



FEMA

Pulling the Plug on Monroe's High Water Problems

Retention and Detention Basins

Retention basins are simply large, scraped-out earthen depressions that catch the runoff from higher elevated areas. Normally, they are lined with rolls of permanent erosion control mats that hold the soil in place, yet allow grass to grow through it.

The difference between retention and detention basins is that a retention basin typically always has some water in it, hence the name retention basin. A detention basin detains water during rainy periods. In drier times they are just that - dry. These are designed to help control runoff and they limit flooding during storms by allowing rainwater to drain off more quickly from the streets. A detention basin will hold water for a short period of time and slowly release it, either through the ground beneath it, or by means of drain pipes that can be opened for controlled release. A retention basin will typically have one or more overflow pipes to prevent the water in it from getting too high, but there may be water in it at all times.

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Water boils out of an inlet culvert in the half-finished 30th Street Project during the June 2007 floods in Monroe.

Monroe, Wisconsin - Monroe is a city with just over 10,800 people. Situated about 12 miles from the Illinois state line, it is in the middle of the southern half of Green County, Wisconsin. Its local claim to fame is cheese, produced by many of the surrounding farms whose earlier pioneering families immigrated here from Germany and Switzerland in the early 1900s. Most people nationwide would recognize its biggest employer as Monroe is the headquarters for a nationally famous Wisconsin cheese gift package shipper.

An aerial view of the city shows it to be surrounded by many square miles of farmland. Thousands of acres of corn reach up into the blue sky in every direction. Numerous large red barns with silos and neat white farm houses are sprinkled amidst miles of corn that stand in long perfect rows and march off into the horizon. Accompanying this are herds of black and white and brown cows which give Wisconsin its well deserved title of "America's Dairyland." But in recent years, their blue skies have been changing, darkening rapidly and then dumping great quantities of rain all over the state. But Monroe has been planning and building

projects to manage the runoff from these seasonal storms.

Normally this is a quiet area, free from the continual siege of serious flooding that has plagued other Wisconsin counties. As Monroe developed, with new businesses and homes adding to the percentage of paved area, heavy rains became more of a nuisance. Monroe's primary problem was rainwater runoff accumulating in streets and parking lots and causing sewer backups in basements. Although the flooding and backups would come and go quickly, they were causing appreciable damage to roads and property.



Green County Courthouse - the centerpiece for Monroe, Wisconsin's town square.

Photo: Barbara Ellis - FEMA

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Retention basins are often fairly small in size, typically less than an acre. Their gently sloping interior walls can accommodate high water during rainy times. This design is for function and safety. Since these basins are generally found in public areas, the shallow, slow sloping sides are needed for safety if people happen to fall in. Most are installed near developed areas where the rain cannot soak in due to pavement and buildings. Often, retention and detention basins are installed in tandem: runoff water is held up in the detention basin and then is slowly drained into the neighboring retention basin.

These flood-proofing types of mitigation projects also serve to remove pollutants and trash. Since they are generally the drainage basins for urban areas, they collect not only runoff water, but also the debris washed into the system by rains.

Retention and detention basins also catch other pollutants from runoff such as petroleum products from roadways, fertilizers from lawns and fields, sediments, bacteria, suspended solids and heavy metals. These pollutants can have negative affects on the overall water quality such as its acidity or alkalinity, turbidity (lack of clarity), and hardness as well as the amount of nutrients (water-soluble nitrates and phosphates) it contains. When the pollutants enter the basin during a rain event, the basin slows the water movement, allowing the heavier pollutants such as suspended solids, sediments, and metals to settle out of the water column and come to rest in the bottom sediments. This greatly improves the overall clarity of the water before it is returned to the ground, neighboring streams or wetlands.



The Villa East detention basin alleviates flooding in the parking lot and buildings of the Countryview Apartment complex. Photo: Barbara Ellis, FEMA

Fortunately, the city had this problem in its sights. In December 1987, Monroe joined the National Flood Insurance Program (NFIP), enabling homeowners to purchase flood insurance. When the August 1996 floods triggered a disaster declaration, detention ponds became a major focus in the city's mitigation plans.

In 2003, the city hired a project developer who was a specialist in storm water control. After completion of the runoff study, Monroe's solution for handling it was mapped out. Plans called for the construction of a storm water management system known as retention and

detention basins. Alan Gerber, Engineering Supervisor at the Monroe Department of Public Works, began devising specific plans to handle the runoffs - a major focus of the city's Hazard Mitigation Plan.

In May 2005, the Federal Emergency Management Agency (FEMA) approved Green County's Multiple Jurisdiction Hazard Mitigation Plan



Alan Gerber, City Engineering Supervisor at the Department of Public Works of Monroe, Wisconsin, points out the direction of flow water takes when draining from the Villa East detention basin. Photo: Barbara Ellis, FEMA

which included the city of Monroe. The City identified flash-flooding as one of its hazards and chose detention and retention basins as mitigation projects to relieve the problem. As a part of its plan, Monroe adopted building codes that require new developments to include controls for the treatment of runoff at pre-development rates. In addition, drainage tiles would be installed in strategic areas to aid in runoff control throughout the city. Stormwater facilities would be improved along with street projects. Riprap and other stream controls were added and more were planned.

Included in the plan were studies of small streams such as Honey Creek to provide guidance for other improvements. To address the sewer-backup issue, the city sent out an informational mailing to residents recommending the installation of backflow valves into residential sewer pipes. Although these check valves are not part of city building codes, the information explained that their installation could prevent backups.

The City of Monroe also implemented a stormwater utility fee to provide a dedicated source of revenue for the city to improve, operate and maintain the city's stormwater management system. Previously these expenses were covered by property taxes or special assessments. This stormwater utility fee applies the charges proportionally to those who contribute to stormwater runoff and receive benefit from stormwater management. Failure to adequately manage the city's stormwater system increases the risk of flooding, affects the operation of other utilities (most notably the sanitary sewer system), increases soil erosion, and threatens the quality of surface waters and the environment.

The Federal Clean Water Act and the regulations of the Wisconsin Department of Natural Resources required the city to make changes in the way it regulates and handles stormwater. The fee is based on the amount of stormwater each property parcel passes to the storm-



The 30th Street project was still under construction during the summer of 2008. This large retention basin drains 200 acres of land within the city of Monroe, Wisconsin. Photo: Barbara Ellis - FEMA

water system. In general, the more runoff a parcel contributes, the greater the fee. However, even if a property were to generate no runoff, there would still be a minimal fee applied to the property for the costs associated with maintaining public roads and public properties that also generate stormwater runoff. The amount of runoff is calculated with the use of detailed maps, aerial photos and site plans to determine the amount of impervious cover that exists on each parcel. For instance, a parcel that is covered 90 percent with buildings and parking lot will generate much more runoff than a parcel with a small house surrounded by driveway, lawn and garden.

Targeted by the city's Hazard Mitigation Plan was Country View Apartments, a mid-sized housing complex located on the east side of Monroe. The area is bordered by corn and soybean fields at its southern tip, and on the northern and eastern ends by paved streets and densely populated neighborhoods. These surrounding neighborhoods are on a slightly higher level than the apartment complex. During long, hard rains the apartments received the brunt of extraordinary amounts of runoff, funneled down paved streets and gutters, flooding the apartment buildings' parking lot.

Initially the Country View Apartment dwellers noticed



A worker staples down plastic erosion control mat that stabilizes sloping sides of the 30th Street retention basin.

Photo: Barbara Ellis - FEMA

the water getting deeper, in some places as much as six-inches deep where they parked cars. Some joked that soon they would be fishing in their parking lot. Eventually, water seeped through the outside walls and into the first floor units of the apartments, wetting carpets and damaging floors.

Work on Monroe's first detention pond began in the summer of 2005. Called the Villa East Project, it was located approximately 300 yards behind and downslope from the Country View Apartments. The completed Villa East pond has a 12-inch concrete inlet pipe at its upper northwest corner. The outlet, also a 12-inch pipe, is located at the bottom northeast corner of the pond, approximately 150 yards from the inlet. The basin is about five feet deep and is surrounded by gently mounded banks now covered by a planting of a hearty, soil-holding grass. The pond's capacity is 1.21 acre feet, which gives it the ability to drain about 25 acres of the neighborhoods located to the north and northwest, and a large area to the south, which is occupied by the city cemetery. Storm drains and culverts now successfully direct all runoff from all of the areas above the complex into the Villa East detention basin. It took approximately three months to complete it at a cost of \$179,529. So now, because of this beautifully sculpted retention basin,

the Villa East section of Monroe and its neighbor, the Country View Apartments, can breathe a sigh of relief and no longer worry about heavy rain runoffs.

Runoff was a problem in many other sections of downtown streets and newly developing neighborhoods. The mitigation project designed to alleviate this problem is situated on the southern end of the city and designated as the 30th Street Pond. This area is much larger than the Villa East project. Work on Monroe's second, larger, retention basin started in September 2007 and continued until winter weather closed it down in late October. Work resumed in the summer of 2008. A huge concrete inlet pipe directs accumulated runoff water from approximately 200 acres of city residential area into a large basin with a capacity of 34.4 acre feet. The estimated total cost of this project, to be completed by fall of 2008, is \$545,000. Funding will be provided by FEMA's Hazard Mitigation Grant Program, supplemented by local and Wisconsin Emergency Management matches.

By developing and implementing a Hazard Mitigation Plan that included projects that mitigate against the inevitable flood waters, Monroe, Wisconsin, has been able to reduce costs associated with flooding and keep its neighborhoods free-flowing and safe for residents.