

Gettysburg Adams Chamber of Commerce Storm Water Management

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Gettysburg Adams Chamber of Commerce Storm Water Management

Section 1 -- Introduction

As a business owner or resident, you may not be able to prevent flooding or other problems caused by storm water, but you can minimize the effects on you and your property.

According to a 1998 survey conducted by the Gettysburg/Adams County Area Chamber of Commerce, businesses in Adams County lost millions of dollars as a result of damage caused by the 1996 flood. Many companies suffered property damage, lost production time, and additional expense in the clean-up process. Other businesses, also located in flooded areas suffered little or no damage. What do those companies know, and what did they do that made a difference?

In some cases it was simply a matter of location. But, for others, the good news resulted from an understanding of the causes of storm water damage and aggressive prevention.

The purpose of this booklet is to provide basic information that will help you plan and prevent, or at least minimize, possible damage to your property. This booklet is not intended to be the definitive source on storm water management nor will it answer all your questions. But it should help you better understand and identify potential problems, plan basic prevention, and at worst case, know when it is to your advantage to call an engineer to assist you. We've also included information on ordinances and laws that should be considered in your storm water plans as well as a list of local resources, agencies, and information available to assist you with storm water management.

Section 2 - Understanding Location and Landscape

2.1 Location. The location of your house or business is an important factor in determining whether or not you will experience flooding. For example, locating your building close to a riverbank or stream is asking for problems. When heavy rains occur, water levels can rise quickly. The closer your building is to a riverbank or stream, the more likely it is that you will experience flood damage. Lands bordering riverbanks are typically classified as flood plains since they are subject to flooding.

Properties located at the bottom of hills or valleys are also more likely to experience flooding. During heavy rains, storm water flows towards the valley and the chance of flooding is greater. Buildings located uphill from streams or waterways are less prone to flooding.

2.2 Landscape. You may be fortunate to have a house or business that is not located on a flood plain; however, water problems could still be a concern during heavy rains or storms. Landscape features such as surface slope, vegetation, soil composition, and surface cover, all play a role in storm water management.

Since water runs down hill, the contour and slope of the land directs water flow during a rainstorm. To prevent water damage to homes and businesses, it is important that the land slopes in a manner that directs water flow away from buildings. Gentle slopes are more effective in managing storm water since water flows at slower speeds allowing more time for it to seep into soil. Steep slopes result in faster flowing water, which can, in turn, result in soil erosion and/or flooding.

Vegetation is an important component in flood control. Dense grass and brush covering the ground slows water flow during heavy rainfalls. Tree, brush, and other plant roots act like sponges absorbing water, which also helps recharge groundwater supplies. Plants also help filter sediments and prevent surface contaminants from reaching nearby rivers and streams.

However, when heavy rain falls on asphalt, concrete, or other impermeable surfaces, it isn't easily absorbed. On road surfaces, driveways, and parking areas, contaminants such as oil, grease, and antifreeze from vehicles collect and are washed into rivers and streams.

Aside from erosion and the possibility of contamination, large quantities of water running off into nearby rivers or streams significantly increases water levels, again increasing the risk of flooding.

The type of soil on your property is another factor that plays an important role in storm water management. The greater the permeability or the more porous the soil, the greater the infiltration, and the less water runs off the surface into nearby streams or rivers.

Section 3 - Understanding The Water Cycle

The water cycle is the continual flow of water between the atmosphere, the surface of the earth and under the ground. Precipitation, usually rain or snow, has essentially three pathways. It either runs over land surfaces into nearby streams, lakes, and wetlands, evaporates into the atmosphere, or is absorbed into the soil. The amount of rainwater that penetrates the earth is determined by several factors.

1. Amount of precipitation.
2. Rate of precipitation
3. Slope of the surface.

4. Permeability and porosity of the soil

3.1 Amount of Precipitation. One generally thinks of rain when they hear the word "precipitation". However, precipitation also includes snow, sleet, and hail. In storm water management, rain and melting snow are the typical concerns.

The amount of precipitation varies considerably throughout the United States. There are significant differences just within Pennsylvania. Typically counties in the eastern portion of the state (i.e. Bucks, Delaware, and Philadelphia) have significantly more rainfall than the western portion of the state. Hydrologists, scientists who study storm and flood management, have developed a classification referred to as "storm type". Storms are the occurrences of rain or snowfalls and are classified based on recurrence intervals or the average time between storm events of a given magnitude. Hydrologists, using past records of storms and the quantity of precipitation measured during each storm event, have calculated the average interval of flooding activity. Table 1 summarizes a 24-hour rainfall by storm type for the Adams County area.

TABLE 1

ADAMS COUNTY RAINFALL DATA

| STORM TYPE | 24-HOUR RAINFALL (in Inches) |
|----------------|------------------------------|
| 1-year storm | 2.5 in |
| 2-year storm | 3.0 in |
| 5-year storm | 3.9 in |
| 10-year storm | 4.8 in |
| 25-year storm | 5.3 in |
| 50-year storm | 6.0 in |
| 100-year storm | 6.7 in |

Historically, in Adams County a storm heavy enough to drop 6.0 inches of rainwater is likely to occur within a fifty-year time span. A storm of that size or greater can occur more frequently, but the probability isn't as great. For example, in 1996 Adams County received 11 inches of rainwater in one day (approximately a 200-year storm). These figures are used for planning and not to predict the future. Planners usually design drains and other storm water management efforts with the 100-year storm in mind.

3.2 Rate of Precipitation. The more rapid the rainfall, the less water will actually be absorbed into ground water supplies. As a result, during a heavy rainfall, larger quantities of water than usual run off the land surface causing rivers and streams to swell. Heavier run-off also increases erosion, which in turn, increases run-off in subsequent storms. Heavy rains and the resulting floodwaters from streams not only carry away soil from open

lands but also wash out river embankments and deposit silt and sediment into rivers and streams. In addition, it increases the concentration of contaminants such as fertilizer, oil, etc., flowing into rivers and streams.

3.3 Slope. As the slope of the ground increases, so does the percentage of water that will run off. The flatter the ground, the more water will be absorbed. Gentler slopes retard the flow of water and allow a longer time for it to soak into the ground.

As the slope of the ground increases, so does the velocity of water as it runs over the ground. The greater the velocity, the greater the scouring effect. Scouring causes erosion and sediment pollution.

3.4 Permeability and Porosity of Soil. Soil is made up of particles. The spaces or pores between particles determine porosity. If a gallon of sand holds 0.3 gallons of water when saturated, the porosity is said to be 30 per cent. Three tenths of the volume of the soil, therefore, is made up of pores (or empty spaces) between the sand grains. Sand allows water to seep easily through to underground water supplies because of large spaces between particles. Clay, on the other hand, does not have large spaces between soil particles and does not promote groundwater recharge. Both types of soil can be useful in managing storm water. For example, clay soil is often used next to buildings to discourage water seepage and protect foundation walls. Conversely, sand and gravel are used in areas where good drainage is desired.

Permeability is a term used to express the ability of soil to transmit water. It is the measure of how fast water seeps or percolates through soil.

3.5 What causes flooding? A flood is the overflowing of water onto land. Flooding is usually caused by one or more of the following:

- 1) Heavy rainfall in a short period of time.
- 2) Poor drainage. During a rain, storm water collects in areas with no drainage outlet.
- 3) Excessive land development with little or no vegetated surfaces.

Section 4 - Identify and Correct Potential Problems

4.1 Survey Your Property. The best way to obtain information about drainage conditions on your property is to conduct a property survey. It is a good idea to start by sketching a property map. On the map place the location of buildings, wooded areas, grassed areas, parking lots, pavement, and surface water (i.e. ponds, creeks, streams, rivers). See Figure 4-1 for an example of the property survey. Next, as a minimum, answer the following questions and note the information on your map:

- 1) First consider the location of surface water. Is your business or home near a riverbank? Areas close to rivers or streams are more prone to flooding and will require special storm water management techniques. The best prevention is to avoid building in a flood plain to begin with.
- 2) Walk around your property and observe the slope. If it were raining which way would the water flow? Mark this on your property map with arrows.
- 3) Note types of surrounding vegetation. Black willows, sycamores, black walnut, and cattails, for example, are plants that tend to grow in areas that have a high water table. These areas are more prone to flooding. Note areas where soil is bare.
- 4) Note the surface composition. Is the majority of the property paved? Are there grassy areas? Woodlands?
- 5) If there are steep slopes on your property, check for gullies, washouts, or other signs of erosion. Are trees starting to tilt? See section 5 for some potential solutions.
- 6) Are there storm water drains on or close to your property? If so, what part of the property drains to them? Are the drains in good condition? Are drains or drain lines filled with debris (i.e. leaves, mud, dead plants or trash)?
- 7) Perform the survey again during a rainstorm. Put on rain gear, walk your property and observe the actual storm water flow. Does the actual flow of water agree with the arrows on your map? If not, adjust your property survey map. Add any new flow paths that might have been missed.
- 8) During the rainstorm, note any obstructions to the flow of water as well as other water management aids that are not working properly. Are gutters clogged or overflowing? Do downspouts direct water away from the foundations or toward them? Are storm water ditches or swales clogged? Do you see water stains indicating water flow against an outside wall? Do you have a wet basement? (See section 5 for possible solutions.)

4.2 Planning repairs and corrections. Using the information you gather from the survey and the potential solutions listed in section 5 you can begin correcting minor problems and building a plan to correct larger ones. Unclogging gutters or clearing drains may be projects you or your staff can handle. However, major repairs or corrections may need to be contracted and/or the expense budgeted.

While planning, business owners should consider whether a Flood Preparedness Plan is required. Check with the Adams County Office of Emergency Services. Even for

homeowners, some type of long-term plan to ensure that repairs and corrections are completed is sensible.

Flood insurance is also an option to consider. Many companies as well as the federal government offer some version of protection at varying costs. While insurance can be expensive, it cannot replace repairs and sound storm water management. It does however offer some protection against financial loss.

Section 5 – Managing Storm Water

5.1 Recommended practices. To better control and manage storm water;

- Identify areas where storm water flows, observe land slope, identify soil type, and note where water collects. Grade and slope the ground to direct water away from foundations and plant appropriate vegetation to slow the flow of water and avoid erosion. For information on water loving-plants and rain gardens (a collection of plants and shrubs specifically designed to absorb water) contact the Penn State Cooperative Extension listed in section 7.
- Check the interior and exterior of building foundations for cracks, holes, or other paths through which water may enter. Check the condition of the foundation sealant. Repair as needed. Check for water stains low on foundation walls that may indicate water flowing against the foundation. Find the source and redirect it.
- Check that sump pumps are of adequate size to handle the volume of water produced by a 100-year storm. Ensure that pipes connecting the pump to the outside of the building will handle the higher volume. Consider installing a secondary or backup pump. Ensure that discharge from sump pumps is directed away from foundations and is not re-entering the building.
- If the sump exits into an underground drain pipe, ensure that the pipe is clear of debris and flows freely. If the sump pipe exits above ground, ensure that the water flows on a slope away from building foundations. Check with your municipal office for ordinances concerning where water can be discharged.
- Ensure gutters, swales or ditches, drains and other water management aids are working properly. Damp or rust coated patches on exterior walls may indicate that gutters are clogged or damaged. Clear clogged swales, ditches, or drains. If the drains are on Penn DOT or other rights-of-way or on a neighbor's property, contact the owner for assistance.

- Check for settling soil next to foundations. A slope of 1 inch in 4 feet is recommended to direct water away from foundations. Use heavy clay fill dirt to slope soil away from the foundation if needed.
- Check existing records (i.e. insurance claims, etc.) for reports of past storm damage and corrective measures recommended. Verify that corrective action was taken.
- If you have a wet basement and can't figure out why, call a professional for assistance.

5.2 Practices to Avoid. To avoid creating conditions favorable to flooding,

- Avoid clear cutting construction sites or other large open areas. Removing ground cover can lead to erosion. It also increases the velocity of water flowing over the ground, which in turn can increase the chance of flooding.
- Avoid installing impermeable surfaces. Opt for gravel parking areas, roads or drives. Construct block and sand or wood slat patios rather than concrete.
- Avoid locating new construction on low ground or close to riverbanks or streams.
- Don't ignore erosion on your property. Erosion will not reverse itself and can cause significant long-term damage to your property as well as to nearby rivers and streams while increasing chances of flooding. (See section 5.2 above).
- Avoid fixing a problem on your property by channeling storm water onto neighboring properties or directly into streams or rivers. Passing storm water management problems onto someone else's property can become a legal issue. Channeling storm water directly into streams raises the water level, increasing the flow velocity and the possibility of flooding.

5.3 Dealing with erosion. Erosion is caused by the impact and movement of water over soil. During storm events, water flows over land carrying sediment with it. To reduce the possibility of soil erosion and sediments damaging streams, rivers, and ponds, it is necessary to reduce the flow velocity. Some simple techniques to reduce the velocity of run-off and prevent erosion include;

- Increase vegetation. Grass is often used for this purpose because it grows quickly, but any kind of ground cover, such as ivy will work to cover the soil and shield it from impact as well as to slow the flow of water over the surface. Adding trees, bushes, and other plants (different root depths) will increase the soils ability to absorb and store water.

- Drainage swales. A swale is a channel lined with vegetation or stone and is used to direct runoff into storm drains or to other areas on your property where it can be absorbed. Improperly constructed, however, swales can cause more problems than they solve. If you're considering a swale, contact a qualified professional to help design it properly.
- Subsurface drains. A subsurface drain, usually flexible, perforated pipe, is sometimes used in areas where the water table is already close to the surface. The pipe redirects excess storm water onto other parts of the property or into storm drains. Subsurface drains are best installed with the assistance or at least advice of a professional.
 - While there are other techniques, they tend to either require the assistance of a professional or to be temporary.

To repair areas of erosion, the following is recommended:

- Repair the surface. Fill in erosion channels with soil and then resurface with vegetation. Grass seed grows quickly and is often used as a fast fix. If you are expecting more rain or storms before grass will have a chance to root, consider using sod or covering the reseeded area with straw.
- Find out what caused the erosion. If erosion was caused simply by rain hitting bare ground, then vegetation should solve the problem. If, however, erosion was caused by steep slopes, efforts should be made to slow down the flow by either reducing the slope or adding rugged vegetation, terraces or heavy stones.

5.4 Know when it's time to call an engineer. Many of the storm water management techniques discussed in the booklet are simple, inexpensive and can be handled by the average home or small business owner. It may be as simple as channeling water safely away from building foundations or installing the right size sump pump to replace one that is inadequate. But, if you encounter multiple or extensive problems, have foundation cracks, or on-going erosion it may be less expensive to call in a professional for a complete evaluation rather than pay for continuing storm water damage. The Conservation District can provide information about local firms that are knowledgeable in dealing with storm water management problems.

Section 6 -- Laws & ordinances

6.1 Municipal. Municipal storm water management requirements are typically presented in sub-division, land development and or zoning ordinances. Municipal offices are listed in the community pages of the phone book under government.

6.2 County. Act 167, the Pennsylvania Storm Water Management Act requires counties to prepare comprehensive plans for watershed storm water management. At present, Adams County is developing such plans as well as local storm water ordinances.

The Adams County Conservation District is responsible for administering the Pennsylvania NPDES Storm Water Program. This organization also assists with erosion and sedimentation control problems. The Adams County Conservation District reviews erosion and sedimentation plans and visits sites where plans are being implemented to ensure that the plans are being followed. The district also assists farmers in designing and implementing conservation plans.

6.3 State.

Pennsylvania Storm Water Management Act (No. 167)

Under this legislation, called Act 167, the Pennsylvania Department of Environmental Protection (PADEP) provides grant money to counties to develop storm water management plans. Each county is responsible for developing storm water management plans for watersheds within its boundaries.

Pennsylvania Clean Stream Law - Chapter 102

Passed in 1937 and amended several times, Chapter 102 was developed to control erosion and sediment pollution for earth moving projects. Developers engaged in earth moving projects may be required to prepare an erosion and sedimentation control plan. Farmers also must implement plans for certain agricultural plowing and tilling operations.

Pennsylvania NPDES Storm Water Program

In 1987 Congress amended the Clean Water Act to include storm water discharges. The U.S EPA developed the NPDES Storm Water Regulations and states such as Pennsylvania adopted them. The Pennsylvania Department of Environmental Protection (PADEP) is responsible for administering and enforcing the program. The PADEP issues NPDES storm water permits for industrial storm water dischargers and for specific construction projects sites. On-site inspections and project reviews are carried out by the Conservation District.

6.4 Federal.

Clean Water Act

The Clean Water Act was amended in the early 1990's to include the NPDES Storm water Permit Program. NPDES stands for National Pollutant Discharge Elimination System. The purpose of the program is to eliminate or reduce the quantity of pollutants that are discharged to rivers, lakes, and streams. Facilities that are affected by the program are those that engage in industrial activities or large construction operations. Examples of activities that require a permit include manufacturing, mining, auto wrecking, scrap and waste material establishments, hazardous waste facilities, and large construction operations. Storm water permits require organizations to use Best Available Technology and Best Conventional Pollutant Control Technology to control the discharge of pollutants to nearby rivers, streams or stormwater drains.

Section 7 -- Local resources

The following are local, state and Federal sources of information on storm water management.

7.1 Local.

The Adams County Planning Office can provide USGS maps and information on flood plains, terrain mapping, topographical mapping, and soil surveys. Phone: (717) 334-6781.

The Conservation District can provide USGS and other maps as well as information on soil types, erosion, and the Pennsylvania NPDES Storm water Program. They can also assist you with state and local regulations and best management practices to prevent or address ongoing erosion or water management problems. Phone: (717) 334-0636.

The Penn State Cooperative Extension (Master Gardeners) can provide information, advice and assistance in selecting plant types for use in landscaping. Phone: (717) 334-6271.

Municipal Offices can provide land development and zoning ordinances, regulatory information, flood plain overlays and historical information on flooding for your property. For the address and phone number of the municipality in which your home or business is located, check the community pages of the phone book.

7.2 State and Federal.

Pennsylvania Department of Environmental Protection (PADEP) can provide booklets on best management practices, handbooks, and fact sheets on storm water planning and watersheds. Phone: (717) 267-3364. Web site: www.dep.state.pa.us.

The US Environmental Protection Agency (regional federal office) can provide information and answer questions on storm water management. Phone: (717) 267-3364. Web site: www.epa.gov.

7.3 Reading or Reference Material.

PA Handbook of Best Management Practices for Developing Areas. Booklet, Pa Department of Environmental Protection. A Copy is available at the Adams County Library on Baltimore Pike, the Adams County Planning office, the Conservation District, or individual municipal offices.

Design Manual for use in Bio-retention in Storm Water Management. Booklet. PADEP. A Copy is available at the Adams County Library, Baltimore Pike, or the Adams County Planning office.

Residential Drainage: A Homeowner's Guide to Drainage Problems and Solutions. Prince George's County, MD. Provides explanations of drainage problems common to homes along with potential solutions. To obtain a copy, call (301) 952-4131.

This information was prepared by members of the Gettysburg Adams Chamber of Commerce Environmental Team. To ask questions or suggest additions, please contact the Chamber at 18 Carlisle St., Ste. 203, Gettysburg, PA 17325. Phone: (717) 334-8151. Email: info@gettysburg-chamber.org. Web site: www.gettysburg-chamber.org.