Section 7
Recommended Watershed Management Plan Elements

Watershed management and protection is about making choices regarding which measures and controls are best to apply, and in what combination. A well-crafted and implemented watershed management plan is arguably the best and most comprehensive tool to protect urban streams and riparian corridors from the cumulative impacts of new land development and existing urbanization. Existing watershed problems were identified and a series of goals, objectives, and priorities for the Nine Mile Run (NMR) watershed were established and documented in Section 2 of this draft watershed management plan. Alternative non-structural and structural management and control measures that were considered for the NMR watershed were identified and described in Sections 4 and 5, respectively. In Section 6, the alternatives were evaluated and screened to determine an optimal mix of recommended management, restoration, rehabilitation and control measures to apply to existing watershed problems and to meet the watershed goals and objectives.

This section will describe the recommended management tools, measures, and controls to utilize within the NMR watershed and the institutional mechanisms to implement them. It must be understood that this document is a **draft** watershed management plan. Watershed stakeholders, like the NMR Watershed Association and the municipalities located within the watershed, will need to carefully review this draft document and associated recommendations, make any needed revisions, and adopt the finalized plan as a comprehensive guidebook for improving the NMR watershed.

7.1 Recommended Institutional Mechanisms

Successful watershed planning in Nine Mile Run will require a combination of existing and new institutional organizations to focus the resources of a diverse group of stakeholders to implement the plan. A long-term management structure is not only critical to prepare and implement the plan, but to revisit and update the plan as goals are achieved or circumstances change over time. Several different options are available to structure a watershed management organization. The hybrid management model is recommended for the NMR watershed to oversee the implementation of the watershed management plan. This management and other management models that were considered but not selected were described and evaluated previously in Section 6.5.

The recommended hybrid management model should include members from the local professional community, government agencies, citizens, and non-profit organizations. The management organization itself would not have regulatory authority, but would make recommendations to local government agencies like municipal government, the Allegheny County Health Department (ACHD), the

Pennsylvania Department of Environmental Protection (PA-DEP), and the PA Department of Conservation and Natural Resources (PA-DCNR) to insure that management strategies are implemented. The goal of the hybrid model is to incorporate and actively involve as many stakeholders as possible in the process of implementing the watershed management plan, either in an advisory or technical role. A technical committee should set up to provide expertise on scientific or engineering issues, while a citizen advisory committee affords the public the opportunity to voice their opinions in the management process. A central principal behind the hybrid model structure is that greater watershed improvements can be achieved when there is proactive involvement of many watershed parties.

Recommended components and attributes of the hybrid management model are summarized as follows:

Formation: Created with some governmental authority and with some support from watershed citizens

Membership: Some members are required to participate, but many are volunteers

Authority: Some members have regulatory authority, and others act in a volunteer or advisory capacity

Funding: Funding comes from a combination of grants and local government cost-sharing agreements

Implementation: Local governments implement the watershed management plan, with some assistance from state and county agencies

Existing institutional entities and the new NMR Watershed Association will all play important roles in implementing the recommended management and restoration measures within the NMR watershed. The following entities either have or will have significant roles in implementing the NMR watershed management plan.

Nine Mile Run Watershed Association: A watershed association currently is being established to oversee and implement the NMR Watershed Management Plan. The association will be comprised of citizen volunteers with diverse backgrounds, interests, and areas of expertise. Association members will represent the interests of the NMR watershed, home and business owners in the watershed, other stakeholders in the watershed. The association also will evaluate and oversee the improvements provided by the Habitat Restoration Program after construction has been completed. The management association will have the primary responsibility for reviewing this draft management plan, making any needed revisions, adopting the plan, and coordinating with the other institutional entities so that the plan is implemented, evaluated, and updated on a regular basis. The watershed association will have no regulatory authority, but will make recommendations to local municipalities, the

ACHD, PA-DEP, and PA-DCNR to implement recommended management strategies, restoration measures, and structural rehabilitation. It is currently envisioned that the NMR Watershed Association will employ a part-time administrator to assist in the daily operation of the association, and the implementation of the watershed management plan.

Municipal Governments: There are four municipalities, each with jurisdiction over their respective portions of the NMR watershed. They are the City of Pittsburgh, and the Boroughs of Edgewood, Swissvale, and Wilkinsburg. These four municipalities will need to work together as a unified watershed entity and transcend existing municipal boarders. The municipalities will have the authority to revise and enforce ordinances that would shape new development and restorative redevelopment, control the disposal of pet wastes and household hazardous wastes, and oversee the rehabilitation of aging sewer, storm drain and pavement systems in the watershed. Municipalities in the NMR watershed also will need to carefully review this draft management plan and make any needed revisions.

Regulatory Agencies: The Allegheny County Health Department (ACHD), PA Department of Protection (PA-DEP), and the PA Department of Conservation and Natural Resources (PA-DCNR) are existing regulatory agencies that have authority and jurisdiction over environmental quality within the NMR watershed. They have been active in the watershed in the past and will have active roles in the future implementation of the NMR Watershed Management Plan. The ACHD has conducted field investigations and laboratory analyses and determined that bacterial concentrations along the NMR stream channel exceed water quality standards. The PA-DEP has issued Consent Order Agreements (COAs) to the Pittsburgh Water and Sewer Authority (PWSA) and the Boroughs of Edgewood, Swissvale, and Wilkinsburg. These orders required comprehensive inspections of aging sewer systems, removal if illicit sewage connections to municipal storm drain systems, assessment of sewer system conveyance capacities, the elimination of SSOs, and meeting the standards of the National CSO Policy. PA-DEP will issue the regulatory permits associated with the construction of many of the structural control measures recommended in the plan and insure that the requirements of the COAs are met.

Sewer Authorities: The Pittsburgh Water and Sewer Authority (PWSA) has the responsibility to operate and maintain the combined and separate sewer systems located within the City of Pittsburgh portions of the NMR watershed. The Allegheny County Sanitary Authority (ALCOSAN) has the responsibility to operate and maintain the M-47 regulator structure that controls the flow of wastewater into the regional interceptor and treatment systems. The separate sanitary sewer and municipal storm drain systems within the rest of the watershed currently are owned and operated by the respective Boroughs of Edgewood, Swissvale, and Wilkinsburg. It is recommended that operation and maintenance responsibility be relinquished by the municipalities and handed over either to a new NMR watershed authority or a larger regional authority. The 3 Rivers Wet Weather Demonstration Program

(3RWWDP), in conjunction with the Wilkes-Penn Authority and the Pennsylvania Economy League, are currently conducting a regional study to identify alternative institutional arrangements for managing, operating, and maintaining sewer and storm drain systems. Implementing either a regional or watershed-wide sewer authority could insure that wastewater and storm water infrastructure would be managed professionally and adequately funded through user fees.

NMR Habitat Restoration Project: The Nine Mile Run Habitat Restoration Project (NMR-HRP) will be the institutional vehicle to implement recommended restoration measures along the existing NMR and Fern Hollow riparian corridors. Under the project, the natural morphology of the stream and the connection to the flood plain will be restored, the stream channel and over-banks will be stabilized to control erosion and bed-loads, new wetland areas will be created, vegetation will be enhanced and managed, and aquatic and terrestrial habitat will be restored. The City of Pittsburgh is the local sponsor for the program that is administered via a WRDA Section 206 grant administered by the Army Corps of Engineers (ACOE).

Required funding to support the various institutional entities that will be active in the NMR watershed will be secured through a number of sources as described below.

The NMR Watershed Association: The members of the association would be a collection of citizen volunteers. Administrative and program support would be funded through a combination of grants from entities such as the Pennsylvania Environmental Council, the PA Growing Greener Initiative, the Heinz Foundation, and/or the Three Rivers Wet Weather Demonstration Program (3RWWDP).

Municipal Government: The cost for activities conducted by municipalities would be provided by general funds, local sewer user fees, bond issues for infrastructure projects, PennVest loans, and possible demonstration grants. The possibility of creating a storm water utility and charging a storm water utility fee could be considered.

Regulatory Agencies: Activities conducted by environmental regulatory agencies would be provided by state and county budgets that are funded through state and county taxes.

Sewer Authorities: Activities implemented by existing and/or future sewer authorities would be funded through user fees paid by customers.

NMR Habitat Restoration Program: Restoration measures implemented under the NMR-HRP are being be funded by a Federal WRDA Section 206 grant with local match requirements being met by combination of a PA-Growing greener initiative grant, PA Section 319 Grant, PA DCNR grant, 3RWWDP grant, and in-kind services from ALCOSAN.

7.2 Land Use Controls

Urbanization and impervious cover directly influence urban streams by increasing surface runoff during storm events. A variety of alternative land use control techniques can be used to directly and indirectly manage land use and impervious cover in the NMR watershed. For the NMR watershed, where much of the developable load is already built out, the tools of restoration redevelopment are especially effective land use controls. It must be understood that the land use controls documented in this **draft** watershed management plan are **draft** recommendations. Watershed stakeholders, like the NMR Watershed Association and the municipalities located within the watershed, will need to carefully review this draft document and associated recommendations, make any needed revisions, and adopt the finalized plan as a comprehensive guidebook for improving the NMR watershed.

7.2.1 Recommended Alternatives

- During future restorative redevelopment projects within the NMR watershed, encourage home and business owners to replace deteriorated driveways, walks and patios with semi-pervious pavement materials, and to direct storm water runoff to flat vegetated areas rather than street curbs.

The NMR watershed is comprised of older communities. Deteriorated driveways, walkways, patios, parking area currently or will need to be replaced. These paving projects will provide opportunities to restore the natural watershed ecosystem and the communities to health and vitality. Home and business owners will be encouraged to eliminate unnecessary pavement areas, to replace existing concrete and asphalt with more pervious alternatives and to direct roof and pavement runoff to flat vegetated areas where it can percolate into the soil. This land use control measure should be teamed with a proactive public education program to maximize opportunities to implement these management practices.

In the NMR watershed, a large portion of the available land already has been urbanized, and restorative development efforts may be the key ingredient toward revitalizing the older, urban watershed. Many of the older properties have deteriorated and will need to be restored, revitalized and reconstructed. The regenerative capacity of vegetation areas is strong and natural processes (such as soil percolation, microbial action, and plant transpiration) are waiting to help mitigate the pollutant loads associated with urban runoff.

More detailed descriptions of the concepts of restorative redevelopment and how they can be applied to the NMR watershed are provided in Section 4.1.3. The evaluation and screening process resulting in pavement reduction being a recommended land use control for the NMR watershed is documented in Section 6.1.2.

- Restore and enhance existing buffer areas within the NMR and Fern Hollow riparian zones to sustain the integrity of aquatic and terrestrial habitat.

A stream buffer is the region immediately beyond the banks of a stream that serves to limit the entrance of sediment, nutrients, and pollutants into the stream. It acts as a right-of-way for a stream and function as in integral part of the stream ecosystem. Existing riparian buffers should be restored and enhanced to promote bank stability, control stream temperature, control pollutant loads, enhance habitat, and provide an aesthetically pleasing greenway for public recreation and enjoyment.

Within the NMR watershed, no private land needs to be acquired to maintain existing open spaces and stream buffers. Stream bank vegetation along the NMR riparian corridor has been degraded, and existing vegetation along the slopes of the slag disposal area is sparse. Revegetation of these areas would be beneficial, particularly where the natural vegetation has been replaced with mowed grass or where there is minimal existing vegetation.

The enhancement and restoration of existing buffer zones along the riparian corridor were described in Section 4.1.4. The screening and evaluation process resulting in buffer zone restoration being recommended as a control measure was discussed in Section 6.1.3.

- Implement a Best Management Practices (BMP) approach directed toward pollution prevention for industrial and commercial facilities located within the NMR watershed.

This pollution prevention approach is intended to achieve a level of on-site pollution control at the point of origin so that pollutants do not leave the site during storms. The approach is highly practical from a business standpoint because it focuses on operational practices, good housekeeping measures, and other low-cost pollution control practices rather than expensive constructed control facilities. Owner and employee training is the vital component in implementing BMP measures.

Even small industrial and commercial business and facilities have the potential to be a significant pollutant contributor and can be considered potential hot spots within the watershed. While only a small portion of the watershed is used for commercial and industrial purposes, routine or accidental discharges from these few facilities can discharge pollutants such as petroleum hydrocarbons, heavy metal, and toxic organic materials in quantities for beyond the proportion of the facility size.

Implementing best management practices as a land use control for commercial and industrial facilities in the watershed was discussed in Section 4.1.5. The evaluation and screening process resulting in these BMP measures being a recommended control measure was documented in Section 6.1.4.

7.2.2 Other Alternatives to Consider

- Use "green" site designs when existing empty "fill in lots" in existing urban neighborhoods are developed in order to limit impervious cover and direct runoff to flat vegetated areas.

Property owners who construct development and redevelopment projects on individual vacant lots should be encouraged to design their homes, driveways, walkways, and patios in ways that reduce the quantity of impervious cover on the lot, and increase the percentage of vegetated landscaping areas to reduce the impact of development. When better site designs are implemented, driveway widths and sidewalk widths are narrowed; patios, driveways and walkways are constructed of semi-pervious building materials, and runoff is directed to flat vegetated areas where it can be percolate into the ground.

There are opportunities to implement better site designs on the individual vacant lots within existing urban neighborhoods, such as those in Wilkinsburg Borough. The use of better site design in new development projects can be highly effective in reducing the quantity of storm water runoff from the site and reducing the associated pollutants that are transported in urban runoff. However, these "better design" alternatives would not be mandatory, and implementation on a large scale could be difficult.

Better site design measures for vacant lots in existing urban neighborhoods were described in Section 4.1.6. The evaluation and screening process that resulted in these control tools being an alternative to consider was discussed in Section 6.1.5.

- Improve resources available for the administration and enforcement of Erosion and Sedimentation (E&S) control requirements by municipal zoning officers and building inspectors whenever new development or redevelopment occurs in the watershed.

An effective Erosion and Sedimentation Control Program is an important management tool to reduce the potentially severe impact generated by the construction process when soils are disturbed and exposed. All of the municipalities within the NMR watershed have existing ordinances that require E&S controls to be implemented at construction sites. Limited municipal staffing and other perceived priorities for municipal personnel may limit the frequency at which construction sites are inspected in the NMR watershed. Improved staffing and funding resources could encourage proactive implementation and enforcement measures and could increase the effectiveness of existing ordinances.

Erosion and Sedimentation control measures and their increased enforcement were described in Section 4.1.1. The evaluation and screening process resulting in this measure being an alternative to consider was discussed in Section 6.1.1.

7.3 Public Education & Volunteer Programs

The public does not always practice good watershed ethic, and continue to engage in many behaviors that are linked to water quality problems. Watershed education is an important watershed management element because it encourages residents to live responsibly in their watershed and is the primary tool for changing these adverse behaviors. This section will address recommended public education and citizen volunteer programs to implement within the NMR watershed. It must be understood that the public education and volunteer programs documented in this **draft** watershed management plan are **draft** recommendations. Watershed stakeholders, like the NMR Watershed Association and watershed residents and business owners, will need to carefully review this draft document and associated recommendations, make any needed revisions, and adopt the finalized plan as a comprehensive guidebook for improving the NMR watershed.

7.3.1 Recommended Alternatives

- Implement an education program to familiarize watershed residents and business owners on how littering and improperly disposed materials can degrade storm water and watershed quality

Education is the key to changing behavior and attitudes with regards to littering, dumping pollutants down storm drains, and improperly disposed materials at vacant lots or other local dump sites. The goal is to successfully educate the public on the problem and its implications. Effective litter and illegal dumping prevention programs use practices such as educational materials, the media, and volunteer cleanup programs to educate and involve the community in an effort to eliminate these problems.

Littering and illegal dumping are pervasive problems in the NMR watershed. Refuse may be blown out of overflowing trash bins or inexcusably tossed by consumers onto streets and into yards. Items such as auto batteries, refrigerators and other scrap appliances may be illegally dumped to avoid disposal fees or the time and effort required for proper disposal at landfills or recycling facilities. Litter and improperly disposed materials can eventually make their way into receiving streams thus making them a risk to public safety and water quality. Illegally dumped hazardous chemicals generated from household, commercial, and industrial sources can contaminate ground and surface water supplies, affect drinking water and public health as well as aquatic habitat.

A more detailed description pertaining to the effects littering can have on the watershed and the recommended approaches toward implementing a public education program regarding litter control can be found in Section 4.2.1. The causes and effects of illegal dumping and educational programs addressing this issue were discussed separately in Section 4.2.2. The screening process used to evaluate how

public education toward littering and illegal dumping could be used as a recommended control measure was discussed in Section 6.2.1.

- Coordinate special cleanup events where community volunteer groups clean up existing dumping sites, enhance the aesthetic quality of the watershed, and encourage community and watershed pride.

Special cleanup events should be organized where community volunteer groups are provided with the resources to properly dispose of illegally dumped materials. These clean up activities should increase the understanding among residents of illegal dumping impacts and supplies opportunities to correctly dispose of these materials. Cleanup projects will require coordinated planning efforts to ensure that adequate resources and funding are available. Once a site has been cleaned, signs, lighting, or barriers should discourage future dumping. Landscaping and beautification efforts should also discourage illegal dumping, as well as provide open space and increased property value. The strongest deterrent to illegal dumping is natural beauty. If property is naturally beautiful and well cared for, it is less likely to be trashed by uncaring people.

Illegally dumped materials can reduce runoff drainage due to blocked streams, culverts, and drainage basins and result in local flooding and channel erosion. Property values can decrease as a result of littering and illegal dumping and the local tax base can be affected. Coordinated cleanup events will provide opportunities to properly dispose of litter and illegally dumped materials and avoid contaminated runoff from entering surface water.

Littering and illegal dumping control and the coordination of special cleanup events was discussed in Sections 4.2.1 and 4.2.2. The evaluation and screening process resulting in coordinated special cleanup events being a recommended alternative control measure was discussed in Section 6.2.1.

- Implement a pollution prevention program to educate watershed residents on lawn care and the water quality impacts associated with lawn care products

Not many people understand that lawn fertilizer, weed controls, and insecticides can cause water quality problems. Materials such as flyers and brochures should be distributed to educate residents and business owners within the watershed on the water quality impacts associated with lawn care and landscaping. These outreach materials will inform residents who perform their own lawn maintenance that runoff from lawns can contribute pollutants that contaminate storm water runoff into watershed streams and can be toxic to both humans and aquatic organisms. Educational materials will encourage management practices such as ways to reduce fertilizer and pesticide application and substitution of watershed friendly products for those that are not.

Chemicals associated with fertilizers (nitrogen, phosphorus, potassium), weed control, and insect control can find their ways to streams and reducing the application of these chemicals can reduce the water quality problems associated with them. As a result, education programs targeted toward watershed residents who perform their own lawn care should be considered. However, studies indicate that product labels and store attendants are the primary and almost exclusive source of lawn care information for the average consumer who takes care of his/her own lawn. This tends to indicate that training employees of lawn and garden centers on lawn care pollution control may be a more effective control measure to implement.

Landscaping and lawn care pollution control and educating residents on lawn care pollution control was discussed in Section 4.2.3. The evaluation and screening process resulting in this measure being a recommended alternative was discussed in Section 6.2.2.

- Implement an outreach and training program for businesses involved in automobile maintenance

Automotive maintenance pollution prevention programs include outreach and training to automobile maintenance businesses and target practices that control pollutants and reduce storm water impacts. Trained inspectors would visit a participating facility and recommend management practices based on his/her observations. Common pollution prevention methods at maintenance shops that should be stressed include waste reduction, the use of safer alternative materials, spill clean up, good housekeeping, and parts cleaning. In order to encourage behavioral changes among participating maintenance facilities, promotional tools like listings in newspaper ads, decals for shop windows, prize drawings, and discount coupon giveaways should be made available to help generate business for these participating facilities.

Automotive maintenance facilities can be significant contributors of hydrocarbons, trace metals, and other pollutants that can affect the quality of storm water runoff. Common activities at maintenance shops that generate this waste include the cleaning of parts, changing of vehicle fluids, and replacement and repair of equipment. Since the number of car owners who perform their own automobile maintenance has dropped steadily in recent decades, automobile maintenance facilities have become the main target for outreach and training of maintenance practices that control pollutants and reduce storm water impacts.

Automobile maintenance and the training of automobile maintenance facility employees were discussed in Section 4.2.4. The evaluation screening process resulting in the training of businesses involved in automobile maintenance being a recommended control measure was discussed in Section 6.2.3.

- Implement a car wash outreach program devoted to providing materials to charity car wash organizers

Car wash outreach programs would provide materials to charity car wash organizers to prevent car wash water from entering storm drains. These "water friendly" car wash kits would be provided free of charge to charity organizers along with training and educational videos on planning an environmentally friendly car wash. Two types of equipment would be available for charity organizations to borrow: a catch-basin insert with a sump pump, or a vacuum/boom device known as a Bubble Buster. Both devices capture wash water runoff, allowing it to be pumped to either a sanitary sewer for treatment or a vegetative area for filtering absorption into the ground. The purchase of wash water containment equipment for charity car washes is often a one-time expense and can be used for a number of years.

Car washing is a common routine for residents and a popular way for organizations such as scout troops, schools, and sports teams to raise funds. Outdoor car washing has potential to result in high loads of nutrients, metals, and hydrocarbons during dry weather conditions, as the detergent-rich water used to wash automobiles flows down the street and into storm drains. Providing materials to charity car wash organizers should be an effective practice to reduce this non-point source pollution.

Car washing and car wash outreach programs were discussed in Section 4.2.5. The screening process resulting in a car wash outreach program being a recommended control measure was discussed in Section 6.2.4.

- Implement an animal waste collection program to educate residents on how and why dog waste can be a water quality problem

An animal waste collection program uses awareness, education, and signs to alert residents as to proper disposal techniques for pet droppings. Brochures and public service announcements will describe proper pet waste disposal techniques and try to create a storm drain water quality link between pet waste and runoff. Often pet waste messages are incorporated into a larger non-point source message relaying the effects of pollution on local water quality. Signs in public parks and along residential streets, and the provision of receptacles for pet waste, would also encourage cleanup.

Animal waste represents a significant source of bacterial contamination in the NMR watershed. The presence of pet waste in storm water runoff has a number of implications on stream water quality with perhaps the greatest impact from fecal bacteria. The bacteria can pose health risks to humans and other animals, and result in the spread of disease. Public education programs are an effective way to encourage pet waste removal.

Animal waste collection programs were discussed in Section 4.2.6. The screening process resulting in an animal waste collection program being a recommended alternative control measure was discussed in Section 6.2.5.

7.3.2 Other Alternatives to Consider

- Provide training for employees of lawn and garden centers regarding lawn care and pollution control.

Convincing watershed residents that a nice green lawn can be achieved without using large amounts of chemicals and fertilizers can be challenging when conventional lawn care techniques are often seen as more effective, less-time consuming, and more convenient. Since product labels and store attendants are the primary and almost exclusive source of lawn care information for the average consumer, the strategy toward implementing a lawn care pollution control program is to encourage the substitution of watershed friendly products for those that are not, and to offer training for the store attendants to pass on to consumers at the point of sale on how to use, and perhaps more importantly, how not to abuse or overuse such products.

Chemicals associated with fertilizers, weed controls, and insecticides can find their ways to streams and the application of these chemicals can affect the water quality of receiving streams. Educating residents on methods to reduce fertilizer and pesticide application and limit water use can help alleviate the potential impacts of this contributor of non-point source pollution in the watershed communities.

Landscaping and lawn care pollution control and the training of lawn care and garden center employees was discussed in Section 4.2.3. The screening process resulting in the training of lawn care and garden center employees being an alternative measure to consider was discussed in Section 6.2.2.

- Implement an education program to instruct those involved in the lawn care industry on the water quality impacts associated with lawn care products

Lawn care industry educational programs would address alternate methods to reduce fertilizer, weed control, and pesticide application and limit water use. Local governments and watershed consumers that want to influence lawn care industries would be encouraged to create an active program that supports those companies that employ “environmentally friendly“ techniques that limit fertilizer and pesticide application by providing promotional opportunities.

Nutrient and chemical runoff from managed lawns can contribute pollutants that contaminate storm water runoff into watershed streams and are toxic to both humans and aquatic organisms. Those who have lawn care services have shown to have the greatest tendency to over-fertilize their lawns. As a result, implementing an educational program to instruct those involved in the lawn care industry on the water quality impacts associated with lawn care products is an alternative to consider. However, there are probably fewer-than-average watershed residents who use these services since many of the residential lawns within the NMR watershed are located on small, urban lots.

Landscaping and lawn care pollution control and educating those involved in the lawn care industry was discussed in Section 4.2.3. The screening process resulting in this measure being an alternative to consider was discussed in Section 6.2.2.

- Provide automobile maintenance educational materials to watershed residents who perform their own vehicle maintenance

Materials such as flyers and brochures would be distributed to educate the general public on the potential water quality impacts of automobile maintenance. These outreach materials would inform residents who perform their own vehicle maintenance that automobile maintenance has the potential to result in significant loads of hydrocarbons, trace metals, and other pollutants. Educational materials would encourage management practices such as the proper cleaning of parts, changing of vehicle fluids, replacement and repair of equipment, proper waste disposal, etc.

A "backyard mechanic" who simply dumps spent automotive fluids down a storm drain can cause major water quality problem, since only a few quarts of oil or a few gallons of antifreeze can have a major impact on streams and wetlands during low flow conditions. As a result, education programs targeted toward watershed residents who perform their own automobile maintenance should be an alternative to consider. However, since the advent of the $20 oil change special, the number of car owners who change their own oil or antifreeze anymore may be minimal thus limiting the potential effectiveness of this control measure.

Automobile maintenance and educating residents on automobile maintenance pollution control was discussed in Section 4.2.4. The screening process resulting in this measure being an alternative to consider was discussed in Section 6.2.3.

- Provide car washing educational materials to watershed residents

This pollution management measure involves educating the general public on the water quality impacts from outdoor washing of automobiles and how to avoid allowing polluted wash water to enter the storm drain system. Materials such as flyers and brochures would be distributed to educate the general public on the water quality impacts associated with this behavior.

Outdoor car washing has potential to result in high loads of nutrients, metals, and hydrocarbons during dry weather conditions, as the detergent-rich water used to wash automobiles flows down the street and into storm drains. As a result, implementing a program to educate watershed residents on the impacts of the outdoor washing of automobiles should be an alternative to consider. However, car washing can be a difficult watershed behavior to change since it is often hard to define better alternatives and the pollutant loading associated with this activity may not be as significant as other non-point sources.

Car washing and educating watershed residents on car washing pollution control was discussed in Section 4.2.5. The screening process resulting in this measure being an alternative to consider was discussed in Section 6.2.4.

- Implement a vegetation control program to educate residents that clippings carried into the storm water system and receiving streams can degrade water quality

Public education on vegetation controls would include properly collecting and disposing of clippings, cutting techniques, and leaving existing vegetation. Residents would be encouraged to set their mowing heights as high as possible, leave their clippings on the lawn to provide nutrients and moisture, and preserve existing vegetation. Distributing informative brochures to the residents of the NMR watershed is the most common approach to educating the public on these vegetation controls.

Traditional lawn care practices call for raking and removing clippings, which were thought to promote thatch and disease. In fact, leaving clippings on the lawn has proven to be beneficial as they provide nutrients and moisture. As a result, implementing a program to educate watershed residents on vegetation controls should be an alternative to consider. However, the reluctance of many residents to change their conventional vegetation control techniques presents a limitation toward implementing this alternative. In addition, the reality that most of the watershed lawns are located on smaller, urban lots may serve as an impediment toward the effectiveness of this control measure.

Vegetation controls were discussed in Section 4.2.8. The screening process resulting in this measure being an alternative to consider was discussed in Section 6.2.6.

- Implement a public education program that encourages residents to convert managed turf and landscaped areas to native vegetation

Community awareness through brochures, programs, seminars, and field trips would be arranged to emphasize the importance of natural areas. Citizens would learn to realize the beauty of a natural setting if exposed to one on a regular basis. Alternative landscaping and the introduction of new vegetation can be a workable goal by also encouraging volunteer community groups to plant native vegetation in public areas such as parklands.

Trees, shrubs, and other vegetation are a watershed priority as they transpire rainfall through their leaves, consume carbon dioxide, release oxygen, and moderate urban temperatures. As a result, existing vegetation should be left in place and new vegetation should be introduced. Most residential lawns have areas that are not suited for grass growth and require a disproportionate amount of water, fertilizers, and care. Converting these areas to less intensive plantings can be an effective strategy for reducing lawn inputs. Existing flowerbeds or groupings of trees and shrubs can be expanded, or groundcovers can be used to replace grass. Other options

include mimicking native plant communities such as forests, meadows, and wetlands and converting lawn areas into mulched landscaping beds.

Converting managed turf and landscaped areas to native vegetation was discussed in Section 4.2.8. The screening process that resulted in this measure being an alternative measure to consider was discussed in Section 6.2.6.

7.4 Non-Structural Municipal Measures

Municipal management programs typically relate to maintaining the existing municipal infrastructure. Leaking sewers and illegal connections, combined sewer overflows, storm water runoff, deicing salts, and the impacts of watershed urbanization among others all can be managed by the municipalities within a watershed. This section will address the recommended non-structural municipal to implement within the NMR watershed. It must be understood that the measures documented in this **draft** watershed management plan are **draft** recommendations. Watershed stakeholders, like the NMR Watershed Association and the municipalities located within the watershed, will need to carefully review this draft document and associated recommendations, make any needed revisions, and adopt the finalized plan as a comprehensive guidebook for improving the NMR watershed.

7.4.1 Recommended Alternatives

- Implement proactive inspection, operation, and maintenance programs for the combined sewer overflow regulator structures located within the NMR watershed

Proactive operation and maintenance (O&M) procedures for combined sewer overflow (CSO) diversion structures should include regularly scheduled inspections; regulator cleaning and preventive maintenance; and corrective maintenance and repair to structures and control facilities. The Pittsburgh Water and Sewer Authority (PWSA) has the responsibility to inspect, operate, and maintain the CSO control structures within the NMR watershed. To implement this control, PWSA would assess how well existing O&M practices are being implemented and documented, and then develop and implement improvements. A proactive O&M program could significantly reduce the magnitude, frequency, and duration of CSO discharges by enabling the existing facilities to perform as effectively as possible.

CSOs contain untreated domestic, commercial, and industrial wastes, as well as surface runoff. Contaminants may include pathogens, oxygen-demanding pollutants, suspended solids, nutrients, toxics, and floatable matter. Because of these pollutants, CSO discharges to watershed streams can have a variety of adverse impacts on the physical characteristics of surface water and impair the viability of aquatic habitats.

A more detailed description pertaining to CSO reduction and O&M of the NMR regulator structures can be found in Section 4.3.1. The evaluation and screening

process resulting in proactive O&M programs being a recommended alternative control measure was discussed in Section 6.3.1.

- Improve upon the existing maintenance of catch basins and storm inlets within the watershed communities

Proactive inspection and maintenance of storm inlets in separate systems includes checking the quantities of trapped gravel and sediment and removal of sediment using a vacuum truck. Inspection and maintenance of catch basins in combined systems includes the above, plus checking the sewer hood to verify that it is functioning properly and removal of trash and debris that is captured by the sewer hood. At a minimum, these drainage structures should be cleaned and inspected at least once or twice per year. The performance of these structures at removing sediment and other pollutants depends on routine maintenance to retain the storage available in the sump to capture sediment.

The proper inspection and maintenance of catch basins and storm inlets are important municipal management measures that can improve water quality within the watershed. Catch basins and storm inlets can act as accumulation points for many of the most critical non-point source pollutants within a watershed. A fast flash of runoff from a storm event can detach, mobilize, and transport these substances directly to surface waters. As a result, it is important for municipalities to regularly engage in cleaning storm drain structures.

The proper inspection and maintenance of catch basins and storm inlets was discussed in Section 4.3.2. The screening process resulting in this alternative being a recommended control measure was discussed in Section 6.2.3.

- Implement a routine sewer cleaning program to remove accumulation of sediment and debris blockages in the NMR sewer system

A routine sewer cleaning program can prevent stoppages and restore optimal hydraulic conditions. Municipalities should identify problem sewers with minimal slopes and clean them has often as necessary to prevent obstructions and stoppages. In addition, critically important collector sewers should be identified and cleaned as often as possible to prevent the possibility of blockages. A comprehensive evaluation of how often sewers should be cleaned is important, since sewer cleaning needs are not the same for every pipe in the collection system.

Hydraulic conditions in sewer lines can deteriorate over time as solids build up, pipes become corroded or cracked, and tree roots intrude into open joints. Dirty or root intruded sewers are less efficient and lose their optimal carrying capacity. Cleaning removes obstructions to flow, such as accumulated sand, slime, grit, grease, roots, and mineral deposits from the sewers. Implementing a sewer cleaning program cannot change flat pipe grades, increase pipe diameters, or fix pipe defects but does help sewers to flow at their optimal capacity.

A more detailed description of implementing a routine sewer cleaning program can be found in Section 4.3.3. The evaluation and screening process resulting in routine sewer cleaning being a recommended control measure was discussed in Section 6.3.4.

- Implement a routine sewer line and manhole inspection program within the NMR watershed

A proactive routine inspection program should be an important tool to help focus maintenance and rehabilitation efforts in the NMR watershed where they are needed most. Frequent inspections would allow the assessment of current manhole and pipeline conditions and are an important tool in determining cleaning, rehabilitation, and maintenance efforts. They provide valuable up-to-date information about the condition of the system as a whole and where maintenance and restoration resources should be directed.

Sewer lines can deteriorate over time as solids build up, pipes become corroded or cracked, and tree roots intrude into open joints. Manholes can have deteriorated joints, cracked walls, and missing bricks among other structural deficiencies. Regular inspections allow for identification of these problems and would generate repair work orders, which in turn have a positive impact on system performance.

Implementing a routine sewer line and manhole inspection program was discussed in Section 4.3.3. The evaluation and screening process resulting in this alternative being a recommended control measure was discussed in Section 6.2.4.

- Implement a household hazardous waste (HHW) collection program to collect and properly dispose of HHW products

HHWs are wastes produced in households that are hazardous in nature, but are not regulated as hazardous waste, under federal and state laws. HHW collection programs would help to ensure that these wastes are recycled, disposed, or otherwise managed in an environmentally preferable way. Such municipal programs would provide sites for residents to drop of their hazardous materials. The materials would then be reused, recycled, and, when necessary, disposed of at a permitted hazardous waste facility.

Hazardous waste products, if carelessly managed can, and frequently do, create environmental and public health hazards. Improper disposal of HHW in NMR can affect stream water quality as wastes may be improperly discarded into municipal storm inlets and catch basins or dumped down sewer drains during storm events. HHW collection can be expected to reduce the presence of toxic materials and heavy metals in storm water runoff.

A more detailed description of HHW collection programs can be found in Section 4.3.7. The evaluation and screening process resulting in HHW collection programs being a recommended alternative control measure was discussed in Section 6.3.6.

- Implement an integrated pest management (IPM) program as a way to introduce alternatives to chemical pesticides and herbicides on public lands

An IPM program is a municipal watershed management tool that encourages the use of alternatives to chemical pesticides on public land. IPM reflects a holistic approach to pest control with the goal not to eliminate pests but to manage them to an acceptable level while avoiding disruptions to the environment. An effective IPM program incorporates practices in combination with non-chemical and chemical pest controls to minimize the use of pesticides and promote natural control of pest species. The IPM practices should be encouraged for municipal parklands and schools to limit pollutants washed off the ground during storm events.

The presence of pesticides and herbicides in storm water runoff has a direct impact on the health of aquatic organisms and can present a threat to humans through contamination of drinking water supplies. The pesticides of greatest concern are insecticides, such as diazinon and chloropyrifos, and can be harmful to aquatic life even at very low levels. The major sources of pesticides in urban streams are applications of products designed to kill insects and weeds.

Implementing the IPM approach toward pest control on public lands was discussed in Section 4.3.8. The evaluation and screening process resulting in this alternative being a recommended control measure was discussed in Section 6.2.7.

- Train municipal employees in improved deicing application techniques, the timing of deicer application, and on the types of deicers to apply to public roads

The waters of the NMR stream at times contain significant concentrations of sodium chloride, which can be attributed to deicing salts. Municipal employees would be trained on improved storage, the handling, and application practices of deicing materials. For example, by routinely calibrating spreaders, a program manager can prevent over-application of deicing materials. Also, different techniques can be employed at each stage of the snowmelt sequence, so as to effectively address the constantly changing flows and pollutant concentrations that occur as snowmelt progresses. In addition, municipal officials and employees would be encouraged to explore the use of alternative de-icing materials to road salt such as calcium magnesium acetate (CMA).

The use of road salt is a public safety as well as a water quality issue. Aside from contaminating surface and groundwater, high levels of sodium chloride from road salt can kill roadside vegetation, impair aquatic ecosystems, and corrode infrastructure such as bridges, roads, and storm water management devices.

A more detailed description of improved deicing techniques and alternatives can be found in Section 4.3.9. The evaluation and screening process resulting in this being a recommended alternative control measure was discussed in Section 6.3.8.

7.4.2 Other Alternatives to Consider

- Disconnect selected roof leaders from the combined sewer system

In combined sewer areas, roof leaders and area drains are permitted to be directly connected to sewers. Property owners cannot be forced to remove these connections, but they can be encouraged and enticed to do so voluntarily. To disconnect rooftop drainage, downspouts can be detached from combined sewers and redirected to flat lawn areas, dry wells, water gardens, or rain barrels. Reconnecting this drainage with natural processes can reduce the volume of surface runoff, filter out pollutants, replenish the groundwater, and maintain stream base flows.

In urban areas like NMR, the drainage from roofs, patios, driveways, and parking areas can be a significant portion of the storm water runoff, and can carry a significant amount of pollutants. In many cases, runoff from roofs, driveways and parking areas can be disconnected from the combined sewer rather easily and are considered non-structural management measures. However, care must be taken to insure that adjacent properties are not flooded, and some disconnections are more complex and require structural modifications, thus limiting the applicability of this non-structural control measure.

Disconnecting selected roof leaders from the combined sewer system was discussed in Section 4.3.1. The screening process resulting in this alternative being a control measure to consider was discussed in Section 6.3.1.

- Pass and enforce pet waste ordinances to regulate pet waste cleanup within the watershed

These “pooper-scooper” ordinances would require the removal and proper disposal of pet waste from public areas and other people’s property before the dog owner leaves the immediate area. A fine would be associated with failure to perform this act as a way to encourage compliance. Pet waste produces three primary pollutants: nutrients, organic matter, and pathogens. The presence of pet waste in storm water runoff has a number of implications for urban stream water quality with perhaps the greatest impact from fecal bacteria. The bacteria pose potential health risks to humans and other animals, and can result in the spread of disease. As a result, passing and enforcing pet waste ordinances should be an alternative to consider.

Passing an ordinance to regulate pet waste cleanup would be relatively easy and carries with it virtually no cost. Many of the municipalities located within the NMR watershed have already passed pet waste ordinances. However, enforcing proper pet waste management can be challenging and would more than likely require a full-time municipal employee to patrol dog walking areas. As a result, this alternative should be considered but may not be the most effective approach toward proper pet waste management considering the cost associated with the enforcement of the ordinance.

Passing and enforcing pet waste ordinances was discussed in Section 4.3.6. The screening process resulting in this alternative being a control measure to consider was discussed in Section 6.3.5.

- Improve the frequency and location of street sweeping within each watershed community's current street sweeping programs

Within the NMR watershed, each municipality performs their own street sweeping. Greater effectiveness in the removal of street pollutants would be achieved by increasing sweeping frequencies. Greater efficiency would be achieved if the municipalities within the NMR watershed (City of Pittsburgh, Edgewood, Wilkinsburg, and Swissvale) pooled their resources and worked together to remove pollutant loads and sediment from the streets within the watershed. Each community's existing street sweeping programs should be examined as to how often and what roads are being swept. Each program's budget and level of desired pollutant removal should be evaluated as well.

Street sweeping programs exist within each watershed municipality and are conducted to remove sediment buildup, debris, and litter from curb gutters that could potentially be conveyed to receiving streams. Street sweeping is also used during the spring snowmelt to reduce pollutant loads from road salt and to reduce sand export to receiving waters. As a result, improving each community's current street sweeping programs should be an alternative to consider. However, limited municipal budgets could make increasing sweeping frequencies difficult to implement.

A more detailed description on improving existing street sweeping programs can be found in Section 4.3.5. The evaluation and screening process resulting in this being a recommended alternative control measure was discussed in Section 6.3.2.

- Incorporate mechanical vegetation controls to actively manage and control vegetation as part of routine operations and maintenance for public works crews

Mechanical vegetation controls include elements such as properly collecting and disposing of clippings, cutting techniques, leaving existing vegetation, etc. Implementing these controls involves the training of municipal employees on proper vegetation control and the possible upgrading of certain mowing equipment for bagging. Since municipal parklands are currently cared for anyway, staffing is usually already in place and alteration of current practices should be relatively easy to implement. Implementing these controls could even be taken one step further and encouraged at schools and cemeteries by educating the grounds crews at these facilities.

Grass clippings carried into the storm water system and receiving streams can degrade water quality in several ways. Suspended solids can increase causing turbidity problems. Since most of the constituents are organic, the biological oxygen demand can increase causing a lowering of the available oxygen to plant and animal

life. Also, clippings and cuttings are almost exclusively leaf and woody material but litter may be intermingled with clippings. Any reduction of clippings carried into the storm water system or receiving streams can reduce the degradation of water quality. As a result, incorporating mechanical vegetation controls should be an alternative to consider. However, the effective of implementing this control may be small when compared to other alternative measures considering the relatively small number of parklands, schools, and cemeteries within the watershed.

Vegetation controls were discussed in Section 4.3.10. The evaluation and screening process resulting in this alternative being a control measure to consider was discussed in Section 6.3.9.

7.5 Structural Control Measures

A comprehensive watershed management plan often requires certain structural control measures to be implemented, along with non-structural controls. A wide range of structural source control measures are available to address problems related to urban runoff. Other structural management measures focus on minimizing the impacts of extraneous flow in sewer collection systems. Structural stream restoration measures focus on correcting the negative impacts of watershed urbanization along watershed streams. This section will address the recommended structural measures to implement within the NMR watershed. It must be understood that the control measures documented in this **draft** watershed management plan are **draft** recommendations. Watershed stakeholders, like the NMR Watershed Association and the municipalities located within the watershed, will need to carefully review this draft document and associated recommendations, make any needed revisions, and adopt the finalized plan as a comprehensive guidebook for improving the NMR watershed.

7.5.1 Recommended Alternatives

- Implement an aggressive program to locate and remove illicit sewage and industrial discharges to municipal storm drain systems.

Non-storm water discharges to municipal storm drain systems may include process wastewaters, cooling water, wash water, and sanitary wastewater. These discharges are not only illegal, but result in significant pollutant concentrations, especially bacteria, that impair receiving water quality. Field investigations and laboratory analyses should be conducted by the watershed municipalities to systematically identify and locate illicit connections. Once illegal connections are identified and located, municipal enforcement measures would be implemented to require property owners to disconnect and redirect the illegal discharges.

Field investigations conducted by the ACHD have confirmed that illicit wastewater connections to storm drain systems exist in the NMR watershed, and that these discharges adversely impact water quality within Nine Mile Run. The PA-DEP has

issued COA's to Edgewood, Swissvale, and Wilkinsburg to locate and remove these illicit connections.

Illicit discharge inspection and disconnection programs were described in Section 5.1.1. The evaluation and screening process resulting in this structural measure being recommended for the watershed management plan is discussed in Section 6.4.1.

- Reduce the quantity of impervious pavement within public parking areas, residential lots, and street rights-of-way, whenever pavement is deteriorated and scheduled to be resurfaced or reconstructed.

Whenever a existing parking area is scheduled to be repaved, business owners should look for opportunities to reduce the number of parking spaces, eliminate unnecessary pavement in non-traffic areas, and covered those areas into landscape islands. Homeowners should look for similar opportunities to narrow driveway widths, eliminate unnecessary paved areas, and convert them to landscaping. Municipalities would have similar opportunities to narrow street and sidewalk widths. Municipalities should evaluate current traffic volumes, the need for on-street parking on both sides of the street, and corresponding street widths whenever existing streets are scheduled to be reconstructed.

Roads, driveways and parking areas represent approximately 56 percent of the total impervious area within the NMR watershed. This demonstrates that significant opportunities exist to reduce the quantity of impervious cover urban storm water runoff, and associated pollutant loads. Unnecessary impervious pavement areas can be converted to landscaping areas that allow storm water to percolate into the soil.

Reconfiguring existing paved surfaces to reduce impervious area in the NMR watershed was discussed in Section 5.1.2. The evaluation and screening process resulting in pavement reconfiguration being a recommended structural control measure was discussed in Section 6.4.1.

- Rehabilitate aging municipal sanitary sewer systems to significantly reduce extraneous infiltration and inflow into sewer pipes and reduce the frequency and duration of SSO discharges.

Sewer rehabilitation, renovation, upgrade and repair are implemented with a variety of alternative construction methods ranging from excavation and replacement to trenchless technologies. Municipalities in the watershed will need to schedule, fund, and implement a proactive sewer rehabilitation program to eliminate sources of infiltration and inflow into pipes, reduce peak storm flow through sewers, and significantly reduce SSO discharges into the watershed. As with pipelines manholes need to be rehabilitated to correct structural deficiencies, address maintenance concerns, and eliminate inflow and infiltration.

For a number of years, municipal sewer systems within the watershed have experienced problems, and existing SSO discharges within the NMR watershed release untreated sewage into basements or out of manholes and onto neighborhood streets, parks. Due to the consent order issued by PA-DEP, extensive sewer rehabilitation efforts will take place within the NMR watershed. The existing deteriorated sewers will undergo rehabilitation, renovation, upgrade, and repair. As a result, the discharge of raw wastewater into receiving streams can be corrected. It is important that the communities within the NMR watershed follow-up rehabilitation efforts with routine preventive maintenance and inspection programs to prevent SSOs and the problems associated with them.

Alternative sanitary sewer rehabilitation measures were discussed in Section 5.2.1. The evaluation and screening process resulting in sewer rehabilitation being recommended for the watershed management plan is discussed in Section 6.4.2.

- Modify existing storm inlets, and catch basins without sewer hoods, so that street litter and floatable debris is trapped and prevented from being discharged into watershed streams.

Street litter and floatable debris that enter watershed streams can have a negative impact on water and aesthetic quality, and lead to degradation of the stream. Existing storm inlets and catch basins within the watershed should be modified to trap these floatable materials. The trapped material would then be removed by municipal cleaning crews rather than being discharged into streams. Devices of various design are available which detain sediment laden runoff and floatable materials within the structure or prevent them from entering a storm inlet.

There are hundreds of existing storm inlets and catch basins located within the NMR watershed. Modifying existing catch basins (in combined sewer areas) and storm inlets (in separate sewer areas) to increase the capture of sediments and floatable materials is an effective structural management measure.

Alternative structural modifications to existing storm inlets and catch basins were described in Section 5.2.3. The evaluation and screening process resulting in these structural modifications being a recommended control measure were discussed in Section 6.4.2.

- Construct new wetland areas within the riparian corridors of Nine Mile Run and Fern Hollow to filter urban pollutants and act as “watershed sponges” to store storm water and augment dry weather stream flow.

Storm water wetlands should be constructed within the watershed as regional facilities. Constructed wetlands are effective pollution control measures because they remove pollutants from urban runoff through vegetation uptake, retention and settling. Constructed wetlands increase wildlife habitat while decreasing the stream gradient and creating slow flow areas to regulate storm flow. The extra wetland flood

plain storage capacity and slower flow-through rates will also reduce bank erosion and increase the variability of stream morphology.

The NMR Habitat Restoration Project will create two new wetland areas within the watershed: one along Fern Hollow just below the confluence with Falls Ravine and a second along NMR just below the confluence with Fern Hollow.

The use of constructed wetlands as a structural watershed management measure was discussed in Section 5.3.3. The evaluation and screening process resulting in wetland construction being a recommended structural management measure is discussed in Section 6.4.3.

- Stabilize existing stream channels, channel banks and over-banks using naturalistic "green engineering" techniques to restore existing eroded areas and prevent future erosion and scour.

Structural stream restoration measures will be used to remediate the negative impacts of watershed urbanization along the Nine Mile Run channel. In-stream stabilization measures such as log vales, root wads, root vanes, boulder backs and step pools will be constructed at selected locations along NMR. These measures will control erosion, stabilize slopes, control stream gradients, create flow diversity and provide aquatic habitat.

There are several locations along NMR where the existing stream channel, channel banks and over-banks are unstable and are being eroded away during periods of peak storm flow. The scope of work for the NMR Habitat Restoration Program will include the construction of stream stabilization measures to control erosion in the watershed.

Detailed descriptions and color images of alternative structural measures used to stabilize stream channels are provided in Section 5.4. The evaluation and screening process resulting in stream stabilization being selected as a recommended structural control tool is described in Section 6.4.4.

- Reconfigure existing stream channels and reconnect them to their adjacent flood plains using sound fluvial geomorphological principles.

The NMR stream channel has become incised, confining storm flow to the channel instead of allowing it to spread out over adjacent flood plains. Reconfiguring the size, shape, and configuration of the stream will reconnect the channel to its over-banks and restore natural connectivity to adjacent flood plains. Fluvial geomorphology is the science that assesses the shape and form of a watercourse and the contributing physical processes.

The stream channel of NMR has been significantly impacted and degraded by urbanization within the watershed. The stream channel has been gouged deeper, wider, and straighter through the valley floor due to the intense and flashy nature of

urban runoff. The scope of work for the NMR Habitat Restoration Program will include reconfiguring the alignment of the stream channel and restoring natural meandering patters through the flood plain. The project will raise the invert of the channel and restore the size and shape of the channel to more natural proportions.

The reconfiguration of the existing stream channel to restore the connection to adjacent flood plain areas was described in Section 5.3 and 6.4.4. The evaluation and screening process resulting in this structural control measure being recommended for the watershed management plan is described in Section 6.4.4.

7.5.2 Other Alternatives to Consider

- Encourage the use of porous pavement materials in lieu of traditional asphalt and concrete within public parking areas and residential properties.

Permeable pavements can be used to reduce the imperviousness created by patios, walkways, driveways, sidewalks, and parking areas. These alternative paving systems can reduce surface runoff, increase infiltration, and improve groundwater recharge characteristics.

Existing concrete or asphalt paving surfaces in the watershed already have or will in the future deteriorate and will need to be replaced. Opportunities exist to encourage the use of porous pavement and this structural alternative is a potentially effective tool to consider. However, permeable paving systems are prone to clogging by suspended solids, construction costs tend to be higher than traditional pavement systems, and property owners may be hesitant to use the new technology.

The use of porous pavement for redevelopment projects was discussed in Section 5.1.3. The screening process resulting in this measure being an alternative to consider was discussed in Section 6.4.1.

- Encourage the construction of tanks or cisterns for existing residential, commercial, and public buildings to capture and store runoff and irrigate vegetated areas.

Rainwater harvesting - capturing and storing rainwater for later use - is a key element in storm water management. Diverting rooftop runoff into storage tanks utilizes rain to its fullest potential. Water harvesting can range from the simple to the complex, depending on need and budget. Water harvesting can be incorporated into plans for building a new home, designing a major subdivision, or, in the case of the NMR watershed, restorative redevelopment efforts. Rainwater harvesting not only helps reduce the quantity of urban runoff, but also decreases the community's dependence on public water supplies to irrigate plants.

In the NMR watershed, storm water from rooftops is typically piped into a storm drain that leads to either a combined sewer system or a municipal storm drain system.

One of the best ways to mitigate the impacts of urban runoff is to manage rooftop runoff on-site instead of moving storm water through a conveyance system. Retrofitting existing properties with constructed cisterns would be a voluntary control measure that many residents and business owners may not choose to implement. However, it can be encouraged, especially during restorative redevelopment projects, and is included as a management measure to consider.

The use of porous pavement for redevelopment projects was discussed in Section 5.1.5. The screening process resulting in this measure being an alternative to consider was discussed in Section 6.4.1.

- Modify and rehabilitate existing combined sewer systems to reduce the frequency, duration, and volume of combined sewer overflow discharges into the watershed.

Structural measures could be implemented to reduce CSO discharges to receiving waters within the NMR watershed. A number of structural alternatives are available to reduce the frequency, duration, and volume of CSO discharges and their associated pollutants, solids, and floatable materials. Structural rehabilitation of combined sewer trunks and manholes, especially those that were constructed along streams, can significantly reduce the quantity of extraneous infiltration and inflow from the stream into the sewer. Structural devices including baffles, screens, and racks can be used to remove coarse solids and floatable materials from combined sewage, and devices such as booms and skimmer vessels can help remove floatables from the surface of the receiving water body.

The Pittsburgh Water and Sewer Authority (PWSA) is currently implementing a comprehensive construction program to install a waterproof structural lining within the combined sewer trunks that are located along Nine Mile Run and Fern Hollow. Other structural control measures will be considered as the City of Pittsburgh develops its Long Term CSO Control Plan. These structural alternatives combined with non-structural control measures (i.e. proactive maintenance and inspection programs) should be used to reduce CSO discharges to the NMR watershed, and the pollutant discharges associated with them.

The use of structural combined sewer overflow control measures was discussed in Section 5.2.2. The screening process resulting in this measure being a structural alternative to consider for the watershed management plan was discussed in Section 6.4.2.

- Construct dry wells and infiltration basins on individual properties to capture storm water runoff and allow it to infiltrate into the ground.

A dry well is an excavated pit, typically ranging from 3 to 10 feet in depth, which is filled with aggregate and receives storm water from roof drainage and direct surface runoff with low sediment loading. For application within the NMR watershed, dry wells would only placed on individual properties. The use of dry wells for storm

water control is applicable where soil is sufficiently permeable to allow for a reasonable rate of infiltration. Soil permeability should be sufficient to drain the entire volume of the water quality design storm within 72 hours. An overflow system would be provided to handle larger storms where the runoff would exceed the capacity of the facility.

The installation of dry wells and infiltration basins is an effective structural management measure for existing properties that are being restored, redeveloped, or improved by the owner. However, soil permeability within the watershed can be low due to the clay content of many soils, which reduces the potential percolation rates and associated effectiveness of the control measure.

The use of dry wells and infiltration basins for redevelopment projects was discussed in Section 5.3.2. The screening process resulting in this measure being an alternative to consider for the watershed management plan was discussed in Section 6.4.1.