IN THE UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF ILLINOIS
WESTERN DIVISION

THE UNITED STATES OF AMERICA and THE STATE OF ILLINOIS Plaintiffs, v. THE CITY OF ROCKFORD, ILLINOIS, Defendant.	)	Civil Action No. 3:15cv50250

CONSENT DECREE
APPENDIX N

CITY OF ROCKFORD
STORMWATER
TECHNICAL GUIDANCE MANUAL

May 18, 2015

CITY OF ROCKFORD – STORMWATER TECHNICAL GUIDANCE MANUAL

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INTRODUCTION

The City of Rockford Stormwater Technical Guidance Manual (Manual) is a technical guide to provide developers and applicant's assistance in complying with the Stormwater Ordinance and the technical requirements of a stormwater permit application.

Purpose

The purpose of the Technical Guidance Manual is to supplement the City of Rockford Stormwater Ordinance (Ordinance) by providing background, detail, and intent of the technical requirements in the Ordinance. This manual contains discussion, tables, figures and exhibits covering most of the topics found in the Ordinance to assist the applicant in preparing a complete Stormwater Management Permit Application. The examples illustrated in this Manual are general and attempt to cover the most common requirements. In practice there will be situations that arise in the design of a development that will not be directly related to one of the examples in this manual. The concepts illustrated can be applied to a variety of developments.

The Manual is linked directly to the City of Rockford Stormwater Management Ordinance by using the same Section numbers as those contained in the Ordinance, with a "T" added to the number.

The Manual is to facilitate implementation and provide guidance necessary to achieve the objectives and standards of the Ordinance. Other techniques may exist that will exceed the criteria with less effort or at a lower cost. The applicant accepts the burden of demonstrating the technical adequacy of the development design and is completely responsible for conformance with the criteria of the Ordinance.

The different technical requirements are further defined in this Manual by use of charts, tables and example problems. Recommended forms for compliance with the Ordinance are also provided.

TECHNICAL GUIDANCE

ARTICLE 2 — REQUIREMENTS FOR STORMWATER MANAGEMENT

T2-00 General Requirements

The guidance in this manual provides the minimum interpretation of the requirements of the Ordinance and serves as a baseline for preparation of a Stormwater Management Permit. In order to determine if a development requires a City of Rockford Stormwater Management permit, the applicant must refer to § 500 of the Ordinance. In general, a stormwater management permit does not apply to hydraulically disturbed areas less than or equal to 5,000 s.f. of aggregate development, unless the development is located in a Special Management Area, as defined in § 104 of the Ordinance. For activities exempt from the Ordinance, the applicant is referred to § 801. For any project with more than one permitting authority, it is advisable to have one review specialist.

Road development in the right-of-way, under the ownership or control of a unit of local government with greater than one acre of new impervious surfaces in aggregate shall consider stormwater detention. When questions arise regarding the one acre provision, the Administrator will be the sole judge in determining if the one acre of new impervious surfaces in aggregate has been exceeded.

Existing agricultural land uses are not addressed directly in the Ordinance, but in general only agricultural activities that create new impervious surfaces are regulated, and hydraulic disturbances greater than 5000 s.f. will require a permit. Hydraulic disturbances $\geq$1 acre will also require NPDES filed with IEPA. The definition of development excludes maintenance of existing agricultural systems for cultivated areas and crop productions. It also excludes activities undertaken as part of an NRCS conservation plan, such as terracing or other soil erosion prevention measures. When new rooftops or roadways on existing agricultural lands total 25,000 s.f. or more in aggregate, then detention is required similar to additions to other existing land uses.

T2-00(b) Site Runoff Storage Requirements

For developments requiring a general Stormwater Management Permit application, the owner and developer must attest to an understanding of the Ordinance criteria and an intent to comply, before initiating development.

T2-01 General Stormwater Requirements

Stormwater drainage requirements are applied to all development and redevelopment throughout the City of Rockford to prevent inappropriate site drainage contributing to increased flood damage. Proper site drainage analysis is meant to protect existing and future structures, as well as subsurface infrastructure and to improve water quality for the City. The developer must consider possible adverse effects of the proposed activity and avoid knowingly undertaking any activity that will cause a violation of the general Standards specified in § 201 of the Ordinance.

The erosion and sediment control must be installed prior to commencement of general construction and detention shall be complete before issuing occupancy.

T2-01(d) Overland Flow Paths

Overland flow paths should be designed to safely convey the 1% annual chance flood event. Overland flow paths can be

- Side/rear yard swales,
- Roadways,
- Storm sewers for upstream tributary areas <20 acres.

No development shall—

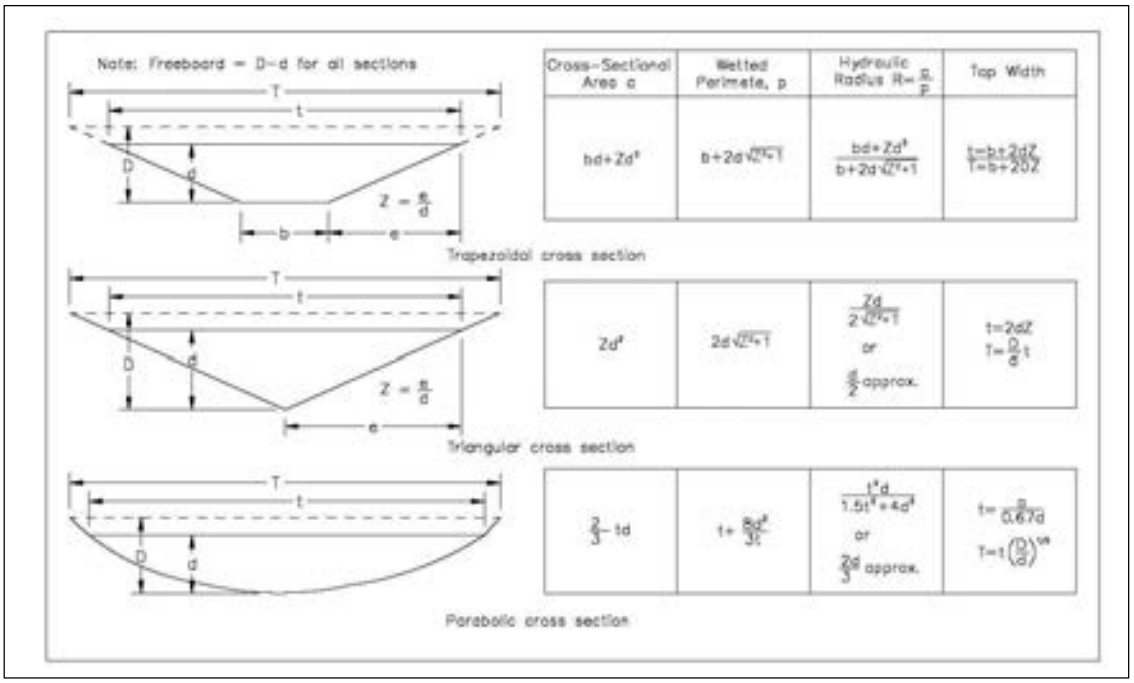
(1) result in any new or additional expense to any person other than the developer for flood protection; or

(2) increase flood elevations or decrease flood conveyance capacity upstream or downstream of the site.

$$Q = (1.49/n)\, AR^{2/3}\, S^{1/2}$$

where *n* is the channel roughness coefficient.

FIGURE 1
Geometric Elements of Channel Sections
(Reference: Chow, Ven Te, 1959; Open-Channel Hydraulics)



T2-01(e) Protection of Buildings

All usable space in new buildings, additions, and buildings undergoing substantial improvement must be protected against flooding from the base flood. A measure of protection has been added to the usable space of a building by requiring the usable space to be protected to the flood protection elevation (FPE), which is higher than the base flood elevation (BFE). This can be accomplished by elevating the buildings or floodproofing. Requirements for elevating and floodproofing are described in § 407. All usable space in buildings must be 2 feet above the base flood elevation. The required flood protection elevations for buildings is illustrated in Figure 1. Buildings proposed, but located in the floodplain must be elevated to the flood protection elevation whereas, buildings outside the floodplain in a known flood prone area must be protected to the flood protection elevation.

T2-01(f) Planning Principles

Meeting the requirements of this Ordinance has to be considered long before a site plan is approved, and this section defines some planning criteria necessary to accomplish this. It also states that zoning variances should be considered where current zoning creates a conflict, such as excessive set-back requirements and the intent to minimize impervious surfaces. The Ordinance of course does not require the applicant to request these types of variances officially; they should at least be discussed at a staff level when the site plan is being developed.

T2-01(g) Depressional Storage

Note that by definition, the depressional storage does not have a direct gravity outlet but if in agricultural production, it is more than likely drained by a tile and should be modeled as "empty" at the beginning of a storm. Flood storage on-site with a positive gravity surface outlet does not need to be compensated for, except when it qualifies as floodplain storage in Article 4 or when its loss causes a violation of a requirement of § 201.

The function cf any existing depressional storage should be modeled using an event hydrograph model [acceptable event hydrograph models are listed in § T202(e)] to determine the volume of storage that exists and its effect on existing site release rate. In order to prepare such a model, certain information must be obtained, including delineating the tributary drainage area, the stage-storage relationship and discharge rating curve, and identifying the capacity and elevation of the outlet(s).

The tributary area should be delineated on the best available topographic data. When the tributary area is confined to the project site, the site topographic map (1' contour interval) shall be used. If the tributary area to the depressional storage extends beyond the project limits, the Winnebago County 2' topographic maps should be used to supplement on-site survey data. If the County maps are not available, the United States Geological Survey (USGS) maps may be used for off-site areas.

After determining the tributary area, a hydrologic analysis of the watershed should be performed, including a calculation of the appropriate composite runoff curve number and time of concentration. Stage-storage data for the depressional area should be obtained

from the site topographic map. The outlet should be clearly marked and any calculations performed to create a stage-discharge rating curve should be included with the stormwater submittal.

A critical duration analysis should be performed within the depressional storage and the corresponding storage volume. The 100-year recurrence interval storm should be used for the 1-, 2-, 3-, 6-, 12-, 18-, 24-, 48-, 72-, 120-and 240-hour storm events. See § T202(f) for more information on the critical duration analysis.

Any depressional storage to be filled by the proposed development must be compensated for at a 1:1 ratio. If the entire existing tributary area is conveyed to the site runoff storage facility, the compensatory storage may be provided in the facility. If the off-site area tributary to the depressional area is not conveyed to the detention basin, a separate detention basin should be considered at the location of the existing depressional storage location so off-site flow is attenuated to the same degree in pre-project compared to in post-project conditions. The required compensatory storage should be added to the site storage requirement, and this total volume requirement should be available below the detention basin overflow elevation. It is not necessary to provide incremental compensatory storage for fill of depressional storage.

T2-02 Site Runoff Requirements

§ T202 lists some of the appropriate hydrologic and hydraulic calculation methods with which runoff can be calculated and suggest ways in which it can be adequately collected and conveyed without causing any negative impacts for a given design frequency. A site runoff example is contained in Figure 2, where the proposed site drains to one facility.

T2-02(a) Stormwater Facility Discharges

For simple developments with few drainage facilities, these criteria should be met if:

1. All site runoff exits the site through vegetated swales (i.e., runoff velocities are minimized); and

2. All site runoff exits the site either into an adjacent drainage way or spreads overland in the same direction as the predevelopment drainage, or into a drainage easement that is continuous until it reaches an existing downstream drainageway.

3. The runoff from the site demonstrated to be safely conveyed to a stream.

For larger developments or smaller developments that do not meet the above conditions, these criteria require that the developer consider the full impact site drainage system may have on downstream locations. It is necessary to:

1. Identify all points where runoff will exit the drainage site. This will include point discharge locations (where sump pumps discharge or where flows from drainage pipes, culverts, swales, or other drainage ways exit the site) as well as areas where diffused overland flow will exit the site.

2. Determine whether these immediate discharge points will be affected by the discharge. This will include considering the exit points susceptibility to water

damage (i.e., is the drainage ditch expected to convey water, or is a walkway expected to stay dry, etc.).

3. Determine whether the discharge quantity will affect the discharge point adversely. In general, if:

   a) The existing drainage patterns have been retained such that the points of discharge from the site have the same tributary areas as before discharges; and

   b) The discharge quantity at each point will be less than the pre-development flow rate to that point under pre-development conditions; and

   c) The point has been historically free from flood damage; then

The discharge quantity will probably not cause damage to the adjacent property. It is the responsibility of the applicant to check if the waterway can handle the post development flows long term without causing severe erosion. The applicant shall use an energy dissipater system at the outlet) of a storm sewer system that empties into a waterway, unless otherwise approved by the Stormwater Administrator.

If all the conditions above are not met, the developer must demonstrate that the proposed site drainage will not affect adjacent properties adversely. The developer is not responsible for rectifying off-site pre-existing failures to meet the criteria of the Ordinance. However, the developer is responsible for demonstrating that the development will not exacerbate existing related flood problems.

FIGURE 2
Detention Example

DETENTION EXAMPLE

FIGURE 2
Detention Example (continued)

PROCEDURE TO DETERMINE REQUIRED STORAGE

Step 1: Calculate volume to be retained to account for existing drain tile systems

VOLUME = RUNOFF x DCI AREA
DCI AREA = HYDRAULICALLY DISTURBED AREA x 0.30
For this example, the retention volume below the invert of the outlet is 3.88 acre-ft

Step 2: Calculate the allowable release rates

Q_{100} = 0.2 cfs/acre = 60 cfs

Step 3: Calculate Detention Storage Volume

To calculate the detention storage volume, begin by using the methodology found in the Natural Resources Conservation Service (NRCS) TR-55 Manual. Find the runoff depths of the 100-year design storm event. Using values associated with the example, the following runoff value is say:
Q_{100} = 5.50 in.

Using the following equation, the preliminary detention volume may be found (converted to acre-feet).
VOLUME = RUNOFF x ON-SITE TRIBUTARY AREA
V_{100} = 138 acre-feet

To finalize the detention basin design, a hydrologic model will be used in proposed detention basin designs and outlet release rates. Using NRCS TR-20 (a computer modeling software), enter in the data from the project site. After running the program for the 100-year event, the dimensions for the retention/detention facility will be found through several iterations.

Step 4: Add the Retention Volume to the Detention Facility

After designing the detention facility, the retention portion of the basin can be added. The retention volume will be added to the bottom of the detention facility, below the gravity outlet. Calculate the area of the bottom of the detention facility. With the value and the retention volume from step 1, calculate the depth below the outlet. This depth should not be greater than 18-inches. If the depth is greater than 18-inches, the detention area may need to be redesigned. The design may need to account for evaporation and inundation of the detention facility.

Step 5: Surcharge Storage Area

Two additional feet have been added to the top of the detention facility to control overflow from the dentention basin in the event the gravity outlet is blocked. A vegitated earth weir has been designed at the overflow point of the facility. The width of the weir is calculated by designing 2 feet of head and passing the pre-developed flow rate from the site, as required in the ordinance.

T2-02(b) Minor Stormwater System Criteria

Minor stormwater system drainageways are swales, channels, catch basins, drains, storm sewers, etc., that are designed for the motoring safety and convenience of the public (the normal drainage systems that convey water during frequent storms rather than allowing the runoff to pond or run on walkways, streets, or other locations where it would inconvenience public access or use of a site). The 10-year recurrence frequency is selected to define the upper limit for the minor stormwater system.

T2-02(c) Major Stormwater System Criteria

Major stormwater system drainageways are flow paths used only during major storms when the minor systems are overloaded. Restricting major stormwater flows to drainageways reduces the potential for flood damage.

All drainageways through the property that convey flows from areas off the development site should be left undisturbed or sized in accordance with the guidance set forth below.

Design of the major/minor systems may require:

1. Calculation of runoff rates for both the minor system criteria (typically 10-year design storm event) and the major system criteria (the 100-year design storm event);

2. Designing culverts, swales, catch basins and other "minor" drains to convey the minor design event fully; and

3. Calculating overland flow paths (broad swales, roadways, etc.) sufficient to carry the major design event flows and verifying that these flow paths do not result in property damage.

Sizing of the drainageways should:

1. Use the Manning's equation for open channels as shown in § T201(d). All drainageways should be designed for open-channel flow conditions. Surcharged design is acceptable only where the designer has fully considered the potential for hydrodynamic transients and the impacts on all connected drainageways. For minor stormwater systems that do not use open-channels, the drainageways may be calculated using the Modified Rational Method.

2. Have major stormwater system hydraulic gradelines (water surface elevation plus the pressure head) below elevations that could potentially cause damage. Hydraulic grade line evaluations must proceed upstream from:

   a) A demonstrated free overflow; or

   b) The expected base flood elevation of the most downstream point analyzed; or

   c) An alternative assumption demonstrated to be appropriate and conservative.

Steady-state backwater calculations are appropriate for calculating hydraulic grade lines in low-impact systems remote from the floodplain. Such calculations must consider at least the pressure and velocity heads of all drainageways. Tools that may be appropriate to assist in calculations include spreadsheets, WSP-2, HEC-2, HEC-RAS and, FHWA's HYDRA and Hydraflow.

3. Employ flood routing techniques for hydraulic evaluations for drainageways downstream of storage systems that address the time-varying nature of the storage facility adequately. If all storage basins are off-line or not in sequence, time-varying hydraulic routing need not be considered. Include the maximum discharge rated from the storage facility in the flow estimate at all downstream points.

   For in-line or sequential basins, the routing downstream must consider explicitly, or estimate conservatively, the impact of sequential storms, alternative storm patterns, and routing impacts between storage facilities. Continuous hydrologic routing techniques provide the explicit treatment of these factors. Such routing can be accomplished manually or by using appropriate time-varying hydraulic programs (e.g., STORM, SWMM, FEQ, UNET, HSPF).

4. Control maximum drainage system velocities in flow over roadways to address public safety needs. A commonly applied guide is that the product of velocity (ft./sec.) and depth (ft.) should not exceed a value of 4 for the storm with a 0.01 probability of occurrence in any year. § T2-02(h) defines the maximum allowable flow depths for transverse stream crossings of roads. This Guidance does not apply to existing watercourses for which the applicant has no control over the design.

Design of drainageways should:

1. Have sufficient energy dissipation at the outlet to prevent scouring of the streambank, bed, or downstream land. Armoring of the stream channel should not be considered in lieu of energy dissipation. Energy dissipation is essential to avoid transferring scour and stability problems further downstream.

2. To the extent possible, open-channel drainageways should have permanently deep rooted vegetated side slopes and inverts with velocities sufficiently limited to prevent scouring. This guide addresses the Plan requirement to control sediment and erosion from drainageways.

3. Have reasonable sideslopes given the engineering properties of the materials. A 3:1 sideslope typically provides adequate stability in an earth channel. If desired to be mowable a 4.1 is best. Deviations from the minimum value should be justified by appropriate calculations (e.g., slope stability calculations) and maintenance plans that do not require mowing.

T2-02(d) Existing Sub-Surface and Surface Drainage Systems

The applicant must locate all existing field tile systems on the project site. Particular attention should be paid to those field tile systems that are used to convey off-site flow

through the site to a downstream location. It is the responsibility of the developer to maintain adequate capacity of off-site drain tile systems entering the site. The potential for expansion of an existing agricultural drain can be determined by checking the topography tributary area upstream of a development which contains hydric soil and multiplying by 0.003 cfs/acre. If a drain tile system outlets into an adjacent property's drain tile system, the downstream drain tile capacity must be calculated using the slope and size of the drain tile. If the developer is not able to determine the capacity of the downstream system, then the assumption for the capacity should be limited to 0.003 cfs/acre multiplied by the amount of acres of hydric soil tributary to the downstream system at the point where it exits the developer's property. The developer has the option of:

1. Release into the existing drain tile system at the pro-rated capacity of the downstream field tile or 0.003 cfs/acre, whichever is less; or

2. Negotiate with the downstream property owner to upsize the field tile system to a greater capacity.

If the developer releases at 0.003 cfs/acre for the storm with 1% probability of occurrence in any year, the remaining 0.097 cfs/acre would need to be safely conveyed overland to the downstream property and discharged without scouring. The pro-rated capacity of a field tile can be determined as a percentage of the tributary area.

All field tile systems that do not serve a particular benefit (i.e., - draining open space) must be removed. It is not acceptable to only remove a few sections of the tile system. The concentration and conveyance of infiltrated runoff may cause problems if partial tile systems are left in place. Any on-site field tiles which remain on-site must be identified in record drawings.

T2-02(e) Design Runoff Rate

The design runoff rate for a development shall be the lesser of:

1. The runoff rate at the time of permit application, without the proposed project (i.e.- existing runoff rate); or

2. 0.2 cfs/acre of development.

The pre-developed runoff rate must account for any depressional storage and all other hydrologic features (e.g., soil conditions, ground cover and topography).

Acceptable event hydrograph computer models for determining the allowable release rate are: HEC-HMS, HEC-1 with SCS runoff method, SWMM, TR-20, and TR-55 tabular method. For calculation of design rates for conveyance, the Rational Method can be used for small subareas if the total drainage area at the point of design is 20 acres or less. The Administrator has the discretion to allow other event hydrograph models. The models listed in the Ordinance are all public domain models.

T2-02(f) Design Rainfall

For design storm events, the Illinois State Water Survey (ISWS) Bulletin 70 Northwest Sectional Rainfall Statistics shall be used. When designing for storage volume the 24-hour duration must be used. To design the conveyance capacity for stormwater system, the critical duration with the highest peak discharge shall be selected. The duration's that comprise a critical duration analysis are the 1-. 2-. 3-, 6-, 12-, 18-, 24-, 48-, 72-, 120-, 240- hour storm events. Table 1 lists the ISWS Bulletin 70 precipitation depths for various duration's and recurrence intervals.

TABLE 1
Illinois State Water Survey Bulletin 70
Rainfall Depths for Northwest Sectional

	Frequency						
Duration	**1-year**	**2-year**	**5-year**	**10-year**	**25-year**	**50-year**	**100-year**
5 min	0.31	0.37	0.47	0.56	0.67	0.78	0.89
10 min	0.57	0.68	0.87	1.02	1.23	1.44	1.62
15 min	0.70	0.84	1.07	1.25	1.51	1.76	1.99
30 min	0.95	1.15	1.46	1.71	2.07	2.42	2.77
1 hour	1.21	1.46	1.86	2.18	2.63	3.07	3.51
2 hour	1.52	1.83	2.33	2.74	3.31	3.86	4.47
3 hour	1.65	1.99	2.53	2.97	3.59	4.18	4.90
6 hour	1.93	2.33	2.96	3.48	4.20	4.90	5.69
12 hour	2.24	2.71	3.43	4.03	4.88	5.66	6.51
18 hour	2.37	2.86	3.63	4.26	5.15	6.01	6.92
24 hour	2.57	3.11	3.95	4.63	5.60	6.53	7.36
48 hour	2.80	3.42	4.28	4.96	6.07	7.02	8.07
72 hour	3.06	3.73	4.67	5.42	6.59	7.64	8.87
120 hour	3.45	4.13	5.10	5.91	7.21	8.36	9.97
240 hour	4.37	5.23	6.30	7.14	8.39	9.64	11.09

T2-02(g) Stormwater System Easements

The criteria of § 202(g) of the Ordinance suggests the land should be graded to drain to an existing public easement on the property (e.g., a public utility easement or existing drainage easement). If no such easement exists on the property, easements providing access for inspection and maintenance shall be granted on the property title for any stormwater structures (e.g., culverts, swales, ponds). Easement shall be noted "Maintained by the Individual Property Owners."

For development sites, the easement determination criteria required are:

1. Mapping of both the major and minor stormwater systems.

2. Mapping of an easement sufficient for maintenance for each of the stormwater facilities shown. A sufficient maintenance easement should be at least 10 feet wide around the perimeter of storage basins and along the drainageway, and extend continuously from a public roadway.

3. Dedication of the mapped easement on all plats or titles of all parcels containing

the easement. The dedication must indicate clearly that the purpose of the easement is for maintenance access to the stormwater facilities. This requirement does not require access for other public purposes, such as trails.

T2-02(h) Flow Depths

The major stormwater system may use roadways for conveyance of flows if such use of roadways is not otherwise prohibited (e.g., use of major traffic routes may be prohibited by highway regulations for safety reasons). In cases where roadways are included in the major drainage system, the depth of flow shall be calculated by the hydraulic methods described in § T202(c). Figure 3 helps explain the criteria of the Ordinance in regards to the maximum allowable flow depths on roadways.

T2-02(i) Diversions of Flow to Another Watershed

The criteria of § 202(i) of the Ordinance can be met best by designing all post-project runoff flow to a discharge from the site at the same location where it drained in pre-project conditions. Illinois drainage law must be consulted with regard to diversions and this Ordinance does not allow diversions prohibited by Illinois drainage law.

If the developer wishes to change the discharge locations this discharge must be approved in writing by the Administrator [§ 202(a)]. It will be necessary to calculate flows and hydraulic grade lines on all affected waterways for both the minor system design criteria and the major system design criteria, and to verify that the resultant hydraulic grade lines are below low entry point elevations or other damaging elevations.

The calculations should extend down both affected drainageways to the point where the prediversion flow direction joins the post diversion flow stream and up the affected drainageways to the point where the prediversion hydraulic grade line is calculated to be within 0.1 foot of the post diversion hydraulic grade line. If any of these drainageways have defined floodplains, the calculations must be accomplished in accordance with the guidance for floodplain hydraulic analysis [see Article 4 of the Ordinance]

T2-02(j) Best Management Practices Requirements

The City requires Best Management Practices (BMP's) to be considered for stormwater management. This section contains guidelines and standards to reduce and manage stormwater runoff. A hierarchy of BMP strategies shown below:

1. Minimize impervious surfaces on site to control increases in stormwater runoff

2. Preserve natural drainage features. Grass or vegetated swales, channels or flow paths should be left undisturbed to minimize impacts downstream of the subject site.

3. Utilize filter strips and level spreaders directly downstream of runoff contributing area to reduce runoff.

4. Utilize stormwater infiltration methods such as porous and permeable pavements and infiltration trenches to reduce and store stormwater runoff

5. Utilize bio-retention methods and rain gardens to infiltrate stormwater and reduce the need for traditional stormwater detention

6. To the extent practicable, drainage should be directed to and through on-site storage swales. The swales should be vegetated with water-tolerant species to prevent erosion and promote infiltration and pollutant capture

Directing sump pump flow away from storm sewers and impervious areas where practical to an infiltration area is an effective method to control stormwater flow. Redirecting sump pumps to a sanitary sewer system is not allowed.

The following standards and methods from the Illinois Urban Manual dated June 2013 shall be used as technical guidance for the BMP used:

NATURAL RESOURCES CONSERVATION SERVICE
ILLINOIS URBAN MANUAL
PRACTICE STANDARD

FILTER STRIP

(acre)
CODE 835

(Source:OH Rainwater and Land Development)

DEFINITION

A created or preserved area of vegetation designed to remove sediment and other pollutants and to enhance the infiltration of surface water runoff.

PURPOSE

The principal purpose of this practice is to remove sediment and other pollutants from runoff water by filtration, deposition, infiltration, absorption, and vegetative uptake. Another purpose is to reduce runoff quantities from impervious surfaces by infiltrating it into the ground.

CONDITIONS WHERE PRACTICE APPLIES

This practice may be applied in a variety of urban land uses where surface water runoff is discharged as overland sheet flow. Some typical locations of vegetated filter strips include:

1. Adjacent to roadways, parking lots, and other impervious surfaces to filter and convey runoff before it is discharged to swales, storm sewers, or surface water bodies
2. Lawns where roof downspouts are discharged to disperse and infiltrate runoff
3. Adjacent to wetlands, streams, ponds or lakes, or conservation practices to provide the runoff mitigation benefits described above and to serve as a wildlife habitat buffer
4. On construction sites and land undergoing development to filter sediment from overland sheet flow

CRITERIA

The maximum drainage area to a filter strip shall be 5 acres.

Vegetative filter strips shall have slopes 15% or less.

The minimum length (dimension parallel to flow path) of the filter strip is determined by the drainage area being treated and the width of the filter strip. The filter strip length shall be at least 1/2 the unit area length. The unit area

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length is calculated by dividing the drainage area to the filter strip, in square feet, by the filter strip width (dimension perpendicular to flow path), in feet. The minimum filter strip length shall be 5 feet except on construction sites where the minimum length shall be 25 feet.

The width (dimension perpendicular to flow path) of the filter strip determines the required length of the filter strip. The wider the filter strip, the shorter the required filter strip length. The width shall be as near the same width as the impervious area being treated.

Some applications (e.g., roof downspouts) may require a level spreader to prevent a concentrated flow path through the filter strip. Level spreaders shall be installed according to the requirements in practice standard LEVEL SPREADER 870. For parking lots and roadways, a level spreader will not be needed if the edge of the contributing runoff area is reasonably level and uniform. Level spreaders shall be installed in the filter strip every 50 feet of filter strip length on slopes greater than 5% and every 100 feet of filter strip length on slopes 5% or less.

The maximum flow velocity through the filter strip shall be calculated for the 10-year frequency, 24-hour duration storm event and shall not exceed the maximum permissible velocities as described in practice standard GRASSED LINED CHANNEL 840.

Vegetation shall follow the requirements of practice standard PERMANENT VEGETATION 880 and be protected with an erosion control blanket meeting the requirements of practice standard EROSION BLANKET 830 or mulched meeting the requirements of practice standard MULCHING 875. In place of permanent seeding, the filter strip may be vegetated with sod following the requirements of practice standard SODDING 925.

The filter strip vegetation should be fully established before the contributing impervious surface is created and its runoff directed onto the filter strip. Where this is not possible, the filter strip shall be vegetated with sod.

CONSIDERATIONS

Nearly 80% of the maximum potential settleable solids removal is achieved with the sizing criteria listed above. The efficiency can be increased to nearly 90% if the filter strip length is increased so that it has a length equaling or exceeding the unit area length.

Ideally, filter strips function best on slopes 5% or less. However, on slopes 1 % or less, vegetation used should be tolerant of saturated soil conditions.

It is critical that appropriate soil stabilization materials be applied immediately after seeding on all vegetative filter strips to minimize rill development during cover establishment. Due to the added runoff volumes coming from the impervious surfaces, an erosion control blanket will be necessary in most installations. Mulch may be adequate on relatively flat slopes where the contributing drainage area is small. In addition to stabilizing soils, these materials should significantly aid seed germination and early plant establishment.

Native prairie vegetation should be used if possible. Native vegetation has distinct advantages over turf grass,

including denser, deeper root structure to enhance infiltration; reduced maintenance needs (particularly less need for herbicides and fertilizer); and enhanced wildlife habitat.

If site constraints prevent the installation of broad filter strips meeting the specified sizing criteria, even narrower strips can provide substantial stormwater mitigation benefits in contrast to conventional curb and gutter storm sewer approaches.

Protect the filter strips from heavy foot and vehicular traffic during construction to prevent compaction and loss of infiltration capacity.

The filter strip area should be cleared of trees, stumps, brush, rocks, and similar materials if they are likely to interfere with installation of the filter strip (e.g., cause short-circuiting or concentrations of flow). Ideally, uniform, well vegetated strips of natural/native vegetation should be preserved as filter strips since their infiltration capacities are likely to be greater if grading is avoided.

On construction sites and other areas with bare soil where the filter strip is being used as a temporary sediment control technique, it is critical that temporary stabilization be applied to exposed soils and that concentrated flow through the filter strip be avoided. If the potential for concentrated flow exists, consideration should be given to construction of other sediment control practices above the filter strip. These practices shall meet the requirements of practice standards found in this manual such as practice standard TEMPORARY SEDIMENT TRAP 960, and SILT FENCE 920.

PLANS AND SPECIFICATIONS

Plans and specifications for installing filter strips shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose. At a minimum include the following items:

1. Location of the practice
2. Length and width of the filter strip
3. Slope of the filter strip
4. Required appurtenant practices such as level spreaders or temporary sediment basins
5. Grading requirements, topsoil stockpiling and utilization requirements
6. Soil preparation, seeding and temporary soil stabilization (i.e., erosion control blanket or mulching) requirements

All plans shall include installation, inspection, and maintenance schedules with the responsible party identified.

Standard drawing FILTER STRIP – GRASSED IL-535 may be used as the plan sheet.

OPERATION AND MAINTENANCE

On active construction sites, the filter strip shall be inspected after every runoff producing rain and repairs made as needed. After construction, filter strips should be inspected during and after major storm events, particularly during the first one or two years. After the first one or two years, the filter strip may be inspected each spring and after major storm events.

Filter strips should be inspected for proper distribution of flows and signs of erosion. The filter strip should be kept

free of litter. Irrigation needs should be minimal except during extended dry periods. Periodic aeration of the soils may be beneficial if the underlying soils have a high clay content, or there is difficulty in maintaining a good vegetative cover due to compaction.

If erosion is discovered, the eroded areas should be filled, reseeded, and mulched. Then the causes for the erosion should be determined and prevented from recurring.

Maintain the vegetation at the most dense stand possible.

Filter strips vegetated with turf grass should be mowed and the residue harvested a minimum of two or three times a year to promote good growth and vegetative density at ground level, nutrient removal from the system, and filtering ability.

Caution should be used when applying herbicides to filter strips or adjacent areas to minimize pollution to the water resources being protected.

Filter strips vegetated with native species should be managed through prescribed burning once every two to three years, after the vegetation is established. Where prescribed burning is not feasible, mowing may be substituted. In contrast to turf grass, native vegetation should be mowed higher and less frequently.

Filter strips that have accumulated so much sediment that they are higher than adjacent areas should be disked or graded as necessary to reestablish shallow sheet flow conditions, and be reseeded.

REFERENCES

Dreher, D.W. and T.H. Price, 1997. Reducing the Impacts of Urban Runoff: The Advantages of Alternative Site Design. Northeastern Illinois Planning Commission, Chicago, IL

Ohio Department of Natural Resources, Division of Soil and Water Conservation, 1996. Rainwater and Land Development, 2nd ed., OH

Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation, 1992. Virginia Erosion and Sediment Control Handbook, 3rd ed., VA

NRCS IL January 1999

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NATURAL RESOURCES CONSERVATION SERVICE
ILLINOIS URBAN MANUAL
PRACTICE STANDARD

LEVEL SPREADER

(no.)
CODE 870

(Source: VA Erosion and Sediment Control Handbook)

DEFINITION

A device used to disperse concentrated runoff uniformly over the ground surface as sheet flow.

PURPOSE

The purpose of this practice is to convert concentrated, potentially erosive flow to sheet flow and release it uniformly over a stabilized area or filter strip. The resultant sheet flow enhances pollutant filtering and runoff infiltration and reduces the potential for erosion.

CONDITIONS WHERE PRACTICE APPLIES

The principal application of a level spreader is to convey runoff from impervious surfaces, such as parking lots or roadways, uniformly onto vegetated filter strips. Level spreaders can also be applied as outlets for diversion structures. Level spreaders are appropriate and/or necessary under the following conditions:

1. Where runoff from an impervious surface is uneven and/or runoff is released as concentrated flow, such as through curb cuts or roof downspouts
2. At the ends of diversions
3. Where the runoff water will not re-concentrate after release from the level spreader until it reaches an outlet designed for concentrated flow
4. Where sediment-free storm runoff can be released in sheet flow down a stabilized slope without causing erosion
5. Where the lip of the level spreader can be constructed in undisturbed soil
6. Where there will be no traffic over the spreader

CRITERIA

Criteria for level spreader design can vary greatly depending on the application. For this reason, two sets of criteria are specified for several of the factors that follow.

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For impervious surface runoff applications:

The capacity for the level spreader is determined in the design of the filter strip to which it discharges (see practice standard FILTER STRIP 835).

The spreader shall run linearly along the entire width of the filter strip to which it discharges. In most cases, the spreader will be the same width as the contributing impervious surface. The ends of the spreader shall be tied into higher ground to prevent flow around the spreader.

The minimum depth shall be 6 inches and the minimum width shall be 6 feet for the lower side slope. Side slopes shall be 2:1 (horizontal to vertical) or flatter.

The grade of the spreader shall be 0%.

The discharge area shall meet the requirements of practice standard FILTER STRIP 835.

For diversion outlet applications:

The capacity of the spreader shall be determined using the peak flow from the 10-year frequency, 24-hour duration storm. The drainage area shall be restricted so that maximum flows into the spreader will not exceed 30 cfs.

Spreader dimensions: Select the length and depth of the spreader from the table below. The length dimension is parallel to the diversion.

Design Flow (cfs)	Minimum Depth (ft)	Minimum Length (ft)
0-10	0.5	10
10-20	0.6	20
20-30	0.7	30

The minimum width of the spreader shall be 6 feet for the lower side slope. Side slopes shall be 2:1 (horizontal to vertical) or flatter.

Construct a 20 foot transition section in the diversion channel so the width of the channel will smoothly meet the width of the spreader to ensure uniform outflow.

The last 20 feet of the diversion channel shall provide a smooth transition from the channel grade to the level spreader and where possible, shall be less than or equal to 1%. The grade of the level spreader shall be 0%.

The outlet discharge area must be generally smooth and well vegetated with a maximum slope of 10%.

For all applications:

The spreader lip shall be constructed to a uniform height and zero grade over the length of the spreader. For design flows of 4 cfs or greater, a rigid lip of non-erodible material, such as pressure-treated timbers or concrete curbing, shall be used. For flows less than 4 cfs, a vegetated lip may be used. The spreader lip shall be constructed on undisturbed soil.

When using a vegetated lip it shall be protected with an erosion control blanket to prevent erosion and allow the vegetation to become established. The erosion control blanket for a vegetated lip shall meet the requirements of

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practice standard EROSION BLANKET 830. The blanket shall be a minimum of 4 feet wide extending a minimum of 1 foot downstream over the level lip. The blanket shall be secured with heavy duty staples and the downstream and upstream edges shall be buried at least 6 inches deep in a vertical trench.

When using a rigid lip it shall be entrenched at least 4 inches below existing ground and securely anchored to prevent displacement. An apron of coarse aggregate meeting IDOT CA-1 or CA-3 gradation shall be placed to the top of the rigid lip and extend downslope at least 3 feet. A filter fabric shall be placed under the coarse aggregate. The filter fabric shall meet the requirements of material specification 592 GEOTEXTILE Table 1 or 2, Class I, II, or IV.

Immediately after level spreader construction, seed and mulch the entire disturbed area of the spreader. Seeding shall meet the requirements of practice standard PERMANENT VEGETATION 880 and mulching shall meet the requirements of practice standard MULCHING 875.

CONSIDERATIONS

The level spreader is a relatively low-cost structure to:

1. Disperse impervious surface runoff uniformly to a filter strip or
2. Release small volumes of concentrated flow from diversions when conditions are suitable

To accomplish these purposes, particular care must be taken to construct the spreader lip completely level. Any depressions in the lip will concentrate the flow, resulting in a loss of pollutant filtering effectiveness and/or erosion. Evaluate the outlet system to be sure that flow does not concentrate below the outlet.

For filter strip applications, the determination of whether a level spreader is needed should be based on how the runoff is entering the filter strip. If the runoff is concentrated by curb cuts, and particularly if a large area of impervious surface drains to one point, a level spreader is essential to achieve effective pollutant removal in the filter strip. A level spreader also is important if the filter strip is relatively steep in order to avoid erosion from concentrated runoff discharge. If the runoff is evenly distributed over the width of the impervious surface (e.g., a curbless, even-sloped road or parking lot), a level spreader may not be necessary.

When the level spreader is used as an outlet for temporary or permanent diversions and diversion dikes, runoff containing high sediment loads must be treated in a sediment trapping device such as practice standard TEMPORARY SEDIMENT TRAP 960 or IMPOUNDMENT STRUCTURE-ROUTED 842 before release into a level spreader.

PLANS AND SPECIFICATIONS

Plans and specifications for installing a level spreader shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose. At a minimum include the following items:

1. The spreader location
2. The length and width

3. For filter strip applications, plans for both the adjacent impervious surface and the filter strip, for diversion outlets, plans detailing the diversion structure and the adjacent outlet area
4. Lip details: vegetated or rigid
5. Stone gradation
6. Filter fabric specifications if used
7. Rigid lip material specifications if used
8. Erosion control blanket specifications if used
9. Seeding and mulching requirements

All plans shall include installation, inspection, and maintenance schedules with the responsible party identified.

Standard drawing LEVEL SPREADER IL-570 may be used as the plan sheet.

OPERATION AND MAINTENANCE

Inspect level spreaders after every rainfall until vegetation is established, and promptly make needed repairs. After the area has been stabilized, make periodic inspections and maintain vegetation in a healthy, vigorous condition.

Verify that the level spreader is distributing flow evenly. If problems are noted, make appropriate modifications to ensure even flow distribution.

REFERENCES

Illinois Department of Transportation, 1997. Standard Specifications for Road and Bridge Construction. IL

North Carolina Sedimentation Control Commission, 1988. Erosion and Sediment Control Planning and Design Manual. NC

Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation, 1992. Virginia Erosion and Sediment Control Handbook, 3rd ed., VA

NRCS IL January 1999

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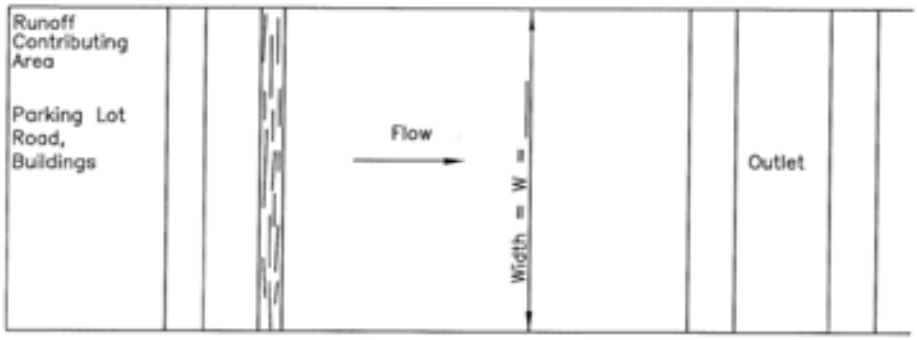
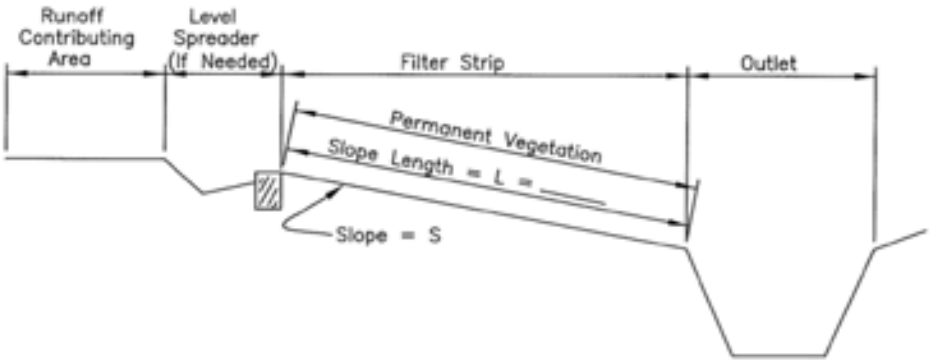
FILTER STRIP - GRASSED



PLAN VIEW



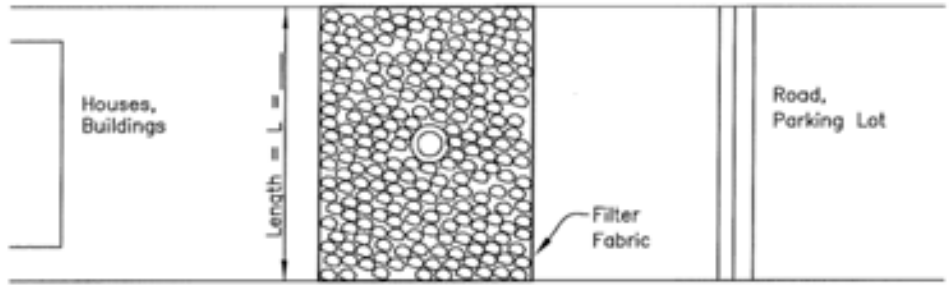
SECTION VIEW

Area To Be Seeded L x W = ____

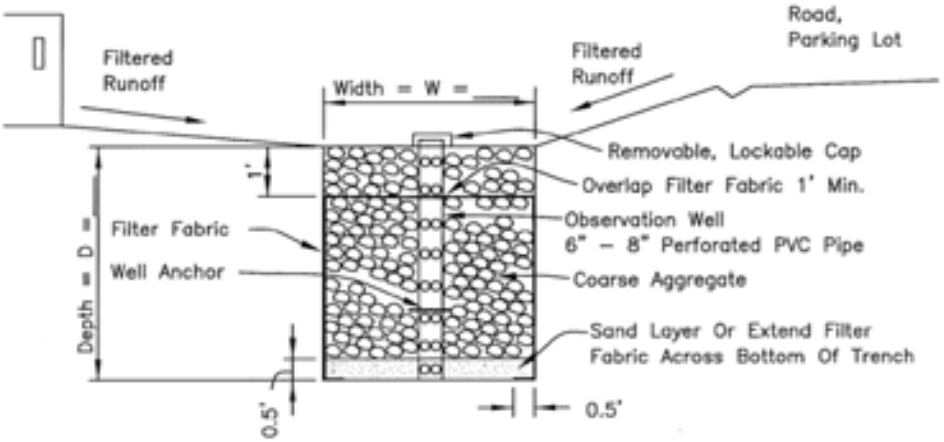
See plans for permanent vegetation requirements.
See plans for S, L and W dimensions.
Slope shall not exceed 15% (0.15 foot of fall per foot of horizontal distance).
See sheet LEVEL SPREADER IL-570 for level spreader requirements.

REFERENCE	NRCS Natural Resources Conservation Service	STANDARD DWG. NO.
Project ____		IL-535
Designed ____ Date ____		SHEET 1 OF 1
Checked ____ Date ____		DATE 1-29-99
Approved ____ Date ____		

INFILTRATION TRENCH



PLAN VIEW

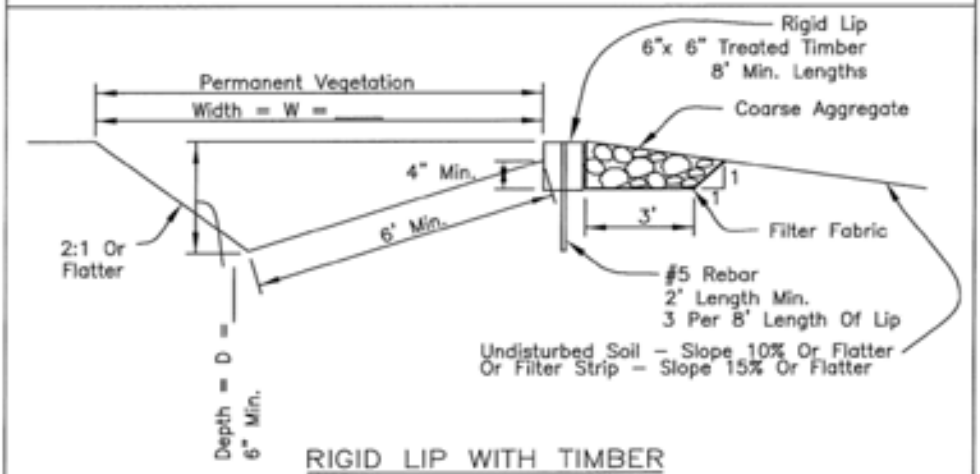


SECTION VIEW

NOTES:
1. Coarse aggregates shall meet one of the following IDOT gradations: CA–1 or CA–3.
2. Sand, if used, shall meet one of the following IDOT gradations: CA–14, CA–15 or CA–16.
3. Filter fabric shall meet the requirements of material specification 592 GEOTEXTILE Table 1 or 2, Class I with an apparent opening size of at least 30 for non–woven and 50 for woven.
4. PVC pipe shall meet material specification 547 PLASTIC (PVC, PE, ABS) PIPE.
5. See plans for L, W and D dimensions.

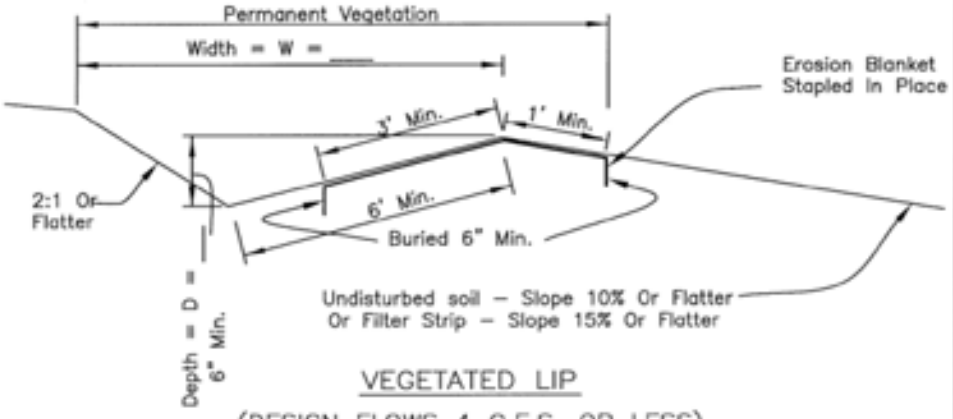
REFERENCE	NRCS	STANDARD DWG. NO.
Project _____	Natural Resources Conservation Service	IL-547
Designed _____ Date _____		SHEET 1 OF 1
Checked _____ Date _____		DATE 1-29-99
Approved _____ Date _____		

LEVEL SPREADER



RIGID LIP WITH TIMBER

(DESIGN FLOWS 4 C.F.S. TO 30 C.F.S.)



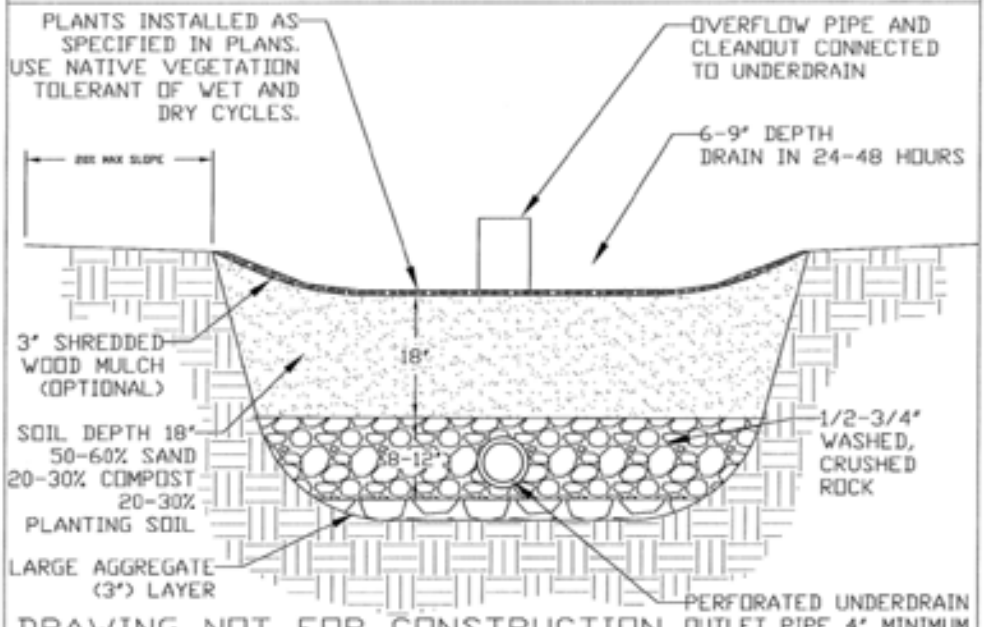
VEGETATED LIP

(DESIGN FLOWS 4 C.F.S. OR LESS)

NOTES:
1. Coarse aggregate shall meet one of the following IDOT gradations: CA–1, or CA–3.
2. Filter fabric shall meet the requirements of material specification 592 GEOTEXTILE, Table 1 or 2, Class I, II, or IV.
3. See sheet FILTER STRIP–GRASSED IL–535 for filter strip requirements.
4. See sheet EROSION BLANKET IL–530 for blanket material and installation requirements.
5. See plans for permanent seeding requirements.
6. See plans for D and W dimensions.

REFERENCE	NRCS	STANDARD DWG. NO.
Project ____	Natural Resources Conservation Service	IL-570
Designed ____ Date ____		SHEET 2 OF 2
Checked ____ Date ____		DATE 1-29-99
Approved ____ Date ____		

BIORETENTION FACILITY PLAN



DRAWING NOT FOR CONSTRUCTION

NOTES:

1. LOCATE FACILITIES AT LEAST 100 FEET FROM ANY WELLS OR SOURCE WATER LOCATIONS.
2. LOCATE FACILITY AT LEAST 25 FEET FROM ANY SEPTIC FIELDS AND UPGRADIENT IF POSSIBLE.
3. LOCATE FACILITY AT LEAST 25 FEET AND DOWNGRADIENT FROM BASEMENTS.
4. LOCATE FACILITY 5 FEET OR GREATER FROM A SLAB OR FOUNDATION.
5. RECOMMENDED MINIMUM AREA SHALL BE 200 SQUARE FEET WITH THE LENGTH AT A 2:1 RATIO OF THE WIDTH.
6. ADDITIONAL REGULATIONS MAY BE REQUIRED BY LOCAL ORDINANCES.
7. A GEOTEXTILE FABRIC SEPARATING THE LARGE AGGREGATE AND SOIL IS OPTIONAL.
7. DRAWING NOT TO SCALE.

REFERENCE		STANDARD DWG. NO.
Project		IUM-500
Designed ____ Date ____		SHEET 1 OF 1
Checked ____ Date ____		DATE 11-18-13
Approved ____ Date ____		

NATURAL RESOURCES CONSERVATION SERVICE
ILLINOIS URBAN MANUAL
PRACTICE STANDARD

GRASS-LINED CHANNEL

(acre)
CODE 840

(Source: NC Erosion and Sediment Control Field Manual)

DEFINITION

A natural or constructed channel that is shaped or graded to required dimensions and established with suitable vegetation for stable conveyance of runoff.

PURPOSE

The purpose of this practice is to convey and dispose of concentrated surface runoff without damage from erosion, deposition, or flooding.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to construction sites and developing areas where:

1. Concentrated runoff will cause damage from erosion or flooding;
2. Sufficient depth of soil materials are present to allow establishment of vegetation that will stabilize the cross section and grade of the channel;
3. Slopes are generally less than 5%;
4. Space is available for a relatively large cross section.

Typical uses include roadside ditches, channels at property boundaries, outlets for diversions, and other channels and drainage of low areas.

CRITERIA

Capacity - As a minimum, grass-lined channels shall carry the peak runoff from the 10-year frequency, 24-hour duration storm. Where flood hazard exists, increase the capacity according to the potential damage. For grass-lined channels with a grade of less than 1 percent, out-of-bank flow may be permitted if such flow will not cause erosion, property or flooding damage. The minimum channel capacity in such cases shall be a 2-year frequency storm. Channel dimensions may be determined by using design tables with appropriate retarding factors or by Manning's formula using an appropriate "n" value. When retarding factors are used, the capacity may be based on "C" retardance and stability on "E" retardance, where the waterway will be regularly mowed and otherwise maintained.

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Velocity - The maximum permissible velocities of flow shall not exceed the values shown in Table 1.

Cross section - The channel shape may be parabolic, trapezoidal, or V-shaped, depending on the need and site conditions. The design water surface elevation of a grass-lined channel receiving water from diversions or other tributary channels shall be equal to or less than the design water surface elevation in the diversion or other tributary channels. The parabolic shape is the preferred cross section. The triangular cross-section concentrates flow in the "v" of the channel causing higher and more erosive velocities. When vegetated triangular channels are used, the minimum side slopes should be 6:1 or flatter.

Drainage - Base flow shall be handled by a stone lined center, subsurface drain, or other suitable means since sustained wetness usually prevents adequate vegetative cover. The cross-sectional area of the stone lined center or subsurface drain size to be provided shall accommodate a flow rate of 0.1 cfs/acre or by actual maximum base flow.

Where tile is used along the channel, it should be located as close to 1/3 of the channel (top) width from the center of the waterway as practical. The top of the tile should be at least 2.0 feet (up to 4 feet, where possible) below the bottom of the channel, except where soil or outlet conditions make this depth unpractical. The tile shall meet the requirements shown in the practice standard SUBSURFACE DRAIN 945.

Alignment - Minor changes may be made to improve alignment. Care must be taken to avoid exposing soil materials (such as sodium soils or high clay content glacial till subsoil) that are not conducive to the establishment and maintenance of adequate vegetative cover.

Outlets - All grass-lined channels shall have a stable outlet with adequate capacity to prevent ponding or flooding damages. Appropriate measures must be taken to dissipate the energy of the flow to prevent scouring of the outlet channel. Examples of acceptable outlets include but are not limited to GRASS-LINED CHANNELS 840, IMPOUNDMENT STRUCTURE - FULL FLOW 841, IMPOUNDMENT STRUCTURE - ROUTED 842, INFILTRATION TRENCH 847, LEVEL SPREADER 870, and ROCK OUTLET PROTECTION 910.

Establishment of vegetation - Grass-lined channels shall be vegetated according to the practice standard PERMANENT VEGETATION 880.

Side slopes - Side slopes shall not be steeper than a ratio of 2 horizontal to 1 vertical. They should be designed to accommodate the equipment used for maintenance. Where planned to be crossed by large equipment, trapezoidal channels shall have side slopes of 8:1 or flatter and be protected according to the practice standard STABILIZED CONSTRUCTION ENTRANCE 930. When triangular (V-shaped) channels are used, the minimum side slopes should be 6:1 or flatter.

Sedimentation protection - Protect permanent grass-lined channels from sediment produced in the watershed, especially during the construction period. This can be accomplished by

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the effective use of diversions, sediment traps, protected side inlets and vegetative filter strips along the channel.

Construction - The grass-lined channel will be constructed meeting the requirements of Construction Specification 27 - DIVERSIONS AND WATERWAYS.

CONSIDERATIONS

Generally, channels should be located to conform with and use the natural drainage system. Channels may also be needed along development boundaries, roadways, and back lot lines. In all situations channels should be located so that they do not make sharp, unnatural changes in direction or grade of flow. Avoid channels crossing watershed boundaries or ridges.

Major reconfiguration of the drainage system often entails increased maintenance and risk of failure.

Establishment of a dense, erosion resistant vegetation is essential. Construct and vegetate grass-lined channels early in the construction schedule before grading and paving increase the rate of runoff.

All grass-lined channels should be designed to permit easy crossing of equipment during construction and maintenance.

If local ordinances permit, storm sewers may be used to extend existing agricultural tile or base flow across a development. They may also be used as an under drain for the channel if the conduit is open jointed.

Geotextile fabrics or special mulch protection such as fiberglass roving or straw and netting provide stability until the vegetation is fully established. It may also be necessary to divert water from the channel until vegetation is established or to line the channel with sod. Rock checks or filter fabric checks may also be needed to protect the channel before vegetation is established. Sediment traps may be needed at channel inlets and outlets.

Applicable state drainage laws, traditional case law precedent and local ordinances and regulations must be observed in locating grass-lined channels.

PLANS AND SPECIFICATIONS

Plans and specifications for installing grass-lined channels shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose. At a minimum include the following items:

1. Channel location and alignment.
2. Grade, depth and width.
3. Channel cross section type.
4. Seeding specifications and dates.
5. Subsurface drainage, if needed.

All plans shall include the installation, inspection, and maintenance schedules with the responsible party identified.

The grass-lined channel will be constructed meeting the requirements of Construction Specification 27 DIVERSIONS AND WATERWAYS. Standard drawings WATERWAY PLAN IL-540 P, T, or V may be used as the plan sheet.

OPERATION AND MAINTENANCE

During the establishment period, inspect grass-lined channels after every rainfall.

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After grass is established, check the channel at regular intervals and after every heavy rainfall event. Immediately make repairs. It is particularly important to check the channel outlet and all road crossings for bank stability and evidence of piping or scour holes. Remove all significant sediment accumulations to maintain the designed carrying capacity. Keep the grass in a healthy, vigorous condition at all times, since it is the primary erosion protection for the channel.

NRCS IL October 2001

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TABLE 1

PERMISSIBLE VELOCITIES FOR CHANNELS LINED WITH VEGETATION

Channel Slope (%)	Lining	Permissible Velocity (ft./sec.) [1/]
0 – 5	Tall fescue Kentucky bluegrass Smooth bromegrass	5
	Grass-legume mixture	4
	Red fescue Redtop	3
	Small grains [2/]	2.5
5 – 10	Tall fescue	5
	Kentucky bluegrass Smooth bromegrass	4
	Grass-legume mixture	3
Greater than 10	Tall fescue Kentucky bluegrass Smooth bromegrass	3

[1/] For highly erodible soils, permissible velocities should be decreased 25%. An erodibility factor (K) greater than 0.35 would indicate a highly erodible soil. Erodibility factors (K-factors) for Illinois soils are available in every NRCS office.

[2/] For temporary seedings.

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ILLINOIS URBAN MANUAL
PRACTICE STANDARD

POUROUS AND PERMEABLE PAVEMENTS

(sq. ft.)
CODE 890

Source: IUM Technical Review Committee

DEFINITION

Alternate pavement systems are designed to allow water to pass through the surface into the subsurface for storage and infiltration and to also reduce peak runoff rates and volumes, as well as reduce pollution loads.

PURPOSE

The purpose of this practice is to promote volume reduction, peak flow reduction and to reduce pollution into downstream water bodies.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies where pavement is desirable or required, including but not limited to:

1. Parking lots
2. Driveways for residential and light commercial use
3. Alleys
4. Low traffic roadways
5. Boat ramps
6. Paths and sidewalks
7. Fire lanes
8. Community spaces
9. As an alternative to conventional paving

CRITERIA

1. Permeable soils.
2. Tributary area is less than 3 times the porous/pervious pavement area. Things that may affect this are: soil permeability, stabilization practice and amount of overland flow.

890-1

3. The site slope is less than 2%.
4. If the soils are not permeable then some type of under drain system should be used when the sub-grade soil permeability is less than 0.5 in / hr.
5. Under drain use must require a storm drain infrastructure.
6. Depth of water table. If water table is less than 2 feet below finish surface this practice should not be considered.
7. To facilitate infiltration, a graded stone and/or geo-textile fabric (IUM 592) should be used.
8. Heavy traffic loading will affect performance and longevity.
9. Ice management; low or no chloride, no sanding or cinders
10. Owner needs to be prepared for extensive maintenance.
11. Not suitable for storm water hot spots, areas with high pollutant loads or contaminated soils.
12. Roadway and parking lot marking should be applied as paint vs. an adhesive tape.
13. The base material shall be free of contaminates to allow for water passage.
14. ASTM test C1701 should be used to identify the needed flow through the porous / pervious pavement layer.

CONSIDERATIONS

1. Pretreatment of flows may be necessary
2. A porous system is going to have more void space in its cross section than a pervious system, allowing more water passage.
3. ADA compliant.
4. Pollutants of concern shall be identified along with the appropriate Best Management Practices to address or mitigate them.
5. Materials may consist of vegetation, interlocking blocks (P-ACM/M), unbound aggregate, concrete, asphalt, paver bricks and recycled glass.
6. Recommend draw down time of the sub-surface layer to be less than 48 hours.
7. Pipe under drains shall be sized for flow requirements. Perforations shall be slotted vs. round. A geo-textile may be needed (IUM 592).
8. Some practices are better suited to reduce contributions to the heat island effect.
9. No seal coating or sealers can be used with this practice because of reduced volume of water flow.
10. Street sweeping is one method that may help to remove debris; however, it may not remove debris far enough into the cross section.
11. Should not be used for high speed roads.
12. Areas of concern if used would be:
    a. Sediment laden runoff
    b. High traffic counts
    c. Heavy repetitive loading

890 - 2

d. Not accessible for maintenance

e. Non-permeable soils or a high water table

f. Removal of dissolved pollutants limited with under drain use.

g. Near or up against basement walls.

PLANS AND SPECIFICATIONS

Plans and specifications shall be prepared in accordance with the criteria of this standard and shall describe the requirements for applying the practice to achieve its intended use.

The extent of porous and pervious pavement shall be identified on the plans with some type of cross hatching.

A cross sectional detail showing locations and thickness of the materials needs to be included.

Installation sequence of materials may need to be listed.

A detailed specification should be developed to insure the proper type of porous or pervious pavement is installed.

STANDARD DRAWINGS

Pretreatment (IUM-XXX) – *to be developed*

OPERATION AND MAINTENANCE

1. No sanding or cinder use with this practice.
2. Low or no chloride ice management.
3. Rubber or plastic tipped snow plow blades shall be used.
4. Clean out of pretreatment practices.
5. Landscapes waste (leafs, clippings, branches, seeds, etc.) shall be removed or captured to prevent clogging of the surface.
6. If flushing is the method chosen to clean the cross section, the debris that is washed through must be removed.
7. Air wands are one method of cleaning the cross section; however, care should be taken not to blow the debris deeper into the pavement.

REFERENCES

IL Urban Manual Technical Committee

Geosyntec Consultants Permeable Pavement Technical Document

Michigan DEQ

urbst890.doc June 2013

ILLINOIS URBAN MANUAL
PRACTICE STANDARD

BIORETENTION FACILITY

(feet)
CODE 800

Source: Jessica Cocroft, Winnebago Soil and Water Conservation District

DEFINITION

Facility that utilizes a soil media, mulch, and vegetation to treat stormwater runoff through filtration in clay soils areas and through infiltration in areas with porous soils.

A bioretention facility is also sometimes referred to as a rain garden. However, the term rain garden is typically used to describe a small, planted depression on an individual homeowner's property. A bioretention facility serves the same purpose but typically describes larger projects in community common areas as well as non-residential applications. Bioretention facilities may take on greater impervious areas due to their applications in commercial developments.

PURPOSE

The purposes of a properly designed bioretention facility include the decrease of peak flow rates and volume for smaller storms in the receiving stream and the removal of pollutants from stormwater runoff utilizing the chemical, biological, and physical properties of plants, microbes, and soils. A bioretention basin may be applied individually or as part of a system of stormwater management practices.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies where the following or similar conditions exist:

- Drainage area is small, less than four acres (preferably less than one acre) with an impervious area of less than one acre;
- Impervious areas with shallow grade allow for sheet flow over level entrance areas;
- Stormwater runoff from impervious surfaces is diverted or conveyed by a curb or gutter to specific location(s) with inflow protection;
- The hydraulic conductivity, or permeability, of soil is sufficient for drainage within a 48 hour period;
- If soil permeability is not sufficient, replacement of clay soils with a sand mixture and/or an under drain system allows for adequate drainage; and,

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- Sufficient fall can be achieved between inlet and outlet for under drain if required.

CRITERIA

Construction projects may be subject to local, county, state and federal rules and regulations. Bioretention facilities shall be designed by a registered professional engineer as part of the overall site design for long-term water quality and quantity. A landscape architect should be used to determine types of plants needed and locations in the facility. A landscape architect may also provide valuable insight during the design, construction and maintenance phases. Plans and specifications shall be referred to by the site superintendent and field personnel during the construction process.

The facility shall not be constructed within a stream buffer or in areas adjacent to streams where sediment may be deposited during flood events.

Bioretention is not a suitable BMP at locations where the wet season water table is within four feet of the proposed ground surface and where soil is unstable. A water table that is too shallow can prevent stormwater runoff from draining completely through the facility.

The size and the design shall be based on the contributing drainage area, underlying soils, utilities, and existing vegetation. It is recommended to size a bioretention facility for a 1 year, 24 hour storm. A bypass is recommended for use in larger storms.

Locate facilities at least 100 feet from any wells or source water locations; at least 25 feet from any septic fields and upgradient if possible; at least 25 feet and downgradient from basements; five feet or greater from a slab or foundation; and, shall not cross property lines.

The recommended minimum area shall be 200 square feet with the length at a 2:1 ratio of the width. This is to allow enough space for a dense, randomly distributed planting area while decreasing the chances of concentrated flow. The facility must have soil with sufficient hydraulic conductivity (or replaced with a sand mixture of over 50%). A planting soil bed, with either a mulch layer or a grass mixture as a cover crop is highly recommended.

Vegetation must be able to withstand periods of inundation and drought such as some native plants.

The facility shall be designed to capture stormwater runoff and filter the water through the soil bed over a period of 24 to 48 hours.

Inflow velocities shall be reduced to less than three feet per second upstream of the facility to prevent erosion and facilitate uniform distribution across the BMP. This may require the installation of practices such as **FILTER STRIP 835** or **ROCK OUTLET PROTECTION 910**.

The bioretention facility can be excavated before final stabilization of the surrounding watershed; however, the soil mixture and/or underdrain system shall not be placed until the entire contributing drainage area has been stabilized and any restrictive layer remediated. Bioretention facilities should not be used for control of sediment and erosion on construction sites. Stabilization may require the installation of practices such as **EROSION CONTROL BLANKET 830**, **EROSION CONTROL BLANKET – TURF REINFORCEMENT MAT (TRM) 831** and **MULCHING FOR SEEDING AND SOIL STABILIZATION 875**.

Final graded dimensions, side slopes, and final elevations shall be constructed according to design drawings and specifications.

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Underdrains are recommended for all facilities that do not have sufficient hydraulic conductivity (cannot drain within 48 hours). An underdrain increases the ability of the soil to drain and therefore ensures an adequate aerobic state that allows plants to grow. A minimum 4-inch perforated pipe (**PLASTIC PIPE 547**) with an 8- to 12-inch gravel bed shall be installed as an underdrain system. Space the pipe at a maximum of ten foot on-center and maintain a minimum grade of 0.5 percent. At least one cleanout shall be installed every 50 feet on each underdrain. The cleanout can also be used as an overflow relief system if situated one foot above the bioretention facility. It is recommended to cover the overflow with a grate or screen to keep large debris from clogging the pipe. The under drain shall connect to a stormwater system with adequate capacity or daylight to a suitable outfall with erosion protection such as **ROCK OUTLET PROTECTION 910**. Before placement of the aggregate, underdrain, and bioretention soil mixture, the bottom of the excavated area shall be roto-tilled to a minimum depth of six inches to alleviate any compaction that might impede infiltration. The underdrain may include an adjustable flow regulator to provide the right amount of infiltration.

Two layers of aggregate are recommended under the soil bed. A layer of ½ - and ¾-inch washed, crushed rock (CA-8: IDOT Course Aggregate gradation number 8) shall separate the soil bed from the larger 3 inch aggregate (CA-1). A geotextile fabric is optional over the tilled soil surface and under the large aggregate. The fabric should have a sufficient permeability to drain the bioretention facility in 48 hours. Geotextiles shall be selected according to material specification **GEOTEXTILE 592**.

The planting soil bed is a mixture of organic mulch, planting soil, and sand. Typically the mixture consists of 20-30 percent planting soil, 20-30 percent organic compost, and 50-60 percent sand. Clay shall be limited to less than 5 percent. A minimum depth of 18 inches is recommended to provide adequate moisture capacity and create space for the root systems of plants. If larger vegetation is used (i.e. trees or shrubs), the planting soil must be at least four inches deeper than the bottom of the largest root ball. This soil mix will not be as firm as natural soils, so larger trees or shrubs shall be supported with guy wires or similar support. The planting soil mixture shall be free of stones, stumps, roots, or weedy material over one inch in diameter. Brush or seeds from noxious weeds shall not be present in the material.

Set the bioretention facility ponding depth to 6-9 inches, not exceeding 1 foot. Ponding design depths shall be kept to a minimum to reduce hydraulic overload of the soil bed and to maximize the surface area to facility depth ratio. Design the overflow structure to maintain the integrity of the facility and ponding depth. The rate and volume of overflow from the bioretention facility must not cause downstream erosion.

Trees, shrubs, and other plant materials shall be installed as specified in the project plans and according to applicable landscape standards with the exception that pesticides, herbicides and fertilizer shall not be applied during planting under any circumstances. After establishment, pesticides, fertilizer and other soil amendments may be applied at a minimum. Plant selection shall include native species tolerant of both wet and dry cycles. Deep rooted perennials are encouraged to increase the rate of infiltration.

An optional layer of the bioretention cell is the mulch. The mulch layer plays an important role in the performance of the bioretention facility. It helps maintain soil moisture and helps prevent erosion. It serves as a pre-treatment layer by trapping sediments. The mulch layer should be a standard landscape style,

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shredded hardwood mulch. The mulch shall be milled and screened to a maximum four inch particle size and shall be free from sawdust, clay, trash and any artificially introduced chemical compounds. Grass clippings shall not be used as mulch. The layer of mulch shall not exceed three inches in depth to ensure plant roots are rooted in the soil. Ensure clearance of mulch around new plantings to facilitate watering and air exchange. The mulch may float and move as water backs up so raking the mulch back into place or reapplication may be necessary. If not using mulch, grass used as a cover crop would be an acceptable alternative.

Native vegetation including native trees and shrubs shall be used whenever possible.

CONSIDERATIONS

Bioretention is not recommended for upland areas with slopes greater than 20 percent. Steeper slopes may contribute to clogging if the area receives runoff with high sediment loads. Removing clogged sediment from the bioretention facility can be difficult.

When properly designed and maintained, bioretention facilities provide aesthetic enhancement as well as habitat for wildlife.

Provisions for safety may be mandatory based on local ordinance and should be considered regardless of requirements. A perimeter fence may be required based on local ordinance or specific site conditions.

PLANS AND SPECIFICATIONS

Plans and specifications for installing and maintaining a bioretention facility shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose. Standard construction documents, including a grading plan, planting plan, technical specifications, and a facility maintenance plan should include the following items:

1. Facility location and alignment
2. Grade, depth, width, and side slope grade
3. Facility cross section
4. Material specifications including planting prescriptions

All plans shall include the installation, inspection, and maintenance schedules with the responsible party identified.

Bioretention facilities control stormwater runoff close to the source. They are typically shallow depressions located in upland areas used to treat stormwater runoff from pervious and impervious surfaces at commercial, residential, industrial areas and other developments. They can be designed so the runoff is either diverted directly into the bioretention facility or conveyed via a curb, gutter and/or pipe collection system.

Bioretention facilities are adaptable to most sites and integrate well with buffers, landscape berms, and setback areas.

The bioretention facility may also include pretreatment, a storage layer, flow regulation and an observation well.

Be aware of salt use in the drainage area of the bioretention facility. Salt tolerant plants or diverting the runoff away from the facility may reduce the number of replantings.

OPERATION AND MAINTENANCE

An operation and maintenance plan shall be provided for the bioretention facility.

For the first one to three years, bioretention systems require significant maintenance to ensure successful establishment. The primary

maintenance requirements are inspection, and repair and replacement of damaged or failed components and vegetation. Conduct routine inspections. Inspections are particularly important during vegetative establishment and should be done immediately following significant rainfall events. Routine inspections for standing water and corrective measures to restore proper infiltration rates are necessary. Invasive and/or weedy vegetation shall be removed immediately upon discovery. During the first growing season, watering and weeding shall be completed on a weekly basis or as needed.

Over the lifetime of the facility, bioretention maintenance resembles that of any maintained landscape area and shall include:

1. Inspect biannually for erosion
2. Mulch as needed to cover bare soil
3. Annually inspect vegetation to evaluate health and replace dead or diseased vegetation
4. If stressed vegetation is present, investigate soil further. If soil is contaminated, full or partial soil replacement is required
5. Inspect overflow devices
6. Remove trash and sediment as necessary
7. Aerate periodically

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NATURAL RESOURCES CONSERVATION SERVICE
ILLINOIS URBAN MANUAL
PRACTICE STANDARD

INFILTRATION TRENCH

(ft.)
CODE 847

(Source: Center for Watershed Protection)

DEFINITION

An excavated trench filled with coarse granular material in which stormwater runoff is collected for temporary storage and infiltration.

PURPOSE

The purposes of this practice are to reduce runoff volume and peak discharges from a site, increase groundwater recharge and baseflow, and to filter soluble contaminants out of runoff before it reaches receiving waters. Infiltration trenches are not intended to remove coarse sediments.

CONDITIONS WHERE PRACTICE APPLIES

This permanent site development practice applies to small drainage areas not exceeding 5 acres.

The soils surrounding the trench shall have permeability rates of 0.5 to 2.41 in/hr, a minimum available water capacity of 0.15 in/in, and clay content less than 35%. These values can be found in published soil surveys.

Because infiltration trenches are not designed to filter coarse particulate matter, appropriate sediment control devices must be included in the site design and must be installed prior to the construction of the trench.

CRITERIA

Design capacity shall be a minimum volume of 0.5 inches of runoff per acre of drainage area.

The capacity of the trench shall be based on the porosity (% voids) of the coarse aggregate used in the system. If test data is not available, use 40% porosity for the coarse aggregate.

The trench shall be filled with coarse aggregate which meets IDOT CA-1, or CA-3 gradation. The bottom 6 inch layer in the trench shall be sand which meets IDOT CA-14, CA-15 or CA-16 gradation. The coarse aggregate shall be separated from the soil surrounding the trench by a filter fabric. The fabric

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shall meet the requirements in material specification 592 GEOTEXTILE Table 1 or 2, Class 1 with an apparent opening size of at least 30 for non-woven and 50 for woven. The fabric shall extend through the coarse aggregate one foot below the trench surface to prevent plugging. The filter fabric may be extended across the trench bottom in place of the sand layer.

Infiltration trenches shall be designed to dewater within 72 hours. Table 1 lists the maximum trench depths allowed for various soil types for 48 and 72 hour dewatering time periods. The permeability rate shall be field verified to a depth 3 feet below the trench bottom.

The width of the infiltration trench is determined using the design volume and final trench depth values.

All infiltration trenches must have an overflow component since they are not designed to handle large runoff volumes.

The location of the infiltration trench shall meet the following requirements. The bottom of the trench shall be a minimum of 3 feet above the seasonal high water table, bedrock, an impermeable soil layer or dissimilar soil layer. The trench shall be a minimum of 20 feet downslope or 100 feet upslope from any building foundation. The trench shall be a minimum of 100 feet from drinking water wells, septic tanks, drainfields etc. The trench shall not be installed on landslopes greater than 15% and shall be at least 50 feet from where landslopes are greater than 15%. The trench shall not be installed in fill soils.

Observation wells shall be included with the infiltration trench to enable inspection of their performance. Observation wells shall be constructed of 6-8 inch diameter perforated pipe embedded vertically through the aggregate and extended above the ground surface. The surface protrusion shall be capped and protected against vandalism. A well anchor shall be secured to the pipe to prevent the well from being pulled out of the trench. The well anchor may consist of a metal plate or bar secured at or near the bottom of the observation well.

CONSIDERATIONS

It is absolutely critical that settleable particles and floatable organic materials be removed from runoff water before it enters the infiltration trench. The trench will clog and become nonfunctional if excessive particulate matter is allowed to enter the trench. Runoff filtering practices such as practice standard FILTER STRIP 835, and GRASSED LINED CHANNEL 840 must be installed upstream of the trench. If there are uncontrolled sources of grease or oil, grease traps also need to be installed upstream of the trench.

For the same reasons, control of construction site sediment is critical during trench installation. Appropriate sediment control practices such as practice standards TEMPORARY SEDIMENT TRAP 960 and SILT FENCE 920 must be installed and maintained during construction. A more reliable alternative is to wait to install the trench until construction is complete and the upstream drainage area is stabilized.

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Infiltration trenches should not be installed if there is not a reliable long term commitment to upstream sediment control.

Care must be taken to prevent groundwater contamination by not installing infiltration trenches in highly permeable sand or gravel seams that are directly connected to underlying aquifers.

For removal of soluble contaminants, a 12 inch soil layer with a cation exchange capacity (CEC) of 0.5 millieq/100g or greater needs to be present. In Illinois, most soils that meet the permeability, available water capacity and clay content criteria will have a CEC of 0.5 millieq/100g or greater.

PLANS AND SPECIFICATIONS

Plans and specifications for installing infiltration trenches shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose. At a minimum include the following items:

1. System location
2. Depth, width and length
3. Aggregate gradation
4. Filter fabric requirements
5. Observation well details
6. Identification of upstream sediment control BMPs

All plans shall include installation, inspection, and maintenance schedules with the responsible party identified.

Standard drawing INFILTRATION TRENCH IL-547 may be used as the plan sheet.

OPERATION AND MAINTENANCE

During the first year after construction, the observation well should be inspected after each significant rainfall event to ensure that the trench is draining properly. Thereafter, the well should be inspected seasonally.

If the trench clogs, it may be necessary to remove and replace all or part of the filter fabric and possibly the coarse aggregate. The frequency of such repairs will depend on the adequacy of pre-treatment as discussed previously.

Most of the maintenance should be concentrated on the pretreatment practices, such as filter strips and swales, upstream of the trench to ensure that sediment does not reach the infiltration trench.

Maintenance needs are to be discussed with the landowner or operator who is responsible for maintaining the practice.

REFERENCES

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TABLE 1

MAXIMUN DEPTH FOR TRENCHES AND BASINS LIMITED BY SOIL PERMEABILITY RATE

Soil Texture	Minimum Permeability (fc) in/hr	Maximum Depth of Trench (d) in.	
		48 hours (T)	72 hours (T)
Sand	13	NA	NA
Loamy Sand	6	NA	NA
Sandy Loam	2	240	360
Loam	1	120	180
Silt Loam	1	120	180
Sandy Clay Loam	1	120	180
Clay Loam <35% Clay	0.8	96	144
Clay Loam >35% Clay	0.4	NA	NA
Silty Clay Loam <35% Clay	0.8	96	144
Silty Clay Loam >35% Clay	0.4	NA	NA
Sandy Clay <40% Clay	0.4	NA	NA
Sandy Clay >40% Clay	<0.06	NA	NA
Silty Clay	<0.06	NA	NA
Clay	<0.06	NA	NA

NA – not applicable Values based on a Soil Porosity of 40 %.

Maximum allowable depth computed by:

$$d = \frac{(fc)(T)100}{P}$$

where

d = depth — inch

fc = permeability rate — inch/hour

T = time to dewater — hour

P = porosity (% voids) — %

Design Volume of Trench = Required Runoff Volume / Porosity

Porosity = Volume of Voids / Total Volume

Required Runoff Volume = Volume of Voids in Trench

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ILLINOIS URBAN MANUAL
PRACTICE STANDARD

RAIN GARDEN

(feet)
CODE 897

Source: Kendall County Soil and Water Conservation District

DEFINITION

Rain gardens are small, shallow, flat bottomed depressions constructed to temporarily hold and infiltrate stormwater allowing stormwater to soak into the ground onsite rather than leaving a property as runoff.

Designed to be periodically inundated with water for short periods of time, rain gardens are planted with vegetation tolerant of being periodically wet and dry.

PURPOSE

Rain gardens are constructed to:

- Retain stormwater runoff and facilitate infiltration;
- Improve water quality by trapping sediment and debris;
- Remove other pollutants through the biological, chemical and physical properties of plants, microbes and soils;
- Create a unique landscape feature and provide habitat for wildlife such as birds and insects including pollinators.

CONDITIONS WHERE PRACTICE APPLIES

In developed areas, impervious and compacted surfaces increase stormwater runoff significantly. Rain gardens capture runoff from rooftops, driveways, sidewalks, lawns and other impervious and compacted surfaces.

This practice applies to small drainage locations and locations with soils that will allow adequate infiltration unless constructed with engineered soil and/or an underdrain system.

CRITERIA

Regulations

Plan, design and construct stormwater runoff practices to comply with

917-1

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CRITERIA

Regulations

Plan, design and construct stormwater runoff practices to comply with

917-1

applicable federal, state and local laws and regulations.

Utilities and Permits

The landowner and/or contractor shall be responsible for locating all buried utilities (Dial 811 to call JULIE) in the project area, including drainage tiles and other structural measures.

The landowner shall obtain all necessary permissions from regulatory agencies, including, but not limited to, local, state and federal units of government, or document that no permits are required.

Vegetation Selection

Stabilize all areas disturbed by construction with vegetation as soon as possible after construction and in accordance with IUM practice standard PERMANENT VEGETATION 880.

Select vegetation tolerant of the site conditions, particularly moisture and sun exposure conditions, in which the vegetation will be planted. A plant selection guide can be found in TABLE 897-1. If the rain garden is expected to receive pollutants, select vegetation tolerant of those pollutants.

Location and Design

- Locate the rain garden so that the drainage area is less than 2 acres with any impermeable portion of drainage area no greater than 1 acre.
- Locate the rain garden where soil remains stable when saturated.
- Locate the rain garden to avoid damage to any structures or negative impacts to wastewater treatment systems or wells. Rain gardens shall be a minimum of 25 feet from private sewage disposal systems and wells. Avoid areas within a source water protection area for public drinking water supply.
- Rain gardens shall be located a minimum of 10 feet away from any utilities or building structure to prevent infiltrating water from seeping into the foundation. A minimum of 35-40 feet separation is preferred.
- Direct outflow from the rain garden away from any building foundation.
- The bottom of the rain garden shall be flat, not exceeding 0.5% slope, to facilitate distribution of stormwater runoff and maximize infiltration.
- Rate and volume of overflow from the rain garden must not cause downstream erosion.
- Stormwater must be directed to the rain garden through means such as topography, swales, or tile connected to downspouts.
- Soil surface where runoff water will enter the rain garden must be stable. Include measures such as rock to dissipate energy where concentrated flow is expected.
- Include pretreatment or pollution removal areas such as grass filters or settling areas when runoff is expected to contribute excessive sediment, trash, debris

or other pollutants such as salt or oil that would be damaging to the system. These areas must be adequately designed to handle the expected load capacity. Locate and build such areas so they are easy to access and maintain.

- Provide, at minimum, 2 feet of soil between the bottom of the rain garden and fractured bedrock or high water table. The target separation should be 3 feet. Where there is an increased risk of groundwater pollution, an impermeable liner or layer of compacted earth may be used to separate the rain garden and the water table where there is an increased risk of groundwater pollution.

- Rain gardens are typically between 3 and 9 inches deep, but never exceeding 12 inches in depth.

- Mound excavated material on the downhill side of the rain garden no higher than 1 foot above the bottom of the rain garden.

- Side slopes within the ponding area must be 3:1 (H:V) or flatter. Slopes of any mounded spoil outside of the ponding area must be 5:1 or flatter.

- Design the rain garden to dewater within 48 hours or less. The target dewatering time shall be 24 hours or less. Locations with existing soils that do not meet the criteria above may need a designed underdrain or soil amendment.

- Design the rain garden to drain completely between designed storm events. Any runoff directed to the rain garden, such as runoff from downspouts, lawns and paved surfaces must be intermittent. Sump pumps which discharge continuously shall not be directed to the rain garden.

CONSIDERATIONS

- Illinois rain events are typically 1 inch or less. Designing the rain garden to capture the first 1 inch of runoff will capture a significant amount of stormwater runoff flowing to the rain garden thus treating the pollutants coming into the rain garden. The first flush of runoff carries with it the majority of the pollutants from a storm event.

- Soils with a hydrologic group designation of A or B, a USDA soil textural classification of:
  - Sand
  - Loamy sand
  - Sandy loam
  - Loam

  or an infiltration rate of at least 1 inch per hour are preferable for rain gardens. Soils with slower infiltration rates shall be amended or modified to increase infiltration. When appropriate, install underdrains where the soils have infiltration rates of ½ inch per hour or less. For soils information see USDA Web Soil Survey.

- Avoid compaction in infiltration areas during construction

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including compaction from foot traffic. Ensure that any impermeable layer in the infiltration area of the rain garden is removed or broken up prior to planting on sites where compaction has occurred, particularly where construction equipment has been used to construct the rain garden.

- It is important to note, rain gardens shall not be used to control construction site erosion. Additionally, any sediment which builds up over time shall be removed from the rain garden.
- Sediment deposition can create a crust on the surface of the rain garden which will begin to limit infiltration. It is important to note removal of sediment build-up over time is necessary.
- Rain garden size typically ranges from 100 to 300 square feet in area, commonly 10-30% of the drainage area.
- Avoid construction of rain gardens on slopes greater than 12%.
- Rain gardens should not be located upslope from any building foundation from which runoff is being collected such as from downspouts.
- To adequately establish vegetation, select plants based on sun exposure, soils and moisture availability at the proposed site location. If the rain garden is expected to receive pollutants select plants tolerant of those pollutants. Road salts can be of particular concern.
- Vegetation placed in the infiltration area of the rain garden must be tolerant of periodically dry and periodically inundated conditions.
- Vegetation selection and placement is crucial to a successful rain garden. Select vegetation based on position and associated moisture regime within the rain garden.

Position	Moisture Tolerance
Low	Moist to Average
Medium	Average Moisture
High	Average to Dry

- It is important to note rain gardens are not intended to retain permanent water. Avoid plants that prefer saturated or wet conditions.
- Rain gardens can be located in areas of shade, partial sun or full sun. Partial sun and full sun, however, are preferable due to the availability of a larger selection of plant material. Areas beneath trees should also be avoided to prevent root damage to trees.
- Ensure an adequate growing medium for vegetation. Specified soil mixes or natural topsoil must be of sufficient depth to support

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the root zone of the desired vegetation.

- Deep rooted native vegetation should be used and will improve soil infiltration over time. Native vegetation will typically perform better without added fertilizers.
- Consider including species beneficial for pollinators. Pollinator habitat areas consist of a sufficient variety of plant species to sustain the target pollinators throughout the growing season.
- Consider grouping plants and including signage to facilitate maintenance.
- Successful plant establishment is most easily accomplished during spring and fall when soil moisture is readily available. During vegetation establishment ensure adequate maintenance resources and watering capabilities exist.
- Seeding is not recommended as seeds can be washed away and are slow to establish. Plant the infiltration area of the rain garden with dormant or actively growing nursery stock. Ensure that trees and other vegetation will not hinder water from entering the rain garden, create traffic or safety issues, or obstruct utilities.
- Mulch vegetation after planting to suppress weeds and conserve moisture. Use shredded hardwood mulch or equivalent non-floatable mulch. Spread mulch evenly to a maximum depth of 3 inches. Ensure clearance of mulch around new plantings to facilitate watering and air exchange. Where phosphorous levels are a concern, discontinue adding mulch once plants are established.
- Consider diverting water or lowering the rain garden outlet until vegetation is established. Remove the diversion or complete construction of outlet to design depth when plants grow taller than ponding depth.
- Consider temporarily fencing around the rain garden to protect plantings if herbivore pressure exists.
- A single rain garden will not significantly impact flooding issues or water quality problems in a community. However, the cumulative impact of rain gardens in conjunction with other stormwater management practices has the potential to tangibly affect flooding, stream flow, local groundwater recharge and water quality concerns.

PLANS AND SPECIFICATIONS

Plans and specifications for installing a rain garden shall be in compliance with this standard and shall describe the requirements for applying the practice to achieve its intended purpose. At a minimum include the following items:

1. Rain garden location
2. Grade, depth, width, length and side slope grade

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3. Rain garden cross-section
4. Material specifications
5. Construction specifications

All plans shall include the installation, inspection and maintenance schedules with the responsible party identified.

OPERATION AND MAINTENANCE

An operation and maintenance plan shall be provided for the rain garden to include at a minimum:

- Periodic inspections during vegetative establishment and immediately following significant rainfall events.
- Prompt repair or replacement of damaged components such as areas subject to wear or erosion, as well as, failed plantings.
- Periodic inspection to remove accumulated sediment and debris.
- Rain garden vegetation will require regular watering and weeding during plant establishment.
- Prune trees and shrubs as needed. Weed rain garden to control unwanted vegetation. Annually, in early spring, remove or mulch in place the previous year's herbaceous growth which has died back.

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March 2014

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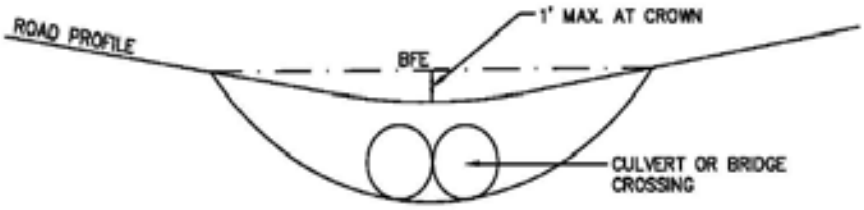
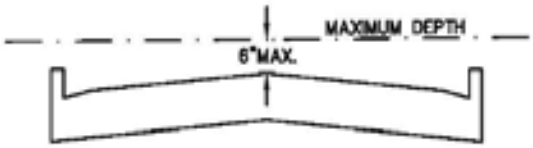
FIGURE 3
Maximum Allowable Flow Depths on Roadways

TRANSVERSE STREAM CROSSINGS



STREAM CROSS-SECTION

FLOW PARALLEL TO ROADWAY



ROAD CROSS-SECTION

Missman, INC.
Professional Engineers & Land Surveyors

CITY OF ROCKFORD
STORMWATER TECHNICAL MANUAL

MAXIMUM ALLOWABLE FLOW DEPTHS ON ROADWAYS

REVISIONS

No.	DESCRIPTION	DATE

FIG. 4

T2-03 Site Runoff Storage Requirements (Detention)

The objective of § T203 is to discuss the hydrologic models that can be used to develop peak-discharge frequency estimates for any watershed in question. The hydrologic models are used to size appropriate stormwater system(s) that are used to attenuate the increase in peak discharges due to additional impervious surfaces.

T2-03(a) Area of Disturbance

Site runoff storage volume is required for only the area of the site that has been hydrologically disturbed. If the development on a 60-acre site disturbs only 40-acres of the site, then the site runoff storage volume is necessary for only 40-acres. Figure 5 shows an example of this requirement.

T2-03(b) Release Rate

The peak release rate from a development site shall not exceed 0.2 cfs/acre of development for the 0.01 probability in any year. This has been found to be the natural safe stormwater discharging capacity of the downstream systems in the City of Rockford.

If the design required an outlet size smaller than 4-inches, then a waiver of detention rights can be requested. Other BMPS shall be used to detain as much water as possible. Appropriate protection of the outlet shall be designed to avoid the opening from being plugged.

The release rate is to be calculated by determining the hydrologically disturbed area of the development. If the site has more than one outlet, the allowable release for each discharge point shall be calculated based on the hydrologically disturbed area of the development to that particular outlet.

All central structures shall be provided with an intercepter for trash and debris and it shall be designed and constructed to prevent soil erosion and not require manual adjustments for its proper operation.

FIGURE 4
Hydrologically Disturbed Area Example

T2-03(c) Design Methods

In order to calculate the required storage volume, an event hydrograph routing method shall be used. There are several computer programs developed explicitly for determining the required storage volume using event hydrograph routing methods. Acceptable models include HEC-1 (only when used with SCS runoff method), HEC-HMS (also, using the SCS runoff method), SWMM, TR-20 or TR-55 tabular method. The HEC-1 and HECHMS are U.S. Army Corps of Engineers hydrologic models. TR-20 and TR55 were developed by the Soil Conservation Service (now named the Natural Resources Conservation Service). The HEC programs can be downloaded off the internet from:

http://www.hec.usace.army.mil/software/software-distrib/index.html

The TR-20 program can be downloaded off the internet from:

http://www.wcc.nrcs.usda.gov/water/quality/common/tr20/tr20.html

The SWMM program can be downloaded off the internet from:

http://www.epa.gov/ceampubl/DOS/SVVMM.INSTALSW.EXE

All event hydrograph routing methods shall use the Huff rainfall distribution appropriate for the storm duration as shown in Tables 2 and 3. Rainfall depths for different frequencies and durations are shown in Table 2 in § T202(f). Figure 5 shows the four Huff Quartile Distributions in graphical format. The only exception to using the Huff Quartile Distributions is when the TR-55 tabular method is used. When using the TR-55 tabular method it is acceptable to use the SCS Type II rainfall distribution. An antecedent moisture condition of 2 must be used when using the TR-20 event hydrograph program.

TABLE 2
Huff Rainfall Distributions

Rainfall Duration (hours)	Huff Distribution
1	1st
2	1st
3	1st
6	1St
12	2nd
18	3rd
24	3rd
48	4th
72	4th
120	4th
240	4th

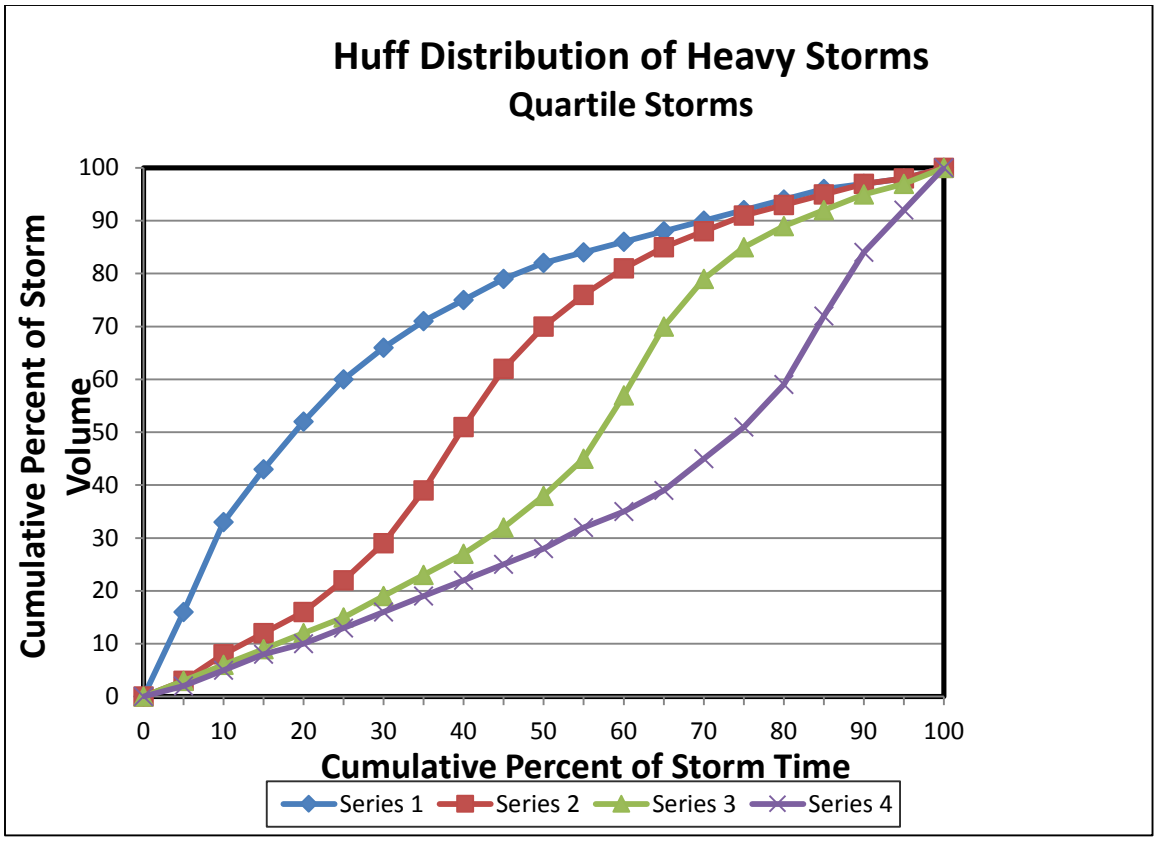
TABLE 3
Huff Quartile Distributions*

Cumulative Storm Percentage	Percent of Total Rainfall			
	1st Quartile	2nd Quartile	3rd Quartile	4th Quartile
05	16	03	03	02
10	33	08	06	05
15	43	12	09	08
20	52	16	12	10
25	60	22	15	13
30	66	29	19	16
35	71	39	23	19
40	75	51	27	22
45	79	62	32	25
50	82	70	38	28
55	84	76	45	32
60	86	81	57	35
65	88	85	70	39
70	90	88	79	45
75	92	91	85	51
80	94	93	89	59
85	96	95	92	72
90	97	97	95	84
95	98	98	97	92

* Applies to drainage areas less than 10 square miles.

FIGURE 5

Median Time Distribution of Heavy Storm Rainfall at a Point
(Reference: ISWS, 1992; Rainfall Frequency Atlas of the Midwest)



Example: A development has an off-site drainage area of 100 acres as delineated on the Winnebago County 2-foot topographic map. The time of concentration for the off-site area is 1.5 hours, and the Runoff Curve Number is 80. Determine the critical duration and peak discharge to be by-passed through the development.

Solution: ATR-20 hydrologic model was used for the critical duration analysis. The following data was input to the model:

Drainage Area =	0.15625 square miles (100ac)
Time of Concentration=	1.5 hours
Runoff Curve Number=	80

The rainfall tables used (RAINFL 6, 7, 8, 9) are the Huff 1st, 2nd, 3rd, and 4th quartile distributions. The rainfall depths used are ISWS Bulletin 70 values, as listed in Table 1. The TR-20 hydrologic model input/output is listed below.

FIGURE 5
Median Time Distribution of Heavy Storm Rainfall at a Point
(continued)

```
*****************80-80 LIST OF INPUT DATA FOR TR-20 HYDROLOGY**.******.********

JOB TR-20                                                    NOPLOTS   JJJ
TITLE       Kane County Technical Manual
TITLE       Critical Duration Analysis Example APR00
5 RAINFL 6              0.05                                          HUFF 1ST
8             0.00  0.16          0.33        0.43          0.52    QUARTILE
8             0,60  0.66          0.71        0.75          0.79
8             0.82  0.84          0.86        0.88          0.90
8             0.92  0.94          0.96        0.97          0.98
8             1.    1.            1.          1.            1.
9 ENDTBL
5 RAINFL 7            0.05
8             0.00  0.03          0.08        0.12          0.16    HUFF 2ND
8             0.22  0.29          0.39        0.51          0.62    QUARTILE
8             0.70  0.76          0.81        0.85          0.88
8             0.91  0.93          0.95        0.97          0.98
8             1.    1.            1.          1.            1.
9 ENDTBL
5 RAINFL 8            0.05
8             0.00  0.03          0.06        6.09          0.12    HUFF 3RD
8             0.15  0.19          0.23        0.27          0.32    QUARTILE
8             0.38  0.45          0.57        0.70          0.79
8             0.85  0.89          0.92        0.95          0.97
8             1.00  1.00          too         1.00          1.00
9 ENDTBL
5 RAINFL 9            0.05
8             0.00  0.02          0.05        0.08          0.10    HUFF 4TH
8             0.13  0.16          0.19        0.22          0.25    QUARTILE
8             0.28  0.32          0.35        0.39          0.45
8             0.51  0.59          0,72        0.84          0.92
8             1.    1.            1.          1.            1.
9 ENDTBL
6 RUNOFF 1    1     2 .15625      80.         1.50                1 100ac
ENDATA
7 INCREM 6            1.00
7 COMPUT 7    1     1       0.0   3.56        1.        6 2       1  1hr
ENDCMP 1
7 COMPUT 7    1     1      0.0    4.47        2.        6 2       1  2hr
ENDCMP 1
7 COMPUT 7    1     1       0.0   4.85        3.        6 2       1  3hr
ENDCMP 1
7 COMPUT 7    1     1      0.0    5.68        6.        6 2       1  6hr
ENDCMP 1
7 COMPUT 7    1     1      0.0    6.59        12.       7 2       1  12hr
ENDCMP 1
7 COMPUT 7    1     1      0.0    6.97        18.       8 2       1  18hr
ENDCMP 1


          80-80 LIST OF INPUT DATA (CONTINUED).********************

7 COMPUT 7    1     1       0.0   7.58          24.     8 2       1   24hr
ENDCMP 1
7 COMPUT 7    1     1       0.0   8.16          48.     9 2       1   48hr
ENDCMP 1
7 COMPUT 7    1     1       0.0   8.78          72.     9 2       1   72hr
ENDCMP 1
7 COMPUT 7    1     1       0.0   9.96         120.     9 2       1   120hr
ENDCMP 1
7 COMPUT 7    1     1       0.0   11.14        240.     9 2       1   240hr
ENDCMP 1
ENDJOB 2
  0************.*****************END OF 80-80 usT*********************************
```

FIGURE 5
Median Time Distribution of Heavy Storm Rainfall at a Point
(continued)

SUMMARY TABLE 1 - SELECTED RESULTS OF STANDARD AND EXECUTIVE CONTROL INSTRUCTIONS IN THE ORDER PERFORMED
(A STAR(*) AFTER THE PEAK DISCHARGE TIME AND RATE (CFS) VALUES INDICATES A FLAT TOP HYDROGRAPH
A QUESTION MARK(?) INDICATES A HYDROGRAPH WITH PEAK AS LAST POINT.)

SECTION/ STRUCTURE ID	STANDARD CONTROL OPERATION	DRAINAGE AREA (SQ MI)	RAIN TABLE #	ANTEC MOIST COND	MAIN TIME INCREM (HR)	PRECIPITATION BEGIN (HR)	PRECIPITATION AMOUNT (IN)	PRECIPITATION DURATION (HR)	RUNOFF AMOUNT (IN)	PEAK DISCHARGE ELEVATION (FT)	PEAK DISCHARGE TIME (HR)	PEAK DISCHARGE RATE (CFS)	PEAK DISCHARGE RATE (CSM)
ALTERNATE 0 STORM 1													
+													
XSECTION 1	RUNOFF	.16	6	2	1.00	.0	3.56	1.00	1.81		1.34	91.84	587.8
XSECTION 1	RUNOFF	.16	6	2	1.00	.0	4.47	2.00	2.48		1.82	111.32	712.5
XSECTION 1	RUNOFF	.16	6	2	1.00	.0	4.85	3.00	2.75		2.03	112.13	717.7
XSECTION 1	RUNOFF	.16	6	2	1.00	.0	5.68	6.00	3.44		2.28	103.48	662.2
XSECTION 1	RUNOFF	.16	7	2	1.00	.0	6.59	12.00	4.31		6.02	88.89	568.9
XSECTION 1	RUNOFF	.16	8	2	1.00	.0	6.97	18.00	4.66		12.18	77.53	496.2
XSECTION 1	RUNOFF	.16	8	2	1.00	.0	7.58	24.00	5.22		15.92	67.74	433.5
XSECTION 1	RUNOFF	.16	9	2	1.00	.0	8.16	48.00	5.76		41.30	39.02	.249.7
%SECTION 1	RUNOFF	.16	9	2	1.00	.0	8.78	72.00	6.36		61.20	28.64	183.3
XSECTION 1	RUNOFF	.16	9	2	1.00	.0	9.96	120.00	7.47		101.62	20.08	128.5

1

TR20 XEQ 10-18-00 13:01 Kane County Technical Manual JOB 1 SUMMARY
REV PC 09183(.2) Critical Duration Analysis Example JJJ APR00 PAGE 5

SUMMARY TABLE 3 - DISCHARGE (CFS) AT XSECTIONS AND STRUCTURES FOR ALL STORMS AND ALTERNATES

XSECTION/DRAINAGE STRUCTURE ID	AREA (SQ MI)	STORM NUMBERS 1
0 XSECTION 1	.16	
ALTERNATE 0		11.38

LEND OF 1 JOBS IN THIS RUN

Summary Table 1 shows that the peak discharge from the 100 acre offsite basin is 112 cfs, and the corresponding critical duration is the 3-hour event.

All runoff volumes shall be calculated using the 24-hour duration with a 1% probability of occurrence in any one year. An antecedent moisture condition (AMC) of 2 shall be used for all runoff calculations. An AMC=2 represents average soil moisture conditions.

T2-03(d) Existing Release Rate Less Than Allowable

For all developments, the existing conditions release rate must be computed. If the existing release rate for the design storm event with a 1% probability of occurrence in any one year with a 24-hour duration is less than 0.2 cfs/acre, then that will be the developed release rate. It is common for sites with small amounts of tributary area and significant depressional storage to have the existing undeveloped release rate less than 0.2 cfs/acre.

T2-03(e) Downstream Water Surface Elevations

Outfalls are hydraulic structures whose capacity is governed by a balance between upstream and downstream head. Outfall capacity must be calculated within the range of differences in upstream and downstream hydraulic grade line that can be expected to occur statistically for a 100-year return period. It is important to make realistic assumptions about the outfall capacity.

Calculations should assume free outfall conditions only if hydraulic grade line calculations for the discharge channel indicate the outfall will be free during major storms. Hydraulic grade line evaluations must proceed upstream from:

1. A demonstrated free overflow; or

2. The expected 1% probability in any 1-year flood elevation at the most downstream point analyzed; or

3. An alternative assumption demonstrated to be appropriate and conservative.

When the outfall occurs in a regulatory floodplain, see the discussion in T2-03(i).

T2-03(f) Retention Requirement (Reserved)

T2-03(g) Site Runoff Storage Facility Design Requirements

The steps in designing the site runoff storage facility are as follows:

1. Determine the site and development area and the natural outlet point(s).

2. Calculate the off-site tributary area and the corresponding peak runoff rate from the 100-year, critical duration design storm event.

3. Determine if regulatory floodplain or floodway exists on the development site.

4. Calculate the existing release rate from the site, accounting for any depressional storage.

5. From the hydrologically disturbed area, determine the percent impervious area and calculate the approximate detention volume required using Figure 7.

6. Determine the location(s) of stormwater storage facilities and the existing outlets, including invert/overland flow elevations.

7. Use an event hydrograph routing method to iterate the size of the detention pond knowing the allowable release rate, an approximate storage volume, , and modeling the inflow hydrograph from the development area.

T2-03(h) Site Runoff Storage Facility Requirements Within the Regulatory Floodplain

The Ordinance does not prohibit the construction of site runoff storage facilities in the floodplain, but requires that their design consider carefully the function of the facility during flood flows. Detention volume sizing shall assume a free discharge, establishing a required volume. However, analysis of the operation of the facility must consider the requirement that existing conditions 100-year peak runoff rate not be exceeded where the restrictor is blocked. "Berming off" of existing floodplain storage and uncontrolled site discharge (on-line storage) is highly discouraged.

If it can be shown using detailed hydrologic and hydraulic analysis that the design of a storage facility within the regulatory floodplain provides a watershed benefit, the Administrator may approve the design. To show a watershed benefit, the applicant must demonstrate that there is a decrease in flood elevations for the 100-year, critical design storm event, either upstream and/or downstream of the development site. The decrease in elevation should be greater than 0.1 feet and in no locations, upstream or downstream of the development site should water surface elevations increase.

T2-03(j) Requirements Within the Regulatory Floodway

A hydrologic and hydraulic analysis must be performed to demonstrate no adverse impact upstream or downstream of the development site, as well as demonstrating that the required site storage volume will actually be available under all stream conditions. The storage facility shall provide a net watershed benefit.

T2-03(k) Off-Site Facilities

It is assumed that the site runoff storage will normally be located on the development site. If this is not the case, then the runoff storage site will itself constitute a development site and be subject to all of the requirements for development under the Ordinance.

The storage volume in the offsite facility, therefore, must be at least equal to the sum of the storage volume required for the original development, plus the volume required for development of the storage facility. If any other areas drain to the storage facility, additional storage volume must be provided as indicated under "Off-Site Flows", above. Further, the developer must demonstrate that the required storage volume is intentionally and operationally available under the full range of hydrologic and hydraulic conditions from dry weather to base flood conditions.

Runoff from the development site must be conveyed to the storage site. It precludes the option of oversizing an offsite storage volume and undersizing the outlet to compensate for allowing a larger discharge rate on the original development site. Conveyance from the development site to the storage site must be sized to convey the base flood peak flows considering both tailwater and headwater hydraulic conditions.

T2-03(l) See City Ordinance 2-03(L)

T2-03(m) Structures Built Across a Channel for Site Runoff Storage Facilities

Where a stream traverses a development site, special considerations for the location of detention facilities are warranted. The practice of building an impounding structure or dam across the stream to meet detention requirements is often problematic when a longer term view of the stream system is taken. In perennial streams, which in general are streams that exhibit a constant flow, a number of other processes are at work which the cross stream structure interrupts. These are (1) the movement of sediments downstream and (2) distribution of nutrients to aquatic organisms. In general the impact of this interruption is much more severe on perennial than intermittent streams where these processes are more likely to be in evidence. Therefore, structures built across a channel to impound water to obtain the required site runoff storage requirements are prohibited on any perennial stream unless it is part of a public flood control project with a net watershed benefit.

A stream's bed and bank configuration at any given time is related to a number of factors, but generally it is a product of the base flow, energy gradient, total sediment load, and size of the sediment particles. A change in any one of these four factors causes the stream to experience a long period of instability that tends back towards stability in a new configuration. A dam can affect the base flow of the stream and interrupts the sediment load that the stream is carrying. Sediment starved discharges from the impoundment pick up a new sediment load downstream. Increases in the base flow velocity can cause stream banks to widen in response to seeking equilibrium.

An ephemeral stream has no base flow by definition. The ephemeral portions of streams

are located in the upland watershed where under certain circumstances cross stream structures can actually be beneficial to the watershed on a regional basis when considering peak discharges.

When no better information is available, USGS 7.5-minute quadrangle maps can be consulted for the location of an intermittent stream. Intermittent streams are shown as "broken blue" lines. Where a stream is shown as a "solid blue" line on these maps, they are assumed to be perennial unless better information is submitted and accepted by the Administrator. Better information may include documented flow monitoring. The flow monitoring must be carried on for a minimum of one water year (October 1 through September 30) and documented by an individual who has had training in stream monitoring protocol and statistical analysis of stream flows.

Streams are shown as other than solid blue lines on a USGS Quadrangle Map may be assumed to be intermittent if they have a defined bed and banks and no flow is observed in them for some period of time. Where no bed and banks of a stream are observed, or above the discharge point of agricultural field tile systems, streams may be assumed ephemeral.

Stream stability calculations must document the streams current geomorphological classification for a significant reach downstream and upstream that would be influenced by the proposed dam. This length can vary based on the particular conditions but should be assumed to be no less than one thousand feet upstream of the pool and downstream of the impounding structure. This distance may extend off site. The submittal must include documentation that the proposed dam will not substantially change the base flow of the stream system, nor exacerbate known stream instability problems within the influenced reach. This submittal also must document the likelihood that other aquatic resources are present and what impact the cross stream structure would be on these resources. Where the impacts cannot be adequately mitigated then the cross stream structure should be considered prohibited.

These requirements are in addition to any requirements imposed by the U.S. Army Corps of Engineers (COE) in their permitting process or other requirements imposed by this ordinance. Also, any impounding structure must also satisfy Illinois Department of Natural Resources — Office of Water Resources Dam Safety permitting requirements.

ARTICLE 3 — EROSION AND SEDIMENT CONTROL

Erosion and sedimentation are naturally occurring geological phenomena. Land development activities have initiated more drastic, undesirable and damaging alterations in the natural cycle by accelerating the erosion — sedimentation process. The original natural vegetative cover of prairie grasses, trees and shrubs allowed only a minimal amount of soil to be eroded. But as soon as cover was disturbed, first by the plow, and more recently by development activities, the exposed ground surface has become subject to accelerated stormwater runoff and resultant soil erosion. The primary cause of soil erosion is the energy impact of the falling rain on the exposed soil.

Stream beds tend to build-up with sediment during the construction phase of development and then erode dramatically as the area stabilizes and runoff increases. As such, erosion interferes with water uses, degrades water quality, destroys natural plant growth and buries substrates important for fish feeding and spawning.

T3-00(a) Site Planning

The primary goal of any erosion and sediment control site plan should be to prevent soil erosion by minimizing the amount of bare soil exposed at any one time during construction. On-site sediment control is a secondary mechanism to prevent eroded soil from leaving the development site. Surface and erodibility for the mapped soils were obtained from the NRCS web soil survey located at:

http://websoilsurvey.nrcs.usda.gov/app

Soil erodibility factors have been calculated for all soil types in the County and are shown in Table 4. The potential erodibility of surface soil becomes greater with an increase in the erodibility co-efficient (k) used. Soil type information will provide assistance to the designer in selection of appropriate management practices for both temporary and permanent stabilization

TABLE 4
Soil Erodibility

Soil Map Unit	Soil	Surface Erosion Factor (k)	Subsurface Erosion Factor (k); 12" – 70" Depth Range	Erosion Risk
21B, C2	Pecatonica	.43	.49	Slight
22B, C2, D2	Westville	.43 (C2); .37 (D2)	.37	Slight (B, C2); Moderate (D2)
51A	Muscatine	.32	.49	Slight
61A	Atterberry	.37	.55	Slight
68A	Sable	.24	.49	Slight
86A, B, C2	Osco	.32 (A, B); .37 (C2)	.49	Slight
93E2	Rodman	.20	.20	Moderate
100A	Palms	N/A	.32	Slight
102A	La Hogue	.24	.37	Slight
104A	Virgil	.37	.43	Slight
119B	Elco	.37	.43	Slight
125A	Selma	.24	.28	Slight

146A	Elliot	.32	.49	Slight
152A	Drummer	.24	.37	Slight
172A	Hoopeston	.10	.20	Slight
188A	Beardstown	.20	.32	Slight
197A	Troxel	.28	.37	Slight
198A	Elburn	.28	.37	Slight
199A, B, C2	Plano	.37	.43	Slight
223B	Varna	.37	.43	Slight
227B	Argyle	.37	.43	Slight
242A	Kendall	.43	.43	Slight
243A, B, C2	St. Charles	.37 (A); .43 (B, C2)	.55 (A); .43 (B, C2)	Slight
259B2, C2	Assumption	.37	.43	Slight
278A	Stronghurst	.43	.49	Slight
279A	Rozetta	.37	.49	Slight
280B, C2	Fayette	.37	.49	Slight
290A, B, D2	Warsaw	.20 (A); .28 (B); .32 (D2)	.32 (A); .28 (B); .24 (D2)	Slight
293A	Andres	.28	.49	Slight
297B, D2	Ringwood	.28 (B); .32 (D2)	.37	Slight
310B, D2	McHenry	.49 (B); .37 (D2)	.37	Slight
327B, D2	Fox	.37 (B); .43 (D2)	.24 (B); .37 (D2)	Slight
329A	Will	.17	.32	Slight
330A	Peotone	.24	.37	Slight
332A, B	Billett	.17	.20 (A); .17 (B)	Slight
343A	Kane	.32	.37	Slight
354A, B	Hononegah	.02	.05	Slight
361B, D2, D3	Kidder	.28 (B, D3); .37 (D2)	.32 (B, D2); .28 (D3)	Slight
363B, D2	Griswold	.32	.32	Slight
369A	Waupecan	.32	.43	Slight
379A	Dakota	.20	.28	Slight
387A, B	Ockley	.37 (A); .43 (B)	.32	Slight
403C, E, F	Elizabeth	.32 (C, E); .28 (F)	.05 (E)	Slight (C); Moderate (E, F)
411B, C2	Ashdale	.37	.43	Slight
412B	Ogle	.37	.43	Slight
419A, B, C2	Flagg	.37	.43	Slight
429B, C2	Palsgrove	.43 (B); .49 (C2)	.43	Slight
440A, B, C2	Jasper	.37 (A, B); .43 (C2)	.43 (A, C2); .55 (B)	Slight
490A	Odell	.32	.43	Slight
505C2, D2, E2	Dunbarton	.37	.43 (C2, D2); .17 (E2)	Slight (C2, D2); Moderate (E2)
506A, B, C2	Hitt	.28 (A, B); .43 (C2)	.37	Slight
512B, C2	Danabrook	.37	.43	Slight
528A	Lahoguess	.28	.28	Slight
529A	Selmass	.24	.28	Slight
533	Urban Land	N/A	N/A	N/A

561B, C2, D2	Whalan & New Glarus	.37	.32 (B); .24 (C2); .28 (D2)	Slight (B, C2); Moderate (D2)
566B, C2, D2	Rockton & Dodgeville	.24 (B); .28 (C2, D2)	.32	Slight
570A, B, D2	Martinsville	.43	.43 (A); .28 (B); .32 (D2)	Slight
618B, C2	Senachwine	.32 (B); .37 (C2)	.43	Slight
622B, C2	Wyanet	.37 (B); .43 (C2)	.49	Slight
623A, B	Kishwaukee	.32	.32	Slight
675A, B	Greenbush	.37	.49	Slight
728B, C2, D2	Winnebago	.37	.37 (B); .32 (C2, D2)	Slight (B, C2); Moderate (D2)
768B, C, D	Backbone	.02	.37	
769B, D, E2	Edmund	.37	.20 (B); .24 (D)	Slight (B, D); Moderate (E2)
771A	Hayfield	.32	.37	Slight
772A	Marshan	.20	.32	Slight
777A	Adrian	N/A	.10	Slight
779B, D	Chelsea	.02	.28	Slight
780B, C2	Grellton	.28	.55 (B); .49 (C2)	Slight
781A, B	Friesland	.28	.55	Slight
783A, B	Flagler	.17	.17	Slight
802B	Orthents	.28	.37	Slight
835G	Earthen	N/A	N/A	N/A
864	Pits, quarries	N/A	N/A	N/A
865	Pits, gravel	N/A	N/A	N/A
939C2, D2	Rodman-Warsaw	.20	.20	Slight
1100A	Palms	N/A	.32	Slight
1103A	Houghton	N/A	N/A	Slight
1776A	Comfrey (undrained)	.32	.37	Slight
1777A	Adrian (undrained)	N/A	.10	Slight
3082A	Millington	.28	.32	Slight
3107A	Sawmill	.32	.43	Slight
3415A	Orion	.49	.55	Slight
3776A	Comfrey	.32	.37	Slight
3800A	Psamments	.02	.02	Slight
8451A	Lawson	.32	.43	Slight
8782A	Juneau	.49	.55	Slight
9051AA	Muscatine (terrace)	.32	.55	Slight
9061A	Atterberry (terrace)	.37	.55	Slight
9068A	Sable (terrace)	.32	.49	Slight
9086A	Osco (terrace)	.32	.49	Slight
9278A	Stronghurst (terrace)	.43	.49	Slight

9279A	Rozetta (terrace)	.37	.49	Slight
9675A	Greenbush (terrace)	.37	.49	Slight

(1) K factors are for Whole Soils.
(2) Subsurface K factor ratings are a weighted average for the depth range.
(3) Erosion risks are based on slope and soil erosion factor (k) of the soil types.

T3-00(a)(1) Phased Construction

When site vegetation is inadequate to stabilize areas not currently being constructed in a phased development, several options are available for vegetative stabilization.

1. If construction will occur within one-year the site may be planted with a temporary cover of annual grasses included in Table 5.

2. If construction of the phase will be greater than 1 year, stabilization may be accomplished with a cover that uses a mix of annual and perennial grasses shown in Table 6.

TABLE 5
Seed Mixtures For Temporary Stabilization
Remaining Less Than One Year

Seed	**Rate**	**Soil Drainage**				**Planting Period**
	Lbs./ac.	ED	WD	SP	PD	
Timothy	5		X	X	X	Spring
Kentucky Blue Grass	5		X	X		Spring/Fall
With one of the following:						
Oats	90					Early Spring-July 1
Cereal Rye	90					Early Spring-Oct 15
Spring or Winter Wheat	90					Early Spring-Oct 15
Spring Planting — Early Spring to June 15 Fall Planting — August 1 to October 15						

*ED = Excessively Drained; WD = Well Drained; SP = Somewhat Poorly Drained; PD = Poorly Drained

TABLE 6
Seed Mixtures For Temporary or Permanent Stabilization
Remaining For More Than One Year

Mix/Seed	Rate Lbs./ac.	Soil Drainage				Planting Period
		ED	WD	SP	PD	
1. Tall Fescue	24.0	X	X	X		Spring/Fall/Dormant
2. Smooth Brome	24.0	X	X			Spring/Fall/Dormant
3. Tall Fescue or Smooth Brome and Alfalfa	24.0 8.0	X	X			Spring/Dormant
4. Tall Fescue and Timothy or Red Top	14.5 3.0, 3.0	X	X	X	X	Spring/Fall/Dormant
5. Tall Fescue	14.5		X	X		
Red Top	3.0					
Alsike Clover	9.5					
6. Orchard Grass	7.0		X			Spring
Alsike or Ladino Clover	3.5					
7. Timothy and Alsike or Ladino Clover	4.0 8.0		X	X	X	Spring
Havland Mixtures						
8. Alfalfa	12.0		X			Spring/Dormant
9. Alfalfa and	8.0		X			Spring/Dormant
10. Orchard Grass	4.0					Spring/Dormant
11. Alfalfa and	8.0 4.0		X	X	X	Spring/Dormant
12. Alfalfa and Tall Fescue or Smooth Brome	8.0 6.0		X	X		Spring/Dormant
With one of the following:						
A. Oats	30					Early Spring-July 1
B. Cereal Rye	30					Early Spring-Oct 15
C. Spring or Winter Wheat	20					Early Spring-Oct 15

*ED = Excessively Drained; WD = Well Drained; SP = Somewhat Poorly Drained; PD = Poorly Drained

Erosion control methods should be appropriate for the size of site, the duration of construction and the slope, length and grade. Soil stabilization with vegetative cover is generally the most effective stabilization. Hydroseeding with mulch application or periodic hydromulching may be used for soil stabilization alone on slopes flatter than 3:1. When hydroseeding does not produce dense vegetation, areas should be re-seeded periodically until growth occurs or if short duration summer stabilization is required and hydroseeding should be supplemented with heavy hydromulching. For steep slopes and drainage ways, erosion control blankets or gypsum-plaster may be more appropriate.

T3-00(b) Standards and Specifications

The "Illinois Urban Manual: A Technical Manual Designated for Urban Ecosystem Protection and Enhancement" is the primary resource for design detail for effective erosion and sediment control.

The "Illinois Urban Manual" may be viewed from the following website link: http://www/aoswcd/orgIUM

T3-00(c) General Requirements

Sediment control facilities are utilized to prevent sediment from leaving the site or entering buffers or special management areas within a development site. Sediment control structures commonly used include, sediment basins, sediment traps and silt fences. Sediment control facilities will be in place for all drainage leaving the site prior to mass grading. Plans for sediment control facilities should include grading or installation plan, sizing information, and maintenance procedures. Straw bale dikes are not preferred sediment control structures and should be used only where other alternatives are impractical

T3 00(d) Reserved

T3-00(e) Extended Construction Shutdown Periods

The condition of the site for extended construction shut down periods should be one of maximum stabilization and sediment trapping. All of the site that will not be constructed prior to the fall planting season should be stabilized with appropriate vegetative cover. The fall planting season ends on approximately October 15. Temporary seeding should be completed by this date. From October 1st until October 15, heavy mulch should be applied with the seed to prevent seedling losses to early frost. Prior to October 1st standard mulching rates apply. In years with prolonged summer droughts, heavy mulching should be applied with all seeding. The use of erosion control blankets with seeding is preferred on slopes 3:1 or greater and that are more than 100 feet in length.

Areas that are to be worked after October 15th shall be stabilized with tacified heavy mulch or erosion control blankets.

T3-00(f) Hydraulic and Hydrologic Design Requirements

Construction of sediment control structures is economically most practical when combined with stormwater management facilities. Because the site must have sediment control prior to mass grading, construction of the permanent detention facility as a sediment stilling basin is preferred. The ordinance sets a minimum design standard for sediment basins and traps that is commensurate with the duration of the rainfall event and the size of the drainage area.

For all areas greater than 3-acres, the minimum storm frequency to the detained for sediment removal is as follows:

Project Length	Design Event	Probability of Occurrence
< 6 months	2 year	50%
6 months — 1 year	5 year	20%
> 1 year	10 year	10%

Sufficient volume shall be created to retain all sediment from these design storm events. The facility shall be sized to hold the required volume for a period not less than 10-hours. This is the minimum settling time necessary to remove a substantial volume of the sediment from the runoff. To achieve a minimum 10-hour detention time from a 10-year, 24-hour storm event, the maximum design outflow would be limited to 0.065 cfs per acre-inch of runoff. The actual size of the facility may need to be larger where a site has one or more of the following conditions:

- The area of disturbance is greater than 75% of the maximum.
- Long or steep unvegetated slopes are present and will remain unstabilized for periods in excess of 7 days.
- The site drains into an adjacent wetland or special aquatic resource.
- The site drains into a previously developed parcel.
- The site drains across public highway or off-site private road.

T3-00(g) "As Needed" Practices on the Plans

"As needed practices" provide the permitee and the Administrator with a means to correct a deficiency in the management of erosion or in sediment control. Measures should be divided into temporary stabilization and sedimentation control measures. For each of these measures a typical detail should be provided. The project budget and contract should include each as well on a per unit basis. Projects shall utilize Soil Stabilization and Sediment Control measure details that are in accordance with the Illinois Urban Manual latest edition. Reference attached Figures 6 and 7 for Soil Stabilization and Sediment Control plan details.

Sediment Control (Figure 6)

a) Sediment Basin Dewatering
b) Temporary Sediment Trap
c) Temporary Sediment Trap
d) Silt Fence
e) Silt Fence Wire Support Plan
f) Fence Splicing Two Fences

Stabilization (Figure 7)

a) Erosion Blanket
b) Erosion Blanket
c) Erosion Blanket Turf Reinforcement Mat

Figure 6 A
Sediment Basin Dewatering

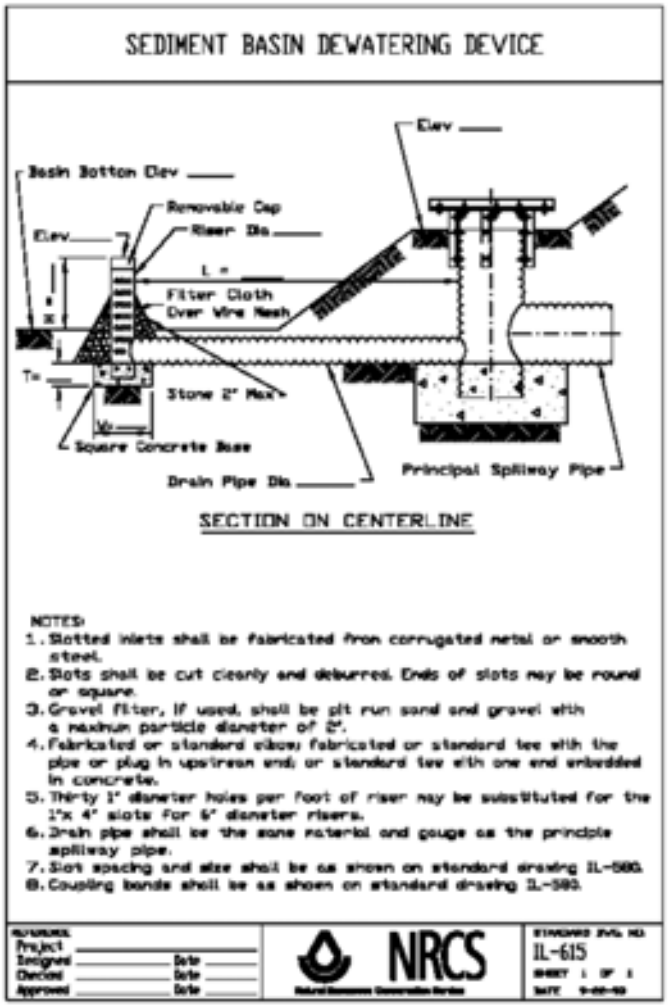


Figure 6 B
Temporary Sediment Trap

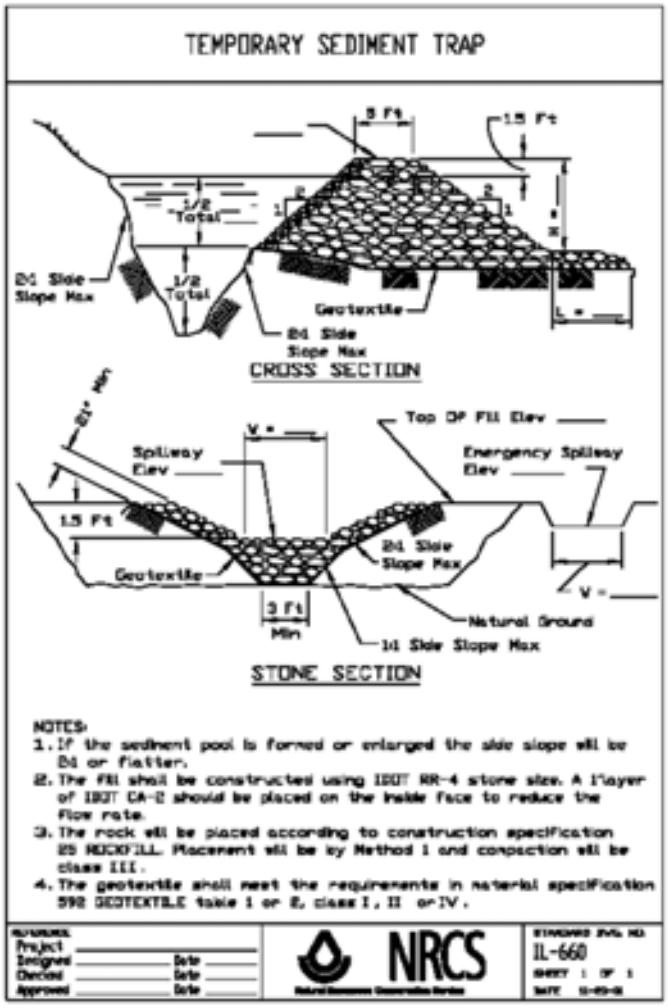
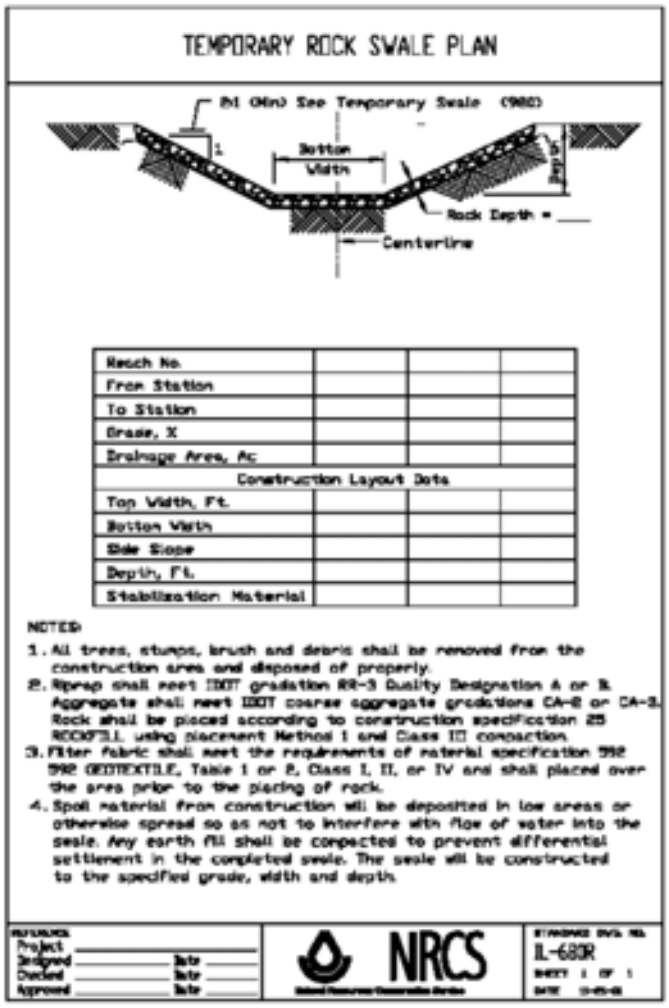


Figure 6 C
Temporary Sediment Trap



TEMPORARY ROCK SWALE PLAN

(h1 (Min) See Temporary Swale (560))

Bottom Width

Depth

Rock Depth = ____

Centerline

Reach No.			
From Station			
To Station			
Grade, %			
Drainage Area, Ac			
Construction Layout Data			
Top Width, Ft.			
Bottom Width			
Side Slope			
Depth, Ft.			
Stabilization Material			

NOTES:

1. All trees, stumps, brush and debris shall be removed from the construction area and disposed of properly.
2. Riprap shall meet IDOT gradation RR-3 Quality Designation A or B. Aggregate shall meet IDOT coarse aggregate gradations CA-8 or CA-3. Rock shall be placed according to construction specification 25 ROCKFILL using placement Method 1 and Class III compaction.
3. Filter fabric shall meet the requirements of material specification 592 592 GEOTEXTILE, Table 1 or 2, Class I, II, or IV and shall placed over the area prior to the placing of rock.
4. Spoil material from construction will be deposited in low areas or otherwise spread so as not to interfere with flow of water into the swale. Any earth fill shall be compacted to prevent differential settlement in the completed swale. The swale will be constructed to the specified grade, width and depth.

Project
Designed ____ Date ____
Checked ____ Date ____
Approved ____ Date ____

NRCS

IL-680R

Figure 6 D
Silt Fence

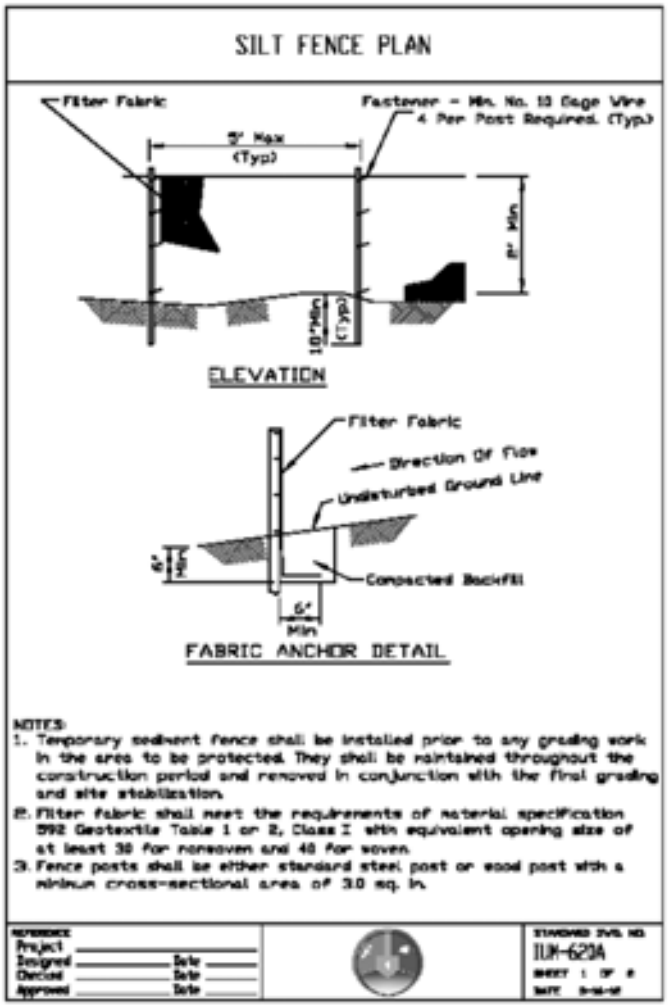


Figure 6 E
Silt Fence Wire Support

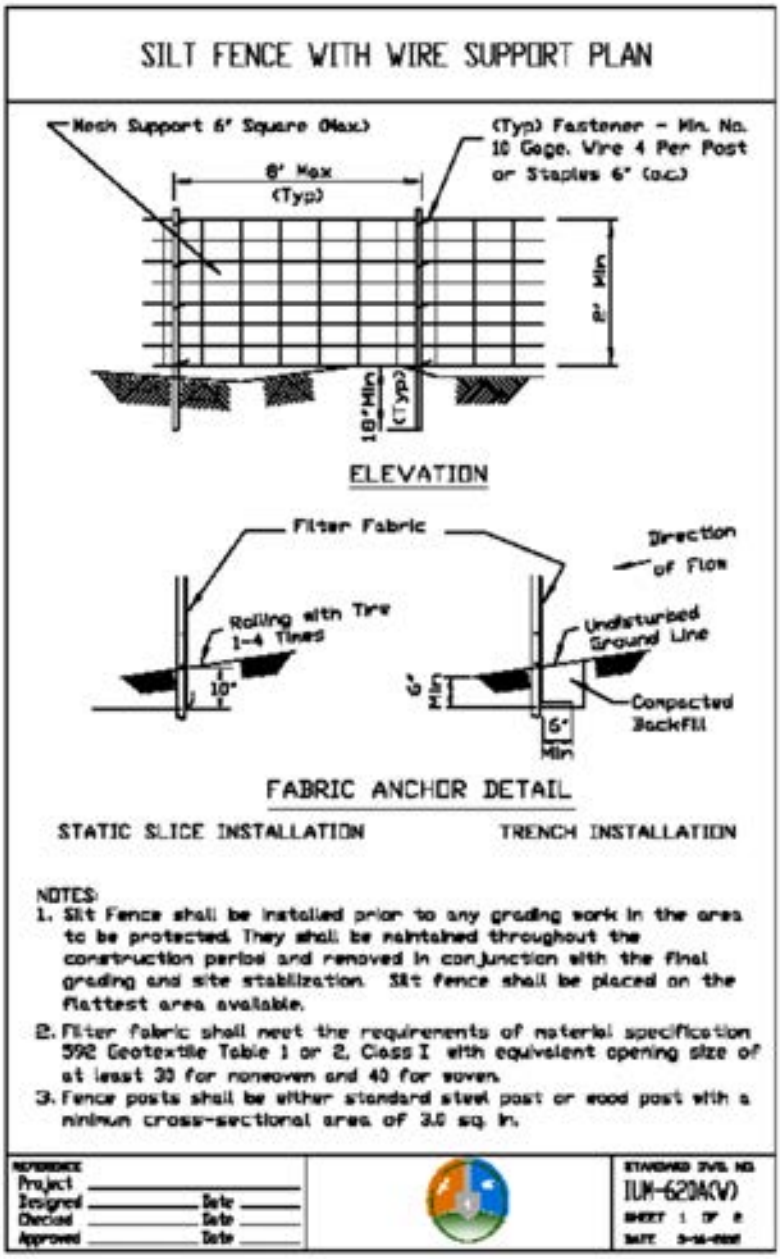


Figure 6 F
Fence Splicing Two Fences

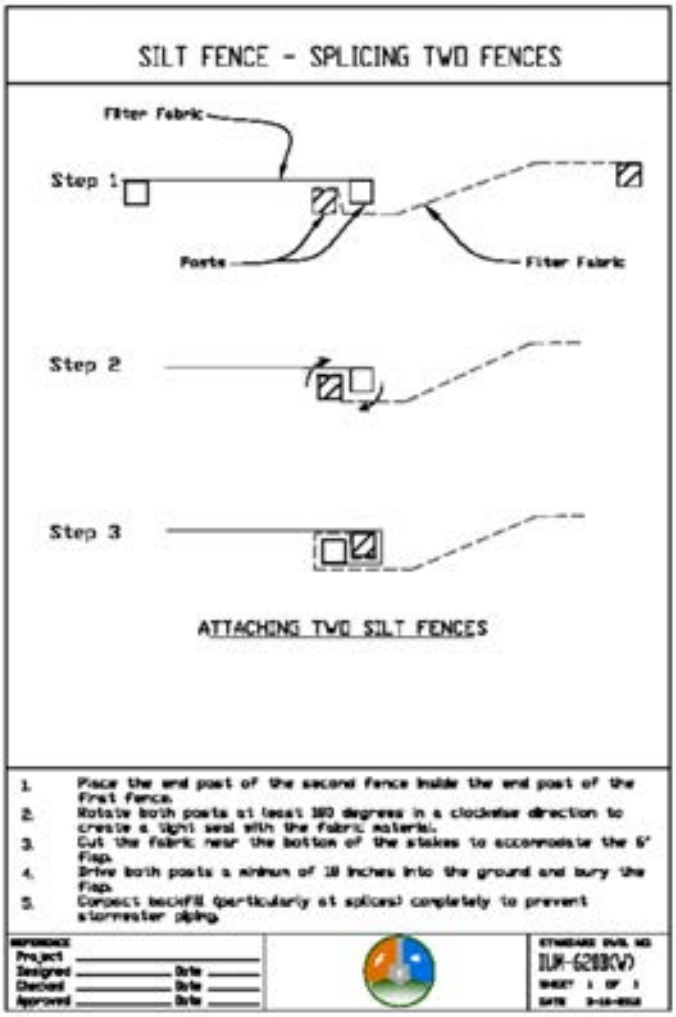


Figure 7 A
Erosion Blanket

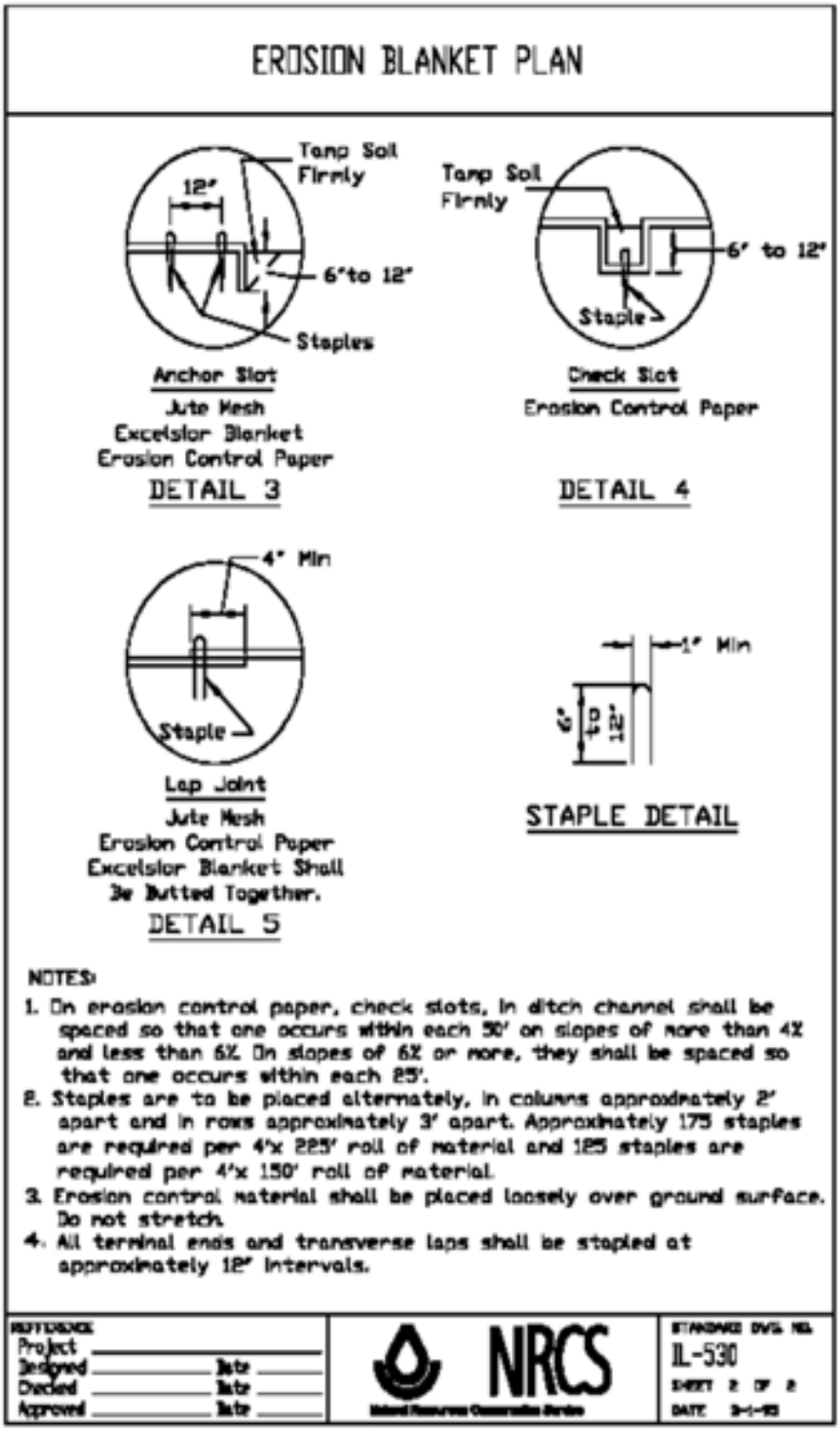


Figure 7 B
Erosion Blanket

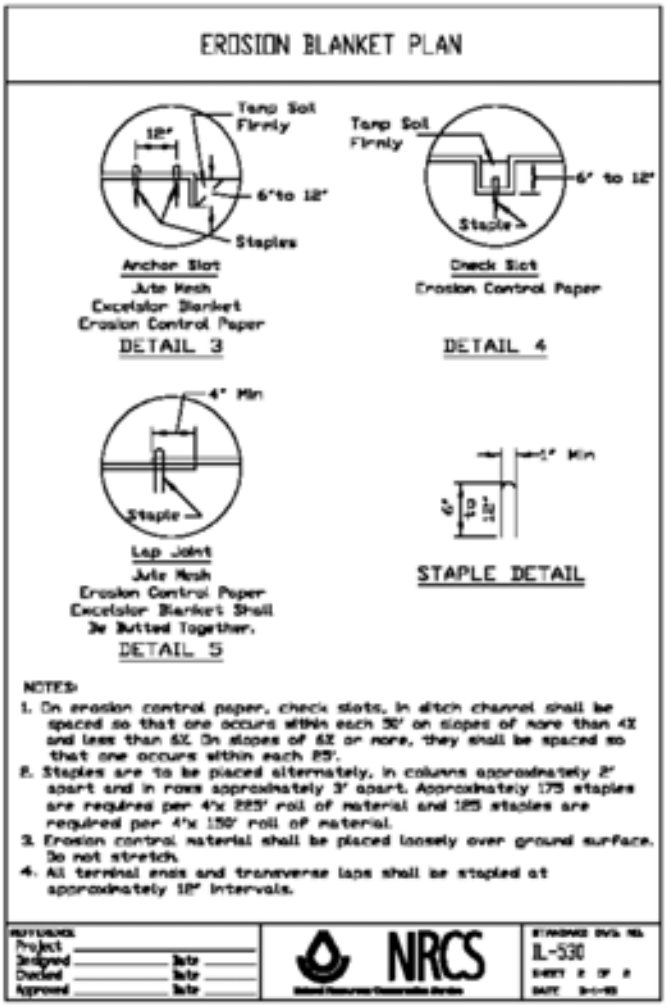
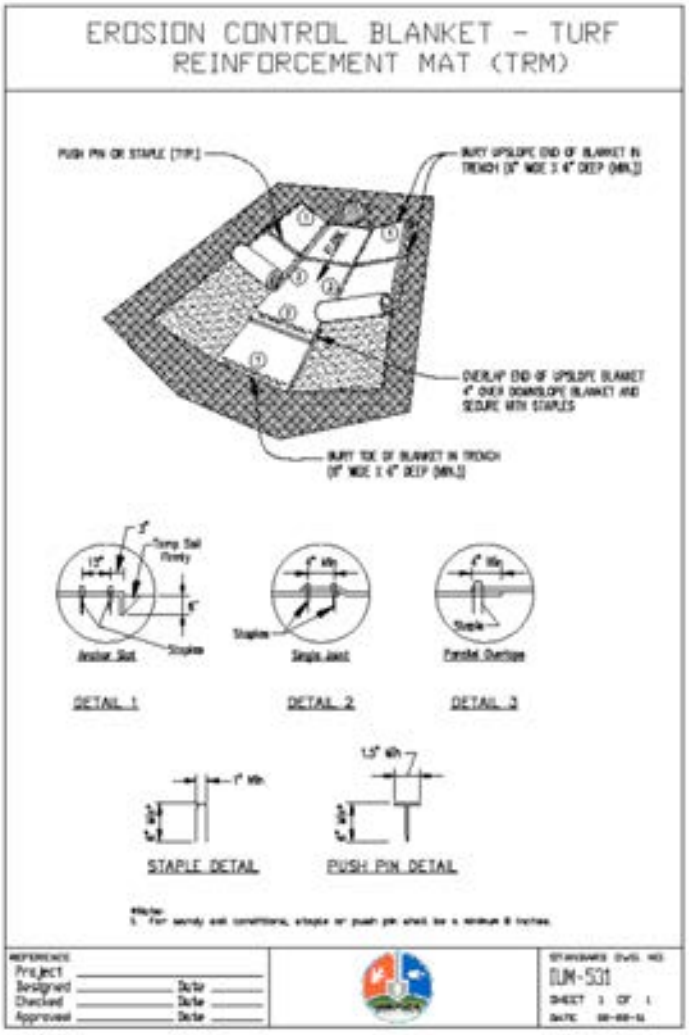


Figure 7 C
Erosion Blanket



T3-00(h) Limitation on Site Disturbance

The limitation on site disturbance is in recognition of the need to prevent erosion in preference to controlling sediment. Site disturbances shall not exceed 20 acres at any one time unless it is to balance cut and fill, for which a maximum of 40 acres may be disturbed at any one time. The Administrator has considerable flexibility to vary the maximum area of disturbance based on site or project specific conditions, or in recognition of a particularly effective plan with aggressive and effective implementation. The amount of area open to erosion at any one time poses a risk for delivery of sediment downstream and the risk needs to be minimized consistent with the requirements of getting the project constructed.

The plan for limiting disturbance should be fully developed with both the applicant and the contractor and may not be finalized until a permit is issued but before construction. It should also be flexible to meet the challenges of the City of Rockford weather patterns in the prime construction season.

Certain areas will be disturbed repeatedly, such as utility corridors and haul roads. These areas are not exempt from sediment and erosion control, but when defined on a plan or in the field, do not become subject to the limitation on disturbed area. Areas such as sedimentation basins and detention/retention facilities are also exempt from the area limitations.

Outside the normal spring and fall planting seasons, temporary stabilization may be accomplished by hydroseeding with heavy mulch. Multiple treatments may be necessary to adequately stabilize the site. The use of erosion control blankets with or without seed also meet the requirements. Permanent stabilization requires the placement of seed or sod. In the case of dormant season seeding the use of erosion control blankets or heavy mulching with permanent seeding satisfies the requirement. The use of heavy mulch may require multiple treatments depending on weather conditions and dislodgment protection.

T3-00(i) Erosion and Sediment Control Plan Requirements

Figure 16 illustrates the minimum components necessary for an erosion and sediment control plan sheet. The plan should clearly detail all phases of site construction and the erosion and sediment control practices to be installed. Weekly inspections shall be performed until final stabilization has occurred as defined and required by the Illinois Environmental Protection Agency's General Construction Permit (ILR10).

FIGURE 8
Sediment and Erosion Control Plan

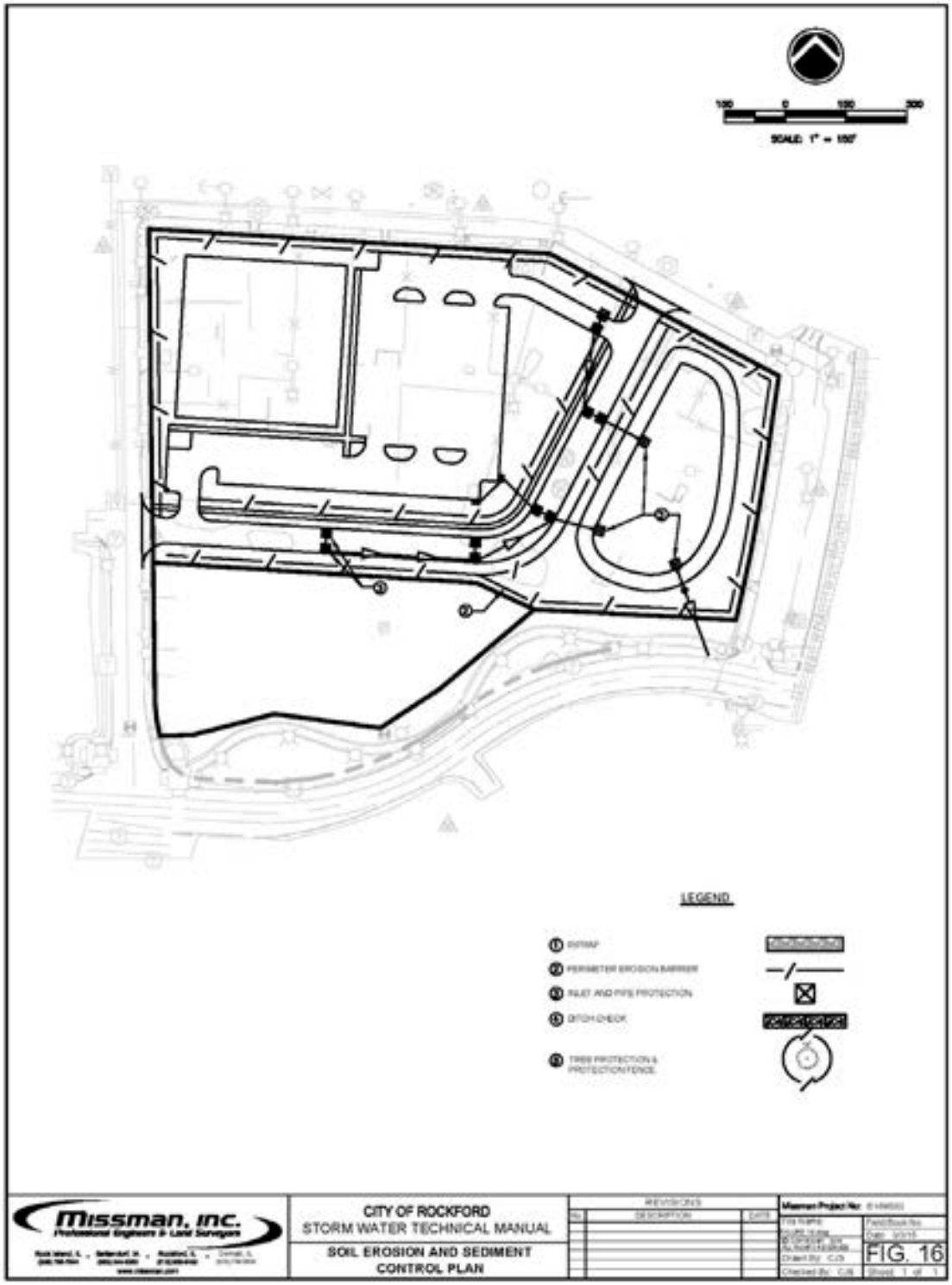


TABLE 7
Permanent Stabilization Practices

Permanent Stabilization Strategy	Urban Manual Code	Sheet & Rill Erosion	Rill & Gully Erosion	Stream-Bank Erosion	Stream Channel Erosion	Nutrients, Heavy Metal & Salt	Flooding	Increased Peak Discharge	Sediment Damage
Urban Stormwater Wetlands	880				Excellent	Excellent			Excellent
Erosion Blanket	830	Good	Fair	Fair	Fair				Fair
Filter Strip (Buffer)	835	Good		Excellent	Excellent	Good			Excellent
Vegetated Channels (Swales)	840			Good	Good	Fair	Fair		Fair
Infiltration Trench	847	Fair	Fair			Fair		Fair	
Level Spreader	870	Fair	Fair	Fair		Fair			Fair
Mulching	875	Good	Good	Fair		Fair		Fair	
Permanent Seeding	880	Excellent	Excellent	Good		Good			Good
Permeable Pavement	890	Fair	Fair	Fair		Fair	Fair	Fair	Fair
Pool & Riffle System				Fair	Good				Good
Rock Check Dam	905		Good						Fair
Rock Outlet Protection	910	Good	Good	Good					Good
Sedimentation Forebay						Good			Good
Sodding	925	Excellent	Excellent	Good		Good			Good
Structural Streambank Stabilization	940			Excellent					Excellent
Vegetative Streambank Stabilization	995			Excellent					Excellent

At a minimum the 2-year and 10-year runoff rates for all off-site flows need to be shown along with an appropriate method for conveying the flows without increased velocities or erosion from within the construction site.

A maintenance schedule and weekly inspection worksheet should also be included. The maintenance schedule should be placed on the erosion and sediment control plan sheet. Form 12 shows an inspection worksheet. The inspection shall evaluate stabilization as well as sediment control. Inspections shall be scheduled weekly and after 0.5 inch of rainfall or greater until permanent stabilization has been completely established. Weekly inspections may be reduced upon installation of permanent stabilization.

T3-00(j) Conveyance of Off-Site Flow

Ditches and waterways that convey off-site flow through the site shall be permanently stabilized upon construction. The permanent stabilization should replace temporary measures but it may be necessary to leave some temporary measures in place while the permanent stabilization establishes. Stabilization of off-site conveyance must protect the downstream land from erosion and sedimentation. Permanent stabilization must therefore include velocity reduction features at the property boundary. Use of level spreaders, lined aprons, and drop inlet pipe spillways are preferred.

T3-00(k) Stockpiles

Stockpiles are not to be placed in any special management areas or buffers. Sediment control measures shall be installed in stockpile area prior to mass excavation and stockpile placement. Control measures shall be in place on the down gradient side to prevent sediment runoff. When stockpiles remain for more than 3 days they require temporary stabilization. An adequate distance should be kept between the stockpile and special management areas such that maintenance of stabilization can be performed without entry into the special management area.

T3-00(m) Construction Dewatering

Discharge from site dewatering activities must be maintained in a manner that does not increase on-site erosion, convey sediment off-site or cause off-site flood damages. Dewatering discharge may not be outletted into wetlands on or off-site where practicable; discharge from on-site dewatering shall be routed into the site sediment basin. Thus, sediment basin volume of storage should include site dewatering.

T3-00(n) Protection of Public/Private Roadways

Public and private roadways must be kept free of nuisance soil. Access to the site must be large enough to provide a stabilized construction entrance (Figure 17) of sufficient width and length, on-site parking, and vehicle washdown facility where appropriate. Soil tracked onto public right-of-way must be cleaned before lie end of each workday. Street sweeping provides a mechanism for removal of loose soil materials, but may not be sufficient to remove materials compacted onto the roadway surfaces. Removal of such compacted materials during each workday and when required by the Administrator is also required. Removal of adhered soil materials will be done in a manner that does not damage the roadway or other right-of-way appurtenances.

T3-00(o) Construction Waste

Potential sources of pollution expected to be present on site during construction include but are not limited to oil, petroleum based additives, cleaning solvents, tar, cleaning solvents, fertilizers, soil stabilization additives and solids, and construction wastes. Contractor shall employ good housekeeping efforts, secondary containment measure, etc. to prevent spill or other accidental exposure of materials and substances to storm water runoff and shall train all personnel in the proper handling and cleanup of spilled materials.

Construction waste shall not be allowed to enter the City's storm system (inlets, curblines, drainageways, creek, ditches etc.) nor can it be poured on the ground surface. Similar to the SWPPP for the project, an approved washout or waste receptacle must be avaialable onsite. Code No. 954 of the Illinois Urban Manual discusses procedures for Temporary Washout Facilities.

T3-00(p) Temporary Stream Crossings

Temporary stream crossings (bridges, fords, and culvert crossings) should be designed for short-term use periods not to exceed 1 year. Temporary stream crossings are to be used only where there is no practicable alternative for moving heavy equipment from one side of a stream channel to another or where light duty equipment must cross a stream frequently for a very short period (<3 months). Prior to any in-stream work, appropriate agency(ies) permitting shall be obtained, if applicable.

Temporary stream crossings are applicable where the upstream drainage area does not exceed one square mile. For areas greater than one square mile, engineered structures should be designed. The following criteria should be addressed when designing temporary stream crossings:

- Erosion and sediment control
- Structural stability
- Safety
- Utility

At a minimum, the structure must be designed to pass the 2-year, 24-hour event and withstand erosion force of the 100-year (BFE) event. The outlet design velocity of the stream crossing structure should be non-erosive for the receiving stream. A swale or other water diversion shall be constructed (across the roadway) on both approaches a maximum of 50 feet on either side of the crossing to prevent direct runoff to the stream.

Figure 9 A
Stabilized Construction Entrance Plan

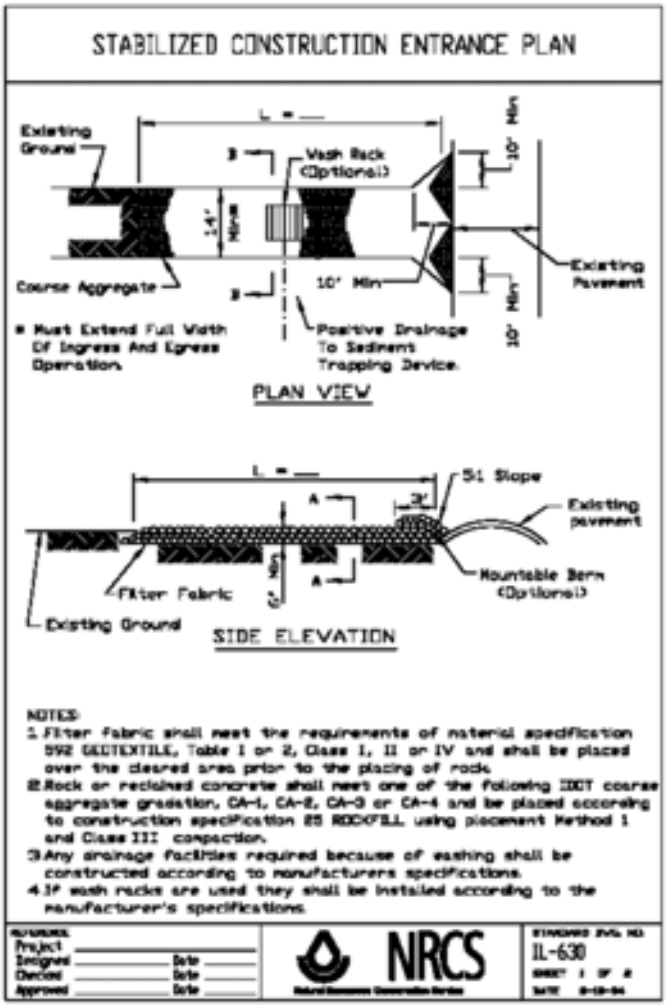
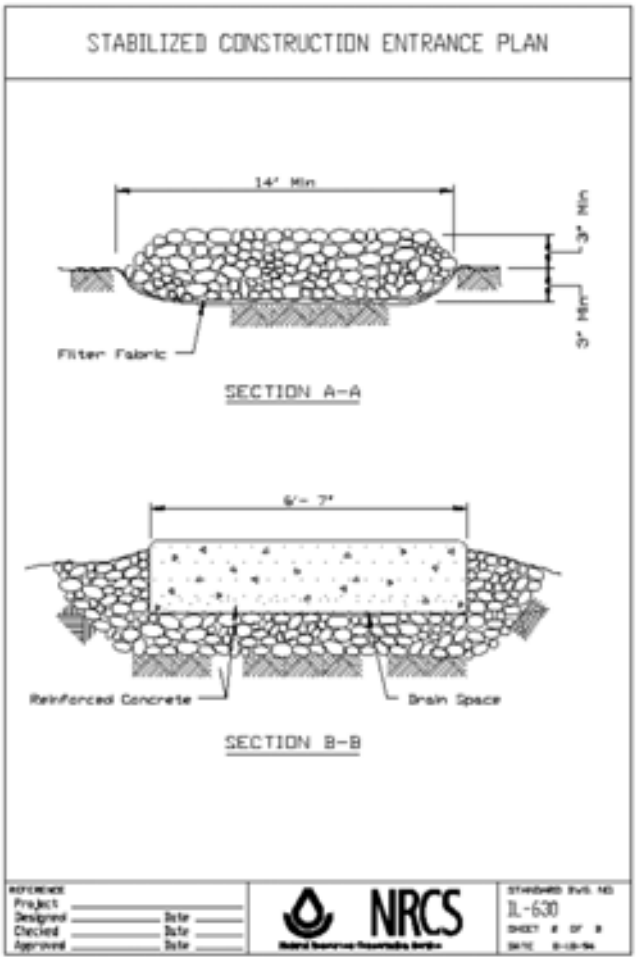


Figure 9 B
Stabilized Construction Entrance



ARTICLE 4— PROTECTION OF SPECIAL MANAGEMENT AREAS

A Special Management Area is defined as a floodplain, regulatory floodplains, and waters of the United States including: wetlands, streams, rivers, linear water bodies, and other water bodies.

The Ordinance includes basic objectives for development, which are directly related to special management areas and completed watershed studies are summarized below:

1. Prevent damages, including loss of life and inconveniences to the public, due to periodic flooding, to the greatest extent possible.

2. Assure the new development does not increase flood hazards to others.

3. Minimize new financial burdens for taxpayers for operations related to flooding.

4. Promote the orderly development of land and water resources and conserve the natural functions of floodplains.

5. Maintain and enhance the special aquatic resources of the City of Rockford and Winnebago County.

T4-01 Disclaimer

Nothing in this ordinance purports to alter or affect the regulatory program administered by IDNR- OWR. Anything in this ordinance to the contrary notwithstanding, if under the rules and regulations administered by IDNR-OWR a submittal need not be made to IDNR-OWR, or a review, approval or permit from IDNR-OWR need not be obtained, then nothing in this ordinance shall be construed to impose a requirement that such a submittal be made or that such a review, approval or permit be obtained from IDNR-OWR. Similarly, if IDNR-OWR has delegated its regulatory authority to another entity, then anything in this ordinance to the contrary notwithstanding, if required by such entity, such submittal shall be made or such review, approval or permit shall be obtained from such entity

T4-02 Statewide and Regional Permits

The Ordinance recognizes the general and specific conditions of the Statewide Permits and Regional Permits. For projects which meet the tests for applicability, and can meet the requirements of these permits, no additional requirements of the Ordinance with respect to floodplains apply. The applicant must send the Administrator documentation that the project complies with a Statewide or Regional permits.

T4-03 Floodplain Management

The applicant must identify floodplain limits using the best available information, or the applicant, Director, or Administrator may choose to develop a project-specific floodplain delineation.

The best available information may include reports and studies published by the U.S.

Army Corps of Engineers (COE), the U.S. Department of Agriculture — Natural Resources Conservation Service (NRCS), the U.S. Geological Survey (USGS), the Illinois State Water Survey (ISWS), the Illinois Department of Transportation, and the Illinois Department of Natural Resources-Office of Water Resources (IDNR-OWR). The Administrator will need to approve the use of any floodplain study not previously designated as a regulatory study prior b the use of the BFEs, flood profiles or delineations. Applicants should check for the best available information with ISWS Floodplain Repository for BFE data associated with "A Zone" delineations on FEMA maps. Project specific floodplain delineation requires detailed and sophisticated studies. Determining the relationship between the project site and the floodplain is the responsibility of the applicant.

Table 403 of the Ordinance contains a summary of the requirements for developments in the floodplain. The left column of the Table refers to the type of floodplain on-site. References in the Table to "all" refer to projects of the type noted or with the designation of floodplain noted, and they must meet the applicable requirements of the referenced section. The difference between the floodplain and the regulatory floodplain is the jurisdiction of IDNR-OWR. The floodplain is a more general area with elevations at or below the base flood elevation that does not necessarily have one square mile of drainage area. A site without any type of stream or creek flowing through or near it could have floodplain on site if there is a depressional area that contains runoff at or below the base flood elevation determined from a hydrologic model of the tributary watershed area.

T4-04 Floodplain, Regulatory Floodplain, Base Flood Elevation (BFE) and Regulatory Floodway Locations

This ordinance's protection standard is the base flood. The best available base flood data are listed below. Whenever a party disagrees with the best available data, the party shall finance the detailed engineering study needed to replace the existing data with better data and submit it to the FEMA and IDNR/OWR for approval prior to any development of the site.

1. The base flood elevation for the floodplains of Ditch No. 3, Dry Creek, Keith Creek, Kilburn Creek, Kilbuck Creek, Kishwaukee River, Madigan Creek, Main Drainage Ditch, Manning Creek, McDonald Creek, Mud Creek, North Branch Otter Creek, North Kent Creek, North Kinnikinnick Creek, Otter Creek, Pecatonica River, Randalls Creek, Rock River, South Branch Dry Creek, South Branch Kishwaukee River, South Branch Otter Creek, South Ditch, South Kent Creek/Kent Creek, South Kinnikinnick Creek shall be as delineated on the 100-year flood profiles in the countywide Flood Insurance Study of Winnebago County prepared by the Federal Emergency Management Agency and dated September 6, 2006.

2. The base flood elevation for each floodplain delineated as an "AH Zone" or AO Zone" shall be that elevation (or depth) delineated on the county wide Flood Insurance Rate Map of Winnebago County

3. The base flood elevation for each of the remaining floodplains delineated as an "A Zone" on the countywide Flood Insurance Rate Map of Winnebago County shall be according to the best data available from federal, state or sources. Should no other

data exist, an engineering study must be financed by the applicant to determine base flood elevations.

4. The base flood elevation for the floodplains of those parts of unincorporated Winnebago County that are within the extraterritorial jurisdiction of the City of Rockford or that may be annexed into the City of Rockford, shall be as delineated on the 100-year flood profiles in the Flood Insurance Study of Winnebago County prepared by the Federal Emergency Management Agency and dated September 6, 2006.

    a) The Administrator may require the use of a floodplain study not yet approved by IDNR-OWR and FEMA if its use would establish a higher BFE than the approved study.

5. The location of the regulatory floodway shall be as delineated on the current applicable regulatory map(s). The location of the regulatory floodway boundary shall be scaled on the site plan using references common to both the map and the plan (typically the centerlines of adjacent roadways). Where an interpretation is needed to determine the exact location of the regulatory floodway boundary, IDNR/OWR should be contacted. If an area of the site is located in the regulatory floodway that is higher than the BFE, that area is subject to the floodway standards of this Article, including the appropriate use criteria, until such time as a LOMA/LOMR receives concurrence from IDNR/OWR and is issued by FEMA.

    a) General criteria for analysis of flood elevations in the regulatory floodway are as follows:

        (i) The flood profiles, flows and data from the current applicable regulatory map must be used for analysis of the base conditions. If the study data appears to be in error or conditions have changed, FEMA and IDNR/OWR shall be contacted for approval and concurrence on the appropriate base conditions data to use. The same Manning's "n" value shall be used for both existing and proposed conditions unless a recorded maintenance agreement obligates a public entity to maintain the proposed conditions or the land cover is changing from vegetative to non-vegetative. The Director shall be copied on all related correspondence.

    b) If the BFE at the site is affected by backwater from a downstream receiving stream with a larger drainage area, the proposed development shall be shown to meet the requirements of this section with the receiving stream at both the normal water elevation and BFE.

    c) If the applicant is informed by IDNR/OWR, a local government or a private owner that a downstream or upstream restrictive bridge or culvert is scheduled to be removed, reconstructed or modified, or a regional flood control project is scheduled to be built, removed, constructed or modified within the next five years, the proposed development shall be analyzed and shown to meet the requirements of this section for both the existing conditions and the expected flood profile conditions when the bridge, culvert or flood control project is built, removed or modified.

    d) If the appropriate use will result in a change in the location of the regulatory

floodway or a change in the BFE, the applicant shall submit the information required for the issuance of a CLOMR to IDNR/OWR and FEMA. A public notice inviting public comment on the proposed change in the BFE or location of the regulatory floodway will be issued by IDNR/OWR or its designee before a CLOMR is issued. Filling, grading, dredging or excavating may take place upon issuance of a conditional approval from IDNR/OWR and the Administrator. No further development activities shall take place in the existing or proposed floodplain until a LOMR is issued by FEMA unless such activities meet all the requirements of Secs. 4-03 through 4-13 of this ordinance. The Director shall be copied on all related correspondence.

e) In the circumstances listed below and located in a regulatory floodway, at a minimum, the information set forth below shall be submitted to IDNR/OWR for its review and approval:

(i) analysis of the flood profile due to a proposed bridge, culvert crossing or roadway approach;

(ii) an engineer's determination that an existing bridge, culvert crossing or approach road is not a source of flood damage and the analysis indicating the proposed flood profile;

(iii) alternative transition sections and hydraulically equivalent compensatory storage; and

(iv) stormwater management permits issued to local units of government for regulatory floodway and floodplain development.

(v) IDNR/OWR will issue permits for any IDNR/OWR, state, federal or community projects.

T4-05 General performance standards

The following general performance standards are applicable to all development in a regulatory floodplain. The standards of this section apply except when superseded by more stringent requirements in subsequent sections.

1. No development shall be allowed in the regulatory floodplain that singularly or cumulatively creates any increase in flood stage or velocity offsite, or a damaging or potentially damaging increase in flood heights or velocity onsite or a threat to the public health, safety and welfare.

2. For all projects involving a channel modification, fill, stream maintenance or a levee, the flood conveyance and storage capacity of the regulatory floodplain shall not be reduced.

3. If the proposed development would result in a change in the regulatory floodplain or BFE the applicant shall obtain a LOMR from FEMA. No buildings may be built in the existing or proposed regulatory floodplain until the LOMR is obtained from FEMA unless the building meets all the building protection standards of Sec. 4-07. Proposed changes to the regulatory floodway delineation and the BFE must be submitted to IDNR/OWR for approval.

4. If the development is located in the Rock River a permit must also be received from IDNR/OWR.

5. Prior to the commencement of any construction, modification or removal of a dam the developer shall obtain an IDNR/OWR Dam Safety Permit or letter indicating a permit is not required.

6. For public flood control projects, Secs. 4-03 through 4-13 will be deemed met if the applicant demonstrates to IDNR/OWR and the Administrator—

   a) by hydraulic and hydrologic modeling that the proposed project will not singularly or cumulatively result in increased flood heights outside the project site or that any increases will be contained in easements for all flood events up to and including the base flood event;

   b) that the project will be operated and maintained by a public entity;

   c) that the project will reduce flood damage to an existing building or structure.

7. Fences within the floodplain shall not impede the base flood.

Nothing in this section precludes the design, engineering, construction or financing, in whole or in part, of a public flood control project by persons who are not public entities.

T4-06 Public health protection standards

1. Public health standards must be met for all floodplain development. In addition to the requirements of Sections 6 and 7 of this ordinance the following standards apply:

   a) No development in the floodplain shall include locating or storing chemicals, explosives, buoyant materials, flammable liquids, pollutants, or other hazardous or toxic materials below the flood protection elevation unless such materials are stored in a floodproofed and anchored storage tank and certified by a professional engineer or floodproofed building constructed according to the requirements of Section 7 of this ordinance.

   b) Public utilities and facilities such as sewer, gas and electric shall be located and constructed to minimize or eliminate flood damage.

   c) Public sanitary sewer systems and water supply systems shall be located and constructed to minimize or eliminate infiltration of flood waters into the systems and discharges from the systems into flood waters.

   d) New and replacement on-site sanitary sewer lines or waste disposal systems shall be located and constructed to avoid impairment to them or contamination from them during flooding. Manholes or other above ground openings located below the flood protection elevation shall be watertight.

   e) Construction of new or substantially improved critical facilities shall be located outside the limits of the floodplain. Construction of new critical facilities shall be permissible within the floodplain if no feasible alternative site is available. Critical facilities constructed within the SFHA shall have the lowest floor (including

basement) elevated or structurally dry floodproofed to the 500-year flood frequency elevation or three feet above the level of the 100-year flood frequency elevation whichever is greater. Floodproofing and sealing measures must be taken to ensure that toxic substances will not be displaced by or released into floodwaters. Access routes elevated to or above the level of the base flood elevation shall be provided to all critical facilities.

c) All other activities defined as development shall be designed so as not to alter flood flows or increase potential flood damages.

T4-07 Building Protection Standards

This section applies to all buildings located in the regulatory floodplain. However, most new and replacement buildings are not appropriate uses of the regulatory floodway.

1. In addition to the state permit and damage prevention requirements of this ordinance, all buildings located in the floodplain shall be protected from flood damage below the flood protection elevation. This building protection requirement applies to the following situations:

   a) Construction or placement of a new building or alteration or addition to an existing building valued at more than one thousand dollars ($1,000) or seventy (70) square feet.

   b) Substantial improvements or structural alterations made to an existing building that increase the floor area by more than twenty percent (20%) or equal or exceed the market value by fifty percent (50%). Alteration shall be figured cumulatively during the life of the building. If substantially improved, the existing structure and the addition must meet the flood protection standards of this section.

   c) Repairs made to a substantially damaged building. These repairs shall be figured cumulatively during the life of the building. If substantially damaged the entire structure must meet the flood protection standards of this section within 24 months of the date the damage occurred.

   d) Installing a manufactured home on a new site or a new manufactured home on an existing site. (The building protection requirements do not apply to returning a manufactured home to the same site it lawfully occupied before it was removed to avoid flood damage).

   d) Installing a travel trailer or recreational vehicle on a site for more than one hundred eighty (180) days per year.

   e) Repetitive loss to an existing building as defined in Article 1.

2. Residential or non-residential buildings can meet the building protection requirements by one of the following methods:

   a. The building may be constructed on permanent land fill in accordance with the following:

(i) The lowest floor (including basement) shall be at or above the flood protection elevation.

(ii) The fill shall be placed in layers no greater than six inches before compaction and should extend at least ten (10) feet beyond the foundation before sloping below the flood protection elevation.

(iii) The fill shall be protected against erosion and scour during flooding by vegetative cover, riprap, or other structural measure.

(iv) The fill shall be composed of rock or soil and not incorporated debris or refuse material, and

(v) Shall not adversely affect the flow of surface drainage from or onto neighboring properties and when necessary stormwater management techniques such as swales or basins shall be incorporated.

b. The building may be elevated on solid walls in accordance with the following:

(i) The building or improvements shall be elevated on stilts, piles, walls, crawlspace, or other foundation that is permanently open to flood waters.

(ii) The lowest floor and all electrical, heating, ventilating, plumbing, and air conditioning equipment and utility meters shall be located at or above the flood protection elevation.

(iii) If walls are used, all enclosed areas below the flood protection elevation shall address hydrostatic pressures by allowing the automatic entry and exit of flood waters. Designs must either be certified by a licensed professional engineer or by having a minimum of one (1) permanent opening on each wall no more than one (1) foot above grade with a minimum of two (2) openings. The openings shall provide a total net area of not less than one (1) square inch for every one (1) square foot of enclosed area subject to flooding below the base flood elevation, and

c. The foundation and supporting members shall be anchored, designed, and certified so as to minimize exposure to hydrodynamic forces such as current, waves, ice, and floating debris.

i. All structural components below the flood protection elevation shall be constructed of materials resistant to flood damage.

ii. Water and sewer pipes, electrical and telephone lines, submersible pumps, and other service facilities may be located below the flood protection elevation provided they are waterproofed.

iii. The area below the flood protection elevation shall be used solely for parking or building access and not later modified or occupied as habitable space, or

iv. In lieu of the above criteria, the design methods to comply with these requirements may be certified by a licensed professional engineer or architect.

3. The building may be constructed with a crawlspace located below the flood protection elevation provided that the following conditions are met:

   a) The building must be designed and adequately anchored to resist flotation, collapse, and lateral movement of the structure resulting from hydrodynamic and hydrostatic loads, including the effects of buoyancy.

   b) Any enclosed area below the flood protection elevation shall have openings that equalize hydrostatic pressures by allowing for the automatic entry and exit of floodwaters. A minimum of one opening on each wall having a total net area of not less than one (1) square inch per one (1) square foot of enclosed area. The openings shall be no more than one (1) foot above grade.

   c) The interior grade of the crawlspace below the flood protection elevation must not be more than two (2) feet below the lowest adjacent exterior grade.

   d) The interior height of the crawlspace measured from the interior grade of the crawl to the top of the foundations wall must not exceed four (4) feet at any point.

   e) An adequate drainage system must be installed to remove floodwaters from the interior area of the crawlspace within a reasonable period of time after a flood event.

   f) Portions of the building below the flood protection elevation must be constructed with materials resistant to flood damage, and

   g) Utility systems within the crawlspace must be elevated above the flood protection elevation.

4. Non-residential buildings may be structurally dry floodproofed (in lieu of elevation) provided a licensed professional engineer or architect certifies that:

   a) Below the flood protection elevation the structure and attendant utility facilities are watertight and capable of resisting the effects of the base flood.

   b) The building design accounts for flood velocities, duration, rate of rise, hydrostatic and hydrodynamic forces, the effects of buoyancy, and the impact from debris and ice.

   c) Floodproofing measures will be incorporated into the building design and operable without human intervention and without an outside source of electricity.

   d) Levees, berms, floodwalls and similar works are not considered floodproofing for the purpose of this subsection.

5. Manufactured homes or travel trailers to be permanently installed on site shall be:

   a) Elevated to or above the flood protection elevation in accordance with Section 7(B), and

   b) Anchored to resist flotation, collapse, or lateral movement by being tied down in accordance with the rules and regulations for the Illinois Mobile Home Tie-Down Act issued pursuant to 77 Ill. Adm. Code § 870.

6. Travel trailers and recreational vehicles on site for more than one hundred eighty (180) days per year shall meet the elevation requirements of section 7(D) unless the following conditions are met:

   a) The vehicle must be either self-propelled or towable by a light duty truck.

   b) The hitch must remain on the vehicle at all times.

   c) The vehicle must not be attached to external structures such as decks and porches

   d) The vehicle must be designed solely for recreation, camping, travel, or seasonal use rather than as a permanent dwelling.

   e) The vehicles largest horizontal projections must be no larger than four hundred (400) square feet.

   f) The vehicle's wheels must remain on axles and inflated.

   g) Air conditioning units must be attached to the frame so as to be safe for movement of the floodplain.

   h) Propane tanks as well as electrical and sewage connections must be quick-disconnect.

   i) The vehicle must be licensed and titled as a recreational vehicle or park model, and

   j) Must either:

      (i) entirely be supported by jacks, or

      (ii) have a hitch jack permanently mounted, have the tires touching the ground and be supported by block in a manner that will allow the block to be easily removed by used of the hitch jack.

7. Garages, sheds or other minor accessory structures constructed ancillary to an existing residential use may be permitted provided the following conditions are met:

   a) The garage of shed must be non-habitable.

   b) The garage or shed must be used only for the storage of vehicles and tools and cannot be modified later into another use.

c) The garage or shed must be located outside of the floodway or have the appropriate state and/or federal permits.

d) The garage or shed must be on a single family lot and be accessory to an existing principle structure on the same lot.

e) Below the base flood elevation, the garage or shed must be built of materials not susceptible to flood damage.

f) All utilities, plumbing, heating, air conditioning and electrical must be elevated above the flood protection elevation.

g) The garage or shed must have at least one permanent opening on each wall not more than one (1) foot above grade with one (1) square inch of opening for every one (1) square foot of floor area.

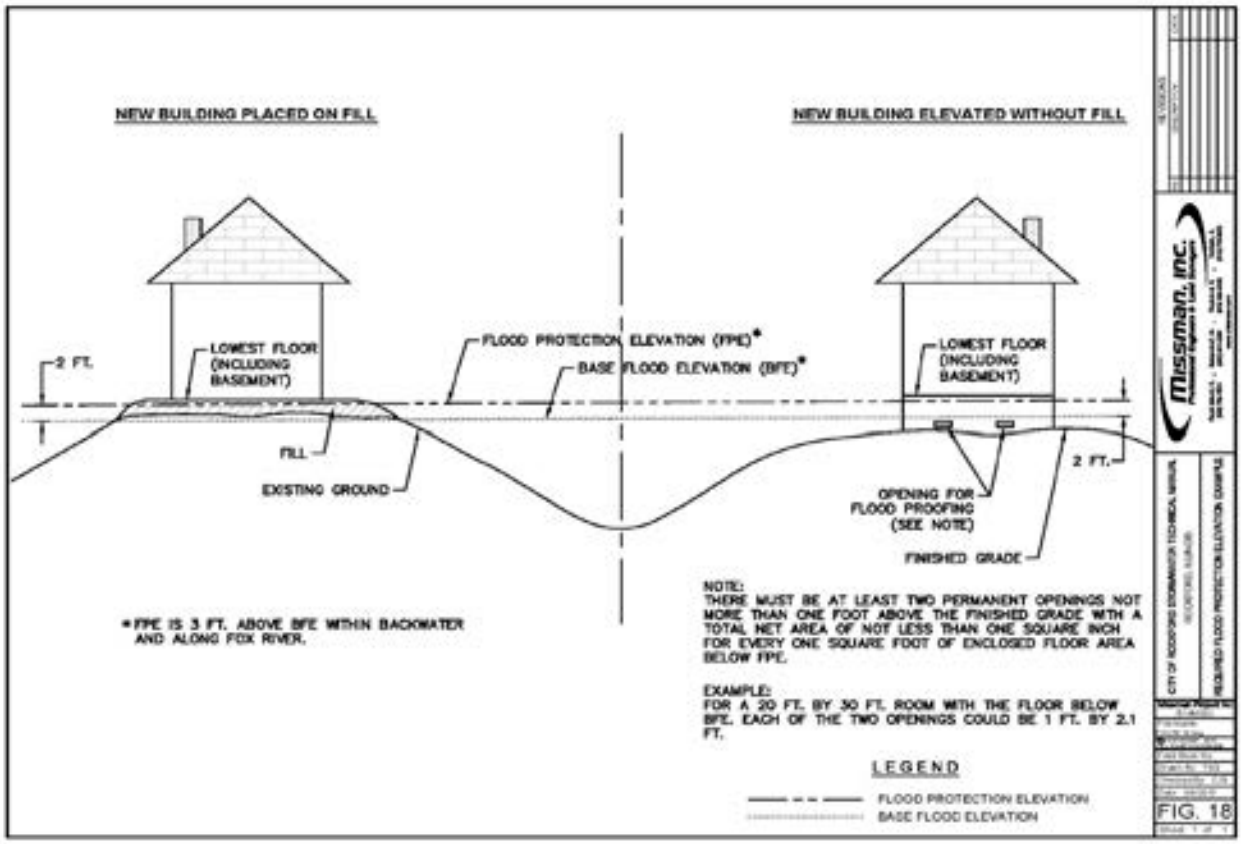
h) The garage or shed must be less than fifteen thousand dollars ($15,000) in market value or replacement cost whichever is greater or less than five hundred and seventy six (576) square feet (24'x24').

i) The structure shall be anchored to resist floatation and overturning.

j) All flammable or toxic materials (gasoline, paint, insecticides, fertilizers, etc.) shall be stored above the flood protection elevation.

k) The lowest floor elevation should be documented and the owner advised of the flood insurance implications.

FIGURE 10
Required Flood Protection Elevation



T4-08 Non-Conforming Structures

A structure that is non-conforming to the Ordinance contains a lowest floor, including basement, which is below the **FPE.** A non-conforming structure that is damaged by flood, fire, wind or other natural or man-made disaster may be restored on-site as long as the damage does not exceed 50% of its market value prior to being damaged, and the accumulative repairs over the life does not exceed 50%. Damage in excess of 50% of the structure's market value places the restoration into the substantial improvement category and therefore, the building must conform to the requirements of Article 4, § T407.

1. Lowest Opening

Proposed structures outside the Regulatory Floodplain shall be built with the lowest opening above the FPE.

2. Preventing Increased Flood Heights and Resulting Damages

No development in the floodplain shall create a threat to public health and safety.

a. Compensatory Storage.

(i) Whenever any portion of a floodplain is authorized for use, the volume of space which will be occupied by the authorized fill or structure below the base flood or 100-year frequency flood elevation shall be compensated for and balanced by a hydraulically equivalent volume of excavation taken from below the base flood or 100-year frequency flood elevation.

(ii) The excavation volume shall be at least equal to ***1.5 times*** the volume of storage lost due to the fill or structure

(iii) In the case of streams and watercourses, such excavation shall be made opposite or adjacent to the areas so filled or occupied.

(iv) All floodplain storage lost below the existing 10-year flood elevation shall be replaced below the proposed 10-year flood elevation. All floodplain storage lost above the existing 10-year flood elevation shall be replaced above the proposed 10-year flood elevation.

(v) All such excavations shall be constructed to drain freely and openly to the watercourse.

Within any floodway identified on the countywide Flood Insurance Rate Map, and within all other floodplains where a floodway has not been delineated, the following standards shall apply:

b. The only development in a floodway which will be allowed are Appropriate Uses, which will not cause a rise in the base flood elevation, and which will not create

a damaging or potentially damaging increase in flood heights or velocity or be a threat to public health and safety and welfare or impair the natural hydrologic and hydraulic functions of the floodway or channel, or permanently impair existing water quality or aquatic habitat. Construction impacts shall be minimized by appropriate mitigation methods as called for in this Ordinance. The approved Appropriate Uses are as follows:

(i) Flood control structures, dikes, dams and other public works or private improvements relating to the control of drainage, flooding, erosion, or water quality or habitat for fish and wildlife.

(ii) Structures or facilities relating to the use of, or requiring access to, the water or shoreline, such as pumping and treatment facilities, and facilities and improvements related to recreational boating, commercial shipping and other functionally water dependent uses;

(iii) Storm and sanitary sewer relief outfalls;

(iv) Underground and overhead utilities;

(v) Recreational facilities such as playing fields and trail systems, including any related fencing (at least 50 percent open when viewed from any one direction) built parallel to the direction of flood flows, and including open air pavilions and toilet facilities (4 stall maximum) that will not block flood flows nor reduce floodway storage;

(vi) Detached garages, storage sheds, or other non-habitable accessory structures that will not block flood flows nor reduce floodway storage;

(vii) Bridges, culverts, roadways, sidewalks, railways, runways and taxiways and any modification thereto;

(viii) Parking lots built at or below existing grade where either:

A) The depth of flooding at the 100-year frequency flood event will not exceed 1.0 foot; or

B) The applicant of a short-term recreational use facility parking lot formally agrees to restrict access during overbank flooding events and accepts liability for all damage caused by vehicular access during all overbank flooding events.

(ix) Floodproofing activities to protect previously existing lawful structures including the construction of water tight window wells, elevating structures, or construction of floodwalls around residential, commercial or industrial principal structures where the outside toe of the floodwall shall be no more than ten (10) feet away from the exterior wall of the existing structure, and, which are not considered substantial improvements to the structure.

(x) The replacement, reconstruction, or repair of a damaged building, provided that the outside dimensions are not increased, and if the building

was damaged to fifty (50%) percent or more of the market value before the damage occurred, the building will be protected from flooding to the flood protection elevation.

Modifications to an existing building that would not increase the enclosed floor area of the building below the 100-year frequency flood elevation, and which will not block flood flows including but not limited to, fireplaces, bay windows, decks, patios, and second story additions. If the building is improved to fifty (50%) percent or more of the market value before the modification occurred (i.e., a substantial improvement), the building will be protected from flooding to the flood protection elevation.

Appropriate uses do not include the construction or placement of any new structures, fill, building additions, excavation or channel modifications done to accommodate otherwise non-appropriate uses in the floodway, fencing (including landscaping or planting designed to act as a fence) and storage of materials except as specifically defined above as an Appropriate Use.

c. Compensatory storage in noted in Article 4.09A shall apply.

d. Except as provided in Article 4.09B of this ordinance, no development shall be allowed which, acting in combination with existing and anticipated development will cause any increase in flood heights or velocities or threat to public health and safety. The following specific development activities shall be considered as meeting this requirement*:

(i) Bridge and culvert crossings of streams in rural areas meeting the conditions of the Illinois Department of Natural Resources, Office of Water Resources Statewide Permit Number 2:

(ii) Barge fleeting facilities meeting the conditions of IDNR/OWR Statewide Permit Number 3:

(iii) Aerial utility crossings meeting the conditions of IDNR/OWR Statewide Permit Number 4;

(iv) Minor boat docks meeting the following conditions of IDNR/OWR Statewide Permit Number 5:

(v) Minor, non-obstructive activities such as underground utility lines, light poles, sign posts, driveways, athletic fields, patios, playground equipment, minor storage buildings not exceeding 70 square feet and raising buildings on the same footprint which does not involve fill and any other activity meeting the conditions of IDNR/OWR Statewide Permit Number 6:

(vi) Outfall Structures and drainage ditch outlets meeting the following conditions of IDNR/OWR Statewide Permit Number 7:

(vii) Underground pipeline and utility crossings meeting the conditions of IDNR/OWR Statewide Permit Number 8:

(viii) Bank stabilization projects meeting the conditions of IDNR/OWR Statewide Permit Number 9:

(ix) Accessory structures and additions to existing residential buildings meeting the conditions of IDNR/OWR Statewide Permit Number 10:

(x) Minor maintenance dredging activities meeting the following conditions of IDNR/OWR Statewide Permit Number 11:

(xi) Bridge and culvert replacement structures and bridge widening meeting the following conditions of IDNR/OWR statewide Permit Number 12:

(xii) Temporary construction activities meeting the following conditions of IDNR/OWR statewide Permit Number 13:

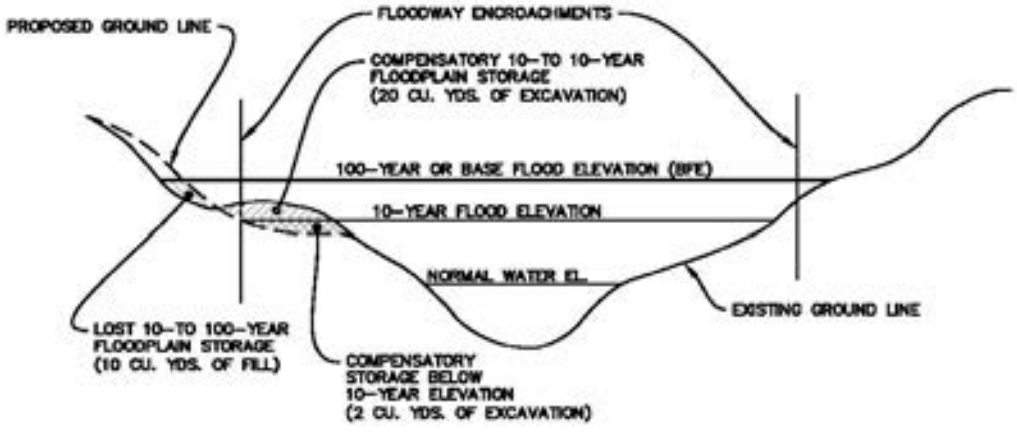
(xiii) Any Development determined by IDNR/OWR to be located entirely within a flood fringe area shall be exempt from State Floodway permit requirements.

e. Other development activities not listed in 10(B) may be permitted only if:

(i) Permit has been issued for the work by IDNR/OWR (or written documentation is provided that an IDNR/OWR permit is not required), or

(ii) Sufficient data has been provided to FEMA when necessary, and approval obtained from FEMA for a revision of the regulatory map and base flood elevation.

FIGURE 11
Compensatory Storage Example



COMPENSATORY STORAGE

Flood storage is measured between the normal water surface elevation and the BFE for a particular cross-section. The Ordinance defines hydraulically equivalent compen-satory storage as storage placed between the proposed

normal water surface elevation and the proposed BFE. All lost storage below the existing 10-year flood elevation is replaced below the proposed 10-year flood elevation and the storage lost above the existing 10-year flood elevation is replaced above the proposed 10-year flood elevation. It is important that the distinction between existing and proposed water surface elevations be maintained, since large scale regrading of the floodplain by excavation and fill will often result in a change in flood elevation for a given flood frequency. Isolated areas of minor fill in the floodplain will not normally change the flood profile of streams with larger drainage areas, so the existing and proposed flood profiles may be the same.

The Ordinance requires that the compensatory storage for fill or structures in a riverine floodplain equal 1.5 times the volume of floodplain storage lost. The increment of storage compensated over 100% may be at any elevation below BFE and above normal water surface elevation, as long as at least 100% of the lost storage increment between the existing normal water surface elevation and the existing 10-year flood elevation, and between the existing 10-year flood elevation and the existing BFE, is replaced within the respective proposed flood elevations.

Non-riverine floodplain storage need only be replaced with compensatory storage at the rate of 1:1, between the normal water surface elevation and the BFE.

When developing a grading plan to provide compensatory storage, the Ordinance provisions concerning channel modifications, grading transitions, and buffers must also be followed. The compensatory storage should be located adjacent or opposite the site of the fill, but must also comply with the other Ordinance provisions. This requirement will often limit the extent to which a floodplain may be filled at a particular location.

Where regulatory floodways are mapped, the compensatory storage must be contained within the proposed floodway boundaries. Shifting of the floodway boundaries outside of the existing floodway may be permissible as a way of providing floodway compensatory storage, but all other provisions of the Ordinance regarding floodplains and flood easements must be met and both IDNR-OWR or its designee and FEMA must approve the floodway boundary change. Hydraulically equivalent compensatory storage for fill in the floodway associated with roadway crossings shall meet the same requirements stated above. Artificially created storage upstream of a restrictive bridge or culvert need not be replaced, provided that damages will not occur downstream. Normally, regulatory flows are not attenuated by restrictive stream crossings and are therefore unchanged upstream and downstream of the restrictive crossing. The floodplain downstream of the crossing should be reviewed to determine whether structures are damaged. If it appears that there is a risk of additional damage, a detailed hydrologic investigation should be performed to establish the extent to which the artificial storage decreases flood flows and to determine what damages might be incurred.

For riverine floodplains, or any floodplain with a regulatory floodway, calculations for floodplain volume shall be submitted in tabular form showing

calculations by cross-section. The volume of floodplain storage under the without-project conditions and the with-project conditions should be determined using the average end-area method with plotted cross-sections.

Floodplain storage cross-sections should be prepared as follows:

(i) Cross-sections should be located parallel to each other and perpendicular to a stream reference line shown on the grading plan. The cross-sections used in the hydraulic analysis should be located perpendicular to flood flows, and may not be suitable for volumetric calculations.

(ii) All cross-sections should be plotted at the same standard engineering scale and should be at a horizontal:vertical ratio of between 5:1 and 10:1.

(iii) The scale chosen should be large enough to show the intent of the proposed grading.

(iv) Cross-sections should reflect both the existing and proposed conditions on the same plot.

(v) All cross-sections should show the normal water level and the 100-year flood elevation. For riverine floodplains, the cross-sections should also include the 10-year flood frequency elevation and where there is a regulatory floodway, the regulatory floodway encroachments should be scaled onto the cross-sections.

(vi) Cross-section should span the full floodplain and should include all existing and proposed structures.

In non-riverine floodplains, where the grading plan utilizes a one-foot contour interval and the drawing is at a maximum scale of 1"=50', floodplain storage may be calculated by measuring contour areas.

A grading plan of the project site should be provided to show existing and with-project conditions for the following details:

(i) Planimetric Data for All Structures and Construction (Including Location and Dimensions);

(ii) All Property Lines:

(iii) Certified Elevation Data, Including Ground Contours at Intervals of 2 Feet or less;

(iv) Location of Drainage and Flood Control Easements; and

(v) Location and Orientation of Cross-Sections.

3. Floodway Standards

Development proposed within the regulatory floodway will require hydraulic calculations to analyze the impacts of the development upon the floodway and floodplain. Backwater models such as HEC-2, WSP-2, and WSPRO are acceptable models. For simple crossings such as culverts or clear-span bridges, hand calculations such as USGS regression equations or the equations found in the Federal Highway Administration (FHWA) manuals may be sufficient.

Appropriate Uses

Development in the floodway must be an appropriate use of the floodway as stated in the Ordinance (Article 4, § 4-11(a)). Only development that is an appropriate use will be allowed in the floodway.

Modifications to an existing building that would not increase the enclosed floor area of the building below the BFE, and which will not obstruct flood flows are an appropriate use of the floodway and will require a permit from the Certified Community. Allowable modifications include fireplaces, bay windows, decks, patios, and second story additions.

If the proposed development within a regulatory floodway is not an appropriate use under the Ordinance, the development may only take place by revising the regulatory floodway designation on the site. It will be necessary to construct that portion of the project that revised the floodway on the property prior to the initiation of any building construction. In order to do this, the applicant must obtain local government concurrence of the revised floodway and an agreement from the unit local government to maintain it. The FEMA Community Acknowledgement form, to accompany the request for a proposed revision to the floodway is included as Form 11 in the next part of the manual. The maintenance agreement should be a statement from a community official that acknowledges the revised floodway and that the unit of local government will either assume responsibility to operate and maintain any revised floodway or will agree, upon default of the party responsible for such operation and maintenance, to undertake such operation and maintenance. In addition, all the information required to obtain a CLOMR must be submitted to IDNR-OWR or its designee and then. FEMA (depending on the source of the map). A stormwater permit may then be issued to proceed with the revision of the floodway. Upon completion of the construction necessary to revise the floodway, as-built plans must be submitted to the Administrator and FEMA to have a LOMR issued. Once a LOMR is issued revising the floodway map, and all necessary permits have been obtained, development may proceed in the former floodway area.

A minimum 20-foot buffer of open space is required on either side of the channel. Where floodway and buffer criteria apply to the same area, the more restrictive criteria shall be applied. The appropriate use definition applies to the floodway and any overlapping buffer area.

Engineering Criteria

Conveyance

Regulatory floodway conveyance must be maintained for all flood events up to and including the 100-year frequency flood except at bridges, culvert crossings, and dams. Conveyance is defined as:

K=[1.486/n]*A*[R^(2/3)], where

n = Manning's roughness factor
A = effective area of the cross-section
R = hydraulic radius

The same Manning's n-value shall be used for both existing and proposed conditions unless a recorded maintenance agreement with a federal, state, or local unit of government can assure the proposed conditions will be maintained or the land cover is changing from a vegetative to a non-vegetative land cover. (For a discussion of conveyance, consult Open Channel Hydraulics by Ven Te Chow, 1959, McGraw-Hill, New York, New York.)

Transition Sections

Expansion and contraction of flow require transition sections to determine effective regulatory floodway conveyance and shall be located and determined as described in the Ordinance. Alternative transitions shall require review and approval by IDNR-OWR. Expansion is the hydraulic condition of water flowing from a narrower section to a wider section and shall be assumed to occur no faster than at a rate of one foot horizontal for every four feet of the stream length. Contraction, the condition of water flowing from a wider section to a narrower section, shall be assumed to occur no faster than at a rate of one foot horizontal for every one foot of stream length. The floodplain area outside of the expansion and contraction flow area is considered to be ineffective flow area. Effective conveyance transition sections and expansion and contraction of flow are demonstrated in many hydraulic textbooks and manuals for hydraulic computer programs. When considering effective conveyance in a vertical direction, the expanding and contracting vertical transition shall be one foot vertical transition for every ten feet of stream length. The compensatory storage required by the ordinance may be placed within areas of ineffective conveyance within the floodway.

Average Channel Velocities

Channel velocities shall not be increased as a result of development. Minor increases may be permissible at some cross-sections along the project reach but the flow velocity of the change must remain below the scour velocity. Channel conditions vary, but channel scour must be considered if a velocity of above five feet per second is attained.

Flood Elevations

Flood elevations generated by the regulatory model must first be duplicated before updated data to reflect the existing conditions is input to the model. The flood profiles, flows and floodway data in the regulatory floodway study must be

used for analysis of the regulatory conditions. If the study data appears to be in error or conditions have changed, IDNR-OWR or its designee shall be contacted for approval and concurrence on the appropriate existing conditions data. Once the output of the regulatory model has been duplicated to within 0.1 foot of the regulatory profile, revisions should be input to reflect the existing conditions.

If existing conditions in the watershed outside of the applicant's project site will be affected by the development, the applicant shall obtain the best available information of the proposed off-site changes to anticipate the impacts of the proposed change. The existing and with-project conditions shall be modeled based on this data.

On-stream structures built for the purpose of retaining water must be approved by the Dam Safety Section of IDNR-OWR by way of a permit or a letter stating that a permit is not required. The address for the Dam Safety Section is:

Illinois Department of Natural Resources
Office of Water Resources
2300 South Dirksen Parkway
Springfield, Illinois 62764-9484
Attn: Dam Safety Section

Floodway Permit Applications Involving Hydraulic Analysis

There are two different conditions for development within a regulatory floodway. Either the applicant is trying to maintain the existing regulatory profile and floodway boundaries or a LOMR is requested.

The discharges from the regulatory model shall be used except where the Administrator requires new discharges. The necessity for new discharges will depend on the correlation between the existing conditions profile, the regulatory profile, and the magnitude of the impacts on the profile due to the project. If the existing conditions profile is calculated to be lower than the regulatory profile, the effects of lost storage must be analyzed and the new hydrologic analysis must reflect the future land use. The Administrator or the applicant may contact the Director for an opinion on the suitability of the regulatory discharges. New discharges shall be developed based on stream gage analysis (if available), or shall follow the methodologies outlined in the "Hydrologic Techniques" section within the "Stormwater Runoff' portion of this manual.

The first step to determine if a revision of the regulatory floodway conditions is desired, is to duplicate the regulatory profile using the same hydraulic model (usually HEC-2 or WSP-2). Data input into the duplicate model should be identical to the data, which generated the regulatory profile. It is not necessary to duplicate the entire regulatory profile but the applicant should start the profile at least four cross-section downstream of the project site. Once the input from the regulatory model has been duplicated, the output of the duplicate model should be verified against the output of the regulatory model. A copy of the

regulatory profile should be submitted along with the duplicate model run as part of the permit application package.

Where there is a designated floodway mapped, but there is no computer model available, the engineer should consult the Director about how to proceed with the specifics of modeling the existing conditions.

Once the duplicated model has been prepared and is operational, it must be updated to create an existing conditions model for a comparison against the with-project conditions. As discussed in "Floodplain Performance Standards", cross-sections should be added to the regulatory model where it is appropriate to add them for both the existing and with-project hydraulic analyses. The existing conditions model should include all corrections to the regulatory profile and should be modeled with attention to areas of ineffective conveyance. The applicant is responsible for all existing field conditions within the watershed which may affect the existing conditions hydraulic model. These areas can be maintained in the model for storage volume and area calculations by imputing an artificially high n-value for these areas (such as 99). This will cause the computer model to treat these areas as ones of ineffective flow, but the cross-sectional area is still maintained for the area and volume calculations. Ineffective flow areas should be clearly annotated on the plans and cross-sections.

The existing conditions profile must tie-in to the regulatory profile to within 0.5 foot, based on FEMA requirements, upstream and downstream of the project reach. Where it is not possible to meet the regulatory profile, a new hydrology study is required.

If the applicant is trying to maintain the existing regulatory floodway boundaries, he should scale the floodway encroachments off the regulatory floodway map and input this data into the existing conditions model. This will create the existing conditions floodway model. The with-project model must demonstrate that the proposed development has no incremental impact if the with-project condition maintains the conveyance, storage, and travel time of the existing conditions model and the flood stages are not increased.

If the applicant is trying to establish or revise a regulatory floodway, one of the standard floodway encroachment methodologies from the computer models shall be utilized. The floodway must meet the floodway definition of this Ordinance.

The floodway is considered to meet the surcharge criteria of no more than a 0.1 foot increase if the floodway meets the requirements of the Ordinance. It will be necessary for the applicant to check that the 10% velocity rule is met and these calculations should be part of the submittal to the Administrator.

The preferred approach for developing floodway encroachments involves the use of an equal amount of flood conveyance on each side of the stream centerline. Modifications to the floodway encroachment, which reduce conveyance on one side of the stream, shall first consider an increase of

conveyance on the streamside directly opposite the modified encroachment. When proposed floodway modifications form the affected property owners. Floodway encroachment methodologies generally create floodways by removing conveyance from the ends of the cross-sections and will typically create floodways with a considerably narrower floodway than necessary to meet the velocity criteria. The routines are a useful tool in developing a floodway that centers its conveyance about the centerline of the stream. The applicant will have to manually adjust the encroachments to develop a floodway which meets all the criteria of the Ordinance floodway definition.

When manually adjusting the floodway encroachments at every cross-section, the applicant should start at the most downstream cross-section and work upstream. In using a backwater model floodway encroachment methodology, the upstream cross-sections should generally not have any effect on the generated encroachments form the downstream section.

The with-project conditions model will use the same regulatory discharges and cross-section locations as the regulatory conditions model to reflect the development on the site. The applicant should first run the model using the with-project topography with the fixed encroachments set at the existing condition. If the conveyance, storage, and travel time are maintained and the flood stages are not increased, the with-project floodway will be allowed if it does not differ from the existing conditions floodway. If the rules are not yet met, there are two options: to revise the design to meet the criteria of the Ordinance or to develop a new floodway that meets the Ordinance definition and obtain a LOMR from FEMA, revising the regulatory floodway. Table 9 identifies the data requirements and reviewing agencies for the various types of revisions.

TABLE 8
Data Requirements for Revisions to Mapped Areas

Type of Revision	Data or Hydraulic Model (H.M.) Utilized	Reviewing/Approving Agency
LOMA	Elevation	Administrator, FEMA

LOMR Based on Fill	Elevation, Certification of Fill Compaction	Administrator, FEMA
Revision to Regulatory BFEs Based on Existing Conditions	Regulatory Conditions H.M. Existing Conditions H.M.	Administrator, IDNR-OWR, FEMA
Revision to Regulatory BFEs Based on Proposed Project	Regulatory conditions H.M. Existing Conditions H.M. With- Project H.M.	Administrator, IDNR-OWR, FEMA
Revision to Regulatory Floodplain Boundaries	Elevation	Administrator, IDNR-OWR, FEMA
Revision to Regulatory Floodway Based on Existing Conditions	*Regulatory Conditions Floodway H.M. *Existing Conditions Floodway H.M.	Administrator, IDNR-OWR, FEMA
Revision to Regulatory Floodway Based on a Proposed Project	Regulatory Conditions H.M. Existing Conditions H.M. With-Project Conditions Floodway H.M.	Administrator, IDNR-OWR, FEMA

* Where applicable, otherwise use the regulatory profile with scaled and encoded floodway encroachments. Note:

Forward copies of all submittals to the Administrator.

Public Flood Control Project

Public flood control project will be considered compliant with the Ordinance if the applicant can demonstrate to the Administrator and IDNR-OWR through a detailed hydrologic and hydraulic analysis that the proposed project will not singularly or cumulatively result in increased flood heights outside the project right-of-way or easements. This must be valid for all flood events up to and including the 100-year flood. A public control project shall have a public agency as either the applicant or co-applicant.

4. Riverine Floodplain

Within all regulatory riverine floodplains where the regulatory floodway has not been determined by the IDNR-OWR or FEMA, the applicant must provide a detailed hydrologic and hydraulic analysis which demonstrates a stormwater runoff conveyance path for the proposed development. The detailed analysis must conform to the hydrologic and hydraulic modeling requirements described in the "Basic Stormwater Management Requirement" section of the manual and this section, respectively. For mapped regulatory floodplains with certified 100-year flood discharges, the applicant may request from the Administrator permission to use the existing 100-year flood discharge. However, if the study conditions have changed, the Administrator may require a new hydrologic analysis. By definition, the stormwater conveyance path determination is slightly less detailed than a floodway determination under IDNR-OWR regulations. The stormwater conveyance path is essentially a conveyance floodway only and will not require an analysis of the floodway storage component.

The stormwater conveyance path must demonstrate that the proposed development will have no singular or cumulative impact on flood heights or velocities. A detailed analysis must be submitted and approved by the Administrator prior to the issuance of a watershed development permit. For riverine floodplains with a drainage area greater than 1.0 square mile, the applicant must also request and receive IDNR-OWR approval. In cases where the analysis of the flood conveyance path yields a revision to the FEMA mapped floodplain boundaries, the applicant will also need to request a LOMR from FEMA.

Upon acceptance of the stormwater conveyance path by the Administrator, the applicant shall locate all of the development outside the flood conveyance path and floodway performance standards. The hydraulic analysis of the relocated stormwater conveyance path cannot impact adjacent properties by more than 0.1 foot.

The applicant may limit the study to a floodplain determination and apply the performance standards of Article 4, § 411 to the entire floodplain, with the exception of the appropriate use requirements of Section 411.8.9. Therefore, compensatory storage for the displacement of floodplain storage due to fill or structures, will be required at a rate of 1.5 times the volume of floodplain storage lost.

5. Bridge and Culvert Standards

Permits involving new stream crossings or any significant modifications to existing structures will require a hydraulic model if the stream has a regulatory floodway. Both the existing and with-project conditions should contain the same cross-section locations so that each case can be compared at all locations along the reach.

For modification or replacement of existing structures, a determination must be made whether or not the existing structure is a source of flood damage. This is done by comparing the profile of the natural channel (as if the structure did not exist) against the profile of the channel with the existing structure in place. By delineating the floodplains of each of the two profiles upstream of the restrictive structure, the applicant can determine the area that is impacted by backwater created by the restrictive structure. If a building is located in the floodplain when analyzing a restrictive structure, but not in the floodplain when the structure is removed, the structure may be a source of flood damage. The applicant must then evaluate the feasibility of redesigning the structure to reduce the existing backwater, taking into consideration the effects on flood stages on upstream and downstream properties.

All excavations for new construction or modifications to existing structures at crossings must be designed in accordance with Article 4, § 401 of the Ordinance for limitations on average channel or regulatory floodway velocities.

Lost floodway storage must be compensated for as required in the "General Performance Standards" of the Ordinance except that artificially created storage lost due to a reduction in head loss behind a bridge shall not be required to be replaced, provided no damage will be incurred downstream.

Application submittal material should be submitted to IDNR-OWR for stream crossings over public bodies of water so that IDNR-OWR may issue a public notice. Also, where hydraulic analyses are required for road crossings, the application submittal material should also be submitted to IDNR-OWR for concurrence that a conditional LOMR is not required.

The detailed hydraulic analysis of upstream flood stages must be based on the Administrator approved regulatory discharges and corresponding flood elevations for tailwater conditions. Culverts must be analyzed using the U.S. DOT, FHWA Hydraulic Chart for the Selection of Highway Culverts. Bridges must be analyzed using the FHWA Hydraulics of Bridge Waterways calculation procedures, or an appropriate hydraulic computer model approved for use by the Administrator.

T4-10 Requirements for Wetland Delineation

Wetland delineations are required for all developments which have on-site waters of the U.S. or are adjacent to wetlands, isolated wetlands, or farmed wetlands. The Wetland delineation report shall identify the boundaries, locations, limits and area of all on-site wetlands.

This wetland delineation will follow the current federal guidance, which is conducted in

accordance with the standard methods sanctioned by the COE Corps of Engineers Wetland Delineation Manual (1987) and Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual; Midwest Region (2008). Wetland delineations under this section shall be valid for five years. The presence of wetland areas to be developed in agricultural areas requires that the NRCS certified delineation or determination be completed prior to submission of the wetland delineation report. Coordination of wetland delineation tasks with the NRCS is encouraged to minimize disagreements in identifying the boundary of such wetlands. Winnebago County lies within the boundaries of the Rock Island District COE. Specific Information on the current delineation of wetlands may be obtained from the District.

U.S. Army Corps of Engineers
Rock Island District
ATTN: Regulatory Branch
Clock Tower Building
Post Office Box 2004
Rock Island, IL 61204-2004
Phone: 309-794-5057
Fax: 309-794-5190 or 5191

T4-10(a) Delineation Hierarchy

In addition to identifying the location, extent, and area of on-site wetlands, off-site wetlands must be evaluated to a distance of at least 50 feet beyond the edge of the site to verify buffer requirements. This should be included in the wetland delineation report and show on the wetland delineation exhibit. The location and extent of off-site wetlands shall be determined by using the first of the following documents or procedures at the time of development.

1. Site specific delineation, if one has been performed
2. Wetlands that are identified in ADID studies or watershed plans
3. Wetlands identified in interim watershed plans
4. Wetlands identified in NRCS wetland inventory maps.

The purpose in including off-site wetland delineation is to determine the overall value of the wetland complexes that occur on more than one property, and to determine whether or not there is a buffer required on a development site due to the existing off-site wetland.

Information concerning delineation by the NRCS method can be obtained from:

District Conservationist
USDA-NRCS
4833 Owen Center Road
Rockford, IL 61101-6007
(815) 965-2392

T4-11 Mitigation to be Local

All wetland mitigation required under a Corps of Engineers §404 permit for wetland impacts must occur in Winnebago County. Every effort should be made to mitigate in the same watershed where the impacts occur.

T4-12 Threatened and Endangered Species Consultation

Prior to the issuance of a stormwater management permit or Building Permit, the applicant shall consult with the IDNR via utilizing their Ecological Compliance Assessment Tool (EcoCat) http://dnr.illinois.gov/EcoPublic/ with respect to the presence of threatened and endangered species. The applicant must obtain a statement of "consultation terminated" from the IDNR either by the EcoCat (immediate response) or by letter following IDNR review.

If COE 404 permitting is required, consultation with the U.S. Fish and Wildlife Service shall also be completed. The consultation process can be obtained at the following website:

http://www.fws.gov/midwest/Endangered /section7/s7process/index.html

Illinois Department of Natural Resources
524 S. Second Street
Springfield, IL 62701

The U.S. Fish and Wildlife Services may be contacted at the:

Rock Island Ecological Field Office
1511 47th Avenue
Moline, IL 61265
(309)_ 757-5800

T4-13 Wetland Preservation During Development

Jurisdictional wetland/stream areas that are not to be impacted by development shall be protected during all phases of construction activities by the best management practices available.

T4-14 Buffer Requirements

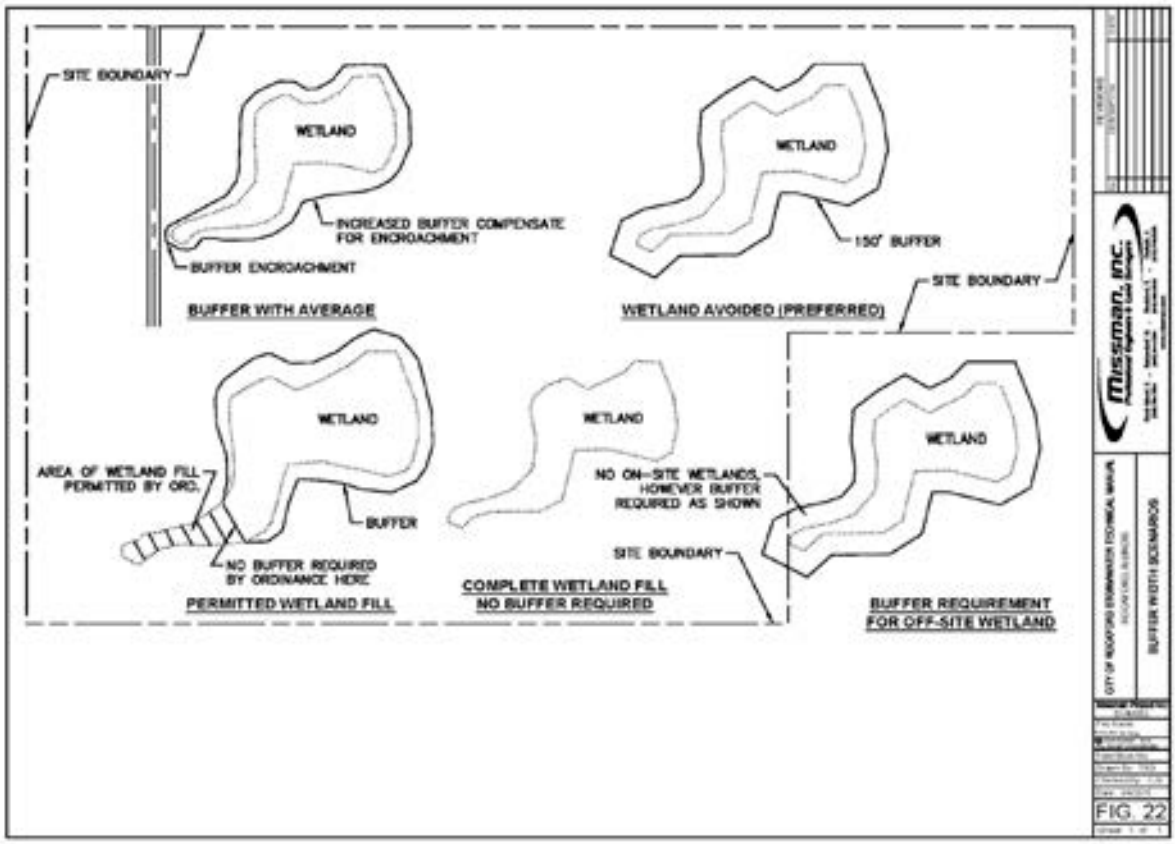
All buffer requirements shall be in accordance with all appropriate sections of Article 4-18 of the City of Rockford Stormwater Ordinance. Ordinance and COE requirements shall supercede all items discussed in the following article.

Buffers are defined as vegetated upland that serves a variety of functions including shoreline stabilization, sediment filtration, habitat, promotion of infiltration, and nutrient sequestration. Every attempt should be made to reduce or eliminate cut and fill activities, topsoil respread and soil compaction. Development of buffer areas in naturally occurring soils is preferred.

T4-14(a) Plantings in Buffers

Native vegetation, particularly deep-rooted warm season grasses and prairie forbs, are required for seeding, re-seeding, or inter-planting buffers. Only native plants with local (Upper Midwest) provenance maybe used. Plant material selection information may also be found in the Native Plant Guide for Streams and Stormwater Facilities in Northeastern Illinois prepared by USDA-N RCS.

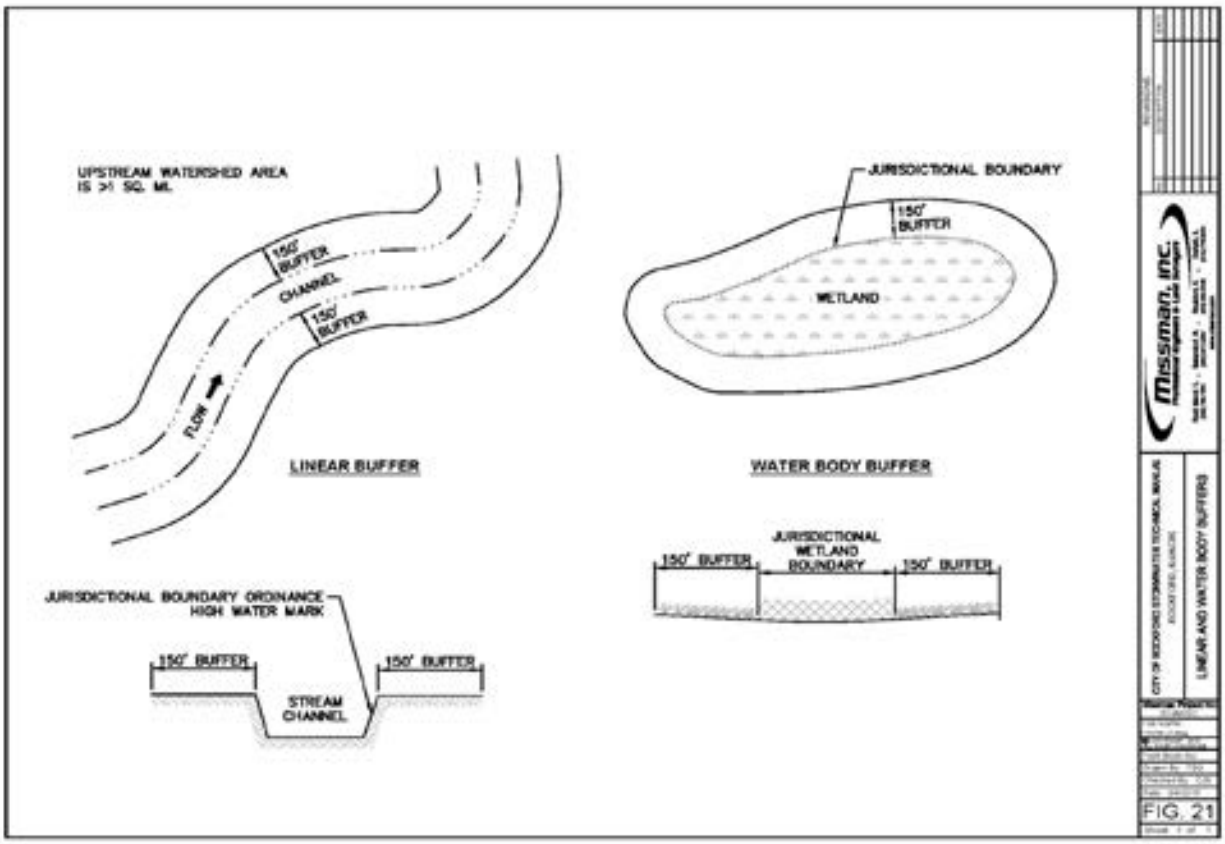
FIGURE 12
Buffer Width Scenarios



T4-14(b) Buffer Width Requirements

Two types of buffers are recognized: linear buffers and water body buffers (Figure 13).

FIGURE 13
Linear and Water Body Buffers

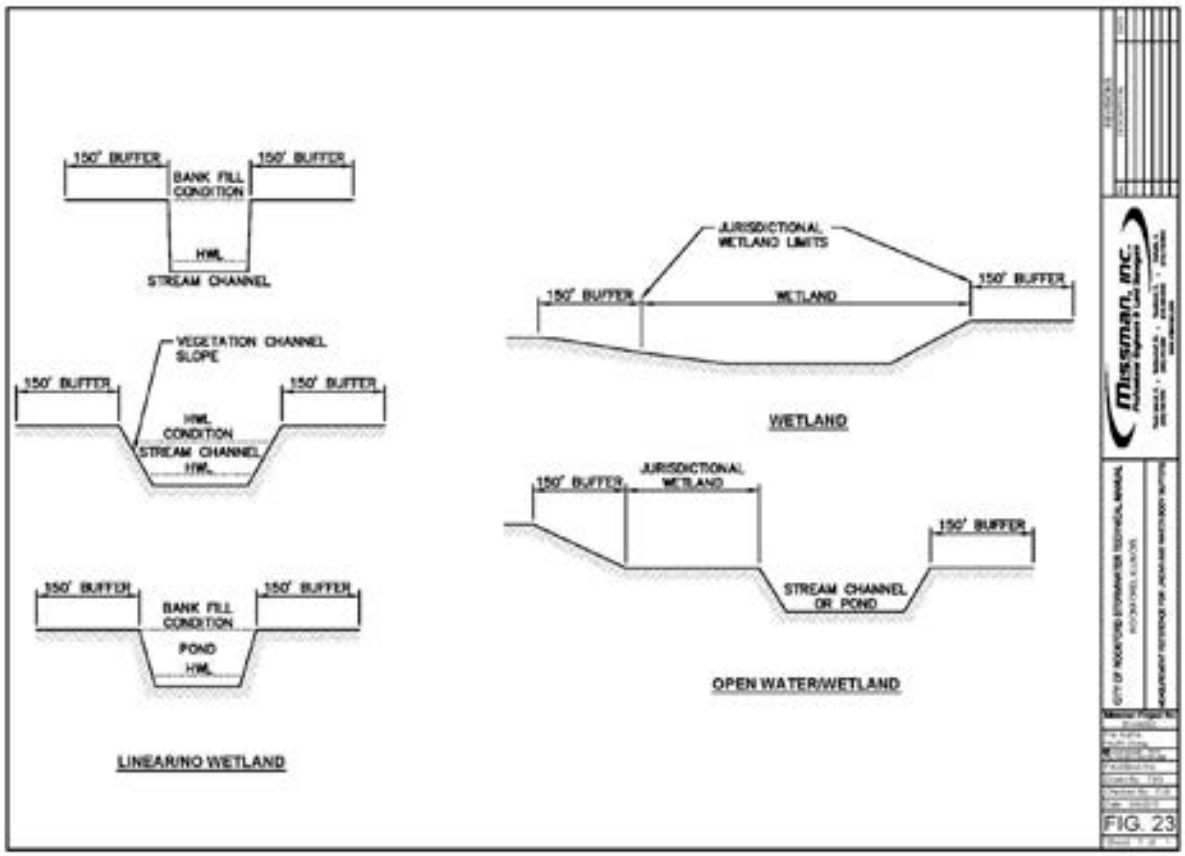


Buffer areas including the "Waters of the U.S." they protect shall be shown as easements on all newly platted lots and maintenance requirements for the buffer shall be recorded as a note against the deed. Buffer widths required are determined as part of the COE 404 permit. Jurisdictional “Waters of the U.S.”, including regulated wetlands, may not be considered buffer and shall not be encroached upon to create buffer.

Measurement Reference

For the purpose of measuring the width of the buffer, the interior edge of the buffer shall begin at the jurisdictional edge for wetlands and at the normal high water mark for other waters. Typically, this will be the edge of bank for ponds and lakes and the top of bank for linear water courses (Figure 14).

FIGURE 14
Measurement Reference for Linear and Water Body Buffers



Linear and Water Body Buffers

Linear buffers shall be designated along “Waters of the U.S.” including associated wetlands. This includes:

- Intermittent water courses
- Creeks
- Streams
- Rivers

Floodplain wetlands associated with streams are covered by § 418.1(d) and include:

- Floodplain wetland
- Backwater slough
- Oxbow
- Bordering wetland complex

As a general rule, linear buffer widths are 50 feet, if the drainage area is greater than 640 acres. For drainage areas less than 640 acres, the buffer width may be reduced by using the formula:

$$X = (A*0.0547)+15$$

Where X = buffer area

A = drainage area

The buffer width calculated will be rounded up to the nearest five feet.

Buffer protective measures include effective stabilization measures included in the “Illinois Urban Manual” or those approved by the Administrator.

MEASURE	IL URBAN STANDARD	USE
• Erosion Blanket	Std. 830	Temp
• Silt Fence	Std. 920	Temp
• Sodding (as temp measure)	Std. 925	Temp
• Deep-rooted grasses — Sod or Seed		Perm
• Sediment Trap	Std. 960	Temp
• Sediment Basin	Std. 841 & 842	Temp/Perm

If lineal "Waters of the U.S." are partially or completely relocated, the channel design must accommodate naturalized revegetation and utilize best management practices including:

- Vegetatively Stabilized Banks
- Pool and Riffle Design for Low Flow Conditions
- Channel Meanders
- Other Biological Stream Enhancements Approved by the Administrator.

Water body buffers shall encompass all non-linear "Waters of the U.S." including, but not

limited to lakes, ponds, and wetlands.

In both linear and water body buffers, buffer width averaging may be utilized. A conceptual buffer is illustrated in Figure 13 to show the ways in which buffer averaging may be applied.

T4-14(c) Access

Access by equipment into buffer areas is allowed to the extent necessary to provide maintenance to the buffer and/or maintenance and monitoring activities associated with wetlands within buffers.

Buffer areas shall typically remain private property and thus, not accessible to the general public.

T4-14(d) Undetained Stormwater

Per Ordinance § 4-14(d), undetained stormwater which has not passed through a site runoff storage facility shall discharge through an area or structure meeting the definition of best management practices or buffer before entering a jurisdictional Waters of the U.S. or wetland.

T4-14(e) Disturbance During Construction

Construction disturbance in buffer areas are prohibited. Disturbances include, but not limited to the following:

- Topsoil stockpiles
- Material stockpiles
- On-site equipment maintenance
- On-site equipment storage

ARTICLE 5 — STORMWATER MANAGEMENT
PERMIT SUBMITTAL REQUIREMENTS

T5-00 Stormwater Management and Other Permits Required

1. A stormwater management permit is required if—

   a) the development is located in the regulatory floodplain;

   b) a substantial improvement is to be located in the regulatory floodplain;

   c) there is any regulatory floodplain within the site; or

   d) the development disturbs more than 5,000 square feet of ground or 250 cubic yards of soil, unless the development consists solely of—

      (i) the installation, renovation or replacement of a septic system, potable water service line or other utility serving an existing structure;

      (ii) the maintenance, repair or at grade replacement of existing lawn areas not otherwise requiring a stormwater permit under this ordinance;

      (iii) the maintenance of an existing stormwater facility, not requiring other state or federal permits or approvals.

Section 500(a)(4) of the Ordinance includes exclusions from the necessity of obtaining a Stormwater Management Permit for developments that disturb more than 5,000 square feet of ground cover. The installation of storm sewers are not included as an exclusion because the storm sewers would be considered an improvement to the hydraulic conveyance of runoff that would otherwise have to flow overland or be absorbed into the ground.

Developments that do not require a Stormwater Management Permit are not excluded from obtaining all other appropriate stormwater management related approvals from federal, state and regional authorities.

T5-00(d) Professional Seals and Certification Required

A professional engineer shall certify a Stormwater Management Permit application by signing and sealing the application. By certifying of the application, the professional engineer is attesting to the contents of the entire bound application. If the professional engineer does not attest to a sheet or part of the application, it must be noted. Otherwise, it will be assumed that the contents of entire bound document are being attested to by the signature and seal of the professional engineer. For applications with separate plan sheets from the bound application, the professional engineer shall sign and seal the front cover of the bound plan set. When the total project site is over 20 acres, the survey must also be tied into the Winnebago County or City Survey Control Network. New Plats, for parcels greater than 20-acres in size, must also be submitted in an electronic format designated by the County. These files will not be used to define or record property holdings.

T5-01(a) Permit Expiration

Permits are valid for a minimum of three years. Permits expire on December 31 of the third year following the date of their issuance. If a permit is issued on January 2, 2015, the permit shall expire on December 31, 2018. If a permit is issued December 1, 2015 the permit shall expire on December 31, 2018.

T5-01(b) Permit Extension

The permittee may request an extension of a permit to pursue the permitted activity before the expiration date if the permitted activity has been started. For permitted activities in special management areas, a permit extension may be applied for but the activity must be in compliance with the current requirements of the Ordinance on December 31st of the year in which the original permit expires.

T5-01(c) Permit Revision

In cases where a permit has been issued for a particular activity and after receiving the permit, the design for the proposed activity is changed; the permittee shall submit revised plans to be reviewed along with a written explanation of the changes and the reason for the changes. These changes cannot be started until a written permit revision is received from the Administrator.

T5-02 Required Submittals

The applicant shall refer to Table 5-02 in §502 of the Ordinance to determine the required permit submittal sections. All Stormwater Management Permit applications shall include an application and project overview, plan set submittal, performance security, and maintenance schedule and funding. All permitted activities shall provide record drawings at the completion of the project. Applicants shall review and complete all necessary parts of the City of Rockford Stormwater Management Submittal and include the original forms with the required signatures in the bound application.

T5-02(a) Required Submittals

If the developer/applicant believes their project warrants special consideration for which a part of the submittal requirements are not required, the developer/applicant shall request in writing from the Administrator a modification in the requirements of the submittal. For example, if a developer was to redevelop a one square block in a downtown area that is nearly 100% impervious, they may request from the Administrator that no subsurface drainage investigation be performed because of the site's impervious area and location.

T5-03 Application and Project Overview

The applicant may obtain from the developer a letter authorizing the applicant to sign any documents related to the Stormwater Management Permit Applicaton. In such cases the signed letter by the developer shall be attached to the Stormwater Management Application. In completing parts (7) through (9) of §503(a), the sheet(s) addressing each part shall be attached to the application.

T5-04 Plan Set Submittal

An example plan set submittal for a hypothetical development is attached at a reduced scale. The correct scale for the submittal should be 1 inch = 100 feet or larger. The Winnebago County benchmark used for the project shall be identified on the plan set. Where it is practical, two FEMA benchmarks should be tied-in to verify accuracy. All benchmarks shall be labeled on the plan set. A plan set submittal shall be include the following:

1. Site Topographic Map.
2. General Plan View Drawing.
3. Sediment/Erosion Control Plan.
4. Vicinity Topographic Map.

T5-05 Stormwater Submittal

A stormwater submittal shall document a plan hydrologic and hydraulic evaluation that is required when any land is subdivided or developed. The plan evaluates stormwater runoff conditions and determines the need for site runoff controls and stormwater drainage facilities consistent with watershed capacities.

It is important that each stormwater management project and permit application be handled in an equitable, fair and consistent manner. A stormwater submittal provides the technical basis for accomplishing this and is an accepted practice throughout the country. The Ordinance provides the basis for determining capacities of existing facilities and thus for identifying the need to control potential problems associated with proposed changes. In addition, the relationship of a specific project to watershed concerns, such as off-site impacts or the use of a regional stormwater storage facility, also can be considered. Certification that the stormwater calculations and plans are prepared under the direct supervision of a professional engineer is required to encourage proper technical input.

Calculations should be submitted in the form of design reports, calculation sheets, and/or computer model documentation identifying and explaining the assumptions, data, and coefficients used in sizing the major and minor stormwater systems. The calculation of the hydraulic grade lines must be documented. Any time a computer model is used in the stormwater calculations the output should be included along with the input and output on diskette or other common media.

For the subsurface drainage investigations, all existing field tile systems, including the tiles entering and exiting the site, should be shown. The size, type, quality, and depth for each field tile should be noted, as well as the percentage of flow and silt found for each slit trench location. The percentage of the total depth of flow found is the percentage of tile diameter occupied by active flow. Any restrictions or surcharged conditions should be noted. Similarly, for percentage of silt, the percentage of tile diameter that is restricted by silt should be identified. If possible, field tile lines should be identified as mainline tile, sub-main tile or lateral tile.

An example of a narrative description is as follows:

Example:
"The Main project proposes a development of a 50 acre parcel located in the City of Rockford, Illinois. The existing site conditions consist of farmed row crops. The Main project will consist of 40 acres of [1]4-acre residential lots and 10-acres of open space. The general drainage pattern or the site is from the northwest to the southeast. There is 20-acres of off-site area that is tributary to the site and enters the site at the northwest corner. The off-site tributary area is conveyed through a detention pond prior to entering the Main project site. A storm sewer has been sized to collect and convey the 10-year off-site flow through the site. Flows greater than the 10-year design storm event will be conveyed via swale to the southeast corner of the site. The Main project will have two stormwater storage facilities on the east side of the site. The outflows from both facilities will be directed into an existing storm sewer which has been demonstrated to have existing capacity to accept this additional volume without surcharging."

The applicant will have to address each of the statements with technical support, calculations and models where necessary. All stormwater storage facilities should be functional and in working order prior to development of the remainder of the site. In projects with tributary site flow, a stormwater system shall also be in place to safely convey off-site flow prior to development of the site.

T5-06 Floodplain Submittal

A floodplain submittal is required whenever a hydrologic disturbance is proposed within a floodplain. The submittal is required if any part of the hydrologic disturbance will be in the floodplain, even if the majority of the development lies outside the floodplain. All floodplain modifications shall be the minimum required to accomplish the development.

The applicant shall provide a copy of the permit obtained from IDNR-OWR and approval from FEMA for all new base flood and floodway determinations when their permitting authority applies. It will be the decision of the Administrator whether or not the review of the stormwater permit application will begin prior to written receipt of IDNR-OWR and FEMA approval in such cases as permits are required. Hydraulic disturbance of the base flood and floodway shall not occur until all necessary permits are issued and received by the Administrator.

The floodplain submittal must include sufficient information for the qualified review specialist to ascertain compliance or noncompliance of the proposed development with the criteria of the Ordinance.

At a minimum, the floodplain submittal must contain:

1. Floodplain delineation.
2. Floodway delineation.
3. Floodplain calculations.
4. Topographic survey with Winnebago County benchmark used.
5. IDNR-OWR permits and FEMA approval, if required.

The applicant must provide the delineation by a professional engineer of floodplain boundaries on or adjacent to the proposed development site. The floodplain must be delineated for pre-development and post-development conditions. The floodplain delineations should be shown on maps at the same scale as these required for the site stormwater submittals (floodplain boundaries on the development site should be shown on the site topographic map and nearby off-site floodplain boundaries should be shown on a vicinity topographic map).

The applicant must provide calculations and drawings sufficient for the certified review specialist to determine compliance of the proposed development set forth in Article 4 of the Ordinance. In addition, the calculations and drawings must be sufficient to meet the requirements of the NFIP regulations.

T5-07 Wetland Submittal

For all activities which do not encroach into on-site wetlands or water but still have direct impacts, the following information must be submitted to the Administrator along with a written opinion from a firm which provides wetland related services. The firm, which provides the written opinion, will review and discuss the applicability of current Federal permits.

At a minimum, the wetland submittal shall include the following:

a) Wetland Delineation Report.
The wetland delineation report will be based upon the current federal methodology in place at the time of submittal. The report will clearly detail the wetland flora, hydric soils, wetland hydrology, and surrounding upland data. The delineation report shall also include representative, current growing season photographs of each wetland plant community. All field data and inventories shall be provided on current Federal forms or approved equivalent

b) Buffer Requirements.
The buffer requirements for the wetland or waters shall be shown on the wetland delineation plan. The calculation of buffer size and the vegetative quality of the buffer areas shall be included in the delineation report and referenced on the plan sheet.

c) Wetland Delineation Plan.
The wetland delineation plan will at a minimum identify the following (Figure 15).

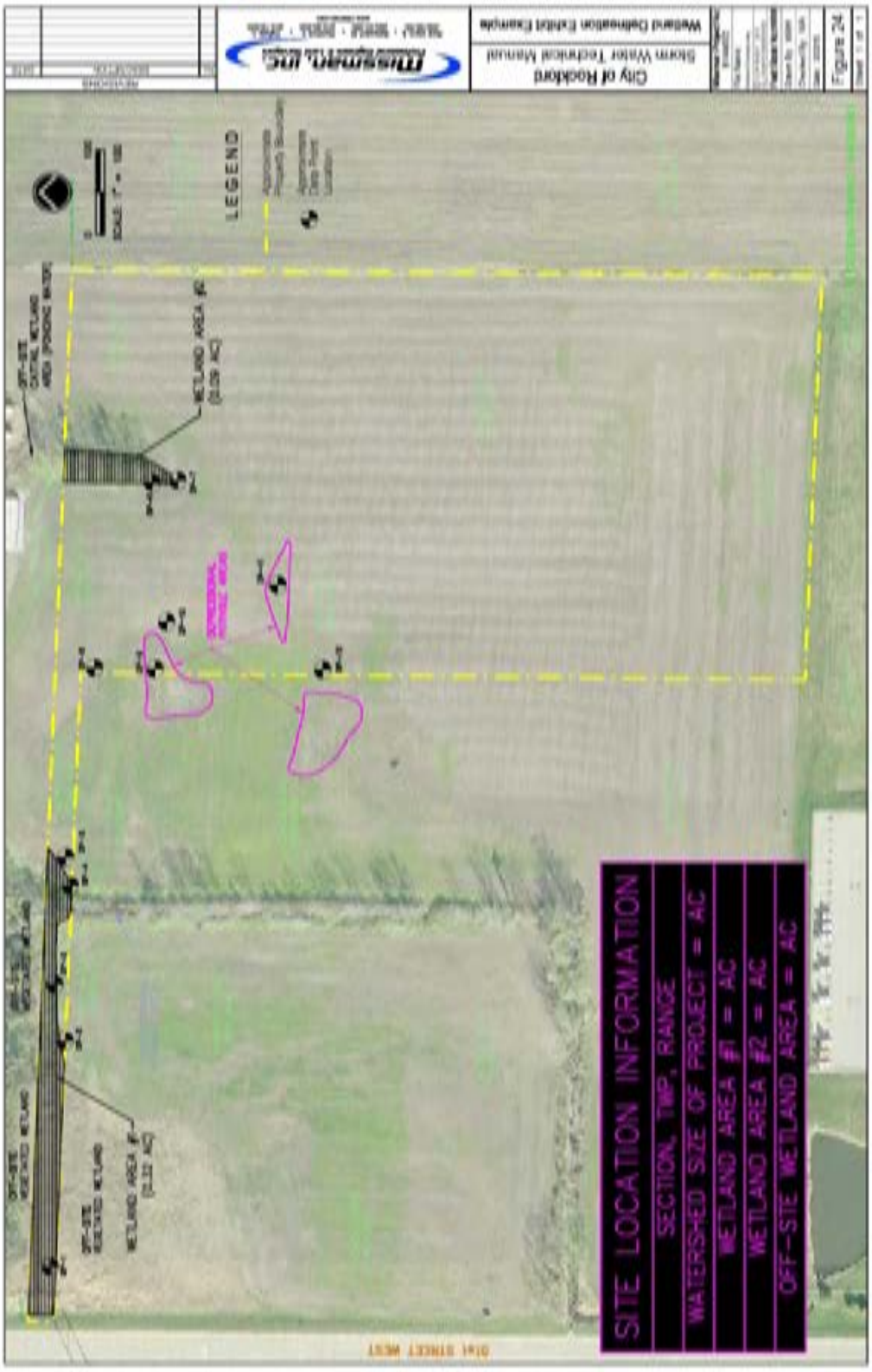
- All existing wetlands or waters on-site
- All existing off-site wetlands that lie all or in part within 50 ft. of the site boundary.

- Proposed impacts to wetlands and waters including size, shape and type of impact
- An indication of direct and indirect impacts
- Any on-site wetland mitigation plan.

- Planting plan for buffers including planting specifications, species lists, and appropriate stabilization measures.
- Wetland maintenance and monitoring activities and schedules.

Requirements for maintaining site conditions, including vegetation, soils and hydrology are set by the U.S. Army Corps of Engineers.

FIGURE 15
Wetland Delineation Example


City of Rockford
Storm Water Technical Manual
Wetland Delineation Exhibit Example
Figure 24
LEGEND
SITE LOCATION INFORMATION
SECTION, TWP, RANGE
WATERSHED SIZE OF PROJECT = AC
WETLAND AREA #1 = AC
WETLAND AREA #2 = AC
OFF-SITE WETLAND AREA = AC

ARTICLE 6 — LONG-TERM MAINTENANCE

The scheduled maintenance program must include at least:

1. A list of the planned maintenance tasks to be performed for each drainage facility and the frequency of each task; and

2. All supporting infrastructure (storm sewer, swales, etc.)

3. Identification of the party responsible for performing the maintenance of the drainage facility.

It is expected that naturally vegetated detention storage facilities, preserved wetlands, and preserved woodlands within private lots of a development meet a set of minimum performance standards. The performance standards have been developed in order for the Certified community to conclude if the plantings were "successful" enough to warrant a finding of compliance, and that the preserved areas are not degrading. If compliance is not met, corrective measures and subsequent monitoring is required to meet the terms and conditions of the Certified Community. The corrective measures will be funded by the SSA or backup SSA.

The success of naturalized detention ponds, preserved wetlands and woodlands, and buffers in achieving the desired effect is very dependent upon periodic management with a set of goals. The following is an example management and monitoring plan that includes a schedule describing minimum management requirements for success of the naturalized detention ponds and preserved wetlands and woodlands contained within a project site. A set of goals has been developed to assist the entity/person responsible for the maintenance with defining what is acceptable under the Ordinance.

T6-00 Long-Term Maintenance

- Protection of preserved areas from impacts directly associated with development activities.

- Provide a native vegetated buffer around detention ponds and preserve wetland areas to assist with filtering detrimental contaminants in the runoff.

- Enhance the preserved wetland areas by elimination of invasive, non-native species to increase the quality of the site.

A qualified consultant shall periodically visit the site during the first five years after planting to monitor the progress and health of the plantings and the preserved areas. These visits are to determine if remedial measures are required and to recommend procedures to correct any deficiencies. In most cases, these deficiencies are related to the maintenance of the wetlands (i.e. eroded side slopes, clogged outlets, trash, debris dumping). The following minimum maintenance activities shall be completed every other month unless otherwise indicated during the growing season (March 1-October 31):

1. Debris Management: All trash, brush, grass clippings, debris, etc. shall be removed from the created detention ponds, preserved wetlands, and buffer areas.

2. Stormwater Management Structures: All stormwater control structures and silt basins, etc. shall be cleaned out and/or repaired every two weeks to prevent clogging. This

is especially important in early spring and late fall. Dammed water can drown certain wetland plants if not rectified quickly.

3. Soil Erosion Control Management: All soil erosion control devices, structures and features, etc. are to be installed as required by the soil erosion control plan, and function properly at all times. Any deficiencies shall be corrected immediately.

The following management activities should be completed annually unless otherwise specified in the management plan:

1. Prescribed Burn Management: The detention ponds and preserved wetlands shall undergo periodic prescribed burns after the second growing season or as fuel allows. These burns help to reduce undesirable weedy species and encourage native species. These burns should only be performed by a qualified burn contractor.

2. Invasive Non-native Weeds: Purple loosestrife, reed canary grass, common reed, willow, thistle and other invasive weeds shall be controlled by the following: mechanically, through the use of mowing no sooner than the 3rd week of July, fire (as fuels allow), application of herbicide, or a combination of these methods.

3. Protection of Preserved Woodlands on Private Lots:Preserved woodlands shall have construction fencing placed around the limits of no construction zone. No equipment or materials shall be stored within the no construction zone and no equipment shall be driven within it.

An example of performance standards for the detention ponds and preserved wetlands is as follows:

1. A temporary cover crop shall be planted on all slopes immediately upon completion of detention pond grading. Within 3 months, at least 90% of the slopes, as measured by aerial cover, shall be vegetated. If the long-term slope vegetation is not planted with the temporary crop, then it should be planted in the first available growing season appropriate for each species. Prior to replanting, rill erosion shall require drainage improvements to eliminate them from reoccurring. All cover crop species must be non-persistent or native and not allelopathic. If a temporary cover crop is not planted immediately upon completion of grading, erosion blanket or heavy mulch must be installed to prevent erosion.

2. By the end of the fifth year, no individual area over the entire detention pond buffer area greater than 0.25 square meter shall be devoid of vegetation, as measured by aerial coverage.

3. By the end of the fifth year, none of the three most dominant plant species in any of the mitigated or preserved wetland community zones may be non-native or weedy species including by not limited to: cattails, reed canary grass, giant reed, blue grass, purple loosestrife, sandbar willow, thistle or barnyard grass, unless otherwise indicated on the approved mitigation plan.

Vegetation sampling is conducted to assist with determining if the performance standards have been met.

The sampling must occur prior to early June and again in August/September following the planting and be completed twice in Years 3, 4, and 5 during the monitoring period. Sampling will consist of a time meander search to record species presence. A visual estimate of species dominance and cover will be made. A Floristic Quality Assessment shall be performed (see § T412(c)). The number of native species present should increase over the 5 year monitoring period. Representative photographs will be taken at the time of sampling. An annual monitoring report will contain the following information:

a) Vegetation Map - This information shall be descriptive and shall define the limits of all vegetation areas by general community type, based on field observations. Dominant species within each zone shall be identified. Representative photographs of each vegetation area by general community zone shall be submitted to the entity responsible for maintenance and the certified community.

b) Cover shall be determined by visual estimate to ensure no bare earth is exposed leaving the area open to erosion.

An annual monitoring report based on the above sampling and soil erosion control inspection reports shall be submitted to the Administrator by the end of February of the year following the completion of monitoring and management tasks. The report will include a review of progress toward meeting goals and performance standards. If any of the performance criteria are not met for any year, the responsible entity must provide a detailed explanation and propose corrective measures. Particular attention should be given at the end of the second year to areas initially planted with native vegetation.

It is the applicant's responsibility to rectify any deficiencies in the detention ponds, mitigation areas and preserved areas through replanting and management including but not limited to burning and selective herbicide use.