



Engineering Design Standards for Storm Water Management

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Prepared By:

**WSB & Associates, Inc.
701 Xenia Avenue S., Suite 300
Minneapolis, MN 55416
(763) 541-4800
(763) 541-1700 (Fax)**

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1 DESIGN OVERVIEW

The City of Coon Rapids' (the City) Storm Water Pollution Prevention Plan (SWPPP) identifies the goals and policies that define the City's storm water management program, which are implemented via the City's Surface Water Management Ordinance (Chapter 8-1200) and these Engineering Design Standards. The storm water requirements were written to meet the City's goals to preserve, protect, and manage its water resources as well as to meet federal, state, and watershed storm water regulations and to meet the following objectives:

1. Minimize increases in storm water runoff rates from any development in order to reduce flooding, siltation, and erosion and in order to maintain the integrity of stream channels;
2. Minimize increases in nonpoint source pollution caused by storm water runoff from development which would otherwise degrade local water quality;
3. Minimize the total annual volume of surface water runoff that flows from any specific site during and following development so as not to exceed the predevelopment hydrologic regime, to the maximum extent practicable;
4. Ensure that these management controls are properly maintained and pose no threat to public safety; and
5. Implement storm water management controls to help meet current and future total maximum daily load (TMDL) goals, to address the need to improve water quality, and to meet objectives in the Local Surface Water Management Plan.

2 DEFINITIONS

For the purpose of these Engineering Design Guidelines, the following definitions describe the meaning of the terms used in this manual:

Applicant means a property owner or agent of a property owner who has filed an application for a building, grading or subdivision permit.

Applicability means any land disturbing activity requiring a Storm Water Management Plan as defined in City Code Chapter 8-1200 Surface Water Management.

Channel means a natural or artificial watercourse with a definite bed and banks that conducts continuously or periodically flowing water.

Impervious Area means those surfaces that cannot effectively infiltrate rainfall (e.g., building rooftops, pavement, sidewalks, gravel, driveways, swimming pools, etc.).

Land Disturbance Activity means any activity which changes the volume or peak flow discharge rate of rainfall runoff from the land surface. This may include the grading, digging, cutting, scraping or excavating of soil, placement of fill materials, paving, construction, substantial removal of vegetation, or any activity which bares soil or rock or involves the maintenance, repair, improvement, diversion, or piping of any natural or man-made watercourse.

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Maintenance Agreement means document recorded against the property which provides for long-term maintenance of storm water treatment practices.

Municipal Separate Storm Sewer System (MS4) means a conveyance or system of conveyances (roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, storm drains, etc.) that is also:

- Owned or operated by a public entity (which can include cities, townships, counties, military bases, hospitals, prison complexes, highway departments, universities, etc.) having jurisdiction over disposal of sewage, industrial wastes, stormwater, or other wastes, including special districts under State law such as a sewer district, flood control district or drainage districts, or similar entity, or an Indian tribe or an authorized Indian tribal organization, or a designated and approved management agency under section 208 of the Clean Water Act that discharges to waters of the United States;
- Designed or used for collecting or conveying stormwater;
- Which is not a combined sewer; and
- Which is not part of a publicly owned treatment works.

Nonpoint Source Pollution means pollution from any source other than from any discernible, confined, and discrete conveyances, and shall include but not be limited to, pollutants from agricultural, silvicultural, mining, construction, subsurface disposal and urban runoff sources.

Off-Site Facility means a storm water management measure located outside the subject property boundary described in the permit application for land development activity.

Redevelopment means for projects with one acre or greater of impervious and reconstructing greater than 15 percent of the existing impervious surfaces the requirements of the MPCA's Minimal Impact Design Standards (MIDS) will apply to both the reconstructed and new impervious surface. For projects reconstructing less than 15 percent of the existing impervious only the new impervious will be subject to conformance with the MIDS requirements. (*MPCA, Tech Support Document for Post-Construction Storm Water Management*).

Responsible Party means the entity which will be responsible for ownership and maintenance of Storm Water Treatment Practices.

Stop Work Order means an order which requires that all construction activity on a site be stopped.

Storm Water Management means the use of structural or non-structural practices that are design to reduce storm water runoff pollutant loads, discharge volumes, and/or peak discharge rates.

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Storm Water Management Plan means a set of drawings or other documents submitted by a person as a prerequisite to obtaining a storm water management approval, which contains all of the required information and specifications pertaining to Storm Water Management.

Storm Water Reviews means any site that either increases impervious surface by greater than one acre or redevelops one acre or greater of impervious. The review will be completed to evaluate compliance with the MPCA's MIDS. For sites either creating or redeveloping less than one acre of impervious, the City will work with the applicant to determine if water quality practices can be incorporated into the site. Sites less than one acre in size will also not be allowed to have its site drainage negatively impact downstream properties (or water bodies).

Storm Water Runoff means flow on the surface of the ground, resulting from precipitation.

Storm Water Treatment Practices (STPs) means measures, either structural or nonstructural, that are determined to be the most effective and practical means of preventing or reducing point source or nonpoint source pollution inputs to storm water runoff and waterbodies.

Water Quality Volume (WQ_v) means that runoff storage volume needed to treat the specified phosphorus loading as determined in the Coon Rapids Engineering Design Guidelines.

Watercourse means a permanent or intermittent stream or other body of water, either natural or fabricated, which gathers or carries surface water.

Watershed means the total drainage area contributing runoff to a single point.

3 PROCEDURE FOR REVIEWING STORM WATER MANAGEMENT PLANS

3.1 City of Coon Rapids' Procedures for Review

Every applicant for a building permit, subdivision approval, or a permit to allow land disturbing activity must submit an Erosion Control Plan and a Storm Water Management Plan to the City's Community Development Department. However, the following activities are exempt from the Erosion Control Plan and Storm Water Management Plan requirements:

1. Any part of a subdivision or a plat for the subdivision that has been approved by the City Council on or before the effective date of City Ordinance Chapter 8-1200: Surface Water Management;
2. Any land disturbing activity for which plans have been approved by the watershed management organization within six months prior to the effective date of City Ordinance Chapter 8-1200: Surface Water Management;
3. A lot for which a building permit has been approved on or before the effective date of City Ordinance Chapter 8-1200: Surface Water Management;

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4. Installation of fence, sign, telephone, and electric poles and other kinds of posts or poles;
or
5. Emergency work to protect life, limb, or property.

The general review process, from the submittal of the concept and final plans to the issuance of the Storm Water Management Plan approval, is summarized in the following six steps:

1. Determine what storm water management provisions apply (storm water management, erosion control, buffers, floodplain management).
2. What permits, or approvals, are required for the project site, and what waivers and/or exemptions are applicable (COE, DNR, MPCA, Watershed, WCA, etc.)
3. Are the selected practices appropriate for this site? Do selected practices need higher engineering review before approval?
4. Are the practices designed to meet the minimum performance criteria?
5. Does the Plan meet other resource protection requirements as specified in the City of Coon Rapids Code and Comprehensive Plan?
6. Are provisions for long-term maintenance adequate, including access and methods for maintenance defined?
7. Is the project within one mile of an impaired water?

3.2 Coon Creek Watershed District's (CCWD) Procedures for Review

Prior to receiving any of the building, grading, or land development permits required for land disturbance activities applicants must first meet the requirements of the CCWD's Rules.

1. Schedule a pre-application meeting with CCWD staff. A technical assistance application can also be filled out and submitted to determine if a watershed permit is required.
2. Submit Grading & Development application materials, as required by the CCWD. Refer to the CCWD's permit applications forms and Rules at www.cooncreekwd.org for application and submittal requirements.
3. CCWD Board meetings are held on the 2nd and 4th Monday of each month. For a proposed project to be included on the agenda, submit plans to CCWD twelve and one half (12 ½) days prior to a regularly scheduled Board meeting. Complex projects may require additional review time.
4. The applicant shall submit an application form, two sets of plans, specifications, and supporting materials for CCWD to review. All submittals shall be in hard copy format.
5. Upon receipt of a submittal, CCWD staff will review the submittal and prepare findings and recommendations to the Board. A memorandum describing each project and the staff findings and recommendations will be sent to the Board and applicant about two to three days before each meeting.
6. The CCWD will review and comment on the submittal at its regularly scheduled meeting and then approve, table, or deny the submittal. A letter with CCWD comments, including a list of deficiencies or required modifications, will be sent to the applicant and the City of Coon Rapids.

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Any activity affecting the course, current, cross-section, or quality of water within the CCWD will require review by the CCWD:

Floodplain

If the project proposes to alter or fill below the 100-year critical flood elevation (as determined by the CCWD model or Federal Emergency Management Agency (FEMA) of any waters, wetlands, and ditch or conveyance system within the CCWD, the applicant must obtain a Grading and Development permit from the CCWD.

Soils & Erosion Control

The following activities will require a Grading and Development permit from the CCWD:

1. Land disturbing activities on lands within the CCWD of one acre or more of cumulative land disturbance.
2. Land disturbing activities within 100 feet of 3rd, 4th, or 5th order streams, lakes or type 3, 4, 5 wetlands.
3. Land disturbing activities within 50 feet of 1st and 2nd order streams, or Type 1, 2, 6, or 7 wetlands.
4. Land disturbing activities involving excavation or filling or a combination of excavation and filling of dirt, sand or other excavation or fill material including the laying, repairing, replacing, or enlarging of an underground pipe or facility where it crosses a public ditch or waters of the state.
5. Land disturbance of any amount within one mile of an impaired water.

Storm Water

The following activities will require a Grading and Development permit from the CCWD:

1. Land disturbing activities of one acre or greater of cumulative impact.
2. Work adjacent to lakes or wetlands.
3. Activities upstream from land that is dependent upon removal of water from the soil profile for their continued use (Drainage Sensitive Land Uses).

Water Quality

The following activities will require a Water Quality permit from the CCWD:

1. Land disturbing activities of one acre or more of cumulative disturbance. Projects containing greater than or equal to one acre of impervious surface shall contain storm-water detention, erosion and sediment control and pollution prevention BMPs.
2. Work adjacent to or discharging into wetlands, lakes or water courses.

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Wetlands

If the project proposes to impact a wetland by draining, filling or excavating, the applicant must obtain a Wetland permit from the CCWD.

4 SUBMITTAL REQUIREMENTS

4.1 City Submittal Requirements for Storm Water Management Plan Approval

4.1.1 Storm Water Management Plan Required

No storm water management permit will be approved unless it includes a Storm Water Management Plan detailing how runoff and associated water quality impacts resulting from the development will be controlled or managed (note the exceptions in Section 3.). This plan must indicate whether storm water will be managed on-site or off-site and, if on-site, the general location and type of practices.

The Storm Water Management Plan must be signed by a licensed professional engineer in the State of Minnesota, who will verify that the design of all storm water management practices meet the submittal requirements outlined in the Submittal Checklist found in the section below. No building permit, grading permit, or subdivision approval shall be issued until a satisfactory final Storm Water Management Plan, or a waiver thereof, shall have undergone a review and been approved by the City after determining that the plan waiver is consistent with the requirements of these Engineering Design Guidelines.

4.1.2 Storm Water Management Conceptual Plan Requirements (Optional)

A Storm Water Management Conceptual Plan submittal is optional, but highly encouraged. In addition, applicants are encouraged to submit their Storm Water Management Conceptual Plan to the CCWD for their review. A conceptual plan identifies basic site information, locations of proposed development features, and preliminary locations and sizing of STPs, and treatment levels. The conceptual submittal has a greater chance of identifying major obstacles and can facilitate alternative storm water management arrangements in a timely fashion and at the onset of project planning. If a conceptual plan is submitted for review, it should include sufficient information (e.g., maps, basic hydrologic and water quality calculations etc.) to evaluate the environmental characteristics of the project site. This information should show the potential impacts of all proposed development of the site, both present and future, on the water resources, and show the effectiveness and acceptability of the measures proposed for managing storm water generated at the project site. The intent of this conceptual planning process is to determine the type of storm water management of storm water runoff from future development, and to identify major issues prior to completing final plans. The conceptual plan is less time consuming and more efficient to evaluate proposed development plans with this step of the review process. The final plan provides more detailed design information for the proposed STPs, and includes much more detail in terms of hydrologic conditions and site features.

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For redevelopment an applicant should include within a conceptual plan measures for controlling existing storm water runoff discharges and water quality from the site in accordance with the standards of this manual. After review of the conceptual plan and modifications are made to that plan as deemed necessary by the City, a final Storm Water Management Plan may be submitted for approval.

4.1.3 Storm Water Management Plan Requirements (Required)

Record drawings are required for all projects that impact wetlands and/or the floodplain, require water quality ponding, have significant grade changes, and/or have other unusual circumstances. Record drawings must be certified by a professional land surveyor or civil engineer. Record drawings should not include temporary erosion control measures.

Plan Details

- North arrow, street names, and lot and block numbers for property or subdivision.
- Location of benchmark, based on the City/County benchmark system.
- Key with all line types, symbols, shading, and cross-hatching denoted.
- Illustration key showing symbols for all information pertaining to lot and building design, including grades, easements, lot and block, setbacks, etc.
- Plan scale (shown graphically on a bar scale) of: 1 inch = 20 feet, 1 inch = 30 feet, 1 inch = 40 feet, 1 inch = 50 feet, or 1 inch = 100 feet. Plans in other scales will not be reviewed.
- Total area of subject property, with subtotals of disturbed **and** undisturbed areas (tabulation permitted).
- Subject property's boundary lines, lot lines, and right of way lines.
- All existing and proposed drainage and utility easements.
- All man-made features, including existing and proposed buildings, structures, and paved areas.
- All existing storm sewer facilities within 150 feet of the subject parcel.
- All proposed storm sewer facilities (include grades and size of structures).
- All existing and proposed natural features including, but not limited to, significant trees and tree lines, wetlands, ponds, lakes, streams, drainage channels, floodplain, etc.
- Show setbacks and buffers for wetlands, ponds, lakes, streams, and floodplains.
- All adjacent plats, parcels, rights-of-way, section lines, extended a minimum of 150 feet beyond the subject parcel in all directions.

Topography

- Topography details in a minimum of two-foot contour intervals with existing contours as **dashed lines** and proposed contours as dark, **solid lines**, labeled at each edge of the plan and at other appropriate locations.
- Standard lot benching detail, where appropriate (maximum slopes: 3:1).
- Direction arrows indicating swales and lot drainage patterns (show percent grades along drainage swales on plan).

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Elevation Information

- Proposed top of curb elevations at lot corners and driveway or entrances.
- Finished spot elevations at all high and low points.
- Proposed elevations at garage and lowest floor for proposed buildings.
- Proposed finished ground elevations around home for final grading.

Temporary Erosion Control Best Management Practices (BMPs)

Show location of all structural erosion control measures (with standard detail plates and maintenance information for each), including, but not limited to:

- Temporary rock entrance/exit for all vehicle access points (show on plan and provide detail).
- Perimeter silt fence: silt fence and/or bale checks should also be placed along swales or slopes greater than 50 feet in length (flare ends of silt fence up slope).
- Storm sewer inlet filters (indicate type and show graphically on plan at each location).
- Temporary sediment basins.
- Erosion control mats, fiber blankets, netting, temporary seed, or temporary mulch. All exposed soil areas must be stabilized as soon as possible to limit soil erosion, but in no case later than 14 days after the construction activity if that portion of the site has temporarily or permanently ceased, and no later than seven days after construction activity in that portion of the site where construction has temporarily or permanently ceased and discharge points on the project are within one mile of a special or impaired water, as well as flows to that special or impaired water.
- Soil stockpile areas (indicate temporary stabilization measures).
- Street Sweeping Required: Plans must include a note indicating that all adjacent streets will be swept daily, or as directed by the City, to remove all accumulated materials. Failure to perform any street sweeping within six hours of notice by the City will result in the work being performed by the City and all associated costs billed. The City also requires removal of accumulated materials on streets during winter.

Final Stabilization

New residential construction requires vegetated stabilization from the front curb line to the back of the structure for the entire width of the lot. Show seeding and/or turf establishment locations and specifications, including:

- Type of seeding (permanent, temporary, dormant).
- Seed type and application rate.
- Fertilizer type and application rate.
- Mulch type, application rate, and method of anchoring.
- Specifications for installation and maintenance of erosion control mats, blankets, or netting.
- Note requiring seeding/restoration to be completed within 48 hours of final grading.

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- Location of all areas to be vegetated.

Tree Preservation

Show the following standards when a Tree Preservation Permit is required (see Tree Preservation ordinance for more requirements and information).

- Identify, tally, and locate all significant trees on site (tally and show graphically on plan).
- Identify, tally, and locate all significant tree removals on site (tally and show graphically on plan).
- Use tally information and calculations from ordinance to determine if mitigation is required.
- If mitigation is required, provide separate landscape plan identifying requirements.
- Show location of all tree preservation fencing required by ordinance specifications (heavy-duty silt fence can also be used for tree protection).

4.2 CCWD Submittal Requirements

Floodplain

- Site plan showing boundary lines, delineation and existing elevation contours of the work area, ordinary high water level, and 100-year critical flood elevation. All elevations shall be referenced to NAVD88 datum.
- Grading plan showing any proposed elevation changes.
- Preliminary plat of any proposed subdivision.
- Determination by a registered professional engineer of the 100-year critical flood elevation before and after the proposed activity.
- Computation of the change in flood storage capacity as a result of the proposed alteration or fill.
- Erosion and sediment control plan which complies with the CCWD's Rules.
- Soil boring logs and report, if available.

Soils & Erosion Control

- A natural resource map identifying soils, forest cover, and resources protected under other provisions of this rule, city rule or state statute.
- A sequence or construction of the development site including: clearing and grubbing, rough grading, construction of utilities, infrastructure, and buildings as well as final grading and landscaping. Sequencing shall identify the expected date on which clearing will begin and the duration of exposure of cleared areas, areas of clearing, installation of temporary erosion and sediment control measures, and establishment of permanent vegetation.
- All erosion and sediment control measures necessary to meet the objectives of this local regulation throughout all phases of construction and after completion of development of

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the site. Depending upon the complexity of the project, the drafting and implementation of intermediate plans may be required at the close of each season.

- Seeding mixtures and rates, types of sod, method of seed bed preparation, expected seeding dates, type and rate of fertilizer application, and kind and quantity of mulching for both temporary and permanent vegetative control measures
- Provisions for maintenance of control facilities including easements and estimates of the cost of maintenance.
- Explanation of how the site will be stabilized after construction, but who will be responsible for the maintenance of vegetation at the site and what practices will be employed to ensure that adequate vegetative cover is preserved.

Storm Water

- Topographic base map.
- Calculations: hydrologic and hydraulic design calculations (using Atlas 14) for pre- and post-development conditions for the design storms specific in the CCWD's Rules.
- Soils information.
- Maintenance plan.
- Landscaping plan.
- Maintenance easements.
- Erosion and sediment control plans for construction of storm water management measures.

Water Quality

- The applicant must submit with its permit application the exhibits for the Storm Water permit requirements.

Wetlands

- A site plan showing property lines and delineation of lands in which the applicant has an ownership or legal interest: existing and proposed elevation contours, including existing runoff elevation and flow capacity of the wetland outlet, and area of the wetland proposed to be filled, drained or excavated
- A complete delineation of all existing wetland(s), including data sheets with complete and detailed information on field indicators (soils, vegetation and hydrology) and summary report. Wetland delineations must be performed during the normal growing season. Wetland boundaries must be staked in the field, easily identifiable, and accompanied by data sheets.
- The total wetland acres, wetland types and number of jurisdictional wetland basins on the property
- Identification of the water source and hydric period for each wetland basin and the depth and duration for all proposed storm water discharges.
- The size and nature of the proposed impact to each wetlands and the reason the impact is unavoidable shall be identified.

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- The wetland dependence of each proposed impact of the project shall be determined.
- The nature and scope of the appropriate Wetland Conservation Act exemption shall be noted if applicable.
- Alternatives to avoid and minimize each proposed impact.

5 LIST OF ACCEPTABLE PRACTICES

In the development of the STP appropriate for the development or redevelopment, infiltration (water quality volume) is foremost in importance to apply in the design. Filtration is warranted when site conditions do not allow for an effective infiltration facility. For flooding or rate control, detention systems are typically the preferred practice. Low Impact Design (LID) practices are encouraged when they can be functionally incorporated into the design. Alternative practices may be approved at the discretion of the City Engineer. For when infiltration is not feasible the STPs proposed shall meet the performance standards identified in the MIDS Flexible Treatment Options (FTO).

5.1 Volume Control Systems:

1. Infiltration trench/basin
2. Raingarden
3. Underground storage
4. Reuse
5. Green Roofs
6. Trees/Tree Planters

5.2 Filtration Systems:

1. Surface sand filter
2. Underground sand filter
3. Perimeter sand filter
4. Organic filter
5. Bioretention system
6. Raingarden with underdrain
7. Pervious pavement with underdrain
8. Underground storage with underdrain
9. Tree trench

5.3 Detention Systems:

1. Wet pond
2. Storm water re-use systems
3. Multiple pond systems
4. Extended detention basin
5. Micro-pool extended detention basin
6. Dry detention ponds

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7. Underground storage
8. Other, as approved by the City of Coon Rapids

5.4 **Wetlands:**

1. Shallow wetland
2. Pond/wetland systems

5.5 **Open Channel Systems:**

1. Dry swale
2. Wet swale
3. Grass swale
4. Natural channel, or stream

6 **CONSTRUCTION SITE STORM WATER RUNOFF CONTROL**

6.1 **Training**

The SWPPP must provide a chain of command showing who prepared the SWPPP as well who is responsible for the management of the construction site and inspections.

The training shall consist of a course developed by a local, state or federal agency, professional organization, water management organization, or soil and water conservation district and must contain information that is related to erosion prevention, sediment control, or permanent storm water management and must relate to the work that you are responsible for managing.

6.2 **Erosion Control**

1. The permittee must plan for and implement appropriate construction phasing vegetative buffer strips, horizontal slope grading, and other construction practices to minimize erosion. All areas not to be disturbed shall be marked (e.g. with flags, stakes, signs, silt fence etc.) on the project site before any work begins.
2. All exposed soil areas must be stabilized as soon as possible to limit soil erosion but in no case later than 14 days after the construction activity in that portion of the site has temporarily or permanently ceased and no later than seven days after construction activity in that portion of the site has temporarily or permanently ceased when discharge points on the project are within one mile of a special or impaired water and flows to that special or impaired water.
3. Additional BMPs together with enhanced runoff controls are required for discharges to special waters and impaired waters. The BMPs identified for each special or impaired water are required for those areas of the project draining to a discharge point on the project that is within one mile of a special or impaired water and flows to that water.
4. The permittee must stabilize the normal wetted perimeter of any temporary or permanent drainage ditch or swale that drains water from any portion of the construction site, or

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- diverts water around the site, within 200 lineal feet from the property edge, or from the point of discharge into any surface water. Stabilization of the last 200 lineal feet must be completed within 24 hours after connecting to a surface water or property edge.
5. Pipe outlet must have temporary or permanent energy dissipation before connecting to surface water.
 6. When possible, all slopes must be graded in such a fashion so that tracking marks made from heavy equipment are perpendicular to the slope.
 7. All areas disturbed during construction must be restored as detailed in these requirements. The type of permanent restoration shall be clearly shown on the plans including but not limited to sod, seed, impervious cover and structures. A minimum of six inches of topsoil must be installed prior to permanent restoration. Areas in which the topsoil has been placed and finish graded, or areas that have been disturbed and other grading or site building construction operations are not actively underway must be temporary or permanently restored as set forth in the following requirements.
 - a. Areas with slopes that are less than 3:1 must be seeded and mulched within 14 days of the area not being actively worked.
 - b. Areas with slopes that are greater or equal to 3:1 must be seeded and erosion control blanket placed within 14 days of the area not being actively worked.
 - c. All seeded areas must be either mulched and disc anchored, hydro- mulched, or covered by erosion control blanket to reduce erosion and protect the seed. Temporary or permanent mulch must be disc anchored and applied at a uniform rate of two tons per acre and have 90% coverage.
 - d. If the disturbed area will be re-disturbed within a six month period, temporary vegetative cover may be required consisting of an approved seed mixture and application rate.
 - e. If the disturbed area will not be re-disturbed within a six month period, permanent vegetative cover shall be required consisting of an approved seed mixture and application rate.
 - f. All areas that will not have maintenance done such as mowing as part of the final design shall be permanently restored using an approved seed mixture and application rate.
 - g. Restoration of disturbed wetland areas shall be accomplished using an approved seed mixture and application rate.
 8. All erosion control measures must be maintained for the duration of the project until final stabilization has been achieved in accordance with Section 1.7. If construction operations or natural events damage or interfere with any erosion control measures, they shall be restored to serve their intended function.
 9. Additional erosion control measures shall be added as necessary to effectively protect the natural resources of the City. The temporary and permanent erosion control plans shall be revised as needed based on current site conditions and to comply with all applicable requirements.

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6.3 Sediment Control Practices

1. Sediment control practices must be established on all down gradient perimeters before any upgradient land disturbing activities begin. These practices must remain in place until final stabilization has been achieved.
2. If down gradient treatment system is overloaded additional up gradient sediment control practices must be installed to eliminate overloading. The SWPPP must be amended to identify the additional practices.
3. All storm drain inlets must be protected by approved BMPs during construction until all potential sources for discharge have been stabilized. These devices must be maintained until final stabilization is achieved. Inlet protection may be removed if a specific safety concern (street flooding/freezing) has been identified.
4. Temporary stockpiles must have silt fence or other effective sediment controls on the down gradient side of the stockpile and shall not be placed at least 25 feet from any road, wetland, protected water, drainage channel, or storm water inlets. Stockpiles left for more than 14 days must be stabilized with mulch, vegetation, tarps or other approved means.
5. Vehicle tracking of sediment from project shall be minimized by approved BMPs. These shall be installed and maintained at the City approved entrances. Individual lots shall each be required to install and maintain entrances throughout the construction building until a paved driveway is installed.
6. Sediment that has washed or tracked from site by motor vehicles or equipment shall be cleaned from paved surfaces throughout the duration of construction.
7. Silt fence or other approved sediment control devices must be installed in all areas as shown on the SWPPP.
8. Silt fence or other approved sediment control devices shall be required along the entire curb line, except for approved openings where construction entrances will be installed or drainage flows away from curb. This device must be maintained until final stabilization is achieved. Ditch checks shall be required in ditch bottoms. Spacing for the check must be as follows: [***Height in feet*** (of the sediment device used)] $\times 100 /$ ***Slope Gradient***
9. Dust control measures, such as application of water must be performed periodically due to weather, construction activity, and/or as directed by the City.
10. Flows from diversion channels or pipes (temporary or permanent) must be routed to sedimentation basins or appropriate energy dissipaters to prevent the transport of sediment to outflow or lateral conveyors, and to prevent erosion and sediment buildup when runoff flows into the conveyors.
11. A concrete washout shall be installed on projects that require the use of concrete. All liquid and solid wastes generated by concrete washout operations must be contained in a leak-proof containment facility or impermeable liner. A sign must be installed adjacent to each washout facility to inform operators to utilize the proper facilities.
12. All sediment control measures shall be used and maintained for the duration of the project until final. If construction operations or natural events damage or interfere with any erosion control measures, they must be restored to serve their intended function.

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13. Additional sediment control measures shall be added as necessary to effectively protect the natural resources of the City. The temporary and permanent erosion control plans shall be revised as needed based on current site conditions and to comply with all applicable requirements.
14. Restrict clearing and grading within 20 feet of an existing wetland boundary to provide for a protective buffer strip of natural vegetation.

6.4 Waterway and Watercourse Protection

1. A temporary stream crossing must be installed and approved by the local government unit administering the Wetland Conservation Act and ditch authority, and regulating agency if a wet watercourse will be crossed regularly during construction. In addition, a temporary stream crossing will require a permit from CCWD for wetlands or county ditches.
2. The watercourse channel shall be stabilized before, during, and within 24 hours after any in-channel work.
3. No in-water work shall be allowed in Public Waters during the MnDNR's work exclusion dates.
4. Prior to placement of any equipment into any waters, all equipment must be free of aquatic plants and non-native animals.
5. All on-site storm water conveyance channels shall be designed according to the criteria outlined in this document.
6. Stabilization adequate to prevent erosion located at the outlets of all pipes and paved channels is required.

6.5 Temporary Sediment Basins

1. A temporary sediment basin (or permanent) shall be provided when 10 or more acres of disturbed soil drain to a common location prior to the runoff leaving the site or entering surface waters. The permittee is also encouraged, but not required, to install temporary sediment basins in areas with steep slope or highly erodible soils even if the area is less than 10 acres and it drains to one common area. The basins shall be designed and constructed according to the following requirements.
 - a. The basins must provide storage below the outlet pipe for a calculated volume of runoff from a 2-year, 24-hour storm from each acre drained to the basin, except that in no case shall the basin provide less than 1,800 cubic feet of storage below the outlet pipe from each acre drained to the basin.
 - b. Where no such calculation has been performed, a temporary (or permanent) sediment basin providing 3,600 cubic feet of storage below the outlet pipe per acre drained to the basin shall be provided where attainable until final stabilization of the site.
 - c. Temporary basin outlets will be designed to prevent short-circuiting and the discharge of floating debris. The basin must be designed with the ability to allow complete basin drawdown (e.g., perforated riser pipe wrapped with filter fabric and covered with crushed gravel, pumps or other means) for maintenance activities, and provide a

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- stabilized emergency overflow to prevent failure of pond integrity. Energy dissipation must be provided for the basin outlet.
- d. Temporary (or permanent) basins must be constructed and made operational concurrent with the start of soil disturbance that is up gradient of the area and contributes runoff to the pond.
 - e. Where the temporary sediment basin is not attainable due to site limitations, equivalent sediment controls such as smaller sediment basins, and/or sediment traps, silt fences, vegetative buffer strips, or any appropriate combination of measures are required for all down slope boundaries of the construction area and for those side slope boundaries deemed appropriate as dictated by individual site conditions. In determining whether installing a sediment basin is attainable, the permittee must consider public safety and may consider factors such as site soils, slope, and available area on site. This determination must be documented in the SWPPP.
 - f. The permittee shall maintain the sedimentation basins and will remain functional until an acceptable vegetative cover is restored to the site. The City will not issue building permits for lots containing sediment basins until they have been removed or relocated based on the projects restoration progress.
 - g. Basins designed to be used for permanent storm water management shall be brought back to their original design contours prior to acceptance by the City.

6.6 Dewatering and Basin Draining

1. If water cannot be discharged into a sedimentation basin before entering a surface water, it must be treated with the appropriate BMPs, such that the discharge does not adversely affect the receiving water or downstream landowners. The permittee must make sure discharge points are appropriately protected from erosion and scour. The discharge must be dispersed over riprap, sand bags, plastic sheeting, or other acceptable energy dissipation measures. Adequate sediment control measures are required for discharging water that contains suspended soils.
2. All water from dewatering or basin draining must discharge in a manner that does not cause nuisance conditions, erosion in receiving channels, on down slope properties, or inundation in wetlands causing significant adverse impact to wetlands.

6.7 Inspections and Maintenance

1. The permittee shall be responsible for inspecting and maintenance of the BMPs.
2. The permittee must routinely inspect the construction project once every seven days during active construction and within 24 hours of a rainfall event of 0.5 inches or greater in 24 hours.
3. All inspections and maintenance conducted during construction must be recorded in writing and must be retained with the SWPPP. Records of each inspection and maintenance activity shall include:
 - a. Date and time of inspection.
 - b. Name of person(s) conducting the inspections.
 - c. Findings of inspections, including recommendations for corrective actions.

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- d. Corrective actions taken (including dates, times, and the party completing the maintenance activities).
 - e. Date and amount of all rainfall events 0.5 inches or greater in 24 hours.
 - f. Documentation of changes made to SWPPP.
4. Parts of the construction site that have achieved final stabilization, but work continues on other parts of the site, inspections of the stabilized areas can be reduced to once a month. If work has been suspended due to frozen ground conditions, the required inspections and maintenance must take place as soon as runoff occurs or prior to resuming construction, whichever happens first.
 5. All erosion and sediment BMPs shall be inspected to ensure integrity and effectiveness. All nonfunctional BMPs shall be repaired, replaced or supplemented with a functional BMP. The permittee shall investigate and comply with the following inspection and maintenance requirements.
 6. All silt fences must be repaired, replaced, or supplemented when they become nonfunctional or the sediment reaches half of the height of the fence. These repairs shall be made within 24 hours of discovery, or as soon as field conditions allow access.
 7. Temporary and permanent sedimentation basins must be drained and the sediment removed when the depth of sediment collected in the basin reaches half the storage volume. Drainage and removal must be completed within 72 hours of discovery, or as soon as field conditions allow access.
 8. Channels that receive sediment must be cleaned when channel becomes one quarter full of sediment.
 9. Surface waters, including drainage ditches and conveyance systems, must be inspected for evidence of sediment being deposited by erosion. The permittee shall remove all deltas and sediment deposited in surface waters, including drainage ways, catch basins, and other drainage systems, and restabilize the areas where sediment removal results in exposed soil. The removal and stabilization shall take place within seven days of discovery unless precluded by legal, regulatory, or physical access constraints. The permittee shall use all reasonable efforts to obtain access. If precluded, removal and stabilization shall take place within seven calendar days of obtaining access. The permittee is responsible for contacting all local, regional, state, and federal authorities and receiving any applicable permits, prior to conducting any work.
 10. Construction site vehicle exit locations shall be inspected for evidence of off-site sediment tracking onto paved surfaces. Tracked sediment shall be removed from all off-site paved surfaces, within 24 hours of discovery, or if applicable, within a shorter time.
 11. The permittee is responsible for the operation and maintenance of temporary and permanent water quality management BMPs, as well as all erosion prevention and sediment control BMPs, for the duration of the construction work at the site. The permittee is responsible until another permittee has assumed control over all areas of the site that have not been finally stabilized or the site has undergone final stabilization, and a Notice Of Termination has been submitted to the MPCA.
 12. If sediment escapes the construction site, off-site accumulations of sediment shall be removed in a manner and at a frequency sufficient to minimize off-site impacts (e.g.

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fugitive sediment in streets could be washed into storm sewers by the next rain and/or pose a safety hazard to users of public streets).

13. All infiltration areas shall be inspected to ensure that no sediment from ongoing construction activities is reaching the infiltration area and these areas are protected from compaction due to construction equipment driving across the infiltration area.

6.8 Pollution Management Measures/Construction Site Waste Control

1. The permittee must implement the following pollution prevention management measures on the site.
 - a. Solid Waste – collected sediment, asphalt and concrete millings, floating debris, paper, plastic, fabric, construction and demolition debris, and other wastes must be disposed of properly and must comply with MPCA disposal requirements.
 - b. Hazardous Materials such as oil, gasoline, paint, and any hazardous substances must be properly stored, including secondary containment, to prevent spills, leaks or other discharge. Restricted access to storage areas shall be provided to prevent vandalism. Storage and disposal of hazardous waste shall be in compliance with MPCA regulations.
 - c. External washing of trucks and other construction vehicles must be limited to a defined area of the site. Runoff shall be contained and waste properly disposed of. No engine degreasing is allowed on site.
 - d. The City prohibits discharges of any material other than storm water, and discharges from dewatering or basin draining activities. Prohibited discharges include but are not limited to vehicle and equipment washing, maintenance spills, wash water, and discharges of oil and other hazardous substances.

6.9 Final Stabilization

The permittee must ensure final stabilization of the project. Final stabilization is not complete until the following criteria are met:

1. All soil disturbing activities at the site have been completed and all soils will be stabilized by a uniform perennial vegetative cover with a density of at least 70 percent over the entire pervious surface area, or other equivalent means necessary to prevent soil failure under erosive conditions and;
 - a. All drainage ditches, constructed to drain water from the site after construction is complete, must be stabilized to preclude erosion; and
 - b. All temporary synthetic, and structural erosion prevention and sediment control BMPs (such as silt fence) must be removed as part of the site final stabilization; and
 - c. The permittee must clean out all sediment from conveyances and from temporary sedimentation basins that are to be used as permanent water quality management basins. Sediment must be stabilized to prevent it from washing back into the basin, conveyances or drainage ways discharging off-site or to surface waters. The cleanout of permanent basins must be sufficient to return the basin to design capacity.

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2. For residential construction only, final stabilization has been achieved when:
 - a. Temporary erosion protection and down gradient perimeter control for individual lots has been completed, and the residence has been transferred to the homeowner.
 - b. The Permittee must distribute the MPCA “homeowner factsheet” to the homeowner so the homeowner is informed for the need, and benefits, of final stabilization.

7 GUIDANCE ON STORM WATER TREATMENT PRACTICES (STPS)

Designers are expected to follow the Minimal Impact Design Standards (MIDS) flowchart detailed in the *Minnesota Stormwater Manual* (Appendix D). Deviations from recommended guidance in the *Minnesota Stormwater Manual* will require detailed written explanation. Approval of any deviation from the *Minnesota Stormwater Manual* guidance will be at the discretion of the City.

8 BASIC SIZING CRITERIA

Proposed Storm Water Management Plans must incorporate Volume Control, Water Quality Control, and Rate Control as the basis for storm water management in the proposed development plan. The City of Coon Rapids, as a permitted Municipal Separate Storm Sewer System (MS4), requires for new development projects to have a no net increase from pre-project conditions of total volume, TSS, and TP; in addition, for redevelopment projects within the city, it is required to have a net reduction from pre-project conditions of total volume, TSS and TP.

8.1 Volume Control Requirements

Volume control measures are required on projects to meet the water quality criteria of the City of Coon Rapids’ City Code Chapter 8-1200 and to meet the requirements of the City’s MS4 Permit obligations. Volume control shall be required for proposed new impervious areas greater than one acre or redevelopment of impervious greater than one acre. If an applicant can demonstrate that the volume control standard has been met, then the water quality sizing criteria shall be considered satisfied.

8.2 Volume Control Calculations

Depending on applicability, a proposed development shall capture and retain on site 1.1 inches of runoff from the impervious surfaces in post-construction conditions for increases in impervious surface greater than one acre. For redevelopment projects, the performance goal is to capture and retain on site 1.1 inches of runoff from the new and/or fully redeveloped impervious surfaces over one acre. For projects less than one acre, the City encourages applicants to incorporate volume control or the water quality provisions to the extent feasible. For linear projects, the performance goal is to capture and retain onsite the larger of the following:

- 0.55 inches of runoff from the new and fully reconstructed impervious surfaces
- 1.1 inches of runoff from the net increase in impervious surfaces

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The use of infiltration techniques shall be prohibited where the infiltration BMP will be will receive discharges from or be in constructed in areas where:

- Industrial facilities are not authorized to infiltrate industrial storm water under an NPDES/SDS Industrial Stormwater Permit issued by the MPCA.
- Vehicle fueling and maintenance occur.
- Less than three feet of separation distance from the bottom of the infiltration system to the elevation of the seasonally saturated soils or the top of the bedrock.
- High levels of contaminant in soil or groundwater will be mobilized by the infiltrating storm water.

The use of infiltration techniques shall be restricted and subject to additional review where the infiltration BMP will be constructed in any of the following areas:

- Soils are predominately Hydrologic Soil Group D (clay) soils.
- Drinking Water Supply Management Areas are present, as defined by Minn. R. 4720.51000, subp.13, unless precluded by a local unit of government with an MS4 permit.
- Within 1,000 feet up-gradient, or 100 feet down-gradient of active karst features.
- Soil infiltration rates are more than 8.3 inches per hour unless soils are amended to flow the infiltration rate below 8.3 inches per hour.

Where the site factors listed above limit the construction of infiltration systems, the project proposer shall provide appropriate documentation to the City regarding the limitations. If the City determines that infiltration is restricted or prohibited onsite, the applicant shall consider alternative volume reduction STPs according to the MIDS flexible treatment options outlined below, in addition to the MIDS Design Sequence Flowchart (Appendix D).

8.2.1 MIDS Flexible Treatment Options:

Option 1:

- Applicant attempts to comply with the following conditions:
 - Achieve at least 0.55 inch volume reduction goal, and
 - Remove 75 percent of the annual total phosphorus load, and
 - Options considered and presented shall examine the merits of relocating project elements to address varying soil conditions and other constraints across the site.

Option 2:

- Applicant attempts to comply with the following conditions:
 - Achieve volume reduction to the maximum extent practicable (as determined by the Local Authority), and
 - Remove 60 percent of the annual total phosphorus load, and
 - Options considered and presented shall examine the merits of relocating project elements to address varying soil conditions and other constraints across the site.

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Option 3:

- Off-site mitigation (including banking or cash or treatment on another project, as determined by the local authority) equivalent to the volume reduction performance goal can be used in areas selected in the following order of preference:
 - Locations that yield benefits to the same receiving water that receives runoff from the original construction activity.
 - Locations within the same Department of Natural Resources (DNR) catchment area as the original construction activity.
 - Locations in the next adjacent DNR catchment area up-stream.
 - Locations anywhere within the local authority's jurisdiction.

If off-site mitigation is required, mitigation projects will be chosen in the following order of preference:

1. Locations that yield benefits to the same receiving water that receives runoff from the original construction activity.
2. Locations within the same Department of Natural Resource (DNR) catchment area as the original construction activity.
3. Locations in the next adjacent DNR catchment area up-stream.
4. Locations anywhere within the City of Coon Rapids.

In addition, mitigation projects shall ensure the following requirements are met:

- Mitigation projects shall involve the establishment of new structural storm water BMPs, or the retrofit of existing structural storm water BMPs, or the use of a properly designed regional structural storm water BMP.
- Previously required routine maintenance of structural storm water BMPs cannot be considered mitigation.
- Mitigation projects must be finished within 24 months after the original construction activity begins.
- A maintenance agreement specifying the responsible party for long-term maintenance shall be identified.

8.3 Water Quality Control

For new development, the water quality control standard shall be considered satisfied if the volume control standard has been satisfied. In the event that it is infeasible to meet the volume control standard due to contaminated soils, site constraints, etc., the proposed STP will need to satisfy the water quality standards using the MIDS flexible treatment options as outlined above, in addition to the MIDS Design Sequence Flowchart (Appendix D).

8.3.1 Rate Control

1. At a minimum, detention basins shall maintain existing flow rates for the 2-, 10-, and 100-year 24-hour rainfalls in accordance to the Atlas14 data as shown in the table below:

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Event	Rainfall/Snowmelt Depth (inches)
2-year, 24 hour	2.86
10-year, 24 hour	4.27
100-year, 24 hour	7.22
100-year, 10 day snowmelt	10.1

2. Detention basins shall be designed with capacity for the critical 100-year event, which is defined as the 100-year event that produces the highest water level among a 24 hour rainfall event or the 10-day snowmelt runoff event.
3. The maximum duration for rainfall critical event analysis shall be 24 hours except in cases where basins are landlocked, where back to back 24-hour events and the 10-day snowmelt runoff event shall also be used. In all cases, a hydrograph method of analysis should be used. For the 24-hour rainfall event, or back to back 24-hour rainfall events, an SCS Type II distribution should be used. For shorter duration critical events other distributions may be used with the approval of the City Engineer.
4. All drainage system analyses and designs shall be based on proposed full development land use patterns.
5. Development adjacent to a landlocked basin and the basin is not provided an outlet, freeboard should be determined based on one of three methods (whichever provides for the highest freeboard elevation):
 - a. Three feet above the HWL determined by modeling back to back 100- year, 24-hour events,
 - b. Three feet above the highest known water level, or
 - c. Five feet above the HWL determined by modeling a single 100-year, 24- hour event.
6. When modeling landlocked basins, the starting water surface elevation should be the basins Ordinary High Water elevation, which can be determined through hydrologic modeling or, in the case of a DNR regulated basin, from a DNR survey.
7. For basins with a suitable outlet, freeboard will be two feet above the HWL determined by modeling the 100-year critical event. Emergency overflows a minimum of one and a half feet below lowest ground elevation adjacent to a structure should also be provided.
8. Adjacent to channels, creeks, and ravines, freeboard will also be two feet to the 100-year critical event elevation.
9. A Type II 24-hour rainfall distribution with average antecedent moisture conditions should be utilized for runoff calculations.
10. The recommended minimum outlet diameter is six inches due to plugging susceptibility and may supersede the rate control requirement for the 2-year event.
11. City standard detail plates should be utilized for pond outlet structures.
12. Outlet structures should be designed in three phases with primary outlet structure and secondary overflow structure routed to the storm sewer and a defined emergency overflow as the tertiary outlet structure.

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8.4 Freeboard

Elevation separations of buildings with respect to ponds, lakes, streams, and storm water features shall be designed as follows:

1. At least two feet of vertical separation is required from the low floor elevation above the 100-year high water elevation and DNR Ordinary High Water level (if applicable) for the area providing the structure is flood proofed in accordance with Section 11.60 of the City Code. Drainage easements and outlots for ponds, lakes, wetlands, streams, etc., shall encompass an area to the calculated two foot above the 100-year HWL.

8.5 Floodplain Management

The City prohibits filling activities within the 100-year floodplain that will cause an increase in the stage of the 100-year or regional flood, or cause an increase in the flood damages in the reach affected unless compensatory storage is provided and/or channel improvement is provided that will not result in the flood stage. Filling within the floodway is prohibited unless the filling meets FEMA, DNR, and Watershed District requirements, and City Code Chapter 11-1101: Floodplain Management Regulations. Applications proposing to alter the floodplain shall submit the following:

1. Conditional Use Permit and Variances
2. Cut/fill diagrams along with calculations demonstrating that the filling or alteration of the floodplain is not resulting in a reduction in the flood stage/storage. Compensatory storage may be required.
3. Approval by the CCWD.

8.6 Buffers

Buffers are required adjacent to wetlands and encouraged adjacent to 1st and 2nd order streams and lakes for projects requiring a storm water management permit as defined in City Code Chapter 11-1102: Wetland Management.

1. The following standards shall guide the creation or restoration of buffers to achieve the goals and policies of the City's Wetland Management Plan. The City Engineer may modify or waive standards depending on each project Site and goals for the wetland.
2. The buffers zones per the CCWD are as follows:
 - a. Ditches or watercourses of stream order 1, 2 – 15 feet
 - b. Ditches or watercourses of stream order 3, 4, 5 – 25 feet
 - c. Lakes – 25 feet
3. Wetland buffers shall be managed as outlined below:
 - a. Average buffer zones with a minimum width of 15 feet around existing wetlands will be required for all new or redevelopment as follows:
 - i. Preserve – 40 feet

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- ii. Manage 1 – 25 feet for wetlands less than two acres; 35 feet for wetlands larger than two acres.
 - iii. Manage 2 – 15 feet for wetlands less than two acres; 25 feet for wetlands larger than two acres
 - iv. Manage 3 – 15 feet
 - v. Restore – 25 feet
 - vi. Storm Ponds – 15 feet
- b. These buffer zones will be platted as easements and marked with monumentation. Public trails or sidewalks that are a maximum of 10 feet in width can be included within the buffer provided the designated buffer width is maintained. Private access to a water body will be allowed provided that the dock or access is no more than 30 feet wide along the shoreline or one-half the width of the lot, whichever is less. Public water body access is not regulated by this ordinance. Storm water ponds are allowed within the buffer. A buffer commensurate with the width required for the wetland impacted is also required around newly created wetland mitigation sites. If the applicant believes that implementation of the buffer is a hardship, the applicant may apply for a variance in accordance with subsection 11-304.9.
- c. Buffer strip vegetation should be appropriate to the goals for the water body. Where acceptable natural vegetation exists in buffer strip areas, the retention of such vegetation in an undisturbed state is preferred. The Minnesota PCA’s manual “Plants for Storm water Design: Species Selection for the Upper Midwest” provides guidance on buffer plant selection.

8.7 Shoreland Management

The City code has established setbacks for placement of structures and impervious surfaces and also requirements for shoreland alterations. The City also encourages the following for work occurring within the shoreland zone:

1. Encourage the use of natural vegetation or bioengineering techniques for the stabilization of shorelines.
2. Use materials such as granite or fieldstone for shoreline stabilization project where hard armoring is necessary.
3. Encourage the use of techniques that will minimize runoff and improve water quality associated with new development and redevelopment. When possible use existing natural drainage ways, wetlands, and vegetated soil surfaces to convey, store, filter, and retain storm water runoff before discharge to public waters. When development density, topographic features, and soil and vegetation conditions are not sufficient to adequately handle storm water runoff using natural features and vegetation, various types of constructed facilities such as diversions, settling basins, skimming devices, dikes, waterways, and ponds may be used. Preference shall be given to designs using surface drainage, vegetated filter strips, bioretention areas, rainwater gardens, enhanced swales, off-line retention areas, and natural depressions for infiltration rather than buried pipes

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and human-made materials and facilities (*MnDNR Alternative Shoreland Standards, 2005*).

8.8 Long Term Inspection and Maintenance of Storm Water Facilities

1. No private storm water facilities may be approved unless a maintenance plan is provided that defines how access will be provided, who will conduct the maintenance, the type of maintenance and the maintenance intervals. At a minimum, all private storm water facilities shall be inspected annually and maintained in proper condition consistent with the performance goals for which they were originally designed and as executed in the storm water facilities maintenance agreement.
2. Access to all storm water facilities must be inspected annually and maintained as necessary. The applicant shall obtain all necessary easement or other property interests to allow access to the facilities for inspection or maintenance for both the responsible party and the City of Coon Rapids.
3. All settled materials including settled solids, shall be removed from ponds, sumps, grit chambers, and other devices, and disposed of properly.

9 STORM WATER TREATMENT PRACTICE DESIGN STANDARDS

9.1 Storm Sewers

1. Manhole spacing shall not exceed 400 feet.
2. Where more than one pipe enters a structure, a catch basin/manhole shall be used.
3. Storm sewer pipe should match top of pipe on top of pipe unless grade constraints prevent this. In that case, hydraulic calculations will be necessary to verify that excessive surcharging will not occur.
4. Storm water pipes shall be designed utilizing the Rational Method. Channel design shall be hydrograph method only. All methods are subject to the City Engineer's approval.
5. Lateral systems shall be designed for the 10-year rainfall using the Rational Method. State Aid roadway storm sewer shall be designed per State Aid requirements.
6. The minimum full flow velocity within the storm sewer should be three feet per second (fps). The maximum velocity shall be 10 fps, except when entering a pond, where the maximum velocity shall be limited to six fps.
7. Trunk storm sewer should be designed at a minimum to carry 100-year pond discharge in addition to the 10-year design flow for direct tributary areas. The following table shall be used for the calculation of peak rates using the Rational Method:

Cover Type	10-Year Runoff Coefficient
Single-family Residential	0.4
Multi-family Residential	0.5
Commercial	0.7
Industrial	0.7
Parks, Open Space	0.2
Ponds, Wetlands	1.0

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8. For storms greater than the 10-year event, and in the case of plugged inlets, transient street ponding will occur. For safety reasons, the maximum depth in streets should not exceed one and a half feet at the deepest point.
9. To promote efficient hydraulics within manholes, manhole benching shall be provided to half the diameter of the largest pipe entering or leaving the manhole.
10. Vaned grate catch basin castings shall be used on all streets.
11. The maximum design flow at a catch basin for the 10-year storm event shall be three cubic feet per second (cfs), unless high capacity grates are provided. Catch basins at low points will be evaluated for higher flow with the approval of the City Engineer.
12. All structures located in the street are to be a minimum of four-feet-deep (rim to invert) and a minimum of three-feet-deep elsewhere. Two-by-three catch basins are to be four-feet-deep.

9.2 Outlet and Inlet Pipes

1. Inlet pipes of storm water ponds shall be extended to the pond normal water level whenever possible.
2. Outfalls with velocities greater than four fps into channels, where the angle of the outfall to the channel flow direction is greater than 30-degrees, requires energy dissipation or stilling basins.
3. Outfalls with velocities of less than four fps, that project flows downstream into a channel in a direction 30-degrees or less from the channel flow direction, generally do not require energy dissipaters or stilling basins, but will require riprap protection.
4. In the case of discharge to channels, riprap shall be provided on all outlets to an adequate depth below the channel grade and to a height above the outfall or channel bottom. Riprap shall be placed over a suitably graded filter material and filter fabric to ensure that soil particles do not migrate through the riprap and reduce its stability. Riprap shall be placed to a thickness at least two and a half times the mean rock diameter to ensure that it will not be undermined or rendered ineffective by displacement. If riprap is used as protection for overland drainage routes, grouting may be recommended.
5. Discharge velocity into a pond at the outlet elevation shall be six fps or less. Riprap protection is required at all inlet pipes into ponds from the NWL to the pond bottom.
6. Where outlet velocities to ponds exceed six fps, the design should be based on the unique site conditions present. Submergence of the outlet or installation of a stilling basin approved by the City is required when excessive outlet velocities are experienced.

9.3 Channels and Overland Drainage

1. Overland drainage routes where velocities exceed four fps should be reviewed by the City Engineer and approved only when suitable stabilization measures are proposed.
2. Open channels and swales are recommended where flows and small grade differences prohibit the economical construction of an underground conduit. Open channels and swales can provide infiltration and filtration benefits not provided by rip rap.
3. The minimum grade in all unpaved areas shall be two percent.
4. Maximum length for drainage swales shall be 400 feet.

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5. Channel side slopes should be a maximum of 4:1 (horizontal to vertical) with gentler slopes being desirable.
6. Riprap shall be provided at all points of juncture, particularly between two open channels and where storm sewer pipes discharge into a channel.
7. Open channels should be designed to handle the expected velocity from a 10-year design storm without erosion. Riprap may need to be provided.
8. Periodic cleaning of an open channel is required to ensure that the design capacity is maintained. Therefore, all channels shall be designed to allow easy access for equipment.

9.4 Ponds

1. Where on-site water quality detention basins are required, copies of the calculations determining the design of the basin(s) will be provided. The size and design considerations will be dependent on the receiving water body's water quality category, the imperviousness of the development and the degree to which on-site infiltration of runoff is achieved. Design of on-site detention basins, as described in the site's runoff water management plan, shall incorporate recommendations from the nationwide urban runoff program (NURP) and "Protecting Water Quality in Urban Areas", published by the Minnesota pollution control agency, as adopted by the City, or the applicable publications, as adopted by the City. The following design considerations are required for on-site water quality detention basins based on the receiving water's water quality category. These designs include permanent detention for water quality treatment; extended detention designs may be substituted provided that they provide treatment equivalent to the requirements below:
 - a. A permanent pool (dead storage) volume below the normal outlet shall be greater than or equal to the runoff from a two and one-half inch 24-hour storm over the entire contributing drainage area assuming full development.
 - b. A permanent pool average depth (basin volume/basin area) which shall be greater than four feet, with a maximum depth of less than 10 feet.
 - c. An emergency spillway (emergency outlet) adequate to control the 100-year frequency critical duration rainfall event.
 - d. Basin side slopes above the normal water level should be no steeper than 3:1 when possible, and preferably flatter. A basin shelf with a minimum width of 10 feet and a maximum slope of 10:1 below the normal water level is recommended to enhance wildlife habitat, reduce potential safety hazards, and improve access for long term maintenance.
 - e. To prevent short circuiting, the distance between the major inlets and normal outlet shall be maximized.
 - f. A flood pool (temporary storage) volume above the principal outlet spillway shall be adequate so that the peak discharge rate from the 1-, 10- and 100-year frequency critical duration storm is not greater than the peak discharge for a similar storm and predevelopment watershed conditions.
 - g. Extended detention of runoff from the more frequent (1-year to 5-year) storms shall be achieved through a principal spillway design which shall include a perforated vertical riser, a small orifice outlet or a compound weir. The spillway must be

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- constructed of a limited maintenance material. The use of treated or naturally decay resistant timber shall not be allowed.
- h. Effective energy dissipation devices which reduce outlet velocities to four feet per second or less shall consist of riprap, stilling pools or other such measures to prevent erosion at all storm water outfalls into the basin and at the detention basin outlet.
 - i. Trash and floatable debris skimming devices shall be placed on the outlet of all on site detention basins to provide treatment up to the critical duration 10-year storm event. These devices can consist of baffled weirs, submerged inlets or other such measures capable of restricting the overflow of floatable materials, including litter, oil and grease. The skimming device must be constructed of a limited maintenance material. The use of treated or naturally decay resistant timber shall not be allowed. Computations for the design of such devices shall be included. The maximum velocity through the skimming device shall be less than one foot per second (fps) on the 2-year 24-hour event.
 - j. For purposes of erosion control, vegetation protection and wildlife habitat enhancement, the 10-year flood level of the basin shall be no more than two feet above the normal level of the basin.
 - k. All constructed ponds shall be provided a maintenance access from an adjacent roadway. The maintenance access shall be provided in the form of an easement no narrower than 20 feet. The maintenance access shall have a longitudinal slope no steeper than 6:1 and minimal cross slope. Maintenance access routes, due to their extra width, also serve well as emergency overflow (EOF) routes.

9.5 Infiltration/Filtration Practices

1. Sizing of filtration/infiltration practices, or STPs, shall be in conformance with the volume control requirements of these Engineering Design Guidelines and the *Minnesota Stormwater Manual*.
2. When designing an infiltration practice for volume control and water quality management, on-site testing and detailed analysis are strongly encouraged in order to determine the infiltration rates of the proposed infiltration facility. Documented site-specific infiltration or hydraulic conductivity measurements (double-ring infiltrometer) completed by a licensed soil scientist or engineer is required. In the absence of a detailed analysis, the saturated infiltration rates listed in the Infiltration Rates for Infiltration STPs table found on the *Minnesota Stormwater Manual* shall be used. A piezometer shall be installed in order to ascertain the level of the local groundwater table and demonstrate at least three feet of separation between the bottom of the proposed facility and the groundwater. The soil boring is required to go to a depth of at least five feet below the proposed bottom of the STP. The soils shall be classified using the Unified Soil Classification system. The least permeable soil horizon will dictate the infiltration rate. Infiltration practices shall be designed to infiltrate the required runoff volume within 48 hours.
3. Pretreatment, in the form of ponds, forebays, filter strips, or other approved methods, shall be provided for all infiltration areas. Pretreatment upstream of volume management practices is a key element in the long-term viability of infiltration areas. The level of

Engineering Design Standards

pretreatment varies largely depending on the STP and drainage area, CCWD, City staff, and *Minnesota Stormwater Manual* recommendations shall be utilized for determining the appropriate level of pretreatment on a case-by-case basis.

4. The infiltration practice shall not be used within 50 feet of a municipal, community or private well, unless specifically allowed by an approved wellhead protection plan.
5. The infiltration practice shall not be used for runoff from fueling and vehicle maintenance areas and industrial areas with exposed materials posing contamination risk, unless the infiltration practice is designed to allow for spill containment and oil/grit separators are used to remove coarse sediment, oils and grease from storm water prior to delivery to the infiltration/filtration feature.
6. The infiltration practice shall not be used in Hydrologic Soil Group (HSG) D soils without soil corrections.
7. Vegetation of infiltration/filtration practices shall be as shown in the City of Coon Rapids Standard Details. A plan for management of vegetation shall be included in the Storm Water Pollution Prevention Plan.
8. If soils are unsuitable for infiltration, then filtration may be used with drain tile, provided in accordance with the City of Coon Rapids Standard Details.
9. Subgrade soils for infiltration/filtration practices shall be as presented in the City of Coon Rapids Standard Details. Assume a 40 percent void ratio for clean washed rock and 20 percent for construction sand for the purposes of volume calculations.
10. Rock storage beds shall be constructed using crushed angular granite that has been thoroughly washed to remove all fine particles that could result in clogging of the system.
11. For infiltration benches adjacent to ponds, benches shall have slopes no steeper than 5:1 over the proposed infiltration zone. A slope of 10:1 is preferred. The *Minnesota Stormwater Manual* cites concerns with locating infiltration features immediately adjacent to ponds. To address this, benches shall be located to maintain hydraulic separation from the saturated zone of the pond in order to minimize the loss of infiltration potential over time.

9.6 Emergency Overflow Paths

1. EOFs shall be sized with a minimum bottom width of five feet and 4:1 side slopes.
2. The maximum flow depth in EOFs shall be less than or equal to one foot as calculated for a 100-year back-to-back storm event.

10 DESIGN EXAMPLES

The design process for each of the acceptable Storm Water Treatment Practices is detailed in the *Minnesota Stormwater Manual*, http://stormwater.pca.state.mn.us/index.php/Main_Page.

11 STORM WATER TREATMENT PRACTICE DETAIL DRAWINGS

Please refer to the City of Coon Rapids' Engineering Details for the following:

- Bioretention

Engineering Design Standards

- Sand Filter System
- Wet & Dry Swale
- Infiltration Trench
- Infiltration Basin
- Storm Water Pond/Wetland

12 CONSTRUCTION SPECIFICATIONS

Construction specifications and details are found in the *Minnesota Stormwater Manual* for each of the acceptable STPs, unless otherwise restricted by these Engineering Design Guidelines.

13 CHECKLISTS

Refer to Appendix A & B

- Checklists for Construction Inspection and Operation & Maintenance
- Construction Inspection and Operation & Maintenance Checklists for each of the approved Storm water Treatment Practices are available in the *Minnesota Stormwater Manual*.

City of Coon Rapids Site Plan Review

Address:		Permit No:	
PID:		Date Approved:	
Date Received:		Signature:	
Site Size (acres):		Area of Disturbance(acres):	
Existing Impervious (acres):		Proposed Impervious (acres):	

Submittals Received

Date	Document	Author

General Site Plan		
	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Scale of Survey. Minimum scale 1" = 50'. Maximum size plan sheet 24" x 36"		
Survey signed by a registered survey with elevations in NGVD-1929 datum for the following locations:		
<ul style="list-style-type: none"> • Each lot corner 		
<ul style="list-style-type: none"> • Grade elevation at the foundation and elevation of top of foundation of structures on adjacent lots 		
<ul style="list-style-type: none"> • Grade elevation at the foundation, elevation of top of foundation and garage floor of proposed new construction 		
<ul style="list-style-type: none"> • Lowest point of entry (i.e. door sill or top of window well) of proposed and existing construction 		
<ul style="list-style-type: none"> • Lowest floor of proposed and existing construction 		
Any proposed retaining wall must have a top and bottom elevation and bottom elevation would be finish grade. Also, no retaining wall is allowed to be built on private property		
Retaining walls greater than 4.0 feet in height have been designed and certified by a licensed professional engineer and a building permit has been acquired		
Easements are clear of any encroachments?		
New curb cuts proposed? If new curb cut is proposed, stamp all survey maps with the curb cut stamp. Also, write a note on the Residential Plan & Routing Approval form reminding the builder that a curb cut permit is required if the driveway is moved or a new driveway is added		
Low floor a minimum of 4.25' (feet) above the sanitary sewer invert elevation		

Comments:

Erosion Control Plan		
	Yes ✓	No ✓
SWPPP notes provided on the plan		
Temporary stabilization measures provided		
Erosion control blankets provided on all slopes greater than 3:1		
Perimeter Control i.e., Silt Fence, Filter Log, etc.		
Phasing for sites that are ≥ 1 acre		
CB Inlet Protection		
Dewatering		
Sediment control		
Waste control		
Concrete washout		
Rock entrance		
Street sweeping schedule		
Permanent restoration plan		
SWPPP includes an erosion and sediment control inspection schedule and person responsible for maintenance		

Comments:

Stormwater Management Plan		
	Yes ✓	No ✓
Delineation map		
Modeling calculations for existing and proposed conditions		
<ul style="list-style-type: none"> • 2, 10, 100, Snowmelt • Modeled direct connected impervious separate 		
Off-site drainage included		
Wetlands shown on plans and wetland permitting completed		
Pretreatment		
Skimmer structures provided on the outlets of all ponds.		
Soil borings		
Design Infiltration Rate Determination		
Seasonal High Water Elevation		

Comments:

Water Quality		
	Yes ✓	No ✓
Volume control provided as per the Coon Creek Watershed District		
Sequencing provided for alternatives where infiltration is infeasible		
Required Water Quality Volume:		
Provided Water Quality Volume:		

Comments:

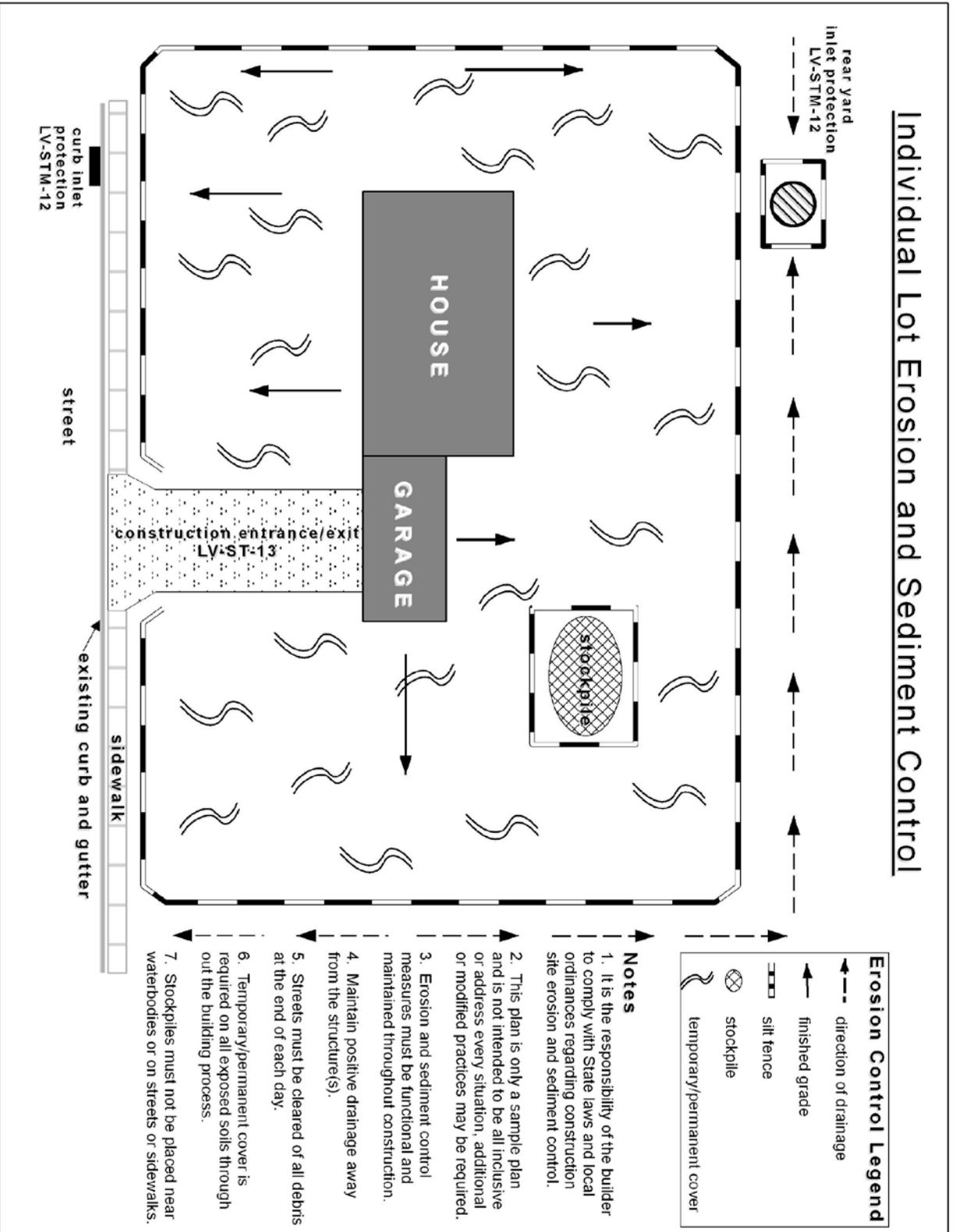
Rate Control		
	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Peak Discharge Rates < Existing		

Comments:

Freeboard		
	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Building Opening:		
<ul style="list-style-type: none"> • 3' above the critical 100-yr HWL of local basins, wetlands, & infiltration basins 		
<ul style="list-style-type: none"> • 2' above EOF of local basins, wetlands, & infiltration basins 		
<ul style="list-style-type: none"> • 2' above the 100-yr flow elevation of a swale or channel at the point where the swale channel is closest to the building 		
Low Floor Elevation:		
<ul style="list-style-type: none"> • 2' above the critical 100-yr HWL of major basins 		
<ul style="list-style-type: none"> • 2' above EOF of major basins 		
<ul style="list-style-type: none"> • For landlocked basins: 2' above the HWL from back to back 100-yr rainfalls or 2' above the HWL from the 100-yr 10-day snowmelt, whichever is higher. Starting elevation of the basin/waterbody prior to runoff is one of the following: 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ○ Existing Ordinary High Water level established by the Minnesota Department of Natural Resources 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ○ Annual water balance calculation approved by the City 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ○ Local observation well records, as approved by the City 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ○ Mottled soil 		

Comments:

Individual Lot Erosion and Sediment Control



Erosion Control Legend

- direction of drainage
- finished grade
- ▬ silt fence
- ⊗ stockpile
- ▭ temporary/permanent cover

Notes

1. It is the responsibility of the builder to comply with State laws and local ordinances regarding construction site erosion and sediment control.
2. This plan is only a sample plan and is not intended to be all inclusive or address every situation, additional or modified practices may be required.
3. Erosion and sediment control measures must be functional and maintained throughout construction.
4. Maintain positive drainage away from the structure(s).
5. Streets must be cleared of all debris at the end of each day.
6. Temporary/permanent cover is required on all exposed soils throughout the building process.
7. Stockpiles must not be placed near waterbodies or on streets or sidewalks.

Construction Site Stormwater Runoff ESC Inspection Form

Site Name:	Permit No.:	Inspector(s):
Address:	Inspection Date: ____ / ____ / ____ Time: _____ am/pm	Photos Taken? <input type="checkbox"/> Yes <input type="checkbox"/> No
Owner:	Weather:	Date of Last Inspection: ____ / ____ / ____
Contractor:	Priority Area: <input type="checkbox"/> Yes <input type="checkbox"/> No	Last Rain Date: ____ / ____ / ____ Amount: _____(inches)
Inspection Reason: <input type="checkbox"/> Routine <input type="checkbox"/> Complaint <input type="checkbox"/> Spot-Check	Today's Rainfall Amount : _____(inches)	Rainfall Data Source : <input type="checkbox"/> On-site Gauge <input type="checkbox"/> Weather Station w/in 1 mile

	BMP	Compliant?	Maintenance Required?	Corrective Action(s) Needed & Notes	Date Corrected
1.	Perimeter controls installed/maintained?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		
2.	Natural features are protected with a BMP?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		
3.	Storm drain inlets are properly protected?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		
4.	Stockpiles protected and not placed in a conveyance?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		
5.	Construction entrance prevents tracking?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		
6.	Trash/litter collected and contained?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		
7.	Non-active disturbed areas are stabilized?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		
8.	Discharge points are free of sediment deposits?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		
9.	Washout facilities are available/used?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		
10.	Vehicle fueling areas are free of leaks and spills?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		
11.	Potential contaminants are protected?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		

BMP		Compliant?	Maintenance Required?	Corrective Action(s) Needed & Notes	Date Corrected
12.	Any evidence of discharges?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		
13.	Portable toilets are upright and secure?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		
15	Dewatering activities are using appropriate BMPs to avoid scour and selected chemicals are suited to soil types?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		
16.	SWPPP on site?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		
17.	Inspection reports available?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		
18.	Training documentation is available?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		
19.	Other:	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		
20.	Other:	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		
Additional Comments:					

CITY OF COON RAPIDS
COUNTY OF ANOKA
STATE OF MINNESOTA

**STORMWATER FACILITIES MAINTENANCE AGREEMENT
WITH ACCESS RIGHTS AND COVENANTS**

(_____ Insert Project Reference Numbers _____)

This AGREEMENT, made and entered into this ___ day of _____, 20___, for the maintenance and repair of certain Stormwater Management Facilities is entered into between

_____ (hereinafter referred to as "OWNER") and the City of Coon Rapids (hereinafter referred to as "CITY") for the benefit of the CITY, the OWNER, the successors in interest to the CITY or the OWNER, and the public generally.

WITNESSETH

WHEREAS, the undersigned is the owner of that certain real property lying and being in the _____ Land Lot/District, _____ identified as [Tax Map/Parcel Identification Number] _____ and being more particularly described by deed as recorded in the land records of the City of Coon Rapids, Minnesota, Deed Book _____ Page _____, hereinafter called the "Property".

WHEREAS, the undersigned is proceeding to build on and develop the property; and has submitted the Site Plan/Subdivision Plan known as _____, (Name of Plan/Development) hereinafter called the "Plan", which is expressly made a part hereof, as approved or to be approved by the City, provides for detention of stormwater within the confines of the property; and

WHEREAS, the City and the undersigned, its successors and assigns, including any homeowners association, (hereinafter the "Landowner") agree that the health, safety, and welfare of the residents of the City of Coon Rapids, Minnesota, requires that on-site stormwater management facilities be constructed and maintained on the Property; and

WHEREAS, the City requires that on-site stormwater management facilities as shown on the Plan (the "Facilities") be constructed and adequately maintained by the Landowner.

NOW, THEREFORE, in consideration of the foregoing premises, the mutual covenants contained herein, and the following terms and conditions, the parties hereto agree as follows:

- (1) When a new drainage control facility is installed, the party having the facility installed shall obtain a copy of the as-built plans from the City of Coon Rapids Engineering Department. Responsible parties shall make records of the installation and of all maintenance and repair, and shall retain the records for at least ten years. These records shall be made available to the City of Coon Rapids' City Engineer during Inspection of the facility and at other reasonable times upon request of the City Engineer.

- (2) The following operational maintenance activities shall be performed on all permitted systems on a regular basis or as needed:
 - a) Removal of trash and debris,
 - b) Inspection of inlets and outlets,
 - c) Removal of sediments when the storage volume or conveyance capacity of the stormwater management system is below design levels
 - d) Ensure systems designed for infiltration are drawing down within 48 hours, and
 - e) Stabilization and restoration of eroded areas.

- (3) Specific operational maintenance activities are required, depending on the type of permitted system, in addition to the practices listed in subsection (2), above.
 - a) Retention, swale and underdrain systems shall include provisions for:
 1. Mowing and removal of grass clippings, and
 2. Aeration, tilling, or replacement of topsoil as needed to restore the percolation capability of the system. If tilling or replacement of the topsoil is utilized, vegetation must be established on the disturbed surfaces.
 - b) Exfiltration systems shall include provisions for removal of sediment and debris from pretreatment or sediment collection systems.
 - c) Wet detention systems shall include provisions for operational maintenance of the littoral zone. Replanting shall be required if the percentage of vegetative cover falls below the permitted level. It is recommended that native vegetation be maintained in the littoral zone as part of the system's operation and maintenance plan. Undesirable species such as cattail and exotic plants should be controlled if they become a nuisance.
 - d) Dry detention systems shall include provisions for mowing and removal of grass clippings.

- (4) If the system is not functioning as designed and permitted, operational maintenance must be performed immediately to restore the system. If operational maintenance measures are insufficient to enable the system to meet the design and performance standards of this chapter, the permittee must either replace the system or construct an alternative design.

- (5) In the event the Landowner fails to maintain the Facilities in good working condition acceptable to the City, the City may enter upon the Property and take such steps as are necessary to correct deficiencies identified in the inspection report and to charge the costs of such repairs to the Landowner. This provision shall not be construed to allow the City to erect any structure of permanent nature on the land of the Landowner outside of the easement for the stormwater management facilities. It is expressly understood and agreed that the City is under no obligation to routinely maintain or repair said facilities, and in no event shall this Agreement be construed to impose any such obligation on the City. The Landowner grants to the City, its authorized agents and employees, a non-exclusive, perpetual easement over, across, under and through the Property for such purposes.

IN WITNESS THEREOF, the parties hereto acting through their duly authorized agents have caused this Agreement to be signed, sealed and delivered:

(Insert Company/Corporation/Partnership Name) [SEAL]

By: (Type Name and Title)

The foregoing Agreement was acknowledged before me
this ____ day of _____, 20____, by

Unofficial Witness

NOTARY PUBLIC

My Commission Expires: _____
CITY OF COON RAPIDS, MINNESOTA

**ATTACHMENT 1: CITY OF COON RAPIDS
GENERAL ENGINEERING STANDARDS FOR STORM WATER
TREATMENT FACILITIES**

The following are the maintenance requirements for the proper operation of water quality treatment structures provided by the *Minnesota Stormwater Manual*, as amended, and the *Minnesota BMP Manual*, as amended:

Pond Maintenance Requirements

1. Annual inspection, maintenance reporting and certification by a professional engineer (Provided by Owner). Information must be submitted to the City annually.
2. Excavate pond to original design capacity when one half (1/2) of the wet volume of the pond is lost due to sediment deposition.
3. Remove floatable debris in and around the pond area including, but not limited to: oils, gases, debris and other pollutants.
4. Maintain landscape adjacent to the facility per original design, including but not limited to: maintenance of the buffer strip and other plant materials as per original plan design.
5. Maintenance of all erosion control measures including but not limited to: rip rap storm sewer outlets, catch basin inlets, etc.

Environmental Manhole Maintenance Requirements

1. Annual inspection, maintenance reporting and certification by a professional engineer (Provided by Owner). Information must be submitted to the City annually.
2. Maintenance should be performed once the sediment or oil depth exceeds the established requirements recommended by the manufacturer.
3. Maintenance should occur immediately after a spill takes place. Appropriate regulatory agencies should also be notified in the event of a spill.
4. Disposal of materials shall be in accordance with local, state and federal requirements as applicable.

Rain Garden Maintenance Requirements

1. Inlet and Overflow Spillway – Remove any sediment build-up or blockage and correct any erosion.
2. Vegetation
 - a. Maintain at least 80% surface area coverage of plants approved per plan.
 - b. Removal of invasive plants and undesirable woody vegetation.
 - c. Removal of dried, dead and diseased vegetation.
 - d. Re-mulch void or disturbed/exposed areas.
3. Annual inspection and maintenance efforts must be documented and submitted to the City.

Filtration Basin Maintenance Requirements

1. Sweep sediment from parking lot 4 times per year
2. Ongoing and as needed:
 - a. Prune and weed to maintain appearance
 - b. Remove trash and debris
 - c. Maintain at least 80% surface area coverage of plants approved per plan.
 - d. Removal of invasive plants and undesirable woody vegetation.
 - e. Removal of dried, dead and diseased vegetation.
 - f. Re-mulch void or disturbed/exposed areas.
3. Semi-annually:
 - a. Remove sediment from inflow points (off-line systems)
 - b. Inspect aggregate filter system and clean as needed
 - c. Shrubs should be inspected to evaluate health. Remove dead and diseased vegetation.
4. Annually:
 - a. Inspect and remove any sediment and debris build-up in pre-treatment areas
 - b. Inspect inflow points and bioretention surface for buildup of road sand associated with spring melt period. Remove and replant as necessary.
5. 2 to 3 years:
 - a. Test pH of planting soils. If pH is below 5.2, add limestone. If pH is 7.0 to 8.0, add iron sulfate plus sulfur.
6. Annual inspection and maintenance efforts must be documented and submitted to the City.

MIDS DESIGN SEQUENCE FLOW CHART

- Conduct Site Review:**
- Aerial Photos and Topographic Maps
 - County Soil Surveys and other Soil Information as Available
 - County Geologic Atlas
 - Local Groundwater Levels
 - DWSMA and Wellhead Protection Maps
 - FEMA and Local Floodplain Maps
 - Soil Borings and Site Survey
 - MPCA Listing of Potentially Contaminated Sites
 - Phase 1 and 2 Environmental Site Assessments
 - TMDLs and Local Water Quality Standards
 - Wetland Delineations, MNRAM Assessments, and Wetland Classifications
 - Proposed Conditions, Conceptual/Preliminary Site Design
 - Local zoning and land use requirements/ordinances, including stormwater rate control requirements
 - Communication with Local Landowners, LGU, or Others Knowledgeable about the Site
 - Site Inspection

Define Performance Goal
 New and redevelopment projects: Retain on site a volume of 1.1" from impervious surfaces
 Linear projects: Retain on site the larger of 1.1" from all new, or .55" from all new and fully reconstructed (D) impervious surfaces.



MIDS Project Flexible Treatment Options (FTO)

The Flexible Treatment Options (FTO) alternatives presented here should be employed when the Performance Goal is not feasible and/or allowed. The designer should document the reasons why the Performance Goal and rejected FTO Alternatives are not feasible and/or allowed.

FTO #1
 Applicant attempts to comply with the following conditions:
 1.a. Achieve at least 0.55" volume reduction goal, and
 1.b. Remove 75% of the annual TP load, and
 1.c. Options considered and presented shall examine the merits of relocating project elements to address, varying soil conditions and other constraints across the site

FTO #2
 Applicant attempts to comply with the following conditions:
 2.a. Achieve volume reduction to the maximum extent practicable (as determined by the Local Authority), and
 2.b. Remove 60% of the annual TP load, and
 2.c. Options considered and presented shall examine the merits of relocating project elements to address, varying soil conditions and other constraints across the site.

FTO #3
 Off-site mitigation (including banking or cash or treatment on another project, as determined by the local authority) equivalent to the volume reduction performance goal can be used in areas selected in the following order of preference:
 1. Locations that yield benefits to the same receiving water that receives runoff from the original construction activity
 2) Locations within the same Department of Natural Resource (DNR) catchment area as the original construction activity
 3) Locations in the next adjacent DNR catchment area up-stream
 4) Locations anywhere within the local authorities jurisdiction

Notes:
 A. Volume reduction techniques considered shall include infiltration, rainwater harvesting & reuse, bioretention, permeable pavement, tree boxes, grass swales and/or additional techniques included in the MIDS calculator or the Minnesota Stormwater Manual.
 B. Applicant shall document the flexible treatment options decision sequence, following the order of alternatives presented here.
 C. For Alternative #2, the applicant is encouraged to use BMPs that reduce volume. Secondary preference is to employ filtration techniques, followed by rate control BMPs.
 D. Fully reconstructed impervious surfaces: Areas where impervious surfaces have been removed down to the underlying soils. Activities such as structure renovation, mill and overlay projects and other pavement rehabilitation projects that do not alter the underlying soil material beneath the structure, pavement or activity are not considered full reconstruction. In addition, other maintenance activities such as catch basin and pipe repair/replacement, lighting, and pedestrian ramp improvements shall not be considered fully reconstructed impervious surfaces. Reusing an existing building foundation and re-roofing of an existing building are not considered fully reconstructed.
 E. Soils that infiltrate too quickly may not provide sufficient pollutant removal before the infiltrated runoff enters groundwater.
 F. A reasonable attempt must be made to obtain right-of-way during the project planning process
 G. Other, this is not an exhaustive list
 H. Hotspots includes any portion of a facility where infiltration is prohibited under an NPDES/SDS industrial stormwater permit issued by the MPCA

Select FTO #3. Provide site survey, maps, regulations, and/or cost estimates documenting that meeting the original performance goal or FTO alternatives is not feasible in addition to other documentation as required by LGU.

Select FTO Alternative No. 2
 • No infiltration practices allowed
 • Explore non-infiltration volume reduction practices
 • Provide soil boring or infiltration test results documenting low infiltration rates.

Complete Design Using Performance Goal
 (As modified by FTO Alternatives, if applicable)

Bioinfiltration

There is no underdrain, so all runoff that flows into the basin and does not overflow into an overflow structure is abstracted from the stormsewer system through infiltration or evapotranspiration.

Since there is no underdrain, in-situ soils must be able to handle discharge through the soil or filter media in 48 hours or less. The period of inundation is defined as the time from the high water level in the practice to 1 to 2 inches above the bottom of the facility

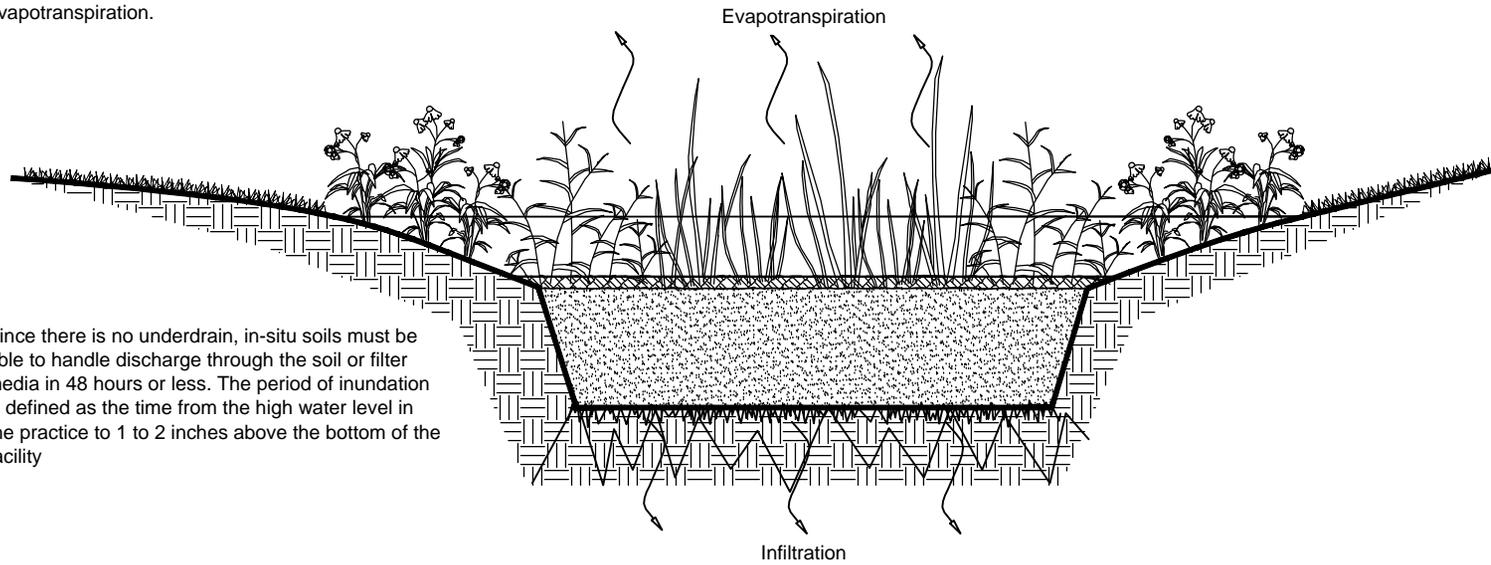
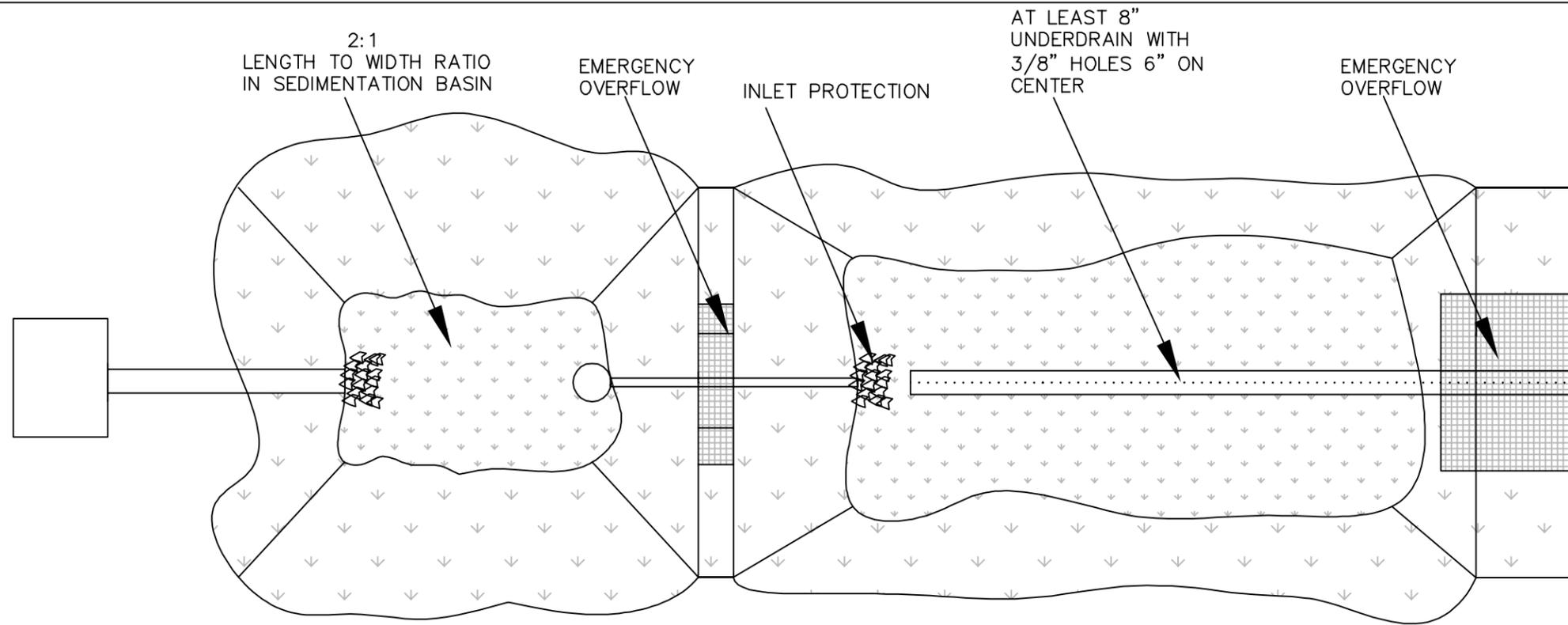


Figure 2-1: Bioinfiltration

Not To Scale

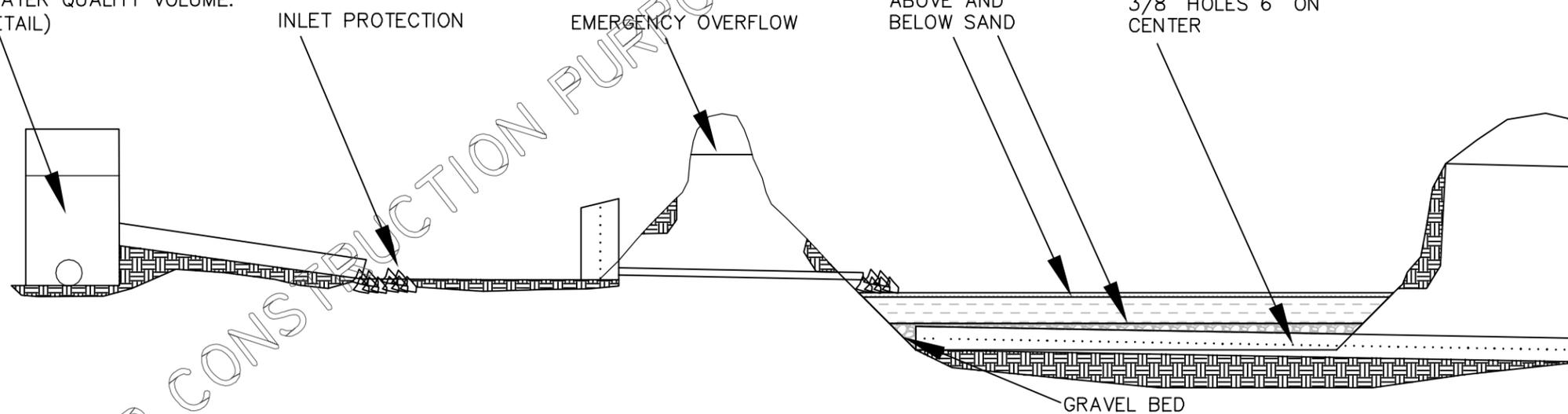
NOT FOR CONSTRUCTION PURPOSES

I hereby certify that this plan was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.		NO.	REVISION DESCRIPTION	DATE BY
Date	Print Name:			
Designed By	Sign Name:			
Drawn By	Date			
	License No.			
Sheet No.		of		
		Sheets		



PLAN

USE FLOW DIVERSION TO BYPASS FILTER FOR VOLUMES GREATER THAN WATER QUALITY VOLUME. (SEE DETAIL)



PROFILE

SURFACE SAND FILTER DETAILS

NOT TO SCALE

CONSTRUCTION SEQUENCING:

- PERFORM CONTINUOUS INSPECTIONS OF EROSION CONTROL PRACTICES.
- INSTALL SILT FENCE ALONG THE PERIMETER OF THE SITE TO PREVENT SEDIMENT FROM LEAVING THE SITE DURING THE CONSTRUCTION PROCESS.
- ALL DOWNGRADIENT PERIMETER SEDIMENT-CONTROL BMPs MUST BE IN PLACE BEFORE ANY UP GRADIENT LAND-DISTURBING ACTIVITY BEGINS.
- REMOVE TOPSOIL FROM THE SITE AND PLACE IN TEMPORARY STOCKPILE LOCATION. TEMPORARY SEED THE STOCKPILE.
- INSTALL UNDERGROUND UTILITIES (WATER, SANITARY SEWER, ELECTRIC AND PHONES) TAKING THE LOCATION AND FUNCTION OF STORM WATER BMPs INTO CONSIDERATION.
- SEED AND MULCH DISTURBED AREAS ON SITE.
- CONSTRUCT THE ROADS TAKING THE LOCATION AND FUNCTION OF STORM WATER BMPs INTO CONSIDERATION.
- PERFORM ALL OTHER SITE IMPROVEMENTS TAKING THE LOCATION AND FUNCTION OF THE STORM WATER BMPs INTO CONSIDERATION.
- FINAL GRADE THE SITE.
- STABILIZE THE SITE BY IMPLEMENTING THE NATIVE SEEDING AND PLANTING PORTION OF THE LANDSCAPING PLAN.
- INSTALL THE EROSION CONTROL BLANKET
- REMOVE THE SILT FENCE AFTER THE SITE IS STABILIZED PER PROJECT ENGINEER APPROVAL.

GENERAL NOTES:

- INSTALL ALL TEMPORARY EROSION CONTROL MEASURES (IN ACCORDANCE WITH MnDOT GENERAL CONDITIONS 2573) PRIOR TO THE START OF ANY CONSTRUCTION OPERATION THAT MAY CAUSE ANY SEDIMENTATION OR SILTATION AT THE SITE.
- INSTALL STORM DRAIN INLET PROTECTION TO PREVENT CLOGGING OF THE STORM SEWER AND SEDIMENT LOADS TO DOWNSTREAM STORM WATER FACILITIES OR WATERBODIES.
- EXCAVATE THE INFILTRATION BASIN TO THE SPECIFIED DEPTH (ELEVATION). IT IS RECOMMENDED THAT ALL SUB MATERIAL BELOW THE SPECIFIED ELEVATION SHALL BE LEFT UNDISTURBED, UNLESS OTHERWISE DIRECTED BY THE ENGINEER.
- GRADE TO THE DEPTH (ELEVATION) SPECIFIED IN THE CONSTRUCTION DOCUMENTS UNLESS OTHERWISE DIRECTED BY THE ENGINEER.
- IN THE EVENT THAT SEDIMENT IS INTRODUCED INTO THE BMP DURING OR IMMEDIATELY FOLLOWING EXCAVATION, THIS MATERIAL WILL NEED TO BE REMOVED FROM THE BASIN PRIOR TO INITIATING THE NEXT STEP IN THE CONSTRUCTION PROCESS. SEDIMENT THAT HAS BEEN WASHED INTO THE BASIN DURING THE EXCAVATION PROCESS CAN SEAL THE PERMEABLE MATERIAL, SIGNIFICANTLY REDUCING THE INFILTRATION CAPACITY OF THE SOILS.
- NON-STANDARD COMPONENT:** CLEAN, WASHED 1.5 TO 3.5-INCH GRAVEL SHALL BE PLACED IN THE BOTTOM OF THE BASIN TO THE DEPTH OF AT LEAST 12 INCHES OR AS SPECIFIED IN THE CONSTRUCTION DOCUMENTS. GRAVEL SHOULD BE PLACED IN LIFTS AND LIGHTLY COMPACTED WITH PLATE COMPACTORS.
- NON-STANDARD COMPONENT:** THE PERFORATED PIPE (UNDERDRAIN) SHALL BE LAID DIRECTLY ON THE GRAVEL BED. GRADE AND ALIGNMENT SHALL NOT VARY FROM THE PRESCRIBED GRADE BY MORE THAN 0.03 FEET (9 MM) AT ANY POINT. THE JOINTS BETWEEN SECTIONS OF PIPE SHALL BE CONNECTED IN A FASHION ACCEPTABLE TO ENGINEER. ONCE THE PIPE IS IN PLACE, IT SHALL BE COVERED IMMEDIATELY WITH GRANULAR MATERIAL AS SPECIFIED IN THE CONSTRUCTION DOCUMENTS. THE GRANULAR MATERIAL SHALL BE OF UNIFORM DEPTH ON BOTH SIDES OF THE PIPE. SPECIAL INLETS AND SPECIAL DEVICES AT THE OUTLET END OF THE PIPE SHALL BE CONSTRUCTED AS SHOWN IN THE PLANS.
- SEEDING AND INSTALLATION OF EROSION CONTROL BLANKET SHALL BE COMPLETED WITHIN 48 HOURS OF FINAL GRADING.

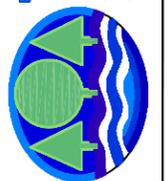
NO.	REVISION DESCRIPTION	DATE	BY

I hereby certify that this plan was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.

Print Name: _____
 Sign Name: _____
 Date: _____ License No. _____

Date: _____
 Designed By: _____
 Drawn By: _____

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 520 Lafayette Road
 St. Paul, MN 55155-4194
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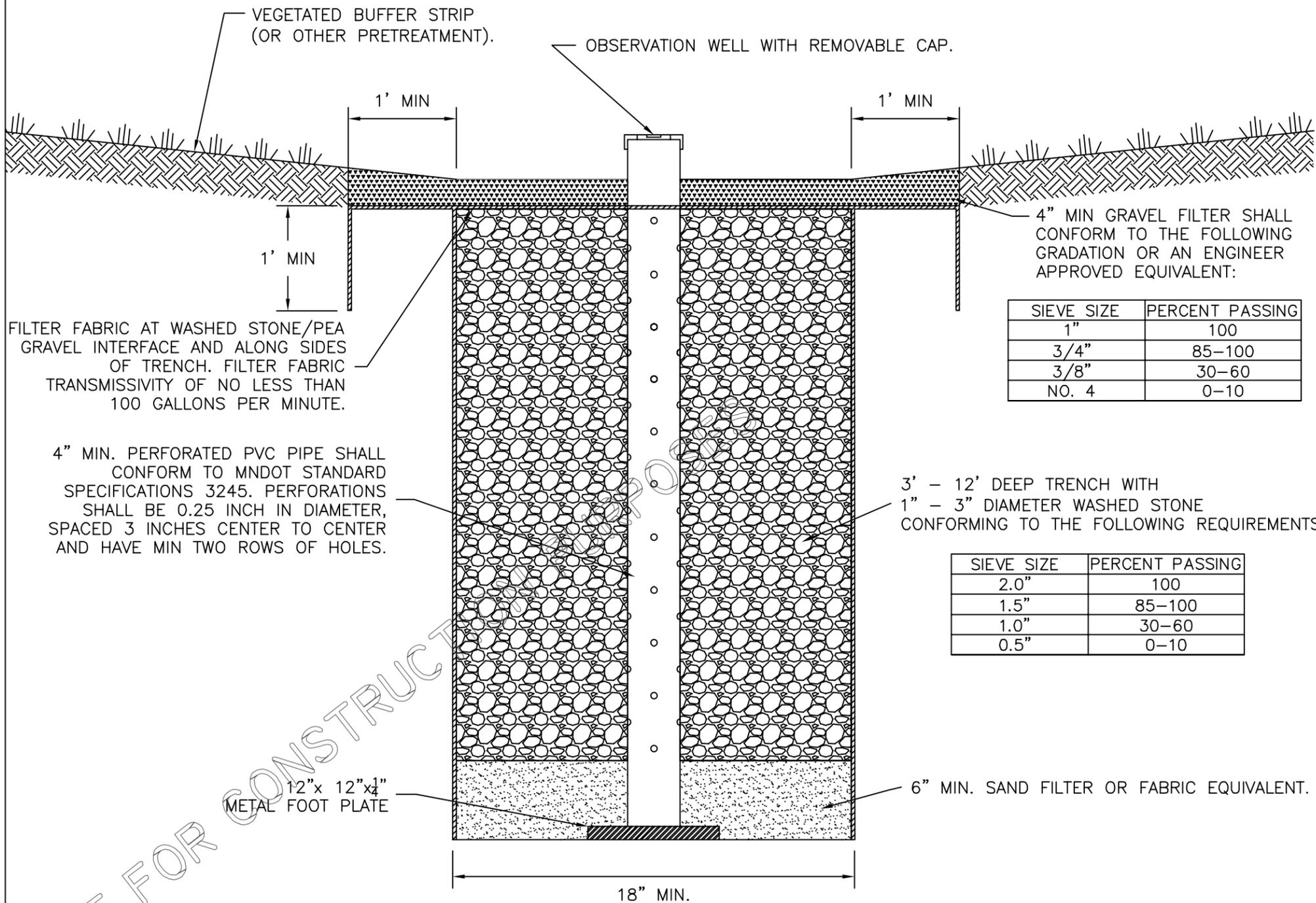


2005 MINNESOTA
 STORMWATER
 MANUAL

SURFACE
 SAND FILTER
 DETAILS

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NOT FOR CONSTRUCTION PURPOSES



FILTER FABRIC AT WASHED STONE/PEA GRAVEL INTERFACE AND ALONG SIDES OF TRENCH. FILTER FABRIC TRANSMISSIVITY OF NO LESS THAN 100 GALLONS PER MINUTE.

4" MIN. PERFORATED PVC PIPE SHALL CONFORM TO MNDOT STANDARD SPECIFICATIONS 3245. PERFORATIONS SHALL BE 0.25 INCH IN DIAMETER, SPACED 3 INCHES CENTER TO CENTER AND HAVE MIN TWO ROWS OF HOLES.

4" MIN GRAVEL FILTER SHALL CONFORM TO THE FOLLOWING GRADATION OR AN ENGINEER APPROVED EQUIVALENT:

SIEVE SIZE	PERCENT PASSING
1"	100
3/4"	85-100
3/8"	30-60
NO. 4	0-10

3' - 12' DEEP TRENCH WITH 1" - 3" DIAMETER WASHED STONE CONFORMING TO THE FOLLOWING REQUIREMENTS:

SIEVE SIZE	PERCENT PASSING
2.0"	100
1.5"	85-100
1.0"	30-60
0.5"	0-10

6" MIN. SAND FILTER OR FABRIC EQUIVALENT.

TYPICAL INFILTRATION TRENCH CROSS-SECTION

NOT TO SCALE

CONSTRUCTION SEQUENCING:

- PERFORM CONTINUOUS INSPECTION OF EROSION CONTROL PRACTICES.
- INSTALL SILT FENCE ALONG THE PERIMETER OF THE SITE TO PREVENT SEDIMENT FROM LEAVING THE SITE DURING THE CONSTRUCTION PROCESS.
- ALL DOWNGRADIENT PERIMETER SEDIMENT-CONTROL BMPS MUST BE IN PLACE BEFORE ANY UP GRADIENT LAND-DISTURBING ACTIVITY BEGINS.
- REMOVE TOPSOIL FROM THE SITE AND PLACE IN TEMPORARY STOCKPILE LOCATION. TEMPORARY SEED THE STOCKPILE.
- INSTALL UNDERGROUND UTILITIES (WATER, SANITARY SEWER, ELECTRIC AND PHONES) TAKING THE LOCATION AND FUNCTION OF STORM WATER BMPS INTO CONSIDERATION.
- ROUGH GRADE THE SITE. IF THE INFILTRATION TRENCH IS GOING TO BE USED FOR TEMPORARY SEDIMENT CONTROL, GRADE THE INFILTRATION TRENCH TO WITHIN THREE (3) FEET OF FINAL GRADE TO PREVENT CLOGGING OF INSITU SOIL.
- SEED AND MULCH DISTURBED AREAS ON SITE.
- CONSTRUCT THE ROADS TAKING THE LOCATION AND FUNCTION OF STORM WATER BMPS INTO CONSIDERATION.
- PERFORM ALL OTHER SITE IMPROVEMENTS TAKING THE LOCATION AND FUNCTION OF THE STORM WATER BMPS INTO CONSIDERATION.
- FINAL GRADE THE SITE.
- STABILIZE THE SITE BY IMPLEMENTING THE NATIVE SEEDING AND PLANTING PORTION OF THE LANDSCAPING PLAN.
- REMOVE THE SILT FENCE AFTER THE SITE IS STABILIZED PER PROJECT ENGINEER APPROVAL.

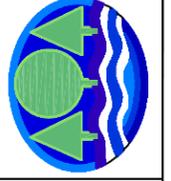
GENERAL NOTES:

- INSTALL ALL TEMPORARY EROSION CONTROL MEASURES (IN ACCORDANCE WITH MNDOT GENERAL CONDITIONS 2573) PRIOR TO SITE DISTURBANCE.
- INSTALL STORM DRAIN INLET PROTECTION TO PREVENT CLOGGING OF THE STORM SEWER AND SEDIMENT LOADS TO DOWNSTREAM STORM WATER FACILITIES OR WATERBODIES.
- IF THE STORM WATER BMP IS BEING DESIGNED TO SERVE AS A TEMPORARY SEDIMENT BASIN, GRADE THE BMP TO WITHIN THREE (3) FEET OF FINAL GRADE TO PREVENT CLOGGING OF INSITU SOIL. ONCE CONSTRUCTION IN THE CONTRIBUTING DRAINAGE AREA HAS BEEN COMPLETED AND THE SITE IS STABILIZED, EXCAVATE THE INFILTRATION TRENCH TO FINAL GRADE AND COMPLETE CONSTRUCTION OF THE INFILTRATION TRENCH.
- GRADING OF THE INFILTRATION TRENCH SHALL BE ACCOMPLISHED USING LOW-IMPACT EARTH-MOVING EQUIPMENT TO PREVENT COMPACTION OF THE UNDERLYING SOILS. WIDE TRACKED VEHICLES SUCH AS BACK HOES, SMALL DOZERS AND BOBCATS ARE RECOMMENDED.
- EXCAVATE THE INFILTRATION TRENCH TO THE SPECIFIED DEPTH (ELEVATION). ALL SUB MATERIAL BELOW THE SPECIFIED ELEVATION SHALL BE LEFT UNDISTURBED, UNLESS OTHERWISE DIRECTED BY THE ENGINEER.
- GRADE TO THE DEPTH (ELEVATION) SPECIFIED IN THE CONSTRUCTION DOCUMENTS UNLESS OTHERWISE DIRECTED BY THE ENGINEER.
- IN THE EVENT THAT SEDIMENT IS INTRODUCED INTO THE BMP DURING OR IMMEDIATELY FOLLOWING EXCAVATION, THE SEDIMENT WILL NEED TO BE REMOVED FROM THE INFILTRATION TRENCH PRIOR TO INITIATING THE NEXT STEP IN THE INFILTRATION TRENCH CONSTRUCTION PROCESS.
- MATERIAL EXCAVATED FROM THE INFILTRATION TRENCH SHALL BE DISPOSED OF ON-SITE AT LOCATIONS (TEMPORARY STOCKPILE AREAS) DESIGNATED BY ENGINEER.
- CLEAN, WASHED 1 TO 3-INCH GRAVEL SHALL BE PLACED IN THE BOTTOM OF THE INFILTRATION TRENCH TO THE DEPTH SPECIFIED IN THE CONSTRUCTION DOCUMENTS. GRAVEL SHOULD BE PLACED IN LIFTS AND LIGHTLY COMPACTED WITH PLATE COMPACTORS.

NO.	REVISION DESCRIPTION	DATE	BY

I hereby certify that this plan was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.

Date: _____
 Designed By: _____
 Drawn By: _____

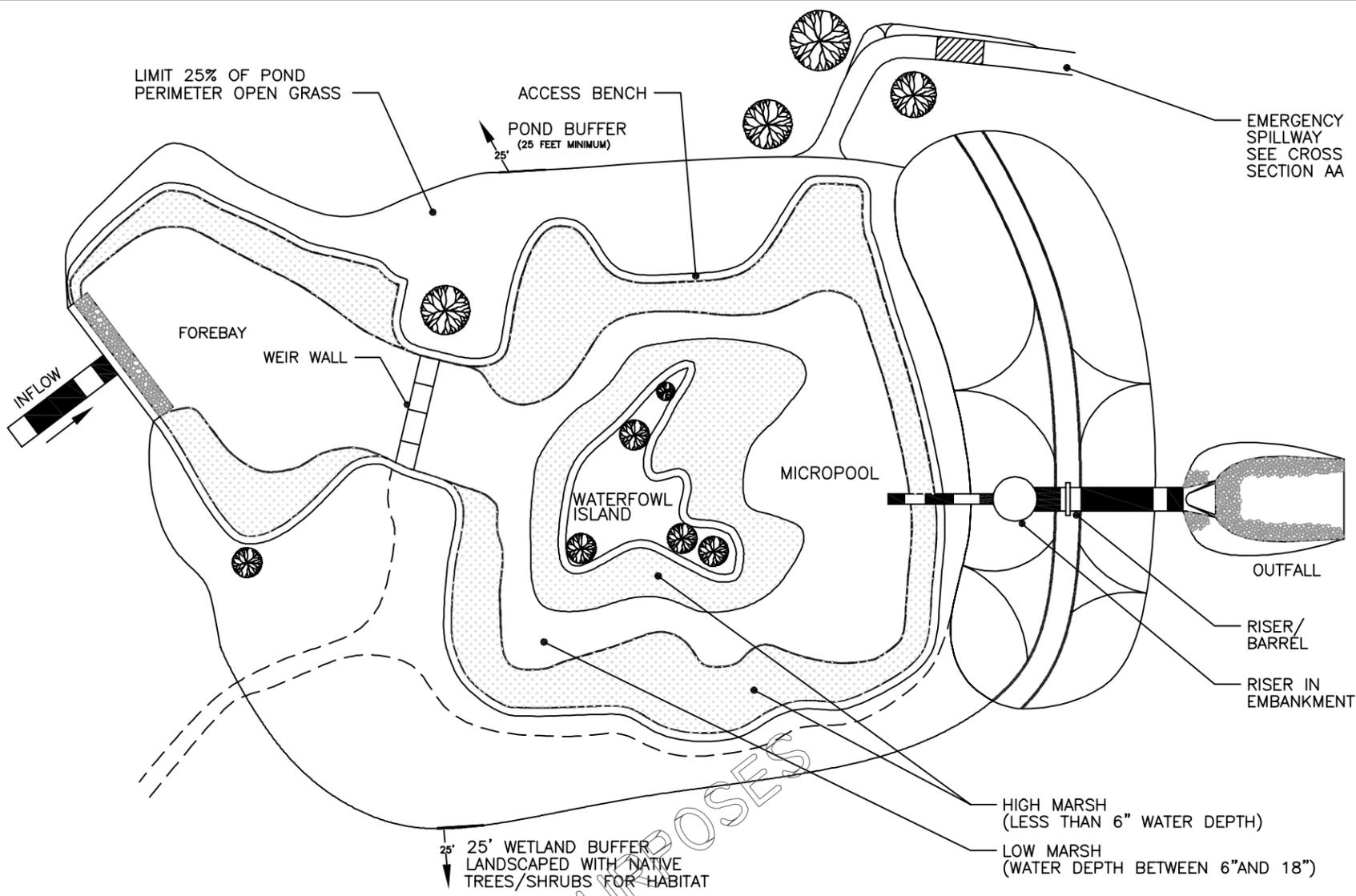


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 St. Paul, MN 55155-4194
 Phone: (651) 296-6300
 TTY: (651) 282-5332
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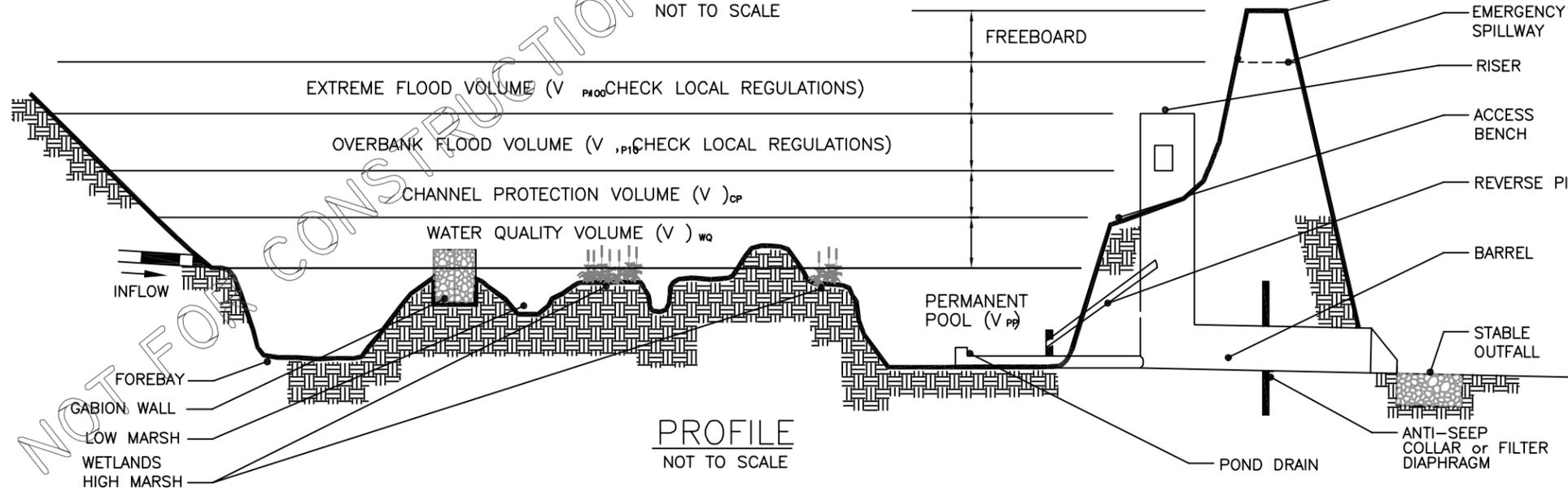
TYPICAL INFILTRATION TRENCH CROSS-SECTION

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PLAN VIEW
NOT TO SCALE

NOTE: OUTLET STRUCTURE SHOWN IS ONE EXAMPLE. OTHER DESIGNS/CONFIGURATIONS COULD ACHIEVE SIMILAR PERFORMANCE.



PROFILE
NOT TO SCALE

CONSTRUCTION STANDARDS AND SPECIFICATIONS
(ADAPTED FROM STORMWATER MANAGER'S RESOURCE CENTER, [WWW.STORMWATERCENTER.NET](http://www.stormwatercenter.net) <http://www.stormwatercenter.net> WITH SOME ADDITIONS)

SITE PREPARATION

1. TEMPORARY EROSION CONTROL MEASURES IN ACCORDANCE WITH MNDOT GENERAL CONDITIONS 2573 SHALL BE INSTALLED PRIOR TO THE START OF ANY CONSTRUCTION OPERATION THAT MAY CAUSE ANY SEDIMENTATION OR SILTATION AT THE SITE.
2. AREAS DESIGNATED FOR BORROW AREAS, EMBANKMENT, AND STRUCTURAL WORKS SHALL BE CLEARED, GRUBBED AND STRIPPED OF TOPSOIL.
3. VEGETATION AND OTHER MATERIAL SHALL BE CLEARED FROM POND AREA.
4. TOPSOIL SHALL BE STOCKPILED FOR FUTURE USE AS SPECIFIED.

EARTH FILL

1. FILL MATERIAL SHALL BE TAKEN FROM APPROVED BORROW AREAS AND SHALL BE FREE OF ROOTS, STUMPS, WOOD, RUBBISH, STONES GREATER THAN 6", FROZEN MATERIAL, AND OTHER OBJECTIONABLE MATERIALS.
2. FILL MATERIAL FOR CENTER OF EMBANKMENT SHALL CONFORM TO UNIFIED SOIL CLASSIFICATION GC, SC, CH, OR CL AND MUST HAVE AT LEAST 30% PASSING THE #200 SIEVE. CONSIDERATION MAY BE GIVEN TO THE USE OF OTHER MATERIALS IN THE EMBANKMENT IF DESIGNED BY A GEOTECHNICAL ENGINEER.
3. MATERIALS USED IN THE OUTER SHELL OF THE EMBANKMENT MUST HAVE THE CAPABILITY TO SUPPORT VEGETATION OF THE QUALITY REQUIRED TO PREVENT EROSION OF THE EMBANKMENT.
4. AREAS ON WHICH FILL IS TO BE PLACED SHALL BE SCARIFIED PRIOR TO PLACEMENT OF FILL. FILL MATERIALS SHALL BE PLACED IN MAXIMUM 8 INCH THICK (BEFORE COMPACTION) LAYERS WHICH ARE TO BE CONTINUOUS OVER THE ENTIRE LENGTH OF THE FILL. THE MOST PERMEABLE BORROW MATERIAL SHALL BE PLACED IN THE DOWNSTREAM PORTIONS OF THE EMBANKMENT. THE PRINCIPAL SPILLWAY MUST BE INSTALLED CONCURRENTLY WITH FILL PLACEMENT AND NOT EXCAVATED INTO THE EMBANKMENT.
5. WHEN REQUIRED BY THE REVIEWING AGENCY THE MINIMUM REQUIRED DENSITY SHALL NOT BE LESS THAN 95% OF MAXIMUM DRY DENSITY WITH A MOISTURE CONTENT WITHIN 2% OF THE OPTIMUM. EACH LAYER OF FILL SHALL BE COMPACTED AS NECESSARY TO OBTAIN THAT DENSITY, AND IS TO BE CERTIFIED BY THE ENGINEER AT THE TIME OF CONSTRUCTION. ALL COMPACTION IS TO BE DETERMINED BY AASHTO METHOD T-99 (STANDARD PROCTOR).
6. THE CORE OF THE EMBANKMENT SHALL BE PARALLEL TO THE CENTERLINE OF THE EMBANKMENT. THE TOP WIDTH OF THE CORE SHALL BE A MINIMUM OF FOUR FEET. THE HEIGHT SHALL EXTEND UP TO AT LEAST THE 10 YEAR WATER ELEVATION OR AS SHOWN ON THE PLANS. THE SIDE SLOPES SHALL BE 1 TO 1 OR FLATTER. THE CORE SHALL BE COMPACTED WITH CONSTRUCTION EQUIPMENT, ROLLERS, OR HAND TAMPERS TO ASSURE MAXIMUM DENSITY AND MINIMUM PERMEABILITY. IN ADDITION, THE CORE SHALL BE PLACED CONCURRENTLY WITH THE OUTER SHELL OF THE EMBANKMENT.

STRUCTURE BACKFILL

1. BACKFILL ADJACENT TO PIPES OR STRUCTURES SHALL BE OF THE TYPE AND QUALITY CONFORMING TO THAT SPECIFIED FOR THE ADJOINING FILL MATERIAL. THE FILL SHALL BE PLACED IN HORIZONTAL LAYERS NOT TO EXCEED FOUR INCHES IN THICKNESS AND COMPACTED BY HAND TAMPERS OR OTHER MANUALLY DIRECTED COMPACTION EQUIPMENT. THE MATERIAL NEEDS TO FILL COMPLETELY ALL SPACES UNDER AND ADJACENT TO THE PIPE.
2. AT NO TIME DURING THE BACKFILLING OPERATION SHALL DRIVEN EQUIPMENT BE ALLOWED TO OPERATE CLOSER THAN FOUR FEET, MEASURED HORIZONTALLY, TO ANY PART OF A STRUCTURE. UNDER NO CIRCUMSTANCES SHALL EQUIPMENT BE DRIVEN OVER ANY PART OF A CONCRETE STRUCTURE OR PIPE, UNLESS THERE IS A COMPACTED FILL OF 24" OR GREATER OVER THE STRUCTURE OR PIPE.

CARE OF WATER DURING CONSTRUCTION

1. ALL WORK ON PERMANENT STRUCTURES SHALL BE CARRIED OUT IN AREAS FREE FROM WATER. TEMPORARY DIKES, LEVEES, COFFERDAMS, DRAINAGE CHANNELS, AND STREAM DIVERSIONS NECESSARY TO PROTECT THE AREAS TO BE OCCUPIED BY THE PERMANENT WORKS SHALL BE INSTALLED, AS WELL AS PUMPING AND OTHER EQUIPMENT REQUIRED FOR REMOVAL OF WATER FROM VARIOUS PARTS OF THE WORK.
2. AFTER HAVING SERVED THEIR PURPOSE, ALL TEMPORARY PROTECTIVE WORKS SHALL BE REMOVED OR LEVELED AND GRADED TO THE EXTENT REQUIRED TO PREVENT OBSTRUCTION OF THE FLOW OF WATER TO THE SPILLWAY OR OUTLET WORKS.
3. STREAM DIVERSIONS SHALL BE MAINTAINED UNTIL THE FULL FLOW CAN BE PASSED THROUGH THE PERMANENT WORKS.

STABILIZATION AND EROSION CONTROL

1. ALL EXPOSED SURFACES OF THE EMBANKMENT, SPILLWAY, SPOIL AND BORROW AREAS, AND BERMS SHALL BE STABILIZED BY SEEDING, LIMING, FERTILIZING AND MULCHING IN ACCORDANCE WITH LOCAL NATURAL RESOURCES CONSERVATION SERVICE STANDARDS AND SPECIFICATIONS. A 4-INCH LAYER OF TOPSOIL SHALL BE PLACED ON THESE AREAS TO SUPPORT STABILIZING VEGETATION
2. FILTER FABRIC PLACED BENEATH THE RIP-RAP SHALL MEET STATE OR LOCAL DEPARTMENT OF TRANSPORTATION REQUIREMENTS FOR A CLASS "C" FILTER FABRIC.

NO.	REVISION DESCRIPTION	DATE	BY

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 Sign Name: _____ Date _____

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SHALLOW
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 PLAN AND PROFILE

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