Illinois Urban Manual

An Erosion and Sediment Control Best Management Practice Manual

Association of Illinois Soil and Water Conservation Districts

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Section 1

Introduction to Illinois Urban Manual

Preface

This manual is intended for use as a technical reference by developers, planners, engineers, government officials and others involved in land use planning, building site development, and natural resource conservation in rural and urban communities and developing areas.

The standards and associated materials describe best management practices (BMPs) for controlling non-point source pollution impacts that affect ecosystems in existing communities and developing areas. The manual includes an array of BMPs in the following broad categories:

- soil erosion and sediment control;
- stormwater management; and
- special area protection.

Beyond conventional BMP considerations, the manual addresses fish and wildlife habitat improvement, visual and environmental quality and other relevant ecosystem enhancement applications. Where previous BMP manuals have tended to focus on limited aspects of construction site erosion or stormwater runoff control, this manual is designed for more comprehensive, multi-objective ecosystem protection and enhancement.

This manual supersedes the Illinois EPA's 1987 *"Standards and Specifications for Soil Erosion and Sediment Control"* (commonly known as the "Yellowbook") and the original *"1995 Illinois Urban Manual."* It also replaces Chapter 6, entitled "Procedures and Specifications", of the Association of Illinois Soil and Water Conservation District's 1988 *"Procedures and Standards for Urban Soil Erosion and Sedimentation Control in Illinois"* (commonly known as the "Greenbook"). This manual was prepared for the Illinois Environmental Protection Agency (EPA) by the United States Department of Agriculture's (USDA) - Natural Resources Conservation Service (NRCS) in Illinois. The NRCS was formerly known and recognized as the Soil Conservation Service (SCS). Initially released in 1995, the manual is being revised by a committee made up of federal and state resource agencies, regional planning commissions, local units of government, and the private sector.

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Section revised June 2009

Introduction

This manual is intended to be a dynamic document. Several sections may stay static for long periods of time. Others, such as sections 4, 5, 6, and 7, will likely be expanded on a regular basis to include additional conservation practice standards, construction specifications, material specifications and standard drawings not yet developed.

This manual sets no policy, rules, regulations or restrictions. However, it is anticipated that various units of government and local, state, or federal agencies would use these technical materials to guide development of policy, ordinances, restrictions, or regulations. If adopted by reference in a regulatory program, such as in a Soil Erosion and Sediment Control Ordinance adopted by a local jurisdiction, the contents of the manual have the force of law.

No individual section of this manual will contain all the guidance or material necessary to fully assist users to develop or implement site specific plans. Other references or sections of other manuals or handbooks that supplement this publication should be utilized as appropriate. Other primary reference materials to support this manual are listed in the References section of the practice standards or in Section 9 - References. All references to IDOT in the practice standards and on the standard drawings refer to the *Illinois Department of Transportation Standard Specifications for Road and Bridge Construction,* adopted 2007 or the latest version. The standard drawings use an 'RR' designation in place of a gradation number. Assume the 'RR' to be synonymous with 'Gradation'.

Users of the manual are encouraged to contact the following if you have any questions or additional information or assistance is needed:

1. NRCS/SWCD County Office (in the phone book under U.S. Government, Department of Agriculture, the Illinois NRCS website www.il.nrcs.usda.gov under "Directories", or the AISWCD website http://aiswcd.org, or

2. Illinois EPA, Bureau of Water - Watershed Management Section, 1021 North Grand Avenue East, PO Box 19276, Springfield, IL 62794-9276 (phone 217-782-3362), website: www.epa.state.il.us/water/index.html, or

3. Kelly Thompson, AISWCD Program Coordinator, at 4285 North Walnut Street Road Springfield, IL 62707 (phone 217-744-3414), Email at kelly.thompson@aiswcd.org

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AISWCD

Section 2

Non-point Source Pollution Control Processes and Planning Principles

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Introduction

This section is intended to provide a basic understanding of nonpoint source (NPS) pollution processes and the principles for minimizing or preventing their effects. These principles must be understood in order to facilitate a comprehensive management strategy, including the design and application of techniques which can effectively control undesired consequences of urban development. Although this manual is primarily developed to address nonpoint source impacts, other considerations also need to be addressed. Comprehensive natural resource planning will include components that address soil, water, air, plant, and animal resources. In addition, the human aspect of cultural, social, and economic issues needs to be considered. While this section does not provide a complete discussion of the many issues that should be considered to develop an effective NPS pollution control plan, it does provide a general description of the following key principles and processes:

A. Overview of Nonpoint Sources and Impacts;
B. Planning Principles for Selecting and Implementing Best Management Practices (BMPs);
C. Soil Erosion and Sediment Control;
D. Stormwater Management; and
E. Special Area Protection.

Most NPS pollution control plans will be prepared, and BMPs designed, to meet the requirements of existing ordinances or other governmental or agency regulations or codes. These requirements must be clearly understood so that planning can proceed in a timely and cost effective manner. However, considering the limited scope of many local ordinances, it is strongly recommended that NPS pollution control plans, and site designs, go beyond the required components to address resource concerns in a holistic, multi-objective manner.

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A. Overview of Non-Point Pollution Sources and Impacts

Recent reports acknowledge that a principal water quality problem in our Nation is nonpoint source (NPS) pollution. The U.S. Environmental Protection Agency (USEPA) defines NPS pollution as precipitation driven stormwater runoff, generated by land-based activities, such as agriculture, construction, mining, or silviculture. These activities result in diffuse runoff, seepage or percolation of pollutants from the land surface to ground and surface waters.

The Illinois Environmental Protection Agency (EPA) has documented the nature and degree of NPS pollution impacts throughout the State. Numerous watershed assessments have further documented these impacts. To put nonpoint sources of pollution and the need for their control into perspective, the Illinois EPA first evaluates streams, lakes, and other aquatic ecosystems with respect to their ability to support designated uses, such as aquatic life or swimming. If a use is impaired, causes are identified. Typically, a number of sources, both point and nonpoint, are identified as contributors. Finally, a list of appropriate BMPs is provided to control the identified nonpoint sources. While this manual focuses on the selection, design, and implementation of those BMPs, it is important to understand the linkage between BMPs, nonpoint sources, causes, and use impairments to appreciate the importance of a multi-objective management plan.

A notable distinction between the USEPA definition of nonpoint source pollution, cited above, and Illinois EPA's definition is the recognition that nonpoint sources affect not just water quality but also the physical habitat of aquatic ecosystems. The Illinois EPA identifies eight basic categories of NPS pollution which encompass agricultural, urban, and special land development activities (e.g., mining). This manual focuses on NPS pollution in the following categories:

* erosion from construction sites;

* urban runoff; and

* hydrologic/habitat modification.

Development has both direct and indirect impacts on water bodies and other valuable natural features. These impacts occur both during construction and after the development is complete. Some impacts result from the direct modification or destruction of streams, lakes, and wetlands. Other impacts occur primarily offsite due to changes in the quality and quantity of runoff from the development. Some common NPS pollution sources from development are described below.

1. Erosion from Construction Sites

Erosion and sedimentation are natural geologic processes that human activities often accelerate. Erosion occurs through the action of water or wind. In Illinois, water is the primary cause of erosion. Wind erosion in urban areas is a minor concern, but it can be a nuisance and even a safety hazard in areas near a site under development.

There are three major processes that must be understood to effectively control or limit soil erosion and sedimentation on construction sites. These are detachment, transport, and deposition. Four types of erosion showing detachment and transport of soil on an exposed slope are shown in Figure 2.1. The four erosion types are as follows:

Raindrop erosion is erosion resulting from the direct impact of falling drops of rain on soil particles. This impact dislodges soil particles and splashes them into the air.

The dislodged soil particles can then be easily transported by the flow of surface runoff.

Sheet erosion is the removal of a layer of exposed surface soil by the action of raindrop splash and runoff. The water moves in broad sheets over the land and is not confined in small depressions.

Rill and Gully erosion occurs after runoff flows concentrate into rivulets, cutting several inches deep into the soil surface. These grooves are called rills. Gullies may develop from rills if not repaired or in other areas where a concentrated flow of water moves over the soil.

Stream and Channel erosion occurs with an increase in the volume and velocity of runoff. These larger and faster flows detach and then transport soil from the stream bottom and the stream bank toe. If not repaired, large sections of the stream bank may fail or slump into the stream.

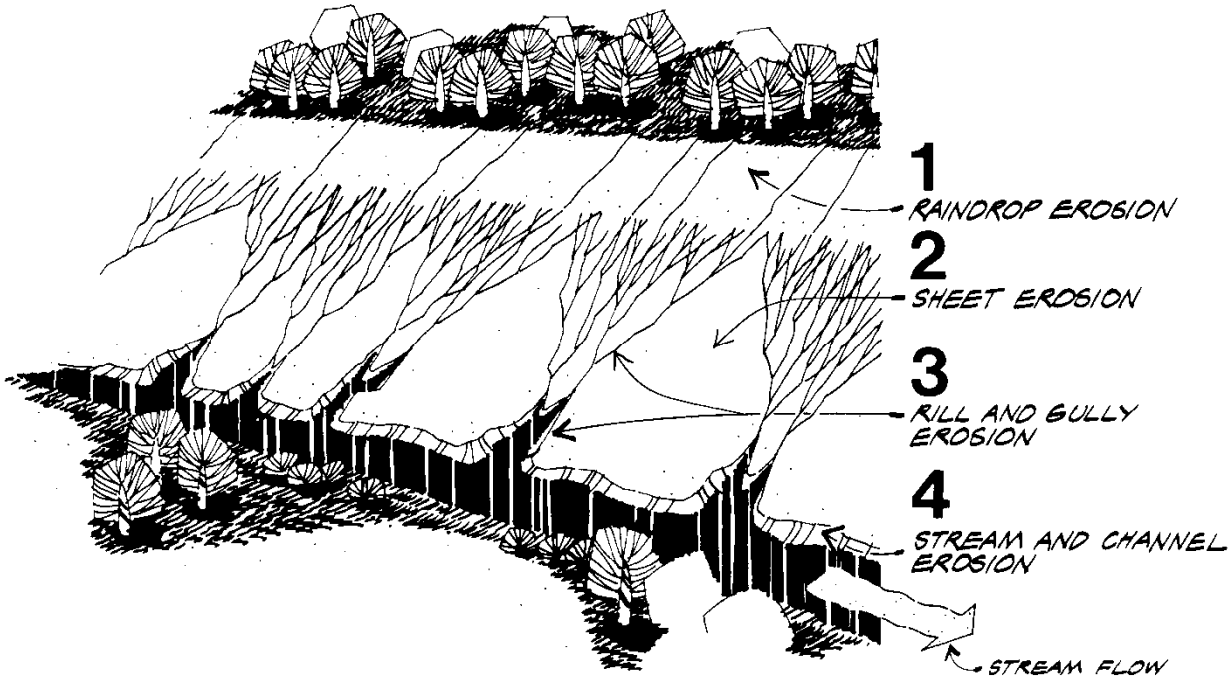
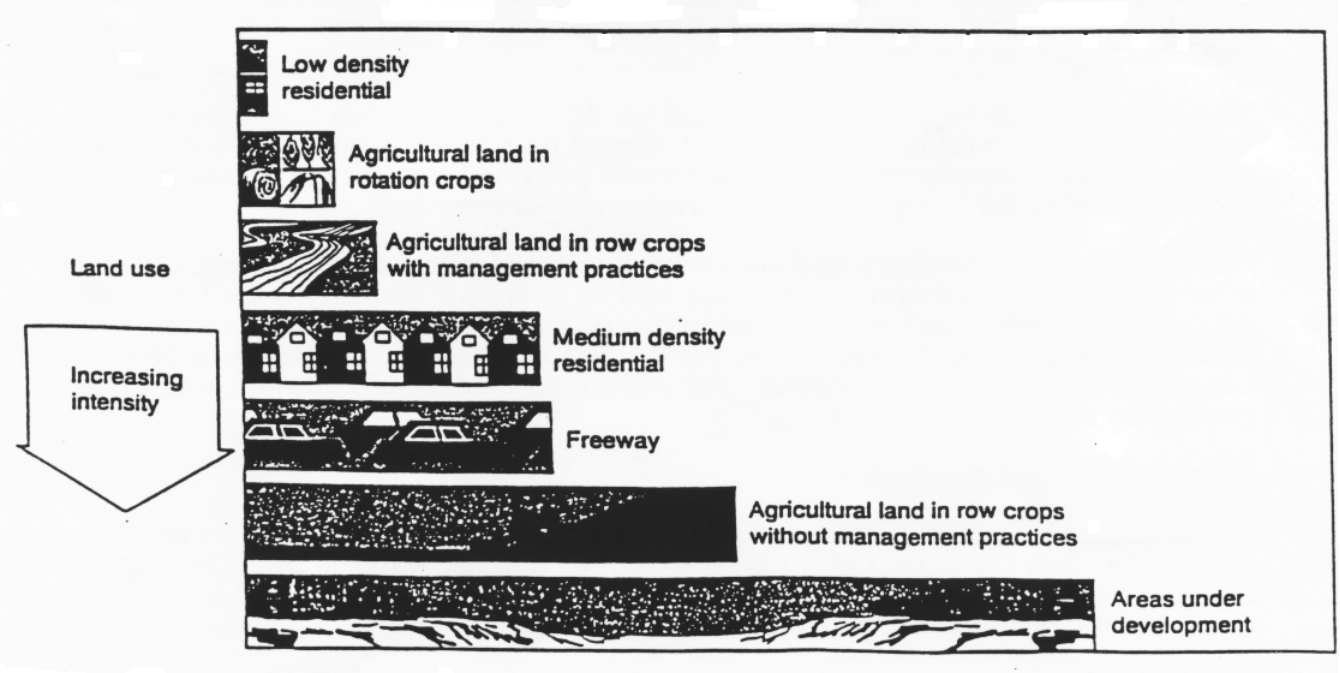


Figure 2-1 The Four Types of Soil Erosion on an Exposed Slope

Many of the BMPs included in Section 4 of this manual will individually address one or more types of erosion. Of these, most will impact the detachment or movement of sediment or provide storage methods.

National estimates indicate that uncontrolled erosion from construction activities can generate enormous quantities of sediment -- 20 to 200 tons per acre per year. In comparison, typical erosion rates from croplands range from 1 to 20 tons per acre per year. Figure 2-2 shows a relative comparison of suspended sediment loading, again indicating the relatively high contribution of sediment from construction sites.

Relative Suspended Sediment Loads



Adapted from Wisconsin Department of Natural Resources
Figure 2-2 Sediment Losses Related to Land Use Practices

Construction site erosion and the movement of sediment as it leaves the site causes several offsite problems. Also, a site that has been degraded from excessive erosion is more expensive to landscape and maintain. The resultant sediment deposits are expensive to remove from culverts, ditches, lakes, or streams. A brief summary of environmental impacts follows.

> **Water quality impairment**: Sediment from construction sites adversely affects water clarity, which reduces sunlight penetration thereby limiting photosynthesis by aquatic plants. In addition, impaired water clarity negatively impacts fish searching for their prey. Sediment-laden runoff also transfers nutrients and other pollutants to downstream lakes and rivers and increases costs for water treatment. Sediment also impairs aquatic habitats by reducing structure used for shelter and clouding the water which inhibits breeding, herbivory, and predation.: Excess sediment from construction sites fills storm sewers and ditches, detention

basins, wetlands, and stream and river channels. This sediment must be removed to maintain the flow or storage capacity. If not removed, this accumulated sediment worsens drainage and flooding problems and can limit the navigability of river channels. In addition, increased rates of runoff from construction sites can cause local flooding problems.

Degradation of natural areas: Over time, sediment accumulation can lead to the degradation of natural plant communities, such as prairies and wetlands. Sediment accumulation has several negative effects on natural communities. The sediment can bury or suffocate existing plants, smother the native seed bank present, and can act as a medium for the germination of exotic plant seeds that were carried in with the sediment. Many of the exotic species are aggressive (e.g., purple loosestrife, reed canary grass) and can eliminate other more desirable species within a short period of time.

Safety and nuisance problems: Sediment on roadways, conveyed either by direct runoff from construction sites or tracking by construction vehicles, can be a traffic safety hazard. Dust generated from unprotected soil on uncontrolled construction sites is a nuisance for adjacent property owners.

2. Urban Runoff

Urban runoff has been sampled at numerous locations in Illinois and around the country. These data show that urban runoff is contaminated with a number of pollutants, including sediment, heavy metals, petroleum-based hydrocarbons, nutrients, pesticides, chlorides, bacteria, and oxygen-demanding organic matter. It is becoming apparent that pollution in urban runoff is more damaging to many water bodies and ecosystems than pollution from municipal and industrial treatment plants, known as point sources.

Much of the pollutant load is generated from impervious surfaces, particularly roadways and parking lots, and is related to automobile traffic. It is not surprising, therefore, that high density development activities, such as commercial, industrial, and highway projects, generally contribute higher pollutant loads than lower density residential developments. Another important factor controlling the level of pollutant runoff from urban areas is the opportunity for natural vegetative filtering on the site. Unfortunately, most modern developments route runoff from impervious surfaces directly into storm sewers or paved channels which effectively convey the pollutants, without any opportunity for infiltration or filtering, into receiving water bodies.

Water quality impacts of urban runoff have been extensively documented around the country. The following are some common impacts noted in Illinois:

Nutrient enrichment/eutrophication: Pollutant loads of phosphorus and nitrogen in urban runoff are substantially higher than in runoff from undeveloped lands. Most nutrients applied in the urban setting are used on lawns, golf courses and other intensively used and maintained landscapes. Nutrients either

move with the water, like nitrogen, or are attached to eroded soil, like phosphorous. High nutrient levels in lakes and slow moving rivers can result in excessive growth of algae and other aquatic plants which can impair aesthetics, water quality, and recreational potential.

Toxicity to aquatic life: Urban runoff pollutant concentrations often exceed water quality standards. Potential toxicants include pesticides, other organic compounds, and heavy metals. Such toxicants can move with the water, in the air, attached to soil particles, or in plants and animals depending on their solubility in water, origin, mode of application, and other chemical and physical properties. While existing data are not conclusive in showing that these pollutants occur in water bodies in concentrations which are acutely toxic to aquatic biota, there is evidence to indicate that adverse impacts may result from chronic exposure and bioaccumulation of pollutants in the tissue of sensitive organisms. Factors that may worsen toxicity effects include high water temperature (discussed below) and low dissolved oxygen. Dissolved oxygen may be reduced to dangerous levels due to the decomposition of organic matter that is washed off of urban land surfaces by storm events, particularly during the summer time. Low dissolved oxygen also may be a problem during winter ice-cover conditions due to the oxygen demand of contaminated sediments and decaying plant matter. Fish kills are common in urban lakes and detention ponds as a result of such factors.

Sediment contamination: The bottom substrates of water bodies of Illinois are typically coated with a layer of contaminated sediment resulting from runoff. This sediment may interfere with the reproduction and feeding mechanisms of aquatic organisms, including fish. It also may be toxic to some sensitive organisms due to elevated concentrations of pesticides, heavy metals, and petroleum-based organic compounds. Urban runoff sediments may also have a relatively high organic content that exerts an oxygen demand as it is "broken down" in receiving water bodies.

Bacterial contamination: The water quality standard for fecal coliform bacteria is frequently violated in urban water bodies following storm events. The violation of this standard generally reflects the presence of significant animal or human waste in the water, and is commonly used as an indicator for the closing of swimming beaches. Additional tests are typically needed to verify whether the contamination is of human origin, such as from faulty septic systems or illicit connections between sanitary sewers and storm sewers.

Salt contamination: The use of salt as a deicing agent can result in extremely high salinity levels in roadside ditches and downstream water bodies. While salinity levels are typically not high enough to be acutely toxic to fish and other aquatic organisms, they may adversely impact sensitive plant communities, particularly wetland species. Further, salt and other soluble urban runoff constituents can degrade aquifers used as a source of water supply.

Impaired aesthetic conditions: Urban runoff carries a number of constituents that may impair the visual appeal and clarity of receiving water bodies. These constituents, including trash and debris, suspended solids, and oil and grease, reduce the recreational potential of many water bodies.

Elevated water temperatures: Watershed urbanization has been shown to significantly increase summertime temperatures in receiving streams. This effect is due to a number of factors, including the removal of natural shading and the reduction of base flows, as discussed below. Runoff from impervious surfaces that have been heated by the sun also contributes to this effect. The resultant elevated water temperatures are directly stressful to native aquatic life and increases water quality problems.

Impairment of water supplies: Many of the contaminants listed above adversely affect both surface and groundwater sources of water supply. While surface water impacts can be directly determined from existing data, it is much more difficult to assess the effects to groundwater because of the complexity of multiple sources and routes into underground aquifers.

Beyond their effects on runoff quality, development activities invariably alter runoff patterns by converting pervious land to impervious surfaces and compacting remaining pervious surfaces (e.g., lawns). This conversion results in dramatic increases in the rate and volume of storm runoff and reductions in groundwater recharge. Also, urban drainage features such as storm sewers and lined channels convey runoff water downstream at a much faster rate. This leads to a number of consequences, several of which are explained below.

Increased flooding: Flood flow rates have been shown to increase by 100 to 200 percent or more if a watershed is urbanized without effective stormwater detention. Local drainage problems also are made more severe. As a result, flood damages may be sustained by downstream residences and businesses, and government officials may be forced to implement expensive remedial projects.

Stream channel erosion: Increased rates of runoff and resultant high channel velocities can destabilize downstream channels leading to excessive bank erosion and/or down cutting of the channel, often threatening adjacent structures. This problem is common in Illinois streams, particularly where alterations have been made to the stream or watershed.

Hydrologic destabilization: Development generally results in higher, and more frequent storm flows, and lower and longer duration low flows. The more frequent high flows and the high velocities that accompany them can sometimes "flush out" natural substrates and bottom dwelling organisms. The lower low flows tend to concentrate stream pollutants and reduce stream depths necessary for the survival of fish. Extended low flows also can result in higher summertime water temperatures that further stress fish and other aquatic organisms.

Reduced recharge rates can also result in lower water levels in lakes and wetlands during critical dry periods.

3. Hydrologic/Habitat Modification

Some urban development directly impacts sensitive water bodies and wetlands. To accommodate development plans, streams are sometimes channelized or rerouted. Wetlands may be filled, excavated, or drained. More subtle forms of modification include the removal of native vegetation from stream banks and lakeshores. These activities not only destroy critical aquatic habitats, they also impair other valuable functions. These impacts are summarized below.

Destruction of aquatic and terrestrial habitat: Draining, straightening, vegetation removal, filling, and dredging of natural water bodies and wetlands adversely affects habitat for water dependent fish, wildlife, and waterfowl. In addition to short-term effects caused by construction, significant long-term effects often result due to the elimination of spawning and breeding areas, cover, shading, and a general reduction in habitat diversity. Often, the result of construction in a water body or wetland is the replacement of native vegetation with man-made structures such as riprap or metal retaining walls. Such man-made structures typically do not address the habitat needs of resident aquatic life and wildlife.

Water quality impairment: Construction in and adjacent to water bodies and wetlands create both long-term and short-term effects on water quality. The primary short-term effect is erosion, which was discussed previously. However, the consequences of construction in water bodies and wetlands are often much more severe than construction in upland locations because of the erosive effects of flowing water and wave action. The long-term effects of development in water bodies and wetlands relate primarily to the elimination of vegetation and other natural materials. The typical consequences of these alterations include reduced shading and a resultant increase in water temperature, reduced capacity for pollutant filtering, and an increased propensity for instability and erosion.

Alteration of natural storage and conveyance functions: While state and federal regulations place some constraints on the degree of alteration allowed in floodplains and wetlands, there may still be significant adverse impacts on natural stormwater storage and conveyance functions. Typical consequences include the reduction in stream roughness (or flow retardance) and length due to channel modifications and loss of stormwater storage due to draining or filling of small wetlands. This results in increased flow velocities and volumes, which cause stream channel erosion and increased flooding.

The ultimate concern regarding nonpoint sources is whether they impair the desired uses of water bodies and aquatic ecosystems – particularly aquatic life, swimming, and water supply uses. There now is clear evidence from Illinois and around the country that watershed urbanization has serious adverse impacts on the beneficial uses of

downstream water bodies. In northeastern Illinois, an analysis of data from over forty streams and rivers showed that virtually all streams with urban or suburban watersheds had degraded fish communities (i.e., fair to poor conditions based on the Index of Biotic Integrity). In contrast, nearly all streams in rural/agricultural watersheds had good to excellent fish communities. While this correlation may not apply statewide, it does indicate the need to better control urban nonpoint source impacts to avoid the otherwise inevitable degradation of receiving water bodies.

B. Planning Principles for Selecting and Implementing Best Management Practices

Planning principles are the overall guidelines that need to be considered to develop and implement a nonpoint source control plan that will survive the test of time and provide ecologically and economically sustainable development, while meeting the needs of society. The basic planning principles listed below apply both to new developments as well as existing sites in need of remedial BMPs.

1. Thoroughly collect, review and understand all existing local, state, federal governmental or agency rules, regulations, restrictions, codes, permits, etc.

2. Determine who can help you develop a plan that meets your needs and addresses identified resource concerns.

3. Thoroughly document the pre-development characteristics of the site and immediate surroundings, focusing particularly on topography, drainage patterns, soils, and the presence of important natural features such as streams, water bodies, wetlands, woodlands, and natural area remnants.

4. Plan the development or remedial project to fit the particular topography, soil, drainage patterns and natural vegetation of the site.

Application of these planning principles is particularly important for new developments. Good site planning is often the key to minimizing adverse environmental impacts. Effective site planning and design will result in minimal impacts to water quality, natural hydrologic characteristics, and sensitive landscape features. Site design and the application of sound planning principles are critical factors in achieving effective soil erosion and sediment control, stormwater management, and protection of stream, lake, and wetland resources as described below.

C. Planning Principles for Soil Erosion and Sediment Control

This manual describes BMPs to accomplish three basic elements of erosion and sediment control:

- Soil stabilization;

- Runoff control; and
- Sediment control.

The most important, and most often neglected, task is to provide effective soil stabilization throughout the duration of a construction project. Soil stabilization is based on a simple premise: If water cannot detach the soil, it cannot be transported (i.e., erosion does not occur). The easiest, most economical, and environmentally sound way to prevent detachment is by keeping a good vegetative cover in place. It also can be accomplished via other techniques such as mulching or use of erosion blankets.

Runoff control measures are needed to deal with concentrated runoff. Concentrated runoff is a common occurrence on large sites containing existing drainageways and is made more severe by grading activities that removes water absorbent topsoil and compact underlying soils. If concentrated runoff occurs, it will further erode the soil and carry it into streams, lakes, or road ditches. The basic principles behind runoff control measures are to provide stabilized channels for runoff water and to divert concentrated runoff from exposed, erodible soils.

Once the soil is detached, flowing water transports the soil to downslope positions. Sediment control measures are needed to filter, trap, or otherwise remove eroded sediments before they can leave the construction site.

In implementing the erosion and sediment control BMPs described in this manual, it is important to understand them in the context of an overall construction site plan. The following site design, management, and maintenance principles should be implemented on all construction sites.

1. Plan the development to fit the particular topography, soil, drainage patterns and natural vegetation of the site.
2. Preserve and protect areas of natural vegetation on the site.
3. Take special precautions to prevent damages that could result from development activity adjacent to watercourses, lakes, and wetlands.
4. Minimize the extent and duration of the area exposed at one time.
5. Apply temporary erosion control practices as soon as possible to stabilize exposed soils and prevent on-site damage.
6. Install sediment basins or traps, filter barriers, diversions, and perimeter control practices prior to site clearing and grading to protect the disturbed area from off-site and onsite runoff and to prevent sedimentation damage to areas below the development site.
7. Keep runoff velocities low and retain runoff on the site, as much as possible.

8. Provide measures to prevent sediment from being tracked onto public or private roadways.

9. Implement final grading and install permanent vegetation on disturbed areas as soon as possible.

10. Implement a thorough inspection, maintenance, and follow-up program.

D. Planning Principles for Stormwater Management

This manual describes BMPs to accomplish two basic elements of stormwater management:

- Drainage control; and
- Detention.

In implementing drainage and detention BMPs, however, it is critical that site design decisions reflect the ultimate goal of effective stormwater management--*to minimize the adverse impacts of stormwater runoff both onsite and offsite*. In other words, stormwater management should be looked at as part of the whole watershed, not just the site being developed.

The philosophy endorsed in this manual is to develop stormwater systems that mimic, as closely as possible, the runoff process of the site in its natural state. This philosophy involves the preservation of natural storage, infiltration, and filtering functions.

The primary objectives of the recommended stormwater management approach are to: 1) minimize water quality degradation; 2) minimize downstream channel erosion and habitat loss; 3) maintain natural base flows and groundwater recharge; 4) prevent increases in downstream flooding; 5) provide opportunities for multiple use of drainage and storage facilities; and 6) provide for economical, safe, aesthetic, and socially acceptable drainage within new developments.

Ideally, stormwater management based on this philosophy will not only preserve beneficial uses of downstream water bodies but also will reduce drainage system construction costs. This is accomplished by minimizing the need for expensive capital improvements to the existing drainage system to convey, store, and treat increased runoff volumes and rates.

In order to achieve these objectives, the following site planning and design principles should be implemented on all developments. These principles constitute what is sometimes called a runoff reduction hierarchy.

1. Plan the development to fit the particular topography, soil, drainage patterns and natural vegetation of the site.

2. Minimize impervious surfaces on the property, consistent with the needs

of the project, to maximize infiltration opportunities.

3. Reduce flows by use of open vegetated swales, filter strips, and natural depressions and preserve existing natural drainageways.

4. Infiltrate runoff on-site, as allowed by local soil conditions.

5. Provide stormwater detention designed to emulate natural wetland and pond systems.

6. Construct storm sewers only on an as-needed basis.

E. Planning Principles for Special Area Protection

The final category of BMPs included in this manual deal with the protection and restoration of special areas, including:

- Streambanks and shorelines;
- Wetlands and water bodies;
- Trees and native vegetation (including natural areas);
- Steep slopes; and
- Karst areas.

The objectives of special area protection include the preservation of important recreational and habitat amenities and the restoration of degraded resources to a higher functional level. Ultimately, accomplishing these objectives will require site planners to view natural areas from the perspective of long-term sustainability. Planners and developers also should view protection and restoration of natural areas in terms of their positive impacts on site aesthetics, marketing, property values, and reduced long-term maintenance.

The following site planning and design principles will aid decision-makers in identifying and implementing appropriate BMPs.

1. Plan the development to fit the particular topography, soil, drainage patterns and natural vegetation of the site.

2. Consider the unique characteristics of a site, particularly natural areas, as potential amenities which can enhance the aesthetics, land value, and marketing potential of the development.

3. Avoid, wherever possible, the disturbance of existing natural areas including stream corridors, lakes, wetlands, native woodlands and prairies, steep slopes and karst.

4. Protect the integrity and long-term health of natural areas through the utilization of buffers, setbacks, and cluster development techniques.

5. Where feasible, utilize native vegetation and natural materials in the design of BMPs based on local soil, topographic, and pre-settlement vegetation conditions.

Best Management Practices (BMPs)

Section 4 of this manual contains standards for best management practices (BMPs). These BMPs address site-specific NPS pollution problems and opportunities. These practices have been listed two ways: alphabetically and grouped to address the three principal topics identified above (soil erosion and sediment control, stormwater management, and special area protection). These listings should be useful for selecting individual practices or grouping practices to protect or enhance the planned site, as well as adjacent or downstream areas.

It also should be noted that while a practice may be listed in a particular topical area, the same practice also may be applicable in another area. For example, the most common application of a level spreader is probably a stormwater management BMP to evenly distribute runoff from an impervious surface onto a filter strip. Level spreaders also may be used to minimize erosion by dispersing concentrated runoff on construction sites or to establish and maintain desired hydrologic conditions in wetlands.

To implement effective site planning and BMP selection one must understand the preceding NPS pollution processes and follow sound planning principles. The Practice Selection Guide in Table 2.1 indicates the relative impacts that individual practices have on specified problems. Planning procedures, as described in Section 3 of this manual, will assist with problem identification and selection of practices or groups of practices. Section 8 of this manual contains evaluation criteria and provides information relative to effectiveness for addressing a broad spectrum of resource concerns, whether soil, water, air, plant, or animal.

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U.S. Environmental Protection Agency, *Results of the Nationwide Urban Runoff Program*, Washington, D.C., December, 1983.

Practice Selection Guide

TABLE 2.1 PRACTICE SELECTION GUIDE — January 2013 selguide.xls

NAME	CODE	BRIEF DEFINITION	Sheet & Rill Erosion	Rill & Gully Erosion	Streambank Erosion	Stream Channel Erosion	Toxics & Salt Reducion	Flooding	Increased Peak Flow	Nutrient Pollution	Pesticide Pollution	Sediment Damage	Dust Control	Construction Road Maintenance	Water Table Control	Organic Pollution
Bioretention	800	Constructed wetland to improve stormwater quality				3	3	3	3	3	3	3			3	3
Cofferdam	803	Temporary structure designed to provide a dry work area					2			2	2	3				2
Construction Road Stabilization	806	Stabilize temporary roads to reduce erosion		3								2	2	3		
Culvert Inlet Protection	808	Temporary sediment filter at culvert inlets										2				
Dewatering	813	Removal of water from construction sites								1		1			1	
Diversion	815	Channel and ridge constructed to collect and divert runoff	2	2	1		1	1		1	1	1				
Diversion Dike	820	Perimeter dike to manage and divert runoff	2	2	1		1	1		1	1	1				
Dust Control	825	Controlling dust on construction sites and roads	1				1						3	1		
Erosion Control Blanket	830	Preformed degradable erosion blanket	2		1	1				1	1	2	1			
Erosion Control Blanket - TRM	831	Preformed nondegradable erosion mat	2		2	3				1	1	2	1			
Filter Strip	835	Vegetated filter zone to remove pollutants			2		1			1	1	2				
Grass-Lined Channels	840	Natural or constructed channel vegetated to convey water		2		2		1		1	1	1			1	
Infiltration Trench	847	Pits or trenches designed to hold water to increase infiltration	1	1				1	1	1	1					
Inlet Protection-Excavated Drain	855	Excavated area to trap sediment at storm drain inlet								1	1	1				
Inlet Protection-Fabric Drop	860	Temporary practice to control sediment at storm drain inlet								1	1	2				
Inlet Protection - Paved Areas	861	Temporary sediment control barrier at storm drain inlet								1	1	1				
Inlet Protection-Sod Filter	862	Sediment filter using sod around a storm drain drop inlet								1	1	1				
Inlet Protection - Unpaved Areas	863	Temporary practice to control sediment at storm drain inlet								1	1	1				
Land Grading	865	Smoothing surface to planned grade to improve site	2	2				1		1	1	1		2		
Level Spreader	870	Structure to spread water flow uniformly	1	1	1					1	1	1				
Lined Channel or Outlet	872	A constructed channel or outlet having an erosion-resistant lining		3								2				
Mulching	875	Placing materials to protect soil surface	2	2	1				1	2	2	2	2			
Open Channel	878	Construction of or improvement to a channel in which water flows						2								
Permanent Vegetation	880	Establishing permanent vegetative cover	3	3	2		2	2	2	3	3	3	3	1		
Permeable Pavement	890	Pavement having interspersed sod, gravel, or sand areas	1	1				1	1	1	1					
Polyacrylamide (PAM) for Temporary Soil Stabilization	893	Agent to bind soil and prevent erosion.	3	1								3	3			
Polyacrylamide (PAM) for Turbidity Reduction and Sediment Control	894	Agent to flocculate fine silts and clay in stormwater.						1		2		3				
Portable Sediment Tank	895	Container for trapping sediment from runoff water								1	1	2				
Right-of-way Diversion	900	Structure to control roadway erosion		1				1				1		2		
Rock Check Dam	905	Structure to control erosion in ditch or grass swale		3								2				
Rock Outlet Protection	910	Rocked area at outlets to reduce flow erosion		2		2						1				
Silt Curtain	917	Temporary sediment barrier of geosynthetic fabric in a water body			2					1		1				
Silt Fence	920	Temporary sediment barrier of filter fabric	3	2						1	1					
Sodding	925	Laying blanket of established turf to protect area	3	3	2		1	2	2	3	3	3	3	1		
Stabilized Construction Entrance	930	Rock pad at entrance or exit to control tracking of mud to streets										1		3		
Structural Streambank Stabilization	940	Structure to control streambank erosion			3							2				
Subsurface Drain	945	An underground water collection and transport tube	1	1	2		2	1	2	1	1	1		2	3	
Sump Pit	950	Temporary pit to trap and filter water								2	2	2				
Surface Roughening	953	Grooving, stair stepping, or tracking across a slope	1	1					1			1				
Temporary Concrete Washout Fac.	954	Management of solid and liquid wastes from concrete					3					2				
Temporary Diversion	955	Temporary diversion for runoff control	2	2	1		1	1		1	1	1				
Temporary Sediment Trap	960	Temporary ponding basin to trap sediment		1					1	1	1	2				
Temporary Seeding	965	Planting vegetation to protect areas from erosion	3	2	2		2	2	2	2	2	2	2			
Temporary Slope Drain	970	Short term water conveyance down a sloping area		2						1	1	1		1		
Temporary Stream Crossing	975	Short term stream crossing for equipment			1	1								2		
Temporary Stream Diversion	976	Short term stream diversion to allow construction in the dry.				1						6				
Temporary Swale	980	Temporary excavated drainageway to control runoff		1		1		1		1	1	1				
Topsoiling	981	Adding or replacing quality soil to the surface	2	1			2	1	1	1	1	1				
Tree/Forest Ecosystem Preservation	984	Protecting contiguous stands of trees from construction damage	2	2	2			2	1	3	3	1	2		1	
Tree and Shrub Planting	985	Planting trees and shrubs	3	3	3		2	1	2	3	3	3	3		2	
Tree Protection	990	Protecting individual trees from construction damage	1	1	1			1	1	1	1	1	1		1	
Tree Protection-Augering	991	Protecting individual trees from underground construction damage	1	1	1			1	1	1	1	1	1		1	
Vegetative Streambank Stabilization	995	Vegetation to control streambank erosion			3					1	1	1				
Well Decommissioning	996	Permanent sealing of a water well, boring, or monitoring well								3	3					3

Section 3

Planning Procedures

Introduction

Selection and design of best management practices (BMPs) must involve more than choosing a practice from a list and installing it on a site. It also involves a planning process which considers the problem to be avoided, or remediated, and also factors in the characteristics of the site. Advance planning should occur first in the development of local ordinances in which local governments identify appropriate BMP requirements for new development. Such advance planning will reduce the burden on developers and facilitate the selection of BMPs.

In the context of remedial projects, however, there typically will be no ordinance or "cookbook" to follow. In this setting, planning becomes even more critical in the selection and design of appropriate BMPs.

Planning involves more than simply managing or treating individual problems or resources. It involves a careful, deliberate, and organized approach that is centered on purpose, problem identification, analysis, evaluation, decision-making, and maintenance.

This section of the manual outlines and explains a procedure to identify problems, needs, and objectives; how to inventory, analyze and evaluate BMP alternatives; and finally, how to select and implement practices based on social, environmental, and economic considerations.

Although this manual was developed primarily to address non-point source (NPS) pollution issues, the use and application of the standards are intended to protect, conserve, and enhance natural resources. If planning is approached in this manner, the human impact on the ecosystem will be minimized and related adverse impacts, such as increased flooding, will be minimized.

The Procedures section will cover the following major issues:

A. Planning process;

B. Criteria for BMP selection;

C. Practices and systems; and

D. Evaluation and monitoring.

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All sites being developed will vary in their suitability for different types of development. Knowing the soil type, topography, natural landscape values, drainage area, on and offsite hydrology, flooding potential and other pertinent data helps to identify both beneficial features and potential problems of a site and adjacent areas. Generally, the location of the site has already been determined. What is needed then are the best procedures for identifying and addressing potential or existing problems, or to address established restrictions, ordinances, or regulations to develop a site in a quality manner.

A. Planning Process

The process outlined in this manual is a standard process used by NRCS and others. It is a nine-step process that is fully explained in NRCS's National Planning Procedures Handbook.

The nine steps are outlined below:

1. Identify problems - Identify existing, potential, and perceived natural resource problems, opportunities and concerns, including short-term and long-term issues relating to site resources and offsite impacts. As planning progresses and additional information is gathered, other problems and opportunities may be identified.

2. Determine objectives - Determine how the site will be used, what are the site features, what should be enhanced, and what rules, codes, or restrictions need to be addressed. Develop an understanding of the desired future conditions for the planning area as compared to the existing conditions. This includes the desired resource uses, resource problem reductions, and on-site and off-site ecological protection. Non-point source control processes and planning principles are discussed in Section 2. As resources are inventoried, their interactions analyzed, and alternatives formulated, objectives may need to be reviewed and modified.

3. Inventory resources - Collect appropriate natural resource (soil, water, air, plant, and animal), economic, and social information about the planning area. Also consider impacts offsite, such as water running onto or through the site. Use this information to further define existing and potential problems and opportunities, clarify concerns, and to formulate and evaluate alternatives. Gather information as needed concerning the affected resources, the human considerations, and operation and management.

4. Analyze resource data - Study the resource data and clearly define the natural resource conditions, including limitations to their use and potentials. This step provides the information needed to formulate and evaluate alternatives. The analyses should clearly establish the cause and effect relationships and provide information about existing and future conditions. Qualify and quantify resource use and development impacts. Appendix C "Methods for Estimating Water Quality Impacts of Urban and Suburban Development" contains methods to

estimate the impacts of development.

5. Formulate alternatives - Develop alternatives that will achieve the objectives, solve the identified problems, take advantage of opportunities, and prevent additional problems from occurring. Alternative practices are selected from BMPs in Section 4 and may need to be grouped into systems to address multiple problems. Include measures that mitigate potential adverse impacts on the resources and address regulatory requirements.

6. Evaluate alternatives - Evaluate the alternatives to determine their effectiveness in addressing the problems, opportunities and objectives. Alternatives should pass the tests of feasibility and acceptability -- socially, economically and environmentally - or adjustments should be made.

7. Make decisions - The decision-maker determines which alternative(s) to implement and the necessary documentation is prepared. Public review and comment are obtained, if needed, before a decision is reached. Alternatives chosen are in compliance with all applicable regulations.

8. Implement plan - Implementing the plan includes installing BMPs and obtaining necessary permits, funding, land rights, surveys, final designs, and inspections. It also includes the operation, maintenance, and management needed to assure proper functioning of practices following installation. Practices are implemented per the site plan to achieve short term and long term objectives and goals.

9. Evaluate plan - Evaluate the effectiveness of the implemented plan to ensure that it is functioning as planned and achieving the objectives; to identify reasons for lack of progress in plan implementation, if applicable; and to obtain information on the applied treatment. Where the actual results differ from those anticipated, provide feedback into the planning process. This could include revision of quality criteria; modification of indicators/target values; changes to current practice standards; and revision of other Urban Manual data.

The outlined procedure works best if certain pre-planning activities have occurred. Some of these activities include:

1. Define the site planning area on a map.

2. Order or prepare needed work maps and determine map bases and scales.

3. Determine planning objectives and needs, particularly how they relate to ordinances, regulations, and restrictions relating to site development and use.

4. Assemble existing information and data on soil, water, air, plant, and animal resources on and around the site.

5. Determine who needs to be involved in the planning and review processes.

6. Consider data needs for the site.

7. Prepare a draft work plan that identifies action items, responsible parties, and deadlines.

Good pre-planning will expedite and improve the planning process.

B. Criteria for BMP Selection

Once problems or issues are identified, it becomes paramount to establish goals for BMP selection. Many of the goals are established as part of local, state, or federal laws or as part of existing ordinances and codes. The development of the plan and nature and extent of treatment will be guided by these goals.

Section 2 of this manual identifies non-point source impacts and describes the principles for controlling these impacts with the practices contained in Section 4. Section 8 provides guidance for evaluating the relative impact that individual practices have on identified problems and other soil, water, air, plant and animal resources. This should be used to guide decisions on the best practice or combination of practices that solve the identified or potential problems without creating new problems.

The NRCS, along with others, have established treatment levels that correspond with soil, water, air, plant, and animal resource concerns. These standards are established in the NRCS's Field Office Technical Guide, Section 3.

C. Practices and Systems

The core of this manual is the BMP standards, construction specifications, material specifications, and standard drawings which are contained in Sections 4, 5, 6 and 7, respectively. These sections are meant to be dynamic and expandable. As new information becomes available, and field experience evolves, updates and additions will be prepared as determined by the agencies supporting the manual.

However, updates and additions will also depend on the needs of units of government and other users. As users, you can guide the nature of changes by personal contact with the agencies involved in preparation of the manual. Practices not currently provided in this manual may be obtained from several of the other sources identified in the reference section. Additional practice standards and related materials will be developed as needs indicate.

Users must understand that typically several practices will be needed to meet established criteria for addressing any given problem or resource concern. When a combination of practices is evaluated together, it is termed a system, or *treatment train*. A system is often needed to fully address any problem or concern. If there are multiple issues to plan treatment for, the complexity of the system may require additional practices. The development of the appropriate system involves the analysis of the following items:

1. Nature and extent of problem(s)
2. Onsite versus offsite considerations
3. Short term versus long term solutions
4. Treatment requirement standards
5. Long term maintenance considerations
6. Economic considerations
7. Regulatory requirements

D. Evaluation and Monitoring

The best practices for addressing key problems and concerns are identified in Table 2.1 in Section 2. A broader evaluation of the practices on a more complete range of problems or issues is contained in Section 8. On any given site these general rankings may be different than indicated. They are meant to provide a relative range of effectiveness and should be used as a guide. Qualified and experienced professionals in the natural resource field should be consulted to adequately assess the impacts of any proposed actions.

Monitoring of BMP effects should accompany plan implementation, where appropriate and feasible. The effects of the practice or system should normally be observable and some of the indicators listed in Section 2 might be used to qualify results. Revisions to plans should always be considered if unexpected problems or changes to use and management occur.

Section 4

Practice Standards

Introduction

This section contains the best management practice (BMP) standards. Each standard includes the following information:

- Definition
- Purpose
- Conditions where practice applies
- Criteria (including minimum or maximum requirements)
- Considerations
- Plans and specifications
- Operation and maintenance
- References

The standards in this section are generally filed in alphabetical order by the name of the practice. This also corresponds to the numerical order for practice code number. A list of the practices grouped into categories based on their principal applications is also provided for cross-reference. This listing is grouped as follows:

Soil Erosion and Sediment Control (SE/SC)

- Soil stabilization
- Runoff control
- Sediment control
- Miscellaneous SE/SC

Stormwater Management

- Drainage control
- Detention

Special Area Protection

- Streambanks and shorelines
- Wetlands and water bodies
- Trees and native vegetation (including natural areas)
- Steep slopes
- Karst areas

As indicated previously, however, some standards (e.g., level spreader or filter strip) may be used for multiple applications.

Standards are usually used in groups as a system to solve a particular concern or multiple concerns. Standards should be selected by professional engineers, planners, site designers, or other natural resource specialists and based on the principles described in Section 2, since any particular standard will not work in all cases.

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List of Urban Standards (Alphabetical)

Name	Code	Date
Urban Stormwater Wetlands*	800	8/94
Cofferdam	803	1/2013
Compost Blanket	804	12/2011
Compost Filter Sock	805	12/2011
Construction Road Stabilization	806	1/99
Culvert Inlet Protection	808	1/99
Dewatering	813	6/10
Ditch Check (Manufactured)	814	12/2011
Diversion	815	3/94
Diversion Dike	820	2/94
Dust Control	825	2/94
Erosion Control Blanket	830	6/09
Erosion Control Blanket – Turf Reinforcement Mat (TRM)	831	2/2011
Filter Strip	835	1/99
Grass - Lined Channel	840	10/01
Infiltration Trench	847	1/99
Inlet Protection - Excavated Drain	855	2/94
Inlet Protection - Fabric Drop	860	2/94
Inlet Protection – Paved Areas	861	11/99
Inlet Protection - Sod Filter	862	11/99
Land Grading	865	2/94
Level Spreader	870	1/99
Lined Channel or Outlet	872	9/2012

Mulching for Seeding and Soil Stabilization	875	6/2010
Open Channel	878	9/2012
Permanent Vegetation	880	10/01
Permanent Vegetation (Table A)		
Grass, Forb & Sedge Species for Low Maintenance Areas	880a	10/2001
Permanent Vegetation (Table B)		
High Maintenance (Turf Grass) Seed Mixtures	880b	10/2001
Permanent Vegetation (Table C)		
Ground Covers & Vines	880c	10/2001
Permeable Pavement	890	1/99
Polyacrylamide (PAM) for Temporary Soil Stabilization	893	9/2011
Polyacrylamide (PAM) Turbidity Reduction & Sediment Control	894	9/2011
Portable Sediment Tank	895	3/94
Right-of-Way Diversion	900	2/94
Rock Check Dam	905	1/99
Rock Outlet Protection	910	8/94
Silt Curtain – Floating	917	5/2012
Silt Fence	920	4/2012
Sodding	925	12/94
Stabilized Construction Entrance	930	8/94
Structural Streambank Stabilization	940	8/94
Name	Code	Date
Subsurface Drain	945	8/94
Sump Pit	950	8/94
Surface Roughening	953	11/99
Temporary Concrete Washout Facility	954	6/09
Temporary Diversion	955	8/94
Temporary Sediment Trap	960	10/01
Temporary Seeding	965	12/94
Temporary Slope Drain	970	8/94
Temporary Stream Crossing	975	8/94
Temporary Stream Diversion	976	9/2011
Temporary Swale	980	2/94
Topsoiling	981	2/94
Tree and Forest Ecosystem Preservation	984	4/00
Tree and Shrub Planting	985	8/94
Tree Protection	990	4/00
Tree Protection - Augering	991	4/00
Vegetative Streambank Stabilization	995	8/94
Well Decommissioning	996	11/99

* This practice was originally entitled Artificial Wetland. It is currently being revised and will be renumbered as soon as it has been finalized and approved.

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AISWCD

List of Urban Standards (Problems Addressed)

Name (Code)	Date
Soil Erosion and Sediment Control (SE/SC)	
Soil Stabilization	
Compost Blanket (804)	12/2011
Compost Filter Sock (805)	12/2011
Construction Road Stabilization (806)	1/99
Ditch Check – Manufactured (814)	12/2011
Erosion Control Blanket (830)	6/2009
Erosion Control Blanket = Turf Reinforcement Mat (831)	2/2011
Land Grading (865)	2/94
Mulching for Seeding and Soil Stabilization (875)	6/2010
Permanent Vegetation (880)	10/2001
Polyacrylamide (PAM) for Temporary Soil Stabilization	9/2011
Polyacrylamide (PAM) for Turbidity Reduction & Sediment Control	9/2011
Rock Outlet Protection (910)	8/94
Sodding (925)	12/94
Surface Roughening (953)	11/99
Temporary Seeding (965)	12/94
Topsoiling (981)	2/94
Runoff Control	
Ditch Check – Manufactured (814)	12/2011
Diversion (815)	3/94
Diversion Dike (820)	2/94
Right-of-Way Diversion (900)	2/94
Rock Check Dam (905)	1/99
Temporary Diversion (955)	8/94
Temporary Slope Drain (970)	8/94
Temporary Swale (980)	2/94
Sediment Control	
Compost Filter Sock (805)	12/2011
Culvert Inlet Protection (808)	1/99
Inlet Protection - Excavated Drain (855)	2/94
Inlet Protection - Fabric Drop (860)	2/94
Inlet Protection – Paved Areas (861)	11/99
Inlet Protection - Sod Filter (862)	11/99
Polyacrylamide (PAM) for Temporary Soil Stabilization (893)	9/2011
Polyacrylamide (PAM) for Turbidity Reduction & Sediment Control	9/2011
Portable Sediment Tank (895)	3/94
Silt Curtain – Floating (917)	5/2012

Silt Fence (920)	4/2012
Stabilized Construction Entrance (930)	8/94
Sump Pit (950)	8/94
Temporary Sediment Trap (960)	10/2001
Miscellaneous SE/SC	
Dewatering (813)	6/10
Dust Control (825)	2/94
Temporary Concrete Washout Facility (954)	6/09
Temporary Stream Crossing (975)	8/94
Temporary Stream Diversion (976)	9/2011

Stormwater Management

Drainage Control	
Filter Strip (835)	1/99
Grass-Lined Channel (840)	10/2001
Infiltration Trench (847)	1/99
Level Spreader (870)	1/99
Name (Code)	Date
Open Channel (878)	9/2012
Permeable Pavement (890)	1/99
Subsurface Drain (945)	8/94
Detention	
Urban Stormwater Wetlands (800)	8/94

Special Area Protection

Streambanks and Shorelines	
Dewatering (813)	6/2010
Erosion Control Blanket – Turf Reinforcement Mat (TRM)	2/2011
Structural Streambank Stabilization (940)	8/94
Vegetative Streambank Stabilization (995)	8/94
Temporary Stream Diversion (976)	9/2011
Wetlands and Waterbodies	
Cofferdam (803)	1/2013
Well Decommissioning (996)	11/99
Temporary Stream Diversion (976)	9/2011
Trees and Native Vegetation	
Tree and Forest Ecosystem Preservation (984)	4/2000
Tree and Shrub Planting (985)	8/94

Tree Protection (990)	4/2000
Tree Protection - Augering (991)	4/2000

Steep Slopes

Karst Areas

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Section 5

Construction Specifications

Introduction

This section contains construction specifications and instructions for their use. The construction specifications along with material specifications (see Section 6) make up the contract specifications and can be used as the requirements in construction contracts. To make the construction specifications complete the last section must be written to identify the specific methods that apply, identify and describe bid items, and list any specific instructions that pertain to the job under construction. This last section is normally shown with the heading ITEMS OF WORK AND CONSTRUCTION DETAILS.

The construction specifications and instructions for use are from NRCS's National Engineering Handbook Series (NEH) Part 642 (formerly referred to as NEH Section 20) as well as several state interim specifications. The interim specifications are numbered starting at 200 and do not usually have a corresponding instruction for use.

A general discussion is included that describes how a bid schedule is set up, how construction specifications are compiled, and how construction details and bid items are set up in the specifications. Some examples are included in the discussion. The discussion is an abridged version from NEH Part 642.

Current updates of construction specifications from NRCS's National Engineering Handbook Series Part 642 can be found at http://www.ftw.nrcs.usda.gov/nehcs.html. The notice for the May 2001 release of the construction specifications in Part 642 identified revisions to Construction Specification 51 - Corrugated Metal Pipe and Construction Specification 94 - Contractor Quality Control. These changes are reflected in this release of Chapter 5 of the Illinois Urban Manual. The dates on the other construction specifications have not been updated; however, the technical content of all other construction specifications has not likely changed.

General Discussion

The body of a construction contract consists of general provisions, a bid schedule, specifications, drawings, inspection requirements, performance time, contract administration data and, when applicable, special provisions and wage rate decisions. Typically the general provisions are administrative and technical requirements that apply to all items of construction and to all contracts. The bid schedule tabulates the items of work for which direct payment will be made, shows the estimated quantities of work and the units of measurement, and provides space for the entry of contract prices. The specifications and drawings include the technical details and requirements of the contract. The office responsible for the design of the work develops the drawings and specifications and, in cooperation with the responsible administrative office, the bid

schedule. The special provisions are administrative instructions and requirements that apply to the specific contract and are prepared by the responsible administrative office.

Terms and Definitions

The following terms and definitions are used relative to specifications for construction contracts:

National Standard Construction Specifications state the technical and workmanship requirements for the various operations required in the construction of the works, the methods of measurement, and the basis of payment.

National Standard Material Specifications state the quality of materials to be incorporated in the permanent works. The material specifications make up Section 6 of this manual.

Interim Specifications are specifications prepared for use in contracts that include construction items or materials not covered by National Standard Specifications.

Standard Specifications are National Standard and Interim specifications.

Construction Details are prepared by the design office and state the special requirements peculiar to a specific work of construction. They may take the form of written addenda to the standard construction specifications or notes on the drawings.

Contract Specifications are the complete specifications prepared for a specific contract and consist of construction and material specifications supplemented by lists and descriptions of items of work and construction details.

National Standard Construction Specifications

National standard construction specifications are to be used verbatim. Some national standard specifications have sections that contain alternative methods of achieving work. The specification writer may delete the methods not used in the contract; however, the method selected must be used verbatim. Only methods identified in the specification may be deleted from the national standard construction specification. Each of the national standard construction specifications is supplemented by instructions for its use. These instructions state the applicability of the specification and discuss the items of information that must be included in the contract specifications and drawings in order to completely define the specified item. They also discuss the conditions under which it may be appropriate to use any of the various methods listed. These instructions are included for use by design personnel and are not to be included in contract specifications.

National Standard Material Specifications

National standard material specifications have been prepared for those materials whose quality must be uniform in all areas of applicability. National standard material specifications are to be used verbatim. They are not supplemented by instructions for use. Items of information that must be included in the contract specifications in order to completely describe the materials required for a specific contract are listed in the instructions for use of the construction specifications to which the material specifications are complementary.

Reference to material specifications may be in national standard construction specifications or may be placed in the construction details (either written in the specifications or noted on the contract drawings).

Interim Specifications

Interim specifications are for items that are not covered by national standard construction and material specifications. Interim specifications follow the same format as the national standard specifications. They are typically unique to a specific locality and therefore are not national in scope.

Selecting Appropriate Standard Specifications

The type of work to be done or the type of structural detail required will often dictate the construction method or sequence. The specification requirements must be compatible with the methods that must be used. The specification writer must also make sure that the methods selected in one specification are compatible with those selected in another. For example, the method of designating pay limits for excavation and earthfill.

Bid Schedule

The bid schedule forms the basis for payments to the Contractor and must list all items of work for which direct payment will be made. Since the efficiency of contract administration is directly affected by the manner in which the schedule is organized, the preparation of the bid schedule requires the close cooperation of the responsible design engineer and the contracting officer. Operating procedures must include provision for administrative review of the bid schedule in the early stages of its development as well as upon completion.

Designating the Items of Work

Considerable judgment based on design, construction, and contracting experience is required to divide the work into items for inclusion in the bid schedule. The schedule must be sufficiently comprehensive to allow the Contractor to make reasonably accurate estimates of the cost of doing the work and to enable the Contracting Officer to keep orderly records of work progress and to accurately compute progress and final

payments due; on the other hand, the number of scheduled items should be held to the minimum needed to accomplish these purposes. The practicable extent to which the work should be divided into scheduled items must be judged in light of the quantities of work involved and local construction practices and procedures. The bid schedule should include those items necessary to result in fair and equitable treatment of the owner(s) and the Contractor.

Division of the Work into Items For maximum efficiency of contract administration, the work should be divided into items on the basis of the following principles:

1. **The work should be divided into items in a manner that will insure reasonable refinement of unit prices.** The cost of any given type of work will vary according to its complexity and the complicating effects of the conditions under which it must be done. Generally, the scope of a bid item should be limited to a given type of work of a particular order of complexity and cost. Exceptions to this rule may be justified on small jobs involving relatively small quantities of work.

2. **The work should be divided into items in a manner that will prevent confusion of supplemental job requirements.** Similar types of work may involve different sizes of components or different qualities of materials. To prevent confusion, each variation of a given type of work should be established as a separate item of work. Also, the grouping of non-related items or similar components of separate works of improvement should be avoided.

3. **The work should be divided into items in a manner consistent with the cost sharing arrangements established in the work plan and the project agreement.** For many projects, certain works of improvement may be paid for entirely or partially by different sponsoring organizations. To facilitate accounting of project costs, the work for such improvements should be established as separate items of work in the bid schedule.

Numbering and Titling

Bid items must be numbered consecutively beginning with the number one (1). Sub-item numbers shall not be used. Each bid item shall be given a descriptive title that distinctly identifies the work to be done. **All items that involve significant quantities of work (or significant procurement cost in the case of prefabricated units) should be designated as separate bid items.**

Pay Items

Measurable items whose quantities may be subject to variation should be designated for payment on a unit price basis, and the estimated quantity of work and units of measurement must be shown in the schedule. Items that involve significant quantities of work, but are not conveniently measurable or whose quantities are not subject to

variation, may be designated for payment on a lump-sum basis. An item involving a **relatively insignificant** quantity of work that is subject to only **very minor variation** may be designated as a subsidiary item, compensation for which is included in the payment for another item which has a logical relationship to the subsidiary item. Subsidiary items will not be numbered nor listed in the bid schedule, but must be designated and described in the "Items of Work and Construction Details" of the item and also referenced in the "Items of Work and Construction Details" Section of the specification for the pay item to which it is subsidiary.

Units of measurement must be compatible with the measurement and payment clauses of the specifications.

Example 1
A typical bid schedule format is demonstrated by the following:

Bid Schedule

1	Clearing, Class A	1	12.5	ac.	_____	_____
2	Mobilization & Demobilization	8	1	Job	xxxx_	_____
3	Excavation, Common	21	300	cu. yd.	_____	_____
4	Loose Rock Riprap	61	500	ton	_____	_____

Contract Specifications

Contract specifications shall consist of an assembly of the appropriate standard construction and material specifications. Each construction specification will be supplemented by a Section entitled: "Items of Work and Construction Details". The supplemental Section of each construction specification shall: (1) be prepared especially for each invitation; (2) designate by number and title all of the bid items (exactly as numbered and titled in the bid schedule) to be performed in conformance with the requirements of the specification; (3) designate all subsidiary items to be performed in conformance with the requirements of the specification; (4) for each designated item of work, state such supplemental requirements and items of information as are needed to relate the construction specification to the job at hand; (5) bear the number that is next in sequence after the number of the last Section of the standard specification; and (6) be inserted into the contract specification as the last page(s) of the construction specification.

Compilation

A contract specification must conform verbatim to the standard construction or material specification except, in a Section for which the standard specification offers methods, not all of the methods need to be included in that Section of the contract specification or be a one-time-use specification. The methods selected must be compatible with one another and with the conditions, materials and methods prevalent in the area of applicability and the requirements of the specified structural element.

More than one method may be included in any Section of a construction specification, in which case, the methods shall be numbered sequentially (i.e., Method 1, Method 2, etc.). The method applicable to each respective item of work, material, measurement and payment shall be identified in the construction detail Section. The instruction for each construction specification identifies the optional methods and provides guidance on their use.

Identifying

The title of each contract specification shall be the same as that of the standard construction or material specification.

When a construction specification is modified for a specific job by deleting specific methods from the standard specification, the state abbreviation and project name shall be added below “NRCS-IL-URB” in the lower left corner to indicate to the user and reviewers that the standard specification has been modified. The date at the bottom of the pages of the national standard specification shall not be changed. The pages should be renumbered consecutively.

When a construction specification is not modified by deleting specific methods from the standard specification, the numbering and footer information on the standard specification shall not be changed.

The Items of Work and Construction Details pages shall have the state abbreviation and the project name below “NRCS-IL-URB” in the lower left corner, the same page numbering format as the standard specification centered at the bottom of the page, and the date of compilation in the lower right corner.

Measurement and Payment

Each construction specification contains a Section that describes the method measurement to be used for the work performed or the material furnished and the manner of payment to be made in full compensation of the work described. The basis for designating separate work items was described earlier under the “Bid Schedule” Section. Within the conditions described therein, each of the construction specifications may be modified to include a lump sum payment method. The format and working of the method will generally be as follows:

For items of work for which specific lump sum prices are established in the contract, the quantity of work will not be measured for payment. Payment for this item will be made at the contract lump sum price for the item and will constitute full compensation for completion of the work.

Preparing Construction Details

The construction details for each item of work should be concise and will normally contain (see individual instruction for use of each construction specification):

1. Such definitions and descriptions as are needed to define the scope of work;
2. The information required to define the types and qualities of materials to be used in the work;
3. Special requirements such as foundation preparation, grading tolerances, provisions for coordinating with other work, obtaining “As Built” geology data, etc.; and
4. Other items of instruction necessary to define the construction requirements peculiar to the item of work.

The construction details should contain only such information and instructions as are needed to relate the construction specification to the job at hand. It is neither necessary nor desirable to emphasize or attempt to interpret provisions of the specification by repetition of the provisions in the construction details in the same or similar words.

In preparing construction details, it must be recognized that notes on the drawings have the effect of specifications in defining the type and quality of materials to be furnished and in defining the scope of the work. Supplemental information or requirements that are directly related to details shown on the drawings may be stated in notes on the drawings rather that in the specifications if that arrangement will more conveniently and effectively convey the information to the appropriate individuals that will benefit from this data. The engineer responsible for the design must use good judgment in deciding where various supplemental data should be located for maximum effectiveness. Usually, information shown by notes on the drawings need not be repeated in the specifications; however, if there is a compelling reason for doing so, great care must be taken to prevent conflicts between the notes and the specifications.

Construction details should not conflict with or interpret the general terms and conditions of the contract. They may modify a clause in the standard specifications if the standard specification contains the phrase “unless otherwise specified

Example 2

The following example demonstrates a typical construction detail for excavation that would be prepared for a specific contract and inserted at the end of Construction Specification 21, Excavation:

11. ITEMS OF WORK AND CONSTRUCTION DETAILS
Items of work to be performed in conformance with this specification and construction details are:

a. **Bid Item 7, Excavation, Foundation, Common**

(1) This item shall consist of the excavation of unsuitable materials from the foundation of the main dam in areas that are located within the base area of the dam but outside the limits of cutoff trench.

(2) The depth of excavation required is estimated at five (5) feet at the central half of the base area of the dam and tapering to about two (2) feet at the edges. The actual depths and extent of foundation excavation will be determined by the engineer after examination of the material encountered.

(3) The sides of all foundation excavations shall not be steeper than 1 -1/2 horizontal to 1 vertical.

(4) In Section 5, Use of Excavated Materials, Method 1 will apply.

(5) In Section 6, Disposal of Waste Materials, Method 2 will apply.

(6) In Section 11, Measurement and Payment, Method 1 will apply.

b. **Bid Item 8, Excavation, Cutoff Trench, Common**

(1) This items consists of all common excavation required within the limits of the cutoff trench as shown on the drawings.

(2) The depth of excavation required is estimated to extend generally down to near elevation 1105. The actual depths of excavation will be determined by the engineer after examination of the materials encountered.

(3) In Section 5, Use of Excavated Materials, Method 1 will apply.

(4) In Section 6, Disposal of Waste Materials, Method 2 will apply.

(5) In Section 11, Measurement and Payment, Method 1 will apply.

c. **Bid Item 9, Excavation, Cutoff Trench, Rock**

(1) This item consists of all rock excavation required within the limits of the cutoff trench as shown on the drawings.

(2) In Section 4, Blasting, a blasting plan shall be furnished to the Contracting Officer for review and approval prior to the start of any blasting operations.

(3) In Section 5, Use of Excavated Materials, Method 1 will apply.

(4) In Section 6, Disposal of Waste Materials, Method 2 will apply.

(5) In Section 11, Measurement and Payment, Method 1 will apply.

d. **Bid Item 10, Excavation, Principal Spillway, Common**

(1) This item consists of all common excavation required within the limits shown on the drawings for the installation of the pipe conduit, riser footing, and outlet structure, except for that portion of the excavation located within the limits of the cutoff trench or above the lower limit of foundation excavation.

(2) In Section 5, Use of Excavated Materials, Method 1 will apply.

(3) In Section 6, Disposal of Waste Materials, Method 2 will apply.

(4) In Section 11, Measurement and Payment, Method 1 will apply.

e. **Bid Item 11, Excavation, Principal Spillway, Rock**

(1) This item consists of all rock excavation required within the limits shown on the drawings for the installation of the pipe conduit, riser footing, and outlet structure except for that portion of the excavation located within the limits of the cutoff trench.

(2) In Section 4, Blasting, a blasting plan shall be provided to the Contracting Officer for review and approval prior to the start of any blasting operations.

(3) In Section 5, Use of Excavated Materials, Method 1 will apply.

(4) In Section 6, Disposal of Waste Materials, Method 2 will apply.

(5) In Section 11, Measurement and Payment, Method 2 will apply.

f. **Bid Item 12, Excavation, Emergency Spillway, Common**

(1) This item consists of all common excavation required within the limits shown on the drawings for the construction of the emergency spillway.

(2) The grading tolerances for emergency excavation control section (Emergency Spillway Stations 11+30 to 12+10) shall be plus or minus 0.1 foot from grade shown. The grading tolerances for other emergency spillway excavations shall be plus or minus 0.2 feet from the grades shown

(3) In Section 5, Use of Excavation Materials, Method 1 will apply.

(4) In Section 6, Disposal of Waste Materials, Method 2 will apply.

(5) In Section 11, Measurement and Payment, Method 1 will apply.

g. **Subsidiary Item, Excavation, Borrow, Common**

(1) This item consists of all common excavation required to obtain suitable earthfill materials required to construct the permanent works.

(2) In Section 9, Borrow Excavation, all borrow areas shall be graded to prevent the ponding of water. Finished slopes shall not be steeper than four (4) horizontal to one (1) vertical.

(3) In Section 11, Measurement and Payment, no separate payment will be made for borrow excavation. Compensation for borrow excavation will be included in the payment for Bid Item 13, Earthfill Zone 1.

Example 3
The following example demonstrates a typical construction detail to cross-reference a subsidiary item, for earthfill that would be written for a specific contract and inserted into Construction Specification 23, EARTHFILL. Refer to item g, Example 2 previously provided:

10. ITEMS OF WORK AND CONSTRUCTION DETAILS
Items of work to be performed in conformance with this specification and construction details are:

a. **Bid Item 13, Earthfill, Zone I**

(1) This item consists of placing and compacting all suitable materials required to construct Zone I of the embankment and the desilting pond, it also includes backfilling the cutoff trench and constructing a two (2) foot thick blanket on the left abutment as shown on the drawings.

(2) In Section 2, Materials, the following shall apply:

(a) The material for Zone I shall be the natural deposits of gravel, sands, silts, and clays obtained from borrow area 1 and suitable materials from the required excavations.

(b) Material selected to construction Zone I, Earthfill, shall contain not less than thirty-five (35) percent fines (material passing the No. 200 sieve) when determined on a dry weight basis of the portion of the mass smaller

than three (3) inches in nominal diameter, when tested in accordance with ASTM D 1140.

(c) Unsuitable or oversize materials shall be removed from fill materials before placement on the embankment and shall be wasted in the designated disposal locations shown on the drawings. Acceptable rock materials larger than six (6) inches in diameter shall be removed from Zone I and placed in Zone II or placed as rock riprap as applicable.

(3) In Section 4, Placement, the fill shall be placed in layers not exceeding nine (9) inches in thickness prior to compaction. The maximum size of rock incorporated in the fill matrix shall be six (6) inches.

(4) In Section 5, Control of Moisture, the moisture content of the fill matrix at the time of compaction shall be maintained with the range of two (2) percentage points below to two (2) percentage points above optimum moisture content.

(5) In Section 6, Compaction, compaction shall be Class A. The fill matrix shall be compacted to at least ninety-five (95) percent of the maximum density determined by compaction tests of the fill materials by the appropriate method outlined in ASTM D 698.

(6) In Section 9, Measurement and Payment, Method 2 and 6 will apply. Such payment will constitute full compensation for related subsidiary Item, Excavation, Borrow, Common.

Section revised April 2000
NRCS

List of Construction Specifications and Instructions for Use (Alphabetical)

Wire Mesh Gabions and Mattresses 64
Twisted (Woven) or Welded Mesh

Table revised October 2001
NRCS

List of Construction Specifications and Instructions for Use (Numerical & Topical)

		Date Instruction	Specification
Site Preparation			
1.	Clearing	5/01	5/01
2.	Clearing and Grubbing	5/01	5/01
3.	Structure Removal	5/01	5/01
4.	Channel Clearing and Snagging	5/01	5/01
5.	Pollution Control	5/01	5/01
6.	Seeding, Sprigging and Mulching	5/01	5/01
7.	Construction Surveys	5/01	5/01
8.	Mobilization and Demobilization	5/01	5/01
9.	Traffic Control	5/01	5/01
10.	Water for Construction	5/01	5/01
Foundation Work			
11.	Removal of Water	5/01	5/01
12.	Relief Wells	5/01	5/01
13.	Piling	5/01	5/01
14.	Pressure Grouting	5/01	5/01
Earthwork			
21.	Excavation	5/01	5/01
23.	Earthfill	5/01	5/01
24.	Drainfill	5/01	5/01
25.	Rockfill	5/01	5/01
26.	Topsoiling	5/01	5/01
27.	Diversions and Waterways	5/01	5/01
28.	Lime-Treated Earthfill	5/01	5/01
29.	Soil-Cement	5/01	5/01
Concrete and Reinforcement			
31.	Concrete for Major Structures	5/01	11/05
32.	Structure Concrete	5/01	5/01
33.	Shotcrete	5/01	5/01
34.	Steel Reinforcement	5/01	11/05
35.	Concrete Repair	5/01	5/01

Non-Metal Pipe Conduits and Drains			
41.	Reinforced Concrete Pressure Pipe Conduits	5/01	5/01
42.	Concrete Pipe Conduits and Drains	5/01	5/01
43.	Clay Pipe	5/01	5/01
44.	Corrugated Polyethylene Tubing	5/01	5/01
45.	Plastic Pipe	5/01	5/01
46.	Tile Drains	5/01	11/05
Metal Pipe Conduits			
51.	Corrugated Metal Pipe	5/01	5/01
52.	Steel Pipe	5/01	5/01
53.	Ductile-Iron Pipe	5/01	5/01
Riprap and Slope Protection			
61.	Rock Riprap	5/01	11/05
62.	Grouted Rock Riprap	5/01	5/01
63.	Treatment of Rock Surfaces	5/01	5/01
64.	Wire Mesh Gabions and Mattresses Twisted (Woven) or Welded Mesh	5/01	11/05
Water Control Gates and Valves			
71.	Water Control Gates	5/01	5/01
Miscellaneous Structural Work			
81.	Metal Fabrication and Installation	5/01	5/01
82.	Painting Metalwork	5/01	11/05
83.	Timber Fabrication and Installation	5/01	5/01
84.	Painting Wood	11/05	11/05
Miscellaneous Construction			
91.	Chain Link Fence	5/01	5/01
92.	Field Fence	5/01	5/01
93.	Identification Markers or Plaques	5/01	5/01
94.	Contractor Quality Control	5/01	5/01
95.	Geotextile	5/01	5/01
96.	Field Office	5/01	5/01
97.	Flexible Membrane Liner	11/05	11/05
98.	Geosynthetic Clay Liner	11/05	11/05
760.	Temporary Stream Diversion	N/A	9/2011
Vegetation			
204.	Sodding		4/00
707.	Digging, Transporting, Planting, and Establishment of Trees, Shrubs and Vines		8/94
750.	Use of Woody Plantings for Streambank		4/00

	Stabilization	
751.	Use of Grasses for Streambank Stabilization	4/00
752.	Stripping, Stockpiling, Site Preparation and Spreading Topsoil	8/94

Table revised June 2011
AISWCD

Section 6

Material Specifications

Introduction

This section contains material specifications. The material specifications are from the NRCS's National Engineering Handbook Series Part 642, also referred to as National Engineering Handbook Section 20 (NEH-20), as well as several state interim specifications. The interim specifications are numbered starting at 800. The material specifications along with construction specifications (see Section 5) make up the contract specifications and can be used as the requirements in construction contracts. The materials selected will be shown on the drawings and/or also in the construction specifications. See the general discussion in Section 5 for a description on specifications (construction and material) and their use in construction contracts.

Section revised April 2000.
AISWCD

List of Material Specifications (Alphabetical)

Metallic-Coated Corrugated Steel Pipe	551
Metal Waterstops	538
Mineral Admixtures for Concrete	532
Non-Metallic Waterstops	537
Non-Reinforced Concrete Pipe	543
Paper and Plastic Netting	800
Plastic Pipe	547
Portland Cement	531
Precast Concrete Piles	513
Preformed Expansion Joint Filler	535
Radial Gates	573
Reinforced Concrete Pressure Pipe	541
(Reserved)	545
(Reserved)	546
Rock for Riprap	523
Sealing Compound for Joints in Concrete and Concrete Pipe	536
Slide Gates	571
Steel Piles	511
Steel Pipe	554
Steel Reinforcement (for Concrete)	539
Straw Blankets	803
Structural Timber and Lumber	584
Wood Piles	512
Wood Preservatives and Treatment	585

Table revised October 2001
NRCS

List of Material Specifications (Numerical & Topical)

804. Material for Topsoiling 8/94

Table revised April 2000
NRCS

Section 7

Standard Drawings

Introduction

This section contains standard drawings to be used with the construction and material specifications. Together with the specifications many jobs can be designed and constructed without a large engineering input. Standard drawings are intended for small jobs and usually have limits to avoid situations that require more detailed engineering design.

Many of the standard drawings require additional information before use. Practice dimensions often vary with site features. The dimensions and labels to make the drawings match the requirements imposed by site conditions should be included on the provided blanks in the drawings where appropriate.

The standard drawings dated before January 1999 were created using VersaCad Version 6.0 Software. New and revised drawings since January 1999 were created using AutoCad version 14, AutoCad LT 97, and AutoCAD 2000 software. All of the standard drawings created in versions prior to AutoCAD 2000 have been converted to AutoCAD 2000 (.dwg) format. This conversion from VersaCad to AutoCAD 2000 format resulted in some loss of information. Every effort has been made to rectify these discrepancies, but some caution is recommended to ensure that the drawings contain the required information before use.

All references to IDOT in the standard drawings refer to the *Illinois Department of Transportation Standard Specifications for Road and Bridge Construction*, adopted January 1, 2002. The standard drawings use the 'RR' designation in place of a gradation number. Assume the 'RR' to be synonymous with 'Gradation'.

All of the drawings are available in the DXF format. This will allow conversion of the drawings into most CAD systems. For non-AutoCAD users, the drawings are also available in DWF and PDF format. DWF files can be viewed and printed by downloading Autodesk WHIP! software. PDF files can be viewed and printed by downloading Adobe Acrobat software. Using WHIP! software with the DWF files is the preferred method for obtaining electronic versions of the standard drawings for non-AutoCAD users because it preserves many of the AutoCAD features, such as layer control and cursor location.

Section revised December 2002
AISWCD

List of Standard Drawings (Alphabetical)

Drawing Name	Number
Bridge Scour Protection	IL-700
CMP Drop Inlet and Baffle	IL-578 (3 sheets)
CMP Water Control Structure	IL-594 (2 sheets)
Construction Road Stabilization	IL-506
Corrugated Metal Pipe Diaphragm	IL-579 (2 sheets)
Corrugated Metal Pipe Support	IL-586 (2 sheets)
Coupling Band for Corrugated Metal Pipe	IL-580 (2 sheets)
Culvert Flared End Section	IL-545 (2 sheets)
Culvert Inlet Protection - Silt Fence	IL-508SF
Culvert Inlet Protection - Stone	IL-508ST
Detail for PVC Canopy Inlet	IL-592
Ditch Check (Manufactured)	IUM-514PC IUM-514RC IUM-514SC IUM-514UF IUM-514VC
Diversion Plan	IL-515
Drain Details for Ponds with CMP Risers Using 8", 10", and 12" Valves	IL-121
Drop Inlet Structure Plan	IL-583 (2 sheets)
Dry Fire Hydrant Details	IL-120 (2 sheets)
Earth Dam Structure Plan	IL-585 (2 sheets)
Erosion Control Blanket	IL-530
Erosion Control Blanket-Turf Reinforcement Mat (TRM)	IUM-531
Fabric Checks for Waterways	IL-542 (2 sheets)
Filter Strip - Grassed	IL-535
Flexible Antiseep Collar	IL-593
Headwall & Safety Guard for Pipe Risers	IL-576 (2 sheets)
Hood Inlet Structure Plan	IL-584 (2 sheets)
Hood Inlet with Baffle for CMP	IL-577 (2 sheets)
Infiltration Trench	IL-547
Inlet for Underground Outlet - Metal	IL-543 (2 sheets)
Inlet for Underground Outlet - Plastic	IL-544 (2 sheets)
Inlet Protection - Excavated Drain Plan	IL-555
Inlet Protection - Fabric Drop Plan	IL-560
Inlet Protection - Paved Areas	IUM-561 (2 sheets)
Inlet Protection - Sod Filter Plan	IL-562
Level Spreader	IL-570 (2 sheets)
Paved Flume	IL-567
Pipe Outlet to Channel	IL-611
Pipe Outlet to Flat Area	IL-610
Planting Procedure for Balled and Burlapped or	IL-685

Container Grown Trees and Shrubs	
Planting Procedure for Shrubs	IL-689
Polyacrylamide: Temporary Mixing Swale with Optional Baffle Pit	IUM594 (2 sheets)
Portable Sediment Tank Plan	IL-595
Right-of-Way Diversion Plan	IL-600
Rock Check Dam - Coarse Aggregate	IL-605CA
Rock Check Dam - Riprap	IL-605R
Rock Checks for Waterways	IL-541 (2 sheets)
Sediment Basin Dewatering Device	IL-615
Silt Curtain – Floating	IUM-617 (2 sheets)
Silt Fence Plan	IUM-620
Silt Fence with Wire Support Plan	IUM-620 (2 sheets)
Stabilized Construction Entrance Plan	IL-630 (2 sheets)
Structural Streambank Stabilization - Gabions	IL-645
Assembly and Lacing Details	
Structural Streambank Stabilization - Gabions	IL-646
1 Basket High with Slope Mat	
Structural Streambank Stabilization - Gabions	IL-642
2 Baskets High with Mat	
Structural Streambank Stabilization - Gabions	IL-641
2 Baskets High w/o Mat	
Structural Streambank Stabilization - Gabions	IL-644
3 Baskets High with Mat	
Structural Streambank Stabilization - Gabions	IL-643
3 Baskets High w/o Mat	
Structural Streambank Stabilization - Riprap	IL-640
Sump Pit Plan	IL-650
Temporary Stream Diversion	IUM-676BP IUM-676DC IUM-676PD
Temporary Diversion Plan	IL-655
Temporary Sediment Trap	IL-660
Temporary Slope Drain Plan	IL-670
Temporary Stream Crossing Plan	IL-675
Temporary Concrete Washout	IUM-654BW IUM-654ET IUM-654SB
Temporary Rock Swale Plan	IL-680R
Temporary Vegetated Swale Plan	IL-680V
Three Guy Method - Trees Over 8'	IL-688
Timber Prop for 18" - 30" Dia. CMP	IL-581
Timber Prop for 36" - 48" Dia. CMP	IL-582
Trash Racks for Hooded Inlet	IL-591
Trash Racks for Pipe Drop Inlet	IL-590 (2 sheets)
Tree and Shrub Planting Site Plan	IL-686 (2 sheets)
Tree Protection - Fencing	IL-690

Two Guy Method - Trees Under 8'	IL-687
Vegetative Streambank Stabilization - Details	IL-696
Vegetative Streambank Stabilization Site Plan	IL-695 (3 sheets)
Waterway Plan (Parabolic)	IL-540P
Waterway Plan (Trapezoidal)	IL-540T
Waterway Plan (V Bottom)	IL-540V

Table revised May 2012
AISWCD

List of Standard Drawings (Numerical)

Drawing Name	Number
Dry Fire Hydrant Details	IL-120 (2 sheets)
Drain Details for Ponds with CMP Risers Using 8", 10", and 12" Valves	IL-121
Construction Road Stabilization	IL-506
Culvert Inlet Protection - Silt Fence	IL-508SF
Culvert Inlet Protection - Stone	IL-508ST
Diversion Plan	IL-515
Erosion Blanket Plan	IUM-530
Erosion Control Blanket – Turf Reinforcement Mat (TRM)	IUM-531
Filter Strip - Grassed	IL-535
Waterway Plan (Parabolic)	IL-540P
Waterway Plan (Trapezoidal)	IL-540T
Waterway Plan (V Bottom)	IL-540V
Rock Checks for Waterways	IL-541 (2 sheets)
Fabric Checks for Waterways	IL-542 (2 sheets)
Inlet for Underground Outlet - Metal	IL-543 (2 sheets)
Inlet for Underground Outlet - Plastic	IL-544 (2 sheets)
Culvert Flared End Section	IL-545 (2 sheets)
Infiltration Trench	IL-547
Inlet Protection - Excavated Drain Plan	IL-555
Inlet Protection - Fabric Drop Plan	IL-560
Inlet Protection – Paved Areas (Curb Protection)	IUM-561C
Inlet Protection – Paved Areas (Drop-In Protection)	IUM-561D
Inlet Protection - Sod Filter Plan	IL-562
Paved Flume	IL-567
Level Spreader	IL-570 (2 sheets)
Headwall & Safety Guard for Pipe Risers	IL-576 (2 sheets)
Hood Inlet with Baffle for CMP	IL-577 (2 sheets)
CMP Drop Inlet and Baffle	IL-578 (3 sheets)
Corrugated Metal Pipe Diaphragm	IL-579 (2 sheets)
Coupling Band for Corrugated Metal Pipe	IL-580 (2 sheets)

Timber Prop for 18" - 30" Dia. CMP	IL-581
Timber Prop for 36" - 48" Dia. CMP	IL-582
Drop Inlet Structure Plan	IL-583 (2 sheets)
Hood Inlet Structure Plan	IL-584 (2 sheets)
Earth Dam Structure Plan	IL-585 (2 sheets)
Corrugated Metal Pipe Support	IL-586 (2 sheets)
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Trash Racks for Hooded Inlet	IL-591
Detail for PVC Canopy Inlet	IL-592
Flexible Antiseep Collar	IL-593
Polyacrylamide: Temporary Mixing Swale w/ Optional Baffle Pit	IUM-594 (2 sheets)
Portable Sediment Tank Plan	IL-595
Right-of-Way Diversion Plan	IL-600
Rock Check Dam - Coarse Aggregate	IL-605CA
Rock Check Dam - Riprap	IL-605R
Pipe Outlet to Flat Area	IL-610
Pipe Outlet to Channel	IL-611
Sediment Basin Dewatering Device	IL-615
Silt Curtain – Floating	IUM-617 (2 sheets)
Silt Fence Plan	IUM-620
Silt Fence with Wire Support Plan	IUM-620W (2 sheets)
Stabilized Construction Entrance Plan	IL-630 (2 sheets)
Structural Streambank Stabilization - Riprap	IL-640
Structural Streambank Stabilization - Gabions 2 Baskets High w/o Mat	IL-641
Structural Streambank Stabilization - Gabions 2 Baskets High with Mat	IL-642
Structural Streambank Stabilization - Gabions 3 Baskets High w/o Mat	IL-643
Structural Streambank Stabilization - Gabions 3 Baskets High with Mat	IL-644
Structural Streambank Stabilization - Gabions Assembly and Lacing Details	IL-645
Structural Streambank Stabilization - Gabions 1 Basket High with Slope Mat	IL-646
Sump Pit Plan	IL-650
Temporary Concrete Washout	IUM-654 (3 Sheets)
Temporary Diversion Plan	IL-655
Temporary Sediment Trap	IL-660
Temporary Slope Drain Plan	IL-670
Temporary Stream Crossing Plan	IL-675
Temporary Stream Diversion	IUM-676 (3 Sheets)
Temporary Rock Swale Plan	IL-680R
Temporary Vegetated Swale Plan	IL-680V
Planting Procedure for Balled and Burlapped or	IL-685

Container Grown Trees and Shrubs

Tree and Shrub Planting Site Plan	IL-686 (2 sheets)
Two Guy Method - Trees Under 8'	IL-687
Three Guy Method - Trees Over 8'	IL-688
Planting Procedure for Shrubs	IL-689
Tree Protection - Fencing	IL-690
Vegetative Streambank Stabilization Site Plan	IL-695 (3 sheets)
Vegetative Streambank Stabilization - Details	IL-696
Bridge Scour Protection	IL-700

Table revised May 2012
AISWCD

Section 8

Evaluation

Introduction

This section provides information on the effects of urban conservation practices on Soil, Water, Air, Plant and Animal (SWAPA) resources within the urban ecosystem.

Urban resource planning cannot be properly completed without considering the interrelationships of the SWAPA resources within the urban ecosystem. As the public's concern for the environment, whether urban or rural, increases, the interrelationships of these resources will become more critical as project plans are developed.

Urban Conservation Practices Physical Effects (CPPE) sheets can provide details on the physical effects that specific urban practices have on the SWAPA resources. These, in turn, can be used to guide decisions on the best practices to use as a part of the resource management system needed to address the resource concerns identified for the project. The estimation of the physical effects for a practice is based on professional experience and available technical information.

The key question that should be asked when reviewing the CPPE is, "if this practice is applied, what effect will it have not only on the identified or potential target resource concerns or considerations, but also on all the others contained in the column headings?". The planner needs to recognize the effect of applying urban conservation practices in order to select combinations of practices that solve the identified or potential concerns without creating new problems.

Conservation practice physical effects for new Illinois Urban Manual practice standards prepared since the original 1995 version of the manual have not yet been completed. Once completed this section will be updated.

Section completed August 1994
AISWCD

RESOURCE	**CONTENTS**
Soil	Effects of urban practices on the soil resources as these relate to urban soil erosion, soil condition and deposition
Water	Effects of urban practices on the water resources especially

	as these relate to water quantity and quality
Air	Effects of urban practices on the air resources as these relate to air quality and condition
Plants	Effects of urban practices on the plant resources as these relate to plant suitability, condition and management
Animals	Effects of urban practices on the animal resources as these relate to urban wildlife habitat and management

Urban Conservation Practices Physical Effects (CPPE) – Soil

See UCPPE_2002_Soil PDF **HERE**

Urban Conservation Practices Physical Effects (CPPE) – Water

See UCPPE_2002_Water PDF **HERE**

Urban Conservation Practices Physical Effects (CPPE) – Air

See UCPPE_2002_Air PDF **HERE**

Urban Conservation Practices Physical Effects (CPPE) – Plants

See UCPPE_2002_Plants PDF **HERE**

Urban Conservation Practices Physical Effects (CPPE) – Animals

See UCPPE_2002_Animals PDF **HERE**

Section 9

References

Introduction

This section contains selected references in the fields of stormwater management, floodplain management, soil erosion and sediment control, and wetland and stream protection. Several of the references were used in the preparation of previous editions of this manual. The references that were chosen to be included are representative of materials that could be reviewed if a unit of government, consultant, or private citizen was interested in learning more about these subjects, or wanted to develop guidance or a regulatory mechanism (e.g., ordinance) to address these issues.

As new conservation practice standards are added to the manual, specific references used to prepare the standards will be included within the standard itself.

Section revised October 2001
AISWCD

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Section 10

Glossary

Introduction

There are many terms used today in erosion and sediment control, work in environmental quality, resource planning, and air and water quality programs that many people do not fully understand. This glossary contains some terms not used in this publication. An attempt has been made to assemble a list of terms used in the field of Natural Resource Conservation in addition to those found in this guide book to aid the users to have a better understanding of the subject.

Glossary

Acid Soil - Soil with pH value of less than 7.0. The term generally is applied to the surface layers or root zone unless otherwise specified.

Acre-Foot - The volume of water that will cover one acre to a depth of one foot. One acre-foot contains 325,851 gallons.

Aerial Photograph - A photograph of the earth's surface taken from airborne equipment, sometimes called aerial photo or air photograph.

Aggradation - The process of building up a surface or channel by deposition; the opposite of degradation. The process is sometimes referred to as siltation.

Agricultural Land - Land in farms regularly used for agricultural production. The term includes all land devoted to crop or livestock enterprises, for example, the farmstead lands, drainage and irrigation ditches, water supply, cropland, and grazing land of every kind in farms.

Agronomic Practices - The soil and crop activities employed in the production of farm crops, such as selecting seed, seedbed preparation, fertilizing, liming, manuring, seeding, cultivation, harvesting, curing, crop sequence, crop rotations, cover crops, strip cropping, pasture development, etc.

Alluvial - Pertaining to material that is transported and deposited by running water.

Angle of Repose - The angle between the horizontal and the maximum slope that a soil assumes through natural processes.

Annual Flood - The highest peak discharge in a water year.

Anti-seep Collar - A device constructed around a pipe or other conduit placed through a dam, dike, or levee for the purpose of reducing seepage losses and piping failures.

Anti-vortex Device - A facility placed at the entrance to a pipe conduit structure such as a drop inlet spillway or hood inlet spillway to prevent air from entering the structure when the pipe is flowing full.

Apron - A floor or lining to protect a surface from erosion. For example, the pavement below chutes, spillways, or at the toes of dams.

Aquifer - A geologic formation or structure that transmits water in sufficient quantity to supply the needs for a water development. The term water-bearing is sometimes used synonymously with aquifer when a stratum furnishes water for a specific use. Aquifers are usually saturated sands, gravel, fractures, cavernous and vesicular rock.

Area, Natural - 1. An area set aside indefinitely to preserve a representative unit of a major forest, range, or wetland type primarily for the purposes of science, research, or education. 2. A site or area in its natural state undisturbed by man's activities.

Auxiliary Spillway - A dam spillway built to carry runoff in excess of that carried by the principal spillway.

Available Water-holding Capacity (soils) - The capacity to store water available for use by plants, usually expressed in linear depths of water per unit depth of soil. Commonly defined as the difference between the percentage of soil water at field capacity and the percentage at wilting point. This difference multiplied by the bulk density and divided by 100 gives a value in surface inches of water per inch depth of soil. See field capacity; wilting point.

Base Flow - The stream discharge from ground water runoff.

Bedding - The process of laying a drain or other conduit in its trench and tamping earth around the conduit to form its bed. The manner of bedding may be specified to conform to the earth load and conduit strength.

Bedload - The sediment that moves by sliding, rolling, or bounding on or very near the streambed; sediment moved mainly by tractive or gravitational forces or both but at velocities less than the surrounding flow.

Bedrock - The more or less solid rock in place either on or beneath the surface of the earth. It may be soft or hard and have a smooth or irregular surface.

Berm - A ledge or shelf that breaks the continuity of a slope, as a ledge across the face of a dam or the shoulder along a paved road.

Blind Drain - A type of drain consisting of an excavated trench refilled with previous materials, such as coarse sand, gravel or crushed stones, through whose voids water percolates and flows toward an outlet. Often referred to as a French drain because of its initial development and widespread use in France.

Borrow Area - A source of earth fill materials used in the construction of embankments or other earth fill structures.

Bottomlands - A term often used to define lowlands adjacent to streams (flood plains in rural areas).

Broadcast Seeding - Any method of planting seed which scatters the seed in a random pattern on the surface of the soil.

Cantilever Outlet - A discharge pipe extending beyond its support.

Cascades - Section of stream without pools consisting primarily of bedrock, rubble, gravel, or other such material. Current usually more swift than in riffles.

Channel - A natural or artificial stream that conveys water. Channels are often further classified by their size and purpose. For example, there are primary and secondary channels based on size, but diversions, waterways, and chutes are also channels.

Channel Improvement - The improvement of the flow characteristics of a channel by clearing, excavating, realigning, lining, or other means in order to increase its capacity. The term is sometimes used to connote channel stabilization.

Channel Stabilization - Erosion prevention and stabilization of velocity distribution in a channel using jetties, drops, revetments, vegetation, and other measures.

Check Dam - Small dam constructed in a gully or other small water- course to decrease the streamflow velocity, minimize channel scour, and promote deposition of sediment.

Chiseling - 1. Performing tillage which breaks or loosens the soil without inverting it. 2. Tilling the soil with a chisel implement. The depth of chiseling is arbitrarily limited to 16 inches or less; beyond 16 inches, the tillage becomes subsoiling.

Chute - A high velocity, open channel for conveying water to a lower level without erosion.

Clay - 1. A soil textural class including particles less than 0.002 millimeters in diameter. 2. A fine-grained soil with a high plasticity index in relation to the liquid limits. 3. Soils with a high clay content which are difficult to excavate or till; sometimes called heavy soils.

Clearcutting (forestry) - A method of cutting that removes the entire timber stand on the area cut. Contrast with selective cutting.

Climate - The sum total of all atmospheric or meteorological influences, principally temperature, moisture, wind, pressure, and evaporation, which combine to characterize a region and give it individuality by influencing the nature of its land forms, soils, vegetation, and land use. Contrast with weather.

Climax Vegetation - Relatively stable vegetation in equilibrium with its environment and with good reproduction of the dominant plants.

Closed Drain - An underground pipe for intercepting and conveying water.

Compost - Organic residues or a mixture of organic residues and soil that have been piled and allowed to undergo biological decomposition.

Conduit - Any structure intended for the conveyance of water, whether open or closed.

Conservation - The protection, improvement, and wise use of natural resources according to nature's principles that will assure their highest environmental, economic and social benefits.

Conservation District - A public organization created under state enabling law or a special-purpose district to develop and carry out a program of soil, water, and related resource conservation, use, and development within its boundaries; usually a subdivision of state government with a local governing body and always with limited authorities. Often it is called a soil conservation district or a soil and water conservation district.

Contour - An imaginary line on the surface of the earth connecting points of the same elevation or a line drawn on a map connecting points of the same elevation. This term may include allowable deviations from the true contour.

Core Wall - A wall of masonry, sheet piling, or compacted earth placed near the center of a dam or embankment to reduce seepage.

Cover, Ground - Any vegetation producing mat on or just above the soil surface. In forestry, low-growing shrubs, vines, and herbaceous plants under the trees.

Cover, Vegetative - All plants of all sizes and species found on an area, irrespective of whether they have forage or other value. Syn. plant cover.

Cradle - A device, usually concrete, used to support a pipe conduit.

Crest - 1. The top of a dam, dike, spillway or weir, frequently restricted to overflow portion. 2. The summit of a wave or peak of a flood.

Cubic Foot Per Second - The rate of fluid flow at which 1 cubic foot of fluid passes a measuring point in one second. Abbreviated as cfs. Syn. with second-foot and CUSEC.

Cut - 1. A portion of land surface or area from which earth has been removed or will be removed by excavation. 2. The depth below original ground surface to excavated surface.

Cut-and-Fill - The process of earth moving by excavating part of an area and using the excavated material for adjacent embankments of fill areas.

Cutoff - 1. A wall, collar, narrow excavation, or other structure, such as a trench, constructed along the centerline of a dam, dike, levee, or embankment, and filled with relatively impervious material intended to reduce seepage of water through porous strata. 2. In river hydraulics, the new and shorter channel formed either naturally or artificially when a stream cuts through the neck of a bend.

Dam - A barrier to confine, divert, or raise water for storage; to create a hydraulic head; to prevent gully erosion; or to retain sediment, rock, and other debris.

Debris - 1. A term applied to the loose material arising from the disintegration of rocks and vegetative material; transportable by streams, ice, or floods. 2. Stones, scrap material; stumps, limbs, and other undesirable vegetative material; waste and trash on a site.

Debris Basin - A basin constructed in a waterway or at other suitable locations to trap sediment and debris.

Degradation - To wear down through erosion, especially through stream action.

Demography - The statistical study of human vital statistics and population dynamics.

Design Highwater - The elevation of the water surface as determined by the flow conditions of the design floods.

Design Life - The period of time for which a facility is expected to perform its intended function.

Dike - An embankment constructed of earth or other suitable materials to protect land against overflow from streams, lakes, or tidal influences or to protect flat land areas from diffused surface water.

Discharge (hydraulics) - 1. Rate of flow, specifically fluid flow. 2. A volume of fluid passing a point per unit time, commonly expressed as cubic feet per second, million gallons per day, gallons per minute, or cubic meters per second.

Diversion - A channel with a supporting ridge on the lower side constructed across a slope for the purpose of intercepting and diverting water.

Drain - 1. A buried pipe or other conduit (closed drain). 2. A ditch (open drain) for carrying off surplus surface water or ground water.

Drainage - 1. The removal of excess surface or ground water from land by means of surface or subsurface drains. 2. Soil characteristics that affect natural drainage.

Drainage Area - The land area from which water drains to a given point.

Drawdown - Lowering of the water surface (in open channel flow), water table, or piezometric surface (in groundwater flow) resulting from a withdrawal of water.

Drill (seeding) - A method of planting seed with an implement which places the seed in closely spaced rows on or slightly below the surface of the soil

Drop Spillway - An overfall structure in which the water drops over a vertical wall onto an apron at a lower elevation.

Drop Inlet Spillway - An overfall structure in which the water drops through a vertical riser connected to a discharge conduit.

Drop Structure - A structure for dropping water to a lower level and dissipating its surplus energy.

Dry Well - A pit or hole in the ground walled up with unmortared stone, concrete blocks, etc. so as to permit drainage into the ground. Normally dry.

Ecosystem - Energy-driven complex of a community of organisms and its controlling environment.

Effluent - 1. The discharge or outflow of water from ground or subsurface storage. 2. The fluids discharged from domestic, industrial, and municipal waste collection systems or treatment facilities.

Embankment - A man-made deposit of soil, rock, or other materials used to form an impoundment.

Emergency Spillway - A spillway used to carry runoff exceeding a given design flood.

Energy Dissipator - A device used to reduce the energy of flowing water.

Environment - The sum total of all the external conditions that may act on an organism or community to influence its development or existence.

Ephemeral Stream - A stream or portion of a stream that flows only in direct response to precipitation. It receives little or no water form springs and no long continued supply from snow or other sources. Its channel is at all times above the water table.

Erosion - 1. The wearing away of the land surface by running water, wind, ice, or other geological agents, including such processes as gravitational creep. 2. Detachment and movement of soil or rock fragments by water, wind, ice, or gravity. The following terms are used to describe different types of water erosion:

> **Accelerated Erosion** - Erosion much more rapid than normal, natural, or geologic erosion, primarily as a result of the influence of the activities of man or, in some cases, of other animals or natural catastrophes that expose base surfaces, for example, fires.

Geological Erosion - The normal or natural erosion caused by geological processes acting over long geologic periods and resulting in the wearing away of mountains, the building up of floodplains, coastal plains, etc. Syn. natural erosion.

Gully Erosion - The erosion process whereby water accumulates in narrow channels and, over short periods, removes the soil from this narrow area to considerable depths, ranging from 1 to 2 feet to as much as 75 to 100 feet.

Natural Erosion - Wearing away of the earth's surface by water, ice, or other natural agents under natural environmental conditions of climate, vegetation, etc., undisturbed by man. Syn. geological erosion.

Normal Erosion - The gradual erosion of land used by man which does not greatly exceed natural erosion. See natural erosion.

Rill Erosion - An erosion process in which numerous small channels only several inches deep are formed; occurs mainly on recently cultivated soils. See rill.

Sheet Erosion - the removal of a fairly uniform layer of soil from the land surface by runoff water.

Splash Erosion - The spattering of small soil particles caused by the impact of raindrops on wet soils. The loosened and spattered particles may or may not be subsequently removed by surface runoff.

Fauna - The animal life of a region.

Fertilizer - Any organic or inorganic material of natural or synthetic origin that is added to a soil to supply elements essential to plant growth.

Fertilizer Analysis - The percentage composition of a fertilizer expressed in terms of elemental nitrogen, phosphoric acid (P205) and potash (K20) or as elemental phosphorous (P) and potassium (K). Examples are 5-10-10, 10-10-10, 0-14-14, and 16-20-0. Minor elements are sometimes included also.

Filter Blanket - A layer of sand and /or gravel designed to prevent the movement of fine-grained soils.

Filter Strip - A long, narrow vegetative planting used to retard or collect sediment for the protection of diversions, drainage basins, or other structures.

Flat - Section of stream with current too slow to be classed as a riffle and too shallow to be classed as a pool. Stream bottom usually composed of sand or finer materials, with coarse rubber, boulders, or bedrock occasionally evident.

Flood - An overflow or inundation that comes from a river or other body of water and causes or threatens damage.

Flood Control - Methods or facilities for reducing flood flows.

Flood Plain - The relatively flat area adjoining the channel of a natural stream which has been or may be hereafter, covered by floodwater.

Flood Routing - Determining the changes in the rise and fall of floodwater as it proceeds downstream through a valley or a reservoir.

Freeboard - The vertical distance between the maximum design water surface elevation and the top of a retaining bank or structure.

Frequency Curve - A graphical representation of the frequency of occurrence of specific events, such as flood peaks, precipitation amounts, annual or seasonal runoff, etc.

Friable Soil - Soil which is easily crumbled or tilled; a desirable characteristic of a soil often associated with good tilth but not necessarily with fertility.

Firm Soil - 1. A characteristic of soil between friable and hard 2. Soil which has been somewhat compressed by tillage operations when preparing a seedbed.

Gabion - A galvanized wire basket filled with stone used for structural purposes. When fastened together used as retaining walls, revetments, slope protection and similar structures.

Gradation (geology) - The bringing of a surface or a streambed to grade, by running water. As used in connection with sedimentation and fragmental products for engineering evaluation, the term gradation refers to the frequency distribution of the various sized grains that constitute a sediment, soil, or other material.

Grade - 1. The slope of a road, channel, or natural ground. 2. Any surface prepared for the support of construction such as that for paving or laying a conduit.

Grade Stabilization Structure - A structure to stabilize the grade or to control head cutting in natural or artificial channels.

Gradient - 1. Change of elevation, velocity, pressure, or other characteristics per unit length. 2. Slope or grade.

Grading - Any stripping, cutting, filling, stockpiling, or combination thereof which modifies the land surface.

Grass - Any member of the botanical family Gramineae; herbaceous plants with blade like leaves arranged in two ranks on a round to flattened stem. Common examples are

fescue, bermudagrass, and bahiagrass. A term sometimes used to indicate a combination of grass and legumes grown for forage or turf purposes.

Grass Lined Channel - A natural or constructed waterway, usually broad and shallow, covered with erosion-resistant grasses, used to conduct surface water from cropland.

Gully - A channel or miniature valley cut by concentrated runoff but through which water commonly flows only during and immediately after heavy rains or during the melting of snow. A gully is a form of water erosion and is distinguished from a rill by the fact that it cannot be obliterated by normal farm tillage operations, whereas a rill can be eliminated by such tillage.

Gully Control Plantings - The planting of forage, legume, or woody plant seeds, seedlings, cuttings, or transplants in gullies to establish or re-establish a vegetative cover adequate to control runoff and erosion and incidentally produce useful products.

Habitat - The environment in which the life needs of a plant or animal are supplied.

Hard Seed - Live seed which is capable of growth but which is slow to germinate or start growth when growing conditions are optimum. This is due to the fact that the seeds do not readily absorb water or oxygen. Hard seed is especially common in the legume family.

Heavy Soil - A term often applied to soils which have a high silt or clay content and which are difficult to pulverize when tilled or excavated.

Heel-in - To store young trees and other plants in a temporary trench, covering the roots with soil, to keep them from drying out before they are permanently planted.

Helminths - A parasitic intestinal nematode.

Highway Erosion Control - The prevention and control of erosion in ditches, at cross drains, and on fills and road banks within a highway right-of-way. Includes vegetative practices and structural practices

Hood Inlet - A pipe entrance wherein the top edge of the pipe is extended 3/4 of the diameter beyond the bottom invert cut on an angle.

Hulled Seed - Seed from which the hull or other outer covering has been removed. Example: Hulled common bermuda grass seed. Hulling usually reduces the amount of seed required to plant an area and encourages quick germination.

Hydraulic Radius - The cross-sectional area of a stream divided by its wetted perimeter. The "r" in Manning's formula.

Hydrograph - A graph showing for a given point on a stream or drainage system, the discharge, stage, velocity, or other property of water with respect to time.

Hydroseeding - A method of broadcasting seed and sometimes lime, fertilizer, and mulch together in a mixture of water.

Impact Basin - A device used to dissipate the energy of flowing water. Generally constructed of concrete in the form of a depressed and partially submerged vessel and may utilize baffles to dissipate velocities.

Inlet (hydraulics) - 1. A surface connection to a closed drain. 2. A structure at the diversion end of a conduit. 3. The upstream end of any structure through which water may flow.

Inoculant - A special culture of nitrogen-fixing bacteria used to treat legume seeds and thus ensure their nitrogen-fixing ability.

Intermittent Stream - A stream or portion of a stream that flows only in direct response to precipitation. It receives little or no water from springs and no long-continued supply from melting snow or other sources. It is dry for a large part of the year, ordinarily more than 3 months.

Interseeding - Seeding into an established vegetation.

Invader Plant Species - Plant species that were absent in undisturbed portions of the original vegetation and will invade under disturbance or continued overuse. Commonly termed invaders.

Land - Any ground, soil, or earth including marshes, swamps, drainageways, and areas not permanently covered by water.

Land Capability - The suitability of land for use without permanent damage. Land capability, as ordinarily used in the United States, is an expression of the effect of physical land conditions, including climate, on the total suitability for use without damage for crops that require regular tillage, for grazing, for woodland, and for wildlife. Land capability involves consideration of (1) the risks of land damage from erosion and other causes and (2) the difficulties in land use owing to physical land characteristics, including climate.

Land Capability Class - One of the eight classes of land in the land capability classification of the Soil Conservation Service. These eight land capability classes, distinguished according to the risk of land damage or the difficulty of land use, are:

Land suitable for cultivation and other uses.

I. Soils in class I have few limitations that restrict their use.

II. Soils in class II have some limitations that reduce the choice of plants or require moderate conservation practices.

III. Soils in class III have severe limitations that reduce the choice of plants or require special conservation practices, or both.

IV. Soils in class IV have very severe limitations that restrict the choice of plants, require very careful management, or both.

Land generally not suitable for cultivation (without major treatment).

V. Soils in class V have little or no erosion hazard but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife food and cover.

VI. Soils in class VI have severe limitations that make them generally unsuited for cultivation and limit their use largely to pasture or range, woodland, or wildlife food and cover.

VII. Soils in class VII have very severe limitations that make them unsuited to cultivation and that restricts their use largely to grazing, woodland, or wildlife.

VIII. Soils and landforms in class VIII have limitations that preclude their use for commercial plant production and restrict their use to recreation, wildlife, water supply, or aesthetic purposes.

Land Resource Area - An area of land reasonably alike in its relationship to agriculture with emphasis on combinations and/or intensities of problems in soil and water conservation, ordinarily larger than a land resource unit and smaller than a land resource region.

Landscape - All the natural features, such as fields, hills, forests, water, etc., that distinguish one part of the earth's surface from another part, usually that portion of land or territory which the eye can comprehend in a single view, including all of its natural characteristics.

Land Use Plan - A community plan outlining proposed future land uses and their distribution.

Land Use Planning - The process by which decisions are made on future land uses over extended time periods that are deemed to best serve the general welfare. These decisions are best made by considering the resource capability of the land to support the type of use planned. Decision-making authorities on land uses are usually vested in state and local governmental units, but citizen participation in the planning process is essential for proper understanding and implementation.

Legume - A member of the botanical family Leguminosae. Some well known legumes are peas, beans, clovers, and sericea. Most legumes have the ability to take nitrogen

from the air for use by plants, and many are important food, forage, and low-maintenance ground cover plants.

Level Spreaders - A shallow channel excavation at the outlet end of a diversion with a level section for the purpose of diffusing the diversion outflow.

Liquid Limit - The moisture content at which the soil passes from a plastic to a liquid state. In engineering, a high liquid limit indicated that the soil has a high content of clay and a low capacity for supporting loads.

Lime (agricultural) - Usually ground limestone applied as a soil amendment to correct the acidity of soil and provide calcium for plant growth. Dolomitic lime also provides magnesium. Other materials used for lime include basic slag, marl, and ground shells.

Liming - The application of lime to land, primarily to reduce soil acidity and supply calcium for plant growth. Dolomitic limestone supplies both calcium and magnesium. May also improve soil structure, organic matter content, and nitrogen content of the soil by encouraging the growth of legumes and soil microorganisms. Liming an acid soil to a pH value of about 6.5 is desirable for maintaining a high degree of availability of most of the nutrient elements required by plants. Succession - The progressive development of vegetation toward its highest ecological expression, the climax; replacement of one plant community by another.

Loam - Technically, a soil textural class; but also a term used to designate topsoil, fertile and friable soils, and soils which are easily tilled.

Manning's Formula (hydraulics) - A formula used to predict the velocity of water flow in an open channel or pipeline:

$$V = \frac{1.486\, r^{2/3}\, s^{1/2}}{n}$$

Where **V** is the main velocity of flow in feet per second, **r** is the hydraulic radius; **s** is the slope of the channel in feet per foot, and **n** is the roughness coefficient or retardance factor of the channel lining.

Marking Trees - Selection and indication, usually by blaze or paint spot, of trees to be cut or retained in a cutting operation.

Marsh - Periodically wet or continually flooded area with the surface not deeply submerged. Covered dominantly with sedges, cattails, rushes, or other hydrophytic plants. Subclasses include freshwater and saltwater marshes. See swamp; miscellaneous land type.

Marsh, Tidal - A low, flat area traversed by interlacing channels and tidal sloughs and periodically inundated by high tides. Vegetation usually consists of salt-tolerant plants.

Meadow - An area of natural or planted vegetation dominated by grasses and grasslike plants used primarily for hay production.

Mine Dumps - Areas covered with overburden and other waste materials from ore and coal mines, quarries, and smelters, usually with little or no vegetative cover. A miscellaneous land type.

Mineral Soil - A soil consisting predominantly of, and having its properties determined predominantly by, mineral matter, usually containing less than 20 percent organic matter but sometimes containing an organic surface layer up to 30 centimeters thick. See organic soil.

Mulch or Mulching - Plant residues, natural, artificial, or other materials spread on the soil to reduce erosion, promote plant growth, conserve moisture, and to minimize temperature fluctuation.

Native Species - A species that is a part of an area's original fauna or flora.

Natural Grassland - An area in which the natural potential plant community is dominated by grasses and grasslike plants. Associated species include forbs and woody plants.

Natural Revegetation - Natural re-establishment of plants; propagation of new-plants over an area by natural processes.

Neutral Soil - A soil that is neither acid nor alkaline; specifically, a soil with a pH of 7.0, but often those with a pH ranging between 6.6 and 7.3.

Nurse Crop - A fast-growing crop grown with a slow-growing crop to provide quick or temporary cover. An example is fast-growing rye planted with a slow-growing bahiagrass. Nurse crops are competitive and must be used with discretion.

Outfall - The point where water flows from a conduit, stream, or drain.

Outlet - The point of water disposal from a stream, river, lake, tidewater, or artificial drain.

Overfall - 1. An abrupt change in stream channel elevation. 2. The part of a dam or weir over which water flows.

Peak Discharge - The maximum instantaneous flow from a given storm condition at a specific location.

Periphyton - Plants growing on other plants, twigs, and stones in water.

Permissible Velocity (hydraulics) - The highest velocity at which water may be carried safely in a channel or other conduit.

pH - A numerical measure of the hydrogen ion concentration in the soil; a term used to indicate the acidity (pH below 7.0) or alkalinity (pH above 7.0) of soil. See acid soil.

Pipe Drop - A circular conduit used to convey water down steep grades.

Plant Material Center - A place where plants are assembled and their value and use in a conservation program is determined. This includes both domestic collections and plant introductions. Plants are assembled; their performance is evaluated; selections are made and increased for field testing; varieties are named and released; and foundation-quality seed and/or stock is produced and distributed to cooperative seed growers and nurseries for commercial production and use.

Plant Succession - The process of vegetation development whereby an area becomes successively occupied by different plant communities of higher ecological order.

Plasticity Index - The moisture content at which a soil changes from a semi-solid to a plastic state.

Playa - A shallow central basin of a plain where water gathers after a rain and is evaporated.

Plunge Pool - A device used to dissipate the energy of flowing water that may be constructed or made by the action of flowing. These facilities may be protected by various lining materials.

Pool - Section of stream deeper and usually wider than normal with appreciably slower current than immediate upstream or downstream areas, and possessing adequate cover (sheer depth or physical condition) for protection of fish. Stream bottom usually a mixture of silt and coarse sand.

Principal Spillway - Generally constructed of permanent material and designed to regulate the normal water level, provide flood protection and reduce the frequency of operation of the emergency spillway.

Pure Live Seed - The product of the percentage of germination plus the hard seed and the percentage of pure seed, divided by 100.

Rainfall Intensity - The rate at which rain is falling at any given instant, usually expressed in inches per hour.

Recreation Area Planting - Establishing grasses, legumes, vines, shrubs, trees, or other plants on recreation areas.

Recreation Area Stabilization - Stabilizing recreation areas subject to heavy use by surfacing with suitable materials or by installing needed structures.

Recreation Land - Land and water used or usable primarily as sites for outdoor recreation facilities and activities.

Recreation Land Grading and Shaping - Altering the surface of land to meet the requirements of recreation facilities.

Recreation Trail and Walkway - A pathway prepared especially for pedestrian, equestrian, and cycle travel.

Renewable Natural Resources - Can be restored and improved to produce the things man needs.

Revetment - Facing of stone or other material, either permanent or temporary, placed along the edge of a stream to stabilize the bank and to protect it from the erosive action of the stream.

Ridge - The bank or dike constructed on the downslope side of a diversion.

Riffle - Section of stream containing gravel or rubble, in which surface water is at least slightly turbulent and current, is swift enough that the surface of the gravel and rubble is kept fairly free from sand and silt.

Rill - small, intermittent water course with steep sides, usually only a few inches deep and, hence, no obstacle to tillage operations.

Riparian Rights - The rights of an owner whose land abuts water. They differ from state to state and often depend on whether the water is a river, lake, or ocean. See water rights.

Riprap - Broken rock, cobbles, or boulders placed on earth surfaces, such as the face of a dam or the bank of a stream, for protection against the action of water.

Riser - The inlet portion of a drop inlet spillway that extends vertically from the pipe conduit and controls the water surface elevation.

River Basin Plan - A plan for development of water and related land resources to make the best use of such resources to meet the basin needs and make the greatest long-term contribution to the economic growth and social well being of the people of the basin and the Nation.

Root Zone - The part of the soil that is penetrated or can be penetrated by plant roots.

Roughness Coefficient (hydraulics) - A factor in velocity and discharge formulas representing the effect of channel roughness on energy losses in flowing water. Manning's "n" is a commonly used roughness coefficient.

Runoff - That portion of the precipitation that makes its way toward stream channels, lakes, or oceans as surface or subsurface flow. When the term "runoff" is used alone, surface runoff usually is implied.

Rural Beautification - Creating, enhancing, and preserving natural beauty in the countryside.

Sand - 1. A soil textural class including soil particles between 0.05 and 2.0 millimeters in diameter. 2. A term sometimes used to indicate sediment.

Scalping - Removal of sod or other vegetation in spots or strips.

Scarified Seed - Seed which has had the hard outer coat scuffed or otherwise treated to improve absorption of moisture and thus facilitate germination. Example: scarified sericea lespedeza seed. Scarified seed require lower seeding rates than unscarified seed, but must be planted closer to optimum seeding dates.

Scarify - To abrade, scratch, or modify the surface. For example, to scratch the impervious seed coat of hard seed or to break the surface of the soil with a narrow-bladed implement.

Scour - To abrade and wear away. Used to describe the wearing away of terrace or diversion channels or streambeds.

Sediment - Solid soil material, both mineral and organic, that is being moved or has been moved from its original site by wind, gravity, flowing water or ice. Also, sometimes referred to as silt or sand.

Sediment Basin - A depression formed by the construction of a barrier or dam built at suitable locations to retain rock, sand, gravel, silt or other material.

Sediment Discharge - The quantity of sediment, measured in dry weight or by volume, transported through a stream cross-section in a given time. It consists of both suspended load and bed-load.

Seedbed - Soil prepared to receive seed and promote the growth of seedlings. The term may apply also to prepared soil in which plants are to be planted by sprigging, sodding, or other means.

Seed Purity - The percentage of the desired species in relation to the total quantity, including other species, weed seed, and foreign matter.

Sheet Flow - Water, usually storm runoff, flowing in a thin layer over the ground surface. Syn. overland flow.

Shrub - A woody perennial plant differing from a perennial herb by its more woody stems and from a tree by its low stature and habit of branching from the base. There is no definite line between herbs and shrubs or between shrubs and trees; all possible intergradations occur.

Side Slopes - The slopes of the sides of a canal, dam, or embankment.

Silt - 1. A soil textural class including soil particles between 0.05 and 0.002 millimeters in diameter. 2. A term often used to indicate sediment.

Sink - Depression in the land surface; a negative potential area, as in a source and a sink.

Site (ecology) - 1. An area considered for its ecological factors with reference to capacity to produce vegetation; the combination of biotic, climatic, and soil conditions of an area. 2. An area sufficiently uniform in soil, climate, and natural biotic conditions to produce a particular climax vegetation.

Sod - 1. Established grass, turf, or sward. 2. Thin rectangles, strips or pieces of earth and matted grass roots and stems that are transplanted to establish grass cover.

Sod Grasses - Stoloniferous or rhizomatous grasses that form a sod or turf.

Soil - The unconsolidated mineral and organic material on the immediate surface of the earth that serves as a natural medium for the growth of land plants.

Soil Horizon - A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes.

Soil Profile - A vertical cross-section of soil layers constitutes the soil profile, which is composed of three major layers designated, A, B, and C horizons. The A and B horizons are layers that have been modified by weathering, while the C horizon is unaltered by soil-forming processes.

> **A horizon**: The original top layer of soil having the same color and texture throughout its depth. It is usually 10 to 12 inches thick but may range from 2 inches to 2 feet. The A horizon is also referred to as the topsoil or surface soil when erosion has not taken place.
>
> **B horizon**: The soil layer just below the A horizon that has about the same color and texture throughout its depth. It is usually 10 to 12 inches thick but may range from 4 inches to 8 feet. The B horizon is also referred to as the subsoil.
>
> **C horizon**: The soil layer just below the B horizon having about the same color and texture throughout its depth. It is quite different from the B horizon. It may be of indefinite thickness. At the beginning of the soil profile development, the C horizon constituted the entire depth, but time, weather, and soil-forming processes have changed the top layers into the A and B horizons described above.

Spillway - An open or closed conduit used to convey water from a reservoir.

Spillway (emergency) - A spillway used to carry runoff exceeding a given design flood; commonly, a channel around the end of a dam built to carry off excess floodwaters.

Spillway (primary) - A spillway used to convey the runoff of a given designed flood; commonly, a metal pipe or concrete riser connected to a closed conduit under a dam which discharges runoff from a given flood.

Sprig - Portions of stems and roots of grasses that are planted to provide rapid ground cover or assure trueness to type.

Sprigging - The planting of a portion of the stem and root of grass.

Sprinkler Systems - All sprinkler lines, main lines, submains, pumping plant, operation control equipment, and other accessories required for applying water to a field by the sprinkler method.

Stabilized Center Section - An area in the bottom of a grassed waterway protected by stone, asphalt, concrete, or other materials to prevent erosion.

Stilling Basin - An open structure or excavation at the foot of an overfall, chute, drop, or spillway to reduce the energy of the descending stream.

Stone Center - A stabilized center section made of stone.

Storm Frequency - An expression or measure of how often a hydrologic event of given size or magnitude should on an average be equaled or exceeded. The average should be based on a reasonable example.

Streambanks - The usual boundaries (not the flood boundaries) of a stream channel. Right and left banks are indicated when facing downstream.

Subsoil - The layers of soil beneath the topsoil. A term sometimes used to indicate soil of low quality for vegetative purposes.

Succession - The progressive development of vegetation toward its highest ecological expression, the climax; replacement of one plant community by another.

Suitable Outlet - An outlet, either natural or artificial, which will dispose of water at non-erosive velocities and without flooding.

Temporary Protection - Stabilization of erosive or sediment- producing areas.

Toe Drain - A drainage system constructed in the downstream portion of an earth dam or levee to prevent excessive hydrostatic pressures.

Topsoil - 1. A vague term applied to the upper layer of soil. 2. The "plow layer" or upper 6 to 8 inches of soil. 3. The "A" horizons of a soil. 4. A term used to indicate friable, fertile soil applied over other soil to improve conditions for plant growth.

Toxic Salt Reduction - Decreasing harmful concentrations of toxic salts in soils, usually by leaching and with or without the addition of soil amendments.

Trash Rack - A structural device used to prevent debris from entering a spillway or other hydraulic structure.

Tributary - Secondary or branch of a stream, drain, or other channel that contributes flow to the primary or main channel.

Unhulled Seed - Seed from which the hull or outer covering has not been removed. Example: Unhulled bermudagrass seed. Unhulled seed can sometimes be used to an advantage but is slower to germinate and requires a higher seeding rate than hulled seed.

Unified Soil Classification System - A classification system based on the identification of soils according to their particle size, gradation, plasticity index, and liquid limit.

Universal Soil Loss Equation - An equation used for the design of water erosion control systems: **A = RKLSPC** wherein **A** = average annual soil loss in tons per acre per year; **R** = rainfall factor; **K** = soil erodibility factor; **L** = length of slope; **S** = percent of slope; **P** = conservation practice factor; and **C** = cropping and management factor. (**T** = soil loss tolerance value that has been assigned each soil, expressed T/A/Year.)

Unscarified Seed - Seed that has not had the hard outer coat scuffed or otherwise treated to improve germination. Example: unscarified sericea lespedeza. Unscarified seed will germinate but exposure to winter temperatures or special treatment is necessary to break its dormancy. This is an advantage when an area must be seeded "off season."

Uplift Forces - Vertical pressures acting upward on a structure, usually caused by a buoyant condition.

Vegetative Protection - Stabilization of erosive or sediment producing areas by covering the soil with:

a. Permanent seeding, producing long-term vegetative cover.
b. Short-term seeding, producing temporary vegetative cover.
c. Sodding, producing areas covered with a turf of perennial sod-forming grass.

Velocity - The rate of flow measured in feet per second.

Watercourse - A natural or constructed channel for the flow of water.

Water Disposal System - A complete system for safely removing excess water from land. On sloping lands, a system may include diversions, grassed waterways, grade stabilization structures, and other practices. Systems on flat lands may consist of surface or subsurface drains, land leveling, and other measures.

Watershed - see Drainage Area.

Watershed Area - All land and water within the confines of a drainage divide or a water problem area consisting in whole or in part of land needing drainage or irrigation.

Watershed Management - The use, regulation, and treatment of water and land resources of a watershed to accomplish stated objectives.

Water Rights - The legal rights to the use of water. They consist of riparian rights and those acquired by appropriation and prescription. Riparian rights are those rights to use and control water by virtue of ownership of the bank or banks. Appropriated rights are those acquired by an individual to the exclusive use of water, based strictly on priority of appropriation and application of the water to beneficial use and without limitation of the place of use to riparian land. Prescribed rights are those to which legal title is acquired by long possession and use without protest of other parties.

Water Table - The upper surface of ground water or the level below which the soil is saturated with water.

Waterway - A natural or constructed channel for the safe disposal of excess water from a field or diversion. Waterways are usually located on sloping ground and must be established in grass to prevent erosion.

Weep-holes (engineering) - Openings left in retaining walls, aprons, linings, or foundations to permit drainage and reduce pressure.

Wetted Perimeter - The length of the wetted contact between a liquid and its containing conduit, measured along a plane at right angles to the direction of flow.

Windbreak - 1. A living barrier of trees or combination of trees and shrubs located adjacent to farm or ranch headquarters and designed to protect the area from cold or hot winds and drifting snow. Also headquarters and livestock windbreaks. 2. A narrow barrier of living trees or combination of trees and shrubs, usually from one to five rows, established within or around a field for the protection of land and crops. May also consist of narrow strips of annual crops, such as corn or sorghum.

Wind Erosion - The detachment and transportation of soil by wind.

Wind Erosion Equation - An equation used for the design of wind erosion control systems. **E = f (IKCLV)** wherein **E** = average annual soil loss, expressed in tons per acre per year; **f** = a function of; **I** = soil erodibility; **K** = soil ridge roughness; **C** = climatic factor; **L** = unsheltered distance across the field along the wind erosion direction; and **V** = vegetative cover.

Woodland - Any land used primarily for growing trees and shrubs. Woodland includes, in addition to what is ordinarily termed "forest" or "forest plantations," shelterbelts, windbreaks, wide hedgerows containing woodland species for wildlife food or cover,

stream and other banks with woodland cover, etc. It also includes farmland and other lands on which woody vegetation is to be established and maintained.

Zoning (rural) - A means by which governmental authority is used to promote the proper use of land under certain circumstances. This power traditionally resides in the state, and the power to regulate land used by zoning is usually delegated to minor units of government, such as town, municipalities, and counties, through an enabling act that specifies powers granted and the conditions under which these are to be exercised.

Zoning Ordinance - The exercise of police power for the purpose of carrying out the land use plan of an area. It may also include regulations to effect control of the size and height of buildings, population density, and use of buildings. For example, residential, commercial, industrial, etc.

APPENDICES

Appendix A

National Pollution Discharge Elimination System (NPDES) Permits for Construction Site Stormwater Discharge

Introduction

This appendix contains information on the National Pollutant Discharge Elimination System (NPDES) permits for construction site storm water discharges in the state of Illinois. It contains a general overview of the program, the NPDES Permit No. ILR10 Construction Site Activities, the Notice of Intent (NOI) form, the Incidence of Non-Compliance (ION) form, and the Notice of Termination (NOT) form.

These materials have been provided by the Illinois Environmental Protection Agency (EPA) who is responsible for administering the program in Illinois. Questions about the program should be directed to the Illinois EPA-Division of Water Pollution Control Permits Section, P.O. Box 19276, Springfield, IL 62794-9276, phone 217-782-0610.

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AISWCD

General

Under the provisions of the Clean Water Act Amendments of 1987 and the federal regulations at 40 CFR Part 122.26(b)(14)(x), operators of construction sites are required to have NPDES permits for the discharge of storm water except "…operations that result in the disturbance of less than five acres of total land area which are not part of a larger common plan of development or sale." The following are the definitions that the United States Environmental Protection Agency (USEPA) uses for "operators" and "part of a larger common plan of development or sale".

- The operator is determined by who has day to day supervision and control of the activities occurring at a site. In some cases, the operator may be the owner or the developer; at other sites the operator may be the general contractor. The operator is responsible for applying for the permit. In the case of construction, the owner may submit an application for a construction activity if the operators have not yet been identified. However, once the operators have been identified, they must become either sole permitees or co-permitees with the owner.
- A "larger common plan of development or sale" is a contiguous area where multiple separate and distinct construction activities may be taking place at different times on different schedules under one plan. For example, if a developer buys a 20 acre lot and builds roads, installs pipes, and runs electricity with the

intention of constructing homes or other structures sometime in the near future, this would be considered a common plan of development or sale. If the land is parceled off or sold, and construction occurs on plots that are less than five acres by separate, independent builders, this activity still would be subject to storm water permitting requirements because USEPA considers it to be part of a larger plan of development (please note that the homes must have been included on the original site plan in order to trigger permit application requirements).

Illinois General Permit for Construction Site Stormwater Discharges

The Illinois Environmental Protection Agency has issued an NPDES general permit for discharges from construction site activities. The major features of the Illinois permit are the following:

- The permit can authorize all discharges of storm water from construction sites anywhere in Illinois regardless of the size of the site.
- Part II of the permit contains detailed instructions on how to apply for coverage under the permit.
- The permit requires each construction site to have a storm water pollution prevention plan prior to the start of construction. Part IV of the permit contains information on how to develop a plan, what elements must be included in the plan, and what the periodic inspection requirements are.
- A copy of the storm water pollution prevention plan must be retained at the construction site from the date of project initiation to the date of final stabilization.
- The permittee is required to have qualified personnel inspect the disturbed areas of the construction site that have not been finally stabilized, structural control measures, and locations where vehicles enter or exit the site at least once every seven calendar days and within 24 hours of the end of a storm that is 0.5 inches of rain or greater or an equivalent snowfall.
- The permittee is required to submit within 5 days an "Incidence of Noncompliance" (ION) report for any violation of the storm water pollution prevention plan observed during an inspection conducted, including those not required by the Plan. The submission is required to be on an ION form and must include specific information on the cause of noncompliance, actions which were taken to prevent any further incidents of noncompliance, and a statement detailing any environmental impact which may have resulted from the noncompliance
- The storm water pollution prevention plan, inspection records and other information must be retained for a period of at least three years from the date that the site is finally stabilized.
- The permit expires on May 31, 2003, but site operators covered by the permit do not have to apply for coverage under the reissued permit since discharges covered under the expiring permit are automatically covered under the reissued permit.

Phase II Stormwater Program

On December 8, 1999 USEPA published final regulations for Phase II of the NPDES storm water program. The new regulations reduce the size of sites that are required to have permits from five acres or more to one acre or more. The larger common plan of development or sale requirement remains unchanged, so a construction project that is less than one acre would need a permit if it was part of a larger common plan of development or sale that would ultimately result in the disturbance of one acre or more. The one acre requirement is effective as of March 10, 2003, and operators of construction sites that result in a total land disturbance of one acre or more must apply for permit coverage on or before March 10, 2003.

Renewal of the General Permit

The renewal of the NPDES General Permit for Stormwater Discharge from Construction Site Activities was finalized on August 11, 2008. This permit is effective August 11, 2008 and will expire July 31, 2013. Significant changes were made as a result of comments received during the public notice period. These major changes that were made as a result of public comments are as follows:

1. Part II.A.1 - has been revised to clarify the need to submit the NOI in sufficient time to allow a 30 day period after receipt of the NOI and the start of construction.
2. Part II.C.7 - has been revised to include electronic submission of the Storm Water Pollution Prevention Plan to the Agency at the following email address: epa.constilr10swppp@illinois.gov .
3. Part IV.D.2.a - has been revised to reflect a 7-day period before stabilization measures must be initiated. The period of construction interruption with stabilization measures has been reduced to 14 days. A sentence has been added to IV.D.2.a.(i) which specifies that local requirements must also be met.
4. Part IV.D.4 - has been revised to include the qualifications of qualified personnel, such as a Professional Engineer (P.E.) a Certified Professional in Erosion and Sediment Control (CPESC), a Certified Erosion Sediment and Storm Water Inspector (CESSWI) or other knowledgeable personnel.
5. Part IV.D.4.d - has been revised to allow telephone, fax, and email notification of incidences of non-compliance. However, at the present time the Agency requires original signatures on the ION forms sent to the Agency following the e-mail submission.
6. A new Notice of Intent has been developed for the Construction Site Activities General Permit and may be submitted electronically along with the SWPPP to: epa.constilr10swppp@illinois.gov .
7. Effective January 1, 2010, online submittals of Notice of Intents will be available. Refer to the Construction Storm Water page for online submittals.

How to Obtain Coverage Under the Permit

To obtain coverage under the permit the operator must complete the one-page Notice of Intent (NOI) form, sign it, and send the original signed copy to the Illinois EPA. Unless notified by the Agency to the contrary, coverage under the permit is automatic, and operators are authorized to discharge storm water from construction sites under the terms and conditions of the permit either:

- 48 hours after the date the NOI is postmarked, if the project had established compliance with Illinois law regarding historic preservation and endangered species prior to submittal of the NOI;

or

- 30 days after the date the NOI is postmarked, if the project had not established compliance with Illinois historic preservation and endangered species requirements prior to submittal of the NOI.

The Agency will confirm the permit coverage and the project's permit number by letter approximately one week after the automatic coverage takes effect.

Termination of Coverage Under the Permit

After the land disturbing activities are complete and the site has been finally stabilized the operator should terminate his coverage under the permit by completing a Notice of Termination form and submitting it to the Agency. USEPA considers that a site has been finally stabilized when all land disturbing activities are complete and a uniform perennial vegetative cover with a density of 70 percent of the cover for unpaved areas and areas not covered by permanent structures has been established or equivalent permanent stabilization measures have been used.

NPDES Permit No. ILR10	See 2008npdes_ilr10.pdf
IEPA Notice of Intent (NOI)	See notice-intent-construction.pdf
IEPA Incidence of Non-compliance (ION) Front Page	See Construction_ION.pdf
IEPA Notice of Termination (NOT)	See notice-termination-construction.pdf

Appendix B

Soil Quality – Urban Technical Notes

Introduction

These technical notes provide information about soil quality-related resource issues tailored for the urban environment. They are intended for use by government employees, homeowners, builders, consultants, developers, and others interested in natural resource conservation.

Urban Technical Note No. #1 provides background information on erosion sedimentation on construction sites. It describes impacts on the soil's ability to perform important functions and suggests management practices for preventing or mitigating soil quality degradation in the urban environment.

Urban Technical Note No. #2 provides background information on urban soil compaction, describes impact of soil compaction on the soil's ability to perform important functions, and suggests management practices for preventing or mitigating soil quality degradation in the urban environment.

Urban Technical Note No. #3 provides background information on heavy metal contamination in soils, along with management practices for preventing or mitigating soil quality degradation in the urban environment.

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NRCS

Urban Technical Note No. 1 See u01.pdf
Erosion and Sedimentation on Construction Sites

Urban Technical Note No. 2 See u02.pdf
Urban Soil Compaction

Urban Technical Note No. 3 See u03.pdf
Heavy Metal Soil Contamination

Appendix C

Methods for Establishing Receiving Water Quality Impacts of Urban and Suburban Development

Introduction

This summary was developed by USEPA Region 5 - Chicago.
This chapter provides an overview of practical methods for estimating short-term and long-term surface water quality impacts related to urban and suburban development sites. These methods may be used by the urban planner or developer to estimate the impacts on receiving waters from development which may result based on various planning conditions and assumptions. Using the approaches presented here, mitigation of water quality impacts may be tested based upon incorporation of various types of management practices.

Impacts of Urban and Suburban Development

There are two principal types of water quality impacts typically associated with urban and suburban development. The first includes the impacts related to the construction phase of development as soils which are destabilized due to clearing grading and excavation are subject to increased erosion by wind and water. Eroded soils associated with construction activity can be carried offsite and deposited in receiving waters such as lakes, rivers and wetlands. Adverse impacts related to these sediments include increased turbidity and habitat modification, including smothering of spawning beds. While the construction phase itself may be relatively short-lived, the impacts to receiving waters from poorly managed construction activities may be extremely severe and long-lasting, particularly to sensitive areas such as wetlands and inland lakes.

Once the construction phase is over, other receiving water quality impacts may become more pronounced due to potentially dramatic changes to the area's hydrology (reduced baseflow and exaggerated peak flow volumes), and the change in land use compared to predevelopment conditions. The increase in impervious areas causes a resultant increase in runoff rates and volumes. This can result in increased streambank erosion and associated water quality problems.

The increased runoff also accelerates the transport of land-borne pollutants into receiving waters. Typical pollutants which may be found in urban storm water at significant levels include heavy metals, oil and grease, pesticides, fertilizers and other nutrients, and toxic organic contaminants. Runoff from roadways and parking lots may cause significant elevations in receiving water temperatures during summer months. Winter road deicing activities can contribute high levels of chlorides or sediment.

In order to properly manage and maintain urban water resources, the impacts associated with new development must be carefully evaluated. Post-development

impacts may be evaluated in terms of short-term (acute) impacts, and long-term (chronic) impacts. Short term impacts include the changes to a receiving water's chemistry, hydrology, temperature, etc, caused by individual runoff events, and are typically on a timescale of hours to days. Long-term impacts are those which are manifested in the weeks-to-years timescale, and include changes to the dry and wet weather hydrology, streambank morphology, and water chemistry of the receiving water. Long-term chemical impacts are most critical for receiving waters with longer residence times such as lakes and wetlands, and for slower moving stream segments.

In terms of the changes to a receiving water's chemistry due to urban runoff, pollutant concentrations are best used to evaluate short-term effects, while pollutant loadings are appropriate for assessing long-term impacts. Land use planners and developers need to understand these impacts and carefully plan in order to mitigate the negative water quality impacts of development. Part of the analysis should be to evaluate changes in both the annual mass of pollutants exported from a developing area (pollutant loading), and instream pollutant concentration related to runoff from new development or redevelopment.

Loading estimates may focus on nutrients such as phosphorus and nitrogen which contribute to algal blooms in lakes and ponds when the assimilative capacity is exceeded. Estimated loadings can be compared with any existing load allocation limitations for a given receiving water. Even when load allocations do not currently exist, loading estimates are very useful for predicting gross changes in the export of various parameters (sediment, oxygen demanding substances, toxic metals and organics, nutrients), and allow for the analysis of various best management practice (BMP) alternatives to modulate any increased loading of pollutants.

Concentration estimates can be compared with applicable State water quality standards to provide an indication of the likelihood that those standards will be exceeded as a result of storm water discharges. This analysis will help in the planning of BMPs to reduce short term impacts such as acute aquatic toxicity, biochemical oxygen demand and bacteria.

Methods

The following is a summary of three methods which may be used to estimate water quality impacts of new development with respect to increased pollutant loading and pollutant concentration.

1. Simple Method and Loading Functions

Pollutant export estimates for a wide variety of pollutants under various planning assumptions can be estimated using the Simple Method (Schueler, 1987). The method is very easy to use as it requires only information which is readily available and does not involve the use of computer models to calculate load estimates. It is recommended that the method be limited in application to sites less than 1 square mile in area.

The annual mass export of a given pollutant in urban runoff may estimated by the following basic form of the Simple Method:

(EQ 1) $L = (P)(P_j)(R_v)(C)(A)(0.227)$ - *(where concentration is in mg/l), or*

(EQ 1a) $L = (P)(P_j)(R_v)(C)(A)(0.000227)$ - *(where concentration is in ug/l)*

where:

L	=	annual mass of pollutant export (lbs/yr)
P	=	annual precipitation (inches)
$\mathbf{P_j}$	=	correction factor for smaller storms which do not produce runoff (dimensionless)
$\mathbf{R_v}$	=	runoff coefficient (dimensionless)
C	=	average concentration of pollutant
A	=	site area (acres)

Annual precipitation Where site specific values for **P** are not available these can be estimated from Figure 1 and Table 1. In Illinois, reasonable estimates fall between 30 inches per year in the northern and central parts of the State to 42 inches per year in the extreme southern section.

FIGURE 1 Rain Zones for the United States (EPA, 1989)

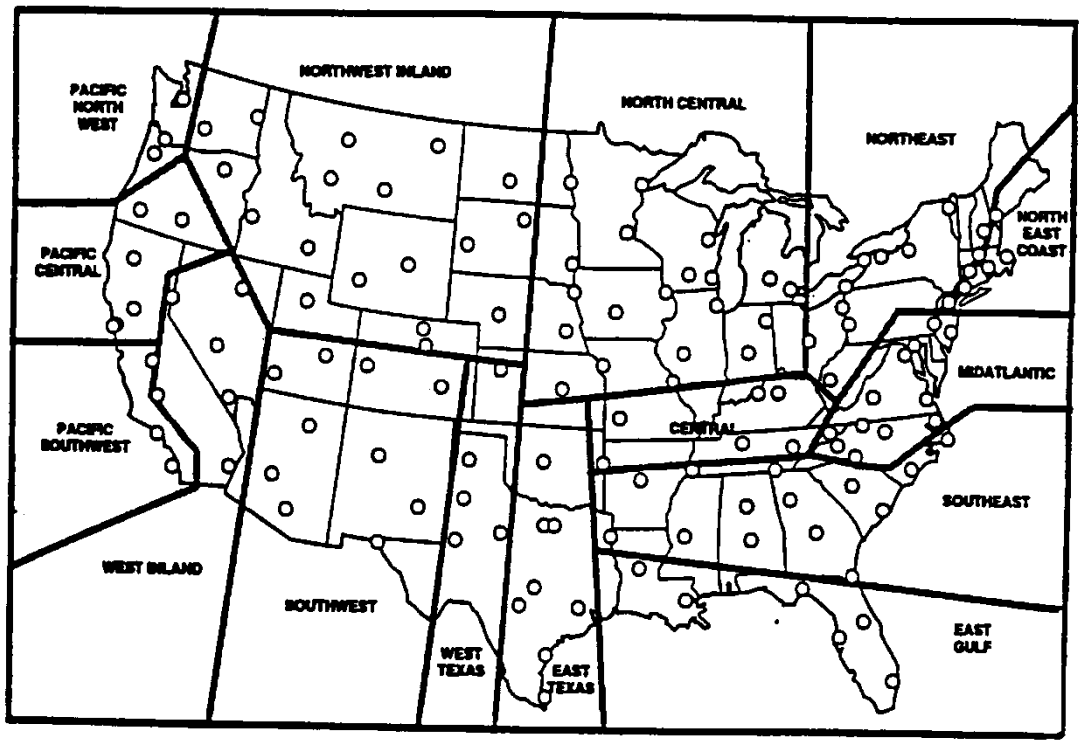

TABLE 1 Typical Values for Annual Precipitation in Rain Zones of the United States (EPA, 1989)

RAIN ZONE	*NUMBER OF STORMS*	*COV*	*PRECIP (IN)*	*COV*
Northeast	*70*	*0.13*	*34.6*	*0.18*
Northeast-Coastal	*62*	*0.12*	*41.4*	*0.21*
Mid-Atlantic	*62*	*0.13*	*39.5*	*0.18*
Central	*68*	*0.14*	*41.9*	*0.19*
North Central	*55*	*0.16*	*29.8*	*0.22*
Southeast	*65*	*0.15*	*49.0*	*0.20*
East Gulf	*68*	*0.17*	*53.7*	*0.23*
East Texas	*41*	*0.22*	*31.2*	*0.29*
West Texas	*30*	*0.27*	*17.3*	*0.33*
Southwest	*20*	*0.30*	*7.4*	*0.37*
West Inland	*14*	*0.38*	*4.9*	*0.43*
Pacific South	*19*	*0.36*	*10.2*	*0.42*
Northwest Inland	*31*	*0.23*	*11.5*	*0.29*
Pacific Central	*32*	*0.26*	*18.4*	*0.33*
Pacific Northwest	*71*	*0.15*	*35.7*	*0.19*

COV = Coefficient of Variation = Standard Deviation/Mean

Correction Factor This factor is used to account for smaller storms which produce no runoff. The value of $\mathbf{P_j}$ may be estimated to be 0.9 where more precise data are unavailable.

Runoff Coefficient $\mathbf{R_v}$ represents that fraction of precipitation which appears as runoff. This may be estimated from the following:

(EQ 2) $R_v = 0.05 + 0.009(I)$ *(Schueler, 1987)*

where **I** is the impervious area for the site expressed as percent. **I** may be estimated by summing the area of impervious surfaces dividing by the total area.

Alternatively, **I** may be estimated for residential areas by:

(EQ 3) $I = 9(PD)^{1/2}$ *(Shelly, 1988)*

where PD is the population density in persons/acre.

Pollutant Concentration The concentration of pollutant **C**, may be determined from flow-weighted composite samples representative of annual average values in urban runoff from a given area. Where such data are not available, estimates may be based on data from the NURP database or other reliable sources. A table of **C** values compiled from NURP data is provided in Table 2. Other data on pollutant concentrations (Schueler, 1987), are presented in Tables 3 and 4.

TABLE 2 Water Quality Characteristics of Urban Runoff from NURP (U.S. EPA, 1983)

Pollutant	*For Media Urban Site*	*For 90th Percentile Urban Site*	*Coefficient of Variation*
TSS (mg/l)	*100*	*300*	*1-2*
BOD (mg/l)	*9*	*15*	*0.5-1.0*
COD (mg/l)	*65*	*140*	*0.5-1.0*
Tot. P (mg/l)	*0.33*	*0.70*	*0.5-1.0*
Sol. P (mg/l)	*0.12*	*0.21*	*0.5-1.0*
TKN (mg/l)	*1.5*	*3.3*	*0.5-1.0*
NO_{2+3} -N (mg/l)	*0.68*	*1.75*	*0.5-1.0*
Copper (ug/l)	*34*	*93*	*0.5-1.0*
Lead (ug/l)	*144*	*350*	*0.5-1.0*
Zinc (ug/l)	*160*	*500*	*0.5-1.0*

TABLE 3 Concentration (C) Values for Use with Simple Method

Pollutant	Residential		Mixed		Commercial		Open/ Nonurban	
	Med	COV	Med	COV	Med	COV	Med	COV
BOD mg/l	10.0	0.41	7.8	0.52	9.3	0.31	--	--
COD mg/l	73	0.55	65	0.58	57	0.39	40	0.78
TSS mg/l	101	0.96	67	1.14	69	0.85	70	2.92
Total P	383	0.69	263	0.75	201	0.67	121	1.66
Soluble P	143	0.46	56	0.75	80	0.71	26	2.11
TKN	1900	0.73	1288	0.50	1179	0.43	965	1.00
Nit.$_{NO2+NO3}$	736	0.83	558	0.67	572	0.48	543	0.91
Copper ug/l	144	0.75	114	1.35	104	0.68	30	1.52
Lead ug/l	33	0.99	27	1.32	29	0.81	--	--
Zinc ug/l	135	0.84	154	0.78	226	1.07	195	0.66

Source: NURP (EPA 1983)

TABLE 4 Concentration Values for Hardwood Forest (OWML, 1983)

Pollutant	Concentration
COD (mg/l)	>40
Tot. P (mg/l)	0.15
Sol. P (mg/l)	0.04
TKN (mg/l)	0.61
NO_2 -N (mg/l)	0.17

EXAMPLE 1

*A proposed 25 acre development in Northeastern Illinois would convert a woodland area (**I** = 2%) to single family homes and townhouses. The total*

imperviousness would be 40%. Estimate the post-development increases in phosphorus and total Kjeldahl nitrogen (TKN) loadings.

Discussion

The annual precipitation is assumed to be 30 inches/year (Table 1). The runoff coefficient is calculated from EQ 2.

*Prior to development, **I** = 2%:*

R_v = 0.05 + 0.009(2) = 0.068

After development:

R_v = 0.05 + 0.009(40) = 0.41

*The concentration values **C**, are taken from Tables 3 and 4. (Mean NURP concentration values are assumed)*

Parameter	Pre-development	Post-development
P	30 inches/year	30 inches/year
P_j	0.9	0.9
R_v	0.068	0.41
C (TKN)	0.61 mg/l	1.5 mg/l
C (total P)	0.15 mg/l	0.33 mg/l
A	25 acres	25 acres

Annual loadings are computed from EQ. 1:

Pre-development:

TKN = [(30 in/yr)(0.9)(0.068)(0.61 mg/l)(25 acres)(0.227)] = 6.4 lbs/yr

P-total = [(30 in/yr)(0.9)(0.068)(0.15 mg/l)((25 acres)(0.227)] = 1.6 lbs/yr

Post-development:

TKN = [(30 in/yr)(0.9)(0.41)(1.5 mg/l)(25 acres)(0.227)] = 94.2 lbs/yr

P-total = [(30 in/yr)(0.9)(0.41)(0.33 mg/l)((25 acres)(0.227)] = 20.7 lbs/yr

Results:

Parameter	Pre-devel.	Post-devel.	Increase
TKN	6.4 lbs/yr	94.2 lbs/yr	1472%

P-total	*1.6 lbs/yr*	*20.7 lbs/yr*	*1294%*

EXAMPLE 2

For the above example, what would be the post development nutrient increase if the total imperviousness were limited to 25%?

Discussion

From Equation 2, R_v = 0.28. From Equation 1, the post development increase would be:

Parameter	*Pre-devel.*	*Post-devel.*	*% Increase*
TKN	*6.4 lbs/yr*	*64.3 lbs/yr*	*1000*
P-total	*1.6 lbs/yr*	*14.1 lbs/yr*	*884*

EXAMPLE 3

Suggest a BMP or group of BMPs which could potentially limit the export of total phosphorus to within 50 % of pre-development levels.

Discussion

Table 15 provides a summary of pollutant removal efficiencies for various storm water runoff control practices. Wet ponds or multiple pond systems are the most reliable practices for controlling nutrients in runoff, and are also generally effective in removing other pollutants of concern.

Loading Functions The simple method may be used to convert typical concentration values to estimates of annual mass loadings. Also known as loading functions, these estimates can be based upon unit area for various land use types and per cent site imperviousness, or other similar constants. Loading functions allow for a direct estimation of pollutant loading for various land use types. Table 4 presents calculated loading functions from various land use types.

TABLE 4 Calculated Pollutant Mass Loadings for Various Land Uses

(Pounds/Acre/Year)

Land Use	*I*	*Total Phos.*	*TKN*	*BOD 5-day*	*Zinc*	*Lead*
Rural	*0*	*0.10*	*0.45*	*2.70*	*0.05*	*0.04*
Residential	*5*	*0.19*	*0.86*	*5.16*	*0.09*	*0.08*
	10	*0.28*	*1.27*	*7.62*	*0.14*	*0.12*
Large Lot Single	*10*	*0.28*	*1.27*	*7.62*	*0.04*	*0.12*
Family	*15*	*0.38*	*1.73*	*10.4*	*0.18*	*0.17*
	20	*0.46*	*2.09*	*12.5*	*0.22*	*0.20*
Medium Density	*20*	*0.46*	*2.09*	*12.5*	*0.22*	*0.20*
Single Family	*25*	*0.55*	*2.50*	*15.0*	*0.27*	*0.24*
	30	*0.64*	*2.92*	*17.5*	*0.31*	*0.28*
	35	*0.74*	*3.36*	*20.2*	*0.36*	*0.32*
	35	*0.74*	*3.36*	*20.2*	*0.36*	*0.32*
Town-house	*40*	*0.83*	*3.77*	*22.6*	*0.40*	*0.36*
	45	*0.92*	*4.18*	*25.1*	*0.45*	*0.40*
	50	*1.01*	*4.59*	*27.5*	*0.49*	*0.44*
Garden	*50*	*1.01*	*4.59*	*27.5*	*0.49*	*0.44*
Apartment	*55*	*1.10*	*5.00*	*30.0*	*0.53*	*0.48*
	60	*1.19*	*5.41*	*32.5*	*0.58*	*0.52*
High Rise,	*60*	*1.19*	*5.41*	*32.5*	*0.58*	*0.52*
Light Commercial/	*65*	*1.28*	*5.82*	*34.9*	*0.62*	*0.56*
Industrial	*70*	*1.37*	*6.23*	*37.4*	*0.66*	*0.60*
	75	*1.46*	*6.64*	*39.8*	*0.70*	*0.64*
	80	*1.55*	*7.05*	*42.3*	*0.75*	*0.68*
Heavy Commercial,	*80*	*1.55*	*7.05*	*42.3*	*0.75*	*0.68*
Shopping Center	*85*	*1.64*	*7.45*	*44.7*	*0.80*	*0.72*
	90	*1.72*	*7.82*	*46.9*	*0.83*	*0.75*
	95	*1.82*	*8.27*	*49.6*	*0.88*	*0.79*
	100	*1.91*	*8.68*	*52.1*	*0.93*	*0.83*

[1] P=30 inches, P_j=0.9, R_v=0.05+0.009(I), A= 1 acre,

C= mean NURP values from Table 2

Similar loading functions can be made using the data in Table 3 or other appropriate data.

Total annual loads are estimated by multiplying the area associated with each given land use type by the loading function for that land use:

(EQ. 4) $L = SUM (L_x)(A_x)$

where:

L = *total loading (lbs/yr)*
L_x = *loading function for land use **x** (lbs/acre/yr)*
A_x = *area of land use **x** (acre)*

In another variation of the Simple Method, Heaney (Mills et al, 1985) has developed a loading function based on population density and street cleaning frequency:

(EQ.5) $L_x = (a_x)(F_x)(Y_x)(P)$

where:

L_x = *loading function for land use x (lbs/acre)*
a_x = *pollutant concentration factor (lbs/acre/in)*
F_x = *population density function*
Y_x = *street cleaning factor*
P = *annual precipitation (inches)*

Total loading is calculated using EQ. 5. Typical $\mathbf{a_x}$ values are given in Table 5.

TABLE 5 Pollutant Concentration Factors (a_x) For use in EQ 5

Land Use	*BOD*	*TSS*	*PO_4*	*Nit.*
Residential	*0.78*	*16*	*0.033*	*0.13*
Commercial	*3.13*	*22*	*0.073*	*0.29*
Industrial	*1.18*	*29*	*0.069*	*0.27*
Other Developed	*0.11*	*2.7*	*0.009*	*0.06*

The population density function, $\mathbf{F_x}$ is a dimensionless parameter. Typical empirical values for $\mathbf{F_x}$ adapted from Heaney et al. are:

***1.0** for commercial and industrial development, and*

(EQ. 6) $0.142 + 0.134\,[0.405(PD)]^{0.54}$ *for residential*

where:

PD = *population density (persons/acre)*

The street cleaning factor is based upon the street sweeping interval in days (N_s):

$Yx = N_s/20$ *for* $N_s < 20$ *days*

$Yx = 1.0$ *for* $N_s > 20$ *days*

EXAMPLE 4

Referring to Example 1, assume that the population density is 25 persons/acre and that street sweeping is performed 1/month, what is the annual nitrogen and phosphorus loading from the development as predicted from EQ. 4 ? How does this compare with the prediction from Example 1?

ANSWER

From TABLE 4, a_x *is 0.033 (lbs/acre/in).*

From EQ. 6, the population density function, $F_x = 0.87$

Y_x *is set to 1.0, since street sweeping frequency is less than 1/20 days.*

$P = 30$ *in/yr.*

From EQ 5, the phosphorus loading function is:

L_x *= (0.033 lbs/acre-inch)(0.87)(1.0)(30 in/yr) =* 0.86 lbs/acre-yr

The total annual load from EQ 3 is:

L *= (25 acres)(0.86 lbs/acre-yr) =* 22 lbs/yr *(Using the simple method in Example 1 predicted* 20.7 lbs/yr*)*

---

2. Phosphorus Load Allocations – The Maine Dept. Method

The Maine Department of Environmental Protection has developed a detailed application of the loading functions method for determining changes in phosphorus loadings which may be expected as a result of different urban and suburban development scenarios (Dennis et al. 1989). Estimated phosphorus loadings can be compared with specified phosphorus loading allocations for Maine lakes. In addition,

the procedure allows for the estimation of phosphorus loading mitigation, based on the use of various combinations of BMPS. By use of simple desk-top calculations, planners and developers are able to estimate in advance whether proposed development areas will comply with the State's phosphorus loading allocations.

The acceptable increase in phosphorus export is determined by:

(EQ. 7) $L_p = (FC)/D$

where:

L_p = *acceptable increase in the phosphorus loading function (lbs/acre/yr)*

^1F = *phosphorus coefficient for the lake watershed (lbs/ppb/yr)*

C = *acceptable increase in lake phosphorus concentration (ppb)*

D = *future area to be developed over next 50 years in the watershed (acres)*

---

[1] ***F factors have been determined for specific lakes in Maine. Similar targets may be established for waterbodies in other areas. In the absence of specific loading limitations, the process may be used to estimate the increase in phosphorus loading resulting from a proposed development.***

C, the acceptable increase in phosphorus concentration, is a function of existing water quality and the level of desired protection. **C** values are given in Table 6.

TABLE 6 C Values - Acceptable Increase in Lake Phosphorus Concentration (Maine DEP, 1989)

Water Quality Category	*Lake Protection Level*		
	High	*Medium*	*Low*
Outstanding	*0.5*	*1.0*	*1.0*
Good	*1.0*	*1.5*	*2.0*
Moderate/Stable	*1.0*	*1.25*	*1.5*
Moderate/Sensitive	*0.75*	*1.0*	*1.25*
Poor/Restorable	*0.1*	*0.5*	*NA*

Poor/Low Priority	*2.0*	*4.0*	*6.0*

D is determined as the total area minus already developed and undevelopable land (steep slopes, wetlands, parks, etc.) and multiplying by a development factor which estimates the portion of undeveloped land which is likely to be developed. In Maine these development factors are:

0.20 - 0.35 *for lake areas near growth centers*

0.15 - 0.25 *for lake areas subject to seasonal development*

0.10 - 0.20 *for lakes for which development is shoreline dependent*

0.10 - 0.15 *for lake areas not subject to development pressure*

It is recommended that conservative upper estimates be used for development factors.

The permitted phosphorus export (PPE) for a site is simply:

(EQ. 8) $PPE = (L_p)(A)$

where:

PPE = *permitted phosphorus export for proposed development (lbs/acre)*

A = *the proposed area of the site (acres)*

The proposed area of the development (A) should include all areas except those which are undevelopable such as wetlands > 1 acre, and steep slopes.

The total predicted phosphorus export (TE) for a development site is the summation of export values from roadways, individual houselots, multi-unit housing, commercial and industrial development. Credit is given for phosphorus control measures which are employed. The general equation for Phosphorus export is:

(EQ. 9) ***(TE) = summation (RE) + (HE) + (CE)***

where:

(TE) = *total predicted phosphorus export*

(RE) = *phosphorus export from roadways*

(HE) = *phosphorus export from individual house lots*

(CE) = *phosphorus export from multi-unit housing, commercial, and industrial development,*

Phosphorus Export from Residential Area Roadways (RE)

Road surface phosphorus export is determined as follows:

(EQ. 9) $(RE) = [(FT)(LBS)(TF_b)(TF_{wp})(TF_i)(TF_o)]/100$

where:

(FT) = *length of roadway being evaluated (feet)*

(LBS) = *annual export of phosphorus from 100 feet of roadway, before treatment*

(TF_b) = *treatment factor for buffer strips*

(TF_{wp}) = *treatment factor for wet ponds*

(TF_i) = *treatment factor for infiltration practice*

(TF_o) = *treatment factor for other treatment factor*

The annual export per 100 feet of roadway is calculated as:

(EQ. 10) ***(LBS) = (road surface width)(0.012) + (road ditch width)(0.004)***

Treatment factors (TF) for all the above calculations and those that follow must be numbers between 0 and 1.0 which reflect the long term phosphorus removal efficiency of the treatment practice or practices employed. Tables in Appendix C-1 present some recommended values. Note that lower numbers reflect higher removal efficiencies. It is also evident that the calculation gives greater credit where redundant treatment practices are employed.

Phosphorus export from individual house lots (HE)

The annual phosphorus export from an individual houselot is calculated as:

(EQ. 11) $(HE) = (BP)(TF_b)(TF_{wp})(TF_i)(TF_o)$

where:

(BP) = *phosphorus export before treatment*

(TF_b) = *treatment factor for buffer strips*

(TF_{wp}) = *treatment factor for wet ponds*

(TF_i) = *treatment factor for infiltration practice*

(TF_o) = *treatment factor for other treatment factor*

Table 11 presents (BP) values for different hydrologic groups

TABLE 11 Phosphorus Export (BP Values) From Lots
Before Treatment - Residential

Hydrologic Group	*Area Cleared per Lot*		
	<10,000 ft	*>10,000 ft*	*>15,000 ft*
A	*.27 (.2)*	*.30 (.30)*	*.35 (.35)*
B	*.32 (.40)*	*.39 (.46)*	*.49 (.54)*
C	*.34 (.48)*	*.44 (.56)*	*.58 (.67)*
D	*.36 (.62)*	*.47 (.62)*	*.62 (.74)*

Note: *Values in parentheses are appropriate for sites where more than 40% of timber volume has been harvested within the last 5 years.*

Phosphorus Export from Multi-unit Housing, Commercial, and Industrial Development (CE)

Phosphorus Export from multi-unit housing, commercial, and industrial development is calculated as:

(EQ. 12) $(CE_x) = (L_x)((BL_x)(TF_b)(TF_{wp})(TF_i)(TF_o)$

where:

(L_x) = *altered land surface area (acres)*

(BL_x) = *additional phosphorus export per acre of altered land surface (lbs/acre)*

(TF_b) = *treatment factor for buffer strips*

(TF_{wp}) = *treatment factor for wet ponds*

(TF_i) = *treatment factor for infiltration practice*

(TF_o) = *treatment factor for other treatment factor*

Values for additional phosphorus export associated with altered land uses are found in Table 12.

TABLE 12 Phosphorus Export from Altered Land Uses

Land Use Category	*Phosphorus Export Before Treatment*
Lawn A	*.30 lbs/acre*
Lawn B	*.65 lbs/acre*
Lawn C	*.97 lbs/acre*
Lawn D	*1.1 lbs/acre*
Road Ditch	*1.8 lbs/acre*
Road Surface	*5.3 lbs/acre*
Impervious Surfaces	*3.5 lbs/acre*

The total loading from multi-unit housing, commercial and industrial areas is the summation of all areas for various land use categories.

EXAMPLE 5

Referring to the proposed development in Example 1, consists of 40 single family units with an average lot size of 0.31 acres, and 29 townhouses with an average of 0.43 acres. The resident soil is Type C. All the runoff will be treated by a wet detention basin. Runoff from the townhouses and roads will also be treated by a 150 foot buffer strip with a slope of 12%. The wet detention basin will be designed with a length to width ratio of 3:1, and mean depth of 5 ft.

The total road length to be added as part of the subdivision is 1,100 feet. The road width is 38 feet with 4 foot shoulders. The main access road which is included in the total road length is 700 feet and has 5 foot ditches on each roadside.

Calculate the additional phosphorus export associated with the proposed development. Also calculate without treatment and compare with Examples 1 and 4.

<u>Discussion</u>

Referring to Appendix C-1, assume a treatment factor of 0.7 for buffer strips 0.5 for the wet detention pond. The analysis must consider the runoff from the houses and townhouses separately. Assuming that < 10,000 ft^2 cleared, phosphorus loading from the single-family dwellings is:

(HE) = (40 lots)(0.48lbs/lot/yr)(0.5) = 9.6 lbs/yr

From the townhouses:

(CE) = (29 lots)(0.43 acres/lot)(0.97 lbs/acre/yr)(0.5)(0.7) = 4.2 lbs/yr

For the roadways, use EQ. 9:

(LBS) = [(38 + 4 + 4)(0.012)] + [(5 + 5)(0.004)] = 0.59 lbs/100 ft

(RE) = (11)(0.59)(0.7)(0.5) = 2.3 lbs/yr

The total additional phosphorus export is then:

HE + CE + RE = 16.1 lbs/yr

Without treatment:

(HE) = (40 lots)(0.48lbs/lot/yr) = 19.2 lbs/yr

From the townhouses:

(CE) = (29 lots)(0.43 acres/lot)(0.97 lbs/acre/yr) = 12.1 lbs/yr

For the roadways, use EQ. 9:

(LBS) = [(38 + 4 + 4)(0.012)] + [(5 + 5)(0.004)] = 0.59 lbs/100 ft

(RE) = (11)(0.59) = 6.5 lbs/yr

The total additional phosphorus export is then:

HE + CE + RE = 37.8 lbs/yr

This is somewhat higher than the solutions to Examples 1 and 4 (20.7 lbs/year and 22 lbs/year, respectively).

EXAMPLE 6

A 7.4 acre office complex in an area with type B soils is proposed. The site includes 4.9 acres of lawn area. Rooftop accounts for 0.9 acres. and 1.1 acre for parking, and 0.3 acres for road surface, and 0.2 acres for road ditch. Calculate the additional phosphorus export.

All flows are to be treated by a 100 ft buffer strip with 10% slope and a wet detention pond with a 4:1 length to width ratio and a mean depth of 4 feet.

Discussion

From Appendix C - 1, TABLES C - 1.1 and C - 1.2, the Treatment factors are 0.6 for the buffer strip and 0.48 for the wet pond. Phosphorus loadings from the various areas are from Table 12 and EQ 9. The total loading is:

(CE) = [(4.9)(0.65) + (0.9)(3.5) + (1.1)((3.5) + (0.3)(5.3) + (0.2)(3.5)] x [(0.6)(0.48)] = 2.77 lbs phosphorus/yr

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Other pollutants

While the Maine procedure was conceived for use in loading estimates of a particular pollutant (phosphorus), and is specific to the State of Maine, the basic concept can be expanded for use with other pollutants of concern in any type of receiving water anywhere in the country. In order to adapt this procedure, the following types of information are necessary:

- Data on annual average loading per unit area for given types of land uses.
- Data on the treatment efficiency of various best management practices in reducing the loading of pollutants of concern.

Where available, these may be compared with target loading ceilings for pollutants of concern.

Table 13 summarizes data on concentrations of various pollutants in runoff from to urban catchments in Wisconsin (Bannerman et al, 1992). In Table 14 these are converted to annual pollutant load per acre, based on 30 inches of precipitation annually. These can be converted to lbs per square foot by dividing by 43,560.

TABLE 13 Pollutant Concentrations from Various Source Areas in Two Urban Catchments in Wisconsin

Source[1]	*Mean Pollutant Concentration*[2]						
	TSS mg/l	*Total Phos mg/l*	*Cd ug/l*	*Cr ug/l*	*Cu ug/l*	*Pb ug/l*	*Zn ug/l*
IndustRoof 1	*54*	*.13*	*.3*	*--*	*7*	*8*	*1348*
Arterial ST 1	*875*	*1.01*	*2.8*	*26*	*85*	*85*	*629*
Arterial ST 2	*241*	*.53*	*2.6*	*18*	*50*	*55*	*554*
Feeder ST 1	*969*	*1.57*	*3.7*	*17*	*97*	*107*	*574*
Feeder ST 2	*1085*	*1.77*	*.8*	*7*	*25*	*38*	*245*
Parking Lot 1	*475*	*.48*	*1.2*	*16*	*47*	*62*	*361*
Parking Lot 2	*91*	*.26*	*.08*	*7*	*21*	*30*	*249*
Outfall 1	*174*	*.38*	*1.1*	*7*	*31*	*26*	*295*
Outfall 2	*374*	*.86*	*.6*	*5*	*20*	*40*	*254*
ResiDriveway 2	*193*	*1.5*	*.5*	*2*	*20*	*20*	*113*
FlatRoof 2	*19*	*.24*	*.4*	*--*	*10*	*10*	*363*
Collector ST 2	*386*	*1.22*	*1.7*	*13*	*61*	*62*	*357*
ResiLawn 2	*457*	*3.47*	*--*	*--*	*13*	*--*	*60*
ResiRoof 2	*36*	*.19*	*.2*	*--*	*5*	*10*	*153*

Source: Bannerman et al, 1992

[1]Study area 1 described as mainly industrial; Study area 2 described as medium density residential

[2]Area = 1 acre P = 30 inches/yr

TABLE 14 Pollutant Loadings per Acre From Various Sources, Based on Wisconsin Data

Source[1]	*Pollutant Loading (lbs/acre/year)*[2]						
	TSS	*Total Phos*	*Cd*	*Cr*	*Cu*	*Pb*	*Zn*
IndustRoof 1	*367*	*.88*	*.002*	*--*	*.05*	*.05*	*9.2*
Arterial ST 1	*5950*	*6.9*	*0.2*	*.18*	*.58*	*.58*	*4.3*
Arterial ST 2	*1639*	*3.6*	*.018*	*.12*	*.34*	*.37*	*3.8*
Feeder ST 1	*6589*	*10.7*	*.025*	*.12*	*.66*	*.73*	*3.9*
Feeder ST 2	*7378*	*12.0*	*.005*	*.05*	*.17*	*.26*	*1.67*
Parking Lot 1	*3230*	*3.26*	*.008*	*.11*	*.32*	*.42*	*2.45*
Parking Lot 2	*619*	*1.77*	*.0005*	*.05*	*.14*	*.20*	*1.69*
Outfall 1	*1183*	*2.58*	*.007*	*.05*	*.21*	*.18*	*2.01*
Outfall 2	*2543*	*5.84*	*.004*	*.03*	*.136*	*.27*	*1.73*
ResiDriveway 2	*1312*	*10.2*	*.003*	*.014*	*.136*	*.136*	*.768*
FlatRoof 2	*129*	*1.63*	*.003*	*--*	*.068*	*.068*	*2.47*
Collector ST 2	*2625*	*8.30*	*.012*	*.088*	*.415*	*.422*	*2.43*
ResiLawn 2	*3108*	*23.6*	*--*	*--*	*.088*	*--*	*0*
ResiRoof 2	*245*	*1.29*	*.0014*	*--*	*.034*	*.068*	*1.04*

Source: Bannerman et al, 1992

[1]Study area 1 described as mainly industrial; Study area 2 described as medium density residential

[2]Area = 1 acre P = 30 inches/year

Schueler has provided an assessment of effectiveness of various control practices in removing pollutants (Schueler, 1992). A summary is provided in Table 15.

TABLE 15 Pollutant Removal Efficiencies For Various Control Practices

Storm Water Management Practice	*Pollutant Removal Efficiency*			
	TSS	*Nutrients*	*Organic*	*Metals*
Extended Detention	*30-70%*	*low to neg. for soluble nutrients*	*15-40% for COD*	
Wet Ponds	*50-90%*	*30-90% for total P 40-80% for sol. nutr.*	*mod-high removal*	*mod-high removal*
Stormwater Wetlands	*slightly higher than wet ponds*	*somewhat lower than wet ponds*		
Multiple Pond System	*Varies with design, but typically enhanced over individual ponds*			
Infiltration Trenches	*+90%*	*60%*		*+90%*
Infiltration Basins				
Porous Pavement	*up to 80%*	*up to 60% for Phos up to 80% for Nit*	*High*	*High*
Sand Filters	*85%*	*40% for dissolved Phosphorus 35% for Nit*		*50-70%*
Peat Sand Filters	*85%*	*70% for Phosphorus 50% for Nit*	*90% for BOD*	
Grassed Swales	*up to 70%*	*30% for Phos 25% for Nit*		*50-90%*
Filter Strip	*28%*			

Source: Schueler et al, 1992

EXAMPLE 7

Returning to Example 1 and Example 5. Assume that the single family units have roofs which are 2,400 square feet (0.055 acre), and the townhouse roofs are 3,000 square feet (0.069 acre). Residential driveways are assumed to average 610 square feet (0.014 acres). Parking for the townhouses consists of 11 lots at an average of 6,500 square feet (0.15 acres) each.

Calculate the zinc loading for the 25 acre single family/townhouse development, using the Tables 14 and 15, and alternatively, EQ 1, before treatment. How do the results compare?

Discussion

The total roof area is:

(40)(0.055) + (29)(0.069) = 4.2 acres rooftops

Total driveway area is:

(40)(0.014 acres) = 0.56 acres driveway

Total parking lot area is:

(11)(0.15 acres) = 1.65 acres parking lot.

The area associated with the roadways (feeder street) is:

(38 + 4 + 4)(1,100) = 50,600 square feet or 1.2 acres

The remaining area is considered to be residential lawn:

25 - [4.2 + 0.56 + 1.65 + 1.2] = 17.4 acres residential lawn

Loading estimates:

Referring to Table 14, the estimated loading rate from rooftops is assumed to be 1.04 lbs zinc/yr, and 0.68 lbs lead/yr. Total loading for the development is:

Zinc - (4.2 acres)(1.04 lbs/acre/yr) = 4.24 lbs/yr

Lead - (4.2 acres)(0.68 lbs/acre/yr) = 2.86 lbs/yr

The estimated loading rate from residential driveways is assumed to be 0.768 lbs zinc/acre/yr, and 0.136 lbs lead/acre/yr. Total loading from residential driveways is:

Zinc - (0.56 acres)(0.768 lbs/acre/yr = 0.43 lbs/yr

Lead - (0.56 acres)(0.136 lbs/acre/yr = 0.076 lbs/yr

The estimated loading rate from parking lots is 1.69 lbs zinc/acre/yr and 0.20 lbs lead/acre/yr (assume study area 2 - medium density residential). Total loading from parking lots is:

Zinc - (1.65 acres)(1.69 lbs/acre/yr) = 2.60 lbs/yr

Lead - (1.65 acres)(0.20 lbs/acre/yr) = 0.33 lbs/yr

The estimated loading rate from the feeder streets is 1.67 lbs zinc/acre/yr, and 0.26 lbs lead/acre/yr. Total loading is:

Zinc - (1.2 acres)(1.67 lbs/acre/yr) = 2.00 lbs/yr

Lead - (1.2 acres)(0.26 lbs/acre/yr) = 0.31 lbs/yr

The estimated loading rate from residential lawns is 0 for zinc and unknown for lead. Therefore, assume no significant increase in metals loading from these areas.

Summing the above the total loading from all areas is gives:

*Zinc - 4.24 + 0.43 + 2.60 + 2.00 = **9.3 lbs/yr***

*Lead - 2.86 + 0.076 + 0.33 + 0.31 = **3.6 lbs/yr***

Using EQ 1a, and referring back to Table 2 and Example 1:

*Zinc = (30 in/yr)(0.9)(0.068)(0.160 mg/l)(25 acres) = **7.3 lbs/yr***

*Lead = (30 in/yr)(0.9)(0.068)(0.144 mg/l)(25 acres) = **6.6 lbs/yr***

The methods provide reasonable agreement for the proposed development.

3. Estimating Acute Concentrations

The approaches outlined above offer tools for predicting changes in long-term loading rates of pollutants to surface waters as an aid to planning activities. These methods do not provide for estimating short term impacts of urban runoff. Such impacts are more properly viewed as the result of instream pollutant concentrations rather than average loading rates. Predicted instream concentrations can be compared with state water quality standards as a means of predicting water quality standards violations due to urban runoff.

Typically much more complex computer models are employed to predict short term wet weather impacts to receiving waters brought about by urbanization. These models integrate hydrological and instream chemical processes in order to estimate instream pollutant concentrations. Models such as STORM and SWMM require significant data input and site specific verification.

Analysis of data collected as part of the National Urban Runoff Program (NURP) indicates that event mean pollutant concentrations may adequately be specified as a lognormal distribution (EPA, 1986). Because of this, the expected concentration for a given probability for a given pollutant in urban runoff can be determined for a particular data set if the central tendency (median or mean value) and the variability (coefficient of variation or standard deviation) are known. This concentration can be compared to some reference concentration such as a water quality standard to indicate the likelihood that an acute water quality impact will occur in the receiving water. Alternatively, the probability that a given concentration level (such as a water quality standard) will be exceeded can be estimated.

The expected runoff concentration for pollutant x is:

(EQ. 13) $C_x = C_m (\exp [Z (\ln\{1+COV\}^2)^{1/2}]$

where:

***** C_x = *expected concentration of pollutant x*

***** Z = *standard normal probability (for specified probability of occurrence)*

***** C_m = *median pollutant concentration*

***** COV = *coefficient of variation*

*** For log-transormed data**

The probability that a specified concentration will be exceeded can be determined by substituting the concentration level of interest for C_x in EQ. 13, solving the equation for Z, and locating the associated probability for the calculated Z value:

(EQ. 14) $Z = (\ln[C_x/C_m])/[(\ln(1+COV^2)^{1/2}]$

Z values for various probabilities of occurrence is presented in Table 16.

Median event mean concentrations and coefficients of variation for NURP data for all land use types are presented in Table 3. If sufficient local data are available these may also be used provided they are transformed into logrhythmic form. Illinois Water quality standards for various pollutants is presented in Table 17. For certain metals these are based on hardness.

TABLE 16 Z Values for Various Probabilities

Z Value	*Probability of Exceedance*
3.090	*0.1%*
2.326	*1%*
2.054	*2%*
1.881	*3%*
1.751	*4%*
1.645	*5%*
1.476	*7%*
1.282	*10%*
1.036	*15%*
0.842	*20%*
0.674	*25%*
0.524	*30%*
0.385	*35%*
0.253	*40%*
0.000	*50%*
-0.253	*60%*
-0.524	*70%*
-0.842	*80%*
-1.282	*90%*

TABLE 17 Illinois Water Quality Standards

Pollutant	***Acute Standard***	***Chronic Standard***
Arsenic (ug/l)	*360*	
Cadmium (ug/l)	*exp[A + B ln(H)] but not > 50ug/l A=-2.98, B=1.128*	*exp[A + B ln(H)] A=-3.49, B=0.785*
Hexavalent Chromium (ug/l)	*16*	*11*
Trivalent Chromium (ug/l)	*exp[A + B ln(H)] A=3.688, B=0.819*	*exp[A + B ln(H)] A=1.561, B=0.819*
Copper (ug/l)	*exp[A + B ln(H)] A=-1.46, B=0.942*	*exp[A + B ln(H)] A=-1.47, B=0.855*
Cyanide (ug/l)	*22*	*5.2*
Lead (ug/l)	*exp[A + B ln(H)] but not >100ug/l A=-1.46, B=1.273*	*NA*
Mercury (ug/l)	*0.5*	*NA*
Barium (mg/l)	*5.0*	*NA*
Boron (mg/l)	*1.0*	*NA*
Chloride (mg/l)	*500*	*NA*
Fluoride (mg/l)	*1.4*	*NA*
Iron Mg/l)	*1.0*	*NA*
Manganese (mg/l)	*1.0*	*NA*
Nickel (mg/l)	*1.0*	*NA*
Phenols (mg/l)	*0.1*	*NA*
Selenium (mg/l)	*1.0*	*NA*
Silver (ug/l)	*5.0*	*NA*
Sulfate (mg/l)	*500*	*NA*
Total Dissolved Solids (mg/l)	*1000*	*NA*
Zinc (mg/l)	*1.0*	*NA*

H = Hardness

EXAMPLE 8

For the development described in Example 1, what is the probability that water quality standards will be violated for zinc and lead, assuming no treatment.

Answer

From Table 15, the acute water quality standard for lead is:

$WQS_{acute} = exp[-1.46 + 1.273(ln(H))]$

Assuming the Hardness = 100 mg/l, then:

$WQS_{acute} = 82$ ug/l lead

From Table 15, the acute water quality standard for zinc is:

$WQS_{acute} = 1.0$ mg/l zinc

From Table 3, the median concentrations and Coefficients of variation for lead and zinc are

Lead: $C_m = 33$ ug/l, COV = 0.99

Zinc: $C_m = 135$ ug/l, COV = 0.84

Applying EQ 14, the probability that lead and zinc water quality standards would be exceeded for any given storm (assuming no treatment or dilution) would be estimated to be:

Lead: $Z = (ln[82/33])/[(ln(1+ 0.99)^2)]^{1/2}$

$Z = 0.77$, which corresponds to an exceedance probability of 20 - 25%

Zinc: $Z = (ln[1000/135])/[(ln(1+ 0.84)^2)]^{1/2}$

$Z = 1.81$, which corresponds to an exceedance probability of less than 5%

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APPENDIX C-1 -- TREATMENT FACTORS FOR USE IN MAINE DEP PROCEDURE

TABLE C-1.1 Treatment Factors (TF) for Buffer Strips

Hydrologic Group A Soils

Treatment Factor- Wooded (Non-Wooded)					
Slope	*25 ft*	*50 ft*	*100 ft*	*150 ft*	*200 ft*
0-10%	*.75 (.95)*	*.4 (.6)*	*.2 (.4)*	*.1 (.3)*	*0 (.2)*
11-15%	*.8 (1.0)*	*5. (.7)*	*.25 (.45)*	*.1 (.3)*	*0 (.2)*
16-20%	*.8 (1.0)*	*.7 (.9)*	*.5 (.7)*	*.25 (.45)*	*.1 (.3)*
21-30%	*.8 (1.0)*	*.75 (.95)*	*.7 (.9)*	*.6 (.8)*	*.3 (.6)*

Hydrologic Group B Soils

Treatment Factor- Wooded (Non-Wooded)					
Slope	*25 ft*	*50 ft*	*100 ft*	*150 ft*	*200 ft*
0-10%	*.75 (.95)*	*.6 (.8)*	*.4 (.6)*	*.2 (.4)*	*.1 (.2)*
11-15%	*.8 (1.0)*	*.75 (.95)*	*.5 (.7)*	*.2 (.4)*	*.1 (.2)*
16-20%	*.8 (1.0)*	*.8 (.1.0)*	*.65 (.85)*	*.4 (.6)*	*.2 (.4)*
21-30%	*.8 (1.0)*	*.8 (.1.0)*	*.7 (.9)*	*.5 (.7)*	*.3 (.6)*

Hydrologic Group C Soils

Treatment Factor- Wooded (Non-Wooded)					
Slope	*25 ft*	*50 ft*	*100 ft*	*150 ft*	*200 ft*
0-10%	*.8 (1.0)*	*.7 (.9)*	*.55 (.75)*	*.45 (.65)*	*.35 (.55)*
11-15%	*.8 (1.0)*	*.75 (.95)*	*.6 (.8)*	*.5 (.7)*	*.4 (.65)*
16-20%	*.8 (1.0)*	*.8 (1.0)*	*.7 (.9)*	*.6 (.8)*	*.5 (.65)*
21-30%	*.8 (1.0)*	*.8 (1.0)*	*.75 (.95)*	*.65 (.85)*	*.5 (.75)*

Hydrologic Group D Soils

Treatment Factor- Wooded (Non-Wooded)					
Slope	*25 ft*	*50 ft*	*100 ft*	*150 ft*	*200 ft*
0-10%	*.9 (1.0)*	*.8 (.65)*	*.75 (.8)*	*.7 (.8)*	*.6 (.75)*
11-15%	*.9 (1.0)*	*.85 (1.0)*	*.8 (.9)*	*.75 (.9)*	*.65 (.8)*
16-20%	*.9 (1.0)*	*.9 (1.0)*	*.85 (1.0)*	*.8 (1.0)*	*.7 (.85)*
21-30%	*.9 (1.0)*	*.9 (1.0)*	*.9 (1.0)*	*.8 (1.0)*	*.75 (.9)*

Source: Maine DEP, 1989

TABLE C-1.2 Treatment Factors (TF) for Wet Ponds

Volume Treated in One Wet Pond

>4:1 length:width (100% plug flow)

Number of Storm Volumes					
		1/2 V	*1V*	*2V*	*3V*
MEAN DEPTH	*3 ft*	*.50*	*.4*	*.33*	*.31*
	5 ft	*.47*	*.34*	*.27*	*.24*
	7 ft	*.44*	*.32*	*.24*	*.20*

4:1-2:1 length:width (50% plug flow)

Number of Storm Volumes					
		1/2 V	*1V*	*2V*	*3V*
MEAN DEPTH	*3 ft*	*.56*	*.48*	*.42*	*.40*
	5 ft	*.52*	*.43*	*.36*	*.33*
	7 ft	*.51*	*.41*	*.33*	*.29*

<2:1 length:width (100% mixed)

Number of Storm Volumes					
		1/2 V	*1V*	*2V*	*3V*
MEAN DEPTH	*3 ft*	*.61*	*.55*	*.51*	*.49*
	5 ft	*.59*	*.51*	*.45*	*.43*
	7 ft	*.58*	*.49*	*.42*	*.39*

Volume Distributed Between Two Wet Ponds

>4:1 length:width (100% plug flow)

Number of Storm Volumes					
		1/2 V	*1V*	*2V*	*3V*
MEAN DEPTH	*3 ft*	*.46*	*.34*	*.26*	*.23*
	5 ft	*.43*	*.31*	*.22*	*.18*
	7 ft	*.43*	*.30*	*.19*	*.16*

4:1-2:1 length:width (50% plug flow)

Number of Storm Volumes					
		1/2 V	*1V*	*2V*	*3V*
MEAN DEPTH	*3 ft*	*.50*	*.39*	*.31*	*.28*
	5 ft	*.48*	*.35*	*.26*	*.23*
	7 ft	*.47*	*.34*	*.24*	*.22*

<2:1 length:width (100% mixed)

Number of Storm Volumes					
		1/2 V	*1V*	*2V*	*3V*
MEAN DEPTH	*3 ft*	*.53*	*.43*	*.36*	*.34*
	5 ft	*.52*	*.41*	*.33*	*.30*
	7 ft	*.51*	*.40*	*.31*	*.26*

Volume Distributed Between Three Wet Ponds

>4:1 length:width (100% plug flow)

Number of Storm Volumes					
		1/2 V	*1V*	*2V*	*3V*
MEAN DEPTH	*3 ft*	*.44*	*.33*	*.23*	*.19*
	5 ft	*.43*	*.30*	*.19*	*.16*
	7 ft	*.42*	*.27*	*.18*	*.15*

4:1-2:1 length:width (50% plug flow)

Number of Storm Volumes					
		1/2 V	*1V*	*2V*	*3V*
MEAN DEPTH	*3 ft*	*.47*	*.35*	*.26*	*.23*
	5 ft	*.46*	*.33*	*.23*	*.19*
	7 ft	*.46*	*.32*	*.22*	*.18*

<2:1 length:width (100% mixed)

Number of Storm Volumes					
		1/2 V	*1V*	*2V*	*3V*
MEAN DEPTH	*3 ft*	*.50*	*.39*	*.31*	*.27*
	5 ft	*.49*	*.36*	*.27*	*.24*
	7 ft	*.48*	*.35*	*.26*	*.22*

Appendix D

NPDES Phase II Stormwater Permit Program for Small Municipal Separate Storm Sewer Systems (MS4s)

Introduction

This appendix contains information on the National Pollutant Discharge Elimination System (NPDES) Phase II storm water permit program for small municipal separate storm sewer systems (MS4s). It contains links to the Storm Water Phase II Compliance Assistance Guide and a series of fact sheets developed by US Environmental Protection Agency (EPA) that give an overview of the Storm Water Phase II Final Rule and Small MS4 program and discuss the six required minimum control measures. Additional information from USEPA is available at www.epa.gov/npdes/stormwater. A copy of the Storm Water Phase II Final Rule (64 *FR* 68722) that appeared in the Federal Register is available at http://cfpub.epa.gov/npdes/stormwater/cgp.cfm#final2008cgp.

This appendix also contains the General NPDES Permit No. ILR40 for Discharges from Small Municipal Separate Storm Sewer Systems and the Notice of Intent (NOI) for General Permit for Discharges from Small Municipal Separate Storm Sewer Systems. The ILR40 Permit and NOI have been provided by the Illinois Environmental Protection Agency (EPA) who is responsible for administering the program in Illinois. The NOI pdf file is in a read-only format, but a word fillable form is available on the IEPA website.

Questions about the program should be directed to the Illinois EPA-Division of Water Pollution Control - Permit Section #15, Bureau of Water, 1021 North Grand Avenue East, P.O. Box 19276, Springfield, IL 62794-9276, phone 217-782-3362, fax 217-782-9891.

The Permit Section website contains information on when a permit is needed, forms, and a list of contacts at Illinois EPA: www.epa.state.il.us/water/permits/waste-water/index.html

Small MS4 Program

- Small MS4 Stormwater Program Overview (Fact Sheet 2.0) [PDF - 212 KB - 3 pp]
- Who's Covered? Designations and Waivers of Regulated Small MS4s (Fact Sheet 2.1) [PDF - 247 KB - 4 pp]
- Urbanized Areas: Definition and Description (Fact Sheet 2.2) [PDF - 264 KB - 3 pp]

Minimum Control Measures

- Public Education and Outreach Minimum Control Measure (Fact Sheet 2.3) [PDF - 223 KB - 3 pp]
- Public Participation/Involvement Minimum Control Measures (Fact Sheet 2.4) [PDF - 219 KB - 3 pp]
- Illicit Discharge Detection and Elimination Minimum Control Measure (Fact Sheet 2.5) [PDF - 262 KB - 4 pp]
- Construction Site Runoff Control Minimum Control Measure (Fact Sheet 2.6) [PDF - 245 KB - 4 pp]

- Post Construction Runoff Control Minimum Control Measure (Fact Sheet 2.7) [PDF - 214 KB - 3 pp]
- Pollution Prevention/Good Housekeeping Minimum Control Measure (Fact Sheet 2.8) [PDF - 210 KB - 2 pp]

Permitting

- Permitting and Reporting: The Process and Requirements (Fact Sheet 2.9) [PDF - 253 KB - 4 pp]
- Federal and State Operated MS4s: Program Implementation (Fact Sheet 2.10) [PDF - 240 KB - 3 pp]
- Small Construction Program Overview (Fact Sheet 3.0) [PDF - 282 KB - 5 pp]
- Construction Rainfall Erosivity Waiver (Fact Sheet 3.1) [PDF - 1.81 MB - 13 pp]
- Conditional No Exposure Exclusion for Industrial Activity Fact Sheet (Fact Sheet 4.0) [PDF - 240 KB - 4 pp]

State Permits

- Illinois' General NPDES permit for Discharges from Small Municipal Separate Storm Sewer Systems [PDF – 4.3 MB - 15 pp]
- Illinois' Notice of Intent for New or Renewal of General Permit for Discharges from Small Municipal Separate Storm Sewer Systems – MS4's

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Appendix E

Sample Natural Resource Protection Ordinances

Introduction

This appendix contains sample natural resource protection ordinances from various regional, county and municipal units of government in Illinois. The ordinances included represent examples and are not meant to be inclusive. Other regional, county, and municipal natural resource protection ordinances have been adopted elsewhere in Illinois and the nation that also may provide useful guidance.

With the advent of NPDES Phase II storm water permit program for small municipal separate storm sewer systems (MS4s), regulated operators of MS4s will be required to develop an ordinance or other regulatory mechanism for the Illicit Discharge Detection and Elimination, Construction Site Runoff Control, and Post-Construction Runoff Control minimum control measures.

The ordinances included in this appendix may be used to provide guidance for developing ordinances for the Construction Site Runoff Control and Post-Construction Runoff Control minimum control measures. In most cases, these ordinances were developed prior to the NPDES Phase II MS4 rules and permit being finalized. As a result, they should be reviewed and adapted to fit local conditions, current regulatory requirements and technology. The ordinances are in portable document file (pdf) format. Contact information is provided for anyone wanting to receive copies in other formats, such as MS Word for Windows or Word Perfect, which will allow for editing.

Additional information and examples of ordinances from other parts of the country can be obtained from the US Environmental Protection Agency “Model Ordinances to Protect Local Resources” website at www.epa.gov/owow/nps/ordinance/index.htm or from the Center for Watershed Protection’s website at www.stormwatercenter.net.

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NRCS

Sample Natural Resource Protection Ordinances

Regional Models

1) The Chicago Metropolitan Agency for Planning (CMAP) is responsible for the northeastern Illinois counties of Cook, DuPage, Kane, Kendall, Lake, McHenry, and Will. CMAP has developed model ordinances to guide communities in writing their own. Additional information may be obtained by contacting CMAP 233 South Wacker Drive, Suite 800, Chicago, IL 60606 312-454-0400 (voice), 312-454-0411 (fax) or at CMAP .

2) The South Suburban Mayor's and Managers Association (SSMMA) is an intergovernmental agency providing technical assistance and joint services to 43 municipalities in Cook and Will Counties. Their model ordinance was prepared for use in SSMMA's South Suburban Stormwater Strategy. Additional information may be obtained by contacting SSMMA at 1904 West 174th Street, East Hazel Crest, IL 60429, phone 708-206-1155 or at www.ssmma.org.

• Model Ordinance for Stormwater and Floodplain Ordinance (August 2000)

3) The Southwestern Illinois Metropolitan and Regional Planning Commission (SWIMRPC) is the official planning agency for Madison, St. Clair, Monroe, Randolph, Bond, Clinton and Washington Counties. Additional information may be obtained by contacting SWIMRPC at 203 West Main Street, Collinsville, IL 62234, phone 618-344-4250.

• Model Ordinance Providing for the Control of Stormwater Drainage and Detention, Soil Erosion and Sediment Control (June 1997), as modified for the Village of Caseyville.

4) The Tri-County Regional Planning Commission (TCRPC) is the official planning agency for Peoria, Tazewell and Woodford Counties. TCRPC assisted in coordinating a multi-county effort to produce a model Erosion, Sediment, and Storm Water Control Ordinance for each county and their municipalities. There are slight differences between the county ordinances. Individual county ordinances are listed below. Intergovernmental agreements have been executed between the counties and the local NRCS/SWCD office to assist in plan review and site inspections. Additional information may be obtained by contacting TCRPC's Environmental Services Planner at 411 Hamilton Boulevard, Suite 2001, Peoria, IL 61602, phone 309-673-9330, or at www.tricountyrpc.org.•

Summary of Significant Differences Between the Peoria, Tazewell and Woodford County Erosion, Sediment, and Storm Water Control Ordinances COUNTY

County Models

1) DuPage County's Stormwater and Floodplain Management Ordinance: Revised by County Board on the 25th day of March 2008. Revisions effective the 1st day of August 2008. The DuPage County Stormwater Management Committee (the "Committee") and the DuPage County Board promulgate this Ordinance pursuant to their authority to adopt ordinances regulating flood plain management and governing the location, width, course, and release rate of all stormwater runoff channels, streams, and basins in DuPage County, in accordance with the adopted DuPage County Stormwater Management Plan (the "Plan"). See the ordinance here.

2) Kane County's Stormwater Management Ordinance was prepared in accordance with the Kane County Comprehensive Countywide Stormwater Management Plan, as authorized in 55 ILCS 5/5-1062. This ordinance provides county-wide minimum standards and applies to all areas within the county, including municipalities. The ordinance was amended to provide protection of isolated wetlands that are no longer offered protection by the U.S. Army Corps of Engineers. A companion Technical Reference Manual (TRM) has been prepared to provide guidance in the implementation of the ordinance. Additional

information may be obtained by contacting Kane County Environmental Management Department, 719 S. Batavia Avenue Bldg. A, Geneva, IL 60134, phone 630-208-5118 or at www.co.kane.il.us/Environment.

• Kane County Stormwater Management Ordinance (October 2001)
• Amendment (December 2001)

2) Kendall County's Stormwater Management Ordinance was prepared in accordance with police powers granted to the County by the Illinois Compiled Statutes and the Kendall County Land Resource Management Plan. It applies only to unincorporated areas within the county. Additional information may be obtained by contacting Strand Associates, Inc., 2400 Glenwood Avenue, Suite 226, Joliet, IL 60435, phone 815-744-4200.

• Kendall County Stormwater Management Ordinance (October 2002)

3) Lake County's Watershed Development Ordinance (WDO) was prepared in accordance with the Lake County Comprehensive Stormwater Management Plan, as authorized in 55 ILCS 5/5-1062. The WDO provides county-wide minimum standards and applies to all areas within the county, including municipalities. The ordinance has been amended several times since initially adopted in 1992, most recently to provide protection of isolated wetlands that are no longer offered protection by the U.S. Army Corps of Engineers. A companion Technical Reference Manual (TRM) has been prepared to provide guidance in the implementation of the WDO. Additional information may be obtained by contacting Lake County Stormwater Management Commission (SMC), 333 Peterson Road, Libertyville, IL 60048, phone 847-918-5260 or at www.co.lake.il.us/smc.

• Lake County's Watershed Development Ordinance (Amended November 2008)

4) Peoria County's Erosion, Sediment, and Storm Water Control ordinance was modeled after the Tri-County Regional Planning Commission's model ordinance. It applies only to unincorporated areas within the county. An intergovernmental agreement has been executed between the county and the local NRCS/SWCD office to assist in plan review and site inspections. Additional information may be obtained by contacting Peoria County Erosion Control Administrator, Peoria County Courthouse, 324 Main Street, Peoria, IL 61602, phone 309-672-6915, or at www.co.peoria.il.us/zoning/pcpzhome.htm or the Peoria County SWCD, 5715 N. Smith Rd., Edwards, IL 61528, phone 309-671-7040 ext.3.

• Peoria County Erosion, Sediment, and Storm Water Control Ordinance (April 1996) Appendix A – Standards for Stormwater Design Analysis and Appendix B – Erosion and Sediment Control Criteria and Specifications are not included.

5) The St. Clair County Soil and Water Conservation District (SWCD) Ordinance for Stormwater Management and Erosion Control represents an updating of the Southwestern Illinois Metropolitan and Regional Planning Commission's model ordinance. It has not been adopted yet. Additional information may be obtained by contacting St. Clair County SWCD, 2031 Mascoutah Avenue, Belleville, IL 62220, phone 618-235-2500 ext.3.

• St. Clair County Soil and Water Conservation District Ordinance for Stormwater Management and Erosion Control (Developed March 2002--Not Yet Adopted)

6) Tazewell County's Erosion, Sediment, and Stormwater Control ordinance was modeled after the Tri-County Regional Planning Commission's model ordinance. It applies only to unincorporated areas within the county. An intergovernmental agreement has been executed between the county and the local NRCS/SWCD office to assist in plan review and site inspections. Additional information may be obtained by contacting Tazewell County Erosion Control Administrator, McKenzie Building, 11 South Fourth Street, Room 400 Pekin, IL 61554, phone 309-477-2235 or the Tazewell County SWCD, 2934 Court St., Pekin, IL 61554, phone 309-346-4462 ext.3.

• Tazewell County Erosion, Sediment, and Storm Water Control Ordinance (April 1996). Appendix A – Standards for Stormwater Design Analysis and Appendix B – Erosion and Sediment Control Criteria and Specifications are not included.

7) Woodford County's Erosion, Sediment, and Storm Water Control Ordinance was modeled after the Tri-County Regional Planning Commission's model ordinance. It applies only to unincorporated areas within the county. An intergovernmental agreement has been executed between the county and the local NRCS/SWCD office to assist in plan review and site inspections. Additional information may be obtained by contacting Woodford County Erosion Control Administrator, Woodford County Courthouse, Eureka, IL 61530, phone 309-467-3023 or the Woodford County SWCD, 937 W. Center St., Eureka, IL 61530, phone 309-467-2387 ext.3.

• Woodford County Erosion, Sediment, and Storm Water Control Ordinance (April 1996). Appendix A – Standards for Stormwater Design Analysis and Appendix B – Erosion and Sediment Control Criteria and Specifications are not included.

Municipal Models

1) The City of Belvidere incorporates soil erosion and sediment control in their subdivision ordinance. Additional information may be obtained by contacting the City of Belvidere's Public Works Department, 119 S. State St., Belvidere, IL 61008, phone 815-544-9256 or the Boone County SWCD, 211 North Appleton Road, P.O. Box 218, Belvidere, IL 61008-0218, phone 815-544-2677 ext.3.

• City of Belvidere Erosion and Sediment Control (Amended August 1997)

2) The Village of Carbon Cliff has a stand-alone ordinance covering stormwater drainage and detention and soil erosion and sediment control. Additional information may be obtained by contacting the Village of Carbon Cliff, 106 1st Avenue, Carbon Cliff, IL 61239, phone 309-792-8235 or the Rock Island County SWCD, 3010 E. First Avenue, Milan, IL 61264, phone 309-764-1486 ext.3.

• Village of Carbon Cliff Ordinance Providing for the Control of Stormwater Drainage and Detention, Soil Erosion and Sediment Control (January 2002)

3) The City of Clinton has a policy covering soil erosion and stormwater management in their zoning ordinance. Additional information may be obtained by contacting Administrative Assistant, City of Clinton, 118 W. Washington, Clinton, IL 61727, phone 217-935-6552 or the DeWitt County SWCD, RR4 Box 344A, Clinton, IL 61727, phone 217-935-6504 ext.3.

• Village of Clinton Soil Erosion and Stormwater Management Policy (November 2001)

4) The Village of Dwight has a stand-alone ordinance covering stormwater drainage and detention and soil erosion and sediment control. Additional information may be obtained by contacting the Village Administrator, Village of Dwight, Village Hall, 209 S. Prairie, Avenue, Dwight, IL 60420, phone 815-584-3077 or Livingston County SWCD, 1510 West Reynolds, Box 80, Pontiac, IL 61764, phone 815-844-6127 ext.3.

• Village of Dwight Ordinance Providing for the Control of Stormwater Drainage and Detention, Soil Erosion and Sediment Control (November 2001)

5) The Village of Plainfield has included modified versions of the NIPC model ordinances in their 2001 Subdivision Code. It should be noted that these versions may not represent the latest version of the NIPC model ordinances that are referenced above. Additional information may be obtained by contacting Village Planner, Village of Plainfield, 530 W. Lockport, Plainfield, IL 60544, phone 815-439-2824.

• Ordinance 1369 – An Ordinance Regulating Development in Special Flood Hazard Areas
• Ordinance 1748 – Soil Erosion and Sedimentation Control Ordinance
• Ordinance 1749 – Stream and Wetland Protection Ordinance
• Ordinance 1747 – Stormwater Drainage and Detention Ordinance

Appendix F

USDA Programs Applicable to urban or Urbanizing Areas

Introduction

This appendix contains information on the United States Department of Agriculture (USDA) programs approved under the Farm Security and Rural Investment Act of 2002 (2002 Farm Bill) regarding the bill's conservation provisions. Although tailored for agricultural lands, these programs may complement local initiatives in urban or urbanizing areas regarding environmentally-sensitive areas and storm water management, floodplain preservation, ground water recharge, wildlife habitat, open space, recreation, and the preservation of rural character. Opportunities may exist for utilizing these programs as land is converted from agricultural to urban land uses. These programs could also be useful in meeting requirements of the Non-point Source Discharge Elimination System (NPDES) phase II. Developers and municipal planners can conceivably take advantage of USDA programs and become a program participant as long as the land associated with the program continues to meet USDA criteria. Crucial issues affecting USDA criteria includes having the land registered with a valid farm tract number and insuring that participation in the USDA program(s) is initiated prior to changes in agricultural land use.

The following is a summary of programs that could possibly assist conservation activities in an urban or urbanizing areas:

Conservation Reserve Program (CRP)

The CRP is a voluntary program for eligible producers that offers incentive and maintenance payments for specified conservation activities on eligible crop or pasture lands. The program's purpose is to encourage the planting of ground covers that improve soil, water and wildlife resources. CRP makes available federal cost-share assistance of up to 50% of the participant's cost in installing approved conservation practices. Contract duration may last from ten to fifteen years. CRP could potentially be used in steep-sloped areas that would otherwise prohibit development. CRP could also be utilized for tree or native grass plantings in conjunction with required buffers between development and sensitive water bodies.

Environmental Quality Incentives Program (EQIP)

EQIP is a voluntary program for eligible producers, on eligible land, that offers incentive payments of up to 90% of the costs on eligible conservation practices. Soon to be available under the EQIP program are Conservation Innovation Grants. These grants, after their draft provisions have been finalized, are anticipated to be available for use by the broader public to leverage federal investment, stimulate innovative approaches, and accelerate technology transfer. Any development proposal that could incorporate conservation best management practices could potentially be eligible under this program. Developers who need to meet local development requirements mandating groundwater protection, buffers and storm water detention, could utilize this program to help offset implementation costs. Some types of practices that could qualify under EQIP include

riparian forest buffers, rock chutes, wetland enhancement, filter strips, diversions, water and sediment control basins, and grassed waterways. One example in Illinois of the use of EQIP funds in an urbanizing area includes a site near East Peoria, where EQIP funds were used prior to site development for the construction of two ponds to include spillway construction, seeding, and mulching.

Farmland Protection Program/Farm and Ranch Lands Protection Program (FPP/FRPP)

The purpose of the FPP/FRPP is to encourage topsoil protection by limiting non-agricultural uses of the land. Under the program, the federal government may contribute up to 50% of the cost for the purchase of development rights regarding a qualifying parcel. At the time of this writing, the FRPP rules were in draft form and open for public comment. The FRPP is anticipated to be similar in many ways to the FPP program, which has been repealed. The FRPP program could potentially be used in conjunction with community development or agricultural land subdivision. The FRPP could be useful for development requirements that encourage open space set-asides which maximizes land remaining on the tax rolls. FRPP would also be useful for planned unit developments or conservation subdivision designs that permit the agreed-upon density, yet allow larger areas of contiguous open space. Land under FRPP could also be used for other than row-crop production. Tree farms, specialty crops, gardens, and nurseries are all potential land uses under the program that could continue to generate revenues for both the land owner and the community while providing open space, aesthetic features, and passive storm water management.

Wildlife Habitat Incentives Program (WHIP)

Through this program, NRCS provides technical expertise and funding needed for practices that enhance wildlife habitat on private land. Landowners may enter into five to ten year agreements to implement an approved habitat enhancement plan. Longer agreements may be available for landowners that are willing to create long-lasting habitat for especially vulnerable species. This program is unique in that a farm tract number is not a requirement for enrollment. Any privately owned land can be eligible under WHIP as long as it enhances wildlife habitat. Examples of where this program could be utilized in site planning and development include odd lots or land contiguous to streams, lakes, or storm water detention/retention areas where native plantings that enhance wildlife habitat are desirable.

Wetlands Reserve Program (WRP)

WRP is a voluntary program that provides technical and financial assistance to eligible landowners to address wetlands, wildlife habitat, and other soil and water natural resource concerns. Through this program, eligible landowners must file an application for either a permanent conservation easement, a 30-year easement, or a minimum 10-year restoration agreement. The federal government may pay up to 100% for wetland restoration and permanent easement costs; 75% of restoration and 75% of the permanent easement costs on a 30-year easement; and 75% of restoration costs for a restoration cost-share agreement.

One example of a development that has taken advantage of the wetland reserve program has been the Hidden Creek development in Ohio, where 232 acres were set aside in

perpetuity to protect wildlife habitat along a nearby creek. The developer, working in cooperation with the NRCS and the local soil and water conservation district, desired to maintain the environmentally-sensitive areas of the property in a natural state and made the decision to qualify and participate. Prior to development, the environmentally-sensitive lands were set aside and the USDA-NRCS, in accordance with WRP program criteria, designed the wetlands and were awarded a permanent conservation easement. The developer was eligible for cost-share money and technical assistance and the wetlands thereafter will provide wetland functions that can be used in conjunction with development: passive storm water detention, ground water filtering, and natural open space.

Included as part of this appendix are fact sheets regarding each of the above mentioned programs.

The intent here is to provide the reader with examples of concepts, incentives and resources from the USDA that could potentially be incorporated into community-based conservation projects. While an effort has been made to provide an accurate listing of program information, this information is constantly changing to better meet the public's needs. For the most up-to-date information regarding programs, please contact your local USDA service center or visit the national USDA-NRCS website at http://www.nrcs.usda.gov.

Section revised November 2002
NRCS

Appendix G

Grant Information Summary for Conservation Projects

Introduction

This summary is intended to assist individuals, groups, and local units of government in search of funding or other financial incentives for community-based conservation projects in Illinois. The list is divided into five categories: federal funding sources, state funding sources, other public/private sources, and private sources. A key has been developed to identify eligible groups for each grant after the title of the grant:

Key to group eligibility:

"I" individuals eligible
"G" local units of government
"O" all organizations eligible to apply
"P" private not-for-profit (501C3) groups only eligible
"E" educational institutions
"U" unknown or eligibility varies, need to contact administrators.

For the purposes of this document, conservation is defined as holistically as possible to include grants or financial incentives that enhance the wise use and management of natural and cultural resources in urban, suburban, and rural communities. Some of these grants may not have conservation as a specific goal, but could be used to achieve multiple objectives that include conservation.

The intent of this document is to provide the reader with examples of what is available in financial incentives. Many other funding alternatives exist, and may better fit local needs. This document is provided as a public service and does not constitute a recommendation or endorsement of any particular grant or program; also note that the absence of any particular grant or program does not constitute a negative endorsement. While an effort has been made to provide an accurate listing, funding information is constantly changing and omissions or errors may occur. Please recycle previous editions. For corrections, comments or additional copies of this summary, please contact:

Contact

USDA- Natural Resources Conservation Service (NRCS)
ATTN: Keith Eichorst, NRCS Community Planner
313-J Plainfield-Naperville Road, Plainfield, IL 60544
Email: Keith.Eichorst@il.usda.gov

Other sources of information should be consulted and evaluated to insure an informed choice is made before actions are taken.

Section Revised in April 2002.
NRCS

Federal Funding Sources

The federal government is an excellent place to investigate funding resources for conservation projects. Once you identify your specific requirements, the Catalog of Federal Domestic Grants (CFDA) is the single best place to look for federal funding sources-the catalog should be available at your local library or you can view the CFDA on-line:

Catalog of Federal Domestic Assistance:
http://www.cfda.gov

Web site for federal forms and grant administration procedures:
http://www.whitehouse.gov/omb/grants/index.html

Web sites of federal agencies may give you more information about individual government programs as well as provide information on other opportunities for assistance:

United States Department of Agriculture (USDA) Illinois Natural Resources Conservation Service (NRCS):
http://www.il.nrcs.usda.gov

Federal Emergency Management Agency (FEMA)
http://www.fema.gov

United States Department of Housing and Urban Development (HUD):
http://www.hud.gov

United States Environmental Protection Agency (USEPA)
http://www.epa.gov/ogd

The following link is to a document requiring Adobe Acrobat.
USEPA Catalog of Funding Sources for Watershed Protection
http://www.epa.gov/owowwtr1/watershed/wacademy/fund/wfund.pdf (PDF)

Partners for Fish and Wildlife: O, I, E, G.
-Eligible projects include restoration or enhancement of wildlife habitat, does not fund land acquisition or salaries.
-Need to call for application deadlines.
-Matching or in-kind services preferred, 10-year habitat development agreement required.
-Contact the US Fish and Wildlife Service (USFWS) at 847-381-2253 or 309-793-5800 for information.

Northeastern Illinois Wetlands Conservation Account: I, G, O, P, E.
-Eligible projects include restoration, enhancement, and preservation of wetlands. Other eligible projects include those that promote understanding, appreciation, and stewardship of wetlands
-Application deadlines vary. $5,000-$150,000 grant range.
-Matching funds preferred but not required. Limited to Northeastern Illinois area.
-Contact the U.S. Fish and Wildlife Service at 847-381-2253 for information.

Challenge Grant Program: O, I, E, G.
-Purpose for wildlife habitat restoration, streambank stabilization, or education.
-Application deadlines from June to August. Grant ranges vary up to $10,000.
-50% Match required.
-Contact U.S. Fish and Wildlife Service at 847-381-2253 or 309-793-5800.

US Environmental Protection Agency - Environmental Education Grants: E, P, G.
-Eligible projects include environmental education activities such as curricula design or dissemination, designing or demonstrating educational field methods, and training educators.
-November deadline. -Requires a minimum of 25% matching funds or in-kind services.
-Contact US Environmental Protection Agency (USEPA) at 312-353-5282.
http://www.epa.gov/region5/enved

Environmental Justice Small Grants: E, P.
-Projects include those that use community-based approaches for environmental protection.
-Project grants shall not exceed $20,000.
-Contact USEPA at 1-312-353-1440 or 1-800-962-6215.
http://www.epa.gov/seahome/resources

Community based Environmental Protection for Communities: U
-Purpose is to provide place-based approaches to address community and environmental approaches to slow the loss of open space, habitat, and wetlands.
-Matching share required.
-Need to call for deadlines -Contact USEPA at 312-886-4856
http://www.epa.gov/ecocommunity

Section 1135 Project Modifications for the Improvement of the Environment: G, P, U.
-Federal funds and technical assistance available for studies, planning, engineering, construction and administration.
-Cost-share up to $5 million plus non-federal match, 25% for project costs.
-Contact Army Corps of Engineers at 312-353-6400, 309-794-5590 or 314-331-8404.

Section 206 Aquatic Ecosystem Restoration: G, P, U.
-Projects include funding and assistance to carry out ecosystem restoration and enhancement that is documented to be in the public interest, will improve the

environment, and is cost effective.
-Federal cost-share of up to $5 million is available, 35% non-federal cost-share required.
-Contact the Army Corps of Engineers at 312-353-6400, 309-794-5590 or 314-331-8404

Scenic Byway Program: U.
-Purpose is to create or preserve treasured American byways or roads.
http://www.byways.org

Federal Tax Incentives for Conservation: I, O, U.
-Owners of environmentally sensitive land that has been donated for conservation purposes, or has been placed in a conservation easement, may qualify for significant federal tax deductions.
-Reference is the Internal Revenue Service (IRS) Code [170(h)].
-Contact the IRS or your federal tax advisor for more information.

State Funding Sources

The State of Illinois administers numerous programs for community-based conservation. Some of the money for these programs originates at the federal level and is "pass-through" funding, but much comes directly from the State.

Useful State websites:

Catalog of State Assistance to Local Governments:
http://www.legis.state.il.us/commission/igcc/catalog1999.pdf

Illinois Dept of Natural Resources (IDNR):
http://www.dnr.state.il.us/finast.htm

Education grants:
http://www.dnr.state.il.us/lands/education/classrm/grant

Illinois Department of Agriculture (IDOA):
http://www.agr.state.il.us

Illinois Environmental Protection Agency (IEPA):
http://www.epa.state.il.us/

Illinois FIRST Program: U
-Conservation purposes include brownfield cleanups and construction of trails and parks.
-Contact your local state legislative office for application details.
http://www100.state.il.us/state/ilfirst

Hazard Mitigation Assistance Program: G.
-Governments must be enrolled and in good standing with the National Flood

Insurance Program (NFIP).
-Eligible initiatives for projects include acquisition of insured structures and underlying real property for open space uses.
-Provides up to 75% of project costs, 25% match required.
-Contact is the Illinois Emergency Management Agency (IEMA) at 217-782-8719.
http://www.state.il.us/iema

Non-point Source Management Program (Section 319 grants): G, O.
-Eligible projects include controlling or eliminating non-point pollution sources.
-Application deadline is August.
-Requires 40% matching funds or in-kind services.
-Contact Illinois Environmental Protection Agency (IEPA) at 217-782-3362.
http://www.epa.state.il.us/water/financial-assistance

Illinois Clean Lakes Program: G.
-Financial assistance available for lakes over 6 acres that are publicly-owned with public access.
-Application deadline is Aug. 31 (pre-approval) and Oct. 31 (final approval).
-Requires 40% match for phase I, 50% local match for phase II.
-Contact IEPA at 217-782-3362.
http://www.epa.state.il.us/water/financial-assistance/index.html

Lake Education Assistance Program: G, E, P.
-Eligible projects include educational programs on inland lakes and lake watersheds.
-Maximum funding of $500 is reimbursed after completion. Deadlines are Sept. & Jan.
-Contact IEPA at 217-782-3362.
http://www.epa.state.il.us/water/financial-assistance/index.html

Priority Lake and Watershed Implementation Program: G.
-Eligible projects include funding to implement protection/restoration practices that improve water quality prioritized publicly-owned lakes.
-Funding up to 100%, projects range from $5,000 to $30,000.
-Contact IEPA at 217-782-3362.
http://www.epa.state.il.us/water/financial-assistance/index.html

Open Space Lands Acquisition and Development (OSLAD) Program & Open Lands Trust Grant Program: G.
-Eligible projects include money for acquisition and development of public parks for passive recreation/open space.
-Application deadlines vary. Conservation easement required with both programs.
-Funding is reimbursable up to 50% of project costs, reimbursable up to $2 million for the Trust Grant.
-Contact Illinois Dept. of Natural Resources (IDNR) for both programs at 217-782-7481.
http://dnr.state.il.us/ocd/

Greenways and Trails Planning Assistance Program: G.

-Eligible units of government include counties and communities > 10,000
-$20,000 maximum awarded, 50% in-kind contribution required.
-Must follow a planning process
-Contact IDNR at 217-782-3715
http://www.dnr.state.il.us/gnthome.htm

Illinois Trail Grant Programs: G,P,O.
-A collection of various trail programs where eligible projects include acquiring or constructing non-motorized bicycle and snowmobile paths and facilities.
-Deadline is March and May.
-0%-50% match required, depending upon which type of trail grant.
-Contact IDNR at 217-782-7481.
http://dnr.state.il.us/ocd/gaoutnew.htm

Urban & Community Forestry Grant Program: G.
-Purpose is to create or enhance local forestry programs in communities with a local forestry ordinance.
-May deadline.
-50% match required, reimbursement up to $5,000.
-Contact IDNR at 217-782-2361.

Illinois Wildlife Preservation Fund (Small Project Program): I, O, U.
-Eligible projects include those that deal with management, site inventories or on-going education programs.
-Deadline is April.
-Funding up to $1,000 per project, match preferred but not required.
-Contact IDNR at 217-785-8774.

Small Projects Fund: G.
-Provides assistance to smaller communities for alleviating locally significant drainage and flood problems.
-Provides funding for planning and implementation of flood control projects in accordance with an adopted plan.
-Grants and technical assistance awarded up to $100,000.
-Contact IDNR-OWR at 217-782-4637.

Schoolyard Habitat Action Grants: E, O.
-Eligible projects include enhancement of wildlife habitat, with emphasis on youth involvement and education.
-Project must involve a trained WILD educator or facilitator, Maximum funding to $600.
-Application deadline is October.
-Contact the IDNR at 217-524-4126.
http://dnr.state.il.us/lands/education/CLASSRM/grants

Conservation 2000 -- Ecosystems Program: O.
-Eligible projects include habitat protection or improvement, technical assistance, and education.
-The Ecosystems Program provides financial and technical support to groups

(ecosystem partners) which seek to maintain and enhance ecological and economic conditions in key watersheds of Illinois.
-February deadline, contact IDNR at 217-782-7940.
http://dnr.state.il.us/c2000

Illinois Transportation Enhancement Program: G.
-Eligible projects include those that support alternative modes of transportation and that preserve visual and cultural resources, including historic preservation and landscaping beautification.
-Planning is encouraged to be completed now for new disbursements. -Local 20% match required for projects, 50% match for land acquisition.
-Contact Illinois Dept. of Transportation (IDOT) at 1-800-493-3434.
http://www.dot.state.il.us

Learn & Serve Illinois: E.
-Eligible projects include those that combine conservation with hands-on learning in public schools.
-Grades K-12 and regional education offices only eligible, similar program exists for colleges/universities.
-Contact is at 312-814-3606 email: ggreene@isbe.net
http://www.isbe.state.il.us/learnserve

Certified Local Government Program [for historic preservation]: G.
-Eligible projects include historical surveys, education and historical preservation planning.
-October deadline, 40% match required.
-Contact the Illinois Historic Preservation Agency at 217-785-5042.
http://www.state.il.us/hpa

Illinois Heritage Grants [for historic preservation]: G, O.
-Eligible projects are those that entail historical construction.
-40% match required.
-Contact the Illinois Historic Preservation Agency at 217-785-5042
http://state.il.us/hpa

State Tax Incentives for Conservation: O, I.
-Urban land that is environmentally sensitive may qualify for significant property tax reductions:
Real Property Conservation Rights Act (765 ILCS 120/1 et seq.).
- If land is qualified by having a conservation easement, it may be assessed at 8 1/3 fair market value.
Illinois Natural Areas Preservation Act (525 ILCS 30/1 et.seq)/17 Ill Adm. Code.
- If land is qualified by being designated as an Illinois Nature Preserve, it may be assessed at $1/year in perpetuity.
Open Space Assessment (Illinois Property Tax Code Sections 10-155).
- A lower use evaluation is used for land in open space, 10 acre minimum area, not applicable in Cook County.
Preferential Assessment of Common Areas (Illinois Property Tax Code Sections 10-35).

- Purpose is to encourage open space in residential developments, if qualifying, assessment is reduced to $1/year.

Other tax incentives may also apply, contact IDNR regarding the Real Property Conservation Rights Act and the Illinois Natural Areas Preservation Act at 217-785-8774. Contact your local township or county assessor to determine eligibility under the Open Space Assessment and Preferential Assessment of Common Areas.

Other Public/Private Sources

Community Development Assistance Program (Community Development Block Grant): G.
-Eligible projects must include activities that improve community welfare, specifically in moderate or low-income areas. Conservation-related projects can possibly include the acquisition of real property (e.g., flood-prone areas), construction of water or sewer facilities, and initiatives for energy conservation. Funding competition is intense.

-Application deadlines vary; no match required.

-Money originates at the federal level as the Community Development Block Grant and is administered directly to “entitlement” communities such as the urbanized counties in Northeastern Illinois and selected municipalities such as the City of Chicago. In other areas, municipalities and other units of local government should contact their county government to apply for funds from the state under the Community Development Assistance Program. Community groups should work through their local municipality in incorporated areas and the next level of local government (i.e. township or county) in other areas.

Conservation 2000 -- Streambank Stabilization & Restoration Program (SSRP): G, O, I.
-Eligible projects include naturalized stream bank stabilization practices in rural and urban communities.
-Application deadlines are January, May and September.
-25% match required, 20% for qualified watershed planning areas.
-Contact the local Soil & Water Conservation District that services your county. Offices are listed in the phone book under “local government.”

Habitat Restoration Fund for the Fox and Kishwaukee River Watersheds: I, O, E, G.
-Eligible projects include native plantings, upland habitat & wetland restoration.
-Deadlines in March and August.
-75% cost-share, up to $5,000.
-Contact the Lake, Kane-DuPage, DeKalb, Boone, McHenry or North Cook Soil and Water Conservation Districts for more information.

Great Lakes Basin Program for Soil Erosion and Sediment Control: U.
-USDA-sponsored projects include protection of Great Lakes Water Quality by

controlling erosion and sedimentation (only available in Lake, Cook, and Will Counties). Typical grant amount around $25,000.
-Application deadline in January.
-Contact the Great Lakes Commission at 734-665-9135
http://www.glc.org/basin/RFP.html

Chicago Wilderness Small Grants: U.
-Eligible projects include natural areas enhancement, education, and research that focus on biological diversity of northeastern Illinois, northwestern Indiana, and the southeastern Wisconsin region.
-Application deadlines vary, need to call -1:1 matching funds or in-kind services required.
-Contact the Chicago Wilderness at 312-346-8166 ext. 30 for information.

Wetland Restoration Fund: G, U.
-Eligible projects include wetlands and other aquatic ecosystem restorations, projects must be in the six-county Chicago metropolitan area and have either a conservation easement or be owned by a government agency.
-Deadline is March and October
-No match required, project site must have a conservation easement, projects range from $5,000-$100,000
-Contact Corelands at 312-427-4256, ext. 241.

River Network's Watershed Assistance Grants Program: U.
-Eligible projects include community-based partnerships that conserve or restore watersheds.
-Deadlines are February 18 and June 15
-Grant amounts range from $1.500-30,000.
-Contact River Network at 503-241-3506 ext. 47.
http://www.rivernetwork.org
email: wag@rivernetwork.org

Community Tree Planting & Partnership Enhancement Monetary Grant Program: P.
-Eligible projects include community tree plantings with seedlings and grants to organizations for urban areas.
-Seedlings are donated directly to organizations conducting the plantings or monetary grants.
-Seedlings must be maintained and reports required for two years after grant award.
-Contact the National Tree Trust at 202-628-8733/Fax-8735 for more information on both these programs.
http://www.nationaltreetrust.com

National Fish and Wildlife Foundation Grants: U.
-Eligible projects include habitat restoration and protection on private lands
-Deadlines vary per individual program
-Sample grant sizes range from under $5,000 to $75,000.
Ph: 202-857-0166

http://www.nfwf.org

North American Lake Management Society: U.
-Grant Programs and other incentives periodically offered to enhance the protection of lake watersheds.
http://www.nalms.org/

America the Beautiful Fund: U.
-Free seeds provided in support of USDA-sponsored initiative
Phone: 202-638-1649
http://www.america-the-beautiful.org

Illinois Conservation Foundation: P, G.
-Eligible projects include those that enhance natural resources.
-February deadlines.
-Grants up to $5,000.
-Ph: 312-814-7237
http://www.icf.org

Private Sources

Private sources of funding for community and urban conservation projects include corporations and individuals that have established foundations for charitable purposes. Many corporate foundations focus their philanthropy in areas near their operations, so local retailers, businesses, or the local chamber of commerce might be a source of revenue for your project. Most, but not all, require that the group applying for funding be sponsored by a not-for-profit [501(c)(3)] corporation. Information about private foundations can be identified through organizations that specialize in grant information research. Fees for services or products may be charged by these organizations, so be sure to clarify if charges will be incurred. For "do-it-your-selfers," local grant data collection centers are available throughout Illinois and in convenient Indiana and Missouri locations:

Resources for Global Sustainability
P.O. Box 3665, Cary, NC 27519.
Ph:1-800-724-1857
RGS publishes a yearly catalog called "Environmental Grantmaking Foundations"
http://www.environmentalgrants.com

The Foundation Center
79 Fifth Street, New York, New York 10003
Ph: 212-620-4230
http://www.fdncenter.org

Sonoran Institute
Useful web site in identifying resources: http://www.sonoran.org/cat/search.asp

State of Illinois Grant Data Collection Centers Foundation Center Cooperating Collections

The Donor's Forum of Chicago
208 S. LaSalle St., Suite 735, Chicago, IL 60604
Ph: 312-578-0175
http://www.donorsforum.org
email: info@donorsforum.org

Metropolitan Association for Philanthropy, Inc
1 Metropolitan Square, Suite 1295 211 North Broadway St. Louis, MO 63102
Ph: 314-621-6220
http://www.mapstl.org

Evanston Public Library
1703 Orrington Ave Evanston, IL 60201.
Ph: 847-866-0305.

Evansville -Vanderburgh County Public Library
22 Southeast Fifth St., Evansville, IN 47708
Ph: 812-428-8218

Rock Island Public Library
401 19th St. Rock Island, IL
Ph: 309-732-7323
http://www.rbls.lib.il.us/rip/index.html

University of Illinois at Springfield (Brookens Library)
Shepherd Rd. Springfield, IL 62794
Ph: 217-206-6633
http://www.uis.edu/library/fdc.htm

Vigo County Public Library
1 Library Sq. Terre Haute, IN 47807
Ph: 812-232-1113

Examples of private grant sources for community-based conservation projects include:

Kodak American Greenways Awards Program: P, G.
-Eligible projects include greenway and trail projects.
-Grants range from $500-$2,500.
Contact Greenways Coordinator at Ph: 703-525-6300 or
http://www.conservationfund.org
email: leighannemcdonald@conservationfund.org

Chicago Community Trust: P
222 N. LaSalle St. Ste 1400 (Chicago area only)

Chicago, IL 60601
Ph: 312-372-3356
http://www.cct.org
info@cct.org

Exxon-mobile Educational Foundation: U, P.
-Emphasis is on conservation and education.
Contact is at 1-972-444-1104
http://www.exxon.mobile.com

Field Foundation of Illinois: P.
-Funding restricted to six-county Chicago metropolitan area.
-Focus is on prevention and reduction of pollution and preservation and protection of the natural environment.
-Call 312-831-0910 for more information.

Gaylord and Dorothy Donnelley Foundation: U, P.
-Eligible projects primarily conservation. Chicago area only, sample grants from $3,000-$50,000 range.
-Contact for deadlines.
Contact is at 35 E. Wacker Drive, Ste. 2600, Chicago, IL 60601, ATTN: Judith Stockdale.
Ph: 312-977-2700
http://www.gddf.org

Wildlife Links: I, G, O
-Eligible projects include management & education projects for conservation on golf courses.
Contact National Fish & Wildlife Foundation at 202-857-0166
http://www.nfwf.org