CITY OF SPOKANE

DEPARTMENT OF ENGINEERING SERVICES

DESIGN STANDARDS

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CITY OF SPOKANE
ENGINEERING SERVICES

DESIGN STANDARDS
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1.0 OVERVIEW

1.1 Purpose and Scope

The purpose of these Standards is to standardize design elements where necessary for consistency and to help assure that the minimum requirements of the public are met, including safety, welfare, convenience, aesthetics and economical maintenance.

These Standards cannot provide for all situations. They are intended to assist, but not to substitute for competent work by design professionals. It is expected that land surveyors, engineers, and architects will bring to each project the best skills and abilities from their respective disciplines to see that the project is designed in a manner consistent with the intent of the Standards.

These Standards are not intended to limit unreasonably any innovative or creative effort which could result in higher quality, lower cost or both. Any proposed departure from these Standards will be judged, however, on the likelihood that such variance produces a compensating or comparable result, in every way suitable for public use.

These Standards shall govern design for new construction and major upgrades to all streets, sewers, water lines and other utilities in new or existing City rights-of-way, easements or areas which are proposed for dedication to the City of Spokane.

Before the City accepts any improvements which are to be maintained by City forces, such improvements shall meet or exceed these Standards.

If any part of these Design Standards is found to be invalid, all other non-conflicting parts shall remain in effect.

1.2 Definitions

The following definitions apply to terms and abbreviations used throughout this manual. Additional terms applicable to specific aspects of design are defined at the beginning of each section.

AASHTO The American Association of State Highway Transportation Officials. The abbreviation may also be used throughout these Standards to reference AASHTO's publication, "A Policy on Geometric Design of Highways and Streets".

ADA Americans with Disabilities Act.

ADAAG Americans with Disabilities Act Accessibility Guidelines.

Applicant An individual or firm applying for design approval from the City for a project.

AWWA The American Water Works Association.

Designer The project engineer or architect.

Developer Refers to the owner (or financial sponsor) of a privately funded project. May also be taken to mean the owner's consulting architect, engineer or other agent.

Engineer The Director of Engineering Services, Streets, Water or Wastewater Management as applicable or his designated representative.

MUTCD The U.S. Department of Transportation Manual on Uniform Traffic Control Devices.

Owner Legal owner of the property on which a project is to be constructed.

Private Project A project which is to be constructed on privately-owned property.

Public Project A project which is to be constructed within the public right-of-way. Public projects may be designed by either private consultants or the City's in-house engineering staff.

P.U.D** or **PUD "Planned Unit Development". A privately developed project normally consisting of multiple residences or commercial units within a single tax parcel. Typically water, sewer and roadway systems within a P.U.D. are privately owned, with maintenance for these systems funded through home owner association dues or a similar arrangement.

RCW Revised Code of Washington.

SEPA State Environmental Policy Act.

SMC Spokane Municipal Code.

Specifications Defined as the most current versions of the following documents:

1. WSDOT Standard Specifications for Road, Bridge and Municipal Construction and the and amendments thereto
2. the City of Spokane General Special Provisions for Private Development (which are intended for privately funded projects) or City of Spokane General Special Provisions (which are intended for City funded projects). Henceforth both are referred to as City of Spokane GSPs.

STA Spokane Transit Authority.

Standard Plans The City of Spokane Standard Plans.

Variance A grant of relief from the requirements of this section that permits construction in a manner that would otherwise be prohibited by these design standards.

WSDOT Washington State Department of Transportation.

1.3 References

Except where these Standards provide otherwise, design, detail, workmanship, and materials shall be in accordance with the current editions of the following publications:

a) Standard Specifications for Road, Bridge, and Municipal Construction as amended. (Published by WSDOT).
b) City of Spokane GSPs.
c) Spokane Regional Stormwater Manual.
d) WSDOT Standard Plans for Road and Bridge Construction..
e) WSDOT Design Manual.
f) WSDOT Hydraulics Manual.
g) NRCS Urban Hydrology for Small Water Sheds TR-55.
h) AWWA Standards.
i) WSDOH Water System Design Manual.
j) Department of Transportation Manual on Uniform Traffic Control Devices, as amended (MUTCD).
k) A Policy on Geometric Design of Highways and Streets (AASHTO).
l) Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG). (Published by the U.S. Architectural and Transportation Barriers Compliance Board).
m) Spokane Transit Authority Design Guidelines.
n) Washington State Department of Ecology Criteria for Sewage Works Design.
o) City and County Design Standards for the Construction of Urban and Rural Arterials and Collectors, Washington State. (Published by WSDOT.)
p) The following elements of the City of Spokane Comprehensive Plan:
   - Arterial Street Plan
   - Comprehensive Water Management Plan
   - Downtown Spokane Development Plan
   - Growth Management Plan
   - Bikeways Plan
   - Critical Areas Report
   - Fire Station Plan
   - Historic Preservation Plan

- Land Use Plan
- Park and Open Spaces Plan
- Shorelines Plan
- Wastewater System Plan
- Neighborhood Design Plans:
  - Browne's Addition
  - East Central
  - Hillyard
  - Lincoln Heights
  - Manito Cannon Hill
  - North Hill
  - West Central
  - Chief Garry Park
  - Emerson Garfield
  - Latah Creek
  - Logan
  - Nevada-Lidgerwood
  - Peaceful Valley
- North River Bank Design Plan
- Sewerage Facilities Plan
- Solid Waste Management Plan
- Wetlands Plan

n) Other specifications. These include the following, which shall be applicable when pertinent, when specifically cited in the Standards, or when required by funding authorities. This list is not intended to be all inclusive, and designers are responsible to meet all requirements applicable to their project(s).
   1. City of Spokane codes and ordinances.
   2. International Building Code (IBC).
   3. Design criteria of governing federal and state agencies.

1.4 Variance Requests

To gain approval for a variance from these Design Standards, the designer shall complete and submit a "Variance Request Form" to the Engineering Services Department, documenting the reasons for the variance request. Additional supporting information, plans or design data prepared by a professional engineer, licensed in the State of Washington should be attached to the form as needed.

Variances from these Standards may be granted by the Engineer upon evidence that such variances are in the public interest, and that requirements for safety, function, fire protection, appearance, and maintainability are fully met.

Variances must be approved prior to construction. Whenever the need for a variance can be identified in advance, the variance should be proposed at the preliminary design stage and included for consideration during plan review and public hearing.

1.5 Environmental Checklist

The State Environmental Policy Act (SEPA) chapter 43.21C RCW, requires all governmental agencies to consider the environmental impacts of a proposal before making decisions. The SEPA environmental checklist, together with the SEPA rules contained in chapter 197-11 WAC are used as guidelines to assess the probable environmental impact of any development which is not otherwise exempt from the process. Categorical exemption guidelines and thresholds are described and defined in the above references. Use of the SEPA checklist provides information to help the developer reduce or avoid impacts from the proposal and to help the agency determine whether an environmental impact statement (EIS) is required. An EIS must be prepared for all proposals with probable significant adverse impacts on the quality of the environment.

The designer is referred to the Spokane Environmental Ordinance (SMC 17E.050), adopted by the City of Spokane on September 17, 1984; and the Spokane Wetlands Protection Ordinance (SMC 11.19), adopted on November 1, 1993.

1.6 Design Coordination/Technical Assistance

Design in accordance with the Standards presented herein will often involve coordinating with

individual sections of the Engineering Services department, and with City departments and divisions outside of Engineering Services. Throughout these Standards, the designer is referred to appropriate City agencies as needed.

Figure 1-1 is provided to show the organization of the Engineering Services Department.

1.7 Permits and Licenses

Applicants are responsible to acquire all permits and licenses necessary for the completion of the project. The City of Spokane will not be held responsible, financially or otherwise, for any delay or additional expenses the applicant may incur due to the Applicant's oversight in obtaining all necessary permits and licenses.

1.8 Material Acceptance

It shall be the applicant's responsibility to provide the City with a materials acceptance list for all materials used on the project when required by the City. The materials acceptance list shall confirm that the items meet City specifications through supplier's verification, materials testing reports or reports stamped and signed by a professional engineer.

All reports, materials verifications and other documents submitted to the City for acceptance shall be stamped and signed by an engineer.

If the Applicant desires to have materials tested after non-acceptance by the City, all materials testing shall be at the expense of the applicant.

1.9 Amendments; Process and Authority

The Engineer has the authority to oversee, approve and implement all amendments issued to these Design Standards. Noted errors or suggested revisions to these Standards should be addressed to the Engineer. All such suggested amendments must be in writing, identifying an issue, providing supporting information as well as providing a suggestion on how to address the issue.

City of Spokane
Department of Engineering Services
808 West Spokane Falls Boulevard
Spokane, Washington 99201-3343

DESIGN STANDARDS VARIANCE REQUEST FORM

Project Name:_____

City Project Number (if applicable):_____

List below any deviations from the City of Spokane Design Standards you are proposing. For each variance requested, explain fully the reasons why City Standards cannot be met, and describe how the proposed variance will satisfy fundamental requirements for safety, function, fire protection, appearance and maintainability. Attach additional supporting information as needed.

_____

_____

_____

_____

_____

_____

_____

_____

Submitted by:
Name (please print)_____

Company _____

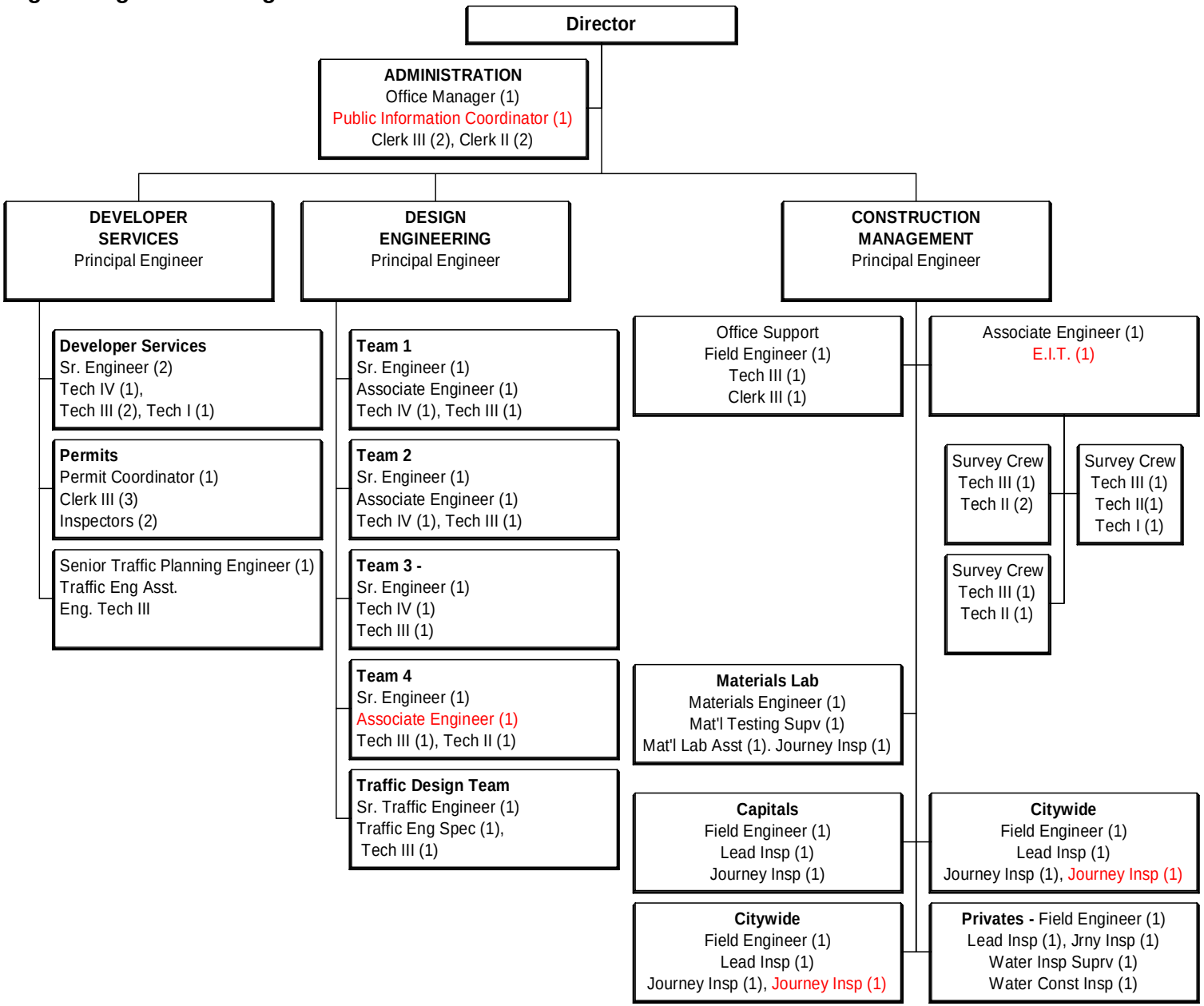
Signature _____ Date ____/____/____

FOR CITY USE ONLY

____Approved ____Denied

_____ _____
Director of Engineering Services Date

Figure 1-1 Engineering Services Organization Chart



Developer Services reviews plat applications, provides property information, existing water and sewer service information, facilitates the street vacation process, performs plan review of proposed private projects, certificate of occupancy inspections for completed private projects related to wastewater, street, sidewalk and on-site stormwater treatment issues, and routine sewer, street and sidewalk inspections.

Design is responsible for designing street, water, sanitary sewer, and storm water facilities, manages consultant engineer contracts for peak workload and specialty design work, maintains City of Spokane GSPs, Standard Plans, design standards, bid estimate system, and contract provisions system, reviews design variances and represents the City in statewide standards committees, coordinates state and federal requirements for inclusion in local and federal funded projects, administers the local improvement district (LID) system and the engineering drawing archive system, provides technical engineering support to other City departments, provides project, non-project, and traffic engineering information to the public through public meetings, letters and individual visits.

Traffic Design is responsible for construction design and management of traffic elements of projects, such as signals, street striping and signing; traffic planning; and review of development projects.

Construction Management is tasked with management of public works projects in the field and inspection of privately funded construction of infrastructure which will be turned over to the City.

2.0 DEVELOPER/CONSULTANT SERVICES

All developers are required to adhere to the requirements contained in the WSDOT Standard Specifications, the City of Spokane GSPs, and these Standards for all construction in the right-of-way or for any project that will or may be dedicated to the City.

The review process outlined below must be followed for all privately-developed sewer, water, street and storm drainage projects in the public right of way; all on-site commercial sewer, storm drainage, and water projects; and all private sewer, water, storm drainage and street projects.

The Developer Services section of the Engineering Services will review plans on behalf of the utility department to ensure that the project adheres to the City of Spokane GSPs and these Design Standards. Any questions or variance requests shall be directed to Engineering Services. Direct access to any City utility department is by appointment only and shall be requested through Engineering Services. Construction by private contractors will be inspected by the Construction Management section of Engineering Services.

2.1 Definitions

Developer See Section 1.2

On-Site Project A *private project*. The term "on-site" is used to describe an area outside the public right of way.

Owner See Section 1.2

Private Project See Section 1.2

Public Project See Section 1.2

P.U.D. See Section 1.2

2.2 Preliminary Procedures

Developers are strongly urged to arrange for a "Pre-Development Conference" through Building Department at (509) 625-6300 prior to applying for design approval. This service is provided free of charge by the City to give the developer feedback on the feasibility of the project and the City requirements involved. The following City departments and divisions will be represented at the Conference:

Streets	Engineering Services – Developer Services
Planning	Solid Waste Management
Fire	Water and Hydro Services
Building and Code Enforcement	Historic Preservation

In addition, the City will request input from the Spokane County Air Pollution Control Authority and Spokane County Health District and any other appropriate departments or agencies.

2.3 Design Review Submittals

The design review procedure which must be followed to gain construction approval from the Engineering Services Developer Services section is outlined below.

The City of Spokane Department of Engineering Services has implemented plan review fees which are to be charged for the review and acceptance of design plans for private construction of private and public sewer, water, street, and storm drainage improvements. These fees were implemented in order to allow the City of Spokane to recover costs associated with time spent reviewing and administering these projects. A fee table is given below.

The following summarizes the design review process for private projects:

1. A transmittal letter is to be forwarded to the Department of Engineering Services – Developer Services. This transmittal letter is to be from the design Engineer/ Architect who is submitting the design plans and requesting the review and acceptance, and is to contain the following information:
    a. The name of the design project
    b. The type(s) of facilities included for project review
    c. The design plan sheets which are being included for review
    d. The name, address, and phone number of the owner of the project
    e. The name of the individual/ organization who will pay the appropriate plan review and inspection fees and/ or charges
    f. A request for permission to construct the project.

    The design plans for each facility must be complete and ready for design review. Partial submittal of the design and/ or plans will be returned to the Engineer/ Architect without review comments. Submittals that do not meet City Design Standards will be returned to the Engineer/ Architect without review comments. The Engineer/ Architect is responsible for providing the required number of plan sets shown in the table below.

Project Location	Project Type	Facilities Reviewed	Number of Plan Sets Required
Inside City Limits	Plat/ PUD	Water, Sewer, Streets, Stormwater	6 Full Sets 2 Drainage Reports
	Major* Building Project		4 Full Sets 2 Drainage Reports
	Minor Building Project		2 Full Sets
Outside City Limits	Plat/ PUD	Water, Sewer	4 Full Sets
	Major* Building Project		4 Full Sets
	Minor Building Project		2 Full Sets

    *Major Building Projects are those Commercial and Residential Projects that require inspection by the City's Construction Field Office. These include all sewer and water main extensions, on-site sewer systems 8" or larger requiring manholes, and on-site water systems longer than 1000 feet and major renovations or changes to existing street improvements.

    When submitting project plans, include as many of the facilities involved with the entire project as possible. This procedure will lower the total review fee required for the project and reduce the number of design acceptance letters that will need to be sent.

2. After receiving the transmittal letter and plan sets, Developer Services will respond back to the Engineer/ Architect in writing and include the plan review fee being charged for the project.

3. Plan review fees must be tendered prior to initiation of the design review process. Upon payment of the plan review fee to the Department of Engineering Services – Developer Services, the design review process will begin. Red line check prints will be sent back to the

design Engineer/ Architect along with a plan review comment letter. These red line check prints must be returned for re-review along with a set of corrected plans. A letter indicating how each of the review comments was addressed or a reason for not making the changes must be included with the re-submittal. If the red lines are not returned, or changes are not properly addressed, the review of the plans will be delayed and/ or additional plan review fees may be charged.

4. During the review process, if the design of the project should change and/ or new plans are re-submitted for review after they have already once been reviewed, an additional plan review fee will be assessed. The additional review fee will be based on the cost of construction for the length of the project which is being re-submitted. Payment of this additional fee will be required before a new review is initiated.

5. Once the project design plans are complete, and all other items relating to the project have been completed, the review engineer will request that mylar copies of the plans be submitted. The letter giving acceptance of the design and permission to construct will be prepared for signature by the project owner and the review engineer. Copies of the letter and plans will be provided to all involved with the project. One copy of stamped, accepted design plans is provided to the design engineer and three copies of the stamped, accepted design plans are provided to the owner/ developer. If additional copies are needed, an additional fee will be charged. If, at a later date, additional design approval letters must be prepared and/ or additional copies of any plans must be made due to developer design changes or request, there will be an additional charge. Letter preparation will be charged $50 and copies of plans will be charged $2 each. These additional charges will be collected prior to the requested action.

The following table shows the established plan review fees for private development of sewer, water, street, and storm water drainage projects and the estimated per foot/ per project cost of construction of each facility along with the calculation table used to determine the review fee. Also included is a copy of the Private Project Checklist that will be used to determine the items needed on the project.

Plan Review Fees (SMC 8.02.065)

Value of Work in Dollars	Plan Review Fee in Dollars
$1 to 10,000	$300
$10,001 to 50,000	$300 plus $15.00 for each $1,000 over $10,000
$50,001 to 100,000	$900 plus $13.00 for each $1,000 over $50,000
$100,001 to 500,000	$1,550 plus $10.50 for each $1,000 over $100,000
$500,001 to 1,000,000	$5,750 plus $9.50 for each $1,000 over $500,000
Over $1,000,000	$10,500 plus $8.75 for each $1,000 over $1,000,000

Unit Costs used in Review Fee Calculations

Facility	Per Foot Cost
Sanitary Sewer	$45
Storm Sewer	$45
Water Main < 12 inches	$45
Water Main > 12 inches	$60
Street	$175

Private Project Checklist

GENERAL

Required for ALL projects

- Vicinity Map
- Title Blocks including project name, street name, sheet limits (station numbers), type of improvement, and whether improvements are public or private. City plan numbers should be included on the first submittal. Information on naming the sheets is included in Appendix B "Drawing Layout and Electronic File Naming". City project numbers will be provided by the review engineer.
- Details shall be drawn to scale.
- All design plans shall be prepared, stamped, and signed by a professional engineer licensed in the State of Washington. Plans shall include the engineer's address and phone number.

May be Required

- For plats, include a copy of the Hearing Examiner's decision and a letter stating how each of the conditions for approval has been addressed.
- For plats, include a copy of the plat map showing the original layout approved under the preliminary plat and the final proposed layout.

SEWER

Required for ALL projects

- Plan/profile and detail sheet(s) for design using Department of Engineering Services design and drafting standards (See examples in Appendix D).
- Service connection location(s) shown on plan from building to public or private sewer line.
- Copy of final plat or final addresses shown for each lot on sewer plans.
- Side sewer fees
- General facilities charges

May be Required

- Sewer study showing adequate capacity in line for project flow
- Utility Connection Annexation Covenant (Provide Legal Description) (Projects located outside the City Limits)
- Easements (provide legal description)
- Private sewer maintenance agreement (provide legal description for projects proposing a private sewer)
- Latecomer fees

WATER

Required for ALL projects

- Plan/profile and detail sheet(s) for design using Department of Engineering Services design and drafting standards (See examples in Appendix D).
- Service connection location(s) shown on plan from building to public or private water main.
- Hydraulic study showing adequate fire flow and domestic service.
- Copy of final plat or final addresses shown for each lot on water plans.
- Tap/meter fees
- General facilities charges

May be Required

- Utility connection annexation covenant (provide legal description for projects located outside the city limits)
- Easements (provide legal description)
- Fire district approval (projects located outside the City Limits)
- Latecomer fees

STREET
Required for ALL projects

- Plan/profile and detail sheet(s) for design using Department of Engineering Services design and drafting standards (See examples in Appendix D).
- Details including typical cross sections for all street plans and a detail for all street patches.
- Signing and striping/channelization plan. Street sign type and placement must be clearly located on the plan. Both existing and proposed signs shall be included.
- Monuments are to be placed at every intersection, the beginning and end of every horizontal curve, and at the center point of each cul-de-sac. The location of the monuments shall be clearly marked on the plan.

May be Required

- Trip generation and distribution letter
- Traffic impact analysis
- Easements (provide legal description)
- Street Dedication (provide legal description) or copy of final plat
- Paving waiver to not protest future LID

STORM WATER DRAINAGE
Required for ALL projects

- Plan/profile of conveyance system and detail sheet(s) for design using Department of Engineering Services design and drafting standards (See examples in Appendix D).
- Grading and drainage plan showing finished contour elevations.
- Drainage study and report with calculated flows. The drainage study shall be prepared in accordance with the Stormwater Manual.
- Erosion and sediment control plan with BMPs identified for stormwater control during and after construction. The erosion and sediment control plan is required for any project prior to issuance of <u>any permits</u> for the project.

May be Required

- Geotechnical report with infiltration capacity, sub-level structure, and roadway design issues addressed when necessary.

SANITARY SEWER PUMP STATIONS
Required for ALL projects

- Plan/profile and detail sheet(s) for design using Department of Engineering Services design and drafting standards (See examples in Appendix D) including:
  - Site layout
  - A cut-away section of the station and wet well with design elevations
  - General site location
  - Service Area
  - Point of connection to the existing line
- Two copies of construction specifications
- Two copies of complete design calculations (including design assumptions and parameters, pump performance curves, force main performance curves and conclusive data showing the impact of discharge on the existing system

All design drawings submitted must conform to the City's Drafting/CAD Standards, which are outlined in Section 10.0. Based on the location and scope of the project, Developer Services may require additional studies. In most cases where stormwater facilities are proposed, a geotechnical report will be required. An erosion and sediment control plan is required for all ground disturbing projects.

Note: The Developer Services Section provides review services only, and shall not be called on to design the project for the Developer. The City reserves the right to refuse to review any project for which the Developer has not demonstrated an earnest effort to design in accordance with the City of Spokane GSPs and these Design Standards. Incomplete submittals may be returned to the engineer without comments. Projects requiring multiple submittals may be charged additional review fees.

Construction for all private projects is initiated and coordinated through the City's Construction Management office after the plans are accepted in writing by Developer Services. Construction drawings shall be turned into final record drawings as outlined in Section 10.0.

2.4 Penalties

Failure to comply with the plan review procedure outlined above may be cause for withholding or withdrawing approval of plans, forfeiture of bond or non-acceptance of work by the City.

4.0 SANITARY SEWERS

Sanitary sewers should be designed to maintain self-cleaning velocities and allow for ease of maintenance.

This section presents design guidance for construction of sewers in the public right-of-way and on private property. Design criteria for wastewater pumping stations are discussed in Section 5.0. Refer to Chapter 13 of the Spokane Municipal Code for additional regulations governing sewers.

4.1 Definitions

Average Design Flow The average daily flow of the maximum month.

Building Drain That part of the lowest piping of a drainage system which receives the sanitary discharge from piping inside the walls of a structure or building, and conveys it to a point two feet outside the outer face of a structure, wall or foundation into the *side sewer* or to an *on-site sewage disposal system*. *Building drains* shall not carry roof drainage, groundwater or surface runoff.

Cleanout An upturned pipe which provides a means for flushing or inserting cleaning tools.

Combined Sewer A sewer which conveys any category of *wastewater*, as permitted by the *Wastewater Director*, and performs the functions for both a *sanitary sewer* and a *storm sewer*.

Cutoff Wall A wall, collar or other structure intended to control movement of the groundwater along a trench constructed for sewer line placement. *Cutoff walls* are typically used in areas of rock, when a natural barrier to groundwater is disturbed by sewer line construction. *Cutoff wall* details are shown in the Standard Plans.

Effluent *Wastewater* or other liquid, partially or completely treated, or in its natural state, flowing out of a reservoir, basin, treatment plant, or industrial treatment plant, or any part thereof.

Exterior Pipe Drop A vertical pipe installed in the sewer line outside a manhole, which allows a deeper connection to the manhole. An *exterior pipe drop* connection is used only where the elevation of the incoming pipe considerably exceeds that of the outgoing sewer, and the size of pipe precludes the use of an *interior pipe drop*.

Industrial Process Wastewater or Process Wastewater: That category of *wastewater* containing water carried wastes other than those traditionally derived from human or household customer sources. *Process wastewater* is also sometimes referred to as "non-domestic sewage". There are two subcategories of *process wastewater*:

a. "Manufacturing Process Wastewater", which is *wastewater* of a nature, concentration, or consistency traditionally originating from industrial or manufacturing customers. This generally includes *sewage* from one or more heavy industrial or manufacturing process sources or industrial cleanup procedures. It includes one-process discharges or several commingled process discharges.
b. "Non-manufacturing Process Wastewater", which includes all other *process wastewater*. This generally includes *wastewater* from business, institutional or commercial customers which generate non-domestic *wastewater* components derived from a business or commercial process other than manufacturing or heavy industry. Examples of included sources are *wastewater* from commercial laundries, radiator shops, photo finishers as well as *wastewater* from vehicles used for storage or transportation of *wastewater*, such as septic tank pumpers or haulers.

Interior Channel Drop A planned drop of the invert elevation within a manhole to convey *wastewater* from the incoming pipe(s) to the outgoing *sewer*.

Interior Pipe Drop A vertical pipe installed inside a manhole where the elevation of the incoming *sewer* considerably exceeds that of the outgoing *sewer.*

Lateral or Lateral Sewer A *sewer* to which *side or private sewers* may be connected from adjacent properties.

Natural Outlet Any outlet into a watercourse, pond, ditch, lake or other body of surface water or groundwater. It does not include connections to the City of Spokane Wastewater Treatment Plant, authorized *on-site sewage, stormwater disposal systems*, or other authorized sewage disposal mechanisms or systems.

Noncontact Cooling Water That category of *wastewater* consisting of water used for cooling, generally in an industrial or manufacturing process, which does not come into direct contact with any raw material, intermediate product, waste product, or finished product. The term excludes all other categories of *wastewater* identified herein.

Nonstandard Strength Sewage *Wastewater* accepted for discharge into the Wastewater Treatment Plant, but which does not meet the criteria for acceptance as *standard strength sewage*, whether because of special characteristics, special treatment requirements, special monitoring or additional handling as a condition of acceptance. *Nonstandard strength sewage* is further defined in Chapter 13 of the Spokane Municipal Code.

On-Site Sewage Disposal System Any system or combination of piping, treatment or other facilities that store, treat, and/or dispose of *sewage* and *effluent* on the property where it originates, or an adjacent or nearby property under the ownership of the *user* of the system or in which the *user* has a recorded interest for the purpose of maintaining the system on such other property. In general, these include septic tanks, drainfields, pressure mounds, etc.

Peak Flow The maximum momentary load placed on a *wastewater* pumping station, sewer main, force main, etc..

Peak Factor A value which, when multiplied by the average design flow, yields an estimate of the highest flow rate to be expected over a short period of time.

Practicable Capable of being accomplished within prudent natural, social or economic constraints using readily available resources and reasonable reliable technology and practices.

Private Pump Station An appurtenance of a *side sewer, private sewer or on-site sewage disposal system* which, alone or in conjunction with the *side sewer or private sewer*, conveys *standard strength sewage* or *effluent* by lifting or pumping to another *sewer*.

Private Sewer A *sewer* which is not controlled or maintained by a public authority, and which serves two or more buildings, residences, or properties, and is constructed by private contract.

Private Storm Sewer A *storm sewer* not controlled or maintained by a public authority.

Public Sewer A *sewer* which is controlled and maintained by a public authority.

Sanitary Sewage Also sometimes referred to as "domestic sewage" is that category of *wastewater* consisting of water-carried wastes from human and household customer sources. The term also includes water-carried wastes from some business, institutional or commercial customers which do not generate *industrial process wastewater*.

Sanitary Sewer A *sewer* which conveys *sanitary sewage*. Additionally, the term is used to mean any *public sewer* except a *storm sewer*.

Sewage A combination of the water-carried wastes from domestic, business or commercial, industrial or manufacturing sources, including residences, business buildings, institutions and industrial establishments. *Sewage* also includes surface water and *storm water* when discharged into a *sewer*.

Sewer A pipe, conduit, structure, or appurtenance for conveying *sewage*.

Side Sewer A *sewer* not directly controlled or maintained by a public authority, which begins two feet outside the outer face of a structure wall or foundation, conveying *wastewater* from the *building drain* to a *public sewer* or *private sewer*, including any tees, taps, wyes, etc. to connect to the public sewer.

Side Sewer Stub That portion of a *side sewer* which is constructed along with the *sewer* prior to direct connection to the premises to be served.

Standard Strength Sewage *Wastewater* which complies with specifications designated by the *Wastewater Director*, City Sewer Rates and Regulations or the Spokane Municipal Code as not requiring special treatment, monitoring or additional handling prior to acceptance by the Wastewater Treatment Plant, considering chemical, physical and organic content, including but not limited to B.O.D., suspended solids, and Phosphorus. The *Wastewater Director* adjusts the definition of *standard strength sewage* in the City Sewer Rates Resolution.

Storm Water That category of *wastewater* consisting of runoff occurring during or following any form of natural precipitation and resulting from such precipitation, including snow melt.

Storm Sewer or Storm Drain A *sewer* which conveys *storm water*.

Trunk Sewer A *sewer* that receives many tributary branches and serves a large territory.

Underdrain A drain that carries away groundwater. Also, the drain laid below a *sewer* through wet ground to facilitate construction.

Wastewater "*Wastewater*" includes anything released into the Wastewater Treatment Plant and generally includes water-carried wastes from domestic, business or commercial, or manufacturing or industrial sources. For purposes of reference, four categories of *wastewater* (as defined herein), based on its generic source are identified in usage:

a) *sanitary sewage;*
b) *storm water;*
c) *industrial process wastewater or process wastewater;*
d) *noncontact cooling water*.

Additionally, *wastewater* is divided into two general classes for purposes of rates and treatment requirements (as defined herein):

a) *standard strength sewage*
b) *nonstandard strength sewage*

Wastewater Director The administrative head of the City Wastewater Management Department.

4.2 Public Sewers

Design of public sanitary sewers shall be in accordance with the City of Spokane's GSPs and the following design parameters.

4.2-1 Pipe Sizes

Minimum pipe size for public sewers shall be 8 inches. Pipe size shall be determined based on the following design criteria:

a) Design population density shall be based on current or future zoning, potential zoning changes and/or site specific requirements. The designer is referred to the Wastewater Facilities Plan element of the City of Spokane Comprehensive Plan for additional guidance.
b) Typical residential design flows are estimated at 100 gallons per capita per day. The following peak factors shall apply:

Population	Peak Factor
0 to 300	3.5
300 to 400	3.0
400 to 1,000	2.5
1,000 to 4,000	2.0
4,000 to 70,000	1.5

The Wastewater Facilities Plan provides additional guidance in determining design flows for all zoning densities.

c) An infiltration rate of 200 gallons per day per inch diameter per mile length of pipe shall be used.
d) Design shall be based on pipe flowing at a depth of 0.7 times the diameter.

4.2-2 Pipe Slopes

All public sewers shall be designed and constructed to give mean velocities, when flowing at a depth of 0.7 times the diameter, of not less than 2.0 feet per second (fps) for the anticipated total flow at build out of the area served by the pipe. The following minimum & desired slopes shall apply:

Sanitary Sewer Size (Inches)	Min. Slope (v = 2.0 fps) (Feet per 100')	Min. Desired Slope (Feet per 100')
8	0.40	0.52
10	0.28	0.36
12	0.22	0.29
15	0.15	0.20
18	0.12	0.16
21	0.10	0.13
24	0.08	0.10
27	0.07	0.09
30	0.06	0.08
36	0.05	0.07

Desired slopes are 1.3 times the minimums shown above, and should be used unless impractical, particularly at the start of lines. Desirable flow conditions shall always take precedence over upsizing a pipe to maintain a shallower grade.

Pipe slopes greater than 0.10 ft/ft shall include a stability analysis addressing the need for anchorage subject to approval of the Wastewater Management Director.

4.2-3 Pipe Depth

When designing to provide basement service to existing structures, the designer shall assume that the sewer pipe invert leaving the structure is 2.5 feet below basement slab elevation (or 11.5 feet below the main floor elevation when basement elevations are unknown), and that the side sewer slope is 0.02 ft/ft.

When designing to provide basement service in undeveloped areas, a depth to pipe invert of 10'-6" feet below ordinance grade is typically recommended; however, the designer shall first consider the service needs of the overall basin. Final design depths in all undeveloped areas must be approved by the Engineer.

When basement service is not required, design depth shall provide for side sewer connections which pass under adjacent water mains. Pipe cover shall provide for frost protection and structural

considerations. A minimum pipe cover of 6 feet shall apply.

Sewers greater than 16 ft. deep shall have a minimum grade 1.2 times the standard minimum to offset construction difficulties.

4.2-4 Roughness Coefficient

A roughness coefficient n = 0.013 shall be used for all pipe. The variable - n curve shown in Figure 4-1 shall be used for design.

4.2-5 Horizontal Alignment

Sanitary sewers shall generally be located along the centerline of the road or alley. Pipeline marking tape shall be installed at mid-depth in the sewer trench directly over the pipe to mark the pipe location as per the City of Spokane GSPs.

The maximum distance between manholes shall be 600 feet on trunk sewers and 400 feet on all other straight sewer lines unless otherwise approved by the Engineer.

Curvilinear sewers are not allowed without approval of the Engineer.

4.2-6 Vertical Alignment

All sewers shall be laid with uniform slope between manholes. Pipe crowns shall be matched when upsizing, subject to the minimum drops specified below. Downsizing of pipes shall be allowed only on approval of the Engineer. When downsizing is approved, a decrease in diameter of only one pipe size smaller shall be allowed at a manhole, and the invert elevation of the smaller (downsized) pipe shall provide the required minimum drop through the manhole.

A minimum interior channel drop of 0.1 feet in a through-manhole, 0.2 feet in the presence of one horizontal bend and 0.3 feet where two laterals enter a manhole shall be required. Maximum interior channel drops shall be determined according to manhole size Standard Plan Z-110.

Interior pipe drops in manholes may be used on the condition that a 48-inch clear space is provided in the manhole (see Standard Plan Z-111). The use of exterior pipe drops is discouraged. Instead, the installation of an additional manhole is preferred where the elevation of the incoming pipe considerably exceeds that of the outgoing sewer, and an interior pipe drop cannot be accommodated. Exterior pipe drop connections will be allowed only on approval of the Engineer.

4.2-7 Manholes

The following design parameters shall apply to manholes in public sewers:

a) When Type II or Type III manholes are used, the manhole opening and steps shall be positioned above the upstream invert. For Type I manholes, steps shall be positioned over the shelf having the largest footing area.
b) Manholes shall be placed at each change of alignment, grade or pipe size, and at the intersection of two or more sewer pipes 8 inches or larger.
c) Manhole spacing requirements are detailed above in Section 4.2-5.
d) Manhole channel drops shall be constructed as required in Section 4.2-6.
e) All manholes shall be located using Washington state plane coordinates shown on the plans

4.2-8 Temporary Manholes

Temporary manholes shall be placed on all extensions of sewer pipes. These manholes are not required to have poured channels and are removed when the line is extended.

4.2-9 Combined Sewers

Combined sanitary and storm sewers are prohibited. No surface, groundwater or roof drain may be connected to a public sanitary sewer without the specific approval of the Engineer.

4.2-10 Separation of Sewers and Other Utilities

Crossings of sanitary sewers and other utilities shall be designed and constructed as shown in the Standard Plans.

4.2-11 Easements

Sewer easements shall be a minimum of thirty feet wide unless otherwise approved by the Engineer. Additional width may be required for sewers.

4.3 Side Sewers

This section provides recommended design guidelines pertaining specifically to sanitary side sewers. **Connection of storm drains, roof drains, underdrains or any other type of surface or ground water collection facility to a side sewer is expressly prohibited.**

4.3-1 Pipe Size and Alignment

Side sewer stubs shall be a minimum of 4-inch diameter for single family residences and duplexes and 6-inch diameter for all other uses including multi-family housing, and shall be installed from the public main to the right-of-way line or to a point 10 feet behind any existing or future sidewalk or curb, whichever is further back. Construction requirements for side sewer connections to the public main are shown in Standard Plan Z-116.

The building drain shall extend at least 2 feet beyond the wall of the building served. Side sewers shall drain away from the building with a minimum slope of 0.02 ft/ft (1/4 inch per foot). Vertical and horizontal curves are not recommended.

4.3-2 Pipe Depth

All side sewers should have at least 3.5 feet of cover in all traveled ways or other locations where the weight of the vehicular traffic might crush the pipe, and not less than 2 feet of cover in other areas. Frost protection via pipe cover or insulation shall be considered in all designs.

4.3-3 Connection to Manholes and Catch Basins

No catch basin or surface drain may be connected to a side, private or public sewer without specific permission from the Engineer. Storm drainage and sanitary sewage shall not be combined in a single sewer on private property.

4.3-4 Connection to Public Sewer Main

All taps shall be made with an approved concrete, vitrified clay or PVC tapping fitting, made by a manufacturer for that purpose. Tapping permits will be issued by the Engineering Services Department only with the consent of the Wastewater Director.

Side sewer connections shall be in accordance with Standard Plan Z-116. Any proposed variance from the construction method shown on Standard Plan Z-116 shall require submittal and approval of a Design Standards Variance Request Form to the Engineering Services Department. Side sewers shall not connect directly to a manhole.

4.3-5 Cleanouts

Cleanouts, no deeper than one foot from the ground surface, are recommended on all side sewers. Cleanouts shall be provided every 100 feet and at every angle point 45 degrees or greater.

4.4 Private Sewers

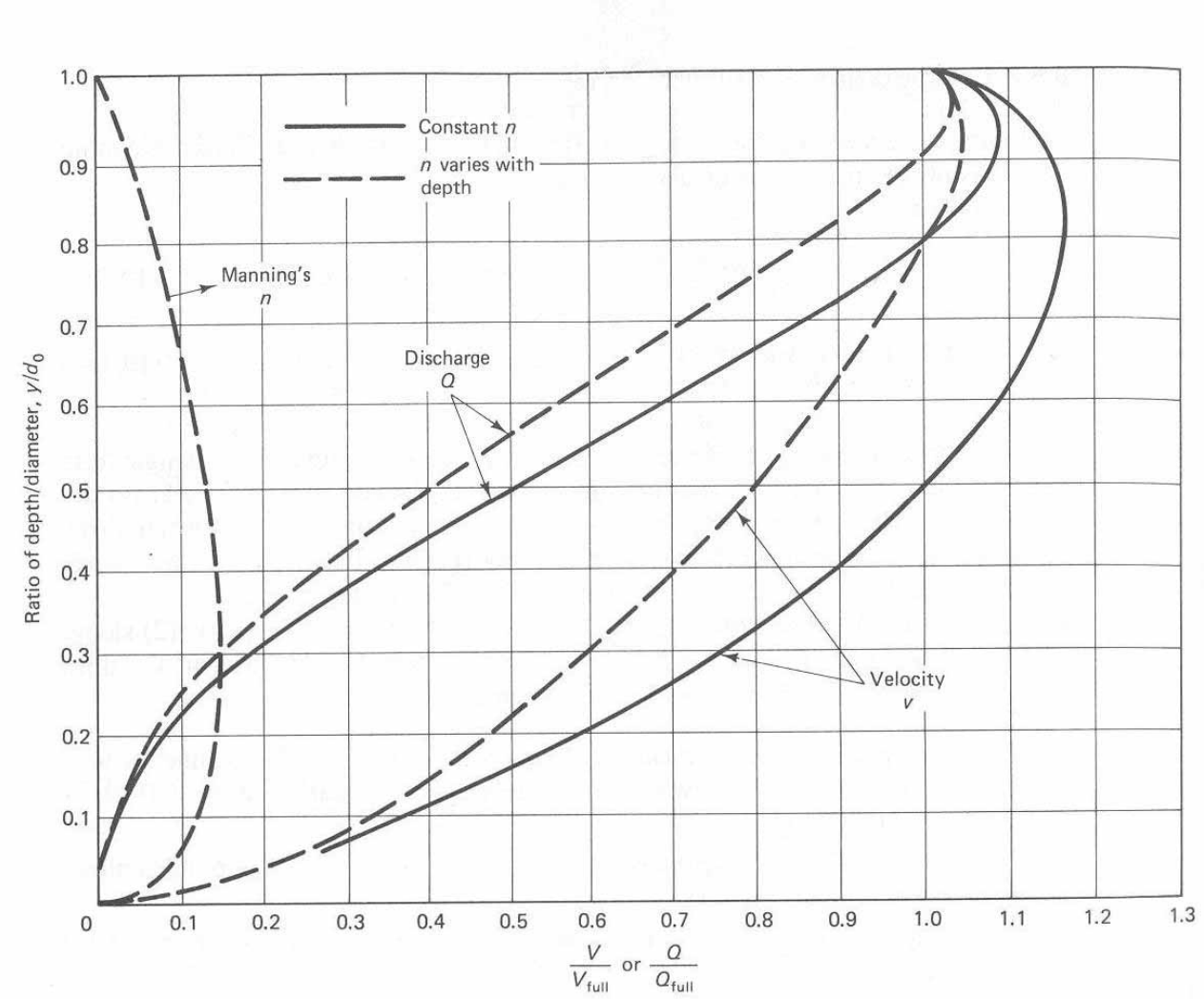
Sewers for Planned Unit Developments (P.U.D.'s) shall adhere to the standards discussed above for Public Sewers. All other private sanitary sewers shall conform to the following design standards:

a) Permission for private sewers will be granted only by the Engineer.
b) Minimum pipe size shall be 6-inch for private sewers.
c) Minimum pipe slope shall be 0.021 feet per foot.
d) Pipe depths for private sewers shall conform to the standards for side sewers in Section 4.3-2.
e) A manhole is required at the intersection of two lines 8-inches in diameter or larger.
f) Manholes are required on private sewers 300 or more feet in length. Where required, manholes shall be at maximum 300' spacing. Where cleanouts are used, they shall be installed at each change in pipe direction; cleanout spacing shall not exceed 100 feet. Cleanout pipes shall be the same size as the pipe they access.
g) Vertical curves are not allowed.

4.5 Tables and Figures

Figure 4-1 Circular Channel Ratios (variable n)

Experiments have shown that n varies slightly with depth. This figure gives velocity and flow rate ratios for varying n (solid line) and constant n (broken line) assumptions.



5.0 WASTEWATER PUMP STATIONS

Design of wastewater pumping stations shall be performed by a professional engineer licensed in the State of Washington. Due consideration shall be given to the selection of all materials used in the construction of wastewater pump stations, because of the presence of hydrogen sulfide and other corrosive gases, greases, oils, and other constituents frequently present in sewage.

5.1 Definitions

Air Release Valve An air valve placed at the high points of a pipeline to release the air automatically and prevent the pipeline from becoming air-bound with a resultant increased head loss.

Average Design Flow The average daily flow of the maximum month.

Backflow Prevention Device Any effective device, method or construction used to prevent backflow into a potable water system.

Bar Screen A rack composed of parallel bars, either vertical or inclined, placed in a waterway to catch debris.

Centrifugal Pump A pump consisting of an impeller fixed on a rotating shaft and enclosed in a casing, and having an inlet and a discharge connection. The rotating impeller creates pressure in the liquid by the velocity derived from centrifugal force.

Combined Sewer See Section 4.1.

Datum Reference point for all readings for *suction lift, suction head, total discharge head (TDH)* and *net positive suction head (NPSH)*. For horizontal shaft pumps, the *datum* elevation is the pump centerline. For vertical shaft pumps, the *datum* elevation is the elevation of the entrance eye of the suction impeller. See Figure 5-1.

Dry Pit A dry compartment in a pumping station, near or below pumping level, where the pumps are located (not to be confused with the dry well defined in Section 6)

Force Main A pressure pipe joining the pump discharge at a wastewater pumping station with a point of gravity flow.

Impeller A rotating set of vanes designed to impel rotation of a mass of fluid.

Lift Station A wastewater pumping station that pumps *wastewater* to a higher elevation when the continuance of the sewer at reasonable slopes would involve excessive depths of trench (depths where repair or replacement would require special or costly construction techniques), or that raises *wastewater* from areas too low to drain into available *sewers*.

Net Positive Suction Head (NPSH) The total *suction head*, in feet of liquid absolute, determined at the suction nozzle, less the vapor pressure of the liquid in feet absolute. See Figure 5-1.

Peak Design Flow The largest estimated flow rate sustained over a 60-minute period in the *design year* of the pump station.

Sewer See Section 4.1.

Static Head The difference in suction and discharge water levels, does not include dynamic losses.

Suction Head *Suction head* exists when the total suction head is above atmospheric pressure. As determined on test, it is the reading of the gage at the suction of the pump converted to feet of liquid and referred to *datum*, plus the *velocity head* at the point of gage attachment. See Figure 5-1.

Suction Lift *Suction lift* exists when the total suction head is below atmospheric pressure. Total *suction lift*, as determined on test, is the reading of a liquid manometer at the suction nozzle of the pump converted to feet of liquid and referred to *datum*, minus the *velocity head* at the point of gage attachment. See Figure 5-1.

Sump A tank or pit that receives wastewater and stores it temporarily, and from which the wastewater is pumped or ejected.

Total Discharge Head The reading of a pressure gage at the discharge of the pump, converted to feet of liquid and referred to *datum*, plus the *velocity head* at the point of gage attachment. See Figure 5-1.

Total Dynamic Head (TDH) Also called "total head", *TDH* is the measure of energy increase per pound of the liquid imparted to it by the pump. Where *suction lift* exists, *TDH* is equal to the sum of the *total discharge head* and total *suction lift*, and, where positive *suction head* exists, *TDH* is the *total discharge head* minus the total *suction head*. See Figure 5-1.

Velocity Head The theoretical vertical height to which a liquid body may be raised by its kinetic energy. It is equal to the square of the velocity divided by twice the acceleration due to gravity ($v^2/2g$). See Figure 5-1.

Wastewater See Section 4.1.

Wastewater Director See Section 4.1.

Water Hammer The phenomenon of oscillations in the pressure of water about its normal pressure in a closed conduit, flowing full, that results from a too-rapid acceleration or retardation of flow. Momentary pressures greatly in excess of the normal static pressure may be produced in a closed conduit by this phenomenon.

Wet Well A compartment in which wastewater is collected, and: (a) to which the suction pipe of a pump is connected, or (b) in which a submersible pump is installed.

5.2 General Requirements

Justification for any proposed lift station is required which clearly exhibits that gravity lines are not available and not economically feasible.

The number of lift stations for each basin shall be optimized.

5.2-1 Minimal Pump Station Design Requirements

The applicant's engineer shall submit all supporting documentation, in report form, including all relevant design information needed for the City to review for adequacy of the proposed design. The report is to be stamped by an engineer, licensed in the State of Washington. At a minimum the following information shall be submitted.

1) The pump station design must have a minimum of two pumps
2) Design flow analysis (break down of phases if applicable)
3) All relevant elevations, such as; pump(s) off, discharge elevation, pump(s) on, alarm elevation, max allowable storage elevation, etc.
4) Maximum static head
5) Force main size and length
6) Pump station capacity (gpm) per each pump and multiple pumps

7) Velocity within force main
8) System head and pump curves (including compound pump curves when applicable)
9) "n" values of force main
10) Friction head loss (calculations)
11) Velocity head
12) Total dynamic head
13) Pump time/cycle and number of cycles per day
14) Storage available and storage required during a power outage scenario (min and max time)
15) Discussion of odor control
16) Water hammer calculations
17) Buoyancy calculations (if the potential for high groundwater exists)
18) Pump station specifications (generator specifications if applicable)
19) Pump(s) specifications
20) System back up plan (i.e. storage method, alternate power source)
21) Maintenance Agreement (for private systems)
22) Wiring Schematic

5.3 Site Selection and Plan

5.3-1 Location

A lift station site shall be selected to serve the entire basin, considering ultimate build-out of the basin.

In selecting a lift station site, consideration shall be given to minimizing its aesthetic, noise, and odor nuisance potential. The site shall be located at least 50 feet from any building or houses and a buffer zone between the lift station and its surrounding environment shall be provided. Buffer zones shall be designed to allow the lift station to blend into the surrounding environment and provide noise mitigation.

The lift station site shall be readily accessible by maintenance vehicles during all weather conditions. The facility should be located off the traveled way of streets and alleys. The station should have a paved access road at least 12 feet wide and a maximum slope of 8%. A paved vehicle turn-around area with a 50 foot outside turning radius to allow a two-ton truck to turn around shall be provided if the access road exceeds 50 feet in length from the nearest dedicated street.

5.3-2 Security/Equipment Protection

The lift station site shall be enclosed in a security fence at least 6 feet high. All slabs, equipment, and utilities shall be located within the fenced area at least 3 feet from the fence.

The lift station structures, electrical and mechanical equipment shall be designed to sustain no physical damage by the 100 year flood. The station should remain fully operational and accessible during the 25 year flood.

5.3-3 Temporary Lift Stations

For temporary lift stations, the owner must grant an easement to the City. A copy of the recorded easement, plat, legal description and any other legal documents granting the easement shall be delivered prior to acceptance for operation and maintenance by the City. The easement shall extend to at least five feet outside the lift station fence and shall include the access road and turn-around areas. This easement shall be separate and in addition to any necessary pipeline easements. If the lift station is to become a permanent installation, transfer of title and ownership of the land to the City will be required prior to acceptance of the station for operation and maintenance.

5.4 Station Access

A suitable and safe means of access to dry/wet pits shall be provided. Entrance hatches larger than 40 inches in diameter shall be spring loaded.

For built-in-place pump stations, a stairway with rest landings shall be provided at vertical intervals not to exceed 12 feet. For factory-built pump stations over 15 feet deep, a rigidly fixed landing shall be provided at vertical intervals not to exceed 10 feet. Where a landing is used, a suitable and rigidly fixed barrier shall be provided to prevent an individual from falling past the intermediate landing to a lower level. Where acceptable to the Wastewater Director, a manlift or elevator may be used in lieu of landings in a factory-built station, provided emergency access is included in the design. Access must meet current WISHA confined space requirements.

5.5 Wet Pit/Dry Pit Station Design

A conventional wet pit/dry pit installation with centrifugal sewage pumps and controls housed in the dry pit shall be required.

5.5-1 Wet Pit Layout

Consideration should be given to dividing the wet pit into multiple sections, properly interconnected, to facilitate repairs and cleaning. The bottom of the wet pit shall have a minimum slope to the intake of 1 vertical to 1 horizontal. There shall be no projections in the wet pit which would allow deposition of solids. Wet pits shall be designed to avoid turbulence near the pump intakes.

The clear distance between the bottom of the pump intake structure and the floor of the wet pit shall be between D/3 and D/2, where D is the diameter of the flared pump inlet or as otherwise may be justified by the design engineer.

The inflow line into the wet pit shall be so designed as to prevent entrapped air from reaching the flared pump inlet. A discharge point below static water level in the wet pit is recommended.

To prevent air entrainment, wastewater should not enter the wet pit with a free vertical drop greater than one foot above high water level. A short distance grade increase in the inflow line is recommended where necessary to achieve this. Exterior pipe drops into the wet pit may be approved. Energy dissipaters at the inlet pipe discharge or non-flared pump intakes may be required to reduce air entrainment.

5.5-2 Wet Pit Storage Volume

The wet pit shall be sized to provide adequate storage volume at peak design flows, and a pump cycle time of sufficient duration to prevent pump short cycling and consequential damage. (See Section 5.7.) Static head shall be calculated for "pump on" and "pump off" elevations in the wet pit and included in the system head pump/pump curve.

The following excerpt from Design of Wastewater and Stormwater Pump Stations, Manual of Practice No. FD-4, published by the Water Pollution Control Federation, describes typical volume calculations for wet pits:

> *From a mechanical standpoint, it is desirable to operate a pump for long periods, if not continuously. Such performance, however, is not compatible with the maintenance of aerobic conditions in the wastewater when it results in long retention periods. Methods have been developed to determine the wet pit volume required to maintain the pump cycle greater than a given time for single and multiple fixed speed pumps.*

The volume of a wet pit between start and stop elevations for a single pump or a single speed control step for variable speed or multispeed operation is given by Equation 4.

$$V = \theta q/4 \qquad (4)$$

where: V = *required capacity in gallons,*
θ = *minimum time of one pumping cycle between successive starts, or speed increases of a pump operating over the control range in minutes, and*
q = *pump capacity in gallons per minute, for one pump, or the incremental pumping capacity for an additional pump, or pump speed*

The use of the above principles allows the pumping system to maintain the required number of starts and stops per hour.

5.5-3 Wet Pit Detention Time

Sewage detention time in the wet pit shall be calculated using the following equations:

$$T_{det} = t_f + t_e$$

where:
t_f = time to fill the wet pit in minutes
t_e = time to empty the wet pit in minutes

$$t_f = V/i \qquad t_e = V/(q-i)$$

where:
V = volume of wet pit between "lead pump on" and "lead pump off" elevations in gallons
q = pump capacity in gpm
i = inflow to the station in gpm

If the lift station serves commercial flow only, the maximum detention time shall be equivalent to the following equation:

$$\frac{24 \text{ hrs}}{\text{day}} - \frac{\text{employee shift hrs}}{\text{day}} = \frac{\text{detention time, hrs}}{\text{day}}$$

5.5-4 Odor Control

Odor control shall be provided for the wet pit if there is no station inflow for 480 minutes or if the wet pit detention time exceeds 480 minutes.

5.5-5 Dry Pit Design

A separate sump pump, equipped with dual check valves shall be provided in the dry pits to remove leakage or drainage, with the discharge located as high as possible. Water ejectors connected to a potable water supply will not be approved. All floor and walkway surfaces should have an adequate slip proof slope to a point of drainage. Pump seal water shall be piped to the sump. The floor shall slope 1/8 inch per foot toward the sump pit.

5.6 Submersible Station Design

Submersible pumps are discouraged. Proposed submersible pump systems require prior approval of the Engineer.

5.7 Pumps

5.7-1 Cycle Time

Pump cycle time, θ, defined as the sum of "pump off" time plus "pump on" time, shall be as follows:

Motor H.P.	θ_{min} (Minimum cycle time, minutes)	Maximum Starts per hour
2 to 50	12	5
51 to 75	15	4
76 to 250	30	2
251 to 1500	45	1.33

Note: Motor contactors must be suitably rated by the manufacturer to meet actual cycle time requirements.
If pumps operate at or above 1,000 gpm, see 5.7-3.
Consider variable frequency drives when pumps exceed 50 hp or 100 ft of head.

5.7-2 Pump Control Staging

Two-Pump: An example of a two-pump staging sequence is as follows:

- ∇ High level alarm
- ∇ Lag pump on
- ∇ Lead pump on
- ∇ Lag pump off
- ∇ Lead pump off
- ∇ Redundant off
- ∇ Low level alarm

Three-Pump: An example of a three-pump starting sequence is as follows:

- ∇ High level alarm
- ∇ Third pump on
- ∇ Second pump on
- ∇ First pump on
- ∇ Third pump off

  1' min.
- ∇ Second pump off

  1' min.
- ∇ First pump off
- ∇ Redundant off
- ∇ Low level alarm

The highest level alarm shall be at least six inches above the last (highest) "pump on" level in the wet pit, and also at least one foot below the flow line of the lowest influent line into the wet pit.

All "pump on" levels shall have a minimum separation of one foot between levels. All "pump off" levels shall be at least 6 inches above the top of the pump's casing. For more than two pumps, the "pump off" levels shall be staged with a minimum separation of one foot between levels.

5.7-3 Number of Pumps

For design flows less than 1,000 gpm, a minimum of two pumps shall be required and each pump

shall be capable of delivering the design flow with the largest pump out of service.

For design flows of 1,000 gpm or larger, multiple pumps shall be installed to efficiently handle the maximum/minimum flows and to reduce the time of detention in the wet pit. When more than two pumps are utilized, the capacity of the pumps shall be such that the design flow can be handled with the largest pump out of service.

Lift stations with more than three pumps require design coordination with the Wastewater Treatment Division.

5.7-4 Net Positive Suction Head (NPSH)

The net positive suction head (NPSH) required by the pump selected shall be compared with the NPSH available in the system at the eye of the impeller. The engineer shall consult the pump manufacturer for the NPSH required values for the pump and compare them with calculated values for the NPSH available. The NPSH available should be greater than or equal to the NPSH required for a flooded suction pump. The following equation may be used for calculating the NPSH available:

$$NPSH_A = P_B \pm H_S - P_V - H_{fs} \approx 29.9 \pm H_S - H_{fs}$$

where: P_B = barometric pressure in feet absolute
H_S = minimum static suction head in feet; positive if flooded; negative if suction
P_V = vapor pressure of liquid in feet absolute
H_{fs} = friction loss in suction pipe in feet.

For lift stations in Spokane, a barometric pressure of 30.5 feet and a vapor pressure of 0.59 feet may be used. These values are based on an altitude of 1740 feet above sea level, a water temperature of 60^o F and a specific gravity of water equaling 0.99905 for 60^o F.

5.7-5 Head Loss Curves

Data points for the system capacity curve shall be provided in tabular form and graphed with pump head capacity curve on the same axis. System capacity curves shall be plotted using the Hazen Williams coefficient values of C=100 and C=130.

Pump output in gpm at maximum and minimum head shall be clearly shown on system curves for each pump and combination of pumps.

For stations with two or more pumps operating in parallel, multiple and single operation points shall be plotted on the system curve.

Pumps with the best efficiencies at all operating points shall be chosen.

If a station is equipped with smaller impellers during start-up to handle lower than design flows, impellers sized to handle the design flow shall also be provided.

5.7-6 Additional Pump Design Parameters

Pumps shall be capable of passing spheres of at least 3 inches in diameter. Pump suction and discharge openings shall be at least 4 inches in diameter.

All suction piping shall be flanged ductile iron and have a minimum diameter of 4 inches. Each pump shall have a separate suction pipe. Suction piping shall have a velocity of 1 to 2 fps. All suction pipes inside the wet pit shall be equipped with a flared type, down-turned intake. (See Section 5.5-1 for mitigation of entrained air.)

All pumps and piping shall be protected from freezing temperatures.

Stations with pump parameters greater than 50 hp or 100 feet of head shall submit a design for variable frequency drives (VFD) as an alternate.

Motors 40 HP and larger shall be high efficiency frames. Overall wire to water efficiency should be

considered in all situations. Maximum temperature rise shall not exceed 90°C over a 40°C ambient. Motors larger than 75 HP shall be designed with a maximum temperature rise not to exceed 80°C over a 40°C ambient. Motors larger than 300 HP may require a higher temperature rise and may be specifically approved with such.

5.7-7 Bypass Piping

All stations shall be designed with bypass piping to the force main. Valves on bypass piping shall be below frost level. An example of bypass piping is shown in Figure 5-2.

5.8 Force Mains

All force mains shall be ductile iron with a minimum diameter of 4 inches. Force main pipe within the station shall be flanged. Alternate pipe materials will be considered in corrosive soils or unusual terrain, provided a locating wire is used.

Minimum depth of cover for force mains shall be 3.5 feet for frost protection. Refer to Standard Plan W-111 for water line/force main crossing requirements.

Force mains shall be sized so that the velocity is between 2.5 and 6.0 feet per second. For interim design flows, force main velocity may be as low as 2.0 feet per second. Velocity should not exceed 8.0 feet per second.

The following flow rates define various pipe capacities.

Force Main Diameter (Inches)	Min. Flow (gpm) (v = 2.0 fps)	Max. Flow (gpm) (v = 8.0 fps)
4	100	300
6	220	700
8	390	1250
10	610	1960
12	880	2820

Force mains shall be designed and tested to withstand twice the operating pressures expected for a minimum of 40 minutes. (Check water hammer.) The minimum allowable test pressure shall be 100 psi. The test method shall be as prescribed for water mains.

Force mains shall always terminate in a discharge manhole and then gravity flow through a gravity line into the main sewer system. The force main should never be designed to allow gravity drainage of the force main itself; this means there shall always be an up-grade slope on the force main leading into the discharge manhole.

The maximum time required to flush the force main shall be calculated on the basis of minimum flow.

Force mains having steep sections (over 33%) must be designed to discharge the volume contained in that section plus 100 additional feet during each pump cycle.

Odor control shall be provided for the force main if the wet pit plus the force main flush time exceeds 480 minutes.

The use of air release valves shall be restricted to installations where, in the opinion of the Engineer, there is no possible alternative. Air release valves, when permitted, shall be located at localized high points along the force main, shall be of a type suitable for sewage service and shall be located in a manhole for purposes of maintenance.

5.9 Power Supply

Stations should be designed to operate on 480 volt 3-phase power supply whenever possible. Electrical system and components (e.g. motors, lights, cables, conduits, switch boxes, control circuits, etc.) in raw sewage wet pits, or in enclosed or partially enclosed spaces where hazardous concentrations of flammable gases or vapors may be present, shall comply with the National Electrical Code requirements for Class I, Group D, Division I locations. In addition, electrical equipment located in the wet pit shall be suitable for use under corrosive conditions. Each flexible cable shall be provided with watertight seal and separate strain relief. A fused disconnect switch located above ground shall be provided for all pumping stations. When such equipment is exposed to weather, it shall meet the minimum requirements of weatherproof equipment (NEMA 3R) and be located in a water resistant maintenance environment.

5.10 Emergency Operation

Provisions shall be provided to accommodate station inflow in the event of a power outage. This may be affected by (a) including an emergency power supply, or (b) construction of emergency storage. All public stations except small STEP areas shall have an emergency backup power supply.

5.10-1 Emergency Power

Provisions for an emergency power supply shall be made either through connection of the station to at least two independent public utility sources, or through installation of in-place internal combustion power generation equipment (See Section 5.11-8).

5.10-2 Emergency Storage

Where storage is to be provided in lieu of an emergency power supply, wet pit capacity above the high level alarm should be sufficient to hold the peak flow expected during the areas maximum historic power outage but not less than twenty four hours

5.11 Miscellaneous Equipment and Appurtenances

5.11-1 Screens, Racks and Traps

Pumps handling stormwater shall be preceded by readily accessible bar racks to protect the pumps from clogging or damage. Bar racks shall have clear openings not exceeding 2 inches. Where a bar rack is provided, a mechanical hoist shall also be provided.

In addition, screens and racks are required on all pump stations with capacity less than 1 million gallons per day capacity. For stations with 1 million gallons per day capacity or greater, mechanically cleaned racks shall be provided.

If necessary, rock traps may be constructed in the manhole immediately upstream of the pump station. A depressed section of the manhole channel may serve as a rock trap, allowing heavy debris to sink and the remaining wastewater to flow over the trap.

5.11-2 Controls/Flow Monitoring

Control systems shall be of the ultrasonic type, located away from the turbulence of incoming flow and pipe suction.

In all stations, provisions should be made to automatically alternate the pumps in use, and to manually change the lead pump.

Suitable devices for measuring sewage flow for stations with pumping rates of 1,000 gpm or greater shall be required. The use of a parshall flume and an ultrasonic measurement device is acceptable.

5.11-3 Valves

Suitable rising stem shutoff valves shall be placed on the suction line of each pump and on the station bypass line to the force main. Suitable shutoff and check valves shall be placed on the discharge line of each pump. The check valve shall be located between the shutoff valve and the pump. Check valves shall be suitable for the material being handled, and shall not be placed on the vertical portion of discharge piping. The seats of all check valves shall be removable without removing the valve itself. Valves shall be capable of withstanding normal pressure and water hammer.

Gate valves higher than 6 feet off the floor shall have chain operators. Valves shall not be located in the wet pit.

Valves larger than 16 inch shall be power-actuated.

5.11-4 Ventilation

Adequate ventilation shall be provided for all pump stations. Where the pump pit is below the ground surface, mechanical ventilation is required, so arranged as to independently ventilate the dry pit and wet pit if screens or mechanical equipment requiring inspection are located in the wet pit. There shall be no interconnection between the wet pit and dry pit ventilation systems.

In pits over 15 feet deep, multiple inlets and outlets are desirable. Dampers should not be used on exhaust or fresh air ducts and fine screens or other restrictions in air ducts should be avoided to prevent clogging.

Switches for operation of ventilation equipment should be marked and located conveniently. All intermittently operated ventilation equipment shall be interconnected with the respective pit lighting system. Consideration should also be given to automatic controls where intermittent operation is used. The fan wheel should be fabricated from non-sparking material. Consideration should be given to installation of automatic heating and/or dehumidifying equipment. Cooling may be required for large motors and controls.

Ventilation for the wet pit may be either continuous or intermittent. Ventilation, if continuous, shall provide at least 12 complete air changes per hour; if intermittent, at least 30 complete air changes per hour. Air shall be forced into the wet pit rather than exhausted from the wet pit.

Ventilation for the dry pit may be either continuous or intermittent. Ventilation, if continuous, shall provide at least 6 complete air changes per hour; if intermittent, at least 30 complete air changes per hour. Temperature compensation may be necessary.

5.11-5 Alarm System

Alarm systems shall be provided for all pumping stations. The alarm shall be activated in cases of power failure, pump failure, use of the lag pump, or any cause of pump station malfunction. Pumping station alarms shall be telemetered, including identification of the alarm condition, to a municipal facility that is manned 24 hours a day. The alarm system and components must have the prior approval of the Wastewater Treatment Plant Pump Station Division.

5.11-6 Trolleys/Hoists

All stations shall be designed with mechanical facilities adequate to lift the pumps.

5.11-7 Egress

All station designs shall include a method to remove workmen from confined spaces, in accordance with applicable WISHA regulations.

5.11-8 Auxiliary Generating Equipment

The following general requirements shall apply to all internal combustion engines used to drive

auxiliary electrical generating equipment:

Engine/Equipment Protection: The engine must be protected from operating conditions that would result in damage to equipment. Unless continuous manual supervision is planned, protective equipment shall be capable of shutting down the engine and activating an alarm on site. Protective equipment shall monitor for conditions of low oil pressure and overheating. Emergency equipment shall be protected from damage at the restoration of regular electrical power (located in a suitable building).

Engine block heaters are required.

Size: The engine shall have adequate rated power to start and continuously operate all connected loads.

Fuel: Reliability and ease of starting, especially during cold weather conditions should be considered in the selection of the type of fuel. Propane or natural gas is preferred. Fuel storage is required to supply a minimum of 12 hours of operation at maximum design load. No buried tanks will be allowed.

Engine Ventilation: The engine shall be located above grade with adequate ventilation of fuel vapors and exhaust gases.

Routine Start-up: All emergency equipment shall be provided with instructions indicating the need for regular starting and running of such units at full loads. Engines shall be automatically exercised every 7 days.

Engine-Driven Generating Equipment: Generating unit size shall be adequate to provide power for pump motor starting current and for lighting, ventilation, and other auxiliary equipment necessary for safety and proper operation of the lift station. Provisions shall be made for automatic and manual start-up and load transfer. The generator must be protected from operating conditions that would result in damage to equipment. Provisions should be considered to allow the engine to start and stabilize at operating speed before assuming the load.

5.12 Buoyancy Calculations

The lift station design shall include a complete analysis of buoyant forces.

5.13 Water Hammer Calculations

Calculations showing maximum pressures which would occur upon total power failure while pumping shall be provided. Water hammer shall be calculated according to the following equations:

$$a = \frac{12\sqrt{(k \times g/w)}}{\sqrt{(1+(K/E)(d/t)C_1)}} \approx \frac{4800}{\sqrt{(1+(K/E)(d/t))}}$$

$$p = \frac{(a)(v)}{(2.31)(g)} + \text{system operation pressure (psi)}$$

where: a = pressure wave velocity (ft/s)

for PVC: $a \approx \frac{4800}{\sqrt{(1+(0.783)(d/t))}}$

for ductile iron: $a \approx \frac{4800}{\sqrt{(1+(0.013)(d/t))}}$

w = specific weight of water (62.4 lb/ft^3)
g = acceleration of gravity (32.2 ft/s^2)
k = bulk modulus of water (313,000 psi)
d = inner diameter of pipe (in)
E = Young's modulus of pipe (psi)
for PVC: E = 4 x 10^5
for ductile iron: E = 24 x 10^6
t = pipe wall thickness (in)
v = flow velocity in pipe (ft/s)
p = water hammer pressure (psi)
C_1 = constant dependent on pipe constraints (1.0 for pipe expansion joints)

Surge control measures shall be provided when pressures due to water hammer exceed the rated working strength of the pipe. The pipe's rated working stress includes the pipe manufacturer's allowance for surge pressures.

Stress and thrust calculations for internal station piping and bends shall be provided for stations with flows over 1,000 gpm.

5.14 Thrust Restraint for Force Mains

Force mains thrust restraint shall be as required for water mains. Refer to part 8.6-3 Pipe Thrust Restraint Design.

5.15 Private Pump Stations

Private pump stations require annual pump maintenance agreements with independent contractors and approval by the City of Spokane. Agreements shall be coordinated with the Wastewater Director.

Private stations shall be designed in accordance with the Standards set forth above and WSDOE's Criteria for Sewage Works Design. A reduction in required piping size to 3-inch diameter will be allowed on private stations with the use of grinders.

5.16 Exceptions

Exceptions to the above specifications for Wastewater Pump Stations must be requested in writing using the Variance Request Form shown in Section 1.4 Written approval from the Wastewater Director must be obtained before any exceptions will be allowed.

5.17 Tables and Figures

Figure 5-1 Pump-Head Relationships

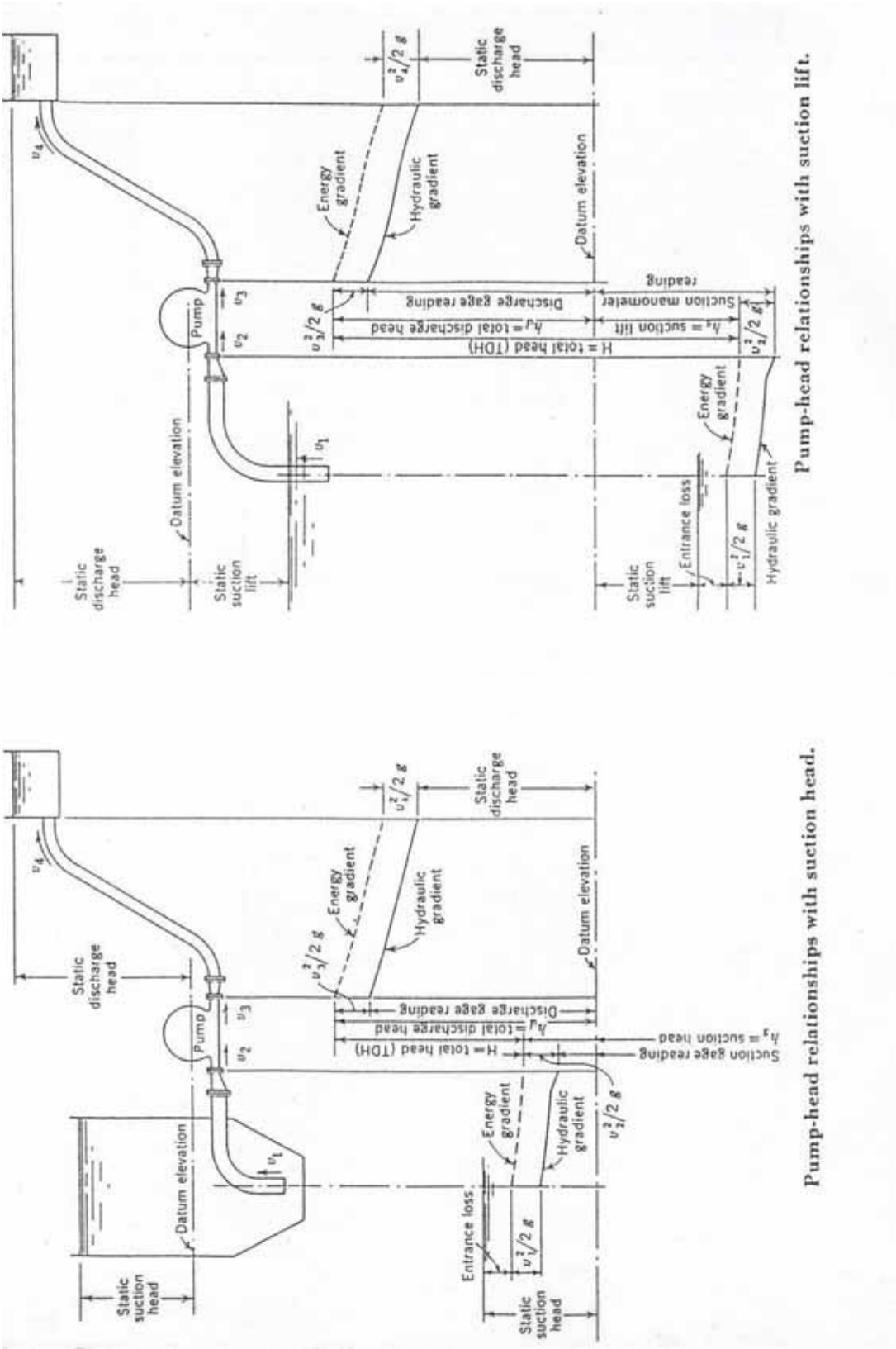
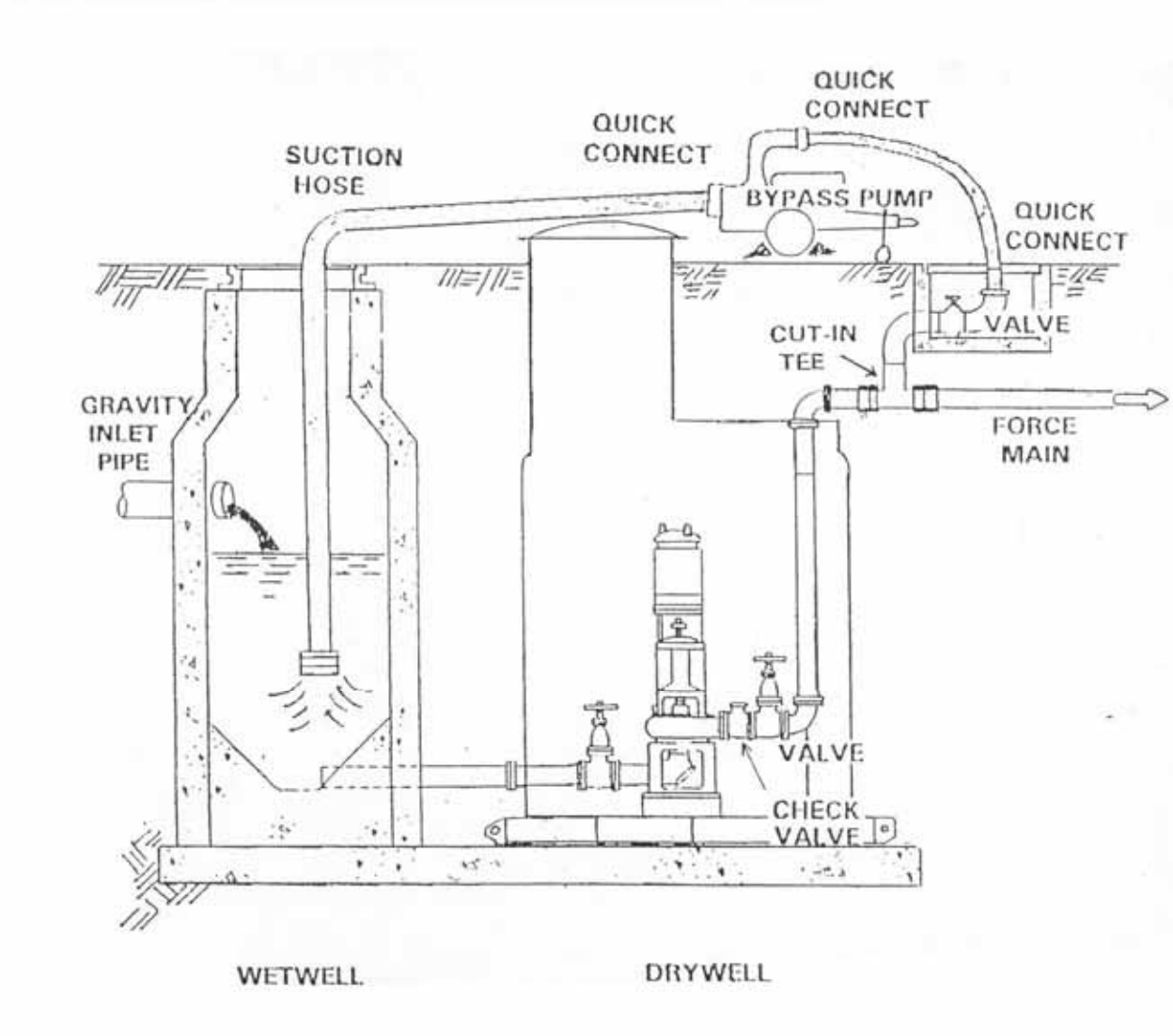


Figure 5-2 Bypass Piping Example



6.0 STORM WATER MANAGEMENT

The Spokane Regional Stormwater Manual, currently under development by the City of Spokane, Spokane County and the City of Spokane Valley, will supersede portions of this section. Until it is adopted, the requirements of this section shall apply.

The Spokane Aquifer Water Quality Management Plan, prepared in 1979 for Spokane County, discusses recommended policies and actions related to stormwater to preserve the quality of the Spokane aquifer. Spokane County's "208" Water Quality Management Program was developed as a result of this study.

This section outlines standard methods for calculating runoff and infiltration rates, and describes acceptable systems for stormwater disposal within the City. Specific handling of stormwater on public and private properties is also discussed.

Erosion and Sediment Control Plans are required for projects or activities which could potentially cause significant excess runoff, erosion, or water quantity/quality impacts. Refer to Section 7.0 for Erosion and Sediment Control Plan requirements.

6.1 Definitions

"208" Swale: See Grass Percolation Area Swale (GPA).

Absorption Trench An underground channel constructed beneath a roadway or paved surface which is filled with gravel and used to store storm water runoff until soil conditions permit natural drainage/absorption into the ground below. Surface runoff enters the absorption trench via a drywell and drain tile.

Aquifer or Spokane Aquifer A subterranean body of flowing water, also known as the Spokane-Rathdrum Aquifer, that runs from Pend Oreille Lake to the Little Spokane River.

Aquifer Sensitive Area That area or overlay zone from which runoff directly recharges the *Aquifer*, including the surface over the *Aquifer* itself, and the hillside areas immediately adjacent to the *Aquifer*.

Backwater Effect The effect which a stream obstruction has in raising the water surface upstream.

Biofiltration The simultaneous process of filtration, *infiltration*, adsorption and biological uptake of pollutants in stormwater that takes place when runoff flows through and ponds in vegetated areas.

Catch Basin A drainage structure which receives stormwater prior to discharge to a storm sewer or subterranean dissipation structure. Generally a catch basin's purpose is to allow sediment and debris to settle out the stormwater, and to retain these materials to prevent them from entering the primary disposal system.

Combined Sewer See Section 4.1.

Culvert A closed conduit used as an artificial channel under a roadway or embankment to maintain free passage of surface drainage water from a natural channel or drainage ditch.

Design Storm The storm frequency for which a hydraulic structure is designed. For example: a "50-year" storm is the largest rainfall event that can be expected to occur once every 50 years. A structure with a 50-year *design storm* should be capable of handling the runoff volume or peak flow rate which is generated by the 50-year storm.

Detention The storage and subsequent release of excess stormwater runoff for a site, generally for flow control purposes. AASHTO defines *detention* as short-term storage, usually less than a

day, with release at a lower, controlled rate.

Drainage

a) The process of removing surplus ground or surface water by artificial means.
b) The manner in which the water of an area is removed.

Drainage Basin An area from which surface runoff is carried away by a single *drainage system*.

Drainage Area The area served by a stormwater disposal system.

Drainage System (or Storm System) A system of conduits and structures for effecting drainage. Also, all piping within public or private premises which conveys stormwater to a legal point of disposal; but which does not include the pipes of a public *sanitary sewer* system.

Flood Frequency The average time interval between occurrences of a hydrologic event of a given or greater magnitude, usually expressed in years. May also be called recurrence interval.

Grass Percolation Area (Swale)*: A grassed percolation area (GPA) designed to accept and treat storm runoff from impervious areas such as roadways, parking lots, roofs, etc.*

Graphical Peak Discharge Method A method presented in SCS TR-55 for determining peak discharge of a watershed.

Hydrograph A graph showing stage, flow, velocity or other property of water with respect to time.

Impervious Not allowing, or allowing only with great difficulty, the movement of water; impermeable.

Infiltration The flow or movement of water through the interstices or pores of a soil or other porous medium.

Infiltration Rate A measure of the speed of water movement through soil. The rate of infiltration at a specific site may vary based on hydraulic head. See Appendix I of the Spokane County Guidelines for Stormwater Management for infiltration rate testing procedures.

Infiltration Gallery An underground channel beneath a landscaped area or swale, which is filled with sand and gravel, and used to store storm water runoff until soil moisture conditions permit natural drainage/absorption into the ground below.

Natural Outlet See Section 4.1.

Noncontact Cooling Water See Section 4.1.

Outfall The point, location or structure where *wastewater* or drainage discharges from a *sewer*, drain or other conduit. Also, the conduit leading to the ultimate disposal area.

Permeability A measure of a soil's ability to absorb and convey water. Unlike the *infiltration rate*, permeability is not dependent on hydraulic head.

Ponding Depth The vertical distance between the top of drywell and the bottom of a *swale*.

Private Storm Sewer A *storm sewer* not controlled or maintained by a public authority, which is connected to a *public sewer* (See Section 4.1) or discharged into a *natural outlet* (See Section 4.1).

Rainfall-Intensity Curve A curve that expresses the relation of rates of rainfall and their duration. Each curve is generally for a period of years during which time the intensities shown will not, on the average, be exceeded more than once.

Rational Method A method of estimating runoff in a drainage basin for a specific point and time by means of the *Rational Runoff Formula*. For each drainage area, the rainfall rate under a stated intensity-duration relationship, the fraction that will appear as runoff, and the basin area above the specified point are estimated. Their product is the flow. This method is used to estimate storm runoff in urban areas and flood flows in streams.

Rational Runoff Formula A formula used to relate rainfall intensity to runoff. It is Q=CiA, where Q is peak discharge in cfs; C is the *runoff coefficient*, generally considered to be that part of the rainfall rate which will contribute to the runoff rate; i is the average intensity of rainfall in inches per hour during the time required for all parts of the watershed to contribute to runoff (*time of concentration*); A is the area of the drainage basin in acres. The formula is based on the approximation that one inch/hr/acre = one cfs.

Retention Storage of stormwater runoff, generally for the purpose of flood control or for treatment by settling or *eutrophication*. Some *retention* facilities have flow-control devices for subsequent release of *stormwater*. Others have no outlet but may allow water to dissipate through soil infiltration or evaporation. AASHTO considers *retention* to mean storage for several days or more; in contrast with *detention*, which is shorter-term storage.

Roof Drain A drain installed to receive water collecting on the surface of a roof and discharge it to the onsite drainage system.

Runoff That part of the precipitation which runs off the surface of a drainage area and reaches a stream or other body of water or a drain or sewer.

Runoff Coefficient Ratio of the maximum rate of runoff to the uniform rate of rainfall with a duration equaling or exceeding the *time of concentration* which produced this rate of runoff.

Runoff Curve Number Method A procedure presented in SCS TR-55 for estimating runoff in conjunction with the *Tabular Hydrograph* method or *Graphical Peak Discharge* method for drainage basin analysis. Briefly, under the *Runoff Curve Number method*, discharge Q is determined using the equation $Q = (P-0.2S)^2/(P+0.8S)$, where P is rainfall in inches, and S is the potential maximum retention after runoff begins (in inches). S is related to soil and cover conditions through a Curve Number (CN) according to the following equation: $S = (1000/CN)-10$. Refer to SCS TR-55 for additional detail on this method.

Runoff Rate The volume of water running off in a unit of time from a surface, expressed in inches depth per hour, cfs, cfs per square mile or other units.

Sanitary Sewer See Section 4.1.

SCS TR-55 U.S. Soil Conservation Service Technical Release 55, "Urban Hydrology for Small Watersheds". See also *Runoff Curve Number method* and *Tabular Hydrograph method*.

Sedimentation Gravitational deposit of transported material in flowing or standing water.

Settling Basin A basin or tank in which water or *wastewater* containing settleable solids is retained to remove by gravity a part of the suspended matter.

Storm Water See Section 4.1.

Storm Sewer or Storm Drain See Section 4.1.

Swale See Grass Percolation Area Swale.

Tabular Hydrograph Method: Method used to develop hydrographs and calculate runoff for drainage areas with *time of concentration* between 0.1 and 2.0 hours. See the U.S. Soil Conservation Service (SCS) Technical Release 55 (TR-55), "Urban Hydrology for Small Watersheds" for further description of this method.

Time of Concentration

a) The period of time required for storm runoff to flow from the most hydraulically remote point of a catchment or drainage area to the outlet or point under consideration. It is not a constant, but varies with depth of flow and condition of channel.
b) The time at which the rate of runoff equals the rate of rainfall of a storm of uniform intensity.

Wastewater See Section 4.1.

6.2 Calculation of Runoff and Soil Permeability

6.2-1 Runoff Calculations - Drainage Areas 10 Acres or Less

Figure 6-1 shows the rainfall intensity duration – frequency curves for the Spokane area. Table 6-B provides coefficients for manually calculating rainfall intensity for a given storm event.

Isopluvial rainfall maps for Spokane County are provided in Spokane County's "Guidelines for Stormwater Management". More detailed rainfall information may be found in the National Oceanic and Atmospheric Administration (NOAA) Atlas 2, "Precipitation Frequency Atlas of the Western United States, Volume IX, Washington".

6.2-2 Runoff Calculations - Drainage Areas over 10 Acres

Table 6-A shows the recommended design storm frequency for stormwater facilities. Runoff calculations shall be made as follows:

a) Drainage areas under 10 acres: The Rational Method is recommended for predicting peak runoff for drainage areas of up to 10 acres. Table 6-B provides runoff coefficients for determining peak design flows from the Rational Method.
b) Drainage areas over 10 acres: Runoff from areas larger than 10 acres should be analyzed using the Tabular Hydrograph method or Graphical Peak Discharge method presented in the U.S. Soil Conservation Service's Technical Release 55 (SCS TR-55), "Urban Hydrology for Small Watersheds". Calculation of runoff for these analyses is performed using the SCS Runoff Curve Number method. See SCS TR-55 and Spokane County's Guidelines for further details. Upon approval by the City Engineer, the rational method may be used on larger areas, in special cases.
c) Estimates of pre-development vs. post-development drainage. Designers of new developments are cautioned that the Rational Method is not recommended for estimating the difference between pre-development and post development runoff. The Rational Method, while acceptable for approximating runoff for design of small-basin storm systems and street drainage, is not adequately refined to model the effects of development on the drainage characteristics of undeveloped property. Designers may use the SCS curve number method for these calculations. Other calculation methods may be used with prior approval by the City Engineer. Refer to Chapter 2 of the WSDOT Hydraulics Manual for further discussion of other runoff calculation methods.

The peak rate and volume of runoff shall not increase from the pre-development conditions.

. In the event that water from this development drain into a critical flood drainage and/or erosion problem area, as determined by the City Engineer, the quantity of water leaving the site shall be restricted to pre-development quantities.

6.2-3 Soil Permeability and Infiltration Rate

The accepted procedures for determining soil permeability and infiltration rates, for proposed subsurface disposal sites are provided in Appendix I of the Spokane County Guidelines for Stormwater Management.

6.3 Methods of Stormwater Conveyance and Disposal

6.3-1 Gutter Flow

Gutter flow design criteria shall be as presented in the WSDOT Hydraulics Manual.

6.3-2 Grass Percolation Areas (GPA's)

Stormwater drainage and runoff from impervious areas in the Aquifer Sensitive area, unless otherwise approved by the Engineer, is to be disposed of by means of biofiltration swales (grass percolation areas.) Swale areas may include green belt areas in developments, median strips in major boulevards, edge strips on surface streets, or areas on private property.

Swale areas shall be as flat as possible, and shall be planted with grass or sod. Domestic grasses should be used when adjacent to existing lawns. Covar Sheep Fescue or other low-growing grasses are recommended; bark, gravel or any other non-vegetative substitutes will not be allowed. The top soil shall be at least four inches in depth, and the ground shall be free-draining. Irrigation of swale areas along arterials is required, and a maintenance plan shall be required of the designer.

Swales should be sized to allow ponding of the first 1/2 inch of runoff from the impervious surfaces served, assuming an instantaneous time of concentration and a frozen ground condition in the swale. One square foot of swale area with a four-inch ponding depth is generally required for every eight square feet of paved (impervious) area. If a six-inch ponding depth is used, the ratio is one square foot of swale to 12 square feet of impervious area. Swale ponding depth should not exceed six inches without approval of the Engineer; an absolute maximum of eight inches of ponding depth may be approved if a soils analysis is conducted and meets the requirements of the Spokane County Guidelines for Stormwater Management (Supplemental Criteria for Grassed Percolation Areas).

Overflow drainage structures shall be installed to drain any water that may exceed ponding capacity and pose a flooding problem for the surrounding property. (Note: the number and type of overflow drywells needed shall be based on hydrologic/geotechnical conditions of the project area. See Appendix I of the Spokane County Guidelines for Stormwater Management). A minimum of two inches shall be maintained between the gutter or swale inlet and the top of the overflow drywell. The top of the drainage structure grate shall be positioned at an elevation four to eight inches above the bottom of the swale, depending on the design ponding depth. Locating drainage structure inlets on the sloped sides of the swale is preferred; the required ponding area of the swale shall not be reduced if the drainage structure is positioned in the flat area of the swale.

An example swale configuration is shown in Figure 6-2. Curb inlet and drywell details for swales are provided in the Standard Plans. See Sections 6.4 and 6.5 for swale applications in the public right of way and on private sites.

6.3-3 Infiltration Galleries

Infiltration galleries may be allowed if approved by the Engineer. The following items shall be submitted for review as part of the design.

a) A supporting geotechnical study and report for the area in which the galleries are to be installed.
b) A statement of the minimum design life of the gallery; and
c) A summary of the operational and maintenance needs of the facility.

All infiltration gallery designs shall provide for pre-treatment of stormwater.

Refer to "Stormwater - Best Management Practices and Detention for Water Quality, Drainage and CSO Management" by Ben Urbanoas and Peter Stahre for additional guidance on infiltration gallery design.

6.3-4 Absorption Trenches

A typical absorption trench design is shown in the Standard Plans. See Section 6.4-2 for absorption trench applications in the public right of way. Refer to Spokane County Health

guidelines for infiltration facility setback requirements.

All absorption trenches must be wrapped with filter fabric to prevent siltation of the drainage rock. When a shallow trench is designed, insulation shall be included over the trench, extending laterally to each side as needed to prevent freezing of water in any portion of the trench.

All stormwater introduced into absorption trenches must enter through a trapped structure.

6.3-5 Drywells

Drywells may be used in conjunction with a catch basin or other pre-treatment facility for subsurface disposal of stormwater outside the aquifer-sensitive area. Within the Aquifer Sensitive Area, drywells shall be used only in conjunction with grass percolation area swales or other approved biofiltration system. (Refer to the variance procedures discussed in Section 1-4 of these Standards if biofiltration is not feasible.)

All drywells shall be set in washed river rock as shown in the Standard Plans. The surrounding river rock envelope shall be protected from sedimentation with filter fabric on the outside edge of the river rock. See Section 6.3-6 for additional sedimentation considerations.

The number and type of drywells shall be determined based on the infiltration rate of the surrounding soil. Drywell capacities shall be supported by geotechnical recommendations or in accordance with the testing as specified in 6.2-3, and calculations. The minimum center to center spacing of 30 feet shall be maintained.

See Section 6.3-2 for drywell installation in grass percolation area swales.

Drywells shall be located in such a manner to provide acceptable access and maintenance.

6.3-6 Sedimentation and Detention Structures

To prevent sedimentation of drainage systems, all lines connected to storm sewers or drywells (with the exception of drywells in grass percolation area swales) must be preceded by a trapped structure. Untrapped connections made directly to storm sewer lines and drywells outside of grass percolation area swales will be allowed only on approval of the Engineer.

Settling basins should be employed when rainfall could cause considerable washing of the soil during and following construction due to disturbance or removal of vegetation. All settling basins and stormwater detention structures shall be impervious (lined) with overflow to an approved treatment or dispersion system. For additional guidance on design of sediment and detention basins, refer to the WSDOT Hydraulics Manual.

6.3-7 Storm Sewers

Design of storm sewers for drainage on either public or private property in lieu of grass percolation area swales will be allowed provided storm sewers are approved for design by the Engineer.

Storm sewer design shall be in accordance with the requirements of Section 4.0 for public sanitary sewer design, with the following additions and exceptions:

a) Horizontal Alignment: Storm sewers shall be located six feet to the south or west of the roadway centerline.
b) Minimum pipe cover shall be three feet.
c) Catch Basins: Design water surface for storm sewer catch basins shall be a minimum of six inches below the gutter grade at the inlet.
d) Storm water inlets shall be designed for the condition where the inlet is half-plugged with sediment and debris.
e) The roughness coefficient n = 0.013 shall be used for all storm sewer pipe. The variable - n curve shown in Figure 4-1 shall be used for design.
f) The minimum velocity in storm drainage pipes is 3 feet per second,

g) resulting in the following minimum slopes for a design flow depth of 1.0 times the diameter:

Storm Sewer Pipe Size (Inches)	Min. Slope (v = 3.0 fps) (Feet per 100') n = 0.013
8	0.75
10	0.56
12	0.44
15	0.33
18	0.26
21	0.21
24	0.17
27	0.13
30	0.10
36	0.07

g) Connection Requirements: See Section 6.3-6 and 6.3-8.

In addition to storm water, noncontact cooling water and some unpolluted industrial process wastewaters may be discharged to a storm sewer upon approval of the Engineer or Wastewater Director and the Washington State Department of Ecology. (City Ordinance No. C-30677, SMC Chapter 13.) Discharge of any other wastewater into a storm sewer is not allowed.

6.3-8 Combined Sewers

Combined sanitary and storm sewers are prohibited. No storm sewer or storm drainage structure may be connected to a sanitary sewer without express approval of the Engineer.

6.4 Stormwater Drainage in the Public Right of Way

6.4-1 Hydraulic Design of Roadways, Gutters and Culverts

Roadway cross slopes, gutter profile slopes and hydraulic design of gutters are covered in Section 3 and Section 6.3-1 of these Standards.

Where required by the Engineer, culverts shall be designed to carry runoff flows without excessive backwater, constriction of flow or outlet velocities. Minimum culvert size shall be as follows:

Culvert Location	Min. Size (inches)
Under roadways	18
From grate inlets or catch basins	12
Under driveways	12

6.4-2 Preferred Stormwater Disposal Methods in the Public Right of Way

In considering methods of disposal for surface water in the public right of way, the designer shall select from the following accepted drainage structures (in order of preference):

a) Within the Aquifer Sensitive Area:
   1. Grass Percolation Area Swale with curb inlets. Grass percolation area swales shall be designed as described in Section 6.3-2. Consideration shall be given to the placement of drywells, curb inlets, driveways and berms constructed in the swales to promote ponding. These structures should be located to optimize use of ponding areas in the swales while minimizing curb cuts. Large swales in separate tracts will be favored over smaller swales scattered over individual lots.

2. When the swale is adjacent to a sidewalk, a flat area at least one foot wide should be maintained next to the walk at the same elevation as the edge of walk. When this flat strip is not provided, the maximum slope of the swale bank adjacent to the sidewalk shall be 4:1.
3. Grass Percolation Area Swales Along Roadways: Sidewalks are recommended to be placed on easements to facilitate wider swale widths.

b) Outside the Aquifer Sensitive Area:
   1. Type 2 catch basin connected to a drywell or storm sewer. Type 2 catch basins with inlet details are shown in the Standard Plans. Grade and ride characteristics of the road should be considered in the design of catch basins.
   2. Surface inlet structure (with outlet trap) connected to a drywell or storm sewer. Catch Basin Types 0, and 1 shall be constructed as per the Standard Plans. Type 0 catch basins may be used where depth restrictions will not allow Type I catch basins with a design variance.
   3. Grate inlet (See Standard Plans) connected to trapped structure and draining to a drywell or storm sewer.

Refer to Spokane County Health guidelines for minimum setback requirements for infiltration facilities.

6.4-3 Draining Stormwater from the Public Right of Way to Private Property

Street dedications, sale of property to the City or easements are required for construction of swales on private property for the purpose of draining stormwater from the public right-of-way. Covenants or deeds shall be established to prohibit alteration or filling in of swale areas. Adjacent property owners shall be required to maintain the swale areas within an easement and provide access for City maintenance personnel.

6.5 Stormwater Drainage on Private Property

6.5-1 Grading/Erosion Control Plans

Grading Plans with one-foot contours and/or Erosion and Sediment Control Plans for private developments may be required by the Plan Review Section of Engineering Services for review and approval. Said plans shall include all platted lots and streets or parking lots which are proposed. Refer to Section 7.0 for Erosion and Sediment Control Plan requirements.

6.5-2 On-Site Stormwater Disposal

Storm water generated on private property shall be disposed of on-site using grass percolation area swales (see Section 6.3-2). Areas of roofs draining directly onto a paved area must be included in the impervious area computation. Alternatively, roof drainage may be "tight-lined" directly into a drywell sized to take the runoff, providing there are no mechanical systems on the building's roof. Construction of swales along private roadways should conform to the requirements for swales in the public right of way in Section 6.4-2.

Swales shall be provided on commercial sites to accept runoff from parking and impervious areas whenever 6,000 sf or more of unpaved (pervious) surface is made impervious (through paving, etc.), and considering the methods used in draining roofs of any new buildings. Additionally, swales shall be installed whenever an existing parking area 6,000 sf or larger is regraded. Design of swales for commercial areas shall conform to the requirements of Section 6.3-2.

Designs employing methods of storm water disposal other than swales on private property shall require approval of the Engineer. (Stormwater collection systems with detention or retention facilities, along with irrigation systems, if appropriate may be approved for larger developments.)

6.7 Tables and Figures

Table 6-A Minimum Design Storm Frequencies for Hydraulic Structures

TYPE OF STRUCTURE	MINIMUM DESIGN STORM FREQUENCY (YEARS) (See note 5)	
	PUBLIC RIGHT-OF-WAY	PRIVATE PROJECTS
GUTTERS/DITCHES	5	5
CULVERTS	10	10
STORM WATER INLETS	See Note 6	See note 6
STORM SEWER LATERALS	10	See note 2
STORM SEWER TRUNK	10	See note 2
DRYWELLS	5	See note 2
GPA SWALES	See note 1	See notes 1 and 4
INFILTRATION GALLERIES	See note 2	See note 2
DETENTION BASINS	50	50-100 (notes 3,4)

General Notes

- This table represents the minimum design storm frequency for any facility in the City of Spokane. consideration shall be given to larger storm events based on flood potential and basin characteristics.
- Prior to 1994, all storm sewers were designed to a 5 year design. Connections to existing systems are not allowed.

Specific Notes:

1. Design to hold first 1/2 inch of runoff from impervious surfaces served.
2. Allowed on approval of the Engineer. Coordinate design criteria with Plan Review.
3. Failure calculations should be made based on sound engineering judgment. (A 50 to 100 year storm is recommended for failure calculations, depending on topography.)
4. Design in hillside areas requires coordination with Plan Review.
5. The effects of failure of all structures due to storm events larger than the design storm frequency provided shall be considered. Design shall incorporate measures to prevent damage to surrounding property in the event of failure of the proposed structures.
6. Use the same design storm frequency as used for design of the facility to be served by the inlet structure. Design surface inlets for half-plugged condition.

Table 6-B Runoff Coefficients for Determining Peak Discharge*

TYPE OF COVER	FLAT	ROLLING 2%-10%	HILLY OVER 10%
PAVEMENT AND ROOFS	0.90	0.90	0.90
EARTH SHOULDERS	0.50	0.50	0.50
DRIVES AND WALKS	0.75	0.80	0.85
GRAVEL PAVEMENT	0.50	0.55	0.60
CITY BUSINESS AREAS	0.80	0.85	0.85
SUBURBAN RESIDENTIAL	0.25	0.35	0.40
SINGLE FAMILY RESIDENTIAL		See chart below	
LAWNS, VERY SANDY SOIL	0.05	0.07	0.10
LAWNS, SANDY SOIL	0.10	0.15	0.20
LAWNS, HEAVY SOIL	0.17	0.22	0.35
GRASS SHOULDERS	0.25	0.25	0.25
SIDE SLOPES, EARTH	0.60	0.60	0.60
SIDE SLOPES, TURF	0.30	0.30	0.30
MEDIAN AREAS, TURF	0.25	0.30	0.30
CULTIVATED LAND, CLAY AND LOAM	0.50	0.55	0.60
CULTIVATED LAND, SAND AND GRAVEL	0.25	0.30	0.35
INDUSTRIAL AREAS, LIGHT	0.50	0.70	0.80
INDUSTRIAL AREAS, HEAVY	0.60	0.80	0.90
PARKS AND CEMETERIES	0.10	0.15	0.25
PLAYGROUNDS	0.20	0.25	0.30
WOODLAND AND FORESTS	0.10	0.15	0.20
MEADOWS AND PASTURE LAND	0.25	0.30	0.35

Runoff Coefficients for Determining Peak Discharge*

SINGLE FAMILY RESIDENTIAL	
DWELLING UNITS/GROSS ACRE	"C" VALUE
0.0 - 1.0	0.15
1.0 - 1.5	0.20
1.5 - 3.0	0.25
3.0 - 3.5	0.30
3.5 - 4.0	0.35
4.0 - 6.0	0.40
6.0 - 9.0	0.60
9.0 - 15.0	0.70

* Source: WSDOT Hydraulics Manual and Spokane County Guidelines for Stormwater Management.

Figure 6-1 Rainfall Intensity-Duration Frequency Curves

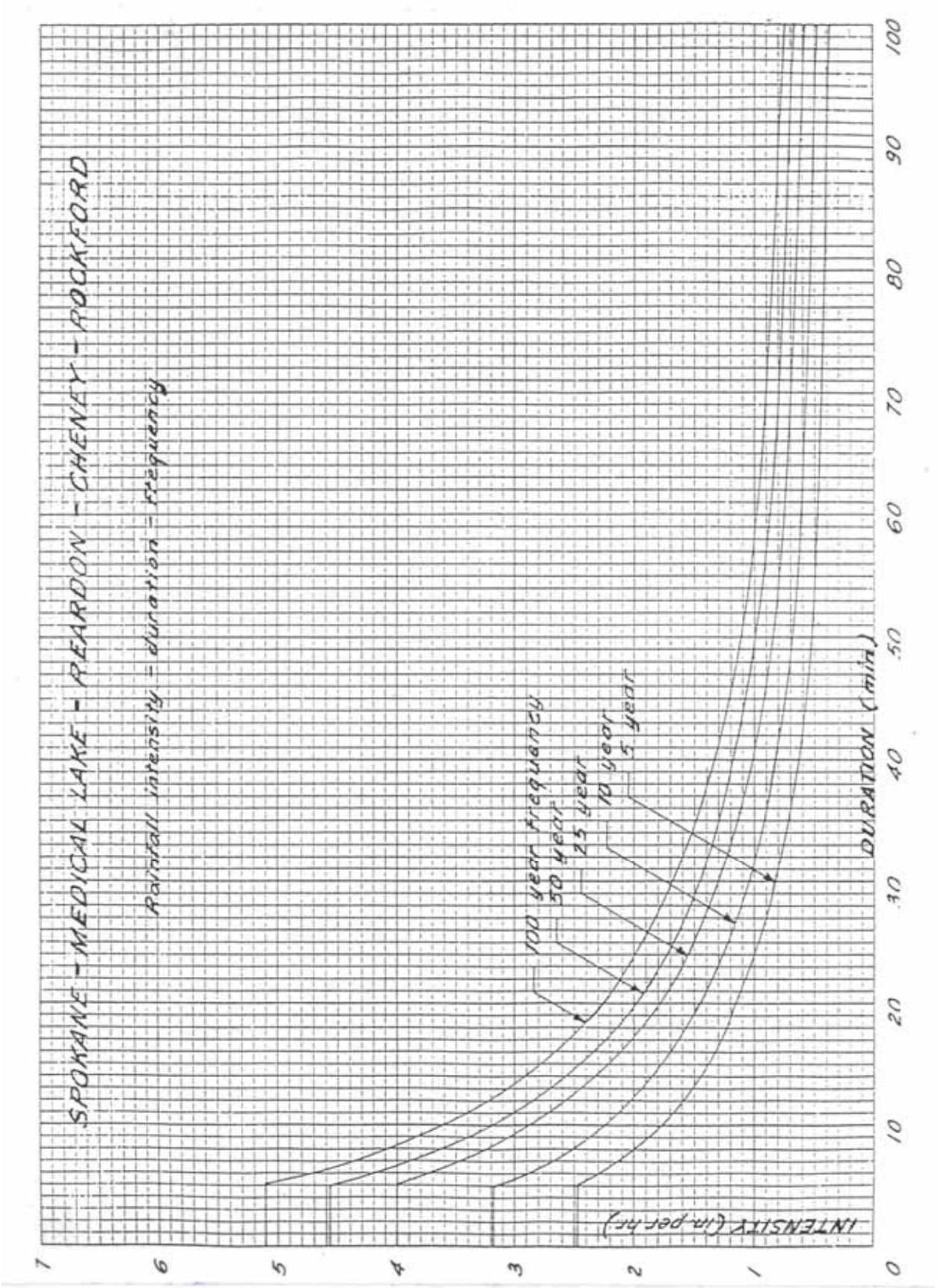
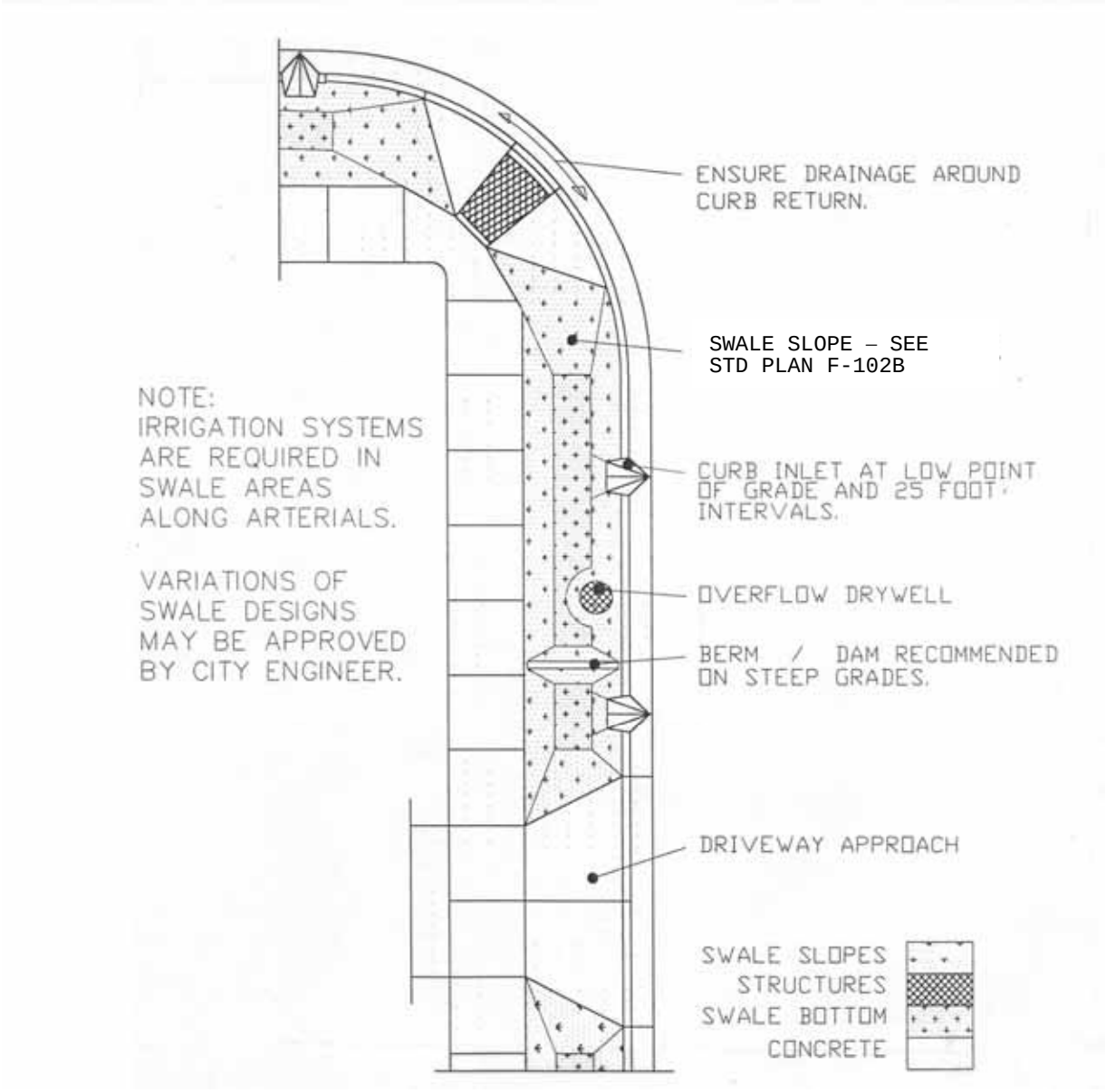


Figure 6-2 Example Swale Configuration in Public Right of Way



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7.0 EROSION AND SEDIMENT CONTROL PLANS <RESERVED>

Contact the Engineering Services Developer Services section for project-specific requirements.

Any grading or erosion control drawings required for submittal shall conform to the requirements of Section 10.0.

8.0 WATER

8.1 Definitions

Air/Vacuum Relief Valve An *air valve* placed at the high points in a pipeline to release air automatically and prevent the pipeline from becoming air-bound with a resultant increase of pressure and also permits inlet of air into an empty pipe to relieve a vacuum.

Backflow A flow condition, induced by a differential in pressure, that causes the flow of water or other liquid into the distribution pipes of a potable water supply from any source or sources other than its intended source.

Check Valve A valve provided with a hinged disk that opens in the direction of normal flow and closes with reversal of flow.

Distribution Main A public water pipe comprising part of the *distribution system* used to deliver potable water, for customer needs which, in many cases, includes irrigation and fire protection, to the customer's individual service line(s); and to deliver water to fire hydrant leads for fire protection.

Distribution System That portion of a public water system which conveys water from the transmission facilities to consumers.

Fire Flow: A water demand calculated by the fire or building official for a specific development to be used in the design of the water system for the project. The system must be designed to deliver this flow, on top of the maximum day demand, without dropping the pressure below 20 PSI, and without exceeding a velocity of 15 feet per second, in any portion of the system, whether new or existing.

Gate Valve A valve in which the closing element consists of a disk which slides over the opening or cross-sectional area through which water passes, and fits tightly against it.

Pressure Reducing Valve (PRV) An automatic control valve designed to reduce a higher inlet pressure to a lower constant outlet pressure regardless of fluctuating flow rates and/or varying inlet pressure.

P.U.D. See Section 1.2

Transmission Main A large diameter public water pipe comprising part of the *distribution system* used to deliver large quantities of potable water over long distances from the source to a reservoir, booster pumping facility, and/or to a networked system of *distribution mains*. Typically, services and fire hydrants are not connected to *transmission mains*.

Water Service Tap & Service Line The *water service tap* is the connection to the *distribution main* of a *service line*. The *service line* is the pipe which extends from the *service tap* into the customer's property used to deliver potable water, for domestic needs as well as, in some cases, irrigation and fire protection.

8.2 Water Demands

8.2-1 Average Day and Maximum Day Demands

The Maximum Day Demands shall be estimated in accordance with the City of Spokane's Comprehensive Water System Plan, 2000 or its most current edition. Calculations shall be based upon the following Spokane area planning factors:

Gallon per Day per Capita (gpcd) Average Day Demand per Captia (ADD)	261
Persons per House	2.5
Houses Per Acre	4
Peaking Factor: Maximum Day Demand MDD/ADD	2.6
Peaking Factor: Peak Hour Demand PHD/MDD	1.7

Use the gross developable acreage when calculating the demands. This demand is used for designing most systems within a well established water grid.

8.2-2 Peak Hour Demands

The Peak Hour Demands shall be estimated as stated above. Use the gross developable acreage when calculating the demands. This demand is used for sizing remote systems, single feed systems, or newly developing areas.

8.2-3 Fire Flow Demands

A minimum fire flow of 1,000 gallons per minute for a two hour duration is required for residential areas with homes containing 3,600 square feet or less floor space (includes the sum of all interior floor levels including overhangs but excluding the garage) and a minimum fire flow of1,500 gallons per minute for a two hour duration is required for residential areas with homes containing over 3,600 square feet floor space. In all cases water facilities shall be provided to supply fire flows commensurate with the fire code.

Where the area served by a reservoir is relatively small and water quality could be affected by large storage volumes, the duration requirement may be reduced, but to not less than 30 minutes, when approved by the Fire Marshall and the Director of the Water Department. In considering such a reduction, factors such as home size, density, topography, landscaping and traffic flow will be evaluated.

Fire flow requirements for commercial and industrial areas are determined on a case-by-case basis.

In sizing piping and other public water system components, the required fire flows are added to Maximum Day Demands for determining total consumptive use.

8.2-4 Hydraulic Modeling

On some projects, the Water Department will require that a hydraulic model be performed to prove that the design meets minimum standards. The determination of whether a project must be modeled is at the sole discretion of the Water Department.

Steady-state hydraulic models are allowed, provided the following conditions are met:

- The system reservoirs shall be modeled at the lowest elevation in their operating range.
- Fire-flow scenarios shall be evaluated under max-day demand conditions.
- The existing water system must be included in the model back to the reservoir, or to a main determined by the Water Department to be large enough that the project's demands would be hydraulically insignificant.

- Demands shall be calculated only in accordance with the method contained in the City of Spokane Water Department's Comprehensive Plan. This calculation shall be included in the model submission.

- The datum used for elevations within the model shall be clearly referenced.

- The model submission shall include a map with pipe and node numbers legibly marked, and reservoirs identified as actual or representative of a tie-in to the existing water system. The map shall also include references to existing streets and features to help orient the map properly.

8.3 Water Pressure

Water pressures during maximum day demand conditions, with reservoirs at average water level, should be designed between 45 and 100 psi at every point in the system with few exceptions. Noted exceptions, upon approval of the Water Department Director, are near the intake of booster stations where pressures may be lower and in rough topography where pressures may be allowed to exceed the 100 psi limit.

Residual water pressures during fire flow demand conditions shall be designed to be no less than 20 psi at every point in the system.

Pressures Over 80 psi: If static pressures exceed 80 psi then each service line shall be required to have an individual pressure reducing valve set to reduce pressures to a maximum of 80 psi. Refer to regulations pertaining to water service taps and meters.

Where the water system is expanded in such a way as to be delivering water in excess of 80 psi of static pressure, a PRV station shall be installed on the distribution line at the location necessary to reduce delivered pressures to below 80 psi.

Areas Served by Pressure Reducing Valves: Some areas may be supplied through pressure reducing valves in the main supply system. In areas where this is allowed, no matter what the local service pressure is, an individual pressure reducing valve is also required for each service connection. Refer to City regulations pertaining to water service taps and meters, available at the Permits counter in Engineering Services.

8.4 Size of Pipe

8.4-1 Standard Sizes

Only City of Spokane standard sizes of pipes shall be allowed. Standard sizes are 6", 8", 10", 12", 18" and increments of every 6" above 18".

Exceptions to the above sizes are as follows:

a) In cases of a bridge crossing (existing bridge) or other conditions where a standard size would be infeasible or would limit the capacity below that needed, special consideration may be given to using non-standard sizes.
b) On permanent cul-de-sacs where fire service can be provided from a hydrant at the entrance to the cul-de-sac a 4" water service line may be allowed. No hydrants shall be allowed to be fed from or through 4" water lines. Guidelines for the distance from any occupiable building to the hydrant must be strictly complied with.

Service line sizes shall be coordinated with the Water Department.

8.4-2 Sizing Based on Velocity

The following criteria shall be used to determine the sizes of the pipes to be used:

a) At maximum day demand, 5 fps maximum design velocity.
b) At fire flow demand, 15 fps maximum at required fire flow.
c) See design parameters above.

8.5 Type of Pipe

Only ductile iron pipe meeting the requirements of Section 9-30.1(1) of the Specifications shall be used for water mains. On bridge crossings or in other locations where pipes are not directly buried in earth fill, restraint shall be provided by the use of TR Flex restrained joint pipe and fittings, or approved equal. On bridge crossings or in other locations where structural constraints exclude the use of bell and spigot pipe, welded steel pipe may be considered.

Service lines smaller than 2" are to be type "K" copper; 2" services are to be high density polyethylene (HDPE) or type "K" copper; and services larger than 2" are to be ductile iron.

8.6 Location For Fittings, Valves, Air Valves, Blow-Off Valves

8.6-1 Distribution Mains

Fittings: Bends are required where a change of direction of the water main occurs which cannot be accommodated by pipe joint deflection as provided in Section 8.11 below. Tees and crosses are required where lateral mains are needed as part of the project and where future needs dictate. Tees are required where fire hydrant leads are needed as part of the project and where future fire hydrant needs dictate. Reducers are needed where a change of pipe size is required. All fittings shall be mechanical joint type unless otherwise specified.

Valves: In-line valves are needed at street intersections so as to allow the distribution system to be isolated and shutdown, block by block, for repairs to the piping and fittings. Generally, the valves are to be installed in line with the intersection right-of-way lines in order to keep the valves out of the intersection itself - the desire here is for the safety of the valve operating personnel in that the intersection itself presents traffic from multiple directions. In-line valves on the distribution main are needed between fire hydrants. Valves are needed on all fire hydrant leads, and shall be located approximately 2 feet from the main between the main and the fire hydrant. All valves shall be mechanical joint type unless otherwise specified.

Air/Vacuum Relief Valves: Air/vacuum relief valves are not typically needed on distribution mains.

Blow-Off Valves: Blow-off valves are not typically needed on distribution mains.

8.6-2 Transmission Mains

Fittings: Bends are required where a change of direction of the water main occurs which cannot be accommodated by pipe joint deflection as provided in Section 8.11 below. Tees and crosses are required where lateral mains are needed as part of the project and where future needs dictate. Reducers are needed where a change of pipe size is required. All fittings shall be mechanical joint type unless otherwise specified.

Valves: In-line valves are needed at intersecting points with other mains and, if possible, at street intersections. Otherwise, in-line valve spacing should generally be 1,500 feet, unless otherwise specified, in order to limit the extent of main shut-down for repair and maintenance. Generally, the valves are to be installed in line with the intersection right-of-way lines in order to keep the valves out of the intersection itself - the desire here is for the safety of the valve operating personnel in that the intersection itself presents traffic from multiple directions. All valves shall be mechanical joint type unless otherwise specified. Operating nuts shall be oriented to the north or east side of

the water main.

Air/Vacuum Relief Valves: Air/vacuum relief valves are needed on transmission mains at high points to allow release of air during filling the pipe with water as well as to allow accumulated air to be expelled under normal operation. Further, air valves are needed to prevent a vacuum from occurring and to allow air into the main when draining the pipe. At least one air valve is required between in-line valves. The high point on the main often occurs on the downhill side of an in-line valve. Typically 2" air valves suffice.

Blow-Off Valves: Blow-off valves are needed on transmission mains at low points to allow the pipe to be drained. At least one blow-off valve is required between in-line valves. The low point on the main often occurs on the uphill side of an in-line valve. Typically 4" blow-off valves suffice. Drained water is generally discharged into a drywell.

8.6-3 Pipe Thrust Restraint Design

The City of Spokane does not allow the use of thrust blocks on water mains as a means of resisting thrust.

The City has developed a Restrained Joint Table (Table 8-A) as a generically approved design standard for restraining pipe sizes 4", 6", 8" and 12". The table is for ductile iron pipe not incorporating polyethylene encasement. The table was established from field experience by City Water Department construction and maintenance personnel and represents conservative results.

Alternatively, the designer is allowed the option of designing the required pipe thrust restrained lengths for the specific project under design. In this case, the criteria and basis of design shall be as published by the Ductile Iron Pipe Research Association (DIPRA) entitled Thrust Restraint Design For Ductile Iron Pipe, current edition.

The parameters to be used shall be as follows:

- Valves, tees (branch direction only), and 90^{o} bends shall be designed as "dead ends".
- When designing a deflection utilizing multiple bends, determine the total angle of deflection and increase the angle design to that of the next standard bend for determining the angle to be restrained.
- Design test pressures shall be 175 psi or 1.5 times working pressure - whichever is greater.
- Factor of safety shall be as follows:
  - 12" and smaller water mains - 2.5
  - 18" water mains - 2.0
  - 24" and larger water mains - 1.5

When DIPRA is used for restraint design, so note this fact on the plans listing: A pipe thrust restraint table along with design pressure, factor of safety, soil type, trench type, and any other assumptions or factors utilized.

In addition to DIPRA, a computer software program for pipe thrust restraint design has been developed by EBAA Iron Sales, Inc. entitled Restrained Length Calculator, current version. The program has been examined and utilized by City Engineering staff. The program is based on the same engineering principles, criteria, and analytical approach as the DIPRA design requirements. Thus, the use of the program by EBAA is hereby approved. The parameters to be used shall be the same as those listed above for DIPRA.

When the EBAA program is used for restraint design, so note this fact on the plans listing: A pipe thrust restraint table along with design pressure, factor of safety, soil type, trench type, and any other assumptions or factors utilized.

8.7 Depth of Pipes

Water mains shall be installed with a depth to invert of 5 1/2 feet. The following exceptions may apply:

a) 7 feet to the invert is maximum and will be allowed only in special cases.
b) 4 1/2 feet to the invert for short distances will be permitted on a case by case basis to allow for adjustment to other previously existing utilities. This is not allowed for lines with little or no flow (i.e. fire hydrant lines, building fire lines, lines feeding irrigation systems).
c) Consideration shall be given to the vertical alignment of future or proposed roadways whenever known.

8.8 Location of Fire Hydrants

Within the City limits, fire hydrant locations will be reviewed by the City Fire Department. Hydrants inside the City limits should ordinarily be located within 250 unobstructed feet along a path of travel to the property line. Hydrants located on the opposite side of four-laned, or larger, arterials shall not be considered in calculating service to a property. Consideration shall be given to placing hydrants at intersections or other access points that allow service in multiple directions. Based on these considerations the maximum distance may be extended to 300 feet.

Locations of hydrants outside the City limits shall be reviewed by the presiding Fire Department or District. Not all Fire Districts follow the same guidelines and each of them may interpret fire codes differently. (Most outside fire districts require hydrants to be within 300 feet of occupiable buildings.) All plans must be reviewed and signed by the fire districts prior to approval, however, the more stringent of the guidelines shall prevail.

All supply valves serving hydrants must meet the City of Spokane standards as provided in the Specifications.

Hydrants shall be located at the ER's (end of radius) at intersections, 2 feet inside of the right-of-way line. The hydrant flange shall be installed 3 inches above the top of curb elevation. Where curbs and sidewalks do not exist, hydrants shall be installed at the intersection of right-of-way lines with the hydrant flange 3 inches above finish grade elevation.

Hydrants shall not be located within 5 feet of wheelchair drops or within 3 feet of driveway drops.

Hydrants shall be installed in locations that provide clear and unobstructed access for operations and maintenance.

8.9 Distance From Other Utilities

Water line locations and distances from other utilities shall be shown in Standard Plans W-110, W-111 and W-112. No new utility pole shall be located within 8 feet of an existing hydrant or water line.

8.10 Pressure Systems

A pressure system consists of its own pumps, reservoirs and distribution mains. In some limited instances, a system consists of pressure reducing valves to maintain water pressure.

As development continues and the water system is expanded, areas will be encountered which are at elevations that will require the establishment of additional pressure zones in order provide water service within appropriate water pressures. Generally this will require the construction of additional booster pumping stations and reservoirs. In some cases the use of pressure reducing valves will be the means of establishing the pressure zone. However, when considering the use of pressure reducing valves, an examination of the potential and feasibility of extending service from an

established pressure zone which will provide the area within appropriate water pressures and which is supported by reservoir(s) storage will be required. If such an established pressure zone can be extended and utilized, preference in this regard will be generally the required approach. The creation of a new pressure zone will be allowed only on approval of the Director of the Water Department.

8.11 Laying Pipe on a Radius

Pipe may be laid on a radius provided the radius is a minimum of 1.33 times the minimum radius allowed by the manufacturer (75% of the manufacturer's allowable joint deflection). If pipe cannot be laid on a radius then it shall be laid on tangent sections with appropriate bends placed at approximately equal intervals around the curve.

For additional information, refer to Section 9-30 of the Specifications and the City of Spokane GSPs.

8.12 Easements

No easement shall be allowed unless approved in advance by the Director of the Water Department. If an easement is to be used it must provide all weather access for two wheel drive service vehicles. In addition, sleeving may be required as directed by the Director of the Water Department.

8.13 Special Regulations for P.U.D.'s

"Wheeling" water through a P.U.D. or any other private water system shall not be permitted. Water from the City's distribution system entering a P.U.D., must not be allowed to return to the public system. A meter and a double check valve assembly must be provided at each connection to the City Water System to prevent water from re-entering the City water system from the P.U.D.

All meter vaults shall be constructed immediately behind the property line of the P.U.D. and all pressure reducing valves and double check valve assemblies shall be placed downstream of the meter. The City's water system and responsibility for maintenance terminates at the meter.

Connections to P.U.Ds are similar to service connections and are subject to City tap and meter regulations. Current regulations are available from the permits counter in the Engineering Services Department.

8.14 Booster Stations

General:
General construction of pump station buildings and appurtenances is required to conform to International Building Code, Uniform Plumbing Code and National Electrical Code. Further, during design and procurement of components that go into the system, many national standards are specified for minimum conformance.

They are as follows:

ANSI -	American National Standards Institute
ASTM -	American Society for Testing and Materials
AWWA -	American Water Works Association
CFR -	Code of Federal Regulations
FSS -	Federal Specifications and Standards, General Services Administration
HIPS -	Hydraulic Institute Pump Standards
IEEE -	Institute of Electrical and Electronics Engineers
NEC	National Electrical Code

NEMA - National Electrical Manufacturers' Association
NEPA - National Environmental Policy Act
NFPA - National Fire Protection association
OSHA - Occupational Safety and Health Administration
RCW - Revised Code of Washington (Laws of the State)
SEPA - State Environmental Policy Act
SSPC - Steel structures Painting Council
UL - Underwriter Laboratory listing
WAC - Washington Administrative Code
WISHA - Washington Industrial Safety and Health Administration

Pump Station:

Booster pump stations shall be incorporated whenever a development needs higher pressure than is available from the existing source. The pump stations shall be above ground, cement block construction, with good insulation and sound barrier unless otherwise approved by the Director of the Water Department. Underground booster stations are not allowed. The roofing shall be long lasting (50- year life), low maintenance type with good insulation for energy conservation.

The pump station shall be designed and located such that it pumps from a storage source on the suction side to a storage facility on the discharge side. There shall be suction and discharge headers with easy accessibility. On the discharge side, there shall be a sufficient straight run of transmission pipe in order to incorporate a flow meter. For maintenance, the flow meter shall be installed inside a vault.

The pump station shall be built to minimize vandalism and break-in. The station shall be equipped with intrusion alarms wired to communicate to the water system operators through the SCADA system.

The pump station shall have provisions to install antennas (provided by City) for radio communication connected to SCADA system.

Pump station site shall be landscaped and irrigated with timed automatic sprinklers. Preference shall be given to shrub patches rather than grass to provide screening and decrease maintenance.

Telephone service to the station is required in order to operate the station with the City's SCADA system.

Ventilation and/or a cooling system is required in or to protect pump motors from high temperatures.

A heating system is required for heating during cold weather.

A flow meter is required on either the suction line or discharge line.

The station shall be designed so as to ease removal of existing pumps and motors for maintenance as well as to allow installation of future pumps and motors. Easy access to the station must be provided for maintenance as well as for daily status inspection.

Pumps and Motors:

The pump stations shall have at least TWO pumps to provide redundancy. The number of pumps required will generally be dictated by the capacity size of the station keeping with prudent modern design for efficiency and flexibility of operation to meet varying demands considering summer to winter average daily demand varies over a factor of two. The station shall be so designed that

required maximum day demand can be met with the largest pump out of service. As the electrical tariff uses a demand factor, it is important to size the pumps so that pump run times are maximized, rather than larger size pumps running for repeated short periods.

The pumps selected shall conform to hydraulic standards and the manufacturer shall conform to applicable NEMA and ANSI standards. Pump types in the order of preference are as follows: horizontal split case, end suction, and vertical.

Pump performance curve shall have smooth drooping characteristic from the cut-off head to the lowest operating head. The pumps chosen shall operate with high efficiency (75% or more) in the operating range.

Pump motor shall always be directly coupled and sized to meet the power required by the pump through the designed range of total pumping heads and pumping volumes. Motors shall have copper windings and operate at efficiency of 92% or above in the operating range. Motors 10 hp or above shall be three phase squirrel cage induction motors.

Pumps shall not be set directly on the floor. Rather, pumps shall be mounted on concrete pedestals to a height for ease of maintenance.

Pump selection shall meet the following criteria:

- The pump performance curve shall support proper pump performance through the designed range of total pumping heads and pumping volumes while operating within the most efficient portion of the pump curve. The proper operation includes performing without cavitation and within suction heads designed for the pump. The performance curve shall always be positive from shutoff head throughout the range of the curve. No pump shall be selected which has the potential of reaching shutoff head through possible adverse system pressure ranges.
- Pump motor shall be sized so as not to exceed maximum rated horsepower through the designed range of the pump.
- Wire-to-water pump/motor efficiency through the designed range of the pump shall be an important consideration when selecting such equipment.
- Pumps with discharge pressures exceeding 100 psi shall be furnished with mechanical seals.
- Generally greased lubricated bearings are preferred.

Each pump shall be equipped with isolation valves in the suction and discharge lines and a check valve in the discharge line.

Electrical:

Electrical service from the utility shall be 3 – phase, 480 volt or lower. If a transformer is provided, the primary shall be connected delta and the distribution side wye with neutral grounded. A separate 240 / 120 volt station service shall be provided by the electric utility or derived from a station service transformer.

All station electrical shall conform to the latest National Electrical Code. All electrical components and wirings shall be UL listed as applicable, and be industrial grade.

Protection systems are required on electrical equipment to protect against phase-to-phase and phase-to-ground faults as well as to protect against single phasing. The booster station shall have a well designed grounding system to which all the equipment grounds need to be connected.

The short circuit ratings of electrical switchgear shall be the calculated available or the industry standard, whichever is higher.

Stations shall have receptacles conveniently placed to ease maintenance equipments to be plugged in without extension cords. All the receptacles shall be GFI or distributed from a GFI circuit breaker installed in the station service panel. One of the duplex receptacles shall be an isolated ground type installed near the enclosure containing the SCADA Remote Terminal Unit (RTU).

The stations shall have good interior lighting and dusk to dawn motion sensor, tamper proof exterior lighting.

All the controllers and the associated protection equipment shall be centrally located in a free standing motor control center (MCC) with copper incoming bus sized adequately in order to allow future expansion. NEMA 12 enclosures are preferred. The control shall be soft-start/soft-stop with pump control and running bypass circuitry.

Each motor drive shall have a motor circuit protector. Further, each motor shall have an integrated protection module to detect and isolate the motor for overload, phase loss, phase reversal and ground faults, as a minimum. There shall be push button switches to turn the pump on and off locally and a selector switch (Local – Off – Remote) to switch from local to remote control. Also, there shall be LED indicator lights – red to indicate running, green as stand-by.

The MCC shall have indicator instrumentation for station voltage, current, power factor, and kW / kWh. Additionally, each of those meters shall incorporate an output signal 4 – 20 mA and / or pulse in order to communicate over the RTU. An integrated instrumentation module with RS 232 / RS 485 output connector (MODBUS PROTOCOL) shall be incorporated.

Provision shall be made to install City supplied RTU by mounting a Hoffman Enclosure (A162006LP for storage facilities and A 242408LP for pump station) on the wall near the MCC and the isolated ground receptacle.

8.15 Reservoirs

Reservoirs shall be above ground, steel, and of “standpipe” design or either “hydropillar” or “spheroid” in design unless otherwise approved by the Director of the Water Department.

All reservoirs constructed and added to the City’s water system shall incorporate an internal passive water mixing system. Water mixing systems shall have no external piping and no mechanical or motorized elements. Water mixing systems shall be the *Tideflex Mixing System* manufactured by The Red Valve Company of Carnegie, Pennsylvania, or approved equal.

8.16 Tables and Figures

Table 8-A Pipe Restraint Table

FITTING TYPE / SIZE	PIPE SIZE			
	12" & 10"	8"	6"	4"
	Number of 18' Pipe Lengths Required with Restrained Joints in Each Direction:			
90^{o} bends, tee branches, valves and dead-ends	6	5	4	3
$11\text{-}1/4^{o}$ bends	2	2	1	1
$22\text{-}1/2^{o}$ bends	3	3	2	2
45^{o} bends	5	4	3	3

NOTE: For static system pressures greater than 85 psi, adjust as follows:

- For 12" & 10" pipe, add one full 18' pipe length per each 10 psi in excess of 85 psi.
- For 8" pipe, add one full 18' pipe length per each 15 psi in excess of 85 psi.
- For 4" and 6" pipe, add one full 18' pipe length per each 20 psi in excess of 85 psi.

8.17 References

American Water Works Association. AWWA Standards.

City of Spokane Department of Water and Hydroelectric Services. City of Spokane Water Department Rules and Regulations. (Handout.)

2000 Comprehensive Water System Plan, City of Spokane, Water & Hydroelectric Services.

Culp, Wesner, Culp, 1986. Handbook of Public Water Systems. New York: Van Nostrand Reinhold Company.

Great Lakes - Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers. 2003 Edition. Recommended Standards for Water Works. Health Educations Services; Albany, New York.

Washington State Department of Health, Division of Environmental Health, Office of Drinking Water. Water System Design Manual. August 2001.

9.0 TRAFFIC CONTROL DEVICES <RESERVED>

Contact the Street Department for project-specific requirements.

10.0 DRAFTING/CADD STANDARDS

10.1 General

All drawings submitted to Engineering Services shall be completed with the current version of the City of Spokane Drafting Standards.

Original construction drawing sheets shall be good quality reproducible. Final record drawings shall be archive quality reproducible, ink on 4 mil mylar (polyester film); or a photo mylar. An electronic format drawing is expected, as well, in *.dxf or *.dwg extension, or as necessary for the City's standards. The City currently uses AutoCAD, and will accept the latest versions.

Cover sheet and lead sheets, plan sheets, plan-profile sheets, and detail sheets shall be 24" x 36". Margins shall be 1" on the right, .7" on the top and bottom, and 2" on the left. The utilized area becomes 22.6" x 33.9".

For assignment of flat sheet limits, and the flat sheet naming convention, refer to Appendix B. Sample plans are provided in Appendix D.

PRIVATE COMPANY LOGOS: Logos and graphics that identify the consulting agencies or design companies are limited to not more than one-half the size of the Official City Logo on any page, but never more than four square inches, exclusive of normal typed address and phone identification text. They are to be removed from the final record drawing. They will remain on record with the redlined copy submitted as the field record drawing upon completion of the project.

10.1-1 Flat Sheet Segment Identity

For each flat sheet segment one of each of the following flat sheets are typically created and the identifier is placed in the upper right portion of the title block to identify the improvement:

"STREET",
"ALLEY",
"WATER",
"SANITARY",
"STORM"
"RIGHT OF WAY"
"EASEMENT"
“TRAIL”
"TRAFFIC"

"DETAIL" and **"IRRIGATION"** labels may also be used as appropriate.

In some cases a sanitary and storm sewer may need to be shown on the same segment sheet, the sheet should then be labeled **"SAN/STO"**.

Streets and alleys may share a flatsheet labeled **"STR/ALY"**, with the alley plan and profile shown on the drawing for the street parallel on the north or west.

10.1-2 Multiple Utility Lines in a Single Segment

Occasionally, more than one flat sheet may be needed for a utility within a given segment. For example, if there are three separate sanitary sewer lines in a roadway segment and not enough room on the profile portion of a single flat sheet to clearly show the three profiles, up to three separate sheets may be generated. In this case, if the sheets are drawn using CADD, all three sheets for that single segment should be combined into one CADD drawing. A **bold** note shall be placed on each sheet referencing the other sewer sheets. The note should be placed in the lower right hand corner of the plan as near to the plan number block as possible.

Whenever a flat sheet shows more than one utility line in the plan view, any utility line not shown in the profile shall be represented in the plan view with a thinner and, for CADD drawings, lighter-shaded line. The line type used should indicate whether the feature is "proposed" (solid line) or "existing" (broken line).

10.1-3 Title Blocks

Refer to the Sample Drawings in Appendix D for title block configuration. Title blocks on each sheet shall include:

a) **SEGMENT LIMITS**, street name and limits for the flat sheet of approximate 1/4 mile length (see Appendix B for assignment of flat sheet limits).
b) **PROJECT LIMITS** which define a current project, are moved to the RECORD DRAWING block when creating the record drawing sheet;
c) **CITY PLAN NUMBER** identifies the flatsheet segment (see Appendix B for flat sheet numbering conventions);
d) **CITY PROJECT NUMBER** is assigned by Engineering Services Administration. It identifies current PROJECT LIMITS and is moved to the ASBUILT box when the project is completed;
e) **TYPE OF IMPROVEMENT**; one of the following labels or identifiers: STREET, ALLEY, WATER, SANITARY, STORM, IRRIGATION, DETAIL, or if combined SAN/STO, or STR/ALY.
f) **EFN** (Electronic File Name) the CADD file name, during construction is placed below the project number. When creating the record drawing the name is placed in the RECORD DRAWING block.
g) **CURRENT DESIGN STANDARDS** record the City of Spokane Design Standards in use at the time.
h) **DATUM** information is available from Engineering Services Field Office or Design office. As of January 1, 2000, all projects shall be designed to NAVD 88 (North American Vertical Datum) datum. The conversion of datum are as follows:
    - NGVD 29 Elevation + 16.93 ft = City Datum Elevation
    - NGVD 29 Elevation + 3.80 ft = NAVD 88 elevation
    - NAVD 88 Elevation + 13.13 ft = City Datum Elevation
i) **COORIDNATE SYSTEM** used for surveys shall be Washington State Plane , North Zone, Lambert conformal conic projection as described in RCW 58.20 and WAC 332.130
j) **SCALE**; Horizontal and Vertical, and a bar scale to verify the scale if the sheet is reproduced at a scale other than the original;
k) **ONE CALL** utility locating service number shown as "CALL BEFORE YOU DIG 456-8000";
l) **GRADE ESTABLISHMENTS LIST;** (Information available in the Engineering Design Support Services Grade Establishment Database references the City Clerk's ordinances.)
m) **REVISION BLOCK;** used to note changes during construction, but critical notes may be retained when creating record drawings;

n) **RECORD DRAWING** information block, project name and numbers, Council acceptance date, limits, and EFN are placed for a permanent record.
o) **ENGINEERING STAMP** and signature of a Professional Engineer registered as such in the State of Washington, shall be shown on the Construction drawings for the current project. On the record drawings, the stamp and signature shall be removed, and the engineer's name, license number, project number and date of original signature shall be recorded in an "Engineer's Record Block".

10.2 Standard Symbols and Line Types

The current version of City of Spokane Drafting Standards layers, symbols and line types shall be used for all drawings.

Appendix C contains additional information on the City of Spokane Drafting Standards symbol standards and menus.

The complete City of Spokane Drafting Standards may be obtained by contacting Engineering Services at 625-6700. There may be a nominal fee for reproduction costs. Refer also to the department website at www.spokaneengineering.org.

In the case where an unconventional item must be drawn for which no standard exists, the designer may adopt a special symbol and/or layer name for the item, referenced with an appropriate legend note, on the "README" layer.

10.3 Construction Drawings

10.3-1 Cover Sheet

Plans consisting of three or more total plan or detail sheets must have a plan cover sheet, or cover sheet and index sheets. Larger plan sets may require an index sheet. The index sheet would provide for overflow from the cover sheet. An example cover sheet is provided in Appendix D. The cover sheet shall be Sheet 1 of the plans, and shall contain the following information:

a) **PROJECT TITLE** shall be in large, bold text, located on the lower center of the cover sheet. Typical project titles shall describe the district title, area, or primary street name and the street termini. If the greater project title describes an area, or project type, the streets are then listed separately in an index.
b) **CITY PROJECT NUMBER** is an official Engineering Services five or seven digit project number assigned by the Engineering Services Administration Section. This number shall always be boldly located in the lower right corner of the Cover Sheet, page 1.
c) **PROJECT DESCRIPTION** identifies the types of works the project includes such as Street paving with sidewalk, curb, Traffic control, Sewer construction, Storm Drainage construction, Lift Station, Reservoir, etc. The description should be located directly above the City Project Number in the lower right corner of cover sheet page 1.
d) **ELECTED AND APPOINTED CITY OFFICIALS** are listed on the upper right-hand portion of the cover sheet near the official City logo. The Mayor is first titled and named; Spokane City Council Members are then listed as on the Official Gazette of the City of Spokane.
    Appointed officials include:
    - "Deputy Mayor"
    - "Director – Public Works"
    - The "Principal Engineer", "Design Engineer", and/or "Director - (department)" may also be shown. Other officials may also require identification.
e) **SITE PLAN / DISTRICT PLAN**; an overall site or district plan drawn to an appropriate scale, showing the entire project and its connection to the existing street network is

typically shown on the central portion of the cover sheet. The site plan scale is set as convenient.

f) **VICINITY AND LOCATION MAPS**; include a vicinity map of the City oriented in the same direction as the site plan, outlining the project site in the left portion of the cover sheet. Scale for vicinity maps may vary according to convenience.

g) **A LOCATION MAP** of the State of Washington, placed in the upper left corner with the City of Spokane identified.

h) **NOTES**; standard notes which are applicable to the project;

i) **INDEX**; The plan set index is shown in the approximate center of the cover sheet, plan/profile site sheets should be referenced to the overall site or district map. The index is usually the first item to be moved to page 2, index sheet.

j) **LEGEND**; The legend may describe directions, and/or symbols not found in the Drafting Standards.

k) **FEDERAL AND STATE REQUIREMENTS**; Capital funded projects usually require particular information which must be obtained from Engineering Services. This information may identify the project with alpha/numeric data, and include a logo that identifies the funding department or governing agency. This logo shall not be smaller than a private logo, and remains on the drawing at record drawings.

l) A note/block will be placed in the lower right hand corner of all plans. The note/block will state, “CONSTRUCTION DRAWINGS, NOT AS-BUILT”.

10.3-2 Plans, Profiles and Details - All Projects

Plan Elements. All projects shall include the following on the plan portion of the drawing sheets:

a) **SCALES**; horizontal scale shall be 1"=50'.

b) **NORTH ARROW**. The north arrow shall be located in the lower right corner of the plan.

c) **DRAWING ORIENTATION**. North should be oriented generally to the top or to the right of the drawing. The plan shall be shown on the lower portion of the sheet with the profile concatenated in the upper portion of the sheet. The drawing shall be oriented according to the current Engineering Services flat sheet layout convention. (See Appendix B for assignment of flat sheet segment limits).

d) **STATIONING**. Stationing shall be 100-foot stationing along the centerline unless otherwise provided for, beginning at the southern or western section line and increasing to the north or east and reading from left to right. At the point a project crosses a section line, stationing shall begin anew with 0+00. Stations for points of curve, tangent and intersection shall be given. Stations shall be tied to monuments or survey control points.

e) **RIGHT-OF-WAY** information. Right-of-way lines, property lines, and easements shall be shown with appropriate dimensions. Subdivisions, blocks, and lots shall be labeled and numbered for the entire segment.

f) **EXISTING TOPOGRAPHIC** features and finished grade. Topographic features shall be shown in areas within the right-of-way limits, future right-of-way limits, and beyond (as deemed necessary by the Engineer) to resolve questions of setback, slope, drainage, access onto abutting property, and street continuations. Generally topography is required for the site and at least 50 feet beyond the site boundaries.

g) **EXISTING STRUCTURES**; Footprints of existing structures within 100 feet of project boundaries.

h) **EXISTING UTILITIES**; all existing utilities and surface improvements (shown with current Drafting Standards).

Service Laterals: On projects where subsurface utility work is performed, the plans will need to show:

1) All side sewers that may be in conflict and are between the surface and two feet below the invert of the proposed pipe. A general note will be placed on the plans noting that the location of the side sewer is not exact but is provided

to indicate the expected number of side sewers that may be encountered.

2) A standard general detail for water services. The detail will show the general location of the water services for a typical lot. A note will be placed below the detail that states, “The detail shown is for general purposes only, the exact locations of the water services for each lot will be marked in the field”.
3) Any private utilities that are known by the project owner to be located within the proposed area of excavation will also be shown. A note will be placed stating, “ The private utility locations shown were provided by the utility”.

i) **PROPOSED UTILITIES**; any proposed utilities and/or surface improvements that are intended for construction (shown with current Drafting Standards).
j) **INTERSECTING STREETS**. Intersecting streets with names and dimensions shall be shown along with their accompanying topography, utilities and other improvements for at least 150 feet.
k) **PROJECT LIMITS**. The construction area for street construction should be shaded at 10% to 20% on the plans.
l) **MONUMENTS AND CONTROL POINTS**. Existing and proposed improvements shall be tied to these points. Some common ties are City benchmarks, city reference monuments, property pipes, section corners, curve points (VPI’s, PIs, PCs, PTs), GPS references. Dimensions shall be placed to ROW lines and curb lines from center line and, or monument lines. See: 10.3-2 e).
m) A note/block will be placed in the lower right hand corner of all plans. The note/block will state, “CONSTRUCTION DRAWINGS, NOT AS-BUILT”.

Profile Elements. All projects shall include the following on the profile portion of the drawing sheets:

a) **THE PROFILE** shall occupy the upper 10" x 33" of the drawing sheet. The profile grid shall consist of horizontal lines forming a one by one grid with a horizontal scale of 1" = 50', and a vertical scale of 1" = 10'. Major grid line 1" squares shall be no more than a 0.35mm solid line. Minor grid lines 0.1" squares shall be a line at least 0.10mm finer than the major grid line, solid, shaded, or a 10x dot grid.
b) **EXISTING GROUND LINE** or **FINISHED STREET GRADE** .
c) **PROPOSED STREET GRADE** to four decimal places (if applicable). Street grade breaks shall be indicated on all water and sewer profile drawings using a small open circle to mark the location of a grade change. **Note that the street grade must be established prior to design of water or sewer mains.**
d) **STATIONING** on the profile shall be coordinated with the plan view.

Detail Sheets. Details for all projects with multiple page plan sets should be consolidated and placed on sheets at the end of the plan set. Plan/profile sheets and detail sheets shall be cross referenced with the sheet and detail numbers of appropriate details.

10.3-3 Street Drawings

In addition to the items listed in Sections 10.3-1 and 10.3-2, plan/profile sheets for street projects shall contain the following information:

a) **TANGENT GRADES** for both curb lines shall be carried to four decimal places. Centerline, traffic islands, walls, and other structures related to construction may also be represented here.
b) **VERTICAL CURVE DATA** including curve length shall be delineated on the profile with a horizontal line with arrows terminating at a vertical dimension line at each end. The Vertical Point of Intersection (VPI), and K-factor shall be called out on the profile with

station and elevation.

c) **HORIZONTAL CURVE DATA** for centerline including radius, delta, arc length, and tangent shall be shown on the plan for all horizontal curves. Stations of the PC, PI, and PT shall be called out on the plan.

d) **CURBLINE CURVE DATA**, for radius, tangents, and elevations; or for multi-centered returns, complete curve data including radius, delta, curve length, PC to PI and PI to PT shall be shown on the plan.

10.3-4 Sanitary/Storm Sewer and Water Drawings

Sanitary sewer, storm sewer and water drawings shall show the following in addition to the information listed in 10.3-1 and 10.3-2, specific NAVD88 elevations shall be used (not project specific datum , nor "±" distances):

a) **HORIZONTAL PIPE ALIGNMENT** including radius, delta, tangent and arc length, and stations of all PC's, PI's and PT's. Size of pipe should be shown on the plan and profile, with text, and graphically as nominal pipe height from invert to top of pipe.

b) **PROFILE** portions of water and sewer drawings shall show invert elevations of all structures, and manhole surface elevations, length of pipe between structures or pipe grade breaks, top of pipe, pipe invert, and pipe grade to four decimal places.

c) **CONNECTIONS**, locations of water lines and side sewers with permit information. The number of tees and wyes, and the pipe distance between structures. Stationing and elevations to be appropriately included on the record drawings.

d) **UTILITY** underground crossings.

e) **LOAD** for rigid pipe sewers.

f) **TYPE OF PIPE**.

g) **LOCATION INFORMATION** of sewer or water easements, if any, with appropriate survey information

h) **STATIONING** and inverts for sewer drawings to include all pipe ends, and at manholes, etc.

i) **CONSTRUCTION DETAILS** for manholes, pipe bedding, etc.

j) **SIGNATURE BLOCK** on all water drawings shall be included for approvals by the appropriate fire department or district.

10.3-5 Grading, Erosion Control and Stormwater Drawings

Grading, Erosion Control and Swale drawings shall include the following in addition to the items listed above in 10.3-1, and 10.3-2:

a) **CONTOURS** in intervals stated on the site plan (extending 50 feet beyond property lines) as follows:

Slope %	Contour Interval (ft.)
0-15	2
16-40	5
>40	10

b) **THE 100-YEAR FLOOD HAZARD ZONE** on the site plan where the project is in or abuts said zone.

c) **SOIL TYPES** and **LOCATIONS** of percolation test and/or bore sites.

d) **CROSS SECTIONS** of all open ditches and/or swales.

e) **DITCH OR SWALE** invert elevations, slopes, and lengths.

f) **INLET** entrance details, elevations, and locations.

g) **SILT FENCES AND TRAP** location and details.

h) **MULCHING AND VEGETATION** plan.

i) **CLEARING AND GRUBBING** limits.

j) **ELEVATIONS** of all inlet grates and low points.

k) **SIZE, TYPES, AND INVERT ELEVATIONS** of all culverts and/or pipe systems, and structures such as catch basins, drywells or manholes.
l) **CONSTRUCTION DETAILS** for inlets, drywells and detention facilities (notes referring to Standard Plans may suffice).
m) **DRAINAGE EASEMENTS** with appropriate survey information.
n) **LOT GRADING ELEVATIONS** where appropriate.
o) **APPLICABLE STORM SEWER DATA** as required in 10.3-4,.
p) **EXISTING AND PROPOSED UNDERGROUND** meters, fuel tanks, wells, etc. within the setbacks specified by Spokane County Health Guidelines.
q) **GRADE**, proposed and existing.
r) **INSPECTION SCHEDULE** for erosion control facilities.

10.4 Record Drawings

Record drawings shall be archive-quality reproducible; ink on 4 mil mylar. The City's record drawings policy is provided in Appendix A.

After construction, drawings shall be modified to include following:

a) **A RECORD BLOCK** for signature and date references pertaining to projects Professional Engineer signature and stamp dates.
b) **PROJECT LIMITS** construction definitions by shading shall be removed, text removed from PROJECT LIMITS title block and placed in Record Drawing information area.
c) Drawings shall be revised to reflect changes made in the field through the project's completion.
d) All improvements that were constructed shall be shown to current City of Spokane Drafting Standards indicating they are now existing features.
e) Sheet limits shall conform to the City's flat sheet layout convention discussed in Appendix B.
f) For CADD drawings without 'Layouts', there shall be one electronic file per roadway segment.
g) Before archiving, if the drawing was generated using CADD, the City's electronic file name shall also be shown in the RECORD DRAWING title block.

Items to be retained include all required items listed in section 10 and Typical Sections when provided. Details should remain provided there is room.
In addition, when old linens or other manually produced flat sheets have been used to generate CADD drawings for a segment, the following shall be done when updating record drawings:

a) All design, ordinance, and record drawings information from the old drawing shall be transferred to the new drawing.
b) An up to date record of all record drawings must be transferred to the RECORD DRAWINGS block on the new drawing. Critical revisions must be maintained with the REVISION block.
c) Any grade ordinance data shown on the old drawings must also be provided on the new drawings GRADE ESTABLISHMENT block.
d) Record blocks to replace or revise all Engineers' stamps shown on the old original shall be placed on the new drawing.
e) **Do not discard the old drawings!** When record drawings are complete, the old and new drawings shall be sent to the archiving technician with a note attached to the old sheets indicating all relevant information has been transferred to new drawings.

11.0 CONTRACT DOCUMENTS

11.1 Plan Sets

Plan sets shall be prepared according to Section 10.0 of these Design Standards. Sheets shall be arranged in the following order:

a) Cover Sheet (if 3 or more plan/profile or detail sheets)
b) Site Map (if not on cover sheet)
c) Index (if not on cover sheet)
d) Plan/Profile Sheets
e) Detail Sheets

11.2 Specifications

The specifications are defined in Section 1.2. City of Spokane GSPs and City Standard Plans may be obtained from the Engineering Services counter in City Hall for a nominal fee.

APPENDIX A - Record Drawings Policy

CITY OF SPOKANE
ENGINEERING SERVICES DEPARTMENT

RECORD DRAWINGS POLICY

I. Materials for Archive

Drawings for archive in the Engineering Services Department must be good quality reproducible ink on 4 mil mylar or sepia mylar. **Note: photocopies, bluelines and electrostatic plots are unacceptable for archive. Only original mylar record drawings, photo mylars, or silverslicks will be accepted.**

All drawings shall be prepared in accordance with the City's CADD/Drafting Standards as set forth in the City of Spokane Design Standards Manual.

NOTE: Five and one-quarter inch floppy disks are obsolete and will not be accepted for electronic files.

II. Public Projects

For all projects designed and constructed in-house by Engineering Services or by a Consultant Firm, the procedure shall be as follows:

a) The Engineering Services Administrative Section shall send fourteen (14) sets of construction plans to the Engineering Services field office.
b) The Design Team or Consulting Firm will provide to Engineering Services electronic construction drawings for archiving.
c) The original drawings shall then be updated by the Construction Management Team assigned to the project or by the Consultant Firm to reflect changes shown on the inspector's redlines.
d) When final, the original **record drawing** mylars, and electronic CADD files on magnetic or optical disk shall be returned to Engineering Services for archive.

III. Water/Hydro Projects

For all projects designed and constructed in-house by the Water/Hydro Department, the following procedure shall apply:

a) The Water/Hydro Department shall provide the Engineering Services Department with two sets of construction Plans. One set for Engineering Services Design Section, the second set for Engineering Services Developer Services Section.
b) When final, the original **record drawing** mylars, and electronic CADD files on Magnetic or Optical disk shall be returned to Engineering Services for archive.

IV. Privately Funded Projects/P.U.D.s

For privately funded projects in the public right of way and Planned Unit Developments (P.U.D.s) the following record drawings procedure shall apply:

<u>Option A - Record Drawings by the Developer:</u>

a) If the developer elects to have record drawings produced by his/her consultant, payment provisions for record drawing services must be included as part of the developer's contract with the consultant. **Proof of a consultant retainer for record drawing services shall be supplied to the City prior to construction approval.** Record drawing services include, but are not limited to the following:
    1. The consultant shall send one (1) complete set of final accepted mylar design drawings to the Engineering Services Developer Services Section. If project is in the public right of way he (the consultant) shall include electronic design drawings for archiving.
    2. The consultant shall provide an engineer at the project site to inspect construction and

coordinate changes with the City's Construction Engineer.

3. The consultant shall update all original design drawings to reflect changes made during construction. Final record drawings shall conform to the City's drafting standards and flat sheet layout convention (see City of Spokane Design Standards Manual).

b) The developer shall send a complete record drawings package to the Engineering Services field office within 30 days of the substantial completion date as defined in the Standard Specifications. This package shall include the following:
   1. Redline field record drawings
   2. Original mylar record drawings per the Design Standards
   3. Electronic CADD files (if any) for original record drawings
   4. Itemized statement of project costs
   5. Completed sewer cards

   If the developer fails to submit the above materials within 30 days, no additional address certificates shall be issued by the Permits department for sewer and water connections on the project until the items are received.

c) After review, the field office shall send the record drawings package to the Archive Technician for archive, and copies of record drawing water drawings to the Water/Hydro Department.

Option B - Record drawings by the City:

If the developer does not retain a consultant for record drawing services, a fee shall be assessed the developer to cover the City's cost of overseeing construction and record drawing the plans. This fee must be paid prior to gaining construction approval. In addition, the following shall apply:

a) Prior to construction, the developer must submit the following materials to the Engineering Services field office:
   1. Original mylar design drawings
   2. Magnetic or optical disks containing CADD files for the design drawings

   Construction approval shall not be given until these materials are received by the City.

b) The field office shall provide inspection services during construction, and shall prepare a set of redline record drawings for the project, along with sewer cards and water stub addresses.

c) When construction is complete, the developer must submit an itemized statement of project costs to the Engineering Services field office.

   If the developer fails to submit project costs within 30 days following the Substantial Project Completion date (as defined in the Standard Specifications), no additional address certificates shall be issued by the Permits department for sewer and water connections on the project until the items are received.

d) The field office shall send the record drawings package (including redlines, sewer cards, and water stub addresses) to the Archive Technician for archive. Copies of record drawings water drawings shall be sent to the Water/Hydro Department.

V. Private On-Site Projects

For private on-site projects (projects outside the public right-of-way), the developer shall be responsible for maintaining record drawings for his/her own record. The City shall not retain record drawings for private on-site projects unless the City is or may be involved in the maintenance of the facilities.

APPENDIX B - Drawing Layout and Electronic File Naming

CITY OF SPOKANE
DEPARTMENT OF ENGINEERING SERVICES

DRAWING LAYOUT AND ELECTRONIC FILE NAMING

Flat Sheet Layout

The City has adopted the following approach for laying out flat sheets (refer to Figure A for pictorial representation):

For typical north-south or east west roads, each flat sheet should try to cover a ¼ mile segment, allowing two sheets per quarter section (See Roadway "A" on Figure A). An angled road should be divided into four 1/8 mile segments per quarter section (see Roadway "B" on Figure A).

Typical or angled segments shall be numbered consecutively from west to east or south to north.

In the case of winding roadways, a segment will be defined as the length of road which will fit on the flat sheet; segments on winding roadways are not constrained by the ¼ or 1/8 mile length convention (See Roadway "C" on Figure A.)

For winding roads, segments are numbered consecutively from the station line in the direction of increasing station. Again, we try to adhere to the "west to east" or "south to north" sequencing as much as possible. Note that since segment numbers and stationing begin at the section line, winding streets originating somewhere in the middle of the section should have segment numbers beginning with 10, and stationing beginning with 100+00. This reserves lower segment numbers and stationing for future extensions of the project from the beginning station and ensures that segment numbers for the roadway can be sequential throughout the section.

If a segment ends no farther than two stations beyond or one station short of an intersection, adjust the flat sheet to end at the intersection. Otherwise, define the segment to the station at the practical limit of the flat sheet. Note: when a flat sheet ends at an intersection, the full intersection should be shown, and then repeated on the next sequential sheet.

Segments should not cross section lines or quarter-section lines (except as required in the preceding paragraph).

Flat sheet names should indicate the entire segment length, not just the limits of the improvements.

Stationing and project limits are south to north and west to east. Stationing begins at 0+00 at the south section line or the west section line.

Flat Sheet Numbers

Flat sheet numbers shall be of the form NNNNN T(ss)q 9-25-43

Example: Eucli V(01)4 5-25-43 As Shown on Flat Sheet: Eucli V(01)4

1ST V(03)2 17-25-43 5-25-43

103RD V(ss)q xx-xx-xx

ALDER I(ss)q xx-xx-xx

ALDER L(ss)q xx-xx-xx

where:

NNNNN = an identifier consisting of up to the first five letters in character-based street names, as example, **EUCLI**d Ave., or in the case of the number-based street names, up to three numbers plus the suffix letters "ST", "ND", "RD" and "TH" as in 1ST, 2ND, 3RD, 4TH, 22ND, 54TH, 127TH, etc.

T = a single letter descriptor used to distinguish the street name:

(**S**)treet; a(**V**)enue; (**C**)ourt; c(**I**)rcle; (**L**)ane; (**P**)lace; (**D**)rive; (**B**)oulevard; (**R**)oad; par(**K**)way; (**W**)ay; (**T**)errace; (**H**)ighway; tr(**A**)il; l(**O**)op; alle(**Y**); (**E**)asement

ss = "segment" number (as discussed above)

q = quarter code

The quarter code identifies the quarter section belonging to the flat sheet. Quarter codes are identical to the County tax assessor quarter codes.

QUARTER	CODE
NE	1
NW	2
SW	3
SE	4

2	1
3	4

For projects in the right of way on or abutting a quarter-section line, assign the improvement flat sheet "q" code to the quarter-section immediately south or east of the improvement.

The last three digits represent section, township and range. Note: for projects in rights of way on or abutting a section line, assign the improvement flat sheet to the section immediately south or east of the improvement.

Naming Electronic Drawing Files

When electronic drawing files are updated to record drawings, the drawings are given final electronic file names. **The electronic file name is to be recorded on the mylar record drawings below the title block**. Electronic file naming conventions are basedthe assigned City Project Number.

Sample electronic file name: 2000405MA

When using 'Layouts':

2000405 (City Project Number) M (multiple sheet dwg) A (first Multiple Sheet Drawing in project).

2000405 (City Project Number) M (multiple sheet dwg) B (second Multiple Sheet Drawing in project).

When a project has been broken into single sheets, whether in 'Model' space or in a ' Layout':

2000405 (City Project Number)02 (Sheet Number in project construction plan set)

The title block location for the EFN will hold about 24 characters,

Therefore additional characters may be added to EFN as required :

2000405ROW, 2000405SIGNING, etc.

Alley projects shall be named with the street to the west or the street to the north, i.e. north/south from west to east, or west/east from south to north.

Sheet Naming Convention

The sheet name is based on the street that the improvement is within, or in the case of an alley, on the street to the west of or to the north of the alley.

APPENDIX C - City of Spokane Drafting Standards

CITY OF SPOKANE
DRAFTING STANDARDS

City of Spokane
Department of Engineering Services
808 W. Spokane Falls Blvd.
Spokane, WA. 99210-3343
(509) 625-6700

NOTE:
THIS SHEET CONTAINS REVISION INFORMATION FOR THE FOLLOWING DRAFTING STANDARDS AND SYMBOLS.

Rev. 1	09/06	Staff		Update/Revisions of Sheets 1 thru 5
NUMBER	DATE	DRAWN BY	APPROV. BY	REVISIONS

CURRENT CITY DESIGN STANDARDS REVISED JUN,2006	
BY	DATES
DRAWN: RDC	06/06
CHECKED:	
APPROVED:	

CITY OF SPOKANE, WASHINGTON
DEPARTMENT OF ENGINEERING SERVICES
808 WEST SPOKANE FALLS BLVD.
SPOKANE, WASHINGTON 99201-3343
(509) 625-6300

CITY OF SPOKANE DESIGN STANDARDS

COVER SHEET, REVISION TABLE

SURVEY SYMBOLS

NOTE: SURVEY COLORS ARE PRESET IN CITY PROTOTYPE DRAWING & PLOTTING FILES. COLOR(S) MAY BE ADJUSTED BY USER AS LONG AS LINEWEIGHT & SHADE INFORMATION IS HELD. PLEASE SEE REFERENCE NUMBER TABLE FOR COMPARABLE PRESET COLOR SELECTIONS.

SYMBOL EXIST.	SYMBOL PROP.	DESCRIPTION (ABBR)	REF.# EXST/PROP	COLOR EXST/PROP	BLOCK	LAYER
△	▲	ANGLE POINT (AP)	11/2	210/12	SAP/SAPP	SV-CTRL-3333-SYM
⌖	⌖	BENCH MARK (BM)	11/2	210/12	SBM/SBMP	SV-CTRL-3333-SYM
○	●	BLOCK CORNER (BC)	11/2	210/12	SBC/SBCP	SV-CTRL-3333-SYM
∘	•	IRON PIPE (IP)	11/2	210/12	SIP/SIPP	SV-CTRL-3333-SYM
⊕	⊕	MONUMENT (SURFACE) (MON)	11/2	210/12	SMON/SMONP	SV-CTRL-3333-SYM
◎	◉	MONUMENT (IN CASE) (MIC)	11/2	210/12	SMIC/SMICP	SV-CTRL-3333-SYM
⊘	⊗	SOIL BORING (SB)	11/2	210/12	SSB/SSBP	SV-SOIL-3333-SYM
SE		SURVEY POINT (SE)	11/NA	210/NA	SSE	SV-CTRL-EXST-SYM
GPS		GPS POINT (GPS)	11/NA	210/NA	GPS	SV-CTRL-EXST-SYM
PC		POINT OF CURVE (PC)	11/NA	210/NA	SVPC	SV-CTRL-EXST-SYM
PT		POINT OF TANGENT (PT)	11/NA	210/NA	SVPT	SV-CTRL-EXST-SYM
PI		POINT OF INTERSECTION (PI)	11/NA	210/NA	SVPI	SV-CTRL-EXST-SYM
MAG		MAGNETIC NAIL (MAG)	11/NA	210/NA	SVMAG	SV-CTRL-EXST-SYM
60d		60d NAIL (60d)	11/NA	210/NA	SV60d	SV-CTRL-EXST-SYM
×		"X" IN CONCRETE	11/NA	210/NA	SVXC	SV-CTRL-EXST-SYM
REF		REFERENCE "X"	11/NA	210/NA	SVREF	SV-CTRL-EXST-SYM
⬭		BRASS TAG/WASHER	11/NA	210/NA	SVBTW	SV-CTRL-EXST-SYM
⊠		HUB & TACK (HT)	11/NA	210/NA	SVBTW	SV-CTRL-EXST-SYM
•		REBAR (RB)	11/NA	210/NA	RB	SV-CTRL-EXST-SYM
•		REBAR W/ CAP (LS)	11/NA	210/NA	LS	SV-CTRL-EXST-SYM
⊛		CITY REBAR & CAP (RC)	11/NA	210/NA	SVCRC	SV-CTRL-EXST-SYM
⊛		PK NAIL (PK)	11/NA	210/NA	PK	SV-CTRL-EXST-SYM
■		ROCK NAIL (RN)	11/NA	210/NA	RN	SV-CTRL-EXST-SYM
⬭		RAILROAD SPIKE (RS)	11/NA	210/NA	RRS	SV-CTRL-EXST-SYM
◈		PIN/ROD (P/R)	11/NA	210/NA	SVPROD	SV-CTRL-EXST-SYM
BS		BOAT SPIKE (BS)	11/NA	210/NA	SVBSPK	SV-CTRL-EXST-SYM
		OWNERSHIP TIE (OT)	11/NA	210/NA	SOT	SV-CTRL-EXST-SYM

SECTION DATA:

4		SECTION CENTER	3	SSCT	SV-SECT-3333-SYM
14 13 23 24	14 13 23 24	SECTION CORNER	2/2	SSC/SSCP	SV-SECT-3333-SYM
12 13	12 13	QUARTER CORNER	2/2	SQC/SQCP	SV-QSCT-3333-SYM
○	●	SIXTEENTH CORNER	1/3	SSXC/SSXCP	SV-16ST-3333-SYM
14 13	14 13	CLOSING CORNER	2/2	SCC/SCCP	SV-222A-3333-SYM
MC	MC	MEANDER CORNER (MC)	11/2	SMC/SMCP	SV-222A-3333-SYM
WC	WC	WITNESS CORNER (WC)	1/2	SWC/SWCP	SV-SECT-3333-SYM
45133.1234		TAX LOT / ASSESSOR NUMBER	3	STLN	SV-222B-3333-SYM
					USE SECT/TWNS/RANG – 222A
					USE PRCL/LOTN – 222B
					USE EXST/PROP/FOUN/THEO – 3333
25		RIGHT OF WAY PLAN PARC. No.	3	SRWN	SV-RWNO-PROP-SYM

REFERENCE/GENERAL NOTATION SYMBOLS

SYMBOL	DESCRIPTION (ABBR)	LINE WIDTH EXST/PROP	BLOCK	LAYER
CALL BEFORE YOU DIG 1-800-424-5555	CALL BEFORE YOU DIG (PLACE ON ALL CONSTRUCTION DRAWINGS)	2	CALL	GN-CALL-PROP-SYM
	BEGIN-END PROJECT ARROW	2	BEARW	GN-SCOP-PROP-SYM
	ARROW	2	ARW	GN-222A-3333-SYM
	INTERSECTION POINT	2	INTP	GN-222B-3333-SYM
				USE FEATURE THAT – 222A IS BEING DIMENSIONED
				USE CRVH – FOR – 222B PT, PC & PI OF HORIZONTAL CURVES
				USE CRVV – FOR – 222B VERTICAL CURVES
				USE SINT – FOR – 222B STREET INTERSECTIONS
				USE EXST/PROP – 3333 OR FOUN/THEO

BLOCK: SNA
LAYER: SV-NORA-3333-SYM

BLOCK: SDAT
LAYER: SV-DATM-3333-SYM

COS PLOTTING & PROTO DRAWING

COLORS ARE PRESET IN CITY PROTOTYPE DRAWING & PLOTTING FILES. COLOR(S) MAY BE ADJUSTED BY USER AS LONG AS LINEWEIGHT & SHADE INFORMATION IS HELD. PLEASE SEE REFERENCE NUMBER TABLE FOR COMPARABLE PRESET COLOR SELECTIONS.

THE CITY OF SPOKANE HAS DEVELOPED 2 CTB FILES THAT SHOULD BE USED TO ACHIEVE PROPER LINEWEIGHTS & SHADES WHEN USING CITY PROTOTYPES. THE 2 FILES ARE a) COS_FULLSIZE_VER1.CTB AND b) COS_HALFSIZE_VER1.CTB. BOTH FILES CAN BE OBTAINED BY CONTACTING THE CITY OF SPOKANE ENGINEERING SERVICES.

COS HAS RESERVED LETTER STYLES "STANDARD" & "ROMANS" FOR SYMBOLS & LINETYPE WORK IN THE PROTO DRAWING & DRAFTING STANDARDS DOCUMENT. USERS SHOULD REFRAIN FROM CHANGING THESE STYLES.

SANITARY/STORM SEWER SYMBOLS

NOTE: SANITARY/STORM SEWER COLORS ARE PRESET IN CITY PROTOTYPE DRAWING & PLOTTING FILES. COLOR(S) MAY BE ADJUSTED BY USER AS LONG AS LINEWEIGHT & SHADE INFORMATION IS HELD. PLEASE SEE REFERENCE NUMBER TABLE FOR COMPARABLE PRESET COLOR SELECTIONS.

SYMBOL EXIST.	SYMBOL PROP.	DESCRIPTION (ABBR)	REF.# EXST/PROP	COLOR EXST/PROP	BLOCK	LAYER
○	●	SAN. SEWER CLEAN OUT (CO)	11/2	80/45	SSCO/SSCOP	SA-STCR-3333-SYM
○	●	SAN. SEWER MANHOLE (SSMH)	11/2	80/45	SSMH/SSMHP	SA-STCR-3333-SYM
□	■	* STORM DRAIN CATCH BASIN (CITY TYPE 1 CB/SICB) (CB)	11/2	61/82	SDCB/SDCBP	SD-STCR-3333-SYM
		STORM DRAIN CULVERT (CULV)	11/2	61/82	SDC/SDCP	SD-GLIN-3333-SYM
◎	◉	STORM DRAIN MANHOLE (SDMH)	11/2	61/82	SDMH/SDMHP	SD-STCR-3333-SYM
◎	◉	STORM DRAIN DRYWELL (DW)	11/2	61/82	SDDW/SDDWP	SD-STCR-3333-SYM
	■	* WSDOT-VANED GRATE (VG)	11/NA	61/82	SDWSV/SDCBP	SD-STCR-3333-SYM
	■	* COS GRATE-INLET (CITY TYPE 3) (GI)	11/NA	61/82	SDT3/SDCBP	SD-STCR-3333-SYM
	■	* TYPE 2 CB-IRON (CB)	11/NA	61/82	SDT2I/SDCBP	SD-STCR-3333-SYM
		GUTTER INLET (SNUFF BOX) (GI)	11/NA	61/NA	SDGI	SD-STCR-3333-SYM
	■	* TYPE 2 CB-CONC (CB)	11/NA	61/82	SDT2C/SDCBP	SD-STCR-3333-SYM
	■	* CI & SI GRATE (GI)	11/NA	61/82	SDTC2/SDCBP	SD-STCR-3333-SYM
		CURB FACE INLET (GI)	11/NA	61/NA	SDCFI	SD-STCR-3333-SYM
	■	* WSDOT-GRATE (GI)	11/NA	61/82	SDWSG/SDCBP	SD-STCR-3333-SYM
SEPT		SEPTIC TANK (ST)	11/NA	61/NA	SEPT	SA-STCR-EXST-SYM
		DRAINAGE ARROW	11/2	61/82	DRAIN_ARROW	SD-GLIN-EXST-SYM
	➤	DESIGNED SA/SD FLOWS	NA/2	NA/45-82	ARWP	SD-GLIN-PROP-SYM
						USE EXST/PROP – 3333

* STORM DRAINAGE CB NOTE: ALL PROPOSED STORM DRAINAGE CB STRUCTURES TO USE THIS SYMBOL. DESIGNED STRUCTURE SHALL BE CALLED OUT ON ACTUAL PLAN SHEET(S).

REFERENCE NUMBER TABLE

(INCLUDES LINE WIDTHS, COLORS & SHADE %)

REFERENCE NUMBER	LINE WIDTH (mm)	COLORS	% SHADE
1	0.25	1, 3, 5, 9, 13	0%
2	0.35	2, 6, 11, 12, 45, 82	0%
3	0.5	7, 8	0%
4	0.7	4, 10	0%
5	0.99	14	0%
6	0.18	15	0%
7	0.18	110	10%
8	0.18	130	30%
9	0.18	140	40%
10	0.18	160	60%
11	0.18	30, 51, 61, 80, 111, 115, 150, 210, 240, 241	80%

COLORS NOTE: EXISTING UTILITIES TO BE PLOTTED AT 80% SHADE. COLORS HAVE BEEN ASSIGNED TO BEST CONFORM WITH INDUSTRY STANDARD LOCATING COLORS. SOME MODIFICATIONS WERE MADE TO ALLOW FOR BETTER DISTINCTION BETWEEN ELEMENTS (IE. SANITARY SEWER & STORM WATER). BELOW ARE CITY OF SPOKANE DRAFTING STANDARDS SCREEN COLORS. THESE COLORS ARE PREDEFINED IN THE CITY STANDARD PROTOTYPE DRAWING AND WILL PLOT PROPERLY WHEN USED WITH THE CITY OF SPOKANE'S DESIGN STANDARD PLOTTING CTB FILE.

UTILITY COLORS: COS DRAWING STANDARDS

UTILITY	EXIST COLOR	* PROP. COLOR
TELEPHONE, TV, CABLE	30	13
GAS, STEAM, OIL	51	2
STORM DRAINAGE	61	82
SANITARY SEWER	80	45
SURFACE FEATURES	115	USER DEFINE
WATER	150	5
SURVEY	210	12
POWER	240	1
TRAFFIC	241	6

* PROPOSED COLOR NOTE: ASSIGNED COLOR IS TO AID IN SCREEN VIEWING, ACTUAL WIDTH (PLOTTED WIDTH) OF PROPOSED LINE CAN BE ADJUSTED TO USERS DESIRED WIDTH BY USING PLINES.

IE. PROPOSED 12" SANITARY: USER MAY USE PLINE WITH 1.0 WIDTH OR IF REQUIRED INCREASE TO 1.5 (OR GREATER) TO ALLOW FOR PROPOSED ITEM TO BE SEEN.

CURRENT CITY DESIGN STANDARDS REVISED JUN,2006

BY		DATES
DRAWN:	RDC/RJS	08/06
CHECKED:		
APPROVED:		

THE CITY OF SPOKANE

CITY OF SPOKANE, WASHINGTON

DEPARTMENT OF ENGINEERING SERVICES

808 WEST SPOKANE FALLS BLVD.
SPOKANE, WASHINGTON 99201-3343
(509) 625-6300

CITY OF SPOKANE DESIGN STANDARDS

GENERAL, SURVEY, SEWER , & LINEWEIGHTS

WATER SYMBOLS

NOTE: WATER COLORS ARE PRESET IN CITY PROTOTYPE DRAWING & PLOTTING FILES. COLOR(S) MAY BE ADJUSTED BY USER AS LONG AS LINEWEIGHT & SHADE INFORMATION IS HELD. PLEASE SEE REFERENCE NUMBER TABLE FOR COMPARABLE PRESET COLOR SELECTIONS.

SYMBOL EXIST.	SYMBOL PROP.	DESCRIPTION (ABBR)		REF.# EXST/PROP	COLOR EXST/PROP	BLOCK	LAYER
WCAP	WCAP	CAP/PLUG		11/1	150/5	WCAP	WA-FITT-3333-SYM
CPL	CPL	COUPLING	(CPL)	11/1	150/5	WCOUP/WCOUPP	WA-FITT-3333-SYM
GP	GP	GUARD POST	(GP)	11/1	150/5	WGP/WGPP	WA-FITT-3333-SYM
RED	RED	REDUCER	(RED)	11/1	150/5	WRED/WREDP	WA-FITT-3333-SYM
TB	TB	THRUST BLOCK	(TB)	11/1	150/5	WTB/WTBP	WA-FITT-3333-SYM
SP	SP	SPRINKLER HEAD	(SP)	11/1	150/5	WSPR/WSPRP	WA-FITT-3333-SYM
WM	WM	WATER METER	(WM)	11/1	150/5	WMET/WMETP	WA-METR-3333-SYM
		FIRE HYDRANTS:		11/1	150/5		
FH	FH	2-NOZZLE	(FH)	11/1	150/5	WFH2/WFH2P	WA-FHYD-3333-SYM
FH	FH	3-NOZZLE	(FH)	11/1	150/5	WFH3/WFH3P	WA-FHYD-3333-SYM
		JOINTS:		11/1	150/5		
FL	FL	FLANGE/BLIND FL	(FL)/(BL FL)	11/1	150/5	WFL/WFLP	WA-FITT-3333-SYM
MJ	MJ	MECHANICAL	(MJ)	11/1	150/5	WMJ/WMJP	WA-FITT-3333-SYM
WHUB	WHUB	PUSH-ON/HUB		11/1	150/5	WHUB/WHUBP	WA-FITT-3333-SYM
THD	THD	THREAD	(THD)	11/1	150/5	WTH/WTHP	WA-FITT-3333-SYM
		VALVES:		11/1	150/5		
AIR	AIR	AIR RELIEF	(AIR)	11/1	150/5	WARV/WARVP	WA-VALV-3333-SYM
BO	BO	BLOW-OFF	(BO)	11/1	150/5	WBOV/WBOVP	WA-VALV-3333-SYM
BF	BF	BUTTERFLY	(BF)	11/1	150/5	WBFV/WBFVP	WA-VALV-3333-SYM
CK	CK	CHECK	(CK)			WCKV/WCKVP	WA-VALV-3333-SYM
		GATE/GENERAL	(WV)	11/1	150/5	WGV/WGVP	WA-VALV-3333-SYM
PV	PV	PLUG VALVE	(PV)	11/1	150/5	WPV/WPVP	WA-VALV-3333-SYM
		ADAPTER, FL. x M.J.		11/1	150/5	WAFM/SAME	WA-FITT-3333-SYM
		BENDS:					
		90 DEGREE BEND, FL.		11/1	150/5	W90F/SAME	WA-FITT-3333-SYM
		45 DEGREE BEND, FL.		11/1	150/5	W45F/SAME	WA-FITT-3333-SYM
		22.5 DEGREE BEND, FL.		11/1	150/5	W22F/SAME	WA-FITT-3333-SYM
		11.25 DEGREE BEND, FL.		11/1	150/5	W11F/SAME	WA-FITT-3333-SYM
		90 DEGREE BEND, M.J.		11/1	150/5	W90M/SAME	WA-FITT-3333-SYM
		45 DEGREE BEND, M.J.		11/1	150/5	W45M/SAME	WA-FITT-3333-SYM
		22.5 DEGREE BEND, M.J.		11/1	150/5	W22M/SAME	WA-FITT-3333-SYM
		11.25 DEGREE BEND, M.J.		11/1	150/5	W11M/SAME	WA-FITT-3333-SYM
		VERTICAL BEND, FL.		11/1	150/5	WVTF/SAME	WA-FITT-3333-SYM
		VERTICAL BEND, M.J.		11/1	150/5	WVTM/SAME	WA-FITT-3333-SYM
		REDUCERS:					
		REDUCER, FL.		11/1	150/5	WRF/WRFP	WA-FITT-3333-SYM
		REDUCER, M.J.		11/1	150/5	WRM/WRMP	WA-FITT-3333-SYM
		REDUCER, M.J. x FL.		11/1	150/5	WRMF/WRMFP	WA-FITT-3333-SYM
		REDUCER, M.J. x P.E.		11/1	150/5	WRMB/WRMBP	WA-FITT-3333-SYM
		REDUCER, P.E. x M.J./FL. x M.J.		11/1	150/5	WRBM/WRBMP	WA-FITT-3333-SYM
		TEES:					
		TAPPING TEE & VALVE, FL. x M.J.		11/1	150/5	WTTM/WTTMP	WA-VALV-3333-SYM
		TEE, FL.		11/1	150/5	WTF/SAME	WA-FITT-3333-SYM
		TEE, M.J.		11/1	150/5	WTM/SAME	WA-FITT-3333-SYM
		TEE, M.J. x FL.		11/1	150/5	WTMF/SAME	WA-FITT-3333-SYM
		VALVES:					
		BUTTERFLY VALVE, FL. x M.J.		11/1	150/5	WBVFM/WBVFMP	WA-VALV-3333-SYM
		BUTTERFLY VALVE, M.J.		11/1	150/5	WBVM/WBVMP	WA-VALV-3333-SYM
		GATE VALVE, FL. x M.J.		11/1	150/5	WGVFM/WGVFMP	WA-VALV-3333-SYM
		GATE VALVE, M.J.		11/1	150/5	WGVM/WGVMP	WA-VALV-3333-SYM
W		* WATER MANHOLE		11/1	150/5	WAMH/WAMHP	WA-STCR-3333-SYM
		WATER VALVE		11/1	150/5	WGV/WGVP	WA-VALV-3333-SYM
		CURB BOX		11/1	150/5	WCB/WCBP	WA-VALV-3333-SYM
		HYD. VALVE BOX		11/1	150/5	WGV/WGVP	WA-VALV-3333-SYM
ARB		ARB BOX		11/NA	150/NA	ARB	WA-STCR-3333-SYM
		* METER MANHOLE		11/1	150/5	WMET/WAMHP	WA-STCR-3333-SYM
FH	FH	HYDRANT (TOPO SYMBOL)		11/1	150/5	WFH/WFH3P	WA-FHYD-3333-SYM
W		* BLOW-OFF MH		11/1	150/5	WAMH/WAMHP	WA-STCR-3333-SYM
		SPRINKLER HEAD		11/NA	150/NA	SPND	WA-FITT-3333-SYM
		SPINKLER CON. BOX		11/NA	150/NA	SCBX	WA-STCR-3333-SYM

USE EXST/PROP - 3333

* WATER MANHOLE NOTE: ALL PROPOSED WATER MANHOLE STRUCTURES TO USE THIS SYMBOL. DESIGNED STRUCTURE SHALL BE CALLED OUT ON ACTUAL PLAN SHEET(S).

GAS/POWER/TEL./CABLE/TV SYMBOLS

NOTE: GAS/POWER & TELEPHONE COLORS ARE PRESET IN CITY PROTOTYPE DRAWING & PLOTTING FILES. COLOR(S) MAY BE ADJUSTED BY USER AS LONG AS LINEWEIGHT & SHADE INFORMATION IS HELD. PLEASE SEE REFERENCE NUMBER TABLE FOR COMPARABLE PRESET COLOR SELECTIONS.

SYMBOL EXIST.	SYMBOL PROP.	DESCRIPTION (ABBR)		REF.# EXST/PROP	COLOR EXST/PROP	BLOCK	LAYER
		GAS MANHOLE	(GMH)	11/2	51/2	GAMH	GS-MHOL-3333-SYM
		GAS METER	(GM)	11/2	51/2	GMET/GMETP	GS-METR-3333-SYM
		GAS VALVE	(GV)	11/2	51/2	GV/GVP	GS-VALV-3333-SYM
		GAS MARKER/SIGN	(GMS)	11/2	51/2	GAMS	GS-MSGN-3333-SYM
		POWER MH/VAULT	(POW MHV)	11/1	240/1	PMHV	PO-STCR-3333-SYM
P	P	POWER VAULT	(POW V)	11/1	240/1	PV/PVP	PO-STCR-3333-SYM
		POWER POLE	(PP)	11/1	240/1	UP/UPP	PO-STCR-3333-SYM
		ANCHOR POLE	(PP)	11/1	240/1	UP/UPP	PO-STCR-3333-SYM
		GUY WIRE		11/1	240/1	UPA/UPAP	PO-STCR-3333-SYM
E		ELEC MARKER/SIGN	(EMSN)	11/1	240/1	POMS	PO-STCR-3333-SYM
		LUMINAIRE POLE	(LUMP)	11/1	240/1	TSLA	PO-STCR-3333-SYM
		FLOOD LIGHT	(FLDL)	11/1	240/1	LUMIN2	PO-STCR-3333-SYM
		PARKING LOT LIGHT	(PLGT)	11/1	240/1	LUMIN	PO-STCR-3333-SYM
		PAD MOUNTED TRANSFORMER	(P TRAN)	11/1	240/1	PTRAN/PTRANP	PO-STCR-3333-SYM
		TRANSMISSION TOWER	(TRANS TWR)	11/1	240/1	PTWR/PTWRP	PO-STCR-EXST-SYM
T	T	TELEPHONE MANHOLE	(TEL MH)	11/1	30/13	TELMH/TELMHP	TL-STCR-3333-SYM
T	T	TELEPHONE MARKER/SIGN	(TEL MS)	11/1	30/13	TLMS/TLMSP	TL-STCR-3333-SYM
FO	FO	FIBER OPTICS MARKER/SIGN	(FO MS)	11/1	30/13	FOMS/FOMSP	TL-STCR-3333-SYM
		TELEPHONE RISER	(TEL R)	11/1	30/13	TELR/TELRP	TL-STCR-3333-SYM
T		TELEPHONE VAULT	(TEL V)	11/1	30/13	TV1	TL-STCR-3333-SYM
CV	CV	COMMUNICATION MH/VAULT		11/1	30/13	CMVLT/CMVLTP	TL-STCR-3333-SYM
		TELEPHONE BOOTH		11/1	30/13	TLB/TLBP	TL-STCR-3333-SYM
		TELEPHONE POLE		11/1	30/13	UP/UPP	TL-STCR-3333-SYM
CA		CABLE VAULT/MH	(CVLT)	11/1	30/13	CAVLT	TL-STCR-3333-SYM
		CABLE RISER	(CRSR)	11/1	30/13	TELR	TL-STCR-3333-SYM
		CABLE BOX	(CBOX)	11/1	30/13	CBX	TL-STCR-3333-SYM
		CABLE POLE	(CPOL)	11/1	30/13	UP	TL-STCR-3333-SYM
		CABLE MARKER/SIGN	(CMSN)	11/1	30/13	CAMS	TL-STCR-3333-SYM
		CABLE/TV POLE		11/1	30/13	UP/UPP	TL-STCR-3333-SYM

USE EXST/PROP - 3333

SURFACE FEATURES/LANDSCAPING

NOTE: SURFACE FEATURES COLORS ARE PRESET IN CITY PROTOTYPE DRAWING & PLOTTING FILES. COLOR(S) MAY BE ADJUSTED BY USER AS LONG AS LINEWEIGHT & SHADE INFORMATION IS HELD. PLEASE SEE REFERENCE NUMBER TABLE FOR COMPARABLE PRESET COLOR SELECTIONS.

SYMBOL EXIST.	SYMBOL PROP.	DESCRIPTION (ABBR)	REF.# EXST/PROP	COLOR EXST/PROP	BLOCK	LAYER
BUS	BUS	BUS STOP	11/2	150/UD	SFBS/SFBSP	SF-STCR-3333-SYM
		EMBANKMENT	11/2	150/UD	SFB/SFBP	SF-EMBT-3333-SYM
		MAIL BOX	11/2	150/UD	SFMB/SFMBP	SF-STCR-3333-SYM
		RIP RAP	11/2	150/UD	SFRR/SFRRP	SF-RIPR-3333-SYM
		ROCKERY	11/2	150/UD	SFR/SFRP	SF-ROCK-3333-SYM
		ABANDON AUTO	11/2	150/UD	CAR1	SF-STCR-3333-SYM
H		HEAT PUMP	11/2	150/UD	HPUMP1	SF-STCR-3333-SYM
		YARD LIGHT	11/2	150/UD	SFL	PO-STCR-3333-SYM
		PARKING LIGHT	11/2	150/UD	LUMIN	PO-STCR-3333-SYM
		FLOOD LIGHT	11/2	150/UD	LUMIN2	PO-STCR-3333-SYM
PM		PARKING METER	11/2	150/UD	SFPM/SFPMP	SF-STCR-3333-SYM
		WHEELCHAIR	11/2	150/UD	WCR	SF-WCHR-3333-SYM
		208 CURB INLET	11/2	150/UD	028	SF-CURB-3333-SYM
	16'	DRIVEWAY	11/2	150/UD	DW(DWRY SIZE #)	SF-DWRY-3333-SYM
		WHEEL STOP	11/2	150/UD	WSTOP	SF-WSTP-3333-SYM
		JERSEY BARRIER	11/2	150/UD	JERB	SF-JERB-3333-SYM
# GATE		# GATE	11/2	150/UD	G(GATE SIZE #)	SF-FENC-3333-SYM
		RAILROAD TIE	11/2	150/UD	RRTIE	SF-RRTI-3333-SYM
		BOULDER	11/2	150/UD	BOUL	SF-ROCK-3333-SYM
		CL (0,I,II,III,IV)	11/2	150/UD	SFD(TREE CLASS)	SF-VEGE-3333-SYM
		ORNAMENTAL TREE	11/2	150/UD	ORN	SF-VEGE-3333-SYM
		SHRUB	11/2	150/UD	SFSHB	SF-VEGE-3333-SYM
		SHRUB ROW	11/2	150/UD	SFS1	SF-VEGE-3333-SYM
		BUSH	11/2	150/UD	SHRB1	SF-VEGE-3333-SYM
		BUSH ROW	11/2	150/UD	SFB1	SF-VEGE-3333-SYM
		STUMP	11/2	150/UD	STUMP	SF-VEGE-3333-SYM
3'DOOR		3' DOOR	11/2	150/UD	DR3	SF-BLDG-3333-SYM
(8,10,12,14,16,XX)		GARAGE DOOR	11/2	150/UD	GD	SF-BLDG-3333-SYM

(UD DENOTES "USER DEFINED")

USE EXST/PROP - 3333

TREE CLASSES = 0,1,2,3,4

DRWY SIZES = 8,10,12,14,16,18,20,24,30,36,XX

GATE SIZES = 3,4,6,8,10,12,16,XX

GARAGE DOOR SIZES = 8,10,12,16,XX

NOTE: ADDITIONAL INFORMATION ON SYMBOLS & INSERT POINTS AVAILABLE AT CITY OF SPOKANE SURVEY/TOPO/DESCRIPTION KEY INDEX.

CURRENT CITY DESIGN STANDARDS REVISED JUN,2006

BY		DATES
DRAWN:	KT/RJS	06/01/06
CHECKED:		
APPROVED:		

THE CITY OF SPOKANE

CITY OF SPOKANE, WASHINGTON

DEPARTMENT OF ENGINEERING SERVICES

808 WEST SPOKANE FALLS BLVD.
SPOKANE, WASHINGTON 99201-3343
(509) 625-6300

CITY OF SPOKANE DESIGN STANDARDS

WATER, GAS, POWER, TELE, TV, & SURFACE FEATURES

PAVEMENT MARKINGS

NOTE: PAVEMENT MARKING COLORS ARE PRESET IN CITY PROTOTYPE DRAWING & PLOTTING FILES. COLOR(S) MAY BE ADJUSTED BY USER AS LONG AS LINEWEIGHT & SHADE INFORMATION IS HELD. PLEASE SEE REFERENCE NUMBER TABLE FOR COMPARABLE PRESET COLOR SELECTIONS.

SYMBOL EXIST.	SYMBOL PROP.	DESCRIPTION	REF.# EXST/PROP	COLOR EXST/PROP	BLOCK	LAYER
		HANDICAP	11/2	241/6	PMH/PMHP	TF-STRP-3333-SYM
		BIKE LANE	11/2	241/6	PMB/PMBP	TF-STRP-3333-SYM
		H.O.V. LANE	11/2	241/6	PMHOV/PMHOVP	TF-STRP-3333-SYM
		YIELD LINE	11/2	241/6	PMYL/PMYLP	TF-STRP-3333-SYM
ONLY	ONLY	ONLY	11/2	241/6	PMO/PMOP	TF-STRP-3333-SYM
AHEAD	AHEAD	AHEAD	11/2	241/6	PMA/PMAP	TF-STRP-3333-SYM
STOP	STOP	STOP	11/2	241/6	PMS/PMSP	TF-STRP-3333-SYM
SCHOOL	SCHOOL	SCHOOL	11/2	241/6	PMSC/PMSCP	TF-STRP-3333-SYM
R X R	R X R	RAILROAD CROSSING	11/2	241/6	PMRX/PMRXP	TF-STRP-3333-SYM
PAVEMENT MARKINGS ARROWS						
		STRAIGHT ARROW	11/2	241/6	PMSA/PMSAP	TF-STRP-3333-SYM
		LEFT TURN ARROW	11/2	241/6	PMLA/PMLAP	TF-STRP-3333-SYM
		RIGHT TURN ARROW	11/2	241/6	PMRA/PMRAP	TF-STRP-3333-SYM
		LEFT-RIGHT-STRAIGHT ARROW	11/2	241/6	PMLRS/PMLRSP	TF-STRP-3333-SYM
		LEFT-RIGHT ARROW	11/2	241/6	PMLR/PMLRP	TF-STRP-3333-SYM
		2-WAY LEFT TURN	11/2	241/6	PM2W/PM2WP	TF-STRP-3333-SYM
		LEFT-STRAIGHT ARROW	11/2	241/6	PMLS/PMLSP	TF-STRP-3333-SYM
		RIGHT-STRAIGHT ARROW	11/2	241/6	PMRS/PMRSP	TF-STRP-3333-SYM
RAISED MARKERS						
		CONCRETE BARRIER	11/2	241/6	RMCB/RMCBP	TF-STRP-3333-SYM
		CONCRETE BARRIER TERMINAL END	11/2	241/6	RMCBT/RMCBTP	TF-STRP-3333-SYM
		CHANNELIZER	11/2	241/6	RMCH/RMCHP	TF-STRP-3333-SYM

USE EXST/PROP = 3333

SIGNALIZATION SYMBOLS

NOTE: SIGNALIZATION SYMBOL COLORS ARE PRESET IN CITY PROTOTYPE DRAWING & PLOTTING FILES. COLOR(S) MAY BE ADJUSTED BY USER AS LONG AS LINEWEIGHT & SHADE INFORMATION IS HELD. PLEASE SEE REFERENCE NUMBER TABLE FOR COMPARABLE PRESET COLOR SELECTIONS.

SYMBOL EXIST.	SYMBOL PROP.	DESCRIPTION	REF.# EXST/PROP	COLOR EXST/PROP	BLOCK	LAYER
		POLES				
		SIGNAL POLE TYPE 1	11/2	241/6	TSP1/TSP1P	TF-SIGL-3333-SYM
		SIGNAL POLE TYPE 1A	11/2	241/6	TSP1A/TSP1AP	TF-SIGL-3333-SYM
		SIGNAL POLE TYPE 2	11/2	241/6	TSP2/TSP2P	TF-SIGL-3333-SYM
		SIGNAL POLE TYPE 3	11/2	241/6	TSP3/TSP3P	TF-SIGL-3333-SYM
		SIGNAL POLE TYPE 4	11/2	241/6	TSP4/TSP4P	TF-SIGL-3333-SYM
		SIGNAL BASE & STANDARD	11/2	241/6	TSB/TSBP	TF-SIGL-3333-SYM
		LUMINAIRE	11/2	241/6	TLUM/TLUMP	PO-STCR-3333-SYM
		SIGNAL HEADS				
		TRAFFIC SIGNAL HEAD W/OUT BACKPLATE	11/2	241/6	TS-B/TS-BP	TF-SIGL-3333-SYM
		TRAFFIC SIGNAL HEAD W/ BACKPLATE	11/2	241/6	TS+B/TS+BP	TF-SIGL-3333-SYM
		PEDESTRIAN PUSH BUTTON	11/2	241/6	TPEDB/TPEDBP	TF-SIGL-3333-SYM
		PEDESTRIAN SIGNAL HEAD	11/2	241/6	TPEDS/TPEDSP	TF-SIGL-3333-SYM
		BOXES/VAULT & CONTROLLER				
		JUNCTION BOX TYPE 1 / TYPE 2 / TYPE 3 / TYPE 7	11/2	241/6	TJB1/TJB1P / TJB2/TJB2P / TJB3/TJB3P / TJB7/TJB7P	TF-STCR-3333-SYM
CV	CV	COMM MH/VAULT (ALSO IN GAS/PWR/TEL/CABLE/TV)	11/1	30/13	CMVLT/CMVLTP	TL-STCR-3333-SYM
PB	PB	PULL BOX	11/2	241/6	TPB/TPBP	TF-STCR-3333-SYM
		CONTROLLER	11/2	241/6	TC/TCP	TF-STCR-3333-SYM
		SERVICE CABINET	11/2	241/6	TSC/TSCP	TF-STCR-3333-SYM
		DETECTORS				
		DETECTOR LOOP TYPE I	11/2	241/6	TD1/TD1P	TF-SIGL-3333-SYM
		DETECTOR LOOP TYPE 2	11/2	241/6	TD2/TD2P	TF-SIGL-3333-SYM
		DETECTOR LOOP TYPE 3	11/2	241/6	TD3/TD3P	TF-SIGL-3333-SYM
		DETECTOR LOOP TYPE 4	11/2	241/6	TD4/TD4P	TF-SIGL-3333-SYM
C	C	VIDEO CAMERA	11/2	241/6	TVC/TVCP	TF-SIGL-3333-SYM
		TRAFFIC SIGNS				
		TRAFFIC SIGN(S)	11/2	241/6	TSGN/TSGNP	TF-SIGN-3333-SYM
		TRAFFIC SIGN(S) DOUBLE POST	11/2	241/6	TSD/TSDP	TF-SIGN-3333-SYM
		STREET NAME ASSEMBLY	11/2	241/6	TSNA/TSNAP	TF-SIGN-3333-SYM
		BRIDGE	11/2	241/6	TSBR/TSBRP	TF-SIGN-3333-SYM
		CANTILEVERED	11/2	241/6	TSCL/TSCLP	TF-SIGN-3333-SYM
		EMERGENCY VEHICLE INDICATOR LIGHTS				
		FLASHING WARNING SYSTEM	11/2	241/6	TFWS/TFWSP	TF-SIGL-3333-SYM
		INDICATOR LIGHTS	11/2	241/6	TIL/TILP	TF-SIGL-3333-SYM
		EVP SENSOR	11/2	241/6	TEVP/TEVPP	TF-SIGL-3333-SYM
		RAILROAD CROSSING				
		R/R CROSSING GATE	11/2	241/6	TRXG/TRXGP	TF-SIGL-3333-SYM
		R/R CROSSING SIGNAL	11/2	241/6	TRXS/TRXSP	TF-SIGL-3333-SYM
		NOTES				
		POLE NOTE	11/2	241/6	TPNP	TEXT-TF
		WIRE NOTE	11/2	241/6	TWNP	TEXT-TF
		CONSTRUCTION NOTE	11/2	241/6	TCNP	TEXT-TF

USE EXST/PROP = 3333

CURRENT CITY DESIGN STANDARDS REVISED JUN,2006

BY	DATES
DRAWN: MDH	08/06
CHECKED:	
APPROVED:	

THE CITY OF SPOKANE

CITY OF SPOKANE, WASHINGTON

DEPARTMENT OF ENGINEERING SERVICES

808 WEST SPOKANE FALLS BLVD.
SPOKANE, WASHINGTON 99201-3343
(509) 625-6300

CITY OF SPOKANE DESIGN STANDARDS

TRAFFIC: PAVEMENT MARKINGS & SIGNALIZATION SYMBOLS

LINETYPES

NOTE: LINETYPES ARE PRESET IN CITY PROTOTYPE DRAWING & PLOTTING FILES. COLOR(S) MAY BE ADJUSTED BY USER AS LONG AS LINEWEIGHT & SHADE INFORMATION IS HELD. PLEASE SEE REFERENCE NUMBER TABLE FOR COMPARABLE PRESET COLOR SELECTIONS.

LINETYPE	DESCRIPTION (ABBR)	REF.#	COLOR	LINETYPE	LAYER
	CHANNELIZATION				
	ROAD-EDGE OF STRIPE (EX)	1	UD	CONTINUOUS	TF-CHRD-EXST-LIN
	ROAD-EDGE OF STRIPE (PROP)	3	UD	CONTINUOUS	TF-CHRD-PROP-LIN
	PAINTED LINES/CHANNEL. (EX)	1	UD	CONTINUOUS	TF-CHAN-EXST-LIN
	PAINTED LINES/CHANNEL. (PROP)	3	UD	CONTINUOUS	TF-CHAN-PROP-LIN
	SHOULDER (EX)	1	UD	CONTINUOUS	TF-CHSH-333A-LIN
	SHOULDER (PROP)	3	UD	CONTINUOUS	TF-CHSH-PROP-LIN
	SURFACE FEATURES:				
	ALLEY-EDGE (EX)	1	UD	XACP	SF-ALLY-EXST-LIN
	ALLEY-EDGE (PROP)	2	UD	CONTINUOUS	SF-ALLY-PROP-LIN
	BUILDING LINE (EX)	1	UD	EXBUILD	SF-BLDG-EXST-LIN
	BUILDING LINE (PROP)	2	UD	CONTINUOUS	SF-BLDG-PROP-LIN
	ROADWAY CROWN (EX)	1	UD	CRN	SF-CRWN-EXST-LIN
	ROADWAY CROWN (PROP)	2	UD	CRN	SF-CRWN-PROP-LIN
	ASPHALT-EDGE (EX)	1	UD	XACP	SF-ASPH-333A-LIN
	ASPHALT-EDGE (PROP)	2	UD	CONTINUOUS	SF-ASPH-PROP-LIN
	GRAVEL/DIRT-EDGE (EX)	1	UD	DASH	SF-GRAV-333A-LIN
	GRAVEL/DIRT-EDGE (PROP)	2	UD	CONTINUOUS	SF-GRAV-PROP-LIN
	CONCRETE-EDGE (EX)	1	UD	DASH	SF-CONC-333A-LIN
	CONCRETE-EDGE (PROP)	2	UD	CONTINUOUS	SF-CONC-PROP-LIN
	CURB (EX)	6	15	MEANDER	SF-CURB-333B-LIN
	CURB (PROP)	2	UD	CONTINUOUS	SF-CURB-PROP-LIN
	SIDEWALK (EX)	6	15	MEANDER	SF-WALK-EXST-LIN
	SIDEWALK (PROP)	2	UD	CONTINUOUS	SF-WALK-PROP-LIN
	GUTTER (EX)	6	15	MEANDER	SF-GUTR-EXST-LIN
	UNIMPROVED ROADWAY (EX)	2	UD	CONTINUOUS	SF-UIMP-333A-LIN
	LITE BIT (EX)	2	UD	CONTINUOUS	SF-LBIT-333A-LIN
	TRAIL (EX)	1	UD	SDASH	SF-TRAL-EXST-LIN
	CREEK/DITCH CENTERLINE (EX)	1	UD	DITCH	SF-222A-EXST-LIN
	CREEK/DITCH CENTERLINE (PROP)	2	UD	DITCH	SF-222A-PROP-LIN
	RIVERBANK/SHORELINE	3	UD	CONTINUOUS	SF-222B-EXST-LIN
	FIELD LINE (EX)	1	UD	SDASH	SF-FELD-EXST-LIN
	FENCE (EX)	11	115	XFEN	SF-FENC-EXST-LIN
	FENCE (PROP)	2	UD	FEN	SF-FENC-PROP-LIN
	GUARDRAIL (EX)	1	UD	*EGR1	SF-GURD-EXST-LIN
	GUARDRAIL (PROP)	3	UD	*PGR1	SF-GURD-PROP-LIN
	LAKE/POND	2	UD	LAKE	SF-LAKE-EXST-LIN
	SWAMP/WETLAND PERIMETER	2	UD	MARSH	SF-WETL-EXST-LIN
	RAILROAD	1	UD	*R1R1	SF-RLRD-EXST-LIN
	WALLS (FROM FIELD NOTES)	11	115	DASHED2	SF-WALL-333C-LIN
	RETAINING WALL (EX)	11	115	*ERW1	SF-WALL-EXST-LIN
	RETAINING WALL (PROP)	2	UD	*PRW1	SF-WALL-PROP-LIN
	TRAILER/MOBILE HOME (EX)	1	UD	EXBUILD	SF-BLDG-EXST-LIN
	DECK LINE	1	UD	CONTINUOUS	SF-DECK-EXST-LIN
	DOCK (EX)	1	UD	CONTINUOUS	SF-DOCK-EXST-LIN
	MAIL BOX (LINE)	1	UD	CONTINUOUS	SF-MAIL-EXST-LIN
	PIPE/NOT DRAINAGE (EX)	1	UD	SDASH	SF-PIPE-EXST-LIN
	PIPE/NOT DRAINAGE (PROP)	2	UD	CONTINUOUS	SF-PIPE-PROP-LIN
	BRIDGE (EX)	1	UD	EXBUILD	SF-BRDG-EXST-LIN
	BRIDGE (PROP)	2	UD	CONTINUOUS	SF-BRDG-PROP-LIN
	GENERAL STRUCT. (EX)	1	UD	CONTINUOUS	SF-MISC-EXST-LIN
	GENERAL STRUCT. (PROP)	2	UD	CONTINUOUS	SF-MISC-PROP-LIN
	PARKING METER (LINE)	1	UD	CONTINUOUS	SF-SIGN-EXST-LIN
	TANK LINE (EX)	1	UD	CONTINUOUS	SF-TANK-EXST-LIN
	VAULT LINE (EX)	1	UD	EXBUILD	SF-VALT-EXST-LIN
	VEGETATION LINE/HEDGE	1	UD	CONTINUOUS	SF-VEGE-EXST-LIN
CUT	CATCH LINE-CUT (PROP)	2	UD	*CONTINUOUS	SF-CTLC-EXST-LIN
FILL	CATCH LINE-FILL (PROP)	2	UD	*CONTINUOUS	SF-CTLF-EXST-LIN

(UD DENOTES "USER DEFINED")

CITY OF SPOKANE LINETYPES:

ALL LINETYPES LINES SHOWN ARE INCLUDED IN THE CITY OF SPOKANE LINETYPE FILE, COS_UTILITY_VER1.LIN. THE LINETYPE FILE IS A COMBINATION OF THE CCS & CITY LINETYPE FILES. SPECIAL FILE TYPES (INDICATED BY *) CAN BE CREATED THRU SPECIAL ROUTINES. PLEASE CONTACT CITY OF SPOKANE FOR INFORMATION.

* – SPECIAL LINETYPE–CREATED THROUGH LISP ROUTINE/& LINETYPE

** – WHEN CREATING TEXT, PLACE TEXT & BREAK LINE AT INTERVALS SUFFICIENT FOR CLARITY

LINETYPE LAYER LEGEND:

2ND COLUMN
-222A : USE CREK or DTCH
-222B : USE RIVR or SHOR

3RD COLUMN
-333A : USE EDGE or EXST
-333B : USE CTOP, CBOT, ITOP, IBOT or EXST
-333C : USE WTOP, WBOT or EXST

LINETYPES

NOTE: LINETYPES ARE PRESET IN CITY PROTOTYPE DRAWING & PLOTTING FILES. COLOR(S) MAY BE ADJUSTED BY USER AS LONG AS LINEWEIGHT & SHADE INFORMATION IS HELD. PLEASE SEE REFERENCE NUMBER TABLE FOR COMPARABLE PRESET COLOR SELECTIONS.

LINETYPE	DESCRIPTION (ABBR)	REF.#	COLOR	LINETYPE	LAYER
	SURVEY:				
	CENTERLINE (PROP) COUNTY	4	4	CONTINUOUS	SV-CNTL-PROP-LIN
	CENTERLINE (PROP) CITY	2	12	CENTER	SV-CTRL-PROP-LIN
	BREAKLINE (EX)	1	UD	CONTINUOUS	SV-BRKL-EXST-LIN
	CONTOUR (DEPRESSION)	1	UD	*DEC1	SV-CONT-DEPR-LIN
	CONTOUR (EX)	1	UD	CON	SV-CONT-EXST-LIN
	CONTOUR (INDEX)	2	UD	CON	SV-CONT-INDX-LIN
	CONTOUR (PROPOSED)	2	UD	CONTINUOUS	SV-CONT-PROP-LIN
	DONATION LAND CLAIM (EX)	1	UD	DLC	SV-DLCM-EXST-LIN
	DONATION LAND CLAIM (PROP)	3	UD	DLC	SV-DLCM-PROP-LIN
	EASEMENT (PERMANENT)	2	UD	CONTINUOUS	SV-ESMT-PERM-LIN
	EASEMENT (TEMPORARY)	3	UD	TEMPESMT	SV-ESMT-TEMP-LIN
	MEANDER LINE	1	UD	MEANDER	SV-MEAN-EXST-LIN
	PROPERTY LINE (EX)	6	115	PROPERT	SV-PROP-EXST-LIN
	PROPERTY LINE (PROP)	3	UD	CONTINUOUS	SV-PROP-PROP-LIN
	RANGE/TOWNSHIP LINE	4	UD	CONTINUOUS	SV-222C-EXST-LIN
	RESERVATION/PARK/FOREST (EX)	2	UD	PARK	SV-PARK-EXST-LIN
	RESERVATION/PARK/FOREST (PRO)	4	UD	PARK	SV-PARK-PROP-LIN
	RIGHT-OF-WAY (EX)	2	UD	EXROW	SV-ROFW-EXST-LIN
	RIGHT-OF-WAY (PROP)	3	UD	CONTINUOUS	SV-ROFW-PROP-LIN
	RIGHT-OF-WAY (LIMITED ACCESS)	1	UD	*ROWL1	SV-LROW-EXST-LIN
	RIGHT-OF-WAY (LIMITED ACCESS)	3	UD	*ROWL1	SV-LROW-PROP-LIN
	SECTION LINE	3	UD	SECT	SV-SECT-EXST-LIN
	QUARTER SECTION LINE	2	UD	QTRSECT	SV-QSCT-EXST-LIN
	SIXTEENTH SECTION LINE	1	UD	16THSECT	SV-16ST-EXST-LIN
	STATE/COUNTY/CORPORATE LIMIT	2	UD	STATE	SV-222D-EXST-LIN
	STATE/COUNTY/CORPORATE LIMIT	4	UD	STATE (PLINE .03"WIDE) 222C-USE RANG/TWNS 222D-USE STAT/CNTY/CITY	SV-222D-PROP-LIN
	SURVEY CENTERLINE	1	UD	EXCNTL	SV-CLSV-EXST-LIN
	PROPERTY OWNERSHIP	4	UD	OWNDOT	SV-OWNS-EXST-LIN
	RAILROAD RIGHT OF WAY	2	UD	RRW	SV-RWRR-EXST-LIN
	CONSTRUCTION PERMIT	3	UD	CONTINUOUS	SV-CPMT-PROP-LIN

LINETYPE DESCRIPTOR EXISTING	PROPOSED	DESCRIPTION (ABBR)	REF.# EXST/PROP	COLOR EXST/PROP	LINETYPE	LAYER
		UTILITIES :				
ATV	ATV	CABLE TELEVISION (AERIAL)	11/1	30/13	ATV	TV-ALIN-3333-LIN
TV	TV	CABLE TELEVISION (BURIED)	11/1	30/13	TV	TV-BLIN-3333-LIN
ATF	ATF	TRAFFIC (AERIAL)	11/2	241/6	ATF	TF-ALIN-3333-LIN
TF	TF	TRAFFIC (BURIED)	11/2	241/6	TF	TF-BLIN-3333-LIN
COM	COM	COMMUNICATION/CONDUIT (MULTI-USE) (BURIED)	11/1	30/13	T	TL-BLIN-3333-LIN
HPG	HPG	HIGH PRESSURE GAS (INCL. SIZE, ie. 8" HPG)	11/2	51/2	G	GS-PLIN-3333-LIN
G	G	GAS (INCL. SIZE, ie. 2" G)	11/2	51/2	G	GS-PLIN-3333-LIN
O	O	OIL (INCL. SIZE, ie. 8" O)	11/2	51/2	O	OL-PLIN-3333-LIN
AP	AP	POWER (AERIAL)	11/1	240/1	AP	PO-ALIN-3333-LIN
P	P	POWER (BURIED)	11/1	240/1	P	PO-BLIN-3333-LIN
SA	SA	SANITARY SEWER (INCL. SIZE, ie. 8" SA)	11/2	80/45	SA	SA-222F-3333-LIN
FM	FM	FORCE MAIN (INCL. SIZE, ie. 8" FM)	11/2	80/45	FM	SA-PLIN-3333-LIN
STE	STE	STEAM (INCL. SIZE, ie. 8" STE)	11/2	51/2	STE	ST-PLIN-3333-LIN
SD	SD	STORM DRAINAGE (INCL. SIZE, ie. 8" SD)	11/2	61/82	SD	SD-222F-3333-LIN
AT	AT	TELEPHONE (AERIAL)	11/1	30/13	AT	TL-ALIN-3333-LIN
T	T	TELEPHONE (BURIED)	11/1	30/13	T	TL-BLIN-3333-LIN
FO	FO	FIBER OPTIC (BURIED)	11/1	30/13	FO	TL-BLIN-3333-LIN
W	W	WATER (INCL. SIZE, ie. 8" W)	11/1	150/5	WA	WA-222F-3333-LIN

TYPES OF PIPE (OPTIONAL)
STL – STEEL
CNC – CONCRETE
PVC – POLYVINYL CHLORIDE
DI – DUCTILE IRON
AC – ASBESTOS CONCRETE
AL – ALUMINUM

USE GLIN/PLIN = – 222F
USE EXST/PROP – 3333

ALIN – AERIAL LINE
BLIN – BURIED CONDUIT
GLIN – GRAVITY LINE
PLIN – PRESSURE LINE

PLATTING & DIMENSION TEXT

(UD DENOTES "USER DEFINED")

ITEM	TEXT HEIGHT	REF. #	COLOR
ADDITION TEXT	10	2	UD
BLOCK NAME	10	2	UD
STREET NAME	8	2	UD
LOT NUMBER	6	1	UD
STREET DIMENSIONS	4	1	UD
ALLEY DIMENSIONS	4	1	UD
LOT DIMENSIONS	5	1	UD
CENTERLINE STATIONS	3	1	UD
KEYNOTES	5	1	UD
GENERAL NOTES	5	2	UD

CURRENT CITY DESIGN STANDARDS REVISED JUN,2006

BY		DATES
DRAWN:	RDC/RJS	08/06
CHECKED:	RJS/DGB	09/06
APPROVED:		

THE CITY OF SPOKANE

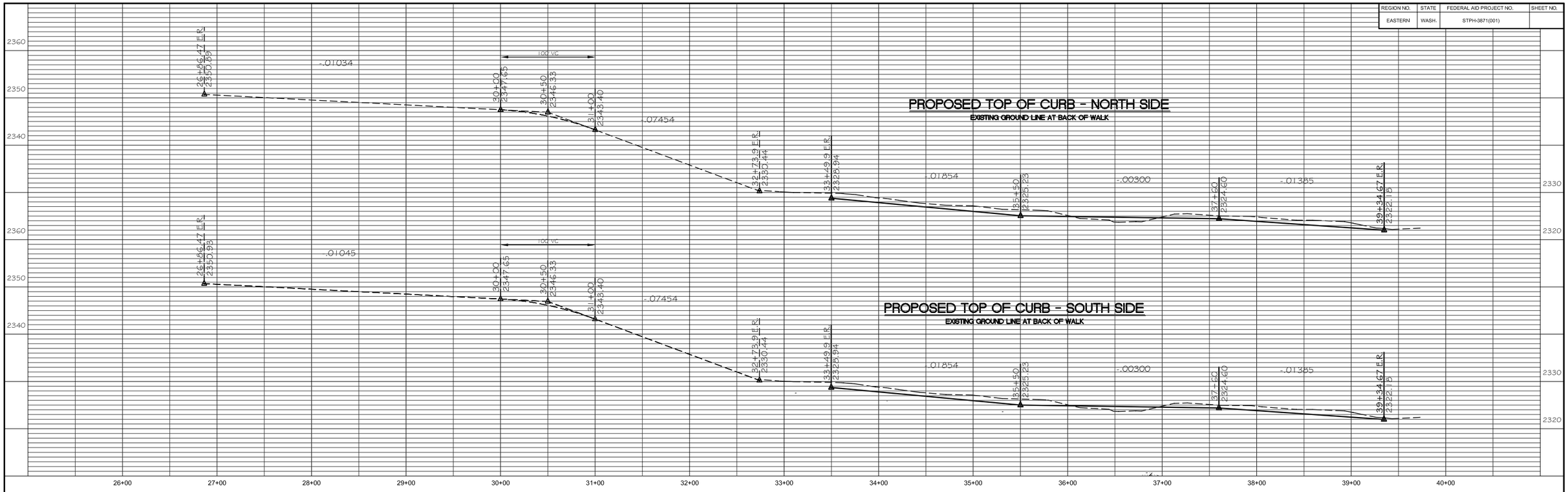
CITY OF SPOKANE, WASHINGTON
DEPARTMENT OF ENGINEERING SERVICES
808 WEST SPOKANE FALLS BLVD.
SPOKANE, WASHINGTON 99201-3343
(509) 625-6300

CITY OF SPOKANE DESIGN STANDARDS

LINETYPES & TEXT

APPENDIX D - Sample Plans

REGION NO.	STATE	FEDERAL AID PROJECT NO.	SHEET NO.
EASTERN	WASH.	STPH-3871(001)	

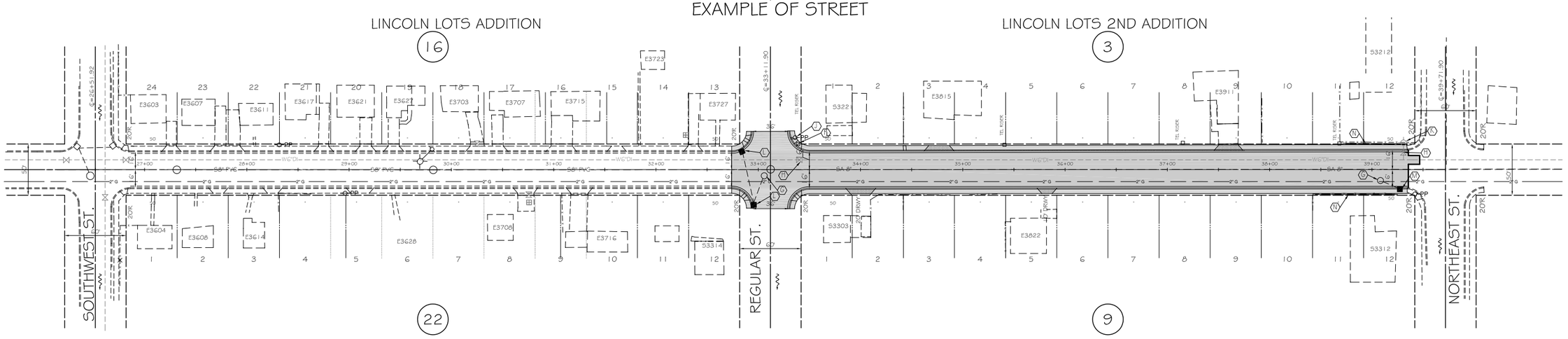


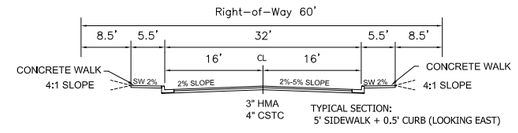
ELEVATIONS ARE TO NAVD88 DATUM

AS-BUILT PROJECT

PROPOSED PROJECT

EXAMPLE OF STREET





Typical Section to remain on as-built

PROJECT LEGEND

- (G) ADJUST MH OR CB TO GRADE
- (H) ADJUST VALVE BOX TO GRADE
- (J) RELOCATE UTILITY POLE BY OTHERS
- (K) RELOCATE FIRE HYDRANT BY OTHERS
- (L) CONSTRUCT C.B. TYPE 1
- (M) CONSTRUCT C.B. TYPE 2
- (N) CONSTRUCT CURB WALL
- (P) RELOCATE TEL. RISER BY OTHERS

The Engineer's Seal was removed during the As-Built process.
The information of record is as follows:

City Project Number	Name of Engineer of Record	State Engineering License Number	Engineer's Approval Date
77345	L.I. Censed	#005041	01/21/99

S-1
03 of 03

DATE	BY	PROJ	DESCRIPTION
REVISIONS			

DATE	BY	PROJ	E.F.N. - U.S.N.	FROM	TO	COUNCIL ACCEPT DATE
AS BUILT						

FROM	TO	ORD. NO.	DATE	FILE NO.
GRADE ORDINANCE LIST				

NAVD88 = (OLD CDM ELEV.) - (1.3.13)

AS OF JANUARY, 2000 USE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88)

BENCH MARK LOCATION: FIRST LINE DESCRIPTION / SECOND LINE DESCRIPTION / THIRD LINE DESCRIPTION

NAVD88 ELEV. ELEVATION

CDM NO. CDM #

NAVD88 DATUM

BAR IS ONE INCH ON ORIGINAL DRAWING

IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE

HORIZONTAL PLAN/PROFILE 1" = 50'

VERTICAL PROFILE ONLY 1" = 10'

CURRENT CITY/COUNTY DESIGN STANDARDS ADOPTED FEB.1995

	BY	DATES
DRAWN:	DGB	05/00
REVISED:	RDC	09/06
CHECKED:	RJS	09/06
APPROVED:	RJS	09/06

CITY OF SPOKANE, WASHINGTON
DEPARTMENT OF ENGINEERING SERVICES
808 WEST SPOKANE FALLS BLVD.
SPOKANE, WASHINGTON 99201-3343
(509) 625-6300

PROJECT NAME: EXAMPLE AVENUE

SEGMENT LIMITS: EXAMPLE AVENUE
SOUTHWEST ST. to NORTHEAST ST.

PROJECT LIMITS: SOUTHWEST TO NORTHEAST

TYPE OF IMPROVEMENT: STREET

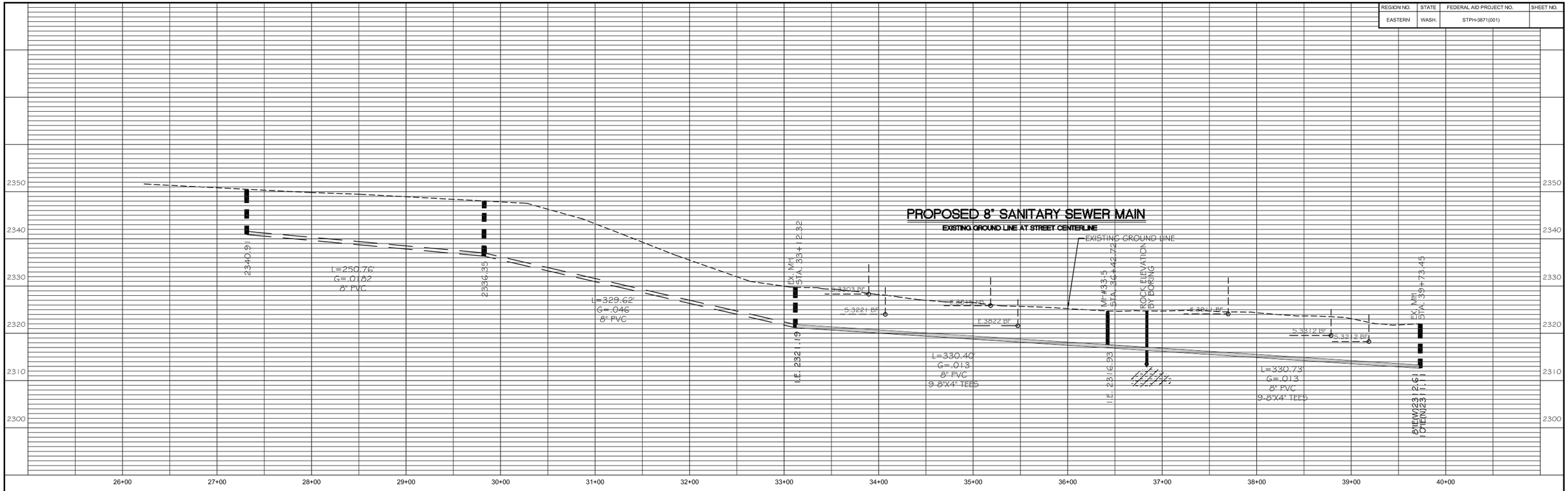
CITY PROJECT NUMBER: 2006000

CITY PLAN NUMBER: EXMPL V(4)4 5-25-43

EFN: 123450 IMA.DWG

CALL BEFORE YOU DIG 1-800-424-5555

REGION NO.	STATE	FEDERAL AID PROJECT NO.	SHEET NO.
EASTERN	WASH.	STPH-3871(001)	

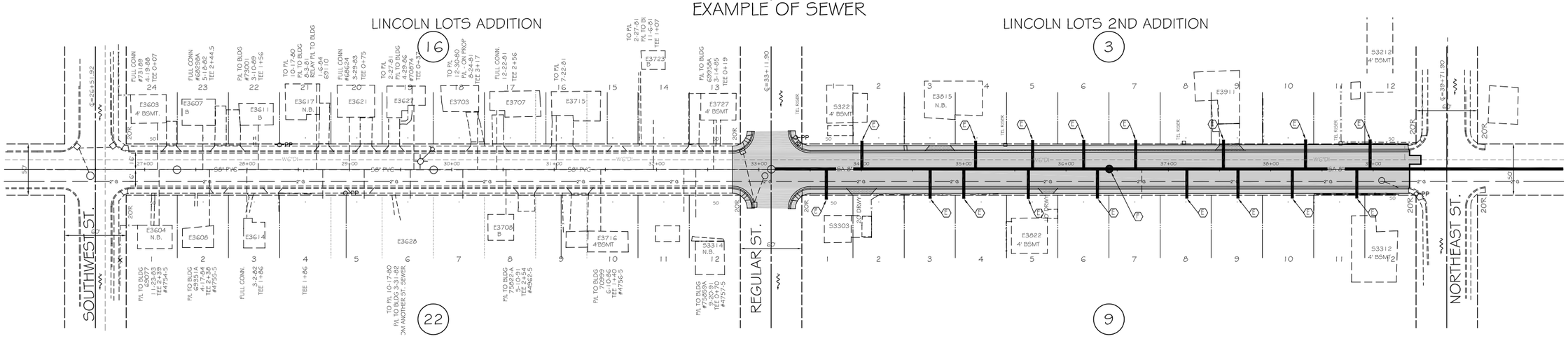


ELEVATIONS ARE TO NAVD88 DATUM

AS-BUILT PROJECT

PROPOSED PROJECT

EXAMPLE OF SEWER



PROJECT LEGEND

(E) INSTALL SIDE SEWER TO 5 FT. BEYOND BACK OF WALK

(P) CONSTRUCT SANITARY MANHOLE

SA-1
02 of 03

The Engineer's Seal was removed during the As-Built process.
The information of record is as follows:

City Project Number	Name of Engineer of Record	State Engineering License Number	Engineer's Approval Date
77345	L.I. Censed	#005041	01/21/99

DATE	BY	PROJ	DESCRIPTION
REVISIONS			

DATE	BY	PROJ	E.F.N., U.S.N.	FROM	TO	COUNCIL ACCEPT DATE
AS BUILT						

FROM	TO	ORD. NO.	DATE	FILE NO.
GRADE ORDINANCE LIST				

NAVD88 = (OLD CDM ELEV.) - (1.3.13)

AS OF JANUARY, 2000 USE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88)

BENCH MARK LOCATION

FIRST LINE DESCRIPTION
SECOND LINE DESCRIPTION
THIRD LINE DESCRIPTION

NAVD88 ELEV. ELEVATION

CDM NO. CDM #

BAR IS ONE INCH ON ORIGINAL DRAWING

IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

NAVD88 DATUM

HORIZONTAL PLAN/PROFILE 1" = 50'

VERTICAL PROFILE ONLY 1" = 10'

SCALE

CURRENT CITY/COUNTY DESIGN STANDARDS ADOPTED FEB. 1995

	BY	DATES
DRAWN:	DGB	05/00
REVISED:	RDC	09/06
CHECKED:	RJS	09/06
APPROVED:	RJS	09/06

CITY OF SPOKANE, WASHINGTON
DEPARTMENT OF ENGINEERING SERVICES
808 WEST SPOKANE FALLS BLVD.
SPOKANE, WASHINGTON 99201-3343
(509) 625-6300

PROJECT NAME: EXAMPLE AVENUE

SEGMENT LIMITS: EXAMPLE AVENUE
SOUTHWEST ST. to NORTHEAST ST.

PROJECT LIMITS: SOUTHWEST TO NORTHEAST

TYPE OF IMPROVEMENT: SEWER

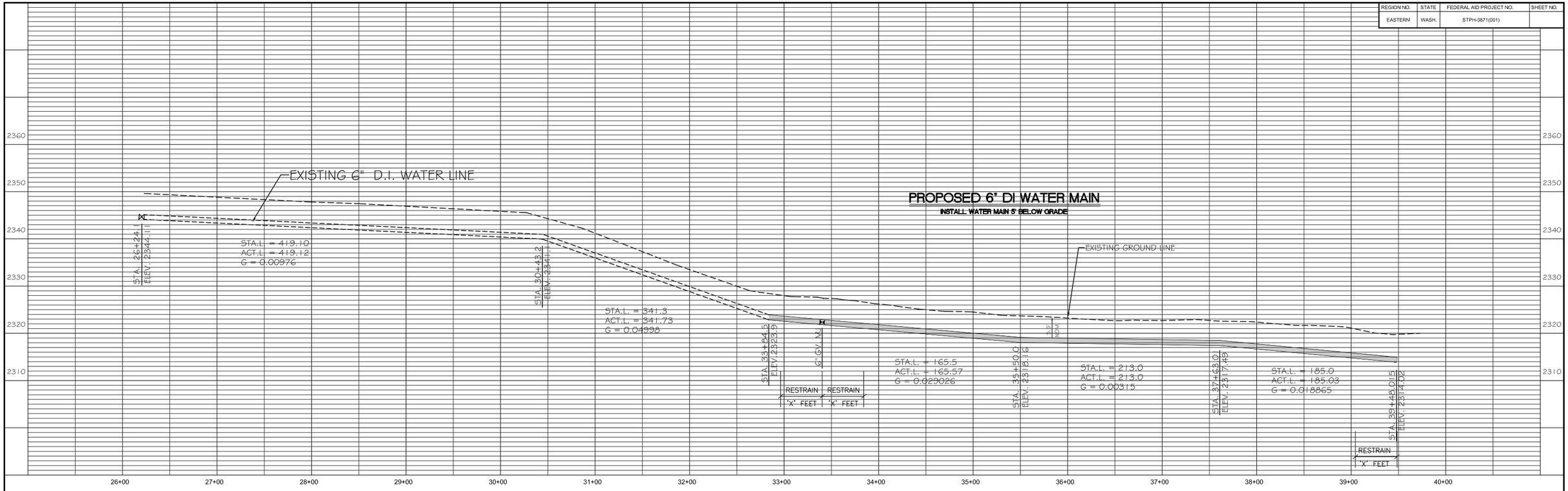
CITY PROJECT NUMBER: 2006000

CITY PLAN NUMBER: EXMPL V(4)4 5-25-43

EFN: 123450 MA.DWG

CALL BEFORE YOU DIG 1-800-424-5555

REGION NO.	STATE	FEDERAL AID PROJECT NO.	SHEET NO.
EASTERN	WASH.	STPH-3871(001)	

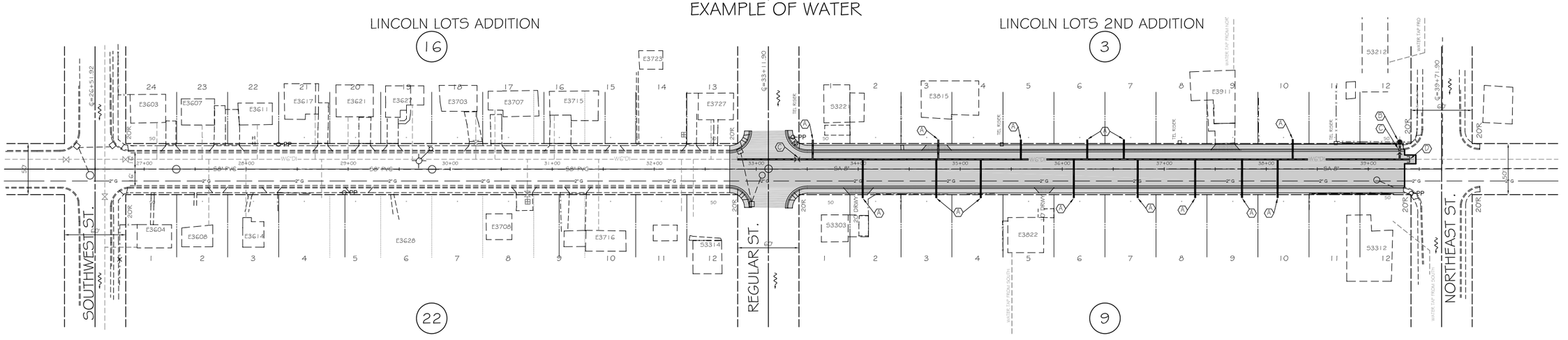


ELEVATIONS ARE TO NAVD88 DATUM

AS-BUILT PROJECT

PROPOSED PROJECT

EXAMPLE OF WATER



PROJECT LEGEND

- (A) CONSTRUCT WATER TAP - BY CITY FORCES
- (B) INSTALL FIRE HYDRANT
- (C) INSTALL GATE VALVE
- (D) INSTALL DIMJ CAP

WA-1
01 of 03

The Engineer's Seal was removed during the As-Built process.
The information of record is as follows:

City Project Number	Name of Engineer of Record	State Engineering License Number	Engineer's Approval Date
77345	L.I. Censed	#005041	01/21/99

DATE	BY	PROJ	DESCRIPTION

REVISIONS

DATE	BY	PROJ	E.F.N. - U.S.N.	FROM	TO	COUNCIL ACCEPT DATE

AS BUILT

FROM	TO	ORD. NO.	DATE	FILE NO.

GRADE ORDINANCE LIST

NAVD88 = (OLD CGM ELEV.) - (1.3.13)

AS OF JANUARY, 2000 USE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88)

BENCH MARK LOCATION

FIRST LINE DESCRIPTION
SECOND LINE DESCRIPTION
THIRD LINE DESCRIPTION

NAVD88 ELEV. ELEVATION

CBM NO. CBM #

NAVD88 DATUM

BAR IS ONE INCH ON ORIGINAL DRAWING

IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

HORIZONTAL PLAN/PROFILE 1" = 50'

VERTICAL PROFILE ONLY 1" = 10'

SCALE

CURRENT CITY/COUNTY DESIGN STANDARDS ADOPTED FEB.1995

	BY	DATES
DRAWN:	DGB	05/00
REVISED:	RDC	09/06
CHECKED:	RJS	09/06
APPROVED:	RJS	09/06

CITY OF SPOKANE

CITY OF SPOKANE, WASHINGTON
DEPARTMENT OF ENGINEERING SERVICES
808 WEST SPOKANE FALLS BLVD.
SPOKANE, WASHINGTON 99201-3343
(509) 625-6300

PROJECT NAME: EXAMPLE AVENUE

SEGMENT LIMITS:
EXAMPLE AVENUE
SOUTHWEST ST. to NORTHEAST ST.

PROJECT LIMITS: SOUTHWEST TO NORTHEAST

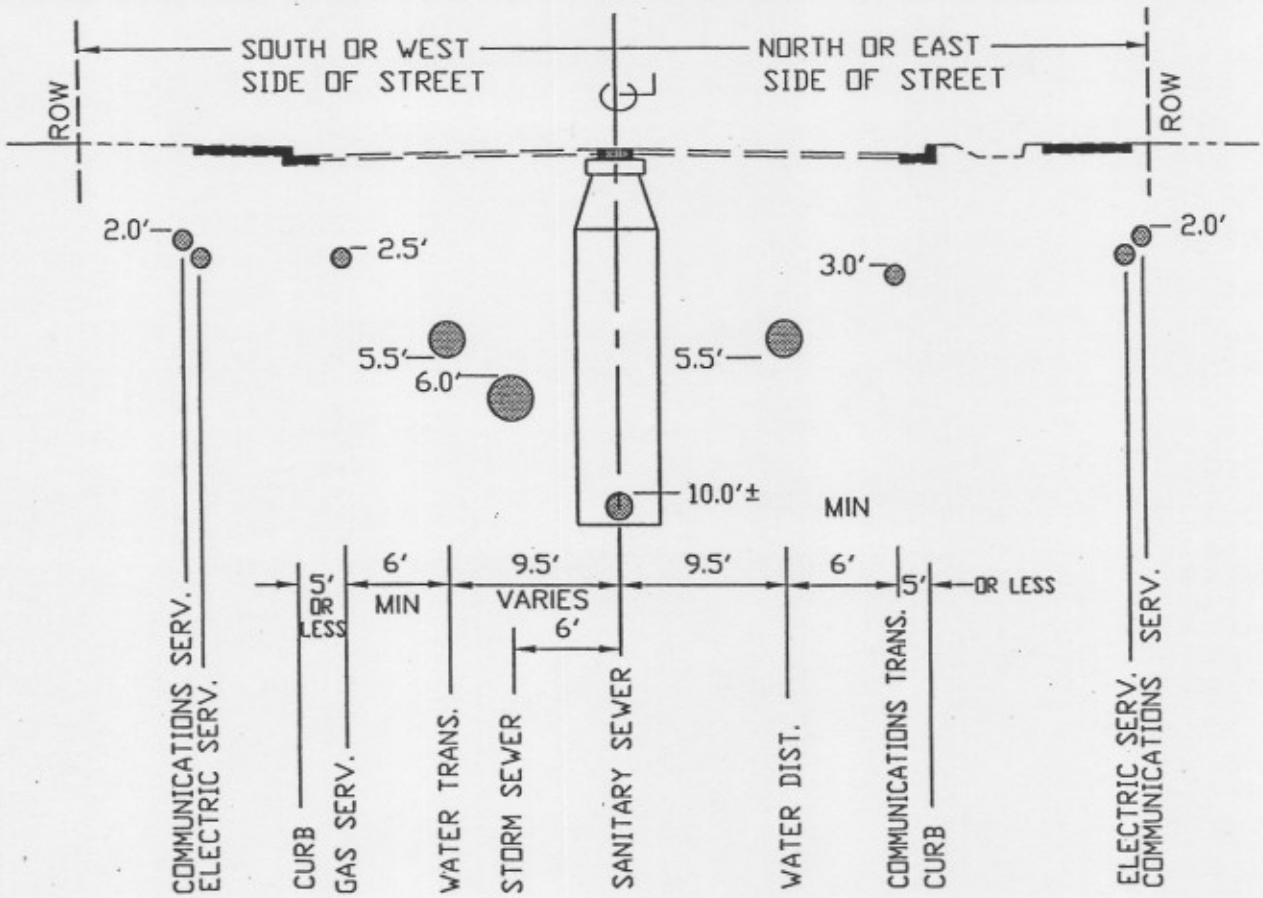
TYPE OF IMPROVEMENT: WATER

CITY PROJECT NUMBER	CITY PLAN NUMBER
2006000	EXMPL V(4)4 5-25-43

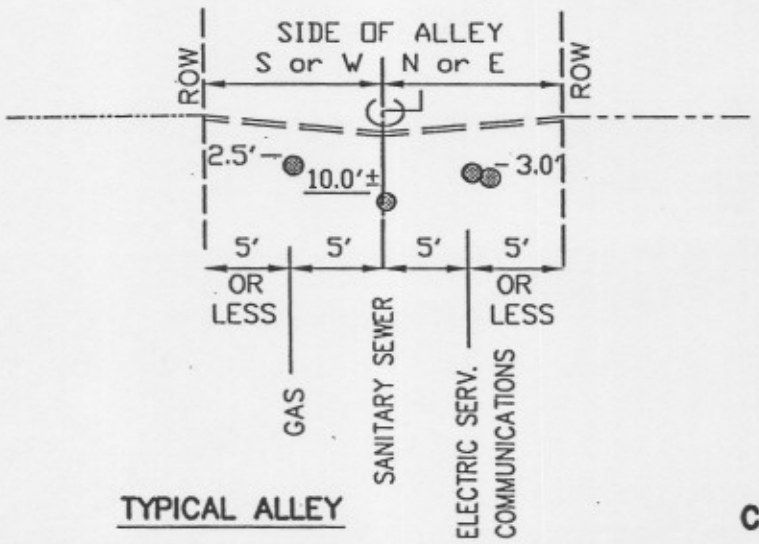
EFN: 123450 MA.DWG

CALL BEFORE YOU DIG 1-800-424-5555

APPENDIX E - Underground Utility Location



TYPICAL STREET



TYPICAL ALLEY

NOTES:
1. LOCATIONS ARE STANDARD FOR UNDERGROUND INSTALLATIONS AND VARIATION SHALL REQUIRE PRE-APPROVAL OF THE CITY ENGINEER.

2. ALL LOCATIONS & DEPTHS OF EXISTING UTILITIES SHOULD BE VERIFIED BY RESPECTIVE OWNERS PRIOR TO NEW INSTALLATIONS.

CALL BEFORE YOU DIG 456-8000

APPROVED BY

Katy Allen
DIRECTOR, ENGINEERING SERVICES — KATY D. ALLEN, P.E.

Jim R. Smith
PRINCIPAL ENGINEER, DESIGN — JIM R. SMITH, P.E.

ADOPTED: 2/86
REVISED: 12/98
SUPERSEDES: 2/86
SCALE: NOT TO SCALE
DWG./REV BY: DGB

UNDERGROUND UTILITY LOCATION

ENGINEERING SERVICES
CITY OF SPOKANE, WASHINGTON

STANDARD PLAN No. W-109A

APPENDIX F - Other Policies and Ordinances

Pavement Cut Policy

Recommended Street Trees

AGENDA SHEET FOR COUNCIL MEETING OF: April 4, 2005

RECEIVED
MAR 24 2005
CITY CLERK'S OFFICE
SPOKANE, WA

Submitting Dept.	Contact Person	Phone No.
Engineering Services	Tom Arnold	6307

LGL 2005-0016

ADMINISTRATIVE SESSION
- o Contract
- o Report
- o Claims

LEGISLATIVE SESSION
- o Emergency Ord
- ● Resolution
- o Final Reading Ord
- o First Reading Ord
- o Special Consideration
- o Hearing

CITY PRIORITY
- o Communications
- o Economic Development
- o Growth Management
- o Human Services
- o Neighborhoods
- o Public Safety
- o Quality Service Delivery
- o Racial Equity/Cultural Diversity
- ● Rebuild/Maintain Infrastructure

STANDING COMMITTEES (Date of Notification)
- o Finance _____
- o Neighborhoods _____
- o Planning/Community & Econ Dev _____
- o Public Safety _____
- o Public Works 2-28-05

CLERK'S FILE ~~PRO~~
RENEWS
CROSS REF
ENG
BID
REQUISITION

Neighborhood/Commission/Committee Notified:

Action Taken:

AGENDA WORDING: A Resolution adopting a new regional pavement cut policy for the City of Spokane.

BACKGROUND: (Attach additional sheet if necessary) City of Spokane and Spokane County staff have been working together to develop a new regional policy to identify the proper and consistent application of pavement cut repairs and warranty requirements. The purpose of this policy is to preserve the life of streets by minimizing the impact of utility cuts on the lifecycle of our roads, to provide an improved driving surface and a more pleasing appearance to our roadway surfaces that have undergone utility work. The policy has been developed through coordination with public and private utilities. The policy will be reviewed on an annual basis for minor changes that may need to be made.

RECOMMENDATION:
Adopt resolution

Fiscal Impact o N/A	**Budget Account:** o N/A
o Expenditure: $	#
o Revenue: $	#
o Budget Neutral	

ATTACHMENTS:
Include in Packets: Resolution, Pavement Cut Policy

SIGNATURES:

Director, Engineering Services

Director, Public Works & Utilities

Finance

Legal

Deputy Mayor

Council President

DISTRIBUTION: Engineering Services, S Decker Neighborhood Services

\agenda\Pavement Cut Resolution agenda.doc

COUNCIL ACTION:

ADOPTED BY
SPOKANE CITY COUNCIL:
April 4, 2005
CITY CLERK

RES 2005-0031

RESOLUTION NO. 2005-0031

A resolution adopting a new regional pavement cut policy for the City of Spokane.

WHEREAS, the City in 1999 adopted an utility / pavement cut policy. In 2001 this was revised administratively and is presently referenced in the City of Spokane Design Standards – Department of Engineering Services (Appendix G); and

WHEREAS, the purpose of this policy is to preserve and protect the life of streets by minimizing the impact of utility cuts on the lifecycle of the roads, to provide for an improved driving surface and a more pleasing appearance to the roadways that have undergone utility work; and to improve coordination of utility excavations and the street repairs; and

WHEREAS, the City of Spokane and Spokane County staff have been working together to develop a new regional policy to identify the proper and consistent application of pavement cut repairs and warranty requirements; and

WHEREAS, both City of Spokane and Spokane County staff have coordinated and developed the new policy through a deliberative and thorough stakeholder process including both public and private utilities; and

WHEREAS, the City of Spokane Valley participated in the development and will review the policy for adoption separately; and

WHEREAS, all parties agree to review the policy on an annual basis for minor changes to reflect actual practices followed in the field as well as to incorporate new technology and/or techniques when developed; and

WHEREAS, future minor amendments of the policy will take place through either an administrative action as part of the annual review process with signature by the Deputy Mayor in accordance with adopted policies or through re-adoption of the Engineering Service Design Standards through Council action when applicable; -- Now, Therefore,

BE IT RESOLVED by the city council for the City of Spokane that it hereby adopts the attached regional pavement cut policy for the City of Spokane and the policy shall become effective immediately upon passage of this resolution for the start of the 2005 construction season; and

BE IT FURTHER RESOLVED that as a result of this cooperative effort, the City of Spokane encourages the formation of a Regional Utility Coordinating Council to assist in coordinating the construction, repair, and maintenance of both private and public utilities with roadway repairs and preservation efforts.

ADOPTED BY THE CITY COUNCIL ON April 4, 2005

City Clerk

Approved as to form:

Assistant City Attorney

(LGL-2005-0016)

CITY OF SPOKANE ADMINISTRATIVE POLICY AND PROCEDURE	ADMIN 0370-05-02
TITLE: **REGIONAL PAVEMENT CUTS** EFFECTIVE DATE REVISION DATE:	

1.0 GENERAL

1.1 INTRODUCTION

The local governmental entities within Spokane County are faced with the same challenges as many other municipalities throughout the country. Pavement cuts are a necessary operation and cannot be avoided. Utilities need to serve new customers and repair existing facilities. There is a common good for all utilities to be placed in the Public Right-of-Way. All parties shall strive to reduce the burden to the taxpayer/ratepayer, and damage to the roadways.

Studies conducted by multiple groups and organizations have determined that poorly restored pavement cuts cause permanent structural and functional damage increasing maintenance costs, future rehabilitation costs, and produce a rough ride. If realized, the increased costs and rough ride are a burden for the taxpayer/ratepayer.

As Exhibit A shows, the pavement beyond the trench may be weakened by sagging which results from loss of lateral support. Heavy construction traffic also weakens the area adjacent to the trench. Studies (see attached bibliography) have shown that the pavement life may be reduced by pavement cuts. Poorly constructed patches tend not to last through the life of the existing road and fail prematurely when there is a lack of good construction techniques used when backfilling and compacting. This causes an additional burden to maintenance departments and taxpayers/ratepayers. A poorly constructed pavement cut usually requires repair before the road needs to be resurfaced; problems typically appear in the first two years. Studies also reveal that patch areas probably require thicker overlays compared to the rest of the pavement in the area. This also results in higher costs to the taxpayer/ratepayer.

1.2 EXECUTIVE SUMMARY

This document outlines Spokane County, the City of Spokane Valley, and the City of Spokane's joint regional policy regarding pavement cuts. It addresses excavation problems, construction requirements, warranties and other related aspects. In addition, it modifies the County's Five-year New Pavement Cut Moratorium, creating a new Regional Three-Year Cut Moratorium as outlined in this agreement and Exhibit B. Any road will remain available to be cut if there is no other means to take care of an emergency situation (broken water, sewer or gas lines or as approved by the Agency Engineer). The utility shall attempt to use other innovative ideas for servicing customers other than cutting into the public Right-of-Way while not diminishing safety standards.

1.3 TABLE OF CONTENTS

2.0 DEPARTMENTS/DIVISIONS AFFECTED

This policy shall apply to all City departments and divisions.

3.0 REFERENCES

Resolution 2005-0031

4.0 DEFINITIONS

4.1 "Agency Engineer" means the City or County Engineer, his/her designee (Engineers, Inspectors, Project Managers, Field Personnel) representing a Local Agency.

4.2 "Assignee" means the contractor who is taking out the permit.

4.3 "Length of Patch" means for this document the length of all patches is the patch dimension parallel to the roadway.

4.3 "New Roadway" means any roadway that has had a designed rehabilitation in the permitted excavation location that is less than or equal to three (3) years.

4.4 "Patch" means a cut in the pavement as part of the current permitted job.

4.5 "Permittee" means the utility company or contractor who submits an application for a permit to obstruct and/or conduct construction operations in the public right-of-way. Local Agencies and their contractors shall be considered permittees for application of this policy even though the respective agencies and/or their contractors may not take out permits.

4.6 "Project Completion" means the date when the following has occurred: final permanent restoration of roadway is complete and approved by the inspector, and all as-built documentation has been submitted to the Local Agency. A fax transmittal confirmation ticket of 'as built' shall be considered confirmation.

4.7 "Standard Specifications" means the current version of the WSDOT Standard Specifications for Road, Bridge, and Municipal Construction, Supplemental Specifications and/or Drawings as attached by Local Agencies.

4.8 "Width of Patch" means for this document the width of all patches is the patch dimension perpendicular to the roadway.

5.0 POLICY

5.1 CONSTRUCTION REQUIREMENTS

5.1.1 A Pavement Cut Moratorium will be in effect for a period of three (3) years for all new roadways (see Exhibit B).

5.1.2 No patching material will be allowed within an existing patch if the new patch exceeds seventy percent (70%) or more of the existing patch. In this case, the entire existing patch must be replaced.

5.1.3 All patching materials and construction requirements not addressed in this document shall conform to each Local Agency's Standards, copies available from Local Agencies. Longitudinal cuts that extend through multiple tier classifications will require discussion with the Local Agency to determine appropriate patching approach. In principle, each road section will be patched according to the tier in which it is ranked.

5.1.4 All existing traffic control markings will be replaced as soon as possible after permanent paving is completed. Temporary markings for lane lines and stop lines shall be in place prior to the roadway opening for traffic. All remaining temporary striping will be completed within seven (7) days of new pavement completion and shall be maintained by permittee until permanently restored. All traffic markings will be replaced per normal work practices.

5.1.5 Full depth full lane pavement removal and replacement shall be constructed beyond the nominal completed trench edge longitudinally, and transversely per Exhibit B. The goal is that the tee section does will not arbitrarily force patch into adjacent lanes, dependent on quality and care of trenching. The minimum length of the patch parallel to the road shall be six feet. If any part of the excavation, patch or damaged area intrudes into an adjacent lane, that lane shall also be replaced per the tiered chart. For new patches adjacent to any existing patch, all attempts will be made to install the utility at the existing patch line. When this is not feasible, no gap of four (4) feet or less shall exist.

5.1.6 The permittee shall be allowed to make emergency repairs provided a more reasonable alternative does not exist. Every reasonable effort will be made to restore the roadway quickly. (Note: an emergency will not allow permittee to coordinate and plan with asphalt company). (See "Repairs of Pavement Cuts").

5.1.7 Only saw cutting or approved grinding device will be allowed. Only parallel and perpendicular pavement cuts will be allowed. No jagged, broken or undermined edges.

5.1.8 Bicycle/pedestrian/parking/travel lanes to be repaired per tier chart and attached drawings.

5.1.9 Each Local Agency shall have the prerogative to encourage the permittee to contribute permittee's normal patching costs to local agencies to accomplish paving or full depth replacement of the roadway. (This does not apply to work done within larger projects, i.e. sewer projects). The Local Agency should be notified of existing problems with the adjacent roadway to a proposed patch. Every effort will be made to leverage both utility and agency dollars for street improvements.

5.1.10 When two (2) or more patches are created within a given job that measure fifteen (15) feet or less longitudinally or transversely they will be incorporated into a single patch. Anytime five (5) or more patches are required within a three hundred fifty (350) foot longitudinal area, the utility will notify the agency to determine if cost sharing is an option to expand the pavement repair/replacement area.

5.1.11 Potholing to find utilities shall be allowed. The use of innovative technologies is encouraged (Keyhole etc.). To be exempt from the gap and patching policy, cuts shall be a maximum of two (2) square feet with no longitudinal joints in the wheel path and shall be backfilled with controlled density or other approved fill from six (6) inches above the utility to six (6) inches below bottom of asphalt. Round vs. square cuts are preferred.

5.1.12 Chip sealed roads shall be rehabilitated according to construction requirements for asphalt roads as outlined in this document.

5.1.13 All temporary traffic control for the work zone shall conform to the MUTCD and Washington State modifications to the MUTCD. All traffic control is subject to the approval of the Agency Engineer or his/her designee (See temporary patching section).

5.1.14 All existing pavement types shall be constructed at the existing depth of asphalt and crushed surfacing, in accordance with applicable Local Agency Standards (including any fabric or membranes); however, the replacement section of asphalt and crushed rock shall not be less than the minimum section specified in Local Agency's Design Standards.

5.1.15 All concrete road cuts shall be pre-approved before beginning work (except in the case of an emergency situation). Concrete roads shall require full panel replacement unless approved otherwise by Local Agency. All concrete joints shall require an approved tie bar and dowel retrofit. Depth of concrete replacement shall match the existing thickness, or as per Local Agency's Standards. Care shall be made not to undermine the existing panels. If the adjacent panels are disturbed or damaged, they also shall be replaced. All joints shall be sealed with an approved material.

5.1.16 Asphalt over concrete road cuts, if known, shall be approved before beginning work (except in the case of an emergency situation). Saw cutting or other approved practice for removal of the concrete shall be allowed at the discretion of Local Agency. The asphalt portion of the cut shall be constructed according to the pavement cut policy.

5.1.17 All areas outside of the roadway that are affected by the work shall be restored to their original condition. All shoulders shall be restored to their original condition.

5.1.18 Valve and manhole repairs shall be exempt from the patching requirements of this policy. Valve and manhole patching requirements shall be per each Local Agency's Standards. All warranty and construction requirements shall be met. No longitudinal construction joints shall be allowed in the wheel path.

5.1.19 The permittee shall provide a detailed "As-built" record of the pavement cut after construction is completed (see attached Exhibit C). The permittee shall provide details indicating

existing pavement section, new pavement section and any unusual conditions at the location of the constructed utility. The location shall include the name of the road the work is being performed on and the name of the closest intersections in each direction. Distance measurements shall be from intersecting streets. This information will be provided to the Local Agency's Permit department as a permanent record. This information shall be returned no later than seven (7) days after the completion of the permitted project by mail, fax, or other electronic means by either permittee or patching contractor. The intent of this process is to record small patching details. Larger projects shall be reviewed and approved prior to construction.

5.1.20 The moratorium policy will be explained both as to costs and to construction practices by the Local Agencies as part of the permitting/zoning process for new construction or major remodeling projects. Individual permittees/utilities will not be responsible for this function. Individual permittees/utilities will be responsible for doing the work and the costs associated with the moratorium policy as they open roadways for work. Cost recovery from developers will be calculated and coordinated by permittee/utility.

5.2 SURFACE SMOOTHNESS REQUIREMENTS

The completed surface of all courses shall be of uniform texture; smooth, uniform as to crown and grade and free from defects. The completed surface of the wearing course shall not vary more than one-fourth inch (1/4") from the lower edge of a ten-foot (10') straight edge placed parallel to the centerline. Recognition and consideration will be made for existing roadway conditions. The Agency Engineer must approve corrective measures.

5.3 WARRANTY REQUIREMENTS

5.3.1 Pavement cuts on roadways ten (10) years old or less require a warranty period of five (5) years. The patch in the roadway shall be repaired as necessary until the warranty has passed.

5.3.2 All other roadways shall require a minimum three (3) year warranty period. All warranties shall become void if rehabilitation work is performed to the road within the patching limits.

5.3.3 For road cuts performed by a Utility using its internal capability, that Utility or assignee will be responsible for repairs required during the warranty period. All curb, sidewalks and structures that are affected by the excavation shall be included in this policy and have a warranty for five (5) years.

5.4 WARRANTY PROVISIONS

5.4.1 Sunken pavement patches greater than or equal one-fourth inch (1/4") (Measured by a ten (10) foot straight edge).

5.4.2 Visual rating of patch = to medium or high (Per Agency's rating procedure).

5.4.3 Visual rating of construction joint = to medium or high (Per Agency's rating procedure).

5.4.4 Poor workmanship (To be determined by each Agency's Engineer).

5.4.5 Compaction requirement per Agency Standard.

5.4.6 Sunken or damaged curb and sidewalks in excavation work area (To be determined by each Agency's Engineer).

5.4.7 Sunken or damaged drywells and catch basins in excavation work area (To be determined by each Agency's Engineer).

5.5 REPAIRS OF PAVEMENT CUTS

5.5.1 If emergency repairs are needed due to safety concerns, the permittee shall have twenty-four (24) hours in which to make such repairs from time of verbal notice by the Local Agency. For non-emergency repairs on arterial roads the permittee shall have forty-eight (48) hours to make such temporary repairs. On residential streets, the permittee shall have up to seven (7) days to make such temporary repairs. If these repairs are not

accomplished within the specified timeframe, the work shall be privately contracted by the Local Agency or the Local Agency's maintenance crew shall perform the needed repairs.

5.5.2 The permittee will be assessed all costs associated with the repairs. The costs shall be based on the average bid items for comparable projects for the year preceding plus ten percent (10%) overhead fees. If repairs other than seam sealing are made to the warranted patch, a new warranty will be implemented for the new patch.

5.5.3 The permittee shall have two (2) days to notify its asphalt company of the needed permanent repairs. If the work is not done in a timely manner and following notification the work shall be privately contracted or Local Agency maintenance crews will perform the needed repairs. The permittee shall be assessed the associated fees for the repairs. All utility cut construction shall follow the construction and warranty requirements per Local Agency Standards.

5.6 TEMPORARY PATCHING

5.6.1 During winter asphalt concrete paving plant closures or outside of temperature specifications (see section 5-04 of the Standard Specifications) the permittee shall install and maintain a temporary patch until it can construct a permanent patch. A temporary patch will be required if the road must be opened to traffic before a permanent patch can be made.

5.6.2 The temporary patch shall consist of two inches (2") of crushed surfacing and two inches of cold-mix asphalt pavement and/or steel plates or, upon approval of the Agency Engineer, crushed surfacing top coarse may be used. On arterials, when a temporary patch is required for more than two (2) months, Portland Cement Concrete shall be used to construct the temporary patch (Contact Local Agency for mix design requirements). The permittee shall maintain the temporary patch until the patch has been permanently restored.

5.7 PERMITS

5.7.1 All work in the 'Public Right-of Way' requires a permit. Permittee shall take out all permits and perform all work.

5.7.2 The permittee shall fax or send a letter to the appropriate Local Agency permit center designating its assignees. The permittee will be required to submit a construction and traffic control plan (traffic control for arterial work and roadways above 35 M.P.H.) when applying for a permit. If the Agency Engineer determines that abuse of obligations are prevalent, future construction permits shall not be issued until the permittee has fulfilled all obligations to existing permits. Written notification by Local Agency will be sent prior to this action.

5.8 RESPONSIBLE PARTY

The permittee shall be responsible for all construction and warranty requirements of this policy. Utilities will provide identity of excavator/permittee as known to Local Agencies. Local Agencies will attempt to get permittee to correct warranty defects. If permittee is a subcontractor for utilities, the utilities will assume responsibility if permittee can not/will not make repairs.

5.9 WAIVERS AND EXEMPTIONS

It is understood that field conditions may warrant a waiver or an exemption from these regulations. Permittee may file for a waiver, and such waivers shall be at the discretion of the Agency Engineer or his/her designee.

5.10 POLICY REVIEW

The Local Agencies will host a meeting with each other and other interested stakeholders at the end of each construction season for the purpose of reviewing the effectiveness of the policy for the completed construction season and suggested improvements for future construction seasons.

5.11 AMENDMENTS

The mayor may make minor revisions, additions or deletions to this policy without city council approval.

6.0 PROCEDURE

6.1 Not Applicable

7.0 RESPONSIBILITIES

The Engineering Services Department is responsible for administering this policy.

8.0 APPENDICES

Bibliography
Exhibit A – Typical Trench Excavation
Exhibit B – Tiers
Exhibit B1 – Moratorium/Full Policy – Arterial
Exhibit B2 – Moratorium/Full Policy – Residential/Local Access
Exhibit B3 – Moratorium/Full Policy – Intersections
Exhibit B4 – Modified Policy – Arterial
Exhibit B5 – Modified Policy – Residential/Local Access
Exhibit C – Asphalt and Concrete Pavement Repair Request

APPROVED BY:

City Attorney (Asst)

Engineering Services, Director

Director, Public Works and Utilities

April 5, 2005
~~Deputy Mayor~~ Date

~~Date~~ Deputy Mayor

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AGA. White Paper. *Gas Industry's Use of Public Right-of-Way.* Sept. 1998.

APWA. *Managing Utility Cuts.* Aug. 1997.

City of Bellevue. *Trench Restoration Requirements*".

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City of Seattle. *Impact of Utility Cuts on Pavement Performance.*

Metropolitan Transportation Commission. *Utility Trench Cut Restoration Specifications.* Jan. 1997

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EXHIBIT A

PAVEMENT CUT POLICY
TYPICAL TRENCH EXCAVATION

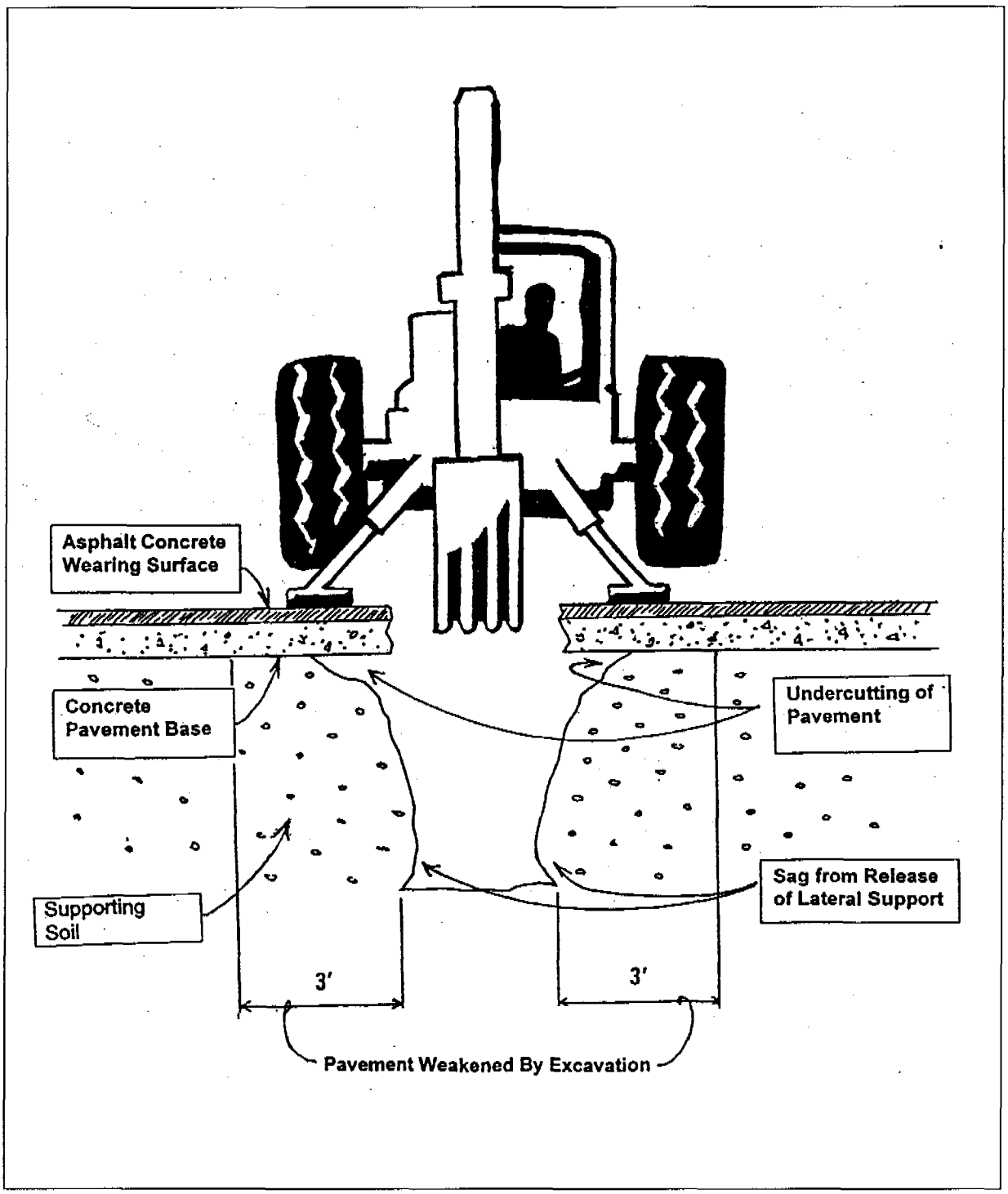


EXHIBIT B

PAVEMENT CUT POLICY
TIERS

	Tier 1	Tier 2	Tier 3	Tier 4
Arterial Streets:	≤ 3 years	Years 4-5	Years 6-12	> 12 years
Principle	Moratorium Policy	Full Policy	Full Policy	Modified Policy
Minor	Moratorium Policy	Full Policy	Modified Policy	Trench Only
Neighborhood Collector	Moratorium Policy	Full Policy	Modified Policy	Trench Only
Local Access Streets:				
Industrial/Commercial	Moratorium Policy	Modified Policy	Modified Policy	Trench Only
Residential	Moratorium Policy	Modified policy	Modified Policy	Trench Only

Exhibit B Notes

Moratorium Policy = Half roadway or full roadway replacement for longitudinal cuts in new roadways. This policy requires prior approval from Agency having jurisdiction.

Full Policy = Policy w/paving to established/dedicated lane lines. Cut full depth 2 feet beyond excavation. No gaps ≤ 4' from curb or gutter.

Modified Policy = If no striping for lane line, lane is = to 12', can patch to middle of lane lines, cannot leave any gap ≤4' from curb or gutter. Cut 1' beyond excavation.

Trench Only = Cut 1' beyond excavation all locations. No longitudinal joints in the wheel path

Note: It is the discretion of each jurisdiction to review the individual road segment ages to determine patch requirements on longitudinal installation over multiple roadway segments with variable ratings. In principle, each road section will be patched according to the tier in which it is ranked.

Note: Any deviation from the Tier Policy will require approval in advance by the local agency.

Note: Each agency will provide date of last major reconstruct either electronically or on each permit. Maintenance does not constitute a reconstruct for age determination.

Note: Moratorium policy will be reviewed as seam-sealing technology improves.

EXHIBIT B1

MORATORIUM/FULL POLICY - ARTERIAL

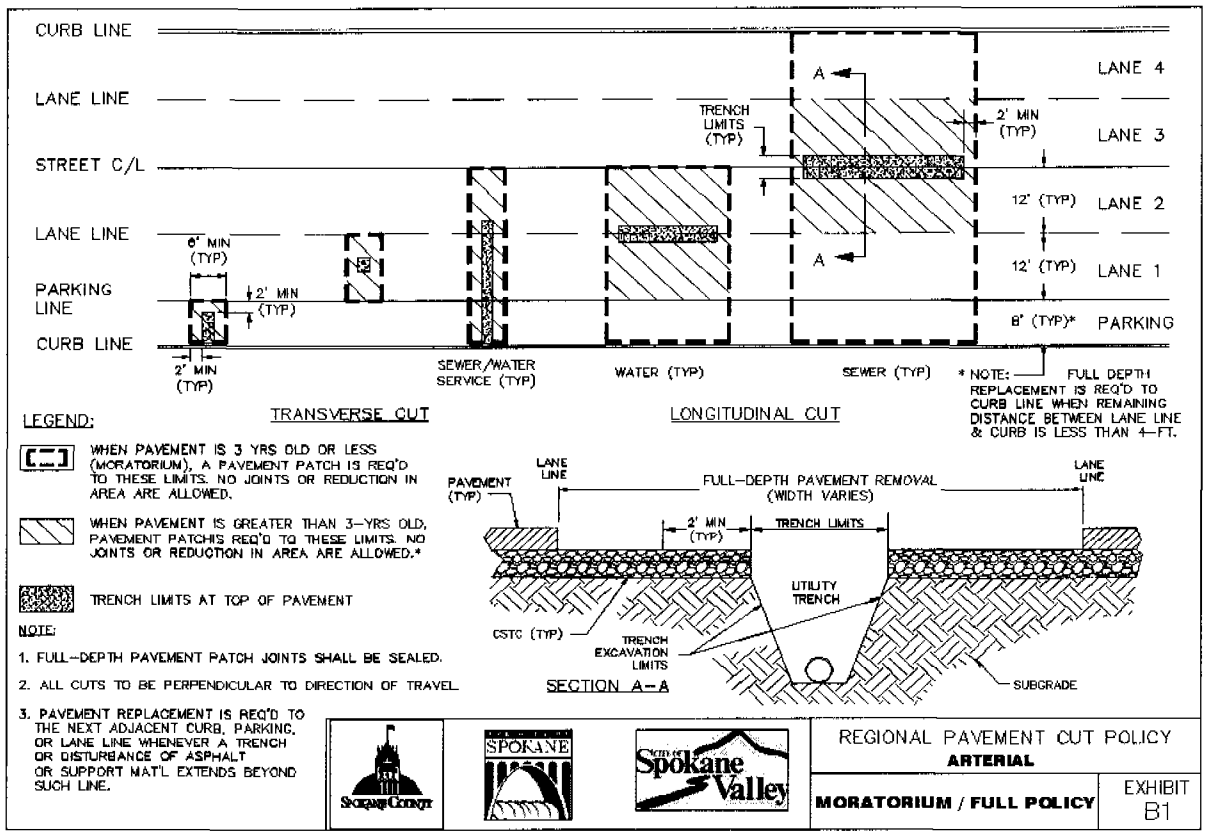


EXHIBIT B2

MORATORIUM/FULL POLICY – RESIDENTIAL /LOCAL ACCESS

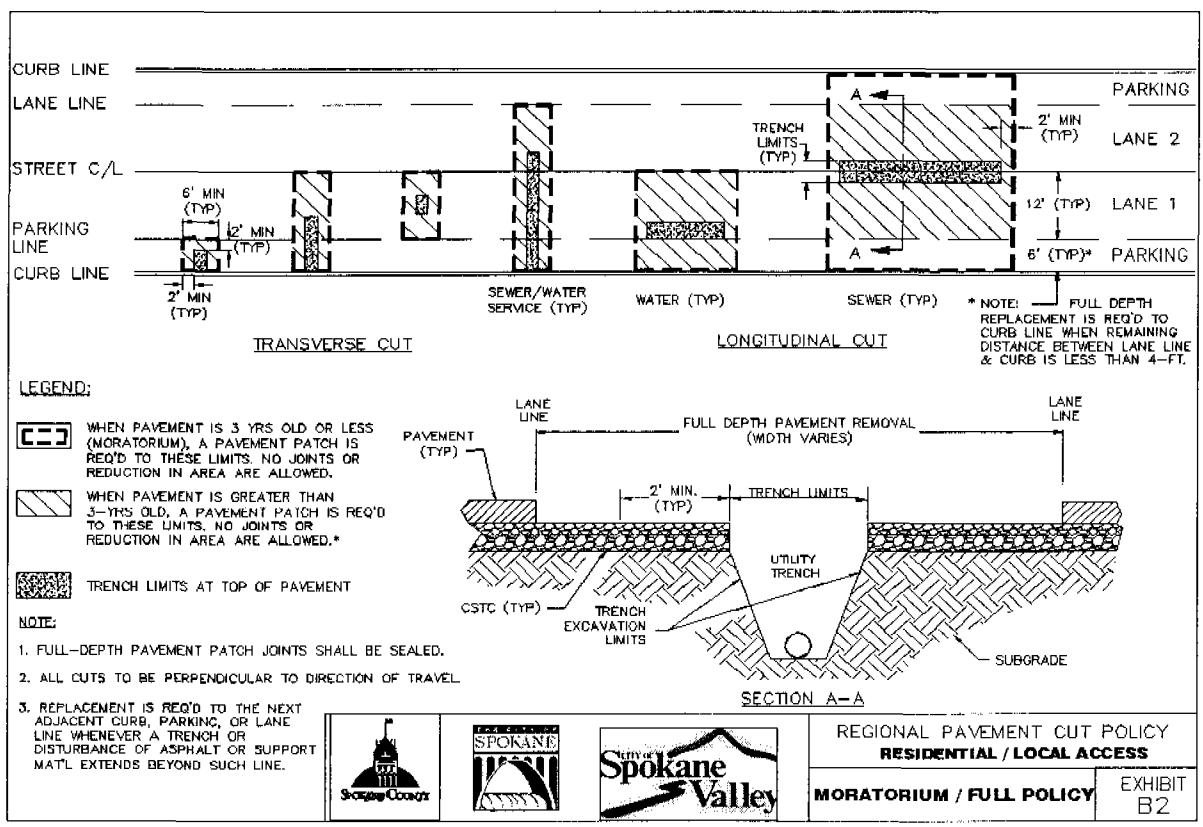


EXHIBIT B3

MORATORIUM/FULL POLICY – INTERSECTIONS

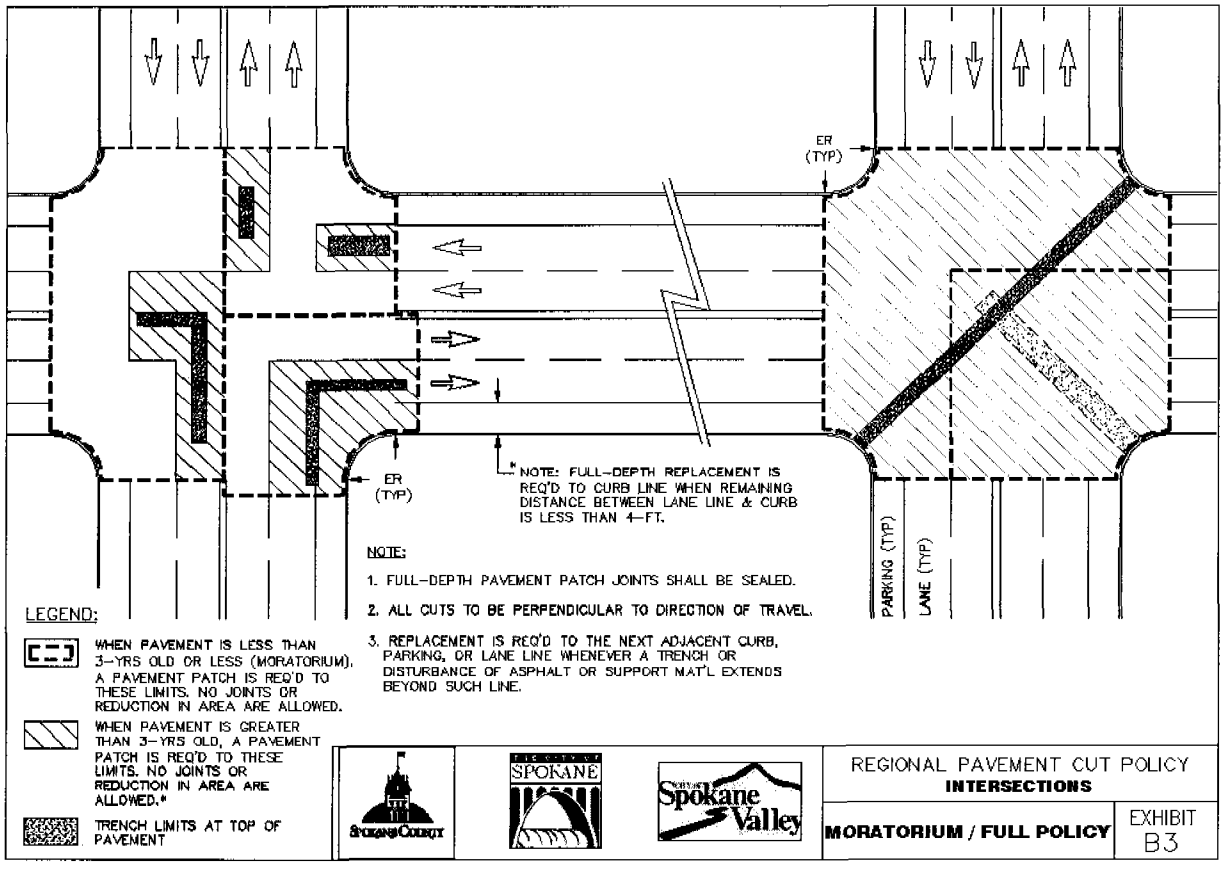


EXHIBIT B4

MODIFIED POLICY - ARTERIAL

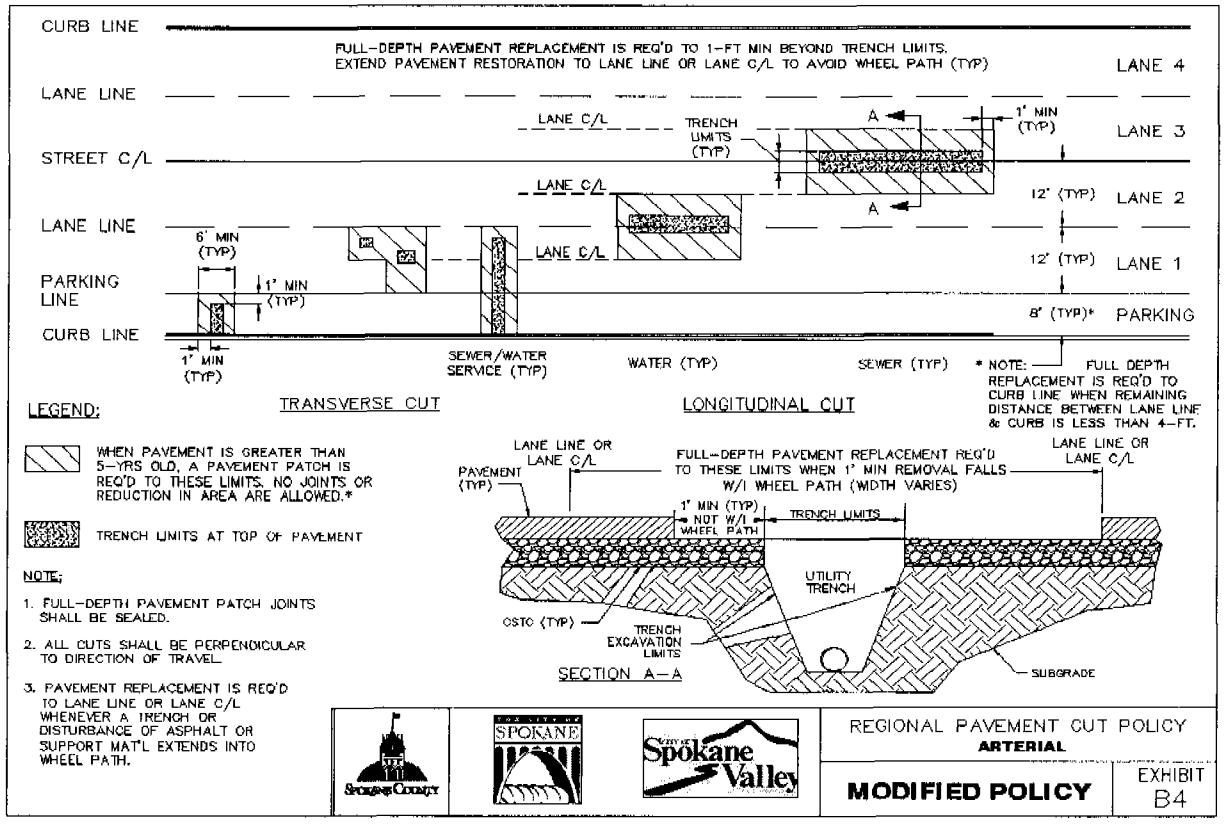


EXHIBIT B5

MODIFIED POLICY – RESIDENTIAL/LOCAL ACCESS

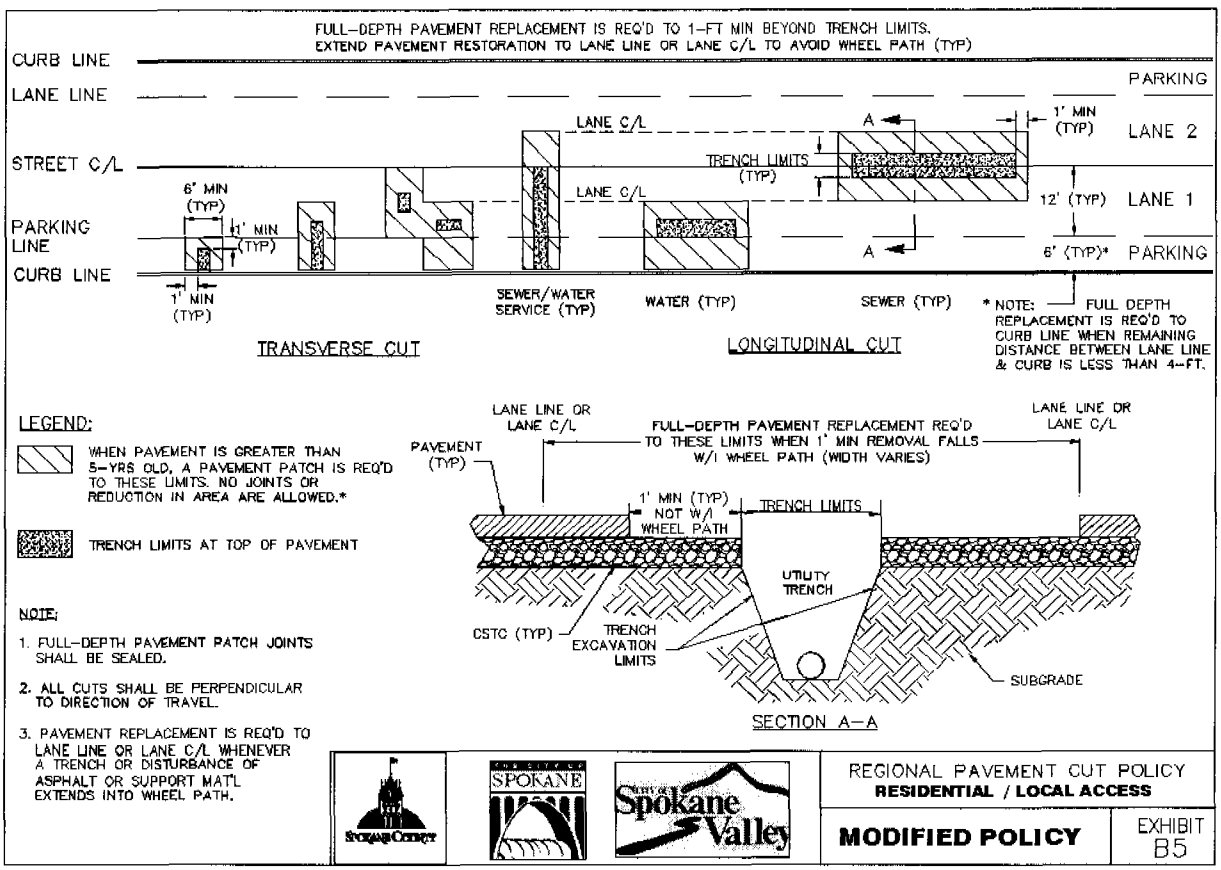


EXHIBIT C

PAVEMENT CUT POLICY

ASPHALT AND CONCRETE PAVEMENT REPAIR

Permittee Name: _____

Job Address: _____ (if no house number, please list hundred-block) **Coordinates :** _____ (Example : 15N 24W) ☐ Street ☐ Alley

Project/Task #: _____

Date Cut: _____ **Crew:** _____

PO/Job #: _____ **City/County Permit #:** _____

Unusual Conditions/Special Instructions: _____

_____

_____

Tier#: (Please circle) 1 2 3 4

Policy: (Please circle) Moritorium Full Modified Trench

Condition of Cut (Circle any that apply)	**Type of Work**	**Type of Repair**	**Existing Road Condition**
6" Gravel (required)	Gas	Asphalt	Depth of Asphalt _____
Cold Mix	Electric	Concrete	Depth of Gravel _____
Winter Mix	Water		Sub Base Type _____
Sawcut	CATV		
Grind	Communications		
	Sewer		
	Other _____		

Asphalt

Width x Length

_____ x _____

_____ x _____

_____ x _____

_____ x _____

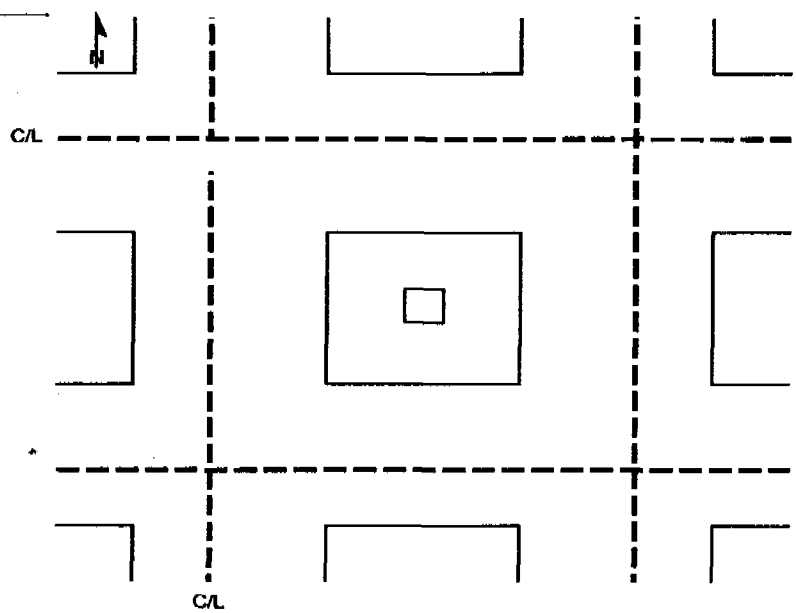
Concrete

Width x Length

_____ x _____

_____ x _____

striping (linear foot) _____



Date Sent for Repair: _____

Date Completed: _____

Patching Co. Signoff: _____

(patching company to fax to local agency at completion)

Fax Completed Form to: Spokane County, Sylvia Lightfoot: 509/477-7198
City of Spokane, Dan Eaton: 509/625-6124

RES 05-31

RECOMMENDED STREET TREES
CLASS I

Class I Trees

For use in 5' width planting strips and under power lines regardless of planting strip width

Red Buckeye
Aesculus pavia

Height: 20'
Spread: 20'
Hardiness: -20
A small tree with a rounded or shrubby habit. Lustrous dark green palmate leaves accent the red flowers in April and May. No appreciable fall color. Some tolerance for shade, drought and poor soils.

Autumn Brilliance Serviceberry
Amelanchier x grandiflora
'Autumn Brilliance' (treeform)

Height: 20'
Spread: 15'
Hardiness: -30
Tree form of serviceberry with an upright spreading crown, white flowers and a reliable, bright red fall color. The fruit is edible. Tolerates some drought.

Cumulus Allegheny Serviceberry
Amelanchier laevis
'Cumulus' (treeform)

Height: 25'
Spread: 20'
Hardiness: -30
A serviceberry with a distinct upright and oval tree habit, fleecy white flowers in spring and a yellowish to orange-scarlet fall color. Smooth gray bark.

American Hornbeam
Carpinus caroliniana

Height: 25'
Spread: 25'
Hardiness: -40
A small tree with an irregular spreading habit, with a rounded outline. Dark green leaves change to yellow, orange and scarlet in the fall. Smooth, gray, irregular twisting bark adds interest in winter. Will grow in heavy shade and wet soils.

Kousa Dogwood
Cornus kousa

Height: 25'
Spread: 20'
Hardiness: -20
A small tree, vase shaped in youth, forming a rounded habit with distinct horizontal layering of the branches and exfoliating bark with age. Creamy, white bracts, resembling flowers, in spring, dark green leaves that change to reddish purple in the fall.
'Satomi'
Pink flowered selection. Very ornate with layered branches.

Golden Glory Dogwood
Cornus mas 'Golden Glory'

Height: 20 - 25'
Spread: 15'
Hardiness: -15
More upright and free flowering than species (Corneliancherry Dogwood). The tree takes on a mounded shape, like an inverted pear. Great show of yellow flowers in spring and later bright red fruit. Foliage is dark green and turns purple in fall. Excellent tree for contrast.

Lavalle Hawthorn
Crataegus x lavallei

Height: 25'
Spread: 20'
Hardiness: -40
A small, dense oval canopy tree with shiny dark green foliage turning to bronzy copper-red in the fall. Usually thornless or with small one inch thorns. Quite free of rust and very adaptable.

Thicket Hawthorn
'Ohio Pioneer'
Crataegus punctata
var. inermis

Height: 20 - 30'
Spread: 25 - 35'
Hardiness: -20
Broad-rounded tree, low branching usually becoming wider than tall at maturity. Thornless variety with excellent vigor. Foliage is gray green, contrasted by abundant white flowers in spring and dark red fruits in September and October. Fruits are usually persistent adding interest in winter.

Winterberry Euonymus
Euonymus bungeanus

Height: 20'
Spread: 20'
Hardiness: -20
Small rounded or shrubby tree with pendulous branches. Leaves are light green and flowers are yellow. Beautiful in fruit.

European Euonymus
Euonymus europaeus

Height: 15-30'
Spread: 10-20'
Hardiness: -30
A narrowly upright tree in youth broadening as it ages with a rounded outline when mature. Early leaf out with a flat dark green color turning from yellow to reddish purple in fall. Fruits ripen pink to red in September and are quite attractive.

Korean Evodia
Evodia daniellii

Height: 25 - 30'
Spread: 25 - 30'
Hardiness: -20
Interesting small tree with a rounded shape. Lustrous dark green foliage complemented by profuse white flowers borne on stalks in June and July. No major insect or disease problems. Great mix of structure and ornamental display for urban area.

Golden Desert Ash
Fraxinus excelsior 'Aureafolia'

Height: 20'
Spread: 18'
Hardiness: -15
Small rounded tree with bright yellow twigs and golden stems. Foliage emerges yellow and greens slowly through the spring and early summer turning back to gold in late summer. Beautiful specimen, great contrasting tree and attractive in winter.

RECOMMENDED STREET TREES
CLASS I

Leprachaun Ash
Fraxinus pennsylvanica 'Johnson'

Height: 18'
Spread: 16'
Hardiness: -25
True dwarf of green ash. Compact tapered oval shape, rounding with maturity. Foliage is glossy dark green, turns yellow in fall. Excellent tree for restricted areas.

Amur Maackia
Maackia amurensis

Height: 25'
Spread: 25'
Hardiness: -25
A small round headed tree. Leaves emerge a silvery gray and gradually become dark green. Fragrant pale white flowers light the tree in July and August. Bark peels with maturity exposing a shiny amber to brown color, becoming curly in texture. Prefers moist, well drained soil, but is quite adaptable to environmental conditions.

Merril Loebner Magnolia
Magnolia x loebneri 'Merrill'

Height: 30'
Spread: 30'
Hardiness: -30
An upright habit becoming round with age. Leaves are thick and rigid, dark green and turn yellow in fall. Flowering peaks in April, where the tree resembles a white cloud covered with fragrant snowy blossoms. A vigorous grower and cherished landscape tree.

Yulan magnolia
Magnolia denudata

Height: 35'
Spread: 30'
Hardiness: -30
Tree with spreading branches somewhat irregular, producing an informal outline. Leaves are thick and resilient turning yellow in fall. Flowers are fragrant, white and 4-6 inches wide, blooming in spring. New nursery stock.

Magnolia x 'Elizabeth'

Height: 30-40
Spread: 20'
Hardiness: -30
Compact oval tree, tall for a magnolia. Glossy green tough leaves and yellow flower (unique for magnolias), 6 inches wide and fragrant, bloom in spring before the leaves break.

Galaxy Magnolia
Magnolia x 'Galaxy'

Height: 20 - 25'
Spread: 15'
Hardiness: -20
A tree form magnolia with a strong central leader and pyramidal to oval shape. The foliage is lustrous green and flowers are large, 8 to 10 inches wide, blooming in spring on bare stems, pink outside and white inside. Good selection for a landscape or street where space is limited or confined.

Royal Star Magnolia
Magnollia stellata 'Royal Star'

Height: 20'
Spread: 15'
Hardiness: -30
A hardy, compact, rounded tree with deep green foliage and yellow fall color. The large fragrant flowers bloom in early spring, before the leaves break. An excellent ornamental tree for small sites in urban landscapes.

Persian Parrotia
Parrotia persica

Height: 20 - 30'
Spread: 15 - 25'
Hardiness: -20
Small single stemmed tree with upright to wide spreading branches, oval outline. Pink to purple emerging leaves blend to glossy green and turn a beautiful succession of yellow to orange to red in fall. An excellent selection for streets and landscapes, given size, color display and remarkable resistance to pests and disease.

Summer Glow Bird Cherry
Prunus padus 'DTR 117'

Height: 25'
Spread: 20'
Hardiness: -20
Low growing tree with a slightly wandering leader and curving branches. Leafs early, emerging green and maturing to reddish purple, turning darker purple in fall. White flowers are draped about the tree in dangling clusters. Small red fruits are harvested by birds. Excellent urban tree for areas where space is limited.

Cascade Snow Cherry
Prunus 'Berry'

Height: 25'
Spread: 20'
Hardiness: -20
Upright spreading vase form. Large pure white flowers cover this tree in spring followed by glossy dark green foliage which turns yellowish to bronze-orange in fall. This cultivar has shown an increased resistance to diseases that affect other ornamental cherries

Sargent Cherry
Prunus sargentii

Height: 30'
Spread: 30'
Hardiness: -30
Upright spreading branches forming a rounded crown. Pink flowers clusters usher in spring, followed by large dark green leaves which, in fall, change to a striking mix of bronze and orange-red. The bark is a beautiful mahogany color and holds year round interest. One of the hardier ornamental cherries.

Columnar Sargent Cherry
Prunus sargentii 'Columnaris'

Height: 35'
Spread: 15'
Hardiness: -30
Upright, columnar to narrowly vase shaped at maturity. Flowers, foliage and bark with the same attractive qualities as the species. The narrow habit lends itself for street tree use.

RECOMMENDED STREET TREES
CLASS I

Prairie Gem Pear
Pyrus ussuriensis 'Mordak'

Height: 25'
Spread: 20'
Hardiness: -30
Densely branched and compact tree with a round canopy. Leaves are bright green, thick and leathery turning golden yellow in fall. White flowers blanket the tree in early spring. Excellent pear for urban plantings.

Ivory Silk Lilac
Syringa reticulata 'Ivory Silk'

Height: 25'
Spread: 15'
Hardiness: -20
Tree form lilac, oval and compact with upward curving branches. Foliage is dark green, flowering when young. Displays large white flower clusters in early July. Excellent choice for beauty and adds variety to urban landscapes.

Flowering Crabapples

Malus sp. (Red Flowers)
Hardiness: -20 (-30)

'Adams'
Height: 20'
Spread: 20'
Dense and rounded symmetrical habit. Pink flowers, red persistent fruit.

'Amazam' American Masterpiece
Height: 25'
Spread: 18 - 20'
Pyramidal habit. Bright red leaves emerge and mature to dark maroon. Brilliant red flowers change to unique pumpkin orange fruits in fall that persist through winter.

'Bechtel' Klehm's Improved Crab
Height: 15 - 20'
Spread: 15 - 20'
Rounded form, dense dark green foliage, turning orange to orange red in fall. Large double pink flowers cover the tree in spring. Improved strain for disease resistance. Seldom fruits, very tidy tree.

Flowering Crabapples

'Centzam' Centurion Crabapple
Height: 20'
Spread: 15'
Narrow upright habit, spreading slightly with maturity. Purple emerging leaves changing to bronze-green. Rose-red flowers ripen to bright red fruits persisting through the winter.

'Prairifire' Prairifire Crabapple
Height: 20'
Spread: 20'
Upright spreading habit becoming rounded. Reddish stems with foliage changing from purple to red hued green. Excellent color change from crimson buds to dark pink flowers to deep red fruits which persist through winter.

Malus sp. (White Flowers)
Hardiness: -20 (-30)

'Adirondack'
Height: 18'
Spread: 10'
Densely upright inverted cone shape. The cut of this cultivar combined with an overabundant white flowers in spring makes this a "standard" to which other flowering crabs are compared. Bright red fruits carry interest through winter.

'Hargozam' Harvest Gold Crab
Height: 25'
Spread: 15'
Upright, moderately columnar habit. White flowers in spring are but a precursor to the golden fruits which adorn this tree through winter making it a show stopper in the landscape.

Professor Sprenger'
Height: 20'
Spread: 20'
Stark upright habit makes for a larger more stately looking tree than other crabs. Red buds bloom white with pink tones ripening to orange-red fruits and endure on the noble frame through winter.

Flowering Crabapples

'Sentinel'
Height: 20'
Spread: 12'
Vase shaped, an unusual form for a crab makes its mark as an excellent street tree under power lines. Flowers are white with a touch of pink , fragrant, with bright red fruits that carry through the winter.

'Spring Snow'
Height: 25'
Spread: 20'
Dense and oval shaped, quite large for a flowering crab. Flowers are white and sterile, the tree is without fruit and is an excellent addition to the landscape where dropping fruits would be objectionable.

'Sutyzam' Sugar Tyme Crabapple
Height: 18'
Spread: 15'
Upright spreading with a somewhat irregular oval outline. Great informal character, smothered in sweet white flowers in spring. Fruits are wine red and persist through winter.

Golden Raindrops Crabapple
Malus transitoria 'Schmidtleaf'

Height: 20'
Spread: 15'
Hardiness: -20
Upright vase shaped habit. Very unusual cherry, with a delicate appearance, slender branches are draped in uniquely cut glossy green leaves. An abundance of small white flowers ripen to tiny bright yellow fruits which hang like drops of rain from this elegant tree.

RECOMMENDED STREET TREES
CLASS II

Class II Trees

For use in 5' – 8' planting strip width

Italian Alder
Alnus cordata

Height: 30 - 45'
Spread: 25 - 35'
Hardiness: -15
A pyramidal to pyramidal rounded tree with a rather dense canopy for alders. Leaves are spade shaped and finely toothed, dark green and lighter underneath. Trees are compared in outline to Little Leaf Lindens and Common Pear in appearance. Will tolerate poor soil conditions and does best near water. Little used, but highly recommended for urban landscapes.

Black Alder
Alnus glutinosa

Height: 40 - 50'
Spread: 30 - 35'
Hardiness: -30
Fast growing tree with a broadly pyramidal habit, somewhat irregular. Dark green leaves change to yellow in the fall. These trees thrive near water and perform well in poor soils. Good tree for an alternative to willows and other poplars. The 'Pyramidalis' cultivar has an excellent narrow form and recommended for confined space areas.

European Hornbeam
Carpinus betulus

Height: 25 - 40'
Spread: 25 - 35'
Hardiness: -20
Pyramidal shape, quite dense with dark green leaves. Fall color is usually yellow but during cold winters can turn dark red. Heat and drought resistant.
'Fastigiata', a columnar cultivar, is taller, but only spreads 15', making it preferable for confined urban spaces.
.

Katsuratree
Cercidiphyllum japonicum

Height: 40 - 50'
Spread: 40
Hardiness: -20
In youth pyramidal and maturing to a variety of pyramidal rounding forms. Leaves are heart shaped and emerge red-purple and change gradually to bluish green with great fall colors, yellow to apricot and sometimes crimson. Performs better if shaded from afternoon sun.

American Yellowwood
Cladrastis lutea

Height: 30 - 50'
Spread: 40 - 55'
Hardiness: -20
Round tree, often wider than tall. Leaves are bright green, resembling those of English Walnut and turn brilliant to golden yellow in Fall. The bark is smooth and gray much like a Beech. The name derived from the color of the heartwood. Terrific displays of white flowers with a sweet fragrance in May and June.

Turkish Filbert or Hazel
Corylus colurna

Height: 50'
Spread: 30'
Hardiness: -20
Broadly pyramidal , somewhat compact. Dark green foliage with exfoliating bark when mature. Fall color of little significance. Tolerates environmental extremes and conditions exhibiting stress in other trees. No serious pest or disease problems. Stately and formal character, excellent for urban plantings.

Hardy Rubber Tree
Eucommia ulmoides

Height: 45'
Spread: 45'
Hardiness: -20
Tree with a rounded outline and ascending branches. Foliage is spectacular, glossy dark green and pest free. The bark of mature specimens adds to the trees interest. Fall color is minimal. Tolerates a variety of soil conditions. Unique tree species for cold climates.

European Ash
Fraxinus excelsior

Height: 40 - 60'
Spread: 30 - 60'
Hardiness: -15
Trees generally form a round headed, broadly spreading canopy with the lower branches curving upward. Foliage is much the same as other ashes. Cultivars may have widely diverging shape from species and may be difficult to obtain.

Blue Ash
Fraxinus quadrangulata

Height: 40 - 50'
Spread: 30 - 35'
Hardiness: -20
Broadly oval, sometimes irregular outlined tree. Leaves are dark green and turn yellow in fall. Bluish square stems and plate-like or shaggy bark on the trunk make this an exceptional tree for winter interest.

European Beech
Fagus sylvatica

Height: 40 - 50'
Spread: 15 - 40'
Hardiness: -20
Stately tree, narrowly compact to densely pyramidal to broadly oval, branching close to the ground. Leaf color varies dramatically between cultivars. It is said that the right cultivar of this tree can enhance any landscape. Care should be used with planting lower branching trees to avoid creating a traffic nuisance.

'Fastigiata' Fastigate Beech
Trees deep green, tight form makes it one of the most striking columnar trees.
'Riversii' Rivers Purple Beech
Broadly oval habit, foliage has striking purple shades, spring through summer.
'Zlatia' Golden Beech
Upright pyramidal habit, young leaves are yellow maturing to golden green.

RECOMMENDED STREET TREES
CLASS II

White Ash
Fraxinus americana

Height: 45 - 55'
Spread: 30 - 40'
Hardiness: -25
A variety of forms usually oval. Bark is ash-gray to grayish-brown aging with diamond furrows with slender ridges. Leaves are pinnately compound with a range of green and a variety of fall colors. Most cultivars have been selected or breed with disease and pest resistant characteristics. The trees are widely used and make good selections for urban plantings.

'Autumn Purple'
Rounded habit, purple fall color. Signature purple ash.

'Champaign County'
Dense oval habit, yellow fall color. Thick trunk and strong branches.

'Rosehill'
Upright oval habit, bronze red fall color. Strong central leader.

Green Ash
Fraxinus pennsylvanica

Height: 45 - 50'
Spread: 25 - 35'
Hardiness: -30
A variety of forms usually oval. Bark is ash-gray to grayish-brown aging with diamond furrows with slender ridges. Leaves have a range of green and yellow fall color. Cultivars have been selected or breed with disease and pest resistant characteristics, the tendency towards irregular growth has been reduced as well. The trees are widely used and make good selections for urban plantings. Care should be taken not to encourage diseases and pests by overuse of any tree species.

'Bergeson'
Strong, upright growth, oval. Tends to be smaller in size.

'Cimmaron'
Narrow oval habit, Glossy green foliage, brick red fall color

'Patmore'
Symmetrical branching, oval canopy. Yellow in fall.

'Summit'
Uniform branching, narrowly oval with a good leader. Yellow fall color.

Maidenhair Tree
Ginkgo Biloba

Height: 40 - 55'
Spread: 15 - 35'
Hardiness: -25
Young trees are irregularly shaped, but finish broadly symmetrical. Usually all marketed trees are male due to the offensive smell of the female trees in fruit. The leaves are uniquely lobed and bright green on both sides, changing to bright to golden yellow in fall. Having outlived most of its enemies Ginkgo is a fine specimen for urban planting.

'Autumn Gold'
Very uniform and balanced pyramidal tree. Spreading at maturity.

'Magyar'
Narrow pyramidal form with a strong central leader. Well spaced branches.

'Princeton Sentry'
Narrow tapering growth almost columnar. Tallest of the three.

Honeylocust
Gleditsia

Height: 35 - 45'
Spread: 35 - 40'
Hardiness: -20
Usually a tree with a squat trunk and open spreading branches. Cultivars are thornless, or have very few thorns. Often overused in landscapes which can promote pest and disease problems.

'Halka'
Heavy caliper and full even crown with an oval form. Yellow in fall.

'Moraine'
Rapid growth with a vase shape and rounded outline. Golden fall color.

'Shademaster'
Irregular vase with rectangular outline. Good form for street use. Yellow in fall.

'Skyline'
Broadly pyramidal, good branch angles. Form lends itself to urban design.

American Sweetgum
Liquidambar styraciflua

Height: 45 - 55'
Spread: 25 - 35'
Hardiness: -20
Regular pyramidal form when young maturing into a pleasing symmetrical rounded crown. Leaves are a unique, star shape, dark glossy green upper and silver green lower surfaces, persisting late with beautiful fall colors of yellow, purple and red tones. Some problems with fruit debris, but a beautiful addition to a landscape.

Tupelo
Nyssa sylvatica

Height: 30 - 40'
Spread: 20 - 35'
Hardiness: -20
Also known as Black Gum, Sour Gum and Pepperidge. In youth the tree is pyramidal, but becomes rounded or oval as it ages. Leaves are glossy green and fall color is excellent, turning bright yellow, orange coppery red, or purple. Tolerates poor drainage and some drought. Makes a great park or street tree for residential areas.

American Hophornbeam
Ostrya viginiana

Height: 30 - 45'
Spread: 25'
Hardiness: -30
Rounded oval shape made up of slender branches, sometimes arching up or down. Leaves are bright green turning yellow to brown in fall often persisting adding winter interest along with the hop like fruits. Tolerates dry conditions and free of major disease and insect problems.

Sawtooth Oak
Quercus acutissima

Height: 40 - 50'
Spread: 50 - 60'
Hardiness: -20
Tree typically develops a widely spreading and dense canopy that is rounded at maturity. May need protection in youth, but once established the trees handle harsh winters well. Emerging leaves are brilliant yellow and fall color is bronze. Deeply ridged and furrowed bark adds winter interest. Lacks pest and disease problems. The only detraction for street tree use is acorn debris.

RECOMMENDED STREET TREES
CLASS II

Chinkapin Oak
Quercus muehlenbergii

Height: 40 - 50'
Spread: 50 - 60'
Hardiness: -15
In youth the tree is rounded and somewhat irregular, but gains stature and elegance with maturity. The leaves are indented to slightly lobed, lustrous yellow green turning to various shades of yellow to orangish brown in fall. Somewhat difficult to transplant and dislikes alkali soils, but once established it performs well.

Sassafras
Sassafras albidum

Height: 30 - 60'
Spread: 25 - 40'
Hardiness: -20
Pyramidal shape in youth changing to an irregular flat top with an oblong outline. Bright green leaves offset yellow, often, red stems which enhance an excellent fall display with shades of yellow and orange to scarlet and purple. The mahogany bark of mature trees and fragrance are additional interests.

American Linden
Tilia americana

Height: 35 - 50'
Spread: 20 - 35'
Hardiness: -40
Tall stately trees, cultivars generally smaller in size especially when used in urban areas. Leaves are generally 4 to 8 inches long and about as wide in a range of green shades. Bark is gray to brown with narrow lateral furrows. The wood is soft and easily prunes, but is elastic enough to handle most weather extremes. These trees will entirely block the sun in their shadow so place them appropriately.

'Boulevard'
Dense, narrow pyramidal habit with ascending branches. Yellow in fall.
'Legend'
Rounded pyramidal habit, yellow fall color.
'Lincoln'
Slender, upright and compact form with light green leaves, 25' by 15' in 25 years.
'Redmond'
Full pyramidal form, uniform with large leaves and red branches, winter interest.

Littleleaf Linden
Tilia cordata

Height: 40 - 45'
Spread: 45'
Hardiness: -30
Trees are pyramidal, rounding with maturity. Leaves are generally smaller, 2 to 3 inches long and wide, (except Glenleven) finely serrated and turn yellow in fall. Trunks are usually straight and bark smooth. Likes well drained alkali soils, but pH adaptable and tolerates pollution well. Makes an excellent selection for any urban planting.
'Chancellor'
Fastigiate in youth, becoming pyramidal with age. Good branch development.
'Corzam' Corinthian Linden
Narrowly pyramidal, 15' spread. Yellow in fall. Excellent tree for limited space.
'Glenleven' Glenleven Linden
Fast growing with a straight trunk, leaves twice the size of 'Greenspire'
'Greenspire'
Single straight leader, good branch angle. Tolerates difficult conditions.
'Olympic'
Very symmetrical pyramid form, better branching than some other cultivars.

Sterling Silver Linden
Tilia tomentosa 'Sterling'

Height: 45'
Spread: 35'
Hardiness: -20
Upright pyramidal form with a superior branching frame, smooth bark and straight trunk make it a very appealing tree for all seasons. Furry green leaves, silvery white underside, turn yellow in fall. Shows distinction from Tilia cordata cultivars and is an excellent addition to the Linden family

Athena Chinese Elm
Ulmus parvifolia 'Emer I'

Height: 30'
Spread: 35'
Hardiness: -20
Tree with a broadly rounded shape with arching branches. Flowers inconspicuous, masked by the glossy green leaves, changing to yellowish purple in fall. Resistant to Dutch Elm Disease and Phloem Necrosis. Tolerates poor soils and dry or wet conditions making it an excellent selection for urban plantings.

RECOMMENDED STREET TREES
CLASS III

Class III Trees

For use in 8' – 12' width planting strips

Bitternut Hickory
Carya cordiformis

Height: 50 - 75'
Spread: 35 - 50'
Hardiness: -20
Usually a slender tree with an irregular oval crown, often widest at the top. The foliage is light green turning yellow to bronze in fall. This hickory is free of most major pest and disease problems and seems to do better than most in restricted sites. Squirrels avoid the inedible fruits, so the nuisance of fruit drop is not so severe. Recommended for Park and Boulevard use.

Kentucky Coffeetree
Gymnocladus dioicus

Height: 50 - 65'
Spread: 40 - 50'
Hardiness: -30
Sharply ascending branches, rising to form a narrow oval crown. The bark is unique, developing on young stems. Spring leaves are late to emerge, their pinks and purples are a nice contrast to greening trees. Seldom bothered by pests or disease, pollution tolerant and strong, upright growth make this an excellent street tree.

Butternut
Juglans cinerea

Height: 40 - 60'
Spread: 30 - 50'
Hardiness: -30
Round topped tree with wide spreading crown of large horizontal branches and stout laterals. Leaves are dark green and woolly, white ridges and gray furrows make up the mature bark. Fruit debris may be a nuisance. Performs well in the rocky, dry and limestone based soils, a prevalent soil type in Spokane. Usable as Boulevard and Park tree.

Swamp White Oak
Quercus bicolor

Height: 50 - 60'
Spread: 40 - 50'
Hardiness: -25
A broad openly branching tree with rounded crown on a short trunk. Leaves are smoothly lobed, leathery and dark green, changing to orange and yellow-brown in fall. Better transplant success than White Oak and does well in wet sites. Useful as a Park or Boulevard tree, acorns can be a nuisance.

Shingle Oak
Quercus imbricaria

Height: 50'
Spread: 40'
Hardiness: -20
Pyramidal form when young, maturing to a rounded habit. Leaves lacking lobes, wavy, bright glossy green changing from yellowish to rusty red in fall. Tolerates dry conditions and has small acorns making it an excellent tree for streets and other urban sites.

Chestnut Oak
Quercus prinus

Height: 50 - 60'
Spread: 50 - 60'
Hardiness: -20
Rounded and dense irregular spreading canopy. Leaves are bluntly and shallowly toothed, dark yellow-green turning orange-yellow to yellow-brown in fall. Performs well in dry, rocky and lime based soils, a prevalent soil type in Spokane. Great informal character, good for Parks and Boulevards where acorn debris can be managed.

English Oak
Quercus robur

Height: 50'
Spread: 40'
Hardiness: -20
Short and stout tree with a large rounded crown of open thick branches, somewhat irregular. Leaves are variably lobed, dark green upper and pale green lower surfaces. Adapts to soils and climates types well.

'Fastigiata' Skyrocket Oak
Narrow oval form, uniform and stately, excellent for confined sites.

'Michround'
The Westminster Globe Oak is very uniform and symmetrical tree.

Red Oak
Quercus rubra

Height: 50 - 60'
Spread: 45 - 50'
Hardiness: -30
Broad headed tree with a rounded crown. Leaves are sharply toothed dark green and turning brilliant to deep red in fall. Rapidly growing and readily transplanted giving it advantages over other Oaks for use in urban landscapes.

Shumard Oak
Quercus shumardii

Height: 40 - 60'
Spread: 40 - 60'
Hardiness: -15
Pyramidal form, becoming upright spreading and broadly oval. Sharply cut dark green foliage with reliable red fall color. Adapts to soil conditions and is drought tolerant. One of the better transplanting oaks.

Japanese Zelkova
Zelkova serrata

Height: 40 - 60'
Spread: 30 - 50'
Hardiness: -20
Vase habit rounding with maturity. Leaves toothed like elm (same family), usually dark green with a choice of fall color, depending on the cultivar. Bark color and texture is of interest from youth to maturity. All cultivars are resistant to Dutch Elm Disease. Beetle damage also appears to be less problematic. Handsome trees, excellent for urban landscapes and streets.

'Green Vase'
Fast growing, graceful vase form, dapple shade tree. Orange in fall.

'Halka'
Widening vase, with large feathery branches. Yellow in fall.

'Village Green'
Broad vase to rounded form, very vigorous. Rust red in fall.

RECOMMENDED STREET TREES
CLASS IV

Class IV Trees

For use in 12'+ width planting strips

Hackberry
Celtis occidentalis

Height: 50 - 75' (100')
Spread: 40 - 50'
Hardiness: -50
Cold tolerant tree will uncommonly obtain heights of 100 feet, but in urban settings usually does not exceed 60'. Rounded or vase shaped crown with graceful splaying of the branches. No spectacular foliage or flower display, more the trees unique character and ability to tolerate adverse conditions that make it an excellent choice for a Park or Boulevard.

Tulip Tree
Liriodendron tulipifera

Height: 70 - 90'
Spread: 35 - 50'
Hardiness: -20
Tree develops quickly with a tall straight trunk , several large sinuous branches develop a narrow oval frame. The leaves actually appear tulip like medium green changing to yellow and golden in autumn.

Cucumbertree Magnolia
Magnolia acuminata

Height: 50 - 80'
Spread: 40 - 80'
Hardiness: -25
Pyramidal growth habit when young aging to a broad-rounded outline with massive spreading branches often arching towards the ground. Foliage is dark green, flowers are smaller than some magnolias, but in abundance. Makes a great tree for parks, golf courses and other open areas, where it can have room to spread.

Black Walnut
Juglans nigra

Height: 50 - 75' (100')
Spread: 50 - 75'
Hardiness: -20
Develops a rounded well formed crown that is devoid of branches a third to two thirds the way up the tree. Leaves are finer than Bitternut and less furry. Bark is brown to grayish black and roughly diamond shaped. May inhibit the growth of other plants near the site. Tolerates dry conditions and can be used for streets where ground clearance is needed, but performs best when used for Parks and Boulevards, due to dropping fruit.

Dawn Redwood
Metasequoia Glyptostroboides

Height: 60 - 100'
Spread: 25 - 40'
Hardiness: -20
Deciduous conifer, tall pyramidal or conical form. Large basal spread. Bright green foliage, renewed every year. Grows rapidly and tolerate wet sites if drainage is not restricted. In winter the skeletal frame of larger trees is starkly majestic. Definitely a tree for large areas so select sites appropriately.

Bloodgood London Planetree
Platanus x acerifolia 'Bloodgood'

Height: 50 - 80'
Spread: 40 - 60'
Hardiness: -15
Broadly pyramidal, rounding with thick spreading branches at maturity. Large basal spread. Large maple like leaves turn yellow in fall. Bark is peeling creating a brown/cream mottling with year round interest. Better resistance to anthracnose disease than other sycamores but still can be a problem if trees are over used.

White Oak
Quercus alba

Height: 60 - 80'
Spread: 50 - 70'
Hardiness: -30
Juvenile shape is pyramidal maturing with a broad and majestic crown. Leaves are bluntly lobed, dark green to blue-green. Autumn color varies from brown to red. A challenge to transplant and establish, but worth the effort.

Bur Oak
Quercus macrocarpa

Height: 55 - 80'
Spread: 50 - 70'
Hardiness: -40
Weakly pyramidal or oval to start, developing into a large broad-rounded tree with a massive trunk. Foliage is partially lobed, dark green above and grayish below, turning yellow-brown to purplish in fall. Corky bark on smaller branches adds interest. Adapts to a wide range of soil types, drought and pollution tolerant, makes an excellent tree for urban areas where acorn debris can be managed.