LINN COUNTY

STORMWATER MANAGEMENT PROGRAM MANUAL

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Linn County Road Department
3010 Ferry Street, S.W.
Albany, Oregon 97322

Linn County Planning & Building Department
300 SW 4th Avenue, Room 114
Albany, Oregon 97322

Linn County Environmental Health
315 SW 4th Ave, 1st Floor
Albany, Oregon 97322

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1 INTRODUCTION

Pursuant to 40 CFR §122.34(a), the County has developed, implemented and will enforce a Stormwater Management Program (SWMP) designed to reduce pollutants from the Municipal Separate Stormwater System (MS4) to the maximum extent practicable, to protect water quality and to satisfy the appropriate water quality requirement of the Clean Water Act.

In addition to the MS4 area, Linn County will use the SWMP to reduce pollutants from public and private development and/or construction activities.

The Stormwater Management Program identifies the management practices, control techniques and system, and design and engineering methods necessary to meet this standard.

1.1 ACRONYMS

BMP	Best Management Practice
CFR	Code of Federal Regulations
Corps	US Army Corps of Engineers
DEQ	Department of Environmental Quality
DSL	Division of State Lands
ECSI	Environmental Cleanup Site Inspection
EPA	Environmental Protection Agency
ESCP	Erosion and Sediment Control Plan
FIRM	Flood Insurance Rate Map
HDPE	High Density Polyethylene Pipe
LCC	Linn County Code
NPDES	National Pollutant Discharge Elimination System
MS4	Municipal Separate Storm Sewer Systems
O&M	Operation and Maintenance
OAR	Oregon Administrative Rules
ODA	Oregon Department of Agriculture
ODOT	Oregon Department of Transportation
ORS	Oregon Revised Statutes
OSS	Oregon Standard Specifications for Construction
PCP	Pollution Control Plan
SBUH	Santa Barbara Unit Hydrograph
SCS	Soil Conservation Service
SWMP	Stormwater Management Program
USDA	United States Department of Agriculture
TMDL	Total Maximum Daily Load
TSS	Total Suspended Solids

1.2 POLICIES

1.2.1 County Code, Title 8: Chapter 860, Surface Waters

In 2023 the Linn County Commissioners adopted Stormwater Management requirements as part of Linn County Code (LCC) Section 860. Specifically, 860.200 has been dedicated to Stormwater Management.

Details of the County's SWMP requirements, including permitting and inspection, are included in Chapter 3 of this manual.

1.3 STORMWATER MANAGEMENT PROGRAM COVERAGE AND ALLOWANCES

1.3.1 Stormwater Discharges Not Covered

The stormwater management program does not cover:

A. discharges regulated through DEQ's NPDES Industrial Stormwater General Permits and DEQ's NPDES Construction Stormwater General Permits; or another appropriate NPDES permit.
    a. Stormwater discharges associated with industrial activities [as defined in 40 CFR §122.26(b)(14)] or
    b. stormwater associated with construction activities [as defined in 40 CFR §122.26(b)(14)(x) and (b)(15)].

B. Stormwater discharges to underground injection control (UIC) systems.

1.3.2 Allowable Non-Stormwater

The stormwater management program does not cover discharge of non-stormwater from the MS4, except where such discharges satisfy one of the following conditions:

A. The non-stormwater discharge is regulated under a separate NPDES permit.

B. The non-stormwater discharge originates from emergency firefighting activities.

C. the non-stormwater discharge is categorized as an authorized or allowable non-stormwater discharge listed below:
    a. Uncontaminated water line flushing.
    b. Landscape irrigation. For County owned or operated areas landscape irrigation will be considered allowable only if pesticides and fertilizers are applied in accordance with manufacturer's instructions.
    c. Diverted stream flows.
    d. Uncontaminated groundwater infiltration (as defined at 40 CFR §35.2005(20)) to separate storm sewers.
    e. Rising groundwaters.
    f. Uncontaminated pumped ground water.
    g. Potable water sources (including potable groundwater monitoring wells and draining and flushing of municipal potable water storage reservoirs).
    h. Startup flushing of groundwater wells.
    i. Foundation, footing and crawlspace drains (where flows are not contaminated [i.e., process materials or other pollutant]).
    j. Uncontaminated air conditioning or compressor condensate.
    k. Irrigation water.
    l. Springs.
    m. Lawn watering.
    n. Individual residential car washing.
    o. Charity car washing (provided that chemicals, soaps, detergents, steam or heated water are not used. Washing is restricted to the outside of the vehicle, no engines, transmissions or undercarriages).

p. Flows from riparian habitats and wetlands.
q. Dechlorinated swimming pool discharges including hot tubs (heated water must be cooled for at least 12 hours prior to discharge).
r. Fire hydrant flushing.
s. Street and pavement washwaters (provided that chemicals, soaps, detergents, steam or heated water are not used).
t. Routine external building wash-down (provided that chemicals, soaps, detergents, steam or heated water are not used).
u. Water associated with dye testing activity.
v. Discharges of treated water from investigation, removal and remedial actions selected or approved by DEQ pursuant to Oregon Revised Statute (ORS) Chapter 465. If any of these allowable non-stormwater discharges are or becomes a significant source of pollutants, the County must prohibit that discharge or require implementation of appropriate BMPs to reduce the discharge of pollutants associated with the source before discharge to the MS4.

1.4 MS4 STORMWATER MAPS

The County will maintain current MS4 Maps of the 3 urban areas included within the MS4 area; Millersburg, Albany and Tangent. These maps are included in Appendix B. Each of these maps will identify:

A. The MS4 area delineated by storm sewer drainage basin, and
B. Conveyance system and stormwater control locations.

2 CONTROL MEASURES

The MS4 Phase II NPDES Permit requires, by September 1, 2023, the County develop and implement five stormwater management program control measures; Public Education and Outreach, Public Involvement and Participation, Illicit Discharge Detection and Elimination, Construction Site Runoff Control, Post-Construction Site Runoff for New Development and Redevelopment, and Pollution Prevention and Good Housekeeping for Municipal Operations.

2.1 PUBLIC EDUCATION AND OUTREACH

The County will conduct an ongoing education and outreach program to inform the public about the impacts of stormwater discharges on waterbodies and the steps that they can take to reduce pollutants in stormwater runoff. The education and outreach program is designed to address stormwater issues of significance within the MS4 communities.

2.1.1 Education and Outreach Program

The education and outreach program is intended to inform the public about the impacts of stormwater discharges on waterbodies and the steps that they can take to reduce pollutants in stormwater runoff. The goal of the education and outreach program is to reduce the behaviors and practices that cause or contribute to adverse stormwater impacts on receiving waters. The program is intended to promote specific actions to increase audience understanding of how to reduce pollutant discharges in stormwater runoff and prevent illicit discharge from entering the MS4 impacting receiving waters.

2.1.2 Stormwater Education Activities

Educational messages or activities may include printed materials (for example, brochures or newsletters); electronic materials (for example, social media, websites or e-newsletters); mass media (for example, newspaper articles or public service announcements); targeted workshops, or other educational events or formats.

2.1.3 Target Audiences and Topics

The education and outreach program will target three audiences:

1. General public, homeowners, homeowner association, schoolchildren, and businesses (including home-based and mobile business).
2. Local elected officials, land use planners and engineers.
3. Construction site operators.

The education and outreach program will address the following target topics:

1. Impacts of illicit discharges on receiving waters and how to report them.
2. Impacts from impervious surfaces and appropriate techniques to avoid adverse impacts.
3. Best management practices for proper use, application and storage of pesticides and fertilizers.
4. Best management practices for litter and trash control.
5. Best management practices for recycling programs.
6. Best management practices for power washing, carpet cleaning and auto repair and maintenance.
7. Low-impact development/green infrastructure.
8. Septic systems, information pertaining to maintenance of septic systems.
9. Watershed awareness and how storm drains lead to local creeks and rivers, and potential impacts to fish and other wildlife.
10. Stormwater issues of significance identified by permit registrant.

2.1.4 Education on Construction Site Control Measures

The County will provide educational outreach to target construction site operators working within the community. This will be accomplished by including printed materials, such as flyers or brochures, in Building Permit, Access Permit and Utility Permit packets. The County will also include the printed material(s) in the County monthly newsletter. The material will include the links to the County's Stormwater Management Program Manual, Erosion and Sediment Control Manual and the Illicit Discharge Detection and Elimination Program documents that provide appropriate selection, design, installation, use, and maintenance of construction site control measures required.

2.1.5 Tracking and Assessment

The County will track implementation of the Public Education and Outreach requirements through the Planning and Building Department and the Road Department Permitting processes. In each corresponding Annual Report, the County will assess their progress toward implementation of the program, including the evaluation of at least one education and outreach activity corresponding to the reporting timeframe for the associated Annual Report.

2.2 PUBLIC INVOLVEMENT AND PARTICIPATION

The County's public involvement and participation program provides opportunities for the public to effectively participate in the development of the SWMP control measures. The Linn County Commissioner's office manages public notices and publishes the agendas to all the Board of Commissioner's meetings along with the minutes to those meetings. The County Commissioners website can be found at: https://www.linncountyor.gov/commissioners

2.2.1 Publically Accessible Website

The County's publicly accessible website (https://www.linncountyor.gov/roads) has information on the County's SWMP implementation, the SWMP Documents, contact information, and educational materials. The website will be maintained with current information, and will be updated at least annually. The website includes the following:

A. Illicit Discharge Complaint or Report Form.

B. Draft documents issued for public comment, and final reports, plans and other official SWMP policy documents.

C. Links to all ordinances, policies and/or guidance documents related to the construction and post-construction stormwater management control programs, including education, training, licensing, and permitting.

D. The County's contact information for relevant staff, including phone numbers, mailing addresses and email addresses.

2.2.2 Stewarship Opportunity

The County, at a minimum, will create or partner in the development of one stewardship opportunity.

The following are some stewardship opportunities that could be considered:

1. Stream team activities,
2. Storm drain marking or stenciling,
3. Volunteer monitoring,
4. Riparian plantings/facility enhancement,
5. Neighborhood low-impact development activities,
6. Adopt-A-Road,
7. Citizen advisory committee, or
8. Other locally relevant opportunities.

2.2.3 Tracking and Assessment

Public involvement and participation is tracked through the County Commissioners Office, by means of regularly scheduled public meetings held at the County Courthouse.

2.3 ILLICIT DISCHARGE DETECTION AND ELIMINATION

The County has implemented a program to detect and eliminate illicit discharges into the MS4, to the extent allowable by state laws. An illicit discharge is any discharge to a MS4 that is not composed entirely of stormwater.

This Illicit Discharge Detection and Elimination Program includes MS4 area maps, the Ordinance and/or Other Regulatory Mechanisms, enforcement procedures, program guidelines to detect and eliminate illicit discharges, dry weather monitoring, training and education, and tracking and assessment.

This program can be found in the Linn County Illicit Discharge and Elimination Program Documents. These documents can be found on the Linn County website at: https://www.co.linn.or.us/roads.

2.4 CONSTRUCTION SITE RUNOFF

The County has implemented and will enforce a construction site runoff control program to reduce discharges of pollutants from construction sites both within the MS4 area and throughout Linn County. Through LCC 860, to the extent allowable under state law, sediment controls, and waste materials management controls will be used and maintained at all qualifying construction projects from initial clearing through final stabilization to reduce pollutants in stormwater discharges from construction sites.

2.4.1 Erosion and Sediment Control Plans

Private construction site operators are required to complete and implement an Erosion and Sediment Control Plan (ESCP) for construction project sites that results in a minimum land disturbance of 10,890 square feet (a quarter of an acre) or more, cumulatively. The written specifications that address the proper installation and maintenance of such controls during all phases of construction activity can be found in the Linn County Erosion and Sediment Control Manual. This manual can be found on the Linn County website at: https://www.co.linn.or.us/roads.

Erosion and Sediment Control Plans are to be maintained and updated as site conditions change, or as needed and are to be kept on site and made available for review by the County, DEQ, or another administrating entity.

An Erosion control inspection report will be completed weekly for active sites, every 2 weeks for inactive sites, or within 24 hours after ½" or more rainfall occurs. This report can be found in the Linn County Erosion and Sediment Control Manual and on the Linn County Road Department website.

2.4.2 Compliance with Other NPDES Permits

Construction projects that disturb one or more acres (or that disturb less than one acre, if it is part of a "common plan of development or sale" disturbing one or more acres), will be referred to DEQ, or the appropriate DEQ agent, to obtain NPDES Construction Stormwater Permit coverage. The NPDES Construction Stormwater General Permit requirements are in addition to the County's construction site runoff control requirements.

2.5 POST-CONSTRUCTION SITE RUNOFF FOR NEW DEVELOPMENT AND REDEVELOPMENT

The County has implemented a post-construction site runoff program to reduce discharges of pollutants and control stormwater runoff from new development and redevelopment project sites in its stormwater management area.

2.5.1 Ordinance and/or Other Regulatory Mechanisms

Through Section 860.200 of the LCC, or to the extent allowable under state law, for project sites discharging stormwater to the MS4 that create or replace 1/4 acre (10,480 square feet) or more of impervious surface area, the following is required:

A. The use of stormwater controls at all qualifying sites.

B. A site-specific stormwater management approach that targets natural surface or predevelopment hydrological function through the installation and long-term operation and maintenance of stormwater controls.

For project sites discharging stormwater to the MS4 that create 1 acre (43,560 square feet) or more of land distrubance area, the following is required:

A. Long-term operation and maintenance of stormwater controls at project sites that are under the ownership of a private entity.

2.5.2 Prioritization of Low Impact Development Requirements

Currently, no County ordinance or code or development standard inhibit design and implementation techniques intended to minimize impervious surfaces and reduce stormwater runoff (Low Impact Development and Green Infrastructure).

2.5.3 Stormwater Permit

A stormwater drainage permit is required for project sites discharging stormwater to the MS4 that create or replace 1/4 acre (10,480 square feet) or more of impervious surface area. The permit shall require an applicant to install any applicable stormwater treatment facilities as required by the Linn County Stormwater Quality Treatment Engineering Standards in effect on the date of the applicant's application for a stormwater permit. An Operation and Maintenance Agreement and Plan will be required meeting the requirements of Section 2.5.6.

2.5.3.1 Permit Holder

Stormwater Permits must be obtained by the owner of the property. The owner of the property, as permit holder, shall assume responsibility for site conditions, inspection and maintenance of the stormwater facilities throughout the duration of land-disturbing activities, and until such time as the site has been adequately stabilized and the permit has been closed or transferred. Permits may not be transferred to any person or entity except upon transfer of title for the property.

When the ownership of a property with an active Stormwater Permit is transferred, the person(s) or entity transferring title for the property is obligated to inform the person(s) or entity assuming ownership of their obligation to transfer the Stormwater Permit and to obtain a new permit.

2.5.3.2 Permit Duration

Stormwater Permits are valid for a period of one year, or until land disturbing activities are completed, and surface conditions stabilized with permanent stormwater facilities. If land disturbing activities continue beyond the permit's expiration date, or if the land has not been permanently stabilized, the permit holder may make a written request for an extension. Extensions, if approved, shall be for twelve months and may be subject to administrative fees.

2.5.3.3 Stormwater Permit Process

Upon receipt of an application for a stormwater Permit, the Roadmaster, or their designee, will review the submitted application and attached Post-Construction Stormwater Plan and design calculations. Each plan shall comply with the minimum standards outlined in the engineering standards, construction standards, and the provisions of Chapter 3. Each post-construction stormwater quality plan submitted shall be reviewed, approved, and stamped by a professional licensed in Oregon as a civil or environmental engineer. Upon approval of the plans and calculations, a permit will be issued. No land disturbing activities may commence until a Stormwater Permit has been issued.

2.5.3.4 Site Inspections

For construction activities that will result in land disturbance of 10,890 square feet (1/4 of an acre) or more, cumulatively, the site will be inspected, at a minimum:

A. At least once during the permit term;

B. If a complaint or report is received; or

C. At completion of the construction of the post-construction stormwater facilities

2.5.3.5 Permit Closeout

After the completion of all land disturbing activities, the owner will make a request to the County to perform a final inspection. Upon verification by the inspector that permanent stormwater facilities have been installed and are functioning effectively, and the Operation and Maintenance Agreement has been recorded, if necessary, the Stormwater Permit will be closed.

2.5.4 Post-Construction Stormwater Management Requirements

The County has developed enforceable post-construction stormwater management requirements ordinance, at a minimum, include the following technical standards:

A. Site Performance Standard - The County has established a site performance standard with a numeric stormwater retention requirement (Section 3.5) to target natural surface or predevelopment hydrologic function to retain rainfall on-site and minimize the offsite discharge of precipitation utilizing stormwater controls that infiltrate and evapotranspirate stormwater. This retention requirement must use one of the following:
    a. Volume-based method.
    b. Storm event percentile-based method.
    c. Annual average runoff-based method.

    For projects complying with the retention requirement, the County can allow for an exception of this retention requirement in the site performance standard in instances where full compliance with this requirement cannot be achieved based on factors of technical infeasibility (see Section D below).

B. Treatment Standard - For projects that are unable to fully meet the retention requirement, the remainder of the rainfall/runoff associated with this retention requirement must be treated prior to discharge with a structural stormwater control (Section 3.4). This stormwater structural control must be designed to remove, at minimum, 80 percent of the total suspended solids.

In treating the stormwater discharge offsite, use of green infrastructure will be given priority before considering other structural stormwater controls. This runoff discharged offsite must target natural surface or predevelopment hydrologic function.

C. Structural Stormwater Control Design and Specifications - The description of all allowable structural stormwater controls including site-specific design requirements, design requirements that do not inhibit maintenance, conditions where each control applies, and operation and maintenance standards for each control can be found in Section 3 . Conditions where the implementation of green infrastructure or equivalent approaches may be impracticable will be identified.

D. Allowance for Alternative Compliance - Alternatives for projects to comply with the retention requirement at a project site may be allowed based on factors of technical infeasibility or site constraints. Such feasibility or constraint factors may include, but are not limited to, shallow bedrock, high groundwater, groundwater contamination, soil instability as documented by geotechnical analysis, or a land use that is inconsistent with capture, reuse and/or infiltration of stormwater. The determination that full compliance cannot be achieved at the project site must be based on review criteria considering multiple factors and cannot be based solely on the difficulty or cost.

   For project sites requesting alternative compliance, the County requires and will subsequently review the written technical justification as to evaluate the technical infeasibility or site constraints, which prevent the onsite management of the runoff amount stipulated in the stormwater retention requirement or a portion thereof. Where alternative compliance is utilized, runoff must comply with the treatment standard. The written technical justification must be in the form of a site-specific hydrologic or design analysis conducted and endorsed by an Oregon registered Professional Engineer or Oregon Certified Engineering Geologist.

2.5.5 Post-Construction Site Runoff Plan Review

The County will review and approve plans for structural stormwater control at new development and redevelopment sites that result from a land disturbance of one or more acres (or that disturb less than one acre, if it is part of a “common plan of development or sale” disturbing one or more acres); and sites that use alternative compliance to meet the retention requirement, before the start of the project.

Plans will be reviewed for consistency with the ordinance/regulatory mechanism and specifications required by Section 3.3. The County will not approve or recommend for approval any plans for structural controls that do not meet minimum requirements to meet Section 2.5.4 and Section 2.5.6.

2.5.6 Long-Term Operation and Maintenance (O&M)

The County will maintain an inventory and will ensure that all stormwater controls are operated and maintained to meet the site performance standard in Section 2.5.4 by means of the Private Stormwater Facilities Operation and Maintenance Agreement and the Plan and Checklist provided in Appendix A. This strategy will, at minimum, include the following:

A. Legal authority allowing the County to inspect and require effective operation and maintenance of privately owned and operated stormwater controls.

B. Inspection procedures and an inspection schedule ensuring compliance with the O&M requirements of each stormwater control operated by the County and by other private entities.

C. A tracking mechanism for documenting inspections and the O&M requirements for each stormwater control. This tracking mechanism will document enforcement actions and compliance response. For stormwater controls that include vegetation, the O&M requirements must at minimum include requirements to maintain and/or replace vegetation to ensure the functionality of this control. For stormwater controls that include soils in the treatment process, O&M requirements will, at minimum, include requirements to maintain soil permeability.

D. Reporting requirements for privately owned and operated stormwater controls that document compliance with the O&M requirement in Section 2.6.

E. The location of all public and private stormwater controls installed will be included with the respective MS4 Maps.

If the proposed facility types do not match the stormwater management facilities in Appendix A, the owner and design engineer will be responsible for creating any details, maintenance specifications, and an inspection checklist to be incorporated into the O&M Plan.

The O&M Agreement and Plan for privately owned/maintained facilities shall be recorded with the County and runs with the land in perpetuity (passing with a transfer or sale of a property), per LCC 860.235.

2.5.7 Training and Education

Staff responsible for performing post-construction runoff site plan reviews, administrating the alternative compliance program, or performing O&M practices or evaluating compliance with long-term O&M requirements will be trained or otherwise qualified to conduct such activities.

Orientation and training will be provided to all new staff working to implement the post-construction runoff control program within 30 days of their assignment to this program. All staff must receive training at least once during the permit term. The County must provide follow-up training as procedures and/or technology utilized in this program change.

2.5.8 Tracking and Assessment

The County will maintain records for activities to meet the requirements of the Post-Construction Site Runoff program requirements through the Stormwater permit process.

2.6 POLLUTION PREVENTION AND GOOD HOUSEKEEPING FOR MUNICIPAL OPERATIONS

The County will properly operate and maintain its facilities, using prudent pollution prevention and good housekeeping to reduce the discharge of pollutants through the MS4 to waters of the state.

Management of construction site pollutants and pollution control BMP's can be found in Section 5 of the Linn County Erosion and Sediment Control Manual. This manual can be found on the Linn County website at: https://www.co.linn.or.us/roads.

2.6.1 Operation and Maintenance Strategy for Existing Controls

For existing stormwater controls, the County has developed and implemented an operation and maintenance strategy for both County-owned controls and controls owned and operated by another

entity discharging to the MS4. The O&M strategy for stormwater controls will include, at minimum, the long-term O&M requirements in Section 2.5.6.

2.6.2 Inspection and Cleaning of Catch Basins

At least 50 percent of the County-owned or operated catch basins and inlets within the MS4 will be inspected at least once every five years and take all appropriate maintenance or cleaning action based on those inspections to ensure the catch basins and inlets continue to function as designed.

Catch basin inspection records and cleaning records will be maintained by the County Road Department. See Appendix C.

2.6.3 Pollution Prevention in Facilities and Operations

The County will conduct its municipal O&M activities in a manner that reduces the discharge of pollutants through the MS4 to protect water quality. The County will review, and if necessary update, existing procedures for inspection and maintenance schedules to ensure pollution prevention and good housekeeping practices are conducted for the following activities:

1. Pipe cleaning for stormwater and wastewater conveyance systems.
2. Cleaning of culverts conveying stormwater in roadside ditches.
3. Ditch maintenance.
4. Road and bridge maintenance.
5. Road repair and resurfacing including pavement grinding.
6. Dust control for roads and municipal construction sites.
7. Winter road maintenance, including salt or de-icing storage areas.
8. Fleet maintenance and vehicle washing.
9. Building and sidewalk maintenance including washing.
10. Solid waste transfer and disposal areas.
11. Municipal landscape maintenance.
12. Material storage and transfer areas, including fertilizer and pesticide, Hazardous material, used oil storage, and fuel
13. Firefighting training activities.
14. Maintenance of municipal facilities including public parks and open space, golf courses, airports, parking lots, swimming pools, marinas, etc.

2.6.4 County-Owned NPDES Industrial Stormwater Permit Facilities

County-owned or operated facilities with industrial activity as defined in 40 CFR §122.26(b)(14) discharging stormwater to the waters of the state must have coverage under DEQ's NPDES Industrial Stormwater General Permit. The County may use the actions required in the NPDES Industrial Stormwater Permit to address the applicable facility requirements in Section 2.6.5.

2.6.5 Requirements for Pesticide and Fertilizer Applications

The County has implemented practices to reduce the discharge of pollutants to the MS4 associated with the County's application and storage of pesticides and fertilizers within County's public right-of-ways, parks, recreational facilities, and landscaped areas. The County administers herbicides which contain some regulated, EPA approved, pesticides. The County utilizes computerized equipment that provide application rates approved by the EPA and ODA and written records of application rates are also kept.

All County employees or contractors applying herbicides, which contain pesticides, must follow all label requirements, including those regarding application methods, rates, number of applications allowed, and disposal of the pesticide, fertilizer and rinsate.

2.6.6 Litter Control

The County has implemented methods to reduce litter within its jurisdiction through regular County road maintenance activities, public complaints, by LCC 531, Solid Waste Code, LCC 531 Public Nuisance Code, and LCC 240 Code Enforcement. The County will work cooperatively with other departments, organization, or other entities to control litter on a regular basis and after major public events in order to reduce the discharge of pollutants and litter.

2.6.7 Materials Disposal

All collected material or pollutants removed in the course of maintenance, treatment, control of stormwater, or other wastewaters will be managed and disposed of in a manner such as to prevent such pollutants from entering the waters of the state in accordance with state and federal rules.

2.6.8 Stormwater Infrastructure Staff Training

All staff responsible for evaluating O&M practices, evaluating compliance with long-term O&M requirements or ensuring pollution prevention at facilities and during operations are trained or otherwise qualified to conduct such activities.

Orientation and training will be provided to all new staff working to implement the pollution prevention and good housekeeping for municipal operations program within 30 days of their assignment to this program and at least once during the permit term. Follow-up training will be provided as procedures and/or technology utilized in this program change.

2.6.9 Tracking and Assessment

The County will maintain records for activities to meet the requirements of the Pollution Prevention and Good Housekeeping for Municipal Operations program requirements by retaining stormwater facility cleaning logs, erosion and sediment control inspection reports, and O&M Agreements.

2.7 TOTAL MAXIMUM DAILY LOADS (TMDL)

A TMDL, or total pollutant load to a waterbody, is the sum of individual waste loads allocated to point sources, load allocations assigned to non-point sources and loads assigned to background. The amount of pollutant that a waterbody can receive and still meet the applicable water quality standard is referred to as the “loading” or “assimilative capacity” of the waterbody, and it is calculated as part of the TMDL. Loading from all pollutant sources must not exceed the loading or assimilative capacity (also referred to as the TMDL) of a waterbody and must include an appropriate margin of safety.

Load allocations are portions of the loading capacity that are attributed to either natural background sources, such as soils, or from non-point sources, such as urban, rural agriculture, or forestry activities. Wasteload allocations are portions of the load that are allotted to point sources of pollution, such as sewage treatment plants or industries. The wasteload allocations are used to establish effluent limits in discharge permits. Allocations can also be reserved for future uses, also known as the “reserve capacity.” Allocations are quantified measures that assure water quality standards will be met and may distribute

the pollutant loads between nonpoint and point sources. This general TMDL concept is represented by the following equation:

TMDL = Wasteload Allocation + Load Allocation + Reserve Capacity + Margin of Safety

Together, these elements establish the mercury loads necessary to meet the applicable water quality standards for mercury and protect human health, wildlife, aquatic life and other beneficial uses.

2.7.1 TMDL Program

Linn County has developed a Total Maximum Daily Loads Program. This Program outlines the actions for minimizing mercury and sediment inputs into surface waters from those areas where the county has jurisdiction to reduce mercury and sediment in the Willamette Basin in order to protect people who regularly eat fish and shellfish from streams and lakes across the basin. Documents pertaining to Linn County's TMDL program can be found on the Linn County Environmental Health Website at: https://www.linncountyhealth.org/eh. Documents within this program, include, but are not limited to:

- TMDL Implementation Plan
- TMDL Annual Reports
- TMDL Management Strategy Matrix
- Linn County Willamette River Basin TMDL Area Maps

3 STORMWATER MANAGEMENT REQUIREMENTS

The purpose of these Stormwater Management Engineering Standards is to provide a consistent policy under which certain physical aspects of stormwater management will be implemented. Most of the elements contained in this document are Engineering oriented and most are related to the development or platting process; however, it is intended that they apply to both public and private work designated herein.

These Engineering Standards cannot provide for all situations. They are intended to assist, but not to serve as a substitute for competent work by design professionals. Engineers are expected to bring the best skills from their respective disciplines to each project. If the Engineer anticipates challenges in meeting these standards, they should contact the County prior to extensive design efforts.

These Engineering Standards are not intended to limit unreasonably any innovative or creative effort that could result in better quality, better cost savings, or both. Any proposed alternatives from the Engineering Standards will be judged on the likelihood that such variance will produce a compensating or comparable result, in every way adequate for the user and County over the lifecycle of the improvement.

The standards have the objective of developing a stormwater management system that will:

A. Be of adequate design to safely manage stormwater generated upstream and on the site from given storm intervals to an approved point of disposal.

B. Provide points of connection for stormwater generated by future development upstream.

C. Prevent the uncontrolled or irresponsible discharge of stormwater onto adjoining public or private property.

D. Prevent the capacity of downstream channels and storm drainage facilities from being exceeded.

E. Have sufficient structural strength to resist erosion and all external loads that may be imposed.

F. Maintain the runoff characteristics of the original undeveloped drainage basin, where feasible, as determined by the County Engineer.

G. Protect the County's natural drainage system of streams, lakes, and wetlands.

H. Maintain or improve overall stormwater quality.

I. Be designed in a manner to allow economical future maintenance.

J. Be designed using materials to insure a minimum practical design life of 75 years.

K. Be consistent with the Linn County Code (LCC), Oregon Standard Specifications for Construction (OSS) and all applicable state and federal regulations and requirements for stormwater quantity and quality.

3.1 APPLICABILITY

These Engineering Standards shall govern construction and upgrading of all public stormwater management facilities through the MS4 to waters of the state. These Engineering Standards shall also govern the construction of private stormwater management facilities that require County review. Permanent stormwater management facilities shall be provided on all property improvements within the MS4 per these Engineering Standards for the following types of development:

A. All major partitions and subdivisions.

B. All public and private development that requires stormwater reviews and/or approvals from the County.

C. Developments entailing construction that would change the point of discharge of surface waters, the quantity of discharge, or discharge surface waters at a higher velocity or flow than that of the preconstruction discharge rate, or could contribute to pollution of surface waters.

D. Developments that adds or replaces more than 1/4 acre (10,480 square feet) of impervious surface.

E. Construction or reconstruction of public roadways and temporary detours.

F. Developments entailing construction in or adjacent to any existing stream or surface watercourse including intermittent streams.

G. Developments requiring construction in or adjacent to the 100-year floodplain of any stream.

3.2 DEFINITIONS

Definition of Words - Wherever in this plan the words directed, required, permitted, ordered, designated, or words of like importance are used, they shall be understood to mean the direction, requirement, permission, or order of designation of the County Engineer. Similarly, the words approved, acceptable, and satisfactory shall mean approved by, acceptable to, or satisfactory to the County Engineer.

Definitions can be found in the Glossary of Terms in Appendix F.

3.3 STORMWATER PLAN

Stormwater site plans, drawn to scale, showing the existing and proposed stormwater systems and other required information shall be submitted with the stormwater report for a development. The existing and proposed stormwater site plan shall be on separate plan sheets. The proposed plan shall show profile and plan view of the proposed improvements. The stormwater report shall include post-construction stormwater quality facility sizing forms and calculations, and sizing calculations for stormwater conveyance and detention facilities.

3.3.1 Existing Stormwater Site Plans

A topographical contour map, drawn to scale, and clearly defining existing conditions:

A. The plan shall clearly show the drainage basins within, and/or contributing to, the improvement limits. Existing routing and discharge locations of the basins shall be shown.

B. Existing contours of the land at two-foot intervals, or as otherwise required or approved by the County Engineer, with the location of existing buildings, structures, and public and private utilities on the property. Location of any existing building or structure on adjacent property that is within 15 feet of a proposed stormwater facility.

C. All areas improved or unimproved, lying upstream and draining to or through the proposed development.

D. All areas improved or unimproved, lying downstream, to a trunk line, that will receive the runoff developed from the site.

E. Location of existing stormwater facilities that transport surface water onto, across, or from the site, including natural watercourses, artificial channels, drain pipes, or culverts.

F. Location of any existing post-construction stormwater quality facilities.

G. Location of any septic drain fields and areas of known contaminated soil or groundwater.

H. Locations of springs, wells, or other subsurface water sources.

I. Arrows indicating drainage direction in all public and private property and for all stormwater conveyance systems.

J. The route used in determining the pre-developed time of concentration.

K. Existing structures and impervious surfaces.

L. Floodplains, Natural Resource Overlay Districts, and wetlands.

3.3.2 Proposed Stormwater Site Plans

The proposed stormwater site plan sheets shall clearly define the proposed improvements and include necessary construction details. (The requirements of this section, as applicable, satisfy the requirements for a post-construction stormwater quality plan as identified in Section 2.5).

A. The plan shall clearly show the drainage basins within, and/or contributing to, the improvement limits. Proposed routing of all piping and other drainage improvements and discharge locations of the basins shall be shown.

B. Proposed contours of the land after completion of the project at two-foot intervals, or as otherwise required or approved by the County Engineer. This shall include elevations, dimensions and location, extent, and slopes of all grading work proposed to be done.

C. Identify cut and fill areas, soil types, topography, and vegetation.

D. Location of proposed stormwater facilities that transport surface water across or from the site, including, but not limited to, natural watercourses, artificial channels, under drain pipes, and culverts.

E. Location, type, size, capacity, and details of proposed post-construction stormwater quality facilities, detention facilities, and excess flow escape routing. Clearly identify all impervious surfaces contributing to each facility.

F. Planting plans for post-construction stormwater quality facilities.

G. Boundaries and total square footage of all impervious surfaces and areas that will be otherwise altered in a manner that will increase surface water runoff and boundaries of all areas to remain in an existing or natural condition.

H. The route used in determining the post-developed time of concentration.

3.4 STORMWATER QUALITY MANAGEMENT DESIGN AND CALCULATIONS

Post-construction stormwater quality facilities are encouraged on all development and re-development projects and are required in most situations per Section 2.5. Private facilities will be required to be privately maintained consistent with the requirements of Section 2.5 and the Private Stormwater Facilities Operations and Maintenance Agreement and Plan and checklists provided in Appendix A.

A. These requirements are established to comply with state and federal water quality and stormwater regulations, and the Linn County Development Code. The purpose of the stormwater quality facilities standards are to:
    a. reduce pollutant loads,
    b. reduce the velocity and quantity of stormwater runoff, and
    c. provide for the capture and treatment of stormwater runoff on or as close as possible to the site where it is generated.

B. Additionally, the goal of these standards is to encourage design and construction of stormwater quality facilities that are visually attractive and integrated into site designs and landscaping. Generally, vegetated stormwater quality facilities may be located in site landscaping (such as parking lot islands, open space, and street-side planter strips).

3.4.1 Facility Selection and Location

Most residential subdivisions, partitions, and small site developments should be able to locate post-construction stormwater quality facilities within private property being developed. Additionally, residential subdivisions may locate a stormwater quality pond onsite, within a separate tract. When projects, such as larger site developments, have more impervious area proposed than can be treated within the area required, private facilities shall be incorporated into the site design. Private facilities will require that a Private Stormwater Facilities Operations and Maintenance Agreement (Appendix A) be recorded with the property.

There are three categories of stormwater quality facilities that may be designed to meet post-construction stormwater quality requirements, although restrictions apply for various site types and conditions:

A. Vegetated Stormwater Quality Facilities. These facilities are encouraged for use on all projects on private property. Treatment by these facilities is achieved by filtering stormwater through vegetation and growing medium. They may be sized using a simplified sizing factor method, and may be located as approved within site landscaping, street landscape strips, designated open space, floodplains, and adjacent to or in some cases encroaching within Significant Natural Resource overlays.

B. Dry Pond Treatment Facilities. Dry ponds meet treatment requirements via gravitational processes; treatment is achieved by filtering stormwater through vegetation and growing medium. Dry ponds can also be designed to meet detention requirements consistent with Section 3.9. Dry pond facilities have separate design criteria compared to Vegetated Stormwater Quality Facilities and there are no simplified sizing factors. Submittal will require hydrologic and hydraulic analysis.

C. Manufactured Facilities. Manufactured treatment technologies may be approved on a case-by-case basis when other stormwater facilities are not a feasible option due to site constraints. These facilities will not be allowed as publicly owned, operated, or maintained facilities.

The County recognizes there will be situations where alternate treatment facilities may be more appropriate to meet post-construction stormwater quality requirements, compared to construction of the three categories of facilities outlined in these standards. The County Engineer will consider alternate facilities such as wet ponds, wetlands, or grassy swales on a case-by-case basis.

Stormwater quality facilities are sized based on the amount of impervious surface in the contributing drainage area.

Tables 3.4.a and 3.4.b list approved stormwater quality facilities and their applicability for various land use and site conditions to assist in selection of the most appropriate measures and facilities for a project site.

Table 3.4.a - Stormwater Quality Facility by Land Use

Facility Type	Single Family	Residential Subdivision	Commercial, Industrial, Multi-Family (Onsite)	Private or Local Access Street
Vegetated Stormwater Quality Facility (Filtration)				
Street-side Planter				**X**
Street-side Shallow Swale				**X**
Curb Extension Planter				**X**
Onsite Planter	**X**	**X**	**X**	
Onsite Swale	**X**	**X**	**X**	
Dry Pond Treatment Facility				
Dry Pond	**X**	**X**	**X**	
Manufactured Stormwater Quality Facilities				
Manufactured Facility	**X**	**X**	**X**	**X**

Table 3.4.b - Stormwater Quality Facility by Site Conditions

Facility Type	On or Next to Building	Parking lot	Landscaped Area	Floodplain	Steep Slope (>12%) or Landslide Area	On Fill (5 Ft. Deep)	Contaminated Soils
Vegetated Stormwater Quality Facility (Filtration)							
Street-side Planter			**X**	**X**	**X[1]**	**X[1]**	**X[1]**
Street-side Shallow Swale			**X**	**X**	**X[1]**	**X[1]**	**X[1]**
Curb Extension Planter			**X**	**X**	**X[1]**	**X[1]**	**X[1]**
Onsite Planter	**X[1]**	**X[1]**	**X**	**X**	**X[1]**	**X[1]**	**X[1]**
Onsite Swale	**X[1]**	**X**	**X**	**X**	**X[1]**	**X[1]**	**X[1]**
Dry Pond Treatment Facility							
Dry Pond	**X[3]**	**X**	**X**	**X**		**X[2]**	**X[1]**
Manufactured Stormwater Quality Facilities							
Manufactured Facility		**X**			**X**	**X**	**X**

[1]Impermeable liner required. May have additional building code requirements for facilities on or adjacent to buildings. Even with liners, the presence of certain contaminants may prohibit installation of post-construction stormwater quality facilities.
[2]Geotechnical report required
[3]Setback requirements apply.

3.4.2 Stormwater Quality Facility Sizing

The stormwater quality design criteria are as follows:

A. Capture and treatment of 50 percent of the 2-year, 24-hour rain event. This event is herein referred to as the Water Quality Design Storm.
B. Based on a target removal of 80 percent of the total suspended solids (TSS) from the captured runoff volume. Removal of TSS is a design surrogate for water quality treatment for various pollutants including the County's regulatory requirements to address mercury and bacteria Total Maximum Daily Loads for the Willamette Basin, per the Oregon Department of Environmental Quality.
C. Vegetated stormwater quality facilities and dry ponds listed in this Section and designed according to County standards have been established to meet the stormwater quality design criteria.

The Stormwater Quality Facility Sizing by Facility Type are as follows:

A. Vegetated Stormwater Quality Facilities (Filtration). The facility sizing method for filtration-based vegetated stormwater quality facilities uses a simple surface area ratio calculation. The impervious area requiring treatment is multiplied by the applicable sizing factor (See Table 3.4.c) to produce the minimum required surface treatment area of the facility. The Water Quality Design Storm is the basis for the sizing factors. The facilities that may be designed using this simplified sizing method are: street-side planters, street-side shallow swales, curb extension

planters, onsite planters, and onsite swales. The sizing factor analyses were based on the Santa Barbara Urban Hydrograph (SBUH) method.

The development site should be divided into subcatchment drainage areas, and the required facility sizing determined separately for each area. For onsite planters and onsite swales, the impervious surface area within individual sub-catchment areas shall be less than 20,000 square feet, unless otherwise approved by the City Engineer. Multiple facilities and facility types may be used to meet the treatment requirements. The treatment area calculated using the sizing factors is the surface area required at the maximum stormwater quality treatment ponding depth (listed in the Facility Design Criteria Section 3.4.3) for the flow-through facility dimensions identified in these standards. Variations in facility dimensions and ponding depths will require more detailed evaluations to determine appropriate sizing factors for the respective design. Any proposed non-flow-through facility would also require detailed evaluation of appropriate sizing factors. Table 3.4.c provides stormwater quality facility sizing factors by facility type.

Table 3.4.c – Sizing Factors for Vegetated Stormwater Quality Facilities

Facility Type	Sizing Factor	Notes
Street-side Planter	0.018	Size = surface area of vegetated facility with vertical walls. Design treatment ponding depth = 8 inches above soil surface
Street-side Shallow Swale	0.025	Size = surface area of facility at design treatment ponding depth of 5 inches, not total surface area of facility.
Curb Extension Planter	0.018	Size = surface area of vegetated facility with vertical walls. Design treatment ponding depth = 8 inches above soil surface.
Onsite Planter	0.018	Size = surface area of vegetated facility with vertical walls. Design treatment ponding depth = 8 inches above soil surface.
Onsite Swale	0.025	Size = surface area of facility at design treatment ponding depth of 8 inches, not total surface area of facility.

B. Dry Pond Treatment Facilities. Facility sizing for dry ponds will be based on hydrologic routing of the Water Quality Design Storm. Runoff hydrographs will be required for all volume based, e.g., water quality pond, design. The required method for development of hydrographs is the Santa Barbara Unit Hydrograph (SBUH) method. Similar unit hydrograph methods such as the Soil Conservation Service (SCS) TR-55 method or a continuous runoff model may be used if approved. Similar routing methods will be required if the dry pond facility is to also be used as a dual treatment/detention facility. Dry ponds utilized for detention must also meet applicable flow control requirements as described in Section 3.9.

C. Manufactured Treatment Technologies. The use of manufactured devices for treatment of stormwater runoff must be approved by the County Engineer. The treatment device shall be sized according to the manufacturer's recommendations and shall be designed to meet the County's stormwater quality design criteria.

Sizing of stormwater quality facilities is based on the amount of impervious area draining to the facility. Determination of Impervious Area Requiring Treatment is as follows:

A. Calculating Gross Impervious Area:

a. For single-family residential development, the gross impervious area shall be determined by multiplying the number of single-family residential lots (all phases and parcels) by 2,700 square feet and adding it to the measured actual impervious area of streets and sidewalks from engineering site plans.
b. For all other development, gross impervious area shall be calculated by measuring actual impervious area from engineering site plans. The gross impervious area is the total of:
    i. New impervious area, plus replaced and/or re-surfaced impervious area, plus any additional pre-existing impervious area that will drain across the new or replaced/re-surfaced impervious area.

3.4.3 Facility Design Criteria

This section provides design criteria for the County's approved post-construction stormwater quality facilities. The approved facilities were developed with the intent of providing flexibility to the design engineer to select the most appropriate facility for each unique situation. However, it should be noted that the County reserves the right to require design modifications for public facilities in order to minimize long-term operation and maintenance costs and to accommodate other public needs such as preservation of on-street parking.

A. Post-Construction Stormwater Quality Criteria by Facility Type. Post-construction stormwater quality facilities include vegetated stormwater quality facilities, dry pond treatment facilities, and manufactured treatment systems. Each facility shall be sized appropriately to treat the contributing drainage area. Vegetated stormwater quality facilities and dry ponds shall be designed as flowthrough facilities. The use of non-flow-through facilities would require approval of the County Engineer and would be subject to additional requirements. Construction requirements, and design guide drawings for vegetated water quality facilities and dry ponds are included in these standards and in the Oregon Standard Specifications for Construction.
    a. Vegetated Stormwater Quality Facilities (Filtration). Sizing factors developed for these facilities are based on treating and conveying all design flows to a piped or other approved drainage facility. The use of non-flow-through facilities would require approval of the County Engineer and would be subject to additional requirements and, site specific facility sizing to meet treatment requirements. The treatment area calculated using the sizing factors is the surface area required at the stormwater quality treatment ponding depth for the flowthrough facility dimensions identified in these standards. Proposed variations in facility dimensions and ponding depths will require more detailed evaluations to determine appropriate sizing factors for the respective design.
        i. Infiltration Planter. Infiltration planters are structural, vertical-walled, landscaped facilities located in the planter strip adjacent to the street and/or sidewalk (Image 1). They are designed to collect and treat stormwater runoff from the street, sidewalk, and, in many instances, adjacent properties. These facilities are envisioned more in commercial areas and

Image 1. Street-Side Infiltration Planter

on nonresidential streets; however, their use is allowed in a residential subdivision setting.

The street-side planter has a standard treatment depth of six inches. An eight-inch ponding depth below the gutter line elevation at the curb-notch entrance is required to provide two inches of freeboard for overflows over check dams and to outlet structures. Facilities are comprised of a layer of growing medium over a layer of drain rock. The soil surface shall be level to promote infiltration of stormwater throughout the entire surface of the facility. The elevation of the soil surface shall be called out on the construction plans. Check dams may be used to maintain required soil surface elevations while also maintaining facility length on steeper sites. A perforated pipe in the drain rock and the surface overflow system collect stormwater and direct it to the storm drain system. Some facilities may require impermeable liners. See Section 3.4.3(C) for use of liners. Planters shall be designed such that the vertical height of walls and vegetation above ground do not interfere with required lines of sight.

ii. Shallow Swale. Shallow swales are landscaped facilities located adjacent to the street (Image 2) or behind the sidewalk. They are designed to collect and treat stormwater runoff from the street, sidewalk, and, in many instances, adjacent properties. These facilities are envisioned for use in residential subdivisions and other low-traffic volume settings. The primary advantage is they are generally easier to construct than planters.

Image 2. Street-Side Shallow Swale

Shallow swales have a 2-foot-wide bottom and side slopes; 3 horizontal:1 vertical adjacent to the street and 2 horizontal:1 vertical adjacent to the sidewalk. The street-side swale has a standard treatment depth of three inches. A five-inch-ponding depth below the gutter line elevation at the curb-notch entrance is required to provide two inches of freeboard for overflows over check dams and to outlet structures. Facilities are comprised of a layer of growing medium over a layer of drain rock. The soil surface on the bottom of the facility shall be level to promote infiltration of stormwater throughout the entire length of the facility. The elevation of the soil surface shall be identified on the construction plans. Check dams may be used to maintain soil surface elevations while also maintaining facility length on steeper sites. A perforated pipe in the drain rock and the surface overflow system collect stormwater and direct it to the storm drain system.

iii. Curb Extension Planters and Biocells. Curb extension planters and biocells are essentially large street-side planters that utilize additional space within the roadway for treatment area rather than relying solely on the space within the landscape strip (Image 3). They are designed to collect and treat stormwater runoff from the street, sidewalk, and, in many instances, adjacent properties.

These facilities are adaptable to most settings. They can be incorporated into a bulb-out at an intersection or constructed as midblock extensions.

The difference between standard curb extension planters and pods are that biocell are smaller in scale and are intended only to supplement other post-construction stormwater quality facilities on a project. Their use is only envisioned in residential settings, on low traffic-volume roads.

Image 3. Curb Extension Planter

Curb extension planters and biocells have a standard treatment depth of six inches. An eight-inch-ponding depth below the gutter-line elevation at the curb-notch entrance is required to provide two inches of freeboard for overflows over check dams and to outlet structures (pods may also have a curb-notch exit, the ponding depth for treatment is set from the lowest curb-notch elevation). Facilities are comprised of a layer of a layer of growing medium over a layer of drain rock to promote infiltration of stormwater throughout the entire surface of the facility. The elevation of the soil surface shall be called out on the construction plans. Check dams may be used to maintain required soil surface elevations while also maintaining facility length on steeper sites. A perforated pipe in the drain rock and the surface overflow system collect stormwater and direct it to the storm drain system. Some facilities may require impermeable liners. See Section 3.4.3(C) for use of liners.

Extensions into the roadway shall be as follows:

Table 3.4.d –Curb Extension Limits

Standard Roadway Width	Intersection Bulb-Out	Mid-Block Bulb-out
28-foot	3-foot	4-foot
30-foot or greater	4-foot	6-foot

For curb extension planters constructed as part of a bulb-out at the intersection of two residential streets, the minimum curb return radii shall be 20 feet. Separation between the nearest driveway and the bulb-out shall be 22 feet.

The cross slope of the pavement between the centerline of the road and curb and gutter shall remain constant and shall not vary with the incorporation of curb extension planters.

Similar to standard curb returns, all curb return data around a curb extension planter or pod shall be summarized in a table on the construction plans. The table

shall show the total length of the return, delta angle, curb radius distance, and stationing and elevations of the beginning, ¼ delta, ½ delta, ¾ delta, and end of the return.

In no instance shall the use of curb extension planters or pods on a new street result in a loss of 50 percent of on-street parking for the block on which they are being installed, when compared to what would otherwise be provided.

Curb Extension Planter walls exceeding 40 feet in length require special design considerations for a keyed joint.

Curb extension planters shall be designed such that the vertical height of walls and vegetation above ground do not interfere with required lines of sight.

iv. Onsite Planter. Onsite planters are structural, vertical-walled, landscaped facilities that could be located in parking lots, adjacent to buildings and pathways, courtyards, or other site landscaping areas (Image 4). They are designed to collect stormwater runoff onsite from private property.

Image 4. On-Site Planter

Onsite planters shall have a level soil surface to promote infiltration of stormwater throughout the entire surface of the facility. The elevation of the soil surface shall be shown on the construction plans. Check dams may be used to maintain soil surface elevations while also maintaining facility length on steeper sites. The onsite planter has a standard six-inch ponding depth in the vegetation zone plus a minimum of two inches freeboard that provides for overflows over check dams and flows to outlet structures (creating an eight-inch design treatment depth), and is underlain by soil media and drain rock layers. A perforated pipe in the drain rock and the surface overflow system collect stormwater and direct it to the storm drain system.

When walkways are proposed adjacent to onsite planters, care shall be taken to minimize the vertical distance between the walkway and the designed soil surface. Structural protective measures, such as curbing, shall be incorporated into the design to physically separate pedestrians from the facility.

Onsite planters shall be designed such that the vertical height of walls and vegetation above ground do not interfere with required lines of sight. Planter walls exceeding 40 feet in length require special design consideration for a keyed joint.

In general, street-side planter design requirements will be used as a guide for reviewing similar components of proposed onsite planter designs.

The maximum amount of impervious surface draining to each onsite planter shall be 20,000 square feet. Multiple facilities can be used to meet treatment requirements.

Careful consideration shall be given to the overflow design. These facilities are only intended to handle the water quality storm. It is the design engineer's responsibility to ensure larger storm events are also appropriately considered in the site design.

Since these facilities will be constructed on private property, land use approvals and building permits may be required from the Planning and Building Department.

All vehicular and pedestrian safety (including ADA) requirements shall be incorporated into onsite designs. It is the property owner and design engineer's responsibility to ensure these requirements are met. County review of private facility design is limited to stormwater quality functions.

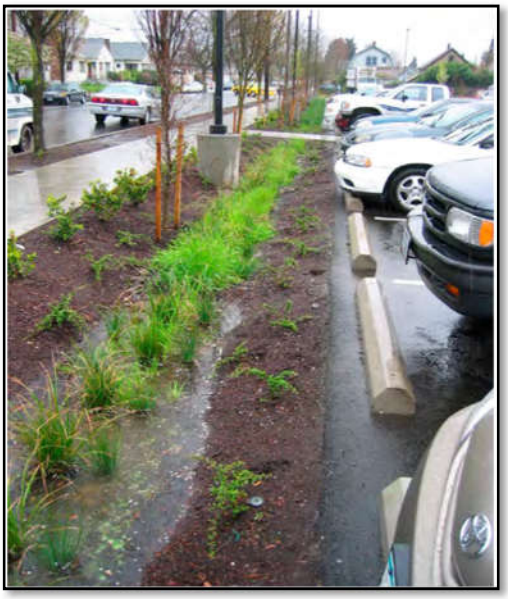


Image 5. Onsite Swale

Onsite Swale. Onsite swales are shallow, vegetated depressions with side slopes (maximum 3 horizontal:1 vertical) and a two-foot-wide bottom that is flat, with no grade (Image 5). The elevation of the soil surface shall be shown on the construction plans. Check dams may be used to maintain soil surface elevations while also maintaining facility length on steeper sites. Swales may be located in parking lots and other site landscaping areas. They are designed to collect stormwater runoff onsite from private property. The onsite swale has a standard six-inch-ponding depth in the vegetation zone plus a minimum of two inches freeboard that provides for overflows over check dams and flows to outlet structures (creating an eight-inch design treatment depth), underlain by soil media and drain rock layers. A perforated pipe in the drain rock and the surface overflow system collect stormwater and direct it to the storm drain system. Sizing factors for onsite swales are based on 3:1 side slopes and the identified bottom width, and an eight-inch treatment depth. Any variation from these standards will require calculation of a facility-specific sizing factor.

If walkways are proposed adjacent to these facilities, the design engineer will need to consider whether additional measures are required, such as curbing, to separate the walkway from the side slope on the stormwater quality facility. When parking is proposed adjacent to these facilities, curbing or wheel stops are required to prevent vehicles from accidently driving into the facility.

The maximum amount of impervious surface draining to each onsite swale shall be 20,000 square feet. Multiple facilities can be used to meet treatment requirements.

Careful consideration shall be given to the overflow design. These facilities are only intended to handle the water quality storm. It is the design engineer's responsibility to ensure larger storm events are also appropriately considered in the site design.

Since these facilities will be constructed on private property, land use approvals and building permits may be required from the Planning and Building Department. All vehicular and pedestrian safety (including ADA) requirements shall be incorporated into onsite designs. It is the property owner and design engineer's responsibility to ensure these requirements are met. County review of private facility design is limited to stormwater quality functions.

v. Dry Pond Treatment Facilities. Sizing of dry pond facilities is based on hydrologic routing of the Water Quality Design Storm. Sizing factors, such as those provided for Vegetated Water Quality Facilities, are not appropriate for ponds due to variations in design parameters. When used to meet stormwater quality and detention requirements, dry ponds must also meet applicable flow control requirements as described in Section 3.9.

Image 6. Dry Pond

Dry ponds are designed to fill during storm events and slowly release the water quality design storm volume through an underdrain system. When constructed to also serve as a detention, volumes greater than the water quality storm volume are routed through an outlet control structure (Image 6).

The pond bottom is comprised of an 18-inch layer of growing medium constructed over 12 inches of drain rock. The growing medium, but not the rock, extends from the pond bottom up to the water quality event design surface elevation. Above the water quality design surface elevation, 12 inches of topsoil shall be placed to the top of the bank, and beyond the top of bank to the extent necessary to support required/proposed plantings.

A rock energy dissipater shall be installed at pipe inlets. The top of the rock energy dissipater shall be set at 12 inches below the water quality design water surface and have maximum side slopes of 2H:1V. The energy dissipater shall be designed to be stable for all anticipated hydraulic conditions. The energy dissipater rock gradation shall be sufficient to allow for deposition and retention of larger sediment at the inlet.

An underdrain system shall be placed along the entire length of the facility such that flow/treatment is evenly dispersed throughout. The design shall assume a three-inch per-hour infiltration rate through the growing medium. The required number and spacing of drain pipe shall be designed assuming no infiltration is occurring into native soils such that the underdrain system is the primary means of conveyance for the water quality storm. The underdrain system shall not be relied upon to meet detention requirements beyond the water quality design storm.

Underdrain systems can have many different configurations; pipe sizing and lateral spacing shall be based on facility size and individual site conditions. However, minimum requirements shall include the following:

- Minimum perforated pipe size shall be four-inch diameter.
- Underdrain laterals shall be placed at no more than 10-foot-on-center-spacing; at minimum provide one underdrain for every 1,000 square feet of surface area.
- Include at least one cleanout for each underdrain lateral at the downstream end.
- Piping shall conform to the requirements of the Uniform Plumbing Code

The soil surface on the bottom of the facility shall be generally level to promote infiltration of stormwater throughout the entire length of the facility. The elevation of the soil surface shall be identified on the construction plans.

The minimum freeboard in ponds shall be one foot above the emergency overflow structure or spillway elevation.

Dry ponds shall have a maximum water depth of four feet. The minimum width at the bottom of the pond shall be four feet. The width of the pond shall vary by four feet at a minimum of two separate points to produce a more natural pond shape.

Maximum side slopes in both the forebay and treatment cell are 3H:1V. Also refer to section 3.9.2 Surface Ponds for requirements related to pond berms and embankments.

b. Manufactured Stormwater Quality Facilities. If manufactured treatment facilities are approved for use, the type of facility to be installed must be approved by the County Engineer. The treatment device shall be designed and installed according to the manufacturer's recommendations.

Since these facilities may be constructed on private property, land use approvals and building permits may be required from the Planning and Building Department.

B. Inlets, Outlets, and Overflows:

a. Curb Notches. The station and invert elevation of each curb notch shall be identified on the construction plans. Curb notches shall be spaced to assure that flow along the gutter line can be intercepted by post-construction stormwater quality facilities during the water quality design storm (image 7). Curb notches are typically located at the upstream end of each facility. However, the maximum length between curb notches is 30 feet. If a facility has more than one curb notch serving it, the elevations of each notch must be set such that the anticipated treatment (ponding) depth within the facility will not short-circuit. Deviations in the maximum elevation between the curb/sidewalk and the soil surface to accommodate additional curb notches requires the approval of the County Engineer.

Image 7. Curb Notch

In some instances, it may be desirable to also place a curb notch at the downstream end of the last facility along a block length in order to capture and treat all of the water along the project. These instances will require similar reviews and approvals for elevation changes as described in the preceding paragraph.

b. Sidewalk Drainage Notch. Four-inch sidewalk drainage notches shall be placed in the exposure of planter walls (planters, pods, and extensions) adjacent to the sidewalk to assure that the flow from sidewalk can be intercepted and ponding on the sidewalk does not occur during the design storm event. Notches shall typically be centered on sidewalk panel joints every 10 to 15 feet, or one per cell of a multi-cell facility, but in no case shall the spacing exceed 20 feet (Image 8).

Image 8. Sidewalk Drainage Notch

c. Sediment Traps. Some locations within the development may have higher sediment loads than others. High sediment load areas can be problematic for post-construction stormwater quality facilities by "clogging" the soils and reducing overall infiltration. This results in increased maintenance costs and a reduced service life for the facility. To avoid this situation, sediment traps can be incorporated into the inlet design. Sediment traps may be required by the County Engineer in the following locations:

- Facilities on high traffic-volume streets (arterials and collectors).
- Facilities adjacent to, or immediately downstream of, unimproved roads or lots.
- Other locations identified by the County Engineer as having a potential for high sediment loads.

d. Roof Drains. Roof drains should connect to the street at the standard curb and gutter location, or into the roadside ditch. Locations of connections shall be shown on the construction plans. Direct connection of roof drains to post-construction vegetated

stormwater quality facilities is discouraged and requires approval from the County Engineer.

e. Pretreatment Manhole. Dry ponds, and any other larger water quality facility, shall require a pretreatment manhole. Pretreatment manholes have a deeper sump and an outlet 'tee' for oils. These structures are intended to provide partial solids retention prior to conveying stormwater to the pond. The pretreatment water quality manhole is not intended to meet other agency requirements for TSS removal.

f. Underdrain System. The primary outlet for post-construction stormwater quality facilities is through the underdrain system. Flow is collected in the underdrain system and routed to the standard stormwater collection system. Methods of connection include:
   - Connection to an adjacent curb inlet.
   - Stormwater lateral connection to standard piped stormwater system.
   - Connection to the underdrain system on an adjacent facility. This option may be considered when two facilities are located on the same side of the street and separated by a short distance, such as a driveway width. The purpose of such a connection would be to reduce, or eliminate, the use of stormwater laterals. When connecting to adjacent facilities the ability of the underdrain system to accept the additional flow will need to be verified.

   Invert elevations and stationing shall be shown for all points of connection.

g. Overflows. All post-construction stormwater quality facility designs shall incorporate an overflow system in the event the stormwater facility temporarily fails or rainfall exceeds the stormwater quality design storm. The overflow system shall be designed to maintain public safety and avoid property damage. Overflow elevations shall be identified on the construction plans.
   i. Street-Side Facilities. A small overflow shall be incorporated into the cleanout at the downstream end of the facility. The overflow shall be fitted with an atrium grate sized to the pipe to protect the perforated drain pipe system from debris and sediment. This overflow will supplement the primary overflow, which is also the inlet on most street-side facilities. Larger overflow structures will be required when escape/overflow to the street and a standard stormwater collection/ conveyance system is not feasible.
   ii. On-Site Facilities. Overflow systems may include an overflow structure similar to street-side facilities and/or, when approved, storage in parking lots or landscaping areas. Flow routing shall be identified on the construction plans to illustrate where flood conditions or ponding is expected to occur during larger rain events.
   iii. Dry Pond Facilities. An overflow structure shall be provided as either a grated inlet or atrium grate set just above the maximum water surface elevation of the water quality design storm. If the dry pond is also intended to serve detention requirements, then the overflow water surface elevations will vary with the coinciding water surface elevation for the respective storm events. Design criteria for detention is provided in Section 3.9.

   In addition, an emergency overflow spillway or structure will be required for all ponds. The emergency overflow spillway or structure must be designed to

accommodate the potential inflow to the facility up to the 100-year storm event. The overflow shall be sited to protect the structural integrity of the facility and be designed to convey/direct flows into downstream conveyance systems. The emergency overflow spillway shall be armored with riprap or other flow-resistant material that will protect the embankment and minimize erosion. Minimum freeboard shall be one foot above the highest potential water surface elevation (one-foot above the emergency overflow structure or spillway elevation).

C. Liners.

a. Unless required by this section or otherwise required by the County, vegetated stormwater quality facilities shall be designed and constructed to allow incidental infiltration into underlying native soils. As such, the use of liners is not allowed except as required below.

b. Impermeable liners are required for the following site conditions:

i. Steep Slopes. Facilities located on slopes >12 percent and facilities located closer to the top of the slope than the vertical height of the slope area that is >12 percent.

ii. Landslide Areas. Facilities located 200 feet or closer to known landslide-prone areas.

iii. Set-backs. Facilities located within ten feet of habitable structures. Facilities within five feet of a property line when the invert of the underdrain piping is at a higher elevation than the ground surface on the adjacent property.

iv. Contaminated Soils. Facilities located on or within 50 feet of contaminated soils as defined or identified by Oregon Department of Environmental Quality in the Environmental Cleanup Site Information (ECSI) database. Note: presence of certain contaminants may prohibit the construction of post-construction stormwater quality facilities, even with liners.

v. Contamination Risk Areas. Post-construction stormwater quality facilities are not designed to replace required containment or other source control measures. Regardless, impermeable liners are required for post-construction stormwater quality facilities that will receive drainage from or are adjacent to loading docks, refueling areas, areas of hazardous and toxic material storage or handling, and/or materials storage or handling areas.

vi. Fill Areas. Facilities located on fill soils deeper than five feet as measured from the highest finish grade adjacent to the proposed facility and the lowest existing grade under the proposed facility. Note: liner may not be required if a stamped geotechnical report for site fill conditions is submitted and indicates suitable stability for unlined facilities.

c. When required, impermeable liners shall be shown on the construction plans and be constructed to underlay all areas of the facility that are at or below the overflow elevation for the water quality design storm.

d. Perforated underdrain pipes shall be located at the bottom of the drain rock and above the impermeable liner, in facilities with impermeable liners.

D. Check Dams. Check dams shall be used to create multi-cell facilities when longitudinal slopes and facility lengths prevent having one continuous facility with a flat soil surface in all directions (Image 9). Check dams may similarly be used for onsite planters and swales as needed to accommodate site slope and grading conditions.
   a. Provide elevations and stationing and/or dimensioning for Check dam elevations shall not cause stormwater to overflow to sidewalk.
   b. Table 3.4.e provides check dam spacing requirements by longitudinal slope. Spacing is based on providing four inches of clearance between top of each check dam and the top face of curb.
   c. check dam locations.

Image 9. Check dams

Table 3.4.e – Check Dam Spacing

longitudinal Slope	On-Center Spacing
1%	35-feet
2%	19-feet
3%	13-feet
4%	11-feet
5%	9-feet
6%	8-feet
>6%	Too steep for post-construction stormwater quality facilities

E. Utility Crossings.
   a. General:
      i. Utility crossings under street-side, post-construction stormwater quality facilities are discouraged and only allowed on a case-by-case basis.
      ii. When crossings are necessary, one foot of clearance shall be provided between the bottom of post-construction stormwater quality facility and the crossing utility
   b. Water Services:
      i. Water services should cross a standard landscape strip section whenever possible. When that isn't possible, services should be placed in the driveway rather than under a post-construction stormwater quality facility.
      ii. Water service lines shall be located no closer to curb extensions than the point of tangency.
      iii. No hydrant shall be placed closer than five feet to a post-construction stormwater quality facility

F. Street Cross Slope. The integration of street-side, post-construction stormwater quality facilities in the right-of-way shall not change the underlying street cross slopes, including those between the sidewalk and the top face of curb.

G. Sidewalk Location and Timing of Construction.

a. Location. The sidewalk is typically positioned within the right-of-way such that there is a six-inch space between the back of sidewalk and the adjacent property line. Post-construction stormwater quality facilities should be located 1 foot behind the sidewalk, or six inches behind the right-of-way.
b. Timing of Construction. Generally, sidewalk construction cannot be deferred on projects involving construction of post-construction stormwater quality facilities. Although the size and location of driveways must be identified on the construction plans, the County engineer may allow deferral of driveway construction until construction of other on-site improvements.

H. Pond Fences. Fences for pond facilities may be required by the County Engineer, and should be anticipated to be a requirement if any variations to maximum pool depth or vertical walls are approved. When required, fence standards including; location, height, material, gates, and locking mechanisms, will be set by the County Engineer.

I. Pond Walls. In response to site constraints, walls may be approved by the County Engineer on a case-by-case basis. Walls will not be allowed within the treatment areas of water quality facilities. Other conditions will be site specific as determined by the County Engineer. Walls that are four feet or higher or periodically inundated shall be designed by a licensed engineer and may require building permits.

J. Maintenance Access for Ponds. Access roads shall be provided for maintenance of all stormwater quality ponds and must provide direct connections to any pond access ramps. The following criteria apply:
a. Access road shall be paved a minimum distance of 15 feet back, or to the edge of right-of-way, whichever is less, from the edge of pavement meeting minimum driveway requirements in the LCC 935.
b. Strengthened sidewalk sections shall be used where maintenance vehicles will cross.
c. Maximum longitudinal grade shall be 10 percent with a maximum 4 percent cross-slope.
d. Minimum width shall be 12 feet.
e. All access roads shall be constructed with a minimum of 12 inches of 100 percent fractured face crushed aggregate base placed on a geotextile subgrade fabric.
f. Access shall extend to within ten feet of the center of the pretreatment manhole and primary outlet structures.
g. The side slope for road embankments shall be 2H:1V or flatter.
h. A vehicle turnaround shall be provided when the access road exceeds 150 feet in length.

K. Pond Signage. The County may require that ponds with high public exposure require signage. Signage requirements will be determined during plan review.

3.4.4 Landscape Requirements

The main purpose of vegetation in stormwater quality facilities is to provide the maximum amount of water quality benefit for stormwater management. This section addresses the landscape requirements that apply to the design (planting plans) of vegetated post-construction stormwater quality facilities.

Planting plans are an important mechanism to ensure the proper selection and installation of vegetation in these facilities. The objectives of these standards are:

- To provide adequate plant coverage;
- To provide information on placing plants in the proper location per varying context factors;

- To encouraging plant diversity;
- For maintaining some year-round foliage; and
- To define how to maintain clear lines of sight/access.

A. Moisture Zones. Careful consideration of the soil moisture conditions within a stormwater facility will help to ensure the success of a planting design. Planting conditions for stormwater quality facilities with side slopes have a variety of moisture levels from dry to wet. Soil conditions at and near the bottom of the facility can be wet due to frequent or constant inundation, and side slopes vary from wet at the bottom to relatively dry near the top. The moisture gradient varies with the designed maximum water depth, the time it takes for a facility to drain after a storm event, and the steepness of the side slopes. The zone from the bottom of the facility to the designed high water line (the designed treatment area or storage areas for ponds) should be planted with plants that tolerate occasional standing water and wet-to-moist conditions. Above the designed high water line vegetation is not affected by stormwater entering the facility and should be planted with species well suited to the local climate and site-specific conditions. Planting conditions are more uniform for vertical-walled planters because of the relatively uniform and flat surface.

   Vegetation for post-construction vegetated stormwater facilities is categorized according to the degree of soil moisture that will be encountered in the facility during the growing season. Consideration of these zones will enhance the success of a facility's planting design (Appendix D).
   - Moist (Zone A): periodically saturated; anaerobic and/or aerobic soils
   - Dry (Zones B): infrequent inundation/saturation, if any; aerobic soils Zone B plantings are appropriate in the detention area in combined detention and water quality ponds as long as they are outside the treatment area.

B. Planting Plan Requirements. Planting plans are required for design and construction of post-construction stormwater quality facilities. At a minimum, planting plans shall provide the following:
   - Scaled planting plan sheets identifying the location of the facilities within the project limits with call-outs to applicable planting diagrams and tables.
   - A dimensioned planting diagram for each facility with each plant type assigned its own symbol. See Appendix D for guidance.
   - Planting table (Appendix D) that identifies quantities and documents the common name, scientific name, category (herbaceous, small shrub, etc.), distribution (zone and spacing), and size of planting for each facility. Quantities shall be based on the typical on-center spacing.
   - Planting legend.
   - Recommended long-term irrigation plan, including identification of water source and maintenance of the system, if applicable.
   - References to applicable portions of OSS Section 01040 for growing medium, surface treatments, timing for plantings, and installation requirements.

C. Plant Selection. The County's approved plant list is provided in Appendix D. Each planting list includes a suitability matrix for limiting factors such as a listing of specific characteristics for each species, an indication of the appropriate moisture zone, if it is evergreen, its average height and

a recommended on-center spacing. These plant matrices provide a short list of plants that are appropriate for the stormwater facilities in a variety of conditions. Other plants may be approved if they meet applicable criteria for type/width of facility, condition, location, size of plant material at maturity, etc.

D. Landscape Design Requirements:
   a. Quantities. Plant quantities shall be as follows. All quantities are listed on a per 100 square feet of facility area. Plant spacing guidance is provided in planting matrices in Appendix D.
      i. Street-side Facilities:
         - Six small shrubs/100 square feet.
         - The remainder of the area must be planted with groundcover/herbaceous plants in swales and herbaceous plants only in planters. The plants must be spaced to cover the area within three years.
      ii. Onsite Facilities (swales and planters):
         - Three large shrubs, four small shrubs/100 square feet.
         - The remainder of the area must be planted with groundcover/herbaceous plants in swales and herbaceous plants only in planters. The plants must be spaced to cover the area within three years.
         - Onsite facilities located in areas where sustained lines of sight are required shall have ONLY small shrubs with the remaining area planted with groundcover/herbaceous plants, as applicable. In these locations, instead of three large shrubs and four small shrubs, six small shrubs per 100 square feet shall be required.
      iii. Dry Pond Facilities:
         - Landscaping designs for dry pond facilities will be site specific and designed on a case-by-case basis. General requirements are described below but may be modified as necessary to meet design objectives, subject to County approval
            - Native grass seed mix (90 percent coverage minimum) or 115 herbaceous plants per 100 square feet extending up to the water quality design surface.
            - The remainder of the area must be planted with native grass seed mix (90 percent coverage minimum), or groundcover/herbaceous plants (90 percent coverage minimum) and four shrubs per 100 square feet. Appropriate size of shrubs will be site specific with special consideration given to maintenance impacts on city-maintained facilities.
   b. Size. Minimum plant size at installation:

Herbaceous Plants:	4-inch container
Small Shrubs/Groundcover:	1-gallon container
Large Shrubs	30-inch height

   c. Installation:
      i. Street-side facilities and onsite swales and planters shall have a minimum of 50 percent evergreen plants, by number.

ii. Street-side facilities and onsite swales and planters shall have at least two species from the Herbaceous plant community.
iii. Deep rooting trees and shrubs shall not be planted in lined facilities, on top of public utilities, or within ten feet of retaining walls, inlet/outlet structures or other culverts.
iv. Shallow swales shall have a 12-inch groundcover zone from back of curb or back of sidewalk. In this zone, only low groundcover that can withstand foot traffic shall be planted. All groundcover plants in the plant matrix meet this requirement.

3.4.5 Operation and Maintenance

In order to function for their intended purpose over the long term, post-construction stormwater quality facilities must be periodically maintained. Public facilities will be maintained by the County. Private facility maintenance shall be the responsibility of the property owner.

Per LCC Section 860.300, private post-construction stormwater quality facilities require that the owner sign a Private Stormwater Facilities Operation and Maintenance (O&M) Agreement with the County, committing the owner, and future owners, to certain operation and maintenance activities. The standard Operations and Maintenance Agreement and required operations and maintenance activities are located in Appendix A. The operations and maintenance practices have been adapted from the *Clean Water Services – Low Impact Development Approaches Handbook*.

Appendix A does not provide maintenance checklists for manufactured facilities. Manufactured facilities shall be maintained according to manufacturer's recommendations.

3.5 STORMWATER QUANTITY MANAGEMENT DESIGN AND CALCULATIONS

Storm drainage design within a development area must include provisions to adequately control runoff from all public and private streets and the roof, footing, and area drains of residential, multifamily, commercial, or industrial buildings, and to insure future extension of the drainage system to the entire drainage basin in conformance with the LCC and adopted Stormwater Management Plans. The ODOT Hydraulics Manual is a great reference for stormwater design guidance and calculations and can be found at: https://www.oregon.gov/odot/hydraulics/Pages/Hydraulics-Manual.aspx. Control of both water quantity and quality shall be included as part of the design considerations. Provisions that must be met are:

A. Surface or subsurface drainage, caused or affected by the changing of the natural grade of the existing ground or removal of natural ground cover or placement of impervious surfaces, shall not be allowed to flow over adjacent public or private property in a volume and/or rate or location materially different from that which existed before development occurred, but shall be collected and conveyed in an approved manner to an approved point of disposal. Section 860.125 of the LCC requirements shall also be met regarding alteration of drainage patterns.

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

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

D. When private property must be crossed in order to reach an approved point of discharge, it shall be the developer's responsibility to acquire a recorded drainage easement from the private property owner meeting the approval of the County Engineer. The developer must secure all signed easement documents from private property owners prior to final plan approval.

E. The peak discharge from the subject property may not be increased from conditions existing prior to the proposed development except where it can be satisfactorily demonstrated by the applicant that there is no adverse impact.

F. Retention/detention facilities must be provided in order to maintain surface water discharge rates at or below the existing design storm peak discharge except where it can be demonstrated by the applicant that no adverse impact will result from not providing said facilities. A basin analysis may be required to ensure the detention system does not adversely impact the operation of the storm drain system to which it is discharging

G. All storm drain system designs (conveyance, flow restrictions, detention) shall make adequate provisions for collecting all stormwater runoff. The system shall accommodate all runoff from upstream tributary areas whether or not such areas are within the proposed development. The amount of runoff to be accommodated shall be based on ultimate development of all upstream tributary areas. Proposed storm drain systems shall not discharge flows into inadequate downstream systems unless approved by the County Engineer.

   All other State and Federal permitting requirements must be met. The Developer shall produce copies of approved permits for the County prior to final plan approval.

3.5.1 Runoff Calculations and System Capacity

Calculations for storm drain design shall be submitted with all storm drain improvement projects. Calculations shall clearly show how flows were calculated and also how the proposed storm system is capable of conveying these flows. For projects that require detention, full pre-development and post-development calculations shall be submitted.

Basin maps shall be submitted with all calculations and shall show clearly how stormwater is being routed through the improvements.

Tables and Figures presented in this section originate from the USDA Urban Hydrology for Small Watersheds, TR-55 handbook (TR55). This document can be found at:
https://nationalstormwater.com/urban-hydrology-for-small-watersheds-tr-55/

A. Rational Method. The rational method is an acceptable way to calculate peak discharge for the sizing of storm drainage conveyance systems for laterals and collector systems in which detention is NOT required. It may NOT be used to size detention systems or trunk lines or for projects that are greater than 100 acres in size. Refer to Section 3.5.1.D to determine which design storm the improvement must convey.

Equation $Q = C \times i \times A$

Where:

Q = peak flow (cubic feet per second)

C = a runoff coefficient determined by ground cover. The engineer must document the methodology used in determining the value proposed.

i = rainfall intensity (inches per hour). Rainfall intensity found on the appropriate Zone of the ODOT I-D-F curve (see Appendix E) shall be used. For the rational method, the basin time of concentration is used as the storm duration. The time of concentration must first be calculated (see Section 3.5.1.C), then the rainfall intensity can be read from the I-D-F curve.

A = the basin area (acres)

B. Basin Hydrographs. Runoff hydrographs will be required for all volume based design. The method for development of hydrographs is the Santa Barbara Unit Hydrograph (SBUH) method. Similar unit hydrograph methods such as the Soil Conservation Service (SCS) TR-55 method or a continuous runoff model may be used if approved in advance by the County Engineer. Runoff hydrographs are dependent on a selection of variables summarized below:

- Basin Area. The total area of pervious and impervious surface areas within a drainage basin, shall be quantified in order to evaluate critical contributing areas and the resulting site runoff. Each area within a basin shall be analyzed separately and their hydrographs combined to determine the total basin hydrograph. Areas shall be selected to represent homogenous land use/development units.
- Time of Concentration (see Section 3.5.1.C).
- Curve Number (CN). The CN takes into account the ground cover and the soil type. Linn County soil surveys shall be used to determine the soil type. The SCS "Urban Hydrology for Small Watersheds" handbook, Tables 2-2a thru 2-2.c, shall be used in determining the curve numbers. Most soils in Linn County are group "C" or "D." These tables can also be found in Appendix E.
- Rainfall distribution. Linn County has a Type IA rainfall distribution.
- Total 24-hour Rainfall for the MS4 area. Table 3.5.a, as published in the City of Albany's Stormwater Management Engineering Standards, identifies the peak 24-hour rainfall for the MS4 area:

Table 3.5.a – MS4 Area Peak 24-Hour Rainfall

Return Interval	Peak 24-Hour Rainfall
Water Quality Storm	1.00 inch
2 year	2.47 inches
5 year	2.86 inches
10 year	3.374 inches
25 year	3.94 inches
50 year	4.38 inches
100 year	4.83 inches

C. Time of Concentration. The time of concentration is the time for runoff to travel from the hydraulically most distant point in the watershed to the point of reference downstream. Time of concentration calculations shall be submitted for review.

There are three components that shall be considered when determining time of concentration: sheet flow, shallow concentrated flow, and channel/pipe flow. Each of these should be calculated separately and then added together to determine the basin time of concentration.

a. Sheet Flow. This is the first leg of runoff. It is generally accepted that sheet flow only occurs for a maximum of 300 feet before the flow regime turns to shallow concentrated flow. Sheet flow shall be calculated using the Manning's kinematic solution:

$$T_t = 0.007(nL)^{0.8} / (P_2)^{0.5}S^{0.4}$$

Where:

T_t = Travel Time (hours)
n = Manning's n
L = Length of flow (feet)
P_2 = 2-year, 24-hour rainfall (inches)
S = Slope (feet/foot)

b. Shallow-Concentrated Flow. To determine the flow time of runoff in the shallow-concentrated flow regime, you need to estimate the flow velocity. Use Figure 3-1 in Appendix E to determine the flow velocity of the shallow concentrated flow. Once the velocity is estimated, divide the distance of flow by velocity to get flow time.

c. Channel/Pipe Flow. Use Manning's equation to calculate velocities in the channels and pipes, then divide flow length by velocity to get flow time

The three runoff flow components shall be added together to determine the total time of concentration. A map showing the assumed flow path shall be provided with the time of concentration calculations.

D. Drainage System Capacity. For design purposes, it is necessary to define the various parts of the storm drainage system and to specify the magnitude of flow that each part must be capable of carry in.

Pipes, culverts, and ditches shall be designed to convey the peak discharge of the storm shown in the table below.

Table 3.6.a –Conveyance System and Design Storm Requirements

Conveyance System	Definition	24-Hour Design Storm
Catch Basins/Inlets	Catch basins and inlets located within roadways, or private development.	10 year
Feeder	Pipe/ditch of any size that serves a private development or single subdivision of 5 acres or less.	10 year
Collector	Pipe/ditch of any size that serves multiple private developments/subdivisions or a single private development or subdivision equal to or greater than 5 acres within the same drainage sub-basin.	25 year
Trunk	Drainage improvements that serve more than 100 acres and/or multiple drainage sub-basins or as otherwise required by the County Engineer.	50 year

3.5.2 Supporting Data

Background computations for sizing drainage facilities shall include:

A. Peak discharge rate and volume of surface water for the design storm currently entering and leaving the subject property; or if the County Engineer determines that the property is in an interim flood hazard area, then a 50-year storm shall be used. Discharge volumes shall be computed for both the current land use conditions and full development of the tributary basin area.

B. Peak discharge and rate of runoff that will be generated within the subject property due to the design storm after development occurs.

C. Peak discharge and rate of runoff that will be generated by the design storm at all naturally occurring points of discharge from the property (cubic feet per second, predevelopment, and post-development). For projects that require detention, 2-year, 5-year, 10-year, and 25-year storms must be analyzed. See Table 3.5.a for rate of runoff values.

D. The proposed methods of handling, storing, and discharging of peak loads:
    a. Proposed improvement for handling the computed runoff, including the location and capacity of all natural or proposed drainage facilities and easements. The method of discharging storm drainage offsite at the naturally occurring location and provisions needed to control the velocity, volume, and direction of the discharge in order to minimize damage to other properties, stream banks, and overall water quality.
    b. Drawings of proposed open channel and closed conduit system to be shown on construction drawings.
        i. Proposed cross-section of the channel with stable side slopes shown on the plan.
        ii. For open channel improvements, the water surface elevation (backwater curve) of the flow for the design storm shall be indicated on the cross-section.
        iii. For closed conduit improvements, the hydraulic grade line (HGL) of the flow for the design storms shall be indicated on the cross-section.

3.6 PIPES AND CLOSED CONDUIT

All storm drains shall be laid on a consistent and uniform grade as specified in the latest edition of the Oregon Standard Specifications for Construction (OSS) Section 00405.12. Changes in piping size and grade shall only occur at manholes. All pipes and closed conduit materials and means of construction shall conform to the OSS Section 00445. Joints shall have gaskets and be water tight.

3.6.1 Pipe Size

The minimum size for storm drains shall not be less than ten inches inside diameter and shall begin at a structure and shall terminate at an approved point of disposal. Proposed exceptions to the above will be reviewed and considered for approval on a case-by-case basis by the County Engineer. When two parallel pipes are installed in-lieu-of one large pipe or a box culvert, the minimum separation between the pipes shall be one foot or one-third the diameter of the largest diameter pipe, whichever is greater. This requirement may be waived if the void between the pipes below the spring line is filled by grouting or other approved method/substance.

3.6.2 Pipe Grade

All storm drains shall be laid on a grade that will produce a mean velocity (when flowing full) of at least 3 feet per second, based upon Manning's pipe friction formula using a roughness coefficient valued at not less than 0.011, a minimum grade of 0.003 feet/foot (0.30%), or the pipe manufacturer's recommendations, whichever is greater.

The minimum grade may be reduced to produce an absolute minimum velocity of 2.0 fps upon approval of the County Engineer. But the grade of any pipe, regardless of diameter, shall not be less than .003 feet per foot unless otherwise authorized by the County Engineer. Other cases requiring a flatter grade than permitted above shall also be reviewed on a case-by-case basis for approval by the County Engineer.

Engineers are cautioned not to specify storm drains of sizes that are obviously larger than is necessary for satisfactory carrying capacity, but which are specified solely in order to meet grade requirements, i.e., a 12- inch pipe for a 10-inch pipe to acquire a decrease in slope.

The maximum grade for storm drains will generally be limited such that pipeline velocities when flowing full do not exceed 15 feet/second. If, out of necessity, velocities greater than this will result, ductile iron piping shall be used. Outside drop manholes with flatter pipe slopes can also be used.

3.6.3 Pipe Alignment

Generally, storm drains shall be laid on a straight alignment between catch basins and between manholes:

A. Where storm drains are being designed for installation parallel to other utility pipe or conduit lines, the vertical location shall be in such a manner that will permit future side connections of main or lateral storm drains and avoid conflicts with parallel utilities without abrupt changes in vertical grade of main or lateral storm drains. Location within easements or rights-of-way shall be in accordance with the Standard Construction Specifications. A minimum separation of 10 feet shall be maintained between storm drain lines and all other public utilities.

B. Under normal conditions, storm drains shall be located in the street right-of-way along the centerline. If the development is within a local jurisdiction, the location of the storm line may be determined by that jurisdiction. Piping between curb inlets and storm drain lines shall be at near right angles to the street and other utility lines. All exceptions shall be reviewed on a case-by-case basis for approval.

C. Easement locations for private storm drains, apartment complexes, or commercial/industrial development shall be in parking lots, private drives, or similar open areas that will allow unobstructed vehicle access for maintenance.

D. Provide a copy of the recorded easement to the County Engineer.

3.6.4 Pipe Cover Requirements

Storm drains shall be at a minimum depth of three feet or greater below the finish grade elevation. Minimum pipe depth shall be measured between the finished surface grade at the centerline of the storm drain and the top of storm drain pipe. Storm drains at depths less than this create problems with water line crossings, sewer lateral crossings, and proper cover over the pipe per manufacture's recommendations. Fill may be required on development sites to maintain adequate cover over sewer lines.

In some extreme locations where flat terrain limits the extension of storm drains, the County Engineer may allow some pipeline configuration changes as well as alternate pipe cover depths in conjunction with site filling. Storm drain pipes with depths less than three feet, where allowed by the County Engineer, shall be connected from catch basin to catch basin in lieu of the use of manholes. Special pipe material such as ductile iron pipe (down to 30 inches of cover) or reinforced concrete pipe (down to 18 inches of cover) will be required.

In areas of flat terrain, the design engineer must show that sufficient depth is provided at the boundary of the development to properly drain the remainder of the upstream basin area tributary to the site or that other drainage options are available to the upstream property.

3.7 INLETS, OUTLETS, CONNECTIONS

Inlet, outlet and connection materials and means of construction shall conform to the OSS Section 00470 and 00490.

3.7.1 Curb Inlets

A. Curb inlet basins may be connected together (maximum of four) at intersections to minimize the number of pipe crossings of the streets and number of manhole penetrations required. Curb inlet piping shall be connected to the storm drain system at manholes.

B. Inlets shall be spaced to assure that the flow in the streets can be intercepted and no ponding in the street occurs during the design storm. However, the maximum total length of curb and gutter that may be drained by a curb inlet is 350 feet. Curb inlets shall be located on the upstream side of curb returns. In addition, catch basins shall be installed where street improvements end on a descending grade and shall be piped to an approved point of disposal.

C. The width of gutter flow shall not extend into the travel lanes or overtop the curbs for a 25-year design storm at any point along the street.

D. Curb inlets shall be designed to completely intercept the 25- year design storm gutter flow.

E. Curb inlets shall be located so as not to interfere with other construction elements (e.g., driveways, pedestrian ramps, etc.). Exceptions will be considered on a case-by-case basis.

3.7.2 Surface Drainage Interception

Inlet structures shall be built wherever a surface drainage (creek/ditch/swale) is intercepted and placed into a piped system. The inlet structure shall be concrete. All inlet structures for pipes shall have grating covering the inlet. The grate shall have the bars oriented in the vertical direction. The inlet grate shall be removable.

The invert of the inlet structure shall be at or below the invert of the drainage being intercepted. The inlet shall be designed to accommodate the anticipated peak flows of the surface drainage at the design storm outlined in Table 3.5.a.

Special attention shall be paid to where water will accumulate and flow should the inlet become clogged or blocked. In sensitive areas, accommodations for overflows caused by inlet clogging shall be made such that the overflow does not damage downstream areas.

3.7.3 Slope Intercept Inlets

Slope intercept drains shall be provided at the following locations:

A. Along the upper boundaries of a development where the natural ground slope exceeds 10 percent to intercept drainage from the tributary area above the site.

B. Along the lower boundary of a development where the natural ground slope exceeds 10 percent to prevent drainage onto a lower tributary area other than by means of an approved point of disposal.

C. Along the top of all cuts that exceed four feet with cut slopes that exceed 2:1 where the tributary drainage area above the cut slopes towards the cut and has a drainage path greater than 40 feet, measured horizontally.

3.7.4 Subsurface Drainage Interception

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

A. On all cut and fill slopes in excess of four feet for stability except when a soils report submitted by a registered professional engineer experienced in soils certifies they are not required.

B. For all existing springs or springs intercepted during construction activity for other facilities, i.e., sewer, water mains, or street excavations.

C. Where high ground water exists or when it is necessary to reduce the piezometric surface to an acceptable level to prevent land slippage or underfloor flooding of buildings.

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

3.7.5 Outlets Into Surface Drainage Channels

Storm drain lines shall enter a creek or drainage channel at 90° or less to the direction of flow. The outlet shall have a head wall and scour pad or riprap to prevent erosion of the existing bank or channel bottom. All outlet structures for pipes of 24 inches in diameter or greater shall have grating covering the outlet. The grate shall have the bars oriented in the vertical direction. Outlet grates shall be attached to the outlet structure with a hinged connection at the top of the grate.

The outlet shall not intrude into the channel and reduce flow capacity of the channel. Pipe ends shall be beveled to match the side slope of the channel. Energy dissipation measures and armament of the opposite channel bank are required at the outlet. The size of the receiving facility will govern what protective measures are required.

Backflow valves may be required on outlet structures to prevent backwater from surcharging and flooding the new storm drain improvements.

Permits from outside agencies such as the Oregon Department of State Lands (DSL), the US Army Corps of Engineers (Corps), and the Oregon Department of Environmental Quality (DEQ) may also be required.

3.7.6 Manholes

Changes in piping size and grade shall only occur at manholes. In general, storm drains shall be designed to have access for cleaning no further than 350 feet apart. Manhole rims in unimproved areas shall be a

minimum of 12 inches above the surrounding ground and be marked with a metal marker post. Manhole materials and means of construction shall conform to the OSS Section 00470.

A. All connections, junctions, changes of grade, changes in size and alignment shall be made at manholes. Tee connections in storm lines shall not be allowed (with the exception of four- and six-inch service laterals). All private connections to the public system shall be reviewed on a case-by-case basis. Private connections to the public system might be allowed using a tee connection under specific conditions.

B. Where the pipe size decreases downstream through the manhole, the downstream pipe invert shall be 0.10 inches below the invert elevation of the upstream pipe. Where grade is limited, matching inverts of the pipes may be allowed.

C. In some extreme locations where flat terrain limits the extension of storm drains, the County Engineer may allow some pipeline configuration changes in conjunction with site filling. Storm drain pipes with depths less than three feet, where allowed by the County Engineer, shall be connected from catch basin to catch basin in lieu of the use of manholes.

3.8 SURFACE DRAINAGE

3.8.1 Surface Drainage

For purposes of these Engineering Standards, surface drainage routes will be classified according to two general categories: constructed watercourses and natural creeks.

Plan requirements for surface drainage courses shall include the requirements previously specified in Section 3.3 and the following supporting data and calculations:

A. Profile of the channel showing the existing flowline and top of bank, proposed flowline and top of bank, and design water surface profile (backwater curve).

B. A minimum of three (3) cross sections of the existing channel adjoining or crossing the property taken at the upstream, midsection, and downstream boundaries of the property. More sections may be required depending on the length of the reach and existing channel alignment.

C. Calculations for arriving at the design flow rate: the County will furnish the flow rate when records are available. Analyze the proposed system and show that the channel cross section after improvement will pass the design storm with one foot of freeboard to the top of bank. For channels shown on the FIRM. maps, show that the channel cross section after improvement will pass the base flood at or below the 100-year flood elevation shown on the FIRM.

D. Open channels shall have easements sufficient in width to cover the 100-year Floodplain Line when a 100-year design storm is required or 15 feet from the top of the recognized bank, whichever is greater.

3.8.2 Constructed Watercourse Requirements

A. Constructed watercourses shall be designed with a "natural" curved alignment with a variable side slope not to exceed four to one (4H:1V), except that in tight spots created by existing natural features (e.g., boulders, large trees, etc.) where the slope can be three to one (3H:1V) until the natural feature is bypassed or where steeper slopes are needed and do not impair the hydraulic efficiency of the waterway. The watercourse shall include a low flow channel as described below and will be reviewed on a case-by-case basis for approval (Image 10).

Image 10. Constructed Watercourse

The bank shall be designed with one foot of freeboard above the design storm with a minimum top of bank width of six feet. A larger width shall be provided when required by the County Engineer for maintenance purposes. The backslope of the bank shall not exceed two horizontal to one vertical. The existing ground adjacent to the toe of the bank backslope shall be graded to slope away at two percent to prevent water ponding at the backslope toe.Design shall be curvilinear with a 100-foot minimum radius. Tighter curves may be used if the County Engineer determines that sufficient erosion control has been incorporated into the design to maintain stable bank conditions following development.

B. A low flow channel shall be designed to carry a two-year design storm or the normal low water flow of a year-round creek, whichever is greater. Low flow channel slopes shall not exceed two to one (2:1) and shall be stabilized to the satisfaction of the County Engineer. In general, bank stabilization will be required in any channel with a design flow velocity in excess of three feet per second.

C. Capacity of channels shall be determined by the Manning Formula. The value for “n” shall be 0.033 for maintained grass-lined swales. The value for “n” shall be 0.035 for channels with rock-lined bottoms.

D. Existing ditches approved for the point of discharge for storm drains and culverts shall be provided with rock-lined bottoms and side slopes at the discharge point of storm drain or culvert. The rock shall extend for a minimum distance of eight feet downstream from the end of the storm drain or culvert.

E. All channel sides and bottoms shall be seeded, sodded, or rock lined immediately following construction. Bank stabilization measures shall be designed and included in the construction plans.

F. Points of discharge from culverts and storm drains into ditches and swales 15 percent or greater in grade shall be rock lined with boulders with one face a minimum of 24 inches in dimension. Said rock lining shall extend for a distance of ten feet minimum from the point of culvert or storm drain discharge and shall have a width three feet in excess of the diameter of the culvert or storm drain. Special energy dissipaters may be substituted for boulders at the discretion of the County Engineer.

3.8.3 Constructed Creek Requirements

A permit must be obtained from the Division of State Lands, the Department of Fish and Wildlife and the US Army Corps of Engineers, as necessary, for all work between the creek banks.

A. Natural creeks shall be preserved and all work in and adjacent to creeks shall incorporate both temporary and permanent erosion control measures to protect disturbed areas from erosion and damage. No alteration will be permitted that reduces the overall creek capacity.

B. Creek channel design and construction practices shall be such that the cumulative incremental effects of creek work considered alone or together with existing or similar projects in the vicinity will not result in substantial damage to existing waterways and surface waters by erosion, siltation or sedimentation, significant changes in water quality, increased downstream water velocity, significant harmful deterioration of groundwater drainage, or significant deterioration of aquatic wildlife habitat as determined by the County Engineer.

C. Creek construction, relocation, and/or reconstruction may be approved if the County Engineer determines that such a proposal will result in an overall benefit to or maintenance of a surface water system of equal quality in terms of water quantity and quality control and the Developer can obtain the appropriate State and Federal permits.

D. Any and all stream work shall be consistent with the floodplain management policies and regulations as set forth in LCC 870, or any amendments thereto.

3.9 STORMWATER DETENTION

3.9.1 General Requirements

A. All storm drainage runoff originating from and/or draining to any proposed development shall be controlled and/or conveyed in accordance with all County standards and policies as described in these Engineering Standards. When existing conditions make storm drainage detention impossible for a portion of a site, the County Engineer may permit compensatory storage volume to be provided on another portion of the site, provided the total site area is tributary to one drainage basin both prior to and after development. In no case shall the runoff rate from the total site exceed the allowable release rate.

B. Detention facilities shall be open basins, ponds, underground storage (pipe/chamber), or combinations thereof.

C. Detention requirements may be waived by the County Engineer on a case-by-case basis.

D. Detention basins will be required to detain post-developed runoff from the 2-year, 5-year, 10-year, and 25-year, 24-hour storm to pre-developed quantities. If the project area is greater than 100 acres or covers multiple drainage sub-basins, then the 50-year, 24-hour storm must also be detained to pre-developed peak volumes. Potential downstream damage due to detention system failure/overflow may require greater detention requirements or improvements downstream. In no case shall the release rates increase the flooding conditions downstream. An emergency overflow must be designed to accommodate 100-year storm flows.

E. A flow control structure must be used to restrict flow rates exiting a detention facility. Refer to the design guide drawing in Appendix E for an example of an acceptable control structure design. An orifice provides the appropriate flow control to accommodate pre-development flow rates. The orifice diameter shall be calculated using the ODOT Hydraulics Manual Equation for water quality orifice diameter:

$$d = \left[\frac{4Q_o}{\pi C(2gh)^{0.5}}\right]^{0.5}$$

Where:

d = Orifice diameter (feet)

Q_o = Water quality outflow rate (cubic feet per second)

C = Orifice coefficient (0.60)

g = Gravity constant (32.2 feet per second squared)

h = Effective head (E_{WS} - E_{WQ}) (feet)

F. The minimum allowable diameter for an orifice in a flow control structure shall be two inches due to the possibility of clogging or plugging.

G. All detention ponds shall have emergency overflow structure incorporated into their design. Flow capacity of the overflow shall be calculated and shown in supporting information. The emergency overflow shall accommodate the potential peak flow conveyed to the facility up to a 100-year storm event.

H. Stormwater plans shall include a plan and profile of the facilities. The profile requirement for private drainage systems may be waived at the discretion of the County Engineer when sufficient data is provided on the plan in a clear and concise manner including the following minimum hydraulic and physical data:

   a. Grades, bottom elevations of ditches, channels, ponds and swales, parking lots and recharge trenches;
   b. Inverts of pipes;
   c. Inverts and tops of all structures such as manholes, catch basins, chambers, or similar structures; and
   d. Size, length, and slope of all pipes or other detention or conveyance facilities, including the invert elevations of the existing or any other storm drainage system the subject drainage proposes to discharge into.

   The design volume of all detention ponds shall also be shown on the plan as well as a note indicating that ponds shall be inspected prior to landscaping.

I. All aspects of the on-site drainage system must be properly designed to handle all flows developed on-site and all flows that flow through the site from upstream. Designers should conceptualize how water will move into, through, and out of the system, looking for such potential problems as flow impediments, construction difficulties, future maintenance problems, and soil erosion potential.

J. All aspects of public health, safety, maintenance, nuisance abatement, and vector control must be carefully reviewed in every drainage control system plan. Protective measures are often necessary and shall be required whenever appropriate. The protective measures themselves shall be designed so as not to constitute hazards or nuisances.

K. The impact of a system failure should be analyzed both in terms of on-site and off-site effects. The impacts may be to adjacent properties, or to elements of the public drainage system or other private systems. The downstream consequences of failure of a detention pond shall be included in determining location and design parameters.

L. The frequency and difficulty of future maintenance can be minimized by thorough consideration during design of what could possibly go wrong in the system and what would be required to correct the problem. Facility design must incorporate maintenance considerations to ease such problems.

M. The use of the site should be evaluated to determine if hazardous materials or other pollutants are likely to be present, and if extraordinary design considerations are necessary.

N. It is important that runoff from rooftops pass through the detention system; the design should clearly indicate how roof runoff moves through the system.

O. All weather access, passable by a maintenance vehicle, to all control structures shall be provided. Easements dedicated to the City may be required.

3.9.2 Surface Ponds

A. Slopes on all interiors of surface ponds shall not exceed three feet horizontal to one foot vertical. If interior side slopes of surface ponds need to be mowed then the interior side slopes shall not exceed four feet horizontal to one foot vertical. Slopes on pond exteriors shall not exceed two horizontal to one vertical.

B. The maximum depth of any pond shall be four feet.

C. All ponds shall be landscaped so as to provide slope stability and pleasant appearance by utilizing sodding, seeding, and planting of trees and shrubbery. Under no circumstances shall use of easily floatable or erodible materials (such as “bark dust”) be permitted in pond interiors.

D. Maintenance of surface ponds or detention ponds in commercial, industrial, and multifamily and single family developments shall be the responsibility of the property owner or owner’s association. Maintenance of detention pond landscaping in single-family residential developments shall be the responsibility of an owner’s association or community club and shall be so stated on the face of the plat unless accepted for maintenance by the County. Failure to maintain a weed abatement program will be cause for the County to perform the work and bill the owner or owners.

E. All privately maintained detention pond control structures shall be accessible for maintenance and operation. Access easements shall be provided, which shall be a minimum 12 feet wide and shall be improved to accommodate vehicular traffic year-round. Control structures shall be designed to operate automatically as much as possible.

F. Minimum freeboard shall be one foot above the highest potential water surface elevation (one foot above the emergency overflow structure or spillway elevation).

G. The minimum distance from the edge of the maximum water surface elevation to property line is 20 feet. Minimum distance from the toe of the pond berm or embankment to the nearest property line is one-half of the berm height and a minimum of five feet. Minimum distance from the edge of the maximum water surface elevation to the top of a slope greater than 12 percent is 200 feet, unless a geotechnical report is submitted and approved by the County. Minimum distance from the edge of the pond water surface to a well is 100 feet.

H. All berms and embankments shall have a minimum top width of one foot. Where maintenance access is provided along the top of a berm, the minimum top width of the berm shall be 15 feet. The bottom of all constructed and graded retention/detention ponds shall be sloped no flatter than 0.01 foot/foot (1%) toward the outlets for drainage. EXCEPTION: This requirement need not apply to natural ponds, which exist and are utilized for stormwater detention.

I. All detention ponds shall have a well-defined low flow channel to contain runoff of lesser storms. Any low flow channel shall be designed so as to enhance the pond landscaping and overall pond appearance.

J. Outlets of all detention ponds shall be provided with suitable debris barriers designed to protect the outlet from blockage or plugging. Properly-sized overflow structures shall be designed into the pond.

K. The design volume of the detention pond shall be shown on the plan and the pond volume inspected prior to landscaping (a note to this effect shall be shown on the plans).

3.9.3 Closed Detention System

A. A minimum grade of 0.003 feet/foot (0.30%) shall be used in any pipes or vaults used for closed detention systems.

B. The outfall control structure shall meet the standards set forth in Section 3.9.1.e or as approved by the County Engineer.

C. Access to closed detention systems shall be provided at the upstream and downstream terminus of the system. The maximum distance between access points shall be 400 feet. Improvements shall be made to facilitate maintenance equipment access to the maintenance access points year-round. Maintenance access point shall not be in areas that can be fenced off by private property owners.

3.10 EROSION AND SEDIMENT CONTROL

3.10.1 Erosion and Sediment Control Program

The County erosion and sediment control requirements are in addition to any state or federal permitting requirements.

The County's Erosion and Sediment Control Manual can be found on the County's website at: https://www.co.linn.or.us/roads.

APPENDIX A

OPERATION & MAINTENANCE AGREEMENT
AND
OPERATION & MAINTENANCE PLAN AND CHECKLIST

LINN COUNTY
PRIVATE STORMWATER FACILITIES OPERATIONS AND MAINTENANCE AGREEMENT

This Agreement is made and entered into this _____ day of _____ 20___, by and between Linn County (County) and _____ (Owner) whose address is _____.

RECITALS

A. Owner has developed the private stormwater facilities (Facilities) listed below and shown on attached, and/or referenced, as-built construction drawings in order to satisfy the requirements of Linn County Code Section 860:

   _____

B. The Facilities enable development of property while mitigating the impacts of additional surface water and pollutants associated with stormwater runoff prior to discharge from the property to the public stormwater system or waters of the state. The consideration for this Agreement is connection to the public stormwater system and/or Waters of the State.

C. The property benefited by the Facilities and subject to the obligation of this Agreement is described with the legal description below or in Exhibit A (Property) attached hereto and incorporated by reference.

D. The Facilities have been designed by a registered professional engineer to accommodate the anticipated volume of runoff and to detain and treat runoff in accordance with Linn County Code, Engineering standards, and Oregon Standard Specifications for Construction, as applicable.

E. The O & M Plan represents current best management practices for operation and maintenance activities. It is acknowledged that best management practices for O & M activities may change over time.

F. Even with routine maintenance conducted through the O & M Plan, over time, there is potential for the Facilities to lose treatment capacity through extended filtration and absorption of pollutants.

G. Failure to inspect and maintain the Facilities can result in an unacceptable impact to the public stormwater system and/or waters of the state.

NOW, THEREFORE, it is agreed by and between the Parties as follows:

1. **INCORPORATION OF RECITALS**: The recitals above are acknowledged and agreed to by all Parties.

2. **CONSIDERATION**: Owner undertakes the obligations set forth herein in consideration of development approval granted by Linn County and acknowledges that said consideration is adequate to support these obligations.

3. **PARTIES**: The terms of this agreement apply to the named Parties, their agents, contractors, successors, and assigns.

4. **O & M PLAN**: Best management practices for O & M activities change over time. The owner will be bound to the most current standard operation and maintenance requirements set forth in the most current version of the County's Engineering Standards or like requirements. It is the County's responsibility to notify the owner of any required modifications to current practices.

5. **TERM**: Owners obligations hereunder are perpetual and may only be modified or eliminated by amendment as described herein.

6. **OWNER INSPECTIONS**: Owner agrees to operate, inspect, and maintain each Facility in accordance with design parameters and the O&M Plan, attached hereto as Exhibit B and incorporated by reference. Owner shall retain a copy of this agreement, the O & M plan, and applicable as-built drawings on site. The owner shall also maintain a log of all inspection activities on site. The agreements, O & M plan, as-builts, and maintenance log shall be available to the County upon request or during County inspections.

7. **OWNER NOTICE OF FACILITY FAILURE**: Owner shall provide notice to the County if Facilities fail to function as designed. Notice shall be provided within ten (10) days of identifying the failure. Additionally, Owner shall provide immediate notice to the County of any potentially damaging discharge or spill to the Facilities, public storm drain system, or Waters of the State.

8. **DEFICIENCIES**: All aspects in which the Facilities fail to satisfy the O&M Plan, and/or provide the level of treatment intended with their design, shall be noted as "Deficiencies".

9. **OWNER CORRECTIONS**: All Deficiencies shall be corrected at Owner's expense within thirty (30) days after completion of the inspection. In addition to the maintenance practices identified in the O & M Plan, corrections may include replacement of treatment soil, vegetation, drain rock, and/or other system components as applicable if the County determines that the Facility no longer provides the designed level of treatment. If more than thirty (30) days is needed to correct a Deficiency, the County may provide a time extension, in writing, to correct the Deficiency so long as the correction commenced within the initial thirty (30) day period and is diligently prosecuted to completion.

10. **COUNTY INSPECTIONS**: Owner grants County right of entry to inspect the Facilities. County will endeavor to give ten (10) days prior notice to Owner, except that no notice shall be required in case of an emergency. Inspections are not limited to the activities identified in the O & M plan and may include testing as necessary to determine if the Facilities are retaining their designed treatment capacity. County shall determine whether Deficiencies need to be corrected. Owner will be notified in writing of the Deficiencies and shall make corrections within 30 days of the date of the notice.

11. **RIGHT OF ENTRY**: Owner herby authorizes and consents to the exercise of all entry authority granted to the County pursuant to LCC 860.140 as it now exists, or may hereafter be amended, to permit inspections and testing of the private post-construction stormwater quality facilities. The same rights of entry shall apply to County Corrections.

12. **COUNTY CORRECTIONS**: If correction of all Owner or County identified Deficiencies is not completed within thirty (30) days (or the "time extension" as described in Section 9) after Owner's inspection or County notice, County shall have the right to correct any identified Deficiencies. County shall have access to the Facilities for the purpose of correcting such Deficiencies. Owner shall pay all costs reasonably incurred by County for work performed to correct the Deficiencies (County Correction Costs) following Owner's failure to correct any Deficiencies in the Facilities. Owner shall pay County the County Correction Costs within thirty (30) days of the date of the invoice. Owner understands and agrees that upon non-payment, County Correction Costs shall be secured by a lien on the Property for the County Correction Cost plus interest and penalties. County lien shall take priority over all other liens and encumbrances to the maximum extent permitted by law. County Correction Costs are defined as all County expenses incurred in taking the corrective actions authorized herein. These costs include, but are not limited to, all amounts paid, or to be paid, to third party contractors as well as all direct and indirect County costs including, but not limited to, labor, benefits, equipment, engineering, administrative, and legal costs. Costs will be determined using the County's current cost accounting methodology.

13. **EMERGENCY MEASURES**: If at any time County reasonably determines that the Facilities create any imminent threat to public health, safety or welfare, County is hereby granted immediate right of access and may immediately, and without prior notice to Owner, take measures reasonably designed to remedy the threat.

County shall provide notice of the threat and the measures taken to Owner as soon as reasonably practicable, and charge Owner for the cost of these corrective measures.

14. **COVENANT RUNNING WITH THE LAND:** The terms of this agreement shall be recorded with the Linn County Clerk and shall be a covenant running with the land and binding on all owners of the Property present and future, and their heirs, successors and assigns. Owner shall notify County of any change in property ownership and/or change in the owner representative designated to receive notices in Section 21 below.

15. **AMENDMENTS**: The terms of this Agreement may be amended only by mutual agreement of the Parties. Any amendments shall be in writing, shall refer specifically to this Agreement, and shall be valid only when executed by the owners of the Property, County and recorded with the Linn County Clerk.

16. **REMEDIES CUMULATIVE**: Remedies provided herein for breach of this agreement are cumulative and in addition to any and all other civil and criminal remedies.

17. **VENUE AND ATTORNEY FEES**: Any litigation concerning this Agreement shall be brought in the Circuit Court of the State of Oregon for Linn County and the prevailing party shall be entitled to recover all costs, including reasonable attorney's fees as may be determined by the court, including those on appeal. Citations issued for violations of LCC Chapter 860 as a Class A violation will be enforced pursuant to LCC Chapter 240 and will not be entitled to recover any costs to include attorney' fees.

18. **SEVERABILITY**: The invalidity of any section, clause, sentence, or provision of this Agreement shall not affect the validity of any other part of this Agreement which can be given effect without such invalid part or parts.

19. **AMBIGUITIES**: Ambiguities in this agreement, if any, shall not be resolved against the drafter.

20. **COMPLETE INTEGRATION**: This Agreement is a complete integration of all of the Parties' understandings and expectations of the other with regard to the subject of this Agreement. Prior discussions or representations which are not included in this Agreement are of no effect.

21. **NOTICES**: Any notice required or permitted under this Agreement shall be given when actually delivered within three (3) business days following deposit in the United States Mail, certified mail, and addressed as follows:

    A. To the Owner: _____

    _____

    _____

    _____

    B. To the County: Linn County Road Department
    Attn: County Engineer
    3010 Ferry St SW
    Albany, OR 97322-3998

IN WITNESS WHEREOF, Owner has signed this Agreement.

NOTORIZE DOCUMENT BELOW

INDIVIDUAL OWNER SIGN BELOW

_____
Owner (Individual)

_____
Owner (Individual)

CORPORATE, LLC, PARTNERSHIP, TRUST OR OTHER LEGAL ENTITY SIGN BELOW

_____
(Entity Name)

By: _____
(Sign here for entity)

Title: _____

LINN COUNTY

By: _____
(County Engineer)

APPROVED AS TO FORM

_____
(County Counsel)

[Use this notary block if OWNER is an individual.]

STATE OF OREGON)
) ss.
County of Linn)

This instrument was acknowledged before me this_____day of _____, 20_____,
by _____

_____
Notary Public

My Commission Expires:_____

[Use this notary block if OWNER is an entity.]

STATE OF OREGON)
) ss.
County of Linn)

This instrument was acknowledged before me this_____day of _____, 20_____,

by _____ (name of person) as _____ (title) of

_____(name of entity).

_____
Notary Public

My Commission Expires:_____

STORMWATER MANAGEMENT PROGRAM

OPERATION & MAINTENANCE PLAN and CHECKLIST

☐ **Monthly Inspection** ☐ **Annual Inspection** ☐ **Periodic Inspection**

All inspections shall be performed annually. It is recommended to perform inspections monthly during wet weather (November thru April) and when there is more than 1/2 inch of precipitation in a 24-hour period.

PLANTER / CURB EXTENSION / SWALE ☐ **Not Applicable**

These vegetated post-construction stormwater quality facilities are designed to accept stormwater runoff from adjacent impervious surfaces. They remove pollutants by filtering runoff through vegetation and soil media. Water should drain through the facility within 24 hours after a storm event. This checklist describes required inspection and maintenance activities to provide for proper facility function.

Facility	Conditions to Check For	Problem	Maintenance Practices	Complete
General	Sediment depth greater than 2”.	Sediment Accumulation in Treatment Area	Remove sediment from vegetated treatment area. Rake to ensure facility is level across bottom and water drains freely through soil media. Replace soil media or vegetation as needed.	☐ ☐ N/A
	Eroded or scoured facility bottom due to flow channelization, or higher flows.	Erosion Scouring	Repair ruts or bare areas by filling with facility soil media; repair or add splash blocks or rock energy dissipaters at curb and pipe inlets; regrade and replant large bare areas; use erosion control measures as needed.	☐ ☐ N/A
	Standing water in the facility between storms that does not drain freely; no standing water should exist within 24 hours after any large storm (1-inch in 24 hours or larger).	Standing Water	Remove sediment or trash blockages and rake soil to clear of debris; remove sediment from clean-outs and clear perforated underdrains as needed.	☐ ☐ N/A
	Evidence of rodents or water piping through facility via rodent holes.	Rodents	Repair facility, fill rodent holes, and remove rodents.	☐ ☐ N/A
	Insects such as wasps and hornets interfere with maintenance activities.	Insects	Remove harmful insects and insect nests as needed.	☐ ☐ N/A
	Visual evidence of trash, debris or dumping.	Trash and Debris	Remove trash and debris from facility.	☐ ☐ N/A
	Any evidence of spills or excess oil, gasoline, contaminants, or other pollutants.	Contamination and Pollution	Remove/cleanup contaminants. Coordinate removal/cleanup with County Heath, Planning & Building, and Roads Departments.	☐ ☐ N/A
	Facility is not receiving flow and/or draining properly; structural malfunction or broken, misaligned or missing parts have created a safety, drainage, and/or other design problem.	Facility Malfunction; Lack of Drainage even after maintenance for sediment or standing water	Repair or replace entire facility or broken/non-functioning elements to meet design standards and plans.	☐ ☐ N/A

PLANTER / CURB EXTENSION / SWALE (Continued)			☐ **Not Applicable**	
Facility	**Conditions to Check For**	**Problem**	**Maintenance Practices**	**Complete**
Check Dams	Scoured flow paths around sides or from underneath check dams; wood rot or holes; check dam is properly attached, aligned and secure; ballast rock on downstream side is in place.	Erosion, Scouring, Flow Undermining	Repair ruts and scour areas with compost or facility soil media; Replace ballast rock; Repair or replace check dam as needed.	☐ ☐ N/A
	Flows unevenly distributed between check dams due to sediment buildup or damaged check dams.	Flow not Distributed Evenly	Remove sediment buildup and repair or replace damaged check dams.	
Inlets / Outlets	Inlet/outlet areas clogged with sediment, vegetation or debris; sediment trap, if present, is ½ or more full; overflow or clean-out pipes are damaged or parts are missing.	Obstructed or Non-working Inlet/Outlet	Remove material to clear inlet and outlet areas, inflow pipes or downspouts, and sediment traps. Clear perforated drain pipe as needed. Repair or replace drain pipe, cap, grate structure or other elements as needed.	☐ ☐ N/A
	Vegetation blocking more than 10% of the inlet or outlet opening.	Vegetation Blockages	Trim or remove excess vegetation and soil. No vegetation should block flow at inlets/outlets or overflows. If removing excess vegetation, protect area from erosion.	☐ ☐ N/A
	Grate is missing or only partially on-place or may have missing or broken grate members	Grate Damage, Missing	Replace or repair any open structure.	☐ ☐ N/A
	Damage to frame, frame not siting flush, frame not securely attached, fractures of cracks in walls or bottom, or structure settlement.	Damage to Structure	Replace or repair structure to original design standards.	☐ ☐ N/A
Vegetation	Vegetation is dead, stressed, sparse, bare, or soil eroded in more than 10% of the facility.	Dead or Stressed Vegetation and/or Poor Vegetation Coverage	Determine cause of poor growth and correct the condition; replant with containerized plants as needed to meet design density standards.	☐ ☐ N/A
	Nuisance weeds present. Invasive vegetation is present, including but not limited to the following: Himalayan Blackberry; Reed Canary Grass; Teasel English Ivy; Nightshade; Clematis; Cattail Thistle; Scotch Broom.	Invasive Vegetation and Weeds	Remove excessive weeds and invasive vegetation.	☐ ☐ N/A
	Vegetation growth is poor because sunlight does not reach facility.	Excessive Shading	Remove brushy vegetation as needed; re-plant with shade tolerant plants as needed.	☐ ☐ N/A
Liner	Exposed or damaged liner with evidence of, or potential for, damage or leakage.	Exposed or Damaged Liner, Leaks from lined facility	Repair or replace liner and restore cover material.	☐ ☐ N/A

DRY PONDS			☐ **Not Applicable**	
These facilities provide pre-treatment by settling sediment and large debris. This checklist describes required inspection and maintenance activities to provide for proper facility function.				
Facility	**Conditions to Check For**	**Problem**	**Maintenance Practices**	**Complete**
General	Evidence of trash or debris.	Trash and Debris	Remove trash and debris.	☐ ☐ N/A
	For facilities not providing detention: Standing water in the facility between storms that does not drain freely. No standing water should be present within 72 hours after any large storm (1-inch in 24 hours or larger). For facilities providing detention: Standing water for a period in excess of design.	Standing Water	Remove sediment or trash blockages and rake soil to clear debris; remove sediment from clean-outs and clear perforated underdrains as needed.	☐ ☐ N/A
	Evidence of spills, or excess oil, gasoline, contaminants or pollutants.	Contaminants and Pollution	Remove/cleanup contaminants. Coordinate removal/cleanup with County Heath, Planning & Building, and Roads Departments.	☐ ☐ N/A
	Evidence of rodents or water piping through facility via rodent holes.	Rodents	Repair facility, fill rodent holes, and remove rodents.	☐ ☐ N/A
	Nuisance insects (e.g. wasps, hornets, fire ants) that interfere with maintenance activities.	Insects	Remove insects and nests as needed.	☐ ☐ N/A
Vegetation	Sparse or dying design planting, or when design plantings are not thriving across 80% or more of the design vegetated areas within the pond.	Poor Vegetation Condition/ Coverage	Replace plantings necessary to comply with planting plan requirements.	☐ ☐ N/A
	Nuisance weeds present. Invasive vegetation is present, including but not limited to the following: Himalayan Blackberry; Reed Canary Grass; Teasel English Ivy; Nightshade; Clematis; Cattail Thistle; Scotch Broom.	Invasive Vegetation	Replace plantings necessary to comply with planting plan requirements.	☐ ☐ N/A
	Tree/shrub growth interferes with access for maintenance (e.g. slope mowing, silt removal, vactoring, or equipment movements).	Undesirable Tree/Shrub Growth	Trim Trees/shrubs, minimally, to not hinder maintenance practices.	☐ ☐ N/A
	Dead, dying or diseased trees.	Hazard Trees	Remove and replace dead, dying or diseased trees that have become a hazard. Consult with a certified arborist as necessary, tree removal permits may be required.	☐ ☐ N/A
Embankments	Evidence of erosion/scour or settlement.	Erosion Scour, Settlement	Make repairs following consultation with a licensed Civil Engineer as necessary for assessment and identification of potential corrective actions.	☐ ☐ N/A

DRY PONDS (Continued)			☐ **Not Applicable**	
Facility	**Conditions to Check For**	**Problem**	**Maintenance Practices**	**Complete**
Inlets/outlets	Inlet/outlet areas clogged with sediment, vegetation or debris; Sediment trap, overflow or clean-out pipes are damaged, or parts are missing.	Obstructed or Non-Working Inlet/Outlet/ Overflow	Remove debris and material as necessary from all features and repair features as necessary to allow for proper function.	☐ ☐ N/A
	Grate is missing or only partially on-place or may have missing or broken grate members	Grate Damage, Missing	Replace or repair any open structure.	☐ ☐ N/A
	Damage to frame, frame not siting flush, frame not securely attached, fractures of cracks in walls or bottom, or structure settlement.	Damage to Structure	Replace or repair structure to original design standards.	☐ ☐ N/A
Pond Bottom	If sediment accumulation effects proper function or exceeds 6 inches in forebay or treatment cell.	Sediment Accumulation	Remove as necessary to maintain proper function.	☐ ☐ N/A
	Evidence of erosion/scour.	Erosion/scour	Repair eroded area with like material. Consult with a licensed Civil Engineer as necessary for assessment and identification of potential corrective actions.	☐ ☐ N/A
Liner	Exposed or damaged liner with evidence of, or potential for, damage or leakage.	Exposed or Damaged Liner, Leaks from lined facility	Repair or replace liner and restore cover material.	☐ ☐ N/A

WATER QUALITY MANHOLE/STRUCTURE	☐ **Not Applicable**

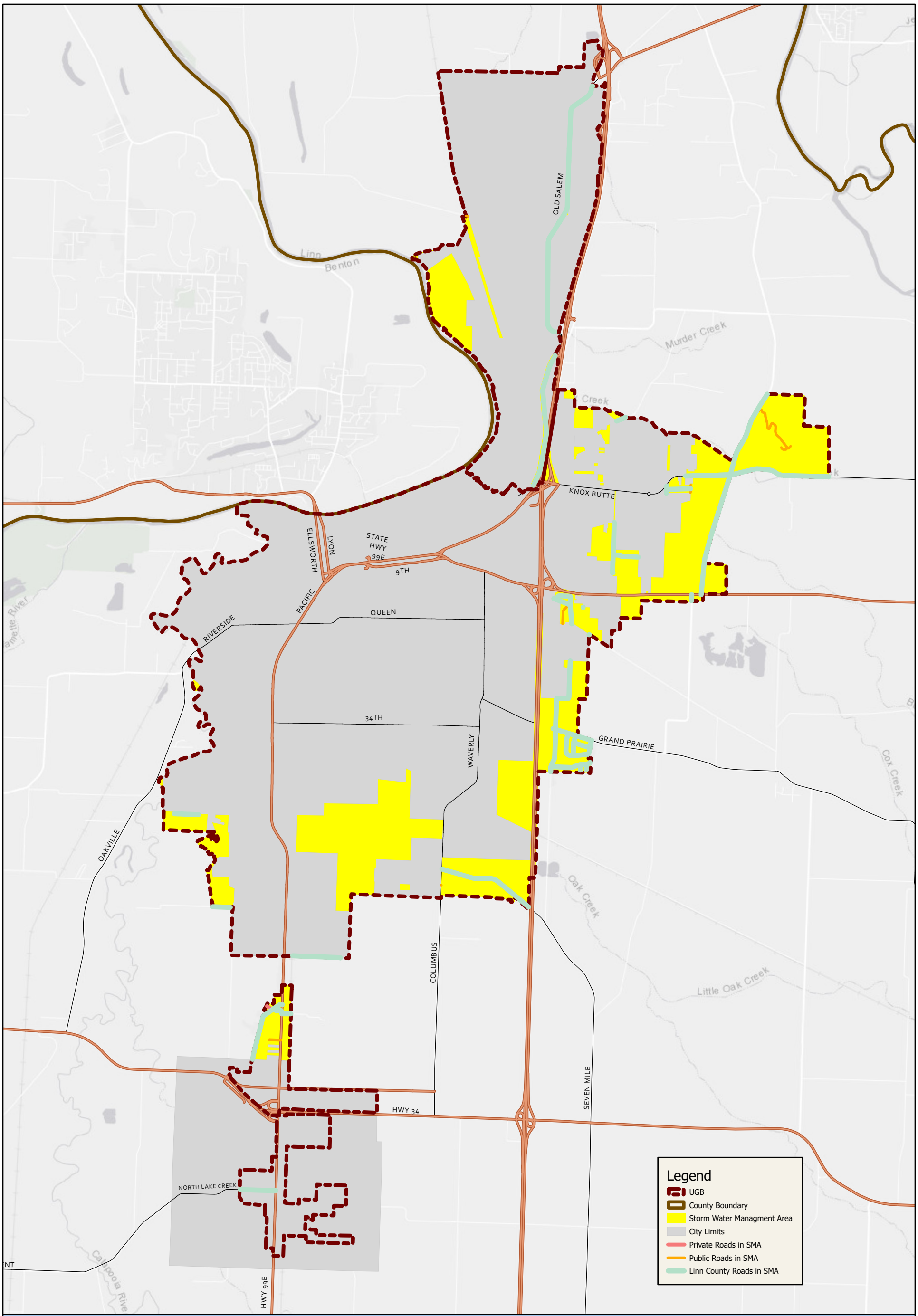
These facilities provide pre-treatment by settling sediment and large debris. This checklist describes required inspection and maintenance activities to provide for proper facility function.

Facility	Conditions to Check For	Problem	Maintenance Practices	Complete
General	Material exceeds 50% of sump depth or one foot below the Tee or Snout.	Trash, Debris and Sediment	Remove trash, debris, and sediment.	☐ ☐ N/A
	Tee or Snout is not securely attached to manhole wall.	Structural Damage	Securely attach snout or tee to wall and outlet pipe.	☐ ☐ N/A
	Structure is not upright (allow up to 10% from plumb).		Ensure structure is in correct position.	☐ ☐ N/A
	Connections to outlet pipe are not watertight.		Repair or replace structure to work as designed.	☐ ☐ N/A
	Any holes or cracks in the structure (other than designed).		Repair/replace structure as needed to original design.	☐ ☐ N/A
Manhole	Mechanism cannot be opened by one maintenance person with proper tools; bolts into frame have less than 1/2 inch of thread (may not apply to self-locking lids).	Locking Mechanism not Working	Replace/repair as necessary to ensure mechanism opens appropriately.	☐ ☐ N/A
	Cover is missing or only partially in place	Cover not in Place	Replace cover and/or secure cover in place.	☐ ☐ N/A
	One maintenance person cannot remove lid using normal lifting pressure; cover makes access for maintenance difficult.	Cover Difficult to Remove	Ensure cover can be removed by one maintenance person.	☐ ☐ N/A
	Ladder is unsafe (missing rungs, loose rungs, misalignment, rust, cracks).	Ladder Rungs Unsafe	Repair or secure ladder immediately. Ladder must meet design standards and allow safe access for maintenance.	☐ ☐ N/A

Date of Inspection:_____ **Inspected By:**_____

APPENDIX B

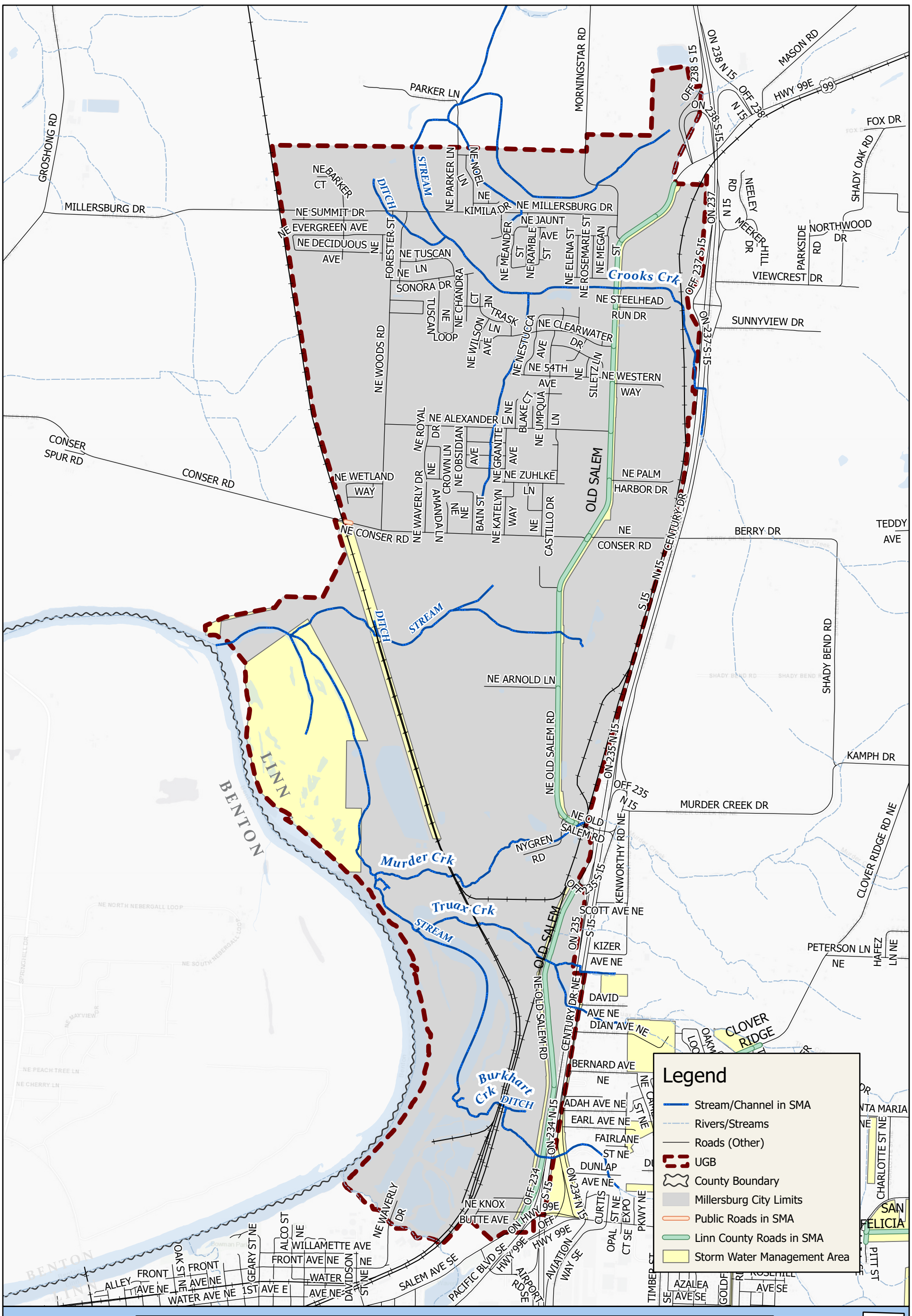
MS4 STORMWATER MANAGEMENT AREA MAPS



Linn County Stormwater Management Area

Map by Linn County GIS Department
Printed on July 20, 2023

Linn County Storm Water Management Area
Millersburg



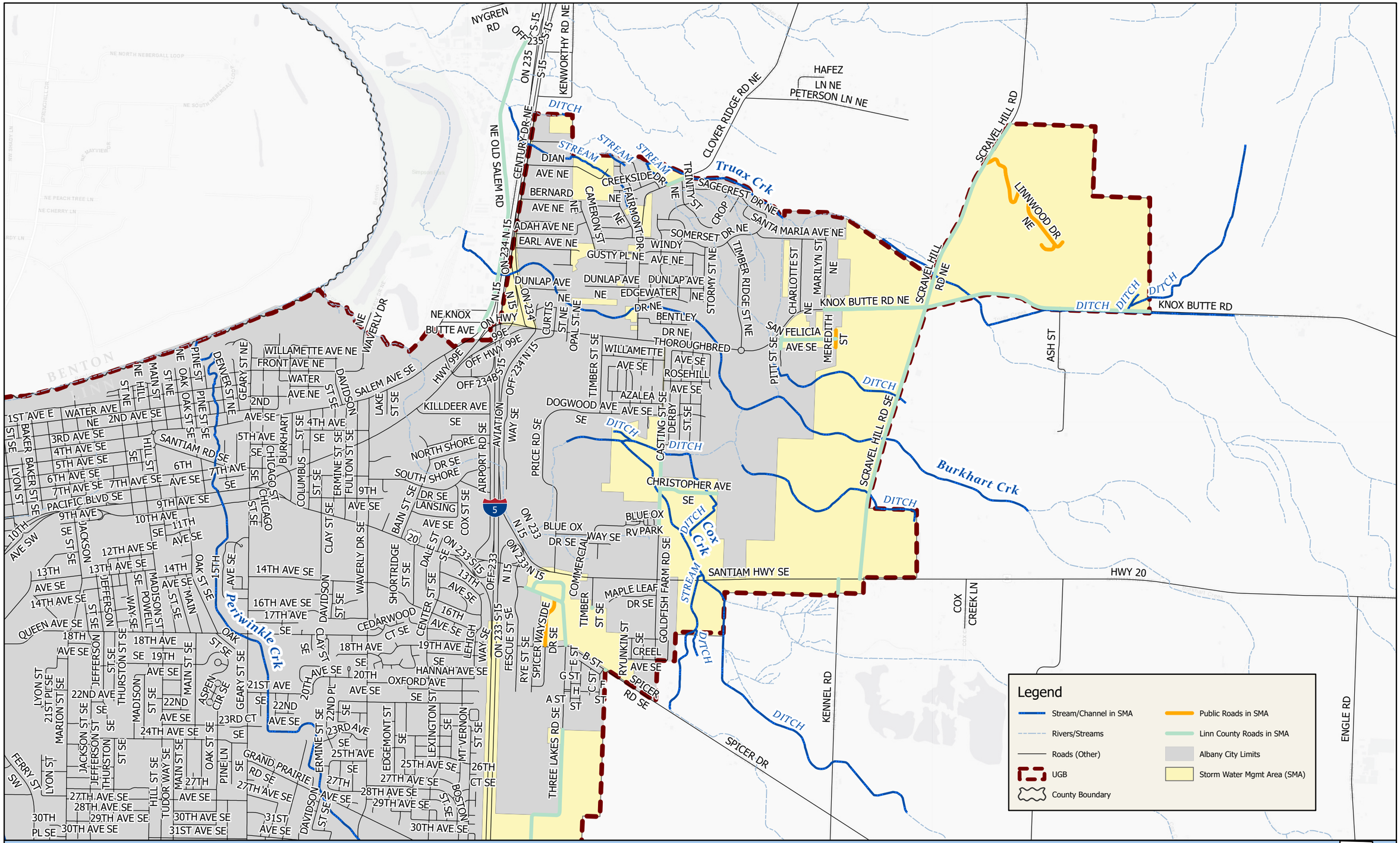
Legend

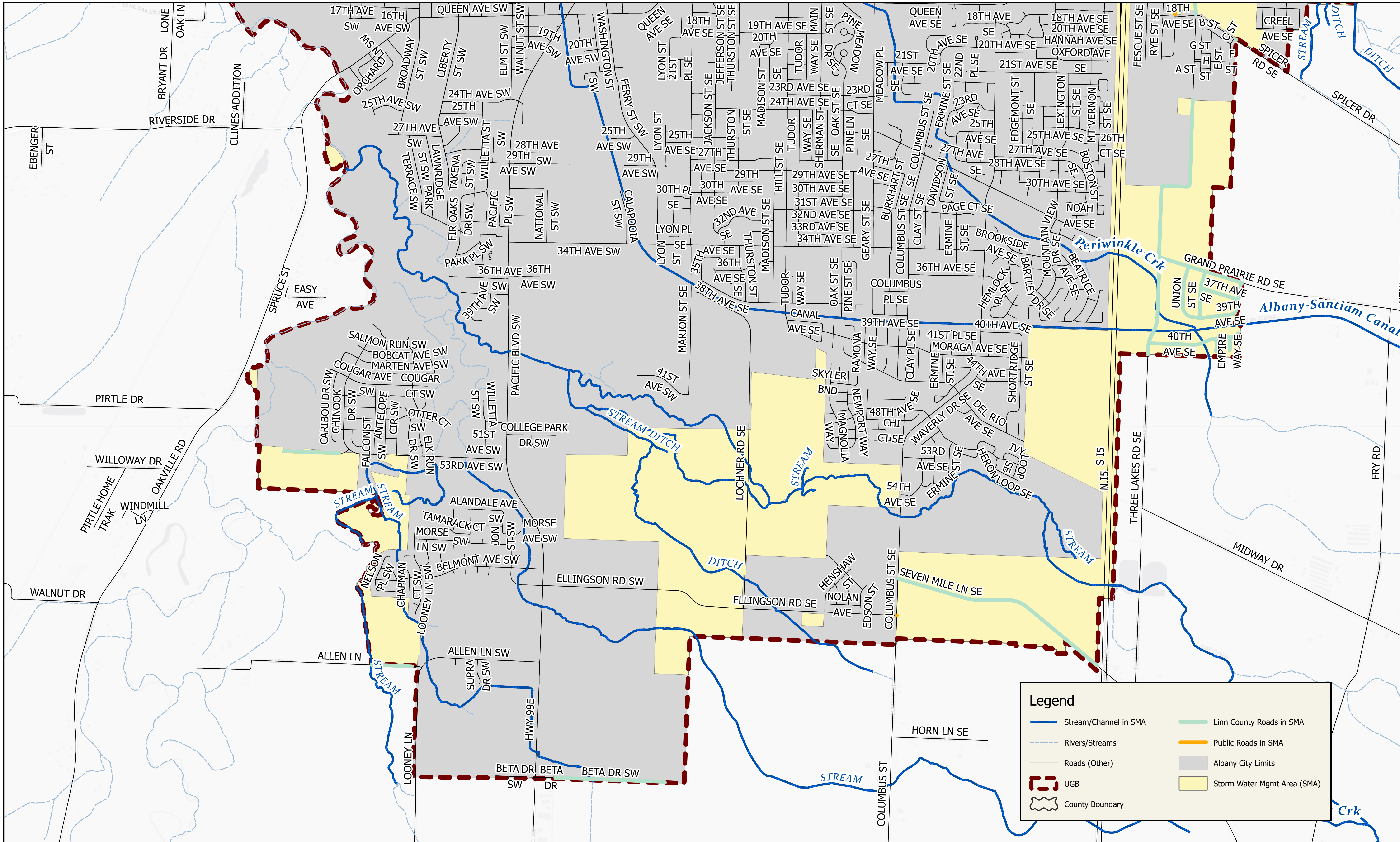
- Stream/Channel in SMA
- Rivers/Streams
- Roads (Other)
- UGB
- County Boundary
- Millersburg City Limits
- Public Roads in SMA
- Linn County Roads in SMA
- Storm Water Management Area

N

0 0.38 0.75 1.5 Miles

Map by Linn County GIS Department
Printed on July 20, 2023


Truax Crk
Burkhart Crk
Cox Crk
Periwinkle Crk
STREAM
DITCH
NE OLD SALEM RD
CENTURY DR NE
CLOVER RIDGE RD NE
SCRAVEL HILL RD
SCRAVEL HILL RD NE
SCRAVEL HILL RD SE
KNOX BUTTE RD NE
KNOX BUTTE RD
NE KNOX BUTTE AVE
SANTIAM RD SE
SANTIAM HWY SE
HWY 20
SPICER DR
KENNEL RD
ENGLE RD
COX CREEK LN
ASH ST
Legend
Stream/Channel in SMA
Rivers/Streams
Roads (Other)
UGB
County Boundary
Public Roads in SMA
Linn County Roads in SMA
Albany City Limits
Storm Water Mgmt Area (SMA)
Linn County Storm Water Management Area
Albany - North
0
0.5
1
2 Miles
N
Map by Linn County GIS Department
Printed on July 20, 2023

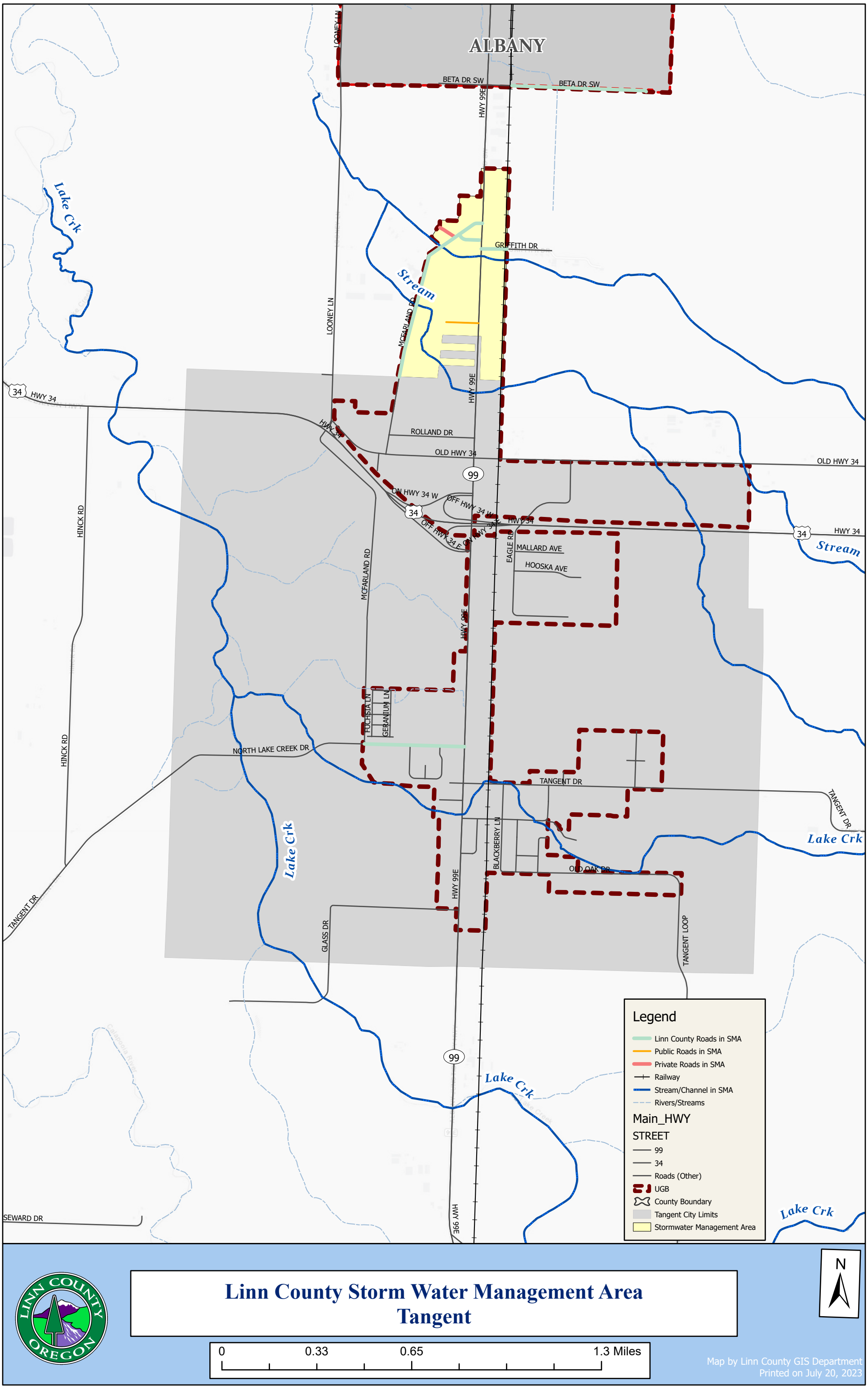


N

Linn County Stormwater Management Area
Albany - South

0 0.5 1 2 Miles

Map by Linn County GIS Department
Printed on July 20, 2023


ALBANY
BETA DR SW
BETA DR SW
LOONEY LN
HWY 99E
Lake Crk
GRIFFITH DR
Stream
LOONEY LN
MCFARLAND RD
HWY 99E
34
HWY 34
ROLLAND DR
OLD HWY 34
OLD HWY 34
99
ON HWY 34 W
OFF HWY 34 W
34
OFF HWY 34 E
ON HWY 34 E
HWY 34
34
HWY 34
Stream
EAGLE RD
MALLARD AVE
HOOSKA AVE
HINCK RD
MCFARLAND RD
HWY 99E
FUCHSIA LN
GERANIUM LN
HINCK RD
NORTH LAKE CREEK DR
TANGENT DR
TANGENT DR
Lake Crk
BLACKBERRY LN
OLD OAK DR
HWY 99E
TANGENT DR
GLASS DR
TANGENT LOOP
99
Lake Crk
Lake Crk
SEWARD DR
HWY 99E
Legend
Linn County Roads in SMA
Public Roads in SMA
Private Roads in SMA
Railway
Stream/Channel in SMA
Rivers/Streams
Main_HWY
STREET
99
34
Roads (Other)
UGB
County Boundary
Tangent City Limits
Stormwater Management Area
N
Linn County Storm Water Management Area
Tangent
0
0.33
0.65
1.3 Miles
Map by Linn County GIS Department
Printed on July 20, 2023

APPENDIX C

STORMWATER FACILITY MAPS AND CLEANING LOG

LINN COUNTY STORMWATER MANAGEMENT AREA

OLD SALEM
KNOX BUTTE
STATE HWY 99E
ELLSWORTH
LYON
9TH
PACIFIC
QUEEN
RIVERSIDE
34TH
WAVERLY
GRAND PRAIRIE
OAKVILLE
COLUMBUS
SEVEN MILE
HWY 34
NORTH LAKE CREEK
HWY 99E
Linn
Benton
Murder Creek
Cox Creek
Oak Creek
Little Oak Creek

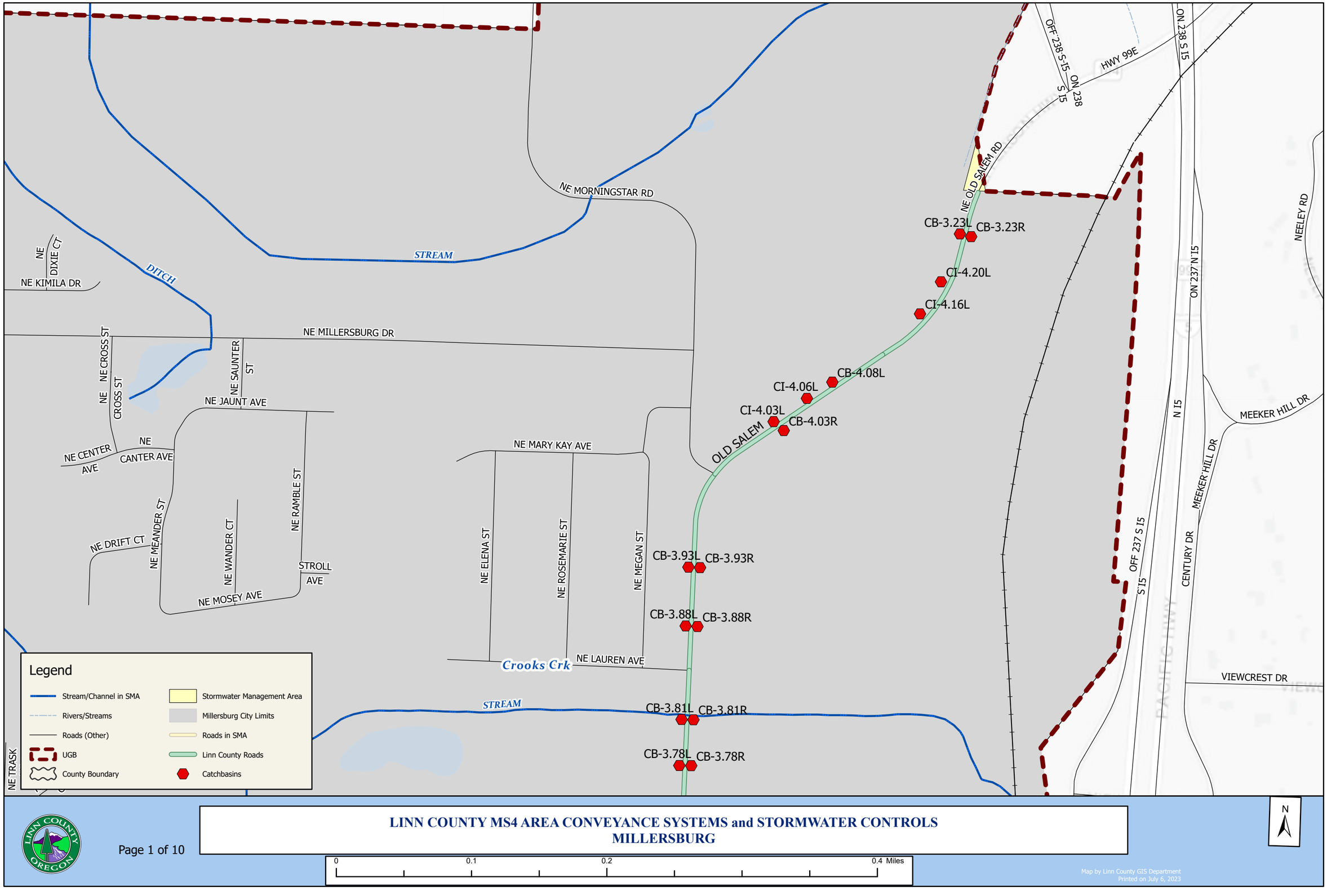
Legend

- UGB
- County Boundary
- Storm Water Managment Area
- City Limits

N

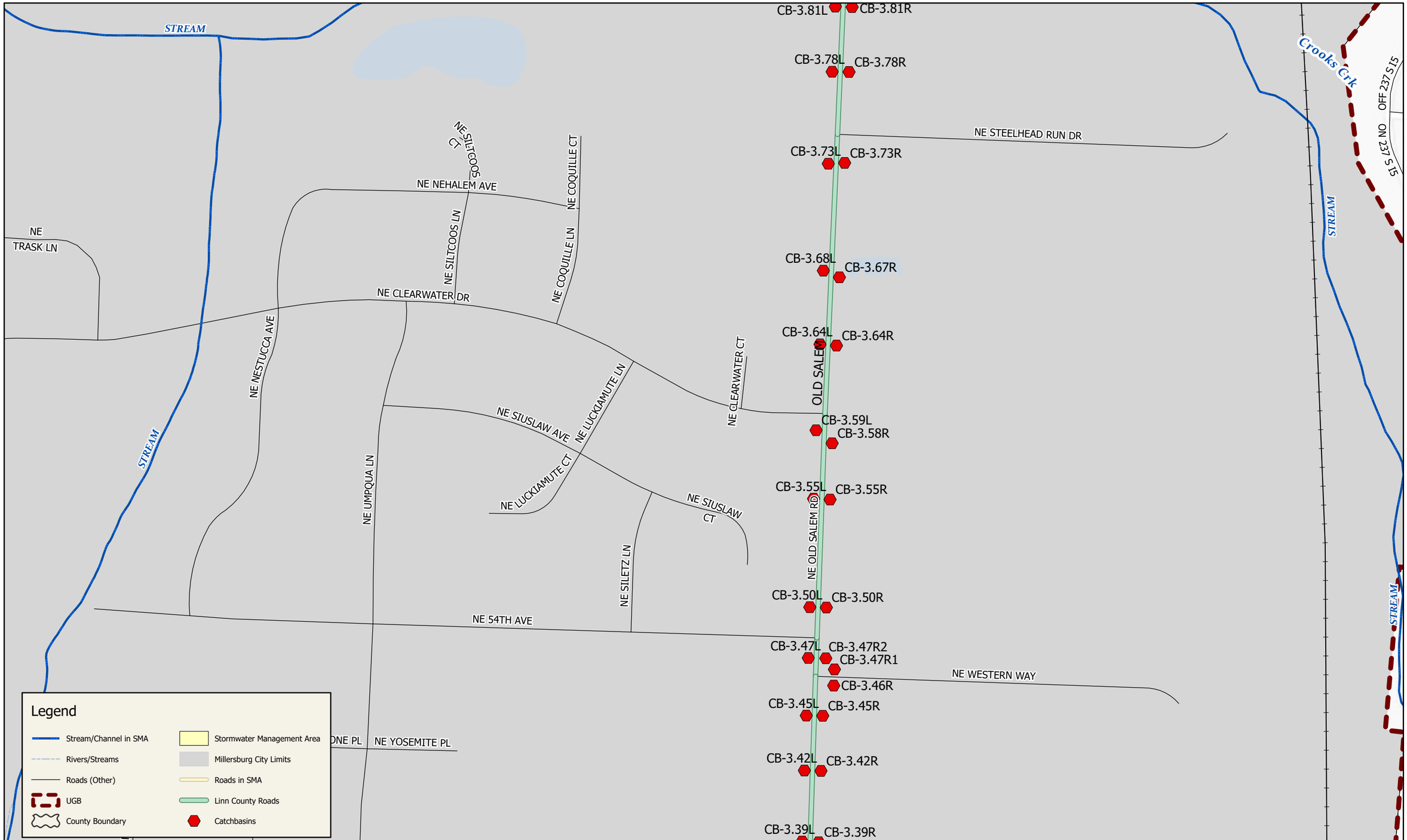
0 1 2 4 Miles

Map by Linn County GIS Department
Printed on July 5, 2023



LINN COUNTY MS4 AREA CONVEYANCE SYSTEMS and STORMWATER CONTROLS
MILLERSBURG

Map by Linn County GIS Department
Printed on July 6, 2023



LINN COUNTY MS4 AREA CONVEYANCE SYSTEMS and STORMWATER CONTROLS
MILLERSBURG

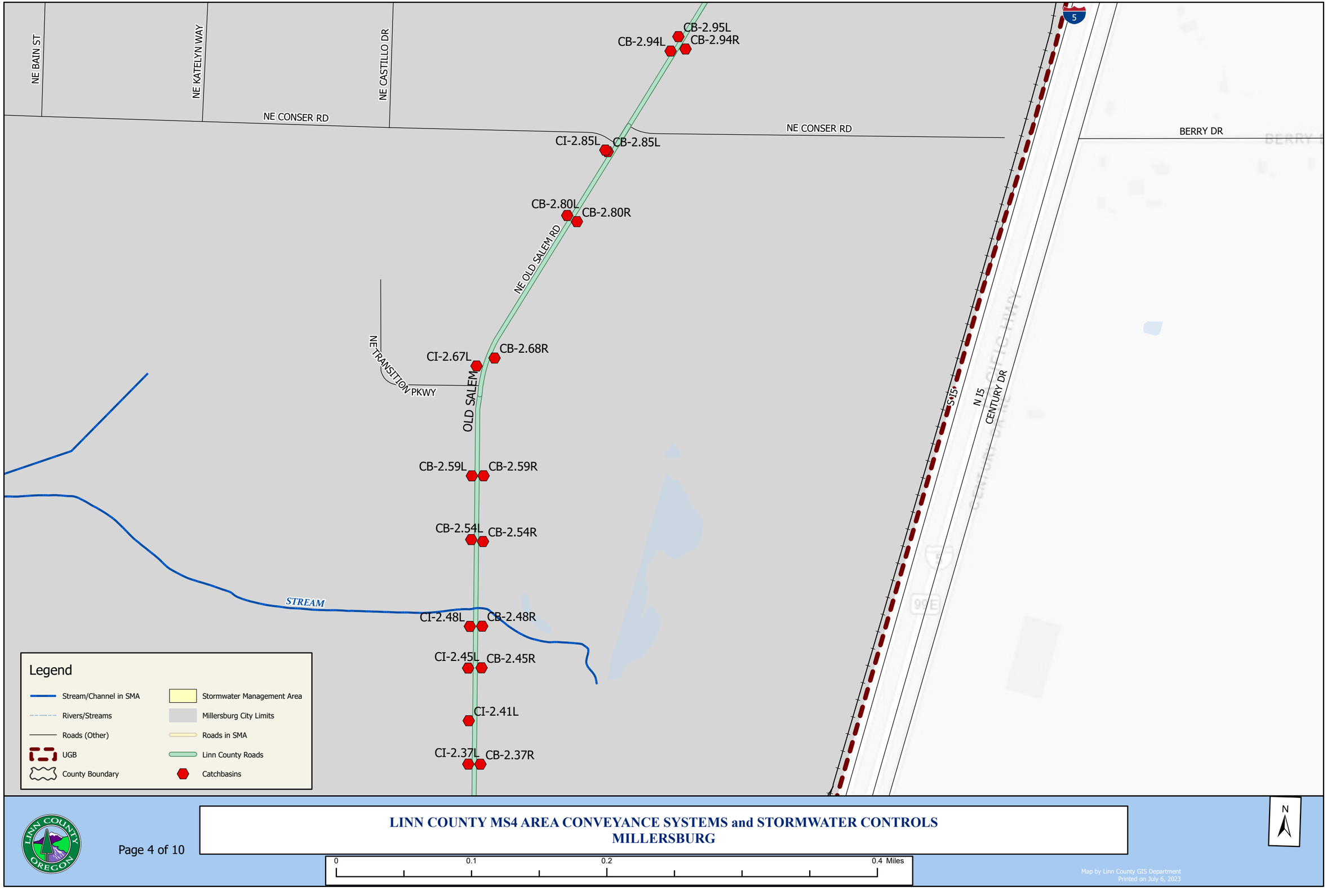
Map by Linn County GIS Department
Printed on July 6, 2023

LINN COUNTY MS4 AREA CONVEYANCE SYSTEMS and STORMWATER CONTROLS
MILLERSBURG

0 0.07 0.15 0.3 Miles

N

Map by Linn County GIS Department
Printed on July 6, 2023



LINN COUNTY MS4 AREA CONVEYANCE SYSTEMS and STORMWATER CONTROLS
MILLERSBURG

Map by Linn County GIS Department
Printed on July 6, 2023

CI-2.37L
CB-2.37R
CB-2.39R
CI-2.33L
CI-2.32L2
CI-2.32L1
CB-2.30R
NE ARNOLD LN
CI-2.28L
CB-2.27L
CB-2.21R
CB-2.21L
CB-2.23L
CB-2.17L
OLD SALEM
CB-2.14R
CB-2.13L
CB-2.09L
CB-2.09R
CB-2.05L
CB-2.02L
CB-2.02R
NE OLD SALEM RD
S I5
N I5
CENTURY DR
ON-235-N-I5

Legend

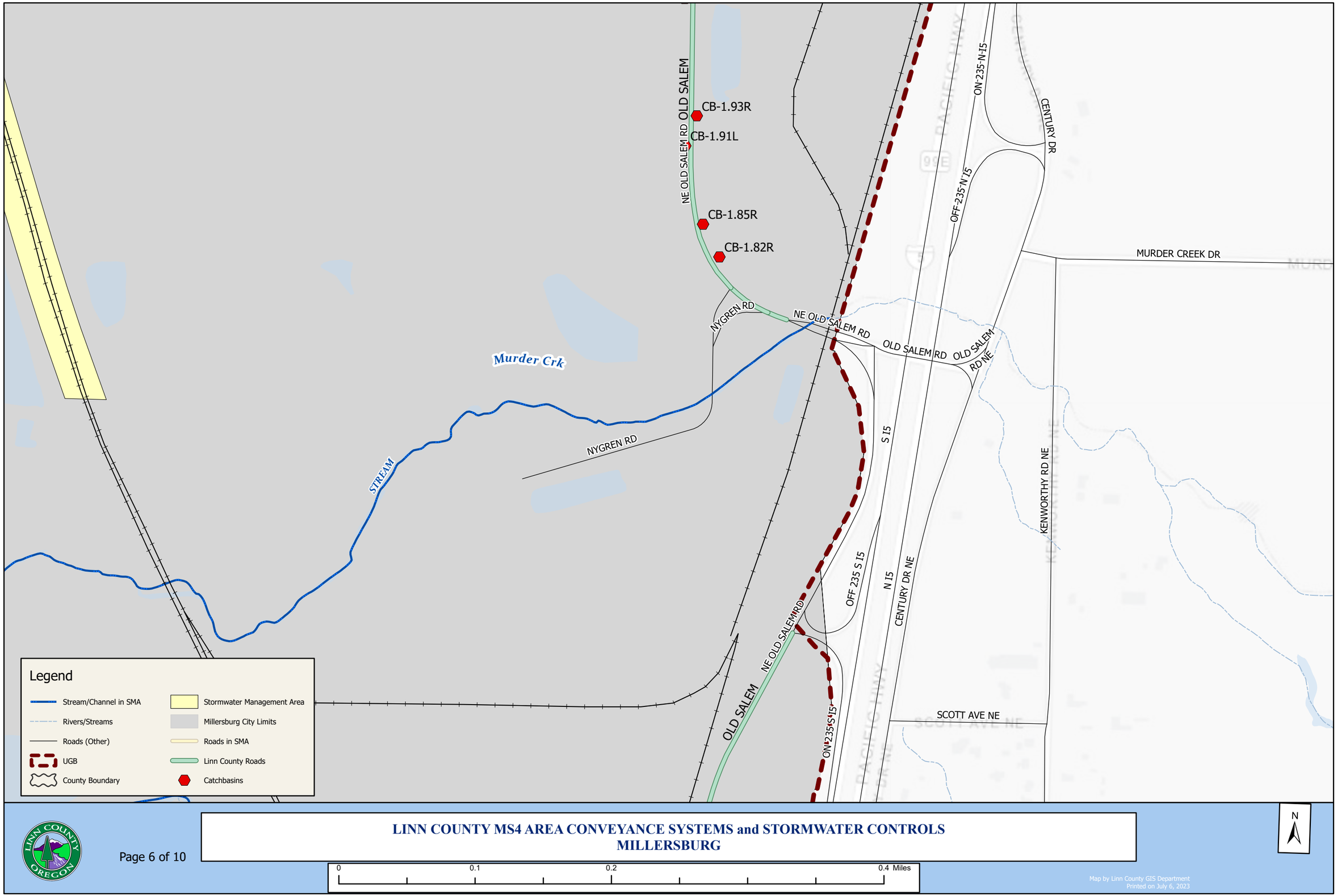
- Stream/Channel in SMA
- Rivers/Streams
- Roads (Other)
- UGB
- County Boundary
- Stormwater Management Area
- Millersburg City Limits
- Roads in SMA
- Linn County Roads
- Catchbasins

LINN COUNTY MS4 AREA CONVEYANCE SYSTEMS and STORMWATER CONTROLS
MILLERSBURG

0 0.07 0.15 0.3 Miles

N

Map by Linn County GIS Department
Printed on July 6, 2023

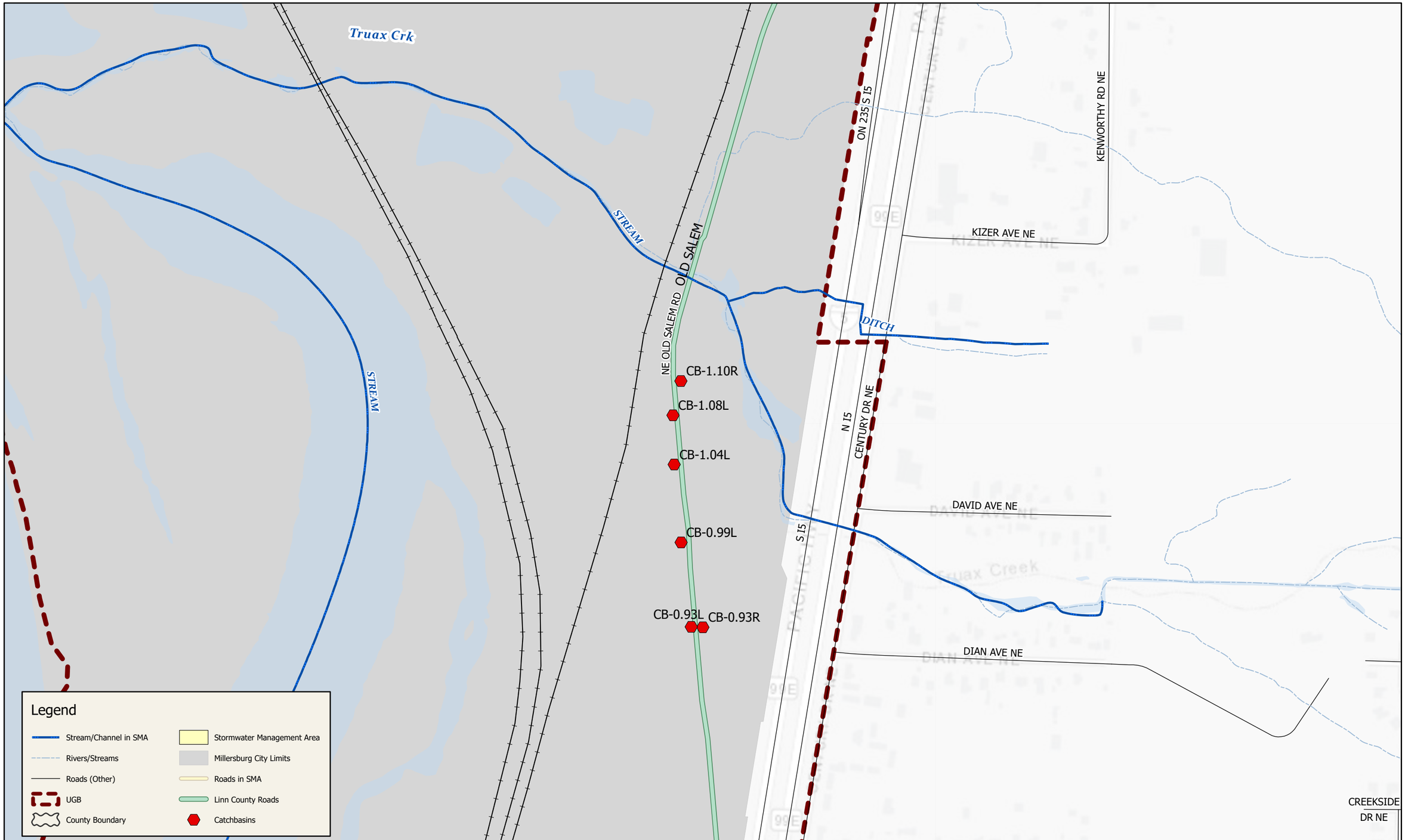


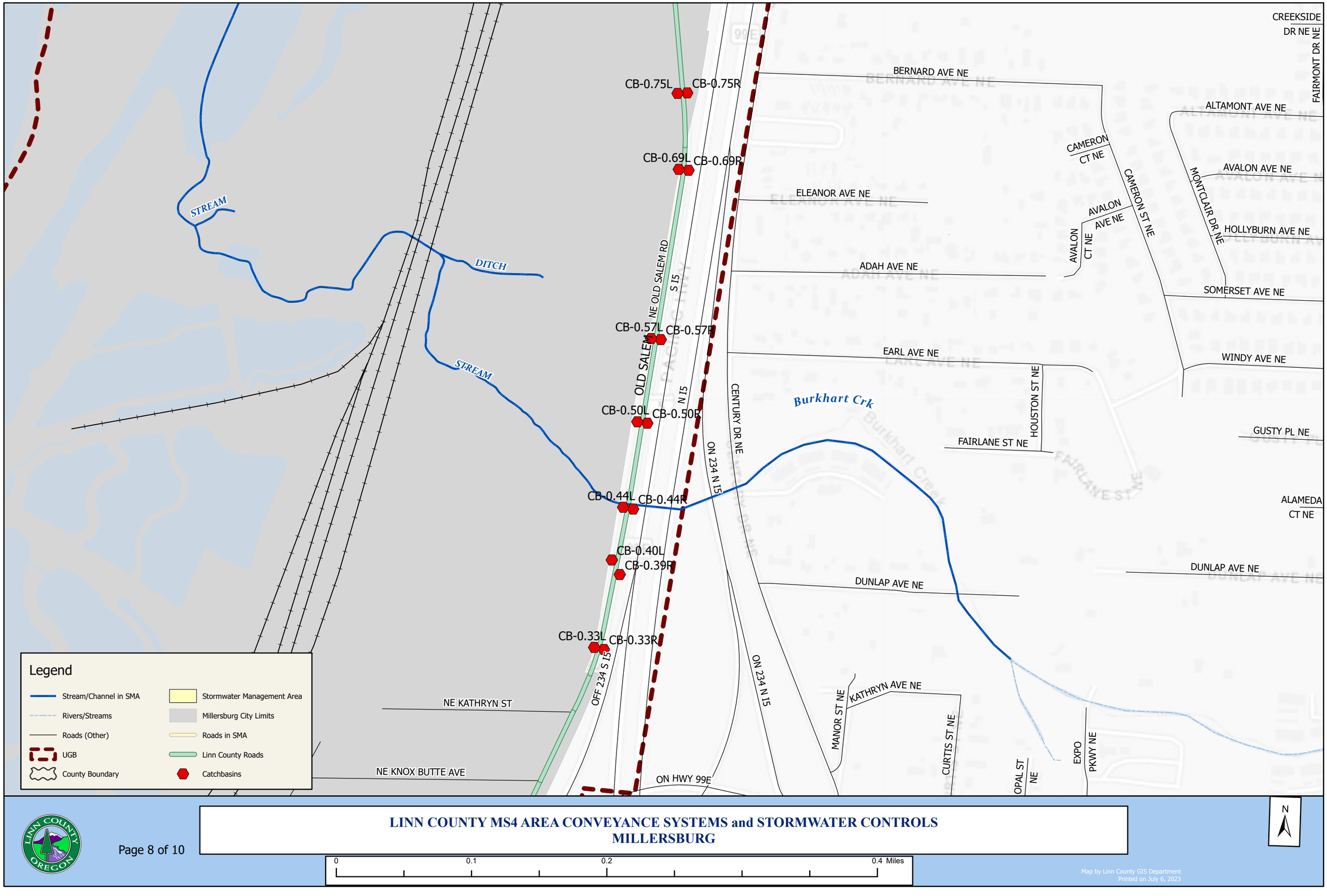
LINN COUNTY MS4 AREA CONVEYANCE SYSTEMS and STORMWATER CONTROLS
MILLERSBURG

0 0.1 0.2 0.4 Miles

N

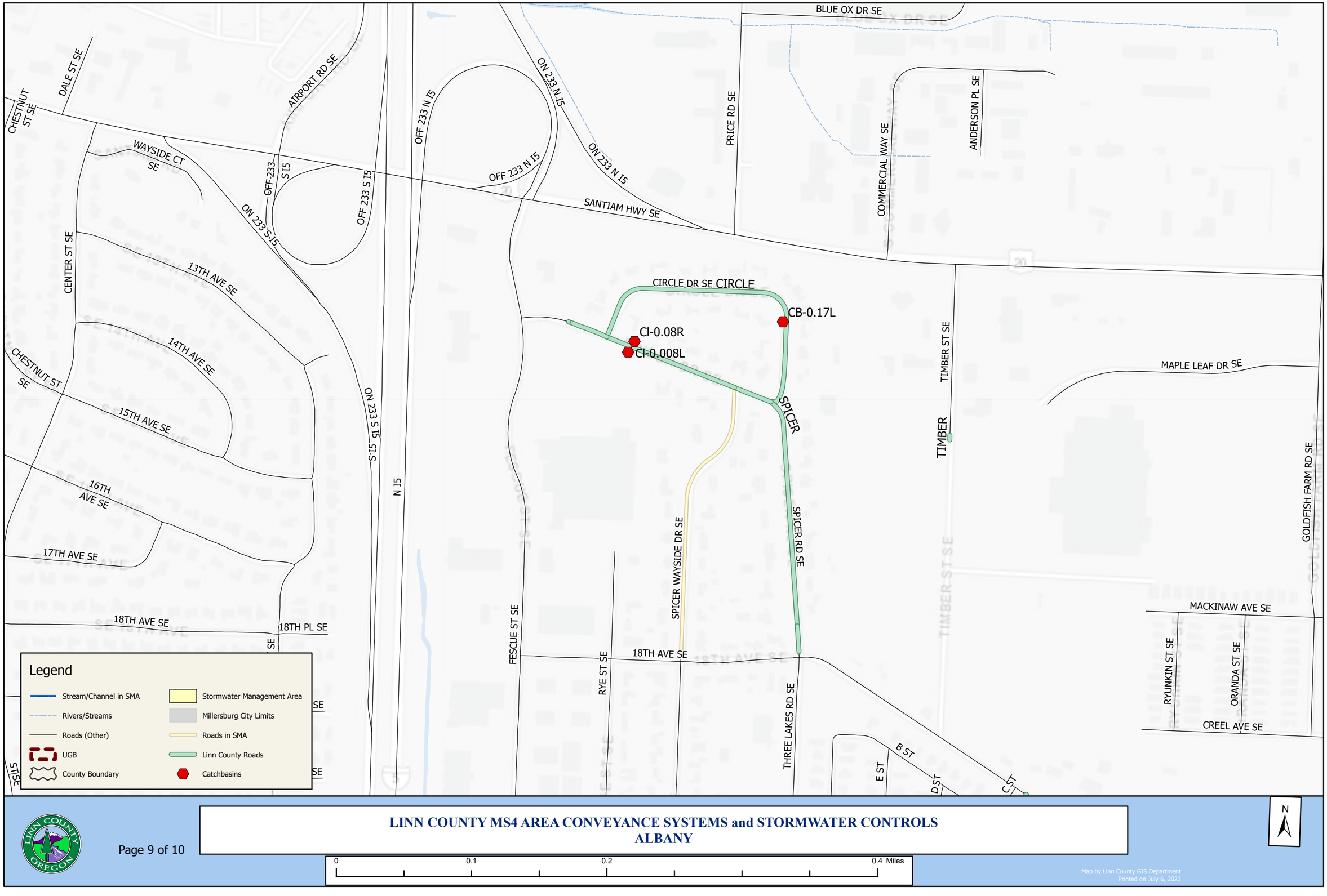
Map by Linn County GIS Department
Printed on July 6, 2023


Truax Crk
STREAM
STREAM
DITCH
OLD SALEM
NE OLD SALEM RD
CB-1.10R
CB-1.08L
CB-1.04L
CB-0.99L
CB-0.93L
CB-0.93R
I5 N
I5 S
N I5
S I5
CENTURY DR NE
KENWORTHY RD NE
KIZER AVE NE
DAVID AVE NE
DIAN AVE NE
CREEKSIDE DR NE
Truax Creek
99E
Legend
Stream/Channel in SMA
Rivers/Streams
Roads (Other)
UGB
County Boundary
Stormwater Management Area
Millersburg City Limits
Roads in SMA
Linn County Roads
Catchbasins
LINN COUNTY OREGON
LINN COUNTY MS4 AREA CONVEYANCE SYSTEMS and STORMWATER CONTROLS
MILLERSBURG
0
0.1
0.2
0.4 Miles
N
Map by Linn County GIS Department
Printed on July 6, 2023



LINN COUNTY MS4 AREA CONVEYANCE SYSTEMS and STORMWATER CONTROLS
MILLERSBURG

Map by Linn County GIS Department
Printed on July 6, 2023



LINN COUNTY MS4 AREA CONVEYANCE SYSTEMS and STORMWATER CONTROLS
ALBANY

Map by Linn County GIS Department
Printed on July 6, 2023

WISTERIA LN
DAHLIA LN
FORSYTHIA LN
BEGONIA LN
HYDRANGEA LN
MCFARLAND RD
FUCHSIA LN
GERANIUM LN
NORTH LAKE CREEK DR
CI-0.04R
CI-0.004L
CONSER PL
MEADOWLARK LOOP
HWY 99E
ALBANY ST
TANGENT DR
SEQUOIA ST
QUEEN ANNES LACE
BLACKBERRY LN
GARDEN LN
BIRDFOOT DR
OLD MILL RD
OLD CHURCH RD
QUAIL RUN
WILDROSE DR

Legend

- Stream/Channel in SMA
- Rivers/Streams
- Roads (Other)
- UGB
- County Boundary
- Stormwater Management Area
- Millersburg City Limits
- Roads in SMA
- Linn County Roads
- Catchbasins

LINN COUNTY MS4 AREA CONVEYANCE SYSTEMS and STORMWATER CONTROLS
TANGENT

0 0.1 0.2 0.4 Miles

N

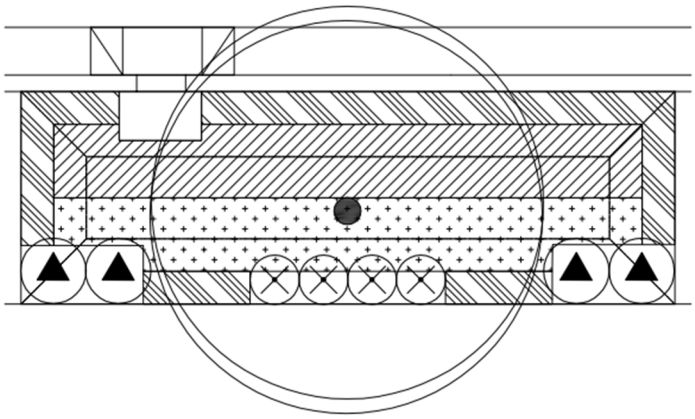
Map by Linn County GIS Department
Printed on July 6, 2023

APPENDIX D

PLANTING LIST AND DIAGRAMS

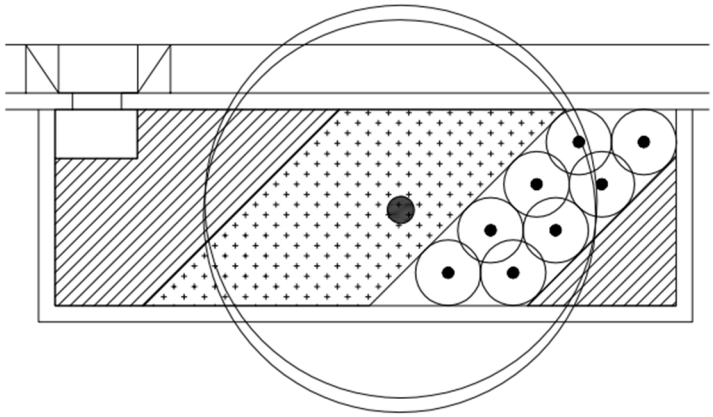
Stormwater Facility Plant List										
Plant Name	**Zone**		**Type and Size**			**Factors**				
Botanical Name, Common Name	**Moisture Zone A Uniformly Wet to Moist**	**Moisture Zone B Drier Transitional Area**	**(E) Evergreen / (D) Deciduous**	**Potential Height**	**Typical On-Center Spacing**	**(S) Sun / (SH) Shade**	**Lined Facility / Over Utilities**	**Parking Areas**	**Streets / Line of Sight**	**Adjacent to Buildings**
Herbaceous Plants										
Carex densa, Dense sedge	x		E	24”	12”	S	x	x	x	x
Carex morrowii 'Variegata', Variegated Japanese sedge	x		E	18”	12”	S	x	x	x	x
Carex obnupta, Slough sedge	x		E	24”	12”	S	x	x	x	x
Carex rupestris, Curly sedge	x		D	14”	12”	S	x	x	x	x
Carex testacea, New Zealand orange sedge	x		E	24”	12”	S	x	x	x	x
Deschampsia caespitosa, Tufted hair grass	x	x	D	36”	12”	S/SH	x	x	x	x
Eleocharis ovata, Ovate spike rush	x	x	D	30”	12”	S	x	x	x	x
Elymus glaucus, Blue wild rye		x	E	24”	12”	S	x	x	x	x
Juncus ensifolius, Dagger-leaf rush	x		D	10”	12”	S	x	x	x	x
Juncus patens 'Elk Blue', Elk Blue gray Rush	x	x	E	18”	12”	S/SH	x	x	x	x
Scirpus microcarpus, Small fruited bulrush	x		E	24”	12”	S	x	x	x	x
Groundcover										
Arctostaphylos uva-ursi, Kinnickinnick		x	E	6”	12”	S	x	x	x	x
Fragaria chiloensis, Coastal strawberry		x	E	6”	12”	S	x	x	x	x
Rubus calycinoides, Creeping Raspberry		x	E	6”	18”	S	x	x	x	x
Small Shrubs										
Cornus sericea 'Kelseyi', Kelsey dogwood	x	x	D	24”	24”	S/SH	x	x	x	x
Mahonia repens, Creeping Oregon grape	x	x	E	18”	18”	S/SH	x	x	x	x
Polystichum munitum, Sword fern	x	x	E	24”	24”	SH	x	x	x	x
Rosa gymnocarpa , Dwarf Wood rose	x	x	D	36”	24”	S/SH	x	x	x	x
Spirea betulifolia, Birchleaf spiraea	x	x	D	24”	24”	S/SH	x	x	x	x
Spirea densiflora, Subapline spiraea	x	x	D	24”	24”	S/SH	x	x	x	x
Spirea japonica 'Goldmound, Goldmound spiraea	x	x	D	24”	18”	S/SH	x	x	x	x
Spirea japonica 'Magic Carpet', Magic Carpet spiraea	x	x	D	18”	24”	S/SH	x	x	x	x
Symphoricarpus alba, Snowberry	x	x	D	36”	36”	S/SH	x	x	x	x
Large Shrubs										
Cornus sericea, Red-Twig dogwood	x	x	D	6’	4’	S/SH	x			
Holodiscus discolor, Western serviceberry	x	x	D	6’	4’	S/SH	x	x		
Rosa nutkana, Nootka rose	x	x	D	8’	4’	S/SH	x			
Omleria cerasiformis, Indian plum	x		D	6’	4’	S/SH	x	x		
Physocarpus capitatus, Pacific ninebark	x		D	6’	36”	S/SH	x			
Ribes sanguimeum, Red flowering currant	x	x	D	8’	4’	S/SH	x	x		x
Spirea douglasii, Douglas spiraea	x	x	D	7’	4’	S/SH	x	x		x

SAMPLE PLANTING DIAGRAMS



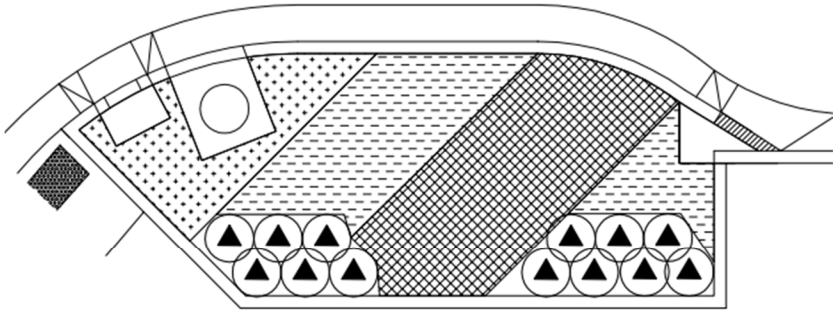
Symbol	Botanical name COMMON NAME	E/D	O.C.	QTY
ZONE A				
	Carex morrowii 'Variegata' VARIEGATED JAPANESE SEDGE	E	12"	36
	Juncus patens 'Elk Blue' ELK BLUE GRAY RUSH	E	12"	39
ZONE B				
	Rubus calycinoides CREEPING RASPBERRY	E	18"	31
	Mahonia repens CREEPING OREGON GRAPE	E	18"	4
	Rosa gymnocarpa DWARF WOOD ROSE	D	24"	4

SWALE EXAMPLE PLANTING DIAGRAM AND TABLE



Symbol	Botanical name COMMON NAME	E/D	O.C.	QTY
	Carex morrowii 'Variegata' VARIEGATED JAPANESE SEDGE	E	12"	56
	Deschampsia caespitosa TUFTED HAIR GRASS	D	12"	26
	Rosa gymnocarpa DWARF WOOD ROSE	D	24"	8

PLANTER EXAMPLE PLANTING DIAGRAM AND TABLE



Symbol	Botanical name COMMON NAME	E/D	O.C.	QTY
	Carex obnupta SLOUGH SEDGE	E	12"	58
	Carex morrowii 'Variegata' VARIEGATED JAPANESE SEDGE	E	12"	30
	Carex testacea NEW ZEALAND ORANGE SEDGE	E	12"	68
	Rosa gymnocarpa DWARF WOOD ROSE	D	24"	13

CURB EXTENSION EXAMPLE PLANTING DIAGRAM AND TABLE

APPENDIX E

STORMWATER QUANTITY FIGURES, TABLES AND DIAGRAMS

I-D-F CURVE FOR MS4 AREA

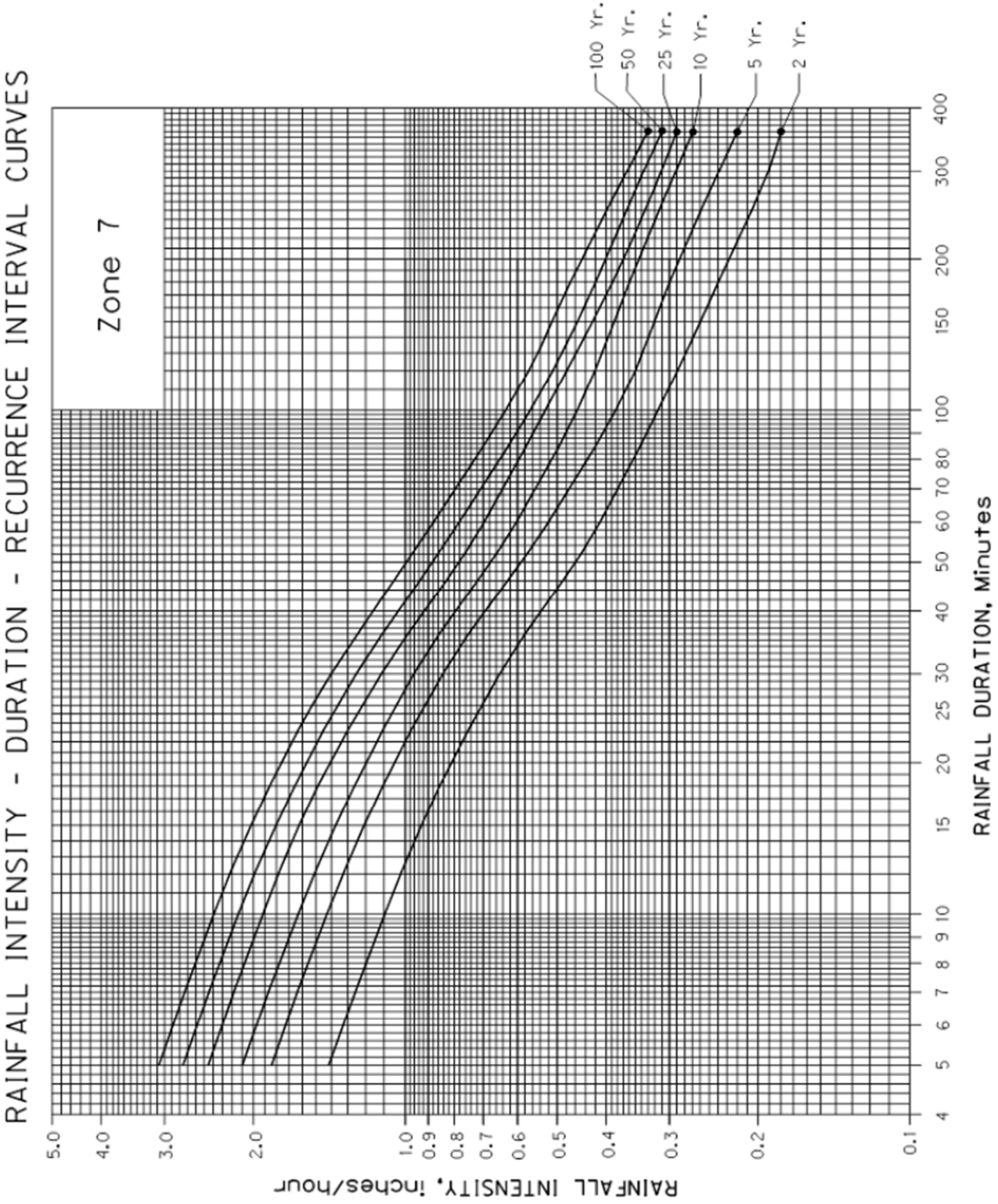


Table 2-2a Runoff curve numbers for urban areas [1]

Cover description		Curve numbers for hydrologic soil group			
Cover type and hydrologic condition	Average percent impervious area [2]	A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.) [3]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) [4]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation) [5]		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

[1] Average runoff condition, and $I_a = 0.2S$.

[2] The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.

[3] CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

[4] Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.

[5] Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4 based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

Table 2-2b Runoff curve numbers for cultivated agricultural lands [1]

Cover description			Curve numbers for hydrologic soil group			
Cover type	Treatment [2]	Hydrologic condition [3]	A	B	C	D
Fallow	Bare soil	—	77	86	91	94
	Crop residue cover (CR)	Poor	76	85	90	93
		Good	74	83	88	90
Row crops	Straight row (SR)	Poor	72	81	88	91
		Good	67	78	85	89
	SR + CR	Poor	71	80	87	90
		Good	64	75	82	85
	Contoured (C)	Poor	70	79	84	88
		Good	65	75	82	86
	C + CR	Poor	69	78	83	87
		Good	64	74	81	85
	Contoured & terraced (C&T)	Poor	66	74	80	82
		Good	62	71	78	81
	C&T+ CR	Poor	65	73	79	81
		Good	61	70	77	80
Small grain	SR	Poor	65	76	84	88
		Good	63	75	83	87
	SR + CR	Poor	64	75	83	86
		Good	60	72	80	84
	C	Poor	63	74	82	85
		Good	61	73	81	84
	C + CR	Poor	62	73	81	84
		Good	60	72	80	83
	C&T	Poor	61	72	79	82
		Good	59	70	78	81
	C&T+ CR	Poor	60	71	78	81
		Good	58	69	77	80
Close-seeded or broadcast legumes or rotation meadow	SR	Poor	66	77	85	89
		Good	58	72	81	85
	C	Poor	64	75	83	85
		Good	55	69	78	83
	C&T	Poor	63	73	80	83
		Good	51	67	76	80

[1] Average runoff condition, and I_a=0.2S

[2] Crop residue cover applies only if residue is on at least 5% of the surface throughout the year.

[3] Hydraulic condition is based on combination factors that affect infiltration and runoff, including (a) density and canopy of vegetative areas, (b) amount of year-round cover, (c) amount of grass or close-seeded legumes, (d) percent of residue cover on the land surface (good ≥ 20%), and (e) degree of surface roughness.

Poor: Factors impair infiltration and tend to increase runoff.

Good: Factors encourage average and better than average infiltration and tend to decrease runoff.

Table 2-2c Runoff curve numbers for other agricultural lands [1/]

Cover description		Curve numbers for hydrologic soil group			
Cover type	Hydrologic condition	A	B	C	D
Pasture, grassland, or range—continuous forage for grazing. [2/]	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow—continuous grass, protected from grazing and generally mowed for hay.	—	30	58	71	78
Brush—brush-weed-grass mixture with brush the major element. [3/]	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30 [4/]	48	65	73
Woods—grass combination (orchard or tree farm). [5/]	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods. [6/]	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30 [4/]	55	70	77
Farmsteads—buildings, lanes, driveways, and surrounding lots.	—	59	74	82	86

1 Average runoff condition, and $I_a = 0.2S$.

2 *Poor:* <50%) ground cover or heavily grazed with no mulch.
Fair: 50 to 75% ground cover and not heavily grazed.
Good: > 75% ground cover and lightly or only occasionally grazed.

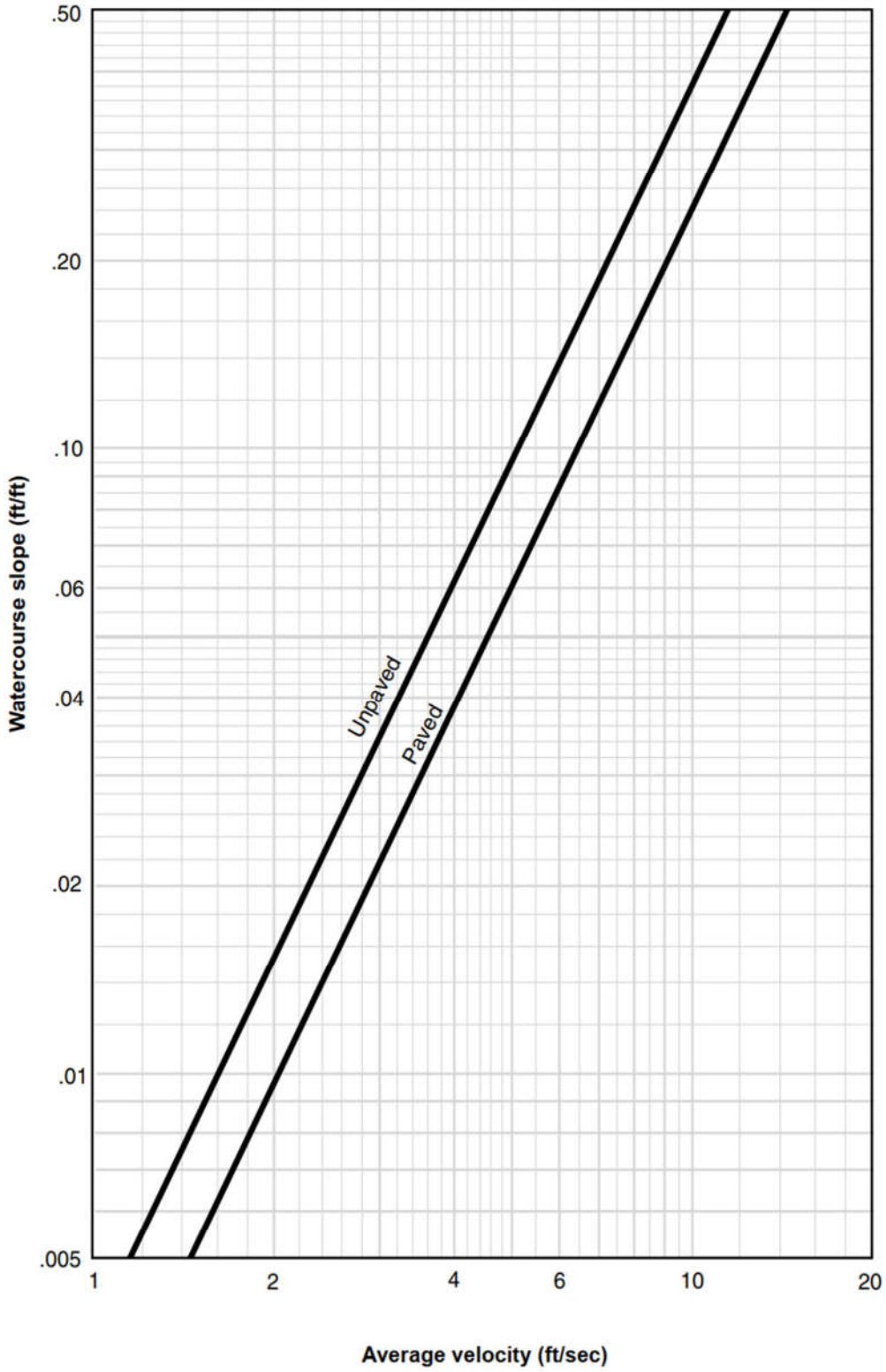
3 *Poor:* <50% ground cover.
Fair: 50 to 75% ground cover.
Good: >75% ground cover.

4 Actual curve number is less than 30; use CN = 30 for runoff computations.

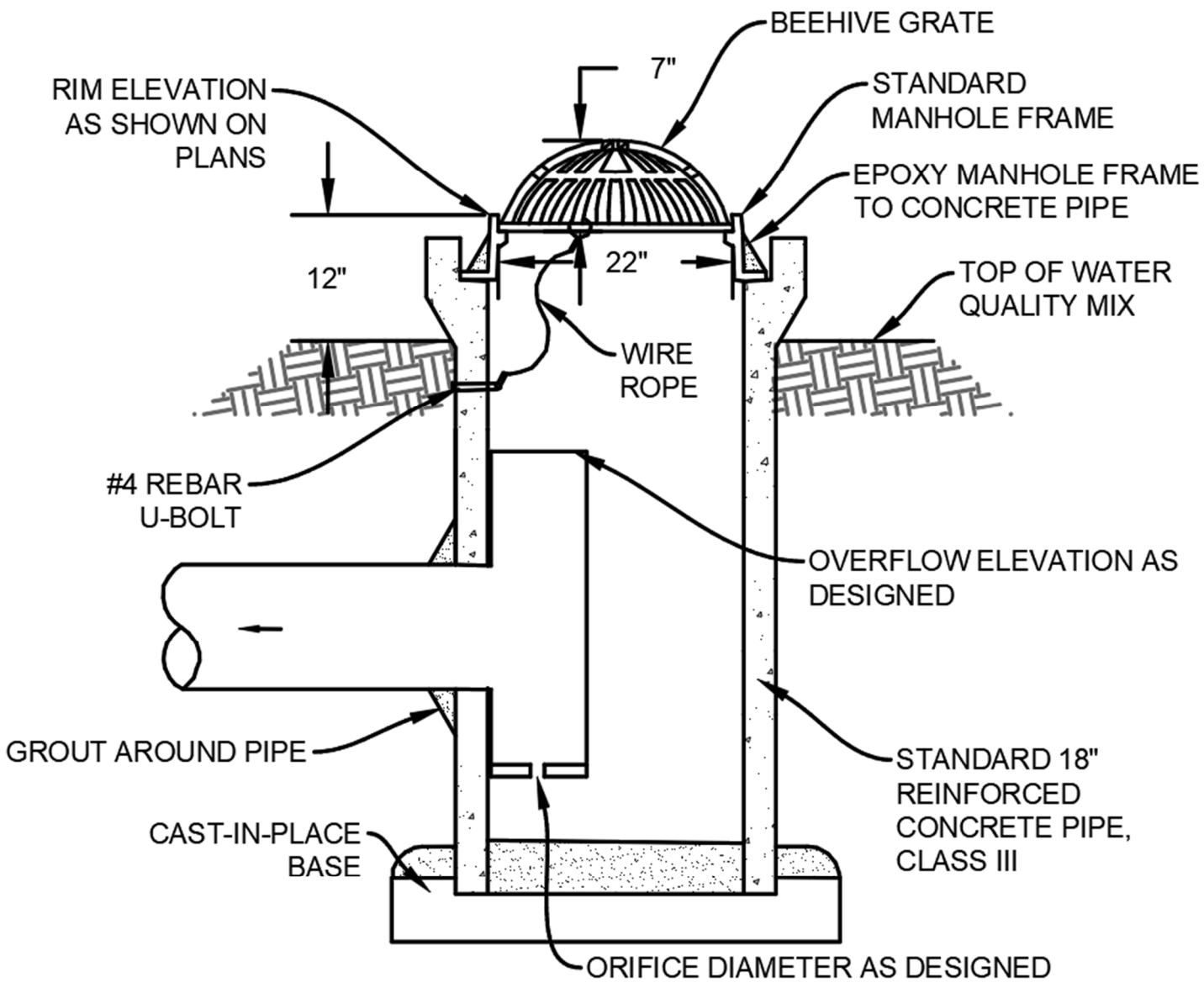
5 CN's shown were computed for areas with 50% woods and 50% grass (pasture) cover. Other combinations of conditions may be computed from the CN's for woods and pasture.

6 *Poor:* Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning.
Fair: Woods are grazed but not burned, and some forest litter covers the soil.
Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

Figure 3-1 Average velocities for estimating travel time for shallow concentrated flow



EXAMPLE FLOW CONTROL STRUCTURE



OVERFLOW INLET WITH BEEHIVE GRATE

APPENDIX F

GLOSSRY OF TERMS

GLOSSARY OF TERMS

Accelerated Erosion	Erosion much more rapid than normal or geologic erosion, primarily as a result of the activities of man.
Adsorption	The adhesion of a substance to the surface of a solid or liquid. Heavy metals such as zinc and lead often adsorb onto particles.
Berm	A constructed barrier of compacted earth or aggregate.
Best Management Practices	Physical, structural and/or managerial practices employed to (BMP's) avoid or mitigate damage or potential damage from the contamination or pollution of surface waters or wetlands. Structural BMP's are actual physical installations rather than procedural/managerial BMP's, such as good housekeeping and employee training.
Bioretention	The water quality and water quantity stormwater management practice using the chemical, biological land physical properties of plants, microbes, and soils for the removal of pollution from stormawater runoff.
Catch Basin	A grated inlet, curb opening or combination inlet with or without a sump which admits storm water to a sewer or sub-drain.
Channel	A natural stream or excavated ditch that conveys water.
Channel Erosion	The erosion process whereby the volume and velocity of flow wears away the bed and/or banks of a well-defined channel.
Channel Stabilization	Protecting the sides and bed of a channel from erosion by controlling flow velocities and flow directions using jetties, drops or other structures and/or by lining the channel with a suitable liner such as vegetation, riprap, concrete or other similar material.
Channelization	Alteration of a stream channel by widening, deepening, straightening, or paving certain areas to improve flow characteristics.
Check Dam	A small dam constructed in a gully or other small watercourse to decrease flow velocity , minimize channel scour and promote sediment deposition.
Chronic Illicit Discharge	Continuous illicit discharges resulting from sanitary/wastewater connections to an MS4, sanitary/wastewater inflows into a MS4 and unpermitted industrial wastewater discharges to the MS4.
Chute	A high-velocity, open channel for conveying water down a steep slope without erosion , usually paved.
Clay	(1) Soil fraction consisting of particles less than 0.002 mm in diameter. (2) A soil texture class which is dominated by clay or at least has a larger proportion of clay than either silt or sand.
Clean Water Act	Establishes the basic structure for regulating discharges of pollutants into the waters of the United States and regulating quality standards for surface waters. The basis of the CWA was enacted in 1948 and was called the Federal Water Pollution Control Act, but the Act was significantly reorganized and expanded in 1972. "Clean Water Act" became the Act's common name with amendments in 1972.
Climate	The weather conditions prevailing in an area in general or over a long period.
Coir	Fiber made from coconut husks.
Compost	A mixture that consists largely of decayed organic matter and is used for fertilizing and conditioning land.
Construction Activity	Includes, but is not limited to, clearing , grading, excavation, and other site preparation work related to the construction of residential building and non-residential buildings, and heavy construction.
Conventional Pollutants	Contaminants (other than nutrients) such as sediment, oil, and vehicle fluids.
Contour	An imaginary line on the surface of the earth connecting points of the same elevation.

Control Measure	Any action, activity, or BMP or other method used to control the discharge of pollutants in MS4 discharges.
County Engineer	The Linn County Engineer or his/her authorized representative.
Creek	Any and all surface water routes generally consisting of a channel having a bed, banks, and/or sides in which surface waters flow in draining from higher to lower land, both perennial and intermittent; the channel, banks, and intervening artificial components, excluding flows that do not persist for more than 24 hours after cessation of one-half (1/2) inch of rainfall in a 24-hour period from October through March.
Culvert	A structure, such as a pipe, that channels water past an obstacle or to a subterranean waterway.
Cut	Portion of ground surface or area from which earth has been removed or will be removed by excavating; the depth below the original ground surface to the excavated surface.
Cut and Fill	Process of earth grading by excavating part of a higher area and using the excavated material for fill to raise the surface of an adjacent lower area.
Cutting	leaf, stem or branch cut form a plant to establish a new plant.
Design Life	The period of time for which a facility is expected to perform its intended function.
Design Storm	Selected storm of a given frequency used for designing a design storm system. Hypothetical storm derived from intensity- duration-frequency curves. A prescribed hydrograph and total precipitation amount (for a specific duration recurrence frequency) used to estimate runoff in order to analyze existing drainage, design new drainage facilities or assess impacts of a proposed project on surface water flow.
Detention	The holding of runoff for a short period of time and then releasing it to the natural water course where it returns to the hydrologic cycle.
Detention Facility	An above or below ground facility, such as a pond or tank, which temporarily stores storm water runoff and releases it at a controlled rate. There is little or no infiltration of the stored storm water.
Detention Time	The theoretical time required to displace the contents of a tank or unit at a given rate of discharge (volume divided by rate of discharge).
Dewatering	The removal of water temporarily impounded in a holding basin.
Dike	An embankment to confine or control water, often built along the banks of a river to prevent overflow of lowlands; a levee.
Discharge	Usually the rate of water flow; a volume of fluid passing a point per unit time commonly expressed as cubic feet per second, cubic meters per second, gallons per minute, or millions of gallons per day.
Dispersion, Soil	The breaking down of fine soil aggregates into individual particles, resulting in single-grain structure. Ease of dispersion influences the erodibility of soils. Generally speaking, the more easily dispersed the soil, the more erodible it is.
Ditch	A narrow channel dug in the ground, typically used for drainage alongside a road.
Diversion	A channel with a supporting ridge on the lower side constructed at the top, across, or at the bottom of a slope for the purpose of controlling surface runoff.
Diversion Dike	A barrier built to divert surface runoff.
Drain	A buried slotted or perforated pipe or other conduit (subsurface drain) or a ditch (open drain) for carrying off surplus groundwater or surface water.
Drainage	The removal of excess surface water or groundwater from land by means of ditches or subsurface drains.
Drainageway	A natural or artificial depression that carries surface water to a larger watercourse or outlet such as a river, lake, or bay.

Drainage Facilities	Pipes, ditches, detention basins, creeks, culverts, bridges, etc., used singularly or in combination with each other for the purpose of conveying or storing runoff.
Drop Inlet	Below ground structure in which the water drops through a vertical riser connected to a discharge conduit or storm sewer.
Dry Pond	A facility which provides storm water quantity control by detaining runoff in a detention basin , then releasing the runoff at allowable rates.
Easement	Easements are rights of use over property of another. New stormwater easements granting rights to the County shall be prepared on County forms.
Effective Functioning	Preventing erosion, controlling runoff, or controlling sediment in each location where an ESC is needed so erosion-related impacts of site construction are mitigated as required.
Elongation	The increase in length produced in the gage length produced by a tensile load.
Embankment	A man-made deposit of soil, rock, or other material often used to form an impoundment.
Energy Dissipator	Devices designed to protect downstream areas from erosion by reducing the velocity of flow to acceptable limits.
Environment	The sum total of all the external conditions that may act upon a living organism or community to influence its development or existence.
Erodibility	Susceptibility to erosion.
Erosion	The wearing away of the land surface by water, wind, ice, gravity, or other geological agents. The following terms are used to describe different types of water erosion and can be found in the glossary: **Accelerated Erosion**, **Channel Erosion**, **Gully Erosion**, **Rill Erosion**, **Splash Erosion**, and **Sheet Erosion**.
Erosion and Sediment Control	Any temporary or permanent measures taken to reduce erosion, control siltation and sedimentation, and ensure that sediment- laden water does not leave a site.
Erosion and Sediment Control Plan (ESCP)	Plans, specification and BMP details intended to prevent and control erosion and sediment related to the project construction activities.
Establishment	The act of starting or creating something that will last a long time.
Evapotranspiration	The combined loss of water from an area by evaporation from the soil surface and by transpiration of plants.
Excavate	To uncover, or dig away earth.
Excess Rain	The amount of rainfall that runs directly off an area.
Filter Blanket	A layer of sand and/or gravel designed to prevent the movement .1 of fine-grained soils.
Filter Fabric	A woven or non-woven, water penetrable material generally made of synthetic products such a polypropylene and used in erosion and sediment control applications to trap sediment or prevent the movement of fine soil particles. Often used instead of a filter blanket.
Flood Insurance Rate Maps (FIRM)	Maps which have been developed by the Federal Emergency Management Agency, showing 100-year, base flood elevations for various creeks and rivers.
Floodplain	The lowland that borders a stream and is subject to flooding when the stream overflows its banks.
Floodway	A channel, either natural, excavated, or bounded by dikes and levees, used to carry flood flows.
Flow Spreader	An erosion control device designed to reduce water pollution by mitigating the impact of high-velocity stormwater surface runoff.
Flow-Through Facility	A Post-Construction Stormwater Quality Facility that is designed to remove pollutants from stormwater by filtering through vegetation and soil media, with subsequent discharge to an approved drainage facility. A Flow-Through

	Facility may or may not allow incidental infiltration into underlying native soils, but design and sizing is based on treating and conveying all design flows to a piped or other approved drainage facility.
Foundation	The part of a building that fixes it into the soil and provides support for the main structures that appear above the ground.
Freeboard	Vertical clearance between the normal operating level and the top side of an open conduit or channel. Vertical distance between the design water surface elevation and the elevation of the barrier retaining the water.
Free-Draining	
Frequency of Storm (design storm frequency)	The anticipated period in years that will elapse before another storm of equal intensity and/or total volume will recur: a 10-year storm can be expected to occur on the average once every 10 years.
Gauge	Device for measuring precipitation, water level., discharge, velocity, pressure, temperature, etc., e.g., a rain gauge. A measure of the thickness of metal, e.g., diameter of wire or wall thickness of steel pipe.
Geotextile	Any permeable textile used with foundation, rock, earth or any other geotechnical engineering-related material as an integral part of a human-made project, structure or system.
Grade	(1) The slope of a road, a channel, or natural, ground. (2) The finished surface of canal, bed, roadbed, top of embankment, or bottom of excavation; any surface prepared to a design elevation for the support of construction such as paving or the laying of a conduit. (3) To finish the surface of a canal bed, roadbed, top of embankment , or bottom of excavation, or other land area to a smooth, even.
Gradient	Change of elevation, velocity , pressure, or other characteristics per unit length; slope.
Grading	The cutting and/or filling of the land surface to a desired slope or elevation.
Grass	A member of the botanical family Gramineae, characterized by blade-like leaves that originate as a sheath wrapped around the stem.
Grassed Lined Waterway	A natural or constructed waterway, usually broad and shallow, covered with erosion-resistant grasses and used to safely conduct surface water from an area.
Ground Cover	Low-growing, spreading plants useful for low- maintenance landscape areas.
Gully Erosion	The erosion process whereby runoff water accumulates in narrow channels and, over relatively short periods, removes the soil to considerable depths, ranging from 1 to 2 feet to as much as 75 to 100 feet.
Habitat	The environment in which the life needs of a plant or animal are c supplied.
Harmful Pollutant	A substance which has adverse effects on an organism. Adverse effects include immediate death , chronic poisoning, impaired reproduction and other conditions.
Hazardous Waste	A waste with properties that make it dangerous or capable of having a harmful effect on human health or the environment.
Head	The height of water above any plain of reference. The energy, either kinetic or potential, possessed by each unit weight of a liquid, expressed as the vertical height through which a unit weight would have to fall to release the average energy possessed. Used in various compound terms such as pressure head of velocity head.
Head Loss	Energy loss due to friction, eddies, changes in velocity, elevation or direction of flow.
Headwater	The source of a stream. The water upstream from a structure or point a stream.

Heavy Metals	Metals having a high specific gravity , present in municipal and industrial wastes, that pose long-tern environmental hazards. Such metals include cadmium, chromium , cobalt, copper, lead, mercury, nickel and zinc.
Hydrologic Cycle	The circuit of water movement from the atmosphere to the earth and back to the atmosphere through various stages or processes such as precipitation, interception, runoff, infiltration, percolation, storage, evaporation, and transpiration.
Hydrology	The science of the behavior of water in the atmosphere; on the surface of the earth, and underground.
Illicit Connections	Include, but are not limited to, pipes, drains, open channels, or other conveyances that have the potential to result in an illicit discharge.
Illicit Discharge	Any discharge to a municipal separate storm sewer system that is not composed entirely of stormwater except authorized discharges permitted by a NPDES permit or other start or federal permit, or otherwise authorized by DEQ.
Impervious Surfaces/Impervious Areas	Those hard surface areas located upon real property that either prevent or retard saturation of water into the land surface, as existed under natural conditions pre-existent to development, and cause water to run off the land surface in greater quantities or at an increased rate of flow from that present under natural conditions pre-existent to development. Common impervious surfaces include, but are not limited to rooftops, concrete or asphalt sidewalks, walkways, patio areas, driveways, parking lots or storage areas and graveled, oiled, macadam or other surfaces that similarly impact the natural saturation or runoff patterns that existed prior to development.
Infiltration	The process by which stormwater penetrates into the soil.
Inlet Protection	A temporary sediment control barrier placed around an inlet that minimizes sediment from entering the storm drain.
Matting	Material used for mats, especially coarse fabric woven from a natural fiber.
Mean Depth	Average depth; cross-sectional area of stream or channel divided by its surface or top width.
Mean Velocity	The average velocity of a stream flowing in a channel or conduit at a given cross-section or in a given reach. It is equal to the discharge divided by the cross-section area of the reach.
Mitigation	Means in the following order of importance: (1) A voiding the impact altogether by not taking a certain action or part of an action. (2) Minimizing impacts by limiting the degree or magnitude of the action and its implementation, by using appropriate technology, or by taking affirmative steps to avoid or reduce impacts. (3) Rectifying the impact by repairing, rehabilitating or restoring the affected environment. (4) Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action, and (5) Compensation for the impact by replacing, enhancing, or providing substitute resources or environments.
Mulch	A natural or artificial layer of plant residue or other materials covering the land surface which conserves moisture, holds soil in place, aids in establishing plant cover , and minimizes temperature fluctuations.
Municipal Separate Storm Sewer System (MS4)	Is a conveyance or system of conveyances that is: (1) Owned by a state, city, town, village, or other public entity that discharges to waters of the U.S., (2) Designed or used to collect or convey stormwater (e.g., storm drains, pipes, ditches),

	(3) Not a combined sewer, and (4) Not part of a sewage treatment plant, or publicly owned treatment work.
Municipality	A City, town, borough, county, parish, district, association, or other public body created by or under state law and having jurisdiction over disposal of sewage, industrial wastes, or other wastes.
National Pollutant Discharge Elimination System (NPDES)	The part of the Federal Clean Water Act which requires permits (NPDES permits) for point and nonpoint source discharges.
Natural Drainage	The flow patterns of storm water runoff over the land in its pre- development state.
Natural Location	The location of those channels, swales, and other non-manmade conveyance systems as defined by the first documented topographic contours existing for the subject property either from maps or photographs.
Nonpoint Source Pollution	Pollution that enters a waterbody from diffuse origins on the watershed and does not result from discernible, confined, or discrete conveyances.
Nutrients	Essential chemicals for plant and animal growth. Excessive amounts can lead to water quality degradation and algae blooms. Some nutrients are toxic at high concentrations.
Onsite	The term "onsite" in these standards when used in reference to stormwater quality facilities is used to describe a subset of facilities located outside the public right-of-way. It is not necessarily a distinction between publicly or privately maintained stormwater facilities (e.g., dry ponds).
Open Drain	Natural watercourse or constructed open channel that conveys drainage water.
Orifice	An opening with closed perimeter, usually of regular form, through which water may flow, generally to control outlet flow.
Outfall	The point, location, or structure where wastewater or drainage discharge from a sewer to a receiving body of water.
Outlet	Point of water disposal from a stream, river, lake, tidewater, or artificial drain.
Particle Size	The diameter or volume of the grains in a sediment or sedimentary rock.
Peak Discharge	The maximum, instantaneous flow rate during a storm, usually in ~ reference to a specific design storm event.
Permanent Stabilization	Maintenance-free measures or methods necessary to prevent erosion or sediments from leaving the Project Site.
Permeability	A generic term for the ability of a material to allow liquids to pass through.
Permeable Soils	Soil materials with filtration rate of 10 minutes per inch or better. Such soils allow infiltration and reduce or eliminate surface and storm water runoff. Classified as SCS (Soil Conservation Services) Type A.
Permeability Rate	The rate at which water will move through a saturated soil. Permeability rates are classified as follows: **Very slow** - Less than 0.06 inches per hour. **Slow** - 0.06 to 0.20 inches per hour. **Moderately slow** - 0.20 to 0.63 inches per hour. **Moderate** - 0.63 to 2.0 inches per hour. **Rapid** - 6.3 to 20.0 inches per hour. **Very rapid** - More than 20.0 inches per hour.
Permittivity	For a geotextile, the volumetric flow rate if water per unit cross- y section area, per unit head, under laminar flow conditions, in the normal direction through the fabric.
Pervious	Allowing movement of water.
Petroleum Product	Are materials derived from crude oil (petroleum) as it is processed in oil refineries.

pH	A numerical measures of hydrogen ion activity .The neutral point is pH 7.0. All pH values below 7.0 are acid and all above 7.0 are alkaline.
Phase II MS4s	The Phase II regulation requires small MS4s in U.S. Census Bureau defined urbanized areas, as well as MS4s designated by the permitting authority, to obtain NPDES permit coverage for their stormwater discharges.
Plans	Construction plans, including system site plans, storm drain plans and profiles, cross sections, detailed drawings, etc., or reproductions thereof, approved or to be approved by the County Engineer, which show the location, character, dimensions, and details for the work to be done, in which constitute a supplement to these Engineering Standards.
Plasticity Index	The numerical difference between the liquid limit and the plastic limit of soil; the range of moisture content within which the soil remains plastic.
Plastic Limit	The moisture content at which a soil changes from a semi-solid to a plastic state.
Point Source	Any discernible, confined an discrete conveyance, including but not limited to any pipe ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock , concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged.
Point Source Pollutants	Pollution which enters a water body resulting from discernible confined or discrete conveyances.
Pollutant	Dredged soil; solid waste; incinerator residue; sewage; garbage; sewerage sludge; munitions; chemical wastes; biological materials; radioactive materials; heat; wrecked or discarded equipment; rock; sand; cellar dirt; and industrial, municipal, and agricultural waste discharged into water.
Pollution Control Plan (PCP)	Consists of Pollution Control Plan form, narrative, site map and details describing measures to prevent pollution related to contractor activities.
Porosity	The volume of pore space in soil or rock.
Post-Construction Stormwater Quality Facility	Permanent stormwater infrastructure incorporated into a development or redevelopment project designed to reduce pollutant loads and runoff velocity from impervious surfaces, and which may also include improvements constructed to reduce the quantity of stormwater runoff leaving the site. May also be referred to as a "Stormwater Quality Facility" in this document.
Predevelopment Hydrologic Function	The hydrology of a site reflecting the local rainfall patterns, soil characteristics, land cover, evapotranspiration, and topography.
Post-Construction Site Runoff Plan	A plan developed by a site owner or operator and/or their designer to demonstrate compliance with the post-construction stormwater management and long-term operation and maintenance requirements.
Private Storm Drain	A storm drain facility located on private property and/or one that is not considered a public storm drain facility.
Public Storm Drain	Any storm drain facility in the public right-of-way or easement operated and maintained by the County.
Rainfall Intensity	The rate at which rain is falling at any given instant, usually expressed in inches per hour.
Rational Method	A means of computing storm drainage flow rates, Q, by use of the formula Q=CIA, where C is a coefficient describing the physical drainage area, I is the rainfall intensity and A is the area.
Receiving Bodies of Water	Creeks, streams, lakes, and other bodies of water into which waters are artificially or naturally directed.
Redevelopment	A project on a previously developed site that results in the addition or replacement of impervious surface.
Release Rate	The controlled rate of release of drainage, storm, and runoff water from property, storage pond, runoff detention pond, or other facility during and following a storm event.

Retention	The process of collecting and holding surface and storm water runoff with no surface overflow.
Retention/Detention Facility	A type of drainage facility designed either to hold water for a considerable length of time and then release it by evaporation, plant transpiration, and/or infiltration into the ground, or to hold surface and storm water runoff for a short period of time and then release it to the surface and storm water management system.
Retention Structure	A natural or artificial basin that functions similar to a detention structure except that it maintains a permanent water supply.
Right-of-Way	All land or interest therein which by deed, conveyance, agreement, easement, dedication, usage, or process of law is reserved for or dedicated to the use of the general public within which the County has the right to install and maintain storm drains.
Rill Erosion	An erosion process in which numerous small channels only several inches deep are formed; occurs mainly on recently disturbed and exposed soils.
Rinsate	A mixture of pesticides diluted by water, solvents, oils, commercial rinsing agents or any other substances that is produced from cleaning pesticides application equipment or pesticides containers.
Riparian	Pertaining to banks of streams, wetlands, lakes or tide waters.
Riser	The inlet portions of a drop inlet spillway that extends vertically from the pipe conduit barrel to the water surface.
Roadmaster	The director of the Linn County Road Department.
Precipitation	Rain, snow, sleet, or hail that falls to the ground.
Runoff	That portion or precipitation that flows from a drainage area on the land surface, in open channels or in storm water conveyance systems.
Safety Data Sheets (SDS)	Data sheets which come with materials. The sheets contain (SDS) information such as pH, flashpoint, reactivity, first aid recommendations and indicate material classification and handling requirements.
Salmonid	A member of the fish family salmonidae. Includes Chinook, coho, chum, sockeye and pink salmon, cutthroat, steelhead, rainbow, Dolly varden, brook, kokanee and whitefish.
Sand	(1) Soil particles between 0.05 and 2.0 mm in diameter. (2) A soil textural class inclusive of all soils which are at least 70% sand and 15% or less clay.
Saturation	In soils, the point at which a soil or an aquifer will no longer absorb any amount of water without losing an equal amount.
Scour	The clearing and digging action of flowing water, especially the downward erosion caused by stream water in sweeping away mud and silt from the stream bed and outside bank of a curved channel.
Sediment	Fragmented material originated from weathering and erosion of rocks and unconsolidated deposits. The material is transported by, suspended in, or deposited by water.
Sedimentation	Disposition of erosional debris-soil sediment displaced by erosion and transported by water from a high elevation to an area of lower gradient where sediments are deposited as a result of slack water.
Sediment Barrier	A temporary sediment control device used on construction sites to protect water quality in nearby streams, rivers, lakes and seas from sediment (loose soil) in stormwater runoff.
Sediment Delivery Ratio	The fraction of the soil eroded from upland sources that actually reaches a stream channel or storage reservoir.
Sediment Discharge	The quality of sediment, measured in dry weight or by volume, transported through a stream cross-section in a given time. Sediment discharge consists of both suspended load and bedload.

Seedling	A young plant grown from seed.
Settling Basin	An enlargement in the channel of a stream to permit the settling of debris carried in suspension.
Sheet Erosion	The gradual removal of a fairly uniform layer of soil from the land surface by runoff water.
Sheet Flow	Relatively uniform flow over a plane surface without concentration of water into conspicuous channels.
Silt	(1) Soil fraction consisting of particles between 0.002 and 0.05 mm in diameter. (2) A soil textural class indicating more than 80% silt.
Siltation	Process by which a river, lake or other water body becomes clogged with sediment. Siltation can clog gravel beds and prevent successful salmon spawning.
Slope	Degree of deviation of a surface from the horizontal; measured as a numerical ratio or percent. Expressed as a ratio, the first number is the horizontal distance (run) and the second is the vertical distance (rise), e.g., 2:1. Slope can also be expressed as the rise over the run. For instance, a 2:1 slope is a 50 percent slope.
Soil	The unconsolidated mineral and organic material on the immediate surface of the earth that serves as a natural medium for the growth of land plants.
Soil Horizon	A horizontal layer of soil that, through processes of soil formation, has developed characteristics distinct from the layers above and below.
Soil Profile	A vertical section of the soil from the surface through all horizons.
Soil Stabilization	Use of rock-lining, vegetation or other methods to prevent soil movement when loads are applied to the soil.
Soil Structure	The relation of particles or groups of particles which impart to the whole soil a characteristic manner of breaking; some types are crumb structure, block structure , platy structure, and columnar structure.
Soil Survey	The systematic examination, description, classification, and mapping of soils in an area.
Soil Texture	The physical structure or character of soil determined by the relative proportions of the soil separates (sand, silt and clay) of which it is composed.
Spillway	A passage such as a paved apron or channel for surplus water over or around or through a dam or similar structure. An open or closed channel, or both, used to convey excess water from a reservoir. It may contain gates, whether manually or automatically controlled, to regulate the discharge of excess water.
Splash Erosion	The spattering of small soil particles caused by the impact of raindrops on wet soils. The loosened and spattered particles mayor may not be subsequently removed by surface runoff.
Stockpile	A large accumulated stock of goods or materials, especially one held in reserve for use at a time of shortage or other emergency.
Storm Frequency	The statistical time interval between major storms of predetermined intensity and runoff volumes for which storm sewers and other structures are designed and constructed to handle hydraulically without surcharge or backflood.
Storm Sewer	A sewer that carries storm water, surface drainage, street wash and other wash waters , but excludes sewage and industrial wastes. Also called a storm drain.
Stormwater	That portion of precipitation that does not percolate into the ground or evaporate, but flows via overland flow, interflow, channels or pipes into a defined surface water channel, or a constructed infiltration facility.
Stormwater Facility	A constructed component of a storm water drainage system, designed or constructed to perform a particular function, or multiple functions. Storm

	water facilities include pipes, swales, ditches, culverts, street gutters, detention basins, retention basins, constructed wetlands and other.
Stormwater Management Facilities	Includes drainage facilities and post-construction stormwater quality facilities as defined above.
Streambanks	The usual boundaries, not the flood boundaries, of a stream channel. Right and left banks are named facing downstream.
Structural BMPs	Actual physical installations rather than procedural/managerial BMPs, such as good housekeeping and employee training.
Subsurface Drain	A pervious backfilled trench-usually containing stone and perforated pipe for intercepting groundwater or seepage.
Surface Runoff	Precipitation that falls onto the surfaces of roofs, streets, the ground, etc., and is not absorbed or retained by that surface, but collects and runs off.
Suspended Solids	Organic or inorganic particles suspended in and carried by water: sand, mud, clay as well as solids.
Swale	An elongated depression in the land surface that is at least seasonally wet, is usually heavily vegetated, and is normally without flowing water. Swales conduct storm water into primary drainage channels and may provide some groundwater recharge.
Tackifier	Are chemical compounds used in formulating adhesives to increase the tack, or the stickiness of the surface of the adhesive.
Temporary Stabilization	Measures or methods necessary to prevent erosion until permanent stabilization measures are in place and established.
Tile	Drain Pipe made of perforated plastic, burned clay, concrete, or similar material, laid to a designed grade and depth, to collect and carry excess water from the soil.
Time of Concentration	The time period necessary for surface water runoff to reach the outlet of a subbasin from the hydraulically most remote point in the tributary drainage area.
Toe of Slope	The base or bottom of a slope at the point where the ground surface abruptly changes to a significantly flatter grade.
Topography	General term to include characteristics of the ground surface such as plains, hills, mountains, degree of relief, steepness of slopes and other physiographic features.
Topsoil	The dark-colored surface layer of A horizon of a soil. When present it ranges in depth from a fraction of an inch to 2 or 3 feet; equivalent to the plow layer of cultivated soils. Commonly used to refer to the surface soil layer(s), enriched in organic matter and haying textural and structural characteristics favorable for plant growth.
Total Maximum Daily Loads (TMDL)	Is a regulatory term in the U.S. Clean Water Act, describing a plan for restoring impaired waters that identifies the maximum amount of a pollutant that a body of water can receive while still meeting water quality standards.
Total Solids	Solids in water , sewage or other liquids including dissolved, filterable and nonfilterable solids. The residue left when moisture evaporates and the remainder is dried at a specified temperature.
Total Suspended Solids (TSS)	The entire amount of organic and inorganic particles dispersed in water. TSS are the larger particles in the water which are more easily removed by sedimentation than smaller particles which cause turbidity.
Toxicity	The characteristic of being poisonous or harmful to plant animal life; the relative degree or severity of this characteristic.
Turbidity	Is caused by silt and clay particles, particles smaller than 0.02 mm, suspended in water. Measurement of turbidity can be done by turbidimeter which

	measures light-beam scatter caused by small suspended particles and converts it to NTU (national turbidity units).
Unified Soil Classification	A classification system based on the identification of soils System according to their particle size, gradation, plasticity index, and liquid limit.
Unstable Ground	A portion of land surface or area which is prone to slipping, sloughing or landslides.
Vactor Waste	The waste material in the bottom of a catch basin or other stormwater structure.
Vegetative Stabilization	Protection of erodible or sediment-producing areas with: **Permanent seeding**, producing long-term vegetative cover, **Short-term (Temporary) seeding**, producing temporary vegetative cover, or **Sodding**, producing areas covered with a turf of perennial sod-forming grass.
Vegetative Cover	The ground area that is covered by vegetation that may be in natural landscapes or agricultural areas.
Waste	A material, substance, or byproduct eliminated or discarded as no longer useful or required after the completion of a process.
Watercourse	A definite channel with bed and banks within which concentrated water flows, either continuously or intermittently.
Water Quality	A term used to describe the chemical, physical, and biological characteristics of water, usually in respect to its suitability for a particular purpose.
Water Resources	The supply of groundwater and surface water in a given area.
Watershed	All land and water within the confines of a drainage divide.
Waters of the State	Any lakes, bays, ponds, impounding reservoirs, springs, wells, rivers, streams, creeks, estuaries, marshes, inlets, canals, the Pacific Ocean within the territorial limits of the State of Oregon and all other bodies of surface or underground waters, natural or artificial, inland or coastal, fresh or salt, public or private (except those private waters that do not combine or effect a junction with natural surface or underground waters), which are wholly or partially within or bordering the State or within its jurisdiction.
Water Table	The free surface of the groundwater. That surface subject to atmospheric pressure under the ground, generally rising and falling with the season, or from other conditions such as water withdrawal.
Weir	Device for measure or regulating the flow of water . Weir Notch The opening in a weir for the passage of water.
Wet Pond	A facility treating storm water by utilizing a permanent pool of water to remove conventional pollutants from runoff. Treatment mechanisms include sedimentation, biological uptake and plant filtration.
Wet Season	October 1 to April 30.