Kentucky

Best Management Practices (BMPs) for Controlling Erosion, Sediment, and Pollutant Runoff from Construction Sites

Planning and Technical Specifications Manual

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Kentucky Division of Conservation
Kentucky Division of Water

Transportation Cabinet
Department of Highways

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BMP Planning and Technical Specifications Manual for Construction Sites in Kentucky

Tetra Tech, Inc., produced this document with funding provided in part by a grant from the U.S. Environmental Protection Agency (EPA) through the Kentucky Division of Water (KDOW), Nonpoint Source Section and the Kentucky Division of Conservation (KDOC), as authorized by the Clean Water Act Amendments of 1987, Section 319(h) Nonpoint Source Implementation Grant #C9994861-01. Mention of trade names or commercial products, if any, does not constitute endorsement. This document is printed on recycled paper.

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1. Introduction

This Planning and Technical Specifications Manual contains information on Best Management Practices (BMPs) for preventing, reducing, and controlling erosion, sediment, and pollutant runoff from construction sites and other cleared, excavated, or filled areas. The manual was developed to help engineers, landscape architects, developers, construction managers, and others plan and implement measures that reduce harmful water quality impacts from construction projects and other land-clearing activities. The manual begins by explaining potential water quality impacts from construction and development, then summarizes applicable federal, state, and local regulations. The next sections explain basic principles for selecting, designing, and implementing construction site BMPs and provide detailed information on the most commonly used BMPs.

The information in this manual can be used to select, install, and maintain BMPs on construction sites and to develop BMP Plans to manage runoff from those sites. BMP Plans are required in Kentucky and other states for all construction projects that expose one acre or more of bare soil. This includes stripping or clearing vegetation, excavation, or placement of fill dirt.

Best Management Practices (BMPs) are planning/operational approaches, structural installations, and other field practices for reducing erosion, sediment loss, and polluted runoff from construction sites or other areas.

The manual is consistent with other Kentucky state and local guides that contain information on controlling polluted runoff from construction sites (see **www.water.ky.gov/permitting/wastewaterpermitting/KPDES/storm/**). Some state agency and local government guides contain additional information that might be helpful in complying with contract terms, local ordinances, regulations, or other requirements. For example, the Kentucky Transportation Cabinet (KYTC) *Specifications for Road and Bridge Construction* should be consulted by those working on state highway projects. Sections 212, 213, and 214 address erosion control, water pollution control, and geotextile construction, respectively (see **www.kytc.state.ky.us/construction/spec/2004/2004_Division200.pdf**). KYTC stormwater management and other water pollution control resources can be found at **www.kytc.state.ky.us/EnvAnalysis/Stormwaterquality/Default.htm**. Projects in Jefferson County should comply with the Louisville-Jefferson County Metropolitan Sewer District *Standard Drawings, Design Manual, and Specifications*, posted at **www.msdlouky.org/insidemsd/standard-drawings.htm**. Kentucky cities that are subject to U.S. Environmental Protection Agency (EPA) Stormwater Phase II requirements for urbanized areas operating municipal separate storm sewer systems (MS4s) can use the information in this manual, which is consistent with the *Kentucky Stormwater Consortium BMP Manual* posted at **www.bgky.org/publicworks/planningdesign/bmpindex.htm.** Timber harvest personnel should consult the *KY Forest Practice Guidelines for Water Quality Management*, the complete handbook of the Best Management Practices required under the Forest Conservation Act. The guidelines are posted at **www.ca.uky.edu/agc/PUBS/for/for67/intro.pdf**.

1.1 Purpose of the Manual

The purpose of this manual is to describe:

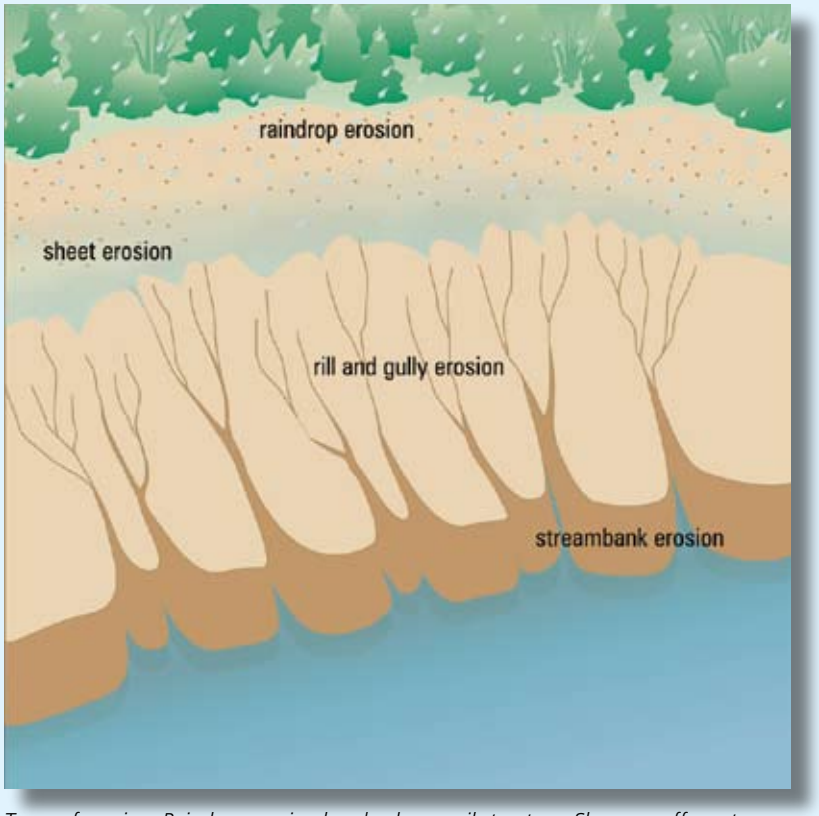
- Potential water quality impacts of construction and development activities
- Procedures for planning, designing, installing, and maintaining BMPs that control pollutants from construction activities and development sites
- Federal, state, and local regulations that apply to construction site runoff
- Technical information on specific BMPs

1.2 Water Quality Impacts during Construction

Clearing, grading, excavation, and placement of fill material expose soil to the weather. Sediment particles are then easily picked up by wind or water and washed away through erosion. When stormwater flows over an active construction site, it picks up other pollutants as well. As runoff velocities increase, the ability of water to dislodge and move larger soil particles and rock increases exponentially. High volumes of runoff water leaving a site can also cause stream bank erosion and destroy downstream aquatic habitat. In addition to the environmental impact, uncontrolled erosion can have a significant financial impact on a construction project.

BMP Plans are written descriptions of construction sites, their soil and drainage characteristics, and how site operators will control erosion, sediment, and pollutant runoff through planning/operational approaches (e.g., prompt seeding and mulching) and structural field installations (e.g., silt fencing, ditch liners, sediment traps). BMP Plans and KPDES permits are required for all construction sites with one acre or more of exposed soil.

Sediment runoff from construction sites is a nonpoint source pollutant of concern in Kentucky causing widespread siltation of stream benthic habitat, increasing overall water column turbidity, and adding to sediment bed loads. According to the *2004 Kentucky Report to Congress on Water Quality*, siltation is the second leading cause of impairment to rivers and streams in the state. Suspended solids, also attributable in part to construction site runoff, are the fifth leading cause of lake impairments, according to the report. Nutrient loading, which can be caused or worsened by construction site runoff, is the sixth leading cause of river and stream impairment and the third leading cause of lake impairment.



Types of erosion. Raindrop erosion breaks down soil structure. Slope runoff creates sheet erosion, which can lead to the formation of small rill channels and larger gullies. Erosion of unprotected stream banks can be caused by removing vegetation and higher flows caused by runoff from pavement, sidewalks, and roofs in newly developed areas.

Leading Causes of Use Impairment for Rivers and Streams in Kentucky

Cause	Miles Affected	Percent
Pathogens	1,560	23
Siltation	1,362	20
PCBs	781	11
Habitat Alterations (non-flow)	587	8
Organic Enrichment/Low DO	454	7
Nutrients	413	6
Metals	368	5

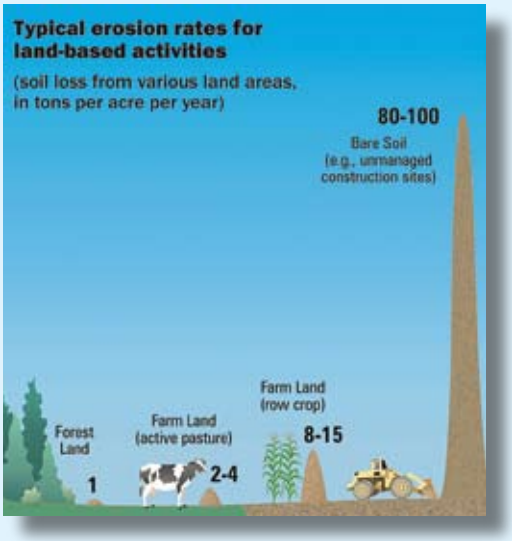
Source: Kentucky 305(b) Report, 2002

Leading Causes of Use Impairment for Lakes in Kentucky

Name	Acres Affected	Percent
Metals	87,825	77
Priority Organics	8,210	7
Nutrients	7,676	7
Organic Enrichment/Low DO	6,035	5
Suspended Solids	1,810	2
Siltation	1,368	1

Source: Kentucky 305(b) Report, 2002

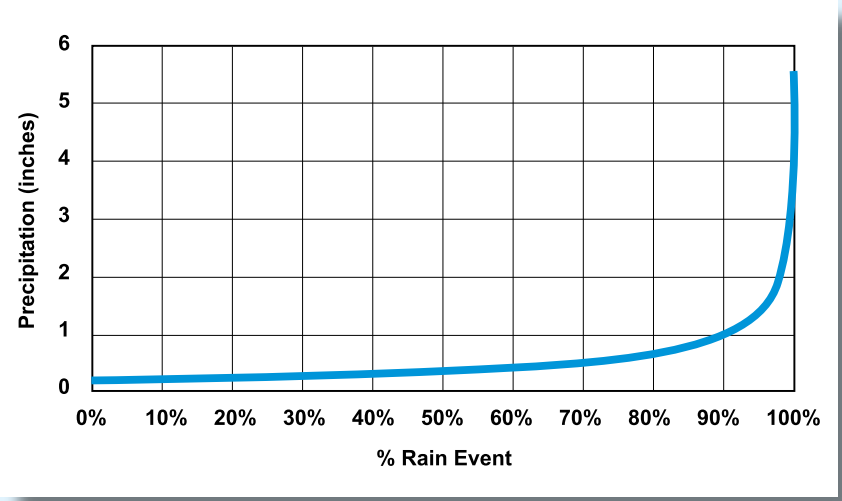
The sources of siltation, suspended solids, and nutrient loads are many, and it is not clear what portion of the problem can be directly attributable to sediment and erosion from construction sites. Sources of siltation, suspended solids, and nutrients vary significantly across the Commonwealth because of land use variability and other factors, but it is generally recognized that new development and construction sites contribute to siltation and nutrient enrichment of surface waters.



It costs money and takes time to repair gullies, replace vegetation, clean sediment-clogged storm drains, replace poorly installed BMPs, and mitigate damage to downstream property or to natural resources. **Preventing soil erosion, sedimentation, and runoff of other pollutants like concrete wastes, paint wash water, trash, and so on, is an important responsibility at all construction sites.** Sediment is most frequently associated with stormwater runoff from construction sites. Other pollutants of concern, such as nutrients; metals; pesticides; oil; grease and fuel; toxic chemicals; and general solid waste such as litter originate from common construction activities and can be discharged during rain events.

1.3 Construction Site Pollutants of Concern

A variety of substances and materials found on construction sites can become pollutants of concern if they are washed into nearby water bodies, dumped onto porous soils, or discharged directly to surface waters or groundwater. The following subsections summarize these potential pollutants.



Rainfall frequency distribution for a typical eastern U.S. city. Runoff controls that target small and medium-sized storms—up to 1.5 inches over a 24 hour period—can make a big impact, because most storms fall within this range.

Sediment—According to the *2004 Kentucky Report to Congress on Water Quality*, siltation is the leading cause of impairment to rivers and streams in the state. Suspended solids, also attributable in part to construction site runoff, are the fifth leading cause of lake impairments, according to the same report. Research over the past three decades has found that erosion rates from construction sites are **an order of magnitude greater** than those measured on row crop lands and several orders of magnitude larger than erosion rates on well-vegetated lands. Soil loss from new development can range from 20–150 tons per acre per year; the national average for soil erosion from crop lands is about 8 tons per acre per year. Sedimentation of streams and rivers from road construction can reduce aquatic insect and fish communities by up to 85 and 40 percent respectively, according to a 1997 study. Other research has found construction-related sediment impacts on small creeks extending as far as 4.8–5.6 kilometers downstream of active construction sites. Siltation is the second leading cause of impaired water quality in rivers and lakes nationally.

Nutrients—Two primary nutrients, phosphorus and nitrogen, are generated by a number of activities on construction sites, such as the application of fertilizer. Sediment, other construction chemicals, and wastes might contain nutrients as well. Discharge of excess nutrients into waterways can result in accelerated growth of vegetation or algae. The decomposition of this vegetation by aerobic bacteria can deplete the oxygen dissolved in the water and cause fish kills. Nutrient loading is the sixth leading cause of river and stream impairment in Kentucky and the third leading cause of lake impairment.

Metals—Metals can become mixed with construction site runoff in a number of ways. They can be washed from surfaces such as treated lumber, paint, or metal materials. Metals also are associated with the operation and maintenance of cars, truck, and other equipment used on construction sites. Metal molecules commonly attach to sediment particles and are washed away through erosion, which occurs during construction. Heavy metals are toxic to aquatic organisms, can accumulate in fish tissue, and have the potential to contaminate drinking water supplies.

Pesticides—Herbicides, insecticides, and rodenticides are commonly used on construction sites. If pesticides are applied improperly or in excess, they can contaminate waterways, kill aquatic organisms and vegetation, and contaminate drinking water. Pesticides can enter waterways through direct contact (improper application or spills), by drifting in the air and settling in water, or through the erosion of soil particles that have come in contact with the chemical.

Oil, grease, and fuels—Various types of equipment that require maintenance and fuel are used on construction projects. Leaks, spills, and dumping are primary sources of these contaminants on construction sites. Asphalt can be a source of oil in runoff as well. Just one quart of oil can produce a 2-acre oil slick on a pond, lake, or river. One gallon of oil

can make one million gallons of water too contaminated to drink, and 35 parts per million of oil will kill fish. Other hydrocarbons generally associated with petroleum products (e.g., gasoline, kerosene, asphalt) can be toxic and might be carcinogenic.

Toxics—The construction of buildings and roads requires the use, storage, and disposal of toxic or hazardous materials such as sealants, concrete, cleaners, adhesives, and solvents. Improper storage and handling of these materials can cause spills and leaks, which can be washed into neighboring waterways during heavy rains. Many of these items contain metals or other toxics that might be harmful to fish and humans.

Solid Waste—A large amount of solid waste is generated at construction sites including concrete waste, mulch, wood material, paper waste, and miscellaneous litter caused by workers. This waste can contribute various pollutants of concern when in contact with runoff water, or the debris can be washed into waterways becoming pollution itself. Solid waste from construction projects can clog waterways or become floatable pollution, resulting in aesthetic impacts, public complaints, fines, and other regulatory action.

1.4 Water Quality Impacts after Construction

Unfortunately, the potential for water quality impacts from polluted or accelerated precipitation runoff does not end when construction ends. Increased impervious area (i.e. driveways, parking lots, rooftops) can dramatically alter how runoff flows and how fast it flows over the land. When water can no longer filter into the ground, it must go overland into the nearest storm drain, ditch, or stream. As it flows, the water picks up pollutants and heat from parking lots, lawns, rooftops, or other surfaces. Many of the same pollutants present during construction can also be potential pollutants of concern after construction. Nutrients and pesticides can be used on lawns or landscaping, and metals, oil, grease, and other toxic materials can drip and settle onto parking lots and driveways. Litter or other debris might also be present, depending upon the type of development. All these materials can be picked up by storm runoff and washed into nearby waterways, becoming nonpoint source pollution after construction is complete.

Increased imperviousness also can cause a greater volume of water to leave a site at higher velocities than before development. This runoff can cause damaging erosion on the site and farther downstream, carrying high loads of sediment to receiving water bodies. The water also can scour streambanks, causing damage to property and aquatic habitat. Increased volume and speed of runoff water also can increase flooding on adjacent and downstream properties.

1.5 General Approach to Construction Site Runoff Management

BMP Plans can provide guidance for field activities, but even the best plans cannot compensate for field personnel who don't know the basics of controlling polluted runoff. BMP Plans and field activities to control erosion, sedimentation, and other runoff pollutants should focus on the following common sense principles:

- ***Fit the project to the site*** by retaining the existing drainage system (if it is stable), minimizing clearing and grading, and maximizing infiltration of precipitation.
- ***Minimize the amount of bare soil exposed*** at any one time by phasing the project, limiting clearing and grading to what can be handled during a three week period, and seeding or mulching promptly.
- ***Before clearing and grading begins***, install silt fences, sediment traps/basins, upland clear water diversions, and other BMPs. Get to final grade quickly, then seed or mulch.
- ***Maintain BMPs*** until the grass is up and the ditches are stable. Deal with ruts and washouts promptly. Keep potential pollutants out of the weather and clean up spills promptly.

2. Regulatory Considerations

This manual focuses on BMPs for all construction sites, no matter how large or small. However, it should be noted that construction sites with a disturbed area (i.e., bare soil exposure) of one acre or more are subject to state and federal stormwater regulations. Local regulations may also affect projects that are much smaller than an acre. The following sections summarize some of these statutory and regulatory provisions.

2.1 KPDES Stormwater Permitting

Public agencies at the federal, state, and local levels have implemented new rules to deal with impacts from the polluted construction site runoff issues summarized in the preceding section. These rules depend heavily on proper construction planning, knowledgeable field personnel, and common sense implementation of polluted runoff controls (i.e., BMPs).

Stormwater pollution prevention (BMP) plans and KPDES permit coverage are required for all construction sites once acre or larger under 2003 regulations. Plans must be kept on-site and available for inspections.

EPA regulations at Title 40 of the *Code of Federal Regulations* (CFR) 122.26(b)(14)(x) and 122.26(b)(15) require National Pollution Discharge Elimination System (NPDES) permit coverage for stormwater discharges from construction activities that disturb one or more acres. These regulations are implemented by general NPDES permits issued by EPA and authorized, in Kentucky, by the Kentucky Division of Water. The Kentucky Pollution Discharge Elimination System (KPDES) Construction General Permit meets all federal permit requirements.

The KPDES Permit covers all stormwater discharges associated with construction activity that disturbs one acre or more. This "one acre rule" includes all lots—even those smaller than an acre—in subdivisions or developments that will have more one acre or more of total disturbance, and long narrow projects such as buried pipelines/conduits/sewer lines if the construction width multiplied by the length would equal or exceed one acre. The area of disturbance is defined as only that portion of the site where ground cover or topsoil is removed, as contrasted to areas where tree or shrub clearing is the only activity. The definition of construction site applies equally to rural, suburban or urban areas but does not include tilled agricultural fields. The main goal of the KPDES permit program is to keep sediment and other pollutants out of lakes, rivers, streams, and wetlands.

KPDES permits are required for all construction sites that disturb one or more acres. The KPDES permit for construction sites that expose one acre of soil or more to the weather can be downloaded from this Web site: www.water.ky.gov/permitting/wastewaterpermitting/KPDES/storm/

Basically, the KPDES construction general permit requires operators of construction projects in Kentucky disturbing one acre or more to

- Submit a signed Notice of Intent (NOI) form to Kentucky Division of Water at least 48 hours before land disturbing activity begins.
- Submit a copy of the NOI to the operator of any MS4 into which the site discharges at least 48 hours before land disturbing activity begins.
- Develop, implement, and continuously update a written BMP Plan.

- Inspect and document the condition of runoff controls every 7 days and after each rain of one-half inch or more.
- Submit a signed Notice of Termination (NOT) form to Kentucky Division of Water after the site has been finally stabilized.

The BMP Plan must be developed in accordance with good engineering practices, and must identify expected sources of pollution and describe how they will be controlled. The BMP Plan is completed before construction, signed, and kept on-site (note: this can be in a vehicle if there is no office or other suitable location at the site). BMP Plans required by KPDES permits are considered reports that must be made available to the public, upon written request, in accordance with section 308(b) of the Clean Water Act. Deficient plans might require modification upon notification by the Kentucky Division of Water or local regulatory authority. Additional information on construction site BMP Plans can be found in section 3.

The construction site operator must apply for the KPDES permit on sites with a disturbed area of one acre or more. In general, the "operator" is the person who has operational control over plans and specifications, or day-to-day control over site activities. The operator is usually the general contractor, developer, or site owner.

2.2. Local Erosion Prevention and Sediment Control Programs

Cities in Kentucky that have a population of 10,000 or more and those that have polluted runoff problems associated with construction and other urban pollutants are subject to the national stormwater permitting program overseen by state water agencies and EPA. The stormwater permit program requires these cities to have ordinances and programs to **control construction site runoff and post-construction runoff impacts**, such as increased stormwater velocity, elevated temperatures, oil and grease contamination, trash, and so on.

Construction site operators (e.g., general contractors, developers, site owners) are responsible for understanding and complying with local ordinances as well as the state KPDES permit program. Most local and state requirements are very similar, but there are some significant differences in Jefferson, Fayette, and northern Kentucky counties. Check with each local government before construction to determine what local regulations and requirements might apply. Below is a summary of local regulations and requirements that in addition to those required by the state KPDES permit.

Louisville-Jefferson County Metropolitan Sewer District (MSD)

The Jefferson County Erosion Prevention and Sediment Control Ordinance applies to all land disturbing activities in Jefferson County that are in excess of 5,000 square feet or that require a building permit. All erosion protection and sediment control (EPSC) measures must be designed and installed to accomplish an 80 percent design removal efficiency goal for total suspended solids, using a 10-year, 24-hour storm event design. The MSD Design Manual, Standard Drawings, and Standard Specifications (Chapter 12) contains approved structural and non-structural BMPs for use in achieving this standard.

Structural BMPs include sediment trapping devices, inlet protection measures, perimeter controls and construction entrances. Non-structural methods include phasing a project into manageable pieces, scheduling activities within each phase to minimize amount of disturbed area and provisions for temporary and final stabilization.

Total Suspended Solids—A measure of the amount of small, particulate solid pollutants, including sediment, that are suspended in the water column.

The permittee or designee is required to conduct inspections of all EPSC measures and perform any modifications, maintenance or repairs as necessary, every 7 calendar days and within 24 hours of each storm event that produces 0.5 inch or more of precipitation. Records of these inspections must be kept on-site at all times for review by the appropriate compliance enforcement agency. Records must be kept on the Self-Inspection Form with

approved construction drawings. MSD has a network of rain gauges that can be queried to determine the amount of rain recorded for a section of the county. MSD will conduct compliance inspections of land disturbing activities and may refer potential violations to MSD for follow-up and enforcement action. For more information and to access the *MSD Design Manual*: **www.msdlouky.org/insidemsd/epsc.htm**.

Lexington-Fayette Urban County Government (LFUCG)

An erosion and sediment control plan is required for all construction with land disturbing activity of one acre or greater (per the KPDES general permit). The plan must be approved before obtaining a grading permit from LFUCG. In addition, land disturbance on a single residential lot, regardless of size, must comply with erosion and sediment control requirements. Home builders who fail to install the erosion and sediment controls will be issued a notice of violation. The plan must be developed and signed by a professional engineer or landscape architect licensed in Kentucky. All hydrologic, hydraulic, structural, and geotechnical design work included in the plan must be done and signed by a professional engineer licensed in Kentucky. Plans must integrate nonstructural and structural practices and procedures to control erosion and sediment loss. Once the erosion and sediment control practices have been constructed, a grading permit can be obtained. The erosion control permit remains in effect throughout the construction project, including the homebuilding phase of construction for residential subdivisions. Land disturbances for the construction of a structure on a single residential lot are permitted through the building permit process and must comply with LFUCG requirements.

A home builder in the Lexington-Fayette urban area is required to install the erosion and sediment controls listed below to minimize the sediment washing into streets, inlets, stormwater pipes, open channels, and adjacent lots:

Silt fence	Surface inlet protection
Construction entrance	Inspection of sediment controls
Seed, sod, and mulch	Street cleaning
Disposal of trash	Drainage system alterations prohibited
Curb inlet protection	Snow fence

An operation and maintenance plan must be developed that provides a schedule for inspection, maintenance and repair of BMPs during construction activities. A maintenance schedule must also be provided to ensure that permanent measures such as vegetation are properly established after construction is complete. All erosion and sediment controls that are identified in the erosion and sediment control plan (ESCP) must be inspected and maintained. Any erosion and sediment control devices that are damaged must be repaired or replaced immediately. For more information, see the manual at **www.lfucg.com/engineering/engmansw.asp**.

Sanitation District # 1 (SD1)

Sanitation District # 1 serves 33 communities in Boone, Campbell, and Kenton Counties of northern Kentucky. SD1 has established a permitting system to control stormwater runoff from construction sites and post-construction stormwater management for new developments and redevelopments. The permits are required for construction activity of one acre or larger in Boone, Campbell, and Kenton Counties and the municipalities in those counties covered by the KPDES Small MS4 Stormwater Permit (with the exception of the city of Florence). The land disturbing activity, development activity, or redevelopment activity cannot commence until the District has issued a clearing, grading, or land disturbance permit.

The land disturbance permit is required for (1) any alteration of the earth's surface where natural or man-made ground cover is altered and for which the applicant has not received a clearing or grading permit and/or (2) the installation of any storm sewer systems (including storm sewer structures and pipes, detention ponds, and so on). The land disturbance permit must also include activities covered by a clearing or grading permit if the applicant did not obtain a separate clearing or grading permit.

The grading permit is required for grading activities on a property. Grading activities include excavation, filling, stockpiling, or other earth moving activities, and any combination thereof. The grading permit may include the construction of sanitary sewers and other utility infrastructure (e.g., water, gas, electric). The installation of storm sewer systems (including storm sewer structures and pipes, detention ponds, and so on) require a land disturbance permit and will not be approved as part of a grading permit. A grading permit is not required if the property owner/applicant receives a land disturbance permit for the property covering the same activity.

The clearing permit is required for clearing activities on a property. Clearing activities include stripping and cutting of trees and ground cover and the removal of roots and associated material. The clearing permit does not include any earth moving activities, including rough shaping of the site. A clearing permit is not required if the property owner/applicant receives a grading or land disturbance permit for the property covering the same activity. Application forms and checklists can be found in the *Northern Kentucky Regional Stormwater Management Program Rules and Regulations* posted at **www.sd1.org**.

2.3 Utility Construction Requirements

In general, utility construction crews and other subcontractors are responsible for their own erosion and sediment controls. General contractors should make sure that all utilities and subcontractors use rock pad construction entrances or other measures to prevent movement of soil onto public roadways. **Tracking mud out onto paved roads can lead to legal liabilities.** If crews disturb areas that have already been stabilized, they should replace any mulch, sod, seed, blanket, matting, rock, silt fencing, or other material disturbed. Failure to properly grade, seed, and stabilize work sites can violate permit requirements. If your project is larger than one acre and covered under a KPDES Stormwater Permit, it is recommended that subcontractors and others conducting excavation or fill activities sign an agreement stating that they will comply with the BMP Plan. If utility projects cross or are conducted in or near streams, Clean Water Act section 404 permit coverage may be required (See Section 2.5).

2.4 Kentucky Transportation Cabinet (KYTC) Requirements

The KYTC inspection performance standard for erosion and sediment control is that no sediment should leave the site. **All KYTC projects are subject to KPDES Stormwater Permit requirements.** KYTC requires that slopes 4:1 or steeper with upland runoff areas exceeding 100 feet and all channels be lined with erosion control blankets. KYTC requires disturbed drainage areas (DDAs) to be identified in construction plans and managed to ensure that no adverse runoff impacts occur. If transportation projects are conducted in or near streams, Clean Water Act section 404 permit coverage may be required (see Section 2.5). KYTC standards also limit the total amount of disturbed area to 750,000 square feet (about 17.2 acres). Written approval from the district engineer is required for exceeding this limit. Bridge construction or repair and other work near streams require substantial erosion and sediment control efforts. KYTC projects are required to establish final grade quickly on as much of the site as possible, then stabilize with seed, mulch, blankets, or matting. Bare soil areas at temporary grade must be seeded and mulched after 14 days if they will not be worked during the following week (i.e., stabilization required after 21 consecutive days).

The KYTC Division of Design prepares the initial BMP Plan for highway construction projects as part of the construction specifications. The final plan is completed with input from the resident engineer and contractor. KYTC also files the NOI for KPDES permit coverage. Contractors and subcontractors are required to review, amend, and sign the BMP Plan and overall erosion and sediment control measures. Erosion control and water pollution control BMPs to be used on KYTC projects are outlined in the *KYTC Specifications Manual* in sections 212 and 213. The manual can be accessed at: **http://transportation.ky.gov/construction**.

2.5 Clean Water Act Sections 401 and 404 Requirements

Federal and state agencies both have additional requirements for projects that impact regulated water bodies, which can range from a large river or lake to a small channel that flows only for a few days after a rain. Any clearing, grading, excavation, or placement of fill material on or near the banks or channel will likely involve added measures to reduce water quality impacts, as summarized below.

Section 404 permits for work in regulated waters

Section 404 of the Clean Water Act regulates the discharges of dredged or fill materials into the waters of the United States, including small streams and wetlands adjacent or connected to regulated waters. These discharges include return water from dredged material disposed of on the upland and generally any fill material (e.g., rock, sand, dirt) used to construct land for site development, roadways, erosion protection, and so on. Basically, if equipment will be operating in or through a creek, wetland, or river, permit coverage is required.

The U.S. Army Corps of Engineers (USACE) administers the permit program dealing with these activities, in cooperation with EPA and in consultation with the U.S. Forest Service and the National Marine Fisheries Service. Individual permits are issued for activities with significant impacts, and nationwide or regional general permits are issued for activities with impacts not deemed to be significant.

For minor activities covered under section 404 nationwide permits (e.g., road culvert installation, utility line activities, bank stabilization), permit requirements are typically deemed to be met if activities result in only short-term, limited effects and if all appropriate and reasonable measures related to erosion and sediment control, project seeding and stabilization, and prevention of water quality degradation (e.g., working during low-flow conditions) are applied and maintained. A general condition of the 2002 nationwide permit is that, "appropriate soil erosion and sediment controls must be used and maintained in effective operating condition during construction, and all exposed soil and other fills, as well as any work below the ordinary high-water mark or high line, must be permanently stabilized at the earliest practicable date."

Contact information for USACE District Offices serving Kentucky:

Huntington District
502 8th Street, Huntington, WV 25701-2070
Tel: 304-529-5487 Fax: 304-529-5085
Web site: **www.lrh.usace.army.mil**

Louisville District
PO Box 59, Louisville, KY 40401-0059
Tel: 502-315-6675 Fax: 502-315-6677
Web site: **www.lrl.usace.army.mil**

Memphis District
Clifford Davis Federal Bldg, Room B-202,
Memphis, TN 38103-1894
Tel: 901-544-3471 Fax: 901-544-0211
Web site: **www.mvm.usace.army.mil**

Nashville District
3701 Bell Road, Nashville, TN 37214
Tel: 615-369-7515 Fax: 615-369-7501
Web site: **www.orn.usace.army.mil**

Overview of Common Nationwide Permits in Kentucky

Nationwide Permit	Activity Covered by the Permit
NWP 3 – Maintenance	Removal of sediment and debris within 200 feet of a structure
NWP 7 – Outfall structures and maintenance	Construction of outfalls and dredging of accumulated sediments
NWP 12 – Utility Line Activities	Activity that fills less than ½ acre of stream or wetland
NWP 13 – Bank Stabilization	Bank stabilization less than 500 feet and less than 1 cubic yard of fill per running foot
NWP 14 – Linear Transportation Facilities	Activity that fills less than ½ acre of stream or wetland
NWP 18 – Minor Discharges	Activity with less than 25 cubic yards of fill (1/10 acre in special aquatic sites)
NWP 19 – Minor Dredging	Activity that dredges less than 25 cubic yards
NWP 21 – Surface Coal Mining	Activities related to mining that have been approved by state and federal agencies
NWP 29 – Single Family Housing	Activity that fills less than ¼ acre of stream or wetland
NWP 35 – Maintenance Dredging of Existing Basins	Dredging to previously authorized depths
NWP 39 – Residential, Commercial, and Institutional Developments	Activity that fills less than ½ acre of stream or wetland and less than 300 linear feet of stream
NWP 40 – Agricultural Activities	Activity that fills less than ½ acre of stream or wetland and less than 300 linear feet of stream
NWP 41 – Reshaping Existing Drainage Ditches	Activities that impact less than 500 feet of stream
NWP 42 – Recreational Facilities	Activity that fills less than ½ acre of stream or wetland and less than 300 linear feet of stream
NWP 43 – Stormwater Management Facilities	Activity that fills less than ½ acre of stream or wetland and less than 300 linear feet of stream
NWP 44 – Mining Activities	Activity that fills less than ½ acre of stream or wetland

If the construction is not covered by a nationwide permit, an individual permit must be obtained from the USACE before beginning work. Processing such permits involves evaluation of individual, project specific applications in what can be considered three steps: pre-application consultation (for major projects), formal project review, and decision making. For more information, see **www.usace.army.mil/inet/functions/cw/cecwo/reg/index.htm**.

Section 401 Water Quality Certification

Activities that result in physical disturbances to wetlands or streams are regulated by the USACE under Clean Water Act section 404 and require a Clean Water Act section 401 Water Quality Certification (WQC) issued by the Kentucky Division of Water. WQC helps ensure that activities that could involve a discharge into waters of the state are consistent with Kentucky's water quality standards in Title 401, Chapter 5 of the Kentucky Administrative Regulations.

Listing the construction site operator and posting applicable permits makes it easy for inspectors to quickly check whether or not a site is in compliance with various state and federal regulations.

Examples of activities that may require a USACE section 404 permit and KY Division of Water section 401 water quality certification include:

- stream relocations
- road crossings
- stream bank protection
- construction of boat ramps
- placing fill
- grading
- dredging
- ditching
- mechanically clearing a wetland
- building in a wetland
- constructing a dam or dike
- stream diversions

For wetland-related impacts involving greater than one acre of wetland loss, the applicant should follow the Wetland Mitigation Requirements when applying for a WQC. Wetland losses involving less than one acre may be regulated by the USACE. The USACE is responsible for making official, jurisdictional wetland determinations.

For stream-related impacts that involve more than 200 linear feet of stream disturbance, the applicant should submit detailed plan and profile drawings along with the application (see draft Stream Mitigation Guidelines on Web site below). Impacts in streams or lakes designated as Special Use Waters require an individual WQC and special attention must be paid to the sediment and erosion control plan. For more information, go to **www.water.ky.gov/permitting/wqcert/**.

2.6 Kentucky Floodplain Construction Permit

Any proposed construction in the floodplain must conform to all Federal Emergency Management Agency (FEMA) and National Flood Insurance Program (NFIP) requirements and The Kentucky Division of Water Floodplain Management Section has the primary responsibility for the approval or denial of proposed construction and other activities in the 100-year floodplain of all streams in the Commonwealth. Typical activities permitted are dams, bridges, culverts, residential and commercial buildings, placement of fill, stream alterations or relocations, small impoundments, and water and wastewater treatment plants.

Applicants must submit a completed application with a location map, plans of the proposed construction, and the addressing of public notice. If the proposed construction lies in an area where there is no existing floodplain information, hydrologic and hydraulic analysis must be performed. KDOW engineers will perform the required analysis provided the Applicant supplies them with the floodplain geometry in the form of cross sections, preferably tabulated on an Excel spreadsheet. This analysis determines the effects the proposed construction has on existing flood conditions and determines the expected 100-year flood heights and the delineation of the floodway (a portion of the natural floodplain that is restricted to little or no construction). From this analysis, construction limits for fills and buildings and required elevations for finished floors or floodproofing can be provided. For all construction, especially bridges and culverts, a check is made to ensure that the project has only minimal impacts on existing flood levels. Regulations limit the effect to a maximum of one foot.

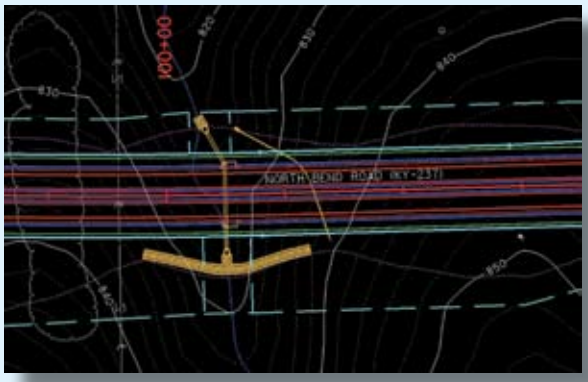
For more information, see **www.water.ky.gov/permitting**.

Case Study: Organizing and Phasing Large Projects—The Kentucky Transportation Cabinet Approach

Large construction projects should be organized via a logical sequence and phased to simplify and reduce management needs for controlling polluted runoff. This approach requires an analysis of the job site to identify work zones, activity sequences, and project phases. The KYTC has developed a procedure for organizing and phasing roadway construction that provides an excellent example of how this approach can be implemented.

Linear construction sites require special attention to drainage within—and into—the construction zone.

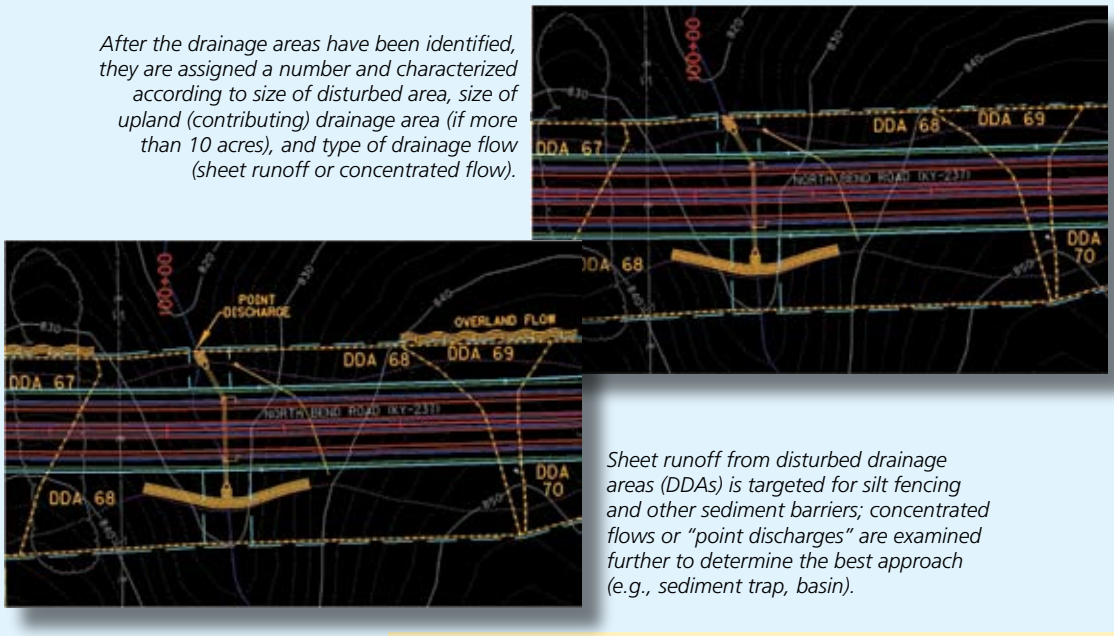
Erosion control plans are developed that show existing conditions overlaid with proposed construction grades and features—roadways, shoulders, and ditches, in this case. Designers are able to identify individual drainage areas along the right-of-way that will potentially be disturbed as construction proceeds. These so-called *disturbed drainage areas* (DDAs) are easily distinguished because they simply outline drainage catchments within the project area. After the DDAs are identified, designers will calculate the disturbed and upland drainage area within each and note whether they drain via sheet flow or concentrated flow. This information provides the basis for selecting appropriate BMPs—rock checks, traps, and basins for concentrated flows, and silt fencing, brush barriers, or other sediment controls for sheet flow.



The first step in developing an erosion and sediment control plan for highway corridors is to identify disturbed drainage areas along the right-of-way by analyzing topography and general drainage patterns.

DDA area (size), flow pattern, and BMP selection are then incorporated into the site BMP Plan. Traps and basins are sized to provide 3,600 cubic feet of total storage per disturbed acre. Areas that drain 10 or more acres require additional analysis to determine whether site-level controls can handle the volume of runoff (i.e., 10-year storm) that might pass through the site. This analysis could indicate that clean water diversions, a larger sediment pond, or more sediment traps installed in series are needed.

After the drainage areas have been identified, they are assigned a number and characterized according to size of disturbed area, size of upland (contributing) drainage area (if more than 10 acres), and type of drainage flow (sheet runoff or concentrated flow).

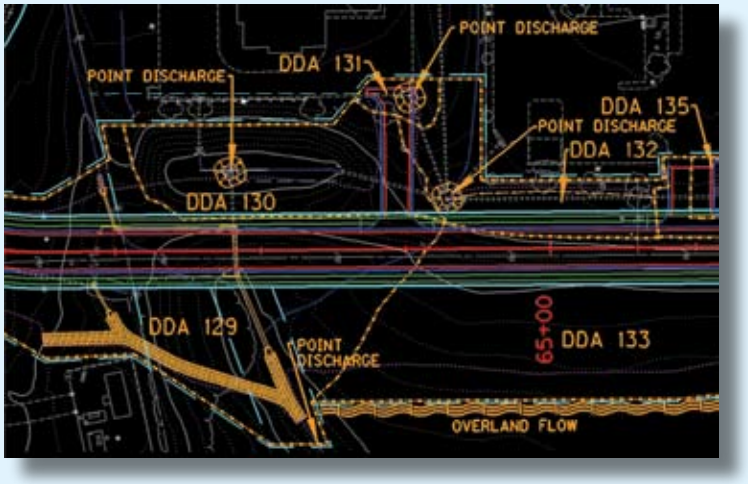


Sheet runoff from disturbed drainage areas (DDAs) is targeted for silt fencing and other sediment barriers; concentrated flows or "point discharges" are examined further to determine the best approach (e.g., sediment trap, basin).

In addition to site-level sediment management, the DDA approach also provides a basis for project phasing. DDAs along the right-of-way are designated for clearing/grubbing according to a logical analysis of how many can be adequately managed at one time. As a group of DDAs is stripped and graded and subjected to BMP controls, the next group is assessed and planned for in project stormwater KPDES permit documents (e.g., the BMP Plan). KYTC phasing requirements limit the DDA total to 750,000 sqare feet (~17 acres).

SECTION	DISTURBED AREA (ACRES)	MAXIMUM SEDIMENT VOLUME (CU FT)
DDA 67	2.01	7,236
DDA 68	1.37	4,932
DDA 69	0.14	504
DDA 70	6.72	24,192
DDA 72	0.52	1,872
DDA 73	8.34	30,024

Potential sediment volumes are calculated for DDAs to facilitate sizing of traps and basins.



The final step in the DDA runoff control process is to determine the type of BMPs needed for each DDA, their locations, and any special considerations beyond the standard notes information.

Linear construction projects, like highway corridors, require special consideration of stream crossings and the unique nature of each piece of the site drainage puzzle. The KY TC "designated drainage area" approach offers a logical process for dealing with these challenging sites. (Images courtesy of Burgess and Niple, the Kentucky Transportation Cabinet, and Tetra Tech.)

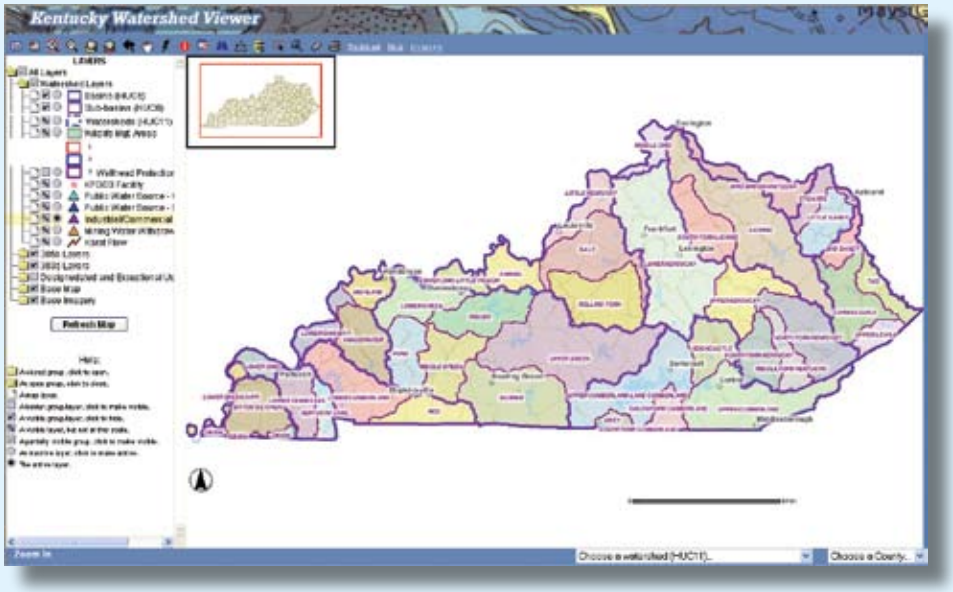
2.7 Integrating Large Projects with Watershed Management Objectives

With proper planning, design, and construction management, large development projects can have a minimal impact on water quality. The Commonwealth of Kentucky supports a wide range of mapping and other tools that provide important project planning data on drainage patterns, water quality, drinking water intakes, treatment facility discharge points, wildlife management areas, mining sites, karst flow zones, and so on. These tools are available for free public use online at **http://map.nr.state.ky.us/website/watershedsz/viewer**.htm, and provide valuable information for those planning large projects throughout the Commonwealth.

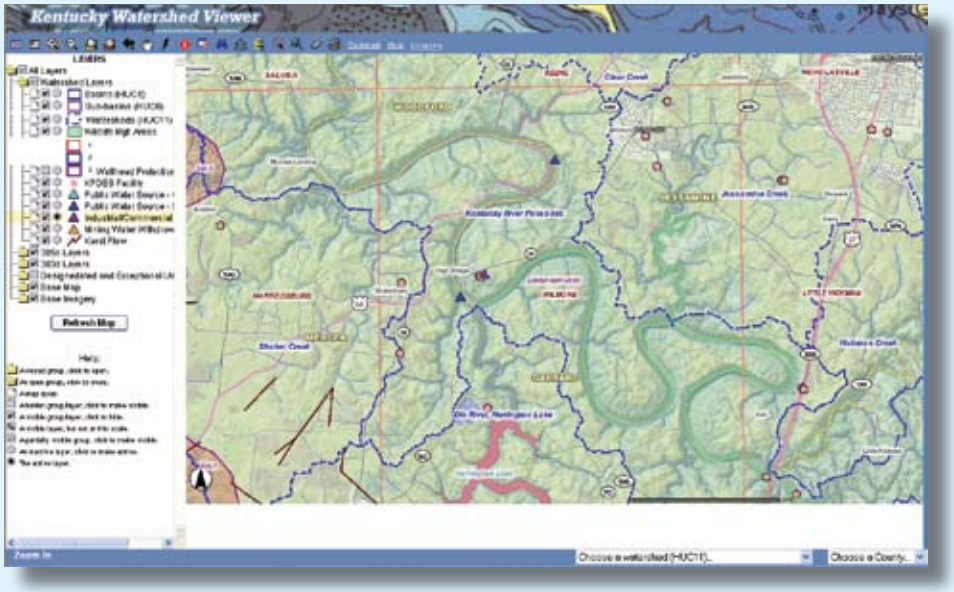
The tools are in the form of interactive global information system (GIS) maps that display a wide range of features. Interactive maps allow users to view GIS or mapped data in their home or office, thus eliminating a trip to an agency to find information. Each interactive map communicates a different theme, for example, Kentucky's Base Map, Oil and Gas Wells, Six-Year Highway Plan, Mined Out Areas, and so forth focus on a certain topic. Interactive mapping sites allow users to integrate local data sources with Internet data sources for display, query, and analysis in an easy-to-use Web browser. Any computer with an Internet connection can access interactive maps about Kentucky, but a high-speed connection is highly recommended

There are many GIS Internet viewers active within Kentucky. They are available for many separate mapping applications and have been developed to allow the staff and the public to view maps and the associated feature attribute data. Although the viewers are very similar, the data presented is different in each instance. Map information is arranged by *layer*. Each layer can be turned on or off and can be selected as the *active* layer. The scale at which each layer becomes visible varies according to its suitability for viewing at a particular scale.

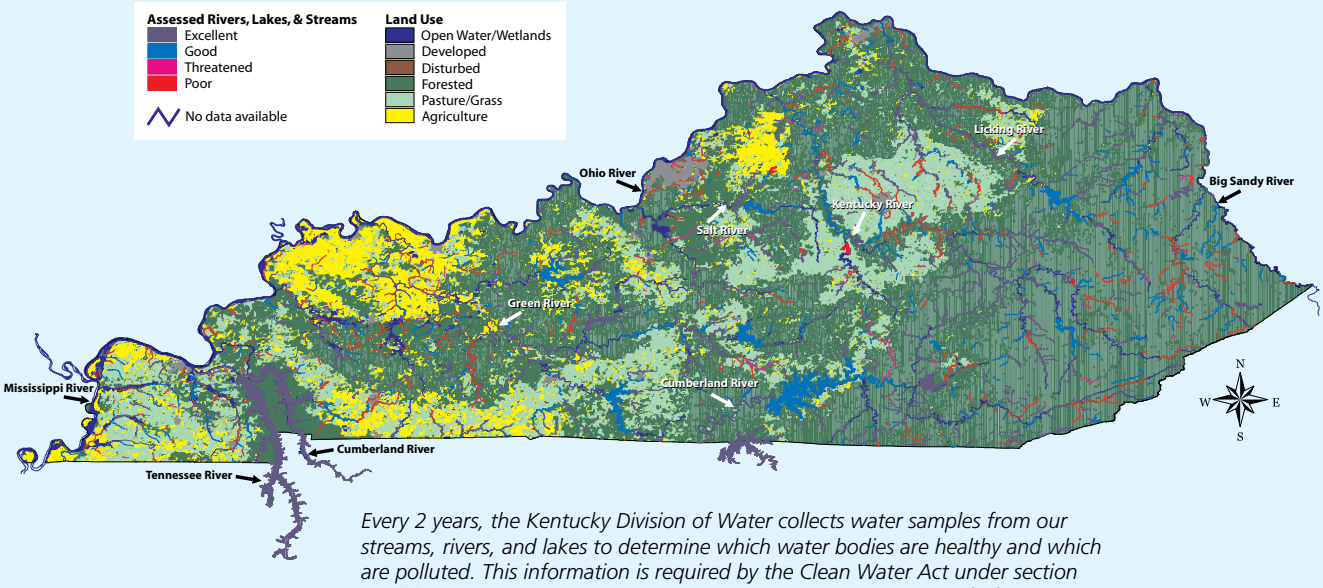
Note that when the user first accesses the site the layer menu is *collapsed*. Also make note of the Help section just below the layer listing. This Help section shows the different layer icons and what they indicate. Simply click on a closed group or folder and it will expand showing the map layers available in that group.



The Kentucky Division of Water, Transportation Cabinet, and other state agencies and university departments support GIS spatial viewers with overlays describing key construction planning inputs (e.g., drainage patterns, stream and river quality, soils, topography). For a full listing of these mapping tools, visit ***http://kentucky.gov/gis/****.*



Zoom and overlay features make the GIS mapping tools a valuable asset in planning large projects. For example, designers wishing to promote on-site infiltration of runoff can consider existing topography, drainage features, and soils.



Every 2 years, the Kentucky Division of Water collects water samples from our streams, rivers, and lakes to determine which water bodies are healthy and which are polluted. This information is required by the Clean Water Act under section 305(b). In 2004, Kentucky reported that water quality in nearly half of all assessed waters was threatened or poor because of polluted runoff. The map above shows the health of Kentucky's streams, rivers, and lakes.

3. Developing a BMP Plan

BMP Plans describe the site and how it will be managed, list the erosion protection and applicable housekeeping measures, and discuss how and when sediment and other controls will be applied as soils are exposed and site drainage is altered. BMP Plans are required for sites with a disturbed area of one acre or more, but they are a good idea for all projects. The following sequence of activities is common to the development and implementation of all BMP Plans in Kentucky:

1 Site Evaluation and Assessment

- Collect site information (soils, slopes, drainage)
- Produce map or drawing of existing site
- Create final project design map or drawing
- Measure the site area and drainage area(s)

2 Selection of Controls (BMP Plan Design)

- Review state and local requirements
- Select erosion and sediment controls
- Select controls for other runoff pollutants
- Indicate location of controls on map/drawing
- Identify the sequence of major activities
- Prepare the inspection and maintenance plan
- Identify all contractors and subcontractors

3 Permitting and Notification

- Assemble plan from previous activities
- Submit Notice of Intent (KPDES permit)
- Apply for and obtain local permits (if necessary)
- Distribute BMP Plan to contractors and subs
- Prepare to commence construction activities

4 Construction and BMP Plan Implementation

- Install basins, traps, drainage, sediment barriers
- Install exit, begin clearing and grading work
- Implement other controls as needed
- Inspect and maintain controls, document actions
- Stabilize disturbed areas within 21 days

5 Final Stabilization and Termination

- Stabilize all bare areas, slopes, and ditches
- Remove all temporary controls and trapped soil
- File Notice of Termination with KPDES
- Notify local government that work is complete

What contributes to erosion?

- *Removing vegetation*
- *Removing topsoil and organic matter*
- *Reshaping the lay of the land*
- *Exposing subsoil to precipitation*
- *Failure to cover bare soil areas*
- *Allowing gullies to form and grow larger*
- *Removing vegetation along stream banks*

Example site drawings and BMP Plans

For examples of site drawings and BMP Plans, see Appendix A and Appendix B. Plans are needed to comply with KPDES Stormwater Permit requirements.

Kentucky regulations require that "existing vegetation must be preserved where possible. All disturbed areas of the site must be stabilized. Stabilization must begin within 14 days on areas of the site where construction activities have permanently or temporarily (for 21 days or more) ceased. When snow cover causes delays, stabilization must begin as soon as possible. Stabilization practices include seeding, mulching, placing sod, planting trees or shrubs, and using geotextile fabrics and other appropriate measures, such as erosion control blankets, turf reinforcement mats, or hydromulching/hydroseeding."

The person responsible for developing the BMP Plan **selects and applies relevant structural and nonstructural runoff controls, and organizes/schedules their installation, operation, and maintenance**. This task includes

- Evaluating and assessing the construction site
- Establishing goals for the site, based on local conditions
- Planning for the phases of construction activity
- Identifying erosion and sediment control BMPs
- Selecting good housekeeping or pollution prevention BMPs
- Identifying post-construction stormwater controls
- Describing plans to inspect and maintain BMPs
- Documenting certification, record-keeping, and other requirements.

The Five Ss of erosion and sediment control

***S**oak it in—maximize seeding, mulching, and infiltration*
***S**low it down—don't let gullies form or grow larger*
***S**ift it out—use silt fences or other sediment filters*
***S**pread it around—break up concentrated flows*
***S**ettle it out—use inlet dams and sediment traps/basins*

BMP Plans for small sites can be fairly short and simple; those for larger sites are usually more complex because of the larger set of conditions typically encountered. This section provides a step-by-step review of how to develop a BMP Plan. The next three subsections discuss broad considerations related to plan development. Section 3.5 contains an outline for a typical BMP Plan that can be used as a template for site planning and BMP selection, scheduling, installation, and maintenance.

3.1 Erosion Prevention and Sediment Control

BMP Plans address two basic types of *muddy runoff* controls that must be used on a construction site to prevent soil (and attached pollutants) from leaving the site: **erosion prevention** and **sediment control**:

- Erosion prevention BMPs are designed to **keep sediment particles in place** at a construction site (e.g., seeding, mulching, erosion blankets or mats, phasing).
- Sediment control BMPs are design to **trap sediment particles** that have become dislodged during rainfall, before the sediment leaves the construction site.

Prioritization of erosion and sediment controls for construction sites

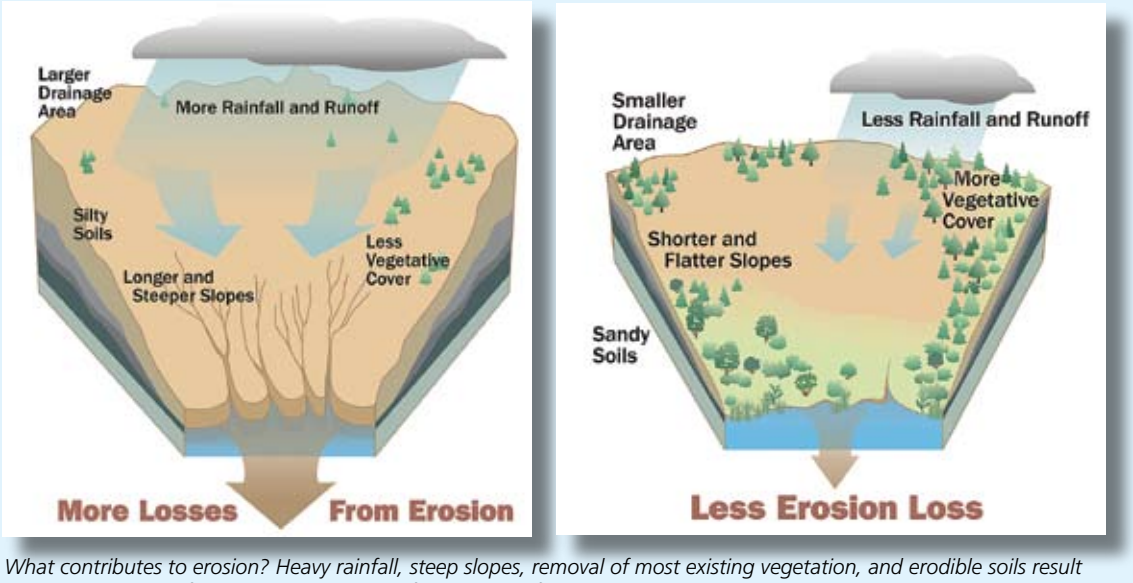
Practice	Cost	Effectiveness
Limiting disturbed areas through **phasing**	$	
Protecting disturbed areas through **mulching and revegetation**	$ $	
Installing diversion around disturbed areas.	$ $ $	
Sediment removal through **detention** of all site drainage	$ $ $ $	
Other **structural controls** to treat sediment-laden flow	$ $ $ $ $	

The cheapest erosion and sediment controls are the most effective. For example, limiting the amount of bare soil by phasing your project and preserving existing vegetation are less expensive and work better than installing large stormwater control basins or ponds.

In other words, erosion prevention BMPs try to minimize the movement of soil, and sediment control BMPs remove soil particles in runoff before they leave the site or enter a waterway. Many BMPs can serve both functions if designed and implemented properly (i.e. a grassy swale can filter runoff while directing it away from a denuded area). Erosion prevention BMPs should always be used first at a construction site where practical, because they work better and are much cheaper than sediment controls. However, a combination of both types of BMPs is normally required to adequately protect water quality.

Erosion prevention

The most important thing to remember when trying to prevent erosion on a construction site is to **minimize the amount and duration of soil exposure**. Maintaining existing cover will slow runoff, protect soil, and hold it in place. Preserving existing vegetation will also save money. Identify natural landscape features to keep, such as large trees, wildflower areas, and grasslands. Plan to fit the project around these features, so they remain in place after construction is completed. Also, try to preserve the existing site drainage system as much as possible, if it is stable. Do not clear vegetation or excavate areas near streams, rivers, lakes, or wetlands without getting the required state and federal permits (see Section 2).



What contributes to erosion? Heavy rainfall, steep slopes, removal of most existing vegetation, and erodible soils result in higher soil losses from erosion. Lower rainfall amounts, flatter slopes, preserving existing vegetation, and less erodible soils result in lower soil loss from erosion.

Most Kentucky cities with a population of 10,000 or more are subject to federal Stormwater Phase II requirements, which stipulate adoption of measures to manage construction site impacts and post-construction runoff.

Are you working in a "Stormwater Phase II City?"

Most Kentucky cities with a population of 10,000 or more have adopted new requirements for construction sites, which closely match the recommendations and information contained in this manual. For more information on the construction site erosion and sediment control procedures in specific Kentucky cities, visit www.kytc.state.ky.us/EnvAnalysis/Stormwaterquality/local_prog_links.htm

Is a stormwater permit required for your construction project?

To determine if your project requires a stormwater permit for construction activities, consider the following questions:

- *Will your construction project disturb one or more acres of land?*
- *Will your construction project disturb less than one acre of land but is part of a larger common plan of development or sale that will disturb a total of one or more acres of land?*
- *Will your construction project disturb less than one acre of land but is designated by the Kentucky Division of Water as a regulated construction activity?*
- *Will stormwater from the construction site flow to a municipal separate storm sewer system (MS4) or a ditch, swale, culvert, or pipe that eventually empties into a creek, stream, or other water of the United States?*

If you have answered "Yes" to any of the first three questions AND "Yes" to the fourth question, you need a stormwater permit for your construction activities. Please note that some municipalities also are required to implement stormwater control programs; therefore, check with your municipality for its own requirements. For more information on the EPA Stormwater Program go to: www.epa.gov/npdes/stormwater

Are you responsible for getting the KPDES permit?

EPA and the Kentucky Division of Water require each party who is considered a construction site "operator" to get permit coverage by submitting a Notice of Intent to the Division of Water. The owner, developer, general contractor, and architect could all be considered "operators" and may be required to obtain permit coverage. Before obtaining permit coverage, you will need to develop a BMP Plan. You must obtain permit coverage if you meet either of the following criteria:

- *Do you have control of construction project plans and specifications, including the ability to make modifications to those plans and specifications?*
- *Do you have day-to-day control of those activities that are necessary to ensure compliance with a BMP Plan for the site or other permit conditions (e.g., are you authorized to direct workers at a site to carry out activities required by the BMP Plan or other permit conditions)?*

If you answer "Yes" to one or both of these questions, you are likely responsible for meeting the permit requirements. (Note: the Kentucky Transportation Cabinet is the KPDES permittee for all state road projects. BMP Plan development and compliance is the responsibility of KYTC and the contractor. Changes to the BMP Plan are made by the contractor.)

Land disturbance should be planned in phases to minimize the amount of area denuded at any one time. A detailed analysis of cuts or fills, soils, and overall site resources is highly recommended for large projects because it can help to divide the project into logical work phases, identify resources that should remain undisturbed, and identify soil, rock and other material or resources that can be used during construction. Ideally, phased zones can be identified that roughly balance cut or fill needs while accommodating the work schedule. Balancing cuts and fills helps minimize exposure and movement of soil and keeps the *working face* of the project at a manageable level.

Once the soil has been exposed, it is critical to **stabilize the area as quickly as possible** with vegetative (i.e. temporary or permanent seeding, sod, landscaping) or non-vegetative covers (i.e. mulch, erosion blankets, pavers, gravel). Stabilizing exposed soil is the most effective means for minimizing pollutant runoff from construction activities.

Structural BMPs can be used to prevent erosion as well. Controls should be installed before grading to divert, store or control runoff to protect vulnerable or denuded areas. Ditches, swales, berms, dikes, or pipes can be used to channel flow away from disturbed areas. These same types of controls can be used to direct any muddy runoff toward sediment control BMPs for pollutant removal.

Sediment control

Sediment control BMPs remove pollutants from runoff by (1) filtering the runoff to remove participles, or (2) slowing or trapping runoff to allow heavy particles to settle out. Some types of controls do both. For example, vegetation (i.e. grassy swales, buffers) filters pollutants from runoff as it flows overland and slows the flow, allowing heavy particles to fall out.

Structural controls can be designed to **trap runoff and promote settling** of suspended sediment. Sediment control can be accomplished with a small

structure such as a check dam (i.e., ditch check), or by installing a large sedimentation basin. Care should be taken in determining the locations for sediment control measures. Structures should receive only the volume and velocity of flow specified in the design (see Section 4). In addition, it is critical that sediment controls be placed at strategic locations throughout the site to micro-manage runoff and capitalize on sediment removal opportunities before ditches or other concentrated flows leave the site. These exits are the final sediment control points. If the site drains to a storm sewer system, the storm drain inlets must be protected.

Measures to prevent tracking of mud and debris off-site are important sediment control practices as well. Properly designed and installed rocky entry or exit pads, wash racks, or regular street sweeping might be necessary prevent streets from being covered with mud.

3.2 Housekeeping and Other Control Measures

Keep construction sites well-graded, clean, and store materials properly to eliminate contaminated runoff. Wash water, fuels, and other potentially hazardous liquids should be managed appropriately.

BMP Plans also address other possible sources of contaminated runoff from construction sites, such as paint and concrete wastes, fuels and oils, spills, groundwater contamination, trash and litter, or other issues. The discharge of many construction site pollutants can be minimized or prevented by implementing good housekeeping practices and keeping a construction site clean. Proper storage and handling of oil, grease, paints, fuel, or other potentially toxic materials used during construction is critical to protect water quality. Whenever possible, maintain and fuel vehicles and equipment away from the site to minimize spills. While it is important to have spill kits and a formal plan in place should a spill occur, it is easier and less time-consuming to prevent leaks, spills, and dumping than cleaning up afterward. During construction, address solid waste storage and disposal, portable toilets (if needed), paint cleanup areas, wash racks, concrete washout locations, and other areas of concern to prevent polluted runoff or other harmful impacts.

3.3 Post-Construction Management of Polluted Runoff

After construction is complete, the project might still have the potential for ongoing runoff of various pollutants unless appropriate post-construction management practices are implemented. For example, pollutants such as oil and grease could be discharged from a gas station while pollutants such as nutrients and pesticides could be discharged from a plant nursery. The potential pollutants generated on-site should be considered when determining the types of runoff water management devices necessary to control pollutants discharged after construction. An effective post-construction runoff management plan requires proper site design, pollutant source controls, and treatment controls to protect water quality. This section provides a very brief summary of some approaches for ensuring that post-construction runoff does not adversely affect water quality. Note that not all of this information is included in the BMP Plan, but awareness of the principles outlined below can help to control future polluted runoff and meet regulatory requirements in municipalities subject to Stormwater Phase I and II permit programs.

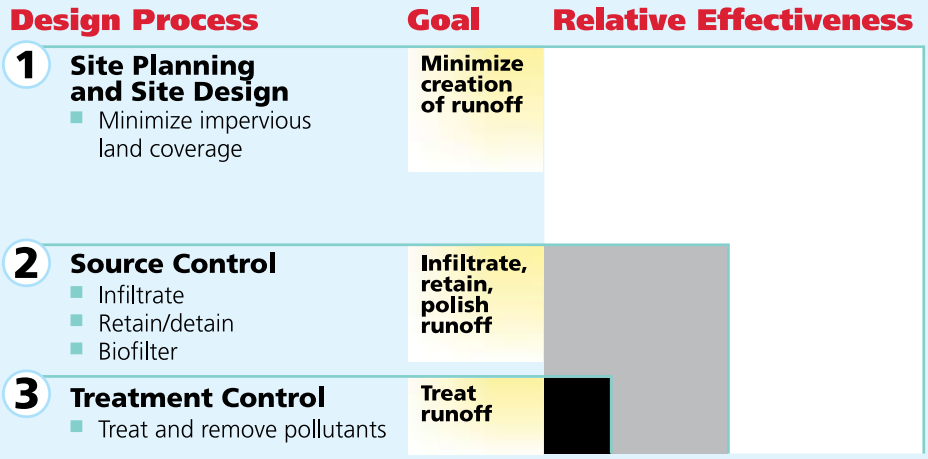
Plan preparation: Think about the types of runoff controls you'll need. Key BMP selection factors are site size, amount of clearing/grading to be done, current land cover, steepness of slopes, and project type. See the technical specifications for planning in Chapter 4.

Site design

In the beginning stages of project planning, it is important to consider the ultimate impacts the site will have on water quality. Minimizing directly connected impervious areas and infiltrating runoff on-site rather than sending it downstream will improve the quality and decrease the quantity and velocity of stormwater runoff. In addition, runoff water management site design can promote groundwater recharge, filtration of sediment and other pollutants from runoff, and help to prevent flooding. There are a variety of measures that can be used to accomplish these goals; however, Low Impact Design (LID) is a popular site-planning approach for managing stormwater in new development. Much has been written about LID; it has been found to be cost effective for the developer while protecting the water quality of streams and lakes.

More information on LID can be found on EPA's Web site at **www.epa.gov/owow/nps/lid/**.

The goal of LID in new development is to **maintain the predevelopment hydrologic conditions**. This is accomplished by controlling runoff near its source and using practices that promote infiltration and evaporation. The LID Site Planning Process is based on the principles below (i.e., site planning and site design is considerably more effective in reducing pollution than pollutant source controls or polluted runoff treatment).



Site planning and design has the greatest potential for addressing polluted runoff. Source controls and treatment for polluted runoff can help, but cannot match the benefits offered by minimizing changes to the existing site drainage.

1. Identify and protect riparian areas during construction, including floodplains, stream buffers, wetlands, woodlands, steep slopes, highly permeable soils, and highly erosive soils.

2. Minimize clearing and grading by

   - Restricting grading to the smallest possible area
   - Locating development away from floodplains, steep slopes, and wetlands
   - Minimizing construction easements
   - Preserving existing trees
   - Minimizing impervious surfaces
   - Disconnecting impervious surfaces to increase infiltration

3. Use hydrology as a design element when considering the location of park and play areas, potential building sites, and drainage paths.

4. Minimize total impervious area by considering

   - Roadway layouts that require less linear feet of streets
   - Narrow road sections
   - Sidewalks on only one side of the road

- Reduced on street parking and shared driveways
- Vertical construction of buildings to minimize roof area
- Limiting driveway width to 9 feet
- Reduced building setback to shorten driveway length

5. Minimize directly connected impervious areas by directing runoff from roof drains, driveway, and other paved surfaces to vegetated areas.

6. Maximize the hydrologic time of concentration by

Low impact development design seeks to capture and infiltrate runoff close to the source area. Small, strategically placed "rain gardens" and other dedicated and managed infiltration sites reduce runoff volumes and remove potential pollutants.

- Increasing overland sheet flow by letting the runoff spread out into grassy areas before reaching the stream
- Increase the drainage flow path by directing runoff into bioretention and infiltration areas before it leaves the lot
- Lengthen and flatten slopes on lots; increase vegetation overall
- Use vegetated swales instead of pipes

For more information on LID

For more on Low Impact Development Design Strategies (1999), see **www.epa.gov/owow/nps/lid/lidnatl.pdf**

For a builder's guide to low impact development, see **www.lowimpactdevelopment.org/lid%20articles/Builder_LID.pdf**

Source control

Pollutant source control (pollution prevention) measures aim to **reduce or eliminate** the sources or exposure of pollutants to prevent contaminated runoff. If pollutants are prevented from getting into runoff, the project can minimize the size and extent of post-construction control practices. Source control BMPs include general housekeeping (i.e., preventing spills, covering trashcans, and proper chemical storage), reduction of dry-weather flows (i.e., irrigation and washing of vehicles, sidewalks, or buildings) that can suspend pollutants in water, and educational efforts (i.e., storm drain stenciling, employee training programs). It is best to have a plan outlining proposed source control BMPs at the onset of the project as certain items might need to be considered or designed in advance (i.e., covered, locked trash enclosure).

Treatment and flow controls

Development of a site often changes the characteristics of the land, such as increasing imperviousness and altering drainage patterns. In addition, the ultimate use of the land can result in higher polluted discharges. Treatment controls attempt to remove pollutants from stormwater, thereby limiting the impact on water quality. Treatment controls can include infiltration devices or sites, filtration devices, and retention or detention facilities. Treatment control BMPs should be considered the final line in the post-construction stormwater management line of defense. The use of treatment controls alone can be more expensive and less effective than using a combination of site design, source controls, and treatment controls. Without site design features that reduce the amount of flow and source controls to minimize pollutants entering the runoff flow, treatment controls typically cannot perform adequately. It is critical that post-construction controls are inspected and maintained regularly if they are to function effectively over the long term.

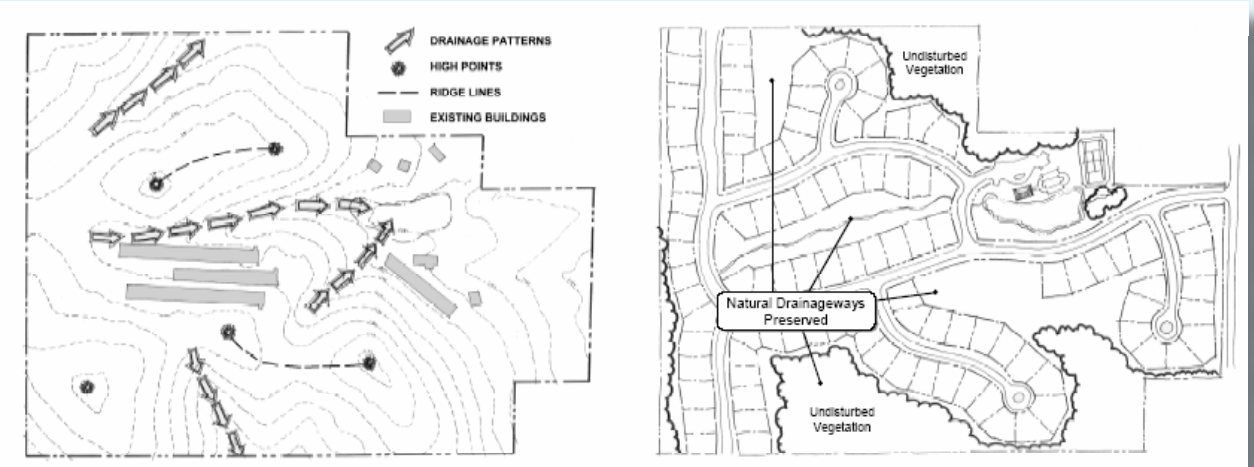


Figure 1.4.2-29 Example of a Subdivision Using Natural Drainageways for Stormwater Conveyance and Management

Fitting the project to the site: work around natural drainage features

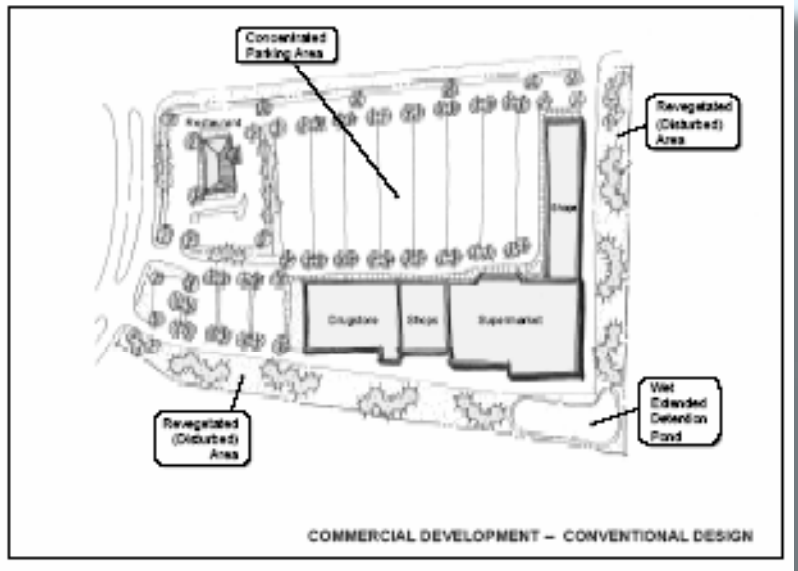
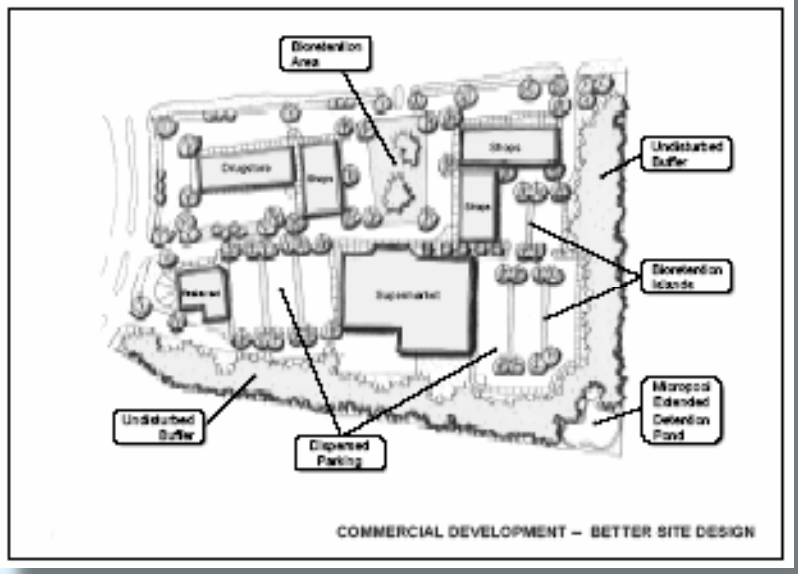


Figure 1.4.3-3 Comparison of a Traditional Commercial Development (above) with an Innovative Site Plan Developed Using Better Site Design Practices (below).



Increasing infiltration areas, trees, and landscaping improves the "look and feel" of a development and keeps runoff clean. In this example, the parking lot has been broken up into separate units surrounded by infiltration (bioretention) areas. Trees and vegetated buffer strips have been added to improve site aesthetics, summertime cooling, and surface runoff treatment. The entire development becomes more inviting, softer, and appealing because of the increase in vegetation and reduction of large expanses of "hard" surfaces.

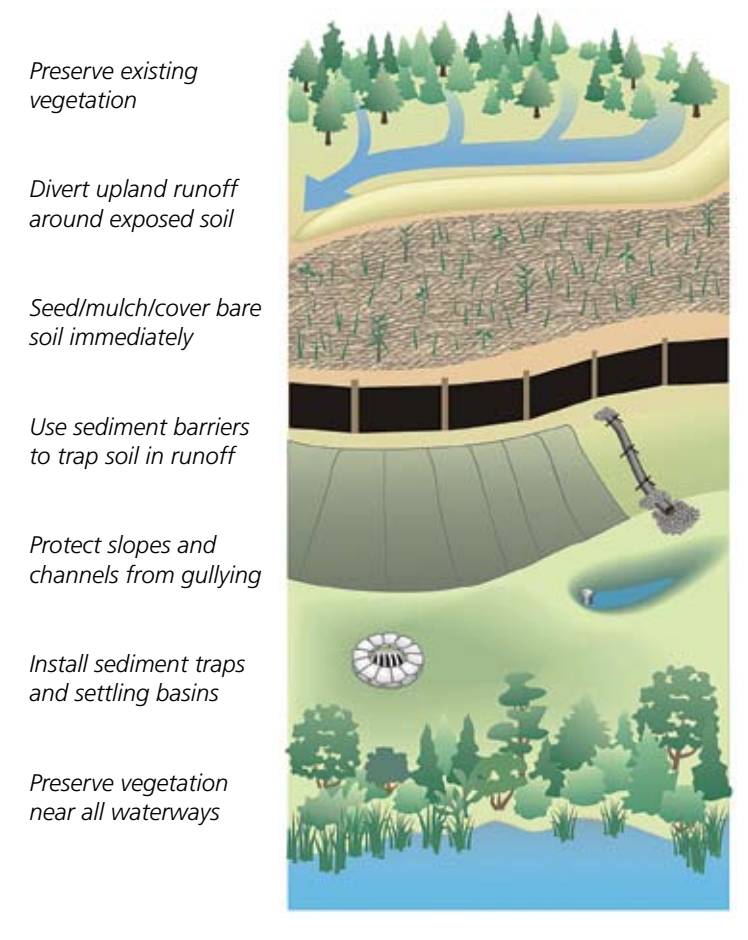
3.4 Principles for Selecting Runoff Controls

BMP Plans identify controls that will be used during various stages of the project—clearing or stripping, grading, utility installation, facility construction, and closeout. The best and most efficient and economical approach is to **divide the project into logical phases, focus construction and runoff controls on the active work zone, and get to final grade, seed, and mulch** as soon as practicable. The table below identifies BMPs that address various objectives, which emerge as the project unfolds.

BMP Principle	Applicable BMPs
1. Minimize needless clearing, grading, and destruction of natural vegetation • *Establish limits of grading on plans* • *Mark or flag clearing limits in the field* • *Phase clearing and grading activities to minimize the amount of land disturbed at any one time*	Setbacks from Waterways Vegetated Buffer Strips
2. Divert runoff and protect waterways/ wetlands • *Divert runoff away from disturbed areas* • *Create setbacks to protect waterways and wetlands* • *Establish vegetated buffer strips to help filter runoff*	Diversion Channel or Berm Setbacks from Waterways Vegetated Buffer Strip Stream Crossing Bioengineered Streambank Stabilization
3. Protect storm drain inlets and channels • *Protect all storm drain inlets receiving runoff from the construction site* • *Create small ponding areas for silt to settle out before entering inlets and pipes* • *Stabilize ditches at pipe outlets* • *Stabilize ditches to minimize erosion*	Inlet Sediment Barrier Pipe Outlet Energy Dissipater Rock Lined Channel Grass Lined Channel Check Dam
4. Protect slopes and disturbed areas • *Cover bare soil with vegetation* • *Use erosion control blankets on steep slopes and in ditches/channels to promote the growth of grass* • *Protect steep slopes from erosion*	Seed, Mulch, and Sod Topsoil Stockpiling, Dust Control Blankets and Mats Surface Roughening Slope Drain, Gabion Cellular Confinement Systems Polyacrylamides
5. Establish stabilized construction entrances to minimize tracking of sediment	Construction Entrance
6. Install sediment barriers on contour and at site perimeter to filter sediments	Silt Fence Brush, Rock, and Commercial Sediment Barriers
7. Use dewatering practices when necessary	Dewatering Structure
8. Control runoff using sediment traps or basins to remove settleable solids	Sediment Trap and Basin
9. Control waste and other pollutants • *Provide cover for all chemicals, liquid products and other materials that could contaminate runoff* • *Provide adequate trash receptacles and debris removal* • *Provide concrete truck washouts* • *Protect fueling and equipment repair areas from runoff water*	Good Housekeeping Practices i. Debris and Trash Management ii. Chemical Management iii. Concrete Waste Management iv. Sanitary Facilities v. Material Delivery, Storage, and Use vi. Employee Training vii. Vehicle/Equipment Fueling/Maintenance viii. Spill Prevention and Control
10. Install, inspect, and maintain BMPs • *Train construction site workers on the purpose of BMPs, installation techniques, and maintenance requirements* • *Install BMPs and implement the BMP Plan* • *Inspect BMPs every 7 days and within 24 hours of every rainfall of 0.5 inch or greater* • *Maintain BMPs*	Covered in the BMP Plan: • *Identify and select appropriate BMPs* • *Locate and label BMP sites* • *Provide BMP installation schedule* • *Describe inspection/maintenance program*

3.5 BMP Plan Contents

Several different types of controls must be considered when planning a development project. Measures must be planned to minimize erosion and remove pollutants from runoff during construction. In addition, ways to direct flows towards areas that will allow infiltration into the ground and treat runoff before it leaves a site after construction must be considered during the early phases of planning. Trying to retrofit construction or development plans to mitigate water quality impacts late in the process can be expensive and time consuming. Planning to include appropriate erosion prevention, sediment control, good housekeeping and stormwater management controls at the outset can help to ensure the protection of water quality and property as well as regulatory compliance. Section 4 of this manual provides specific examples of each type of control measure.



Think about how runoff will move onto, through, and off the site. This exercise will provide the information needed to identify, select, schedule, and maintain the necessary BMPs. An uphill-to-downhill assessment of the site also helps define the best approach for controlling polluted runoff.

As discussed in Section 2.1, construction activity that disturbs one acre or more is required to obtain a KPDES permit and develop a BMP Plan (**See Appendix B and C for examples**). The BMP Plan must include the following:

Site Description—The BMP Plan includes a clear description of the nature of the construction activity, the order of major soil disturbing activities, estimates of the total project area and the total disturbed area, the post-construction runoff coefficient, any existing data describing soil condition or discharge quality, receiving water name, and a site map. The site map indicates drainage patterns and show approximate slopes after grading, areas of disturbance, the location of control measures, surface waters, wetlands, and stormwater discharge locations.

Sediment and Erosion Control Measures—The BMP Plan includes a clear description of what sediment and erosion control measures will be used and when they will be implemented. The following control measures are used as a minimum:

- *Soil Stabilization Practices*—Existing vegetation is preserved where possible. All disturbed areas of the site must be stabilized. Stabilization must begin within 14 days on areas of the site where construction activities have permanently or temporarily (for 21 days or more) ceased. When snow cover causes delays, stabilization must begin as soon as possible. Stabilization practices include seeding, mulching, placing sod, planting trees or shrubs, and using geotextile fabrics and other appropriate measures.

- *Perimeter Structural Practices*—Silt fences or other equivalent structural practices must be used on all side and down-slope borders of the site. Alternatively, a sediment basin must be used that provides 3,600 cubic feet of storage capacity per disturbed acre drained. For common drainage locations that serve more than 10 disturbed acres at one time, a sediment basin must be used if possible. Structural practices include protecting drain inlets and outlets and using silt fences, earthen dikes, drainage swales, sediment traps, check dams, subsurface drains, pipe slope drains, reinforced soil retaining systems, gabions, sediment basins and other appropriate measures.

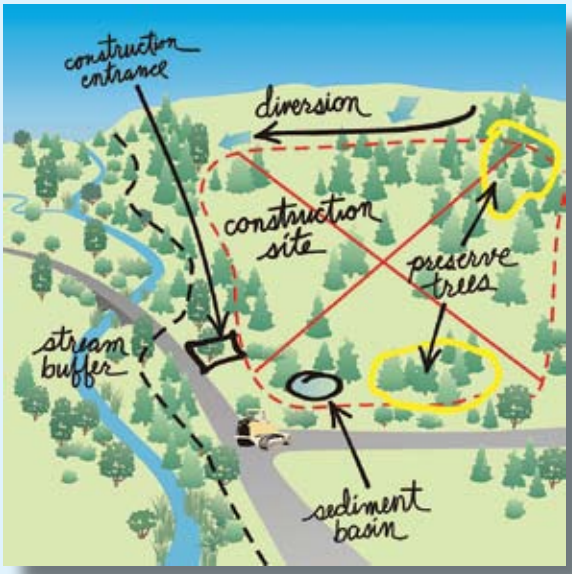
- *Stormwater Management Devices*—Management devices must be installed during construction to control the pollutants in stormwater discharges that will occur after construction has been completed. Velocity dissipation devices must be placed at discharge locations and along outfall channels as necessary to provide a non-erosive flow. The goal should be 80 percent removal of Total Suspended Solids that exceed predevelopment levels. If this goal is not met, the permittee must provide justification for refusing each device on the basis of site conditions.

Other Control Measures—No solid materials, including building materials, may be discharged to waters of the Commonwealth, except as authorized by a section 404 permit. Off-site vehicle sediment tracking and dust generation must be minimized. Waste disposal methods and sanitary sewer or septic systems must comply with applicable state or local regulations.

Other State or Local Plans—The BMP Plan must include any requirements specified in sediment and erosion control plans, stormwater management plans or permits that have been approved by other state or local officials.

Maintenance—The BMP Plan must include a clear description of the maintenance procedures necessary to keep the control measures in good and effective operating condition.

Inspections—Qualified personnel must inspect all stormwater control measures and drainage features at least once every 7 days and within 24 hours of the end of a rainfall that is one-half inch or greater. Discharge locations must be inspected to ensure that velocity dissipaters prevent significant impacts to receiving waters. Vehicle exits must be inspected for evidence of offsite sediment tracking. Disturbed areas and material storage areas that are exposed to precipitation must be inspected for evidence of pollutants entering the drainage system. A signed report summarizing the scope of the inspection, major observations, and any corrective actions taken must be made and kept as part of the BMP Plan.



Identify drainage areas and drainage ditches and channels. Install diversions, grassed channels, sediment traps/basins, downslope sediment barriers, and rock construction entrance before beginning work.

Non-Stormwater Discharges—The BMP Plan must identify and ensure the implementation of appropriate pollution prevention measures for any non-stormwater component of a discharge as listed in Part III C of the permit, except for flows from fire fighting activities.

Contractors and Subcontractors—The BMP Plan must clearly identify the contractor or subcontractors that will implement each control measure listed in the BMP Plan. All contractors and subcontractors identified in the BMP Plan must sign a copy of the certification statement below before conducting any professional service at the site:

> *I certify under penalty of law that I understand the terms and conditions of the general National Pollutant Discharge Elimination System (NPDES) permit that authorizes the stormwater discharges associated with industrial activity from the construction site identified as part of this certification.*

The certification must include the name and title of the person providing the signature; the name, address, and telephone number of the contracted firm; the address, or other identifying description of the site; and the date the certification is made. All certification statements must be included in the BMP Plan. The BMP Plan Checklist on the next page can help ensure that all BMP Plan elements are addressed.

BMP Plan Checklist

Item	BMP Plan Elements	Compliance		
		Good	Fair	Poor
Site Description	• Nature and type of construction activity	❍	❍	❍
	• Sequence of major soil disturbing activities (clearing, grading)	❍	❍	❍
	• Estimates of the total project area and the total disturbed area	❍	❍	❍
	• Post-construction runoff coefficient	❍	❍	❍
	• Existing data describing soil condition, discharges, and such	❍	❍	❍
	• Receiving water name and location (distance)	❍	❍	❍
	• Soil types and locations	❍	❍	❍
	• Construction area, time period, and general schedule	❍	❍	❍
	• Location of BMPs and schedule for installation	❍	❍	❍
Site Map	• Legend; property lines; existing/proposed contours; utilities	❍	❍	❍
	• Ditches, streams, sinkholes, wetlands, lakes	❍	❍	❍
	• Limits of construction and areas of no disturbance	❍	❍	❍
	• Trees to be preserved	❍	❍	❍
	• Existing and proposed buildings	❍	❍	❍
	• Existing and proposed paved areas	❍	❍	❍
	• Proposed pipes, inlets, and open channels	❍	❍	❍
	• Location of runoff discharges and streams/lakes/wetlands	❍	❍	❍
	• Construction entrances	❍	❍	❍
	• Location of equipment storage areas	❍	❍	❍
	• Location of soil stockpiles	❍	❍	❍
	• Sediment basins and sediment traps	❍	❍	❍
	• Silt fence and other sediment barriers	❍	❍	❍
	• Diversion channels or berms upgradient of site	❍	❍	❍
	• Other BMPs to be used on site	❍	❍	❍
	• Inspection and maintenance notes	❍	❍	❍
Erosion Prevention and Sediment Control Measures	*Soil Stabilization (e.g., seed, mulch)*			
	• Seed and mulch specifications	❍	❍	❍
	• Bare areas idle for 21 days to be seeded/mulched	❍	❍	❍
	Perimeter Controls (e.g., silt fence, sediment ponds)			
	• Drawings and specifications showing dimensions and materials	❍	❍	❍
	• Design criteria and calculations	❍	❍	❍
	• Sediment basin for all areas draining 10 acres of disturbed area. (Sediment storage capacity must equal 134 cubic yards per disturbed acre)	❍	❍	❍
	Stormwater Management Devices after construction is completed			
	• Measures to prevent erosion at culvert outlets and in channels/ditches	❍	❍	❍
	• Measures to remove 80% of the TSS that exceeds predevelopment levels	❍	❍	❍
Other Control Measures	• Measures to prevent discharge of debris and building materials	❍	❍	❍
	• Measures to prevent off-site tracking of sediment	❍	❍	❍
	• Measure to prevent dust generation	❍	❍	❍
	• Other good housekeeping measures	❍	❍	❍
Other State or Local Plans	• Identify local or other regulatory requirements	❍	❍	❍
	• Demonstrate compliance with local requirements	❍	❍	❍
Maintenance	• Description of BMP maintenance program	❍	❍	❍
Inspections	• Frequency of inspection (every 7 days and after every rainfall of 0.5" or greater)	❍	❍	❍
	• Documentation procedures for inspections	❍	❍	❍
	• Documentation procedures for making repairs to BMPs	❍	❍	❍
Non-Stormwater Discharges	• Pollution prevention controls (e.g. gasoline or diesel fuel spills)	❍	❍	❍
	• Good housekeeping measures	❍	❍	❍
	• Disposal procedures for trapped sediment	❍	❍	❍
Contractor and Subcontractor	• Name, address, and phone number of contractor & subcontractors	❍	❍	❍
	• Certification statement from each subcontractor	❍	❍	❍

3.6 Standard Notes for BMP Plans

BMP Plans are intended to organize, schedule, and guide runoff controls and site development work. The best BMP Plans will accurately and effectively forecast contractor needs for controlling runoff during clearing, grading, site stabilization, and construction. However, it is difficult to predict how a project will unfold under active field conditions—some areas scheduled for work might not be ready, subcontractors might not finish project phases on schedule, and other challenges might result in changes to the original BMP Plan and schedule.

To establish some common, standard practices regarding typical grading, clearing, excavation, and fill activities, BMP Plan preparers should adopt a system of standard notes for drawings and plans. These standard notes will convey important information regarding how to accommodate frequently encountered situations, like soil stockpiling, dewatering, unanticipated erosion after heavy rains, temporary sediment trap installation, and so forth. The notes will also provide clear authority for field personnel to identify, assess, and act upon conditions that could require immediate attention, such as severe rutting on slopes. The following series of standard notes should be considered for inclusion in all BMP Plans as appropriate:

- The BMP Plan must be implemented before any land-disturbing activities. Sediment controls such as traps and silt fences must be installed before land clearing, excavation, or placement of fill material.
- Detention basins, if used, must be constructed first and must perform as sediment basins until the contributing drainage area is seeded and stabilized. Outlets must be modified, if necessary, to maximize detention and sediment removal during construction.
- Temporary sediment traps with rock or earthen dikes or other approved controls must be installed downgradient of heavily eroded areas as needed to prevent sediment from leaving the site.
- Install construction exit to minimize the tracking of mud, soil, and rock from construction areas onto public roadways. Soil and rock tracked onto the roadway must be removed daily.
- Soil stockpiles must be located away from streams, ponds, swales and catch basins. Stockpiles must be seeded, mulched, and adequately contained through the use of silt fence.
- All stream crossings must use properly designed low-water crossing structures authorized under a USACE Clean Water Act section 404 permit.
- Sediment-laden water encountered during trenching, boring, or other excavation activities must be pumped to a sediment trapping device and cleaned before being discharged. Discharges to storm drains, ditches, or water bodies must be covered under a KPDES general permit.
- All bare soil areas not subject to active clearing, excavation, grading, or fill activities must be stabilized with temporary or permanent seeding or mulching within 14 days if no work is planned in that area during the next week.
- All areas identified as streams, stream buffers, wetlands, sinkholes, critical habitat, permanent native vegetation, or protected areas must be flagged as off-limits to vehicles and equipment.
- Good housekeeping practices must be applied to prevent contaminated runoff or other impacts from paint or concrete wastes, fuels and oils, trash and litter, or other materials.

- Silt fences, ditch checks, non-permanent sediment traps, and other temporary controls must be removed after vegetation in upgradient areas is established and ditches are stable.
- Good housekeeping measures for materials storage and handling, vehicle fueling and maintenance, spill response and cleanup, and waste management must be followed to ensure that runoff from the site is free of contaminants.
- All BMPs will be selected, installed, operated, and maintained according to KY DOW guidelines, manufacturer's requirements, or standard industry practice, as appropriate.

3.7 Inspections and Maintenance

Erosion and sediment controls must be inspected weekly and after each rain exceeding 0.5 inch. Inspections should be conducted by qualified personnel, and should follow the recommended sequence below:

"Qualified personnel" means a person knowledgeable in the principles and practice of erosion and sediment controls who possesses the skills to assess conditions at the construction site that could impact stormwater quality and to assess the effectiveness of any sediment and erosion control measures selected to control the quality of stormwater discharges from the construction activity.

Plan the inspection

Develop a checklist or report to document the inspection, including name and qualifications of the personnel making the inspection, date of the inspection, major observations relating to the implementation of the BMP Plan, and any corrective actions taken. Use the BMP Plan and site map to identify areas and BMPs that need to be inspected. Make sure that copies of required paperwork—permits, NOIs, the BMP Plan, subcontractor certifications, prior inspection reports, USACE 404 permits, and so on—are on hand.

Inspect discharge locations and vehicle exits

Inspect accessible discharge locations (i.e., where ditches or sheet runoff leaves the site) to ensure that velocity dissipation devices or sediment barriers are effective in preventing significant impacts to receiving waters. Inspect all vehicle exit locations for evidence of off-site sediment tracking. Also, inspect all storm drain inlet protection controls to ensure that they are effective and note any that need maintenance.

Inspect disturbed areas

Inspect disturbed areas for evidence of pollutants entering the drainage system or moving off-site. Runoff from disturbed areas should be treated by erosion controls, sediment controls, or a combination of controls before entering the drainage system. Note any disturbed areas with excessive erosion that might need additional controls.

Inspect control measures

Inspect all control measures that are listed in the BMP Plan to ensure correct operation. Inspect the control measures to evaluate whether they have been adequately installed and are effective. Note any controls that need maintenance.

Inspect material storage areas

Inspect all material storage areas exposed to precipitation for any potential for pollutants to enter the drainage system. Note any areas where potential pollutants are exposed or areas where material needs to be covered or contained.

Inspect temporary or permanent stabilized areas at least once a month

Areas that are temporarily or permanently stabilized must be inspected at least once a month to verify that erosion controls are in place. Inspections should also verify that active construction activity is not occurring in these areas. A checklist providing field indicators to assist during inspections is included in the following table.

Kentucky Best Management Practices Plan • Construction Site Inspection Report

Company:	**Site:**	**County:**
Site Operator:		**Date:**
Receiving Water:	**Total Site Area (acres):**	**# Disturbed Acres:**
Inspector Name:	**Inspector Qualifications:**	
Inspection Type: Weekly or ½ Inch Rain	**Days Since Last Rainfall** ____	**# Inches of Last Rainfall:** _____

Field Inspection Observations

BMP Category	Compliance Yes	No	N/A	Field Indicators for Compliance
Project Operations				Notice of Intent (KPDES permit) and other local/state permits on file BMP Plan on site and available for review Project timing/schedule and activities following BMP Plan Weekly inspection and rain-event reports on BMPs available for review Diversions, silt checks/traps/basins, and silt fences/barriers installed prior to clearing Grading and clearing conducted in phases to minimize exposed soil areas No vegetation removal or operations in stream or sinkhole buffer area (25-50 ft min) Rock pad in place on all construction site exits leading to paved roads No sediment, mud, or rock on paved public roads in project area Dust control if needed when working in residential areas during dry conditions
Drainage Management				Upland runoff diverted around bare soil areas with vegetated/lined ditches/berms Drainage channels exiting the site are lined with grass/blanket/rock and stabilized Discharges from dewatering operations cleaned in silt fence enclosure or other filter No muddy runoff leaving site after rains up to 1½ inches
Erosion Protection				Exposed soil seeded/mulched after 2 weeks if no work is planned for the next 7 days Soils on steep slopes seeded/mulched/blanketed as needed to prevent rutting
Sediment Barriers				Silt fence, rock filter, or other sediment barrier below all bare soil areas on slopes Barrier installed across slope on the contour, trenched in, posts on downhill side Multiple sediment barriers at least 125 ft apart on unseeded slopes steeper than 4:1 J-hook interceptors along silt fence where heavy muddy flows run along fencing No visible undercutting or bypassing or blowout of sediment barrier Accumulated sediment is less than halfway to the top of sediment barrier
Slope Protection				Slopes tracked, disked, or conditioned after final grade is established Slopes seeded, mulched, or blanketed within 21 days, no unmanaged rills or gullying Heavy downslope flows controlled by lined downdrain channels or slope drain pipes No muddy runoff from slopes into streams, rivers, lakes, or wetlands
Inlet Protection				Inlet dam/device or filtration unit placed at all inlets receiving muddy flows No visible undercutting, bypassing, or blowout of inlet protection dam or device Accumulated sediment is less than halfway to the top of the inlet protection dam/device
Outlet Protection				High flow discharges have rock or other flow dissipaters of adequate sizing at outlet Culvert outlets show no visible signs of erosion/scour, bank failure, or collapse
Ditch and Channel Stabilization				No unmanaged channel bank erosion or bottom scouring visible within or below site Ditches with slopes more than 3% have check dams spaced as needed, if not grassed Ditch check dams tied in to banks, with center 4" lower than sides, and no bypassing Ditches with slopes of up to 5% are thickly seeded with grass (minimum requirement) Ditches 5% to 15% are lined with thick grass and erosion control blankets as needed Ditches 15% to 33% are lined with thick grass and matting or other approved product Ditches exceeding 33% are paved or lined with rock or other approved product

Sediment Traps and Basins				Storage volume is at least 134 cubic yards for each acre of bare soil area drained Trap or basin is seeded/mulched and stabilized; no collapsing sidewalls or banks Outlet structure is stable and consists of rock-lined notched overflow or outlet riser Rock overflow is 6" lower in center to control overflow discharge Outlet riser pipe has concrete & rock base, ½ inch holes every 3" to 6", and trash rack Area near pipe outlet or overflow is stable, with no scour or erosion Sediment removed before trap or basin is halfway full; disposal is away from ditches
Maintenance of EPSC Management Practices				Sediment behind silt fence and other filters does not reach halfway to top Sediment traps and basins are less than half full of sediment Gullies repaired, silt fences and other controls inspected and repaired/replaced Written documentation of controls installed, inspection results, and repairs performed All controls removed and areas graded, seeded, and stabilized before leaving site
Materials Storage, Handling, and Cleanup				Materials that may leach pollutants stored under cover and out of the weather Fuel tanks located in protected area with double containment system Fuel and/or other spills cleaned up promptly; no evidence of unmanaged spills No evidence of paint, concrete, or other material washouts near drain inlets No storage of hazardous or toxic materials near ditches or water bodies
Waste Disposal				Trash, litter, and other debris in proper containers or properly managed No litter or trash scattered around on the construction site Provisions made for restroom facilities and/or other sanitary waste management Sanitary waste facilities clean and serviced according to schedule No disposal of any wastes into curb or other inlets, ditches, streams, or water bodies

Inspection Notes and Key Observations

List of Stabilized Areas: Vegetation is Established; Ditches are Stabilized; No Exposed Soil
Other Notes or Observations:
Corrective Actions Taken and/or Proposed Revisions to BMP Plan:

I certify under penalty of law that I understand the terms and conditions of the general Kentucky Pollutant Discharge Elimination System (KPDES) permit that authorizes the storm water discharges associated with industrial activity from the construction site identified as part of this certification.

Signature of Inspector: _____

4. Technical Specifications for BMPs

BMPs must be selected, installed, and maintained in a manner appropriate for both the BMP and the unique conditions of the site. This section provides technical specifications for selecting, designing, and installing (or implementing) BMPs. In general, BMPs should be designed to remove 80 percent of the sediment in the runoff and should ensure that water quality standards and public safety are not jeopardized.

It should be noted that while BMP Plans will identify the primary controls needed during each phase of construction, field personnel should be aware of how to select, adapt, operate, and maintain BMPs cited on plans or installed as a result of corrective actions stemming from field observations. The importance of this concept cannot be overstated.

4.1 BMP Selection Guidelines

General guidelines for selecting BMPs for construction sites are contained in the tables on the following pages, and in the Fact Sheets accompanying each BMP. BMPs are organized according to the following categories. Use these categories to find, scan through, and select BMPs that apply to your site:

- Site Preparation: Initial clearing and grading
- Soil Stabilization: Seeding, mulching, and sodding
- Slope Protection: Silt fences, blankets, mats, gabions
- Drainage System Controls: Inlet and outlet protection, ditches
- Sediment Traps/Basins: Small and large settling *ponds*
- Stream and Wetland Protection: Preserving and restoring waterways
- Good Housekeeping: Prevention of other types of polluted runoff

BMPs can also be selected based on their relative cost and effectiveness. In the table that follows, each BMP in the categories above is listed along with its purpose and application, relative effectiveness, and relative cost of installation and maintenance. For more details on BMP applications, including specific purpose, design criteria, construction specifications, and inspection and maintenance information, see each BMP Fact Sheet in this section. The page numbers in the table can be used to locate each Fact Sheet.

The Fact Sheets in this section are mostly focused on erosion and sediment control, but there are other types of runoff pollutants on a construction site that can be washed into nearby waterways after rain storms or during snowmelt. The table also summarizes BMP effectiveness in treating, removing, or immobilizing various pollutants found at construction sites, including sediment.

The reader is also encouraged to review the *Kentucky Erosion Prevention and Sediment Control Field Guide*. The guide describes the erosion and sediment control process, beginning with sections on pre-project planning and operational activities. The rest of the guide discusses erosion prevention and sediment control by starting at the top of the hill, above the project site, and proceeding down the slope through the bare soil area, ditches and channels, traps and basins, and on down to the waterways below. The field guide and other information on the Kentucky stormwater program is posted at **www.water.ky.gov/permitting/wastewaterpermitting/KPDES/storm/**.

BMP Purpose, Effectiveness, and Relative Costs for Various Construction Site Runoff Pollutants

Ref. No.	BMP Categories & Specific Practices	Purpose and Application	Relative Effectiveness	Relative Installation & Maintenance Costs	Sediment	Oil/ Grease	Nutrients	Toxics	Waste
4.3 Site Preparation									
4.3.1	Land Grading	Manage site clearing, excavation, and importation of fill material to minimize muddy runoff and preserve existing drainage system.	High	Low	●	○	●	○	○
4.3.2	Construction Exit	Keep sediment from being tracked onto public or other roadways. A rock pad of No. 2 stone is built where vehicles exit the site.	High	Low	●	○	○	○	○
4.3.3	Temporary Diversion (Berm or Ditch)	Prevent clean runoff from flowing through disturbed areas. Clean water from upslope areas is diverted around or through the site.	High	Low	●	○	◐	○	○
4.3.4	Topsoil Stockpiling	Preserve topsoil for later use when seeding & landscaping.	High	Low	●	○	●	○	○
4.3.5	Surface Roughening	Slow the velocity of water flowing down a slope and keep the seed and mulch in place. A dozer is operated up and down the slope to create small depressions with the tracks.	Moderate	Low	●	○	●	○	○
4.4 Soil Stabilization									
4.4.1	Temporary Seeding	Provide temporary vegetation and reduce erosion. Must be applied to areas where work has temporarily stopped after 14 days.	High	Low	●	○	●	○	○
4.4.2	Permanent Seeding	Provide permanent vegetation and reduce erosion. Must be applied within 14 days to areas that have reached final grade.	High	Low	●	○	●	○	○
4.4.3	Mulching	Reduce erosion, foster the growth of grass, and keep the soil moist by applying organic ground cover materials.	High	Low	●	○	●	○	○
4.4.4	Sodding	Quickly establish vegetation by using live, rooted mats of grass.	High	Low	●	○	●	○	○
4.4.5	Polyacrylamides	Reduce soil erosion by spraying the chemical binder on soil, or adding it to sediment basins to increase the settling of soil particles.	Moderate	High	◐	○	◐	○	○
4.4.6	Dust Control	Control fugitive dust emissions during dry weather on bare sites.	Moderate	High	◐	○	○	○	○

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BMP Purpose, Effectiveness, and Relative Costs For Various Construction Site Runoff Pollutants

Page	BMP Categories & Specific Practices	Purpose and Application	Relative Effectiveness	Relative Installation & Maintenance Costs	Sediment	Oil/ Grease	Nutrients	Toxics	Waste
4.5 Slope Protection									
4.5.1	Silt Fences	Intercept sheet runoff and provide a place for water to pond, so sediment will fall out.	Moderate	Moderate	◐	○	◐	○	○
4.5.2	Brush, Rock, & Other Sediment Barriers	Intercept and slow down runoff and provide a place for water to pond, so sediment will fall out.	Moderate to high	Moderate	◐	○	◐	○	○
4.5.3	Erosion Control Blankets & Turf Reinforcement Mats	Prevent erosion & protect grass seed by applying blankets or mats to bare soil areas. Required for slopes greater than 2:1 and channel velocities greater than 5 feet per second.	High	High	●	○	●	○	○
4.5.4	Temporary Slope Drains	Transport water down the face of a slope without causing erosion. A pipe or concrete lined channel can be used.	Moderate	High	◐	○	○	○	○
4.5.5	Gabion Baskets and Mattresses	Stabilize steep slopes at the inlet or outlet of a pipe or on a stream bank. Should be used only if vegetation or erosion control blankets/mats will not work.	High	High	◐	○	○	○	○
4.5.6	Cellular Confinement Systems	Stabilize steep slopes. Should be used only if vegetation or erosion control blanket/mats will not work.	High	High	●	○	◐	○	○
4.6 Drainage System Controls									
4.6.1	Curb Inlet Sediment Barrier	Create a small ponding area for soil to settle out at the front of the inlet using rock bags or commercial products.	Moderate	Moderate	◐	○	◐	◐	○
4.6.2	Drop Inlet Sediment Barrier	Create a small ponding area for soil to settle out around the perimeter of the drop inlet using rock, filter fabric, or other products.	Moderate	Moderate	◐	○	◐	◐	○
4.6.3	Culvert Inlet Sediment Barrier	Create a small ponding area for soil to settle out at the culvert entrance using rock or products.	Moderate	Moderate	◐	○	◐	◐	○
4.6.4	Culvert Outlet Energy Dissipator	Reduce the velocity of water exiting a pipe using a rock apron.	Moderate	High	●	○	◐	○	○
4.6.5	Rock Lined Ditches and Channels	Prevent channel erosion using rock installed on filter fabric.	High	High	●	○	◐	○	○

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BMP Purpose, Effectiveness, and Relative Costs For Various Construction Site Runoff Pollutants

Page	BMP Categories & Specific Practices	Purpose and Application	Relative Effectiveness	Relative Installation & Maintenance Costs	Sediment	Oil/ Grease	Nutrients	Toxics	Waste
4.6.6	Grass Lined Ditches and Channels	Prevent channel erosion using vegetation protected by mulch, blankets, or turf mats.	High	High	●	○	◐	○	○
4.6.7	Check Dams for Ditches and Channels	Reduce the channel velocity, prevent channel erosion, and trap sediment.	Low	High	◐	○	◐	○	○
4.7 Sediment Traps and Basins									
4.7.1	Temporary Sediment (Silt) Traps	Trap sediment by collecting it in a small depression or bermed area and slowly discharging it.	Moderate	Moderate	◐	○	◐	○	○
4.7.2	Sediment (Detention) Basins	Trap sediment by collecting it in a basin and slowly discharging it. Required for disturbed drainage areas of more than 10 acres.	Moderate to high	High	◐	◐	◐	○	○
4.7.3	Dewatering Devices	Remove sediment from muddy water collected on-site from runoff or groundwater.	High	Moderate	◐	○	○	○	○
4.8 Stream & Wetland Protection									
4.8.1	Buffer Zones	Protect existing vegetation along the banks of a creek, wetland, lake, river, or sinkhole to filter runoff and trap pollutants.	High	Low	●	○	●	◐	○
4.8.2	Filter Strips	Create a vegetative buffer strip along the banks of a creek, wetland, lake, river, or sinkhole to filter runoff and trap pollutants.	High	Moderate	●	○	●	◐	○
4.8.3	Temporary Stream Crossing	Protect stream banks and bottoms from erosion by constructing a span of culverts for vehicles to use in crossing a stream.	Moderate	Moderate	●	○	○	○	○
4.8.4	Bioengineering: Live Staking	Stabilize a stream bank with vegetation by driving live stakes such as willows into the soil to grow.	Moderate	High	●	○	◐	○	○

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BMP Purpose, Effectiveness, and Relative Costs For Various Construction Site Runoff Pollutants

Page	BMP Categories & Specific Practices	Purpose and Application	Relative Effectiveness	Relative Installation & Maintenance Costs	Sediment	Oil/ Grease	Nutrients	Toxics	Waste
4.8.5	Bioengineering: Wattles (Live Fascines)	Stabilize a stream bank with vegetation by binding live branches into long bundles and placing them into trenches along the slope to sprout and grow.	Moderate	High	●	○	◐	○	○
4.8.6	Bioengineering: Brushlayering	Stabilize a stream bank with vegetation by inserting live branches into the soil to sprout and grow.	Moderate	High	●	○	◐	○	○
4.9 Good Housekeeping & Other Controls									
4.9.1	Materials Delivery, Storage, and Use	Safely handle materials that might become potential pollutants.	High	Low	○	●	●	●	●
4.9.2	Spill Prevention and Control	Prevent and contain spills of oil, fuel, paint, fertilizers, or other liquids.	High	Low	○	●	●	●	◐
4.9.3	Vehicle and Equipment Maintenance	Minimize or eliminate runoff pollutants associated with operation of vehicles and equipment on the site.	High	Low	◐	●	○	●	◐
4.9.4	Debris and Trash Management	Provide waste storage containers on-site to minimize the amount of debris that is blown or washed off the site.	High	Moderate	○	○	○	○	●
4.9.5	Hazardous Waste Management	Provide containers for storing chemicals to prevent leaks and spillage.	High	Low	○	◐	○	●	●
4.9.6	Concrete Waste Management	Provide areas where trucks can dump concrete waste so that it does not wash into pipes or streams.	High	Low	◐	○	○	◐	●
4.9.7	Sanitary Facilities	Provide permanent or portable sanitary facilities.	High	Moderate	○	○	◐	○	●
4.9.8	Employee Training	Familiarize employees with overall program of runoff controls.	High	Moderate	●	●	●	●	●

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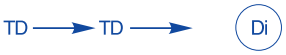
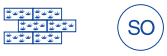
4.2 BMP Map and Plan Symbols

BMP Plans contain information on site runoff management controls (i.e., BMPs). Much of the information is descriptive, but BMP Plans also include maps and plans of the site, showing pre-construction site conditions (e.g., topography, drainage, land cover), the BMPs that will be applied during construction (e.g., silt fences, sediment traps/basins, ditches), and the final project (e.g., drainage, roads, buildings).

The symbols that follow are used to denote specific activities and structural controls that are described in this section of the *BMP Planning and Technical Specifications Manual*. Each symbol corresponds to a Fact Sheet on the BMP containing information on the definition, purpose, design criteria, construction specifications, and inspection or maintenance requirements. The symbols are also depicted on each Fact Sheet—they should be used on construction site plans to indicate where specific runoff control BMPs will be sited or applied.

Symbols Used to Denote BMPs

Ref. No.	BMP Categories and Specific Practices	Symbol
4.3	***Site Preparation***	
4.3.1	Land Grading	
4.3.2	Construction Exit	
4.3.3	Temporary Diversion (Berm or Ditch)	
4.3.4	Topsoil Stockpiling	
4.3.5	Surface Roughening	
4.4	***Soil Stabilization***	
4.4.1	Temporary Seeding	
4.4.2	Permanent Seeding	
4.4.3	Mulching	
4.4.4	Sodding	
4.4.5	Polyacrylamides	
4.4.6	Dust Control	
4.5	***Slope Protection***	
4.5.1	Silt Fences	
4.5.2	Brush, Rock, and Other Sediment Barriers	
4.5.3	Erosion Control Blankets and Turf Reinforcement Mats	
4.5.4	Temporary Slope Drains	
4.5.5	Gabion Baskets and Mattresses	
4.5.6	Cellular Confinement Systems	

Ref. No.	BMP Categories and Specific Practices	Symbol
4.6	***Drainage System Controls***	
4.6.1	Curb Inlet Sediment Barrier	
4.6.2	Drop Inlet Sediment Barrier	
4.6.3	Culvert Inlet Sediment Barrier	
4.6.4	Culvert Outlet Energy Dissipator	
4.6.5	Rock Lined Ditches and Channels	
4.6.6	Grass Lined Ditches and Channels	
4.6.7	Check Dams for Ditches and Channels	
4.7	***Sediment Traps and Basins***	
4.7.1	Temporary Sediment (Silt) Traps	
4.7.2	Sediment (Detention) Basins	
4.7.3	Dewatering Devices	
4.8	***Stream and Wetland Protection***	
4.8.1	Buffer Zones	
4.8.2	Filter Strips	
4.8.3	Temporary Stream Crossing	
4.8.4	Bioengineering: Live Staking	
4.8.5	Bioengineering: Wattles (Live Fascines)	
4.8.6	Bioengineering: Brushlayering	
4.9	***Good Housekeeping / Other Runoff Controls***	
4.9.1	Materials Delivery, Storage, and Use	
4.9.2	Spill Prevention and Control	
4.9.3	Vehicle and Equipment Maintenance	
4.9.4	Debris and Trash Management	
4.9.5	Hazardous Waste Management	
4.9.6	Concrete Waste Management	
4.9.7	Sanitary Facilities	
4.9.8	Employee Training	
4.9.9	Groundwater Protection	

Source: These BMP symbols are based on those used by the Kentucky MS4 Workgroup, Louisville-Jefferson County Metropolitan Sewer District, and Mapping Symbols and Nomenclature for Erosion and Sediment Control Plans for Land Disturbing Activities (ANSI/ASAE S422 MAR95), published by the American National Standards Institute and the American Society of Agricultural and Biological Engineers.