portland Cement concrete curb shall be of the self-propelled type equipped with a material hopper, distributing screw, and adjustable curb forming devices capable of placing and compacting Portland Cement concrete to the lines, grades, and cross sections as shown in an even, homogeneous manner.

2. A grade line gauge or pointer shall be attached to the machine in such a manner that a continual comparison can be made between the curb being placed and the established curb grade as indicated by the offset guideline.

C. Placement and Finishing

1. The top and face of finished curb and curb and gutter shall be true and straight, and the top surface of curb shall be of uniform width free from humps, sags, honeycombs, or other irregularities.

2. When a straightedge 10 feet long is laid on the top face of the curb or on the surface of the gutter, the surface shall not vary more than 0.02 feet from the edge of the straightedge except at grade changes or vertical curves.

3. The Contractor shall construct all curb and gutter within 0.02 feet of true line, within 0.02 feet of established surface grade, cross section, and slope, and within 0.02 feet of specified thickness.

4. When the curbing machine is used, the Contractor shall feed the concrete into the extruding machine at a uniform rate and operate the machine under sufficient restraint in a forward motion to produce a well compacted mass of concrete.

5. All exposed surfaces of the curb or curb and gutter shall be floated, followed by a light brush finish.

6. If forms are used, they shall be removed after the concrete has taken its initial set and while the concrete is still green enough to finish.

7. Minor defects shall be repaired with mortar containing one part Portland Cement and two parts sand. Honeycombed, slumped, and other structurally defective concrete shall be removed and replaced at no expense to the City.

8. All exposed formed surfaces shall receive a rubbed finish utilizing a Carborundum brick or other abrasive until a uniform color and texture is produced.

D. Joints

1. Expansion Joints

a. Expansion joints shall be provided opposite abutting expansion joints, at the end of curved sections, at connections to existing curbs, and adjacent to any structure.

b. The width of joints and thicknesses of filler shall match those of the joints and abutting or underlying concrete; elsewhere the filler thickness shall be 1/2 inch.

c. Each expansion joint shall be at right angles to the structure alignment, vertical to the structure surface, placed full depth of the concrete section, and shall fully separate the concrete section.

2. Transverse Control Joints

a. Transverse control joints of the weakened plane or dummy type shall be formed in the exposed surfaces opposite control joints in abutting Portland Cement concrete and at other locations in the new curb as required to confine the control joint spacing to a maximum of 10 feet. The joints shall be formed by grooving, by insertion and removal of plates

or other devices, by insertion and leaving in place of preformed bituminous filler, or by sawing.

b. Control joints shall be 3/16-inch in width and a minimum depth of one-quarter of the thickness of the concrete. The edges of joints shall be tooled, unfilled grooves, and shall be clean and neat. Joint filler shall be even and flush with the surface of the concrete.

c. If the joints are constructed by sawing, the sawing shall be performed as soon as practical after pouring and prior to the occurrence of any shrinkage cracking.

3.19 Sidewalk and Driveway and Alley Approaches

A. General

Concrete sidewalks shall be constructed in accordance with these Specifications and the lines, grades, and cross sections shown on the Plans.

B. Placement and Finishing

1. Before the concrete is given the final finishing, the surface of the sidewalk shall be checked with a 10-foot straightedge; any irregularities of more than 1/4-inch in 10 feet shall be eliminated.

2. Edges, including those of expansion joints, shall be rounded with an approved finishing tool.

3. The final surface of the concrete shall receive a light cross brooming finish so as to provide a granular or matte texture that will not be slick when wet.

4. Cross brooming shall be transverse to the length of the sidewalk and approaches.

C. Joints

1. Expansion Joints

a. Expansion joints shall be provided as shown on the City Standard Drawings.

b. The width of the joints and thickness of the filler shall match those of the joints and abutting or underlying concrete; elsewhere, the thickness shall be 1/2 inch.

c. Each expansion joint shall be at right angles to the structure alignment, vertical to the structure surface, placed full depth of the concrete section, and shall fully separate the concrete section.

2. Transverse Control Joints

a. Transverse control joints are required to be spaced at a distance of 10 feet.

b. The joints between sections shall be formed by steel templates 1/8-inch in thickness. Joints shall be at right angles to the alignment. Only tooled joints are allowable. Cutting joints with a concrete saw shall not be permitted.

3.20 Steps

A. General

Steps shall be constructed in accordance with these Specifications and to the lines, grades, and cross sections shown on the Plans.

B. Placement and Finishing

1. All edges shall be rounded with an approved finishing tool. All horizontal surface of the step shall receive burlap or cross-brooming finish to provide a granular or matte texture which will not be slick when wet.

2. After the forms are removed and while the concrete is still green, the vertical surfaces shall be finished.

3. Minor defects shall be repaired with a mortar containing one part Portland Cement and two parts sand. Honeycombed, slumped, and other structurally defective concrete shall be removed and replaced at no expense to the City.

4. All vertical surfaces shall receive a rubbed finish utilizing a Carborundum brick or other abrasive until a uniform color and texture is produced.

3.21 Reinforcing Bars

A. Mild steel reinforcing bars shall be furnished, cut, bent, and placed as indicated on the Drawings and to the latest methods of practice approved by the Concrete Reinforcing Steel Institute.

B. At the time of placing concrete, all reinforcement shall be free from loose mill scale, rust, grease, or other coating that might destroy or reduce its bond with concrete. Steel reinforcement not placed in the Work shall be stored under cover to prevent rusting and shall be placed on blocking so no steel touches any ground surfaces.

C. Reinforcing steel shall be in position before concrete placement is begun. All reinforcing steel shall be tied together and supported in such a manner that displacement during placing of concrete will not occur.

3.22 Truncated Dome Detectable Warning Texture

Truncated dome detectable warning texture shall be installed in accordance with the manufacturer's requirements and in accordance with Oregon Standard Drawings, current edition.

3.23 ADA Requirements

All sidewalks, curb ramps, etc., shall be constructed in accordance with all ADA standards and requirements. The Contractor shall immediately notify the City Engineer if non-ADA work is being required or being performed.

3.24 Testing and Inspection

The Contractor shall provide and maintain a quality control program that will ensure the quality of the Work and materials incorporated into the Project. See the Quality Control section of the General Requirements.

A. Contractor's Responsibilities

1. The Contractor shall provide routine testing and inspection services on materials and Work incorporated on the Project for quality control purposes. These tests include, but are not limited to, spot gradation checks, slump, air content, and compressive strength.

a. Slump. Concrete shall be tested for slump in accordance with ASTM C143.

b. Air Content. Air content shall be tested in accordance with ASTM C231.

c. Compressive Strength. Sample concrete cylinders shall be taken from the Work by the Contractor or their representative. At least three identical cylinders may be taken not less than once a day, nor less than once for each 50 cubic yards of concrete placed. When the frequency of testing will provide less than five tests for a given class of concrete, tests may be made from at least five randomly selected batches or from each batch if fewer than five are used, or as required by the City Engineer.

2. All cylinders shall be prepared and cured in accordance with ASTM C31 and tested in accordance with ASTM C39. One cylinder shall be tested at the age of seven days and two at the age of 28 days. Each strength test result shall be the average of the two cylinders from the same Sample tested at 28 days.

3. The results of all tests performed on materials to be used on the Project by the Contractor shall be submitted to the City Engineer.

4. The Contractor shall notify testing and inspection personnel at least 24 hours in advance of operations to allow for personnel assignments and test scheduling.

5. All materials to be tested shall be provided by the Contractor.

6. After tests are completed, the Contractor shall be responsible for repairing test areas to match original conditions. The Contractor shall remove all defective material from the Site.

3.25 Signs and Sign Posts

A. All signs shall be constructed, laid out, and installed in accordance with these Specifications and the Manual on Uniform Traffic Control Devices and in accordance with applicable sections of the Oregon Standard Specifications for Construction, current edition, Sections 00900 and 00910. Signs shall be provided and installed as called for on the Plans. Signs shall be securely set plumb and straight and in a workmanlike manner.

B. Wood sign posts shall be sized according to the current Oregon Standard Drawing TM670.

3.26 Pavement Markings

A. General

1. The Contractor shall place pavement markings as shown on the ODOT Standard Drawings, according to the Manual on Uniform Traffic Control Devices, the current edition of ODOT's Traffic Line Manual, and as specified herein. Apply the markings according to the manufacturer's recommendations. Furnish a copy of the manufacturer's instructions to the City Engineer a minimum of seven days before placing markings. Unless otherwise specified, apply pavement markings before public traffic is allowed on the freshly paved surface.

2. The Contractor shall remove and replace markings not conforming to these Specifications or not properly installed.

3. The Contractor shall install pavement markings so the completed markings have a uniform cross-section. Pre-formed markings 12 inches or wider may be fabricated from 12-inch or 6-inch wide material.

B. Substrate Materials

1. Materials shall be applied to a surface that is clean, dry, free of contaminants, and meets the following requirements:

a. New Asphalt Concrete

Materials shall be applied to new asphalt concrete that is sufficiently cured, normally prior to opening the road to vehicle traffic.

b. Existing Asphalt Concrete

Materials shall be applied to existing asphalt concrete free of surface oils and existing road marking materials.

c. Portland Cement Concrete

Materials shall be applied to concrete that has reached a minimum compressive strength of 3,000 psi and is free of curing agents, laitance, surface oils, and road marking materials, normally prior to opening the road to vehicle traffic.

C. Prepare and Prime Pavement

1. The Contractor shall completely remove, by approved methods, existing pavement markings (painted, thermoplastic, raised buttons, or other durable materials) that are being replaced with new pavement markings, unless otherwise approved.

2. The Contractor shall clean the pavement before application of the marking material and shall remove contaminants such as curing compounds and existing pavement markings by an approved mechanical means. The Contractor shall sweep and air blast the pavement, as necessary, with an acceptable high-pressure system to remove extraneous or loose material. After the pavement surface is clean and dry, a primer shall be applied, if recommended by the manufacturer, to the area receiving the pavement markings. Primer shall be applied in a continuous, solid film according to the recommendations of the primer manufacturer and the pavement markings manufacturer.

D. Application of Pavement Markings

The Contractor shall follow the manufacturer's recommendations for installing the marking materials and shall provide manual or automatic application equipment as necessary for the job requirements.

1. Painted Markings

Paint and traffic beads shall be applied as specified for paint striping. Templates shall be used for the various pavement markings of the specified dimensions. Edges of the markings shall be crisp without excessive bleeding.

2. Type B: Preformed, Fused Thermoplastic Film

Longitudinal and transverse joints will be allowed with no overlap or gap permitted at the joint.

3.27 Pavement Striping

A. Equipment

The Contractor shall use paint sprayers made specifically for the purpose of applying paint, containing traffic paint beads, to a uniform width, thickness, and alignment on the roadway surface, using a truck-mounted three-gun system.

B. General

1. Striping shall be applied to the lines and locations shown in the ODOT Traffic Line Manual, or as directed. For overlays and shoulder widening projects, the Contractor shall replace striping to match existing striping unless otherwise directed. If the roadway has changed significantly or is a new roadway, the Contractor shall propose variations in standard layouts to handle unusual conditions, subject to approval.

2. The Contractor shall place permanent striping prior to traffic being allowed on the pavement or shall provide temporary lane markings such as temporary flexible reflective pavement markers or other approved method in accordance with the Manual of Uniform Traffic Control Devices.

C. Layout and Alignment

The Contractor shall lay out a spot alignment for the striping consisting of control points every 50 feet on tangent and every 25 feet on a curve, or as directed. The Contractor shall not proceed with striping prior to receiving approval of the layout by the design engineer.

D. Application

1. Two separate applications of painted longitudinal pavement markings shall be applied. The Contractor shall retrace the second application directly over the first application, within 1/16-inch as follows:

   - The second application shall be applied after 2 hours but within 48 hours of the first application.
   - For yellow colored markings, the second application shall be applied in the opposite direction of the first application. For white colored markings, the second application shall be applied in the same direction as the first application.

2. Each painted marking application shall be applied at a thickness of 15 mils wet, equivalent to 17 gallons per mile for a 4-inch wide solid stripe.

3. Reflective elements for each application shall be applied at a minimum rate of 5 pounds per gallon of paint. The Contractor shall embed, by means of paint wicking, a minimum of 80 percent of the reflective elements in the paint to a

minimum depth of 50 percent of their diameter. Minimum initial retroreflectivity shall be the following:

- White - 250 mcd/m2/lx
- Yellow - 200 mcd/m2/lx

4. When striping over open-graded HMAC, two applications of pavement striping shall be applied, the second retracing the first. The second application shall be performed approximately three weeks to a month after the initial striping is complete. Each application shall be applied at a thickness of 15 mils (wet), and include traffic paint beads.

5. The Contractor shall immediately clean up paint dribbled beyond the cutoff to avoid tracking of new paint. All areas tracked through will be reviewed by the City Engineer for possible cleanup and retracing.

E. Placement Tolerance

The Contractor shall place striping parallel and true to line and shall make skip ends square and clean. Skip stripes shall be placed so they are in cycle with at least one end of any adjacent project. Allowable tolerances for installation are:

1. Side to side - 1/2-inch on tangents, 1-inch on curves.

2. Length of skips - 10 feet, ±2 inches.

3. End to end on skips - 30 feet, ±2 inches. Place skips on cycle to a tolerance of 2 inches. A tolerance of 12 inches will be allowed on the first skip of a run, but it shall be on cycle in one skip.

4. Double lines - Parallel, with a gap tolerance of 1/2-inch.

3.28 Public Safety and Convenience

A. The Contractor shall provide for the safety and convenience of the public and shall protect applied markings from traffic until sufficiently dry so as not to be damaged or tracked by normal traffic movements. At a minimum, tubular markers or conical markers shall be placed next to all markings, and barricades shall be placed by all areas where cross traffic is anticipated. Additional protection, as required by the City Engineer, may be necessary and will be considered incidental to the pavement markings.

B. The Contractor shall immediately correct improper alignment, broken equipment, spilled product, or other striping problems that impair traffic, including appropriate traffic control. Documentation from the Oregon Department of Environmental Quality shall be provided indicating proper cleanup of spills. Blacking out or covering up the markings and/or lines will not be allowed, except in a short-term emergency, and when approved.

C. The Contractor shall conduct Work at all times for the least possible interference with the traveling public.

D. The Contractor shall not open any Work area to traffic that is not adequately striped and cured.

E. The Contractor shall not perform any Work, or close any lane to traffic, until the area is adequately signed and protected according to the Traffic Control Plan.

3.29 Disposal of Waste

Waste material is the property of the Contractor. All waste materials, including grindings and old markings, shall be removed from the Project Site and disposed of by the Contractor according to applicable state, federal, and local regulations. The cost of disposal will be incidental to the Work under these Specifications.

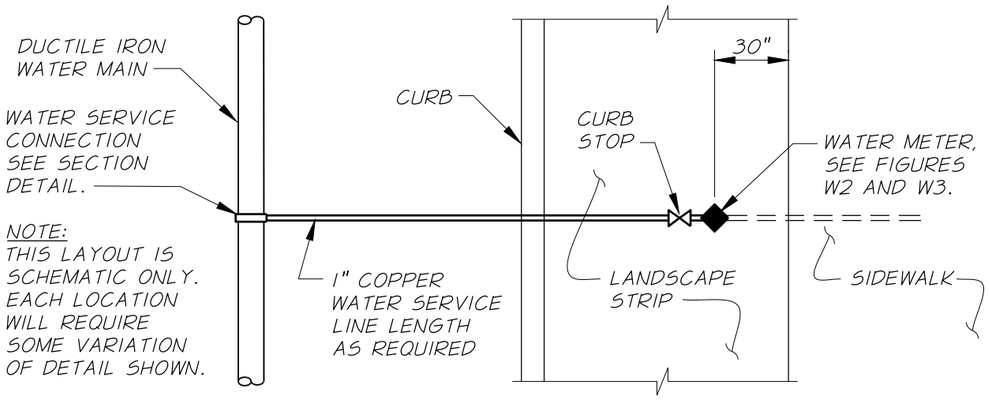
3.30 Removal or Repair of Unacceptable Work

The Contractor shall remove or repair all unacceptable work and dispose of it and shall repair or replace unacceptable work immediately if it causes a safety problem. The removed material becomes the property of the Contractor.

3.31 Paint Markings and Striping Warranty

The Contractor shall guarantee the paint markings and paint striping for a period of one year from the date of application against deterioration and/or delamination beyond normal wear.

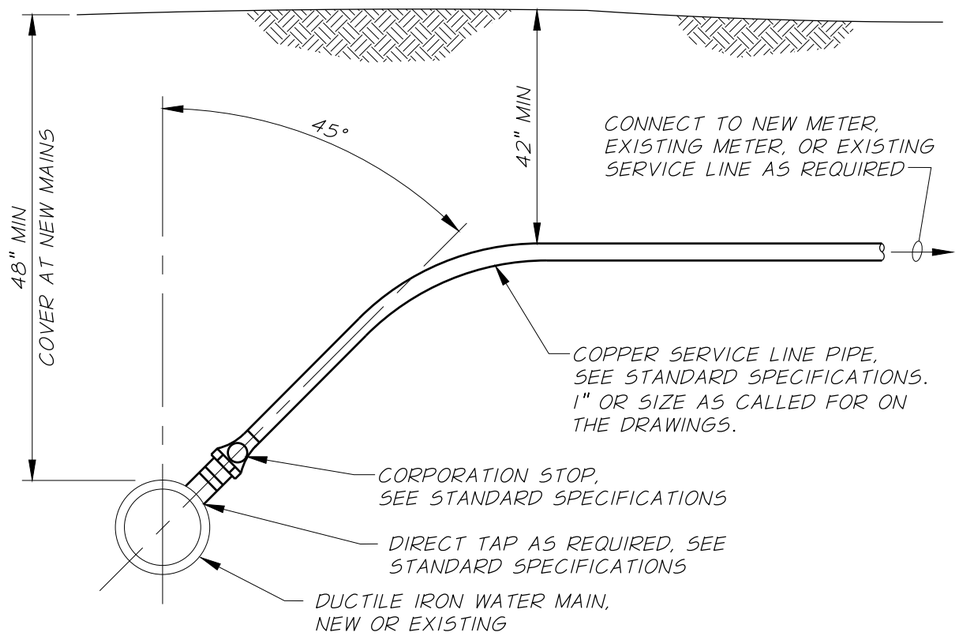
END OF SECTION



WATER SERVICE LINE DETAIL

PLAN

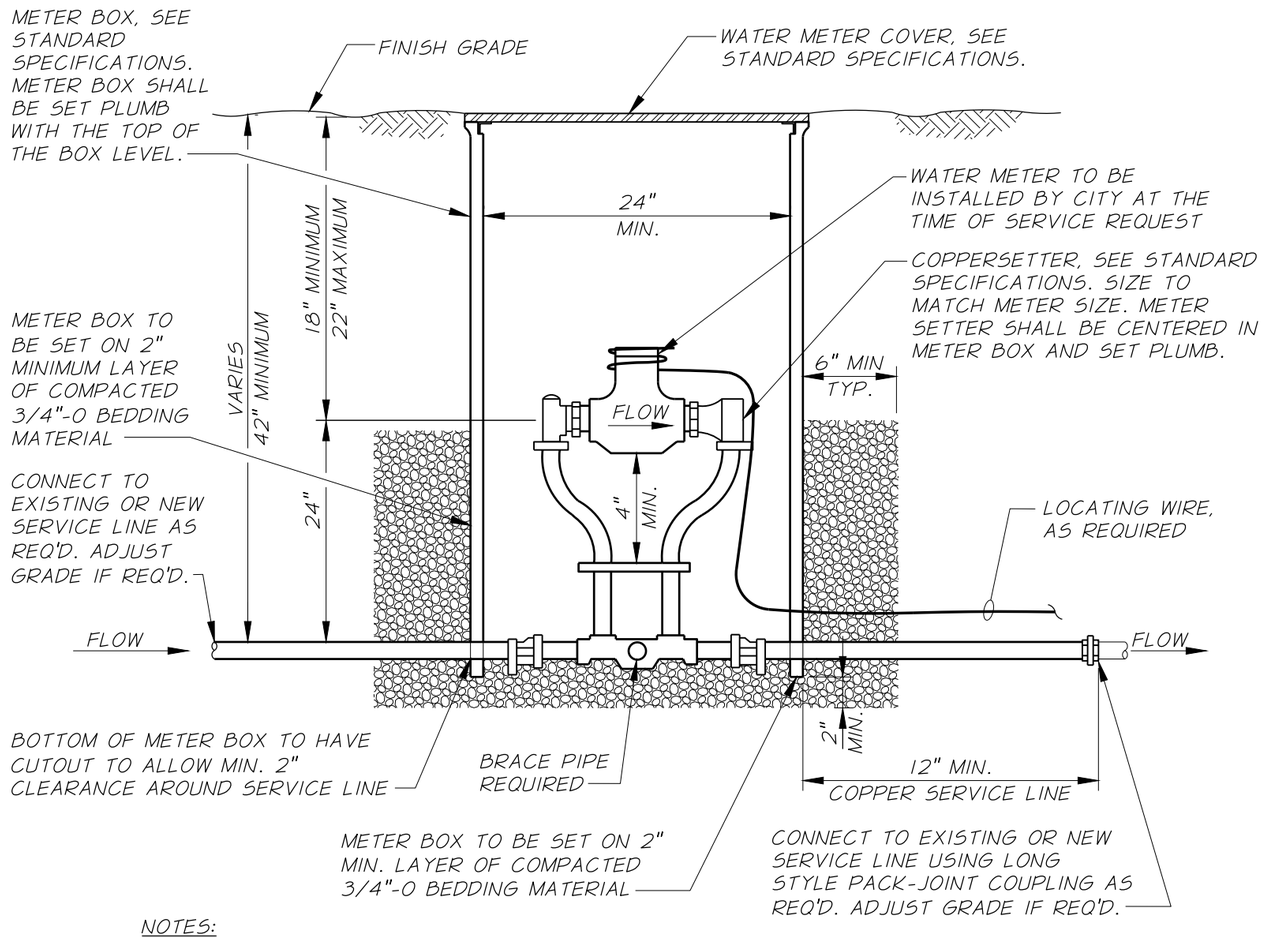
N.T.S.



WATER SERVICE LINE DETAIL

SECTION

N.T.S.



NOTES:

1. WHEN THE IMMEDIATE AREA AROUND THE WATER METER SITE IS HIGHER OR LOWER THAN THE EXISTING GROUND, THE CONTRACTOR SHALL FILL OR EXCAVATE AS REQUIRED TO BRING THE AREA TO A UNIFORM GRADE.
2. NEW DEVELOPMENT PROJECTS REQUIRE INSTALLATION OF COPPERSETTER AND METER BOX AS SHOWN.
3. IN NEW DEVELOPMENT WHEN SIDEWALK CONSTRUCTION IS REQUIRED OR ANTICIPATED, CONTRACTOR SHALL EXTEND WATER LINE FROM METER BOX LOCATION TO STREET RIGHT-OF-WAY LINE.
4. METER SETTER SHALL BE PERPENDICULAR TO CURB LINE.

TYPICAL 1" OR SMALLER WATER METER INSTALLATION

N.T.S.

REVISION	DATE

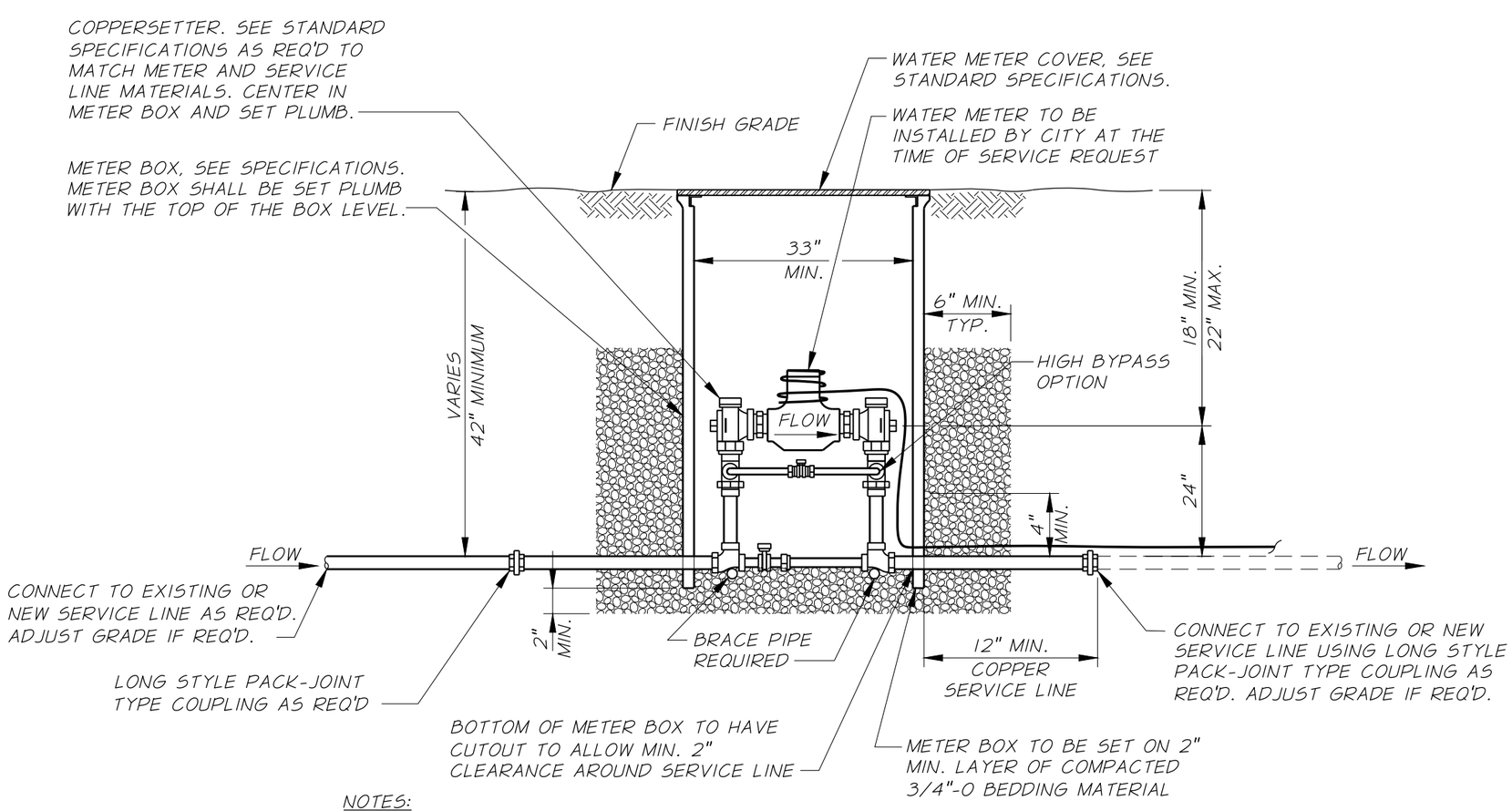
CITY OF
BAKER CITY, OREGON
OFFICE OF TECHNICAL SERVICES

STANDARD WATER DETAILS

WATER SERVICE LINE

FIGURE

W1



NOTES:

1. WHEN THE IMMEDIATE AREA AROUND THE WATER METER SITE IS HIGHER OR LOWER THAN THE EXISTING GROUND, THE CONTRACTOR SHALL FILL OR EXCAVATE AS REQUIRED TO BRING THE AREA TO A UNIFORM GRADE.
2. NEW DEVELOPMENT PROJECTS REQUIRE INSTALLATION OF COPPERSETTER AND METER BOX AS SHOWN.
3. IN NEW DEVELOPMENT WHEN SIDEWALK CONSTRUCTION IS REQUIRED OR ANTICIPATED, CONTRACTOR SHALL EXTEND WATER LINE FROM METER BOX LOCATION TO STREET RIGHT-OF-WAY LINE.
4. METER SETTER SHALL BE PERPENDICULAR TO CURB LINE.

TYPICAL 1 1/2" OR 2" WATER METER INSTALLATION

(WITH HIGH BYPASS OPTION)

N.T.S.

REVISION	DATE

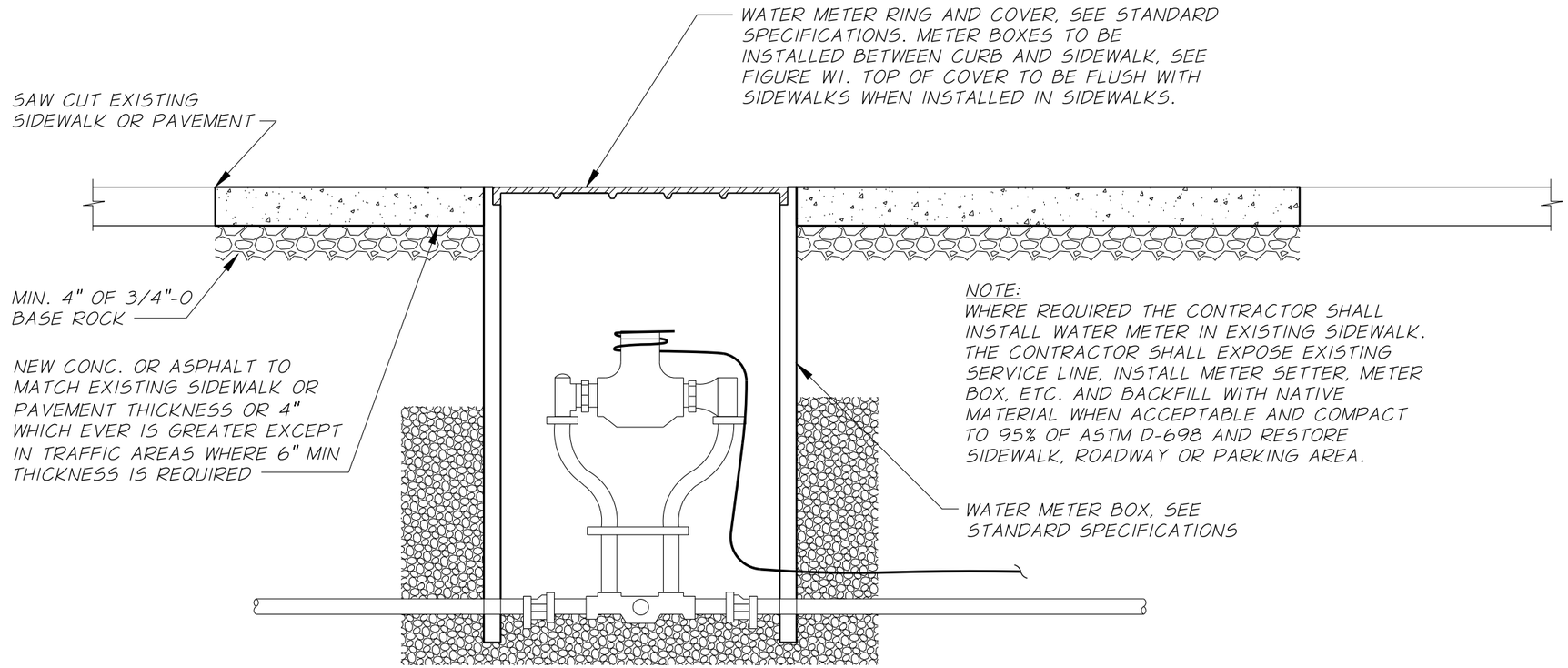
CITY OF
BAKER CITY, OREGON
OFFICE OF TECHNICAL SERVICES

STANDARD WATER DETAILS

LARGE WATER METER INSTALLATION

FIGURE

W2



WATER METER BOX IN SIDEWALK OR TRAFFIC AREAS

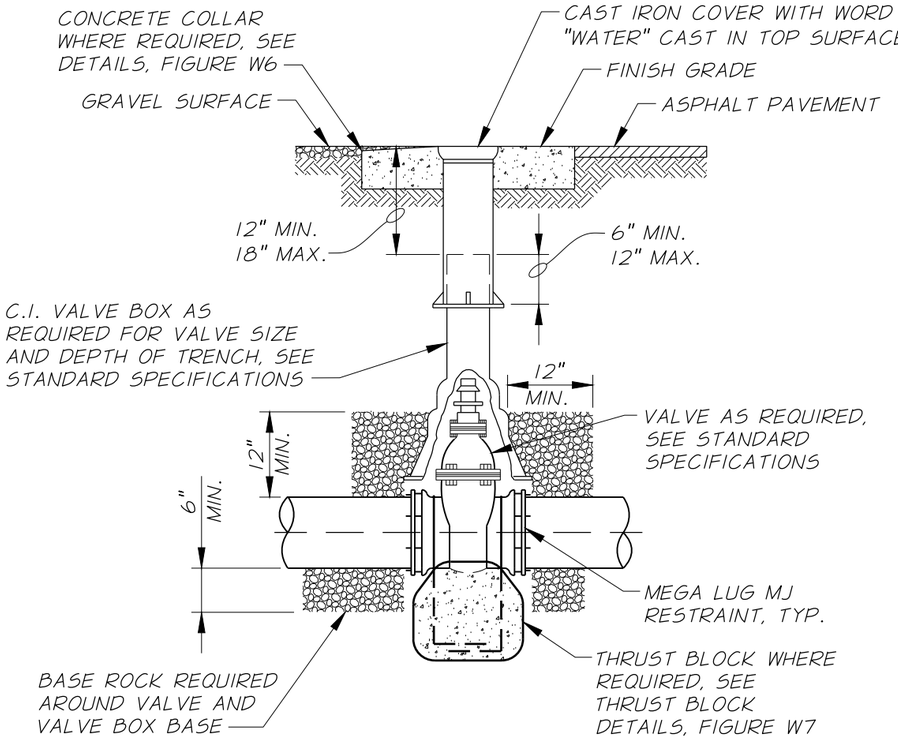
N.T.S.

REVISION	DATE

CITY OF
BAKER CITY, OREGON
OFFICE OF TECHNICAL SERVICES

STANDARD WATER DETAILS
WATER METER BOX IN SIDEWALK OR TRAFFIC AREAS

FIGURE
W3

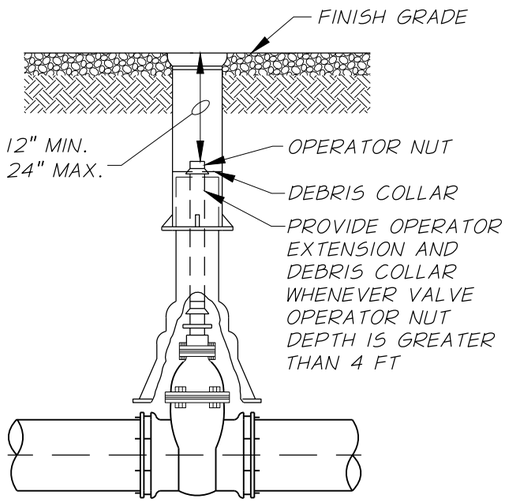


NOTES:

1. VALVE BOX SHALL NOT REST ON OPERATING ASSEMBLY.
2. OPERATOR EXTENSION REQUIRED WHEN VALVE NUT IS DEEPER THAN 4 FEET FROM FINISH GRADE. SEE DETAIL, THIS SHEET.
3. CENTER VALVE BOX ON AXIS OF OPERATOR NUT.
4. VALVE BOXES IN GRAVEL STREETS OR UNDEVELOPED AREAS SHALL BE SET APPROXIMATELY 3-INCHES BELOW FINISH GRADE SURFACE.

VALVE BOX ASSEMBLY DETAIL

N.T.S.

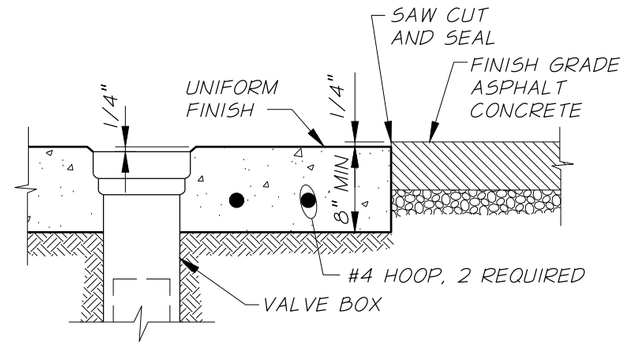


NOTES:

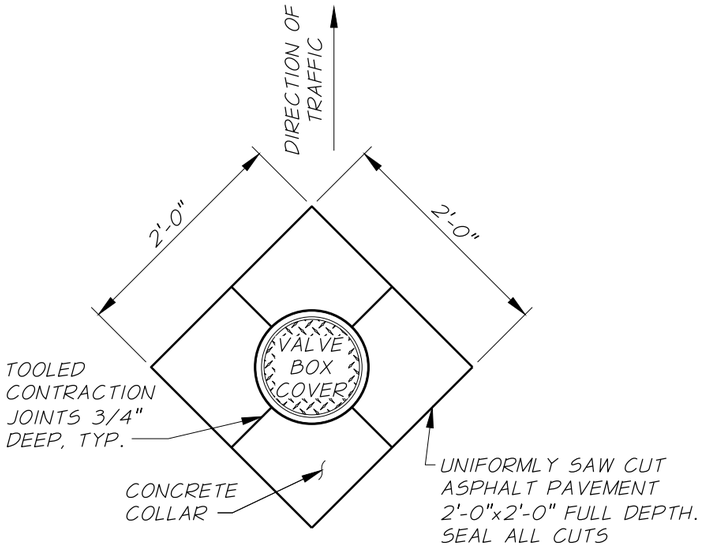
1. VALVE BOX EXTENSION SHALL BE CAST OR DUCTILE IRON.
2. VALVE BOX SHALL NOT REST ON OPERATING ASSEMBLY.
3. CENTER VALVE BOX ON AXIS OF OPERATOR NUT.
4. VALVE BOXES IN GRAVEL STREETS OR UNDEVELOPED AREAS SHALL BE SET APPROXIMATELY 3-INCHES BELOW FINISH GRADE SURFACE.

VALVE OPERATOR EXTENSION ASSEMBLY DETAIL

N.T.S.



TYPICAL SECTION



PLAN

REQUIREMENTS FOR CONCRETE COLLARS:

1. CONCRETE: 3/4", 4000 PSI AT 28 DAYS, 2" TO 4" SLUMP, 4-7% AIR.
2. SMOOTH BROOMED FINISH REQUIRED.
3. APPLY CONCRETE CURING COMPOUND.
4. PROTECT FROM TRAFFIC FOR 4 DAYS MINIMUM.

VALVE BOX CONCRETE COLLAR DETAIL

IN ASPHALT PAVEMENT

N.T.S.

REVISION	DATE

CITY OF
BAKER CITY, OREGON
OFFICE OF TECHNICAL SERVICES

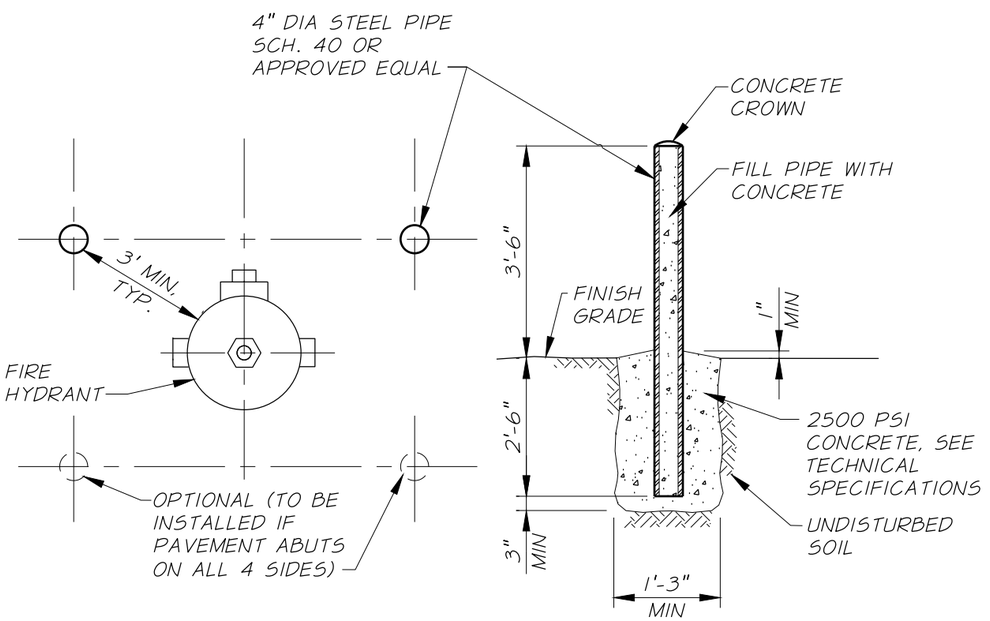
STANDARD WATER DETAILS

VALVE BOX DETAILS

FIGURE

W4

NOTES:
1. EXTENSIONS REQUIRED FOR HYDRANT SYSTEMS SHALL BE INSTALLED TO THE MANUFACTURER'S SPECIFICATIONS.
2. HYDRANTS SHALL BE PLACED TO PROVIDE A MINIMUM OF 3 FT. CLEARANCE FROM DRIVEWAYS, POLES, AND OTHER OBSTRUCTIONS EXCEPT BARRICADES.
3. CONCRETE THRUST BLOCKS SHALL BE CONSTRUCTED AS PER THRUST BLOCK STANDARD DETAILS. DO NOT BLOCK DRAIN HOLES.
4. HYDRANT LOCATION TO BE APPROVED BY THE CITY.



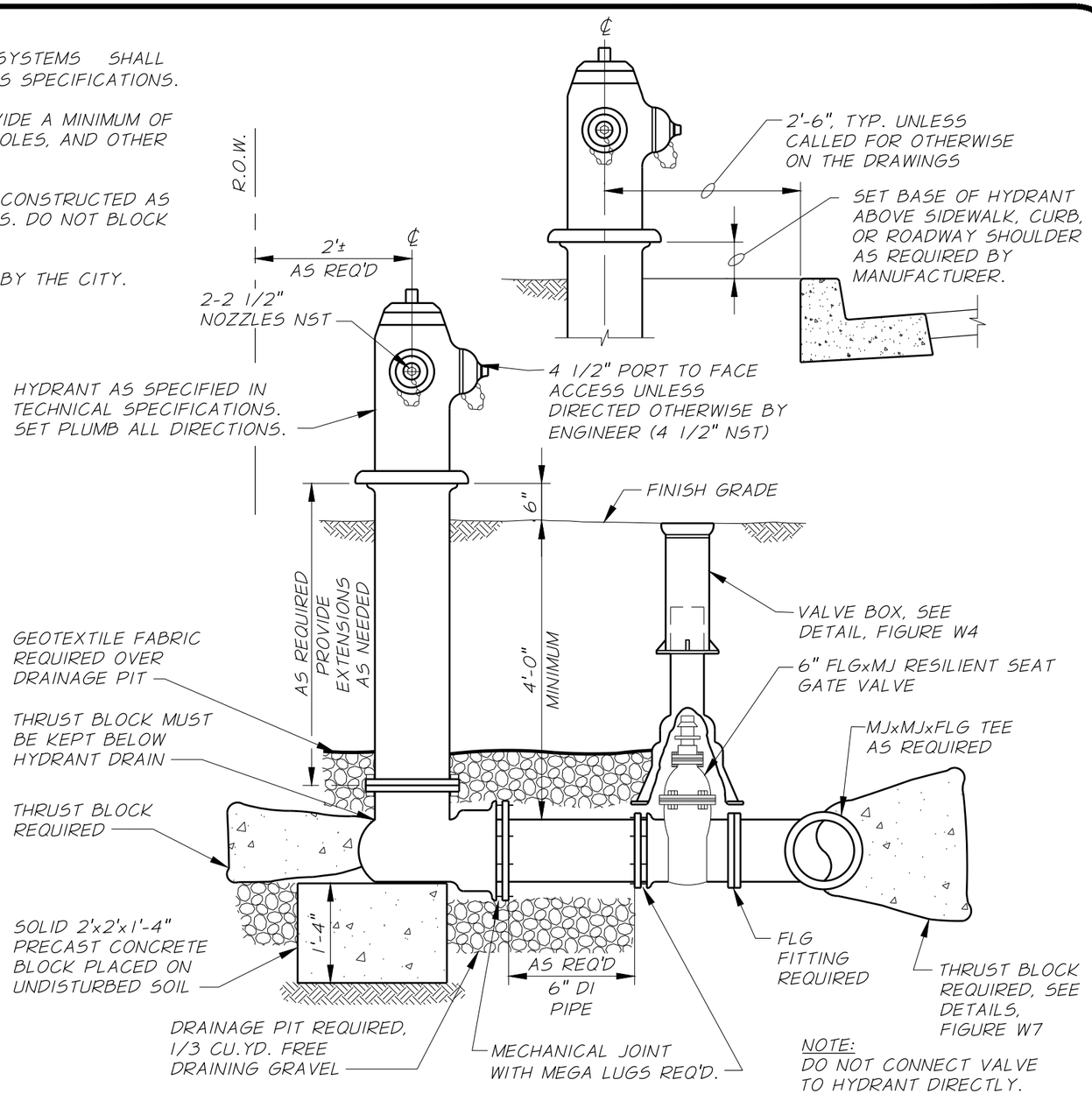
PLAN

SECTION

NOTES:
1. 4" DIA STEEL PIPE SHALL BE PLUMB.
2. LOCATE PIPES EQUIDISTANT FROM FIRE HYDRANT.
3. PAINTING SHALL BE DONE ONLY AFTER SURFACE IS FREE OF RUST, OIL, AND GREASE THE METAL SHALL BE PRIMED AND TWO FINISH COATS, YELLOW IN COLOR APPLIED.

FIRE HYDRANT BARRICADE DETAIL

N.T.S.



NOTE:
DO NOT CONNECT VALVE TO HYDRANT DIRECTLY.

FIRE HYDRANT AND AUXILIARY VALVE DETAIL

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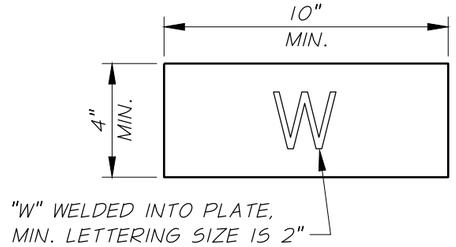
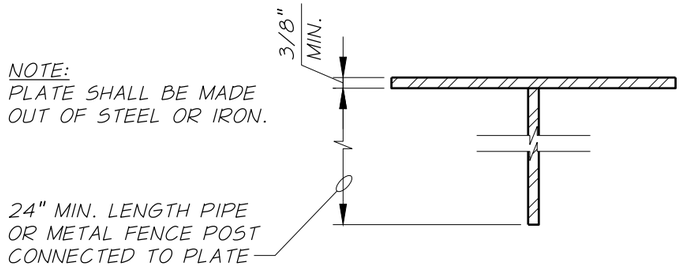
STANDARD WATER DETAILS

FIRE HYDRANT ASSEMBLY

FIGURE
W5



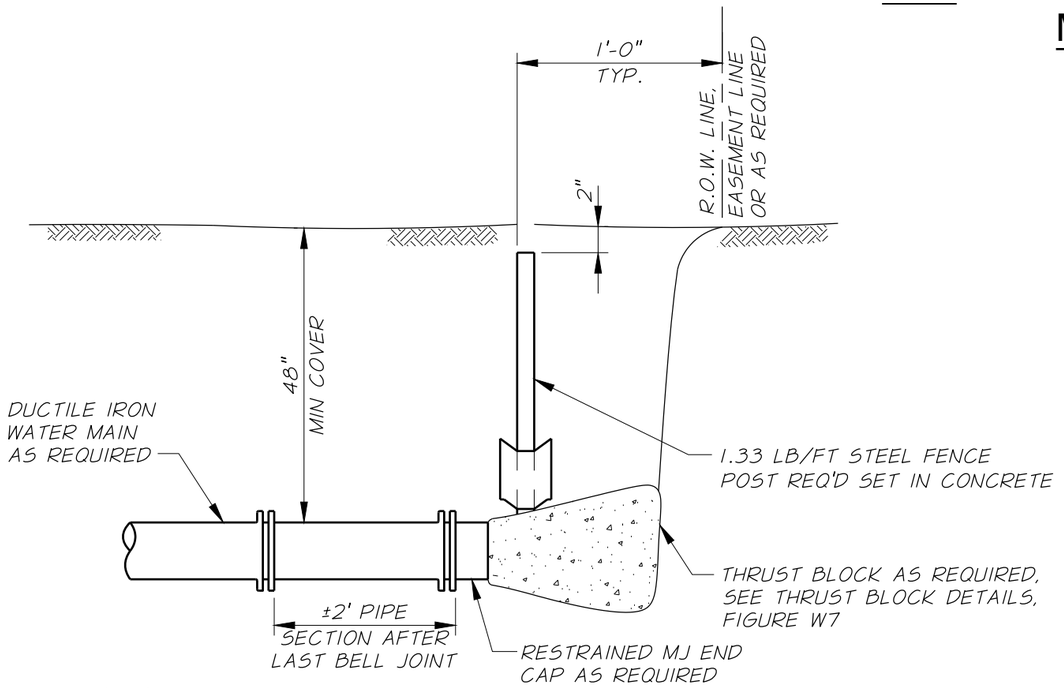
PLAN



SECTION

METAL MARKER DETAIL

N.T.S.



NOTES:

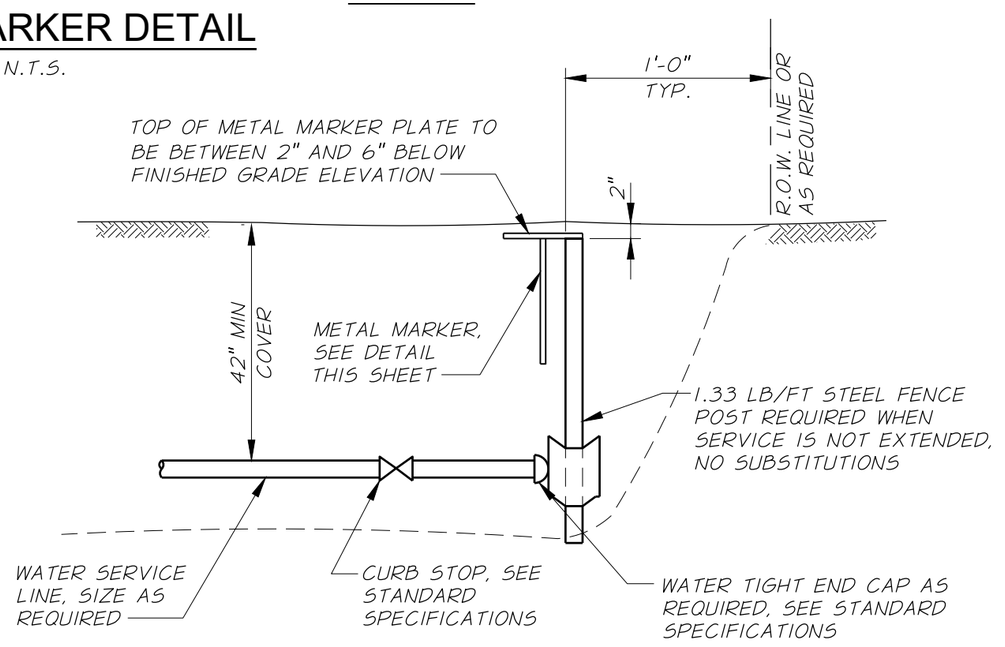
1. THE CONTRACTOR SHALL PROVIDE TWO REFERENCES FROM PERMANENT OBJECTS TO THE END OF WATER MAIN STUB. THESE TIES SHALL BE SHOWN AND DIMENSIONED ON THE "RECORD DRAWINGS" PREPARED BY THE CONTRACTOR.

2. CONTRACTOR SHALL PROVIDE A FIRE HYDRANT ON BLOW-OFF ASSEMBLY AT THE END OF DEAD-END MAIN LINES, AS REQUIRED BY THE CITY.

WATER MAIN STUB DETAIL

SECTION

N.T.S.



NOTE:
THE CONTRACTOR SHALL PROVIDE TWO REFERENCES FROM PERMANENT OBJECTS TO THE END OF WATER SERVICE LINE. THESE TIES SHALL BE SHOWN AND DIMENSIONED ON THE "RECORD DRAWINGS" PREPARED BY THE CONTRACTOR.

TYPICAL WATER SERVICE LINE STUB

SECTION

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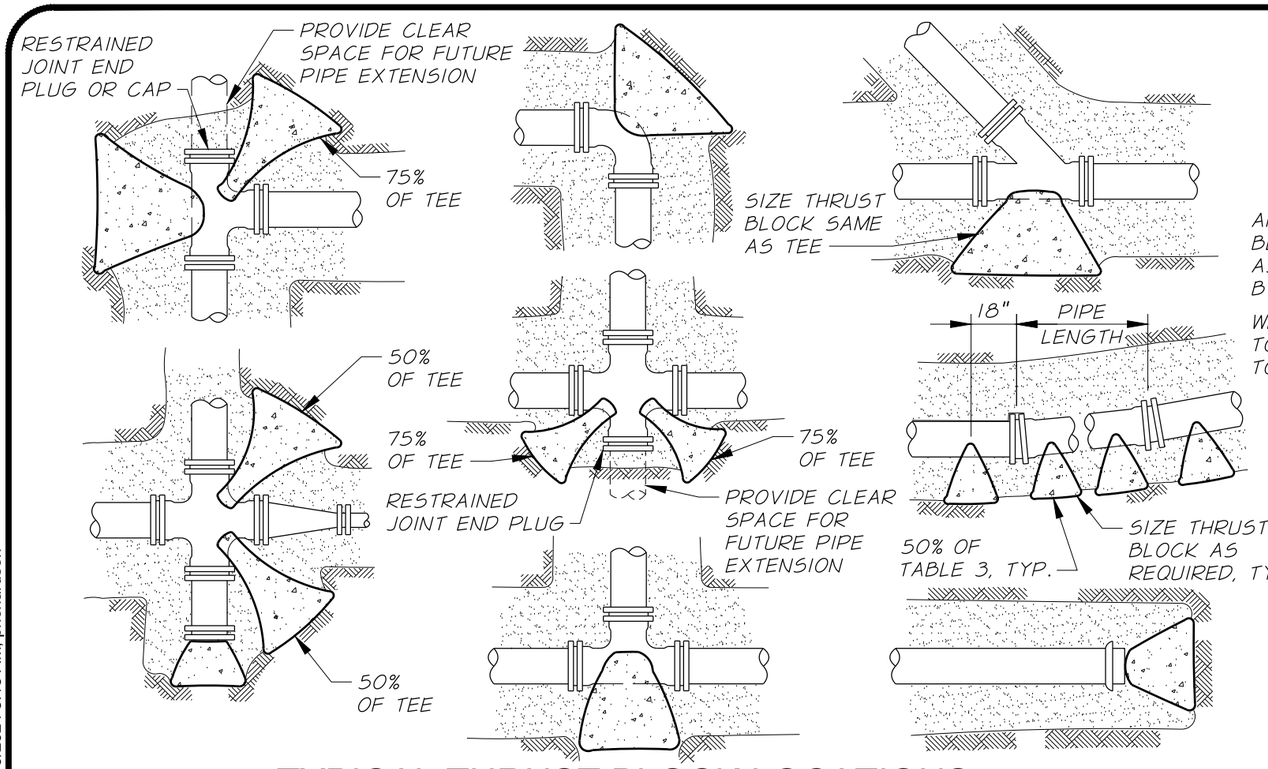
CITY OF
BAKER CITY, OREGON
OFFICE OF TECHNICAL SERVICES

STANDARD WATER DETAILS
WATER MAIN AND SERVICE LINE STUB DETAILS

FIGURE
W6

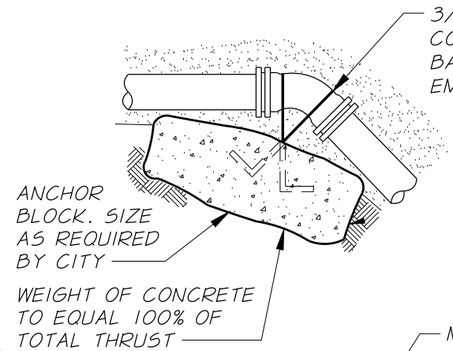


TYPICAL THRUST BLOCK LOCATIONS

PLAN VIEWS

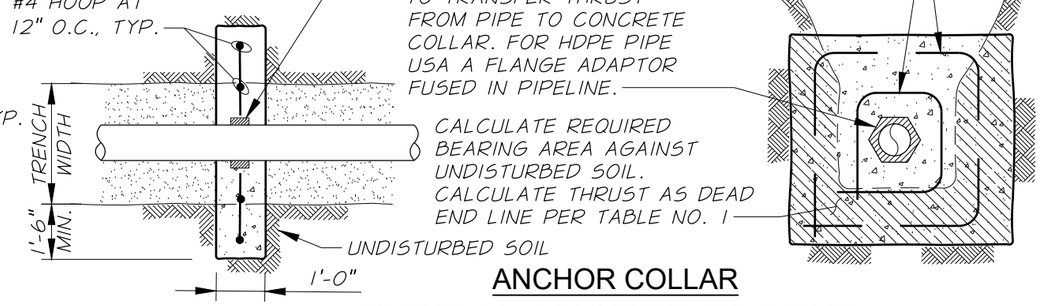
THRUST BLOCK NOTES

1. THRUST BLOCKS SHALL BE REQUIRED AT THE FOLLOWING LOCATIONS:
   A. ALL CHANGES IN DIRECTION.
   B. ALL DEAD-ENDS.
   C. WHEN REDUCERS ARE INSTALLED.
   D. ALL VALVES 8-INCHES AND LARGER SHALL BE SIZED FOR CLOSED CONDITION EXCEPTIONS:
      (1) WHEN RESTRAINED JOINT PIPE IS USED ON BOTH SIDES OF VALVE.
      (2) WHEN VALVE IS RESTRAINED JOINT CONNECTED TO A FITTING WHICH HAS APPROPRIATE THRUST BLOCKING.
   E. AT LOCATIONS SPECIFICALLY CALLED OUT ON THE DRAWINGS.
   F. AT TEMPORARY DEAD ENDS DURING PIPE INSTALLATION AS REQUIRED FOR TEMPORARY PRESSURE TESTING.
   G. AT OTHER LOCATIONS REQUIRED BY THE CITY.
2. THRUST BLOCKS SHALL BE SIZED AS REQUIRED BY SOIL CONDITIONS AND DESIGN PRESSURE.
3. PLACE CONCRETE AGAINST UNDISTURBED TRENCH WALL.
4. CONCRETE SHALL BE 2,500 PSI MINIMUM.
5. ALL CONCRETE SHALL BE PLACED SO THAT PIPE, FITTING JOINTS, BOLTS AND NUTS, ETC., WILL BE ACCESSIBLE FOR REPAIRS.
6. PLACE ONE LAYER OF VISQUEEN BETWEEN FITTING AND CONCRETE TO FACILITATE FUTURE REMOVAL OF THRUST BLOCK IF REQUIRED.
7. ANCHOR RODS SHALL BE 3/4" DIAMETER GALVANIZED STEEL RODS OR #6 EPOXY COATED REINFORCEMENT BAR, AASHTO M284, HAVING AN 18" MINIMUM EMBEDMENT IN CONCRETE.
8. THRUST BLOCK BEARING AREA SHALL BE SHOWN ON PLANS.
9. IF THE REQUIRED BEARING AREA IS LESS THAN 1 SQUARE FOOT, A THRUST BLOCK SHALL NOT BE REQUIRED.



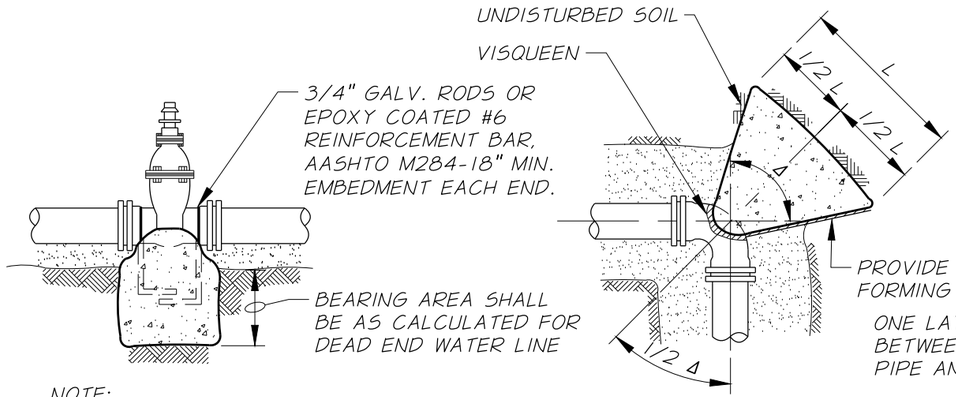
NOTE:
GRAVITY ANCHOR BLOCK TO BE SIZED BY CITY.

SECTIONS



ANCHOR COLLAR

TYPICAL ANCHOR BLOCKS



NOTE:
SEE THRUST BLOCK NOTES THIS SHEET FOR REQUIRED LOCATIONS OF THRUST BLOCKS FOR VALVES.

BEARING AREA (A) = HEIGHT (H) x LENGTH (L)
A=HxL

PLAN

SECTION

TYPICAL VALVE THRUST BLOCK

TYPICAL THRUST BLOCK DETAILS

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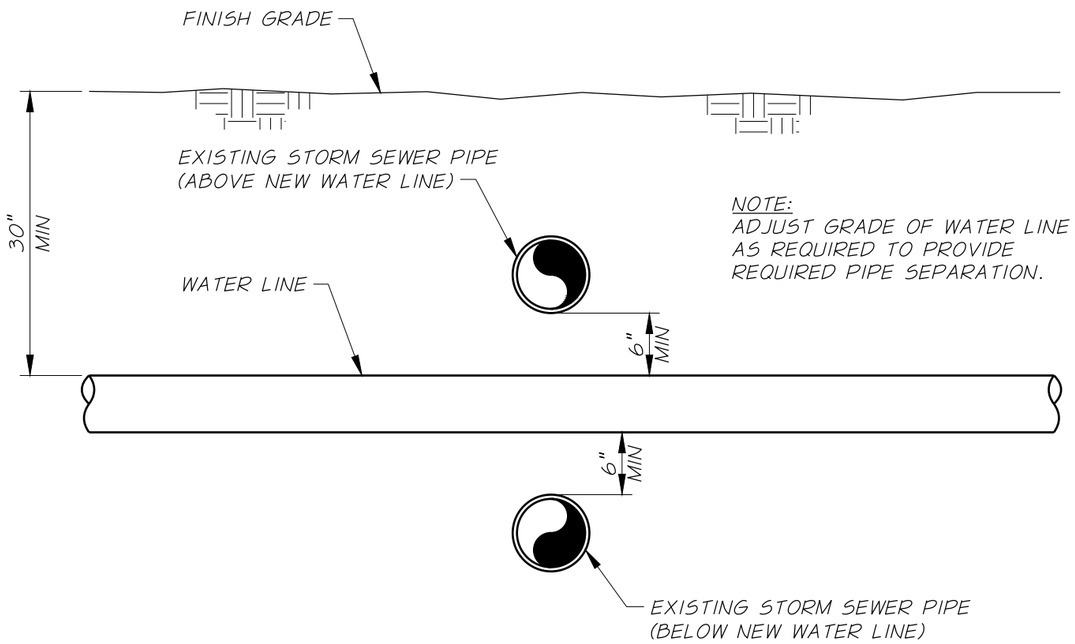
OFFICE OF TECHNICAL SERVICES

STANDARD WATER DETAILS

THRUST BLOCK DETAILS

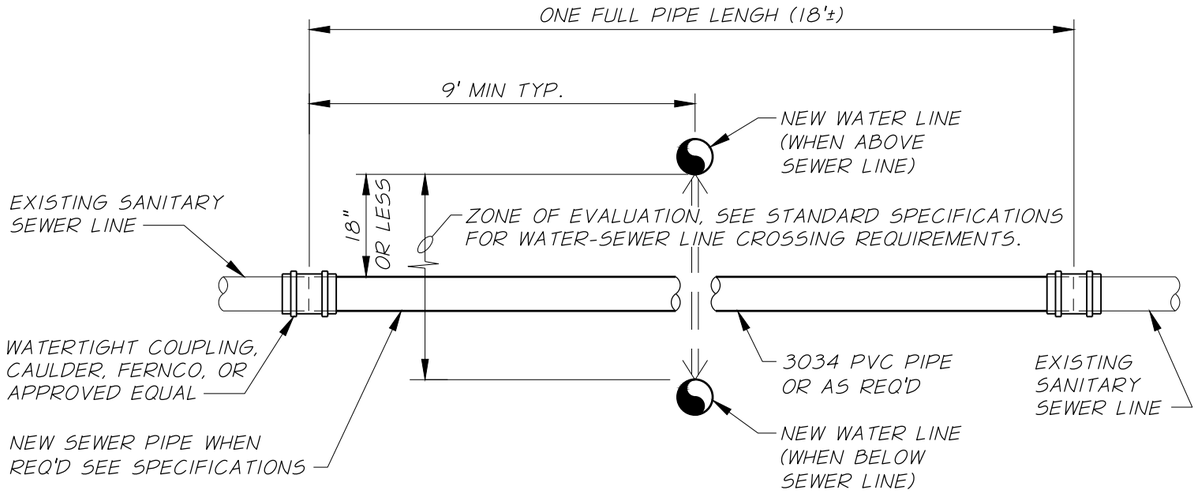
FIGURE

W7



WATER - STORM SEWER CROSSING DETAIL

N.T.S.



NOTE:

1. ALL BACK FILL IN AREA OF WATER-SEWER CROSSING TO A DEPTH 12" ABOVE THE TOP OF THE HIGHEST PIPE SHALL BE CONTROLLED-DENSITY FILL (CDF).

WATER - SEWER CROSSING DETAIL

(NEW WATER LINE CONSTRUCTION)

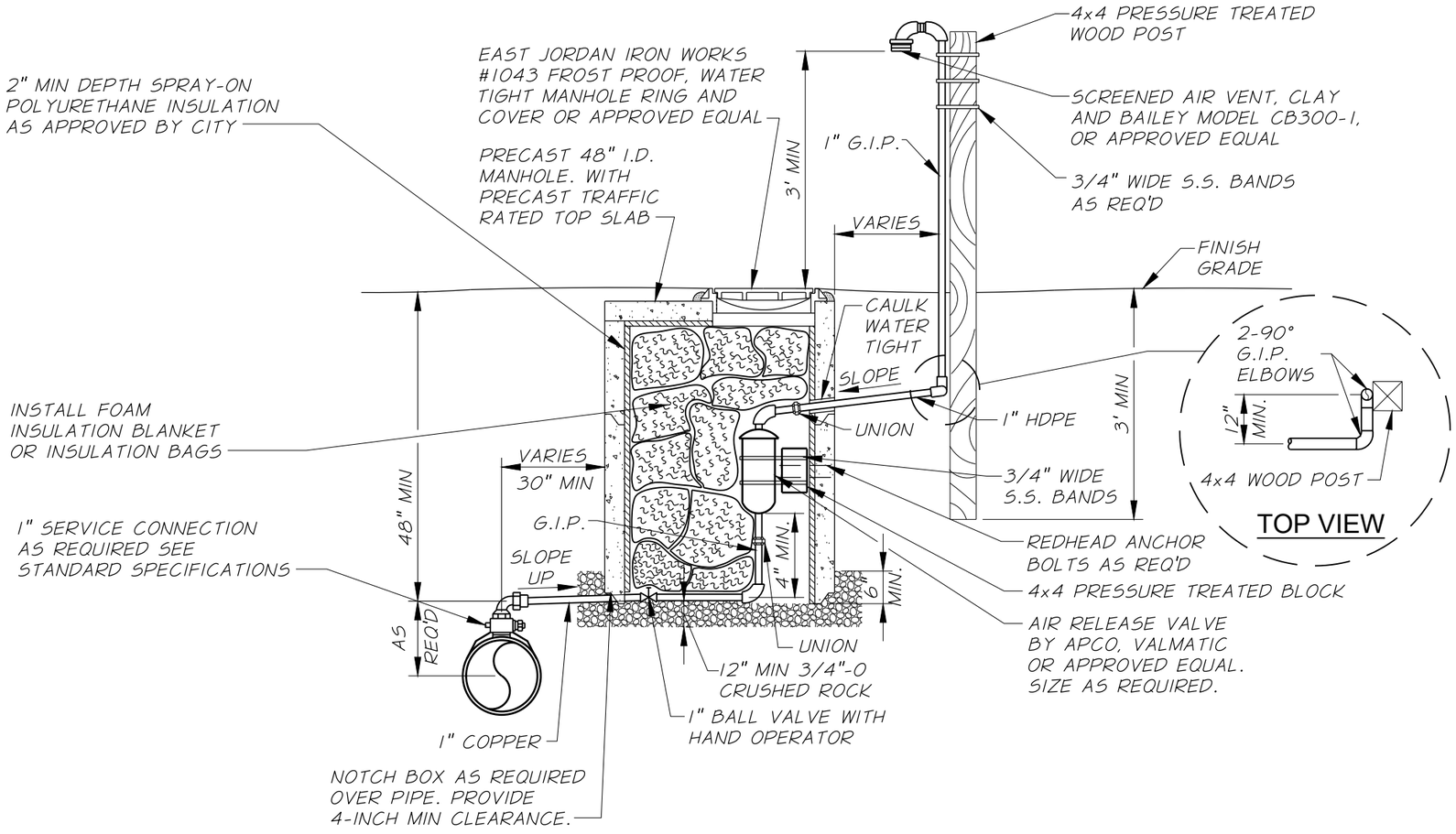
N.T.S.

REVISION	DATE

CITY OF
BAKER CITY, OREGON
OFFICE OF TECHNICAL SERVICES

STANDARD WATER DETAILS
WATER-STORM SEWER AND WATER-SEWER CROSSING DETAILS

FIGURE
W8



AIR RELEASE VALVE DETAIL

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REVISION	DATE

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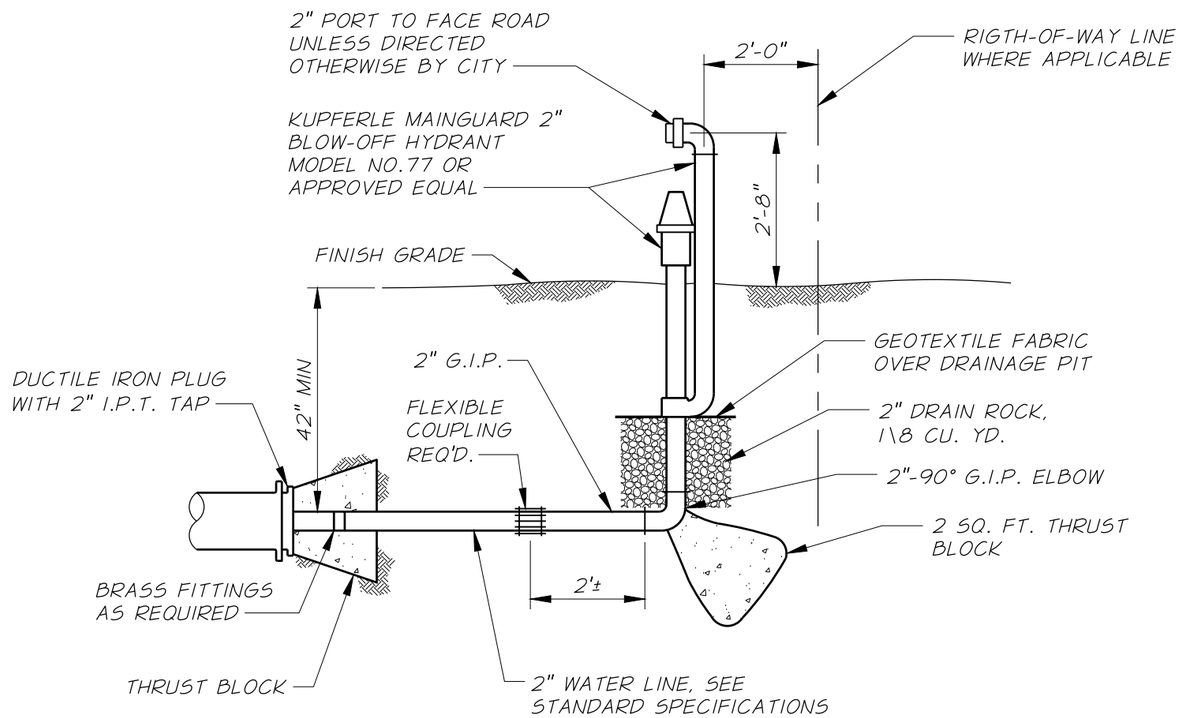
OFFICE OF TECHNICAL SERVICES

STANDARD WATER DETAILS
AIR RELEASE VALVE DETAIL

FIGURE
W9



NOTES:

1. DEAD END BLOW-OFFS TO BE APPROVED BY CITY. A HYDRANT MAY BE REQUIRED.

2. WRAP ALL PIPING TO BE THRUST BLOCKED WITH VISQUEEN TO FACILITATE FUTURE REMOVAL.

2" WATER LINE BLOW-OFF DETAIL

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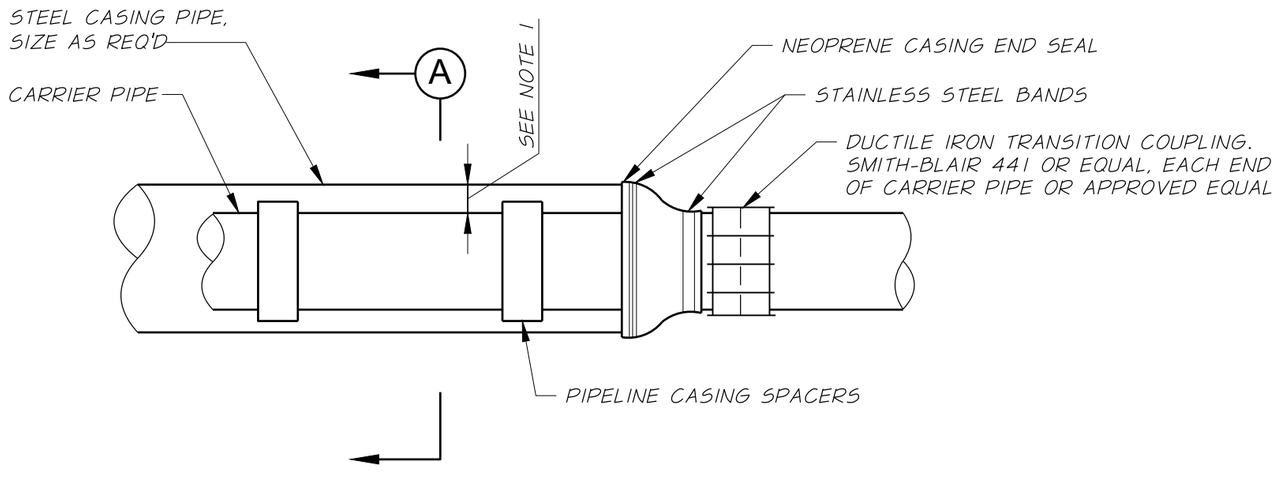
OFFICE OF TECHNICAL SERVICES

STANDARD WATER DETAILS
WATER LINE BLOW-OFF

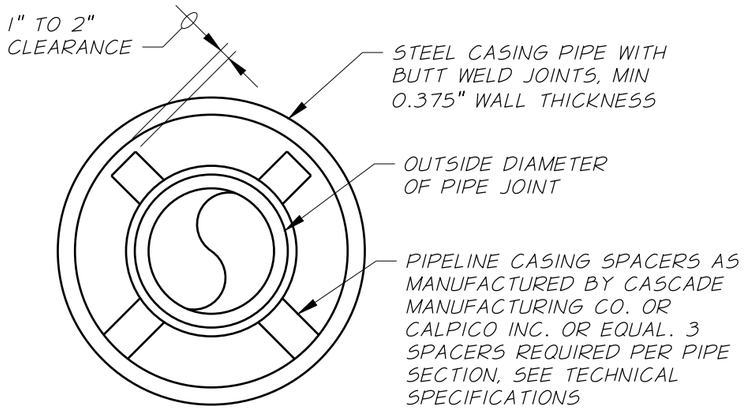
FIGURE
W10

NOTE

PROVIDE 3-INCH MINIMUM CLEARANCE BETWEEN ID OF CASING AND OD OF CARRIER PIPE JOINT.



ELEVATION



SECTION A

WATER MAIN CASING DETAIL

N. T. S.

REVISION	DATE

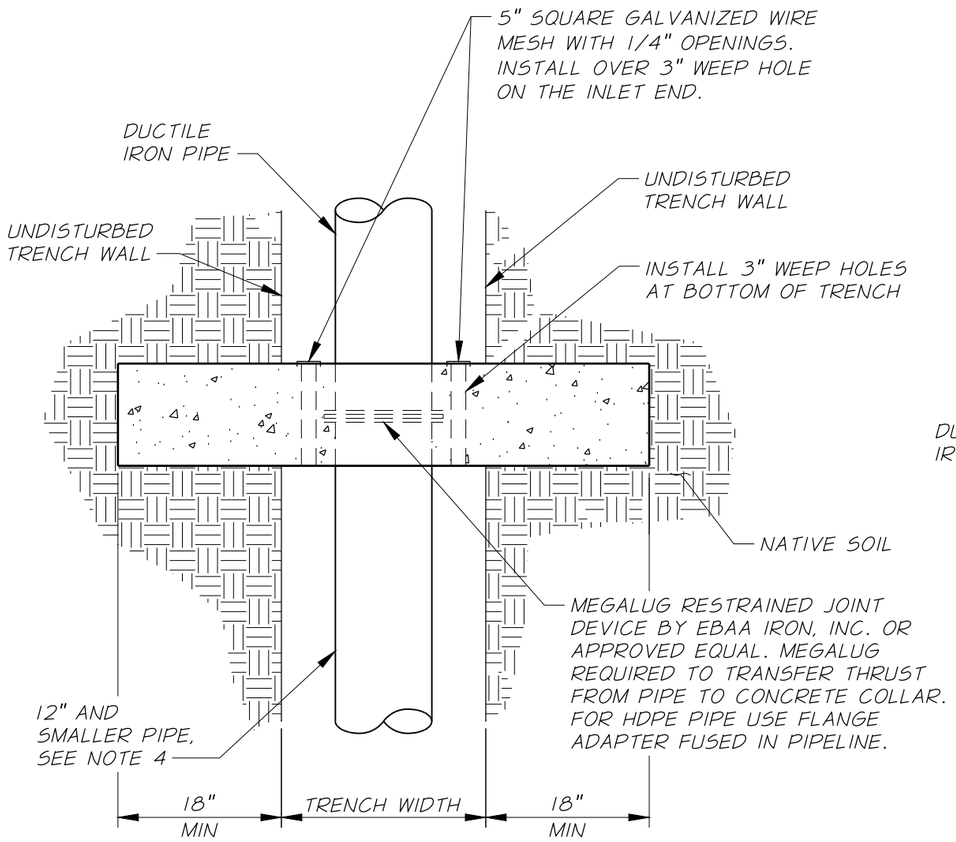
CITY OF
BAKER CITY, OREGON
OFFICE OF TECHNICAL SERVICES

STANDARD WATER DETAILS

WATER MAIN CASING

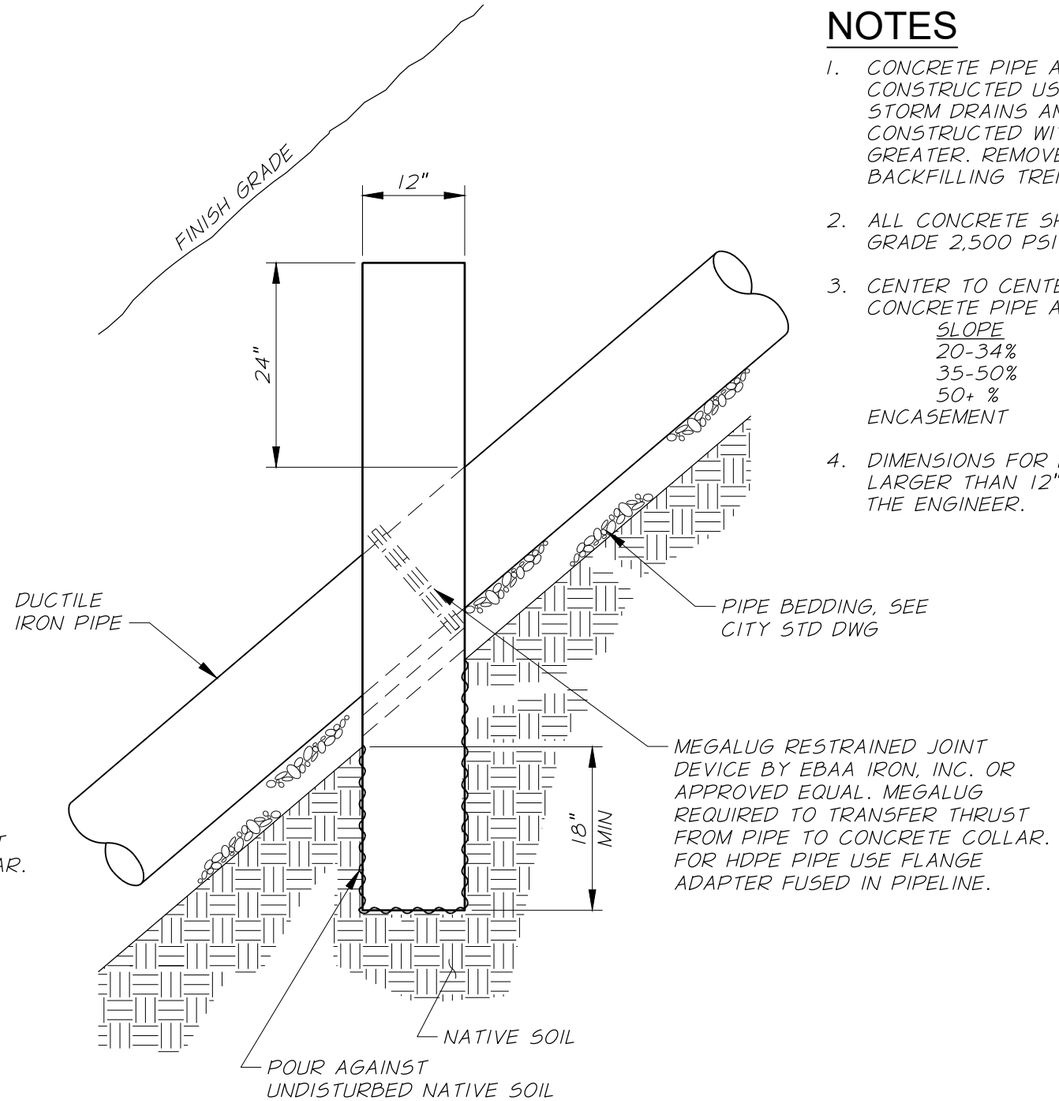
FIGURE

W11



NOTE:
METAL PIPE REQUIRES POLYMERIC COATING WHEN USING SLOPE ANCHORS MADE WITH CONCRETE.

PLAN



ELEVATION

NOTES

1. CONCRETE PIPE ANCHORS SHALL BE CONSTRUCTED USING FORMS WHEN SEWERS, STORM DRAINS AND OTHER PIPELINES ARE CONSTRUCTED WITH SLOPES 20% OR GREATER. REMOVE FORMS PRIOR TO BACKFILLING TRENCH.
2. ALL CONCRETE SHALL BE COMMERCIAL GRADE 2,500 PSI CONCRETE.
3. CENTER TO CENTER MAX. SPACING OF CONCRETE PIPE ANCHORS SHALL BE:

SLOPE	SPACING (ON SLOPE)
20-34%	35'
35-50%	25'
50+ %	15' OR CONCRETE ENCASEMENT

4. DIMENSIONS FOR EMBEDMENT FOR PIPES LARGER THAN 12" SHALL BE APPROVED BY THE ENGINEER.

PIPE SLOPE ANCHORS - CONCRETE

N. T. S.

REVISION	DATE

CITY OF
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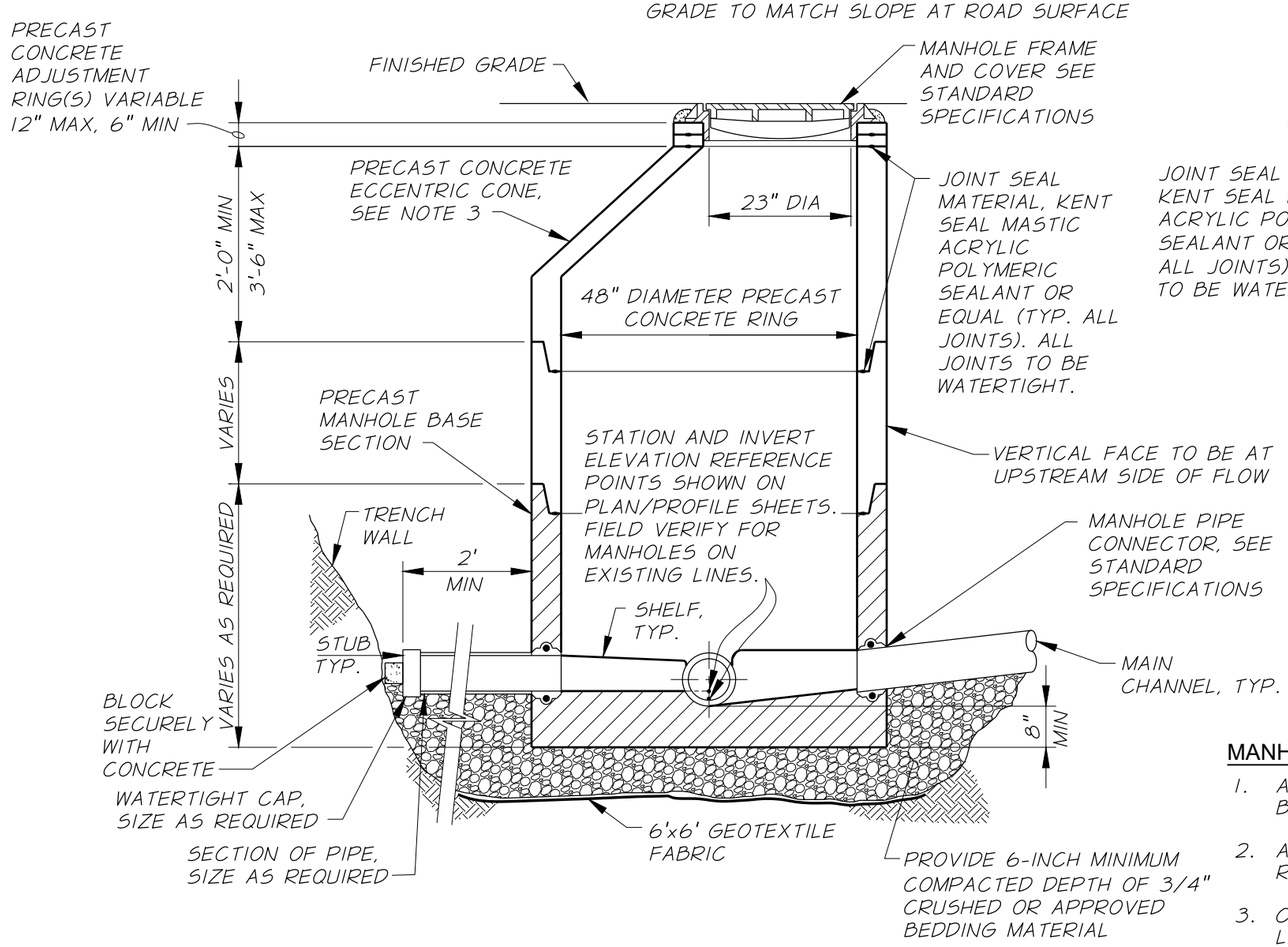
OFFICE OF TECHNICAL SERVICES

STANDARD WATER DETAILS

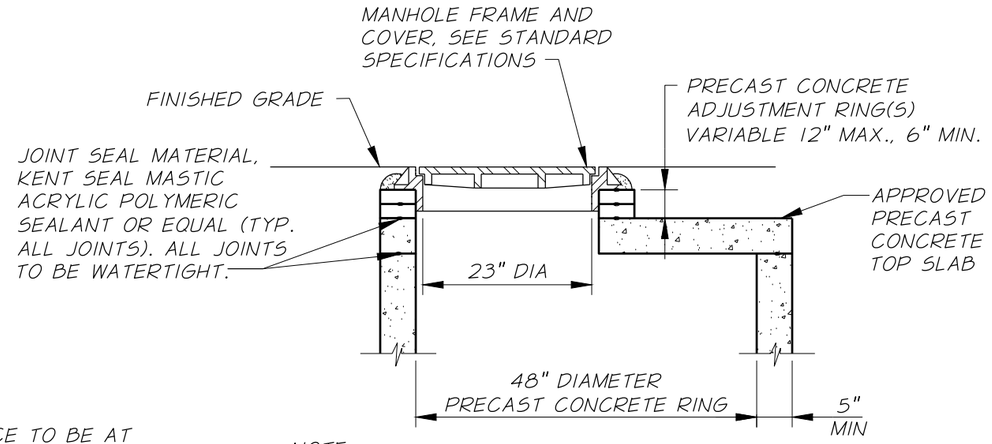
PIPE SLOPE ANCHORS

FIGURE
W12

NOTE:
SET TOP OF MANHOLE RING AND LID AT FINISH GRADE TO MATCH SLOPE AT ROAD SURFACE



STANDARD MANHOLE
TYPE A
N.T.S.



NOTE:
1. SEE TYPE A MANHOLE FOR BASE AND WALLS.
2. USE TYPE B MANHOLE TOP WHEN MANHOLE DEPTH IS 5'-0" OR LESS UNLESS CALLED FOR OTHERWISE ON THE DRAWING.
3. SEE CITY STD. DETAIL SS4 FOR CONCRETE COLLAR.

TOP SLAB MANHOLE
TYPE B
N.T.S.

MANHOLE CONSTRUCTION NOTES

1. ALL MANHOLES SHALL BE PRECAST MANHOLE UNITS UNLESS OTHERWISE APPROVED BY CITY.
2. ANY GAPS, HOLES, ROUGH SPOTS, ETC., IN THE CHANNELS SHALL BE FILLED OR REPAIRED PRIOR TO INSTALLATION.
3. CONE SECTION SHALL BE ECCENTRIC UNLESS MANHOLE DEPTH IS 5.5 FEET OR LESS. MANHOLES 5.5 FEET OR LESS IN DEPTH SHALL BE TYPE B UNLESS OTHERWISE CALLED FOR ON THE DRAWINGS.
4. IN MANUFACTURING THE MANHOLES, THE CONTRACTOR IS ADVISED TO VERIFY FIELD CONDITIONS, IE PIPE INVERTS, PIPE ORIENTATION, AND MANHOLE DEPTH. CONTRACTOR SHOULD ALSO NOTE THAT SEWER PIPE SLOPES ARE CALCULATED TO CENTER OF THE MANHOLE.
5. WHERE THE DISTANCE BETWEEN INLET PIPE INVERT AND MANHOLE CHANNEL INVERT IS GREATER THAN 2 FEET A DROP MANHOLE SHALL BE USED.
6. ALL PRECAST MANHOLE BASE SECTIONS SHALL HAVE FACTORY CAST FLOW CHANNELS.
7. MANHOLE STEPS ARE NOT ALLOWED.
8. SEE CITY STD. DETAIL SS4 FOR CONCRETE COLLAR.

REVISION	DATE

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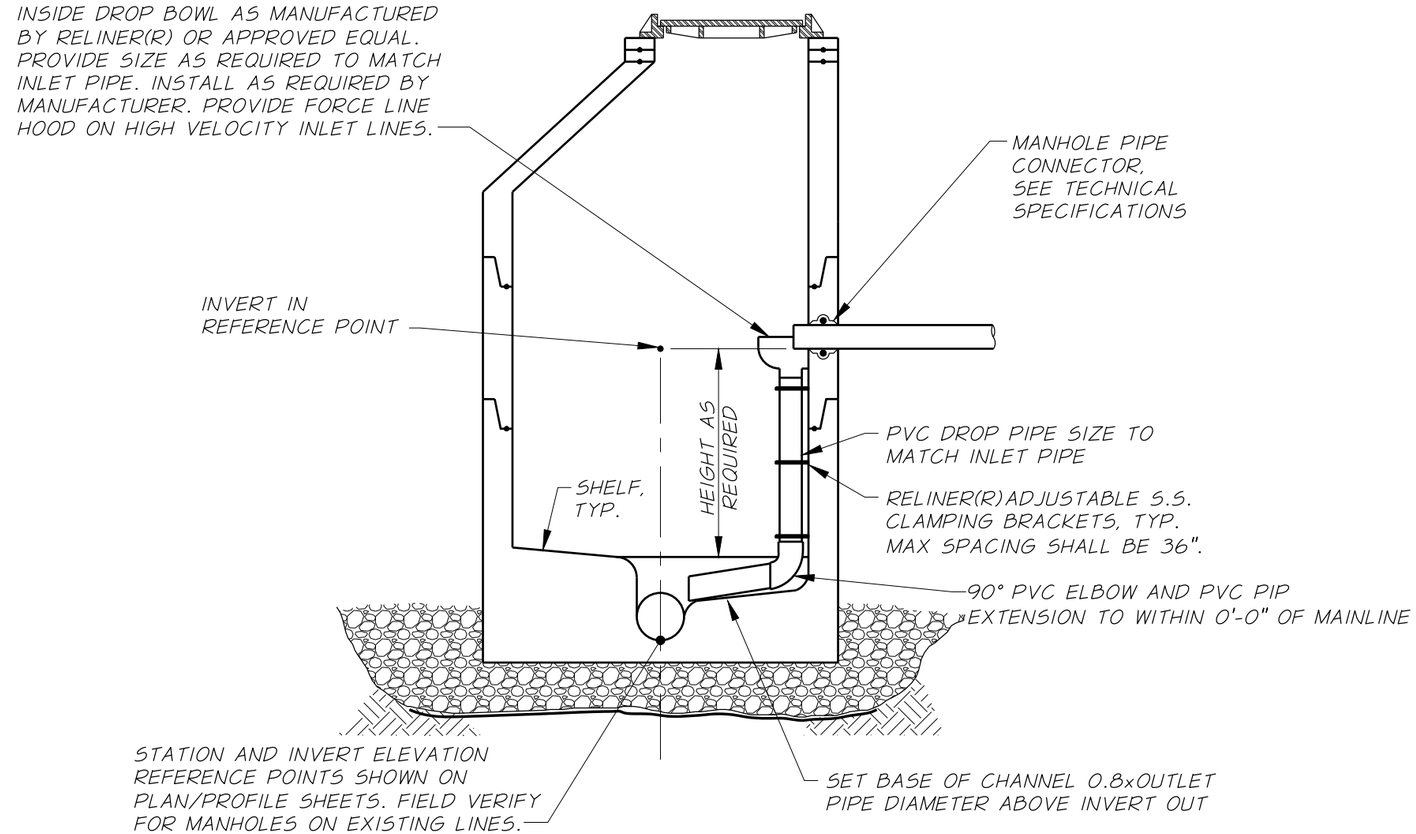
STANDARD SANITARY SEWER DETAILS

STANDARD MANHOLE TYPE A

FIGURE
SS1

NOTE:
SEE APPROPRIATE MANHOLE DETAIL
FOR OTHER MANHOLE REQUIREMENTS.



DROP MANHOLE

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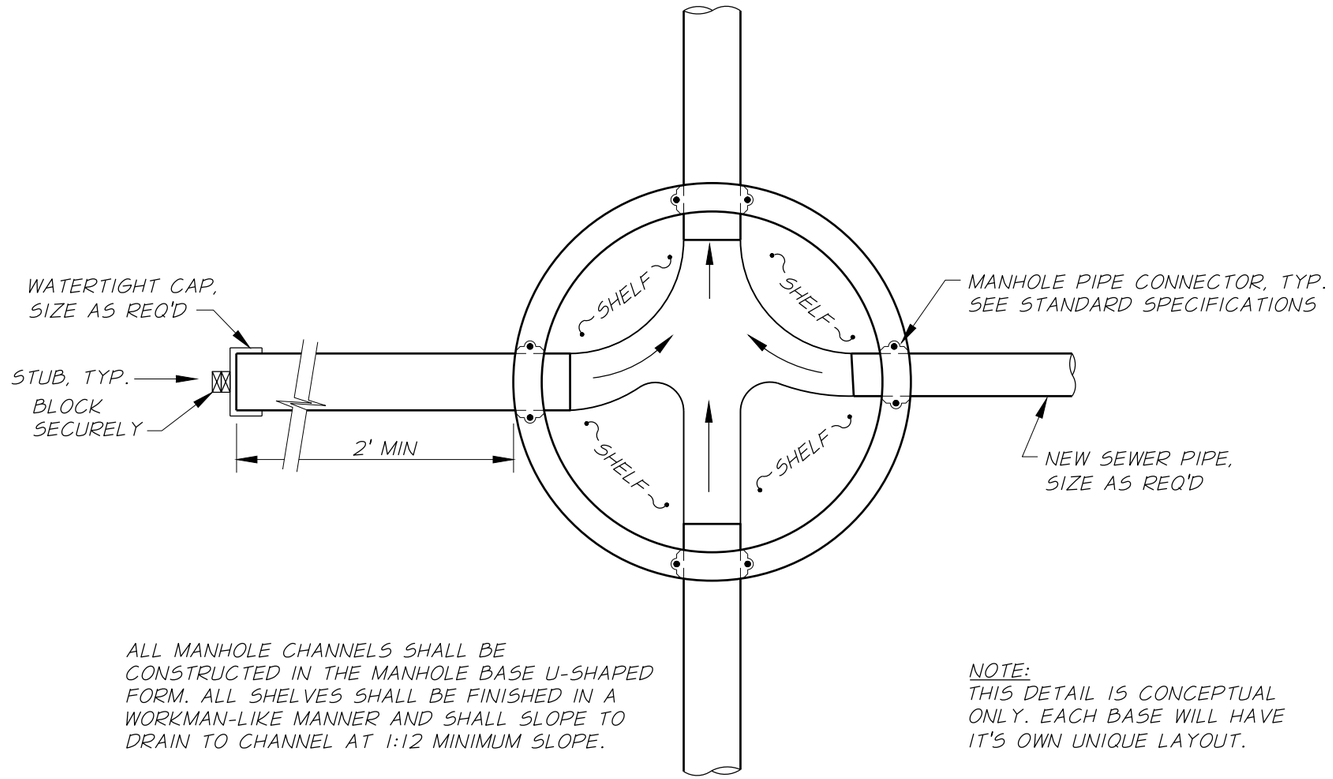
STANDARD SANITARY SEWER DETAILS

DROP MANHOLE

FIGURE

SS2



ALL MANHOLE CHANNELS SHALL BE CONSTRUCTED IN THE MANHOLE BASE U-SHAPED FORM. ALL SHELVES SHALL BE FINISHED IN A WORKMAN-LIKE MANNER AND SHALL SLOPE TO DRAIN TO CHANNEL AT 1:12 MINIMUM SLOPE.

NOTE:
THIS DETAIL IS CONCEPTUAL ONLY. EACH BASE WILL HAVE IT'S OWN UNIQUE LAYOUT.

MANHOLE BASE

PLAN

N.T.S.

REVISION	DATE

CITY OF
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OFFICE OF TECHNICAL SERVICES

STANDARD SANITARY SEWER DETAILS

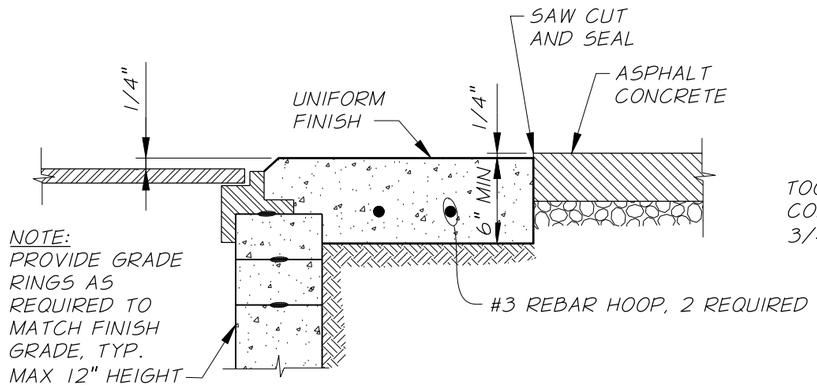
MANHOLE BASE PLAN

FIGURE

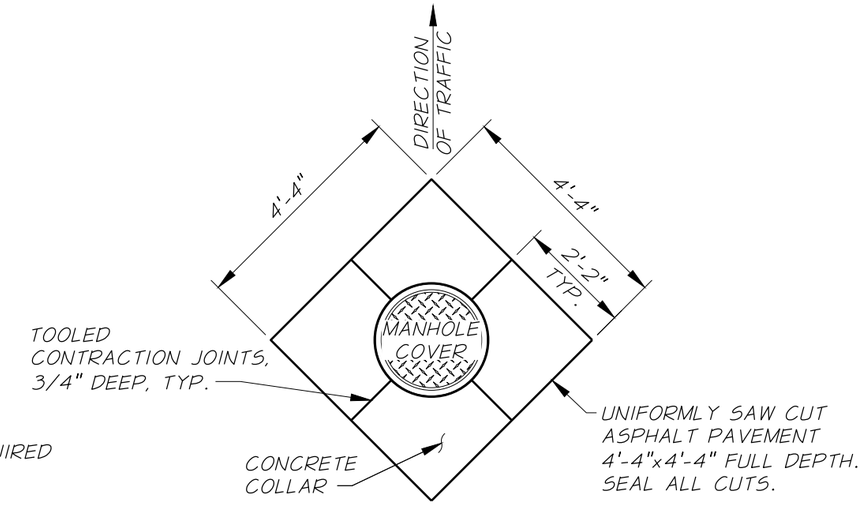
SS3

REQUIREMENTS FOR CONCRETE COLLARS:

1. CONCRETE: 3/4", 7 SACK, 4000 PSI AT 28 DAYS, 2" TO 4" SLUMP, 4-7% AIR.
2. SMOOTH BROOMED FINISH REQUIRED.
3. APPLY CONCRETE CURING COMPOUND.
4. PROTECT CONCRETE FROM FREEZING AND TRAFFIC FOR 4 DAYS MINIMUM OR AS REQUIRED BY CITY ENGINEER.



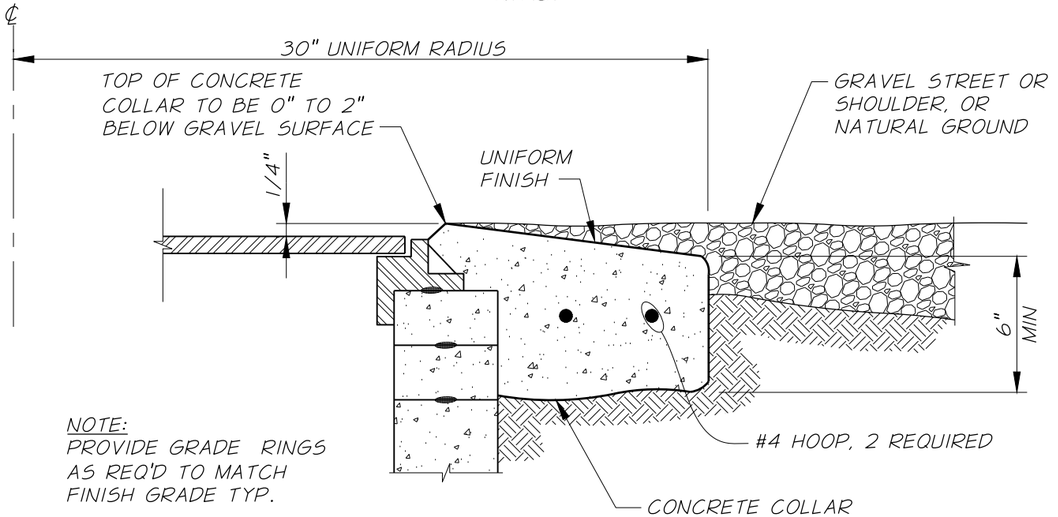
TYPICAL SECTION



PLAN

ASPHALT PAVEMENT INSTALLATION

N.T.S.



TYPICAL SECTION

GRAVEL STREETS OR NATURAL GROUND INSTALLATION

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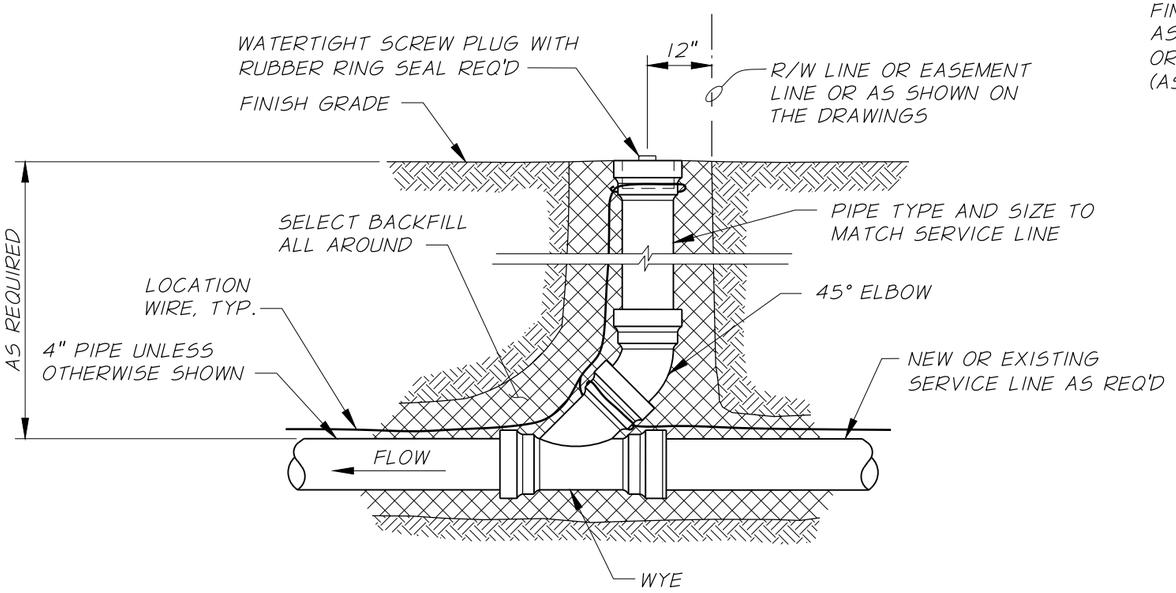
STANDARD SANITARY SEWER DETAILS

MANHOLE CONCRETE COLLAR DETAIL

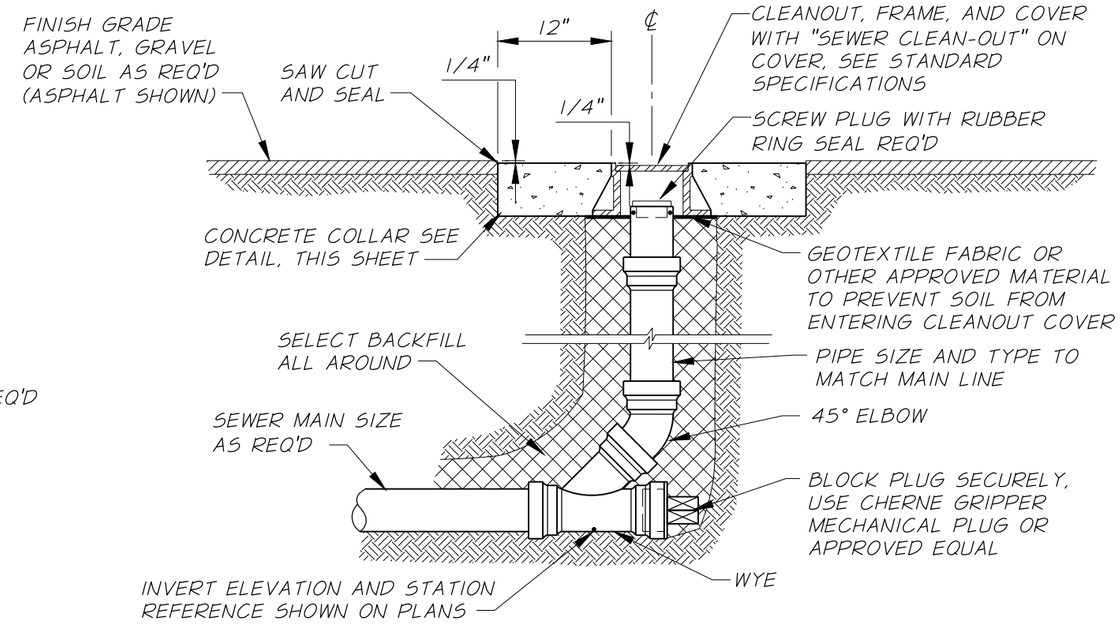
FIGURE

SS4



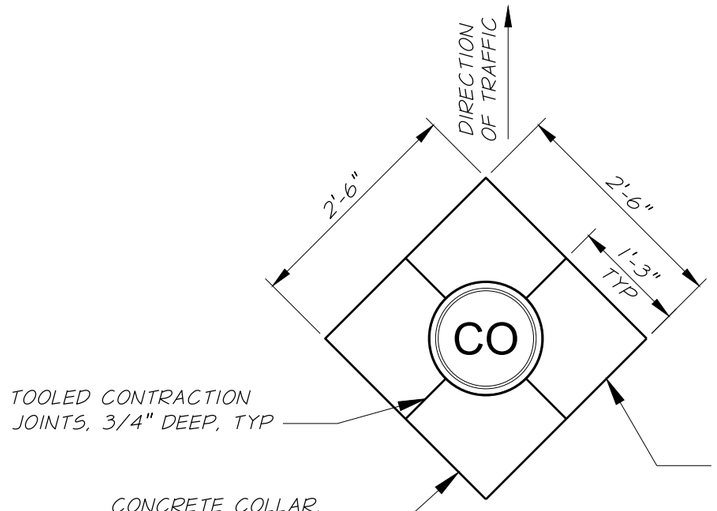
SEWER SERVICE LINE CLEANOUT

N.T.S.



MAIN LINE CLEANOUT

N.T.S.



PLAN

REQUIREMENTS FOR CONCRETE COLLARS:

1. ALL CONCRETE SHALL BE COMMERCIAL GRADE 4000 PSI CONCRETE.
2. COLLAR TO BE FORMED SQUARE.
3. SMOOTH BROOMED FINISH REQUIRED.
4. APPLY CONCRETE CURING COMPOUND.
5. PROTECT FROM TRAFFIC FOR 4 DAYS MINIMUM.

CONCRETE COLLAR DETAIL

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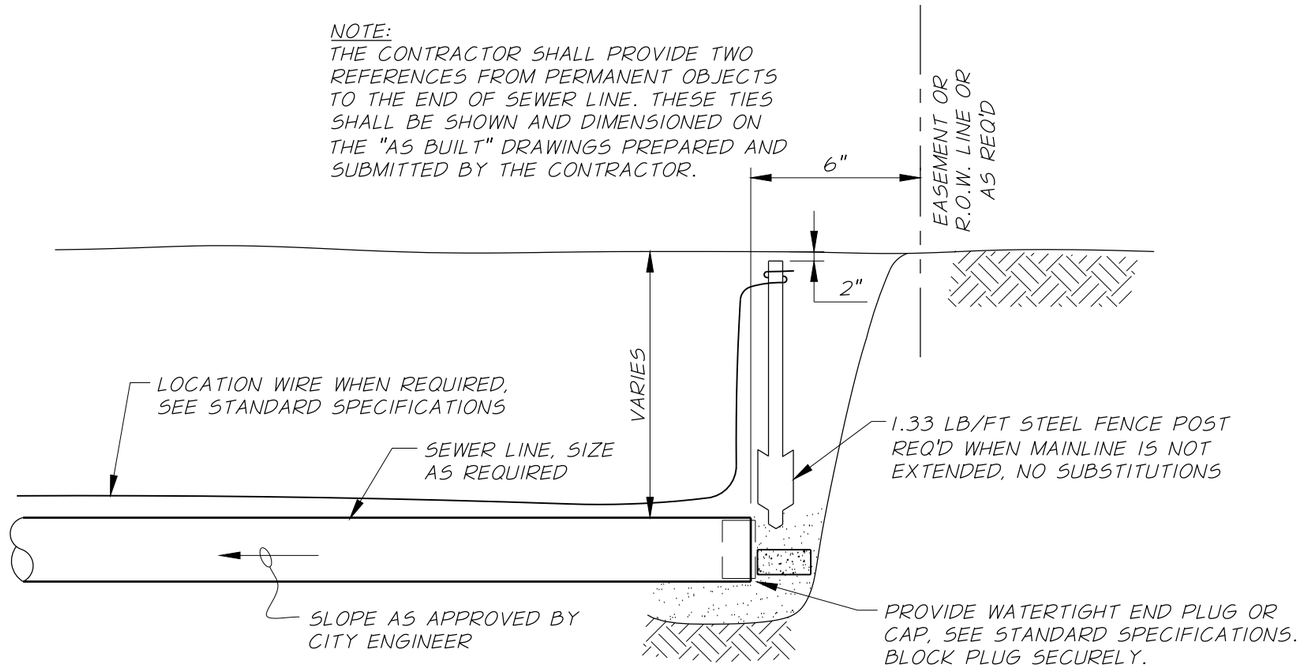
STANDARD SANITARY SEWER DETAILS

CLEANOUT

FIGURE

SS5



SEWER MAIN LINE STUB

N.T.S.

REVISION	DATE

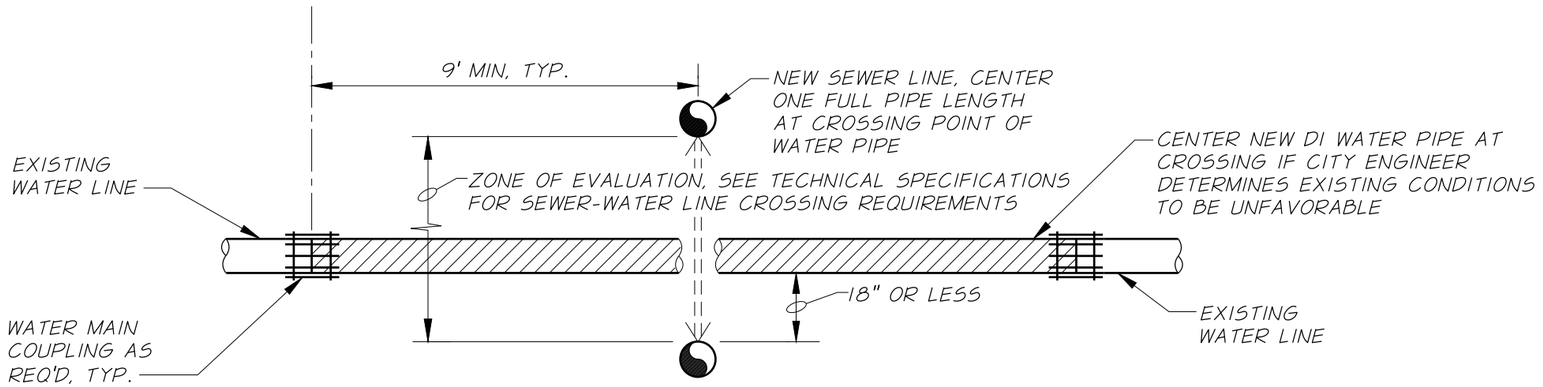
CITY OF
BAKER CITY, OREGON
OFFICE OF TECHNICAL SERVICES

STANDARD SANITARY SEWER DETAILS

SEWER MAIN LINE STUB

FIGURE

SS6



NOTE:
ALL BACK FILL IN AREA OF WATER-SEWER CROSSING TO A DEPTH 12" ABOVE THE TOP OF THE HIGHEST PIPE SHALL BE 3/4"-0 BASE ROCK COMPACTED TO 95% OF ASTM D-698 LABORATORY DENSITY.

SEWER-WATER CROSSING

(NEW SEWER LINE CROSSING)

CROSS SECTON VIEW
N.T.S.

REVISION	DATE

CITY OF
BAKER CITY, OREGON
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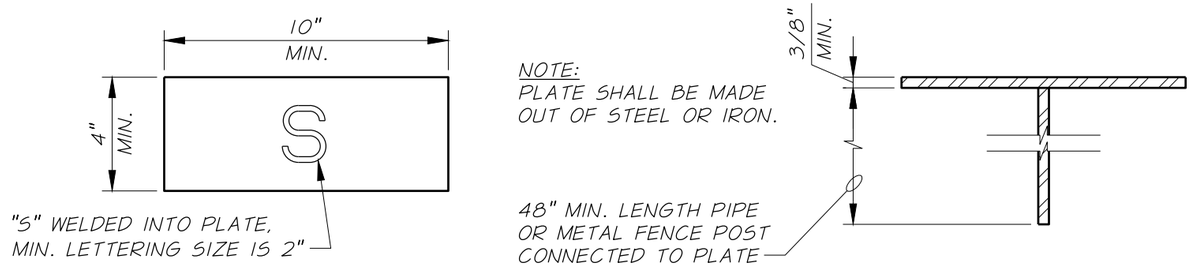
STANDARD SANITARY SEWER DETAILS

SEWER-WATER CROSSING

FIGURE

SS7

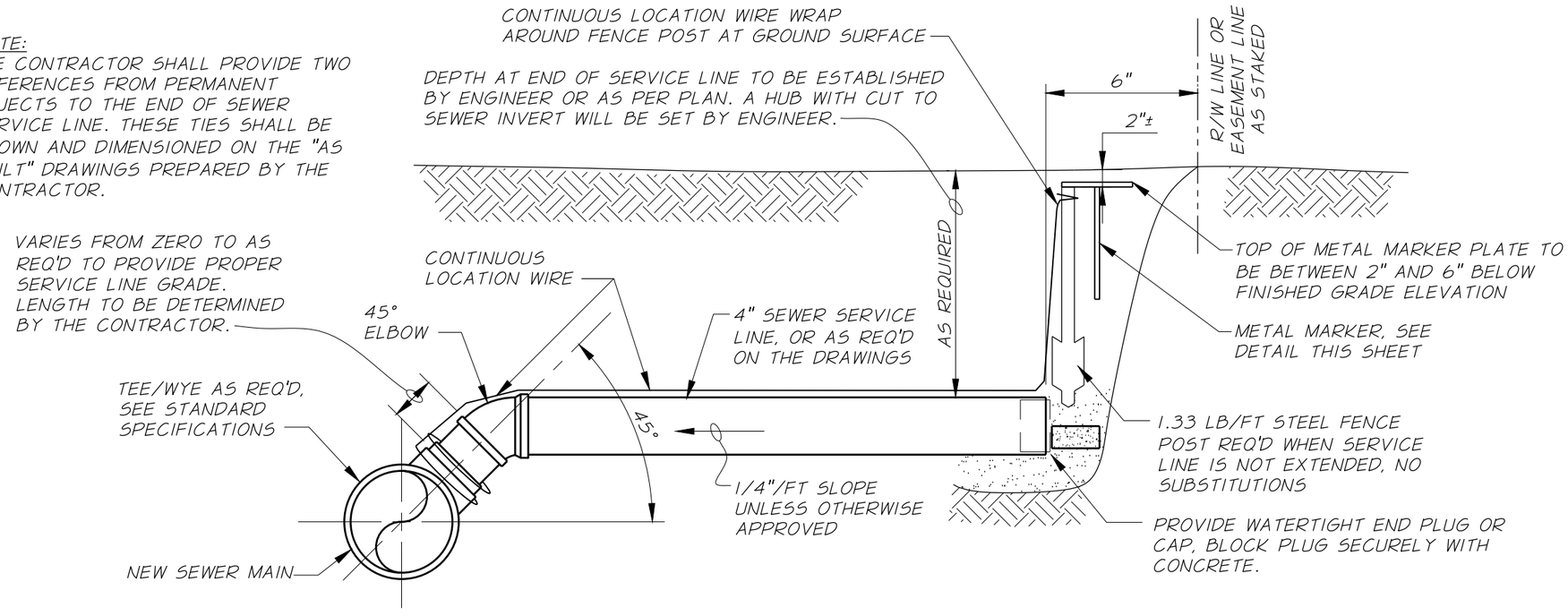


PLAN SECTION

METAL MARKER DETAIL

N.T.S.

NOTE:
THE CONTRACTOR SHALL PROVIDE TWO REFERENCES FROM PERMANENT OBJECTS TO THE END OF SEWER SERVICE LINE. THESE TIES SHALL BE SHOWN AND DIMENSIONED ON THE "AS BUILT" DRAWINGS PREPARED BY THE CONTRACTOR.



NOTE:
SERVICE LINES ARE TO BE AT 90° TO SEWER MAIN. PROVIDE FITTINGS AND CLEANOUTS AS REQ'D TO PROPERLY INSTALL SERVICE.

SEWER SERVICE LINE

(ON NEW SEWER MAIN)

SECTION VIEW
N.T.S.

REVISION	DATE

CITY OF
BAKER CITY, OREGON
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STANDARD SANITARY SEWER DETAILS

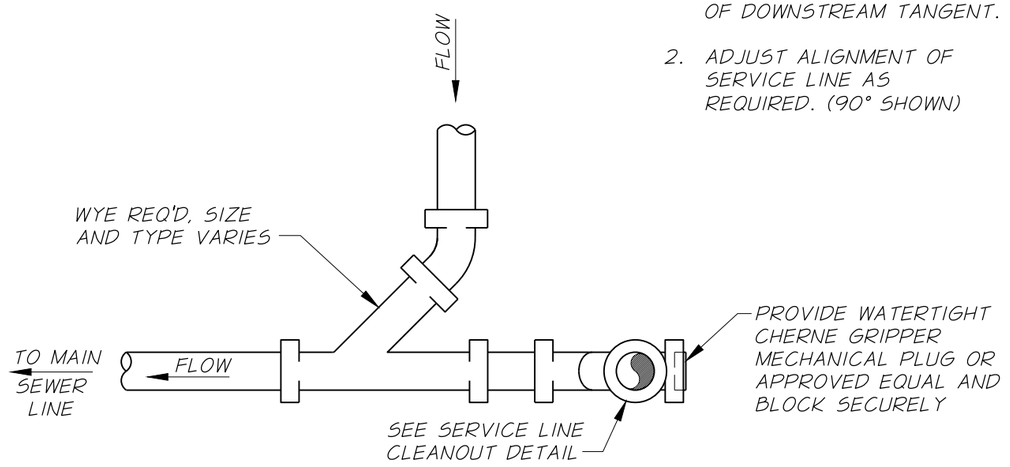
SEWER SERVICE LINE

FIGURE

SS8

NOTES:
1. WHERE POSSIBLE PLACE CLEANOUTS ON OUTSIDE OF BENDS ON EXTENSION OF DOWNSTREAM TANGENT.

2. ADJUST ALIGNMENT OF SERVICE LINE AS REQUIRED. (90° SHOWN)



PLAN VIEW

TYPICAL ANGLE CONNECTION
FOR SEWER SERVICE LINE
N.T.S.

REVISION	DATE

CITY OF
BAKER CITY, OREGON
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STANDARD SANITARY SEWER DETAILS

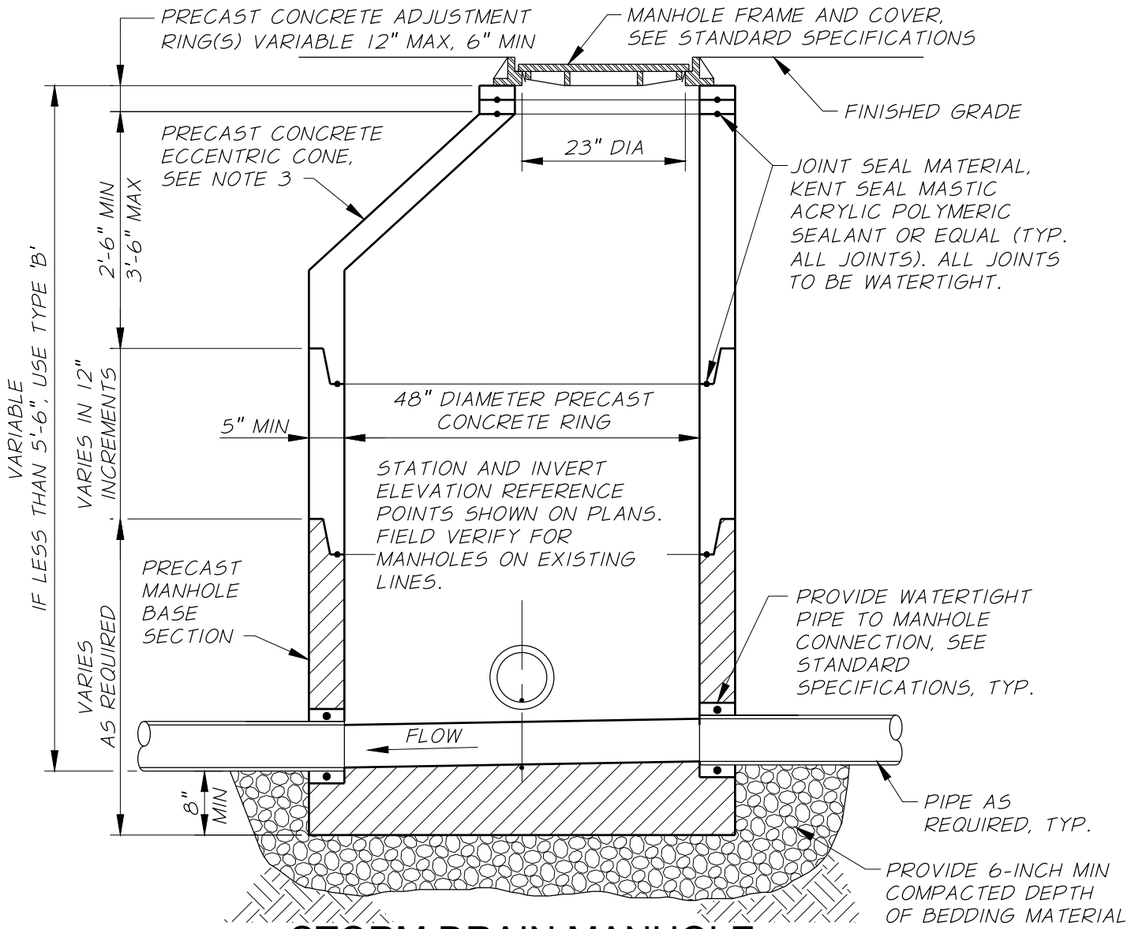
TYPICAL ANGLE CONNECTION

FIGURE

SS9

MANHOLE CONSTRUCTION NOTES

1. ALL MANHOLES SHALL BE PRECAST MANHOLE UNITS UNLESS OTHERWISE APPROVED.
2. ANY GAPS, HOLES, ROUGH SPOTS, ETC., IN THE CHANNELS SHALL BE FILLED OR REPAIRED IN THE FIELD.
3. CONE SECTION SHALL BE ECCENTRIC UNLESS MANHOLE DEPTH IS 5.5 FEET OR LESS. MANHOLES 5.5 FEET OR LESS IN DEPTH SHALL BE TYPE B UNLESS OTHERWISE CALLED FOR ON THE DRAWINGS.
4. IN MANUFACTURING THE MANHOLES, THE CONTRACTOR IS ADVISED TO VERIFY FIELD CONDITIONS, IE PIPE INVERTS, PIPE ORIENTATION, AND MANHOLE DEPTH. CONTRACTOR SHOULD ALSO NOTE THAT PIPE SLOPES ARE CALCULATED TO CENTER OF THE MANHOLE.
5. ALL PRECAST MANHOLE BASE SECTIONS SHALL HAVE FACTORY CAST FLOW CHANNELS.
6. MANHOLE STEPS ARE NOT ALLOWED.
7. SEE CITY STANDARD DETAIL SS4 FOR CONCRETE COLLAR



STORM DRAIN MANHOLE

TYPE A

N.T.S.

REVISION	DATE

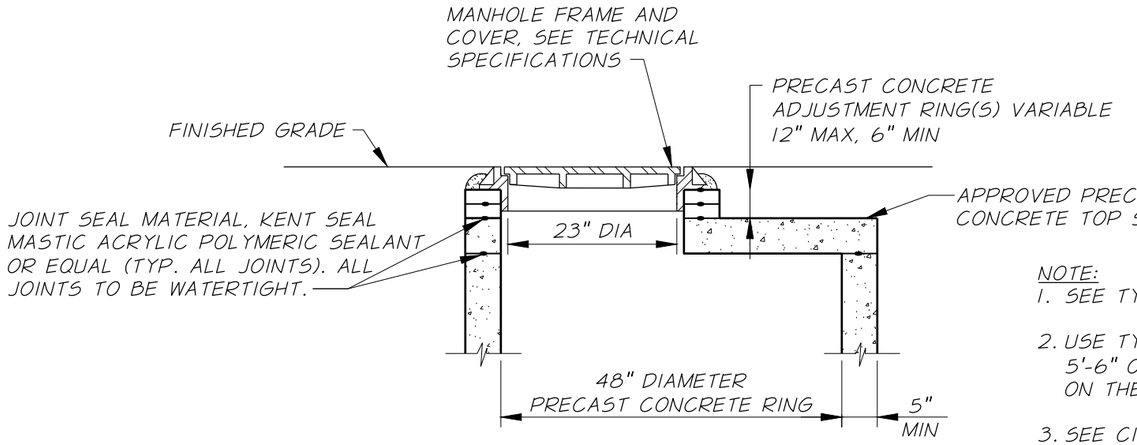
CITY OF
BAKER CITY, OREGON
OFFICE OF TECHNICAL SERVICES

STANDARD STORM DRAINAGE DETAILS

STORM DRAIN MANHOLE

FIGURE

SD1



STORM DRAIN TOP SLAB MANHOLE

TYPE B

N.T.S.

NOTE:

1. SEE TYPE A MANHOLE FOR BASE AND WALLS.
2. USE TYPE B MANHOLE WHEN MANHOLE DEPTH IS 5'-6" OR LESS UNLESS CALLED FOR OTHERWISE ON THE DRAWING.
3. SEE CITY STANDARD DRAWING 554 FOR CONCRETE COLLAR

REVISION	DATE

CITY OF
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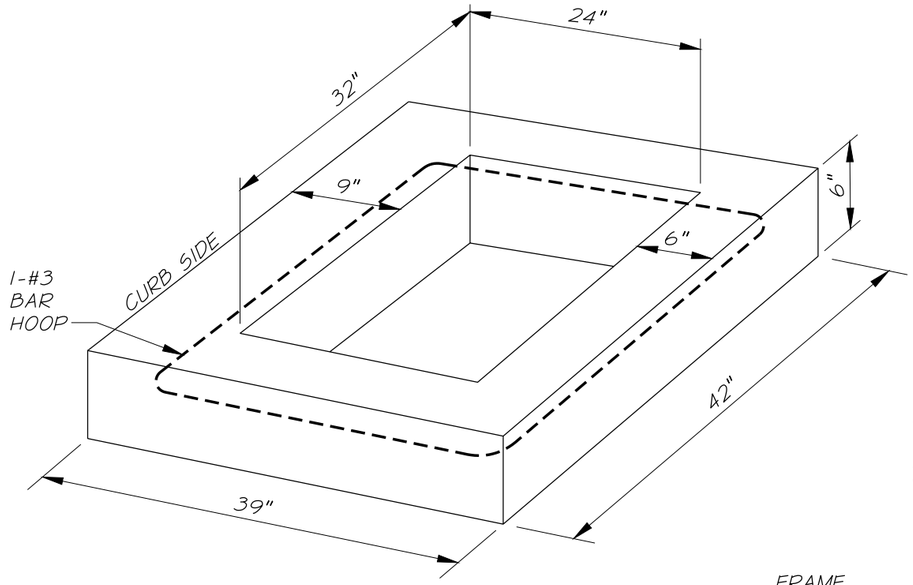
STANDARD STORM DRAINAGE DETAILS

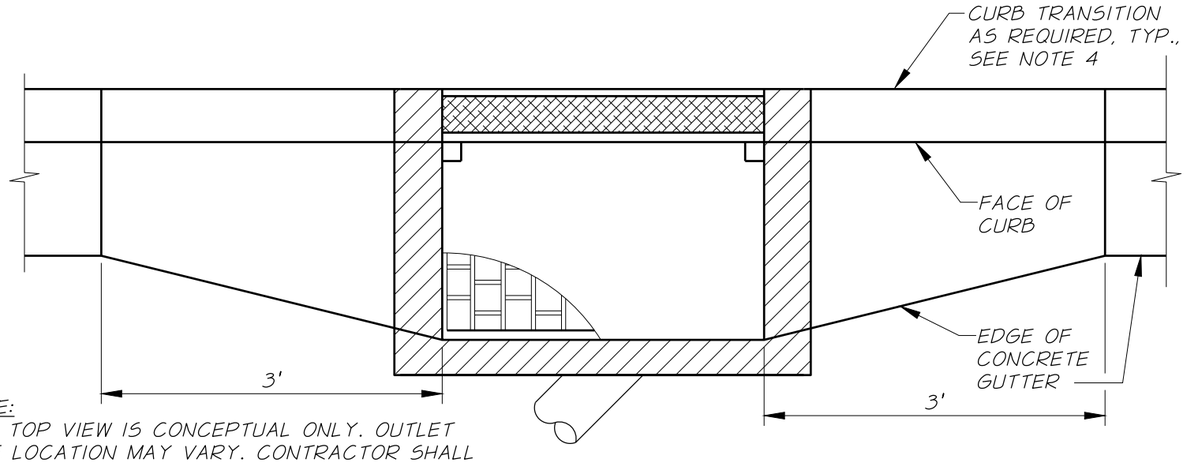
STORM DRAIN TOP SLAB MANHOLE

FIGURE

SD2



ODOT TYPE G-2 INLET BASE ADAPTER

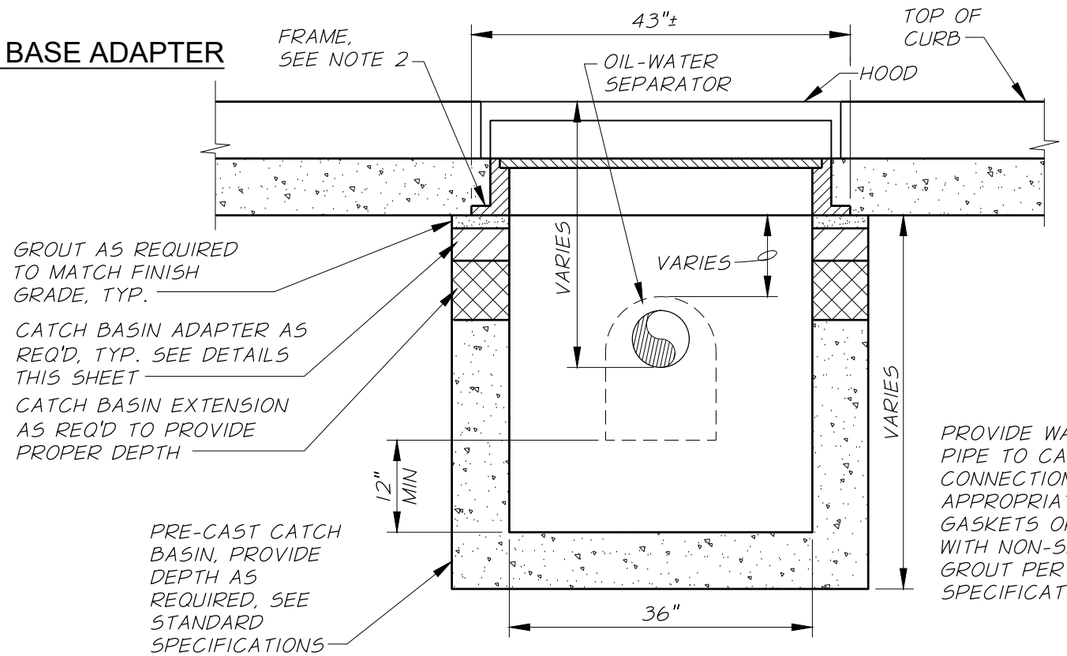


NOTE:
THIS TOP VIEW IS CONCEPTUAL ONLY. OUTLET PIPE LOCATION MAY VARY. CONTRACTOR SHALL VERIFY CATCH BASIN AND OIL/WATER SEPARATOR SIZES WILL ACCOMMODATE ANY OUTLET PIPES AT SKEWED ANGLES.

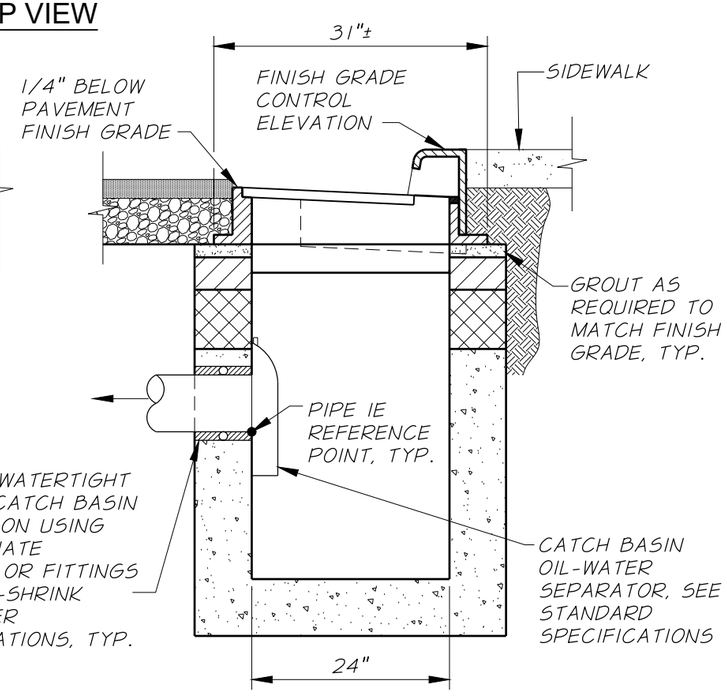
TOP VIEW

CATCH BASIN NOTES:

1. PRE-CAST CATCH BASINS AS REQUIRED, SEE STANDARD SPECIFICATIONS.
2. HOODS, FRAMES, AND GRATES , SEE STANDARD SPECIFICATIONS.
3. ALL ACCESSORIES USED TO INSTALL THE HOOD AND FRAME, INCLUDING BOLTS, WASHERS, AND NUTS, SHALL BE GALV. OR CORROSION RESISTANT.
4. HOOD DIMENSIONS MAY NOT MATCH ALL CURB SECTION DIMENSIONS. CONTRACTOR SHALL HAND FORM ANY CURB TRANSITIONS REQUIRED TO MATCH HOOD DIMENSIONS.
5. 6-INCHES MIN. OF CRUSHED BASE ROCK TO BE PLACED UNDER AND AROUND STRUCTURE.
6. FIELD SET CATCH BASINS TO PROPER GRATE ORIENTATION WITH FINISH GRADE AND ALIGNMENT.



SECTION A



SECTION B

REVISION	DATE

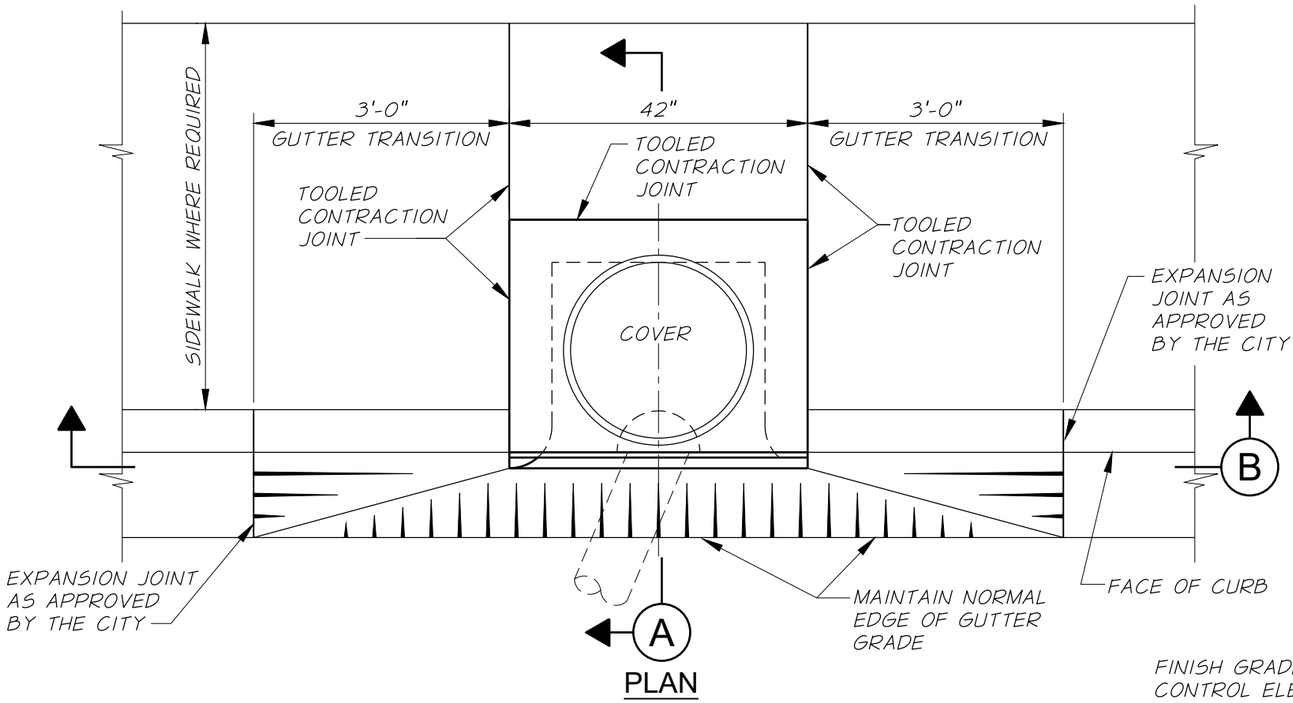
CITY OF
BAKER CITY, OREGON
OFFICE OF TECHNICAL SERVICES

STANDARD STORM DRAINAGE DETAILS

TYPE A CATCH BASIN DETAIL

FIGURE

SD3

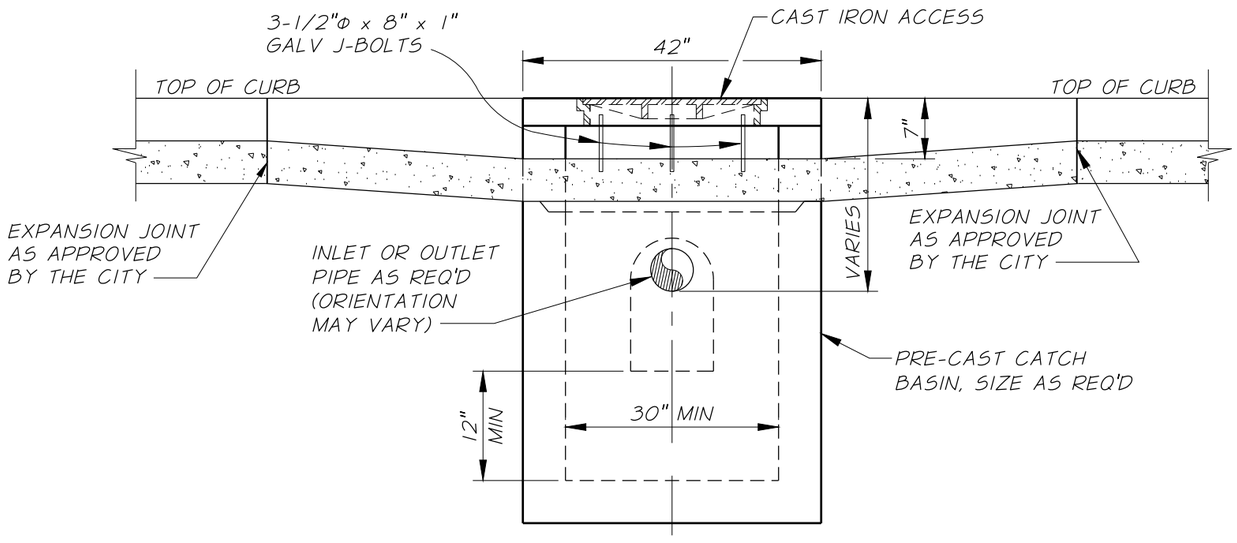


PLAN

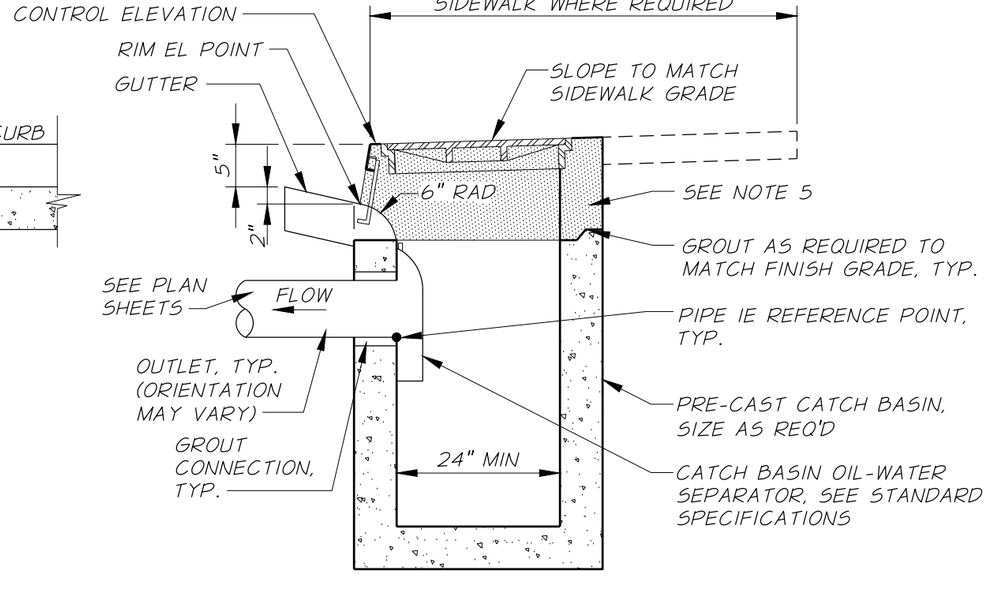
CATCH BASIN NOTES:

1. PRE-CAST CATCH BASINS, AS REQUIRED.
2. 6" OF CRUSHED BASE ROCK TO BE PLACED AROUND STRUCTURE.
3. FIELD SET CATCH BASINS OBTAIN PROPER ORIENTATION WITH FINISH GRADE AND ALIGNMENT.
4. PRE-CAST BASES SHALL BE FURNISHED WITH CUTOUTS OR KNOCKOUTS. KNOCKOUTS SHALL HAVE A WALL THICKNESS OF 2-INCH MINIMUM AND MAY BE LOCATED ON ALL FOUR SIDES.
5. CATCH BASIN TOP SECTION SHALL BE ODOT CG-3 INLET (SEE ODOT STANDARD DRAWING RD372) OR APPROVED EQUAL.

NOTE:
THIS TOP VIEW IS CONCEPTUAL ONLY. OUTLET PIPE LOCATION MAY VARY. CONTRACTOR SHALL VERIFY CATCH BASIN AND OIL/WATER SEPARATOR SIZES WILL ACCOMMODATE ANY OUTLET PIPES AT SKEWED ANGLES.



SECTION B



SECTION A

REVISION	DATE

CITY OF
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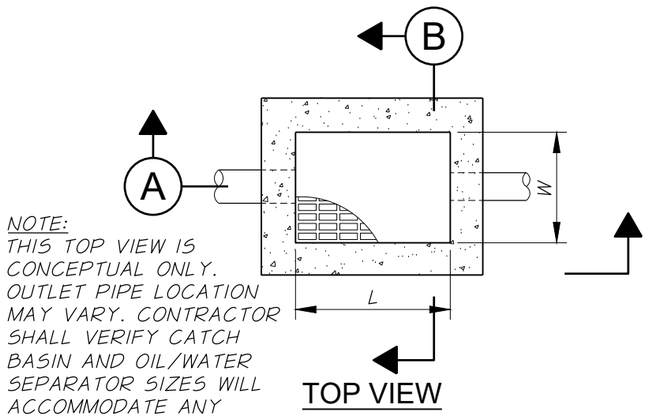
STANDARD STORM DRAINAGE DETAILS

TYPE B CATCH BASIN DETAILS

FIGURE
SD4

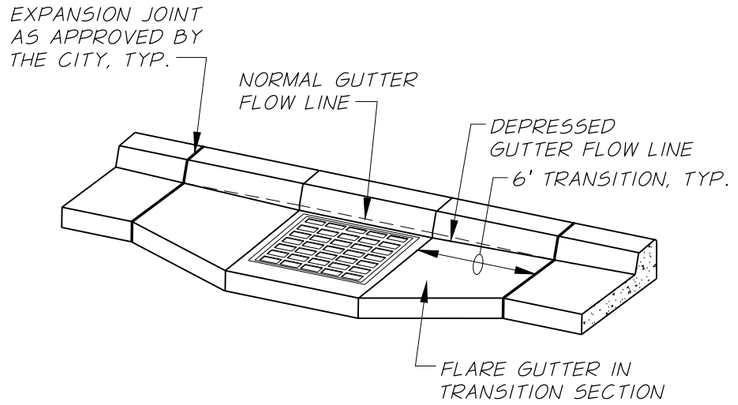


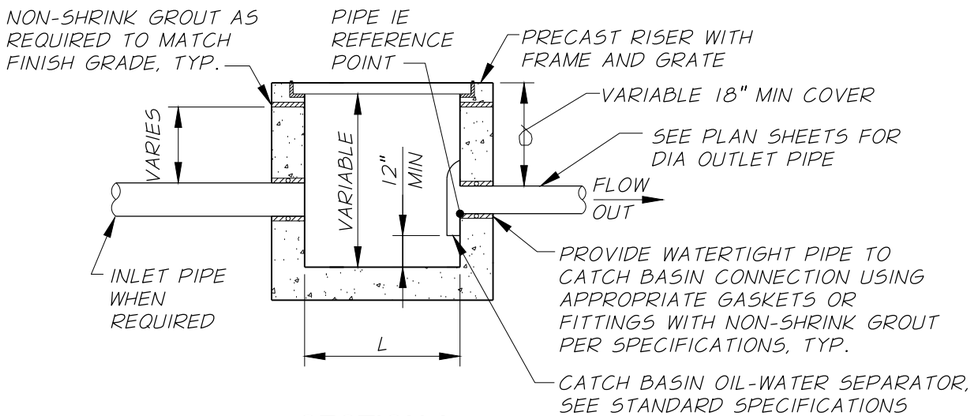
NOTE:
THIS TOP VIEW IS CONCEPTUAL ONLY. OUTLET PIPE LOCATION MAY VARY. CONTRACTOR SHALL VERIFY CATCH BASIN AND OIL/WATER SEPARATOR SIZES WILL ACCOMMODATE ANY OUTLET PIPES AT SKEWED ANGLES.

TOP VIEW

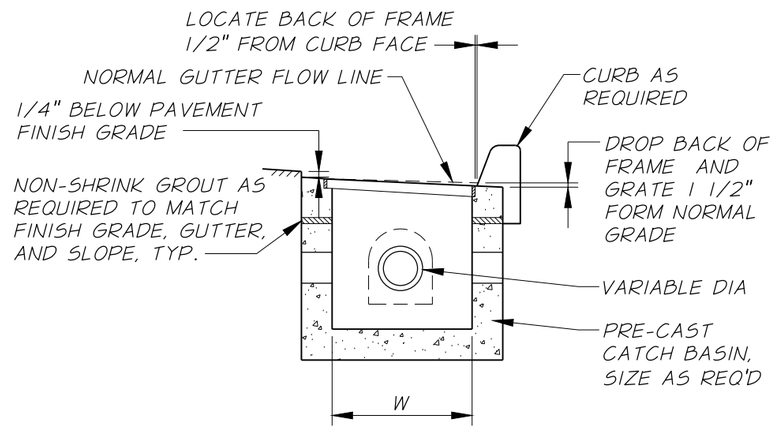
CATCH BASIN NOTES

1. PRE-CAST CATCH BASIN AS REQUIRED, SEE TECHNICAL SPECIFICATIONS.
2. FRAMES, AND GRATES, SEE TECHNICAL SPECIFICATIONS.
3. ALL ACCESSORIES USED TO INSTALL THE FRAME, INCLUDING BOLTS, WASHERS, AND NUTS, SHALL BE GALVANIZED OR CORROSION RESISTANT.
4. 6-INCH MINIMUM OF CRUSHED BASE ROCK TO BE PLACED UNDER AND AROUND STRUCTURE.
5. FIELD SET CATCH BASINS TO PROPER GRATE ORIENTATION WITH FINISH GRADE AND ALIGNMENT.





SECTION A



SECTION B

INLET TYPE	L	W
G-1	2'-4" MIN	1'-9" MIN
G-2	2'-4" MIN	2'-3" MIN

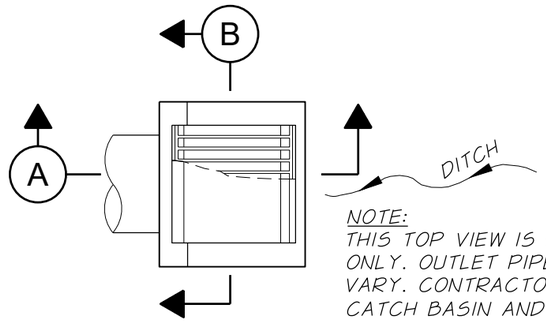
REVISION	DATE

CITY OF
BAKER CITY, OREGON
OFFICE OF TECHNICAL SERVICES

STANDARD STORM DRAINAGE DETAILS

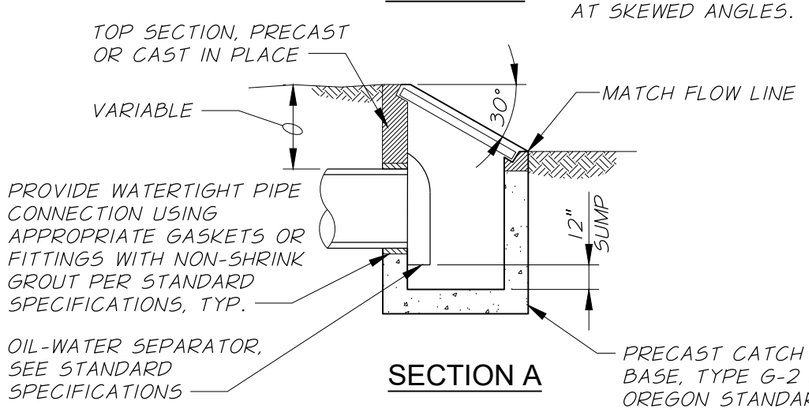
TYPE C CATCH BASIN DETAIL

FIGURE
SD5

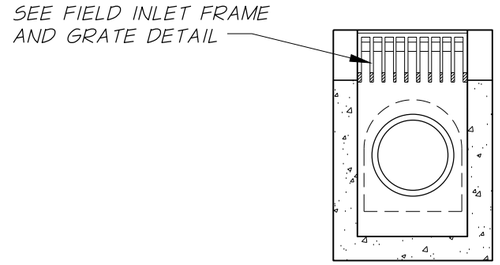


TOP VIEW

NOTE:
THIS TOP VIEW IS CONCEPTUAL ONLY. OUTLET PIPE LOCATION MAY VARY. CONTRACTOR SHALL VERIFY CATCH BASIN AND OIL/WATER SEPARATOR SIZES (IF REQ'D) WILL ACCOMMODATE ANY OUTLET PIPES AT SKEWED ANGLES.



SECTION A

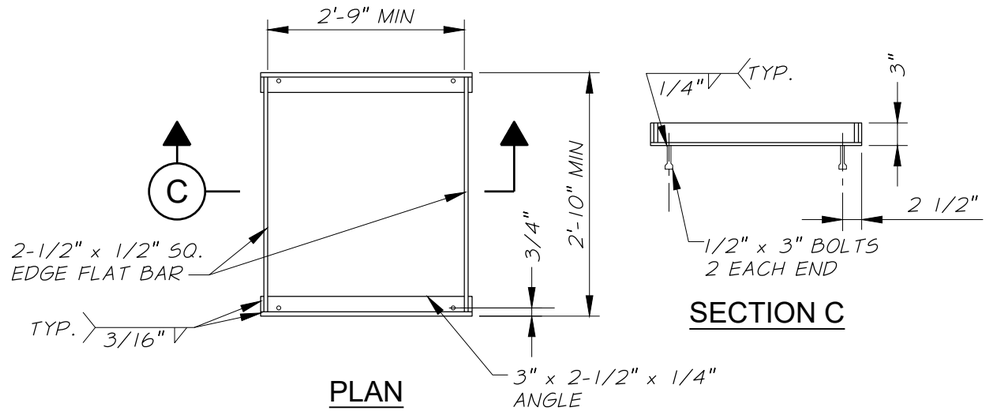


SECTION B

NOTES:
1. 6" OF CRUSHED BASE ROCK TO BE PLACE AROUND STRUCTURE.
2. REINFORCEMENT SHALL NOT BE REQUIRED FOR CAST-IN-PLACE STRUCTURES. REINFORCEMENT IN PRE-CAST STRUCTURES TO BE REBAR MEETING ASTM A-615 GRADE 60 OR WELDED WITHE MEETING ASTM A-497.
3. FIELD SET FIELD INLETS TO OBTAIN PROPER GRADE ORIENTATION WITH FINISH GRADE AND FLOW LINE.
4. PRE-CAST BASES SHALL BE FURNISHED WITH CUTOUTS OF KNOCKOUTS. KNOCKOUTS SHALL HAVE A WALL THICKNESS OF 2-INCH MINIMUM AND MAY BE LOCATED ON ALL FOUT SIDES.

FIELD INLET

N.T.S.

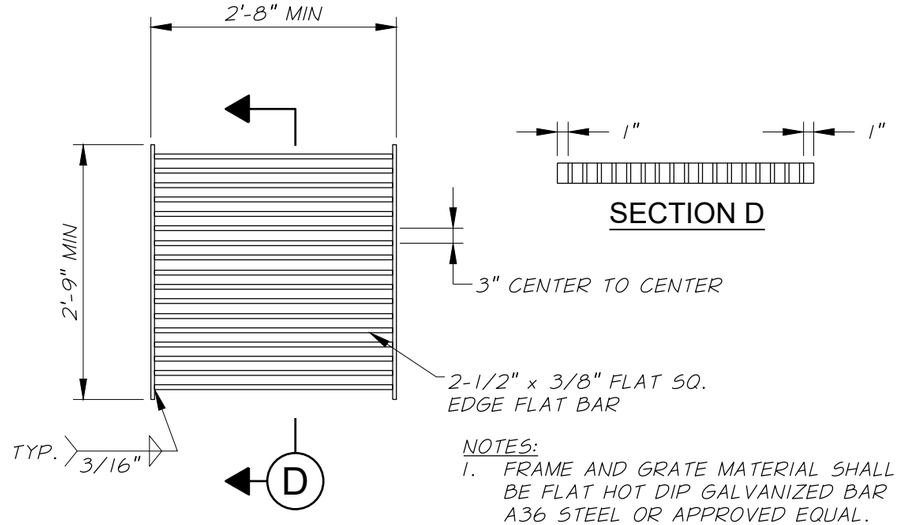


PLAN

SECTION C

FRAME DETAIL

N.T.S.



PLAN

SECTION D

NOTES:
1. FRAME AND GRATE MATERIAL SHALL BE FLAT HOT DIP GALVANIZED BAR A36 STEEL OR APPROVED EQUAL.
2. GRATE DIMENSIONS SHOWN ARE CONCEPTUAL AND SHALL BE CONFIRMED BY THE CONTRACTOR TO FIT ACTUAL FIELD INLETS SUPPLIED.

GRATE DETAIL

N.T.S.

REVISION	DATE

CITY OF
BAKER CITY, OREGON
OFFICE OF TECHNICAL SERVICES

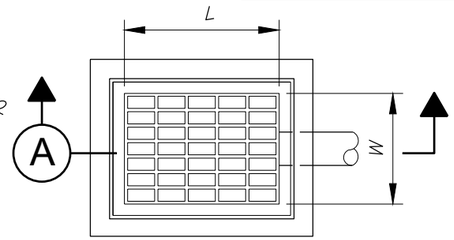
STANDARD STORM DRAINAGE DETAILS

FIELD INLET FRAME AND GRATE DETAIL

FIGURE
SD6

INLET TYPE	L	W
G-1	2'-4" MIN	1'-9" MIN
G-2	2'-4" MIN	2'-3" MIN

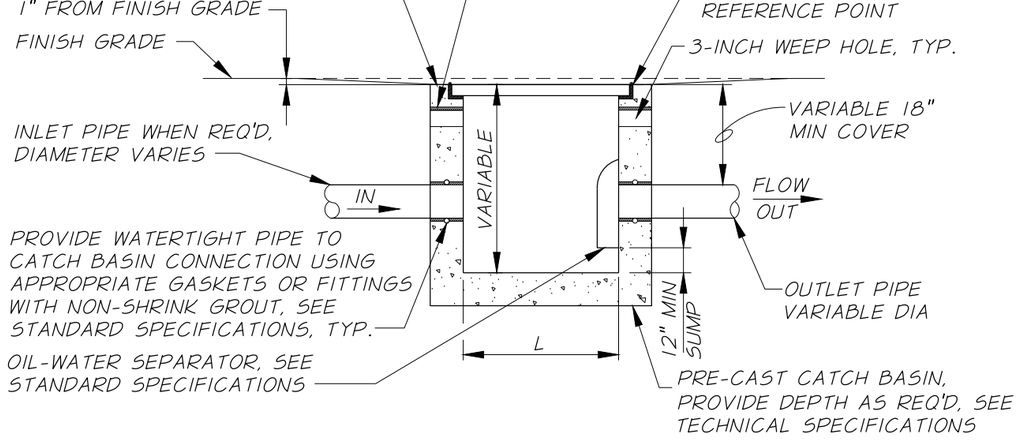
NOTE:
THIS TOP VIEW IS CONCEPTUAL ONLY. OUTLET PIPE LOCATION MAY VARY. CONTRACTOR SHALL VERIFY CATCH BASIN AND OIL/WATER SEPARATOR SIZES WILL ACCOMMODATE ANY OUTLET PIPES AT SKEWED ANGLES.



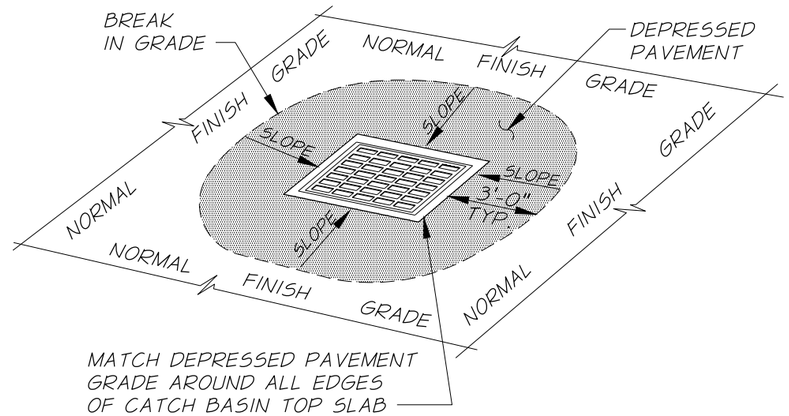
TOP VIEW

NOTES:

1. PRE-CAST CATCH BASINS SHALL BE TYPE G-1 OR G-2 PER OREGON STANDARD DRAWINGS.
2. FRAMES AND GRATES SHALL BE TYPE 2 GRATES PER OREGON STANDARD DRAWINGS.
3. 6" OF CRUSHED BASE ROCK TO BE PLACED AROUND STRUCTURE.
4. REINFORCEMENT SHALL NOT BE REQUIRED FOR CAST-IN-PLACE STRUCTURES. REINFORCEMENT IN PRE-CAST STRUCTURES TO BE REBAR MEETING ASTM A-615 GRADE OR WELDED WIRE MEETING ASTM A-497.
5. FIELD SET AREA DRAIN TO OBTAIN PROPER GRATE ORIENTATION WITH FINISH GRADE.
6. PRE-CAST BASES SHALL BE FURNISHED WITH CUTOUTS OR KNOCKOUTS. KNOCKOUTS SHALL HAVE A WALL THICKNESS OF 2-INCHES MINIMUM AND MAY BE LOCATED ON ALL FOUR SIDES.
7. GRATES SHALL BE CONSTRUCTED FOR BICYCLE SAFETY.



SECTION A



ISOMETRIC

AREA DRAIN DETAIL

N.T.S.

REVISION	DATE

CITY OF
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OFFICE OF TECHNICAL SERVICES

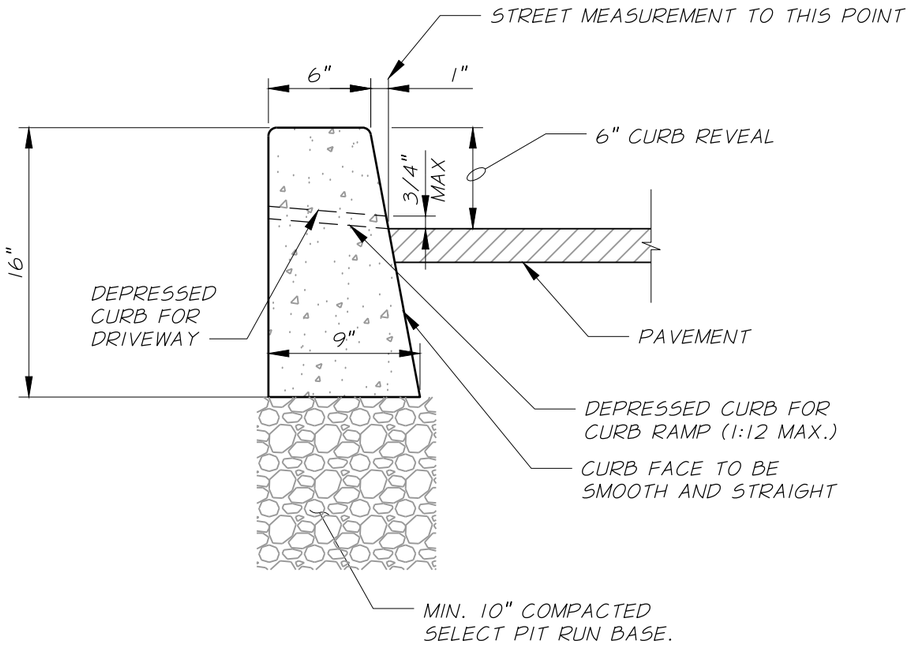
STANDARD STORM DRAINAGE DETAILS

AREA DRAIN DETAIL

FIGURE
SD7

NOTES

1. ALL RADII SHALL BE 3/4" EXCEPT AS OTHERWISE SHOWN.
2. ISOLATION JOINTS SHALL BE PLACED ONLY AS REQUIRED BY CITY.
3. CONTRACTION JOINTS SHALL BE PLACED AT 10-FT. INTERVALS FOR AC CONCRETE STREETS AND SHALL EXTEND FULL WIDTH OF THE CURB AND TO WITHIN 3 INCHED OF THE BOTTOM OF THE CURB.
4. CONTACT BETWEEN CURB AND STREET SHALL NOT VARY BY MORE THAN 1/2") FROM A STRAIGHT LINE.
5. CURB CONTRACTION JOINTS FOR P.O.C. PAVEMENT STREETS SHALL MATCH TRANSVERSE STREET JOINTS. A LAYOUT PLAN MUST BE SUBMITTED FOR CITY APPROVAL.
6. CURB MUST HAVE MIN. 10" OF COMPACTED SELECT PIT RUN BASE



REVISION	DATE

CITY OF
BAKER CITY, OREGON
OFFICE OF TECHNICAL SERVICES

STANDARD STREET DETAILS

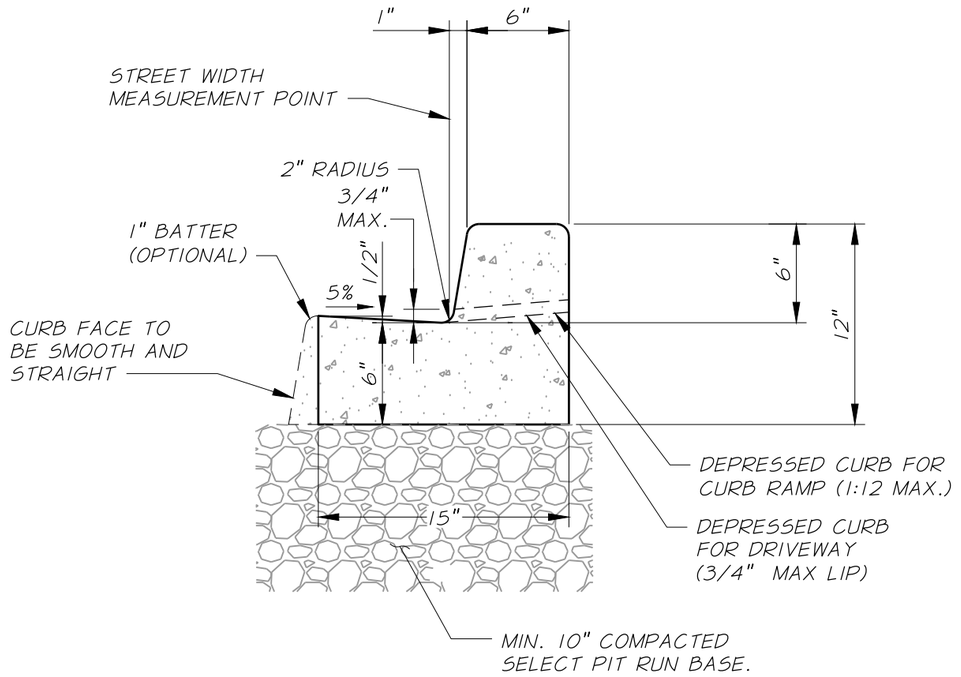
TYPICAL STRAIGHT CURB DETAIL

FIGURE

R1

NOTES

1. ALL RADII SHALL BE 3/4" EXCEPT AS OTHERWISE SHOWN.
2. ISOLATION JOINTS SHALL BE PLACED ONLY AS REQUIRED BY CITY.
3. CONTRACTION JOINTS SHALL BE PLACED AT 10-FT. INTERVALS FOR AC CONCRETE STREETS AND SHALL EXTEND FULL WIDTH OF THE CURB AND TO WITHIN 3 INCHES OF THE BOTTOM OF THE CURB.
4. CONTACT BETWEEN CURB AND STREET SHALL NOT VARY BY MORE THAN 1/2" FROM A STRAIGHT LINE.
5. CURB CONTRACTION JOINTS FOR P.O.C. PAVEMENT STREETS SHALL MATCH TRANSVERSE STREET JOINTS. A LAYOUT PLAN MUST BE SUBMITTED FOR CITY APPROVAL.
6. CURB MUST HAVE MIN. 10" OF COMPACTED SELECT PIT RUN BASE.



REVISION	DATE

CITY OF
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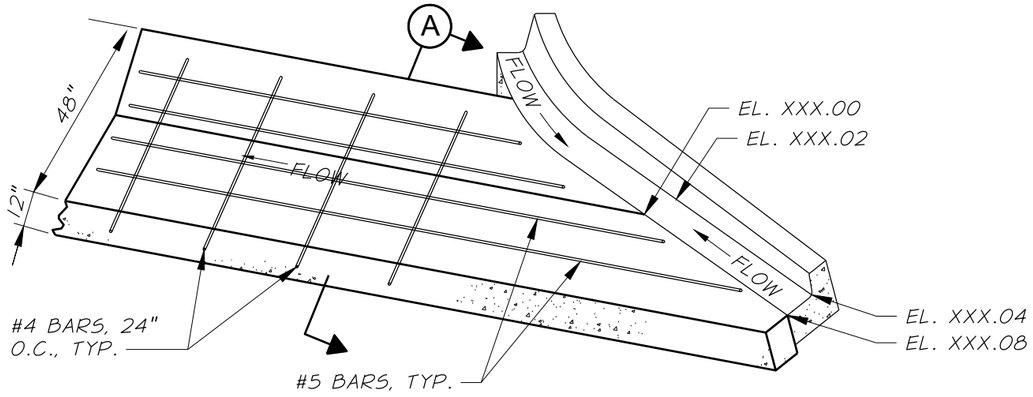
STANDARD STREET DETAILS

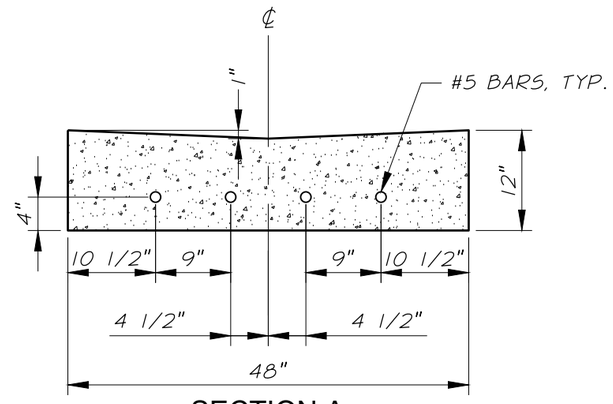
TYPICAL CURB AND GUTTER DETAIL

FIGURE

R2



DETAIL



SECTION A

REVISION	DATE

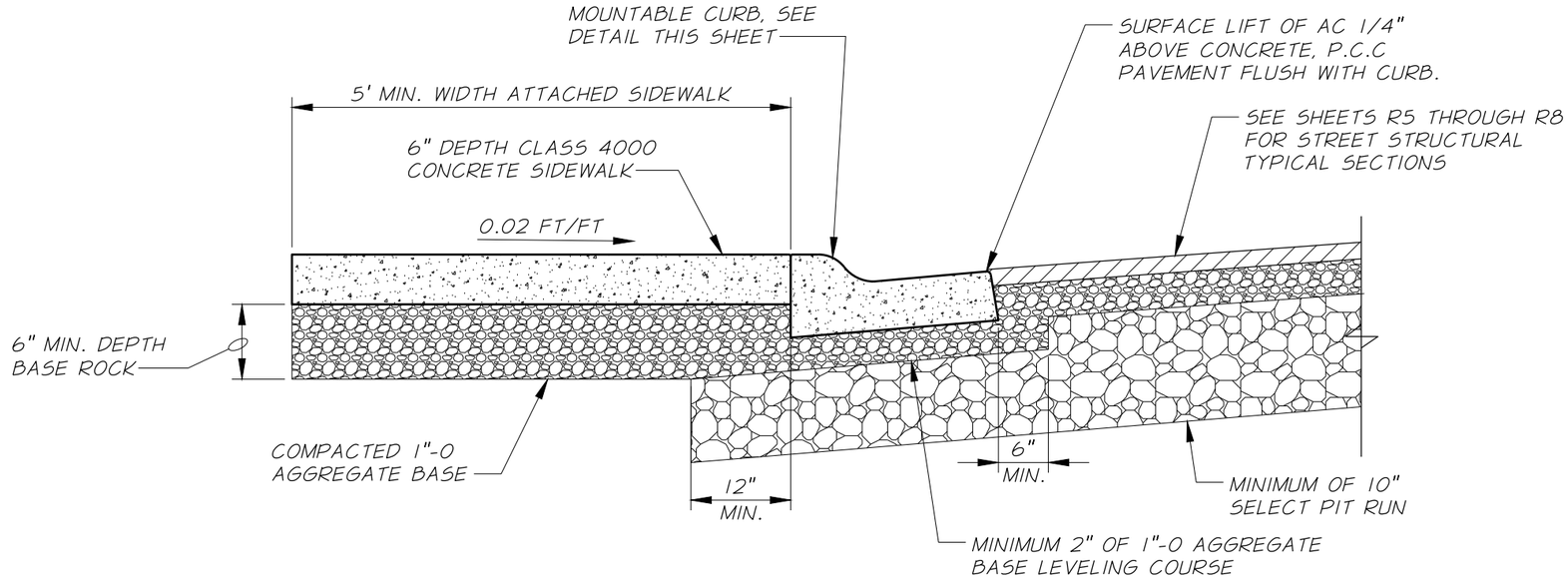
CITY OF
BAKER CITY, OREGON
OFFICE OF TECHNICAL SERVICES

STANDARD STREET DETAILS

CONCRETE CROSS DRAIN

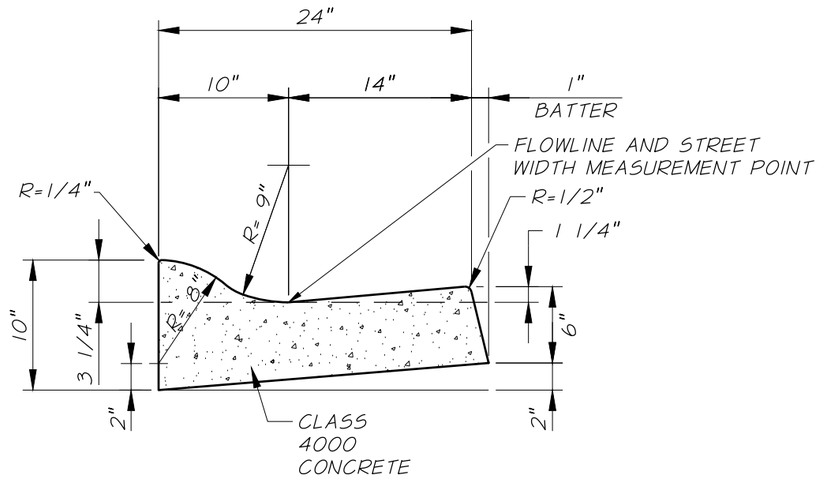
FIGURE

R3



NOTES

1. MOUNTABLE CURB CONSTRUCTION IS ALLOWED ONLY ON RESIDENTIAL STREETS WITH PROJECTED ADT OF LESS THAN 500 AND WITH APPROVAL FROM THE CITY.
2. MINOR VARIATIONS IN CURB PROFILE MAY BE APPROVED BY THE CITY ENGINEER.
3. CONCRETE SHALL BE CLASS 4000.
4. CONTRACTION JOINTS ARE REQUIRED IN THE SIDEWALK EVERY 5 FT. WITH A MINIMUM DEPTH OF 2 INCHES.
5. CONTRACTION JOINTS IN THE CURB SHALL BE PLACED AT 10 FT. INTERVALS FOR AC CONCRETE STREETS AND SHALL EXTEND FULL WIDTH OF THE CURB AND TO WITHIN 2 INCHES OF THE BOTTOM OF THE CURB.
6. CURB CONTRACTION JOINTS FOR P.C.C. PAVEMENT STREETS SHALL MATCH TRANSVERSE STREET JOINTS. A LAYOUT PLAN MUST BE SUBMITTED FOR CITY APPROVAL.
7. CONTACT BETWEEN CURB AND STREET SHALL NOT VARY BY MORE THAN 1/2" FROM A STRAIGHT LINE.

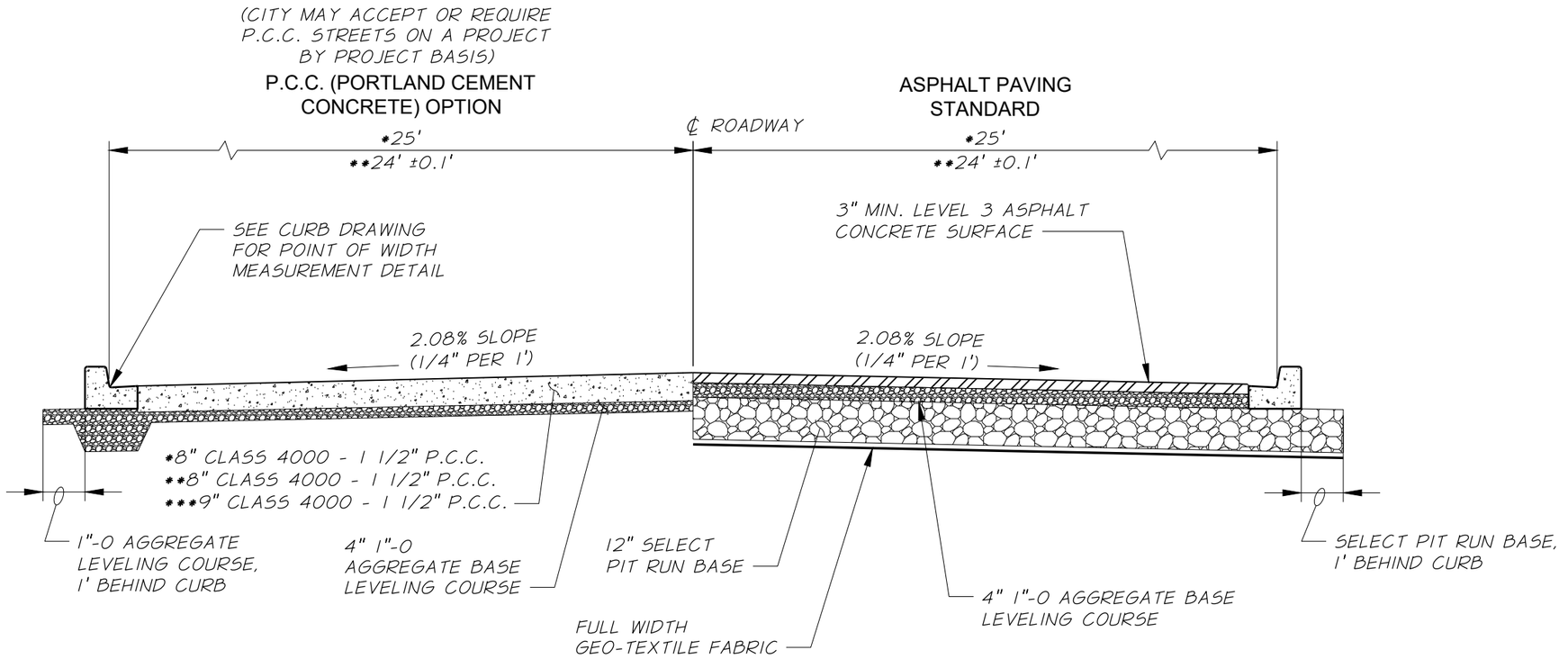


REVISION	DATE

CITY OF
BAKER CITY, OREGON
OFFICE OF TECHNICAL SERVICES

STANDARD STREET DETAILS
MOUNTABLE CURB AND ADJOINING SIDEWALK DETAIL

FIGURE
R4



NOTES

1. SEE DRAWING R6 FOR SIDEWALK LOCATION.
2. SPECIFIED DEPTH ARE MINIMUMS. ADDITIONAL DEPTH MAY BE ADDED TO COMPENSATE FOR CONSTRUCTION VARIATIONS OR OTHER ENGINEER CONCERNS. IF ADDITIONAL DEPTH IS ADDED, SUBGRADE SHOULD BE ADJUSTED SO THAT FINISHED SURFACE GRADE IS AS DESIGNED.
3. VARIABLE WIDTH BASED ON ADT AND DHV.

LEGEND

* URBAN ARTERIAL
** URBAN MAJOR COLLECTOR
*** URBAN INDUSTRIAL

ABBREVIATIONS

ADT: AVERAGE DAILY TRAFFIC

DHV: DESIGN HOUR VOLUME IS THE EXPECTED TRAFFIC VOLUME IN THE PEAK DESIGN HOUR

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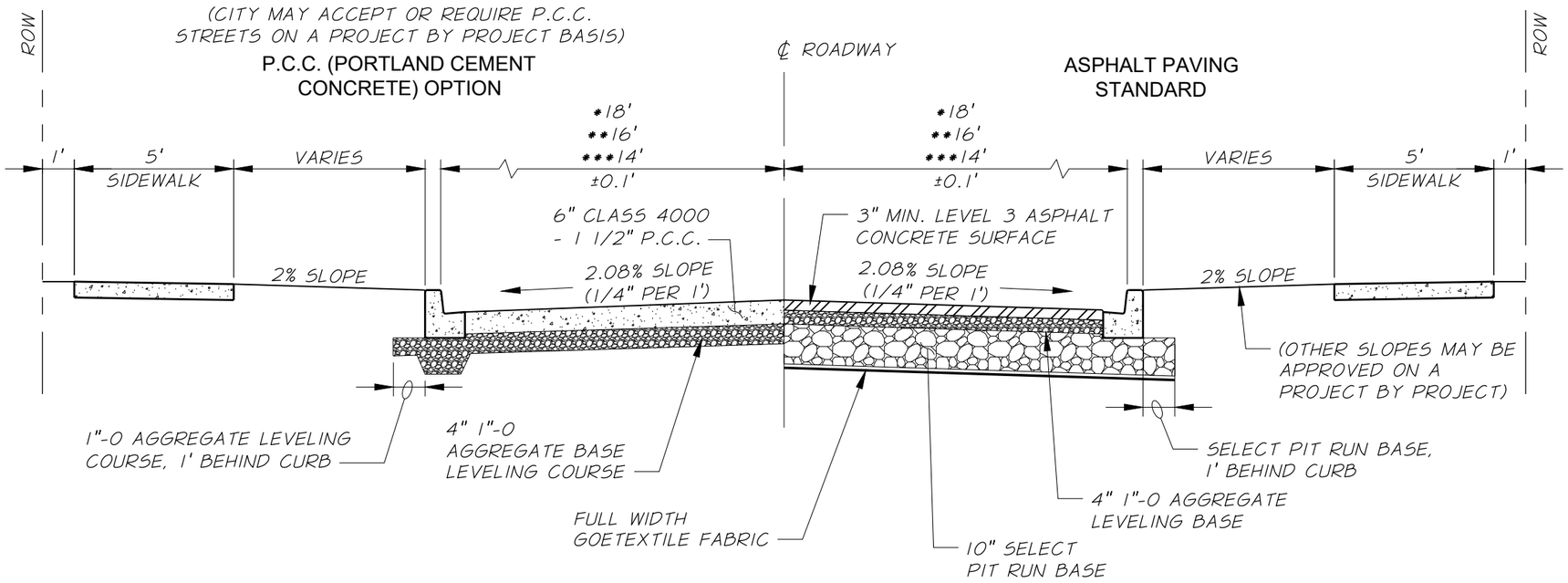
OFFICE OF TECHNICAL SERVICES

STANDARD STREET DETAILS
URBAN TYPICAL SECTIONS, ARTERIAL, MAJOR COLLECTOR, & INDUSTRIAL STREETS

FIGURE
R5



LEGEND

* URBAN MINOR COLECTOR
** URBAN RESIDENTIAL AND CUL-DE-SAC
*** MODIFIED URBAN RESIDENTIAL OR CUL-DE-SAC (USE OF THE MODIFIED RESIDENTIAL OR CUL-DE-SAC SECTION CAN ONLY BE AUTHORIZED BY BAKER CITY COUNCIL ACTION. PARKING IS GENERALLY ALLOWED ON ONE SIDE ONLY.

NOTE

SPECIFIED DEPTH ARE MINIMUMS. ADDITIONAL DEPTH MAY BE ADDED TO COMPENSATE FOR CONSTRUCTION VARIATIONS OR OTHER ENGINEER CONCERNS. IF ADDITIONAL DEPTH IS ADDED, SUBGRADE SHOULD BE ADJUSTED SO THAT FINISHED SURFACE GRADE IS AS DESIGNED.

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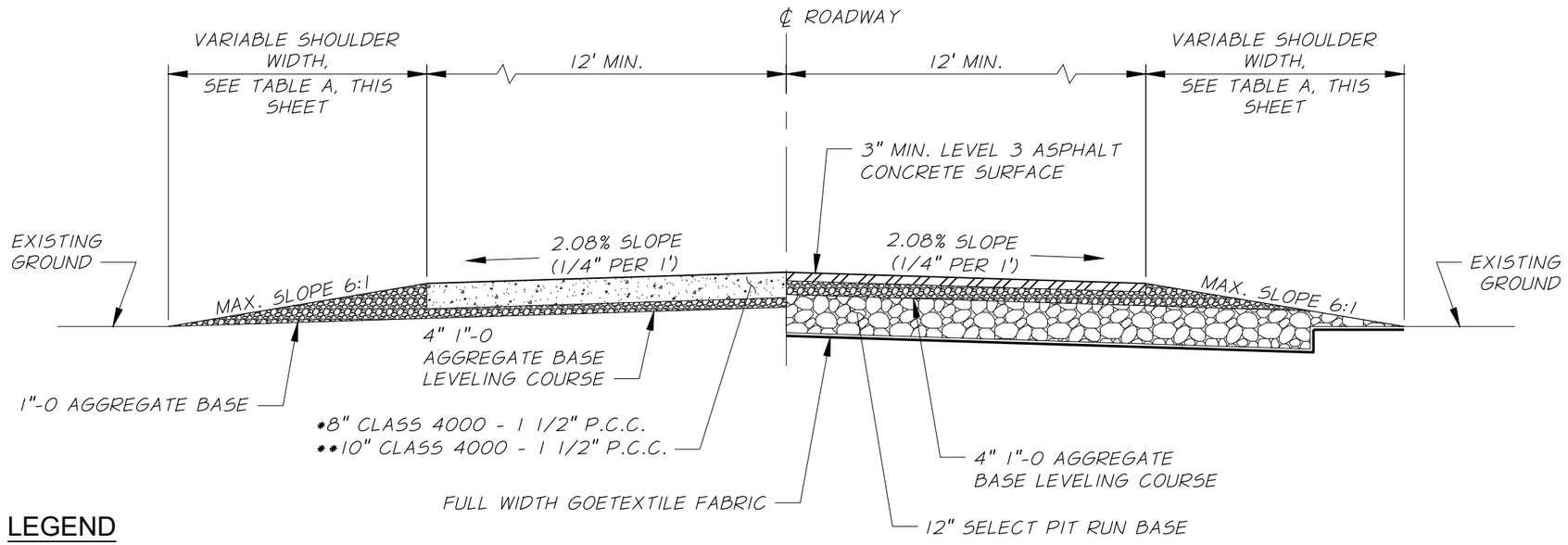
STANDARD STREET DETAILS
URBAN TYPICAL SECT. MINOR CONNECTOR, CUL-DE-SAC AND RESIDENTIAL STREETS

FIGURE
R6

(CITY MAY ACCEPT OR REQUIRE P.C.C. STREETS ON A PROJECT BY PROJECT BASIS)

P.C.C. (PORTLAND CEMENT CONCRETE) OPTION

ASPHALT PAVING STANDARD



LEGEND

* RURAL ARTERIAL
** RURAL INDUSTRIAL

ADT: AVERAGE DAILY TRAFFIC
DHV: DESIGN HOUR VOLUME IS THE EXPECTED TRAFFIC VOLUME IN THE PEAK DESIGN HOUR

NOTES

1. USE OF INDUSTRIAL TYPICAL SECTION CAN ONLY BE AUTHORIZED BY BAKER CITY COUNCIL ACTION.

2. SPECIFIED DEPTH ARE MINIMUMS. ADDITIONAL DEPTH MAY BE ADDED TO COMPENSATE FOR CONSTRUCTION VARIATIONS OR OTHER ENGINEER CONCERNS. IF ADDITIONAL DEPTH IS ADDED, SUBGRADE SHOULD BE ADJUSTED SO THAT FINISHED SURFACE GRADE IS AS DESIGNED.

TABLE A - MINIMUM SHOULDER WIDTH

	ADT<400	ADT<400 DHV<200	DHV>200
RURAL ARTERIAL	-	6 FEET	8 FEET
RURAL INDUSTRIAL	6 FEET	6 FEET	8 FEET

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CITY OF
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OFFICE OF TECHNICAL SERVICES

STANDARD STREET DETAILS
RURAL TYPICAL SECTIONS, ARTERIAL AND INDUSTRIAL STREETS

FIGURE
R7

(CITY MAY ACCEPT OR REQUIRE P.C.C. STREETS ON A PROJECT BY PROJECT BASIS)

P.C.C. (PORTLAND CEMENT CONCRETE) OPTION

ASPHALT PAVING STANDARD

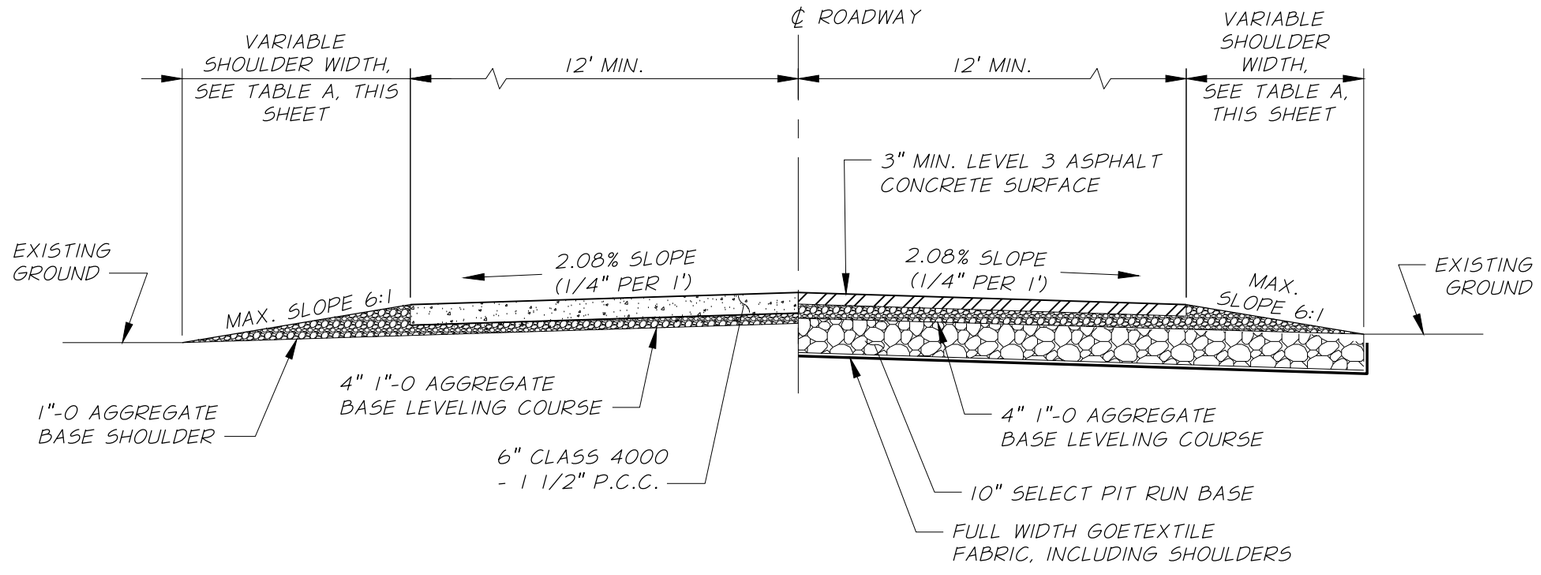

TABLE A - MINIMUM SHOULDER WIDTH (MIN.)

	ADT<400	ADT<400 DHV<100	DHV 200-100	DHV 200-400	DHV>400
RURAL LOCAL STREET	4 FEET	4 FEET	-	6 FEET	8 FEET
RURAL COLLECTOR	4 FEET	4 FEET	6 FEET	8 FEET	8 FEET

ADT: AVERAGE DAILY TRAFFIC
DHV: DESIGN HOUR VOLUME IS THE EXPECTED TRAFFIC VOLUME IN THE PEAK DESIGN HOUR

NOTE

SPECIFIED DEPTHS ARE MINIMUMS. ADDITIONAL DEPTH MAY BE ADDED TO COMPENSATE FOR CONSTRUCTION VARIATIONS OR OTHER ENGINEER CONCERNS. IF ADDITIONAL DEPTH IS ADDED, SUBGRADE SHOULD BE ADJUSTED SO THAT FINISHED SURFACE GRADE IS AS DESIGNED.

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CITY OF
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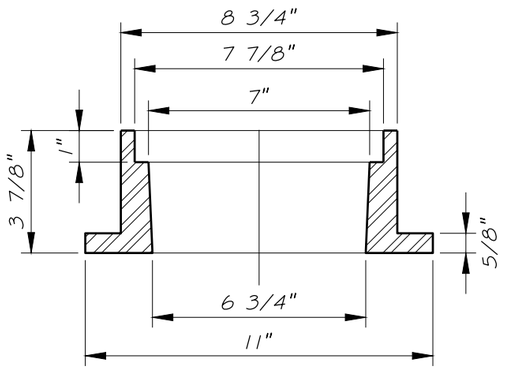
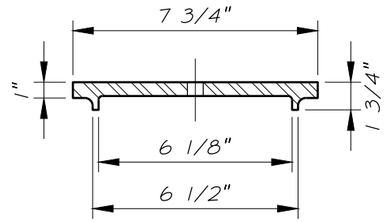
STANDARD STREET DETAILS
RURAL TYPICAL SECTIONS, LOCAL AND COLLECTOR STREETS

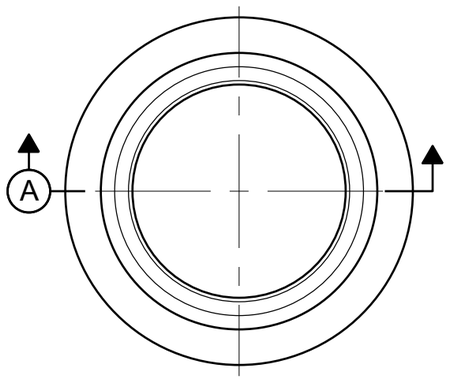
FIGURE
R8



SECTION A

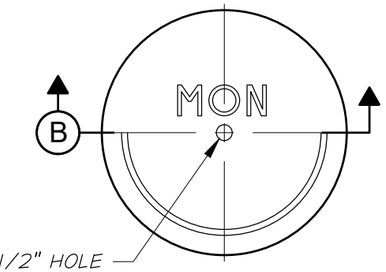


SECTION B



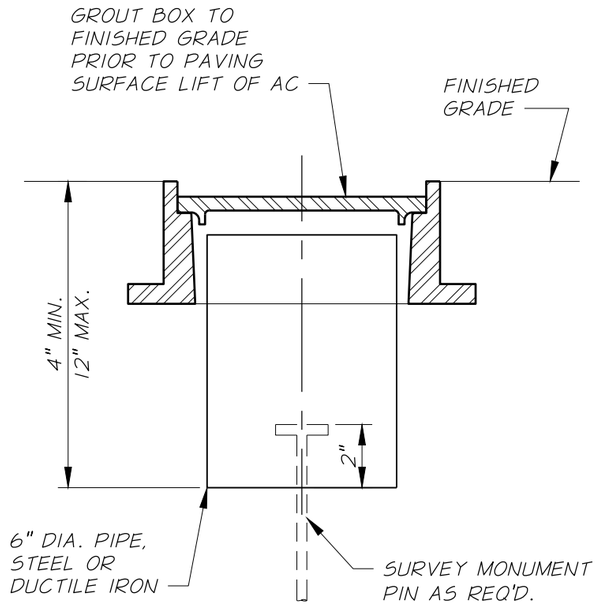
BOX DETAIL

N.T.S.



LID DETAIL

N.T.S.



SECTION

INSTALLATION DETAIL

N.T.S.

NOTES

1. CENTER OF SURVEY MONUMENT TO BE WITHIN 1/2" OF THE CENTER OF MONUMENT BOX.
2. MONUMENT CASING TO BE PLACED AS CLOSE AS POSSIBLE TO VERTICAL POSITION TO ALLOW ACCESS TO MONUMENT WITH SURVEY EQUIPMENT.

REVISION	DATE

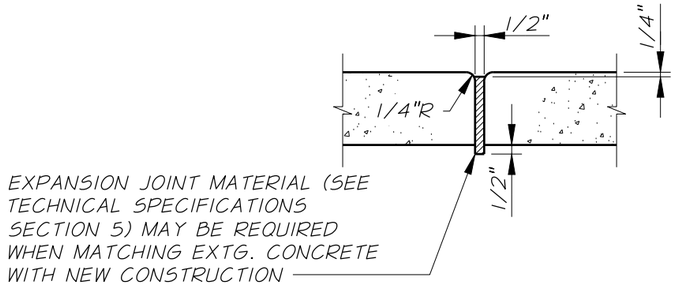
CITY OF
BAKER CITY, OREGON
OFFICE OF TECHNICAL SERVICES

STANDARD STREET DETAILS

SURVEY MONUMENT BOX

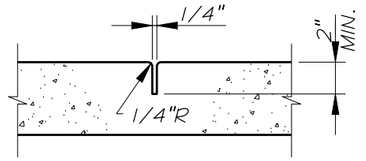
FIGURE

R9



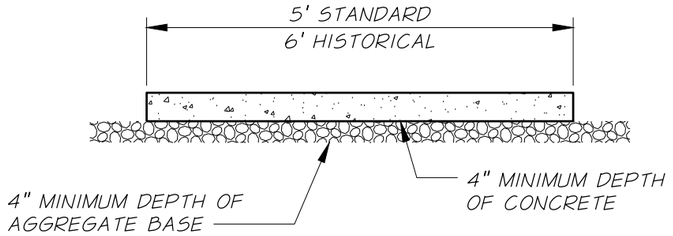
EXPANSION JOINT DETAIL

N.T.S.

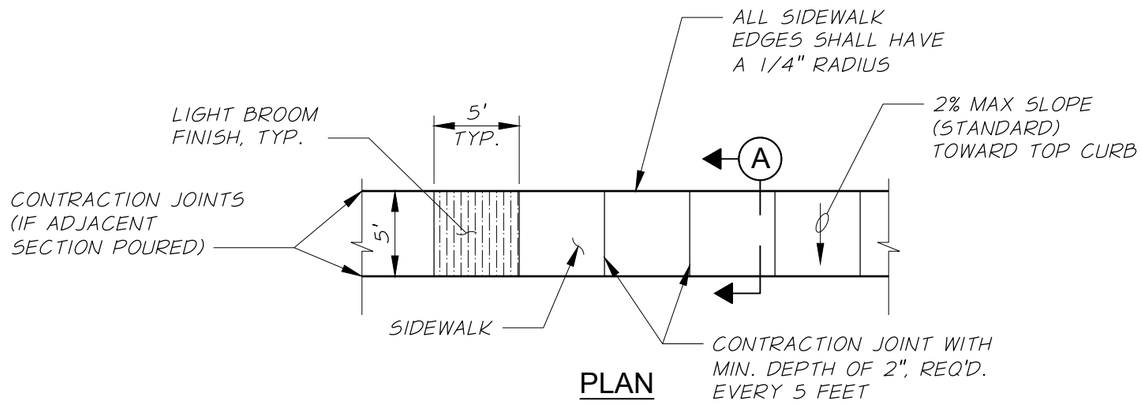


CONTRACTION JOINT DETAIL

N.T.S.



SECTION A



PLAN

SIDEWALK DETAIL

N.T.S.

NOTES

1. ALL JOINTS AND SCORE LINES SHALL BE CONSTRUCTED AT RIGHT ANGLES TO THE CENTERLINE OF THE SIDEWALK WITH AN APPROVED TEMPLATE PRODUCING A STRAIGHT LINE. THEY SHALL BE APPROXIMATELY 1/8" IN WIDTH, FINISHED AND EDGED TRUE TO LINE AND GRADE. ALL JOINTS AND SCORE LINES EDGES SHALL BE TO A 1/4" RADIUS. SAW CUTTING OF JOINTS AND SCORE LINES ARE NOT ALLOWED.
2. BACKFILL BEHIND SIDEWALKS LEVEL WITH SURFACE OF CONCRETE WALL.

REVISION	DATE

CITY OF
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OFFICE OF TECHNICAL SERVICES

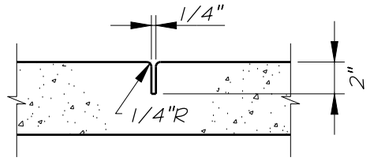
STANDARD STREET DETAILS

STANDARD SIDEWALK JOINTING DETAILS

FIGURE
R10

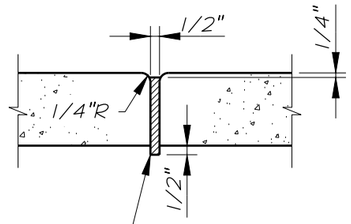
NOTE

ALL JOINTS AND SCORE LINES SHALL BE CONSTRUCTED AT RIGHT ANGLES TO THE CENTERLINE OF THE SIDEWALK WITH AN APPROVED TEMPLATE PRODUCING A STRAIGHT LINE. THEY SHALL BE APPROXIMATELY 1/8" IN WIDTH, FINISHED AND EDGED TRUE TO LINE AND GRADE. ALL JOINTS AND SCORE LINES SHALL BE EDGED TO A 1/4" RADIUS. SAW CUTTING OF JOINTS AND SCORE LINES IS NOT ALLOWED.



CONTRACTION JOINT DETAIL

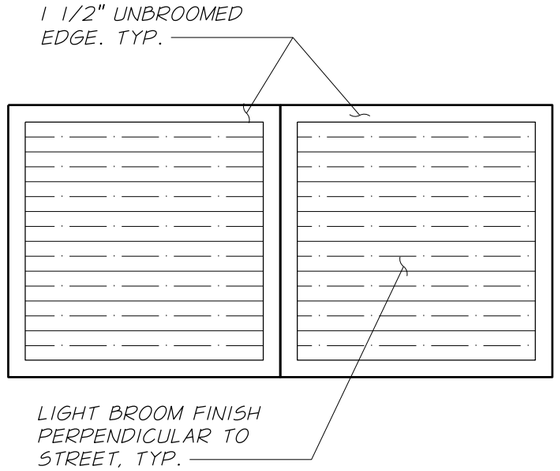
N.T.S.



EXPANSION JOINT MATERIAL (SEE TECHNICAL SPECIFICATIONS SECTION 5) MAY BE REQUIRED WHEN MATCHING EXTG. CONCRETE WITH NEW CONSTRUCTION

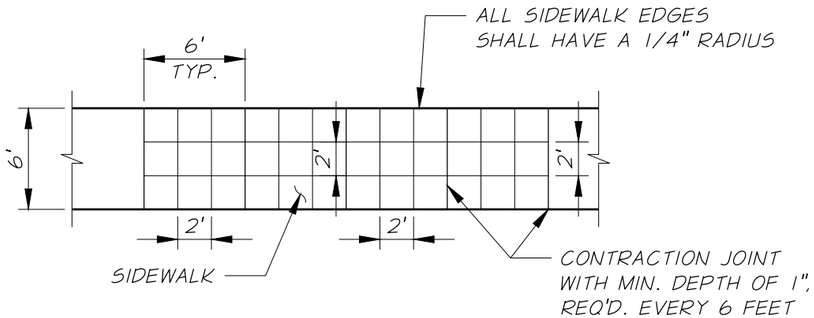
EXPANSION JOINT DETAIL

N.T.S.



2' SQUARE FINISHING DETAIL

N.T.S.



HISTORIC SIDEWALK JOINTING DETAIL

N.T.S.

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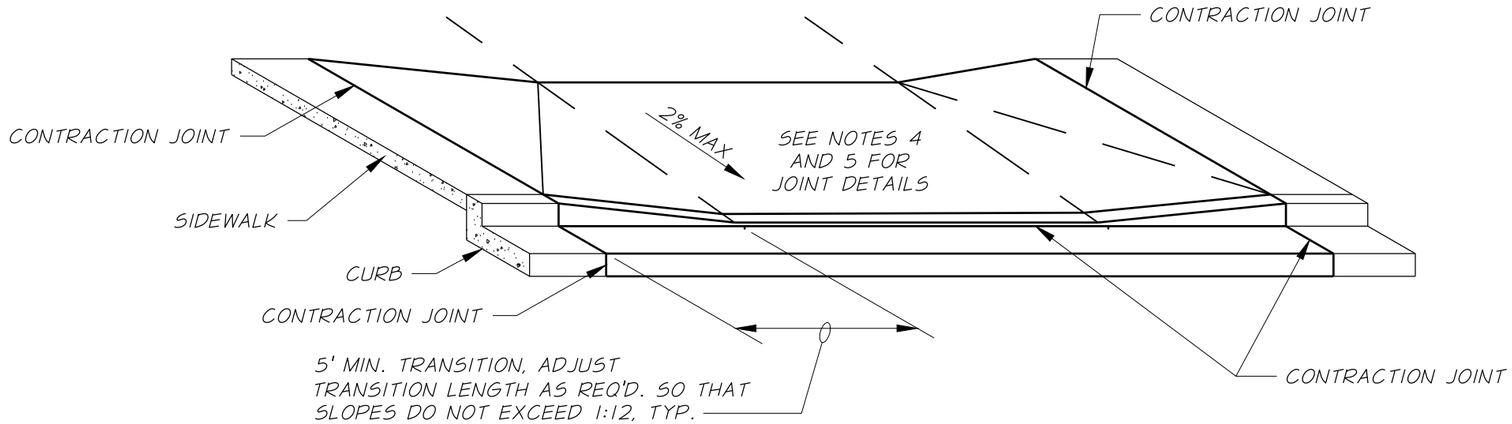
CITY OF
BAKER CITY, OREGON
OFFICE OF TECHNICAL SERVICES

STANDARD STREET DETAILS

HISTORIC SIDEWALK JOINTING DETAILS

FIGURE

R11



NOTES

1. DRIVEWAYS AND SIDEWALK SECTIONS THROUGH DRIVEWAYS SHALL HAVE A MINIMUM THICKNESS OF SIX INCHES OF CLASS 3000 PCS.
2. DRIVEWAYS AND SIDEWALK SECTIONS THROUGH DRIVEWAYS SHALL HAVE MINIMUM THICKNESS OF SIX INCHES OF COMPACTED 3/4"-0 AGGREGATE BASE.
3. MINIMUM WIDTH OF DRIVEWAY SHALL BE 10' (3M). MAXIMUM WIDTH OF DRIVEWAY SHALL BE 24' UNLESS OTHERWISE APPROVED BY THE CITY.
4. CONTRACTION JOINTS SHALL BE EVENLY SPACED WITH NO GREATER THAN 15' SPACING IN ANY DIRECTION. JOINT SPACING SHALL BE SUCH THAT NO ONE SIDE DIMENSION EXCEEDS 150% OF EITHER CONNECTING SIDE DIMENSION.
5. SIDEWALKS BEHIND DRIVEWAY SHALL HAVE CONTRACTION JOINTS TO MATCH SIDEWALK SPECIFICATIONS.

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CITY OF
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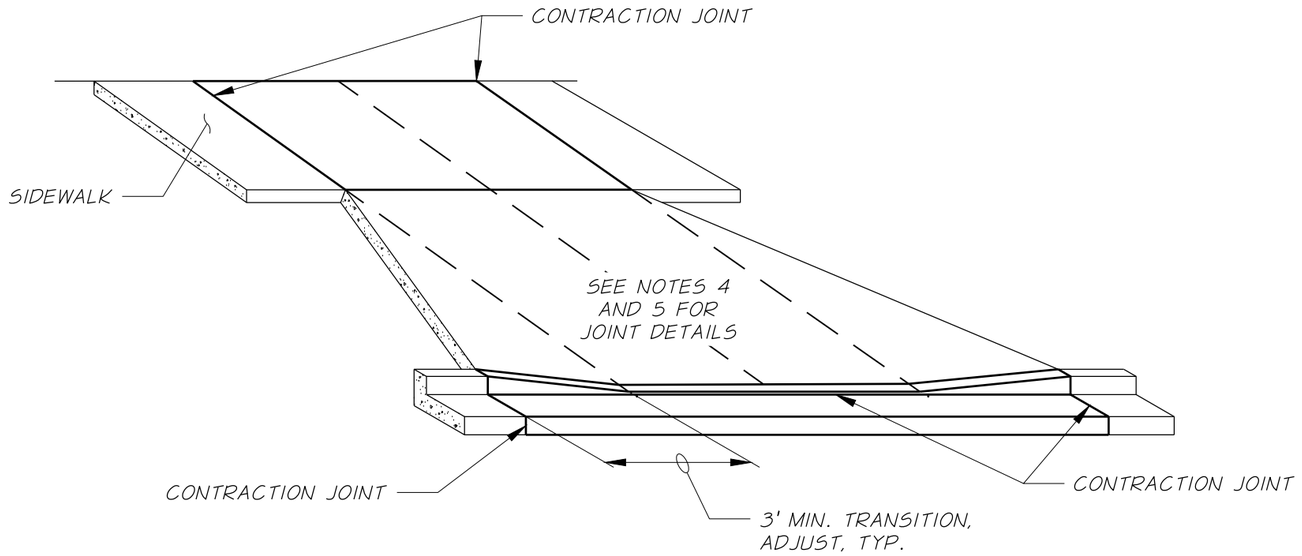
OFFICE OF TECHNICAL SERVICES

STANDARD STREET DETAILS
DRIVEWAY/ALLEY APPROACH FOR CURB LINE SIDEWALK

FIGURE
R12



NOTES

1. DRIVEWAYS AND SIDEWALK SECTIONS THROUGH DRIVEWAYS SHALL HAVE A MINIMUM THICKNESS OF SIX INCHES OF CLASS 3000 PCS.

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5. SIDEWALKS BEHIND DRIVEWAY SHALL HAVE CONTRACTION JOINTS TO MATCH SIDEWALK SPECIFICATIONS.

REVISION	DATE

CITY OF
BAKER CITY, OREGON
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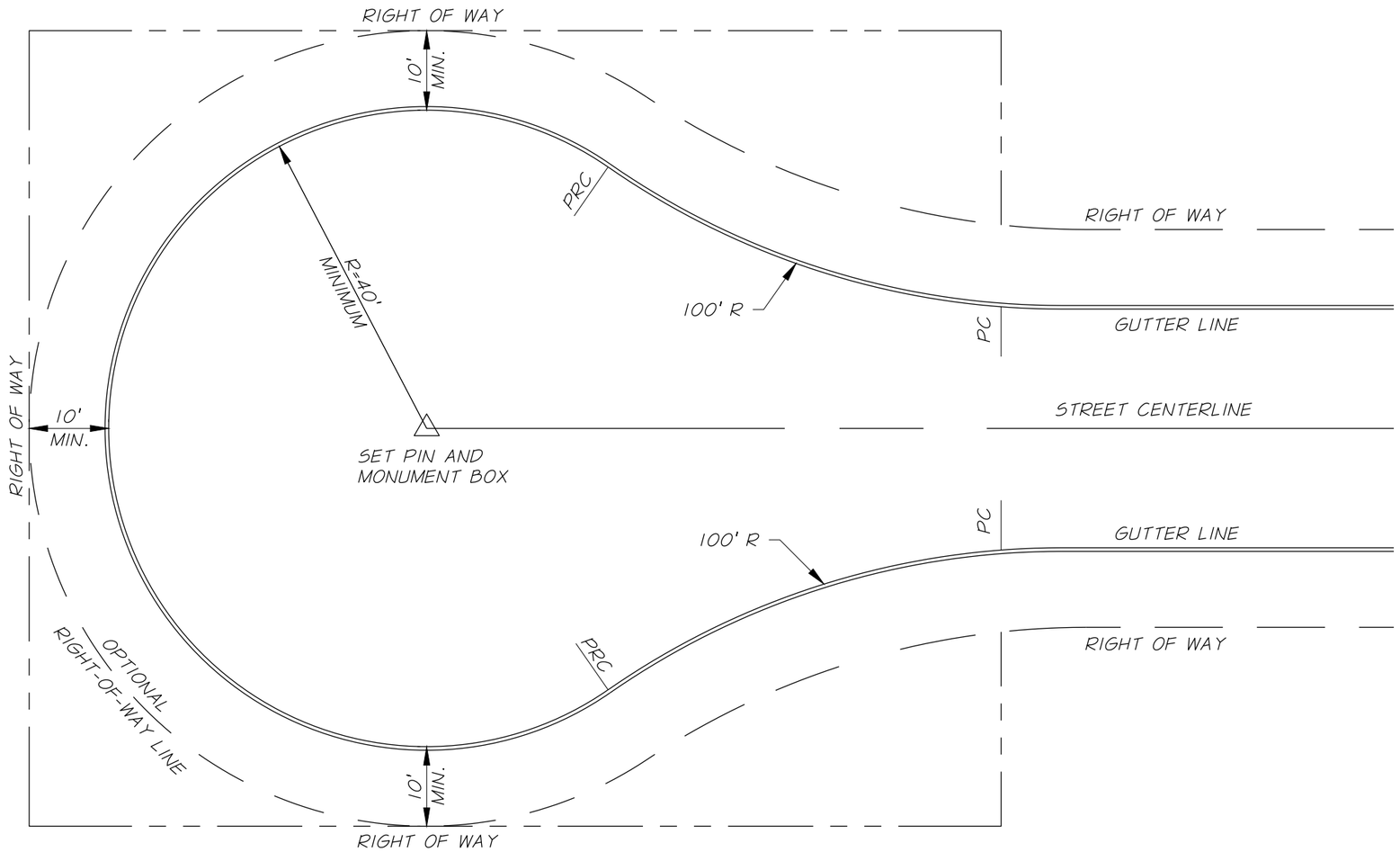
STANDARD STREET DETAILS
DRIVEWAY/ALLEY APPROACH FOR SETBACK SIDEWALK

FIGURE
R13



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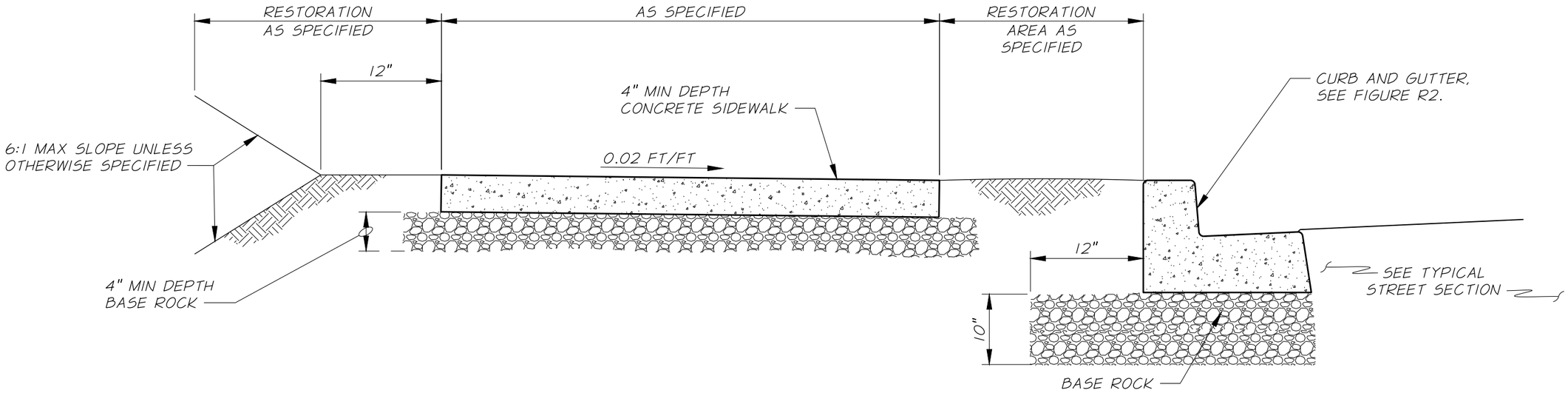
OFFICE OF TECHNICAL SERVICES

STANDARD STREET DETAILS
TYPICAL CUL-DE-SEC

FIGURE
R14



SIDEWALK/CURB AND GUTTER DETAIL

(FOR SETBACK SIDEWALK)

N.T.S.

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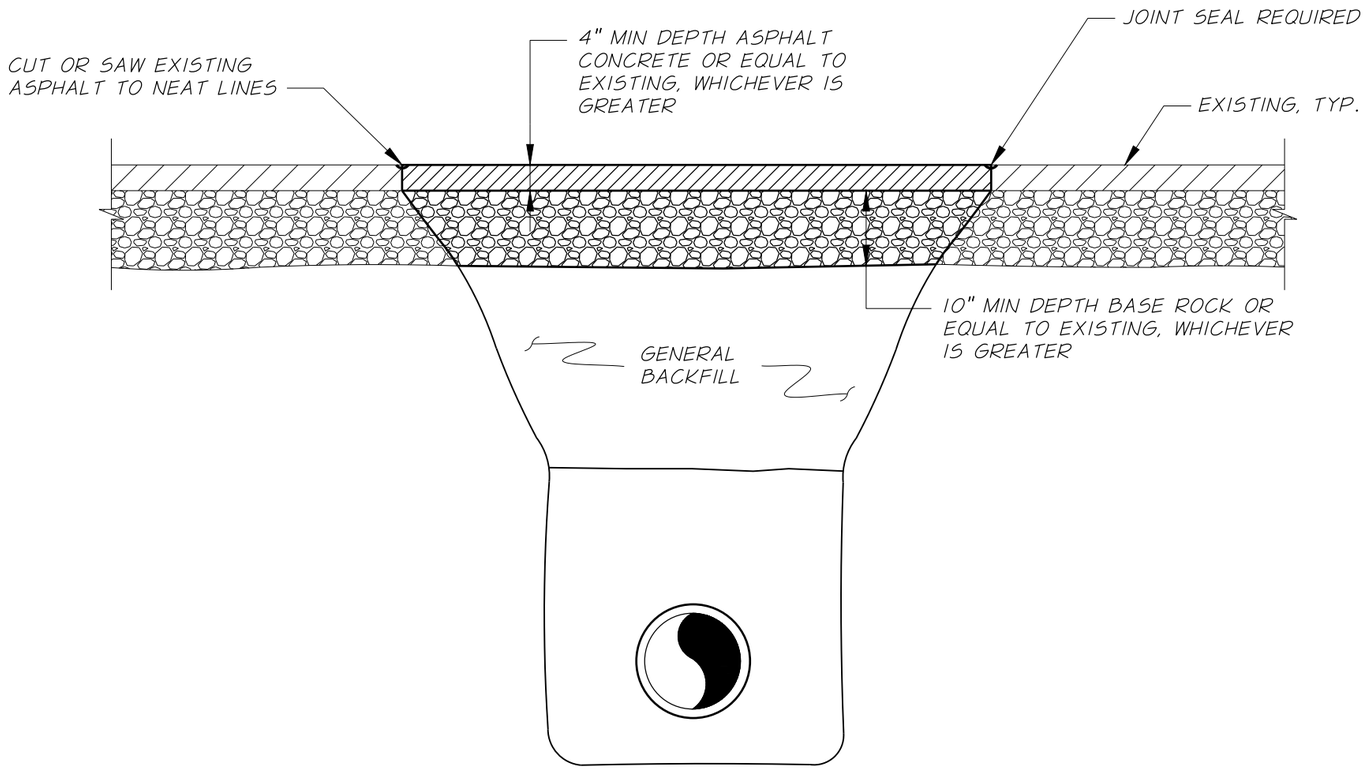
STANDARD STREET DETAILS
SIDEWALK/CURB AMD GUTTER DETAIL (FOR SETBACK SIDEWALK)

FIGURE
R15



TRENCH RESTORATION

PAVED STREETS AND ROADWAYS

N.T.S.

REVISION	DATE

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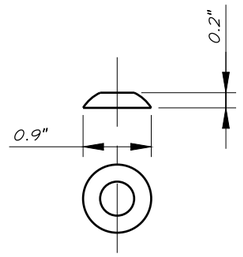
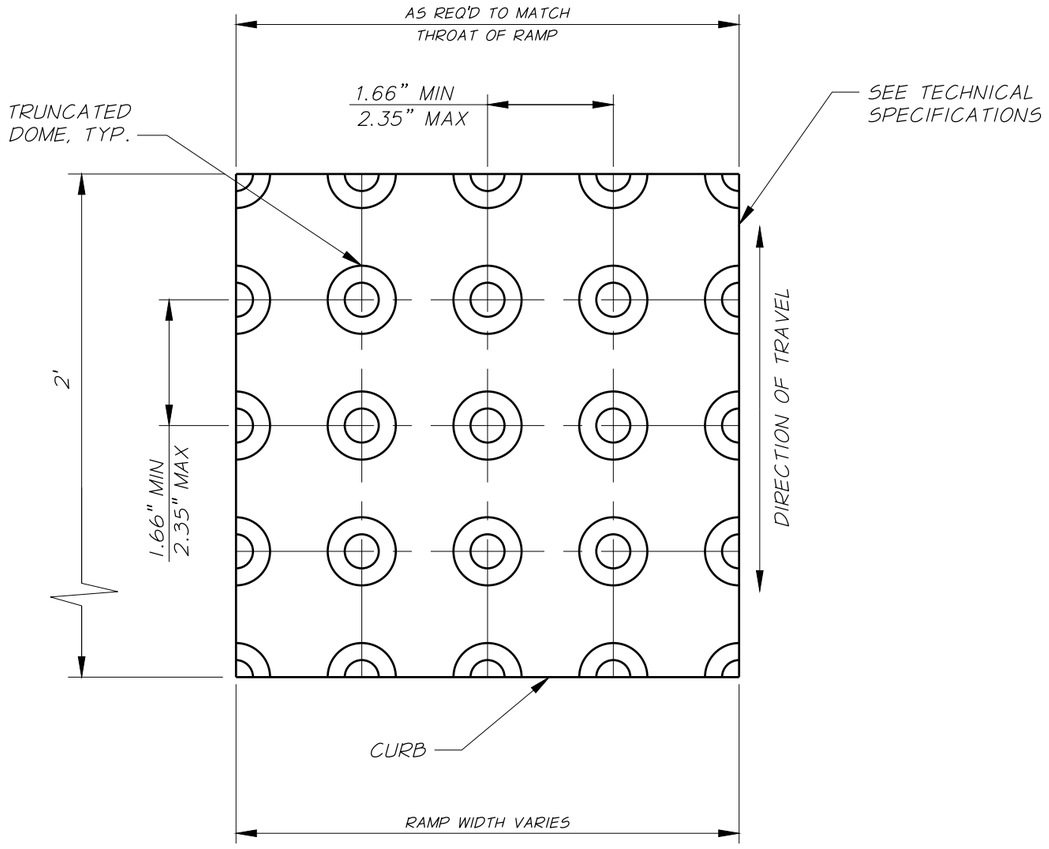
OFFICE OF TECHNICAL SERVICES

STANDARD STREET DETAILS
TRENCH RESTORATION
PAVED STREETS AND ROADWAYS

FIGURE
R16



TRUNCATED DOME



RAMP TEXTURE PATTERN

RAMP TEXTURE PATTERN DETAILS

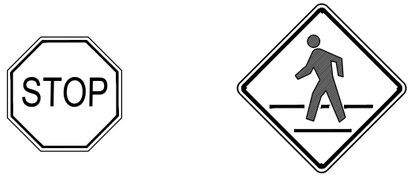
N. T. S.

REVISION	DATE

CITY OF
BAKER CITY, OREGON
OFFICE OF TECHNICAL SERVICES

STANDARD STREET DETAILS
RAMP TEXTURE PATTERN DETAILS

FIGURE
R17



ARROWS ON SIGN AS REQ'D. FOR SIGN LOCATION

N LARCH AVE 6" X VARIABLE

TRAFFIC SIGN INSTALLATION NOTES

1. ALL SIGNS SHALL CONFORM TO THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES FOR STREETS AND HIGHWAYS, CURRENT ADDITION AND CURRENT MODIFICATIONS. STREET SIGNS SHALL BE THE MANUFACTURER AND STYLE AS DESIGNATED BY THE CITY.

2. SIGNS SHALL BE MOUNTED WITH 2 - 5/16" DIA. GALV. BOLTS, NUTS & LOCK WASHERS, TO A U-CHANNEL OR SQUARE TUBE POST.

3. THE POST SHALL BE A 12' LONG METAL U-CHANNEL WEIGHING A MINIMUM 3 LBS/FT. OR A 12' LONG, 2" X 2" METAL SQUARE TUBE WITH 0.105 INCH WALL THICKNESS WITH A GREEN BAKED ENAMEL FINISH OR HOT-DIPPED GALVANIZED.

4. BREAKAWAY STYLE POSTS ARE REQUIRED ON THE STATE HIGHWAY SYSTEM OR WHEN SIGNS ARE TO BE PLACED WITHIN 7' OF A ROAD TRAVEL LANE AND NO CURB IS PRESENT. BREAKAWAY ANCHOR AND V-LOCK SOCKET ASSEMBLIES SHALL BE SUBMITTED FOR APPROVAL BY THE CITY ENGINEER.

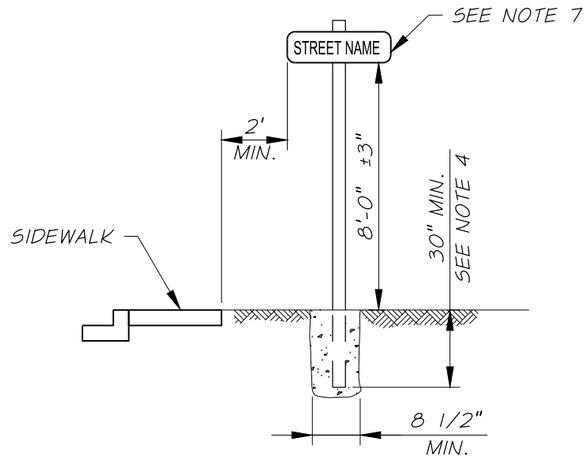
5. FOR STANDARD POSTS WITH 30" TO 36" OF BURY DEPTH, BACKFILL WITH 3000 P.S.I. CONCRETE. NATIVE MATERIAL COMPACTED TO A MINIMUM OF 90% OF TEST METHOD 609 SHALL BE USED FOR DEPTHS OVER 36". BREAKAWAY ANCHOR AND V-LOCK SOCKET ASSEMBLIES SHALL BE SUBMITTED FOR APPROVAL BY THE CITY ENGINEER.

6. SIGNS AND POST SHALL BE INSTALLED SO THEY ARE PLUMB, RESIST SWAYING IN THE WIND AND DISPLACEMENT BY VANDALISM.

7. SIGN POSTS SHALL BE SET AT THE LOCATIONS CALLED OUT ON THE PROJECT DESIGN PLANS, UNLESS OTHERWISE REQUIRED. IF SIDEWALK IS NOT PRESENT, POSTS SHALL GENERALLY BE 2'-6" FROM BACK OF CURB OR EDGE OF PAVEMENT, UNLESS OTHERWISE REQUIRED.

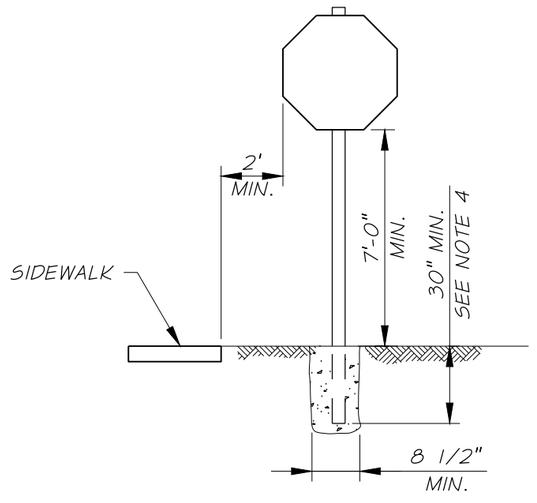
8. ORIENT STREET SIGNS TO PROPERLY DISPLAY STREET NAMES AND ADJUST TO FIELD CONDITIONS.

9. "NO PARKING" SIGNS SHALL BE SET AT AN ANGLE NOT LESS THAN 30° NOR MORE THAN 45° WITH THE LINE OF TRAFFIC FLOW TO BE VISIBLE TO APPROACHING TRAFFIC.



STREET SIGN DETAIL

N.T.S.



TRAFFIC SIGN DETAIL

N.T.S.

REVISION	DATE

CITY OF
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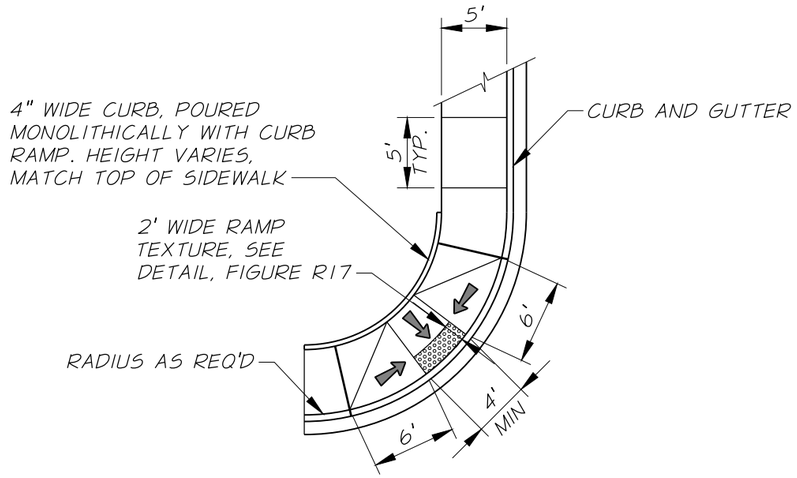
OFFICE OF TECHNICAL SERVICES

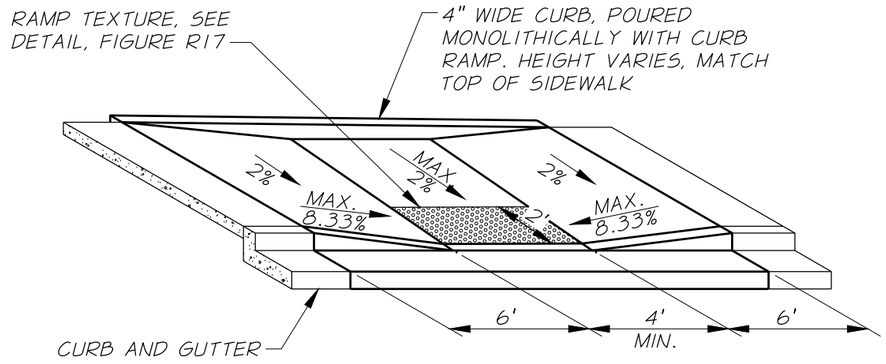
STANDARD STREET DETAILS
SIGN DETAILS

FIGURE
R18



CURB RAMP PLACEMENT DETAIL

N.T.S.



PARALELL CURB RAMP DETAIL

N.T.S.

NOTES:

1. LOCATE CURB RAMPS SO THEY ARE DIRECTLY OPPOSITE CURB RAMP ON OPPOSITE SIDE OF STREET.

2. CURB RAMP TEXTURING SHALL BE TRUNCATED DOME WARNING TEXTURE ONLY. IT SHALL ONLY BE PLACED IN THE LOWER 2' OF THROAT OF RAMP. ALIGN PATTERN RELATIVE TO TRAVEL DIRECTION. COLOR OF TEXTURE TO BE SAFETY YELLOW.

3. SLOPES SHOWN ARE MAXIMUM

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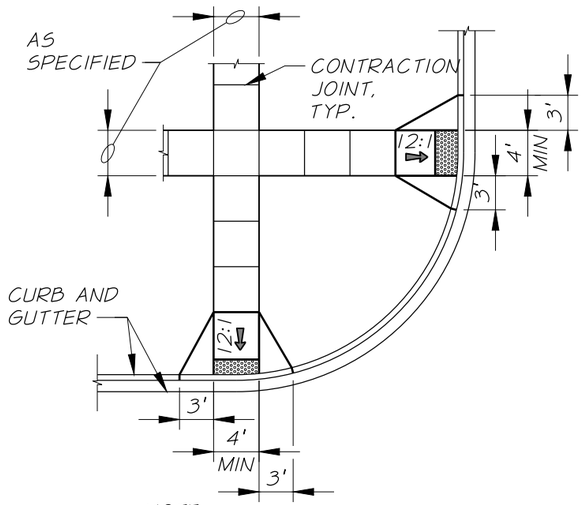
STANDARD STREET DETAILS
SIDEWALK RAMP DETAILS

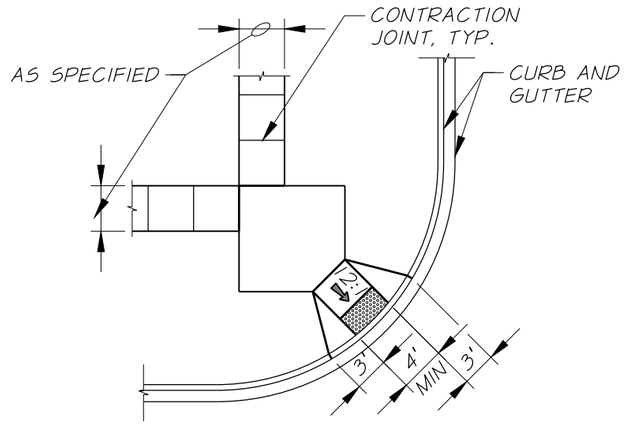
FIGURE
R19



NOTE:
SEE SIDEWALK RAMP DETAIL, SHEET.

END RAMP

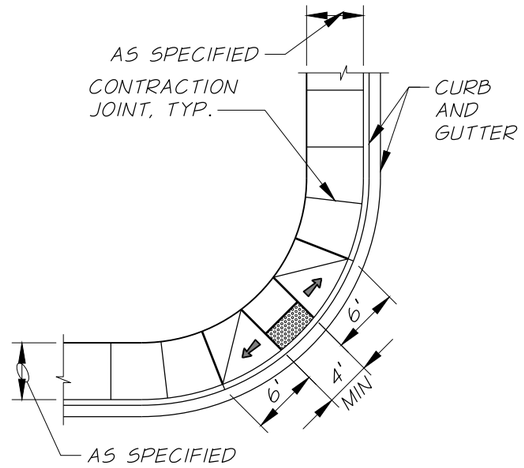
N.T.S.



NOTE:
SEE SIDEWALK RAMP DETAIL, SHEET.

SET BACK SIDEWALK

N.T.S.



NOTE:
SEE SIDEWALK RAMP DETAIL, SHEET.

CENTER RAMP FOR CURBSIDE SIDEWALK

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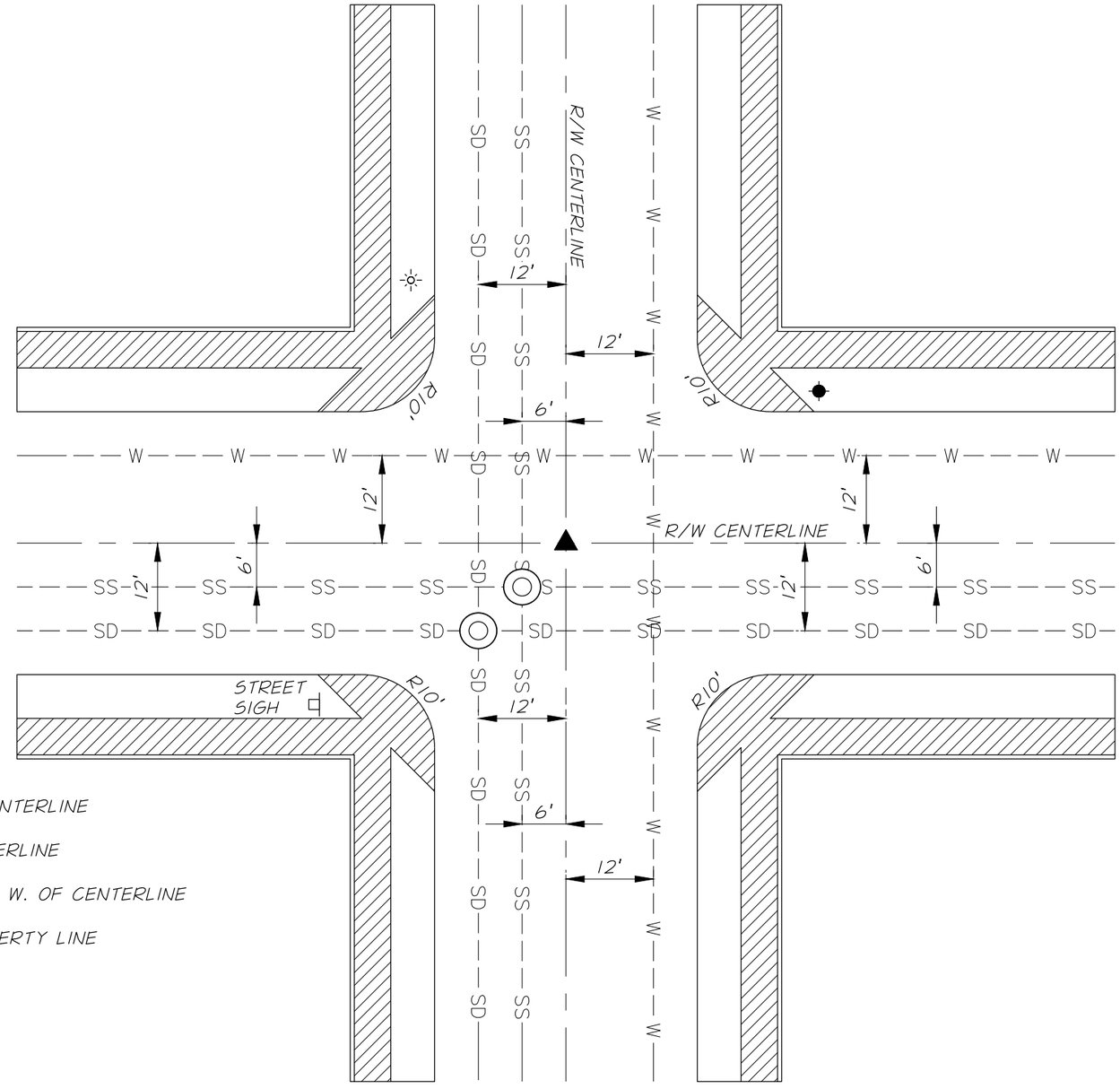
STANDARD STREET DETAILS
SIDEWALK RAMP PLACEMENT DETAIL

FIGURE
R20

NOTES

1. THESE ARE THE STANDARD LOCATION FOR UTILITIES OTHER LOCATIONS MAY BE APPROVED BY THE CITY.
2. OTHER UTILITIES LE. GAS, TELEPHONE, POWER, SHALL BE LOCATED BETWEEN THE EDGE OF THE TRAVELED ROAD AND THE PROPERTY LINE, BUT NOT UNDER THE SIDEWALK AREA.
3. WATER METERS AND SEWER STUBS SHALL BE CENTERED IN THE PARKING STRIP.
4. WATER MAINS SHALL HAVE A 4' MIN. DEPTH.
5. ELECTRICAL UTILITIES SHALL HAVE 4' MIN. DEPTH.
6. HYDRANTS SHALL BE CENTERED IN THE PARKING STRIP.



SD — STORM SEWER 12' S. & W. OF CENTERLINE

W — WATER LINE 12' N. & E. OF CENTERLINE

SS — SANITARY SERE LINES 6' S. AND W. OF CENTERLINE

5' WIDE SIDEWALK 1' FROM PROPERTY LINE

FIRE HYDRANT

STREET SIGH

STREET CENTERLINE MONUMENT

MANHOLE

STREET LIGHT

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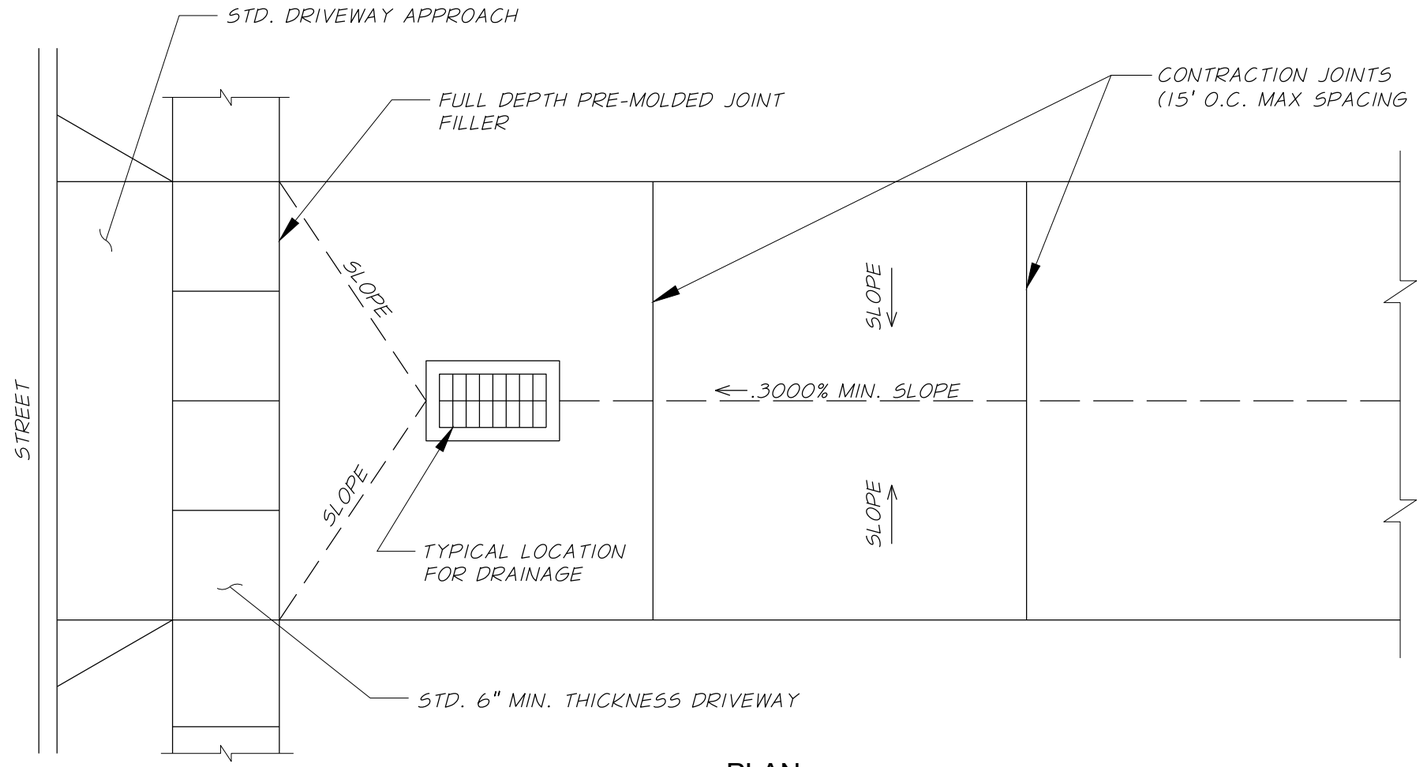
STANDARD STREET DETAILS
TYPICAL STREET UTILITY LOCATIONS

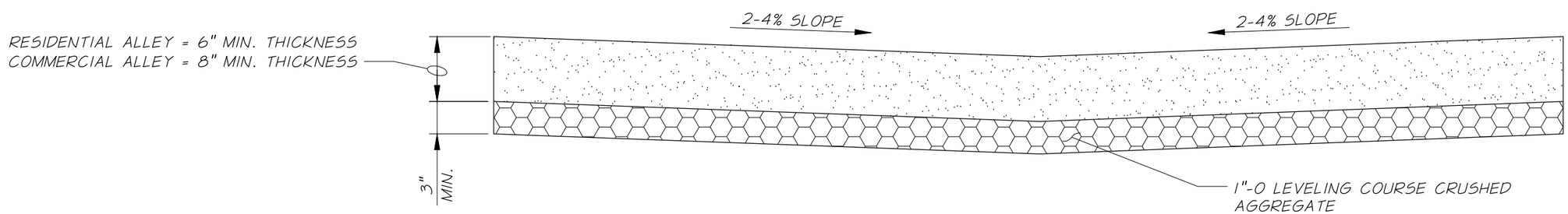
FIGURE
R21

NOTES

1. ALL EDGES SHALL BE TOOLED WITH 3/4" RADIUS.
2. CONCRETE TO BE CLASS 4000 - 1 1/2.
3. SEE DRAWING NO. 207 FOR ISOLATION JOINT DETAILS.
4. A JOINT PLAN MUST BE SUBMITTED TO CITY FOR APPROVAL.



PLAN



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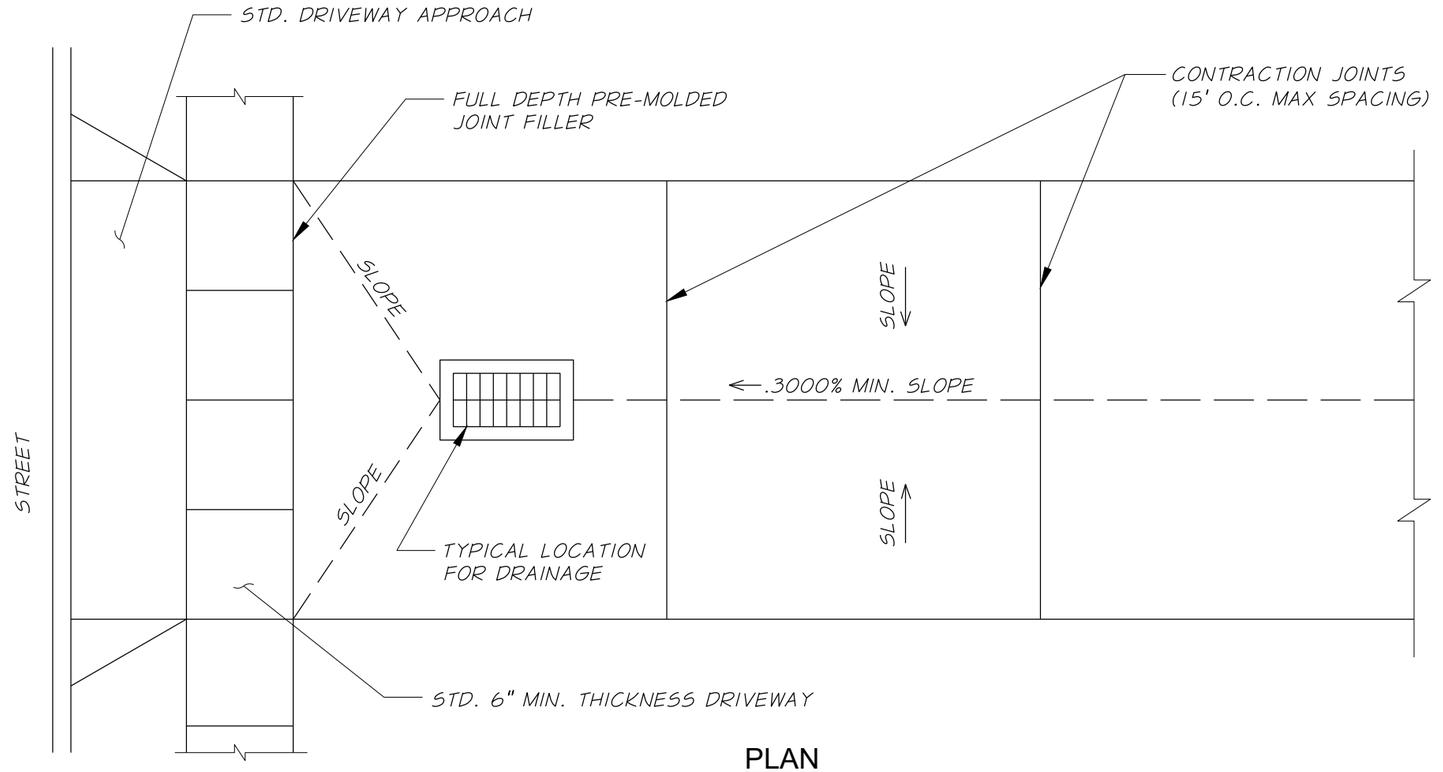
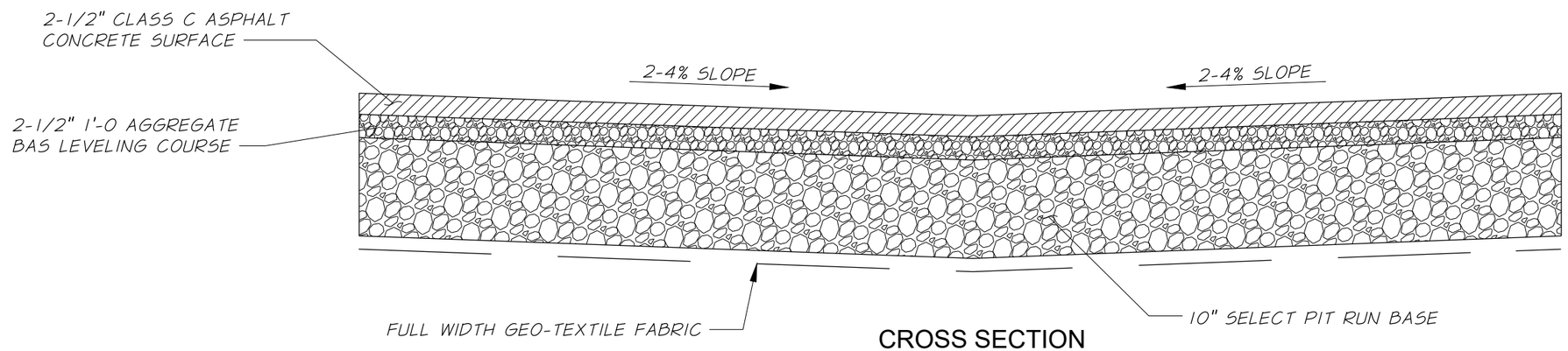
STANDARD STREET DETAILS
P.C.C. PAVEMENT ALLEY

FIGURE
R22



PLAN



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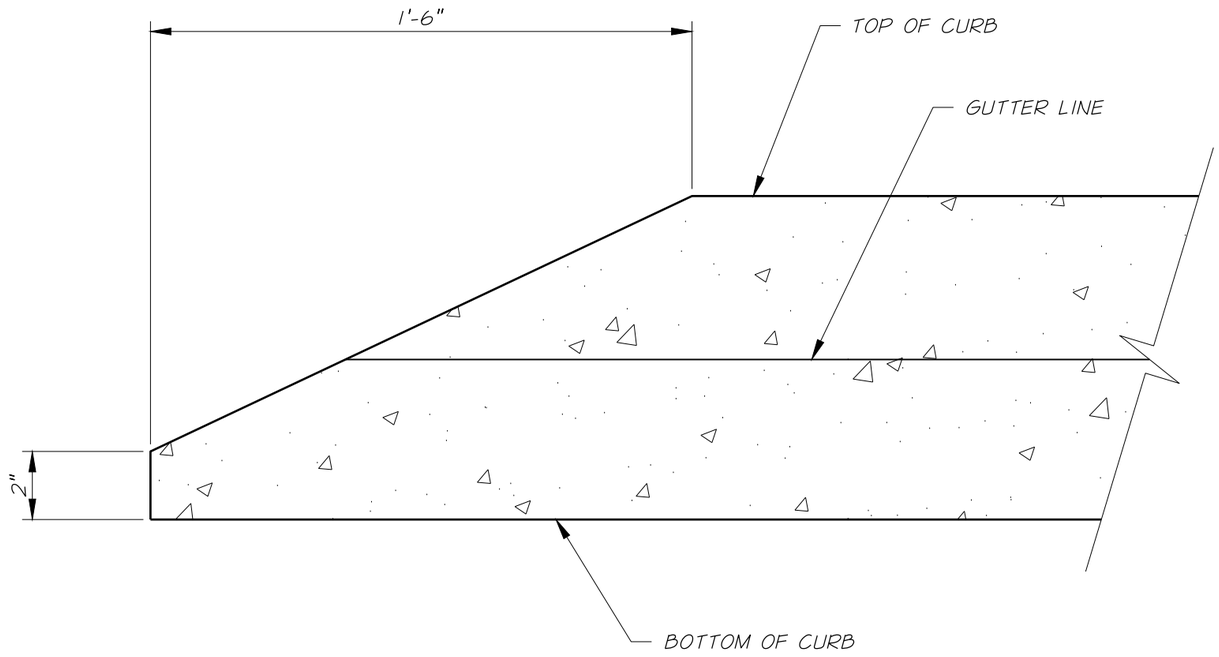
STANDARD STREET DETAILS
ASPHALT CONCRETE ALLEY

FIGURE
R23



CURB TERMINATION DETAIL

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STANDARD STREET DETAILS
CURB TERMINATION DETAIL

FIGURE
R24