Case Study of King Farm, MD: Comprehensive Report of the Impact of Urban Design on Water Resources

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KING FARM (ROCKVILLE, MD)

INTRODUCTION

King Farm is a 435-acre New Urban development in the City of Rockville, a suburb of Washington, D.C. in Montgomery County, Maryland. Convenient access to a subway station, interstate freeways and growing employment centers intensified growth pressures on the site. The demand for development prompted Montgomery County to adopt a high-density, mixed-use plan for the site. To compensate for more intense development, the city and county governments implemented environmental suitability analyses, stormwater management programs, and stream rehabilitation to protect Watts Branch, which flows from King Farm to the Potomac River, which empties into Chesapeake Bay.

Three issues define how King Farm impacted the headwaters of the Watts Branch watershed. Each issue derives from the adoption of a particular land use policy and its implementation through the King Farm site design.

The first issue involved protection of stream valleys at the development site. King Farm, like most New Urban sites, has much higher residential density in addition to large commercial, office, and mixed-use buildings. However, the site also contains the headwaters of Watts Branch. These tributaries flow through valleys that are very sensitive to urban development. A New Urban development in the headwaters could seriously degrade the quality of the entire watershed. Therefore, Montgomery County developed a plan to concentrate development outside of the stream valleys. The developer then adapted their development framework into King Farm's site design through the King Farm Open Space Network.

The second issue involved the need for stormwater management due to King Farm's transition from farmland to high-density urbanization. Through the King Farm Annexation Agreement, the City of Rockville and the developers of King Farm developed a stormwater management program. Negotiations between the city and developers produced a Stormwater Management Concept Plan for the site, but some felt developers did not adequately protect Watts Branch from the impact of urban runoff.

The third issue was the impact of concern over Chesapeake Bay water quality on regional stormwater treatment and stream rehabilitation near King Farm. When the Environmental Protection Agency (EPA) declared the Chesapeake Bay "impaired" in 1999, the Chesapeake Executive Council signed an agreement pledging to clean up the bay by 2010. Otherwise, EPA would enforce a costly regulatory program upon the entire watershed. This potential loss of control catalyzed the entire region, including the City of Rockville. The city created the Watts Branch Watershed Study and Management Plan in 2001 to retrofit stormwater treatment and rehabilitate the upper tributaries that drain King Farm.

SETTING

King Farm is located in the Washington, D.C. suburb of Rockville, Maryland. The site is in the Watts Branch Watershed (see Figure 1) and includes three Watts Branch tributaries. There are also several ponds on site used for stormwater management. The terrain of King Farm is fairly flat with moderate hills in the northeast section, no steep grades, and an overall gentle slope from northeast to southwest. King Farm supported both dairy cows and crops and had been in agricultural use for nearly 75 years before it was approved for development in 1996.

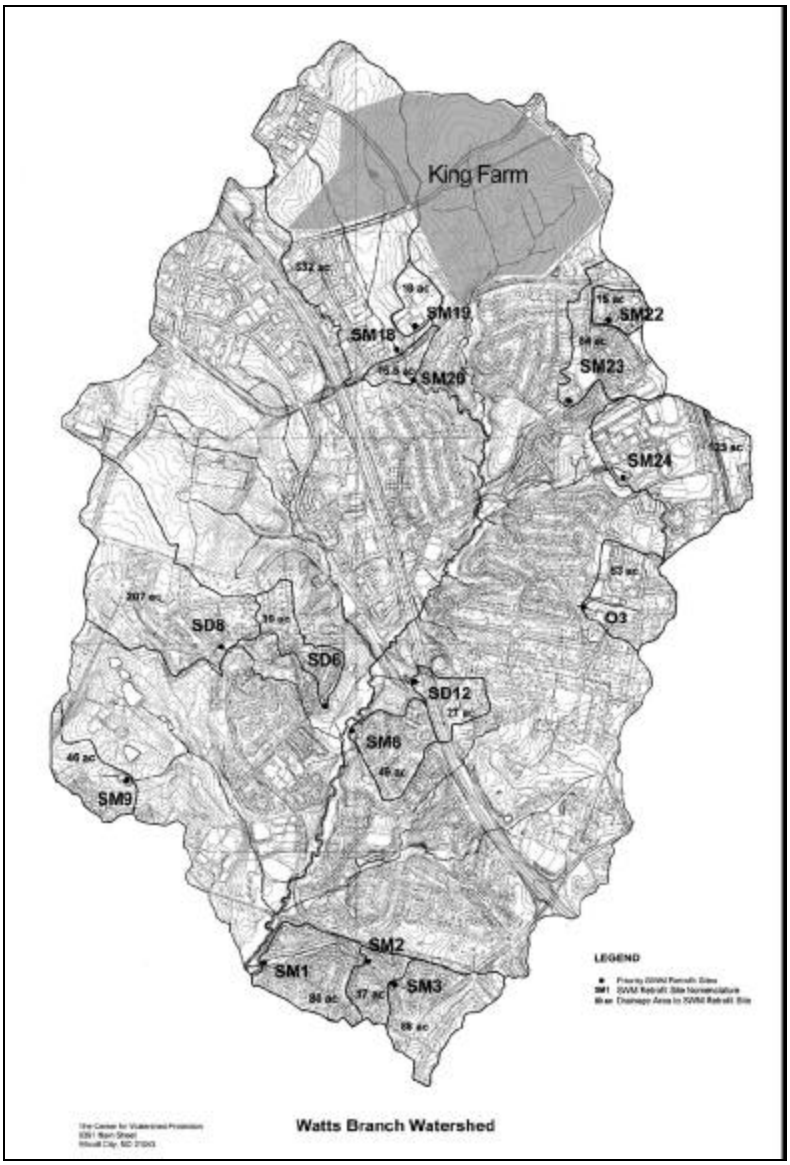

Figure 1. Map of Watts Branch Watershed

While the City of Rockville has experienced only modest growth during the past 20 years, Montgomery County's growth rate has exceeded that of Rockville, Metropolitan

Washington D.C., and the State of Maryland. This growth is due to suburban migration from the District of Columbia and in-migration from other counties and other regions in the United States (see Table 1).

Table 1. Population and Population Growth of Political Jurisdictions that Contain King Farm

SPATIAL UNIT	POPULATION			POP CHANGE (%)
	1980	1990	2000	1980-2000
TOWN	43,811	44,830	47,388	8.2
COUNTY	579,053	762,875	873,341	50.8
METRO AREA	3,477,873	4,223,485	4,923,153	41.6
STATE	4,216,975	4,780,753	5,296,486	25.6
Source: U.S. Census Bureau				

According to Table 1, Montgomery County grew at a rate more than six times that of the City of Rockville. This dramatic difference in growth rates reflects the approach each entity has taken toward growth. While Montgomery County has long been proactive in planning for growth, Rockville has only recently had to face the problems associated with rapid growth and urban sprawl. The slow growth of Rockville during the 1980's and early 1990's likely fed the city's perception of Montgomery County as unable to handle rapid growth, despite the tremendous difference between city and county area and population. Montgomery County, on the other hand, was inundated with new development and eager to let someone else provide the infrastructure and services demanded by new residents and businesses.

These attitudes motivated each government to support the Rockville annexation of the King Farm property in 1995 when the developers came forth with their plan for King Farm. The city would be able to control new development they felt the county would otherwise mismanage, and the county was relieved of the responsibility of providing infrastructure and services King Farm inhabitants would inevitably demand.

SITE DESIGN FEATURES

King Farm exemplifies the most important characteristic of New Urbanism: connectivity. Strong internal connectivity through an extensive grid street and neighborhood shuttle service provides residents and employees in King Farm good access to employment, shopping, and public transit (See Figure 2). The terminus of the Red Line of Washington's METRO heavy rail transit system is Shady Grove Station, a five-minute walk from King Farm's village center (See Figure 3). King Farm also operates two shuttles that move people between Shady Grove Station and neighborhood destinations, including employment centers. Furthermore, the Maryland-National Capital Park and Planning Commission has designated a Corridor Cities Transitway to provide future Light Rail Transit or Bus Rapid Transit along the I-270 corridor in Montgomery County, between Shady Grove Station and Clarksburg Town Center (see Figure 4). Two stations, Washingtonian and East Gaither, are planned for King Farm.

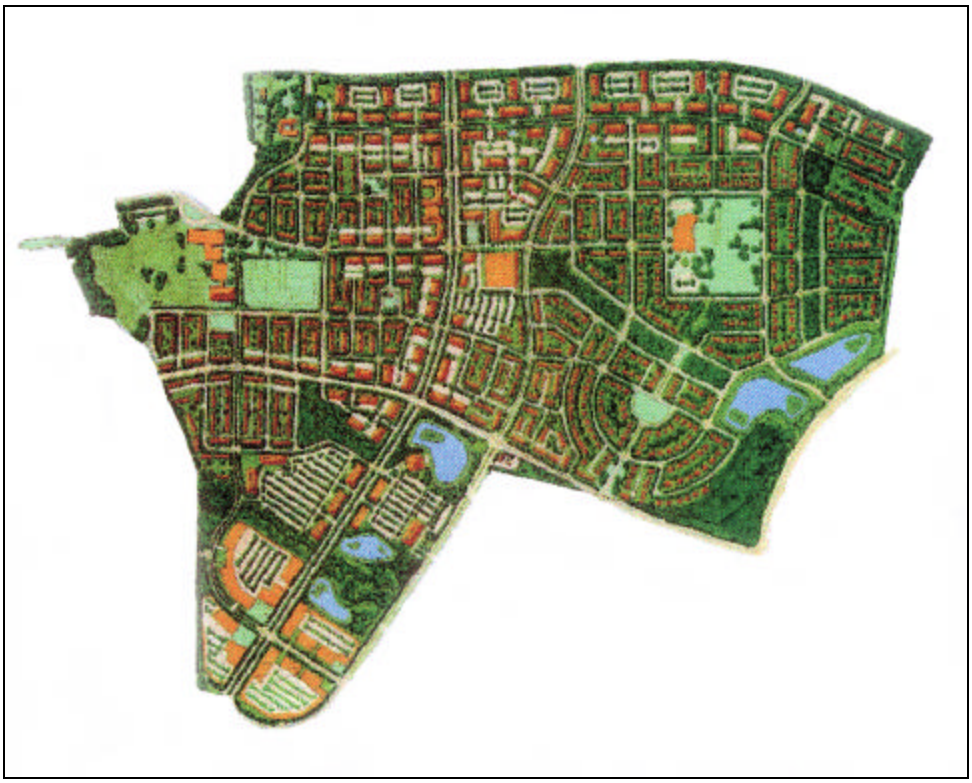

Figure 2. King Farm Development Master Plan

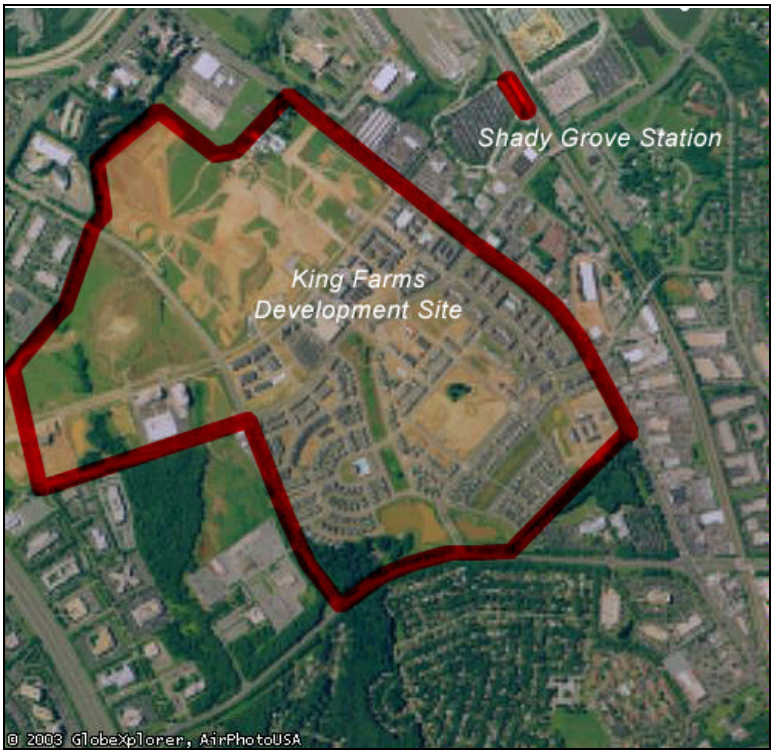

Figure 3. King Farm's location relative to Shady Grove Transit Station

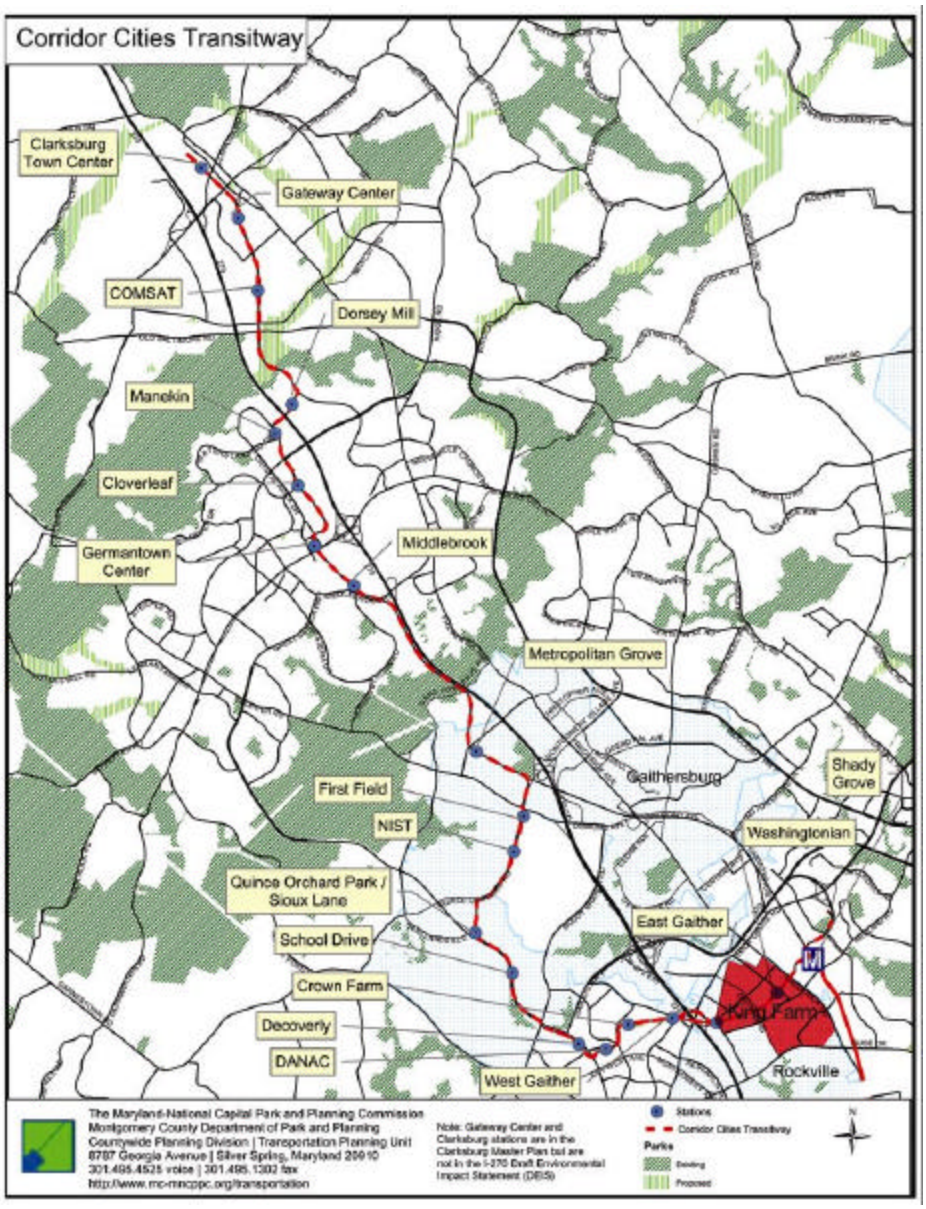

Figure 4. Corridor Cities Transitway Map

The King Farm development plan includes 3,600 dwelling units comprised of single family houses, townhouses, condos, and apartments, 3.2 million square feet of office space and 125,000 square feet of retail area including a large grocery store, a bank, restaurants, hair salons, and other retail shops.

Approximately, 12.5% of the development is designated affordable housing, but Rockville officials placed the word "affordable" in quotes since condominium prices ranged from $250,000 to over $400,000, and single family homes ranged from $300,000 to over $600,000 at the time of interview. Also, City of Rockville planners estimated that most of the people employed in King Farm businesses did not live there.

The school/park sites are city-owned with the stipulation that land area for schools will be provided if and when the need arises. It is uncertain how much of the large park will remain open space after the school and recreational facilities are built. City officials did not have much confidence that schools would be built at all – the area may remain as greenspace. Altogether, the open space network contains about 140 acres, including many pocket parks scattered throughout the development.

LAND USE POLICY FRAMEWORK

Montgomery County and the City of Rockville implemented three key land use policies over a 25-year development history that influenced the impact of King Farm on the Watts Branch watershed: 1) Montgomery County's 1990 Shady Grove Area Plan; 2) The 1995 Annexation Agreement between King Farm developers and the City of Rockville; and 3) The City of Rockville's 2001 Watershed Study and Management Plan for Watts Branch.

First, Montgomery County developed a 1990 plan for the Shady Grove Area, including King Farm, that established the conservation plan developers would use in the King Farm Comprehensive Planned Development to protect the site's stream valleys, wetlands, and floodplains.

In 1977 the area known as King Farm was used for dairy cattle and agriculture. It was across the road from the future site of the Shady Grove Station on the Red Line of the Washington METRO Rail System. Since 1950, this area between Rockville and Gaithersburg had been developing largely as low-density residential. The goals of the 1977 plan were to transform this area into a center for light industry and related development. However, the authors of this plan were very conscientious of the environmental characteristics of the area and specifically mapped those features they felt should be conserved and protected from the harmful impacts light industrial development might impose. Mapped features included shallow soils, steep slopes, wetlands, floodplains, and surface water bodies. A composite of these features helped planners guide more intense development toward areas that were less environmentally sensitive.

Several changes took place after the 1977 plan was approved that prompted the county to rethink its strategies and develop the 1990 Shady Grove Study Area Master Plan. First, the Washington METRO rail transit system was extended to Shady Grove Station in 1984, which opened central and northern Montgomery County to the rest of Metropolitan Washington, D.C. Second, the county produced the 1985 Gaithersburg Vicinity Master Plan which created the concept of a "Research and Development (R & D) Village" for King Farm. The 435-acre site was one of the few areas in the increasingly busy I-270 corridor "with a large amount of vacant land suitable for employment and residential development that is close to I-270, a Metro station, and the center of the County" (Montgomery County 1990). In 1987, research showing that nutrient pollution was the chief cause of declining water quality in the Chesapeake Bay pushed Maryland, Virginia, Pennsylvania, and the District of Columbia to pledge a reduction in nutrient input to the Bay by 40% before 2001 (Alliance for the Chesapeake Bay 2001). Finally, Joseph

Alfandre commissioned Andres Duany and Elizabeth Plater-Zyberk in 1988 to develop a plan for the 352-acre Kentlands property in Gaithersburg, Maryland. Their plan introduced Montgomery County to New Urbanism for the first time (Arkin 2003).

The intersection of new growth pressures, available mass transit to Metropolitan Washington, growing concern over the health of Chesapeake Bay, and the introduction of New Urban design convinced Montgomery County it had to take a different approach to simultaneously combat sprawl and protect water quality. The 1990 Shady Grove Study Area Master Plan proposed conservation of stream valleys, wetlands, and floodplains on the King Farm site if it were ever developed as a mixed-use, high-density urban village (see Figures 5 and 6). The 1990 plan virtually guaranteed the protection of the most hydrologically sensitive areas of the upper Watts Branch watershed.

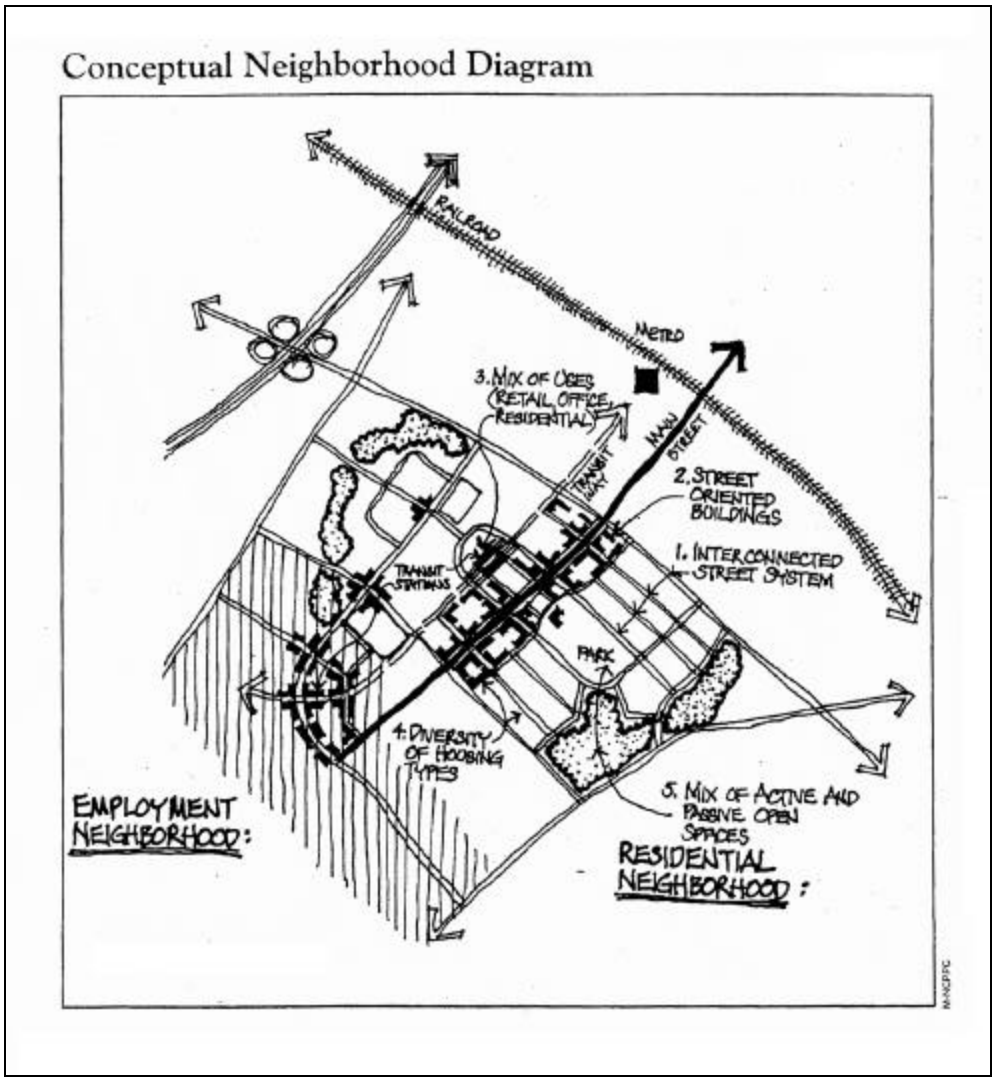

Figure 5. 1990 Conceptual Neighborhood Diagram for Shady Grove Urban Village

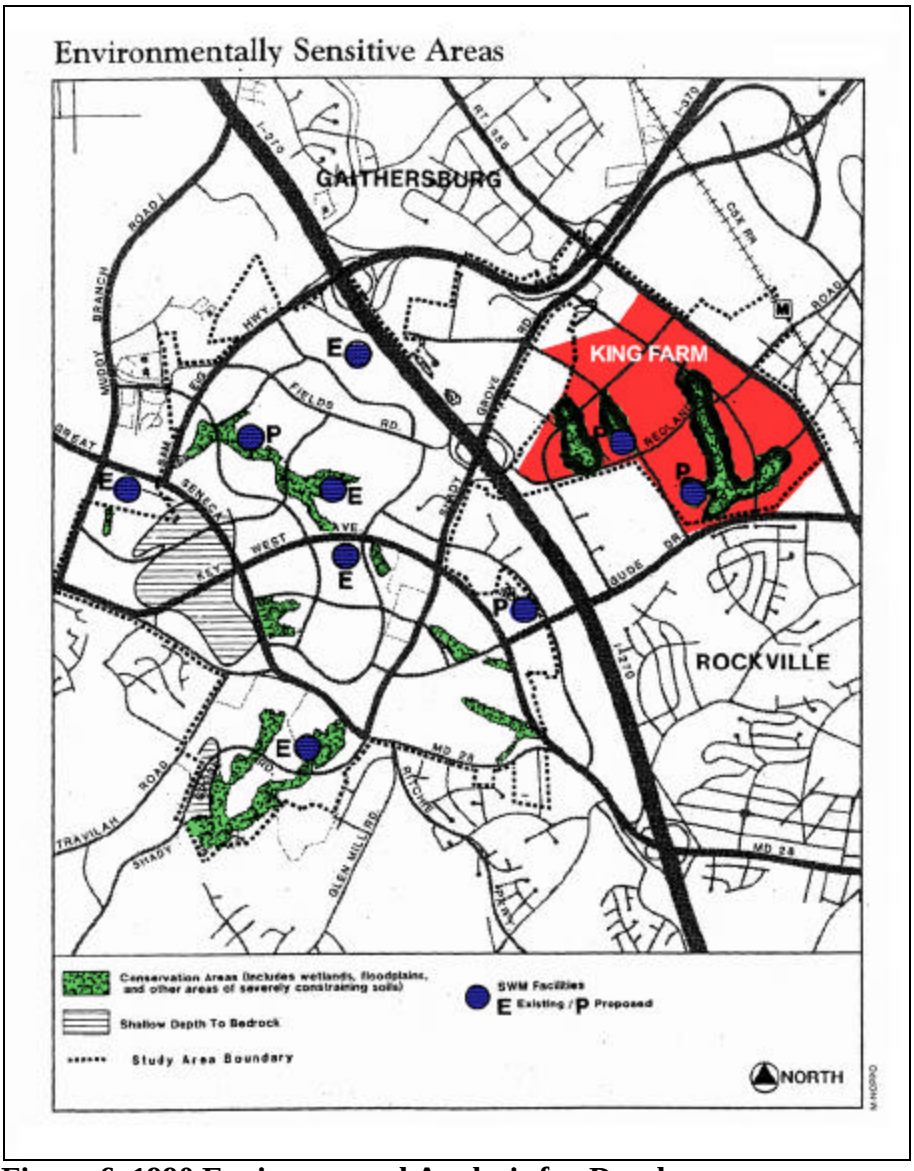

Figure 6. 1990 Environmental Analysis for Development Suitability and Stormwater Management in Shady Grove Study Area

The second key land use policy was a negotiated agreement between the City of Rockville and the developers of King Farm for the annexation of King Farm to the City of Rockville from unincorporated Montgomery County. The details of the Annexation Agreement integrated the requirements of the 1990 plan, the 1993 Rockville Master plan, and the detailed Stormwater Management (SWM) Concept Plan intended to bring best management to the upper Watts Branch watershed, where none had existed in more than seven decades of intense agricultural use.

The proposed conservation areas outlined in the 1990 plan were formally adopted in the 1993 Rockville Master Plan after the annexation process of King Farm by the City of

Rockville had begun (City of Rockville 1993). State of Maryland statutes dictated that the City of Rockville could not execute changes to the land use or zoning of the annexed parcel for 5-years once the property was legally annexed (State of Maryland 1955). Since the Annexation Agreement was signed in 1995, the City of Rockville was bound to the design plan from the 1990 plan until the year 2000. Since the city approved the King Farm Comprehensive Development Plan in 1996, both the King Farm developers and the city were bound to the 1990 plan. The issue of conservation was settled, but the issue of stormwater management was not.

Both city and county governments and developers were eager to have the city annex King Farm from Montgomery County, but for different reasons. The city desired the annexation because it felt the county did not know how to handle growth, listing environmental degradation as one of Rockville's primary concerns. The county wanted the annexation because it did not have adequate funds to provide the necessary infrastructure to support King Farm, including proper stormwater management. The developers wanted the annexation because they felt the development process would be smoother in a much smaller community bureaucracy. Furthermore, the City of Rockville wanted to both control the impact of King Farm and receive the property tax benefits.

Although both the city and the developers agreed upon annexation, each side wanted to exert as much control as possible over the details of design and implementation. The SWM Concept Plan's primary goal was to anticipate then-changing state stormwater regulations and ensure King Farm would satisfy both current city stormwater guidelines and also meet more rigorous future guidelines. The developer's primary goal was to get their plan for King Farm approved as quickly as possible with a minimum of delays down the road. Time is money for developers and the King Farm developers desired only to do what was required by the current city stormwater guidelines, established in 1991. The result was the 1996 King Farm Stormwater Management (SWM) Concept Plan which met current city guidelines.

Although the SWM Concept Plan complied with current regulations, it received mixed reviews by some because developers did not strive to meet regulations under development at the state level. The reality, however, was that the State of Maryland did not adopt its new stormwater guidelines until October 2000 (State of Maryland 2000). The City of Rockville did not require new SWM proposals to meet new state law until January 2002 and the new state rules were not formally adopted by the city until September 2002, more than six years after King Farm's SWM Concept plan was approved (City of Rockville 2003).

The third land use policy involved collaboration between the City of Rockville and the Maryland-based Center for Watershed Protection to develop a watershed study and management plan for Watts Branch, a tributary of the Potomac River and the Chesapeake Bay starting in 1998. Treating their experience with King Farm as a "wake-up call," the city adopted the Watts Branch Watershed Study and Management Plan final report in August 2001.

The city's concern about King Farm's impact on Watts Branch motivated it to pursue the study for two reasons. First, Watts Branch empties into the Potomac River just upstream of a major Washington Suburban Sanitary Commission drinking water intake for suburban Maryland and the city worried that excessive runoff impact would require a significantly higher level of treatment. Second, a 1999 EPA finding that waters of the Chesapeake Bay were now "impaired" catalyzed the entire Chesapeake Bay region to overhaul its 12-year approach to nutrient reduction and water quality improvement. The resulting Chesapeake 2000 Agreement requires new, more specific criteria to reduce nutrients and improve water quality by 2010 to avoid a costly, enforced program to ensure the region meets federal water quality standards.

The 2001 Watts Branch Watershed Study and Management Plan prescribes stormwater retrofits and stream rehabilitation just off-site of King Farm along the tributaries that drain the development and feed Watts Branch (see Figure 7). Although the city approved King Farm's CPD with a SWM Concept Plan, the city recognized that stormwater management standards had changed at the state level and were soon to change at the local level. To ensure maximum watershed protection, the city proposed three stormwater retrofits for one of the King Farm tributaries, intended to provide channel protection storage to reduce the amount of channel erosion and water quality treatment to reduce

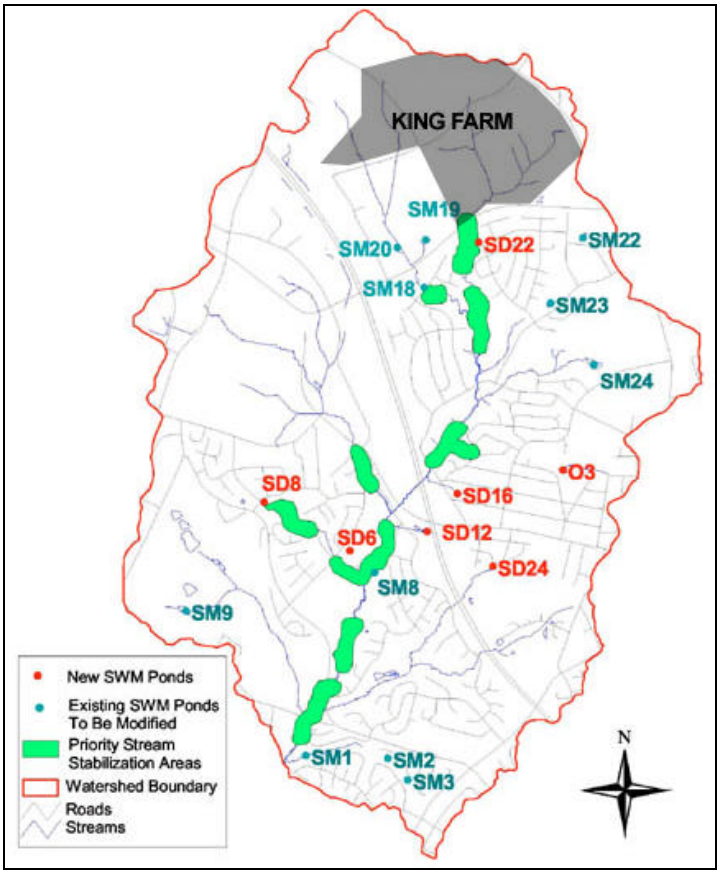

Figure 7. Map of 2001 Proposed Retrofit and Rehabilitation Sites in the Watts Branch Watershed

pollutant loading during stormwater runoff events. The city proposed stream rehabilitation at one point for the tributary with retrofits and stream rehabilitation at eight points for other tributary, intended to improve habitats and reduce channel erosion in the stream valleys and riparian corridors.

SITE DESIGN

The land use policies translated to three site design issues that defined King Farm's impact on the Watts Branch watershed. First, the conservation element of the 1990 Shady Grove Study Area Master Plan provided the framework for the developers to implement King Farm's open space network that protected hydrologically sensitive stream valleys, floodplains, and wetlands for development. Second, the Annexation Agreement between the City of Rockville and the King Farm developers produced a wide range of techniques implemented on the site, though some felt developers could have done more, to recharge groundwater, cool stream water, and reduce pollutant loads. Third, the 2001 Watts Branch Watershed Study and Management Plan prescribed significant stormwater retrofits and stream rehabilitation to the tributaries of Watts Branch that drained King Farm. The city and the Center for Watershed Protection located these watershed protection features downstream from King Farm as testimony to their confidence in the King Farm stormwater management system and their dedication to a cleaner Chesapeake Bay.

Open Space Network

The 1996 Open Space Network Plan for King Farm contains 109 acres, leaving 326 acres available for development. Thus, approximately 25% of the King Farm development is one of 11 different forms of open space (see Table 2).

TABLE 2. COMPONENTS OF KING FARM OPEN SPACE NETWORK

TYPE OF OPEN SPACE	ACRES
Public Open Space (includes stream valleys and stormwater management)	47.7
Park (possible future middle school site)	28.0
Park (possible future elementary school site)	12.0
Landscape Buffer	5.1
Neighborhood Park	5.0
King Farm Boulevard Promenade	3.2
Community Center Green	3.1
Neighborhood Open Space	2.0
Private Recreational Center (includes community buildings)	1.8
Retail Center Green	0.5
Office Center Green	0.5
TOTAL	**108.9**

The configuration of this open space, particularly the nearly 48 acres of public open space, follows the stream valley conservation areas in the 1990 Shady Grove Study Area Master Plan very closely (see Figure 8). This form of open space also fosters open space continuity between King Farm and other open space downstream, through three open space linkages between King Farm and neighboring properties.

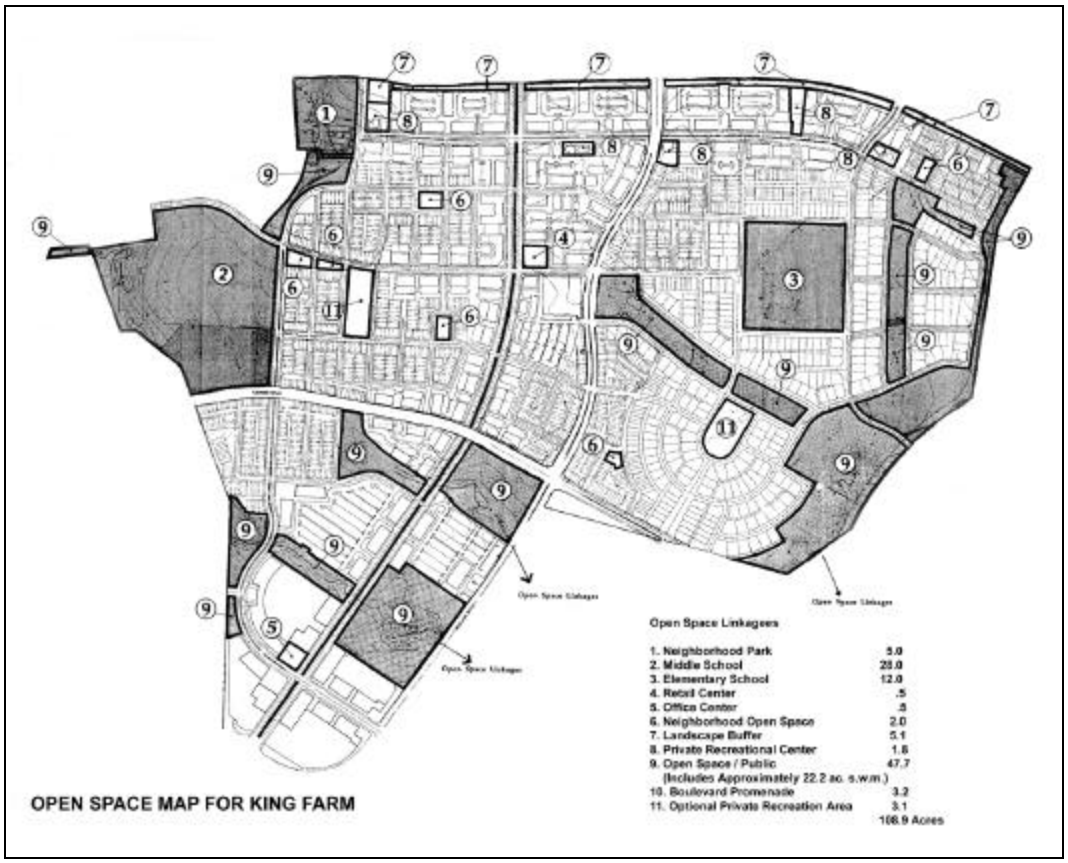

Figure 8. King Farm Open Space Network

The City of Rockville required a Natural Resource Inventory (NRI), including a Forest Stand Delineation (FSD), prior to development. The NRI was, in essence, a snapshot of the site before development takes place and includes an inventory of all streams, wetlands, trees, soils, etc. For King Farm, the NRI was used to support the 1977 and 1990 suitability analyses that indicated the lands more appropriate for environmental conservation and water resource protection (see Figure 6). Besides justifying an open space network to protect these identified areas, the NRI also provided evidence for reforestation on the site so that long denuded farmland would meet the City's forest conservation law of 20% forest cover.

Residents wanted sidewalks around open areas and stream buffers. They were originally somewhat resistant to purely natural areas. In response, the City of Rockville tried to educate the public about how undeveloped stream valleys protect the watershed. The city posted signs to identify streams and creeks and also point out that the natural areas surrounding them are left natural on purpose. There were "Growing, Not Mowing" signs

in the stream buffers (see Figure 9). Though there were no public workshops during the approval process, the city generally relied on the process itself for education and responded to residents concerns through personal communication. The city indicated that King Farm residents have become much more active stewards of the watershed than originally anticipated, in part because of city efforts to increase awareness.

Figure 9. Growing, Not Mowing

Stormwater Management

The King Farm Stormwater Management Concept Plan received mixed reviews from the developers, city employees, and county employees interviewed for this report. King Farm developers argued they already were going beyond the 1991 stormwater standards that were in place when the SWM Concept Plan and Comprehensive Design Plan were approved by the city in 1996. However, some municipal employees wished the developers would have met the new stormwater requirements currently under development in the State of Maryland. Those new standards were not adopted by the state until 2000 and not by the city until 2002. While it does not appear that King Farm developers narrowly dodged the regulation bullet, there was considerable contention between developers and the city over the standards used for the stream valley buffers.

The city planners and engineer were hoping to get stream buffers at the anticipated minimum width of 100 feet on each side of the stream. However, the developers of King Farm agreed only to install 150 foot (total width) vegetative buffers along the stream valleys – the 1991 standard. City officials were somewhat disappointed with the final size of the buffers because this is a smaller stream buffer width than the current law allows. The stream buffers are in the process of being afforested in order to protect stream banks and produce shade over open streams to reduce the water temperature (See Figure 10). The developers also obtained a variance for grading and channel work in the stream valleys.

Figure 10: Stream Valley Conservation Buffer

Despite Rockville's disappointment, the city's requirements regarding the natural environment were generally met and most natural spaces are being treated as conservation areas. The four stream valleys are part of the open space elements of the overall design, as had been suggested in the 1977 and 1990 area plans done by Montgomery County. There are only a few footpaths in the stream buffers and natural vegetation areas because it is believed that footpaths inhibit the usual course of plant growth in the open space. On the other hand, elevated wooden boardwalks allow sheet flow runoff and do not create additional impervious surface. The developers of King Farm placed such a boardwalk in one of the more centrally located stream buffer areas. It is hoped that as the conservation areas mature in a healthy way more boardwalks may be incorporated into them (see Figure 11).

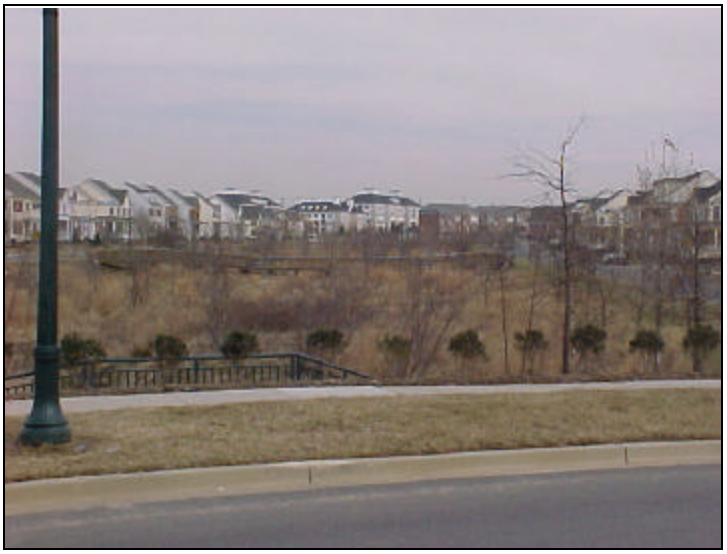

Figure 11: Boardwalk Crossing Stream Valley Buffer

King Farm's Open Space Network created a high net density of 9.8 units per acre (3200 units per 326 developed acres) typical of a New Urban development located on the urban fringe. The higher density did not leave enough room for required on-site parking. Rockville zoning required two off-street parking spaces per dwelling unit (see Figure 12). To prevent additional parking lots from being built, some roads were designated as private because private roads are not subject to city regulations. These private roads were then used to accommodate the additional parking not provided in parking lots. This solution to the parking and transportation cost problem benefited water quality by replacing the amount of impervious surface that might have otherwise been built as surface parking lots with the stream valley conservation areas.

Figure 12. Office/Commercial Area with on Street Parking

Aside from stream valley conservation, the primary stormwater management concerns for King Farm were controlling and treating runoff. Since King Farm sits at the headwaters of the Watts Branch, it contains water of higher quality than areas of Watts Branch that must cope with more runoff. Downstream communities depend on King Farm's stormwater management system to detain runoff so that the rest of Watts Branch maintains sustainable flow during dry periods and treat runoff so that downstream communities do not receive excessive nutrients and sediments from King Farm.

The planners and stormwater engineers were pleased with the detention performance of King Farm's five regional stormwater management (SWM) ponds (see Figure 13). The regional facilities are designed to accommodate all on-site drainage areas, including pretreatment of a small light industrial area adjacent to the King Farm site. The ponds were sized for quantity control for the entire contributory drainage area by providing one-year 12-hour extended detention control, although the 2002 regulations require new BMP ponds to have a release time of 24 hours. Some BMP structures have an outfall to swales in the buffers and were graded, although these were not systematically employed. Level

spreaders disperse concentrated flow where BMPs drop water out into the stream valleys. The level spreaders are used to get sheet flows into the buffer areas and prevent excessive erosion by mitigating high volumes of concentrated runoff.

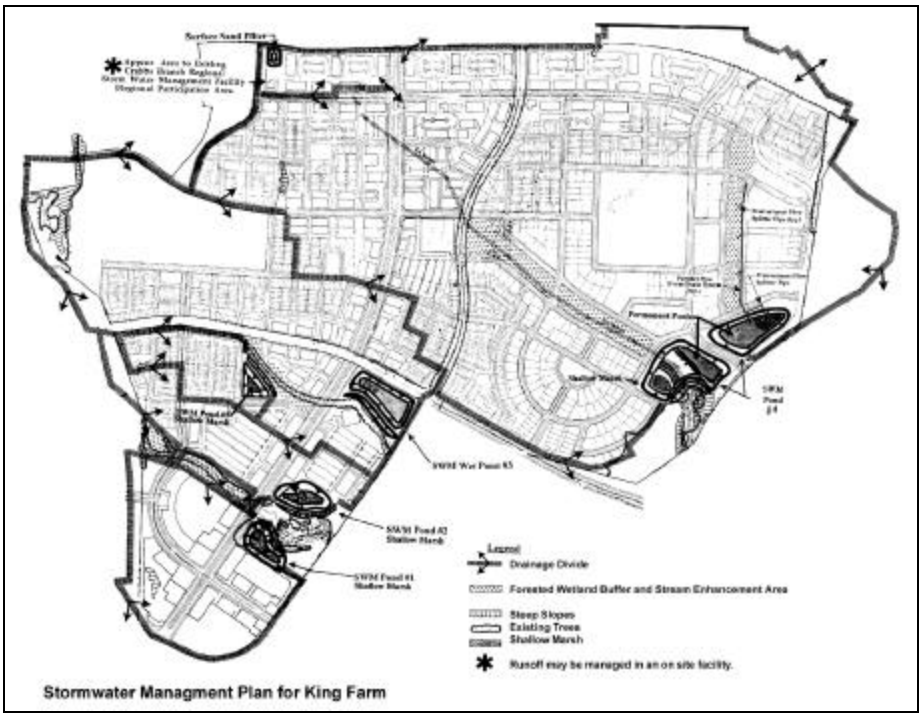

Figure 13: Diagram of Regional Pond System

A subdivision ordinance for stormwater management required the installation of detention ponds to keep all development-induced runoff on the site for at least 12 hours to improve groundwater recharge. If a developer is unable to accommodate all runoff in a detention facility, the ordinance requires an impact fee. The developer of King Farm provided stormwater management on site and was charged an impact fee for only a small area (<1% of escaping stormwater). City planners thought the developers were doing more than their fair share in this regard and used the revenues generated by the impact fee to support stormwater management in the City of Rockville.

Although the waters for the headwaters for Watts Branch are considered high quality, the on-site wetlands are not pristine. Spring heads had been employed as watering troughs for the King Farm's livestock when the site was in agricultural use. Therefore, the developer listed their status as "Prior Converted Cropland," which made them exempt from wetland regulations.[i] Thus, the city had no easy solutions for preserving the wetlands, seeps and springs on King Farm. The city would have required wetland replacement if the wetlands had been pristine. Since there were not, the city could not enforce the replacement regulation.

The city was of the opinion that the designation "prior converted cropland" as it pertains to wetland areas can sometimes be a matter of perception, i.e., in spite of the land being used for many years as a dairy farm, the wetlands might be fairly intact, and may have

been functional or even restorable. Regardless, the city acquiesced on the issue and simply convinced the developers to install underdrains to remove excess groundwater from the area around Watkins Pond and discharge it into surface streams. This permitted the developer to build near the pond (see Figure 14).

Figure 14. Watkins Pond

The City of Rockville also established a goal to clean the runoff and keep nutrients and sediments from leaving King Farm. Of primary concern was how to control erosion during construction. Downstream communities were concerned about how developers would control the sediment coming off the site. In response to their concerns, the City of Rockville initiated a gypsum program.

Sedimentation basins and sediment traps are usually built on construction sites to reduce the load of suspended solids in runoff. However, the basins are not as effective in reducing turbidity caused by fine suspended particles such as clay and slit. The application of agricultural gypsum, $CaSO_4$, causes suspended particles to settle into sediment traps and thereby decrease the amount of downstream sedimentation (Przepiora et. al. 1998). The City of Rockville required each stormwater pond to receive agricultural gypsum during the construction phase of King Farm so that excess sediment in the runoff would settle to the bottom of the pond and protect Watts Branch from excess sediment deposition.

The developers also worked with the city to put a number of sand filters in place which remove sediment before dropping it into the storm drain system. There are about 10 sand filters between the two tributaries for pre-treatment of stormwater. Planned open spaces are also used for pre-treatment and many of the pocket parks have underground filters (See Figure 15). Storm captors (filters in the storm sewers used to intercept debris and

pollutants) were found in some areas. Some dry ponds were also present. However, there were no bio-retention areas or rain gardens. Rip-rap was usually used on storm drain or pond outfalls.

Figure 15. Sand Filters construction in Pocket Park

Downstream Stormwater Retrofits and Stream Rehabilitation

The 2001 Watts Branch Watershed Study and Management Plan prescribes stormwater retrofits and stream rehabilitation just downstream of King Farm (see Figure 7). Although these watershed protection measures do not directly affect the actual site design of King Farm, they are meant to combine with King Farm stormwater management to protect the rest of the Watts Branch watershed from further stream degradation due to urbanization. Furthermore, the action taken by the city to implement watershed protection techniques downstream from King Farm compensates somewhat for what the city perceived was a shortfall on the part of the developers to provide best management of stormwater on the King Farm site.

To ensure maximum watershed protection, the city proposed three stormwater retrofits for one of the King Farm tributaries. The purpose of stormwater retrofits is twofold (City of Rockville 2001). First, a retrofit of existing stormwater management increases detention capacity to provide additional storage of stormwater runoff to protect the stream channel against channel erosion from urbanized sites with poor or with no stormwater management. Second, a retrofit of existing stormwater management provides better water quality treatment to reduce pollutant loading carried by stormwater runoff from sites that do little or no retention to clean runoff.

The following eight steps form the basic implementation strategy for a stormwater retrofit:

- Identify potential retrofit sites
- Verify that sites are feasible and appropriate, then prepare concept designs
- Set up a priority based on watershed protection for implementing future sites.
- Solicit comments and input from the public, particularly residents adjacent to potential sites.
- Prepare construction drawings for specific facilities
- Obtain the necessary approvals and permits for specific facilities
- Ensure that facilities are constructed properly in accordance with the design plans
- Ensure that facilities are adequately maintained.

The design budget for the stormwater retrofits was $81,000 for fiscal year 2002, while the construction budget was $259,000 for fiscal year 2004. Anticipated completion is 2005.

The city proposed nine different stream rehabilitations for the two tributaries that drain King Farm (see Figure 18). Stream rehabilitation involves the recovery of ecosystem functions and processes in disturbed habitat. While rehabilitation does not reestablish predisturbance conditions, it does establish hydrologically stable landscapes capable of supporting the natural ecosystem mosaic (Federal Interagency Stream Corridor Restoration Working Group 1998). Practices may include:

- Riparian reforestation
- Wetland creation
- Wetland enhancement
- Habitat creation
- Streambank stabilization

For the particular stream rehabilitation sites just downstream from King Farm, the focus is on streambank stabilization, using both hard structures and bioengineering (live vegetation) methods. The design budget for the stream rehabilitations was $80,000 for fiscal year 2006, while the construction budget was $256,800 for fiscal year 2008. Anticipated completion is 2009.

CONCLUSION

What Worked?

Watershed protection at King Farm benefited tremendously from its location in the Watts Branch watershed. Watts Branch was made famous by the work of world-renowned hydrologist and river geomorphologist Luna Leopold (1994). Dr. Leopold's extensive observations and well-published research on the impact of urbanizing Montgomery County on Watts Branch (1952-1971) set the tone for the proactive and innovative stormwater management approaches taken by the City of Rockville, Montgomery County, the State of Maryland, and the entire Chesapeake Bay watershed. The developers for King Farm stepped into a detailed, sophisticated, environmentally

sensitive community that had already established the conservation framework for the site. Montgomery County has also been known as one of the most innovative planning jurisdictions in the United States, evidenced in this report by the Kentlands New Urban development. Begun right after Seaside, the first New Urban development in the United States, Kentlands served as a model for Montgomery County to follow when designing what would become King Farm. There probably isn't a site in the entire nation that would enjoy a creative and a forward-thinking approach to integrating high-density, mixed-use urban development with hydrologically-sensitive areas as King Farm.

What Did Not Work?

The City of Rockville felt that King Farm developers did not do enough to protect Watts Branch. They specifically cited a 150-foot buffer and the 12-hour detention time as indications that King Farm's Stormwater Management Concept Plan fell short. However, it is hard to consider these as major problems for Watts Branch since the newer watershed regulations which the city hoped for were not adopted by the city until six years after King Farm was approved. Furthermore, the city adopted a Watershed Management Plan for Watts Branch in 2001 which approved both stormwater retrofits and stream rehabilitation sites for the tributaries that drain King Farm. The policy framework cradling King Farm is about as good as it gets.

What Did King Farm Teach Us?

- Montgomery County protected King Farm's stream valleys in the midst of intense development. Local governments should conduct development suitability analyses prior to development proposals to ensure they know where they want developers to build and where they want developers to protect. This is a proactive approach to watershed protection that reduces the uncertainty and stress faced by local governments and developers during the site plan review process. The end result is almost always likely to be better than if developers "surprise" local governments with high-intensity urban developments.
- Just because all the levels of government may embrace a particular planning goal does not mean the developers will do the same. The City of Rockville had little success in coaxing King Farm developers to do all the watershed protection the city felt was necessary. However, in the long run the city plans to implement extensive stormwater retrofit and stream rehabilitation just downstream from King Farm, the net effect on Watts Branch is not as bad as the city originally thought.
- Major environmental issues such as the health of Chesapeake Bay really motivate local government and developers alike to align their priorities. Even though the developers may not have done everything the city wanted, the developers are in a fairly environmentally conscientious region of the United States because of the publicity surrounding the degradation of Chesapeake Bay. The potential threat of federal enforcement of pollution control in the region where developers have a project provides some impetus to be as cooperative as possible and work with local governments to improve environmental integrity.

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[i] Both state and federal agencies define wetlands as "areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and under **normal circumstances** do support, a prevalence of vegetation typically adapted for life in saturated soil conditions, including swamps,

marshes, bogs and similar areas." Maryland Department of Environment (MDE) and the federal agencies define prior converted cropland as "wetlands that were drained, dredged, filled, leveled or otherwise manipulated including the removal of woody vegetation, before Dec. 23, 1985, for the purpose of, or to have the effect of, making the production of an agricultural commodity possible, and an agricultural commodity was planted or produced at least once prior to Dec. 23, 1985" [as defined in the National Food Security Act Manual (180-V-NFSAM, 3rd Edition, March 1994)]. The prior converted cropland (PC) designation **can be lost** when cropped fields are abandoned for a minimum of five years. Thus, if a prior converted cropland is **not** cropped or enrolled in a set aside program for five years, then the "normal circumstances" can be re-evaluated. When determining whether an area mapped as having hydric soils is prior converted cropland, cropping history is the important factor. If the cropping history has been continuous since Dec. 23, 1985, the field is prior converted cropland. If the field has not been cropped in the most recent five years, it will be considered abandoned. It is important to note that cropping history is also maintained if the field has been enrolled in a government set-aside program. The USDA Natural Resources Conservation Service is responsible for reviewing all jurisdictional determinations on agricultural land. Activities on prior converted croplands are not regulated under the federal Clean Water Act or through state regulations. The landowner may continue farming the PC cropland, construct a farm pond, road, building or other land development activity as if it never was a wetland.