

**CITY OF MONROE PUBLIC WORKS
DESIGN, CONSTRUCTION AND OPERATIONS STANDARDS**

**SECTION 4
STORM AND SURFACE WATER**

TABLE OF CONTENTS

4.1	GENERAL REQUIREMENTS	1
4.1.1	APPLICABILITY	2
4.1.2	OWNERSHIP	2
4.1.3	SITING, EASEMENTS, AND TRACTS	2
4.1.4	STORM DRAINAGE DESIGN	3
4.1.5	PERMITS	5
4.1.6	ILLICIT DISCHARGES	6
4.1.7	MAINTENANCE	5
4.1.8	EMERGENCY OVERFLOW	6
4.1.9	OFF SITE INVESTIGATION	6
4.2	CONSTRUCTION PLANS	6
4.3	EXISTING UTILITIES	8
4.4	TRENCH EXCAVATION, BEDDING, AND BACKFILL FOR STORMWATER PIPE.....	9
4.4.1	SECTION DESCRIPTION	9
4.4.2	GENERAL REQUIREMENTS	9
4.5	INSPECTIONS AND APPROVAL	9
4.5.1	CONSTRUCTION AND MAINTENANCE INSPECTIONS.....	9
4.5.2	CCTV REQUIREMENT	10
4.5.3	FINAL APPROVAL.....	11
4.6	STANDARD STORM DRAWINGS	13

CITY OF MONROE PUBLIC WORKS DESIGN, CONSTRUCTION AND OPERATIONS STANDARDS

SECTION 4 STORM AND SURFACE WATER

4.1 GENERAL REQUIREMENTS

The City of Monroe storm drainage utility service area includes the area within the City of Monroe city limits. The storm drainage utility is implemented in accordance with MMC 15.02 and 23.40, and the National Pollution Discharge Elimination System (NPDES) Phase II Permit, amended in 2014.

The purpose of this chapter is to provide for and promote the health, safety, and welfare of the general public through sound development policies and construction procedures which respect and preserve the City's storm drainage and watercourses; to minimize water quality degradation and control of sedimentation of creeks, streams, ponds, lakes, and other water bodies; to preserve and enhance the suitability of waters for recreation and fish habitat; to preserve and enhance the aesthetic quality of the waters; to maintain and protect valuable groundwater quantities, locations, and flow patterns; to ensure the safety of City roads and rights-of-way; and to decrease drainage-related damages to public and private property.

Design and construction of storm drainage systems must conform to the Monroe Standards and Specifications, and the Department of Ecology Stormwater Management Manual as adopted by the City, the NPDES Phase II Permit with associated Technical Appendices, and the WSDOT Highway Runoff Manual. If inconsistencies occur, the Monroe Standards will have precedence.

The City encourages the use of Low Impact Design (LID) storm drainage features and will encourage LID implementation as part of Capital Projects and new public and private developments. LID designs will be reviewed on a case-by-case basis in accordance with the Technical Appendix 1 of the NPDES Phase II Permit. LID infiltration and dispersion measures must be designed to minimize potential negative impacts to adjacent properties.

Storm drainage system improvements may be required when the existing collection and conveyance system is not adequate for the proposed use because of on-site or off-site inadequacy including, but not limited to, age, pipe diameter, type, slope, and roughness. The improvements must be consistent with the Monroe Standards for new construction.

The standards established by this chapter are intended to represent the minimum design standards for the construction of storm drainage facilities. Compliance with these Standards does not relieve the designer of the responsibility to apply conservative and sound professional engineering judgment to protect the health, safety, and welfare of the general public. Special site conditions and environmental constraints may require a greater level of protection than would normally be required under these Standards. The designer must apply these Standards bearing in mind these constraints.

4.1.1 Applicability

All persons taking the following actions or applying for any of the following permits and/or approvals may be required to submit for approval a stormwater plan with their application and/or request:

1. New development;
2. Redevelopment;
3. Building permit;
4. Subdivision or Short subdivision approval;
5. Commercial, industrial, or multifamily site plan approval;
6. Conditional use permits, Site Plan Review permits;
7. Substantial development permit required under RCW 90.58 (Shoreline Management Act);
8. Right-of-Way use;
9. Logging, clearing, and other land disturbing activities;
10. Projects that discharge stormwater directly, or immediately adjacent, to a floodplain, stream, lake, and wetland or closed depression, erosion or landslide hazards area, or other critical area as defined by MMC 22.80 Critical areas.

4.1.2 Owner

Storm drainage facilities that are located on private land and have drainage basins that serve only private land shall be owned, operated, and maintained by the landowner or owner's association. Examples include commercial shopping centers and residential or mixed-use developments with no public roads. Storm drainage facilities that serve public roads or rights-of-way are owned, operated and maintained by the City. In most cases, the underlying land will be in a private tract owned by the landowner or owner's association. In some situations, the tract of land containing the drainage facility also provides recreation amenities for the project, especially if stormwater detention is provided by an underground vault. In these situations, all landscape and non-drainage facility maintenance will be the responsibility of the landowner or owner's association. For projects that include the recording of a plat or binding site plan or similar land-use instrument, the maintenance obligations will be defined on the recording document and evaluated on a case-by-case basis by the Director.

4.1.3 Siting, Easements, and Tracts

All storm drainage systems owned and/or maintained by the City of Monroe outside of the right-of-way must be in an easement dedicated to the City of Monroe.

All privately owned and maintained storm drainage systems must be located wholly outside of the public right-of-way, include covenants and restrictions requiring annual system maintenance by the owner, annual inspection and reporting to the City by the owner, and access easements for City inspection. In addition, private storm drainage facilities in single-family residential neighborhoods are to be located in a private tract with exclusive use for storm drainage unless uses that do not impact stormwater function, such as public open space or amenities above stormwater vaults, are otherwise approved as part of a development permit.

Storm drainage easements must be exclusive for storm drainage facilities. Private storm drainage flow control and water quality facilities must not be located in dedicated public road right-of-way areas.

All storm drainage construction must be staked prior to construction to ensure placement within designated easements. All stormwater facilities dedicated to the City must be located entirely within dedicated right-of-way, tract, or approved easement.

Easements of publicly maintained storm drainage closed conveyance systems or open channel will be 20 feet in width.

Private easements will be required if conveyance must occur across private properties.

No structures shall be erected within any public drainage easement. Construction of a permitted fence across an easement will be considered on a case-by-case basis.

4.1.4 Storm Drainage Design

All proposed public and private storm drainage systems must be designed, signed, and stamped by a professional engineer, registered with the state of Washington. The design must be consistent with the DOE Stormwater Manual as adopted by the City of Monroe, and the City comprehensive Plan. The designer must meet all applicable federal, state, and local water quality standards prior to discharge to any wetland, stream, river, lake, or other critical area.

The installation of storm drainage improvements must be in accordance with the approved construction plans. Any significant changes to the approved plans are to be reviewed and approved in writing by the Director before the changes are incorporated into the work.

4.1.4.1 Trees & Plants

The location and species of all plants and trees to be installed in and around storm drainage facilities are required to be called out on the plans for the facility or project landscape plan.

No willows, poplars, cottonwoods, birches, soft maple, gum, or any other tree or shrub whose roots are likely to obstruct stormwater functions are allowed within 30 feet of any stormwater pipes or facilities. Any of these trees found to be located within 30 feet of a proposed stormwater pipe or facility must be removed at the Developer's expense. Any of these trees planted or established within 30 feet of constructed stormwater pipes or facilities must be removed by the property owner or owners association.

4.1.4.2 Catch Basins & Maintenance Holes

1. Dumpsters and Dumpster Enclosures – no catch basins are to be located under dumpsters, in dumpster enclosures, or designed to capture runoff from dumpsters. Run off from these types of enclosures are to be directed to the sanitary sewer system and as approved by the Director.

2. Manholes in residential backyards must be with a solid bolt locking lid.
3. Lids in the Roadway - Where possible, installing lids in wheel paths must be avoided. Round lids are required in travel lanes with the exception of gutters where square lids are acceptable.
4. Locking Lids - Bolted lids are preferred over locking lids, which require a specific key for access.
5. Type 1 catch basin rim to flow line elevation is not to exceed 5 feet.
6. Catch Basin grates – Grates and covers shall be ductile iron as per standard details 405, 406 A, 406 B, and 406 C.

4.1.4.3 Control Structures

Control Structures must be located in their own type II structure with an access port directly over top of the control to allow exterior inspection without confined space entry.

4.1.4.4 Detention Facilities

The construction plans are to indicate that the detention facility is privately or publicly maintained.

4.1.4.5 Fish Passage Culverts

Developers must refer to Monroe Municipal Code (MMC), Department of Fish and Wildlife and NPDES Phase 2 Requirements for local fish passage culvert requirements. Conveyance standards detailed above may need to be changed to accommodate fish passage pursuant to MMC 15.01.

4.1.4.6 LID/Flow control BMPs

LID/Flow Control BMP Facility Conditions

Type	A Flow Control BMP Facility
ALL	BMPs must be shown on building permits and as-built plans. Pre-treatment is required prior to all LID / FLOW CONTROL BMPs. At minimum, a Type 1 catch basin with a sump. Failure of on-lot LID facilities requires replacement of facility and/or detention volume. Direct connection to the storm system is not an allowed solution. Emergency overflow BMPs are required to be located on the same lot or tract as the Flow Control BMP. On-lot BMPs not constructed as part of the plat require a separate covenant prior to final building permit approval.
Full Dispersion	Dispersion flowpath area must be contained within a restricted easement.
Full Infiltration	Ensure adequate spacing from existing and new trees to allow for tree growth. Infiltration facilities are to remain outside of the dripline of all trees. No BSBL or setback reduction without an approved Deviation.

Type	A Flow Control BMP Facility
Limited Infiltration	Ensure adequate spacing from existing and new trees to allow for tree growth. Infiltration facilities are to remain outside of the dripline of all trees. No BSBL or setback reduction allowed without an approved Deviation.
Basic Dispersion	Dispersion flowpath area must be contained within a restricted easement.
Bioretention	No utility crossings allowed under infiltrative BMPs without approval and use of impermeable utility crossing backfill.
Permeable pavement (unlined with no underdrain)	Not allowed in public right-of-way unless otherwise approved by the Director.
Grassed modular grid pavement	Plastic gridded style pavers not allowed unless demonstrated to be damage resistant with backfill that will not escape and travel under traffic.
Rainwater harvesting	Must ensure adequate cross connection separation and sewer discharge accommodations.
Minimum disturbance foundation	No additional conditions.
Open grid decking over pervious area	Allowed for ground floor decks. Second story applications will be considered impervious.
Perforated pipe connection	Not allowed in critical drainage areas.

4.1.4.7 Connection Points

1. Cul-de-sacs must contain a sufficient quantity of catch basins to act as connection points for adjacent homes and buildings.
2. When a catch basin is installed adjacent to a sidewalk with an upslope area behind it, rigid perforated PVC drainage pipe must be installed behind the sidewalk to collect seepage and to allow for connection by adjacent properties.

4.1.4.8 Conveyance Design

Conveyance design must account for backwater conditions, needs for energy dissipation, and provide an overflow path should the system overtop flow. For example, 90-degree turns of mainlines at the base of a hill will not be allowed. On slopes greater than 15 percent, pipes may require anchors and catch basins will require energy dissipation, as directed by the reviewer.

When connecting pipe segments of different materials, the installation of a structure will be required.

4.1.5 Permits

In addition to the appropriate permits listed in Section 1, permits may be required by the Washington State Department of Fish and Wildlife, Department of Ecology, Army Corps

of Engineers, or Snohomish County. The Developer must submit copies of the approved permits to the City.

4.1.6 Illicit Discharges

Illicit discharges to the storm drainage system, or surface water, is prohibited in accordance with MMC 13.34.

4.1.7 Maintenance

The frequency and ease of future maintenance shall be thoroughly considered during the design of storm water facilities. Design adjustments to ease maintenance shall be a major consideration.

4.1.8 Emergency Overflow

Emergency overflow provisions must be installed in such a manner as to direct waters away from all structures without causing failure of those structures. The impact of a system failure should be analyzed both in terms of on-site and off-site effects. Adverse impacts must be avoided with respect to adjacent properties, elements of the public drainage system or other private systems, and critical areas. Retention/detention and infiltration facility design must take into account overflows, which may result from:

1. Higher-intensity or longer-duration storms than the design storm;
2. Plugged orifices;
3. Inadequate storage due to sediment buildup;
4. Debris blockage; or
5. Other reasons causing system failure.

4.1.9 Off Site Investigation

If drainage complaints are found within ¼ mile of the project, an offsite analysis and mitigation is required to be conducted during the wet season.

Conduct an off-site analysis of downstream water quality impacts and mitigate such impacts.

The analysis shall extend a minimum of a 1/4 mile downstream from the project.

The potential impacts to be evaluated shall include, but not be limited to, the following:

1. Excessive Sedimentation.
2. Stream bank Erosion
3. Capacity of the existing storm water management infrastructure.
4. Discharges to ground water contributing to recharge zones.
5. Violations of water quality standards.
6. Spills and discharges of priority pollutants.

4.2 CONSTRUCTION PLANS

Construction Plan Requirements

1. Show existing topographic information, including existing structures, vegetation and significant trees, critical areas, existing drainage systems, road right of way limits, property lines, easements, slope setback requirements and other features that will assist in understanding site conditions.
2. Show plan and profile views of all storm drains on 24x36 sheets. Combine with roadway or street improvements. Provide flow directional arrows on pipe runs in plan view. Show crossing pipe information on storm profile views (e.g. pipe size and utility identification).
3. Provide notes referring to specific City Standards for catch basins, manholes, grates and restrictors.
4. On profile sheets, indicate elevations for all inlets and outfalls, grades, structure rim and invert elevations.
5. Storm drainage facilities must be designed and constructed in accordance with an approved Drainage Report and contain necessary information on the plan, profile and detail views (e.g., orifice size and elevations, standard detail references).
6. All on-site and off-site improvements must be shown. Existing and proposed improvements, included in half tone background to show their relative locations, must be depicted including sewer, water, roadway, and landscape construction.
7. Plans must show existing and proposed easements where facilities are on private property. All easements must be executed prior to final construction approval. All easements on the plans are to be noted Public or Private.
8. Before any construction begins, the Developer must complete a pre-construction meeting and provide the City with the name and contact information for the person in charge who can be contacted 24 hours a day regarding construction related problems. The sites CESCL contact information shall be required to be shown at the preconstruction meeting.
9. All stormwater drainage pipe must be designed and constructed to provide gravity flow for drainage associated with the project, include depth and capacity for proposed upstream development, and be located at a depth of at least two feet below the ground surface. Minimum required velocity for full pipe flow is three (3) feet per second. Minimum pipe slope shall be as follows:

Pipe Diameter	Minimum Slope
6"	2.0%
8"	1.0%
12" and greater	0.5%

10. All storm drainage pipe and culverts within the public right-of-way must be minimum 12" diameter. Pipe penetrations into drainage structures shall be limited based on the following table:

Pipe Sizing to Basins

Basin Type	Pipe Size								
	6"	8"	12"	15"	18"	24"	30"	36"	48"
Yard Drain	X								
Curb Inlet	X	X							
Type I CB	X	X	X	X					
Type II CB	X	X	X	X	X				
Type II 48" CB	X	X	X	X	X	X	X		
Type II 54" CB	X	X	X	X	X	X	X	X	
Type II 72" CB	X	X	X	X	X	X	X	X	X

11. Storm drainage pipe from 18 to 24 inches in diameter must be PVC ASTM F-679 SDR-35 pipe and storm drainage pipe greater than 24 inches in diameter will be reviewed on a case-by-case basis. No drainage pipe must be allowed at a depth of less than 12 inches below the ground surface. Above ground conveyance pipe must be approved by the Public Works Director and must be minimum High Density Polyethylene Pipe (HDPE) SDR-11 with an approved engineered anchoring system.
12. Corrugated metal pipe detention tanks, culverts, and other improvements are not allowed within public facilities unless approved by the Director.
13. Black vinyl-coated chain link fence must be provided around all pond facilities. The fence must be six (6) feet high, include top-rail construction, and include vehicle and worker access gates.
14. A copy of approved construction plans must be on site during all phases of construction.
15. All new pipe connections must occur within drainage structures. Pipe cut-in, patching, and banding is not allowed.
16. General Notes for Storm Drainage and Temporary Erosion and Sediment Control Plans must be incorporated into Construction Drawings. Detention facilities are to be noted and identified as Public or Private maintained.
17. All storm drain work must be staked by survey for line and grade prior to starting construction.
18. Individual lot storm drain stubs shall be marked with a 2x4 board and labeled "storm" to be extended 10 feet onto property. A locator wire is to extend from the stub invert to top of 2x4. The 2x4 marker will indicate the storm stub depth.
19. Pipe Trash Racks. All culvert and pipe inlets 12-inch diameter or larger are to be equipped with trash racks. Smaller pipes may be equipped with trash racks where appropriate.
20. Oil-water/floatable material separators. At catch basin locations that have the potential to collect oil or floatable debris, they shall be equipped with oil-water/floatable material separating units onto the outflow storm pipes. Separator units are to be installed per Standard Detail 410 for the protection of infiltration systems and downstream public storm water flows.

4.3 EXISTING UTILITIES

The Developer must investigate and locate all buried utilities or obstructions within the construction area prior to the installation of new facilities. The Developer must establish

the field locations of the existing facilities such as water, sewer, storm drain, power, telephone, cable television, gas, and all other affected utilities.

The Developer must call for utility locates 1-800-424-5555 (or 811) a minimum of 48 hours before any excavation occurs. All services must be located before any excavation occurs.

4.4 TRENCH EXCAVATION, BEDDING, AND BACKFILL FOR STORMWATER PIPE

4.4.1 Section Description

This work must consist of excavating, bedding, and backfilling for stormwater pipe and appurtenances for both temporary and permanent installation under ordinary conditions.

4.4.2 General Requirements

Backfilling Trenches

See Standard Detail 102. The City Construction Inspector and third-party geotechnical inspector will examine excavated native material at the time of excavation to determine its suitability for use as backfill. Unsuitable backfill material will not be allowed and shall be removed and disposed of, and replaced with 5/8 inch minus crushed rock, control density fill (CDF), or with gravel borrow as approved by the City Construction Inspector.

In backfilling the trench, the Developer must take all necessary precautions to protect the pipe from any damage or shifting. Compaction in the pipe zone must be by hand tamping or with mechanical compaction as approved by the City Construction Inspector, so as not to damage the pipe. The first layer of material to be compacted must be 18 inches over the top of pipe.

Trench backfill must be spread in layers and be compacted by mechanical tampers of the impact type approved by the City Construction Inspector. Water settling will not be permitted. After the initial 18 inches of backfill is placed, the remaining backfill material must be placed in successive layers not exceeding 1-foot in loose thickness or as recommended by licensed geotechnical engineer. Each layer shall be compacted as indicated on Standard Detail 102.

During all phases of the backfilling operations and testing, as outlined herein, the Developer must protect the pipe installation, provide for the maintenance of traffic as may be necessary, and provide for the safety of property and persons.

4.5 INSPECTIONS AND APPROVAL

4.5.1 Construction and Maintenance Inspections

The Developer must request scheduling for the following inspections:

1. Temporary Erosion and Sediment Control inspection in accordance with the approved construction drawings. The TESC measures shall be in place and approved prior to beginning grading, excavations, or fill operations.

2. Rough Grading - Whenever all rough grading has been completed.
3. Trench Inspection - During placement of bedding material, and backfill of underground drainage pipe and structures. Trenching must be inspected for soft spots and inconsistencies. Periodic inspection will be as required by the City for compaction and lift thickness requirements.
4. Final Grading - When all work including installation of all drainage structure and site stabilization and compaction testing performed.
5. Planting - When erosion control planting shows active growth. The site may be inspected for compliance with planting requirements upon receiving such notice. The Inspector must inspect the work and will either approve the same or notify the Developer in what respects there has been failure to comply with the requirements of the approved plans. Any portion of the work which does not comply must be promptly corrected by the Developer. In addition, the City may make unscheduled site inspections to ensure compliance with any permit or approval and installation per these Standards.

4.5.2 CCTV Requirement

The City will not issue final acceptance of the project or release maintenance and performance bonds until all new storm lines 12-inches or larger shall be inspected by Closed Circuit Television (CCTV) camera and footage is provided to the City in a DVD or ZIP drive format. A printed paper copy of the main line pipe runs and lengths, manhole or basin numbering, tee or tap direction stationing, and any deficiencies within the pipeline must be included with the video submittal of the inspection. The City does not accept VHS tapes. CCTV operators must have Pipeline Assessment Certification Program (PACP) qualifications in order to upload data to the City's geographic information system (GIS).

The CCTV camera must have zoom capability and a swivel head lens capable of turning and rotating 180 degrees to provide inspection of lateral connections. Each individual storm main inspection, from catch basin to catch basin, must be recorded on one digital file. The City will accept multiple digital files for a single pipe only when the pipe reach cannot be recorded to one digital file due to extreme pipe length or obstructions in the pipe. The City will not accept multiple storm main inspections recorded on a single digital file.

The City will not accept dirty, blurry, foggy, submerged, or otherwise non-viewable inspections.

Prior to final inspection to accept the work, the Contractor must have completed the maintenance hole channeling, catch basin grouting, trench backfill, compaction, and final restoration of the street or easement. The City must have accepted the invert elevations and record drawings. All storm mains and laterals must be cleaned. All lines not clean must be re-flushed, cleaned, and re-inspected.

At least two days prior to the inspection, the Contractor must contact the City to inform the Inspector when and which lines will be inspected.

Immediately preceding the CCTV inspection, water must be poured into the system and must be visible on the DVD recording.

The information listed below must be electronically generated and displayed on the CCTV footage at the beginning of each storm main inspection. This data must be continuously updated, and displayed on the CCTV footage, during the inspection.

1. Date of inspection
2. Contractor company name
3. Operator name
4. Upstream catch basin number to downstream catch basin number
5. Direction of inspection (upstream or downstream)
6. Pipe material and size

A 1-inch ball must be placed immediately in front of the camera, mounted such that the ball is visible and contacts the pipe bottom at all times. CCTV inspection cannot be paused once it begins. Only continuous inspections are acceptable. Pipe joints, catch basins, and lateral connections into catch basins must be thoroughly inspected by panning the entire connection, including maintenance hole risers. Zooming inspection of all lateral connections is required.

The Contractor must bear all costs incurred in correcting any deficiencies found during the CCTV inspection, including the cost of any additional CCTV inspections that may be required by the City to verify that deficiencies have been corrected.

4.5.3 Final Approval

The following steps must be completed before the City will approve the improvements and release the performance bond:

1. All easements must be reviewed, approved, and recorded with the Snohomish County Auditor.
2. The entire drainage system must have been inspected and approved by the City Construction Inspector.
3. Before the City will issue final acceptance of the project, the interior of storm drainage pipes 12" and larger in diameter must be inspected by Closed Circuit Television (CCTV), in electrical format that is acceptable to the City. Camera footage provided to the City in DVD format.
4. Copies of all geotechnical site observations and compaction testing for storm drainage must be submitted to the City for record.
5. The City must receive a satisfactory maintenance bond per Section 1.9.4.
6. Record drawings (also known as as-builts) must be provided, reviewed, corrected, submitted and approved as final in accordance with Section 1.9.5. Record drawing submittals for review may be in paper form, or electronic PDF form at the discretion of the project inspector. A final record drawing will include a complete plan set in electronic format as acceptable to the City, a complete plan set of Mylar's, and one complete paper plan copy sized 24X36.
7. Private operation and maintenance covenants and restrictions must be provided for individual lot BMP's, reduced Impervious Credit Restrictions, or other stormwater restrictions.
8. The Developer shall provide the City with a Bill of Sale for all portions of the system that will become the property of the City.

4.6 STANDARD STORM DRAWINGS

Drawing #	Description
401	Precast Inlet
402	Type I Catch Basin
403	Type 1L Catch Basin
404	Type II Catch Basin
405	Frame
406A	Grate
406B	Herringbone Grate
406C	Solid Catch Basin Cover
406D	Drain Manhole
407	Frame and Grate Installation
408	Inlet Through Curb
409	Inlet Through Curb Frame
410	Floatable Separator
411	Typical Restrictor Installation
412	Restrictor Lift Gate
413	Lift Gate Assembly and Orifice
414	Typical Underground Detention