STORM WATER

MANAGEMENT

STANDARDS

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City Engineer
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A STORM WATER MANAGEMENT STANDARDS

A1 GENERAL

A1.1 Background

a) The City of River Falls developed a Water Management Plan to analyze and minimize the impact of existing and future development on the City's natural resources. It is important to the City to have consistent analysis and data collection. Therefore, all hydrologic, hydraulic and water quality analyses will be prepared in a common format.

A1.2 Applicability

a) These standards promote consistent practices and safeguard the interests of the City of River Falls by ensuring that all storm water management improvements are designed and constructed in conformance with sound engineering principles and accepted standards.

b) This information has been prepared to assist developers, builders and engineers in the development of storm water management plans and specifications in the City of River Falls. It is not intended to be, nor should it be used as a specification for any improvement, but rather a guideline to be used in the preparation of such documents.

A1.3 Engineer

a) All storm water management plans shall be prepared by or under the direction of a Professional Engineer registered under the laws of the State of Wisconsin.

A1.4 Jurisdiction

a) The review and approval of storm water management plans by the City for certain improvements is not exclusive. Other public agencies may have review jurisdiction, including but not limited to Wisconsin Department of Natural Resources, Pierce and St. Croix County Department of Public Works, Wisconsin Department of Transportation, Department of Industry, Labor, and Human Relations, and Army Corps of Engineers. This document is not a substitute for the requirements of other public agencies having review jurisdiction.

b) The design engineer must conform not only to the requirements of the city, but to the legal requirements of all public agencies who may have review jurisdiction and issue permits or require bonds or other securities in order to construct public improvements. This document does not relieve the design engineer of the responsibility to use acceptable engineering principles or to comply with all Federal, State, and Local laws and codes.

A1.5 Checklists and Forms

a) Please refer to the *Storm Water Management Permit Information* sheet to provide steps in the permitting and plan review process.

b) A submittal checklist is included to help determine when all the required information has been completed. Checklists and summary sheets for project-specific data are also included. No final review or approval action will occur until all required data and submittals are received. It is recognized that various methods are available for analysis; however, to be consistent with the Water Management Plan, data must be submitted in a consistent format that will allow for a timely review by City staff.

A1.6 Performance Standards

a) Performance Standards provide consistency throughout the area when developing storm water facilities. When preparing your engineering calculations, remember to follow the requirements from Section 7 of the Storm Water Management Ordinance.

A1.7 Conformance

a) Methods in conformance with the Water Management Plan and the City Engineering Guidelines Manual shall be followed, except when prior written authorization by the City Engineer is granted. Any variance from these standards may also require approval from jurisdictions other than the City.

A2 KEY POINTS

A2.1 General

a) Discharge of urban storm water pollutants to the Kinnickinnic River, its tributaries and wetlands shall be minimized to the maximum extent practical. Where such discharges are proposed, the impact of the proposed discharge on the sensitive resources shall be assessed using a method acceptable to the City Engineer. At a minimum, storm water discharges shall be pre-treated prior to discharge to the Kinnickinnic River, its tributaries and wetlands. Significant degradation of functional values of sensitive resources due to storm water pollutant loads shall be avoided.

b) Storm water discharges shall be pre-treated prior to infiltration where necessary to prolong maintenance of the infiltration practice and to prevent discharge of storm water pollutants at concentrations that will result in exceedances of groundwater preventive action limits or enforcement standards established by the Department of Natural Resources in NR 140 Wisconsin Administrative Code. Storm water shall not be injected underground through excavations or openings that would violate NR 812.05 Wis. Admin. Code.

c) Location of storm water facilities shall be in accordance with the Wellhead Protection Ordinance of the City of River Falls and the following:

(1) Storm water ponds and infiltration devices shall not be located within 100 feet of a well serving a private water system or a transient, non-community public water system.

(2) Storm water ponds and infiltration devices shall not be located within 400 feet of a public well unless a hydrogeologic investigation indicates lesser separation distances would provide adequate protection of a well from contamination.

A2.2 WDNR Compatibility.

Provided is a list of WNDR requirements in which the City has chosen not to adopt. Please note that this list is not comprehensive.

a) The City does not place a 1% cap on the land area required to meet the infiltration requirements.

b) The City does not exempt parking lots less than 5000 square feet in size.

c) The City does not exempt redevelopment sites.

d) The City does not allow flow through infiltration basins.

e) The City applies the same requirements to commercial and residential properties.

f) The City allows infiltration basins to be up to four feet deep.

A3 HYDROLOGY MAJOR FACILITIES (I.E., DETENTION PONDS)

A3.1 U.S.D.A. Natural Resources Conservation Services (NRCS) Method

a) The U.S.D.A. Natural Resources Conservation Services (NRCS) method shall be the basis for all hydrologic studies.

A3.2 Storm Distribution

a) The Design Storm (DS) will be based on a 100-year return period, 24-hour duration, Type II distribution with average soil moisture conditions (AMC-2).

A3.3 Rainfall

a) Rainfall amounts for hydrologic analysis shall be as follows:

(1) 2.5 inches for a 1 year event

(2) 2.8 inches for a 2 year event

(3) 4.2 inches for a 10 year event

(4) 7.2 inches for a 100 year event

These figures are based on NOAA Atlas 14, Volume 8, Version 2.0, Precipitation Frequency Atlas of the United States.

A3.4 Landlocked Areas

a) Detention Ponds shall be designed with adequate overland emergency overflow routes to eliminate any possible flooding of private property due to landlocked areas.

b) In the event that a landlocked storage area cannot be avoided, available storage volume of landlocked areas shall be established by estimating the normal or initial water surface elevation at the beginning of a rainfall event and the additional runoff volume resulting from a 100-year/10-day runoff (7.2 inches) and saturated or frozen soil conditions (CN=100).

A3.5 Natural Pre-Developed Ponding

a) Existing on-site ponding areas shall be included when analyzing the pre-development peak flow rate that exits a given property.

A3.6 Disconnected Impervious Areas

Impervious areas are considered disconnected if they meet the following criteria:

a) A maximum of 75’ of contributing length of rooftop, parking lot of other impervious surface sheet flowing to a pervious area may be considered as disconnected impervious

b) Pervious area providing “disconnection” shall be on a slope of 8% or less and vegetation shall be self-sustaining and in “good” condition.

c) For contributing lengths between 25’ and 75’, the length of the "disconnection" must be equal to or greater than the contributing length and there can be no additional runoff flowing into the pervious area other than that from the source area.

d) For contributing lengths less than 25’, the length of the "disconnection" must be equal to or greater than 1.5 times the contributing length and there can be no additional runoff flowing into the pervious area other than that from the source area.

e) Upon entering the downstream pervious area, all runoff must remain as sheet flow over the required length of disconnection.

f) Impervious areas flowing to grass swales may be considered disconnected in accordance with the above criteria with the maximum area considered disconnected not to exceed the area of the bottom of the swale. V-shaped swales shall not be considered to provide “disconnection.”

g) For subdivisions where specific lot plans are not available, the following shall apply:

(1) A minimum of 1150 square feet of connected impervious for driveway shall be assumed for all lots based on the following:

- Drive approaches are 25' at Property Line and 35' at curb line for an average width of 30' and average Boulevard width is 15' resulting in 450 square feet.

- Internal driveway of at least 25' width and setback of 28 feet from property line results in 700 square feet.

(2) A minimum of 625 square feet of connected impervious for of home shall be assumed for all lots based on the following:

- Average 2500 square foot home with 25% draining to driveway.

h) Where sidewalks are interrupted by drive approaches spaced closer than 150', maximum area considered "disconnected" in accordance with the above criteria shall be limited based on the following:

(1) 0% to 2% longitudinal slope – 60% of sidewalk area maximum

(2) Up to 3% longitudinal slope – 40% of sidewalk area maximum

(3) Up to 4% longitudinal slope – 20% of sidewalk area maximum

(4) Over 4% longitudinal slope – 0% of sidewalk area maximum

A4 HYDROLOGY-MINOR FACILITIES (I.E., STORM SEWER, DITCHES, CULVERTS)

A4.1 Rational Method

a) Rational Method shall be the preferred methodology for the design of minor systems. If a minor system requires the use of hydrograph method for routing purposes, only pre-approved methods will be accepted. Hydrograph methods currently approved include USDA, NRCS, TR20 & TR55, HydroCAD and XP-SWMM. If a method not currently approved is proposed, documentation of the methodology shall be submitted to the City for approval.

b) A local Intensity/Duration/Frequency curve shall be used to determine the peak flow rates for the 10-year event.

A4.2 Analysis and Design

a) The minor drainage system shall be analyzed and designed using a 10-year frequency rainfall.

b) Local systems shall generally provide for containment of flows from 10-year frequency storms within the following parameters:

(1) Local streets shall have one 10-foot driving lane down the center of the roadway.

(2) Collector streets shall have two 7-foot driving lanes.

(3) Arterial streets shall have two 10-foot driving lanes (one in each direction). Three lane arterials may utilize 2 feet on each side of the center turn lane to provide a 10-food drive lane, leaving a 10-foot center turn lane.

c) Drainage report should indicate inlet capacity of each catch basin, how much flow bypasses the catch basin, and spread calculations at worst case scenario points (e.g. sag point or streets with 0.5% slope). Where more than 50% of the flow is shown bypassing a catch basin or the spread violates the standards laid out above, a second catch basin shall be added upslope.

d) Full pipe flow analysis shall be used unless special conditions can be demonstrated to support the consideration of pressure flow.

A4.3 100-Year Overflows

a) When the storm sewer system has reached its capacity and a 24-hour, 100-year storm event occurs, the maximum allowable ponding shall be:

(1) The maximum depth of ponding in a rear yard is18 inches.

(2) The maximum depth of ponding in a parking lot is 9 inches.

(3) The maximum depth of ponding on any street in the gutter line is 12 inches.

- Emergency overflow along with the high point elevation and direction of overflow shall be marked on plans.

- Emergency overflow swales shall meet minimum drainage easement standards noted herein.

b) The path for overflow runoff from the 100-year frequency rainfall shall be evaluated to ensure that structural damage will not occur as a result of street low-point flooding during an extreme (100-year) event.

A4.4 Open Channels

a) Open channels shall carry the 10-year frequency storm flow within the graded portion of the channel and the 100-year storm within the channel easement or right-of-way.

A4.5 Drainage Basin Plan

a) The engineer shall submit a drainage basin plan that is marked to indicate individual watersheds' tributary to inlets, catch basins, or manholes with contributory areas. Each storm structure shall be numbered and the watershed acreage shown on the plan.

A4.6 County or State Systems

a) Culvert crossings or storm systems in County or State right-of-way may have a design frequency that differs from the City's standard.

b) Each agency/unit of government shall be contacted to determine the appropriate design frequency.

A5 HYDRAULICS

A5.1 General

a) Culverts shall be analyzed using methodology consistent with Federal Highway Administration's Hydraulic Design of Highway Culverts, Hydraulic Design Series 5.

A5.2 Emergency Overflows

a) Existing, naturally occurring or man-made emergency overflow hydraulics from detention areas shall be calculated.

b) Emergency overflows shall be analyzed for the 100-year storm as part of the design of the structure.

c) The overflow should be at least one foot below the lowest opening (window or door), unless adequate storage volume exists to assure reasonable property protection from flooding.

A5.3 Anti-Seepage Collars

a) Anti-seepage collars shall be installed so as to increase the creep distance or seepage line along conduit by 15 percent.

b) Maximum spacing should be approximately 14 times the minimum projection of the collar measured perpendicular to the pipe.

c) Anti-seepage collars shall be used on culverts under public streets if all of the following conditions exist:

(1) All water and ponding structures with a pool depth of 2 feet and two-day duration.

(2) 250-acre watershed or more.

(3) Design head of 10 feet or more.

A6 MINIMUM BUILDING ELEVATIONS

A6.1 Minimum Building Opening Elevation

a) The minimum building opening elevation is defined as the lowest elevation for a home or building foundation wall to be terminated.

b) No window or door opening shall be placed below the minimum building opening elevation unless completely surrounded by a watertight foundation wall.

c) The minimum building opening elevation for structures adjacent to water bodies shall be the greatest of the following:

(1) An elevation 2 feet above the 100-year design storm elevation; or

(2) Elevations determined by the City's Flood Insurance Study; or

(3) An elevation based on the location, capacity and elevation of the emergency overflow. Ideally, the overflow should be one foot below the minimum building opening elevation.

d) Plans for ponding areas shall include the minimum building opening elevation for each adjacent lot. This information must be included on both the plat and the construction documents.

A6.2 Minimum Building Slab Elevation

a) The lowest slab elevation for a home or building shall be four feet above the water table.

b) Plans shall indicate groundwater elevations and indicate the minimum building slab elevation applicable to development areas. This information must be included on both the plat and the construction documents. This is typically shown for every lot; however, if reaching groundwater is not a concern on a site, this requirement can be met with a note that indicates the groundwater level and minimum slab elevation for all properties. Note: Groundwater depths are needed to plan for building slab elevations, dewatering activities, excavations, utility installations and to document compliance with water table separation requirements.

A7 POND CONSTRUCTION CRITERIA (GENERAL)

A7.1 Record Drawings

a) Record drawings of ponds shall be provided, with certification by a registered engineer or land surveyor, as required in Chapter 12.16.080.B.2.

b) The drawings shall include finished two-foot contours, normal and 100-year pond levels, elevation of adjacent low slab levels, and final storm sewer configuration. Information shall be provided by crossing out the "old" information, or placed in a separate table. If a separate table is used, all information below shall be addressed in that table.

c) Record information shall include the following:

(1) Specify if storm structures are an inlet, manhole, or outlet structure

(2) Elevation for rim of structures

(3) Elevation for inverts for pipes and structures

(4) Pipe size

(5) Type of structure

(6) Casting number if it is not what is specifies on a "typical" detail

(7) Record information on any detail related to the storm system that is not "typical" (e.g. outlet structures, trench grates, etc.)

A7.2 Maintenance Access

a) Vehicle access lane(s) at least 15 feet wide shall be provided, at a slope less than 15 percent from a public or private road to the pond, to accommodate maintenance vehicles.

b) Surface of vehicle access shall be stabilized to withstand heavy equipment. Stabilization on slopes no greater than 12% may be allowed by using engineered turf reinforcement grids or other similar approved products. For surface on slopes greater than 12% slope, a minimum 2" thick, 12' wide asphalt surface shall be provided.

c) Access shall encircle entire pond area above the 100-year high water elevation for the pond. This access lane shall have a cross slope not to exceed 15:1.

(1) If this access bench is further than 20 feet horizontally from the normal water level, a supplemental access bench shall be provided within 4 feet horizontally from the normal water elevation.

(2) If pond is designed with a defined forebay(s), supplemental access bench may be limited to the area of the forebay(s). The forebay(s) need to capture 60% of the incoming flow to the basin.

A7.3 Energy Dissipation

a) Pond outlets shall be designed with appropriate energy dissipation to reduce discharge velocities to acceptable levels based on the type and condition of the downstream conveyance.

b) Pond inlets shall have concrete end walls and rip rap.

A8 POND CONSTRUCTION CRITERIA (FLOOD CONTROL)

A8.1 General

a) The following criteria will be followed for pond construction above the normal water elevation. This area of the pond will more than likely be the pond area flooded during a storm up to 100-year duration.

(1) Maximum 3:1 (H:V) side slopes.

(2) Proper allowance for access and maintenance easements (see easement and outlot standards, Section A15).

(3) Emergency overflow above the 100-year design storm high water elevation. One foot of freeboard shall be provided in the pond above the emergency overflow.

(4) Erosion control (see erosion control standards, section A14).

(5) Restoration (see restoration standards, section A12).

A9 POND CONSTRUCTION CRITERIA (NUTRIENT TRAPPING AND SEDIMENT RETENTION)

A9.1 General

a) Newly constructed ponds intended for nutrient trapping and removal of total suspended solids shall provide additional storage volume below the outlet to allow for nutrient trapping and accumulation of sediment. Access to the area to allow for sediment removal is required as outlined above.

b) The following general criteria should be used when designing the sediment pond.

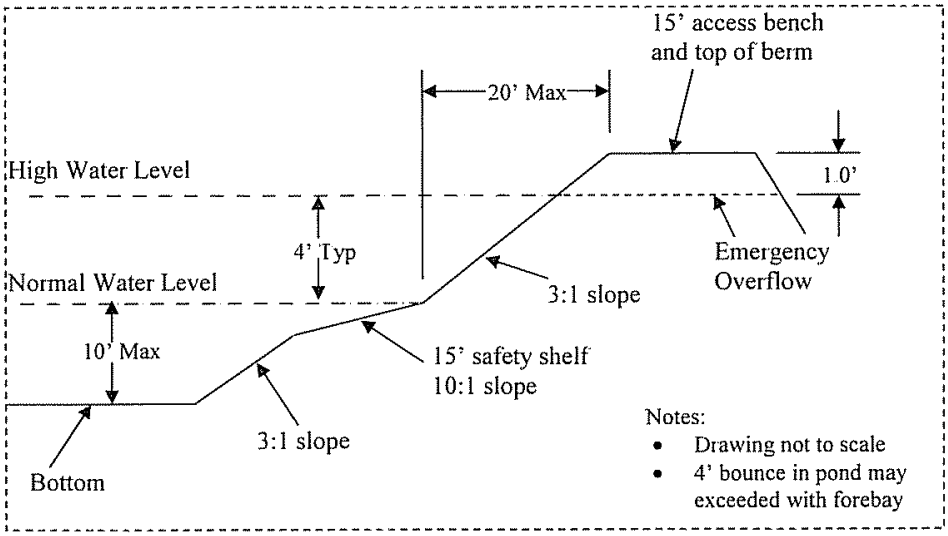
(1) For basins intended to have permanent water levels, a minimum 4 feet of standing water (dead storage depth) is required.

(2) Maximize the separation distance between inlet points and outlets to prevent short-circuiting of storm flows.

(3) A 10:1 slope starting at the normal water level and extending 15 feet from shore, then 3:1 (H:V) maximum slope.

(4) Proper access for maintenance and inspection.

(5) A forebay shall be provided when a pond is greater than 40,000 SF and shall capture at least 60% of the flow entering the pond. A submerged berm (18 inches below the normal water level) shall separate the forebay from the main pond.



A9.2 Size (Volume)

a) Ponds in new developments shall be designed to achieve 85% total suspended solids removal (40% removal is required for redevelopments). Storm water treatment can be provided via a single pond that meets the design and treatment criteria or an on-site network of interconnected ponds, swales and/or ditches. If an on-site network of devices is used, the overall pollutant removal efficiency for the network must meet the criteria.

b) Pond design criteria are as follows:

(1) Permanent pool volume should be greater than or equal to the volume necessary to achieve 85% (or 40% in the case of redevelopment) total suspended solids removal.

(2) Excluding the safety shelf, mean depth of the permanent pool (volume/surface area) should be greater than or equal to 4 feet.

(3) The maximum depth of the permanent pool should be less than or equal to 10 feet.

(4) For basins greater than 20,000 sq. ft., 50% of the total surface area shall be a minimum of 5 feet deep. For basins less than 20,000 sq. ft., maximize the area of 5 foot depth.

(5) The ratio of length to width of the pond should be greater than or equal to 3. Note: This constraint may not be feasible for some small ponds. In such situations, baffles may be installed to isolate the inflow area from the remainder of the pond.

(6) 1 foot of freeboard shall be provided above the emergency overflow.

A9.3 Pond Skimmers

a) Pond skimming devices are required for all storm water facilities and shall be designed to remove oils and floatable materials up to a one-year frequency event. The skimmer should be set 12 inches below the normal surface water elevation and should control the discharge velocity to 0.5 fps. Skimmers shall be optional on private facilities at the discretion of the City Engineer.

A10 POND CONSTRUCTION CRITERIA (INFILTRATION)

A10.1 Design

a) Design volume shall be calculated using TR-55 for a 1.5-inch event. Two subcatchments shall be modeled for each post-development watershed. One subcatchment shall have the direct impervious. The other watershed shall be a composite CN created from the disconnected impervious as well as the pervious area.

b) The basin shall be designed with a maintenance draw down capability.

c) Pretreatment (85% TSS removal) is required prior to all public infiltration basins.

d) 200 foot horizontal setback shall be maintained from down gradient slopes greater than 20%, unless slope stability calculations demonstrated that the slope is stable under saturated conditions at a shorter distance from the practice. Any submitted slope stability calculations shall be signed by a geotechnical engineer registered in the state of Wisconsin. A 20% slope, for the purposes of this requirement, shall be defined as a 2 foot elevation difference over 10 feet.

e) Drainage area shall be less than 50 acres. If drainage area is greater than 50 acres, multiple basins shall be used.

f) Maximum draw down time is 48 hours, based on the design infiltration rate for the facility. Analysis shall be included to show how the water is routed to the infiltration facility. This information should include pipe sizing calculations along with routing information proving the water reaches the infiltration area in 48 hours.

g) Pipes going to infiltration facilities shall be sized to pass two times the volume required for infiltration.
Note: In instances where inverted pipes are used, water will trickle into the infiltration facility long after a storm event. In these cases, the water level in the treatment pond after 48 hours shall be considered the normal water level and the volume required for infiltration shall be provided above that level.

h) A minimum of 3 double ring infiltrometer tests (ASTM D3385) are required to verify the design infiltration rate, both before the design is approved and after construction prior to acceptance. The maximum allowable measured rate shall be 10 inches per hour. Design infiltration rate shall be ½ the measured infiltration rate on the site.

A10.2 Dimensions

a) Maximum depth of infiltration area shall be 2 feet until 1% of the entire site area is utilized (or 2% for commercial areas). After 1% of the entire site is used for infiltration, additional depth will be allowed, up to 4 feet, to meet infiltration requirements.

b) Depth of ponding may be greater than 4 feet in the instance that the rate control pond and infiltration pond are hydraulically connected and rate control backs up into infiltration pond temporarily. Depth held for infiltration shall not exceed that depths specified above.

c) Side slopes 3:1 or flatter.

d) Longitudinal slope 1% maximum.

e) Lateral slopes shall be 0%.

f) 1 foot of freeboard shall be provided above the emergency overflow.

A10.3 Vegetation Cover

a) A cover crop shall be incorporated into the initial seeding of all permanent vegetation.

b) Sod shall not be used.

c) If turf grass is utilized, the basin cannot be used for recreational purposes due to compaction concerns.

d) Native seeding shall be completed in the fall (as dormant seeding prior to first snowfall) or in the spring (between May 1 and June 20), or plugs shall be used.

e) Soil testing shall be used to determine proper fertilizer applications if fertilizer shall be utilized. Fertilizer application shall also conform to the criteria in NRCS Conservation Practice Technical Standard, Critical Area Planting (342) or WDNR Conservation Practice Standard Seeding for Construction Site Erosion Control (1059).

f) Mulch shall conform to the criteria located in the WDNR Conservation Practice Standard for Mulching for Construction Sites (1058).

A11 MINOR FACILITY CONSTRUCTION CRITERIA

A11.1 Public Storm Sewer Pipe

a) Storm sewers shall be constructed of reinforced concrete pipe (RCP) or dual wall HDPE.

b) Minimum RCP pipe size shall be 12 inches.

c) Special requirements for use of HDPE pipe include:

(1) All HDPE storm sewer pipe used for Storm Sewer shall be mandrel tested after test rolling of aggregate base and before placement of bituminous.

(2) HDPE pipe joints shall be watertight.

(3) HDPE shall not be allowed under public streets if the 20-year ADT is in excess of 4500 with the exception of 12" Storm Sewer laterals and culvert crossings.

A11.2 Private Storm Sewer Lines

a) Private storm sewer lines shall connect to existing public structures whenever feasible.

b) If it is not feasible to connect to an existing structure, the City Engineer may approve the addition of an inlet or manhole on the public storm sewer line to support a private drainage system. In these instances, the structure shall be a City structure, there by revocable permit and maintenance shall be performed by the property owner. If the City determines maintenance is needed, the property owner will receive notice.

A11.3 Storm Sewer Cover

a) Minimum cover for public storm sewers shall be as follows:

(1) In non-pavement areas cover shall be 2 feet.

(2) In paved areas, cover shall be 1', measured from the top of the pipe to the bottom of the aggregate base course.

A11.4 Catch Basins

a) All catch basins within the curb areas of City streets shall have 2'x3' grates and curb inlets (Neenah R-3067-V, with embossed "drains to river") in accordance with the Standard Detail Plates unless otherwise approved in writing by the City Engineer.

b) All backyard catch basins in rear yard drainage swales and/or other depressed inlets shall be Neenah R-4341 stool inlet, unless otherwise approved in writing by the City Engineer.

c) Inlets shall be located to prevent runoff from a 10-year storm from flowing through intersections of public roadways. Valley gutters shall not be allowed unless approved in writing by the City Engineer.

d) Drainage report should indicate inlet capacity of each catch basin and how much flow by passes the catch basin. Where more than 50% of the flow is shown bypassing a catch basin, a second catch basin shall be added upslope.

e) Minimum depth of catch basin shall be 3 feet, measured from the pavement to the invert of the catch basin.

f) Catch basins shall not be located in the curb return at intersections but rather adjacent to the curb return.

g) Mid block catch basins shall typically be located on property lines so as not to conflict with potential driveway locations.

h) CB's spaced 600' maximum on collector and arterial streets.

i) CB's spaced 800' maximum on local streets.

A11.5 Public Manholes and Structures

a) All manholes shall be precast unless they are of special design.

b) Manholes shall be sized in accordance with published industry standards for the pipe sizes and configuration being served.

c) All manholes shall be precast reinforced concrete, with offset cone tops (precast corbel section.)

d) Where field conditions prevent the manhole construction with an offset cone top, a reinforced precast flattop (slab or deck) with an opening for the casting may be specified, with the City Engineer's approval.

e) 400’ max. manhole spacing for lines 15” diameter or less.

f) 500’ max. manhole spacing for lines 18” to 30” diameter.

g) Manholes shall be provided at changes in direction or changes in grade.

h) Storm Sewer pipe materials may only change at structures such as catch basins or manholes.

i) Buried “T” connections shall only be allowed when all of the following are met:

(1) The lateral is 15” diameter or less.

(2) The main is at least twice the diameter of the lateral.

(3) The length of lateral measured from the “T” to the next structure on the lateral does not exceed 100 feet.

A11.6 Swales

a) Channelized storm runoff in excess of 0.5 cfs shall discharge into a catch basin or inlet before crossing a sidewalk or curb.

b) Drainage swales where concentrated flow from more than 1 acre or 4 lots is directed shall be stabilized by one of the following methods:

(1) Seeded and protected with wood fiber blankets

(2) Sodded and staked

(3) Stabilized with properly designed hydroseed

c) Velocity computations shall be provided for drainage swales where concentrated flow from more than 2 acres or 8 lots is directed.

d) Permanent turf reinforcement mats shall be installed in drainage swales where design velocities exceed 7 ft/sec.

e) Minimum swale cross section for flows from 1 acre or less or 4 lots or less shall be a V-shaped ditch, 1.9’ deep with 4:1 slopes up to a 15’ easement line.

f) Minimum swale cross section for flows from more than 1 acre or more than 4 lots shall be a ditch, 2’ deep with a 4’ bottom and 4:1 slopes up to a 20’ easement line.

g) All public drainage rear and side yard swales and roadside ditches shall have a minimum of a 1% gradient. If the soils are HSG Type C or D soils, the minimum gradient on public drainage rear and side yard swales and roadside ditches shall be 2%.

h) All rear and side yard swales shall be centered on property lines.

A11.7 Inlets, Outlets & Energy Dissipation

a) Any outfall storm sewer that drains into an existing open ditch or natural watercourse shall have a reinforced concrete head wall or end section.

b) For pipes larger than 15" diameter, discharge direction of flow shall be at 45 degrees or less to the flow direction of receiving ditch or stream.

c) Discharge shall be taken to rear property lines or rear drainage easement line at a minimum.

A12 RESTORATION

A12.1 Above Normal Water Elevation

a) Areas shall be seeded immediately after pond construction with a mixture containing fast germinating seed mixture (i.e., annual rye, oats, barley) and permanent native grasses with characteristics conducive to infiltration and nutrient uptake. Areas may be sodded or hydroseeded instead of seeded.

A12.2 Below Normal Water Elevation

a) Restoration below the normal water elevation will be done if ground water does not maintain the normal water level.

b) When restoration is required, all areas of the 10:1 (H:V) shelf above the ground water and below normal elevation will be restored with annual fast-germinating seed (i.e., annual rye, oats, barley).

c) The pond may need to be pumped down to do the restoration.

A13 GRADING PLANS

A13.1 Introduction

a) A grading plan is an important element in preventing property damage, flooding, standing water, and erosion of embankment areas. The design engineer must consider the existing topography of the development and its relationship with adjacent properties.

b) In all cases, grading plans must ensure positive drainage and conform to the following standards.

A13.2 General

a) Plan is drawn in two-foot contours.

b) All contours are labeled.

c) Plan is 1"=50' or larger scale.

d) North arrow shown (up or to right).

e) Property limits are shown.

f) Temporary and permanent erosion control measures shall be provided for all projects.

A13.3 Existing Conditions

a) Existing 2' contours are dashed and proposed are solid.

b) Existing public and private utilities are shown.

c) Details of terrain and drainage are sufficient to show overall drainage patterns are provided for areas adjacent to the proposed grading.

d) Park and wetland areas are shown

e) Existing wells and drain fields are accurately located and clearly shown.

A13.4 Proposed Grading

a) Each Lot shall have the following information presented:

(1) Proposed elevations of garage floor. This elevation is assumed to also be the ground elevation at the front of the building.

(2) Lowest opening elevation. Lowest opening elevation shall be the elevation at which water would enter the home if the home were surrounded by water. The elevation may correspond to:

- The lowest walkout level
- The lowest wall at a window well formed by foundation walls

- The lowest window opening not protected by a foundation window well

(3) Ground elevation at rear of building.

(4) Minimum slab elevation. This elevation shall be four feet above the seasonal high groundwater elevation. (If groundwater is not a concern on a particular site, this requirement can be met with a note that indicates the groundwater level and minimum slab elevation for all properties.)

(5) Proposed Structure Type as follows:

Type	Style	Front/Back Elevation Change
STD or S	One or Two Story Full Basement or Daylight Split	0 Feet
SWO or LO	Split Entry with Walk Out or Full Basement with Daylights	4-5 Feet
WO	One or Two Story with Walk Out	8-9 Feet

(6) Proposed lot corner elevations.

b) Control Elevations for drainage ways shall be provided.

c) Drainage directional arrows shall be shown.

d) Percent of grade shall be shown for all drainage swales.

e) Drainage shall flow over only one adjacent lot before discharging into a drainage easement or public right-of-way.

f) Drainage swales shall be provided along rear and side yards of proposed buildings or parcels. These swales shall generally be centered on property lines.

g) Other design requirements may be applicable, such as retaining walls or terracing of the property, depending on the land plan and site topography.

h) All grading plans shall match existing grades at the property lines with a slope not to exceed 3:1 within 10 feet of the property line, unless an approved grading plan or a proposed established street grade exists for the future development of adjacent properties that indicates different elevations. The grading plan shall be consistent with all proposed established street grade plans on file with the city engineer. Retaining walls will be allowed in the instance that they are confined (including soil setbacks) to the property.

i) All grading plans shall accommodate offsite drainage.

A13.5 Construction Requirements

a) After the engineering plans are approved and before beginning grading operations for a subdivision or parcel of land, a pre-construction meeting shall be held. The City Engineer shall be notified a minimum of one week in advance to arrange for appropriate pre-construction conferences and construction inspection. The meeting will not be held until all required bonds are posted and permits obtained.

(1) This meeting can be waived, with permission by the City Engineer, for smaller projects where it isn't deemed necessary.

(2) Tailor the meeting to the specific site and project. It may be scheduled at City Hall with various parties meeting to discuss the project there or it may also be scheduled on-site after perimeter erosion control is in place.

A14 EROSION CONTROL

A14.1 General

a) Erosion control elements such as silt fence, bale checks, rock construction site entrances, etc. shall be installed prior to starting any grading activities.

b) Erosion control plan shall clearly identify the contractor(s) and subcontractor(s) who will install and maintain erosion control and storm water management measures.

A14.2 Minimization and Restoration

a) The plan of development shall relate to the topography and soils of the site so as to reduce the potential for excessive runoff and erosion.

b) Permanent vegetative or structural protective measures shall be installed as soon as possible.

c) The smallest practical area of land shall be exposed at any given time during development.

d) All grading, excavating, fills, open cuts, side slopes and other land disturbances shall be mulched, seeded, sodded, rip rapped or otherwise protected so that erosion and sedimentation are controlled during development.

e) All disturbed areas and exposed soils shall be stabilized and/or restored within 14 days of suspension of grading activities. Stabilization may include seeding between April 1 and October 15 or other cover, such as a tarp or mulching.

f) Permanent seeding must be completed by September 15, or sodding must be place by November 15.

g) Downspout extenders shall be used until lawns are established. An established lawn is defined as a lawn which has 85% cover.

h) Drainage ways shall be stabilized within 24 hours of drainage way completion.

A14.3 Sediment at Site Entrances

a) Best Management Practices (BMP's) shall be utilized at all construction sites to minimize tracking and spilling soil on public streets or highways.

b) BMP's may include, but are not limited to, rock construction entrances, washing stations, frequent cleaning of streets adjacent to the construction site or limiting operations when site conditions are unmanageable.

c) The developer/contractor shall be responsible for removing sediment carried by construction traffic at site entrances and access points on a daily basis.

A14.4 Inspection and Condition of Systems

a) All erosion control systems must be maintained by the permittee in a functional condition until the completion of turf and/or structural surfaces that protect the soil from erosion.

b) The permittee must inspect erosion control weekly and immediately after each rainfall event of 0.5 inches or more. Needed maintenance shall be performed within 48 hours.

A14.5 Failure of Systems

a) If erosion breaches the perimeter of a construction site, the permittee shall immediately develop a clean-up and restoration plan, obtain right of entry from the adjoining property owner, and implement the clean-up and restoration plan within 48 hours of obtaining the adjoining property owner's permission.

b) In the event eroded soils enter onto or are tracked or spilled on a public street, highway, sidewalk or trail, the permittee shall remove the soil material and thoroughly sweep the surface within four hours.

c) If eroded soils enter, or entrance appears imminent, into wetlands or other water bodies, clean-up and repair shall be immediate.

d) Permittee shall provide all traffic control and flagging required to protect the traveling public during the clean-up operation.

A14.6 Ground Cover

a) Plans or Specifications shall indicate placement and type of temporary and permanent ground cover.

A14.7 Steep Slopes

a) Disturbed slopes in excess of 4:1 shall be seeded and protected with wood fiber blankets or they shall be sodded and staked.

A14.8 Silt Fence

a) Silt Fence shall be installed in accordance with the City Standard Details.

b) Silt fences shall be provided to protect adjacent property from receiving untreated runoff.

c) Silt fences shall be provided around stockpiles that are to remain in place for more than 7 days.

d) Water bodies and watercourses shall be protected from receiving untreated runoff.

e) Silt fences shall follow contour lines with ends flared uphill to provide storage capacity.

f) Flow length up slope from silt fence shall be limited as follows:

(1) 600' max for slopes less than 3%.

(2) 300’ max. for slopes 3% to 6%.

(3) 150’ max. for slopes greater than 6%.

A14.9 Stabilized Vehicle Exits

a) Stabilized Vehicle Exits shall be provided where construction equipment will exit the site.

A15 EASEMENTS AND OUTLOT STANDARDS

A15.1 Easements

a) Drainage Easements

(1) Drainage easements shall be provided in accordance with the criteria outlined herein.

(2) Drainage easements shall cover all private ponding areas and cover the area that is 2 feet or less above the design high water elevation of the pond or 1 foot above the emergency overflow elevation for the pond, whichever is higher.

(3) Drainage easements shall be provided where concentrated flow from more than 1 adjacent lot is received.

(4) Drainage easements shall be provided at emergency overland overflow locations associated with:

- Catch basins in sag vertical curves
- Detention and Retention ponds
- Any location where failure of the underground storm sewer system to handle 100-year frequency storm flows would result in overland drainage.

(5) Minimum drainage easements widths:

- 15’ wide for flows from 1 acre or less or 4 lots or less.
- 20’ wide for flows from more than 1 acre or more than 4 lots.
- Three times the combination of pipe diameter plus bury depth or 20’, whichever is greater, for all buried pipes.

A15.2 Outlots

a) Outlots used for Storm Water Management Ponds.

(1) Sufficient design computations shall be submitted at the time of preliminary platting to show that the outlot size as shown on the Preliminary Plat is capable of housing the required storm water facility. These computations shall include, but are not limited to the following:

- Subdivision runoff computations showing the required volumes of detention to meet ordinance requirements.
- Details of the proposed rate control structure including information such as location, size and invert of any existing storm sewer pipe to which the proposed pond will discharge.
- Grading plans for the proposed pond showing that required volumes are provided and that pond grading standards can be met with the proposed outlot.

A16 STANDARDS FOR PRIVATE FACILITIES

A16.1 General

a) Standards for private facilities shall conform to City of River Falls Storm Water Management Standards, with the following exceptions.
Note: The City does not approve of these decisions, but will allow the owner to use his/her own discretion.

(1) §A7.2 Maintenance access shall be provided to the site, however the access does not need to conform to City standards.

(2) §A9.1b(3) Aquatic bench may be limited to 8 feet.

(3) §A9.1b(5) A forebay will not be required unless WDNR requirements stipulate the need for one.

(4) §A9.2b(2) Mean depth shall meet WDNR requirements.

(5) §A9.2b(3) Maximum depth shall meet WDNR requirements.

(6) §A9.3 Skimmers on outlets may be omitted with City Engineer approval.

(7) §A10.1c TSS removal shall still be 85%, however the infiltration basin may be used to meet the TSS requirement.

(8) §A11.3a&b Inlet types will not be specified, however the storm sewer system (pipes and inlet grates) shall still control the 10 year storm event.

(9) §A11.3g&h Catch basin spacing may be determined by developer for areas with private streets and private pipes.

(10) §A12.1a Native seeding will not be required in pond areas, but it is encouraged.

(11) §A15.1(3-5) Easements will not be required for privately owned and maintained piping and drainage swales.

A17 CHECKLISTS AND FORMS

A17.1 General

a) Below are descriptions of the various forms and checklist that have been created to standardize the form and function of Storm Water Management Plans submitted to the City of River Falls. Following this section are the actual forms and checklists that may be reproduced for use in storm water management plans.

(1) *Storm Water Management Permit Information*. This sheet provides an outline of the general storm water management permitting process.

(2) *Submittal Checklist*. This checklist will be utilized by the City of River Falls to determine if a submittal is complete. An incomplete submittal will be rejected and not reviewed.

(3) *Project Summary Sheet*. This summary sheet shall be completed by the design engineer and included in the drainage report.

(4) *Plan Sheet Checklist*. This checklist will be utilized by the City of River Falls to review plan sheet submittals.

(5) *General Design Requirements Checklist*. This checklist will be utilized by the City of River Falls to review all designs submitted for approval.

(6) *Wet Pond Summary Sheet*. This summary sheet shall be completed by the design engineer for each wet pond and included in the drainage report.

(7) *Infiltration Summary Sheet*. This summary sheet shall be completed by the design engineer for each infiltration device and included in the drainage report.

A18 STORM WATER MANAGEMENT PERMIT INFORMATION

- ❑ Pre-application meeting with City Engineering staff to discuss project and unique site conditions. This can also be a used to run preliminary storm water management ideas past us.
- ❑ Exceptions to this ordinance are listed on pages 4 & 5 of the ordinance. Please direct any questions regarding the ordinance and/or standards to Crystal at (715) 426-3412 or Reid at 426-3409.
- ❑ Submit Storm Water Management Permit Application and fee with first submittal of plans and/or calculations to City.
- ❑ Respond to comments from engineering department.
- ❑ The City shall have 30 business days to review the first full submittal.
- ❑ The City shall have 15 business days to review any additional submittals.
- ❑ Most projects will require a short-term maintenance and monitoring agreement to be signed and submitted to cover maintenance during the construction phase. This document is drafted by the City, but shall be open to comment and revision from the owner and/or the owner's engineer.
- ❑ After all comments have been addressed and the short-term agreement is on file with the City, and an infiltration test has been conducted, approval of plans and calculations will be granted. The City Engineer will sign the permit application and a copy will be mailed to owner. Permit is valid for 180 days from date of issuance unless extended by City Engineer or property passes final inspection.
- ❑ Ground breaking may commence only once the Storm Water Management Permit is signed. Permit holder shall notify the City at least 5 business days before commencing any work. A copy of the storm water plan shall be available on the job site at all times.
- ❑ Permit holder shall notify the City of any significant modifications it intends to make to an approved storm water plan.
- ❑ Permitee shall inspect all BMP's within 24 hours of any rain event of 0.5 inches or more, and at least once a week. Written records shall be kept of these inspections.
- ❑ Private systems are generally systems that are designed and built to serve only one property. Privately maintained systems will require a long-term storm water management agreement to be signed and filed with the county. Owner must provide proper legal description of property for recording purposes. The City will then draft the document to be signed and notarized by the owner. Once signed and notarized, return to the City to be recorded with the county. This shall be submitted to the City prior to the issuance of an occupancy permit.
- ❑ Close out of projects:
  - ❑ If the systems will be publicly maintained, systems must pass City inspection and be functioning as designed. Please reference our infiltration acceptance procedures.
  - ❑ If the systems will be privately maintained, a certified as-built and/or certification by an engineer registered in the state of WI must be submitted to the City within 6 months of completion of the project. Certification may be simply a memo indicating that systems were constructed per plans (with date given), no changes were made to the plans, and the system should function as intended, etc

Engineering Department
222 Lewis Street, Suite 225
River Falls, WI 54022
(715) 426-3412

A19 SUBMITTAL CHECKLIST

Project Name	Engineering Contact Name

	Submitted
Storm Water Management Permit Application and fee	_____
Full Plan Set:	
Pre-development plan	_____
Post-development plan	_____
Grading and drainage plan	_____
Erosion control plan	_____
Storm sewer system	_____
Full Drainage Report (Please submit Drainage Report in this order):	
Project summary sheet, Submittal checklist, Plan sheet checklist, General design requirements checklist	_____
Any pertinent notes or schematics	_____
Pre-developed hydrographs	_____
Post-developed hydrographs	_____
Construction phase hydrographs as applicable	_____
Wet pond summary sheets and reservoir reports	_____
Outlet structure reports (and details if not in plans)	_____
Water quality analysis (P8 or SLAMM)	_____
Infiltration summary sheets and infiltration calculations	_____
Any offsite analysis (hydrographs, maps, outlets, etc)	_____
Storm sewer analysis	_____
Soil borings and infiltration test results (with mapped locations)	_____
Soils Map	_____
Plan view of storm sewer (if not in plan set)	_____
Pre and post-developed plan view of drainage areas	_____
Storm sewershed map	_____
Flow path used to calculate time of concentration	_____

As project nears permit approval, City will draft short-term maintenance and monitoring agreement which shall be signed prior to permit approval. City will draft long-term maintenance and monitoring agreement to be signed prior to occupancy permit being granted.

A20 PROJECT SUMMARY SHEET

Project Name	Engineering Contact Name

**If additional space is required for any of these parameters, please attach another page.

Brief description of project and storm water practices utilized:

_____
_____
_____
_____

Please list all locations water is currently leaving the site:
Location 1:_____
Location 2:_____
Location 3:_____
Location 4:_____

Please provide rate control summaries in the tables provided for each location water is leaving the site.

Location 1	**1-year (cfs)**	**2-year (cfs)**	**10-year (cfs)**	**100-year (cfs)**
Pre-Developed				
Post-Developed Un-routed				
Post-Developed Routed				

Location 2	**1-year (cfs)**	**2-year (cfs)**	**10-year (cfs)**	**100-year (cfs)**
Pre-Developed				
Post-Developed Un-routed				
Post-Developed Routed				

Location 3	**1-year (cfs)**	**2-year (cfs)**	**10-year (cfs)**	**100-year (cfs)**
Pre-Developed				
Post-Developed Un-routed				
Post-Developed Routed				

Location 4	**1-year (cfs)**	**2-year (cfs)**	**10-year (cfs)**	**100-year (cfs)**
Pre-Developed				
Post-Developed Un-routed				
Post-Developed Routed				

Schedule and Sequencing: Include a description of the intended sequence of major activities that disturb soils for major portions of the site, such as grubbing, excavating or grading. Also describe any staging of land disturbing construction activities to limit exposed soil areas subject to erosion. Include anticipated starting and completion dates of each sequence of land disturbing activities and the anticipated date of completion of erosion runoff control measures and establishment of final cover for each sequence area.

Descriptions of any interim and permanent stabilization practices. Also include descriptions of any structural practices to divert flow away from exposed soils, store flows or otherwise limit runoff and the discharge of pollutants from the construction site:

Any major assumptions used in the design or developing input parameters for the hydrology model:

A21 PLAN SHEET CHECKLIST

Project Name	Engineering Contact Name

Pre-Development Plan Sheet(s)

- ❑ 1"=100' or larger scale
- ❑ Existing 2-foot contours
- ❑ Property lines and easements
- ❑ Existing structures, roads, other paving or impervious cover and vegetative cover
- ❑ Existing topography of site and sufficient adjacent lands to indicate site location and existing drainage patterns, water courses, pipes or structures that may affect or be affected by the proposed development
- ❑ Limits of any natural wetland and/or floodplain based on a 100-year flood
- ❑ Existing public and private utilities are shown.

Post-Development Plan Sheet(s)

- ❑ 1"=100' or larger scale
- ❑ Final proposed topography of the site at a contour interval not greater than 2 feet.
- ❑ Any changes to lakes, streams, wetlands, channels, ditches, and other watercourses on and immediately adjacent to the site are shown.
- ❑ Locations of easements.
- ❑ Limits of any natural wetland and/or floodplain based on a 100-year flood.
- ❑ Location, elevations and dimensions of proposed structures and paved areas.
- ❑ Location and types of utilities to be installed.

Erosion Control Plan Sheet(s)

- ❑ 1"=100' or larger scale
- ❑ Existing and proposed contours
- ❑ Location and sediment controls for temporary stockpile areas are shown.
- ❑ Areas to be sodded or seeded and mulched or otherwise stabilized with vegetation or other permeable/protective cover, describing type of final vegetative cover. Type and quantity of mulch or cover material and method of anchoring shall be indicated, as well as seeding mixtures & rates and lime & fertilizer application rates.
- ❑ Shown location of all BMP's
- ❑ Drainage ways are stabilized
- ❑ Stabilized vehicle exits are provided where construction equipment will exit the site.
- ❑ Velocity dissipation devices at discharge locations and the length of any outfall channel.
- ❑ Temporary and permanent erosion control measures are provided and located.
- ❑ Storm inlets protected from receiving sediment.
- ❑ Smallest area disturbed at any given time.
- ❑ Applicable notes on plan sheet regarding erosion control (please request "City of River Falls Standard Notes for Grading and Erosion Control Plans" if needed).
- ❑ Disturbed slopes in excess of 4:1 are seeded and protected erosion blankets or are sodded and staked.
- ❑ Silt fence shall be installed in accordance with standard details.
- ❑ Silt fences are provided to protect adjacent property from receiving untreated runoff.

- ❑ Identifies contractor(s) or subcontractor(s) who will install and maintain erosion control and storm water management measures.
- ❑ Water bodies and watercourses are protected from receiving untreated runoff.
- ❑ Silt fences follow contour lines with ends flared uphill to provide storage capacity.
- ❑ Silt fences are used in sheet flow areas only, not for concentrated flows.
- ❑ Flow length up slope from silt fence shall is limited as follows:
  - 600' max for slopes less than 3%.
  - 300' max. for slopes 3% to 6%.
  - 150' max. for slopes greater than 6%

Grading/Drainage Plan Sheet(s)

- ❑ 1"=50' or larger scale
- ❑ 2-foot contours (1-foot contours in the pond areas)
- ❑ Contours for existing topography are dashed and proposed are solid. Contours are labeled.
- ❑ North arrow shown (up or to left)
- ❑ Property limits shown
- ❑ Park and wetland areas are shown
- ❑ Existing wells and drain fields are shown
- ❑ Emergency overflows labeled
- ❑ Maximum ponding allowed: 9" in parking lots, 12" in streets, 18" in rear yards
- ❑ Check truck loading docks. In overflow situations, the plan shall show positive overland drainage away from the docking area. Groundwater elevations shown (or accounted for in notes section)
- ❑ Bottom, normal water level and high water level elevations are shown.
- ❑ Flow path and direction for all storm water conveyance sections
- ❑ Location, dimensions and description of all channels, pipes, structures, basins, reservoirs or other conveyances proposed to carry runoff to the nearest adequate outlet.
- ❑ The minimum building opening elevation is shown and complies with the following:
  - 2 feet above the 100-year design storm elevation.
  - At least one foot above the emergency overflow
  - At least 4 feet above the groundwater table
- ❑ Each lot shall have:
  - Proposed elevation of garage floor
  - Lowest opening elevation
  - Ground elevation at front of building.
  - Ground elevation at rear of building.
  - Proposed structure type (STD or S, SWO or LO, WO).
  - Proposed lot corner elevations.
- ❑ High points and low points labeled as needed
- ❑ Drainage directional arrows are shown
- ❑ Percent of grade is shown for all drainage swales
- ❑ Drainage flows over only one adjacent lot before proper discharge
- ❑ All rear and side yard swales shall be centered on property lines
- ❑ Drainage flows away from structures
- ❑ Minimum lot grades are 1% for HSG Types A & B or 2% for HSG Types C & D wherever drainage from only one lot exists
- ❑ Any retaining walls are shown
- ❑ Plan accommodates offsite drainage
- ❑ Plan matches existing grades at the development property lines with a slope not to exceed 3:1 within 10 feet of the property line.

A22 GENERAL DESIGN REQUIREMENTS CHECKLIST

Project Name	Engineering Contact Name

Drainage Easements

- ❑ Provided for all private storm water rate control facilities
- ❑ Provided where concentrated flow from more than 1 adjacent lot is received
- ❑ Provided where emergency overland overflow location associated with:
  - Catch basins in sag vertical curves
  - Detention and retention ponds
  - Anywhere the storm sewer system cannot handle a 100-year event
- ❑ Minimum drainage easement widths shall be as follows:
  - 15’ wide for flows from 1 acre or less, or 4 lots or less
  - 20’ wide for flows from more than 1 acre or more than 4 lots
  - Three times the combination of pipe diameter plus bury depth or20’, whichever is greater, for all other buried pipes.
- ❑ All easements shall be seeded and protected
- ❑ All easements are shown on grading plan

Swales

- ❑ Channelized storm runoff in excess of 0.5cfs discharges into a catch basin or inlet before crossing a sidewalk or curb.
- ❑ Swales are seeded and protected with wood fiber blankets or are sodded and staked where concentrated flow from more than 1 acre or 4 lots is directed.
- ❑ Velocity computations are provided for drainage swales where concentrated flow from more than 2 acres or 8 lots.
- ❑ Permanent turf reinforcement mats are installed in drainage swales where design velocities exceed 7fps.
- ❑ Minimum swale cross section for flows from 1 acre or less or 4 lots or less are a V-shaped ditch, 1.9’ deep with 4:1 side slopes up to a 15’ easement line
- ❑ Minimum swale cross section for flow from more than 1 acre or more than 4 lots shall be a ditch, 2’ deep with a 4’ bottom and 4:1 side slopes up to a 20’ easement line.
- ❑ All public drainage rear yard swales and roadside ditches shall have a min. 1% grade.
- ❑ Rear and side yard swales centered on property lines.

Permanent Ponds

- ❑ Public pond areas are platted as outlots, Private pond areas are platted as drainage easements.
- ❑ 85% sediment removal for new development and 40% sediment removal for redevelopment.
- ❑ Not located within wellhead protection area.
- ❑ Emergency overflow spillway is provided to accommodate events greater than the 100-year event. High point elevation and direction of overflow are marked on plans.

- One foot of freeboard shall be provided above the emergency overflow.
- Access bench shall be no further than 20 feet horizontally from the normal water level.
- Inlet(s) and outlet have energy dissipation devices.
- 4:1 side slopes maximum above the normal water level.
- Storage below outlet for sediment accumulation.
- Inlet(s) and outlet are located at opposite ends to prevent short-circuiting of pond.
- Mean pond depth (volume/surface area) is 4 feet or greater, excluding safety bench.
- Maximum pond depth based on normal water level is 10 feet or less.
- Ponds greater than 20,000sf, 50% of surface area shall be a minimum of 5 feet deep.
- 10:1 slope starting at the pond's normal water level and extending 15 feet from shore, 3:1 max slope there after.
- 15' wide access and turn-around area for maintenance vehicles is shown on a slope no greater than 15%. Access shall encircle the pond above the 100-year high water elevation for the pond.
- Length to width ratio of pond is 3 or greater.
- Control outlet is provided with skimmer to prevent plugging from floating debris
- Trash racks installed as needed
- No utility lines located within basin area
- No utility boxes located in access road to pond.

Infiltration Ponds

- Pretreatment is provided for parking lot and new road construction runoff
- 3 feet separation distance from groundwater
- Half of measured infiltration rate is used as design infiltration rate
- Design infiltration 0.25-5.0 in/hr, verified with 3 double ring infiltrometer tests
- Pipes going to infiltration facility sized to pass two times the volume required for infiltration.
- For inverted pipes: water level in the treatment pond after 48 hours shall be considered the NWL and the volume required for infiltration shall be provided above that level.
- Pond has maintenance draw down device
- 100 foot private well setback;400 ft public well setback (see pg 5)
- 200 foot setback from 20% slopes (2 feet elevation change in 10 feet)
- Erosion protection provided at inlet
- Drainage area is less than 50 acres for each pond
- Maximum depth is 4 feet
- Flat bottom with 4:1 side slopes, longitudinal slope 1% max, lateral slopes 0%
- Pond designed to infiltrate in less than 48 hours, based on the design infiltration rate
- Not located in floodplain
- 1 foot of freeboard is provided above the emergency overflow

Infiltration Trenches

- Depth is not greater than width
- Filter fabric shall surround trench
- 3 feet separation distance from groundwater (5 feet in industrial and commercial areas)
- Infiltration rate 0.5-5.0 in/hr
- Location, surface area, depth, soil types and infiltration rate and volume comps are included.
- Pretreatment is provided for parking lot and new road construction runoff prior to infiltration.
- Half of measured infiltration rate is used as design infiltration rate

- ❑ Observation wells provided
- ❑ Emergency overflow provided

Minor Systems (Storm Sewer, Ditches, Culverts)

- ❑ Local systems provide for containment of flows from 10-year event within parking lanes of roadway without overtopping the curb
- ❑ Drainage report indicates inlet capacity of each CB and how much flow by passes the CB.
- ❑ When a system has reached its capacity and a 24-hour, 100-year storm event occurs, the maximum allowable ponding shall be:
  - 18" in a rear yard
  - 9" in a parking lot
  - 12" in a street or gutter
- ❑ Path for overflows from 100-year event is evaluated to ensure no structural damage will occur as a result of street low-point flooding
- ❑ Open channels shall carry 10-year event within channel and 100-year event in right-of-way.
- ❑ Emergency overflows provided. Overflow should be at least one foot below the lowest opening elevation.
- ❑ Emergency overflows are analyzed for the 100-year storm as part of the design of the structure.
- ❑ Anti-seepage collars used where necessary.

Storm Sewer

- ❑ Storm sewers are reinforced concrete pipe or dual wall HDPE
- ❑ Minimum cover for storm sewer:
  - 2' in non-pavement areas
  - 1' in paved areas and for laterals
- ❑ Catch basins within the curb areas of City streets have 2'x3' grates and curb inlets (Neenah R-3067-V)
- ❑ Drainage does not cross intersections in 10-yr event (no valley gutters).
- ❑ Mid-block CB's on property lines.
- ❑ CB's are not in the curb return at intersections.
- ❑ CB's spaced 600' max. on collectors & arterials.
- ❑ CB's spaced 800' max. on residential streets.
- ❑ Minimum catch basin depth shall be 3' (measured from pavement to invert)
- ❑ All Manholes are precast reinforced concrete with offset cone tops.
- ❑ 400' max. MH spacing for lines 15" diameter or less.
- ❑ 500' max. MH spacing for lines 18" to 30" diameter
- ❑ MH's provided at change in direction or grade.
- ❑ Storm sewer pipe materials only change at MH or CB
- ❑ Buried "T" connections allowed where:
  - The main is at least 2x the diameter of the lateral
  - Length of lateral measured from the "T" to the next structure is not greater than 100'
- ❑ Any outfall storm sewer draining into an existing open ditch or watercourse has a reinforced concrete head wall or end section.
- ❑ Pipes larger than 15" diameter, discharge flow direction shall be at 45 degrees or less to the flow direction of the receiving ditch or stream.
- ❑ Discharge shall be taken to rear property lines at a minimum.

A23 WET POND SUMMARY SHEET

Project Name	Engineering Contact Name

Pond ID: _____

Design Information

Normal Water Elevation _____ft

High Water Elevation for 100-yr Event _____ft

Bottom Elevation _____ft

Surface Area for:

100-year, 24-hour event _____sf

Normal water elevation _____sf

Volume of Pond for:

100-year, 24-hour event _____ac-ft

Normal water elevation _____ac-ft

Overflow Elevation _____ft

Minimum Building Elevation _____ft

Total Suspended Solids Removal _____%

If TSS removal is less than 85% for this device, please explain: _____

_____

Downstream

Downstream Major Water Body_____

Description of where water travels from the pond to the downstream major water body: _____

_____

_____

A24 INFILTRATION SUMMARY SHEET

Project Name	Engineering Contact Name

Facility ID: _____

Soil and Site Investigation

Soil type(s) and location on site:

_____

_____

Design infiltration rate (between 0.25-5 in/hr) _____in/hr

Note: Shall be ½ of measured dual ring infiltrometer tests (minimum of three tests per infiltration area)

Distance from bottom to bedrock (3ft min) _____ft

Distance from bottom to seasonal high groundwater (3ft min) _____ft

Floodplain area Y / N

Wellhead Protection Involved Y / N

Design Information

Volume required (using TR-55, post minus pre) _____ac-ft

Note: Connected impervious shall be modeled in a separate subcatchment from the remaining area

Volume provided below outlet or overflow _____ac-ft

Time required to completely infiltrate stored water (48 hrs max) _____hrs

Bottom area _____sf

Bottom elevation _____ft

Emergency overflow elevation _____ft

Top of berm elevation _____ft

Device(s) providing tretreatment:_____

**Please provide calculations and/or supporting information for all information provided on this page. e.g. soil borings, soils map, dual ring infiltrometer test results and locations, volume computations, etc.