

CHAPTER 3 – DRAINAGE SUBMITTAL



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3.1 INTRODUCTION

This chapter describes the contents of a Drainage Submittal and provides a framework for preparing the submittal in order to promote consistency throughout the Spokane region. Specific best management practices (BMPs), design methods and standards to be used are contained in Chapters 4 through 11. Properly drafted construction engineering plans and supporting documents will help facilitate the operation and maintenance of the proposed system long after its review and acceptance.

The Drainage Submittal is a comprehensive report containing all of the technical information and analysis necessary for regulatory agencies to evaluate a proposed new development or redevelopment project for compliance with stormwater regulations. At a minimum, the Drainage Submittal shall include Construction Plans, Erosion and Sediment Control Plans, and Drainage Calculations. Other supporting documentation shall be submitted as needed. Contents of the Drainage Submittal will vary with the type and size of the project, individual site characteristics, and special requirements of the local jurisdictions.

State law requires that engineering work for the Drainage Submittal be performed by or under the direction of a professional engineer currently licensed in the state of Washington.

3.2 APPLICABILITY

A Drainage Submittal is generally required for any land-disturbing activity. Land-disturbing activities are those activities that result in a change in the existing soil cover (both vegetative and non-vegetative) or site topography. The following sections summarize the activities that require a Drainage Submittal as well as those that are exempt.

3.2.1 REQUIRED

- Projects that meet the regulatory threshold as defined in Section 2.1.1 or propose UIC facilities;
- Plats and binding site plans; and,
- Manufactured and mobile home parks.

3.2.2 GENERALLY REQUIRED

- Commercial building permits including institutional and multi-family residential projects;

- Short plats;
- Change of use permits;
- Conditional use permits;
- Grading permits; and,
- Public or private road projects.

3.2.3 GENERALLY EXEMPT

- Certificates of exemption;
- Single-family residential/duplex building permits (A surface drainage plan and other information may be required in the City of Spokane, however a full drainage submittal is generally not required);
- Temporary use permits, unless the use could cause adverse water quality impacts or other drainage-related impacts;
- Land-disturbing activities that do not require a permit, unless the activity could cause adverse water quality impacts or other drainage-related impacts;
- Underground utility projects that replace the ground surface with in-kind material, or materials with similar runoff characteristics;
- Projects to improve motorized and/or non-motorized user safety that do not increase the traffic capacity of a roadway. Certain safety improvement projects such as sidewalks, bike lanes, bus pull-outs and other transit improvements shall be evaluated case-by-case. A safety improvement project that increases the traffic-carrying capacity is not exempt;
- Legally non-conforming projects, except those that drain to the new construction area and drainage improvements;
- Maintenance projects that do not increase the traffic-carrying capacity of a roadway or parking area, such as:
 - Removing and replacing a concrete or asphalt roadway to base course or subgrade or lower without expanding or improving the impervious surfaces;
 - Repairing a roadway base or subgrade;
 - Resurfacing with in-kind material without expanding the area of coverage;
 - Overlaying existing asphalt or concrete pavement with BST, asphalt or concrete without expanding the area of coverage;
 - Overlaying existing gravel with BST, asphalt or concrete, or overlaying BST with asphalt; in either case, without expanding the

area of coverage. This partial exemption only applies if the overlaid surface continues to drain to the existing facilities or structures and if:

- ◆ The road traffic surface will be subject to an ADT volume of less than 7,500 on an urban road or less than 15,000 on a rural road, freeway, or limited access control highway; or,
- ◆ The parking area traffic surface will be subject to less than 40 trip ends per 1,000 square feet of building area or 100 total trip ends; or,

3.2.4 EXEMPT

- Commercial agriculture as regulated under Revised Code of Washington (RCW) Chapter 84.34.020, except for the construction of impervious surfaces related to commercial agriculture;
- Forest practices regulated under Washington Administrative Code (WAC) Title 222, except for Class IV General Forest Practices that are conversions from timberland to other uses;
- Oil and gas field activities or operations, including construction of drilling sites, waste management pits, access roads, and transportation and treatment infrastructure such as pipelines, natural gas treatment plants, natural gas pipeline compressor stations and crude oil pumping stations;
- Actions by a public utility or any other governmental agency to remove or alleviate an emergency condition, restore utility service, or reopen a public thoroughfare to traffic;
- Records of survey, boundary line adjustments, and property aggregations, unless the action affects drainage tracts and easements;
- Operation and maintenance or repair of existing facilities; and,
- Road and parking area preservation/maintenance projects, such as:
 - Pothole and square-cut patching;
 - Crack sealing;
 - Shoulder grading;
 - Reshaping or regrading drainage system; or,
 - Vegetation maintenance.

3.3 CONCEPT DRAINAGE REPORT

3.3.1 INTRODUCTION

Concept Drainage Reports are used by staff of the local jurisdiction to preliminarily assess the drainage requirements on certain land-use actions and land development permits. The purpose of the Concept Drainage Report is to demonstrate that the proposed drainage facilities can meet the intent of this Manual and are feasible with respect to design, construction, and maintenance. Its contents are similar to those of the Drainage Report described in Section 3.4, though for many items the Concept Drainage Report does not require as much detail as the Drainage Report.

Preparation of a Concept Drainage Report is an initial step in the Drainage Submittal process, and acceptance of a Concept Drainage Report does not imply that the concept proposed is accepted as the final design. Acceptance only implies that the project proponent (or his agent) has demonstrated that stormwater disposal is feasible. It does not relieve the project proponent from a geotechnical site characterization (refer to Chapter 4), a down-gradient analysis, or changes to the design that may be necessary in order to meet the criteria and standards presented in this Manual.

3.3.2 APPLICABILITY

The need for a Concept Drainage Report varies depending upon the nature, scope and complexity of the proposed project and the existing drainage conditions. Due to the number of variables involved, this Manual does not include an exhaustive listing of all scenarios that may require a Concept Drainage Report. Concept Drainage Reports will be required for any of the following situations, and the local jurisdiction has the authority to require a Concept Drainage Report for any other project.

- A Certificate of Concurrency is required per the City of Spokane Municipal Code “Concurrency Certification;”
- The project lies within or drains to critical areas, as designated by the local jurisdiction;
- The project lies within or drains to an official 100-Year Flood Zone as mapped by the Federal Emergency Management Agency (FEMA) (See Section 7.9.2);
- The project lies within or drains to a Special Drainage Area (SDA) or study area as recognized by the local jurisdiction (See Section 7.9.1);
- The project lies within or drains to an area identified as having drainage problems;
- The project lies within or drains to an area identified as having floodplains;

- The project is especially large, phased, or master-planned and may require interim facilities;
- The project involves significant off-site drainage and relies upon a predominant drainageway;
- The project site has features that can be classified as Natural Locations of Drainage Systems (NLDS) (refer to 8.2.4 for definition);
- The project has the potential to impact existing or future regional stormwater facilities;
- The project proposes non-standard stormwater treatment BMPs; and,
- The project proposes conventional subsurface disposal systems in areas that are typically not conducive to subsurface disposal (such as where shallow groundwater or other limiting layers may be present).

3.3.3 EXEMPTIONS

In unincorporated Spokane County and the City of Spokane Valley, standard drainage systems proposed in deep free-draining soils are generally exempt from the Concept Drainage Report requirement. This exemption only applies to sites that do not involve significant off-site drainage issues and are not located in or near a known drainage problem area, floodplain or critical area.

3.3.4 SCOPE

The Concept Drainage Report shall demonstrate that the existing or proposed drainage infrastructure is adequate to control the increase in runoff due to the proposed project by meeting the minimum requirements of this Manual.

A detailed design is not required at this stage because the exact nature of the proposal may not be certain. However, the Concept Drainage Report shall provide sufficient information and analysis to demonstrate that adequate infrastructure can be provided. Due to varying design parameters, design challenges, and potential solutions, the level of requirements can change from site to site. For example, if an infiltration facility is proposed in an area known to have shallow groundwater or bedrock, a geotechnical site characterization would be required at the Concept Drainage Report stage to support the use of infiltration. But a concept drainage report proposing an evaporation facility in the same area would not typically require geotechnical work at this stage.

Any alternatives that will be considered by the project proponent during final design shall be included in the Concept Drainage Report. For projects that require a public hearing, all alternatives shall be presented for review by staff and the public prior to

the hearing. If the concept does not include any other alternatives, it will be assumed that the accepted concept is the final design concept.

The accepted Concept Drainage Report shall be implemented in the final construction plans. New or significantly altered conceptual elements on the final plans are subject to reconsideration or denial.

The Concept Drainage Report shall include the following elements:

- Narrative: The narrative shall generally follow Section 3.4.2 and shall describe all proposed methods and alternatives for stormwater treatment and disposal, as well as provide sufficient information, supporting technical data, assumptions, design criteria, and drainage calculations to demonstrate that the proposed stormwater system will meet the requirements of this Manual. If phasing is anticipated, an explanation of how the drainage system will be phased and constructed shall also be included;
- Schematic: The schematic plan of the proposed stormwater system shall show the approximate size and location of all drainage components;
- Basin Map: The drainage basin maps shall generally follow the requirements for maps presented in Section 3.4.3, but may be less detailed;
- Geotechnical Information: If a non-standard disposal system or infiltration is proposed, then sufficient site characterization work shall be completed in accordance with Chapter 4 to demonstrate that the proposed facilities will function as intended;
- Drainage Features: The report shall generally follow the requirements for pre-development basin information presented in Section 3.4.2, but may be less detailed;
- Critical Areas: The report shall generally follow the requirements for critical areas presented in Section 3.4.2, but may be less detailed;
- Perpetual Maintenance of Facilities: The report shall generally follow the requirements for Perpetual Maintenance of Facilities presented in Section 3.4.2, but may be less detailed;
- Offsite Easements: The report shall follow the requirements for off-site easements presented in Section 3.4.2; and,
- Regional Facilities: The report shall follow the requirements for regional facilities presented in Section 3.4.2.

3.4 DRAINAGE REPORT

3.4.1 INTRODUCTION

The purpose of the Drainage Report is to identify drainage impacts resulting from land development activities and determine the improvements necessary to control the increase in stormwater runoff and to treat the pollutants that can adversely impact water quality.

A Drainage Submittal package is required after a formal decision on a land use action has been made and the conditions of approval have been accepted. If a formal decision is not required for the project, the Drainage Submittal package is submitted as part of the project permit application.

The Drainage Report shall be inclusive, clear, legible, and reproducible. An uninvolved third party shall be able to review the Drainage Submittal and determine whether all applicable standards in this Manual have been met.

The basic elements of a Drainage Report are summarized in the following sections.

3.4.2 NARRATIVE

The drainage report narrative shall include the following elements:

- **Project Description:** The project description shall include information about the size of the project, the number of lots proposed, the project location (including Section, Township and Range), and background information relevant to drainage design, including topography, surface soils, surface and vegetative conditions, etc.;
- **Geotechnical Information:** This part of the narrative shall summarize the geotechnical site characterization (GSC) for the project including recommended outflow rates for drywells, infiltration rates and on-site soil descriptions;
- **Pre-Development Basin Information:** This information shall summarize the pre-development drainage patterns for all basins contributing flow to, on, through, and from the site. This section shall include all assumptions and justifications used to determine curve numbers and/or runoff coefficients used in the analysis, including a table that presents existing impervious and pervious areas as shown in the example in Appendix 3A. The narrative shall identify and discuss all existing on-site and/or off-site drainage facilities, natural or constructed, including but not limited to NLDS, conveyance systems, and any other special features on or near the project;

- Post-Development Basin Information: This information shall summarize all assumptions used to determine the characteristics of the post-developed basins, such as the size of roofs and driveways, and the curve numbers and/or runoff coefficients used in the analysis (refer to Appendix 3A for an example table). In addition, a table shall be included that summarizes the impervious and pervious areas for each subbasin, as shown in Appendix 3A;
- Critical Areas: If the local jurisdiction's Critical Areas Ordinance requires a Critical Areas evaluation for the project proposal, any required mitigation measures shall be incorporated into the proposed drainage facility design and addressed in the Drainage Report and Road and Drainage Plans;
- Down-Gradient Analysis: This analysis shall identify and discuss the probable impacts down-gradient of the project site. Refer to Section 3.4.5 for additional requirements;
- Methodology: The hydraulic methods and storm events used in sizing the drainage facilities, including the BMPs proposed for the project, shall be discussed;
- Water Quality Treatment: A discussion of treatment requirements, based on the criteria in Chapter 6, shall be included;
- Results: The results of the calculations and a description of the proposed stormwater facilities shall be included. When applicable, a table comparing the pre-developed and post-developed conditions including rates and volumes shall also be included. A table shall be provided when applicable, summarizing the maximum water elevation of the facilities for the design storms, outflow structure information, the size of facilities "required" by the calculations, and the size of the facilities "provided" in the proposed design (refer to Appendix 3A for an example table);
- Operational Characteristics: Sufficient information shall be provided about the operation of the stormwater system so that an uninvolved third party can read the report and understand how the proposed system will function under various conditions.
- Perpetual Maintenance of Facilities: A discussion shall be included of the provisions set forth to operate and maintain the drainage facilities. The project proponent's mechanism for funding the operation and maintenance for stormwater facilities, including sinking fund calculations, shall be included (refer to Chapter 11 for operation and maintenance requirements and Chapter 10 for source control requirements);
- Off-Site Easements: The anticipated location of any off-site easements shall be identified either on the basin map or in a separate schematic. Off-site easements will be required for proposed stormwater conveyance or disposal facilities outside the project boundaries. These easements shall be

obtained and recorded prior to the acceptance of the final Drainage Submittal (refer to Chapter 11 for more information); and,

- **Regional Facilities:** A discussion of any expected future impacts on or connections to existing or proposed regional facilities shall be included (refer to Section 7.10).

3.4.3 FIGURES

Basin Map

The drainage report shall include a basin map. In most cases, both a pre-developed and post-developed basin map shall be provided. The minimum elements required include the following:

- Vicinity map, project boundaries, and section, township and range;
- Basin limits:
 - Basin limits shall include on-site, off-site, and bypass areas contributing runoff to or from the project;
 - In all cases, the engineer shall field-verify the basin limits, including any contributing off-site areas, and shall describe how the basin limits were determined.
 - Drainage basins shall be clearly labeled and correlated with the calculations;
- Time of concentration routes, with each segment clearly labeled and correlated with the calculations;
- Labeled topographic contours:
 - Contours shall extend beyond the project or drainage basin boundaries to the extent necessary to confirm basin limits used in the calculations.
 - For commercial projects, spot elevations may be acceptable in lieu of contours on post-developed basin maps.
 - Projects in an urban area shall use a maximum contour spacing of 2 feet.
 - At the discretion of the local jurisdiction, projects outside an urban area, such as a large lot subdivision, may use the best available topographic information; this may involve contours on a scale larger than the 2-foot minimum.
- Any NLDS including, but not limited to, natural or constructed drainage features, wetlands, creeks, streams, seasonal drainageways, closed depressions, ditches, culverts, storm drain systems and drywells;

- Floodplain limits, as defined by FEMA or other studies;
- Any geologically hazardous areas;
- Footprint of proposed drainage facilities such as ponds, infiltration facilities, pipes, and ditches;
- North arrow and scale;
- Existing and proposed easements; and,
- Adjacent streets.

Other Figures

- Soils map;
- Site photos;
- Any graphs, charts, nomographs, maps, or figures used in the design, when applicable; and,
- If infiltration is proposed, a geotechnical site characterization is typically required (refer to Chapter 4). As part of that study, a geologic cross-section of the stormwater disposal area drawn to scale shall be included. The proposed stormwater disposal facilities shall be superimposed on the cross-section. All relevant geologic units shall be clearly identified including the target disposal layer and limiting layers.

3.4.4 CALCULATIONS

Calculations shall be presented in a logical format and provide sufficient information to allow an uninvolved third party to reproduce the results. All assumptions, input and output data, and variables listed in computer printouts and hand calculations shall be clearly identified. Basins and design storm events shall be clearly identified on all calculations.

The Drainage Report shall incorporate all calculations used to determine the size of the facilities. Typical calculations include, but are not limited to:

- Hydrologic/hydraulic calculations including pre- and post-developed peak rate and volume calculations, routing calculations, design information for outflow structures, orifice information, a pond volume rating table or pond volume calculations, etc.;
- Time of concentration calculations;
- Curve number (CN) or runoff coefficient (C)
- Water budget calculations;
- Water quality treatment calculations;

- Inlet capacity and bypass calculations;
- Detention/retention storage capacities;
- Calculations for ditches and natural channels;
- Culvert and pipe calculations;
- Non-flooded width calculations; and,
- Energy dissipation calculations.

Refer to Chapters 5 through 8 for additional information regarding the above calculations.

3.4.5 DOWN-GRADIENT ANALYSIS

The purpose of a Down-Gradient Analysis is to inventory natural and constructed down-gradient drainage features and to identify and evaluate adverse down-gradient impacts that could result from the proposed project. Common adverse impacts of land development include erosion, flooding, slope failures, changed runoff patterns and reduced groundwater recharge (to springs, streams, wetlands and wells, etc.). Proposed drainage facilities are to be designed to mitigate adverse impacts identified in the Down-Gradient Analysis.

A Down-Gradient Analysis is required for all projects, unless waived by the local jurisdiction. The level of detail required will vary depending on the location and complexity of the project. Project sites that have well-draining soils, no identified drainage problems nearby and no features that rely on groundwater recharge in the vicinity may require only a minimal level of effort to meet this requirement. Conversely, if the project is located in an SDA or a known problem drainage area, as determined by the local jurisdiction, if non-standard disposal systems are proposed, or if land features of concern have been identified down-gradient of the project site, then the level of analysis shall match the complexity of the site. Typically, the analysis should extend a quarter of a mile down gradient and may be limited in scope by lack of access to adjacent properties.

At a minimum, this analysis shall include:

- A visual inspection of the site and down-gradient area by the engineer that extends to the location where adverse impacts are anticipated to be negligible;
- A site map that clearly identifies the project boundaries, study area boundaries, down-gradient flow path, and any existing or potential areas that have been identified as problematic;
- A written summary addressing the following items:

- Existing or potential off-site drainage problems that may be aggravated by the project;
- The condition and capacity of the conveyance route including all existing and proposed elements, potential backwater conditions on open channels, constrictions or low capacity zones, surcharging of enclosed systems, or localized flooding;
- The presence of existing natural or constructed land features that are dependent upon pre-developed surface or subsurface drainage patterns;
- Potential changes to groundwater characteristics that may negatively impact sub-level structures, foundations, or surface areas due to an increased amount or increased frequency or duration of groundwater intrusion;
- Existing or potential erosive conditions such as scour or unstable slopes on-site or down-gradient of the project; and,
- Flood hazard areas identified on FEMA maps.

If there are existing or potential off-site drainage problems down-gradient of the project, it shall be demonstrated that the proposed stormwater disposal system has been designed to meet all of the following conditions:

- The stormwater runoff leaves the site in the same manner as that of the pre-developed condition;
- Reduced or increased groundwater recharge has been considered with respect to potential adverse impacts on downgradient features; and
- The proposed design does not aggravate an existing drainage problem or create a new drainage problem.

If down-gradient surface release at a rate or volume greater than the pre-developed condition is proposed, then the following items shall also be addressed in detail:

- Potential adverse impacts on natural or constructed drainage channels due to an increase in stormwater rate, velocity and flow duration; and
- Potential adverse impacts on undeveloped down-gradient properties that, if developed in the future, could be adversely impacted.

3.5 ROAD AND DRAINAGE PLANS

3.5.1 INTRODUCTION

Construction drawings shall be submitted for review by the local jurisdiction. The submittal and acceptance process shall be in accordance with the local jurisdiction's standards and specifications

All plan sheets for every submittal shall be signed and dated by the project proponent, or his authorized agent, and all plan sheets shall be stamped and signed by the project engineer. Road and drainage plans shall include the local jurisdiction's standard notes for construction (refer to Appendix 3B).

Once the Drainage Submittal has been accepted by the local jurisdiction, a set of Road and Drainage plans shall be submitted on good quality, reproducible Mylar media. The Mylar set shall be stamped and signed by the engineer and signed and dated by the project proponent or his authorized agent.

3.5.2 MINIMUM PLAN ELEMENTS

The road and drainage plans shall provide enough detail for a third party to construct the proposed facilities per the engineer's design. At a minimum, the plans shall meet the criteria of the local jurisdiction's standards and specifications, and provide the following information:

- Flow line and/or spot elevations, slopes, lengths, and cross-sections of ditches;
- Rim elevations of inlet grates, drywells, and other structures;
- A profile of the stormwater conveyance system including pipes, culverts, ditches and connections, where applicable. The profile shall include the sizes, material types, lengths and invert elevations of all conveyance elements.
- For lateral pipe connections to storm drain lines in existing right of way (i.e. from a catch basin to a drywell, a main line stormwater system, a pond or a swale), fixed invert elevations are preferred but not required. The minimum depth from finish grade to pipe invert and the minimum pipe slope necessary to satisfy the freeboard and self-cleaning velocity requirements shall be provided. If necessary, invert elevations may be adjusted during construction to avoid potential conflicts with existing utilities in the right of way;
- Where drainage infrastructure such as roadside swales or parallel conveyance ditches or channels may interfere with driveway locations,

driveway locations shall be fixed as part of the road and drainage plans and shown on the lot plans;

- Record drawing information, including invert elevations of any existing drainage system elements that will be used in the new design;
- Construction details drawn to scale or a referenced standard drawing for all structures. Standard details shall be referenced, not reproduced, on the construction drawings;
- Drainage easements with all survey information shown and a recording number if applicable;
- Grading plan for drainage ponds and swales. The grading plan shall include existing and proposed one foot contours and catch points. A cross-section of each pond or swale shall be provided in the plans, showing pond/swale bottom elevation, maximum water surface elevation for the design storm(s), inlet and outlet elevations, berm elevation and slopes, landscaping and vegetation requirements, compaction requirements and keyway location and dimensions;
- Each drainage pond/swale corner, pipe inlet or outlet, pipe system angle point, ditch, and drainage structure, shall be horizontally defined with respect to property corners, street stationing, or a coordinate system; and,
- Material gradation, thickness, and dimensions of riprap pads.

3.5.3 REVISIONS AFTER PLAN ACCEPTANCE

When changes to the design are necessary, acceptance of any proposed plan changes shall be obtained in writing from the local jurisdiction. The proposed revisions shall be stamped and signed by an engineer and submitted to the local jurisdiction for review and acceptance prior to construction. The submittal shall include:

- A brief description of the proposed changes and the purpose for the change;
- Substitute pages of the originally accepted construction plans that include the proposed changes; and,
- Calculations and supporting documentation for the proposed change demonstrating that the proposed modified design is at least equivalent to the originally accepted design.

3.6 OTHER SUBMITTAL ELEMENTS

As determined by the local jurisdiction, the following items shall be included as part of the Drainage Submittal:

- Acknowledgement (acceptable in the form of a letter) of inspection responsibilities. Contact the local jurisdiction for specific project inspection requirements;
- A geotechnical site characterization, which may also include a sub-level structure feasibility analysis, pavement analysis, pavement subgrade sampling, down-gradient analysis, etc. (refer to Chapter 4);
- An erosion and sediment control plan (refer to Chapter 9);
- A draft copy of the Conditions, Covenants and Restrictions (CC&Rs) for the homeowners' association in charge of operating and maintaining the drainage facilities (refer to Chapter 11);
- An operations and maintenance manual (refer to Chapter 11);
- A financial plan (refer to Chapter 11);
- On-site and/or off-site easement documentation (refer to Chapter 11);
- Lot Plans (refer to criteria and example in Appendix 3C).
Note that lot plans are not required when the only drainage facilities for a given project are located within the public right of way. However, when a lot plan is required, and facilities are located both on private property in an easement and in the public right of way, the facilities within the right of way shall be identified and dimensioned as noted.
- UIC registration forms (refer to Section 6.3.2).
- Documentation that applicant has contacted Ecology regarding the need for a NPDES Construction Stormwater Permit

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APPENDIX 3A – EXAMPLE TABLES FOR DRAINAGE REPORT

BASIN INFORMATION SUMMARY TABLE

	Pre-Development Condition	Post-Development Condition
Total Site (acres)	15	15
Pollutant Generating Impervious Surface (acres)	n/a	4.2
Surface Cover	n/a	roads & driveways
NRCS Soil Type	n/a	Type B
CN Value	n/a	98
Hydraulically Unconnected Impervious Surfaces (acres)	1.1	2.4
Surface Cover	dirt road	roofs & sidewalks
NRCS Soil Type	Type B	Type B
CN Value	85	98
Pervious Surfaces (acres)	13.9	8.4
Composite CN	52	59
Surface Cover #1	woods, good	woods, good
Sub-Area #1 (acres)	3.9	0.6
NRCS Soil Type #1	Type A	Type A
CN Value #1	30	30
Surface Cover #2	brush, fair	open space & lawn area, good
Sub-Area #2 (acres)	3	6
NRCS Soil Type #2	Type B	Type B
CN Value #2	56	61
Surface Cover #3	herbaceous, good	herbaceous, good
Sub-Area #3 (acres)	7	1.8
NRCS Soil Type #3	Type A	Type A
CN Value #3	62	62

NRCS – Natural Resources Conservation Service

TREATMENT AND FLOW CONTROL REQUIREMENT SUMMARY TABLE

	Treatment Volume (cubic feet)		10-Year Storm Event Required Volume (cubic feet)	Total Volume Provided (cubic feet)
	Required	Provided		
Basin A	135	150	75	300
Basin B	110	120	95	240
Basin C	255	280	155	560

POLLUTANT-GENERATING IMPERVIOUS SURFACE SUMMARY TABLE

	Total Basin Area (sf)	Grass (sf)	Roof Number	Roofs (sf)	Driveway Number	Driveway Area (sf)	Pavement (sf)	Sidewalk (sf)	PGIS Area (sf)
Basin A	37,575	5,000	10	15,000	10	5,000	12,000	575	17,000
Basin B	16,750	3,500	5	7,500	4	2,000	3,500	250	5,500
Basin C	36,075	4,500	10	15,000	8	4,000	12,000	575	16,000

APPENDIX 3B – STANDARD NOTES FOR ROAD AND DRAINAGE PLANS

1. All work and materials shall be in conformance with the local jurisdiction road standards (insert applicable road standards name), 20XX (insert applicable year per land-action conditions of approval or the most current version for municipal road projects).
2. Prior to site construction, the Contractor is responsible for locating underground utilities. Call the underground utility location service at 1-800-424-5555 before you dig.
3. Locations of existing utilities shown in the plans are approximate. The Contractor shall be responsible for locating all underground utilities. Any conflicting utilities shall be relocated prior to construction of road and drainage facilities.
4. The Contractor is required to have a complete set of the accepted road and drainage plans on the job site whenever construction is in progress.
5. If the Contractor discovers any discrepancies between the plans and existing conditions encountered, the contractor shall immediately notify the design engineer.
6. The Contractor should take precautions to protect the infiltration capacity of stormwater facilities (e.g., line the facility with filter fabric, over-excavate upon completion of the infrastructure, etc.)

Supplemental notes used when applicable

7. For any curb grades less than 0.8% (0.008 ft/ft), a Professional Land Surveyor currently licensed in the State of Washington shall verify that the curb forms are at the grades noted on the accepted plans, prior to placement of concrete. The Contractor is responsible for arranging and coordinating work with the Surveyor.
8. The Contractor shall employ a Professional Land Surveyor currently licensed in the State of Washington to verify that the cross-gutter forms are at the correct plane grade prior to concrete placement. The cross-gutters shall be constructed prior to paving, and the pavement shall then match the edge of concrete gutter.
9. For construction of drywells, install filter fabric (Amoco 4545 or approved equivalent) between the washed drain rock and the native soils.
10. Bio-infiltration ponds/swales shall have a maximum treatment design depth (from pond/swale bottom to elevation of drywell grate or first overflow/outflow mechanism) of 6 inches. Either organic matter content or Cation Exchange Capacity (CEC) testing shall be completed in order to substantiate the treatment soil composition. The tests shall be performed on composite samples taken from the treatment soil layer from the constructed pond bottom. A composite sample consists of well-mixed soil obtained from at least four cores, to a depth of at least 6 inches, randomly distributed over the pond bottom test area. Stockpile samples from on-site or a material supplier can be tested for informational purposes to determine initial

- suitability and possible soil amendments, but will not be accepted in-lieu of in-place testing. A minimum of one test shall be performed for each bio-infiltration pond/swale 1,500 square feet or less, with one additional test for each additional 2,000 square feet of pond/swale bottom, or fraction thereof. "One test" is equal to four core samples taken as described above. Testing results shall be submitted as part of the Construction Certification Submittal required for release of surety posted on project.
11. Concrete aprons are required at the inlet into any swale or pond. The finish grade of the swale/pond side slope, where the concrete inlet apron ends, shall be a minimum of 2 inches below the finished elevation of the concrete curb apron extension. The intention is to allow stormwater runoff to enter the swale/pond unobstructed, without backing up into the street and gutter due to sod overgrowth at the inlet.
 12. Unlined pond and bioinfiltration swale bottoms are expected to infiltrate via the pond floor, and therefore, shall not be heavily compacted; equipment traffic shall be minimized on the pond bottoms. The facility subgrade shall be a medium- to well-draining material, with a minimum thickness of 48 inches and a minimum infiltration rate of 0.15 in/hr. The facility shall drain within 72 hours of a storm event. If the pond also serves as a water quality treatment facility, the treatment zone (sod and 6 inches of treatment soil) shall be a medium- to well-draining material, with a minimum infiltration rate of 0.25-0.50 in/hr.; silty loam or loamy soils are presumed to have an infiltrative rate that falls within this range. Scarify the finish grade of the pond bottom prior to hydroseeding/sodding. Testing that verifies subgrade minimum infiltration rate is required by the local jurisdiction prior to construction certification to ensure adequate drainage. Infiltrative testing of the treatment zone is only required if soils other than silty loam or loamy soils are proposed.
 13. If, during final inspection, it is found that the constructed pond or swale does not conform to the accepted design, the system shall be reconstructed so that it does comply.

Refer to Appendix 9A for Erosion and Sediment Control Standard Notes.

APPENDIX 3C – LOT PLAN CRITERIA AND EXAMPLE

Lot plans, stamped and signed by a Professional Engineer, shall be prepared for residential lots containing any of the following elements:

- Drainage facilities in easements on the lot;
- Drainage facilities located in the public right of way or private road tract which are in front of or adjacent to the lot;
- Floodplain encroachment;
- An easement or tract is located on the lot, including but not limited to sewer, domestic water, access, sight distance, NLDS (refer to Section 8.3.4), aviation, petroleum or utility.

A separate lot plan* shall be prepared for each lot meeting the above conditions and shall contain the following elements or adhere to the following criteria:

- The lot plan and attached section sheets shall be on letter or legal size paper and shall be signed and stamped by an engineer;
- The lot plan shall include a north arrow, scale, lot address (if available), name of adjacent street(s); curb sidewalk and/or edge of asphalt, lot dimensions, lot number, block number and the name of the sub-division;
- All easements shall be labeled and dimensioned with respect to property lines or corners;
- Elevations and dimensions of the pond bottom area shall be clearly shown if applicable;
- Invert or rim elevations for any curb drops, sidewalk inlets, grates, and drywells shall be clearly shown;
- The locations of any required ditches shall be shown, including ditch flow line grade and riprap if required;
- The final/fixed location of driveways shall be shown, including any information about the culvert (material, diameter, length, invert elevation(s), depth of cover, etc.);
- A standard detail for all structures shall be called out;
- Locations of all utilities shall be shown (City of Spokane only);
- Text placed inside the lot lines should be limited to lot line dimensions with all remaining text placed outside of the lot lines for clarity; and,
- The scale of the drawing shall be such that each lot is depicted as large as possible while still including the curb line(s) of the adjacent street(s).

* A “typical” lot plan will be considered representative for more than one lot only if the drainage facility geometry is consistent with regard to length, width, depth and grade, subject to local jurisdiction approval.

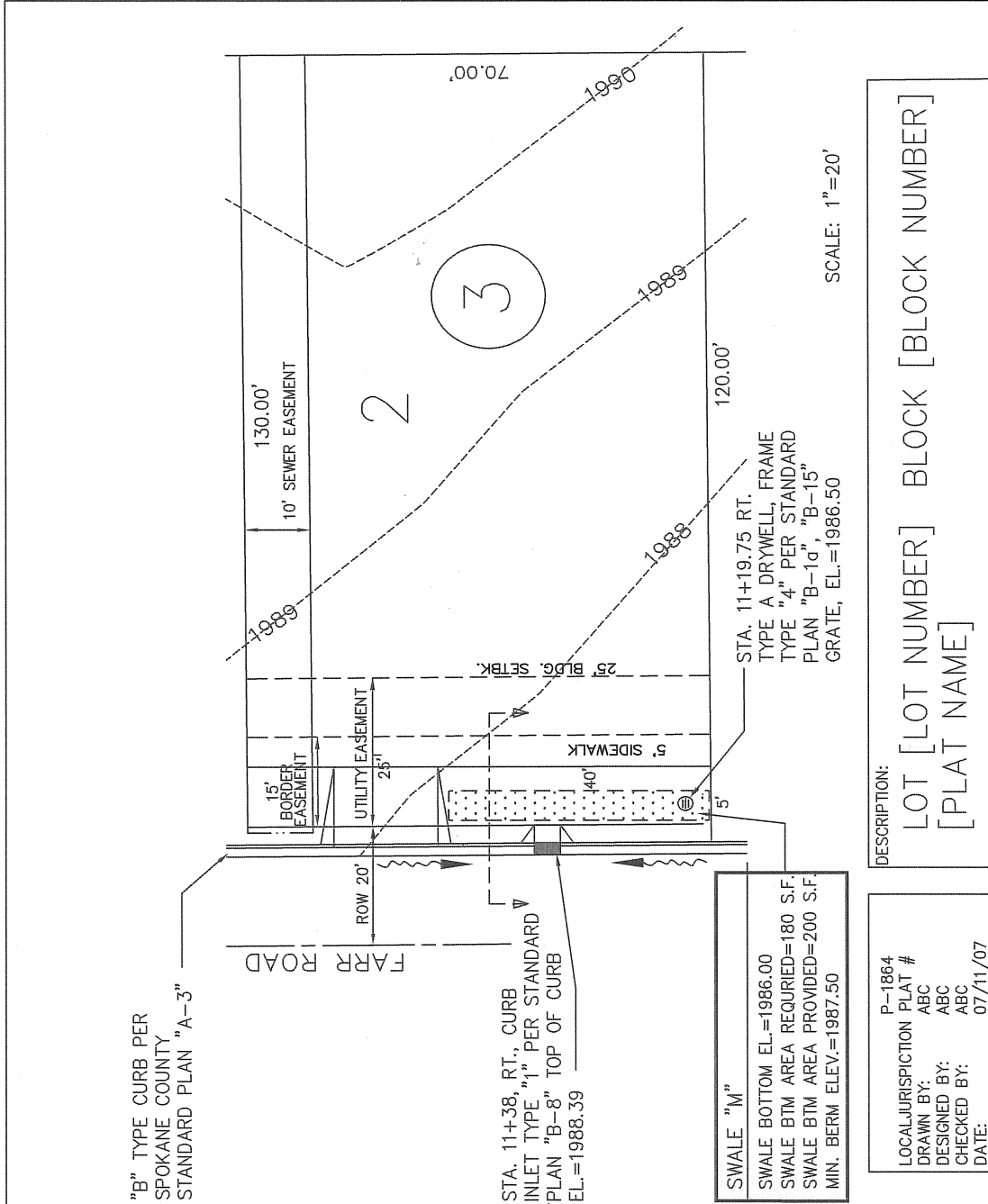
Lot plans shall be accompanied by a dimensioned cross-sectional drawing through the drainage facility. Cross-sections shall be drawn to scale and depict the following items as applicable:

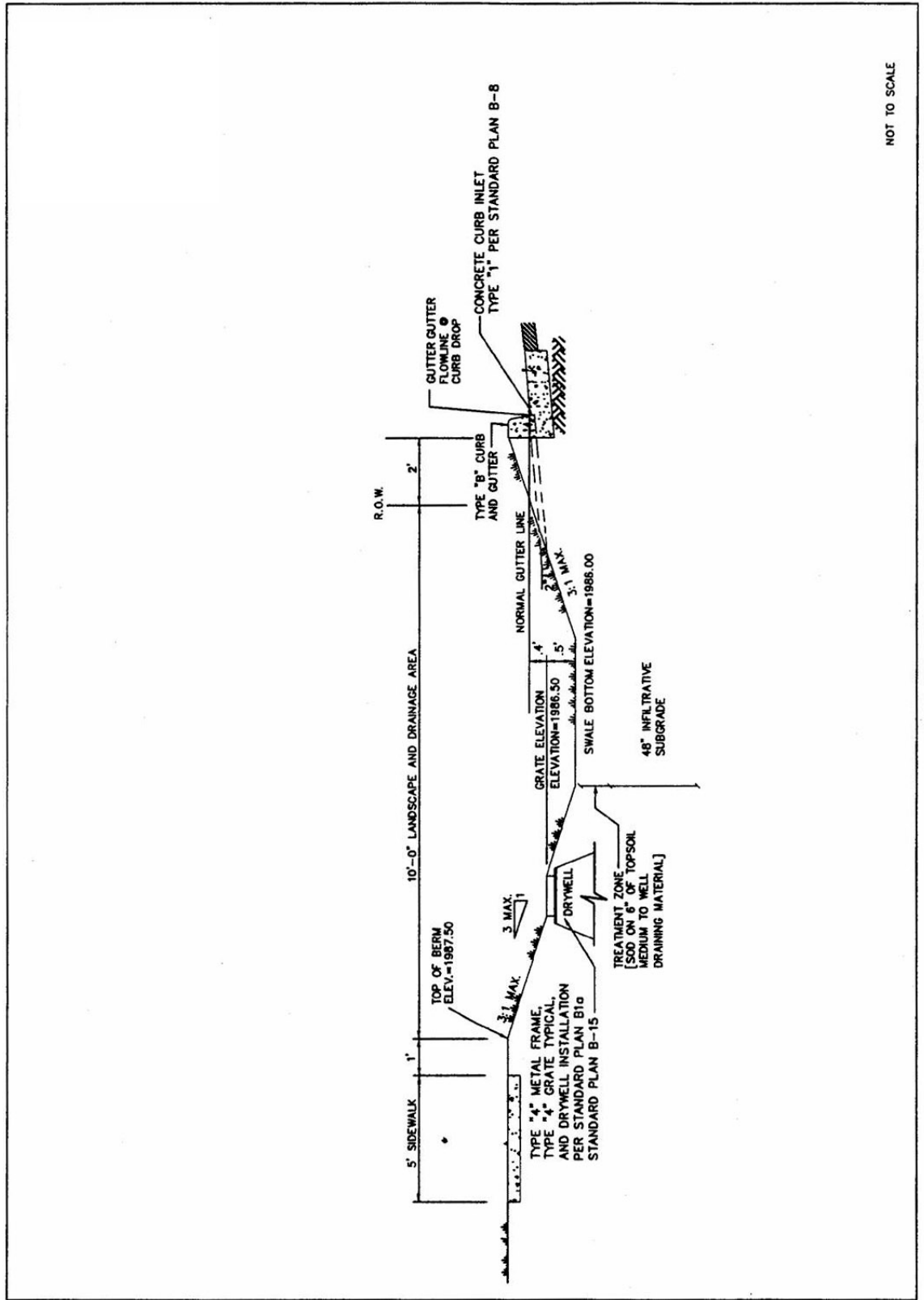
- Property and right of way lines;
- Easements;
- Curb and sidewalk;
- Edge of asphalt;
- Swale side slopes;
- Total depth of swale or ditch;
- Rim elevation of the drywell;
- Spot elevations for normal gutter line, the required 2-inch drop to finish grade below the concrete apron, and the finish grade of the swale bottom;
- Grass, seeding or vegetation requirements; and,
- Any other applicable information which would further assist in achieving the proper construction.

Example plan and cross-sectional drawings are shown on the following pages.

Note that lot plans are not required when the only drainage facilities for a given project are

located within the public right of way. However, when a lot plan is required, and facilities are located both on private property in an easement and in the public right of way, the facilities within the right of way shall be identified and dimensioned as noted above for informational purpose.





LOCAL JURISDICTION PLAT #

DRAWN BY: PSF

DESIGNED BY: CSJ

CHECKED BY: CSJ

DATE: 07/11/05

DESCRIPTION:

TYPICAL SECTION THROUGH SWALES ON [ROAD NAME]

[INSERT PLAT NAME]