CONTRACTOR
TRAINING
PROGRAM

This program was developed through Clean Water Act Section 104 Water Quality Cooperative Agreement CP-98367101.
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I. Part 1-Introduction to Laws and Regulations

Who are you?
CONTRACTOR TRAINING PROGRAM

Course Agenda

- Introduction to Law and Regulations
- Environmental and Economic Impacts
- Principles of Erosion and Sedimentation
- Erosion and Sediment Control Practices
- Vegetative Stabilization
- Principles of Stormwater Runoff
- Stormwater Management BMPs
- Construction Site Pollution Prevention
- Sediment and Stormwater Plans and Review
- Enforcement Procedures
- Course Test

History of Sediment and Stormwater Regulations

- EPA Clean Water Act/NPDES
- State Program Development
- Delaware State Sediment and Stormwater Program
- Delaware General Permit for Construction

The National Pollutant Discharge Elimination System (NPDES) permit program regulates the discharge of pollutants to waters of the United States. The 1987 amendments to the Federal Clean Water Act added stormwater to the NPDES permitting universe. EPA issued new regulations in 1999 to require NPDES stormwater permits from smaller cities and smaller construction sites.

In 1979 Delaware began to develop a state stormwater program in anticipation of federal regulations. In 1991 Delaware established a combination Sediment and Stormwater Law and Regulations. The Delaware General Permit for Construction Activities is renewed every five years.
Definitions & Acronyms

**Responsible Person**
A foreman or superintendent who is in charge of on-site clearing and land disturbing activities for sediment and stormwater control associated with a construction project.

**Land Disturbing Activity**
A land change or construction activity for residential, commercial, industrial and institutional lands which may result in erosion of soil or surface movement of sediments or pollutants into State waters or onto lands in the State, or which may result in accelerated stormwater runoff including but not limited to clearing, grading, excavating, transporting or filling of land.

**Delegated Agency**
An agency with responsibilities for the implementation of one or more elements of the statewide Sediment and Stormwater Program

**BMP** – Best Management Practice
**EPA** – Environmental Protection Agency
**DNREC** – Department of Natural Resources and Environmental Control
**NPDES** – National Pollutant Discharge Elimination System

Some of these key definitions and acronyms will be used throughout the presentation. A more comprehensive list of acronyms and definitions are contained in the appendix.

Law and Regulation Highlights

The Delaware Sediment and Stormwater Regulations latest revision became effective February 11, 2019. We will be focusing on the most important portions of the regulations that you will need to know as the responsible person in the field.

Who’s Covered By The Regulations

All land disturbing activity over 5,000 square feet is covered by the regulations. There are exemptions for:

- Agricultural land management practices
- Emergency projects
- Land disturbing activity less than 5,000 square feet.
All land disturbing activity over 5,000 square feet (unless exempted) must have an approved sediment and stormwater plan. The plan must cover:

- Temporary erosion and sediment control measures
- Pollution prevention requirements
- Post construction stormwater

The Regulations require that the approved Sediment and Stormwater Plan be kept on site at all times.

The Sediment and Stormwater Program is delegated throughout the State to local program jurisdictions. The agencies are listed in the appendix.
Owner/Developer Certification

I hereby certify that all clearing, grading, construction or development shall be accomplished pursuant to the plan and that all responsible personnel involved in the land disturbance will have a Certification of Training at a Department sponsored or approved training program for the control of erosion and sediment control before the initiation of the project.

The Department or delegated inspection agency shall have the right to conduct on-site inspections.

I. M. A developer

On the approved plan, there is also a place where the owner/developer must sign.

Certification

- Responsible person on site
- Right of entry certification
- Construction according to plan

The sequence of construction is a series of steps prescribed by the design engineer on how to proceed through construction while controlling erosion and sediment.
All erosion and sediment (E&S) control practices must be designed in accordance with the Delaware Erosion & Sediment Control Handbook, which is available on the Sediment & Stormwater Program website.

The Sediment and Stormwater Regulations require that all disturbed areas that have not been worked for a period of 14 calendar days, be temporarily or permanently stabilized.

The regulations require that when standard erosion & sediment controls are used grading and construction be accomplished in grading phases so that no more than 20 acres are disturbed at once.
Standard Plan Criteria for a Single Residential Home

The regulations allow certain projects to have a standard plan for E&S. This would include minor earth disturbance for a single residential home. Standard plans can be used for tax ditches, utilities, and agriculture structures.

Under Ground Storage Tanks

For storage tank installations, replacement, and removals, the land disturbance includes the tank size plus the laydown area, stockpile, and vehicle disturbance.

Certified Construction Reviewer

- Private reviewer hired by the developer when required by the review agency
- Five year certification
- Functions under the direction of a Delaware-licensed professional engineer

The regulations allow the Delegated Agency to require a Certified Construction Reviewer (CCR) to review a site. A CCR becomes certified by taking a course from DNREC comprised of two and a half days. CCRs must be third party CCRs, meaning that they are not an employee of the owner or the contractor, excluding the site designer.
The Regulations have provisions for enforcement and penalties for noncompliance.
II. Part 2-Environmental and Economic Impacts of Soil Erosion and Sedimentation

For just a few moments, let’s take a look at some of the reasons that we should be concerned with soil erosion and sedimentation. If adequate measures are not planned or implemented when disturbing land, the result may have devastating effects on our aquatic resources.

In Delaware, you are never far from water. This becomes most important when we consider the impacts of soil loss and sedimentation on our aquatic resources. We depend on clean water for recreation, drinking water sources, and commercial fishing. Our tourism industry in the state would suffer enormous losses if poor water quality prevented vacationers from swimming, fishing, boating and taking advantage of Delaware’s clean water.

We oftentimes hear about construction activities contributing to soil erosion and water pollution. This table represents the erosion rates categorized by land use. Notice that construction, along with surface mining, is the number one contributors according to land use.
Environmental Impacts Summary

- Increased turbidity reduces photosynthesis
- Impacts to aquatic insects
- Impacts to fish
- Impacts to habitat

Turbidity is the cloudiness or haziness of water caused by large numbers of individual soil particles that are generally invisible to the naked eye. The measurement of turbidity is a key test of water quality.

An aerial view of the Chesapeake and Delaware bays.

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III. Part 3-Principles of Erosion and Sedimentation

**PRINCIPLES OF EROSION AND SEDIMENTATION**

- Erosion: the process of the land’s surface being worn away by:
  - Wind
  - Water
  - Ice
  - Gravity
- Water-generated erosion is the most severe type.
- Some erosion is natural or geologic.

**TYPES OF EROSION**

- Raindrop Erosion
- Sheet Erosion
- Rill Erosion
- Gully Erosion
- Stream Channel Erosion

**RAINDROP EROSION**

- Initiates the erosion process
- A raindrop strikes the surface, dislodging soil and making these particles available for transport.

Erosion is the process by which the land’s surface is worn away by **wind, water, ice and gravity**.
Sheet erosion consists of shallow, evenly spread sheets of water flowing across the land. These very shallow sheets of water are seldom the reason for detachment, but the flow transports soil particles which are detached by raindrop erosion. After traveling a short distance, sheet flow will seek out irregularities in the land surface and begin to concentrate.

Rill erosion begins as the flow finds these irregularities and starts to concentrate in low spots. As the flow of water becomes more concentrated, the velocity and turbulence increase. The energy of this concentrated flow is able to both detach and transport soil material; forming small channels only a few inches deep. This type of erosion is usually relatively easy to repair.

As the flows in rill erosion come together in larger channels, gully erosion occurs. The major difference between rill and gully erosion is magnitude. Gullies are too large to repair with conventional tillage equipment. Exposing soils on slopes guarantees gully erosion if the slope is not stabilized prior to the next significant rainfall event.
Stream channel erosion begins as the volume and velocity of flow are too great for the channel to withstand. Stream channels are forced to expand to meet the demands of increased runoff. Both bed and bank erosion occur, frequently damaging stream habitats during the process.

**Soil characteristics**, including particle size, texture, and structure influence how easily particles are dislodged.

**Vegetative cover** acts as a barrier, protecting soil from the impact of raindrops and the erosive flow of runoff.

As the length and **steepness of slopes** increase, runoff intensifies and erosion worsens.

The impact of climate on erosion is related to the frequency, duration and intensity of **rainfall**.

Erosion is the detachment of soil material whereby, sedimentation is the material that has been transported and deposited in a waterway.
IV. Part 4 - Erosion and Sediment Control Practices

Effective control of erosion and sedimentation depends on the proper use of Best Management Practices (BMPs). BMPs fall into two major categories. They are (1) practices that prevent erosion from occurring in the first place and (2) practices that intercept eroded sediment.

Follow the Sequence of Construction

Effective erosion and sediment control will be incorporated into the sequence of construction. Once the control practices are in place, earth disturbance can ensue, follow the steps laid out in the approved Sediment and Stormwater Plan.

Mark Clearing Limits

Marking the limits of disturbance with high visibility fence helps to protect sensitive areas, buffers, trees and adjacent properties from construction equipment and activities.
**Establish Construction Access**

- Underlain by geotextile fabric
- Use DE#3 stone (1.5" - 2"")
- Minimum 50' length
- Full width of entrance/exit
- At least 6 inches thick

A stabilized construction entrance is a pad of stone aggregate that minimizes the site access from becoming sediment sources. Stabilized construction entrances need frequent maintenance to prevent tracking.

**Tire Wash Station**

Tire washing facilities may be required when the stabilized construction entrance is not adequate. All sediment spilled, dropped, washed or tracked onto public rights-of-way must be removed from the roadway by the close of each workday.

**Install Sediment Controls**

- All runoff must pass through a sediment removal BMP
- Practices must be fully functional before land disturbance
- Proper installation is critical

It is critical that all sediment control structures be constructed and installed in accordance with the Delaware Erosion and Sediment Control Handbook.
The purpose of silt fence is to temporarily pond sediment laden stormwater to allow settling to occur before runoff passes through the fabric. The Handbook contains the specifications for the geotextile fabric.

- Must meet specifications
  - 6’ centers
  - 2” nominal hardwood
  - Lath strip
- Sheet flow only
- Trench into ground
- Pull tight and place ends up slope
- Wrap end stakes of adjoining sections
- Reinforced and super silt fence

The purpose of a diversion is to intercept and convey runoff to a stable outlet at non-erosive velocities.

- Waterway backed by a supporting ridge
- Conveys runoff to a stable outlet
- Compact and stabilize
- Typical uses
  - Reduce slopes
  - Shield slopes from overland flow
  - Divert clean water

COMPOSTLOGS

- Three-dimensional barrier (physical, chemical, and biological)
- Can be used as a replacement for silt fence
Sediment traps are temporary containment areas formed by excavation and/or embankment to intercept sediment-laden runoff and to retain the sediment. They must be located so that they can be installed prior to grading or filling in the drainage area.

The primary difference between these two types of traps is the outlet. The stone used in both outlets is four to eight inches. However, the stone outlet sediment trap typically has a one foot thick filter of two inch stone aggregate placed on the upgrade side of the four to eight-inch stone. This additional filtering capability makes the stone outlet sediment trap the preferred choice. However, the maximum drainage area for this type of trap is five acres, while a riprap outlet sediment trap can be used for sediment control in a 15 acre drainage area.

Sediment basins are temporary sediment control devices formed by excavation or embankment construction. Skimmer dewatering devices are used during construction to float on the surface and draw water from the top of the basin for discharge since the top of the water column is the least turbid. At the end of construction the basin is converted to a permanent pond; therefore, the basin must be designed to meet the Pond Code 378 specifications.
GRADING TECHNIQUES TO MINIMIZE EROSION AND SEDIMENTATION

- Create uneven surface to slow overland flows
- Tracking is the most common method
- Track equipment up and down slope to create horizontal grooves
- Reduce slopes
- Provide subsurface drainage

STABILIZE SOILS

- Many methods and materials
- Measures must be appropriate for
  - Time of year
  - Site conditions
  - Duration

Exposed soils must be stabilized within 14 days. Stabilization practices include temporary and permanent seeding, sodding, mulching, plastic covering, erosion control fabrics and matting, stone, gravel, wood chips, compost, polyacrylamides and dust control products.

PROTECT STORM DRAIN INLETS

- All inlets must be protected from sediment
- Many methods and products
- Proper installation critical
- Reduce sediment loads
  - Stabilize soils
  - Divert runoff
  - Sweep streets

Inlets operable during construction shall be protected so that runoff does not enter the conveyance system without first being filtered to remove sediment. Diverting runoff away from the storm sewer system or stabilizing the contributing drainage area is the most effective ways to keep sediment out of the system.
If installed and maintained properly, the silt bags will trap sediment while not impeding the flow of water into the storm sewer.

Channels and outlets are subjected to concentrated flows of water and need to be stabilized so they do not erode and contribute to the problem. Stabilization methods include vegetation, matting, armoring, and velocity reduction. Approved Sediment and Stormwater Plans will include the details and spacing of any check dams that need to be installed in channels. The details for rip rap outlet protection, including shape, stone size, dimensions and filter fabric type are also on the approved plans.

All sediment laden water to be removed from a construction site must be filtered, with no exceptions. Construction managers need to anticipate the need for dewatering, have a method approved, and have all necessary permits in hand. Since dewatering is such a critical activity, you should have the review agency involved and monitor the operation as it progresses. The importance of this issue cannot be overstated. Many violations occur due to improper dewatering practices.
All erosion and sediment control BMPs require regular maintenance to function. These devices are useless in poor condition.

- All BMPs require maintenance
- Proper installation is only the first step
- Review on a regular basis and after every rain
- Designate a person to review E & S controls
HOW DOES VEGETATION REDUCE EROSION?
• Shields soil surface from the impact of falling rain
• Slows the velocity of stormwater runoff
• Holdsoil particles in place
• Maintains the soil’s capacity to absorb water
• Removes subsurface water through evapotranspiration

Establishing vegetation prevents soil from eroding in the first place. This is preferred over relying on sediment control BMPs to trap sediment after it has been displaced by runoff.

THE STEPS FOR SUCCESSFUL STABILIZATION
• Site Preparation
• Soil Additives
• Seed Application
• Mulching and Mulch Anchoring
• Maintenance

These are steps for successful permanent stabilization. Temporary stabilization does not require the site to have final grading and soil additives but seeding, mulching, and mulch anchoring is included in temporary stabilization.
GROUND PREPARATION AND TOPSOILING

- Key in topsoil to prevent slippage
- Topsoil should be free of weeds, rocks, clods, and debris
- Apply topsoil to a depth of at least 4 inches (Del DOT requires 6 “)

Prior to applying topsoil, the ground surface should be grooved to create a rough surface allowing the topsoil to be “keyed in”. It is important to prepare a good seedbed to ensure the success of establishing vegetation. Topsoil should never be applied while in a muddy condition or when the subgrade is excessively wet.

SOIL TESTING AND AMENDMENTS

- Obtain a soil sample
- In lieu of a soil test
  - 2 tons/acre lime
  - 1000 lbs/acre 10-0-0 fertilizer
- Apply only what is necessary
- Incorporate into the soil

Determining the fertility of the soil will provide the precise amount of nutrients needed to establish lawns or other plantings. Please note that all persons who control the application of nutrients to 10 acres or greater shall develop and implement a Nutrient Management Plan developed by a certified individual. A Nutrient Management Plan is a strategy to manage the amount, placement, timing and application of nutrients.

SEEDING

- Temporary or Permanent
- Temporary seeding requires no site preparation
- Permanent seeding requires all steps

Seeding is categorized as either temporary or permanent. The seed mixture must be consistent with the approved plans; check the seed tags to ensure that the correct mix is as specified.
The specifications for vegetative stabilization will always appear on the approved Sediment and Stormwater Plan. It is important to know the application rates to achieve successful stabilization.

SEEDING METHODS

- 3 primary seeding methods
  - Broadcast
  - Drill
  - Hydroseeding

Drill seeders are especially efficient by planting seeds at the desired depth and supplying intimate contact with the soil. Hydroseeding will provide broad coverage for large areas and to difficult-to-reach areas.

MULCHING AND MULCH ANCHORING

- Mulch provides protective cover and retains moisture
- Straw is the preferred mulch material (2 tons/acre)
- Mulch must always be anchored
  - Crimping
  - Tackifier

Mulching is essential for both temporary and permanent seeding. Mulches should be uniformly applied and be appropriate for the time of year and expected duration. Anchoring can be done either mechanically or with a liquid mulch binder. Straw on steeper slopes can actually be tracked into the soil by a machine with cleated tracks. Tackifiers are sprayed onto the mulch to anchor it in place.
HYDRAULICALLY APPLIED MULCHES

- Wood fiber mulches
- Bonded Fiber Matrix is very effective
- Consider required drying time

ROLLED EROSION CONTROL PRODUCTS

- Netless Blanket
- Erosion Control Matting - one of the best materials used on slopes and concentrated flow channels
  - Natural Fibers - Straw, coconut, wood fiber; similar to mulches and biodegradable
  - Turf Reinforcement Matting (TRM) - permanent and used in areas of high runoff velocities

MAINTENANCE

- Takes 1 full year to establish permanent vegetation
- Irrigation
- Fertilization
- Overseeding

Maintenance of seeded areas is necessary to sustain a good stand of vegetation; inspect seeded areas for failure and reestablish vegetation. The closer you follow the steps for proper stabilization, the less time and money you will need to spend on maintenance.
Rolled Erosion Control Products
Video
VI. Part 6-Principals of Stormwater Runoff

**Principals of Stormwater Runoff**

**Water Cycle**

Stormwater runoff is water that runs off from the surface of the land as a result of precipitation. Runoff is only one component of the water cycle it also incorporates evaporation, infiltration, percolation, and transpiration.

**Average Delaware Rainfall**

Delaware receives an average of 45 inches of rainfall annually, including 15 inches of snowfall, with measurable rain occurring statistically every three days. For these reasons, control of even the smallest rain events is important to preserving the integrity of receiving waters in the state.
Average yearly rainfall is just that – an average of the highs and lows. In “Water Year” 2002, the State of Delaware suffered a severe drought compared to the “Water Year” 2003, which the state encountered high levels of precipitation.

The percentage of impervious, or hard surfaces in the landscape, such as roads, parking lots, driveways, and rooftops, directly effects the amount of runoff that occurs. Rain that falls on these hard surfaces cannot infiltrate into the soil and results in more runoff.

During the quality storm event, 2.7” inches of rainfall falling on a one acre parking lot will result in total runoff where the same 2.7” inches of rainfall falling on a one-acre residential lot will result in about 1/10 the amount of runoff.
Deforestation, construction, and change of land use in a watershed can have significant impacts on the ditches, streams, and rivers receiving the runoff if stormwater is not properly managed.

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While you may think that a 100-year storm is the storm event that will occur once every 100 years, that is not true. We often experience more than one 100-year frequency storm in any given year.

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Stormwater designers have to take into consideration each frequency storm event defined by a specific amount of rainfall that occurs in 24 hours.

### 24-Hour Rainfall

<table>
<thead>
<tr>
<th>Frequency</th>
<th>NCC</th>
<th>Kent</th>
<th>Sussex</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-Year</td>
<td>2.7”</td>
<td>2.7”</td>
<td>2.7”</td>
</tr>
<tr>
<td>10-Year</td>
<td>4.9”</td>
<td>5.2”</td>
<td>5.3”</td>
</tr>
<tr>
<td>100-Year</td>
<td>8.1”</td>
<td>8.9”</td>
<td>9.2”</td>
</tr>
</tbody>
</table>

Runoff from parking lots and roadways carries pollutants such as sediment, metals, oil and grease, salts, and debris. In addition to these pollutants, runoff from residential areas are often high in nutrients as a result of fertilizer being over-applied to lawn areas.

### Travel Time

- Flow Path Length
- Slope
- Surface Roughness

### Quality Impacts

- Metals
- Oil & Grease
- Sediment
- Bacteria
- Trash & Debris
- Salts
- Nutrients
Stream quality deteriorates when impervious cover increases in a watershed:

- Watersheds containing less than 5% impervious cover, have stable stream banks, good water quality and provide habitat for a wide range of species.

- 10% impervious cover in a watershed is relatively stable yet shows some signs of erosion.

- 20% impervious cover in a watershed shows serious erosion to the stream banks and channel bed.

- 30% impervious cover, the stream channel has “blown out” and is about five times larger than it was before the watershed was developed.

- Greater than 65% impervious cover, stream erosion has become such a problem that the stream required concrete stabilization.
VII. Part 7-Stormwater Best Management Practices

Stormwater Management
Best Management Practices

Run-off Reduction BMPs

• Conservation Design
• Biofiltration Swales
• Filter Strips
• Bioretention
• Infiltration

The Green Technology approach is designed to intercept runoff from rooftops, parking lots and roads as close as possible to its source, and direct it into vegetative recharge and filtration facilities incorporated into the overall site design and runoff conveyance system.

Conservation Design

• Reduce Impervious Surfaces
• Maintain and Provide Buffers
• Construct Biofiltration Practices
• Create Natural Areas
• Leave Areas Undisturbed
• Cluster Development

Incorporating stormwater management into the core of the site design for a new development allows stormwater to be treated as a resource rather than as an afterthought.
Benefits of Conservation Design

- Increased Infiltration Rates over Traditional Development
- Habitat Preservation
- Open Space Preservation
- Enhanced Property Values

The benefits of low impact development (LID) extend beyond water quality.

Biofiltration Swales

- Shallow depth of flow
- Flat bottom
- Vegetation height typically 6”-8”

Biofiltration swales convey runoff at shallow flow depths through wide swales. Swale bottom widths are generally two to eight feet wide, but can be wider if a level spreader is provided to spread flow evenly throughout the swale bottom.

Filter Strips

- Spread runoff uniformly over vegetation
- Best for treating small areas of impervious cover

Filter strips are designed based on the same principal as biofiltration swales.
Bioretention facilities are landscaped pocket depressions designed to infiltrate runoff through an engineered soil media. The media is porous, containing washed sand, peat, and triple shredded hardwood mulch. During the growing season, plants in the bioretention facility provide pollutant removal.

Most Green Technology BMPs incorporate infiltration as part of the treatment process. However, infiltration trenches located in swales can be considered a Green Technology BMP of their own.

The sand filter is the only engineered structural BMP that has been approved in Delaware as a stand-alone stormwater quality treatment practice. The sand filter is a linear concrete unit with two chambers running the length of the filter.
StormTech System

- A system of underground chambers
- Provides storage for stormwater runoff
- Detention or infiltration
- Isolator row settles out sediment and provides easy access for maintenance

Traditional Approaches

- Wet Ponds
  - Embankment vs. Excavated
- Wet Extended Detention Ponds
- Dry Extended Detention Ponds
- Infiltration

The stormwater management practice with which most people are familiar is the stormwater management pond or basin. Runoff is collected in the pond and either held there to be released at the pre-development discharge rate, or the runoff is infiltrated into the ground. Stormwater ponds can be permanently wet, with typically three to four feet of water. They may also be dry, only containing water during rain events. All stormwater management ponds in the State must be designed and constructed in accordance with USDA Natural Resources Conservation Service’s Pond Code 378.

Wet Ponds

A properly designed wet pond will always contain a pool of water, regardless of when the last rain event occurred. The permanent pool may be supported by groundwater, or totally supported by runoff. Ponds designed to be wet that are constructed in areas of sandy soil may need to be lined with clay or a synthetic liner to prevent the permanent pool from infiltrating.
Embankment vs. Excavated Ponds

Ponds are classified by USDA Natural Resources Conservation Service's Pond Code 378 as either embankment or excavated ponds. In an embankment pond, fill material is used to create a dam to pond water. In an excavated pond the entire basin is excavated below the existing grade. Ponds may also be a combination of embankment and excavation. Any basin, wet, dry or infiltration, may be excavated or embankment.

All of the components necessary to construct the pond embankment and outlet structure will be designed and detailed on the approved plan.

- The principal spillway is composed of the outlet structure and the outfall pipe.
- Anti-seep collars are installed along the pipe to prevent seepage from occurring along the outfall pipe, which can lead to failure of the embankment.
- Rock outlet protection must be provided at the discharge end of the outfall pipe to dissipate energy and protect the area from erosion.
- Embankment ponds are required to have a cutoff trench and the core of the embankment must be constructed from impervious material as well.

The Blue Card holder should be aware that during the entire stormwater BMP installation there must be a CCR or local agency site reviewer to observe construction of the stormwater management BMP and complete the BMP construction checklist.
Pond Safety

- Side slopes no steeper than 3:1
- Two 10’ wide safety benches
  - 1’ above water
  - 1’ below water

Wet ponds are designed with benches, or level areas, around the pond for safety. The side slopes of stormwater management basins are designed to be no steeper than 3:1. A 3:1 slope can be mowed and maintained more easily than steeper slopes and they can be traversed by foot with little difficulty. These benches have the added benefit of providing a good environment for the establishment of aquatic grasses and other vegetation.

Fencing

Fencing of stormwater management facilities, whether a wet pond or a dry infiltration basin, is neither required nor recommended.

Forebays

- Capture heavy sediment
- Allow for concentrated maintenance

Forebays are contained areas at the inlets that are deeper than the remainder of the pond to allow for sediment accumulation. By allowing a place for sediment to settle at the inlet, maintenance of the stormwater pond is easier. Maintenance can be confined to excavating the accumulated sediment from the forebay, rather than dewatering the basin to muck out the sediment from the entire pond bottom.
Dry Extended Detention Basins

- No permanent pool
- Good for flood control, quality control is nominal

The original urban stormwater BMP is the dry basin. This dry basin approach works well for flood control, or stormwater quantity management, but provides little pollutant removal capabilities, or stormwater quality management. By introducing extended detention in dry basins, runoff from the quality storm events must be held in the basin and released over a 24-hour period to allow sediment and other pollutants to settle out.

Maintenance Concerns with Stormwater Ponds

- Safety and Liability
- Algae and Aquatic Weed Control
- Invasive Plant Species
- Mosquito Breeding
- Structural malfunctions

Proper construction practices and pond cleanout prior to conversion from a sediment basin to a permanent pond will help to minimize future maintenance problems.

Infiltration

- Ponds or Basins
  - Dry within 48 hours
- Underground Manifold Systems
  - Volume in pipe and stone voids

Infiltration is a stormwater management practice that may be designed throughout the state, but is most commonly seen in the coastal areas of Sussex County where soil is sandy and infiltration rates are high. In an infiltration facility all of the runoff will be discharged back into the ground. After a rain event, runoff is stored in the infiltration basin until the existing soil can take that runoff in through infiltration.
Other Infiltration Practices

Less common infiltration practices include trenches, pavers, and porous pavement. In an infiltration trench runoff enters a stone-filled trench by surface flow and is held there until the runoff infiltrates.

Summary

- Run-Off Reduction BMPs
  - Conservation Design
  - Disconnect Impervious Surfaces
  - Biofiltration Swales
  - Filter Strips
  - Bioretention
  - Infiltration

- Traditional Approaches
  - Wet Ponds
  - Dry Ponds
  - Infiltration

There are many types of stormwater management BMPs, where implementing the practices accomplish the goal to enhance the quality of runoff from the site and provide flood control.
VIII. Part 8-Construction Site Pollution Prevention

Construction sites typically have a variety of materials, substances and equipment that can become sources of pollution if washed away by stormwater runoff. Fortunately, preventing these sources from reaching receiving waters is usually a matter of employing low cost, common sense practices. The BMPs in this presentation are intended to address pollution prevention from construction activities only.

If you look around a typical construction site, you will see sources for all types of pollutants. Some examples are an overflowing dumpster, an excavator leaking oil, torn fertilizer bags stacked on a pallet and open paint cans.
GOOD HOUSEKEEPING

Reduce, Reuse, Then Recycle

• Recycle
• Use common sense
• Prevent contact between rainfall and pollutant sources
• Filter contaminated runoff

CONSTRUCTION SITE WASTE MANAGEMENT

Managing construction site waste requires a common sense approach that includes maintaining a clean and orderly work environment, regular clean up, and organization. Proper handling, storage, and disposal of waste material need some planning and preparation. Obtaining the right covers, containers, and storage facilities at the beginning of a construction project makes compliance easy.

WASTE MANAGEMENT BMPs

• Properly dispose of all waste materials
• Prohibit littering
• Provide trash containers at lunch spots
• Containers should have watertight lids
• Securely cover all waste stockpiles & storage areas

If these practices are properly employed, rainfall and runoff won't even come into contact with the pollutants. Waste materials and containers should be stored on pallets, if practical, to raise them off the ground. Be sure to store, use and dispose of fertilizers, pesticides and petroleum products carefully and in accordance with all applicable laws and regulations.
Construction site equipment and vehicles need to be washed and maintained frequently, which can pollute stormwater runoff when done on paved surfaces or in drainageways. Pollution can be generated by the equipment being worked on (sediment, automotive fluids) or by the method involved (detergents, solvents). Best management practices typically focus on disconnecting maintenance areas and materials from storm drain systems or overland runoff areas.

Maintenance, storage and disposal areas should be located as far away from rainfall and runoff areas as possible. Fuel transfer activities should take place in a contained area and nozzles must be equipped with automatic shut off devices. **Never top off fuel tanks.**

Emphasis should be placed on concrete truck washout, one of the most common mistakes on construction sites.
ON-SITE CONCRETE BATCH PLANT

• Never place the plant near any type of drainage or stormwater conveyance
• This is a violation

EDUCATION BMPs

• Designate a foreman to oversee pollution prevention activities
• Train laborers in proper material handling, storage and disposal
• Offer hands-on training classes and product demonstrations
• Include pollution prevention in regular progress meetings

Construction site education will promote an understanding of the problems, and promote employee ownership of the solutions. This will help personnel make the link between BMP implementation and protection of the water resources. Include subcontractors in the educational process so that compliance will come from all sectors of personnel on a construction site.
IX. Part 9-Sediment and Stormwater Plans

As we discussed in the beginning of the class, the Sediment and Stormwater Plan should be the guide for all of the information both written and in specification form, to prepare the contractor to build the project in compliance with all sediment and stormwater requirements.

A well designed Sediment and Stormwater Plan will contain two parts; the Plan and the Design Report, will provide a technical foundation for the construction plans. Our next small video clip will provide a brief explanation of the Plan and Design Report.
All of this information is important to the success of the Sediment and Stormwater Plan. Without all of these components in place, the plan cannot be effective.

A Legend or Key is a set of symbols that show up on a plan with a corresponding feature. A legend may depict the limit of disturbance, a specific sediment control practice such as silt fence, or a special area such as wetlands that must be located. The Erosion and Sediment Control Handbook has standard symbols for certain features and practices.

Pay careful attention to the legend as it represents the practices on the plan. Not understanding the symbols may cause a serious problem in the field and result in expensive mistakes being made.
It is important to have one sheet of the plan depicting the project as a birds-eye view, including major E&S features such as limit of disturbance, sediment basins, perimeter controls, rights of way, stockpile locations and any buffers or wetlands.

The written information on the plan must be read and understood for the contractor to have any success in implementing the plan.

The sequence of construction is one of the most important written elements in the plan. The sequence should serve as a roadmap providing enough direction to the contractor to have him or her understand how the project needs to unfold yet build in some flexibility. Each phase of construction may have a separate sequence.
Standards, Details and Specifications

The construction standards, details and specifications are the “how to”, as far as constructing the sediment and stormwater practices, and must be on the plan.

Be Prepared for the Next Site Review

- Know where the approved plans are
- File all site review reports
- Be familiar with issues/problems and corrective actions
- Document self reviews

The responsible person should anticipate the next site review. Be familiar with the approved plans, have the previous report handy and be ready to discuss problems and the measures taken to correct them. Self stormwater monitoring performed weekly and after every rainfall event should be documented.

What To Do With Approved Plans

- Become familiar with the plan
- Have the contact information readily available
- Attend preconstruction meeting
- Review sequence of construction
- Look for problem areas
Preconstruction Meeting

- Meet the people involved in the project and review the plan
- Ask questions
- Bring up any issues with the plan
- Responsibilities are assigned

The Site Review Report

- Provides documentation
- Describes the general site conditions
- Provides a narrative for the specific site conditions

A good site review report is critical to communicating compliance with the approved plan and identifying steps to correct problems on site. The report should:

- Document Site Conditions
- Give an overview of BMP conditions
- Provide a narrative to prescribe the necessary corrections

Interpreting the Site Review Report

- Descriptive
  - The silt fence along the back of the property is not installed properly.

- Prescriptive
  - The silt fence is not trenched in properly. Re-trench and install silt fence along the back of the property per the detail and specification on the approved plan.

In addressing the silt fence installation, it is not enough to simply say that the installation is wrong. The site reviewer should take the time to explain how to do it properly, to ensure that the responsible person knows what is required to correct the problem.
Communicate... It Really Is That Important

Be Proud of Your Work
X. Part 11-Enforcement Procedures

There are several steps that each delegated agency can go through to gain compliance with the approved Sediment and Stormwater Plan. When all delegated agency efforts fail to gain compliance at the local level, DNREC is equipped to utilize enforcement options once the site is referred.

Once a site is referred to DNREC, the first avenue of enforcement action is a Notice to Comply or Notice of Violation. If compliance is not gained on the site quickly, or if the site is severely in violation, DNREC will proceed with penalties. There are two types of penalties – Criminal (Chapter 40 Sediment and Stormwater Law and Chapter 60 Environmental Law) and Administrative.
Projects Referred to DNREC

- CCR and Regulatory reports
  - Document site conditions to be used to show history of non-compliance
  - May be used in enforcement case

Once a site has been referred to DNREC for enforcement, DNREC will conduct a thorough site investigation to verify the conditions as described in both the CCR reports and the delegated agency construction review reports. The DNREC Notice of Violation will establish a timeframe (usually a short window at this point) to bring the site back in compliance.

Common NPDES Permit Violations

- Approved plan not on site
- Weekly construction review reports not on site
- Failure to review the site weekly (through CCR reviews or log entries)

Sediment & Stormwater Violations

Land Disturbing Activity - No Approved Plan

If a project begins land disturbance (over 5000 sq. ft.) without an approved plan, or without notifying the local agency prior to beginning construction, the site is in violation.
The design engineer has taken into account how many acres can be open at one time during construction; phasing is employed through the sequence of construction. Failure to follow the project phasing will put a site into violation quickly.

In this example there is no curb-line silt fence, no inlet protection, and possible stabilization issues; all of which are requirements on the approved Sediment and Stormwater Plan.

Failure to comply with construction site stormwater management review reports from the CCR and/or delegated agency.
Often contractors pump water without a sediment bag. Pumping into a catch basin, over the perimeter silt fence, into a pond or wetland is an automatic Chapter 60 violation.

Sediment & Stormwater Violations
Pumping Without a Sediment Bag

Sites that do not employ the 14-day rule for stabilization will be in violation.

Sediment & Stormwater Violations
Poor or No Stabilization

As you can see, poor stabilization practices can create even bigger problems!
DNREC and the delegated agencies respond to many sediment discharges due to lack of stabilization, poor dewatering practices, not following the sequence of construction, and not installing the erosion and sediment control practices on the approved plan. This example of a sediment discharge decimates the local habitat and is definitely a violation.
XII. Appendix

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LIST OF DELEGATED AGENCIES

The following agencies have delegation of Sediment and Stormwater Program elements consisting of plan review, construction review, and maintenance review for their geographic boundaries.

1) State Agencies

   a) **Department of Natural Resources & Environmental Control**  
   Division of Watershed Stewardship  
   Sediment and Stormwater Program  
   285 Beiser Blvd, Suite 102  
   Dover, DE 19904  

   Phone: (302) 739-9921  
   Fax: (302) 739-6724  


   Responsible for all aspects of administration of the state sediment and stormwater management program under the Delaware Sediment and Stormwater Law and Regulations. Responsible for plan review and inspection of State and Federal Projects.

   b) **Department of Transportation**  
   800 Bay Road  
   P.O. Box 778  
   Dover DE 19903  

   Phone: (302) 760-2251  
   Fax: (302) 739-6360  


   Delegated Area: DeIDOT Construction
2) **New Castle County**

a) **New Castle County Dept. of Land Use**  
Licensing Division  
87 Reads Way  
Corporate Commons  
New Castle DE 19720  

Phone: (302) 395-5400  
Fax: (302) 395-5488  

[http://nccde.org/174/Land-Use](http://nccde.org/174/Land-Use)

Delegated Area: All unincorporated areas of New Castle County

b) **New Castle Conservation District**  
2430 Old County Road  
Newark DE 19702  
[www.newcastleconservationdistrict.org](http://www.newcastleconservationdistrict.org)

Phone: (302) 832-3100, Ext. 3  
Fax: (302) 834-0783  

Delegated Area: All Incorporated areas of New Castle County (except City of Newark, City of Wilmington and Town of Middletown).

c) **City of Newark**  
Public Works Department  
220 Elkton Road  
Newark DE 19711  

Phone: (302) 366-7040  
Fax: (302) 366-7160  


Delegated Area: City of Newark

d) **City of Wilmington**  
Dept. of Public Works  
800 North French Street  
Wilmington DE 19801  

Phone: (302) 576-3056  
Fax: (302) 571-4423  

Delegated Area: City of Wilmington

e) **Town of Middletown**  
19 West Green Street  
Middletown DE 19709  

Phone: (302) 378-1171  
Fax: (302) 378-5675  

[http://www.middletownde.org/index.cfm?fuseaction=content.faq&faqTypeID=51](http://www.middletownde.org/index.cfm?fuseaction=content.faq&faqTypeID=51)

Delegated Area: Town of Middletown

3) **Kent County**

**Kent Conservation District**  
1670 S. DuPont Highway  
Dover, DE 19901  

Phone: (302) 608-5370  
Fax: 302-741-0347  


Delegated Area: Kent County

4) **Sussex County**

**Sussex Conservation District**  
23818 Shortly Road  
Georgetown DE 19947  

Phone: (302) 856-7219  
Fax: (302) 856-0951  

[http://www.sussexconservation.org/sed_sw.htm](http://www.sussexconservation.org/sed_sw.htm)

Delegated Area: Sussex County
ACRONYMS

AASHTO – American Association of State Highway and Transportation Officials
ASTM – American Society for Testing and Materials
BAT – Best Available Technology
BFM – Bonded Fiber Matrix
BMP – Best Management Practice
CCR – Certified Construction Reviewer
cfs – Cubic Feet per Second
CMP – Corrugated Metal Pipe
CN – Curve Number
CWA – Clean Water Act
d$_{50}$ – Average equivalent diameter of stone aggregate
d$_{\text{max}}$ – Maximum equivalent diameter of stone aggregate
DA – Drainage Area
DNREC – Delaware Department of Natural Resources and Environmental Control
DURMM – Delaware Urban Runoff Management Model
E & S – Erosion and Sediment
ECM – Erosion Control Matting
FEMA – Federal Emergency Management Agency
FES – Flared End Section
fps – Feet per Second
GIS – Geographic Information System
GT – Green Technology
HDPE – High Density Polyethylene Pipe
HEC – Hydraulic Engineering Center (designer of various stormwater modeling programs)
IP – Inlet Protection
K – Potassium
LID – Low Impact Development
LOD – Limit of Disturbance
MS4 – Municipal Separate Storm Sewer System
MSDS – Material Safety Data Sheet
N – Nitrogen
NOAA – National Oceanographic and Atmospheric Administration
NOI – Notice of Intent
NOT – Notice of Termination
NOV – Notice of Violation
NPDES – National Pollution Discharge Elimination System
NPS – Nonpoint Source Pollution
NRCS – Natural Resources Conservation Service
NTS – Not to Scale
O & M – Operation and Maintenance
P – Phosphorus
P2 – Pollution Prevention
PAM – Polyacrylamide
PE – Professional Engineer
PLS – Professional Land Surveyor
PVC – Poly Vinyl Chloride
RCP – Reinforced Concrete Pipe
RECP – Rolled Erosion Control Products
RLA – Registered Landscape Architect
ROP – Rock Outlet Protection
RSF – Reinforced Silt Fence
RUSLE – Revised Universal Soil Loss Equation
S & S – Sediment and Stormwater
SCE – Stabilized Construction Entrance
SF – Silt Fence
SHWT – Seasonal High Water Table
SSF – Super Silt Fence
SSM – Soil Stabilization Matting
SWM – Stormwater Management
SWPPP – Stormwater Pollution Prevention Plan
\( t_c \) – Time of Concentration
\( t_t \) – Travel Time
TMDL – Total Maximum Daily Load
TR-20 – Technical Release 20 (stormwater modeling program)
TR-55 – Technical Release 55 (stormwater modeling program)
TRM – Turf Reinforcement Matting
TSS – Total Suspended Solids
USDA – United States Department of Agriculture
USEPA – United States Environmental Protection Agency
USGS – United States Geologic Survey
WSE – Water Surface Elevation
DEFINITIONS

**Adverse Impact** - A negative effect on land or water resulting from a construction or development activity. Adverse impacts include increased risk of flooding; degradation of water quality; increased sedimentation; reduced groundwater recharge; negative impacts on aquatic organisms, wildlife and other resources; and threatened public health.

**Aggregate** – Term for stone, rock or gravel used for various purposes related to sediment and erosion control as well as stormwater management.

**Aquatic Life** – Any species of plant or animal living in water.

**Aquifer** – An underground geological formation that contains usable amounts of groundwater to supply wells or springs. The formation usually contains a stratum of sand, gravel, or fractured rock and will transmit water readily.

**As-Built Plans** – Engineering or site drawings that delineate a specific stormwater management facility as actually constructed.

**Base Flow** – The portion of stream discharge which consists of groundwater drainage and delayed surface drainage.

**Benthic** – Relating to or occurring at the bottom of a body of water such as a stream or lake.

**Best Management Practice (BMP)** - A measure that is implemented to protect water quality, reduce the potential for pollution, and prevent flooding and erosion associated with stormwater runoff. A BMP can be a program, technology, process, siting criteria, operating method or device.
**Biofiltration** – A stormwater conveyance swale designed and vegetated to enhance pollutant removal and infiltration of stormwater runoff.

**Bioretention** – A landscaped depression with a specific soil medium that is designed to provide substantial filtering and/or infiltration of stormwater runoff. This device is particularly effective at nitrogen removal.

**Certified Construction Reviewer (CCR)** – An individual who has completed a DNREC sponsored training course and provides on-site inspections for sediment control and stormwater management in accordance with the Sediment and Stormwater Regulations.

**Check Dam** – A small dam placed across a channel to reduce water velocities.

**Clean Water Act (CWA)** – The CWA, originally enacted by Congress in 1972, is a federal law that requires states to protect, restore and maintain the quality of the waters of the United States, including lakes, rivers, aquifers and coastal areas. As amended in 1987, the CWA is the enabling legislation for the NPDES permitting process which regulates stormwater discharges from construction activities.

**Constructed Wetlands** – Artificial wetlands systems designed and constructed to mitigate the impacts of urban runoff.

**Design Storm** – A typical rainfall event that is used to design a stormwater structure. It is designated by the rainfall frequency (i.e. 10-year storm), the rainfall duration (i.e. 24-hours), and the type of rainfall distribution (i.e. Type II).

**Detention** – The temporary storage of runoff in a stormwater management facility to reduce peak discharge rates and provide settling of pollutants.

**Discharge** – In stormwater management, the volume of water that passes over a given point or through a cross section during a unit of time. Measured in cubic feet per second.
**Diversion** – A channel, berm, embankment or other man-made structure constructed to divert water from one area to another.

**Drainage Area** – That area contributing runoff to a single point measured in a horizontal plane, which is enclosed by a ridge line.

**Dry Pond** – An excavated or embankment stormwater management facility designed to drain completely between runoff events.

**Embankment** – A dam, bank or mound of earth used to hold back water.

**Erosion** – The wearing away of earth surfaces by the action of wind, ice, water or gravity.

**Exemption** – Land development activities that are not subject to the sediment and stormwater regulations.

**Filtration** – The removal of pollutants and particulate matter by passing water through vegetation or other media as designed for such a purpose.

**First Flush** – The early stages of stormwater runoff that commonly conveys a disproportionately large amount of previously accumulated pollutants due to the rapid rate of flow.

**Floodplain** – For a given flood event, that area of land temporarily covered by water which adjoins a watercourse and which is necessary for conveyance of the flood event.

**Forebay** – A storage area provided at the inlet of a stormwater management pond to collect incoming sediments, minimizing their accumulation in the main pool of the pond.

**Freeboard** – The vertical distance between the design water surface elevation and the elevation of the top of the pond embankment.

**Gabion** – A large rectangular box of heavy gauge wire mesh which contains stone. Typically stacked and keyed into slopes or stream banks to prevent erosion from high rate and velocity flows.
Geographic Information System (GIS) – A system of computer hardware and software used for storage, retrieval, mapping and spatial analysis of geographic data.

Geotextile Fabric – Textile of relatively small mesh or pore size that is used to (a) allow water to pass through while holding sediment back, or (b) to provide support for heavier materials and a barrier for underlying soils.

Good Housekeeping – The storage, use, or cleanup of materials performed in a manner that minimizes the discharge of pollutants from a construction site.

Groundwater – Water that is naturally occurring under the earth’s surface.

Hydraulic – Pertaining to, involving, moved or operated by water under pressure or under a gravity-driving force.

Hydrologic – Pertaining to the scientific study of the properties, distribution, and effects of water on or under the earth’s surface, and in the atmosphere.

Impervious Surface – Hard material which resists or blocks the passage of water into the soil, thus causing water to run off the surface in greater quantities and at an increased flow rate.

Infiltration – The penetration of water through the ground surface and into the subsurface soil.

Infiltration Basin – A stormwater management facility designed to promote the percolation of collected runoff into the soil, rather than discharging runoff to receiving waters.

Land Disturbing Activity – Any land change or construction activity which may result in soil erosion or accelerated stormwater runoff, including but not limited to clearing, grading, excavating, transporting and filling of land.
**Level Spreader** – A device used to spread out stormwater runoff uniformly across the ground surface as sheet flow. The purpose is to prevent concentrated, potentially erosive flows from occurring.

**Low Impact Development** – Development designed and constructed to minimize disturbance, mimic pre-development runoff characteristics, protect environmentally sensitive areas and preserve open space.

**Micropool** – A smaller permanent pool within a larger stormwater management facility for collecting and controlling inflow into the facility. Also effective at pollutant reduction.

**National Pollutant Discharge Elimination System (NPDES)** – A nationwide system of stormwater permitting established by EPA and administered in Delaware by DNREC and its delegated agencies. The purpose is to control the discharge of pollutants from construction and land disturbing activities into receiving waters.

**Nonpoint Source Pollution** – Pollution which does not result from a discharge at a specific location such as a pipe, but generally results from overland runoff, atmospheric deposition or percolation.

**Nonstructural Control** – A BMP that does not require construction of a facility to control runoff. One example is the establishment of vegetation to prevent erosion.

**Nutrients** – Elements or substances such as nitrogen and phosphorus which are necessary for plant growth, but can reduce water quality when excess amounts are carried by stormwater runoff into a water body.

**Operator** – An individual or entity that has control over all day-to-day activities on a construction site or a portion of a construction site. The operator is responsible for compliance with the sediment and stormwater law and regulations.

**Outfall** – The terminus of an open or enclosed conveyance system where stormwater is discharged either overland or to a water body.
Outlet Structure – A device constructed as part of a stormwater management facility that controls the detention time of stormwater as well as the discharge of stormwater to the desired rates of flow.

Pathogens - Pathogens include viruses, bacteria, and protozoa, and are a pollutant of concern in storm water runoff.

Peak Flow – The maximum instantaneous rate of flow of water at a particular point resulting from a storm event.
Permanent Pool – Impounded water that remains in a stormwater management facility at all times.

Permeability – The quality of a soil horizon that allows water to pass through. Also used to define the rate of water flow through soil.

Point Source – Pollution arising from a well-defined origin such as a pipe discharge from an industrial plant.

Pollutant - Any constituent present in sufficient quantity to impair the beneficial uses of a receiving water body.

Pretreatment – Implementing measures to capture or trap coarse sediments before they enter a BMP in order to maintain storage volumes and prevent excess sedimentation within the structure.

Receiving Water - A river, lake, ocean, stream or other watercourse into which runoff is discharged.

Responsible Personnel – A foreman or superintendent who is in charge of on-site land disturbing activities for sediment and stormwater control associated with a construction project.

Retrofit – The modification of stormwater management systems to improve or achieve additional water quality or quantity objectives.

Riprap – A combination of large stone, cobbles or boulders used to, among other purposes, reduce runoff velocities at discharge points, line channels, stabilize stream banks and slopes.
**Runoff** – The portion of rainfall that does not infiltrate and flows across the ground surface and eventually to receiving waters.

**Sediment** – Soil or other surficial materials transported and/or deposited by the action of wind, water, ice or gravity as a product of erosion.

**Sinkhole** - A naturally occurring closed depression, where stormwater drainage collects on the earth’s surface that is a minimum of 2 feet deep and typically, is caused by dissolution of the underlying limestone, salt or gypsum. Stormwater drainage typically has no visible surface outlet, and may occur through underground channels that may be enlarged by the collapse of a cavern roof.

**Soil Stabilization** - Vegetation, such as grasses, and other materials, such as straw, fiber, stone, protective blankets, etc. placed to stabilize areas disturbed by grading operations or eroded by natural forces.

**Source Controls** - Measures implemented to prevent the introduction of sediment or other pollutants into stormwater runoff. Source controls preclude or limit the exposure of materials to storm water at the source of those materials.

**Stabilization** – Prevention of soil erosion through the establishment of soil cover through the implementation of vegetative or structural means.

**Stormwater** - Runoff from rain, snow or other forms of precipitation resulting in surface runoff and drainage.

**Stormwater Pollution Prevention Plan (SWPPP)** - A plan that includes site map(s), an identification of construction/contractor activities that could cause pollutants in stormwater, and a description of measures or practices to control these pollutants.

**Stormwater System** - The system of drainage, curbs and gutters, curb inlets, swales, catch basins, manholes, ditches, pipes, lakes, ponds, channels, creeks, streams, storm drains, and similar conveyances and facilities, both natural and manmade, through which stormwater is collected, stored, or conveyed.
**Structural Control** – A practice that involves design and construction of a facility to mitigate the adverse impacts of stormwater runoff.

**Subsoil** – The bed or stratum of earth lying below the surface layer of soil.

**Surface Water** – Water on the earth’s surface exposed to the atmosphere such as rivers, lakes, streams and oceans.

**Swale** - A natural or manmade depression or wide shallow ditch used to store, route or filter runoff.

**Terrace** – A swale extending across a slope to intercept runoff and increase the potential for infiltration.

**Third Party CCR** - any individual CCR that is not an employee of the owner or a contractor of the construction activity, excluding the site designer.

**Time of Concentration** - The time required for stormwater runoff to flow from the most hydraulically remote point of the watershed (longest time) to the location being analyzed. The origin of the time of concentration flow path is not necessarily the longest distance away.

**Total Maximum Daily Load (TMDL)** - TMDLs are pollutant load allocations for all point sources and nonpoint sources, and are intended to achieve a pollutant reduction goal along with a safety factor. TMDLs are developed in response to identification of pollutants as impairing a specific body of water.

**Total Suspended Solids (TSS)** - TSS is the weight of particles that are suspended in water. Suspended solids in water reduce light penetration in the water column, can clog the gills of fish and invertebrates, and are often associated with toxic contaminants because organics and metals tend to bind the particles.

**Underdrain** – Perforated pipe(s) installed at the bottom of a stormwater management facility such as bioretention or biofiltration swales to remove excess runoff.

**Vegetated Filter Strip** – A vegetated section of land designed to accept runoff as sheet flow from upstream development. It may adopt any form from grass meadow to a small forest, with the vegetation facilitating pollutant removal.
**Vegetation** - The collection of plant life (including trees, shrubs, bushes and grass) which is found on a project site or property. Vegetation is desirable because it helps to reduce the quantity of stormwater runoff, encourages sediment settling and nutrient uptake, controls extreme temperatures, and provides habitat.

**Water Quality** – Those characteristics of stormwater runoff from a land disturbing or development activity that relate to the chemical, physical, biological, or radiological integrity of water.

**Water Quantity** – Those characteristics of stormwater runoff that relate to the rate and volume of stormwater runoff to downstream areas resulting from land disturbing or development activities.

**Watershed** - The area that drains to a particular stream or to a particular point. A watershed is bounded by drainage divides.

**Wet Pond** - An excavated or embankment stormwater management facility designed with a permanent pool of water.

**2-year frequency storm** - A storm event with a fifty percent chance of being equaled or exceeded in a given year.

**10-year frequency storm** - A storm event with a ten percent chance of being equaled or exceeded in any given year.

**100-year frequency storm** - A storm event with a one percent chance of being equaled or exceeded in any given year.
DNREC

24-Hour Complaint Line 800-662-8802
   In-state only 302-739-9401

Septic Permits
   Statewide 302-739-9948
   Small Systems (Kent and New Castle) 302-739-9947
   Small Systems (Sussex) 302-739-4561

Well Permits (withdrawal of <50,000 gal/day) 302-739-9944

Water Allocation Permits
   (withdrawal of surface or groundwater >50,000 gal/day) 302-739-9945

State Wetlands and Subaqueous Lands 302-739-9943

NPDES General Permits for Industrial Stormwater Runoff 302-739-9946

Solid and Hazardous Waste Branch 302-739-9403

Emergency Spills 800-662-8802

U.S. Army Corps of Engineers

Wetlands Permits

   Philadelphia District Office 215-656-6728
   Baltimore District Office 410-962-3670
   Dover Field Office 302-736-9763
CONSTRUCTION SITE POLLUTION PREVENTION PLAN

MATERIAL INVENTORY

- Concrete
- Detergents
- Paints (enamel and latex)
- Cleaning solvents
- Pesticides
- Wood Scraps
- Fertilizers
- Petroleum Based Products

GOOD HOUSEKEEPING

- Store only enough product required to do the job
- All materials will be stored in a neat, orderly manner in their original labeled containers and covered
- Substances will not be mixed
- When possible, all of a product will be used up prior to disposal of the container
- Manufacturers’ instructions for disposal will be strictly adhered to
- The site foreman will designate someone to inspect all BMPs daily

WASTE MANAGEMENT PRACTICES

All waste materials will be collected and stored in securely lidded dumpsters in a location that does not drain to a waterbody. The dumpsters will be emptied a minimum of twice per week, or more if necessary. The licensed trash hauler is responsible for cleaning out dumpsters. Trash will be disposed of in accordance with all applicable Delaware laws. Trash cans will be placed at all lunch spots and littering will be strictly prohibited. Recycle bins will be placed near the construction trailer. Fertilizer bags will be kept on a pallet and covered with plastic sheeting which will be overlapped and anchored.

EQUIPMENT MAINTENANCE PRACTICES

Vehicles will be washed with high-pressure water spray without detergents in an area contained by an impervious berm. Drip pans will be used for all equipment maintenance. Equipment will be inspected for leaks on a daily basis. Washout from concrete trucks will be disposed of in a temporary pit for hardening and proper disposal. Fuel nozzles shall be equipped with automatic shut-off valves. All used products such as oil, antifreeze, solvents and tires shall be disposed of in accordance with manufacturers’ recommendations and local, state and federal laws and regulations.

SPILL PREVENTION

Potential spill areas will be identified and contained in areas with no connection to the storm drain system. Warning signs shall be posted in hazardous material storage areas. Preventive maintenance shall be performed on all tanks, valves, pumps, pipes and other equipment as necessary. Low or non-toxic substances will be prioritized for use. Contact information for Delaware’s Emergency Response Team, shall be prominently posted.

EDUCATION

Best management practices for construction site pollution control will be a part of progress meetings. Information regarding waste management, equipment maintenance and spill prevention shall be prominently posted in the construction trailer.

DNREC 24-Hour Toll Free Number  800-662-8802
DNREC Solid & Hazardous Waste Branch  302-739-9403
## Potential Construction Site
### Storm Water Pollutants

<table>
<thead>
<tr>
<th>Trade Name Material</th>
<th>Chemical / Physical Description (1)</th>
<th>Stormwater Pollutants (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pesticides (insecticides, fungicides, herbicides, rodenticides)</td>
<td>Various colored to colorless liquid, powder, pellets, or grains</td>
<td>Chlorinated hydrocarbons, organophosphates, carbamates, arsenic</td>
</tr>
<tr>
<td>Fertilizer</td>
<td>Liquid or solid grains</td>
<td>Nitrogen, phosphorous</td>
</tr>
<tr>
<td>Plaster</td>
<td>White granules or powder</td>
<td>Calcium sulphate, calcium carbonate, sulfuric acid</td>
</tr>
<tr>
<td>Cleaning solvents</td>
<td>Colorless, blue, or yellow-green liquid</td>
<td>Perchloroethylene, methylene chloride, trichloroethylene, petroleum distillates</td>
</tr>
<tr>
<td>Asphalt</td>
<td>Black solid</td>
<td>Oil, petroleum distillates</td>
</tr>
<tr>
<td>Concrete</td>
<td>White solid</td>
<td>Limestone, sand</td>
</tr>
<tr>
<td>Glue, adhesives</td>
<td>White or yellow liquid</td>
<td>Polymers, epoxies</td>
</tr>
<tr>
<td>Paints</td>
<td>Various colored liquid</td>
<td>Metal oxides, stoddard solvent, t alc, calcium carbonate, arsenic</td>
</tr>
<tr>
<td>Curing compounds</td>
<td>Creamy white liquid</td>
<td>Naphtha</td>
</tr>
<tr>
<td>Wastewater from construction equipment washing</td>
<td>Water</td>
<td>Soil, oil &amp; grease, solids</td>
</tr>
<tr>
<td>Wood preservatives</td>
<td>Clear amber or dark brown liquid</td>
<td>Stoddard solvent, petroleum distillates, arsenic, copper, chromium</td>
</tr>
<tr>
<td>Hydraulic oil/fluids</td>
<td>Brown oily petroleum hydrocarbon</td>
<td>Mineral oil</td>
</tr>
<tr>
<td>Gasoline</td>
<td>Colorless, pale brown or pink petroleum hydrocarbon</td>
<td>Benzene, ethyl benzene, toluene, xylene, MTBE</td>
</tr>
<tr>
<td>Diesel Fuel</td>
<td>Clear, blue-green to yellow liquid</td>
<td>Petroleum distillate, oil &amp; grease, naphthalene, xylenes</td>
</tr>
<tr>
<td>Kerosene</td>
<td>Pale yellow liquid petroleum hydrocarbon</td>
<td>Coal oil, petroleum distillates</td>
</tr>
<tr>
<td>Antifreeze / coolant</td>
<td>Clear green / yellow liquid</td>
<td>Ethylene glycol, propylene glycol, heavy metals (copper, lead, zinc)</td>
</tr>
<tr>
<td>Erosion</td>
<td>Solid particles</td>
<td>Soil, sediment</td>
</tr>
</tbody>
</table>

(1) Data obtained from MSDSs when available.
Tips for a Successful Preconstruction Meeting

1. Meet on-site preferably before construction starts.

2. Meet key people involved in the project. (contractor; site subcontractor; utilities; owner/developer; local site reviewer; other agencies)

3. Exchange contact information for all persons connected with the project.

4. Review the plan requirements for sediment and stormwater management.

5. Discuss any conflicts or requested changes to the approved plan with the contractor before construction begins. This may include substitution of materials; change in the sequence of construction; unfamiliarity with practices and specifications; and elimination/substitution of control practices.

6. Review required sequence of construction with emphasis on prior notification requirements. The CCR/Delegated Agency must be on site for E&S review of BMPs, and agency approval for the removal of E&S controls.

7. Discuss chain of command for communication and correspondence, which should include how the signing P.E. will affix his/her signature. Also discuss the logistics of sending the report to the Delegated Agency.

8. Discuss completion requirements for financial guarantees.

9. Discuss construction access and easements.

10. Review related permits or permit restrictions.
How to Conduct the Site Review

- Always have a copy of the approved plan when on site.

- Upon entering the site, stop at the field office, identify yourself and explain purpose (routine inspection, complaint, violation). Ask to speak with the site foreman or superintendent. Have I.D. and the correct gear.

- Ask to have the “Responsible Person” accompany you on the site visit. This will reduce the amount of information that must be relayed to the site foreman in writing.

- Review the previous site review report and the items that were to have been completed by this date.

- During the initial review, walk the perimeter of the site noting the installation of perimeter controls and problems with perimeter controls that were not addressed on the plan.

- Begin your review from the lowest point at the perimeter and work your way upgrade. This helps you be aware of sediment leaving the site and can help you locate the source.

- If sediment is leaving the site, go far enough downstream to see the extent of the damage. Document any damage with field notes, photographs, or video.

- If a control practice has failed, and has been installed in accordance with the approved plan, a design change may be needed. An important part of the inspector’s role is to facilitate that change by documenting this in the report and calling the Delegated Agency.

- In addition to ensuring that the approved plan has been implemented, look for controls needing maintenance.

- If possible, leave a written report on each site visit. If there are no responsible individuals on site, use the designated method of communication agreed to at the preconstruction meeting.
How to Conduct the Site Review (cont...)

- Before leaving the site, review the conditions of the site report or notice of violation to make certain that all parties are aware of what is required by the deadline. In order to achieve compliance with the approved plan, time frames must be reasonable for items that need to be corrected.

- When possible, ask the “Responsible Person” on site to tell you when the deficiencies in the approved plan will be corrected. The key here is to have the responsible individual take the initiative to correct a deficiency in the approved plan, rather than just respond to your deadline.

- If “Responsible Persons” are present during the review, always ask if there are any questions that you may not have answered. Offer to assist technically or procedurally within the scope of your duties.